EVDI
ANNUAL CONGRESS
EDINBURGH-SCOTLAND
14-17 SEPTEMBER 2022

EVDI Congress
14-17 September 2022

PROCEEDINGS

EAVDI

ECVDI®

Index

Welcome

Dear friends and colleagues,

Welcome to the 2022 European Veterinary Diagnostic Imaging Annual Scientific Conference in Edinburgh; Scotland's stunning capital! For three days, the Assembly Rooms, a beautiful 18th century meeting hall on George Street in the heart of Edinburgh's New Town, concealing a state-of-the-art conference centre, will be our home. An excellent scientific programme awaits you with cutting edge oral presentations and posters, as well as stimulating keynote and masterclass lectures and workshops provided by many internationally renowned speakers.

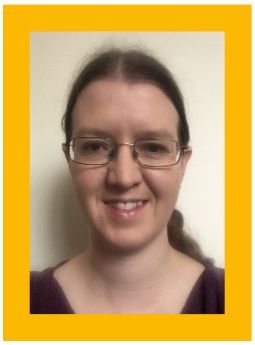
Our social programme meanwhile will explore some of the most culturally and scientifically interesting sites in the city while promising to provide a truly Scottish experience, including bagpipes, ceilidh dancing and the opportunity to sample local delicacies such as smoked salmon and haggis, and tipples such as a wee dram of locally produced whisky or gin.

Edinburgh itself is a compact city, just 30 minutes from the airport, conveniently linked by tram and bus with numerous visitor attractions, hotels, shops and restaurants within walking distance. In addition to the numerous activities in the city itself, Edinburgh makes an excellent starting point for excursions around the rest of Scotland including the vibrant city of Glasgow, the beautiful Scottish Highlands and historic St. Andrews, the home of golf.

We hope you thoroughly enjoy the congress and your stay here with us in Edinburgh.

Sincerely, with warm regards and very best wishes

Prof. Tobias Schwarz
Chair of the LOC



Alison Major
EVDI Conference Director

Programme: Wednesday 14 September 2022

Resident course 2022 – Royal (Dick) School of Veterinary Studies

08.00 | Opening of Resident Day Registration

Chair: John Keen

08.30 - 09.15 | Canine Head Imaging - Tobias Schwarz
09.15 - 10.00 | Equine Head Imaging - Tiziana Liuti

10.00 – 10.30 | Coffee Break | Room: G.01

Chair: Sarah Taylor

10.30 - 11.15 | Feline Head Imaging - Maurizio Longo
11.15 - 12.00 | Rabbit Head Imaging - Jenna Richardson

12.00 – 13.00 | Lunch Break | Room: G.01

Chairs: John Keen & Sarah Taylor

Small Animal Stream | Room: G01, G02 & 02A
13.00 - 15.00 | Mock Exam ECVDI SA-Track Film Reading - Erik Wisner & Silke Hecht

Large Animal Stream | Room: G03&03A
13.00 - 15.00 | Mock Exam ECVDI LA-Track Film Reading - Tiziana Liuti & Sarah Taylor

15.00 – 15.30 | Coffee Break | Room: G.01

Small Animal Stream | Room: G01
15.30 - 16.30 | Mock Exam ECVDI SA-Track Answer Session - Erik Wisner & Silke Hecht

Large Animal Stream | Room: G03 & G03A
15.30 - 16.30 | Mock Exam ECVDI LA-Track Answer Session - Tiziana Liuti & Sarah Taylor

19.30 | Opening of Congress Registration

20.00-23.00 | Welcome Reception
Venue: Assembly Rooms Edinburgh, 54 George Street, EH2 2LR Edinburgh, Scotland

The resident course is generously made possible with the support of:

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Programme: Thursday 15 September 2022

Main Stream

08.30 - 09.15 | Keynote Lecture (Music Hall)
Imaging of Human Dementia - Joanna Wardlaw
Chair: Olga Travetti

09.20 - 10.30 | Oral Abstracts Brain Imaging (Music Hall)
Chair: Olga Travetti

10.30 - 11.00 | Coffee Break, Poster & Exhibition Visit | Ballroom

11.00 - 11.30 | Masterclass (Music Hall)
What the veterinary radiologist needs to know about exotic animals - Jenna Richardson
Chair: Olivier Taeymans

11.35 - 13.00 | Oral Abstracts Exotic Animal & Spinal Imaging (Music Hall)
Chair: Olivier Taeymans

13.00 - 14.00 | Lunch Break, Poster & Exhibition Visit | Ballroom

14.00 - 14.45 | Keynote Lecture (Music Hall)
Radiation Oncology & Radiology: Mutual Perspectives - Sarah Mason
Chair: Jennifer Kinns

14.50 - 16.00 | Oral Abstracts Intestinal & Endocrine Imaging (Music Hall)
Chair: Jennifer Kinns

16.00 - 16.30 | Coffee Break, Poster & Exhibition Visit | Ballroom

Radiation Oncology Stream

16.30 - 17.00 | Masterclass (East Drawing Room)
Client expectations and reality in human and veterinary radiation oncology - Magdalena Parys
Chair: Elizabeth Baines

17.05 - 18.00 | Oral Abstracts Radiation Oncology & Oncological Imaging (East Drawing Room)
Chair: Elizabeth Baines

EAVDI Stream

08.30 - 09.15 | Keynote Lecture (Music Hall)
Imaging of Human Dementia - Joanna Wardlaw
Chair: Olga Travetti

09.25 - 10.30 | Masterclass (West Drawing Room)
CT in the small animal orthopaedic patient - Susanne Boroffka
Chair: Yvonne Espada

10.30 - 11.00 | Coffee Break, Poster & Exhibition Visit | Ballroom

11.00 - 11.30 | Masterclass (Music Hall)
What the veterinary radiologist needs to know about exotic animals - Jenna Richardson
Chair: Olivier Taeymans

11.40 - 12.20 | Masterclass (West Drawing Room)
It is a shoulder lameness but radiographs are normal: What ultrasound can tell us - Giliola Spattini
Chair: Carolina Monteiro

12.20 - 13.00 | Masterclass (West Drawing Room)
Stiff gait in athletic dogs. How to diagnose rear limb diseases ultrasonographically - Giliola Spattini
Chair: Carolina Monteiro

13.00 - 14.00 | Lunch Break, Poster & Exhibition Visit | Ballroom

14.00 - 14.45 | Keynote Lecture (Music Hall)
Radiation Oncology & Radiology: Mutual Perspectives - Sarah Mason
Chair: Jennifer Kinns

14.55 - 16.00 | Masterclass (West Drawing Room)
When is MRI useful in small animal musculoskeletal cases? - Ines Carrera
Chair: Antonella Puggioni

16.00 - 16.30 | Coffee Break, Poster & Exhibition Visit | Ballroom

16.30 - 17.00 | Masterclass (West Drawing Room)
Interactive small animal case review - Susanne Boroffka
Chair: Mauro Pivetta

17.00 - 18.00 | EAVDI Annual General Meeting (West Drawing Room)

Wellbeing, Mindfulness and Professional Skills Stream
09.25 - 10.30 | Workshop (East Drawing Room)
Mindfulness for the busy Radiologists - Petra Agthe
Chair: Marlène Finck

10.30 - 11.00 | Coffee Break, Poster & Exhibition Visit | Ballroom

12.00 - 13.00 | Yoga Class (East Drawing Room)
Gentle Yoga - Elle O'Donnell
Chair: Deborah Jarrett

13.00 - 14.00 | Lunch Break, Poster & Exhibition Visit | Ballroom

14.55 - 16.00 | Workshop (East Drawing Room)
Empathy-Focused Radiology Reporting - Tobias Schwarz
Chair: Marlène Finck

16.00 - 16.30 | Coffee Break, Poster & Exhibition Visit | Ballroom

16.30 - 18.00 | Professional Forum (Music Hall)
Chair: Gawain Hammond

19.30 - 22.00 | Museum Reception
Venue: Surgeons Quarter, Nicolson Street, EH8 9DW Edinburgh, Scotland

Programme: Friday 16 September 2022

Main Stream
08.30 - 09.15 | Keynote Lecture (Music Hall)
The Story of Radiopaedia - Jeremy Jones
Chair: Antje Hartmann

09.20 - 10.30 | Oral Abstracts Musculoskeletal Imaging (Music Hall)
Chair: Antje Hartmann

10.30 - 11.00 | Coffee Break, Poster & Exhibition Visit | Ballroom

11.00 - 11.30 | Masterclass (Music Hall)
The textbook of the future: Designing an online educational resource for veterinary radiology - Allison Zwingenberger
Chair: Chris Warren-Smith

11.50 – 11.55 | Presentation IVRA Congress Dublin 2023 - Antonella Puggioni
11.55 – 12.00 | Presentation EAVDI-BID Autumn 2022 Meeting - Ella Fitzgerald
Chair: Chris Warren-Smith

12.05 - 13.00 | Oral Abstracts Thoracic Imaging (Music Hall)
Chair: Chris Warren-Smith

13.00 - 14.00 | Lunch Break, Poster & Exhibition Visit | Ballroom

Second Stream
08.30 - 09.15 | Keynote Lecture (Music Hall)
The Story of Radiopaedia - Jeremy Jones
Chair: Antje Hartmann

09.25 - 10.30 | Keynote Lecture (West Drawing Room)
Aquatic Species Imaging - Sophie Dennison
Chair: Michaela Gumpenberger

10.30 - 11.00 | Coffee Break, Poster & Exhibition Visit | Ballroom

11.00 - 11.30 | Masterclass (Music Hall)
The textbook of the future: Designing an online educational resource for veterinary radiology - Allison Zwingenberger
Chair: Chris Warren-Smith

13.00 - 14.00 | Lunch Break, Poster & Exhibition Visit | Ballroom

Wellbeing, Mindfulness and Professional Skills Stream
09.25 - 10.30 | Workshop (East Drawing Room)
Vetlucent Acute Abdomen Case Collection - Allison Zwingenberger
Chair: Deborah Jarrett

10.30 - 11.00 | Coffee Break, Poster & Exhibition Visit | Ballroom

11.55 - 13.00 | Workshop (West Drawing Room)
Vetlucent Musculoskeletal Image Collection - Allison Zwingenberger
Chair: Susanne Stieger Vanegas

12.00 - 13.00 | Yoga Class (East Drawing Room)
Gentle Yoga - Elle O'Donnell
Chair: Deborah Jarrett

13.00 - 14.00 | Lunch Break, Poster & Exhibition Visit | Ballroom

Venue: Guided Tours & Evening Reception
14.00 - 18.30 | Excursion tours
18.30 - 22.00 | Evening Reception with Whisky & Gin Tasting

Programme: Saturday 17 September 2022

Main stream

08.30 - 09.15 | Keynote Lecture (Music Hall)
Nose or Brain? Imaging & Clinical Correlation in Dogs and Cats with Naso-Cerebral Pathology - Silke Hecht
Chair: Federica Rossi

09.20 - 10.30 | Oral Abstracts Imaging of the Head (Music Hall)
Chair: Federica Rossi

10.30 - 11.00 | Coffee Break, Poster & Exhibition Visit | Ballroom

11.00 - 11.30 | Masterclass (Music Hall)
Pictures That Don't Lie: An Animal Geneticist's View on the Power of Diagnostic Imaging - Jeffrey Schoenebeck
Chair: Swan Specci

11.35 - 13.00 | Oral Abstracts Abdominal Vascular & Urogenital Imaging (Music Hall)
Chair: Swan Specci

13.00 - 14.00 | Lunch Break, Poster & Exhibition Visit | Ballroom

14.00 - 14.45 | Keynote Lecture (Music Hall)
Feline Infectious Diseases for Veterinary Radiologists - Danièlle Gunn-Moore
Chair: Alison King

14.50 - 16.00 | Oral Abstracts Imaging Technology & Profession (Music Hall)
Chair: Alison King

16.15 - 18.15 | ECVDI Annual General Meeting (Music Hall)

Large Animal Stream

08.30 - 09.15 | Keynote Lecture (West Drawing Room)
State-of-the-Art Equine Cardiac Imaging - John Keen
Chair: Lorrie Gaschen

09.20 - 10.30 | Oral Abstracts Equine Orthopaedic Imaging (West Drawing Room)
Chair: Lorrie Gaschen

10.30 - 11.00 | Coffee Break, Poster & Exhibition Visit | Ballroom

11.00 - 11.30 | Masterclass (Music Hall)
Pictures That Don't Lie: An Animal Geneticist's View on the Power of Diagnostic Imaging - Jeffrey Schoenebeck
Chair: Swan Specci

11.35 - 13.00 | Oral Abstracts Equine Orthopaedic & Ophthalmology Imaging (West Drawing Room)
Chair: Nathalie Rademacher

13.00 - 14.00 | Lunch Break, Poster & Exhibition Visit | Ballroom

14.00 - 14.45 | Keynote Lecture (West Drawing Room)
Equine Dental Imaging - Padriac Dixon
Chair: Lucinda Meehan

14.50 - 16.00 | Oral Abstracts Equine Head Imaging & Scintigraphy (West Drawing Room)
Chair Lucinda Meehan

16.15 - 18.15 | ECVDI Annual General Meeting (Music Hall)

Wellbeing, Mindfulness and Professional Skills Stream
09.25 - 10.30 | Workshop (East Drawing Room)
Life-Work Balance as a Radiologist - Marlène Finck
Chair: Petra Agthe

10.30 - 11.00 | Coffee Break, Poster & Exhibition Visit | Ballroom

12.00 - 13.00 | Yoga Class (East Drawing Room)
Intermediate Yoga - Elle O'Donnell
Chair: Deborah Jarrett

13.00 - 14.00 | Lunch Break, Poster & Exhibition Visit | Ballroom

14.55 - 16.00 | Workshop (East Drawing Room)
Life Hacks for Horos & Osirix - Manuel Pinilla
Chair: Petra Agthe

19.30 - 00.00 | Gala Dinner & Dance Party
Venue: National Museum of Scotland, Chambers Street, EH1 1JF Edinburgh, Scotland

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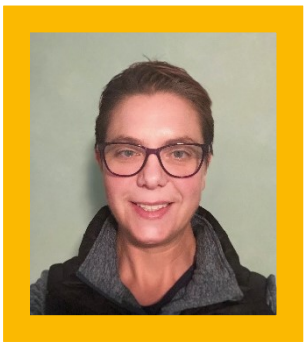
Speakers

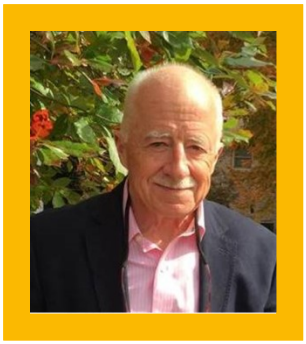
Keynote speakers



Sophie Dennison

Sophie is a proud Dick Vet who graduated in 2000 and started out in mixed practice and emergency medicine. In 2004 she moved to the USA for a two-year residency in marine mammal medicine and pathology, a joint program between UC Davis and The Marine Mammal Center (TMMC). While at TMMC she became involved in an MRI study in sea lions in collaboration with the epilepsy group at UCSF that would alter her career path and lead to her to apply for ACVR-accredited radiology residencies. Sophie completed the University of Wisconsin radiology residency program and became board-certified by the ACVR in 2009 and listed as an RCVS Recognised Specialist in Diagnostic Imaging in 2012. Sophie has built a successful solo teleradiology practice where approximately 50% of her time, sometimes more, is spent interpreting exotics, wildlife and zoo animal imaging studies from facilities around the world.

Lecture:
Friday 16 September | Second Stream | 09.25-10.30: Aquatic Species Imaging



Padraic M. Dixon

Prof PM Dixon is a graduate of University College Dublin, later obtaining a PhD on equine respiratory disease at The University of Edinburgh, where he has worked for most of his professional life including as a lecturer, senior lecturer and reader. He is Professor of Equine Surgery in Edinburgh University where his main clinical and research interests are equine dental disorders and head and neck surgery and he had published extensively on these topics. He is a European Specialist in Equine Dentistry and a Royal College of Veterinary Surgeons Specialist in Equine Soft Tissue Surgery. He has lectured and tutored extensively around the world on these areas.

Lecture:
Saturday 17 September | Large Animal stream | 14.00-14.45: Equine Dental Imaging

Danièlle Gunn-Moore

Danièlle Gunn-Moore graduated from the R(D)SVS, University of Edinburgh, with the Dick Vet Gold Medal (1991). After a year in small animal practice she joined The Feline Centre, University of Bristol, initially as the Feline Advisory Bureau Scholar, then the Duphar Feline Fellow, and completed a PhD study into Feline Infectious Peritonitis in 1997. After a short period as Lecturer in Veterinary Pathology, University of Bristol, she returned to Edinburgh to establish the Feline Clinic and became Professor of Feline Medicine in 2006. She is interested in all aspects of feline medicine; she is an internationally recognised expert in her area, has lectured extensively and published over a 150 peer-reviewed research papers, plus many reviews and book chapters. In 2009 she was awarded the BSAVA Woodrow Award for outstanding contribution in the field of small animal veterinary medicine, in 2011 she was awarded the International Society for Feline Medicine/Hill's award for Outstanding Contributions to Feline Medicine, in 2012 the Royal Dick students voted her "The clinician I would most like to be", in 2016 FECAVA awarded her "Increased Vocalisation in Elderly Cats" the most original paper in the European Journal of Companion Animal Practice that year, and in 2017 she became a Fellow of the RCVS. She shares her home with her husband Frank, a 18 year old Maine Coon boy called Mortlach (named after a Scottish single malt whisky), and a tiny little 18 year old black cat called Sheba-Ardbeg.

Lecture:
Saturday 17 September | Main Stream | 14.00-14.45: Feline Infectious Diseases for Veterinary Radiologists

Silke Hecht

Education
1998 Graduation (Veterinary Degree), Ludwig-Maximilians-University (LMU), Munich, Germany
2001 Doctorate (Dr. med. vet.), LMU, Munich, Germany
1998-2002 Internship and Clinical Instructor, Department of Surgery, LMU, Munich, Germany
2002-2005 Residency in Diagnostic Imaging, Tufts University School of Veterinary Medicine, North Grafton, Massachusetts, USA

Diplomate, American College of Veterinary Radiology (ACVR) 2005
Diplomate, European College of Veterinary Diagnostic Imaging (ECVDI) 2006

Employment
2005-present University of Tennessee College of Veterinary Medicine, Knoxville, TN, USA
Current position: Professor in Radiology

Other
Specialty/areas of interest: Magnetic resonance imaging, computed tomography, neuroimaging, oncologic imaging
2013-2015: President, CT/MRI Society of the American College of Veterinary Radiology (ACVR)
2015-2016: President, American College of Veterinary Radiology
2019-present: Director North America, International Veterinary Radiology Association

Lecture:
Wednesday 14 September | Small Animal Stream | 13.00-15.00: Mock Exam ECVDI SA-Track Film Reading
Wednesday 14 September | Small Animal Stream | 15.30-16.30: Mock Exam ECVDI SA-Track Answer Session
Saturday 17 September | Main Stream | 08.30-09.15: Nose or Brain? Imaging & Clinical Correlation in Dogs and Cats with Naso-Cerebral Pathology

Jeremy Jones

Dr. Jeremy Jones is a Consultant Paediatric Radiologist at the Royal Hospital for Sick Children in Edinburgh and Training Programme Director for Radiology Training in South East Scotland. He is clinical lead for Radiology IT for Scotland and chair of the clinical advisory board for National PACS.

He is Deputy Editor-in-Chief of Radiopaedia which he has been involved in building with Frank Gaillard from 2008 when he started radiology training. He is passionate about open-source material. He is a keen educator and wants to maximise the use of the best of IT to aid training opportunities.

Lecture:
Friday 16 September | Main Stream/Second Stream | 08.30-09.15: The story of Radiopaedia

John Keen

Following graduation from the RVC in 1996, John spent 4 years in mixed and then equine practice before being appointed the RCVS Clarke and Sparrow Resident in Equine Studies at the 'Dick' Vet in 2000, where he has remained ever since. John is currently a senior medicine clinician in the equine hospital. He gained an MSc and PhD investigating the pharmacology and physiology of digital laminar microvasculature; became a Diplomate of ECEIM in 2007; and is an RCVS and European Specialist in equine internal medicine. Clinical and research interests are focussed on cardiovascular disease, metabolic/endocrine disease, laminitis and the potential links between these disorders. In the field of cardiovascular imaging, John has current research activities using novel echocardiographic tools

for assessing both structure and function in the equine athletic heart and common valvular disorders of the equine heart.

Lecture:
Saturday 17 September | Large Animal Stream | 08.30-09.15: State-of-the-Art Equine Cardiac Imaging

Sarah Mason

Sarah is the Head of General Oncology at Southfields Veterinary Specialists in Essex. She is a European Specialist in Oncology and Radiation Oncology.

Sarah obtained the ECVIM diploma in Oncology in 2014, and the ECVIM diploma in Radiation Oncology in 2019.

Sarah is a member of the ECVIM/ECVDI Radiation Oncology Education and Credentials Committee and is passionate about promoting the utility and benefit of radiation as a treatment modality. Her clinical interests include the optimization of chemotherapy protocols in veterinary patients, and the role of chemoradiation in the treatment of small animal neoplasia.

Lecture:
Thursday 15 September | Main Stream/EAVDI Stream | 14.00-14.45: Radiation Oncology & Radiology: Mutual Perspectives

Joanna Wardlaw

Professor Joanna Wardlaw is Professor of Applied Neuroimaging and Consultant Neuroradiologist at the University of Edinburgh and NHS Lothian. She has worked for many years to understand the brain and its blood supply, and on treatments to improve blood flow to the brain. She now focuses on the much more complicated problem of 'small vessel disease', a common cause of stroke and dementia. She and her colleagues have been instrumental in advancing understanding of the causes of small vessel disease in particular the role of the blood-brain barrier, and are now testing possible treatments. She holds a Foundation Chair and Programme in the UK Dementia Research Institute (at the University of Edinburgh Centre in the DRI), is leading the Cross-Centre Theme in Vascular Disease in the UK DRI, and led the Vascular Experimental Medicine Theme of the Dementia Platform UK (2015-2018). A Fellow of the Royal Society of Edinburgh and of the Academy of Medical Sciences, she was made a CBE for services to Medicine and Neuroscience in 2016.

Lecture:
Thursday 15 September | Main Stream/EAVDI Stream | 08.30-09.15: Imaging of Human Dementia

Masterclass speakers

Susanne Boroffka

Dr Boroffka studied at the Free University of Berlin, Germany. Working with Prof. Hartung she discovered her love for diagnostic imaging and was lucky to be able to do her residency at the Division of Diagnostic Imaging at the University of Utrecht. After that she worked there as a staff member for many years and completed her PhD thesis on Diagnostic Imaging of the canine eye and orbit successfully in 2007. 2008/2009 she worked at the Radiology Department at UC Davis, USA, as an associate professor. She published many peer-reviewed scientific articles and co-authored several chapters in comprehensive textbooks.

In 2016 she decided to start a new adventure and started her own company: Boroffka Diagnostic Imaging. She works as a radiologist in a specialist veterinary hospital in Utrecht, as a teleradiologist consultant. She is involved in clinical research and loves teaching diagnostic imaging.

Since 2020 she is vice-president of the European College of Diagnostic Imaging.

Lectures:
Thursday 15 September | EAVDI Stream | 09.25-10.30: CT in the small animal orthopaedic patient
Thursday 15 September | EAVDI Stream | 16.30-17.00: Interactive small animal case review

Ines Carrera

Ines Carrera studied veterinary medicine at the University of Santiago de Compostela (Lugo) in Spain. She did a master's degree and a diagnostic imaging residency at Glashow University Veterinary School and became a diplomate in diagnostic imaging in 2010. She has worked in several universities (Illinois-USA, Sydney-Australia and Zurich-Switzerland). While working at the University of Zurich she did also a PhD in MR spectroscopy of the brain in dogs. She is now working in the UK at Willows Referral Centre and VetOracle (Teleneurology).

Her particular interest is MRI and has published extensively focused on Neuroimaging.

Lecture:
Thursday 15 September | EAVDI Stream | 14.55-16.00: When is MRI useful in small animal musculoskeletal cases?

Magdalena Parys

Dr. Magdalena Parys graduated from the University of Warmia and Mazury in Olsztyn, Poland in 2010. After graduating, she moved to Michigan State University and spent two years working at the Centre for Comparative Oncology as an international fellow and intern. Subsequently, she completed a Medical Oncology Internship at the University of Guelph in Canada. In 2013 she returned to the USA to start a combined Residency and Masters program in Radiation Oncology at Purdue University. Magdalena has been the head of Radiation Oncology Service at the Royal (Dick) School of Veterinary Studies since 2016.

Lecture:
Thursday 15 September | Radiation Oncology Stream | 16.30-17.00: Client expectations and reality in human and veterinary radiation oncology

Jenna Richardson

Jenna graduated from the Royal (Dick) School of Veterinary Studies, Edinburgh, Scotland in 2008. After spending four years working in mixed practice in Wales then Scotland, she returned to Edinburgh to concentrate on a career in rabbit, exotic pet and wildlife veterinary medicine.

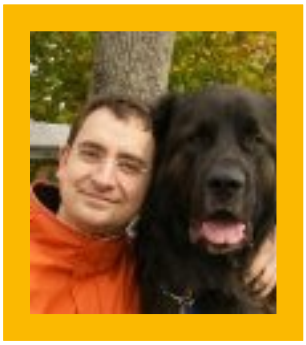
Jenna has written numerous book chapters (both in UK and US print), including BSAVA manuals, and has co-authored a book on Rabbit Medicine and Surgery. She regularly lectures throughout the UK to veterinary surgeons, veterinary nurses and students.

As a 'Lecturer and Clinician in Rabbit, Exotic Animal and Wildlife Medicine and Surgery', her work involves medical and surgical management of a busy first opinion and referral caseload of small mammal, avian, reptile, amphibian, fish and wildlife species.

Jenna is a Royal College of Veterinary Surgeons and European College of Zoological Medicine specialist in Small Mammals Medicine and Surgery. She has a research interest in pet rabbits, particularly relating to the use of computed tomography (CT) in this species and has published on the diagnosis and grading of middle ear disease using CT scanning.

Lecture:
Wednesday 14 September | Resident Course Small Animal Stream | 11.15-12.00 | Rabbit Head

Thursday 15 September | Main Stream/EAVDI Stream | 11.00-11.30: What the veterinary radiologist needs to know about exotic animals



Jeffrey Schoenebeck

Jeff graduated from The Pennsylvania State University (USA) in 1999 with a BS in Biology and minor in Spanish language. Intercalated during his undergraduate studies, he rotated as a technician in the Toxicology and Molecular Genetics units of SmithKline Beecham. After completing his undergraduate degree, he spent two years at the National Institutes of Health (USA) as a research technician. He went on to earn his PhD in developmental genetics at the New York University School of Medicine (USA). During this time, he studied the genetics of cardiac patterning and fate specification using zebrafish. His postdoctoral training was conducted in the laboratory of Dr. Elaine Ostrander, within the National Human Genome Research Institute (USA). During this time, he applied geometric morphometrics methodologies to create quantitative data to genetically map canine skull traits such as face length and skull size. Jeff's research group is based at the Roslin Institute and he is affiliated with the University of Edinburgh Royal (Dick) School of Veterinary Studies. His research group's interests centre on companion animal genetics and genomics, with a focus on discovering the genes and genomic landscapes that underpin canine morphological diversity as well as the diseases caused by breeding extreme phenotypes.

Lecture:
Saturday 17 September | Main Stream/Large Animal Stream | 11.00-11.30: Pictures That Don't Lie: An Animal Geneticist's View on the Power of Diagnostic Imaging

Giliola Spattini

She started an alternate residency program in Diagnostic Imaging, at the Royal Veterinary College of London, under the supervision of Christopher R. Lamb. In 2008 She obtained the Diploma of the European College of Veterinary Diagnostic Imaging (ECVDI). In 2009 She discussed her PhD thesis at the Department of Veterinary Diagnostic Imaging at Parma University. Since 2008 has been working with sport medicine experts on musculoskeletal ultrasound in sportive dogs. She has published in national and international journals. She has contributed to three books on Diagnostic imaging, one of which, has been translated into English. She is a frequent contributor to continuous post-graduate education (CPD) in Italy and around the world. She works in Clinica Veterinaria Castellarano, a private practice in Italy, and as a specialist consultant for Antech. She founded www.diagnosticmindset.com.

Lecture:
Thursday 15 September | EAVDI Stream | 11.40-12.20: It is a shoulder lameness but radiographs are normal: What ultrasound can tell us
Thursday 15 September | EAVDI Stream | 12.20-13.00: Stiff gait in athletic dogs. How to diagnose rear limb diseases ultrasonographically

Allison Zwingenberger

Allison Zwingenberger is a dual-boarded specialist (ACVR, ECVDI) in veterinary radiology. She earned her DVM at the University of Guelph before completing her residency at the University of Pennsylvania and an MAS in Clinical Research at UC Davis where she is Professor, Service Chief, and Co-Director for the In Vivo Translational Imaging Shared Resource. Her research interests include vascular imaging with emphasis on portosystemic shunts and oncologic molecular imaging, with 90 publications to date (http://bit.ly/ALZpubs). She has served as associate editor for Veterinary Radiology and Ultrasound and on the Editorial Review board of Veterinary Surgery.

Dr. Zwingenberger has held positions in both the ACVR and ECVDI to promote and develop the specialty and its members. In the ACVR, she has served on the Examination, Website, and Scientific Conference Committees as well as being president of the CT/MRI Society and Council member. Her ECVDI Committees included the Webmaster, Job Task Analysis, Resident Education Task Force, and service as ECVDI President.

Early in her career, Dr. Zwingenberger developed a passion for creating systems for curating data, creating knowledge, and sharing it with like-minded people worldwide. She provides case-based learning resources for students and veterinarians, as well as teaching resources for educators. She and her co-author, Erik Wisner, published the Atlas of Small Animal CT and MRI in 2015.

Lecture:
Friday 16 September | Wellbeing, Mindfulness and Professional Skills Stream | 09.25-10.30: Vetlucent Acute Abdomen Case Collection
Friday 16 September | Main Stream/Second Stream | 11.00-11.45: The textbook of the future: Designing an online educational resource for veterinary radiology
Friday 16 September | Wellbeing, Mindfulness and Professional Skills Stream | 11.55-13.00: Vetlucent Musculoskeletal Image Collection

Speakers Wellbeing, Mindfulness and Professional Skills Stream

Petra Agthe

Petra Agthe graduated from the TiHo Hannover, Germany. Following several years in general small animal practice, she completed a residency in diagnostic imaging at the University of Cambridge and became an ECVDI diplomate. After her residency, Petra joined Anderson Moores Veterinary Specialists, where she is currently head of service. Her particular clinical interests are MRI and CT. Over the years, Petra has developed a strong interest in psychology in general, and the science of wellbeing and performance in particular, including the role of non-technical skills and errors in radiology. Petra is a certified mindfulness practitioner and currently working on an ICF accredited coaching diploma.

Lecture:
Thursday 15 September | Wellbeing, Mindfulness and Professional Skills Stream | 09.25-10.30: Mindfulness for the busy Radiologists

Marlène Finck

Marlene is a graduate from the University of Veterinary Medicine in Lyon, France. She enrolled into a small animal rotating internship at the University of Liege, Belgium; and then completed an ECVDI approved residency programme at the University of Glasgow, UK. Marlene became a European Specialist in Veterinary Diagnostic Imaging in 2015. After spending a short period of time in a referral centre in England, she moved to the south of France where she now works in a private referral centre in Marseille (CHV Massilia), and also reads part time for Antech Imaging Services.

In her free time, Marlene is very active and is passionate about body movement, including yoga and cross training. She has been a certified yoga instructor (RYT®-200) since 2016.

Lecture:
Saturday 17 September | Wellbeing, Mindfulness and Professional Skills Stream | 09.25-10.30: Life-Work Balance as a Radiologist

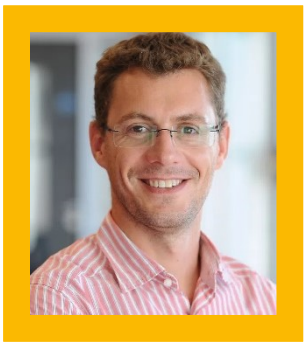
Elle O'Donnell

Elle turned to yoga over fifteen years ago and has been firmly rooted to the mat ever since. She took an Introductory and Foundation Course with the Association of Yoga Studies (AYS) in 2007. In 2008 she completed her teacher training qualification with Yoga Scotland and has been teaching ever since.

Initially combining teaching with full time work in Private Client Investment Administration until a combination of stress and dissatisfaction with corporate life saw her transition away from this. Elle has undertaken further training in: Yoga & Mindfulness, Yoga for MS, Gentle Yoga, Core Strength Yoga, Yoga for Mental Health Problems, Yoga and Disability, Yoga for People Living with Cancer, Ayurveda, Yoga for ME & Chronic Fatigue Syndrome. She has an Aerial Yoga Teaching qualification and a Thai Yoga Massage Diploma

After completing an HNC in Counselling, Elle moved into administration in the charity sector and combines this with her passion for teaching community yoga.

Lecture:
Thursday 15 September & Friday 16 September | Wellbeing, Mindfulness and Professional Skills Stream | 12.00-13.00: Gentle Yoga
Saturday 17 September | Wellbeing, Mindfulness and Professional Skills Stream | 12.00-13.00: Intermediate Yoga



Manuel Pinilla

Manuel studied veterinary medicine at Zaragoza, Spain and Lyon, France, graduating in 2002. He completed a small animal rotating internship at the University of Lyon followed by four years of work in general practice. He completed a residency in diagnostic imaging at University College Dublin in 2009 when he gained the European College of Veterinary Diagnostic Imaging Diploma. He has worked as a radiologist at Murdoch University in Australia, Queen's Veterinary Hospital in Cambridge, University College Dublin and SCVS. He is a senior radiologist in the VetCT team and responsible for much of our quality assurance. He brings a wealth of clinical experience to his role and is highly skilled in radiographic, MRI and CT interpretation.

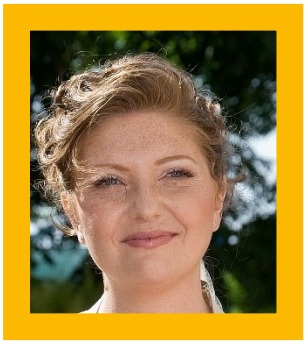
Lecture:
Saturday 17 September | Wellbeing, Mindfulness and Professional Skills Stream | 14.55-16.00: Life Hacks for Horos & Osirix

Tobias Schwarz

Tobias studied veterinary medicine at the Humboldt and Free University of Berlin in Germany. He did a diagnostic imaging residency at Glasgow University Veterinary School and became a Diplomate in Veterinary Radiology with the Royal College of Veterinary Surgeons in the UK, the European College of Veterinary Diagnostic Imaging and the American College of Veterinary Radiology. He has been an academic radiologist at the Universities of Pennsylvania and Wisconsin-Madison and is the head of the Diagnostic Imaging Service at the Royal (Dick) School of Veterinary Studies, The University of Edinburgh. He has been awarded Fellowships of the Royal College of Veterinary Surgeons, the Royal Society of Biology and the Higher Education Academy in the UK. In 2022 he became Chair and Professor of Veterinary Radiology at the University of Edinburgh. He has published over 120 peer-reviewed articles and his particular interests are in thoracic imaging and computed tomography. He has edited a comprehensive textbook on both subjects and lectures extensively worldwide.

Lecture:
Wednesday 14 September | Resident Course | 08.30-09.15: Canine Head Imaging
Thursday 15 September | Wellbeing, Mindfulness and Professional Skills Stream | 14.55-16.00: Empathy-Focussed Radiology Reporting

Resident day speakers



Tiziana Liuti

Education
Degree in Veterinary Medicine, University of Camerino, Italy
Master's Degree in Veterinary Medicine, University of Camerino, Italy

Postgraduate Programme
2003 – 2007 Approved Residency Programme ECVDI, University of Ghent, Faculty Veterinary Medicine

Positions
2008-Present Senior Lecturer in Diagnostic Imaging, Royal (Dick) School of Veterinary Studies, The University of Edinburgh, Scotland
Supervisor of Postgraduate programme (Approved ECVDI residency Programme at Edinburgh University)

Specialty Certification
PhD University of Edinburgh
Diplomate of the European College of Veterinary Diagnostic Imaging (Dipl.ECVDI)
Post Graduate Certificate of Academic Practice (Pg.CAP)
Fellow in High Education Academy (FHEA)
Certified PennHip member

Publications
Author of multiple international publications in ultrasound and Computed Tomography, small and large animal

Main Interest
All aspects of Diagnostic Imaging in particular: ultrasound small animal, Computed Tomography small and large animal (equine)
Radiology of thorax and abdomen.
MRI small animal

Lecture:
Wednesday 14 September | Resident Course | 09.15-10.00: Equine Head Imaging
Wednesday 14 September | Large Animal Stream | 13.00-15.00: Mock Exam ECVDI LA-Track Film Reading
Wednesday 14 September | Large Animal Stream | 15.30-16.30: Mock Exam ECVDI LA-Track Answer Session

Maurizio Longo

Dr Maurizio Longo graduated from the Faculty of Veterinary Medicine of the University of Milan in 2011. After a rotating and Imaging internship at the Istituto Veterinario di Novara, he was enrolled in a PhD program on soft tissue sarcomas, completed in 2016 (Doctor Europaeus). He did a residency in Diagnostic Imaging at the Royal (Dick) School of Veterinary Studies – University of Edinburgh and is now a Diplomate of the European College of Veterinary Diagnostic Imaging. He has a strong interest in research especially focused on the urinary tract, neurodegenerative, oncological and cardiovascular diseases. He is author and co-author of several peer-reviewed publications and reviewers for different scientific journals. He is the Head of the Diagnostic Imaging Unit at the C.T.O. Veterinario located in Arenzano (Genova – ITALY) and Antech Imaging Service teleradiologist.

Lecture:
Wednesday 14 September | Resident Course | 10.30-11.15: Feline Head Imaging

Sarah Taylor

Sarah graduated from the University of Edinburgh in 2001 following which she spent a year in mixed practice before returning to the Dick Vet to undertake a residency in Equine Surgery. Sarah became a Diplomat of the European College of Veterinary Surgeons in 2007. On completion of her PhD in 2010 she returned to the Dick Vet for the second time to accept the post of Senior Lecturer in Equine Surgery. Subsequently Sarah spent a sabbatical during 2011 working as a surgeon at the Liphook Equine Hospital, Surrey. Sarah became RCVS Specialist in Equine Surgery in 2012. She was awarded De Facto Diplomat status by the European College of Veterinary Sports Medicine in 2019. She has a keen clinical interest in equine sports medicine and surgery, while her research interests continue to focus on fractures in racehorses, osteoarthritis and MRI.

Lecture:
Wednesday 14 September | Large Animal Stream | 13.00-15.00: Mock Exam ECVDI LA-Track Film Reading
Wednesday 14 September | Large Animal Stream | 15.30-16.30: Mock Exam ECVDI LA-Track Answer Session

Erik Wisner

Dr. Wisner is currently a professor of diagnostic imaging & past Chair of the Department of Surgical and Radiological Sciences at the UC Davis School of Veterinary Medicine and holds a joint appointment in the UC Davis, School of Medicine, Department of Radiology. His clinical interests are in computed tomography and magnetic resonance imaging with research interests in selective and targeted contrast media delivery and functional imaging. He has previously served as Associate Hospital Director for Imaging Services in the UC Davis Veterinary Medical Teaching Hospital and as Director of the UC Veterinary Center for Clinical Trials. During his career, he has authored over 140 peer-reviewed journal articles, contributed to more than 25 book chapters, written 1 textbook (Atlas of Small Animal CT & MRI) and has trained over 45 diagnostic imaging residents.

Lecture:
Wednesday 14 September | Small Animal Stream | 13.00-15.00: Mock Exam ECVDI SA-Track Film Reading
Wednesday 14 September | Small Animal Stream | 15.30-16.30: Mock Exam ECVDI SA-Track Answer Session

Invited Lectures: Wednesday 14 September 2022

08.30-09.15: Canine Head Imaging

Tobias Schwarz

The head is one of the most challenging anatomic areas to image, as it contains parts of the central nervous system, the respiratory system, and the alimentary system. Dogs are predators by nature and have a very powerful masticatory system.

Dental Imaging

Intra-oral radiography remains the gold standard for dental imaging in dogs. It provides the highest spatial resolution of all imaging modalities, and this is necessary for the small anatomic structures of interest, such as the periodontal ligament and root canals. However, CT has gained popularity in dental imaging, as it is cross-sectional, provides high bone and dental detail, and is excellent for other conditions causing masticatory diseases, which cannot be diagnosed radiographically. A head CT is performed in under one minute under sedation only, providing information of all teeth. All major dental diseases can be diagnosed with CT. Cone beam CT, which is more cost- and space-efficient, can provide excellent detail for dental and bone structures, but not for the soft tissues.

Masticatory Disease

Masticatory trauma can be successfully imaged radiographically, but CT has the edge in detecting skull and temporomandibular (TMJ) fractures. For conditions such as craniomandibular osteopathy, radiography is sufficient. Masticatory myositis is an immune-mediated disease in young and middle-aged large breed dogs. The muscular changes can be seen in CT and MRI best, CT offering the advantage of optimal viewing of dental structures whereas MRI, allowing imaging of the TMJ disk.

Oral Neoplasia

The standard for detection of oral neoplasia is CT. There are some benign oral neoplasms, such as some epulis tumours, however, the majority is malignant. Unlike in other body parts, oral cavity malignant neoplasia can have features of benign masses and cysts. CT is ideal for searching for local and distal metastatic disease.

Imaging of the Tongue

Ultrasound with a submandibular window is a quick, easy, and cost-effective imaging modality for the tongue, particular neoplasia, abscesses and foreign bodies. CT and MRI can both be applied for lingual imaging.

Salivary Gland Imaging

Radiographic sialography allows identification of the salivary ducts and the larger salivary glands. CT and MRI allow good delineation of all monostomatic salivary glands, but CT sialography allows additional assessment of the salivary ducts. Sialolithiasis, sialadenitis, abscesses, neoplasia and sialocele can be diagnosed. For limbic epilepsy, CT and MRI serve to exclude other potential differentials.

Imaging of the Ears

Radiography was traditionally used to diagnose middle ear disease in dogs, but always had a poor sensitivity and specificity. CT is currently the gold standard for external and middle ear disease and MRI for inner ear disease. It can be difficult to differentiate aggressive otitis from neoplasia and cholesteatoma from other mass lesions. Many brachycephalic dogs have a non-infectious secretory otitis, which currently cannot be differentiated from infectious otitis media. With a trigeminate nerve sheath tumour, there is paralysis and later atrophy of the tensor veli palatini muscle, which together with the levator veli palatini muscle, opens the auditory tube. The inability to open and excrete the middle ear secretions can then lead to an obstructive middle ear effusion (Wessmann et al. 2013 Vet Rec 173, 449). The specific muscle is relatively small but can be identified on MRI images, whereas on CT only the general area of these muscles can be seen as atrophied. Occasionally, dogs can have signs of petrous osteitis associated with an ear infection. This is similar to Gradenigo's syndrome in people (triad of periorbital pain, diplopia and otorrhoea) which was a serious condition before antibiotic treatment availability. For otitis interna, the fibrosis of the cochlea lumen replaces the normal endolymph fluid. On transverse MRI T2 series, the normal cochlea fluid resembles the shape of a rubber duck. The absent duck sign signifies then otitis interna. In CT this is not visible, however osteolysis of the petrous temporal bone also causes erosion of the cochlea and absence of a complete duck-like silhouette of the cochlea. In animals with head tilt, it is therefore important to inspect CT or MRI images of the inner ear carefully.

Conclusions

Detailed anatomic knowledge is helpful in interpreting images of the canine head. Radiography was traditionally used for the imaging work-up of the head, but has been replaced by CT and MRI, due to their higher diagnostic yield. Ultrasound is an excellent imaging modality for accessible soft tissue structures. For CT imaging of the head, a good bone kernel reconstruction and pre- and post-contrast soft tissue kernel images series are essential. MRI has the edge on soft tissue structures of the head and the inner ear but is poor for dental and bone assessment.

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09.15-10.00: Equine Head Imaging

Tiziana Liuti

The equine head is a complex anatomical structure with a myriad of bones and air-filled cavities.
Sinonasal and dental diseases are very common problem, and they can be a serious disorder in horses due to the persistence of the former and the common extension of the latter disease to the supporting bones of the skull.
The diagnosis of equine sinonasal and dental disease can be challenging due to the complexity of the skull and adjacent anatomical structure.

Radiography is an important ancillary modality in the diagnosis of equine head disease: it is currently the standard imaging modality and provides diagnostic information for most equine head disorders.
Nasal discharge, (unilateral or less commonly bilateral), facial swelling, nasal airway obstruction, discharging purulent tracts, are the most common reasons for performing equine skull radiography.
However advanced imaging modalities such as Computed Tomography (CT), Scintigraphy and Magnetic Resonance Imaging (MRI) are increasingly recognized as being of great value in improving the diagnosis and identifying the cause of equine sinonasal, dental, skull and temporomandibular (TMJ) disorders.
The use of cross-sectional imaging eliminates the problem of overlying structures.
CT allows the evaluation of thin slices of the equine head in different planes and allows multiplanar reconstruction for lesion evaluation and possible surgical planning.
CT allows superior visualization of bony structures and therefore is the optimal imaging modality to evaluate the equine paranasal sinuses and nasal cavity.
Nuclear medicine has been used to identify localized sites of bone activity and remodelling in horses.
In the equine head, the main use for scintigraphy is for evaluating dental disease and differentiating primary sinusitis from dental sinusitis. In addition, scintigraphy is useful for identifying bone remodelling caused by degenerative joint disease of the temporomandibular and temporo-hyoid joints, which might not be evident on radiographs.
MRI has been used for evaluation of the normal equine head and for detection of sinonasal disease. MRI provided good details of the oral and nasal cavity, paranasal sinuses and associated structures. MRI appears to be a potentially useful head imaging modality but always requires general anaesthesia, with its inherent high costs and high morbidity and mortality risks.
The TMJ and related structures (middle and inner ear) can be responsible of serious clinical signs in horses like pain, swelling an asymmetry of the face.
Radiology and even more CT are important imaging modalities to determine the location and extension of the disease involving the TMJ and the middle and inner ear.
The lecture will cover the diagnostic imaging modalities and findings in horses affected with head pathologies, in particular affecting the paranasal sinuses, teeth, TMJ and skull.

Dr. Tiziana Liuti
DVM, PhD, Dipl.ECVDI, Pg.CAP, MRCVS, FHEA
Senior Lecturer Diagnostic Imaging
Royal (Dick) School of Veterinary Studies, The University of Edinburgh

10.30-11.15: Feline Head Imaging

Maurizio Longo

In feline patients the region of the head might be challenging to investigate through the available diagnostic imaging techniques, mainly due to the small size of the different anatomical structures and the variable densities of the tissues composing the region.

Therefore, the region of the head is normally investigated using a specific search-pattern which is starting from conventional radiography and further implements advanced imaging techniques such as CT and MRI, depending on the pathology and region of interest.

Radiography of the region requires heavy sedation or general anesthesia to allow a symmetrical positioning of the patient avoiding obliquity artifacts, which might affect the final diagnosis.

A standard examination of the skull should include both lateral, ventrodorsal/dorsoventral and oblique views. If there is a specific interest in the tympanic bullae, additional open-mouth views are indicated to avoid superimposition of the mandible and to allow orthogonal and symmetrical analysis of the bullae shape and opacity (rostrocaudal open-mouth ventrodorsal view with flexion of the neck; ventrodorsal open-mouth view). Otitis and ear polyps appear as areas of increased opacity of the bulla content, with the latter ones more typical of young patients and commonly associated with hyperostosis. The use of CT/MRI with the aid of intravenous contrast medium increases the conspicuity of the lesion through the enhancement of the margins and provides a more accurate analysis of the extension of the pathology.

Similarly, the maxilla, the mandible and the teeth can be investigated via radiology using both orthogonal and oblique views. However, in traumatic patients while radiology is useful for visualizing the mandibular body and dental occlusion, CT was proven to be superior for identification of the anatomy and the related traumatic injuries.

Especially in feline patients, CT with the use of a VetMouseTrap is particularly helpful also for the region of the head to collect a significant amount of information in a limited portion of time, without the use of general anesthesia or sedation.

The use of mouth-gags is not recommended in cats due to high risk of compression of the maxillary arteries and consequently reduced cerebral opacification and temporary blindness. And in fact, maxillary arteries of feline patients represent the major supply for the brain and eyes. Furthermore, in feline patients three types of variation of the internal jugular veins are reported and important to identify, particularly on CT.

The retroarticular processes of cats are small and display a pointed appearance which might be affected by fractures in case of temporo-mandibular joint luxation.

Moreover, cats are characterized by small blind-ended maxillary sinuses and non-compartimentalized frontal sinuses, which are larger in intact male patients.

Dental disease in feline patients is mainly characterized by tooth resorption and periodontal disease. Periodontal disease affects approximately 70% of cats by the age of 2 years and is characterized by lucent periodontal lesions due to widening of the ligament and/or expansion of the alveolar bone. Since 30-50% of mineral component should be lost before a lesion is visible on radiographs, CT and MRI are more accurate modalities to identify and determine the extent of a lesion, particularly in the early stage of the disease.

The most common neoplasia affecting the oral cavity of cats is squamous cell carcinoma, accounting for 60–70% of malignant oral neoplasms. These are locally aggressive tumours displaying mixed osteolysis and bone proliferation, with common infiltration of the maxilla and mandible and secondary tooth loss. PET-CT with fluorodeoxyglucose (FDG) was proven to provide superior definition of the tumour margins compared to CT imaging alone.

Rhinitis and rhinosinusitis are characterized by partial obliteration of the nasal cavities and paranasal sinuses by non-contrast enhancing content, associated with different degree of nasal turbinates loss depending on the chronicity of the lesions. Fungal rhinitis and nasal neoplasia might represent overlapping features and evaluation of the cribriform plate is essential for staging. The nasopharyngeal area might be affected by inflammatory or neoplastic disease, and this is most accurately evaluated via advanced imaging.

Both CT and MRI are particularly helpful to determine the extent of the lesion and target further sampling, which is needed to achieve a final diagnosis.

The neurological system is investigated with CT and MRI. Brain neoplasia is rare in cats, although the probability of a neoplastic lesion increases if neurological signs are present and with the mature age of the patients. The three most common neoplasms affecting the

brain are meningioma, lymphoma and pituitary tumour. A typical feature of meningioma is calvarial hyperostosis, which is caused by infiltration/expansion into the calvarial vault. Lymphoma is more accurately diagnosed with MRI with 70% sensitivity. Multiple neoplasm might be concurrently identified in cats when performing advanced imaging.

Finally, infectious meningoencephalitis is common in cats with FIP coronavirus, Toxoplasma gondii granulomas and fungal disease being frequently diagnosed. Bacterial meningoencephalitis is associated with direct extension of a disease process originating from the middle ear or nasal cavity, rarely of iatrogenic origin such as in case of a bite injury.

Maurizio Longo

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University of Milan Research Fellow
Antech Imaging Service Radiologist
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11.15-12.00: Rabbit Head Imaging

Jenna Richardson

With continued advancements in rabbit medicine and surgery it is now, rightly, expected that rabbits should be provided with the same standard of patient care, diagnostic investigation and treatment options as other companion species.

Diagnostic imaging plays a key role in clinical investigation, with radiography previously being the preferred imaging modality of the rabbit skull.
Computed tomography scanning supercedes this, but availability in general practice, cost and requirement for sedation had made it an inaccessable option to many rabbit owners. Now, CT scanning is common place, not only in referral institutes, but also in many privately owned clinics.
This masterclass will equip you with the knowledge of when CT imaging would be the appropriate modality to use on your patient for investigating diseases involving structures of the skull.
To familiarise yourself, the normal CT anatomical appearance of the middle, external and inner ears and dentition will be explored before considering clinical cases. Case examples will be used with identification of pathological processes, their CT appearance and how the scan images can be useful for assisting in treatments and surgical planning.
By the end of the session you should be confident in what you can diagnose and advise as treatment options in rabbits undergoing a computed tomography scan.

Common diseases that result in rabbits presenting for veterinary assessment include dental disease, upper respiratory tract infections and ear disease. When evaluating the structures of the skull, like in other species, a systematic approach should be taken when interpreting scan images, however it is prudent to be aware of common areas of disease for a particular species. In rabbits, consideration should be given specifically to the dentition, nasal passages, aural structures and temperomandibular joints.

Dentition
To accurately report on dental findings, a thorough knowledge of normal anatomy is required. Rabbits' teeth are open-rooted, displaying constant growth, and are long-crowned (aradicular hypsodont). There are 6 incisor teeth, with a growth rate of

approximately 3mm per week. The four main incisors have curved reserved crowns, most apparent to the maxillary arcade. The main incisors meet at a chisel-shaped occlusal angle, designed for chopping and cutting food. The vestigial second pair of upper incisors are located directly behind the first pair and are known as 'peg teeth'.
As herbivores, rabbits lack canine teeth. Instead they have 'cheek teeth' which refers to both the premolar and molar teeth which are functionally identical. The cheek teeth grind the food into a soft paste, ready to be swallowed. The maxillary cheek teeth are set wider apart than the mandibular cheek teeth, such that only one side of the cheek teeth are in occlusion at any one time. The mandibular cheek teeth grow faster than the maxillary teeth and have a longer clinical crown. There is a disparity between the number of upper and lower cheek teeth due to there being three maxillary premolars and only two mandibular premolars.
This gives rabbits the dental formula of:

2X (Incisors 2/1, Canines 0/0, Premolars 3/2, Molars 3/3)

The oral commissure is small, and the oral cavity long. Cheek folds across the diastema make visualisation of the cheek teeth only possible with the aid of an otoscope in the conscious animal. The tongue is large and has a mobile rostral portion and a relatively fixed thicker caudal portion (torus).
There are four pairs of salivary glands: parotid, submaxillary, sublingual and zygomatic.
In some breeds, skull morphology can lead to an increased prevalence of disease e.g. dwarf breed with mandibular prognathism/maxillary brachygnathism leading to incisor malocclusion with sequelae of secondary cheek teeth disease.

Upper Respiratory Tract
Rabbits are obligate nasal breathers and, as a result, upper respiratory exudates or obstructions as well as damage to the nares or turbinates can be very serious. The nose moves up and down in a normal rabbit ("twitching") 20-120 times a minute, but this will stop when the rabbit is very relaxed or anaesthetised. Open mouthed breathing is a poor prognostic indicator and secondary aerophagia with a mild to moderate gastric bloat can often be seen. Evaluation of the nasal turbinates, sinuses and nasopharynx is important.
The glottis is small and visually obscured by the soft palate. The thoracic cavity is small, relative to the size of animal, and breathing is mainly diaphragmatic.

Ear Disease
Lop-eared rabbits are very popular as pets due to their aesthetically pleasing 'cute' appearance. Unfortunately, however, this anatomical abnormality, paired with stenotic external ear canals predisposes to the accumulation of wax and serum which can then lead to otitis externa. More concerning is the development of secondary ear-base swellings, followed by tympanic membrane rupture, and otitis media.
Depending on the severity of otitis media, treatment is either by a medical or surgical route. Typically grade III and grade IV require surgical intervention due to active lysis of the tympanic bulla.
For otitis externa cases, without lateral distension of the external ear canal, endoscopic or otoscopic guided flushing is recommended. Where marked pouching of the ear bases are present, a surgical stoma can be created to facilitate drainage of the wax and debris, preventing pressure on the tympanic membrane, in an effort to avoid secondary otitis media development. Middle ear disease is a common asymptomatic finding in lop-eared rabbits undergoing CT scanning of the skull.

In rabbits, the use of conscious computed tomography (CT) scanning eliminates the need for manual restraint, with image quality dependent on the stillness of the patient, as movement artefact compromises diagnostic quality. Considering rabbit are a prey species, and therefore primed to hide signs of illness, it is favourable to avoid sedation where possible during investigations.
For ill animals, where lethargy and depression are common presenting signs, reduced activity levels are to be expected, increasing the chance of diagnostic quality CT images

being obtained. At Edinburgh Vet School, rabbits routinely undergo conscious CT scanning. Overall this useful, quick and repeatable modality of diagnostic imaging is extremely useful in rabbit and exotic animal veterinary practice.

Preparations for Scanning

1. Blood draw from the lateral saphenous vein, ideally 1.5ml for routine haematology and biochemistry, however our minimum standard is to evaluate urea and creatinine. As long as there is no concern regarding renal disease, a conscious CT scan with intravenous contrast agent is performed.
2. Contrast is placed through a 26g intravenous cannula in the marginal ear vein.

Intravenous Catheter Placement

1. The fur should be clipped over the marginal ear veins of both ears and EMLA cream applied. Clipping both ears allows for a second attempt to be made at catheter placement should there be a complication with one vein.
2. 10-20 minutes post EMLA application, use spirit to clean the skin surface.
   N.B. Where necessary the patient should be wrapped in a towel to prevent struggling.
3. With an assistant raising the vein by occluding the base of the ear, the ear should be held in one hand, with the catheter held in the other.
   N.B. The catheter should be pre-flushed with heparinized saline to reduce the risk of blood clotting in the catheter.
4. The vein is very superficial and when the bevel of the catheter is through the skin, the angle of the catheter should be almost parallel to the ear.
5. Once in the vein, the stylet and catheter should be advanced approximately 0.3 cm before the catheter only is advanced further. 'Flashback' of blood is not always seen due to the small vessel size. Holding a finger under the ear prevents the ear from bending while the catheter is advanced.
6. Once the catheter is completely in the vein, the stylet is removed and an injection port is attached to the catheter.
7. Tape is used to secure the catheter. It is often helpful to use a rolled-up swab in the external ear canal to support the catheter and maintain the natural shape of the ear.
8. The catheter is flushed to double-check correct positioning and patency. The fluid can often be seen running through the vessels of the ear or can be palpated entering the vessel at the level of the catheter.
9. Further bandaging material can then be added, for security – a single layer of soft ban followed by vet wrap.

Jenna Richardson BVM&S DipECZM (SM) FHEA MRCVS (she/her)
RCVS and EBVS® European Veterinary Specialist in Small Mammal Medicine and Surgery
Senior Lecturer in Rabbit, Exotic Animal and Wildlife Medicine and Surgery
The Royal (Dick) School of Veterinary Studies
The University of Edinburgh

13.00-15.00: Mock Exam ECVDI-SA : "Non-Neurologic Head"

Erik Wisner and Silke Hecht

This Mock Exam session is targeted at ECVDI residents and is intended to provide preparation for the practical part of the board examination. Participants will be presented with a variety of cases of non-neurologic conditions of the head in small animals (predominantly dogs and cats), including but not limited to congenital, traumatic, inflammatory and neoplastic diseases of the skull, nasal cavity and paranasal sinuses, teeth

and tympanic bullae. The predominant modalities will be radiography and/or cross-sectional imaging (computed tomography, magnetic resonance imaging). During the first part of the session residents will be presented with cases on individual computers and will write reports. The second part of the session will be an interactive discussion of the cases, providing residents with the chance to assess their own performance and ask questions.

13.00-15.00: Mock Exam ECVDI LA-Track Film Reading

Tiziana Liuti & Sarah Taylor

Invited Lectures: Thursday 15 September 2022

08.30-09.15: Imaging of Human Dementia

Joanna Wardlaw

Dementia is most commonly a condition of older age and most dementias show mixed, rather than a solitary, pathology are contributing to the clinical expression of cognitive impairment. The commonest dementia is Alzheimer's disease with vascular dementia a close second and much overlap between these two. Clinical neuroimaging methods (CT, MRI, molecular imaging eg PET) can demonstrate features that are thought to be related to specific dementias, but often several features are present, and research needs to assess these features together. There is also a wide range of normal changes in the brain with advancing age that should be considered when assessing an individual. This short talk will consider neuroimaging features that are associated with various forms of dementia and their overlap and potential relevance to dementias in other mammals.

Prof JM Wardlaw

CBE, MB ChB(Hons), MD, FRCR, FRCP, FMedSci, FRSE

Professor of Applied Neuroimaging,
Honorary Consultant Neuroradiologist
Head of Division, Neuroimaging Sciences
Director, Edinburgh Imaging
Foundation Chair, UK Dementia Research Institute
University of Edinburgh and NHS Lothian

09.25-10.30: CT in the small animal orthopaedic patient

Susanne Boroffka

Radiography is usually the first diagnostic imaging modality used in orthopedic patients. In small animal's diagnostic work up of musculoskeletal disorders may be challenging using only radiographs. CT examinations are used to further differentiate disease processes, such as congenital and developmental disorders, degenerative, traumatic, inflammatory, neoplastic, and metabolic diseases.

Different diagnostic imaging techniques, such as ultrasonography, scintigraphy CT or MRI may be used, alone or in any combination depending on the history, clinical findings and questions to be answered concerning the patient. Strengths and limitations of a diagnostic imaging technique, availability, radiation hazards, and costs (cost-effectiveness) need to be considered making the best choice.

CT is primarily used in the evaluation for bone disorders and is useful to visualize complicated fractures (joints, pelvis) preoperatively, especially a three-dimensional CT-reconstruction may be very helpful for the surgeon planning the surgery. Also, malformations and developmental disorders of complex joints is best evaluated with CT, for instance in the screening for a fragmented medial coronoid process, sensitivity of radiographs is below 50%, whereas CT has a sensitivity and specificity close to 100%. Other indications for CT are the characterization and assessment of the extent of primary bone tumors or bone affecting tumor's preoperatively or pre-radiation-therapy.

Dr. Susanne AEB Boroffka,
DECVDI, PhD, Dr. med. vet.
Boroffka Diagnostic Imaging, the Netherlands

09.25-10.30: Mindfulness for the busy Radiologists

Petra Agthe

Over the last two decades, mindfulness has become increasingly popular in Western culture, and there is now a large body of evidence in modern neuroscience and psychology demonstrating its positive effects. Despite this, mindfulness is commonly misunderstood and undervalued, being often incorrectly simplified to a relaxation technique, confused with positive thinking or only savouring the positive things in life.

One of the reasons for this misinterpretation is that it is difficult to define mindfulness, as the term can describe a variety of concepts, such as a state of mind, a personality trait or a form of mental practice (such as for example, but not exclusively, meditation).[1] Mindfulness, as a mental practice, could be described as training to pay attention *in a particular way*: namely, with an attitude of openness, curiosity and acceptance.[2]

So why should we, as diagnostic imagers (and human beings), engage in the practice of mindfulness? Well, there are many good reasons. Mindfulness-based interventions have been shown to have a positive effect on mental health (including reduced levels of stress, anxiety and depression, and improved emotion regulation), improved physical health (including positive effects on the cardiovascular system and when living with chronic pain), improved social relationships and increased prosocial behaviour, and enhanced cognitive performance (including increased ability to focus, improved executive function, working memory, cognitive flexibility and body awareness), as well as an overall increased resilience.[2-7]

There is, of course, an argument that it is the largely the responsibility of organisations and systems to reduce stress on individual workers, as the stress is often caused by a mismatch between unreasonable demands of the modern veterinary work place and normal physiological and psychological human needs. For example, many of the mental challenges that we are facing nowadays can be at least partially explained by the fact that our brains were not designed to operate in such a complex environment- and they did certainly not evolve to work in a busy veterinary hospital with multiple demands coming towards us from different directions, regularly having difficult conversations with co-workers and/or to sit in front of a computer and performing high level cognitive work for prolonged periods of time, often exceeding a regular 8 hour working day.

However, while it is undisputed that organizational, systemic and cultural changes need to take place, these take time and may not address all aspects of work life. Therefore, individuals may choose to engage in mindfulness practice in order to take charge of their own wellbeing and work performance, and to allow them to deal with the challenges of the modern work place in more helpful and self-supportive ways.

Modern neuroscience has managed to shed some light onto some of the underlying neural processes of mindfulness practice. Our decision making is often influenced by subconscious factors and we can fall into unhelpful ruts and habits, particularly when we are stressed and/or encounter difficult external circumstances. We commonly spend a lot of our time on 'autopilot', which is a state of mind wandering where we often experience a lower level of wellbeing and tend to react automatically rather than having a conscious and intentional response. Functional magnetic resonance imaging (fMRI) studies have shown that this state of mind wandering is associated with activation of a neural network called the Default Mode Network. On the other hand, when our brain is in a mindful state, and/or deliberately and consciously engaged in an activity, the Task Positive Network is activated; this network is anticorrelated to the Default Mode Network.[2,8]

Furthermore, fMRI studies have also demonstrated that changing our thought and behavioural patterns can over time literally change our brain by creating and strengthening new neural pathways- an effect known as neuroplasticity.[2,5,6,8] One direct way to directly access neuroplasticity is to engage in regular mindfulness training. This deliberate way of exercising and strengthening helpful neural pathways, has been likened to intentionally strengthen certain muscle groups in the gym. Effects of positive neuroplasticity through regular meditation practice have been demonstrated in multiple brain areas including the prefrontal cortex, the insula, the hippocampus, the cingulate cortex, and the amygdala. The changes in these areas are associated with increased attention regulation, body awareness, and improved emotion regulation.[2,6]

Mindfulness can be practiced in different ways. Directly connecting with our five senses (noticing what we see, hear, smell, taste and feel) is one of the simplest and easiest ways to practice mindfulness. While there is a consensus that formal meditation practice is likely to offer the most tangible effects, it is also possible to practice mindfulness in the flow of our daily lives. Even when engaging in formal meditation, the aim is not to become better in meditation, but to find better ways of living, by becoming more fully aware of what is going on around us (our external experiences), our thoughts, emotions, motivations (our internal experiences) and our actions (where we can shift from a place of automatic reaction to a more deliberate and intentional response).[3,4]

The best way to learn to practice mindfulness and meditation is to sign up to a course led by an experienced teacher (e.g. an 8 week Mindfulness-Based Stress Reduction course), but there are also many helpful meditation Apps and other online resources.

In this workshop, we will be reviewing some of the underlying principles of mindfulness and then 'dip our toes' into simple mindfulness practices which can be used even in the busiest working day in imaging practice.

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11.00-11.30: What the veterinary radiologist needs to know about exotic animals

Jenna Richardson

Exotic animal patients commonly present to the veterinary clinic debilitated and requiring urgent veterinary treatment. This is often due to a variety of factors including owner inexperience at recognising signs of disease and identifying abnormal behaviour, as well as the ability of the animal to mask clinical signs of disease.

Particularly in prey species, handling for physical examination, when already in a compromised health state, can be detrimental and even life threatening to the patient. Understandably, performing diagnostic investigations that require manual restraint or a general anaesthetic in such a patient increases the risk of further deterioration or even death.

While both ultrasound and radiography can be performed conscious in the majority of exotic pet species, both typically require manual restraint, which can cause considerable stress to the patient. Furthermore, the quality of the radiographic images, and therefore ability to obtain a diagnosis, is dependent on the appropriate position of the patient, as well as the patient size. Conscious radiography often results in the superimposition of soft tissue and musculoskeletal structures which impedes diagnosis.

At Edinburgh Vet School, while we still commonly use ultrasound and radiography for appropriate cases, there is an ever growing demand for the use of conscious computed tomography scanning. With the use of the VetMousetrap™ device, over 95% of rabbit patients requiring CT evaluation undergo conscious scans. For debilitated patients, where lethargy and depression are common presenting signs, reduced activity levels are to be expected, which reduces the risk of movement artefact. The concurrent use of intravenous contrast agent, further enhances the quality of images obtained.
Overall this useful, quick and repeatable modality of diagnostic imaging is extremely useful in rabbit and exotic animal species.
Due to the increased numbers of rabbits undergoing CT scans at our clinic in recent years, our understanding of common subclinical diseases has vastly improved. The CT images have provided valuable information, not only regarding the disease process being investigated but also, in a large proportion of cases, other subclinical diseases, one of the most common being otitis media. This has led to alterations in our clinical approach to cases and pain management strategies for patients.
Whole body and high definition CT scans provide a wealth of information in clinical practice, with many diseases being identified and treated before causing significant welfare concerns for the rabbit patient. The routine use of intravenous contrast further promotes our understanding of many conditions and allows for more accurate diagnosis and surgical planning.

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11.40-12.20: It is a shoulder lameness but radiographs are normal: What ultrasound can tell us

Giliola Spattini

Musculoskeletal ultrasound (US) is a rapidly growing field within the veterinary caseload. Ultrasound has been commonly used in equine and human medicine and is becoming routinely performed in small animal patients, due to the increased soft tissue injuries, especially in high-level sportive dogs and chronically osteoarthritic patients. Agility, disk dog, obedience, dance dog, and sheepdog are some of the fast-growing canine spots, and with the increased performance, there is a higher risk for teno-muscular injuries. In athletes, both acute (with muscle tear and tendon strain being the most common) and chronic, due to overuse injuries could be present. Ultrasound should never be the first diagnostic imaging modality for them, but should always be performed after a specialized orthopedic and radiographic evaluation. Sportive patients often have a negative or ambiguous orthopedic evaluation and are within normal limits radiographs. They often became sound with rest and relapsed as soon as they go back to work. The knowledge of the chronic changes induced by these sports is fundamental for the ultrasonographer that wants to deal with sportive patients. For example, the chronic overuse of supraspinatus tendon in patients performing agility often increases the size of the fibro-cartilaginous humeral insertion, which affects the biceps tendon mobility (Fig. 1). Repeated minor hemorrhages are common, often becoming mineralized spots. These changes are often not painful and of no clinical meaning until the increased size entraps the shoulder articular capsule and the underlying biceps tendon. The friction of these two structures naturally close, but that shouldn't interfere, can determine a different range of damages, from acute tendonitis on the biceps or supraspinatus tendon to partial tendinous rupture. It is not difficult to diagnose a damaged or inflamed tendon, but if the treatment is only aimed at recovering the damage and not reducing the diameter of the supraspinatus insertion, the patient will be back to being lame as soon as will start training. The orthopedic surgeon, the physiotherapist, and the ultrasonographer need to have a medical discussion to propose a proper treatment plan. A change in sportive protocol and training could be necessary to avoid excessive overload on the supraspinatus tendon and recurrence of the lesions.

Another class of patients in which US can play a relevant role in diagnosis and planning treatment are patients with chronic elbow osteoarthrosis. The change in posture due to the decreased elbow ROM (range of motion) and chronic pain results in altered gait balance and pressures. Because of that, over time, a lot of patients develop shoulder or carpal acute or chronic tendonitis. That usually will result in a severe worsening of their pain condition with failed response to NSAD. Again the radiographic study of the shoulders will be unremarkable, but the pain will be present on physical examination. Physiotherapists

are usually involved in the pain management of arthritic patients, but their treatment will be more efficient if the correct diagnosis is made. The US can define which structures need treatment and is particularly useful in pain management by delivering ultrasound-guided medications. There are several advantages and disadvantages associated with US in this field.

The US is relatively cheap, available, and doesn't require sedation unless the patient is restless and is accurate in differentiating an acute from a chronic tendon or muscle injury. Unfortunately, the US is operator-dependent, and a long learning curve is needed to make this modality the toll that needs to be.

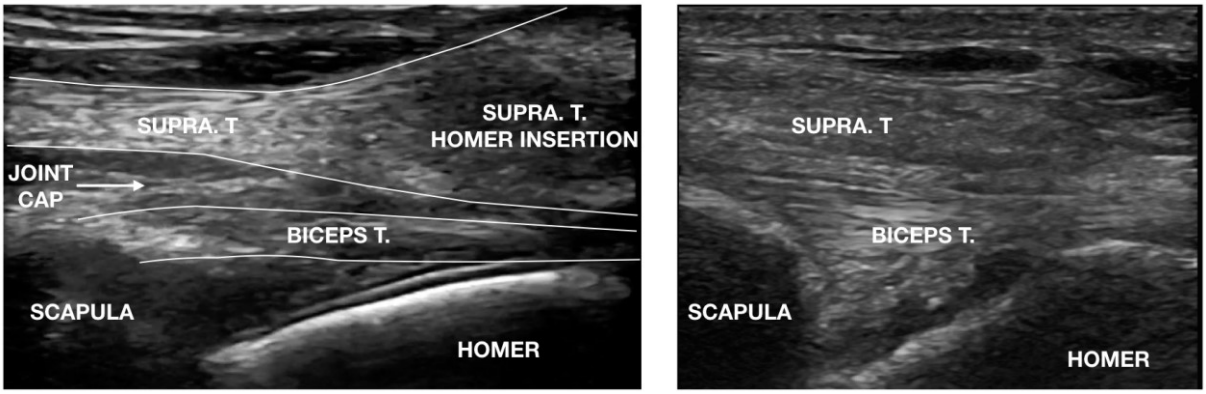

Fig. 1) Example of a within normal range shoulder compared with a sportive patient with chronic supraspinatus tendinopathy and adhesion with the joint capsule and biceps tendon. This condition causes severe lameness in the morning that reduces with mild exercise but worsened with more. A) Normal shoulder, B) affected shoulder.

12.20 - 13.00: Stiff gait in athletic dogs. How to diagnose rear limb diseases ultrasonographically

Giliola Spattini

Hindlimbs lameness can be due to a wide range of diseases. With the increased workload of competing patients, there are increased cases of subtle and chronic changes. These conditions are not so severe to cause lameness but are enough to cause abnormal gait, mainly due to reduction of limbs extension and consequent reduction in competition results. These patients can be a frustration for orthopedic surgeons. They often have a negative physical examination, and it is not easy to detect the cause of pain and lameness. Rarely radiology can be of diagnostic value if the origin of the pain is related to overuse of tendon, muscles, or joints or with acute injuries of the soft tissues. Ultrasound (US) can be of great help if the ultrasonographer is aware of the most common chronic overuse conditions. There is the need to understand which lesions could be related to a specific sport and what are the most common causes responsible for acute tendonitis, strain tendon, or ligament sprain. Scattering artifact is commonly seen on ultrasound and

is extremely specific and sensible to detect inflammation. US should be considered as an extension of an accurate clinical evaluation. The US is dynamic and allows to scan the patient in real-time. Checking the muscles and tendons while the patient is flexing or extending the leg allowed to diagnose adhesions and subtle teno-muscular conditions. Another advanced is that US can easily see and check the fascial planes between the muscles, often interested in chronic overused lesions. Muscle is responsible for generating power but is not able to generate motion. Motion is generated when the muscles are linked together. The fascial planes apparatus is responsible for that. Fascias are too thin to be palpated and only seen as static structures in MRI. The US can check if the fascial planes can move and if thickening, inflammation, or lesion at the fascial planes could cause the decreased performance of the sportive patients. Ileo-psoas injuries are one of the most commonly over-diagnosed conditions in dogs. In the author's experience, at least two-third of the patient clinically diagnosed with ileo-psoas injury have a fascial blockage that reduces the caudal extension of the hip joints. Gracilis, semitendinosus, and semimembranosus myopathy is an easy diagnosis when the condition is end-stage due to the typical duck gait and firm consistency of the muscle on physical examination. Early diagnosis dramatically changes the outcome of the patient due to the possibility of stopping the progression of muscle fibrosis and loss of proper leg function. US is very accurate in finding focal loss of muscle fibers alignment and early diagnosis of this condition (Fig. 1). US hold good promises in the possibility of staging for muscle fibrosis, but more studies are needed in that regard.

US has an equivocal rule in the diagnosis of a cranial cruciate ligament rupture. A total rupture is a clinical and radiographic diagnosis and US is not needed. A partial rupture could be clinically challenging to diagnose. The US can define the rule of the stifle in the present mild lameness or abnormal gain and ruled in or out other teno-muscular components for the gait changes in the patient. The major disadvantage of the US is that it is operator-dependent, and a learning curve is needed to increase the accuracy of the examination. There is a lack of papers, books, and learning material in that regard, but the increasing interest in this topic is promising.

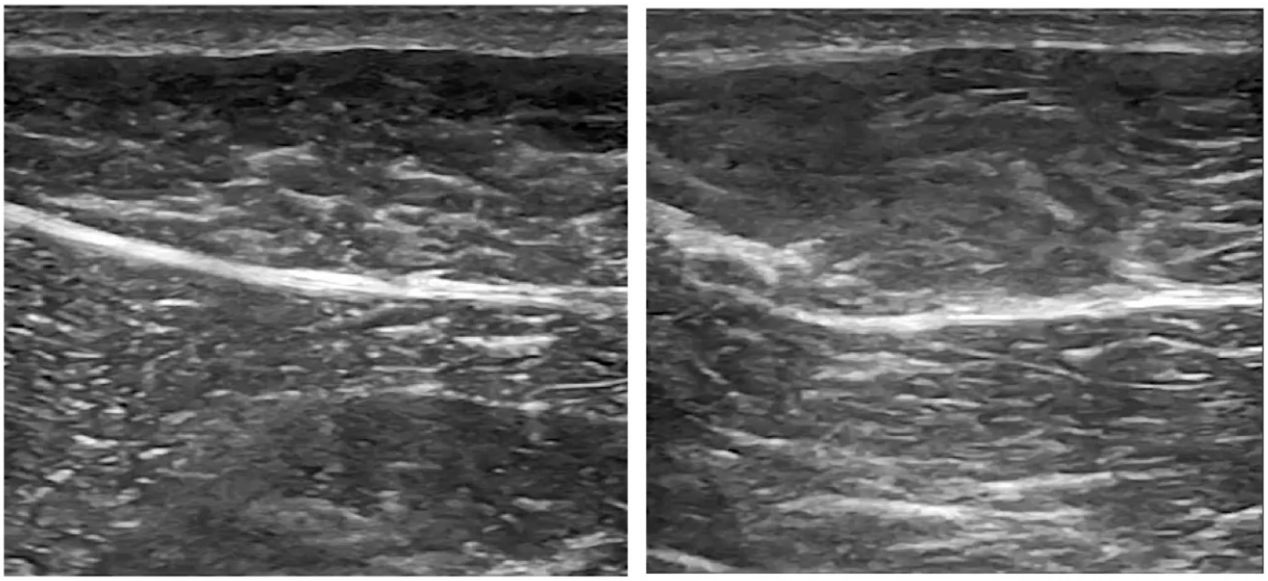

Fig. 1) Gracilis muscles in a Doberman of 6 years old with six months history of abnormal gain on the left hind limb. Wobbler disease was suspected, an MRI of the cervical spine was performed with negative results. The dog was progressively worsening. The orthopedic surgeon had a negative physical examination, and the radiographs were unremarkable. He asked for an ultrasound examination that showed early

disarrangement of the left gracilis muscle fibers. An early phase of a gracilis myopathy was suspected and confirmed over time. The dog improved with physical therapy. A) Normal right gracilis, B) Left gracilis with signs of gracilis myopathy.

14.00-14.45: Radiation Oncology & Radiology: Mutual Perspectives

Sarah Mason

The aim of external beam radiation therapy (EBRT) is to target local disease with radiation that conforms to the target while minimising dose to the organs at risk. Advanced imaging is crucial in determining the tumour volume to be irradiated and the organs at risk to be considered.

As the speciality of radiation oncology expands and more specialist centres are accessible clients can now easily access facilities and information via the internet and the appetite for radiotherapy for pets is growing. Modern radiation techniques and the growth of the discipline in Europe allows us to deliver safe and more accurate treatments and to offer a variety of treatment options.

This presentation will introduce the equipment and treatment planning process used in radiation therapy and discuss the collaboration between the radiation oncologist and the radiologist.

How can radiologists and radiation oncologists work together to streamline and maximise patient outcomes?

A mutual understanding of tumour biology, and the type and intent of radiation treatment is important in using advanced imaging acquisition to maximise patient outcomes. Effective communication between the radiologist and radiation oncologist is essential to ensure the imaging modality and positioning of the patient are appropriate for the planned staging and treatment planning.

What do radiologists need to know about the tools of the radiation oncologists, what is the newest thing, and how do you use it?

Tools: Our workhorse is the Linear Accelerator (Linac), which delivers the treatment and has in built imaging for daily positioning checks. Traditionally this was MV portal imaging, but machines now typically have built in kV capabilities. The multileaf collimator (MLC) is built into the head of the Linac and allows precise shaping of the radiation beam to deliver high radiation doses to the tumour while minimising the dose to the organs at risk.

The Linac gantry and MLC rotate around the patient to allow radiation beams to be delivered from different angles and in some types of radiation such as intensity modulated radiation therapy (IMRT) and volume modulated arc therapy (VMAT) these movements may be continuous during beam delivery.

Treatment planning: Before treatment is delivered a treatment planning CT is obtained using a diagnostic CT scanner and these DICOM images are loaded into the Treatment Planning Software (TPS) computer. Any diagnostic MRI's or pre-surgical CTs are also imported and registered to the planning CT to create a set of images for radiation treatment planning.

CT is used for treatment planning as CT numbers can be correlated with tissue density pixel by pixel allowing heterogeneity corrections in treatment planning. In human radiation therapy some machines can treat from MRI plans, but this is unlikely to develop in veterinary radiation soon.

The most important aspects of the planning CT are to have the patient positioned as accurately and reproducibly as possible. To ensure there is a "set-up" marker to enable us to find the set-up point when formulating the treatment plan and to ensure that no artefacts are present, and that all positioning devices are recorded accurately in the file and labelled with the patients' details. It is also essential that the images are reconstructed with at least 1cm of distance around the skin in case we need to add bolus to the plan which is included in the dose calculations. Planning CTs should be supervised by a member of the radiation team.

The lasers in the CT room should be accurately calibrated to those in the radiation bunker and used to align the patient in the positioning equipment. Patient positioning marks include radiodense markers on the patient or equipment, and the patient themselves may be marked to help us in treatment positioning. We highlight surgical scars with Omnipaque™ to assist with accurate contouring.

The first step in computer treatment planning is contouring. First the organs at risk (OAR) are contoured. Then the gross tumour volume (GTV), and or/clinical target volume (CTV) are created and finally a margin of error known as the planning target volume (PTV) is added. When the radiation oncologist is happy with the contouring, the treatment plan is created either by forward (manual) or inverse (computer algorithm) techniques.

On completion of the treatment plan, digitally reconstructed set up radiographs (DRRs) are created from the three-dimensional images and are used to assist in accurate positioning of the patient for treatment.

Positioning devices for the planning CT and treatment require a flat diagnostic CT couch top and may include vacbags, bite blocks, thermoplastic masks or tissue equivalent bolus, the latter of which is used to build the radiation dose up to skin, when required.

Treatment delivery: On-board imaging is key to delivering accurate radiation treatment. The most basic is the electronic portal imaging device (EPID) which uses MV photons from the Linac to create images. These MV images (portal films) are most useful for bony landmarks and the less intense/larger field treatments such as palliative intent protocols or standard 3D treatments. Many Linacs now have a built-in kV radiography and cone beam CT (CBCT), allowing better soft tissue visualisation, which allows accurate assessment of the patient's day to day position and helps the radiation oncologist to see any shifts in the organs at risk (for example bladder or colon moving into the treatment field) or changes in the tumour which may necessitate a plan modification or positional "shift". CBCT does not have the accuracy of a diagnostic CT machine due to lower resolution and is rarely used for initial planning CTs, rather, occasionally for re-plans during treatment.

What does the radiation oncologist need from the radiologist, and vice versa. What should radiation oncologists know about our toys and our methods of work.

A good working relationship is vital for the radiologist/radiation oncologist team. Reports should include detail of enlarged/contrast enhancing lymph nodes and a description of the likelihood of these being metastatic. For MRI we need information on what is likely to be tumour infiltration versus inflammation/blood/fluid as we use this to guide contouring and plan our treatment volumes.

Radiation oncologists need to have a good understanding of CT image acquisition and interpretation and a working knowledge and ability to interpret MRI; this is obtained during training and through experience as contouring skills are developed. The radiologist plays a significant role in training the radiation oncologist in the rotation weeks designated for advanced imaging.

In human radiation therapy, several advanced imaging modalities which are required to produce the most accurate treatment plan are obtained in the radiation centre, to achieve the best results for patients. Due to constraints in veterinary patients (financial, owner reluctance to have multiple appointments/procedures) we do not always have the luxury of this, e.g., CT and MRI, and especially in cases where the diagnosis, and/or surgery were made in another centre we often rely on diagnostic advanced imaging studies performed there.

Useful References

Khans Treatment Planning in Radiation Oncology, Fourth edition. Wolters Kluwer

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14.55 - 16.00: When is MRI useful in small animal musculoskeletal cases?

Ines Carrera

Magnetic resonance imaging (MRI) is widely used in Veterinary medicine nowadays and the exquisite soft tissue detail that MRI provides is superior than any other imaging modality. When referring to musculoskeletal disease, MRI allows fine detail for the assessment of tendons, ligaments, subchondral bone and in some cases articular cartilage, joint space, bone marrow, muscles and nerves.

As a general rule, MRI is not the first modality of choice for musculoskeletal cases. In order to get the maximum information from an MRI study, a detailed orthopaedic and neurological examination should be performed, together with lack of diagnosis in other imaging modalities. This will allow to narrow down the clinical suspicion to some specific musculoskeletal diseases, and hence, the radiologist can target or focus the MRI examination in those specific clinical suspicions.

This lecture will include an introduction of general MRI protocols for musculoskeletal diseases; followed by several clinical examples in which MRI was very helpful to reach the final diagnosis and/or implement the correct treatment. The clinical cases will include several joint and bone pathologies (such as tendon and ligament injuries, subchondral disease, meniscal injuries, infections and neoplasias), as well as soft tissue/muscle conditions (such as myositis, contractures), and peripheral nerve diseases.

14.55 - 16.00: Empathy-Focused Radiology Reporting

Tobias Schwarz

Introduction
The radiologist's world is changing in the face of artificial intelligence (AI) and a general move towards a technicised medial professional environment and life in general. This workshop is an attempt to adapt to this new world to maintain or profession as viable and meaningful.

Artificial Intelligence and the Radiologist Profession

AI is making inroads into radiologic interpretation in veterinary medicine, and this will soon have an impact on our profession. The straightforward task is to change reporting hierarchies and workflows, allowing radiologists to process more reports with the help of AI. This workshop will not deal with this issue, which boils down to a quantitative task. Instead, we will exam the qualitative aspects of radiology reporting. We need to find a new *raison d'être* for us, focussing on what we as humans can deliver best providing *human intelligence.*

Omissions in the Past

Looking back on the pre-digital world of radiology, we established some reporting habits and rules, which were not particularly helpful for communicating with our audience. A radiology report was often used as a bureaucratic and legalistic tool. Our language was and still is often overcomplicated. For instance, something too dark is called hyperlucency (in German Aufhellung = brightening), hypoattenuating, hypoechoic, or hypointense. Maybe more importantly, we established rules, such as the *Röntgen signs*, which were to be followed in a completely analytic and unbiased way, suppressing any intuitive thinking. But in daily praxis, radiologists at every level follow their intuitions first and foremost (pattern recognition) and then retrofit the *Röntgen signs* to match their expectations. That discrepancy has never been fully addressed in our profession. In order for us to communicate with our audience better, we need to accept our essential human traits, work with them, and get the best out of our human intelligence.

Human Bias and Noise

The work of Daniel Kahneman, who established the discipline of behavioural economics and received the Nobel Prize in 2009, has revolutionised the way we now understand human judgement and decision making. *System 1 thinking* is our intuitive brain function. It is very quick, eager to work and based on stereotypes. This introduces **biases** in our judgement, which are mostly correct, but occasionally wrong. *System 2 thinking* is our analytic brain function. It is slow, not eager to work and exhausting to use. It does provide an analytic and rational analysis, but it is more difficult to engage with.

Pattern recognition (system 1 thinking) is a daily subconscious radiologist activity that cannot be simply switched off. It is therefore best to acknowledge it and engage with it. One way to do this is to first approach an imaging study intuitively and then reflect on it (system 2 thinking). We will go through an example how to do this. Other techniques include blinding yourself to certain clinical information at the onset of the interpretation process.

Human judgement is prone to many types of **noise** (inter-observer, intra-observer, group-specific noise) whereas AI is noise-free. To improve our performance as radiologists, certain techniques can be used, such as using average scores of multiple observers or using pre-defined ranges.

Measurements in Radiology Reports

Digital imaging has amplified the number of measurements included in our reports, because it is easy to do. In our patient populations, normal ranges are difficult to establish. Often these measurements are meaningless because they do not allow categorisation of borderline cases and are superfluous in obvious cases. In many organs, size is just one of many important factors, so a normally sized organ can be abnormal, and an abnormally sized organ can be normal.

However, the readers of our reports subconsciously put more meaning into numbers than into descriptions, creating a false sense of accuracy. Therefore, we should de-emphasize measurements and emphasise descriptions in our reports.

Radiology Report as a Conversation

Conversation can be seen as companionship, and this is an essential human trait that has not changed over centuries (Radtke 2021). It is similar across cultures and is structured as a complex moderation of messages based on immediate feedback. This keeps the speakers in tune and in check within the group and allows us to optimise our decisions based on the group feedback. Collaboration is the most important aspect of the

conversation. It is this conversational aspect that our audience, the clinical veterinarians, is seeking, just as we are. What we need to do is to humanise our role as veterinary radiologists using this basic human trait.

Empathy-Focused Reporting
We can create a more meaningful radiology report by structuring our findings more clearly into likely relevant, equivocal, and likely irrelevant findings, avoid measurement and promote human judgements and give advice in every report. We need to listen to the question clinicians ask and read between the lines for unasked questions. We should put ourselves into the shoes of the clinical veterinarian: How can I help this veterinarian? What would I do if this was my animal? The aim is to create a report with more reflection and communication. We will do several exercises to practise this.

Non-Core Radiology Advice
In order to reach a meaningful connection with our audience we need to leave our comfort zone and consider giving non-core-radiology advice. Many other veterinary discipline specialists do this on a daily basis. In doing and educating ourselves on the fringe areas of our professional competence, we will grow as humans and as specialist and will provide more meaningful advice. The key is to honestly phrase what our competence level is for a particular advice. This can be phrased as a peer-to-peer advice to appropriately reflect this.

Conclusions
Radiologists need to re-shape their interactions with clinical radiologists including our reports. The most value we bring to the table in the modern age is the combination of skills, knowledge, and empathy, but not overtly technical and complicated sterile reporting. We need to understand and manage the subconscious biases we and our audience have. We should engage in the art of conversation. After all, radiology is 50% science and 50% an art. We should re-emphasize the art of radiology.

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16.30-17.00: Interactive small animal case review

Susanne Boroffka

Radiography is usually the first diagnostic imaging modality used in orthopedic patients. In small animal's diagnostic work up of musculoskeletal disorders may be challenging using only radiographs. CT examinations are used to further differentiate disease processes, such as congenital and developmental disorders, degenerative, traumatic, inflammatory, neoplastic, and metabolic diseases.

Different diagnostic imaging techniques, such as ultrasonography, scintigraphy CT or MRI may be used, alone or in any combination depending on the history, clinical findings and questions to be answered concerning the patient. Strengths and limitations of a diagnostic imaging technique, availability, radiation hazards, and costs (cost-effectiveness) need to be considered making the best choice.

CT is primarily used in the evaluation for bone disorders and is useful to visualize complicated fractures (joints, pelvis) preoperatively, especially a three-dimensional CT-reconstruction may be very helpful for the surgeon planning the surgery. Also, malformations and developmental disorders of complex joints is best evaluated with CT, for instance in the screening for a fragmented medial coronoid process, sensitivity of radiographs is below 50%, whereas CT has a sensitivity and specificity close to 100%. Other indications for CT are the characterization and assessment of the extent of primary bone tumors or bone affecting tumor's preoperatively or pre-radiation-therapy.

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16.30-17.00: Client expectations and reality in human and veterinary radiation oncology

Magdalena Parys

The diagnosis of the cancer causes significant distress in human patients, pets' owners and their family members. Further anxiety is due to many unknowns, mainly related to what to expect from the treatment, its efficacy and side effects. In addition, nervousness related to time, travels and costs. Fears and misconceptions regarding RT have been identified by patients as factor why some would not even consider this option. Sadly, people are unaware of advances in the RT field. The modern technology assists radiation oncologist, to be much more accurate, leading to the treatments being safer and more effective. We, as veterinarians can learn a lot from human cancer patients' expectations and experience. This presentation will provide an overview over what we know to date regarding expectations and experience in human and veterinary radiation oncology. Additionally valuable points from human cancer patients and the current techniques of communication, implemented in human medicine will be presented, so that they be potentially introduced into veterinary medicine.

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Roslin, Midlothian
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Invited Lectures: Friday 16 September 2022

08.30-09.15: The Story of Radiopaedia

Jeremy Jones

Radiopaedia's mission is to create the best radiology reference the world has ever seen and to make it available for free, for ever, for all.

During this keynote, we will hear the origin story of Radiopaedia, a story of growth and the challenges that that growth has brought. I'll explain where we are now and discuss some of the plans for the future.

You'll hear about the different parts of Radiopaedia and how it is used day-to-day by individuals, and how we have developed the system to help deliver regional, national and international teaching and training.

09.25-10.30: Aquatic Species Imaging

Sophie Dennison

Aquatic animals present a unique and often challenging series of considerations when diagnostic imaging is indicated for clinical concerns. In addition to transportation, handling and size/weight considerations, fish have unique anatomy, pinnipeds and cetacea have varying anatomical adaptations, as well as physiological adaptations, for the water and diving, and fish and cetaceans are aquatic-obligate with fish requiring water over their gills to respire.

Diagnostic imaging in fish is growing in use for both the aquarium and pet fish collections. Fish have unique anatomy with some variation among species. The most common reasons for imaging are buoyancy disorders although imaging may also be employed to investigate 'bloating', masses, scoliosis, and disorders of the wen of ornamental oranda goldfish. Diagnostic imaging modalities that are most commonly utilised are radiographs (survey and contrast studies) and CT. Ultrasound and MRI are used less frequently. Fish may be adequately restrained in a small tub or bag of aquarium water for imaging provided movement is restricted and the fish does not become unduly stressed. Anaesthesia can be used.

Diagnostic imaging in turtles is used for pets, zoo and aquarium collections and free ranging animals both that strand and enter rehabilitation and that are captured for health assessments. Turtles have unique a unique skeletal anatomy that creates many challenges for imaging, although all modalities can be used. Some species of turtle grow extremely large and may be too large or too heavy for diagnostic quality radiographs or to use CT or MRI. Turtles may be adequately restrained using radiolucent tubs, by perching the carapace on a radiolucent structure such as a foam pad so the appendicular skeleton cannot gain traction, by shackling the front flippers to the shell +/- wrapping the hind flippers with vet wrap to immobilize, or using chemical restraint. Common reasons for imaging include shell pathology/trauma, lameness, fish hook interactions, respiratory disease, buoyancy disorders, follicular stasis/reproductive disease, and in free ranging sea turtles, fibropapillomatosis.

Diagnostic imaging in pinnipeds is used for captive maintained, free-ranging animals in rehabilitation, and is being employed under some circumstances point of care for stranded animals and during research/health assessment captures in free ranging colonies. Pinnipeds are slightly easier to handle than other aquatic animals as they are not aquatic-obligate. Common species that frequently undergo diagnostic imaging include seals (harbor seals, common seals, grey seals, fur seals, northern elephant seals), sea lions (California sea lions, South American sea lions, Steller sea lions), and walrus. Notable anatomical

variations are the dense nasal and ethmoid turbinates that completely fill the nasal cavity without cavernous sinuses being present, the aortic bulb or windkessel, the large hepatic venous sinus, and the reniculate kidneys. Walrus also have tusks (modified canine teeth) and pharyngeal air sacs. Reasons for the use of diagnostic imaging are broad-ranging with common causes for examination including respiratory disease, poor body condition, trauma, blindness, signs of pain and neurological disease and pregnancy examinations among others. All modalities can be used, although some limitations do exist due to size and weight. Captive-maintained animals can frequently be trained for voluntary radiographs and ultrasound, but anaesthesia is needed for advanced imaging, and for free-ranging animals.

Diagnostic imaging in cetaceans is also used for captive maintained, free-ranging animals in rehabilitation and point of care for free-ranging stranded or during health assessment captures. Cetaceans are aquatic-obligate and while captive-maintained animals can be trained and become acclimated to periods of time out of the water, being 'stranded' is extremely stressful on free-ranging animals with catecholamine storms, lung compression and myopathy of great concern. The upper respiratory tract of cetaceans is unique and varies among species, and other anatomical variations include varied vascular rete for shunting during diving, reniculate kidneys, a large hepatic venous sinus, aortic bulb or windkessel, three-chamber stomach, and duodenal bulb. Dolphins communicate and can hear in both sonic and ultrasonic ranges, which can make ultrasound very noisy and stressful for non-acclimated animals. Many cetaceans are very large in size, which limits the imaging modalities that can be utilized, and cetaceans have low internal fat accumulation and a blubber layer between the skin and underlying musculature that can greatly affect the quality of imaging studies. Common reasons for imaging cetaceans include renal disease, nephrolithiasis, respiratory disease, trauma, GI disease, pregnancy diagnosis and monitoring, and reproductive tract disease. Captive-maintained animals can be trained to voluntarily present and hold for imaging studies including advanced imaging, but sedation/anxiolytics may be used as an aid. As the lungs of cetacea are easily compressible, vertical and horizontal beam radiographs are extremely useful for evaluation of the respiratory disease. Post mortem advanced imaging, referred to as "virtopsy", is being utilized with more and more frequency in cetaceans prior to necropsy to gain more information regarding the cause of stranding/death in free ranging individuals, to document evidence of trauma/pathology prior to disruption of the carcass, and to help determine if more challenging to reach anatomical structures require dissection and evaluation as part of the investigation.

Sophie Dennison BVM&S DACVR
RCVS Recognised Specialist in Diagnostic Imaging

09.25-10.30: Vetculent Acute Abdomen Case Collection

Allison Zwingenberger

A collection of teaching cases is historically seen as a valuable source of information for trainees and radiologists alike. Teaching cases have evolved from jackets of films to digital formats, requiring specialized software for archiving, retrieval, and display. Vetlucent is a resource for the veterinary imaging community to be able to create and share teaching cases, expanding access beyond firewalls and borders to colleagues worldwide.

A teaching file is a requirement for residency programs to be able to access common and rare examples of disorders that may not be frequently seen in the course of regular practice. Most radiologists keep a personal teaching file in the form of a list, spreadsheet or archive of images on local storage media. Cases need to be stored in a database to be fully accessible beyond simple organizational structures such as file folders and searchable lists. Advanced search and classification allow much more flexibility in searching for particular cases and enhance the value of the teaching file.

Modern diagnostic imaging cases are comprised of multiple modalities, that may include single images as well as stacks of cross-sectional images. The ability to display multiple studies and multiple series within those studies enhances the understanding of the case and the pathophysiology of disease. The case is often imaged in a progression from screening radiographs to detailed characterization of the lesion by CT or MRI, and developing a sense for modality selection and the information gained is an important part of the learning process.

The acute abdomen is one of the most commonly encountered emergency disorders in veterinary medicine. Animals presenting for abdominal pain can have a variety of conditions needing a spectrum of treatment from medical management to surgery. Abdominal imaging examinations help to screen and classify animals into surgical and non-surgical groups for further treatment. Graduate veterinarians, interns, and residents benefit from seeing a wide variety of acute abdominal imaging examinations and variations of particular disorders as they enter clinical practice.

Vetlucent will be a valuable resource for training students and advanced learners to interpret acute abdominal cases using radiographs, ultrasound and computed tomography. A large collection of cases provides excellent teaching material for use in clinical rotations, residency training and didactic teaching.

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11.00-11.45: The textbook of the future: Designing an online educational resource for veterinary radiology

Allison Zwingenberger

Veterinaryradiology.net was born in 2007 when the internet was in its infancy as a source of educational material. As a faculty member in veterinary diagnostic imaging, the idea of an online educational resource accessed throughout the world fulfilled my vision of curating educational content in imaging to anyone with a desire to learn. To date, these weekly case reports have resulted in a database of 1000 cases. The desire for this information is evidenced by daily use of the content by students and educators around the world. Our mission is to create, collect, and curate knowledge in veterinary diagnostic imaging, and to distribute it freely worldwide.

The traditional world of publishing is changing, and the historical methods by which information is distributed are blurring together as well as becoming more accessible to content creators. The website model of a database of multi-author contributions, instantaneous updating of content, and unlimited size, is the textbook of the future. This model gives radiologists the opportunity to collaborate with others worldwide and leverages non-traditional methods of distribution.

A collaborative approach to subject articles ensures that the most up-to-date information is available and that the authors and editors have reached a consensus on the meaning and quality of the text. An article may start as a stub with a brief title and explanation, and then be fleshed out by several authors having expertise in the area. Thorough referencing

ensures that the writing is evidence based wherever possible, and new items of information can be added as articles are published in the literature.

Case-based teaching forms a core component of education in veterinary radiology. It can be used in a variety of ways to develop base knowledge, learn the thought processes of interpreting images, and build on expertise at any level of knowledge. Teaching theory describes how best to approach learning of any topic, and applying these theories to case-based teaching enhances knowledge transfer and satisfaction for both learners and teachers.

Vetlucent is the next generation of Veterinaryradiology.net, enabling the veterinary radiology community to create and share content. It is a positive initiative that has potential to reach many more people in developing countries, and to support resident training at a time when the specialty is under pressure to retain academic residency programs. Teachers and learners alike will broaden their exposure to learning opportunities and expand their expertise in image interpretation.

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11.55-13.00: Vetlucent Musculoskeletal Case Collection

Allison Zwingenberger

A collection of teaching cases is historically seen as a valuable source of information for trainees and radiologists alike. Teaching cases have evolved from jackets of films stored on shelves to digital formats, requiring specialized software for archiving, retrieval, and display. Vetlucent is a resource for the veterinary imaging community to be able to create and share teaching cases, expanding access beyond firewalls and borders to colleagues worldwide.

A large collection of musculoskeletal cases is a valuable resource for teaching, reference, and learning. One of the unique characteristics of veterinary radiology is the species diversity of our practice. Farm animals, companion animals and exotic animals have a spectrum of musculoskeletal diseases with some areas of commonality and other areas which are unique to the species or purpose of the animal. The musculoskeletal case collection is an important way to study comparative musculoskeletal imaging and to share knowledge of musculoskeletal expertise that is sometimes siloed in institutions or species specialties.

Each of the species that veterinarians treat have musculoskeletal disorders that are important to identify and diagnose for treatment. By using the database to classify organisms and breeds, as well as diagnoses using SNOMED CT terminology, the information can be organized and searched for in a methodical manner. The specialty is diverse in its breadth and depth, and this organization using standard terms is important for communication and clarity in describing cases.

Musculoskeletal diseases are frequently encountered in clinical practice. Veterinary students need to be familiar in the approach, modality selection and interpretation of

disorders that often have a broad differential diagnosis. Exposure to a wide variety of cases, and variations of common diseases, help to establish pattern recognition and the ability to reason through the interpretation of a case. The musculoskeletal case collection helps learners of all levels to add to their expertise in diagnostic imaging.

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Invited Lectures: Saturday 16 September 2022

08.30-09.15: Nose or Brain? Imaging & Clinical Correlation in Dogs and Cats with Naso-Cerebral Pathology

Silke Hecht

Diseases of the head are common in dogs and cats. Cross-sectional imaging has become a routine component in the diagnostic work-up of patients presented with clinical signs referable to the brain, nose/paranasal sinuses, and other structures of the head. Familiarity with normal anatomy and disease features is important when interpreting imaging studies to be able to identify relevant abnormalities and rank appropriate differential diagnoses. This presentation will focus on imaging and clinical findings in dogs and cats with nasal and/or intracranial disease.

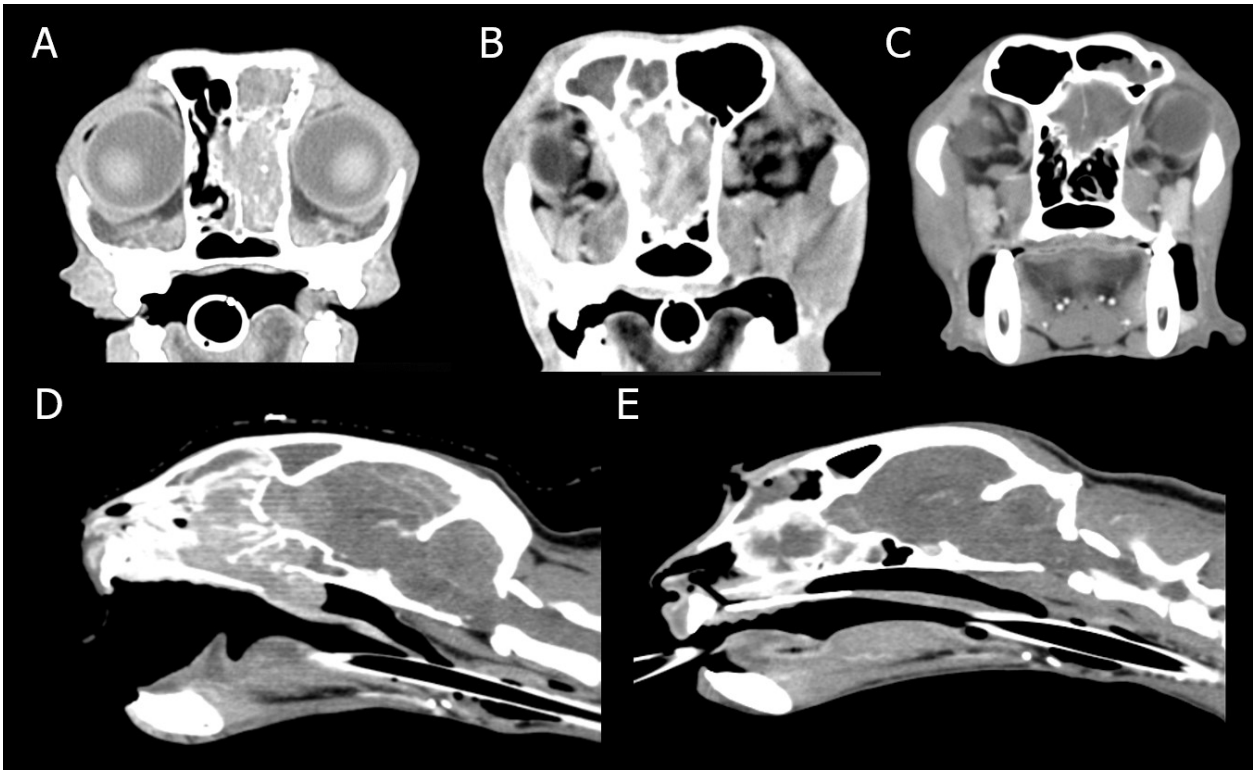
Anatomically, the osseous skull can be subdivided into the bones of the cranium that surround the brain, and the bones of the face that surround the eyes, respiratory and digestive pathways. The nasal cavity and cranial vault are separated by the cribriform plate (lamina cribrosa), a portion of the ethmoid bone. This structure borders the olfactory bulb and contains numerous small openings (olfactory foramina) allowing passage of the olfactory nerves.

Clinical signs related to a disease process of the nasal cavity/paranasal sinuses vs. a disease process within the cranial vault tend to be quite different. Abnormalities found in animals with nasal and paranasal sinus disease include nasal discharge, epistaxis, sneezing, stertor, gagging, and visible or palpable deformity of the facial bones. Clinical signs with forebrain disease include behavioral abnormalities (e.g., aggression or dementia), altered mentation, possibly an abnormal gait, cranial nerve abnormalities (e.g., blindness), variably postural reaction deficits, and seizures. The presenting complaint in a given patient often dictates the choice of imaging modality. Computed tomography (CT) is typically preferred for evaluation of the nasal cavity, while magnetic resonance imaging (MRI) is considered the gold standard for evaluation of the brain. Challenges in disease localization and choice of the appropriate imaging modality arise in animals with atypical presentations or multifocal signs. Certain disease processes may breach the cribriform plate, resulting in signs referable to nasal and/or brain disease and complicating clinical disease localization.

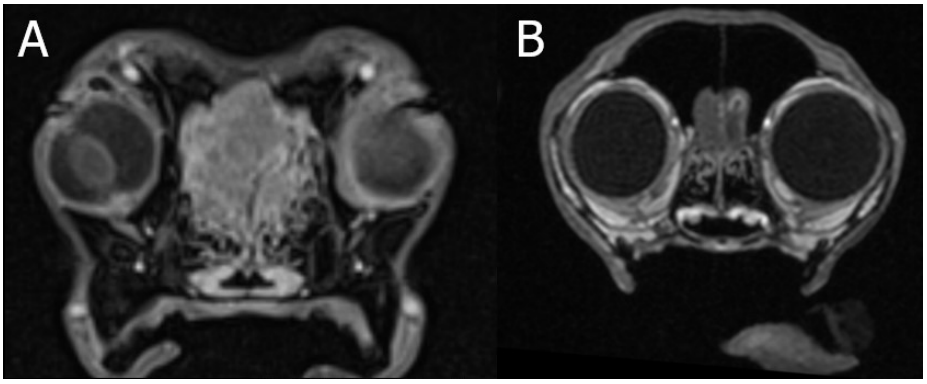
The most common cause of cribriform plate destruction is neoplasia which may either extend from the nasal cavity (e.g., nasal carcinoma in dogs and lymphoma in cats), originate from the cribriform plate (e.g., olfactory neuroblastoma), or extend from the cranial vault (e.g., meningioma). While less common, non-neoplastic mass lesions (e.g. fungal granulomas such as seen with blastomycosis) may also result in cribriform plate lysis and should be considered as possible differential diagnoses. Not all cases of compromise of the barrier between the nasal cavity and the brain are related to the presence of a mass. Destructive rhinitis (e.g., aspergillosis) has the potential to breach the cribriform plate and is characterized by turbinate lysis and intranasal mucus accumulation rather than formation of a true mass. A congenital malformation or (partial) absence of the cribriform plate may result in herniation of meninges and brain parenchyma into the nasal cavity (nasal/ethmoidal meningomyelocele). The bone defect and presence of contiguous intra- and extracranial soft tissue material in these cases should not be confused with a mass. Finally, even though less common, trauma and parasites may damage the cribriform plate and result in an abnormal connection between the nasal cavity and cranial vault.

CT case examples of loss of integrity of the cribriform plate. (A-C) Transverse images in 3 different dogs with nasal squamous cell carcinoma (A), fungal disease (blastomycosis; B),

and a congenital nasal/ethmoidal meningomyelocele (C). (D-E) Sagittal reconstructed images in 2 different cats with lymphoma (D) and fungal disease (aspergillosis; E).



MRI case examples of loss of integrity of the cribriform plate. Transverse T1-weighted post contrast images in a dog with a meningioma (A) and in a cat with aberrant larval migration (B).



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08.30-09.15: State-of-the-Art Equine Cardiac Imaging

John Keen

Introduction

There are limitations to imaging the heart of horses, due to their large size and restricted views or techniques compared to other species. Despite this however, echocardiography in particular has continued to progress in tandem with echocardiography in humans and small animals. Newer ultrasound technologies like three-dimensional echocardiography

(3DE) and strain imaging are starting to have an impact, at least in the research setting, for evaluating cardiac form and function. CT and MRI, which are now relatively standard in human cardiology and increasingly used on small animals are unlikely to be clinically applicable to horses in the near future; but post-mortem evaluation of hearts can provide morphological insight. Newer imaging technologies, not traditionally associated with the diagnostic imaging clinician, offer some exciting possibilities for the evaluation of selected cardiac abnormalities.

Innovations with transthoracic two-dimensional and Doppler echocardiography (2DE)

Image quality in equine echocardiography has improved considerably with advances in hardware and software, at least on the high-end ultrasound machines. While this makes images more visually appealing, whether this makes a clinical difference is arguable and operator experience is more likely a critical factor. Often inexperienced operators in particular fail to use the technology to maximum effect e.g. not acquiring enough or optimal images of chambers in question.

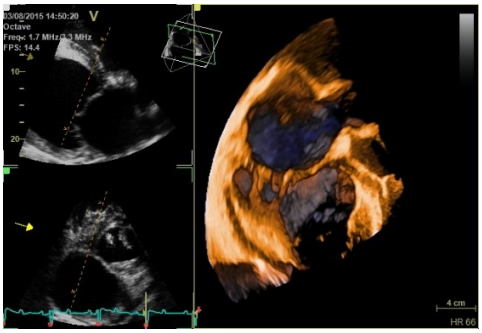
Assessment of cardiac function in horses is currently relatively rudimentary, but technological advances have made this a more realistic proposal. While pulsed wave Doppler assessment of cardiac flow can be reproducible in experienced hands, the problems associated with poor alignment with flow in horses often leads to underestimation of indicators of cardiac function. More recently, there has been interest in assessment of (cardiac muscle) tissue strain using technologies that assess tissue movement. Indices of strain can be calculated from either the displacement (speckle tracking echocardiography [STE]) or the velocity (Pulse waved tissue Doppler imaging [TDI]) associated with tissue movement. Each of these two techniques has advantages and disadvantages, but STE is probably the most easily clinically applicable, with fewer disadvantages. STE has already been validated in a research setting with horses for assessing left ventricular, left atrial and right ventricular systolic function, and shown generally low measurement variability. It can offer real insight into cardiac mechanics. It has also demonstrated myocardial dysfunction caused by ionophore and hypoglycin A toxicity and revealed improvements in myocardial contractile function associated with recovery from equine asthma. Many centres are now starting to use this technology, but is it useful in equine clinical practice where we rarely see obvious myocardial disease? The greatest potential advantage of such a technology could be in detecting early signs of myocardial dysfunction in horses with significant valvular regurgitation. The development of expert consensus agreed guidelines is likely to increase the uptake of these technologies and allow us to learn their benefit.

Transthoracic three-dimensional echocardiography (3DE)

Three dimensional echocardiography technology is advancing rapidly and shows potential for enhancing cardiac imaging in horses. The accurate assessment of valvular regurgitation and its effects is a common goal of most equine echocardiographic examinations. Real-time 3DE may offer:

- Better assessment of valve architecture and motion
- Better assessment of regurgitant orifices
- Better assessment of cardiac chamber volume

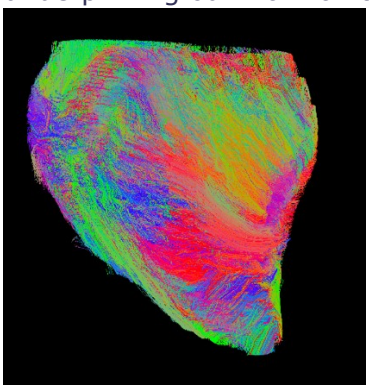
Studies are underway to validate the use of this technology in horses. In our clinic, we now use 3DE routinely for echocardiography, targeting specific areas of interest (e.g chambers, valves) after our standard 2DE examination. Initial experience suggests that the ability to assess structures from innumerable aspects is useful for assessing valves, valve lesions and congenital abnormalities. While this new technique is clinically appealing and visually impressive, whether it offers distinct advantages over standard 2DE is still to be ascertained.



3D image (right) of the left ventricle and atrium (LA) of a pony with endocarditis, upwards to the underside of the abnormally thickened underside of the aortic valve (arrow). The 2D images on the left are slices from the dataset, used for orientation. Image manipulation of the 3D dataset allows unusual viewpoints, in this case showing the papillary muscles (PM) and chordae tendinae of the mitral valve while also viewing up into the left ventricular outflow tract

CT and MRI in equine cardiology

Due to the large size of the equine thorax, there is no realistic chance at present of using these technologies in live horses, although images may be attainable with foals. From a teaching and research perspective however, they can be useful. Volume rendered images can be created and/or converted into printed specimens for teaching anatomy and pathology. Our group has been using contrast enhanced CT and diffusion tensor MRI imaging to help us understand the fibre pattern in the left atrium and ventricle, underpinning our work on the strain and twist in the left ventricles of athletic horses.



Preliminary results with diffusion tensor MRI image of the equine (Thoroughbred) heart, providing information on fibre tract orientation

Melding form and electrical function: electroanatomic mapping

Electroanatomic mapping is a minimally invasive electrophysiology-based technique that uses spatial and electrical information, gleaned from the relationship between intra-cardiac catheters and body surface detectors, to build up a detailed three-dimensional anatomic and electrical activity maps of the chamber under investigation. This technique is now a routine diagnostic and treatment option in human cardiology and has great potential for understanding the normal equine heart and cardiac pathology associated with arrhythmias. Atrial fibrillation in particular is common in equine athletes and this technology may help us investigate this disorder in more detail and offer new treatment options. Due to limitations with fluoroscopy in horses, novel echocardiography techniques such as 3DE and intra-cardiac echocardiography may be useful for guiding catheter placement during these protocols.

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09.25-10.30: Life-Work Balance as a Radiologist

Marlène Finck

Nowadays and more than ever, the modern world and technologies constantly challenges our bodies and minds. We have to multitask, perform both in our private and professional lives.
The world has been impacted by the COVID-19 pandemic, European wars, and dramatic climate changes: we are living in a mentally and physically highly demanding period, and as human beings, we have to adapt.
Veterinary practice has also been rapidly evolving over the last few years, with increased workload and demand for imaging modalities which are now considered as a standard of diagnostics and care by both the veterinary profession and pets owners. This leads to us dealing with performance anxiety and stress, which may be counterproductive. We are not equal performing under the same level of pressure: whereas peak performance requires some degree of stress, too much pressure will leave us overwhelmed, similarly as we will feel disengaged when not enough stimulated.
Life as a radiologist is exciting, exigent but is also an arduous journey. From residency application to credentials to board certifying examinations, we encounter several stressors, and this is only the beginning in our life as radiologists. Pressures will continue to build up after the examination has been passed, we have to deal with excessive case load, loss of control of our schedules, constant interruptions, non imaging related tasks (administrative, driving, etc), musculoskeletal and visual strains, research time pressure and other non clinical duties.
All the while combining with parenthood, friends, social life, and self-care.

In this workshop, attendees will be given the opportunity to exchange about their own experiences of coping with external and internal pressure at work. Some practical evidence-based propositions will be suggested to improve work-life balance.
Optional breathing exercice may be practiced at the end of the session.

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11.00-11.30: Pictures That Don’t Lie: An Animal Geneticist’s View on the Power of Diagnostic Imaging

Jeffrey Schoenebeck

Dogs are among the most morphologically diverse terrestrial species of animals on Earth. Much of this morphological diversity is underpinned by changes to the skeleton, which in extant dogs presents in dramatic changes to shapes and sizes of constituent bones.

Morphological diversification of dogs coincides with their domestication from ancient grey wolves, over 15,000 years before present. However, most of the morphological changes that are obvious among present day pedigree dogs are the products of selective breeding practices that emerged some 200 years ago during the Victorian era. As a consequence of

these practices, the form and function of canine anatomy was decoupled.

Today, various types of skeletal 'dysmorphologies' are pervasive among pedigree dogs. My research group's goals are to understand how such dysmorphologies affect animal welfare, improve our understanding of analogous human conditions, and reveal the genetic and cellular mechanisms that give rise to these morphologies.

Specialising in animal genetics, my group is focussed on heritable basis of skull morphology. To empower our studies, we utilise geometric morphometrics (GMM). Briefly, we extract coordinate data of homologous landmarks from the scans of canine cases that require head CTs. Unlike other sources of morphological data such as linear measurements and angles, GMM enables multivariate analyses that capture, quantify, and preserve the three-dimensional nature of the skull. Moreover, GMM enables visualisation of morphological changes from specimen to specimen.

Our studies demonstrated a bimodal distribution of face lengths occurs among the 85+ pedigree and mixed dogs whose CT scans were available for GMM. The animals were genotyped. Coupling genotypes with GMM-based metrics enabled us to genetically map the genetic basis of canine morphological diversity, including the locus that is associated with brachycephaly. Our research findings reveal a complex landscape of genetic relationships that determine the size and shape of the canine facial skeleton.

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14.00-14.45: Feline Infectious Diseases for Veterinary Radiologists

Danièlle Gunn-Moore

This talk will consider feline infectious diseases that can cause radiographic changes. While it will focus of pulmonary changes, it will also consider abdominal and bony abnormalities; the infections considered will include Mycobacterial infections (including tuberculosis), *Mycoplasma* species, lungworm, feline herpes virus, *Bordetella bronchiseptica*, cowpox virus, Toxoplasmosis and others.

Danielle Gunn Moore
BSc, BVM&S, PhD, FHEA, FRSB, MACVS, FRCVS
Professor of Feline Medicine
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14.00-14.45: Equine Dental Imaging

Padriac Dixon

Introduction

The clinical crowns of all equine teeth can be very well clinically evaluated during an oral examination, especially if an oral endoscope is used. The more important dental disorders such as equine odontoclastic tooth resorption and hypercementosis (EOTRH), clinical (erupted) crown fractures, cheek teeth infundibular cemental hypoplasia and caries, occlusal pulpar exposure, diastemata/periodontal disease and peripheral caries are all readily detected by such examinations. However, the possible changes these lesions have

caused or are associated with in the reserve (subgingival) crown, the apex (root area in adult horses) and supporting bones **can only be evaluated by imaging**.

For dental radiography, horses should be very well sedated and have their head supported on a stand or by ropes held from both sides at a safe distance. Needless to say, excellent knowledge of radiographic techniques, radiographic head anatomy, and age-related and disease-related dental radiographic changes are essential. Computed tomography (CT) is increasing available and provides better assessment of more complex head areas with multiple overlying structures such as cases of suspect dental sinusitis. CT allows excellent imaging of pulps and infundibula, but may not be necessary for many mandibular cheek teeth or incisor investigations.

Incisors and canine teeth

EOTRH is an increasingly recognised disorder, mainly of older horses, that appears to more prevalent in northern Europe. Advanced cases have lytic resorptive lesions or fractures of their clinical crowns and have bulging gingiva over their alveoli (juga). However, the earliest, and in fact most of the pathological changes lie subgingivally in the reserve crowns and apices and can only be evaluated by imaging. The disease tends to start at the Triadan 03s and then progress to the more central incisors and the canine teeth (in males). In contrast to a similar resorptive syndrome in cats, many horses with EOTRH develop hypercementosis of affected areas that in some cases hides the lytic resorptive changes. Intraoral radiographs are optimal (including using the bisecting angle technique and oblique projections to separate the 02s and 03s). Care should be taken to avoid damage to the (expensive) radiographic plate by the horse chewing it, including by using specialised radiolucent speculum biteplates. Trauma to the incisor region can cause dental and supporting bone fracture, including non-displaced subgingival dental fractures and these cases cannot be fully evaluated without imaging, that may reveal hidden fractures of the supporting bones and of the reserve crowns of adjacent teeth with possible apical changes. Low powered dorso-ventral oblique radiographs are needed to image unerupted 1st premolars ("wolf teeth") that may be quite radiolucent.

Cheek teeth

By far the most common reason to perform equine dental radiography is to assess for the presence of pulpar infection (endodontic disease), and especially its progression to the apex of the cheek tooth where it commonly causes periapical infection of the alveolar and supporting bones. Periapical infection in turn often causes recognisable clinical signs, such as facial swellings and/or discharging tracts or unilateral nasal discharge caused by sinusitis (more correctly termed **sinonasal disease)** as about 50% of sinusitis cases have concurrent nasal conchal bulla infections. In early cases of endodontic infection, it can be difficult to confirm radiographically if pulpar and apical infection is present or not, especially in the more caudal maxillary cheek teeth that lie within the maxillary sinuses. If a sinus tract is present (only with rostral maxillary or mandibular cheek teeth infections), it is imperative that a radiograph with a metallic probe is also taken that will give invaluable information. The use of radio-opaque agents is often unsuccessful as they may not penetrate to the affected apex and may contaminate surrounding areas, actually making radiographic diagnosis more difficult.

Recent studies have shown that CT is much more sensitive than radiography in detecting these early apical infections, by allowing accurate imaging of the soft tissues of the pulp and periapical periodontal membranes. Radiographs are also less sensitive than CT in detecting which sinus compartments are affected in horses with sinus disease and the nature of their contents, including the presence of tumours and cysts. Some teeth that require extraction are already fractured or carious and intraoperative and post-extraction

radiographs are essential, including to ensure that no dental or alveolar fragments are left behind.

CT has recently shown that two previously ignored structures within the nasal cavity i.e. the dorsal and ventral nasal conchal bullae are very commonly infected in horses with sinusitis. Persistence of infection in these structures after the initial sinusitis has been treated can be the cause of ongoing clinical signs of unilateral nasal discharge. They can also be imaged relatively satisfactorily by radiography.

Most equine cheek teeth fractures are non-traumatic in origin and these fractures were all previously termed "idiopathic cheek teeth fractures". However, one maxillary cheek tooth fracture pattern is now recognised to be caused by advanced infundibular caries, and these are now termed "infundibular caries-related fractures". Many "idiopathic" fractures were erroneously perceived not to involve the pulp (i.e. cause endodontic disease) but recent CT studies have shown that most idiopathic fractures including "slab fractures" (involving the 1st and 2nd pulp horns) of maxillary cheek teeth actually do have endodontic and apical changes, that may cause minimal or delayed clinical signs in some horses. Infundibular caries-related fractures (in the sagittal midline plane) always cause endodontic and apical disease, and usually do not need imaging to determine this fact. However, imaging may show other maxillary cheek teeth (often the contralateral Triadan 09) and possibly teeth - to have severe infundibular cemental hypoplasia and/or caries. This information allows these other teeth to be restored and so prevent fracture or direct apical infection from later developing in them.

Most periodontal disease in horses is due to cheek teeth diastemata and imaging affected teeth to assess angulations of the peripheral (Triadan 06 and 11) cheek teeth and the distances between the adjacent clinical crowns is very useful in assessing the cause of diastemata and the prognosis following treatment. Dentigerous cysts can be deeply attached to vital structures including the temporal or even the petrous temporal bone and their surgical removal may have serious sequelae in such cases. CT imaging should always be performed pre-operatively in such cases and may even determine that surgery is not indicated.

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14.55-16.00: Life Hacks for Horos & Osirix

Manuel Pinilla

Osirix™ and Horos™ have become one of the most popular DICOM viewers used by radiologists over the years. Besides being extremely powerful, versatile and robust DICOM image viewers, Osirix™ and Horos™ can also be used as DICOM storage, and even as fully featured PACS systems. During the workshop, we will discuss and showcase some of the practical features that can be used to enhance DICOM image storage and display:

Creating personal teaching libraries:

Having an organised, easily accessible and searchable database of cases can be extremely useful for anyone involved in image interpretation and acquisition. Being able to find examples of specific pathological conditions, or just normal anatomy to reference and compare to can greatly facilitate the interpretation process. This can also be extremely useful for anyone involved in research and teaching. This ability to store and organise DICOM images will be invaluable for any radiologist, whether they work in academia, private practice or teleradiology.

During the workshop we will explore some of the built-in functionality in Osirix™ and Horos™, designed to create, display, organise and export these libraries of cases.

We will cover:

- Database window customisation: This will allow you to see the relevant information and perform more accurate database searches.
- Exporting database details to excel and other software options for quick reference.
- Adding custom keywords and labelling cases
- Organising the database into albums and smart albums.
- Anonymising cases for teaching purposes
- Trying not to run out of hard drive storage: How to configure autocleaning
- What to do when you do run out of storage (and you will!)
    - Use of multiple different databases
    - Use of external hard drives
    - Pros and cons of cloud storage as an alternative
- Backing it up. Creating these libraries should be seen as a long-term personal project. Make sure you do not lose all the hard work!
- Q&A: any questions regarding the use of Osirix™ and Horos™ for image storage? Do you have any useful tips regarding teaching libraries?

Image viewing tips:

We all know Osirix™ and Horos™ are very powerful image viewing and processing tools, with lots of tools designed to assist you in the image viewing process. Depending on the time spent on the first part of the workshop, we will discuss some of the tools that may not be as well-known such as:

- Convolution filters: When, how and which ones to use.
- Creating, saving and exporting new MPR series
- Image fusion, subtraction and 3D registration
- 3D:
    - Basic pre-sets and window levelling 3D images
    - Cropping and cutting images
    - Measuring, generating and rendering 3D volumes and ROIs

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ORAL ABSTRACTS

Topic: Canine & Feline
Time: 09.20-09.32

DILATED PERIVASCULAR SPACES CAN PRESENT INCIDENTAL CSF-ISOINTENSE FOCI WITHIN THE VENTRAL FOREBRAIN OF CANINES AND FELINES IN TRANSVERSE MR IMAGES

Fischer Carolin[1], Martin Schmidt[1], Katinka Hartmann[2], Kathrin Büttner[1], Sebastian Schaub[1]

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Keywords:
(dilated) Virchow-Robin-Space, canine, feline

Introduction / Purpose:
Virchow-Robin-Spaces (VRS) are CSF-containing perivascular spaces encompassing brain vessels while coursing through the parenchyma. VRS can enlarge and become visible in magnetic resonance imaging (MRI). While dilatated VRS (dVRS) are mostly incidental findings, they were associated with degenerative brain disease in humans. This retro- and prospective, observational study evaluates their occurrence within the ventral forebrain of canine and feline patients.

Methods:
Medical records of client-owned dogs and cats which underwent MRI brain scans for unrelated reasons (2011-2021) were reviewed. We comprised various magnetic field strengths (1T/3T). 335 patients (293 canines, 42 felines) presented with absent intracranial and CSF abnormalities and were included. Their ventral forebrain was assessed for bi- or unilateral CSF-isointense foci in transverse plane. Statistical correlations were assessed between dVRS, field strength, age, gender, weight, and cranium conformation. Post mortem histopathologic analysis of a dog and cat showing dVRS on MRI confirmed perforating arteries.

Results:
57% of patients presented dVRS (N=191: 170 canines, 21 felines). 43% did not display dVRS (control group; N=144: 123 dogs, 21 cats). A 2,4 increase (p=0,0001) in detection using 3T was observed in canine patients. Canine males overrepresented dVRS 2,4 times. Detection raised with increased weight in canines. No significant difference was detected between dVRS and the control group in age, species or cranium conformation.

Discussion / Conclusion:
dVRS can be seen within the ventral forebrain at the level of the rostral commissure on transverse MR images as symmetrical or unilateral, CSF-isointense foci. Understanding their signal intensity and localization prevents misinterpretation and helps differentiate them from pathological conditions.

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Topic: Canine & Feline
Time: 09.34-09.46

REGIONAL ADC VALUES OF THE MORPHOLOGICALLY NORMAL CANINE BRAIN

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Keywords:
Magnetic resonance imaging, Canine, MRI, ADC, DWI

Introduction / Purpose:
Diffusion-weighted MRI is increasingly available for investigation of the canine brain. Apparent diffusion coefficients (ADC) of normal canine brains are reported only in small numbers of subjects. This study investigated the ADC of different regions of morphologically normal canine brains in a large population in clinical setting, possible influence of patient-related factors, difference between gray and white matter, and right and left hemisphere.

Methods:
MRI examinations including diffusion-weighted images of canine patients presented at the Vetsuisse Faculty- University Zurich between 2015 and 2021 were reviewed retrospectively. Only dogs with a morphologically normal brain were included. ADC values of 15 regions of interest (ROI) were drawn manually and recorded. ROIs included caudate nucleus, internal capsule, thalamus, hippocampus, piriform, parietal and occipital lobe, cerebellum and cerebellar vermis; some ROIs included white or gray matter separately. Except for the cerebellar vermis, each ROI was drawn in the right and left hemisphere.

Results:
A total of 321 dogs of various breeds, gender and age were represented. Significantly higher ADC ($p<0.001$) was measured in gray (mean $0.797\pm0.035 \times 10^{-3} mm^2/s$) compared to white matter (mean $0.712\pm0.033 \times 10^{-3} mm^2/s$). Statistically significant difference was present between right and left hemisphere in 6 ROIs ($p<0.001$–$p=0.047$) and among body-weight classes in 5 ROIs ($p<0.001$–$p=0.030$). ADC decreases from dogs <1 year of age to middle-age (3-8 years) and increases again in dogs >8 years.

Discussion / Conclusion:
ADC values of 15 ROIs were described in 321 morphologically normal canine brains in clinical settings. These results represent baseline data for future research.

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Topic: Canine & Feline
Time: 09.48-10.00

ISCHEMIC STROKE CAN HAVE A T1W HYPERINTENSE SIGNAL IN ABSENCE OF INTRA-LESIONAL HEMORRHAGE

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Keywords:
CVA, infarction, non-hemorrhagic

Introduction / Purpose:
Magnetic Resonance Imaging (MRI) signal changes associated with ischemic stroke are typically described as T2w hyperintense and T1w isointense lesions. Intralesional T1w hyperintensity is attributed to either a hemorrhagic stroke, or an ischemic stroke with a with hemorrhagic transition, and has an associated signal void on gradient echo (GE) sequences. Cases of ischemic stroke with T1w hyperintense signal in absence of associated signal void on GE sequences have been demonstrated in human patients, as well as in dogs with experimentally induced ischemia. This multicenter retrospective descriptive study investigates the presence of T1w hyperintensity in canine stroke without associated signal void on GE sequences.

Methods:
MRI studies of dogs with clinical presentation, MRI features and cerebrospinal fluid results suggestive of non-hemorrhagic stroke were assessed.

Results:
Twelve patients had an intralesional T1w hyperintense signal, with no signal void on T2*w GE or SWI sequences. The mean time between recorded onset of clinical signs and MRI assessment was 3 days, however the age range of lesions with T1w hyperintense signal observed was 1-21days, suggesting such changes are observed in acute, subacute or chronic stages of ischemic stroke. Follow up available in 7/12 cases showed evidence of neurological improvement whilst in hospital, and survival to discharge.

Discussion / Conclusion:
Correlation of the findings in this study with similar lesions observed in human and experimental studies suggests that these T1w hyperintensities are likely caused by partial tissue infarction or selective neuronal necrosis, providing an alternative differential for these T1w hyperintensities observed.

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Topic: Canine & Feline
Time: 10.02-10.14

ASSOCIATION BETWEEN DIFFUSION WEIGHTED MRI AND AGEING OF INTRACRANIAL HEMORRHAGES IN DOGS

Roberto Marazzi[1], Andrea Carloni[1], Melania Moioli[2], Danica Pollard[3], Marco Bernardini[1], Swan Specchi[1]

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Keywords:
T2 blackout, hematoma, ADC, canine

Introduction / Purpose:
MRI appearance of intracranial hemorrhagic lesions in diffusion weighted imaging (DWI) has been poorly described in dogs. In DWI/ADC a T2 blackout effect is commonly seen in hematomas in humans.
The aims of this study were to describe the appearance of canine intracranial hemorrhagic lesions in DWI and associate it with the estimated age of the hemorrhage and to describe the T2 blackout effect in dogs.

Methods:
For this retrospective study, dogs with a brain MRI with a presumed diagnosis of intracranial hemorrhagic lesions based on the combined evaluation of T2* and/or SWI, T1 and T2 images were enrolled. The age of the hemorrhage was estimated according to published criteria based on T1 and T2 sequences. The association between the age of the hemorrhage and some MRI features, including the appearance of each lesion (stratified or mixed), their signal intensities in DWI/ADC and the presence of the T2 blackout effect, was assessed via Fisher's exact test.

Results:
Thirty dogs with a total of 35 hemorrhagic lesions were included: 13/35 lesions were stratified; the others had a mixed aspect. Only the ADC appearance of the peripheral layer in the stratified lesions was significantly associated with estimated age of the hemorrhage (P=0.033), being hypointense in all hyperacute cases and hypo/isointense in acute cases. The T2 blackout effect was present in both DWI/ADC in 29/35 lesions.

Discussion / Conclusion:
DWI shows limited utility to date intracranial hemorrhages in this group of dogs. The T2 blackout effect was commonly seen in both DWI/ADC, potentially masking their diffusion sensitivity.

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Topic: Canine & Feline
Time: 10.16-10.28

STRUCTURAL BRAIN ABNORMALITIES ASSOCIATED WITH CONGENITAL CEREBELLAR ATAXIA IN THE FELINE

Philippa Johnson, Megan Sha

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Keywords:
MRI, cat, malformation, cerebellum

Introduction / Purpose:
Non-progressive congenital cerebellar ataxia (NCCA) is common and often caused by in-utero infection with panleukopenia virus causing cerebellar hypoplasia. There is limited information published on the form and type of brain malformations present in these cats and no description of the associated MRI findings. This case-control study aims to document the structural brain abnormalities present in this condition.

Methods:
Both feline subjects with non-progressive cerebellar ataxia and neurologically normal control subjects were recruited. Each feline underwent a neurological examination and ataxia grading. They underwent MRI under general anesthesia in a 3-tesla GE Discovery. A standard brain protocol together with 3-dimensional T1-weighted were acquired for each subject. The images were evaluated and structural abnormalities documented. T1 data were processed, using FSL, for automated segmentation of the cerebellar white and grey matter. Cerebellar tissue volumes were statistically compared between groups and correlated to ataxia grade.

Results:
5 cats with NCCA and 10 control cats were recruited. All cats with NCCA demonstrated reduction in cerebellar size and two of the NCCA cohort exhibited abnormal widening of the lateral ventricles. Volumetric analysis identified that the NCCA cohort exhibited significant reductions in cerebellar volume ($p= 0.0296$) and that this was predominantly due to loss of grey matter. Cerebellar grey matter volume was significantly correlated with ataxia grade ($r^2 = 0.76$).

Discussion / Conclusion:
These results show that both cerebellar and forebrain malformations are present in NCCA and that the degree of ataxia is correlated to loss of cerebellar grey matter volume.

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Topic: Exotic animal
Time: 11.36-11.48

CT-GRADING SYSTEM FOR RABBIT DENTAL DISEASE

Pierrantonio Battiato[1], Athin Althinodorou[2], Jenna Richardson[2], Loredana Sorrenti[3], Martina Manfredi[1], Giulia Sala[1], Tobias Schwarz[2], Maurizio Longo[1]

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Keywords:
Oryctolagus, malocclusion, abscess, rhinosinusitis

Introduction/Purpose:
Dental disease (DD) is a common pathology in domestic rabbits, often involving adjacent bone and soft tissue structures, nasal and orbital cavities. This study aims to establish a simple CT-based grading system for rabbit DD.

Methods:
For this retrospective study, medical database were evaluated for rabbits with clinically detected dental malocclusion and associated nasal discharge/exophthalmos. Two observers independently and blindly reviewed CT images of rabbits with DD. A grade of 1 to 3b was used to evaluate every dental quadrant: 1= lesions confined to the tooth, 2= lesions involving the maxillary/mandibular bone, 3a= lesions associated with soft tissues swelling, 3b= soft tissue associated lesions extending to the nasal and/or orbital cavities. The inter-observer agreement was evaluated with weight Kappa test. Patients treatment and history were also recorded and statistically compared to the CT grade with Chi-square test. Statistical significance was accepted for p-values < 0.05.

Results:
53 rabbits with clinically suspected dental disease were included, for a total of 212 dental quadrants being individually evaluated**.** The study demonstrates a perfect level of inter-observer agreement for CT grading (weighted K 0.98, p-value <0.001). CT grading provided a high positive correlation between CT findings and severity of clinical dental malocclusion (p-value 0.005), between 3b grade and presence of nasal discharge/exophthalmos (p-value 0.015) and between grading scale and treatment invasiveness (p-value <0.001).

Discussion/Conclusion:
The developed CT grading proved to be a feasible and reliable method to assess dental disease in rabbits.

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Topic: Exotic Animal
Time: 11.50-12.02

CLINICAL AND COMPUTED TOMOGRAPHIC FINDINGS OF RABBITS WITH PULMONARY EMPHYSEMA

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Keywords:
computed tomography, rabbit, pulmonary emphysema

Introduction / Purpose:
Pulmonary emphysema (PE) is a rarely reported and poorly understood condition in pet rabbits. This retrospective study investigates clinical and computed tomographic findings of PE in rabbits.

Methods:
726 archived thoracic CT studies of 529 rabbits were reviewed, alongside their medical records for clinical data. CT studies were scored based on the type and lobar location of PE.

Results:
74 CT studies of 57 rabbits (10.7% of the population) were positive for PE. PE was affecting most commonly the left cranial (52/74) and right cranial (38/74) lung lobes. Of those rabbits that underwent follow-up CT evaluation, pulmonary emphysema was stable in 7/13 and progressive in 6/13, but improved in none. Reason for initial presentation included upper/lower respiratory disease (19.3%/15.6%). Naso-ocular discharge (14.03%), dyspnoea (12.3%), and increased respiratory effort (14.03%) were the most common respiratory clinical signs. Eight rabbits presented with respiratory distress indicated by cyanosis (12.3%) and open-mouth breathing (3.5%) which were considered poor prognostic factors. Twenty-six rabbits (45.6%) were asymptomatic. Euthanasia resulting from respiratory disease was the outcome in 10/55 rabbits (17.5%).

Discussion / Conclusion:
Pulmonary emphysema is a relatively common condition in rabbits. The most common imaging finding is hypoattenuation of the pulmonary parenchyma, which can be focal, multifocal, or diffuse. It is frequently asymptomatic but clinical signs can include increased respiratory effort, naso-ocular discharge, and dyspnoea. Pulmonary emphysema should be considered as a differential diagnosis of respiratory disease in rabbits.

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Topic: Exotic animal
Time: 12.04-12.16

POST-MORTEM COMPUTED TOMOGRAPHY PULMONARY FINDINGS IN HARBOR PORPOISES (PHOCOENA PHOCOENA)

Nienke Kuijpers, Linde van Schalkwijk, Lonneke IJsseldijk, Dorien Willems, Stefanie Veraa

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Keywords:
Cetacean, post-mortem, computed tomography, lung

Introduction / Purpose:
The application of post-mortem computed tomography (PMCT), also known as virtopsy, in veterinary and wildlife research programs is advancing. Together with a high incidence of pulmonary pathology in the harbor porpoise, the value of virtopsy focused on pulmonary assessment needs to be evaluated. The objectives of this study were to describe pulmonary changes as well as autolytic features detected by PMCT examination and to compare those findings with conventional necropsy.

Methods:
Retrospective systematic evaluation of pulmonary PMCT images of 46 harbor porpoises and corresponding conventional necropsy reports was carried out.

Results:
Main pulmonary PMCT findings included: moderate (24/46) to severe (19/46) increased pulmonary soft tissue attenuation, severe tracheobronchial parasite burden (17/46), bronchial wall thickening (30/46) and mild autolysis (26/46). Compared to conventional necropsy, PMCT revealed more frequent identification of pneumothorax (5/46 vs. none), tracheal content (26/46 vs. 7/46) and macroscopic pulmonary mineralization (23/46 vs. 11/46).

Discussion / Conclusion:
PMCT provided increased detection and more detailed spatial information of pulmonary changes. Lung patterns were recognized that may relate to specific pathology and mortality cause, such as drowning or bycaught. The results may serve as a baseline for future prospective designed studies aiming at establishing a relation between PMCT lung changes and ultimate pathology diagnosis. These results indicate that PMCT adds information on pulmonary assessment and is a promising complementary technique for conventional necropsy, despite frequent presence of autolytic features impacting discrimination with nonspecific post-mortem changes.

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Topic: Canine & Feline
Time: 12.18-12.30

RELATIONSHIP BETWEEN MRI FINDINGS AND HISTOLOGICAL GRADE IN PERIPHERAL NERVE SHEATH TUMOURS IN DOGS

Simona Morabito[1], Swan Specchi[1], Pamela Di Donato[1], Danica Pollard[2], Ruth Dennis[3], Luisa De Risio[4], Nicholas J. Bacon[5], Maria Potamopoulou[5], Stefan Rupp[6], Danielle Corlazzoli[7], João Ribeiro[8], Francesca Cozzi[9], Konrad Jurina[10], Rodolfo Cappello[11], Edy Mercuriali[12], Katrin Beckmann[13], Thomas Flegel[14], Marika Menchetti[15], Florian Konig[16], Kaspar Matiasek[17], Marco Rosati[17]

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Keywords:
PNST, MRI, Histology, Dogs

Introduction / Purpose:
Peripheral nerve sheath tumours (PNSTs) are a heterogeneous group of neoplasms originating from either Schwann cells, modified Schwann cells, intraneural fibroblasts or perineural cells. Therapeutic options and prognosis are influenced by their degree of malignancy. The objective of this study was to identify magnetic resonance imaging (MRI) features predictive of PNST histologic grade.

Methods:
A multicentre retrospective study with inclusion criteria of: a) histopathologic diagnosis of PNST; b) MRI studies available for review. Histologic slides were reviewed and graded by a neuropathologist according to a modified French system (FNCLCC) for grading soft tissue sarcomas. MRI studies were reviewed by two board-certified radiologists blinded to the grade of the tumour and the final decision on the imaging characteristics was reached on a consensus basis. Relationships among tumour grade, histological and MRI findings were assessed using Fisher's Exact test or Kruskall-Wallis test, followed by a post-hoc Dunn's test, with significance set at $P < .05$.

Results:
44 cases met inclusion criteria; 16 patients were PNSTs grade 1 (low grade), 19 were PNSTs grade 2 (medium grade) and 9 were PNSTs grade 3 (high grade). Large volume ($p=0.029$) and severe peripheral contrast enhancement ($p=0.045$) were significantly associated with a high tumour grade. Degree of muscle atrophy, heterogeneous signal

and tumour growth into the vertebral canal were not associated with grade.

Discussion / Conclusion:
Grade of malignancy was difficult to identify based on diagnostic imaging alone. However, some MRI features were predictive of high-grade PNSTs including tumour size and peripheral contrast enhancement.

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Topic: Canine & Feline
Time: 12.32-12.44

CLINICAL AND COMPUTED TOMOGRAPHIC FINDINGS OF PRESUMED INTRADURAL/INTRAMEDULLARY INTERVERTEBRAL DISC EXTRUSION IN SIXTEEN DOGS

Alice Levi[1], Pauline Deprez[2], Nathaniel Harran[1]

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Keywords:
intervertebral disc disease, dog, CT

Introduction / Purpose:
Intradural-intramedullary intervertebral disk herniation (IIVDE) is an uncommon form of intervertebral disk disease reported in non-chondrodystrophic dogs following a traumatic event. Magnetic resonance imaging (MRI) findings include an intramedullary linear tract of mixed intensity representing extruded disc and hemorrhage. We sporadically noticed an intramedullary linear tract of contrast on computed tomographic myelography (CTM) that could represent an IIVDEThis retrospective study describes clinical and CTM findings in a series of 16 dogs with presumptive IIVDE.

Methods:
Dogs were included in the study if they had evidence of a focal intramedullary contrast media accumulation without evidence of extradural spinal cord compression on CTM.

Results:
All dogs were presented with acute paraparesis or paraplegia and lesion was localized in the T3-L3 segment, usually following a strenuous exercise or a traumatic. The intramedullary linear tract of contrast medium originated from the ventral or dorsal subarachnoid space and extended into the spinal cord parenchyma. The most common sites were T12-T13 and T13-L1. All dogs received medical treatment and functional rehabilitation by physiotherapy. A 3-months follow-up was available for 12 dogs, and all of them showed marked improvement of their neurological status and were either normal or mildly ataxic. Four dogs were euthanized within 2 months due to lack of improvement. All of them had non-ambulatory paraparesis or paraplegia at initial presentation.

Discussion / Conclusion:
IIVDE is a rare affection of dogs presented with acute thoracolumbar myelopathy. This study presents clinical and CTM findings in dogs with presumed IIVDE.

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Topic: Canine & Feline
Time: 12.46-12.58

QUANTITATIVE ASSESSMENT OF CANINE LUMBAR DISC DEGENERATION USING VARIABLE-FLIP-ANGLE T1-MAPPING AND MULTI-ECHO T2- AND T2*-MAPPING SEQUENCES: A PROSPECTIVE PILOT STUDY.

Nora Bouhsina, Léa Tur, Jean-Baptiste Hardel, Stéphane Madec, Dominique Rouleau, Floriane Etienne, Jérôme Guicheux, Johann Clouet, Marion Fusellier

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Keywords:
dog, quantitative MRI, intervertebral disc

Introduction / Purpose:
MRI is the gold standard to diagnose intervertebral disc degeneration (IVDD) in humans and in dogs. Considering the development of targeted therapy particularly in the field of regenerative medicine, the standard qualitative evaluation of the intervertebral disc (IVD) lacks of accuracy to assess the evolution of the degeneration. Mapping MRI permits to quantify the IVDD but it has scarcely been applied in dogs. The objective of this prospective pilot study was to evaluate the feasibility of variable-flip-angle T1 mapping and multi-echo T2 and T2* mapping to quantify canine lumbar IVDD on twenty canine patients.

Methods:
Ventral and dorsal lumbar IVD heights were measured on X-ray and lumbar IVDs were given a qualitative Pfirrmann grade on T2-weighted sequence. T1, T2 and T2* relaxation times of the *Nucleus pulposus* (NP) were measured on corresponding maps using a manual-drawn ROI. Correlations between IVD heights and relaxation times with Pfirrmann grading were investigated.

Results:
Strong intra- and interrater agreements were found ($p<0.01$). IVD heights and T1, T2, and T2* mapping negatively correlated to Pfirrmann grading ($p<0.01$). Significant differences in T1 relaxation times were found between Pfirrmann grade I and the other grades ($p<0.01$). Significant differences in T2 and T2* relaxation times were found between grade I and the other grades and between grades II and III ($p<0.01$).

Discussion / Conclusion:
T1, T2, and T2* mapping of the NP are accurate tools to assess early canine lumbar IVDD. They might be further considered as valuable quantitative MRI sequences to evaluate IVDD and efficacy of regenerative treatments during longitudinal studies.

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Topic: Canine & Feline
Time: 14.50-15.02

VARIATIONS IN NORMAL TOPOLOGY OF THE CANINE DESCENDING DUODENUM ON COMPUTED TOMOGRAPHY

Stephen Barker, Marie-Aude Genain

Queen's Veterinary School Hospital, University of Cambridge, Cambridge, United Kingdom

Keywords:
Computer tomography, descending duodenum, canine

Introduction / Purpose:

Computer tomography (CT) allows for superior three-dimensional resolution of soft tissue structures within the abdomen allowing easier assessment of the gastrointestinal tract. The aim of this study was to determine if there are variations in the anatomical pathway of the descending duodenum and what factors may influence this.

Methods:

Retrospective observational study reviewing all CT scans performed at a single referral institution meeting the inclusion criteria. Scans were classified as normal or subcategorised depending on the anatomical path of the descending duodenum and pylorus. Data was collected regarding signalment, weight, chest conformation and degree of distension of pylorus and body of stomach.

Results:

567 cases between January 2018 and August 2021 met the inclusion criteria with 531 normal cases, 36 were subcategorised into 4 groups: pathway 1(n=24), pathway 2(n=1), pathway 3(n=7) and pathway 4(n=4). Pathways 1, 2 and 3 had the duodenum running normally to the level of 11^{th}-13^{th} rib prior to running craniodorsally along the caudal aspect of the liver before turning medially and caudally, and in the case of pathway 1 medial to the right kidney. In Pathway 4 the duodenum leaves the stomach medially, then runs caudolaterally across the dorsal aspect of the stomach to the body wall then follows the normal pathway.

Discussion / Conclusion:

Anatomical variations may change the approach needed in visualising these structures on ultrasonographic examinations. In some cases, the duodenum can exit the stomach medially, contrary to the described anatomy and this is seen with mild to marked distension of the pylorus.

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Topic: Canine & Feline
Time: 15.04-15.16

CORRELATION BETWEEN THE PRESENCE OF A SMALL INTESTINAL HYPERECHOIC MUCOSAL BAND AND FIBROSIS IN CATS

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Keywords:
intestine; mucosa; fibrosis; feline

Introduction / Purpose:
A 4-month-old indoor domestic shorthair cat presented with a 2-week history of lethargy and inappetence, with initial vomiting and diarrhoea.

Methods:
Mild neutropenia and hypokalaemia were present. Abdominal ultrasound revealed the presence of a continuous thin hyperechoic band, in the periphery of the mucosal layer of the duodenum and jejunum. No gastrointestinal thickening was observed. As abdominal radiographs indicated constipation, concomitant large intestinal inflammation was suspected. Because of the ultrasonographic suspicion of intestinal fibrosis, small intestinal full thickness biopsies were taken surgically 2 weeks later along with ovariohysterectomy.

Results:
No abnormality was found on the three submitted samples, and the mucosal layer was reported as within normal limits. A second review of the biopsies was performed by a pool of pathologists and Picrosirius red staining for collagen was performed in order to reveal subtle fibrosis. When compared to the WSAVA grading standards, the collagen was within normal limits.

Discussion / Conclusion:
Current literature describes the presence of a hyperechoic mucosal band as indicative of intestinal fibrosis. These findings may point to two hypotheses: 1) ultrasonography is superior to histopathology in identifying early intestinal fibrosis, 2) intestinal fibrosis is currently overdiagnosed, possibly because of the low submission rate of intestine for histopathology. Assuming the latter is true, the authors believe that normal intestine should be included in the differential diagnosis, in young feline patients where an hyperechoic mucosal band is observed. More cases are necessary to confirm this hypothesis.

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Topic: Canine & Feline
Time: 15.18-15.30

IMAGING FEATURES OF INTESTINAL LIPOGRANULOMATOUS LYMPHANGITIS IN 10 DOGS

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Keywords:
Lipogranuloma, canine, inflammatory, muscularis

Introduction / Purpose:
Intestinal lipogranulomatous lymphangitis (ILL) is a granulomatous inflammation of the lymphatic vessels of the intestinal wall and mesentery characterized by lipogranulomas. The purpose of this study is to report the imaging features of canine ILL.

Methods:
Inclusion criteria were an abdominal ultrasound and histological diagnosis of ILL.

Results:
Ten dogs were included. Additional CT was available in 2 cases. Eight dogs had focal and two multifocal distribution. All dogs presented intestinal wall thickening and 2 had a concomitant mesenteric mass adjacent to the intestinal lesion. All lesions were located in the small intestine. Ultrasonographic features were altered wall layering with predominantly muscular and to a lesser extent submucosal layer thickening. Other findings included hyperechoic nodular tissue within the muscular, serosa/subserosal, and mucosal layers, hyperechoic perilesional mesentery, enlarged submucosal blood/lymphatic vessels, mild ascites, intestinal corrugation, and mild lymphadenomegaly. The two intestinal to mesenteric masses presented heterogeneous echostructure, predominantly hyperechoic with multiple hypo/anechoic cavitations filled with mixed fluid and fat attenuation content on CT. Histopathological findings were lymphangiectasia, granulomatous inflammation and structured lipogranulomas affecting mainly submucosa, muscularis and serosa. The intestinal to mesenteric cavitary masses revealed severe suppurative peritonitis with steatonecrosis.

Discussion / Conclusion:
ILL is characterised by focal/multifocal intestinal wall thickening, mainly localized at the jejunum/ileum, involving predominantly the muscular layer, and it is occasionally associated with hyperechoic intramural nodular tissue and mesenteric cavitary mass.

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Topic: Canine & Feline
Stream 1: 15.32-15.44

EFFECT OF CHRONIC DISEASE ON ADRENAL SIZE IN CATS

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Keywords:
adrenal glands; feline; chronic disease

Introduction / Purpose:
Various studies have reported the effect of stress-inducing non-endocrine chronic diseases on the ultrasonographic measurements of feline adrenal glands. The chronicity and severity of chronic diseases may affect the hypothalamic-pituitary-adrenal axis differently than acute disease. The purpose of this anatomic study was to determine if there are differences in the ultrasonographic measurements of feline adrenal glands between cats with chronic renal disease (CRD) and acute enteropathies.

Methods:
49 cats (22 with enteropathies and 27 with CRD) underwent an ultrasound examination and the maximum height of the cranial and caudal poles of both adrenal glands was measured in a sagittal plane.

Results:
Results showed that in the CRD group, left cranial (Median $[Mdn]^{DRC}$ = 4.0; $MdN^{Entropathies}$ =3.4, U= 192,5, p=0.035) and caudal adrenal ($[Mdn]^{DRC}$ = 3.9; $MdN^{Entropathies}$ =3.2, U= 164, p= 0.007) poles were larger when compared to the enteropathy group.

Discussion / Conclusion:
This suggests that cats with CRD may have larger adrenal gland measurements due to the chronic stress induced by the disease process. This may affect the hypophyseal-adrenal axis in cats with chronic illness differently than those with acute enteropathies. These findings should be taken into consideration when assessing adrenal gland measurements, especially when evaluating possible adrenal enlargements in comparison with previously obtained measurements in cats with a history of chronic disease.

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Topic: Canine & Feline
Time: 15.46-15.58

CANINE INSULINOMAS AND THEIR PRESUMED METASTASES ARE MOST CONSPICUOUS IN THE LATE ARTERIAL PHASE IN CONTRAST ENHANCED COMPUTED TOMOGRAPHY.

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Keywords:
dog, multiphasic CT, contrast, injection-duration

Introduction / Purpose:
Avid arterial enhancement is the commonly described characteristic of canine insulinomas in contrast-enhanced computed tomography (CECT). However, this feature is inconsistently reported. The aim of this study was to investigate in detail the contrast enhancement pattern of canine insulinomas and presumed metastases in three consecutive (early, mid and late) arterial phases (EAP, MAP and LAP).

Methods:
This single centre retrospective descriptive study included dogs with clinical, cytological, or histopathological diagnosis of insulinoma and CECT with three arterial and at least one venous phases. The arterial enhancement of pancreatic nodules and presumed metastases were assessed using a visual grading score.

Results:
Twelve dogs with a total of nineteen pancreatic nodules were analysed. Four insulinomas were histopathologically confirmed. Eight patients had a solitary and four dogs multiple pancreatic nodules. LAP demonstrated the largest number of nodules reaching the highest enhancement scores (n=16, 84%). All analysed dogs had CT evidence of arterially enhancing nodular lesions in the liver (n=12), seven in the hepatic and/or splenic lymph nodes and three in the spleen. Three out of five sampled livers and three lymph nodes were metastatic. All sampled spleens were benign.

Discussion / Conclusion:
Avid arterial enhancement was the most dominant feature of canine insulinomas and their metastases in CECT. The highest enhancement scores were observed primarily in LAP, followed by MAP. The authors suggest to always include the LAP in the standard protocol. MAP could be included to improve the rate of insulinomas detection. Any arterial study including only early arterial images risks missing lesions.

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Topic: Canine & Feline
Time: 17.06-17.18

COMPUTED TOMOGRAPHIC FEATURES OF LUNG METASTASES FROM DIFFERENT PRIMARY CANINE NEOPLASIA: A PRELIMINARY STUDY

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Keywords:
CT, LUNG, METASTASES

Introduction / Purpose:
The lungs are a common site of metastasis in most primary neoplasia. In human radiology, CT features help to prioritize the histotype, whereas little information is available for dogs. This retrospective study was aimed to compare the CT characteristics of pulmonary metastases from different primary cancers.

Methods:
CT studies of dogs with cytological/histological confirmed primary neoplasia and pulmonary nodules consistent with a metastatic process were reviewed. Following CT features were recorded: nodule number, distribution, shape, size, margins, attenuation (HU), pattern of enhancement, and presence of other thoracic abnormalities.

Results:
271 dogs were included and subdivided into six groups depending on the primary tumor histotype: epithelial (n=70), bone sarcoma (n=25), soft tissue sarcoma (n=36), melanoma (n=43), hemangiosarcoma (n=62), and histiocytic sarcoma (n=35). Number of lesions did not differ between groups. However, if numerous metastases were present, a diffuse distribution was prevalent, whereas a peripheral location was more common if nodules were less than 10. Following CT features were observed: mineralized nodules in 36% of bone sarcomas; cavitated lesions in 19% of carcinomas, increasing to 60% in transitional cell carcinomas; halo sign in 66% of hemangiosarcomas; air bronchogram and thoracic lymphadenomegaly in 89% and 71% of histiocytic sarcomas.

Discussion / Conclusion:
CT features of lung metastases might suggest neoplasia histotype. This information could be especially useful to orient the search if the primary tumour is not obvious, if two cancers are potential origin of the metastases or when the pulmonary nodules cannot be sampled

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Topic: Canine & Feline
Time: 17.20-17.32

BOOST DOSE TO RESIDUAL TUMOUR VOLUME IN CANINE SINONASAL TUMOUR TREATED WITH RADIATION THERAPY

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Keywords:
Radiation, nasal tumor

Introduction / Purpose:
Most dogs with sinonasal tumors (SNT) treated with radiation therapy (RT) die due to local disease progression. In our previous study, post-treatment cone beam CT (CBCT) performed for monitoring identified residual tumour within the original gross tumour volume (GTV) in all patients. One dog from the original study had received a boost dose to the GTVresidual (GTVr) when treated for his out-of-field recurrence and had no local progression at the last CBCT 18 months post-RT. We hypothesised that giving an extra dose of RT to the GTVr would be safe and potentially increase local control.

Methods:
Included dogs had SNT treated between 2019-2020 except the original dog treated in 2014 with a 1st RT protocol of 10 x 4.2 Gy and an extra 2nd RT boost (3 x 4 Gy) to GTVr identified on CBCT recheck.

Results:
Seven dogs received the boost protocol. The RT boost was administered a median of 152 days (range: 127-293 days) post 1st RT. The original GTV was a median of 28 cm^3 (range: 15-59 cm^3) and the GTVr was a median of 5.4 cm^3 (range: 1.9-16.6 cm^3). Of the seven dogs, 3 (42%) showed no local progression prior to death. All dogs are deceased with a median survival of 527 days (range: 276-1190 days). Leukotrichia was the only observed toxicity.

Discussion / Conclusion:
The boost dose to GTVr does not appear to increase toxicity and could potentially lead to increased local control, however, a larger cohort needs to be evaluated.

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Topic: Radiation Oncology
Time: 17.34-17.46

PITUITARY TUMORS WITH NEUROLOGICAL SIGNS TREATED WITH RADIOTHERAPY

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Keywords:
brain tumor, oncology, radiation therapy

Introduction / Purpose:
Larger pituitary tumors have a less favorable prognosis if treated with surgery or radiation therapy (RT). However, not all dogs showed neurological signs. Different pituitary/brain ratios are described to take the various dog brain sizes into account. Our objective was to evaluate pituitary/brain ratios, neuro-imaging findings, and outcome in dogs with large pituitary tumors causing neurological signs treated with RT.

Methods:
Dogs with imaging-presumed pituitary tumors and neurological signs treated with 10x4Gy were retrospectively included. Neurological signs, pituitary/brain ratios, imaging findings and survival time (ST) were documented.

Results:
Twenty-two client-owned dogs were included. Most common clinical signs were obtundation (91%), abnormal mentation (64%) and behavior changes (62%), 10/22 had suspected hemorrhage on initial imaging. Amelioration or complete normalization of all neurological signs was seen in 22/22 and 11/22 dogs, respectively. Median pituitary-height-to-brain-height ratio was 0.43 (range 0.33-0.55), median pituitary-volume-to-brain-volume ratio 0.43 (range 0.01-0.11). Imaging follow-up in 18 dogs showed a decrease in size in all but one dog at the time of their first imaging re-check (median 6 months, range 0.5-20 months post RT). Hemorrhage decreased in 5/18, increased in 4/18 and newly occurred in 3/18. Median overall ST was 922 days (95%CI: 71;1772), while median disease-specific ST was not reached (mean 1556 days (range 66-2375)). Overall ST was not significantly different if pituitary/brain volume ratio (p=0.65) or pituitary/brain height ratio (p=0.79) was above the median.

Discussion / Conclusion:
Large pituitary tumors with associated neurological signs responded favorably to RT. Suspected pituitary hemorrhage at initial diagnosis and during follow-up was a common finding.

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Topic: Canine & Feline
Time: 17.48-18.00

TOLERABILITY AND EFFICACY FOLLOWING DEFINITIVE INTENT RADIATION THERAPY (48-50GY TOTAL RADIATION DOSE) FOR CANINE PITUITARY MACROADENOMAS

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Keywords:
Canine; Macroadenoma; Radiation therapy

Introduction / Purpose:
Radiation therapy (RT) is the treatment of choice for unresectable canine pituitary tumours. The purpose of this study was to determine the acute adverse event profile and clinical outcome for dogs treated with definitive-intent RT.

Methods:
Dogs with pituitary macroadenomas prescribed 48Gy or 50Gy to the target volume in 3.0Gy or 2.5Gy daily fractions, respectively, were included. Acute adverse events were graded according to VRTOG criteria. Overall survival was measured from the first radiation fraction until death due to any cause. Objective tumour response was evaluated with repeat imaging and was captured from radiology report from a board-certified radiologist using RECIST criteria.

Results:
Thirteen dogs were included. Ten were prescribed 50Gy in 20 fractions and 3 were prescribed 48Gy in 16 fractions. Dogs were treated with 3D-CRT (N=11), IMRT (N=1) or VMAT (N=1). Median follow up time for dogs that are still alive is 520 days. The overall median survival was 960 days (140-1653 days). Five dogs were euthanised at a median of 322 days (218-1127 days). Eight dogs are still alive (140-1653 days). No acute radiation toxicities were reported. Objective tumour response assessment was available in 9/13 dogs. Two dogs had complete responses, 2 partial responses and 5 had stable disease.

Discussion / Conclusion:
Our data support that definitive intent radiotherapy consisting of 48-50Gy total dose is well-tolerated in dogs with pituitary macroadenomas and is associated with long survival. Further study with a larger number of dogs and standardized follow-up is warranted

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Topic: Canine & Feline
Time: 09.20-09.32

REPEATABILITY OF RADIOGRAPHIC ASSESSMENTS FOR FELINE HIP DYSPLASIA: ARE CONSENSUS SCORES IN RADIOLOGY LESS ACCURATE THAN WE ASSUME?

Elisabeth Ball[1], Margareta Uhlhorn[1], Per Eksell[2], Ulrika olsson[3], Åsa Ohlsson[1], Matthew Low[1]

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Keywords:
hip dysplasia; cat; consensus; radiography

Introduction / Purpose:
Variation in the diagnostic interpretation of radiographs is a well-recognized problem in human and veterinary medicine. One common solution is to create a 'consensus' score from multiple observers. While consensus approaches are generally assumed to improve diagnostic repeatability, the extent to which consensus scores are themselves repeatable has rarely been examined. The aim of this study was to assess the intra-observer, inter-observer, majority-consensus and unanimous-consensus repeatability scores for feline hip dysplasia and also assess to what extent the cat's age or the image quality is related to any variations.

Methods:
Standard extended ventrodorsal radiographs from 98 Maine Coon cats were randomly selected from archived results within the database of PawPed's feline hip dysplasia screening programme. Three observers assessed and graded the radiographs for each cat individually at two separate occasions, followed by a consensus assessment grading.

Results:
Intra-observer and inter-observer repeatability was moderate (63-71%). Consensus scores did show reduced variation between assessments compared to individuals, but consensus repeatability was far from perfect. Only 75% of majority consensus scores were in agreement between assessments, and based on multinomial modelling, unanimous consensus scores are estimated to have a repeatability as low as 83%. There was little evidence of the cat's age and positioning playing a role in the repeatability of radiographic scoring.

Discussion / Conclusion:
This study reveals that consensus scores in veterinary radiology can have large uncertainties. Future studies are needed to include consensus-uncertainty estimates if we are to properly interpret radiological diagnoses and the extent to which consensus scores improve diagnostic accuracy.

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Topic: Canine & Feline
Time: 09.34-09.46

MAY A SINGLE FAST PRE-SURGICAL MRI SEQUENCE ACQUISITION REPLACE STANDARD RADIOGRAPHS FOR TPLO SURGICAL PLANNING IN DOGS?

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Keywords:
Cranial cruciate ligament disease, TPA

Introduction / Purpose:
Cranial cruciate ligament (CCL) disease causes variable stifle instability, assessed by specific clinical tests. Radiographs are performed to measure the tibial plateau angle (TPA) for planning tibial plateau leveling osteotomy (TPLO) surgery. Concomitant damage of other intra-articular structures, of unreliable clinical assessment and potentially affecting the surgical outcome, might be associated; joint assessment during TPLO through mini-arthrotomy or arthroscopy is therefore advised, though it increases the risk of complications. MRI offers a non-invasive alternative, adds information about intra- and peri-articular structures, and could potentially be used for TPA measurements.

Methods:
This prospective study aimed to 1) assess the correlation between the TPA measured with the standard pre-surgical radiographs and with a single, fast, sagittal proton density-weighted fat-saturated MRI sequence; 2) compare the surgical findings with the information obtained by the MRI sequence.

Results:
Twenty-two dogs were included; TPA correlation using radiographs-MRI was available for 17 dogs, and surgery-MRI comparison for 18 dogs.
A strong significant correlation was identified between the TPA measurements on radiographs-MRI (Pearson correlation coefficient 0.923; p-value <0.0001).
The sensitivity and specificity of MRI to detect surgically confirmed complete versus partial CCL rupture were 85.7% and 75% respectively; MRI identified 7/8 surgically confirmed injured menisci, and detected abnormal signal intensity in 8/10 menisci and nine caudal cruciate ligaments reported as normal intra-operatively; MRI additionally identified subchondral bone edema in nine dogs and muscular hyperintensity in six cases.

Discussion / Conclusion:
This pre-surgical MRI sequence might replace standard radiographs for TPA measurements and can provide information about concomitant joint injuries with potential prognostic impact.

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Topic: Canine Feline
Time: 09.48-10.00

A PROSPECTIVE AND RETROSPECTIVE STUDY TO DETERMINE THE PRESENCE AND NATURE OF CLAVICLES IN DOGS USING DIFFERENT DIAGNOSTIC IMAGING MODALITIES.

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Keywords:
Clavicle, CT, ultrasound, radiograph

Introduction / Purpose:

The canine clavicle is a vestigial anatomical structure whose non-functional role in the thoracic girdle is associated with low clinical significance. Clavicles may however be misinterpreted as a lesion on diagnostic imaging studies as their normal appearance on various imaging modalities has not yet been described.

Methods:

This observational combined retrospective and prospective study aimed to evaluate the incidence and imaging characteristics of clavicles in a sample of 60 adult dogs equally distributed between small, medium and large breeds. For the retrospective part, the radiographs and computed tomography studies of 60 randomly selected dogs were reviewed to assess presence, shape, opacity or attenuation respectively, and location of the clavicles. For the prospective part of the study, ultrasonography was performed on 6 canine cadavers with the aim to loacalise and describe the clavicles. Their correct localisation was subsequently confirmed by ultrasound-guided injection of iodinated contrast medium combined with methylene blue, followed by radiographs and dissection for histopathology.

Results:

Bilateral symmetrically positioned mineralised clavicles were identified in all cases on computed tomography and most cases on radiography, and these were symmetrical in shape in 59/60 cases. Variations in the shape and size of clavicles were observed both between breeds and between individuals of the same breed. On ultrasonography, clavicles may be visualised as shorT, rectilinear, and hyperechoic with variable acoustic shadowing.

Discussion / Conclusion:

By describing the aspect of canine clavicles on various imaging modalities, this study increases the chances of clinicans correctly identifying them and therefore avoiding their misinterpretation as foreign material or bony fragments.

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Topic: Canine & Feline
Time: 10.02-10.14

INCIDENTAL ULTRASONOGRAPHIC DIAGNOSIS OF BRACHIAL PLEXUS NEOPLASIA IN FIVE PATIENTS WITH FRONT LIMB LAMENESS

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Keywords:
Peripheral sheath tumor,musculoskeletal ultrasound

Introduction / Purpose:

The axillary fossa can be easily scanned during the longitudinal easily scanned during the longitudinal evaluation of the biceps bachii tendomuscolar junctions, angling the probe 20 degrees medially. This retrospective study aimed to define the usefulness of including the axillary region in the ultrasound evaluation of the shoulder.

Methods:

Four dogs and one cat were selected for this study. Inclusion criteria were: front limb lameness localized to the shoulder, absent to minimal pain, unremarkable radiographic examination, and a detected ultrasonographic lesion with a final cytologic or histologic diagnosis.

Results:

All the patients had progressive muscle atrophy of the shoulder. None of the patients were sent to ultrasound for a suspected neurologic condition, but three had a previous negative neurologic examination. One patient had a shoulder CT that failed the diagnosis. A hypoechoic tubular structure was identified in each patient, displacing vessels and altering the typical anatomy of the axillary fossa. Colour Doppler excluded a vascular origin. The etiology of the lesions was confirmed by histology or cytology. MRI was available in three patients to determine the size and extent of the neoplasm.

Discussion / Conclusion:

Peripheral nerve tumors originating from Schwann cells or fibroblasts associated with the epi- or endoneurium may have insidious clinical onset and no apparent pain. The non-specific clinical signs create a challenging diagnosis. The inclusion of axillary fossa in patients scanned for shoulder lameness can aid in diagnosis peripheral nerve tumors, especially if atrophy of the adjacent muscles is present.

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Topic: Canine & Feline
Time: 10.16-10.28

OSTEOCHONDROSIS-LIKE LESION IS FREQUENTLY OBSERVED AMONG LUMBOSACRAL ABNORMALITIES ON SPINAL COMPUTED TOMOGRAPHY OF FRENCH BULLDOGS

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Keywords:
brachycephalic, congenital, spine, malformation

Introduction / Purpose:
Lumbosacral abnormalities are frequently observed on computed tomography (CT) of French Bulldogs. Lumbosacral osteochondrosis is a rare affection preferentially described in large breeds with variable clinical signs which has not been reported in French Bulldogs. Aims of this study were to evaluate CT lumbosacral abnormalities and prevalence of lumbosacral osteochondrosis-like lesions (OCDL) in French Bulldogs.

Methods:
French Bulldogs spinal CT were retrospectively reviewed for evaluation of lumbosacral abnormalities. OCDL was described as an end-plate irregularity sometimes associated with an adjacent mineralized fragment. Location of the irregularity and possible mineralized fragment were recorded. L7-S1 disc protrusion, cauda equina nerve roots compression or thickening, disc mineralization, end-plate sclerosis, spondylosis deformans, S1 articular processes hypertrophy, transitional vertebrae, hemivertebrae, spina bifida and block vertebra were also recorded.

Results:
Lumbosacral CT abnormalities were found in 168 of the 183 included dogs (91.8%). The most common abnormality was L7-S1 dorsal disc protrusion (77.4%). OCDL was commonly observed (47%), most frequently involved L7 (78.5%) and especially its dorsolateral aspect (61,3%). A mineralized fragment was present in 62% of all lesions. OCDL was mostly associated with a L7-S1 disc protrusion (93.7%), often compressive (63.3%) and with endplates sclerosis (65.8%). There was not definitive correlation between the findings and the clinical presentation.

Discussion / Conclusion:
Lumbosacral OCDL seems to be a common finding on spinal CT evaluation of French Bulldogs, affecting preferentially L7. It is often observed together with a dorsal disc protrusion and an adjacent mineralized fragment. Interpretation of its clinical significance has to be considered cautiously.

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Topic: Canine & Feline
Time: 12.06-12.18

THE UNSTRUCTURED INTERSTITIAL PULMONARY PATTERN ON THORACIC RADIOGRAPHS MISCHARACTERIZES RESPIRATORY PATHOLOGY COMPARED TO THORACIC COMPUTED TOMOGRAPHY: A RETROSPECTIVE STUDY.

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Keywords:
CT, thoracic radiographs, pulmonary, interstitial

Introduction / Purpose:

Thoracic radiographic (TR) patterns of increased opacity include bronchial, interstitial, and alveolar patterns; these are generally accepted to indicate disease of airways, interstitium, and alveoli, respectively. Differential diagnoses are based on the presumption that TR reflect the anatomic location of disease which may not be true. In humans, thoracic CT has excellent histologic correlates. This study objective was to describe CT patterns and final diagnoses in dogs with respiratory disease having a TR-interstitial pattern. We hypothesized dogs with respiratory clinical signs and a TR-interstitial pattern would have CT patterns and final diagnoses compatible with disease beyond the pulmonary interstitium, including alveoli, bronchi, and bronchioles.

Methods:

Screening 269 dogs with respiratory disease, 14 had an exclusive TR-interstitial pattern, inspiratory:expiratory-breathhold CT, and airway lavage. CT patterns were classified as increased attenuation, decreased attenuation, linear and nodular patterns, with previously reported sub-patterns. Anatomic localization was based on sub-patterns. Final diagnoses were made by comprehensive evaluation of the entire clinical picture.

Results:

CT sub-patterns were compatible with interstitial (14/14), alveolar (14/14), bronchial (11/14) and bronchiolar (12/14) involvement. Comorbid diseases were present in 11/14 dogs (range, 3-8 diagnoses). The most common final diagnosis was bronchomalacia (10/14); this was captured on 100% CTs and missed on 100% TR. Interstitial lung disease including pulmonary fibrosis (8/14), while compatible with a TR-interstitial pattern, extended to involve small airways in all 8 dogs.

Discussion / Conclusion:

The TR-interstitial pattern underestimates the spectrum of large/small airway and alveolar pathology, especially bronchomalacia and small airway disease associated with interstitial lung disease.

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Topic: Canine & Feline
Time: 12.20-12.32

INCIDENCE OF PULMONARY HYPERTENSION AND RADIOGRAPHIC FINDING OF TORTUOUS PULMONARY ARTERIES IN CATS WITH CONGENITAL HEART DISEASE

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Keywords:
feline, cardiac, defect, cardiomegaly

Introduction / Purpose:
Pulmonary hypertension (PHT) is common in cats with congenital heart defects, particularly those that result in overcirculation of the pulmonary vasculature. Thoracic radiographs are commonly used to screen for associated cardiovascular abnormalities. The study aimed to identify changes to the pulmonary vasculature to support a diagnosis of PHT in cats with congenital heart defects.

Methods:
The medical records, echocardiographic data and thoracic radiographs of cats diagnosed with congenital heart defects and PHT were reviewed. Thoracic radiographs were evaluated for the presence or absence of tortuous pulmonary arteries. A chi-square analysis was done to evaluate for a correlation between the presence of PHT and pulmonary arterial tortuosity. A p-value less than 0.05 was considered significant.

Results:
Sixty-nine cats met inclusion criteria, including 30 cats with and 39 cats without PHT. The most common congenital defects included patent ductus arteriosus, ventricular septal defect, sub-aortic stenosis, mitral valve dysplasia and/or a collection of defects that were characterized as endocardial cushion defects. In cats with PHT (as documented using echocardiography), 26 had tortuous pulmonary vessels and 4 did not. In cats without PHT, 33 cats did not have tortuous arteries and 6 cats were noted to have tortuous arteries. The chi-square analysis resulted in a significant difference between the PHT cats and those that did not have PHT based on the presence of tortuous pulmonary arteries ($p<0.0001$).

Discussion / Conclusion:
When PHT is present, pulmonary arterial tortuosity is a common radiographic finding. The exact etiopathogenesis of the pulmonary arterial changes resulting in PHT are yet to be elucidated.

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Topic: Canine & Feline
Time: 12.34-12.46

CT FEATURES OF CONTRAST MEDIUM ACCUMULATION IN CANINE THORACIC VENOUS VALVES.

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Keywords
Semilunar, valves, axillary, subclavian, leaflet

Introduction / Purpose:
The venous system of the body contains semilunar valves to prevent blood backflow and to ensure proper blood circulation. The axillary and subclavian veins are included among the vessels that exhibit semilunar valves in the human literature. The authors have noted that multiple pin-point to millimetric and paired areas of contrast accumulation are commonly visible on postcontrast canine CT studies at the axillary, subclavian and internal thoracic veins. These areas of contrast accumulation have a consistent inter-patient distribution and appearance. The authors theorise that the visualised foci are compatible with contrast accumulation in the double-leaflet venous semilunar valves.

Methods:
300 thoracic post-contrast CT studies were reviewed by a second year ECVDI resident and supervised by a ECVDI board certified radiologist. Necropsy and histopathological examination of the internal thoracic, subclavian, and axillary veins were performed to confirm the presence of the venous valves.

Results:
The described areas of contrast accumulation were visible at the internal thoracic, subclavian, or axillary veins in 146/300 (48.66 %) of the included canine CT studies. Histopathological evaluation of the veins confirmed the presence of semilunar valves with a similar spatial distribution.

Discussion / Conclusion:
The present study describes that contrast accumulation at the semilunar valves of the internal thoracic, subclavian and axillary veins is a common finding on post contrast CT studies of the dog. This expected and incidental finding should not be confused with pathology.

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Topic: Canine & Feline
Time: 12.48-13.00

COMPUTED TOMOGRAPHY CHARACTERISTICS AND PREVALENCE OF MEDIASTINAL CYSTS IN DOGS

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Keywords:
canine, incidental, mediastinum

Introduction / Purpose:
Mediastinal cysts (MCs) are rare lesions that can arise from embryonic remnants of a variety of mediastinal structures. MCs usually are incidental findings in dogs and cats; however they can reach large size with mass-like appearance. Descriptions of MCs on CT in dogs are limited. The aims of this study were to evaluate the prevalence of MCs in dogs and to assess their CT characteristics.

Methods:
This is a retrospective descriptive study. Hospital archive was searched for dogs that underwent a thoracic CT scan from January 2019 to August 2021. CT images were evaluated for the presence of MCs by two diagnostic imaging interns, two last year diagnostic imaging residents and a board-certified radiologist. Breed, gender, age of the dogs were recorded. Number, size, margins, location, volume, shape, attenuation values of MCs were assessed.

Results:
866 CT scans were reviewed, and 49 MCs were identified. Prevalence of MCs in dogs was 5.66%. MCs were predominantly round, solitary fluid-filled lesions localized in the cranio-ventral mediastinum, with well-defined margins, homogeneous attenuation and no contrast enhancement. Mean attenuation value was 6.48 HU pre-contrast and 8.54 HU post-contrast and mean volume was 3.90 cm3. English Bulldog and crossed breed dogs were over-represented. MCs were more frequently observed in male dogs.

Discussion / Conclusion:
MCs are rare incidental lesions that must be included in the differential's diagnosis of fluid-filled and non-enhancing mediastinal space-occupying lesions without mass effect, and should not be confused with enlarged mediastinal lymph nodes.

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Topic: Canine & Feline
Time: 09.20-09.32

COMPARISON OF COMPUTED TOMOGRAPHIC AND HISTOLOGICAL FINDINGS IN JUVENILE AND ADULT FELINE CHRONIC RHINITIS

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Keywords:
Rhinitis, Feline, Computed tomography

Introduction / Purpose:
Feline chronic rhinitis (CR) is the second most common cause of feline nasal disease after neoplasia and can affect both juvenile and adult cats. The authors believe that cats who developed CR at a young age might be more severely affected. The aims of this descriptive, retrospective study were firstly to evaluate and compare the severity of sinonasal lesions on computed tomography (CT) between cats who developed CR at a young age and those who developed the disease when adult, and secondly to try to correlate histological and CT findings.

Methods:
Medical records of fifty-eight cats with CR were reviewed. The cats were divided into 2 groups, juvenile (group 1, n=30) and adult (group 2, n=28) that were younger and older than 2 years old at the onset of clinical signs, respectively. Computed tomographic findings were graded by a board-certified radiologist and compared between each group and to the histological results.

Results:
The overall CT grade was not significantly different between the 2 groups, yet the severity of turbinate lysis was significantly higher in group 1. Group 1 also had a higher occurrence of sinusal malformation. The overall CT grade was positively associated with the histological severity and group 1 had a more severe CR on histology than group 2.

Discussion / Conclusion:
Further prospective studies with larger populations could help correlate clinical, CT and histological findings, response to treatment and risk of recurrence to refine the prognosis and improve the medical management of this disease.

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Topic: Canine & Feline
Time: 09.34-09.46

COMPUTED TOMOGRAPHY OSTEODENSITOMETRY OF CALVARIAL BONE MINERAL DENSITY IN SKELETALLY HEALTHY CATS

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Keywords:
CT; mineral bone density; cats; osteodensitometry

Introduction / Purpose:
Metabolic bone disease can cause significant morbidity in cats. Calculation of bone mineral density (BMD) using quantitative computed tomography (qCT) is a novel tool. This retrospective study assesses the time requirements and ease-of-use of qCT and osteodensitometry software, establishing BMD reference values for skeletally healthy cats, and relationship between BMD and age, weight, sex and breed.

Methods:
Institutional archives were searched for computed tomography (CT) examinations of skeletally healthy cats including calvarial qCT and patient data. Calvarial BMD was calculated using a dedicated osteodensitometry software. In 50 cats time requirements for qCT and BMD analysis were recorded. Statistical analyses were performed using the R software system. Associations between BMD and categorical variables (breed, sex, and age group) were evaluated using the Kruskal-Wallis test. Correlations between BMD and body weight were assessed using the Spearman's rank correlation.

Results:
Quantitative CT studies of 128 cases met the inclusion criteria. There were no associations between BMD and body weight, sex, age group or breed. The median BMD was 397.3 mg Calcium hydroxyapatite /mL. The mean duration of calvarial qCT scanning was 52.2s (9-174s), and the mean duration of BMD analysis was 13.7s (4-44s), with a mean of 1.1 (1-2) manual adjustments required for bone margin tracing.

Discussion / Conclusion:
Feline qCT BMD assessment of the calvarium can be performed in less than one minute, making it suitable as a routine part of the protocol for head CT scanning, providing information about skeletal health in cats.

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Topic: Canine & Feline
Time: 09.48-10.00

DIFFUSION-WEIGHTED IMAGING CHARACTERISTICS OF MIDDLE EAR CHOLESTEATOMA IN DOGS

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Keywords:
Diagnostic Imaging; MRI; Cholestetomas; DWI

Introduction / Purpose:
Cholesteatomas are lesions formed from keratinizing stratified squamous epithelium mislocated in the middle ear. The secondary hyperkeratosis and shedding of keratin debris usually result in an expansile, cystic mass surrounded by an inflammatory reaction[1,2]. Imaging plays an important role for diagnosis, treatment plan and prognosis of this condition [2]. In human medicine, diffusion weighted imaging (DWI) has been identified recently as a promising tool for diagnosing cholesteatomas, since it has specific signal intensity characteristic on magnetic resonance imaging with high signal intensity on DWI and low signal on apparent diffusion coefficient (ADC) map [3,4], but as far as the authors' concern there has been no published information about the apparent diffusion coefficient values of confirmed cholesteatomas in dogs in the literature.

Methods:
The aim of this retrospective case study is to describe MRI diffusion-weighted imaging characteristics from twelve dogs that underwent head MRI with confirmed middle ear cholesteatomas by histopathology.

Results:
A total of 12 dogs were included, and all lesions (15 cholesteatomas) appeared hyperintense on DWI (b=1000) and hypointense on apparent diffusion coefficient (ADC) map, with mean ADC value equal to $0{,}68 \times 10^{-3}$ ranging from 0.59×10^{-3} to 0.79×10^{-3}, considered low, in agreement to what was reported in humans.

Discussion / Conclusion:
MRI can be an efficient method of choice for evaluating middle ear cholesteatomas in dogs and DWI demonstrated low apparent diffusion coefficients confirming restricted diffusion as expected in humans. Future studies are needed to better access DWI sensitivity and specificity to distinguish cholesteatoma from non-cholesteatoma lesions.

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Topic: Canine & Feline
Time: 10.02-10.14

COMPUTED TOMOGRAPHIC AND OTOSCOPIC FINDINGS IN CANINE OTITIS EXTERNA

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Keywords:
canine, otitis externa, mineralization

Introduction / Purpose:
Otitis externa (OE) is a common condition in dogs. Computed tomography (CT) and otoscopy are commonly used in the diagnostic work-up of canine ear conditions, and can demonstrate different pathological aspects of the external ear canal. Although both modalities are commonly used in conjunction, there is little information about how CT findings correlate with otoscopic examination. The purpose of this study is to establish this, particularly regarding the sensitivity of CT for OE.

Methods:
Head CT studies of dogs with otoscopically confirmed OE were blindly reviewed by two observers. CT features assessed were wall mineralisation, thickness, and contrast enhancement. CT findings were determined by consensus and compared with otoscopic findings, performed by a board-certified dermatologist. We hypothesize that CT will be a sensitive modality for diagnosing OE.

Results:
Twenty-four dogs were included. The sensitivity of CT for diagnosing OE was 100% (41/41 ears, 95% confidence interval [CI]: 91.4-100%), and the CT-derived diagnosis of OE (uni- or bilateral) matched the otoscopic diagnosis in 20/24 cases (83.3%, 95% CI: 62.6-98.3%; $\kappa = 0.52$). CT was sensitive for identifying ear canal stenosis (92.3%, 95% CI: 79.7-97.4%). However, only three of seven ears without otoscopic signs of OE were classified as unaffected on CT. Interestingly, four out of five cases of acute OE had ear canal mineralisation, in contrast to 12/19 (63.2%) chronic cases.

Discussion / Conclusion:
CT is a sensitive diagnostic technique adjunct to otoscopic examination for canine OE. Ear canal wall mineralization does not necessarily imply the presence of chronic OE.

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Topic: Canine & Feline
Time: 10.16-10.28

COMPUTED TOMOGRAPHY FEATURES OF HEMANGIOSARCOMA METASTASES IN DOGS

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Keywords:
CT, HSA, dogs, pulmonary metastases, lung

Introduction / Purpose:
CT is commonly used for hemangiosarcoma (HSA) staging and is helpful to define the origin and the extent of the disease. This retrospective study was aimed to assess the CT characteristics of lung and extrapulmonary metastases in dogs with HSA.

Methods:
CT studies of dogs with confirmed HSA and pulmonary nodules were included in the study and reviewed. Extrapulmonary lesions compatible with metastases were identified. Recorded CT features included number, distribution, shape, size, margins, attenuation (HU), and pattern of enhancement.

Results:
Sixty-two dogs were included. Most pulmonary lesions were numerous (> 10 - 74%), multilobar (69%), miliary (67%) to subcentimetric (91%) in size, and with well-defined margins (98%). When numerous nodules were present, a multilobar distribution was prevalent, while a peripheral location was more common if nodules were < 10 ($p<0.0001$). In 66% of the patients, the presence of an ill-defined, peri-lesional, ground-glass opacity (halo sign) was observed, in 88% cases there was a pulmonary vessel leading directly to the nodule (feeding vessel). After contrast medium, the majority of lung metastases were homogenous (82%), whereas in 24% of the patients an intralesional spotty, linear or amorphous area of intense enhancement was visible. A similar feature was detected in the extra-pulmonary metastases, with a prevalence ranging from 44.4% to 88.9% depending on the organ.

Discussion / Conclusion:
Pulmonary HSA metastases are characterized by diffuse, small (military or subcentimetric), well defined nodule, commonly associated with halo sign and feeding vessel. A spotty post-contrast linear or amorphous strong hyperdensity (S.P.L.A.S.H. sign) was frequently observed especially in extrapulmonary metastases.

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Topic: Canine & Feline
Time: 11.36-11.48

COMPUTED-TOMOGRAPHY ASSESSMENT OF THE MAIN ABDOMINAL VESSELS IN DOGS

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Keywords:
CT, dog, abdominal vessels

Introduction / Purpose:
Computed tomography (CT) characterization of abdominal vessels is poorly studied. The objectives of this study were to assess during growth the evolution of the aorta (Ao), caudal vena cava (CVC), portal vein (PV), length of second lumbar vertebra (L2) and different ratios between these structures; and to determine the influence of dog size and age on the vessels size and ratios.

Methods:
The main abdominal vessels were assessed on CT angiography retrospectively. The first group included 6 Beagles scanned every month from 4-12 months old, then every trimester up to 24 months old. The second group included 26 dogs of different breeds and weights that were considered hemodynamically normal. Those dogs were divided in 3 weight intervals: <10kg, 10 to 30kg and >30kg. The measurements were repeated 3 times by 3 operators.

Results:
The diameter of the Ao, CVC and PV, and the length of the Ao and L2, increased up to 7 months old. Similarly, the different ratios, such as CVC/Ao, VP/Ao, Ao/L2 and CVC/L2 were variable before but became stable after 7 months old. The diameter of the Ao, CVC, PV, the previously cited ratios and L2 length, were variable between weight categories but stable within the category.

Discussion / Conclusion:
The adult vascular standards and ratios published in the literature should not be used in medium dogs younger than 7 months old. As variability is observed between the weight categories, measurements and ratios should be used with care in very small or very large dogs.

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Topic: Canine & Feline
Time: 11.50-12.02

SHEAR WAVE ELASTOGRAPHY MEASUREMENTS IN DOGS WITH CLOSED EXTRAHEPATIC PORTOSYSTEMIC SHUNTS AND IN DOGS WITH MULTIPLE ACQUIRED PORTOSYSTEMIC SHUNTS.

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Keywords:
shear wave elastography, portosystemic shunts

Introduction / Purpose:
Elastography is a non-invasive ultrasound technique that allows qualitative and quantitative estimation of tissue stiffness. The study's main objective was to compare liver stiffness values between dogs with closed congenital extrahepatic portosystemic shunts (cEHPSS), and those with multiple acquired portosystemic shunts (MAPSS) after gradual surgical attenuation and to assess whether this method could be used as an alternative to determine EHPSS closure. As secondary objective, (SWE) velocity measurements obtained from both intercostal and subxiphoidal views were compared for differences.

Methods:
Patients who had undergone surgical treatment for congenital EHPSS in the years between 2013-2018 were prospectively recruited. For inclusion the patients had to have the outcome of the shunt closure confirmed via trans-splenic scintigraphy and/or computed tomography angiography minimally 3 months after the surgical procedure and have a postoperative follow-up period of at least 6 months. Twenty dogs were included: 14 cEHPSS and 6 MAPPS.

Results:
No significant differences between the groups (cEHPSS vs. MAPPS) were identified regarding average, median and maximum shear wave velocities (P=0,5927; P=0,5684; P=0,7486, respectively). Significant difference between the maximum velocity measurement of the intercostal (4.00 +/- 0.20) and subxiphoidal (3.41 +/- 0.17) (P=0.0220) approach (P=0.0220) was found. No significant effects of age, body weight or sex on SWE velocities were observed.

Discussion / Conclusion:
Elastography was unable to differentiate between patients with cEHPSS and those with MAPSS. However, statistically significant difference was identified in the maximum velocity measurements between the intercostal and subxiphoidal approaches.

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Topic: Canine & Feline
Time: 12.04-12.16

URINE ATTENUATION VALUE IN NON-CONTRAST ABDOMINAL COMPUTED TOMOGRAPHY DOES NOT HELP TO DIAGNOSE BACTERIURIA IN DOGS.

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Keywords:
Diagnostic imaging, CT, internal medicine, urology

Introduction / Purpose:
The aim of this study was to investigate the association between urine attenuation value (Hounsfield unit) and positive urine culture in dogs.

Methods:
Dogs were included if complete urinalysis and urine bacteriological culture were performed within 7 days of abdominal CT study. Urine attenuation values were measured at the largest diameter of the bladder; three regions of interest measuring $3cm^2$ within the bladder at this level were evaluated on transverse CT images and an average calculated. Dogs were excluded if the bladder was too small for all measurements to be obtained. Associations between individual urinalysis parameters (turbidity, urine specific gravity, pH and the presence of epithelial cells, red blood cells, white blood cells, protein, glucose, ketones, bilirubin and casts) and urine attenuation value were explored using simple linear regression. The ability of urine attenuation value to predict the presence or absence of positive urine culture was determined by simple logistic regression.

Results:
38 dogs fulfilled the inclusion criteria, 27 with negative and 11 with positive urine cultures. The median (range) urine attenuation values were 15.5 (-4.9 to 53.8) and 11.3 (0.7 to 71.8) HU in each group, respectively. Only urine specific gravity was significantly but weakly correlated with urine attenuation ($R^2 = 0.11$, $p = 0.039$). Urine attenuation values were not predictive of urine culture result ($p = 0.96$).

Discussion / Conclusion:
The average urine attenuation value in non-contrast abdominal CT does not aid in the diagnosis of urinary tract infections in dogs.

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Topic: Canine & Feline
Time: 12.18-12.30

CT FEATURES OF SMOOTH MUSCLE URINARY BLADDER WALL NEOPLASIA IN FOUR DOGS

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Keywords:
smooth muscle, leiomyoma, leiomyosarcoma

Introduction / Purpose:
Smooth muscle urinary bladder wall neoplasia is rare in dogs.(1)

Ultrasound appearance of these tumours has been described.(2)

To date no reference is available regarding the appearance of these tumours on CT.

Methods:
Four dogs were referred from multiple institutions. Three cases were diagnosed with leiomyoma and one with leiomyosarcoma.

Results:
In the three cases diagnosed with leiomyoma, CT identified a urinary bladder mural mass, with an extraluminal extension, a rounded shape, smooth margination, tapering of the margins towards the periphery, uniform attenuation and contrast enhancement. In all three cases the mass was localised in the right ventrolateral aspect of the urinary bladder. In two cases in proximity of the neck of the bladder and in one case partially involving the right ureteral papilla.
In the case diagnosed with leiomyosarcoma the mass presented with a cauliflower shape, a small intraluminal portion and a large extraluminal extension in the peritoneum, with heterogeneous contrast enhancement.
In all cases the mass was surgically removed. In one leiomyoma case, complete resection was impossible due to proximity with the right ureterovesical junction.
CT restaging after one year in this case revealed no regrowth. No regrowth was seen after restaging of the leiomyosarcoma after one year either.

Discussion / Conclusion:
We propose that urinary bladder masses with a growth pattern characterised by an extraluminal extension might indicate smooth muscle neoplasia.
A smooth contour, homogenous attenuation and contrast uptake might be indicative of a benign urinary bladder smooth muscle tumour.

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Topic: Canine & Feline
Time: 12.32-12.44

COMPARISON OF RETROGRADE CT PNEUMOVAGINOGRAPHY WITH POSITIVE CT VAGINOGRAPHY IN THE ASSESSMENT OF THE LOWER UROGENITAL TRACT IN FEMALE DOGS

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Keywords:
Computed tomography, pneumovaginography, dog

Introduction / Purpose:
Computed tomography (CT) is commonly used to investigate pathologies of the urogenital tract in female dogs. Even though positive contrast medium is frequently used, negative contrast medium has proven valuable in the assessment of urinary pathologies. The aim of this study is to compare the use of CT pneumovaginography with positive CT vaginography in the assessment of the lower urogenital tract in female dogs.

Methods:
This retrospective method comparison study gathered 30 cases retrieved from the database of three referral hospitals and equally divided them into two groups: positive contrast CT-vaginography group and CT-pneumovaginography group. Criteria for inclusion in the current study were CT images of diagnostic quality with intravenous post-contrast injection, vaginography, and complete patient history. The degree of visibility of seven anatomical urogenital structures was blindly scored from 0 to 2 by two board-certified radiologists. A mean was established between both observers. The agreement between both readers was assessed with Cohen's kappa statistics. Positive and negative contrast vaginographies were compared using Wilcoxon tests.

Results:
The agreement between readers was near perfect to moderate for the vagina and the external urethral orifice. A significant grading difference was observed for only two structures: the cervix (p-value=0.000592) was better visualized on positive vaginography whilst the external urethral orifice (p-value=0.02136) was better identified on negative vaginography.

Discussion / Conclusion:
Both techniques offered similar quality for most of the scored structures. CT pneumovaginography is a valuable alternative technique to positive CT vaginography to assess the lower urogenital tract in female dogs.

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Topic: Canine & Feline
Time: 12.46-12.58

ULTRASONOGRAPHIC FEATURES OF THE UNCOMPLICATED POSTOPERATIVE ABDOMEN IN DOGS TREATED FOR PYOMETRA BY OVARIOHYSTERECTOMY.

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Keywords:
Canine, ultrasonography, genital tract, surgery

Introduction / Purpose:
Pyometra is a prevalent disease in intact bitches and the standard treatment is ovariohysterectomy (OHE). However, data are lacking on the normal ultrasonographic findings after OHE. Our aim is to describe the ultrasonographic findings of the abdomen post OHE, in dogs with pyometra and an uneventful recovery, at three different time points.

Methods:
In this prospective observational study, the dogs had sequential focused abdominal ultrasound examinations on day 1, 4-6 and 10-15 post surgery. Sonographic features included size and characteristics of the cervical stump and the mesovarium, size of medial iliac lymph nodes (MILNs), detection of free fluid and prevalence of pneumoperitoneum.

Results:
22 dogs were included. The cervical stump appeared as a heterogenous area with a hypoechoic center surrounded by hyperechogenic tissue in all dogs. The cervical stump cross-sectional area was larger at day 4-6 compared to both the day 1 and day 10-15 (P=0.0009). Mesovarian ligature reactions were identified as heterogenous and hyperechoic areas with central and/or edge shadowing in all dogs. The size of the MILNs and the mesovarian reactions did not significantly differ between the different time points. Free fluid was detected in 45%, 41% and 9% and pneumoperitoneum in 95%, 82% and 14% of the dogs at the sequential study points.

Discussion / Conclusion:
In 22 dogs with an uneventful recovery following OHE due to pyometra, the cross-sectional area of the cervical stump was significantly largest at day 4-6. The results of this study could increase veterinarians' ability to interpret the postoperative abdominal tissues in dogs treated surgically for pyometra.

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Topic: Canine & Feline
Time: 14.50-15.02

ACCURACY OF VIRTUAL NON-CONTRAST ABDOMINAL IMAGING COMPARED TO TRUE NON-CONTRAST IMAGING ON DUAL-SOURCE DUAL-ENERGY CT IN DOGS

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Keywords:
Dual-energy CT, virtual non-contrast, dog

Introduction / Purpose:
Dual-energy computed tomography (DECT) permits to generate material-specific images analyzing the energy-dependent changes in the attenuation of different materials. The purpose of this study was to compare quantitative attenuation values (HU) of abdominal organs in dogs between virtual non-contrast (VNC) images and true non-contrast (TNC) images.

Methods:
TNC and VNC images of 45 dogs who underwent abdominal DECT with two different scanners (Flash-Force) between August 2017 and March 2022 were reviewed. The mean attenuation values (HU) were measured at the same level on the TNC and VNC images in nine locations (bone, fat, muscle, liver, spleen, renal cortex, gallbladder, aorta, portal vein). Differences in TNC and VNC measurements for each organ were assessed with a paired t-test or a Wilcoxon rank-sum test; level of significance was set at $\alpha = 0.05$.

Results:
No significant differences were found between TNC and VNC mean attenuation values of aorta, portal vein, liver, spleen. The TNC and VNC values were equivalent, for an equivalence margin of 10 HU, in all tissues but bone and muscle. Mean differences between TNC and VNC values were closer to 0 for Flash scanner.

Discussion / Conclusion:
VNC attenuation values obtained from multiphasic scans with a DECT system were overlapping to that of TNC images in the majority of abdominal structures, but not for bone. As non-enhanced scans are useful in numerous clinical situations, the availability of VNC images is a promising tool for daily clinical routine besides resulting in a substantial reduction of radiation exposure.

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Topic: Canine & Feline
Time: 15.04-15.16

AUTOMATIC ATLAS-BASED BRAIN EXTRACTION ALGORITHM TO ENHANCE QUANTITATIVE NEUROIMAGING ANALYSIS FOR DOGS AND CATS

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HawkCell, Marcy l'Étoile, France

Keywords:
image processing, brain extraction, quantitative

Introduction / Purpose:
Brain extraction is a fundamental pre-processing operation in quantitative neuroimaging analysis, that requires a focus on the brain region only, and it is a preliminary and mandatory step for techniques such as functional MRI, or biomarkers analysis (such as T1 and T2 relaxation times maps). Manual brain segmentation is a heavy and time-consuming task that requires professional expertise to be performed, we thus propose an automatic and robust atlas-based algorithm to perform this task on dogs and cats MRI brain images.

Methods:
The algorithm uses dog (Johnson et al., 2020) and cat (Johnson et al., 2019) brain atlas as templates and elastically registers them to the subject's brain image. A cohort of 30 healthy dogs, equally distributed into brachycephalic, mesocephalic and dolichocephalic breeds, and 10 healthy cats, have been used for the algorithm validation.

Results:
The segmentations generated by our algorithm are compared to manual segmentations performed by experts. The results of the automatic algorithm have a high similarity score, measured with Dice and Jaccard metrics, for all the most common sequences used in veterinary MRI brain protocols: 3D T1-weighted, 2D T2-weighted and FLAIR sequences.

Discussion / Conclusion:
Our automatic brain extraction algorithm proves to be robust. The elastic deformation of the atlas can overcome variability between breeds and subjects. The algorithm can be extended to every animal for which a digital atlas is available. This pre-processing tool encourages the development and use of quantitative neuroimaging MRI biomarkers in veterinary medicine, to further improve diagnosis possibilities.

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Topic: Canine & Feline
Time: 15.18-15.30

ANIMAL POSITIONING SYSTEM FOR STRAIGHT SPINE ALIGNMENT DURING MRI SCANS

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HawkCell, Marcy l'Étoile, France

Keywords:
MRI, Animal positioning, Spinal cord, spine

Introduction / Purpose:
Magnetic Resonance Imaging of spinal disorders requires a straight alignment of the spine to ensure at least one section plane for the entire spinal cord. It's a major challenge for fast and precise MRI scans. We report the development of a novel holding system to accelerate the animal positioning for MRI of the spine.

Methods:
We have developed an universal holding system for cats and dogs to facilitate the animal positioning on the MRI bed.
This device was built using non-magnetic materials to prevent BO & B1 artifacts, but also to ensure the user security.
The animal is positioned in dorsal decubitus (as described in ECVDI literature for spinal cord scans) and held in position with adjustable supports on each animal sides..
This device was tested on more than 200 patients referred for an MRI of the spine. We compare installation times of the holding system with conventional foams.

Results:
The holding system decreases the animal installation time from 10 minutes to one minute and ensure a straight spine alignment. Sagittal images are more easily positioned and give better visualization of the spinal cord on the entire field of view. No susceptibility artifacts were depicted on magnitude and phase images on EPI and diffusion imaging.

Discussion / Conclusion:
This animal positioning system can help operators to accelerate MRI spine examinations and reduce the anesthesia time for faster patient recovery. New modules will be developed and plugged on the system for knee and shoulder MRI scans. Finally, this device could also be used for CT scans.

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Topic: Canine & Feline
Time: 15.32-15.44

COMPARISON OF SELECTED TECHNIQUES FOR REDUCING RESPIRATORY MOTION ARTIFACTS IN CANINE LIVER MRI USING A MOVING PHANTOM

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Keywords:
hepatic, mri, respiratory motion, canine

Introduction / Purpose:
Magnetic Resonance Imaging (MRI) is used as the gold standard for liver imaging in human patients due to its superior contrast properties and the availability of hepatobiliary specific contrast agents. To establish an optimal scan protocol for dogs, the aim of this project is to determine the best compensatory technique for reducing motion artifacts using a moving phantom.

Methods:
A self-built liver phantom was moved by a mechanic ventilator in frequencies of 8 to 20 per minute. Using a 3 Tesla MRI system (Ingenia, Philips, Germany), T2- and T1-weighted sequences were acquired without compensation (FB), during breath hold (BH), with radial k-space sampling (MultiVane XD) (MV), respiratory triggering (RT) and respiratory navigation (RN). Images were randomized and rated by five blinded observers. Acquisition times and ratings were documented. One-way ANOVA with Bonferroni-adjusted post-hoc analysis was performed to compare scores of the techniques.

Results:
Scores were significantly ($p < 0.03$) lower without than with compensation. BH scored significantly higher ($p < 0.05$) than RN and RT in several sequences. There was no significant difference in scores between RN and RT, RN and MV and RT+MV and BH.

Discussion / Conclusion:
In canine liver MRI, compensation for respiratory motion artifacts is mandatory to ensure diagnostic image quality. When possible, acquisition should be performed during breath hold. When using other methods, RT and RN perform equally well and are at the examiner's discretion. Further studies are needed to verify the findings in living dogs.

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Topic: Canine & Feline
Time: 15.46-15.58

A PROSPECTIVE INTERNET-BASED SURVEY EVALUATING THE HABITS AND UTILIZATION OF RADIOGRAPHY AND TELERADIOLOGY SERVICES BY FRENCH AND CHINESE VETERINARIANS

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Keywords:
Teleradiology, radiography, comparison survey

Introduction / Purpose:
Teleradiology is a global service with an overwhelming need in the veterinary community. The aim of this study is to present an overview of the general opinions and habits regarding radiography and teleradiology consultation services among veterinarians in France and China.

Methods:
Data was collected via a web-based survey consisting of nineteen questions that were created and distributed to licensed practitioners by two postgraduate veterinary training companies. 400 responses per country were collected with a total of 789 surveys completed.

Results:
Greater than fifty percent of respondents were employed by two veterinary clinics. Chinese respondents were significantly younger ($p < 0.05$). Nearly all veterinarians had access to a radiographic imaging modality with digital radiography (DR) being more prevalent in China and computed radiography (CR) in France [$p < 0.05$]). Thoracic and abdominal studies were the most frequently acquired with a significantly higher number of abdominal studies performed in China ($p < 0.05$). Chinese practitioners used a teleradiology consulting service significantly more frequent for interpretation of thoracic and abdominal studies whereas French veterinarians predominately submitted thoracic studies for review. Perception on the relative cost of teleradiology services was significantly different amongst Chinese and French practitioners. However, this discordance is largely attributed to the fact that most Chinese respondents were unfamiliar with teleradiology (85.35%) despite having a higher submission rate.

Discussion / Conclusion:
This study highlights the numerous differences regarding general practices, radiographic habits, and the utilization of teleradiology consultation services in these two countries.

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Topic: Large Animal
Time: 09.20-09.32

METALLIC IMPLANT ARTEFACT REDUCTION IN COMPUTED TOMOGRAPHY OF THE EQUINE PROXIMAL PHALANX: RAW DATA BASED ITERATIVE METHODS VERSUS DUAL-ENERGY TECHNIQUES

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Keywords:
metal artefact, SEMAR, dual-energy, equine

Introduction / Purpose:
Metal artefacts in computed tomography (CT) occur due to photon starvation and beam hardening effects and may negatively impact the evaluation of surgical implants and the surrounding tissues. The aim of the study is to evaluate the ability of a single energy metal artifact reduction (SEMAR) algorithm and dual-energy CT virtual mono-energetic (DECTVM) scanning techniques to reduce metal artefacts in equine distal limbs with metallic implants.

Methods:
Two stainless steel screws were surgically inserted into the proximal phalanx of 18 equine cadaver limbs to mimic osteosynthesis for a proximal sagittal P1 fracture/fissure. Seven acquisitions were performed on each limb with a 78cm bore Canon Aquilion One Vision CT scanner: 1) Conventional helical, 2) Conventional volume, 3) Helical +SEMAR, 4) Volume +SEMAR 5) DECTVM 105keV, 6) DECTVM 120keV, 7) DECTVM 135keV. All scans were reconstructed in a bone kernel. Blinded subjective qualitative and un-blinded objective quantitative evaluations of the metal artefacts was performed (two and one observers respectively).

Results:
Subjectively, the best metal artefact reduction was present with Helical + SEMAR and Volume +SEMAR which performed similarly, followed by DECTVM 135keV and DECTVM 120keV. Objectively, DECTVM 135keV was most successful in reducing the size of blooming artefact ($p<0.01$) followed by DECTVM 120 keV, Helical +SEMAR and Volume +SEMAR which all performed similarly ($p>0.05$).

Discussion / Conclusion:
DECTVM at 135keV accomplished the best objective reduction in blooming artefact, however subjective user preference for metal artefact reduction was with SEMAR.

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Topic: Large Animal
Time: 09.34-09.46

THE COMPARABILITY OF MULTIPLE EQUINE FOOT PARAMETERS BETWEEN RADIOGRAPHS AND MAGNETIC RESONANCE IMAGING, INCLUDING THE EFFECT OF HOOF WALL MARKERS

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Keywords:
Equine Foot Radiography MRI Hoof wall markers

Introduction / Purpose:
Foot radiographs are commonly obtained to measure anatomical and conformational foot parameters in horses. This study investigated whether values of these parameters are comparable between radiographs and magnetic resonance (MR) images, and the effect of hoof wall markers (HWM) on measurements.

Methods:
Radiographs of nine equine cadaver distal limbs were obtained with and without HWM, followed by MR imaging foot examination with and without a water-soaked hoof bandage (WSHB). Selected distances and angles were measured and converted to ratios using third phalanx (P3) length. Measurements were compared using the Friedman test. Repeatability was assessed using pairwise Pearson's correlation.

Results:
Magnetic resonance measurements involving the hoof wall were not possible without a WSHB. Some MR distal hoof measurements were not consistently possible, with the WSHB. Magnetic resonance medial and lateral hoof wall thickness was generally not comparable to radiographic measurements. All MR sequences were comparable to radiographs for proximal and mid-dorsal epidermal wall thickness, epidermal solar thickness, hoof capsule angle and the second phalanx angle. For the latter, the dorsodistal to palmar P3 and dorsal P3 angles, the WSHB reduced the measurement's repeatability. In other instances, the WSHB improved the repeatability and, or comparability with radiographs. Radiographic HWM reduced the repeatability of proximal dorsal dermal wall thickness and P3 rotation.

Discussion / Conclusion:
Most MR hoof measurements were not fully comparable to radiographs; their use requires caution in clinical practice. Application of a WSHB and HWM can have a variable effect on repeatability of MR imaging and radiographic measurements respectively.

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Topic: Large Animal
Time: 09.48-10.00

COMPARISON OF CONE-BEAM AND FAN-BEAM COMPUTED TOMOGRAPHY AND LOW-FIELD MAGNETIC RESONANCE IMAGING IN IDENTIFICATION OF HETEROTOPIC MINERALISATION AND ADJACENT PATHOLOGY

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Keywords:
Imaging, Mineralisation, Pathology

Introduction / Purpose:
Heterotopic mineralisation in equine distal limbs has been considered an incidental finding, although in humans it is associated with soft tissue pathology potentially requiring treatment. The study aimed to compare cone-beam (CB) computed tomography (CT), fan-beam (FB) CT, and low-field magnetic resonance imaging (MRI) findings of heterotopic mineralisations and related soft tissue pathology in the equine fetlock region.

Methods:
Twelve cadaver limbs underwent CBCT, FBCT, MRI and macroscopic examination investigating mineralisation/adjacent pathology. Retrospective review of CBCT/MR images from two clinical patients was also included.

Results:
CBCT and FBCT identified thirteen mineralisations characterized by focal homogenous hyperattenuation: capsular (1) and oblique-sesamoidean-ligament (5) without macroscopic abnormality; deep-digital-flexor-tendon (1), and suspensory-branch (6) with soft tissue abnormalities. MRI failed to identify oblique-sesamoidean-ligament and suspensory-branch mineralisations, but detected suspensory ligament splitting, and T2 and STIR hyperintensity in 4 suspensory-branches, and 3 oblique-sesamoidean-ligaments. Locally extensive deep-digital-flexor-tendon mineralisation was detected on CT and MRI with T1 hyperintensity. Macro-examination found corresponding disruption/splitting and discolouration. All modalities identified six fragments showing cortical/trabecular pattern: palmar sagittal ridge (1), proximal phalanx (2) without macroscopic abnormality, and proximal sesamoid bones (3). On MRI, fragments were identifiable on T1 images. All abaxial avulsions had suspensory-branch splitting on T1 images with T2FSE and STIR hyperintensity. Macro-examination showed ligament disruption/splitting and discolouration. Suspensory-branch/intersesamoidean ligament mineralisations were identified by CBCT in clinical patients; one had associated T2 hyperintensity.

Discussion / Conclusion:
Both CT systems were generally superior to MRI in identifying heterotopic mineralisations, while MRI provided information on soft tissue pathology related to the lesions, which may be important for management.

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Topic: Large Animal
Time: 10.02-10.14

LOW FIELD MAGNETIC RESONANCE IMAGING INVESTIGATION OF PALMAR DISTAL PHALANX OSTEOCHONDRAL ARTICULAR FRAGMENTS IN HORSES WITH FOOT PAIN

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Keywords:
Fragmentation, distal phalanx, sport horses

Introduction / Purpose:
The presence of fragmentation of the palmar articular margin of the distal phalanx as a cause of lameness is a new finding in the literature with only a few cases being reported.

Methods:
To describe the magnetic resonance imaging (MRI) appearance of palmar articular fragments of the distal phalanx and concurrent abnormalities of the DIPJ; to investigate the prevalence of these fragments in a population of Sports and Pleasure horses and their potential clinical significance.

Results:
A total of 427 horses underwent MRI examination of one or both front feet. Palmar articular fragments of the distal phalanx were identified in 3 horses (0.7% prevalence). The breeds included one Andalusian horse, one Lusitano and one Warmblood. The age range was 4-17 years old. All fragments were located at the palmarolateral margin of the glenoid of the distal phalanx. Lameness varied from 1-3/5 (AAEP grading). Concurrent imaging abnormalities of the joint were present in all 3 horses.

Discussion / Conclusion:
The prevalence of palmar articular fragments of the distal phalanx was low in this population of horses. Palmar articular fragments must be considered when evaluating lameness localized to the foot, since it was identified only in lame limbs and was correlated with other imaging abnormalities of the DIPJ.

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Topic: Large Animal
Time: 10.16-10.28

CHEMICAL SHIFT IMAGING OF THE EQUINE NAVICULAR BONE - A PRELIMINARY STUDY

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Keywords:
Navicular, equine, MRI, chemical shift, Dixon

Introduction / Purpose:
Navicular disease is a common cause of lameness in the horse. It is characterised by degeneration of the navicular bone and surrounding soft tissue structures. Different imaging modalities have been described to assess progression of disease. The purpose of this study was to investigate whether the use of chemical shift imaging in high field MR imaging can provide additional information about the bone spongiosa compared to T1 and short tau inversion recovery (STIR) sequences and histology.

Methods:
Ten equine limbs were collected post-mortem. Specimens underwent MR imaging using a 3T clinical scanner (MAGNETOM Skyra 3T, Siemens Healthcare, Erlangen, Germany). Dixon sequences were used to calculate the navicular bone spongiosa fat fraction. On sagittal T1 images, articular cortical bone thickness, total thickness and palmar cortical bone thickness were measured. Images were visually assessed and various signs of disease scored (absent to severe). Histological samples were processed, stained with haematoxylin and eosin, and similarly graded.

Results:
The average fat fraction ranged between 0.6 and 0.9; no correlation with histological findings was found. A strong negative correlation was observed between fat fraction and palmar cortical bone thickness of the navicular bone (correlation coefficient = -0.782). Correlation between MRI scores and fat fraction failed to reach statistical significance; however, a trend was observed whereby fat fraction decreases with severity of disease on MRI.

Discussion / Conclusion:
Chemical shift imaging in the context of navicular disease needs to be evaluated in a sample population with greater variation in pathological change to explore its full potential.

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Topic: Large Animal
Time: 11.36-11.48

SUPER-RESOLUTION RECONSTRUCTION FOR 3D MULTI-CONTRAST OSTEOARTICULAR MRI

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Keywords:
image processing, MRI, super-resolution

Introduction / Purpose:
A major challenge in MRI is to obtain 3D acquisitions with isotropic resolution: in clinical practice it is not always possible to acquire 3D volumes, either because of long acquisition times, or because some sequences are not available in 3D, such as the radial k-space acquisitions used for motion-correction. We developed a super-resolution algorithm that can reconstruct a 3D volume from the acquisition of three orthogonal 2D sequences, thus expanding the diagnosis possibilities on 3D images, and we show the interest for a better diagnosis on osteoarticular MRI, where motion correction is particularly meaningful.

Methods:
Three orthogonal 2D sequences (sagittal, dorsal and transverse) of a minipig's wrist were acquired with a radial k-space sequence on a 1.5T MRI system. The slice thickness is three times higher than the in-plane resolution for each of the 2D volumes. An optimization algorithm, based on the solution of an inverse problem modeling the acquisition process, can reconstruct an optimal 3D volume with isotropic voxel resolution from the three 2D acquisitions.

Results:
The 3D volume of the minipig's wrist obtained allows to explore the anatomy with higher detail, thanks to the three-fold enhanced isotropic resolution. Fine structures can be visualized also in custom planes, other than the classic anatomical planes (sagittal, dorsal and transverse).

Discussion / Conclusion:
The super-resolution reconstruction algorithm is not limited to a particular anatomical region or sequence. It is a post-processing technique that can be applied to every anatomical part and every contrast available as 2D acquisition, thus enlarging the 3D contrasts available for finer diagnosis.

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Topic: Large Animal
Time: 11.50-12.02

DIMENSIONAL CHANGES IN PROXIMAL SUSPENSORY LIGAMENT AFTER FASCIOTOMY AND NEURECTOMY OF THE DEEP BRANCH OF LATERAL PLANTAR NERVE IN HORSES.

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Keywords:
Horse, Suspensory ligament, MRI, Neurectomy

Introduction / Purpose:
Neurectomy of the deep branch of the lateral-plantar nerve (DBrLPlN) and deep plantar metatarsal fasciotomy have been used to treat horses with hind limb proximal suspensory ligament desmopathy (PSLD). No studies have quantified the change in size of the proximal suspensory ligament (PSL) following surgery in clinical cases using magnetic resonance imaging (MRI). This study aims to identify the dimensional changes in the PSL in horses undergoing surgical treatment of PSLD.

Methods:
Seven horses diagnosed with PSLD were subjected to low field magnetic resonance imaging (MRI) prior to deep plantar metatarsal fasciotomy and neurectomy of the DBrLPlN. Six weeks post-surgery, follow-up MRI was conducted. Cross sectional area (CSA), latero-medial width (LMW), and dorso-plantar thickness (DPT) were measured at 2.5, 3.5 and 4.5cm from the tarsal metatarsal joint (TMTJ) on both MRI occasions.

Results:
The study included six retired racehorses and 1 pony, for a total of 11 limbs undergoing MRI. All horses were lame on presentation and improved post-operatively. There were significant differences in the CSA and LMW at all levels distal to the TMTJ (CSA 2.5cm: $P=0.001$; 3.5cm $P<0.001$; 4.5cm $P=0.003$; LMW 2.5cm: $P=0.04$; 3.5cm: $P=0.05$; 4.5cm: $P=0.04$). The size reduction in the PSL was uniform along its length

Discussion / Conclusion:
Surgical intervention improved lameness in these horses diagnosed with PSLD.Fasciotomy and neurectomy of the DBrLPlN reduced the CSA and LMW consistently along the PSL as measured on low field MR images

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Topic: Large Animal
Time: 12.04-12.16

COMPARISON OF RADIOGRAPHY AND COMPUTED TOMOGRAPHIC APPEARANCE OF THORACIC INTERVERTEBRAL ARTICULATIONS IN HORSES

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Keywords:
Equine, Thoracic spine, Radiography, CT

Introduction / Purpose:
Osteoarthritis of the thoracic synovial intervertebral articulations (facet joints) is described in horses with back pain. Oblique radiographs are the main diagnostic imaging modality used for diagnosis, but the diagnostic accuracy has not been proven. The aim of this study was to compare findings from oblique radiographs of the thoracic intervertebral articulations and computed tomography (CT).

Methods:
In this prospective study, 14 horses were examined. Lateral and 20° ventral-dorsal oblique radiographs of the facet joints from both sides were obtained. After euthanasia, unrelated to back pain, CT examination of the thoracic spine was performed. Radiographs and CT images were blinded and graded twice by two examiners with at least more than twelve years' experience and intra- and interobserver correlation was investigated. For each joint several parameters were assessed: sclerosis, osteolysis, osteophytes, fragments, width and margins of the joint space.

Results:
Overall, 220 joints were assessed and mild to moderate changes of the joints were commonly observed. Intra- and interobserver agreement was better for CT than for radiographs and the most caudal facet joints could not be assessed with radiographs. A strong correlation was seen for fragments and osteophytes on CT images, but radiographs and other parameters showed only poor to moderate correlation for most findings.

Discussion / Conclusion:
Radiographic findings of the thoracic intervertebral articulations should be interpreted with caution, due to the poor to moderate intra- and interobserver agreement and reduced visibility of the most caudal joints.

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Topic: Large Animal
Time: 12.18-12.30

COMPARATIVE IMAGING OF THE PROXIMAL THIRD METATARSAL BONE AT THE SUSPENSORY LIGAMENT ORIGIN

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University of Liège, Liège, Belgium

Keywords:
Proximal suspensory ligament, CT Scan, Radiographs

Introduction / Purpose:
Metatarsal sclerosis has been reported on limbs with suspensory ligament enthesopathy and in limbs with normal proximal metatarsal Magnetic Resonance Imaging (MRI)1. The aim of this study was to describe morphological variations in a series of isolated limbs with no abnormalities at MRI.

[1] Hinckle FE, Selberg KT, Frisbie DD, Barret MF. Radiographic changes of the proximal third metatarsal bone do not predict presence or severity of proximal suspensory desmopathy in a predominately Quarter Horse population. Equine Vet. J. 2022;00:1-9.

Methods:
Eight hindlimbs were collected from 6 horses with no known history of lameness, euthanized for reasons other than the study (age 3-19 years, weight 386-635kg). Limbs underwent CT, radiographic and ultrasonographic examination. Standing MRI was used to confirm normalcy of the suspensory ligament and absence of subcortical sclerosis.

Results:
All limbs were normal at MRI examination. All limb showed more or less prominent sagittal linear crests on the proximal palmar metatarsal surface. The midline crests were visible as linear increased opacities on DPl views and on transverse ultrasonographic images and were located facing a central small musculo-adipose bundle dividing the 2 suspensory ligament lobes. Because of the obliquity of the plantar metatarsal surface, delineation of the trabecular/cortical interface of the proximal metatarsus was sharper on the L5Pl-MD oblique views.

Discussion / Conclusion:
Proximal metatarsal bone shows significant morphological variations in MRI normal limbs. Because these variations alter homogeneity of bone opacity on DPl radiographic views and may mimic sclerosis, a L5Pl-LMD oblique view is suggested to better assess trabecular/cortical bone interface.

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Topic: Large Animal
Time: 12.32-12.44

TEACHING EQUINE RADIOGRAPHIC TECHNIQUES USING VIRTUAL REALITY (VR)

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Keywords:
VR, equine radiography

Introduction / Purpose:
The sector of veterinary diagnostic imaging has boomed in the last two decades; it is therefore paramount that veterinary educators continue to pursue innovative teaching methods to produce graduates skilled in obtaining good quality radiographs while observing radiation safety rules.
However, in veterinary teaching hospitals, practising radiographic techniques in live animals is limited by several factors including ethics, radiation safety, caseload and caseflow. Finally, unforeseen circumstances such as the recent pandemic, can prevent students from accessing the hospital and have a negative impact on the creation of such practical skills.
VR is an innovative teaching method that represents a viable alternative to "live" practical sessions, providing an environment where students can learn the basics of good radiographic practice in complete safety.

Methods:
Based on our design, the UK-based company Edify engineered a VR lesson recreating the environment of a radiography suite, where basic radiographic techniques can be simulated on a model horse. The author practiced with the VR lesson using an Oculus Quest 2 headset.

Results:
Preliminary testing showed that, although a learning curve is necessary to practice the movements effectively using the headset and hand controllers, the VR lesson should be a useful addition as a teaching and possibly assessing tool in equine radiography.

Discussion / Conclusion:
This is the first example of the use of VR to teach equine radiography.
In human radiography VR has reduced errors, increased student confidence and provided more efficient learning; we have good reasons to think that similar results could be obtained in veterinary education.

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Topic: Large Animal
Time: 12.46-12.58

FEASIBILITY AND REPRODUCIBILITY OF 2D-SHEAR WAVE ELASTOGRAPHY IN EVALUATING LENS STIFFNESS IN HEALTHY AND IN HORSES AFFECTED BY CATARACT

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Keywords:
Elastography, Horses, Lens, Eye, Cataract

Introduction / Purpose:
Cataract is any opacity of the lens due to biochemical changes which results in the alteration of its hardness (1,2). Elastography is an ultrasonographic technique that allows measurement of tissue stiffness (2). The aim of this study was to determine feasibility, reproducibility, and repeatability of two-dimensional Shear wave elastography (2D-SWE) and to establish quantitative reference values for lens stiffness in healthy and in horses affected by cataract.

Methods:
Transpalpebral 2D-SWE was performed by two operators with different experience on diagnostic imaging, using a Logiq S8 (GE Healthcare) and a high frequency linear probe (10 MHz) under sedation after owner consent. Elastographic images were independently analyzed quantitatively by two observers, by manually drawing a region of interest (ROI) of 1 cm in diameter over each lens and measuring shear waves velocity (m/sec) and Young's Modulus (kPa) three times at each selected ROI. Statistical analysis was performed with SPSS software.

Results:
21 horses were included. Intra and interobserver agreement were excellent. Shear Wave velocity and Young's Modulus were significantly higher (P=0.000) in horses affected by cataract (4,63±0,48 and 65,24±14,31) than in healthy horses (4,21±0,29 and 53,54±7,19).

Discussion / Conclusion:
Due to its reproducibility and repeatability 2D-SWE is a practical and reproducible technique that can be applied in clinical settings. Findings from our study support future clinical application of 2D-SW elastography as a noninvasive imaging modality which provides a valuable clinical grading of lens stiffness.
(1) Townsend WM. Equine Vet Educ. 2015;28(12);705-711.
(2) Zhou H-Z et al. Int J Ophthalmol. 2021;14(2),240-244.

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Topic: Large Animal
Time: 14.50-15.02

DIFFERENTIATION OF EQUINE PARANASAL SINUS CYSTS AND PROGRESSIVE ETHMOID HAEMATOMATA ON COMPUTED TOMOGRAPHIC IMAGES

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Keywords:
CT, horse, sinus

Introduction / Purpose:
Paranasal sinus cyst (PSC) and progressive ethmoid haematomata (PEH) are non-neoplastic masses found in the equine sinus system. This study investigated if these could be differentiated on computed tomographic (CT) images.

Methods:
The database of four European equine referral centres were searched retrospectively for horses that underwent CT examinations of the head and had a confirmed PSC or PEH. Additionally, images of horses with confirmed sinusitis were selected as distractors. Blinded images were evaluated for the presence of a PSC or PEH by three diagnostic imaging specialists with at least more than six years' experience in head CT examinations. Kappa- values, sensitivity, specificity, positive (PPV) and negative predicted value (NPV) were calculated for each observer. Thereafter, two observers graded the CT images in consensus for different characteristic of PEH and PSC.

Results:
Substantial to almost perfect agreement between CT diagnosis and final diagnosis for all three observers was found ($\kappa = 0.82 - 0.97$). Sensitivity, specificity, PPV and NPV were at least 0.83 for correctly diagnosing PSC and PEH, except for PEH, where the sensitivity of observer A was 0.71. Heterogeneity and HU was graded significantly higher in PEH ($p < 0.001$). Mineralisation within the soft tissue structure, inner and outer distortion, a mineralised wall, and dental distortion were significantly more commonly observed in PSC ($p < 0.001$).

Discussion / Conclusion:
Differentiation between PEH and PSC on CT images was excellent. The observed different characteristics appear to help clinicians to distinguish between both diseases.

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Topic: Large Animal
Time: 15.04-15.16

COMPUTED TOMOGRAPHIC APPEARANCE OF THE EQUINE TEMPOROHYOID JOINT AND ASSOCIATION BETWEEN RADIOGRAPHIC CHANGE AND POTENTIAL RISK FACTORS

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Keywords:
Equine, imaging, computed tomography, THO

Introduction / Purpose:
Temporohyoid osteoarthropathy is characterised by bone proliferation and cartilage change caused by infectious and degenerative conditions amongst others. We aim to describe the range of computed tomographic (CT) features of the equine temporohyoid joint (THJ), and investigate associations between CT change and potential risk factors.

Methods:
Head CT examinations from one referral hospital between October 2017 and December 2021 were assessed. A grading system was developed for osseous proliferation (Grade 0 [normal] to 3 [severe]) and tympanohyoid cartilage change (Grade 0 [normal] to 3 [complete ossification]). Grades were summed to create an overall grade. Ordinal logistic regression was performed to produce a multivariable model that assessed association between THJ grade and signalment, presenting signs, radiographic features, and final diagnosis.

Results:
The horses included (n=424) most commonly presented for dental and sinus disorders (37.7%). The most frequently observed bone grade, cartilage grade and overall grade were 2 (41.9%), 0 (52.6%) and 2 (27.0%), respectively. Bone proliferation was most common medially, and lateral proliferation was associated with a higher overall grade (odds ratio (OR) 15.81, P <0.001). There was no correlation between increased grade and any presenting sign. Increased overall grade was significantly associated with increased age (OR per year 1.086, P <0.001), Arabians (OR 4.197, P= 0.019) and Thoroughbreds (OR 2.866, P <0.001) relative to Warmbloods.

Discussion / Conclusion:
Mild osseous proliferation of the THJ is a common CT finding in horses presented for unrelated disease. Increased THJ change is associated with increased age and there are certain breed predispositions.

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Topic: Large Animal
Time: 15.18-15.30

HYDROXYMETHYLENE DIPHOSPHONATE (HDP) AND METHYLENE DIPHOSPHONATE (MDP): COMPARING NORMAL BONE-TO-SOFT TISSUE RATIO AND LESION DETECTION ABILITY IN EQUINE SKELETAL SCINTIGRAPHY

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Keywords:
horses, bone scan, bisphosphonate, radiotracer

Introduction / Purpose:
Data regarding the influence of different radiopharmaceuticals on image quality and lesion detection efficacy is lacking in equine bone scintigraphy.

Methods:
In two prospective randomised studies, scintigraphic images of most likely sound radii/tibiae (20 horses) and metacarpi/metatarsi (66 horses) with confirmed insertional desmopathy of the suspensory ligament (IDSL) were acquired 2 to 4 hours after injection of either Technetium-labelled HDP or MDP. Different regions of interest (normal bone, bone lesion, soft tissue and background) were determined to calculate normal bone-to-soft tissue ratios (BSR), lesion-to-normal bone ratios (LBR) and lesion-to-soft tissue ratios (LSR), using different software. Qualitative image scoring and total count rates per image were recorded.

Results:
BSR ratios (HDP and MDP: $P \leq 0.001$) and qualitative score numbers (HDP: $P = 0.001$, MDP: $P \leq 0.001$) significantly increased 4 hours after injection in most likely sound limbs, however no consistent difference was found between the two radiopharmaceuticals in both study designs. Count rates tended to be higher within the HDP groups in most likely sound limbs (4 hours after injection: $P = 0.048$) and in limbs with IDSL ($P = 0.389$). Concerning lesion detection ability, MDP showed significantly higher LBR ($P = 0.007$) and LSR ($P = 0.039$) compared to HDP.

Discussion / Conclusion:
The choice of the radiopharmaceutical seems not to affect BSR. However, the slightly higher bone uptake found for HDP could negatively affect lesion-to-normal bone ratio. This may explain the superiority of MDP in detecting bone lesions in horses with IDSL found in the present study design.

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Topic: Large Animal
Time: 15.32-15.44

PRELIMINARY DATA OF NUCLEAR SCINTIGRAPHY PROTOCOL IN EQUINE: SURVEY STUDY

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Keywords:
Bone scan, Radiation safety, Lameness, Nuclea

Introduction / Purpose:
Nuclear scintigraphy is commonly used as a diagnostic tool in equine orthopedic field. However, the scintigraphy protocol varies in the literature. The current prospective survey study aimed to provide preliminary data regarding nuclear scintigraphy in equine with focus on scanning protocol and radiation safety.

Methods:
An electronic survey (26 questions) was distributed by Medical Imaging Electronic to their customers using an equine scanner scintigraphy unit (n=150). The survey was designed to document staff experience therewith, operating procedures and radiation safety practices.

Results:
The response rate was 30% (45/150). Up to 22% of horses underwent bone scintigraphy as part of the lameness examination. The most commonly used bone tracer was hydroxyethylene diphosphonate (51.1%; 23/45) and the radioisotope was administered intravenously at a dose of ≥10MBq/kg. Vascular and pool phases were rarely (<10% of horses) performed. However, a whole-body scintigraphy was performed in 61-90% of the horses in 53.3% (24/45) of the clinics. The acquisition time of 90 seconds per image was commonly used (46.7%, 21/45), the minimum duration of the whole body scan therefore amounting to 34.8-51.2 minutes. Eighty-four percent of the operators underestimated or did not know the personnel radiation exposure during acquisition bone scintigraphy. Thus, it is not surprising that 34% of the personnel did not wear protective clothes during image acquisition. Non-musculoskeletal scintigraphy was never or rarely used in 88.9% of the clinics.

Discussion / Conclusion:
This survey provides preliminary data, which may be the focus for guidelines for equine nuclear scintigraphy in the future.

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Topic: Large Animal
Time: 15.46-15.58

RADIATION FROM THE EQUINE PERINEAL REGION IS LOW COMPARED TO THE ELBOW AND HEAD 24 HOURS POST SCINTIGRAPHIC EXAMINATION

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Keywords:
horse, scintigraphy, radiation safety

Introduction / Purpose:
The timing of follow up radiography and ultrasound in horses that undergo scintigraphic bone scans for lameness investigation varies internationally and between equine hospitals. The study aimed to estimate radiation levels from horses three and 24 hours after injection of hydroxydiphosphonate labeled with metastable technetium (HDP ^{99m}Tc) and investigate what areas of the horse had higher radiation levels.

Methods:
This prospective longitudinal cohort study consisted of 46 horses referred for lameness investigation between June and December 2021. Radiation levels from the horse surface were measured using an electronic device from six anatomical locations (head, elbow, dorsum, ventrum, stifle and perineum) at two time points and adjusted to three and 24 hours after injection of ^{99m}Tc using the radioactive decay law.

Results:
The radiation measured was significantly different in the various locations of the horses for both time points. At three hours after injection of HDP ^{99m}Tc, the ventrum had the highest radiation dose. At 24 hours, the radiation emitted from the perineal region was significantly lower than in the elbow and head, which had the highest values ($p<0,0001$). There was a negative correlation between age and the radiation detected at 24 hours post injection ($p=0,02$).

Discussion / Conclusion:
Radiation from the perineal region is low compared to other regions of the horse 24 hours post scintigraphy. Additional care should be taken around the ventrum area during scintigraphy and around the elbow and head at 24 hours post scintigraphy to minimize radiation to personnel.

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POSTERS

Topic: Appendicular skeleton
Poster Number: 1

CRANIAL CRUCIATE LIGAMENT AVULSION DUE TO OSTEOCHONDROSIS DISSECANS OF THE STIFLE JOINT IN A GOLDEN RETRIEVER DOG

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Keywords:
Cranial cruciate ligament, computed tomography.

Introduction / Purpose:
This report describes clinical, computed tomography (CT), arthroscopy and histology findings of an unusual case of cranial cruciate ligament avulsion due to osteochondrosis dissecans causing acute, high-grade hind limb lameness in a dog.

Methods:
An 8-month-old, entire male, thirty-two kg Golden retriever dog was presented with a grade 4/5 right hind limb lameness with no trauma history. Clinical symptoms appeared suddenly and spontaneously. Bilateral hind limb CT and right stifle arthroscopy were performed. Histopathology of removed fragments was performed.

Results:
CT revealed moderate right stifle joint effusion, fat pad compression, sclerosis and a displaced subchondral bone fragment at the caudomedial aspect of the lateral femoral condyle, the area of origin of the cranial cruciate ligament. Arthroscopy confirmed the location of the fragment and attachment of the cranial cruciate ligament to it. The fragment and ligament were removed and the damaged cartilage burred. Histologic examination revealed cartilage and bone fragments consistent with osteochondrosis dissecans (OCD) and secondary degenerative changes.

Discussion / Conclusion:
Acute cranial cruciate ligament injury is a rare disease in dogs, and is most commonly seen in young dogs with a trauma history. Stifle OCD is a relatively rare form of OCD in dogs and typically manifests at the distal articular surface of the lateral femoral condyle. This case illustrates that stifle OCD can lead to an avulsion fracture of the cranial cruciate ligament.

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Topic: Appendicular skeleton
Poster Number: 2

ULTRASOUND RECOGNITION OF EARLY, MIDDLE AND LATE STAGES OF GRACILIS MYOPATHY

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Keywords:
Gracilis, Fibrosis, Musculoskeletal Ultrasound

Introduction / Purpose:
Gracilis myopathy is a condition that can lead to muscular fibrosis if an early diagnosis and treatment are not achieved. This retrospective study aimed to define and describe the ultrasonographic features of gracilis myopathy in the early, middle and late stages.

Methods:
Eight large breed patients entered the study. Follow up from 6 months to 8 years were available. The inclusion criteria were:
typical duck gait present or developed before the end of the study,
ultrasonographic lesion on the gracilis muscle,
WNL neurological examination,
orthopaedic and radiographic examinations negative for other conditions.

Results:
Five patients were scanned before they developed the typical duck gait. A focal fascial thickening with decreased vascularization on colour doppler and an adjacent hypoechoic band was detected in three patients in the central portion of the gracilis belly. On top of the reported changes in two patients, there was a focal hyperechoic central lesion of small size and irregular margination surrounded by a thicker hypoechoic area. In the three patients that entered the study affected by duck gait, there was an oval hyperechoic, relatively uniform central lesion with evidence of fibre muscle distortion. No hypoechoic halo was detected. The fascial plane between the gracilis and the semimembranosus muscle was affected in all the patients.

Discussion / Conclusion:
Ultrasonographic early detection of gracilis myopathy could lead to early diagnosis and treatment, providing a better long-term clinical outcome. Three stages most likely corresponding to a different degree of fibrosis were described.

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TOPIC: Appendicular skeleton
Poster Number: 3

COMPUTED TOMOGRAPHIC ASSESSMENT OF RADIO-ULNAR INCONGRUITY (RUI) IN A POPULATION OF GROWING GERMAN SHEPHERD DOGS

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Keywords:
elbow dysplasia, computed tomography, incongruence

Introduction / Purpose:
The aim of this study was to investigate the role of radio-ulnar incongruity (RUI) in a group of growing German shepherd dogs (GSDs) in the development of elbow dysplasia (ED).

Methods:
Thirty-four GSDs underwent computer tomography of the elbows at 6 and 12 months of age. RUI was measured in a standardized multiplanar reconstruction and considered widened when >1.5mm. ROC curves at 6 months were created in relation to the ED final scores at 12 months. A Mann-Whitney U Test was performed comparing RUI in dogs with and without ED. P value <0,05 was considered significant.

Results:
At 6 months of age, RUI indicating a shorter radio was detected in 24 elbows (35.3%). Eight of these RUI improved over time. At 12 months of age, 17 elbows (25%) were accounted for the presence of a quantifiable RUI.
At 12 months, out of the 15 elbows with a positive RUI, 12 had a fragmented coronoid process. A dog with bilateral ununited anconeal process had RUI with a shorter ulna. ROC curves revealed a discreet accuracy. At 6 months of age, radio-ulnar steps were significantly higher in subjects with later development of ED (P value of 0,004).

Discussion / Conclusion:
Our results suggest that in this group of GSDs, the presence of a radio-ulnar step at six months of age could be an early indicator of underlying coronoid pathology; nonetheless, further studies are needed.

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Topic: Osteology
Poster Number: 6

MRI AND CT IMAGING FEATURES OF A MELANOCYTIC TUMOUR AFFECTING THE CERVICAL VERTEBRA IN AN ADULT DOG

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Keywords:
Melanocytic tumour, vertebra, T1W hyperintensity

Introduction / Purpose:
This report describes the MRI and CT characteristics of a melanocytic tumour affecting the C4 vertebra of a dog.

Methods:
A 7-year-old Lhasa Apso was evaluated for chronic, progressive left thoracic limb lameness and neck pain. MRI revealed an extradural, well-defined, rounded solitary mass lesion at the level of the left C4 vertebral lamina. The lesion was homogenously hyperintense on T1W and isointense on T2W and T2*. Mild contrast enhancement of the mass was seen following subtraction imaging. There was also marked, linear irregular contrast enhancement of the left C4 periosteum and adjacent meninges and mild enhancement of epaxial cervical muscles. CT showed an iso-attenuating and contrast enhancing mass centred on the left C4 vertebral lamina with associated bone resorption. Based on this combination of findings, a melanin-containing neoplasia was suspected. Decompressive surgery was performed with subsequent histopathological and immunohistochemical analysis.

Results:
A Melan-A positive melanocytic malignant tumour was diagnosed. The dog showed complete recovery after adjuvant treatment with radiotherapy and melanoma vaccines, with no recurrence of clinical signs 10 months after the diagnosis.

Discussion / Conclusion:
This is the first case report describing MRI and CT findings of a cervical extradural melanocytic tumour in a dog, which highlights the need for a systematic approach when evaluating T1W hyperintense lesions. T1 hyperintensity is caused by different substances, including methaemoglobin, melanin, lipid, protein and minerals. Therefore, a combination of different diagnostic modalities is necessary to achieve a specific diagnosis. Other imaging features (localisation, shape, symmetry) may guide us with the differential diagnosis.

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Topic: Osteology
Poster Number: 5

TALUS METASTASES OF A PRIMARY PULMONARY NEOPLASIA IN A CAT

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Keywords:
cat, neoplasia, bone, metastasis

Introduction / Purpose:

This report describes an unusual case of metastasis of a suspected primary lung tumour to the tarsus and possibly metatarsus in a cat.

Methods:

A 15-year-old neutered male Persian cat was referred because of 2 weeks history of non-weight-bearing lameness in the right hind limb.

Results:

Radiographic studies showed a swelling of soft tissues at the level of the tarsus, and a diffuse and severe osteolysis in the third and fourth tarsal bone. A dislocation with a possible pathological fracture was visible in the fourth tarsal bone. A marked periarticular proliferation of new bone around the joint, and a severe, interrupted, active periosteal reaction, primarily affecting the distal rows of tarsal bone as well as the metatarsal bone, were observed.
A primary bone neoplasia or metastasis from unidentified primary carcinoma involving tarsus and metatarsal bones represented the main differential diagnosis.
Thoracic radiographic examination identified a 7-cm-diameter, oval, smooth, mineralized, well defined soft tissue opaque mass in the dorso-caudal aspect of the left lung.
Histopathological examination of the right tarsus, was suggestive of metastatic carcinoma.
A fine needle aspirate of the pulmonary mass confirmed the presence of epithelial cells with criteria of malignancy.

Discussion / Conclusion:

Metastatic spread to the bone is uncommon in cats but well recognized and is reported most commonly from primary lung cancer.
Metastatic disease to the bone should be included in the differential diagnosis for lameness in elderly cats, independent of the location of the lesion, and thoracic studies should always be taken independent of presence or absence of respiratory signs.

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Topic: Osteology
Poster Number: 4

COMPUTED TOMOGRAPHY OF HYPERATTENUATING BONE MARROW LESIONS IN THE FEMURS OF DOGS AND CATS.

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Keywords:
Computed tomography, bone marrow, intramedullary

Introduction / Purpose:

There is minimal description of CT hyperattenuating bone marrow lesions (HBMLs) and their correlation with peripheral blood changes or systemic diseases in veterinary medicine. This study aimed to determine whether there were any associations between Hounsfield units (HU), distribution or pattern of HBMLs and hematologic findings or clinical diagnoses in dogs or cats undergoing abdominal CT.

Methods:

Retrospective review of contrast CT studies in dogs and cats that included both femurs and had concurrent CBC data available.

Results:

Of 605 abdominal CT studies, 124 animals (109 dogs and 15 cats) had HBMLs. The most common hematologic findings were normal (50%), inflammatory leukogram (16%), non-regenerative (10%) and regenerative anemia (10%). The most common diagnoses were neoplasia (65%), inflammatory (13%) and infectious (6%) etiologies.
Mean pre- and post-contrast HU for all HBMLs were 54.6 and 76.5 HU, respectively. Mean pre- and post-contrast HU were highest in patients with regenerative anemia (69.3 and 96.1 HU, respectively). HBMLs distributed along the entire femoral diaphysis showed mean and max HU > 75 and 100 HU, respectively. Focal HBMLs had max and post-contrast HU < 100 HU. Both distributions were present in animals with multiple hematologic findings and clinical diagnoses. Fisher's exact test showed no significant relationships between hematologic classification, clinical diagnosis and distribution of HBMLs.

Discussion / Conclusion:

HBMLs can be detected using CT in dogs and cats, however the HU and distribution or pattern of HBMLs was not associated with hematologic findings or clinical diagnoses. Further investigation is needed to determine the diagnostic utility of HBMLs detected using CT.

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Topic: Axial Skeleton
Poster Number: 7

EXPERIMENTAL ASSESSMENT OF IMAGING MEASUREMENTS TO DIAGNOSE ATLANTOAXIAL INSTABILITY ON COMPUTED TOMOGRAPHY IMAGES

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Keywords:
Atlantoaxial instability, cut-off values, CT, VCI

Introduction / Purpose:
CT measurements and standardized head-neck positions (HNP) have been proposed for the diagnosis of atlantoaxial (AA) instability in retrospective studies. Study aim: Experimentally assess the diagnostic value of imaging measurements in standardized HNP in dog cadavers before and after transection of AA ligaments.

Methods:
Sagittal reconstructed CT images of eight small breed dog cadavers were evaluated before and after transection of AA ligaments, whose integrity was evaluated on high-resolution MR images and by visual inspection. The ligaments were transected via the foramen magnum, leaving other structures of the craniovertebral junction intact. Repeated measures ANOVA and ROC analysis were performed.

Results:
Several imaging measurements (ventral compression index (VCI), basion-dens interval, AA-distance, C1-C2 overlap, and cranial translation ratio) were significantly different between cadavers with intact and transected AA ligaments in extended and flexed/neutral HNP. Highest sensitivity (100%) and specificity (87.5%) is achieved using a cutoff value of ≥ 0.42 for the VCI in flexed/neutral HNP. In extended HNP, sensitivity is lower (87.5%).

Discussion / Conclusion:
Corresponding to previous studies, imaging measurements were significantly different between cadavers with intact and transected AA ligaments. Also, the VCI as single imaging measurement allows an objective diagnosis of AAI. Recommendation to use a flexed/neutral position is supported, as it has a 100% sensitivity. In extended HNP, the risk of missing an AA Instability case is higher. Previous studies reported lower VCI cutoff values, which may be explained by less variance in the control group due to a stricter selection based on clinical and subjective imaging diagnosis.

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Topic: Axial Skeleton
Poster Number: 9

KINEMATIC MAGNETIC RESONANCE IMAGING (K-MRI) FOR STUDYING THE KINEMATICS OF THE SPINE AND JOINTS IN DOGS: PRELIMINARY STUDY ON CADAVERS.

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Keywords:
MRI, K-MRI, kinetics, spine, joint

Introduction / Purpose:
Kinematic magnetic resonance imaging (kMRI) is a diagnostic technique that consists in the acquisition of a series of static images taken with the target joint flexed/extended at various angles, with the aim to assess joint abnormalities visible only through the dynamic evaluation. In human medicine, kMRI improves the detection of joints and spine disorders.
The goals of our study was to test the feasibility of k-MRI on canine cadaveric models with surgically induced spinal and various joints instability.

Methods:
A low field (0.25 T) MRI unit Esaote Vet-MRGRANDE was used to acquire T1w/T2w images on sagittal and transverse planes. The k-MRI protocol consisted of a 2D HYCE S sequence on sagittal plane, with an operator slowly performing joint movement (extension, flexion, bending, and possibly traction). The procedure was repeated on the same anatomical area after surgically induced instability. The images pre/post surgery were compared by a board certified radiologist.

Results:
The MRI studies were performed on 7 canine cadavers, including 7 cervical spinal tracts, 3 elbows and 4 stifles MRI examinations. The images were reviewed by a radiologist, and considered all diagnostic, with excellent quality for the stifle joints and good for elbow joints and the spine.

Discussion / Conclusion:
The technique provided additional informations compared to the static T1w/T2w images, about spine and joint instability with good to excellent image quality. K-MRI is a promising technique in veterinary medicine. Further studies are needed to assess the real clinical utility in spontaneous diseases.

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Topic: Axial Skeleton
Poster Number: 8

MRI SIGNAL VOID IN DEGENERATED CANINE INTERVERTEBRAL DISKS MAY REPRESENT CALCIFICATION OR GAS

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Keywords:
Vacuum phenomenon, intervertebral disc disease

Introduction / Purpose:
Gas accumulation in canine intervertebral disk (IVD) degeneration, called vacuum phenomenon (VP), is a common CT finding and it is very different in density from degenerative calcification. In MRI, gas and calcification both cause a signal void. This study aims to establish the prevalence of canine IVD MRI signal void without matching CT IVD calcification.

Methods:
This is a retrospective multicenter study. Imaging archives were searched for matching canine spinal CT and MRI examinations (same segment, acquisition within 24 hours). Sagittal T2 series, presence of mineralization or gas in the IVD in CT were inclusion criteria. In CT, the presence of IVD mineralisation and VP and in MRI the presence and pixel value of MRI IVD signal void were recorded.

Results:
Sixteen cases were included in each VP and calcification group based on the CT findings (gold standard). In MRI, all cases showed an IVD signal void area. One-Way ANOVA showed no statistical difference in pixel value of the signal void areas between both groups (P-value> 0.05).

Discussion / Conclusion:
MRI T2 signal void areas in the canine IVD are not necessarily due to calcification, they can represent VP. IVD calcification, but not VP, is associated with one particular type of IVD degeneration (Hansen-Type-1) with specific clinical signs and prognosis. Therefore, VP and thereby other types of IVD degeneration should be considered when identifying MRI signal void in the canine IVD.

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Topic: Neuroimaging & Axial Skeleton
Poster Number: 12

OBSTRUCTIVE HYDROCEPHALUS IN A FIVE-YEAR-OLD GERMAN SHEPHERD DOG WITH PSEUDOMONAS AERUGINOSA VENTRICULITIS

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Keywords:
Obstructive hydrocephalus ventriculitis bacterial

Introduction / Purpose:
This report describes clinical, MRI and necropsy findings of bacterial Pseudomonas aeruginosa
ventriculitis and meningitis and associated obstructive hydrocephalus internus in a dog.

Methods:
A five-year-old male neutered working German Shepherd Dog presented to an emergency hospital for acute onset and rapid progression of obtundation, vertical nystagmus, and ataxia. A brain MRI was performed using a 1.5 T scanner including: T2-weighted, T1-weighted, T1-STIR, T2-FLAIR, T2-GRE, T1 3D GRE and T1- weighted post-contrast series. CSF culture and cytology was obtained after the MRI. The patient was euthanized and a necropsy was performed. Culture of fresh-frozen brain tissue was collected at necropsy.

Results:
MRI results exhibited severe obstructive hydrocephalus and cerebellar herniation through the foramen magnum. Hyperintensity of the lining of the ventricular system was present on a T2-weighted FLAIR sequence, supporting ventricular obstruction. There were subtle FLAIR hyperintensities along the dorsal cerebral cortex and mild meningeal contrast enhancement. Necropsy and histopathology revealed hydrocephalus internus, cerebellar herniation, ventriculitis and meningitis. A moderate yield of Pseudomonas aeruginosa was detected on cerebrospinal fluid and brain tissue culture.

Discussion / Conclusion:
Pseudomonas aeruginosa central nervous system infection has been reported with clinical symptoms and MRI findings in humans similar to this dog. The few canine cases of encephalitis involving Pseudomonas aeruginosa reported in dogs were all described with evidence of external inoculation such as otitis interna, media and migrating nasal foreign bodies. Bacterial encephalitis should be considered as a differential for obstructive hydrocephalus internus in dogs.

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Topic: Neuroimaging & Axial Skeleton
Poster Number: 10

MAGNETIC RESONANCE IMAGING, COMPUTED TOMOGRAPHY, AND HISTOPATHOLOGICAL FEATURES OF A SUSPECTED CERVICAL SPINAL FIBROUS HAMARTOMA IN A YOUNG DOG

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Keywords:
Cervical, diagnostic imaging, intradural, infancy

Introduction / Purpose:
This report describes the clinical, MRI, CT, and post-mortem findings of an unusual presentation of a cervical intradural-extramedullary mass causing non-ambulatory tetraparesis in a young dog.

Methods:
An eight-month-old female German Shepherd was presented with a two-month history of right sided hemiparesis progressive to non-ambulatory tetraparesis. A cervical spine MRI was performed using a 1.5T scanner, which included T2-weighted, T1-weighted pre- and postcontrast, T2-STIR and T2-GE sequences. Additionally, dynamic CT-angiography and CT-myelography of the cervical spine were performed using a 64-row multidetector scanner. A cerebrospinal fluid sample was obtained after the CT. The patient was euthanased, and post-mortem examination and histopathology were performed.

Results:
The MRI showed a multilobulated and faintly contrast-enhancing mass of mixed signal intensity occupying most of the cross-sectional area of the vertebral canal at the level of cervical vertebrae C3-C4. CT-angiography and CT-myelography revealed circumferential attenuation of the subarachnoid space by the mass, with no evidence of vascular involvement. Cerebrospinal fluid analysis revealed normal total cell count with an increased proportion of neutrophils and a mild increase in total protein concentration. Post-mortem examination and histopathology revealed an intradural-extramedullary mass composed of dense bundles of eosinophilic collagen, low density of mesenchymal cells forming fibrous connective tissue and mild adipose tissue infiltration, with no evidence of inflammatory or neoplastic cells.

Discussion / Conclusion:
The age of presentation and histopathological findings of this case are consistent with a fibrous hamartoma of infancy, an uncommon lesion described in the human literature, rarely reported with spinal localisation.

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Topic: Neuroimaging & Axial Skeleton
Poster Number: 11

THE ATP11B KNOCKOUT RAT AS A MODEL OF CEREBRAL SMALL VESSEL DISEASE (SVD)

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Keywords:
Cerebral small vessel disease, endothelial cell

Introduction / Purpose:

Cerebral SVD is the most common cause of vascular dementia in humans and doubles stroke risk. SVD is diagnosed with a combination of clinical signs and neuroimaging features, with distinctive postmortem pathology. The most commonly used rodent model of SVD, the Spontaneously Hypertensive Rat-Stroke Prone (SHRSP) has early vascular pathology and some neuroimaging features similar to human SVD, but is inbred and hypertensive. Work in our laboratory found the SHRSP had a homozygous deletion in *Atp11b*, leading to loss of ATP11B and single nucleotide polymorphisms in human *ATP11B* are associated with sporadic SVD. Therefore, we generated an *Atp11b* knockout rat to provide a novel transgenic model of SVD, which is also normotensive.

Methods:

Here, we report the vascular changes and neuroimaging features of this rat model. We used electron microscopy (EM) to look at endothelial cell morphology and surrounding white matter changes, and magnetic resonance imaging (MRI) with image assessment using a protocol adapted from human MRI analysis.

Results:

Endothelial cells from ATP11BKO rats had abnormal morphology on EM and this correlated with increased surrounding white matter disruption. By MRI, these animals also all had bilateral ventriculomegaly with loss of brain tissue volume and an increased number of suspected microbleeds compared to controls.

Discussion / Conclusion:

These neuroimaging and pathology features in the ATP11BKO rat are similar to those of human SVD. The vascular changes correlate with pathological white matter disruption indicating cross-talk between endothelial cells and oligodendrocytes, supporting the changing view that early endothelial cell changes are initiating the pathology in SVD.

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Topic: Urinary Imaging
Poster Number: 13

RENAL CARCINOMA NEEDLE TRACT SEEDING IN TWO DOGS

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Keywords:
dog, seeding, aspirate, kidney

Introduction / Purpose:
Two clinical cases of needle tract implantation of neoplastic cells on the abdominal wall after ultrasound fine needle aspiration are discussed. Primary tumor was renal carcinoma. All nodules grew up along the needle tract.

Methods:
Case N.1 A 10 year old male, Bracco Italiano dog, showed on abdominal ultrasound (AU) examination an irregular inhomogeneous complex mass in the caudal pole of the right kidney (4 cm in diameter). The mass was aspirated with a 22 G needle three times. On cytology, a population of cohesive epithelial cells with moderate atypia were described. Due to renal vein thrombosis detected on CT, surgery was not performed. 6 months later, an AU check revealed multiple hypoecoheoic nodules (1,5 cm), multilobulate, inside the abdominal wall.
Case N.2 An 8 year old male WHWT was referred for a right renal mass. After AU and total body CT study, Fine needle aspirate (5 times, 22 G) was performed. Nephrectomy was performed and histological diagnosis was renal carcinoma. Six months after, AU showed the presence of three hypoechoinc nodules, well defined margins, 1 cm in size, in the abdominal wall along the needle passage.

Results:
Case n.1: Fine needle aspirated were collected and cytology showed neoplastic epithelial cells highly suspicious for metastatic renal carcinoma.
Case n. 2 : Nodules were surgically removed and metastasis were confirmed on histology.

Discussion / Conclusion:
Needle tract seeding is rare. To our knowledge the seeding of renal carcinoma cells after FNA on the abdominal wall has never been reported in veterinary medicine.

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Topic: Urinary Imaging
Poster Number: 14

COMPUTED TOMOGRAPHIC FEATURES OF TRANSCAVAL URETER IN ONE DOG AND THREE CATS

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Keywords:
novel CVC congenital malformation, vascular ring

Introduction / Purpose:
Congenital malformation of the caudal vena cava (CVC) may have important implication and in-depth knowledge of the anatomy is important to prevent potential surgical complication. Transcaval ureter is a rarely reported human congenital malformation of the pre-renal segment of the inferior vena cava, never described in veterinary medicine. The aim of this multicenter retrospective study was to describe the computed tomographic (CT) features of transcaval ureter in a case series of dog and cats.

Methods:
O Patients from multiple institutions were retrospectively included by searching the report database for the keywords 'atypical CVC malformation'. Several qualitative features were described for each CVC malformation detected.

Results:
Two cats and one dog were included in the study. Two cats were referred for reasons unrelated to disorders of the urinary system. The canine patient was referred for further investigation due to recurrent vomiting. Contrast enhanced computed tomography showed in all cases a CVC malformation consisting in a pre-renal vascular ring encircling the right ureter at the level of L4-L5. In only one case the malformation was associated with hydroureter and mild pyelectasia.

Discussion / Conclusion:
This is the first study describing the CT appearance of transcaval ureter in companion animals. In line with human literature, transcaval ureter was in all cases unilateral and appeared as a vascular ring of the CVC through which the right ureter extends. Computed tomography was a suitable method for the diagnosis of this novel CVC congenital malformation. The clinical relevance of this congenital vascular malformation needs to be further investigated.

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Topic: Urinary Imaging
Poster Number: 15

VENOUS INTRAVASATION OF CONTRAST MEDIUM DURING RETROGRADE URETHROGRAPHY IN A DOG WITH URETHRAL STRICTURE AND URETHRITIS

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Keywords:
Dog, venous intravasation,retrograde urethrography

Introduction / Purpose:
Retrograde urethrography is a commonly used imaging modality to investigate urethral diseases. Complications are uncommon and include iatrogenic urinary tract rupture and infection. Extravasation of contrast medium has been described into the peritoneal space, cavernous tissues of the penis or soft tissues adjacent to the urethra in case of urethral rupture.

Methods:
A 12-year-old castrated pug was referred for a suspicion of urethral stricture. The dog presented with a history of dysuria and stranguria for 3 weeks, requiring multiple urethral catheterisations.

Results:
A retrograde urethrography showed a focal luminal narrowing with an irregular mucosal margin of the penile urethra. Contrast medium was observed within the penile tissue, venous sinuses of the bulbus glandis, dorsal veins of the penis, internal pudendal, internal iliac and common iliac veins, as well as in the caudal vena cava. Urethroscopy confirmed urethral stricture associated with severe urethritis in the region of the bulbus glandis. Cytology samples taken by cytobrush showed mixed inflammatory cells associated with bacterial infection. Scrotal urethrostomy was performed along with a medical treatment for concurrent prostatitis.

Discussion / Conclusion:
Urethral stricture can be the sequela of infectious/non-infectious urethritis, previous urethral instrumentation and/or trauma. Urethro-venous contrast medium intravasation is a rare complication of retrograde urethrography in human medicine and has been reported only once in veterinary medicine, more proximally in the urethra. Intravasation is due to the alteration of the integrity and permeability of the urethral wall and can therefore be observed concomitantly with stenosis and/or urethritis.

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Topic: Gastrointestinal Imaging
Poster Number: 16

COMPUTED TOMOGRAPHIC APPEARANCE OF GASTROPEXY SITES IN 22 DOGS

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Keywords:
Gastropexy, Computed Tomography, GDV

Introduction / Purpose:
Gastropexy is primarily performed in order to prevent the recurrence of gastric dilatation-volvulus. This retrospective observational study aimed to describe the CT appearance of gastropexy sites and report their anatomical and suspected functional abnormalities.

Methods:
22 dogs with prior gastropexy that underwent CT were included, with time since gastropexy ranging from 16-1552 (mean) days.
For statistical analyses, animals were divided into two groups depending on the degree of gastric anatomic distortion and gastropexy site. Animals were allocated to either the anatomic (10) or non-anatomic (12) group based on subjective assessment of distortion.

Results:
CT features of gastropexy included attenuation of 36 HU (6-57) and focal slight thickening of the gastric wall and adjacent muscle. 15/22 dogs had local hypervascularization. Gastric distension was present in 7/22 dogs, and a gravel sign in 16/22 dogs.
A significant difference between groups was found for gastric angles, with acute angles (mean 52°) in non-anatomic and obtuse angles (mean 94°) in the anatomic group, and a narrow pedicle width seen more commonly in the non-anatomic group. No significant difference was found between groups regarding the position of gastropexy site, and presence of gastric distension or gravel sign.

Discussion / Conclusion:
Therefore, the current study identified not only specific CT imaging features of gastropexy sites aiding understanding of normal range of appearance, but also detected anatomic distortion caused by gastropexy. It also identified signs of suspected gastric functional abnormalities in patients with and without anatomic distortion that can be useful in assessment of future cases with clinical signs.

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Topic: Gastrointestinal Imaging
Poster Number: 18

ULTRASONOGRAPHIC FEATURES OF ACUTE EROSIVE HEMORRHAGIC GASTRITIS DUE TO INGESTION OF PINE PROCESSIONARY IN A DOG

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Keywords:
Gastritis, dog, erosive hemorrhagic, processionary

Introduction / Purpose:

Direct contact with the Pine Processionary Caterpillar (PPC) induces severe local allergic and toxic reactions. Acute lingual and gingival oedema, ulceration and vesicular lesions are the most frequent clinical signs. The objective of this report is to describe the ultrasonographic features of a case of intramural gastric haemorrhage with gastric ulceration secondary to ingestion of PPC in a dog.

Methods:

A 7 months-old, 7.6 kg, female mixed breed dog was presented with haematemesis, hypersalivation and facial oedema. The patient lived in a pine forest area. Physical examination, hematological (CBC) and biochemical analyses, coagulation test and abdominal ultrasound were performed after the initial treatment.

Results:

Physical examination showed hyperthermia (39.5ºC), ptyalism and focal colour changes in the tongue.Biochemical profile revealed increased C-reactive protein, ferritin, aspartate aminotransferase, alanine aminotransferase and creatine kinase. D-dimer elevation was also observed.
Abdominal ultrasound revealed diffuse gastric thickening (8.2 mm) and the mucosal layer was enlarged (6.1 mm) and hyperechoic. A focal crater-shaped mural defect containing hyperechoic microbubble accumulations was observed in the mucosa of the gastric fundus. Based on physical examination, ultrasound, and clinical findings intramural gastric haemorrhage with erosive lesion due to ingestion of PPC was suspected. After 48 hours of treatment, abdominal ultrasound showed a decreased in gastric wall thickness (4.3 mm) without identifying ulceration.

Discussion / Conclusion:

To the authors' knowledge, this is the first description of the ultrasound features of gastric intramural erosive gastritis secondary to PCC ingestion. In conclusion, ultrasound examination in dogs with suspected PPC ingestion should be performed to confirm haemorrhagic erosive gastritis.

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Topic: Gastrointestinal Imaging
Poster Number: 17

ROLE OF CT IN THE STAGING OF COLORECTAL TUMORS IN DOGS: A PRELIMINARY STUDY

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Keywords:
large bowel; oncology; computed tomography;

Introduction / Purpose:
Colorectal tumors are uncommon in dogs and due to the non-specific clinical presentation, an early diagnosis is challenging. In human medicine, computed tomography (CT) represents a reliable technique to define the precise location of the lesion and to perform an accurate tumor staging. The aim of this retrospective study was to define the tomographic features of colorectal tumors in dogs and the utility of CT in tumor staging.

Methods:
Dogs with histologically-diagnosed colorectal tumors that underwent pre- and post-contrast CT pneumocolography between 2018 and 2022 were included. For each case, location, thickness, extension, contrast enhancement, invasiveness, regional lymphadenopathy and distant metastasis were evaluated.

Results:
Eight dogs with different colorectal tumors were included: adenocarcinoma (n=4), carcinoma (n=2) and leiomyosarcoma (n=2). Lesions were located at colorectal (n=4), colic (n=3), and anorectal (n=1) level. Mean tumor extension was 53 mm ± 23 mm. All cases but one had circumferential transmural thickening with asymmetrical appearance in 85% of dogs. One case of leiomyosarcoma showed a mineralized exophytic mass. Mean pre- and post-contrast densities were 48 ± 6.2 HU and 92 ± 13 HU, respectively, with heterogenous enhancement in all dogs. Invasion of surrounding structures (i.e. anal sacs and tail muscles) was observed in one adenocarcinoma. Regional lymphadenopathy (jejunal, colic, caudal mesenteric and/or ileo-sacral lymph nodes) was noted in all cases. Distant metastases were not detected.

Discussion / Conclusion:
CT may be useful in the evaluation of colorectal tumors, in particular for identifying location, extension and invasiveness. Further studies are needed to understand its accuracy in tumor staging.

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Topic: Hepatic Imaging
Poster Number: 21

INTRAHEPATIC PORTAL GAS ASSOCIATED WITH A FOREIGN BODY OBSTRUCTION IN A 9 MONTHS OLD COCKER SPANIEL

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Keywords:
Portal gas, foreign body, ultrasound, canine

Introduction / Purpose:
Portal vein gas is a radiological sign representing the accumulation of gas in the portal veins and branches. In veterinary medicine, intraportal gas has been associated with gastrointestinal disorders.The case report describes ultrasound aspects of intrahepatic portal gas in a young canine, secondary to foreign body obstruction, no association between the two entities being made until now in veterinary medicine from the author's knowledge.

Methods:
A 9-month-old Cocker Spaniel was presented for episodes of vomiting with no clinical improvement after symptomatic treatment. Ultrasonography was suggestive of jejunal foreign body obstruction followed by surgery and a full recovery.

Results:
A 5cm jejunal mechanical obstruction, with moderate plication was seen ultrasonographically alongside multiple hyperechoic hepatic foci, peripherally located, antigravitational mobile, following the landmarks of the portal vein intraluminally. Post-surgery, normal appearance of the portal vein was recorded.

Discussion / Conclusion:
Even though CT scan represents the method of choice for detecting small amounts of gas in the portal system, a full diagnosis of foreign body obstruction has been achieved in this case only by ultrasound examination. Ultrasonographically, portal gas is described as antigravitational, highly echogenic particles within the portal lumen. Hypothesis of the intrahepatic portal gas was represented in this situation by possible damage of the intestinal and gastric mucosa, alteration of the epithelium and systemic inflammation with secondary immunosuppression (suggested by haematology results). The case report aims to describe intrahepatic portal gas secondary to foreign body obstruction and ultrasound findings associated with it, the attention being directed to the same principles described by human medicine studies.

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Topic: Hepatic Imaging
Poster Number: 20

EVALUATION OF LIVER STIFFNESS IN A POPULATION OF NORMAL DOGS IN A CLINICAL SETTING: INTRAOBSERVER RELIABILITY.

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Keywords:
Shear wave elastogrephy, healthy canine liver

Introduction / Purpose:

Sonoelastographic techniques can complement conventional grey-scale and Doppler ultrasonography by evaluating tissue elasticity, which has the potential to provide differentiation between malignant and benign conditions. The goal of this study is to assess liver stiffness in a diverse population of healthy dogs in a clinical setting. Previous studies on the effects of confounding factors (technical and patient related) have been contradicting

Methods:

Forty healthy client-owned dogs were prospectively enrolled. Inclusion criteria were the normal bloodwork including hematology, serum biochemistry, pre- and postprandial serum bile acids, and normal abdominal ultrasound. Shear wave elastography was performed on two separate days. Mean SWV were recorded, ICC (interclass correlation coefficient) for intra-observer variability calculated and correlation with patient characteristics assessed.

Results:

Mean liver 2D SWE (95% CI) velocities were 2.20-3.23 m/s. The interclass correlation coefficient (ICC) for intra-observer variability was 0.57-0.60.
No statistically significant correlation was found between the velocity measurements and patient sex (P=0.39-0.40) or age (P=0.68-0.93).
Considering the weight and regarding AvgVel and MedVel measurements with every unit increase in weight statistically significant decrease in the velocity result was seen (P= 0.024).

Discussion / Conclusion:

Although, 2D SWE is a feasible method to apply on a diverse population of dogs in a clinical setting, the moderate intra-observer variability mandates standardization of patient related and technical factors to overcome excessive variability in measurements. The negative correlation between weight and SWE velocity measurements makes it important to investigate possible breed and weight related differences on results further.

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Topic: Hepatic Imaging
Poster Number: 19

CT APPEARANCE OF CANINE HEPATIC ALVEOLAR ECHINOCOCCOSIS

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Keywords:
alveolar echinococcosis, CT, liver, dog

Introduction / Purpose:
Alveolar echinococcosis (AE) is a parasitic disease that is caused by the tapeworm Echinococcus multilocularis. Dogs are potential incidental intermediate hosts, with the liver being most commonly affected. CT is increasingly used in abdominal imaging and can provide valuable information, especially in cases with large masses and decreased accessibility in ultrasound. To the author's knowledge, there are only four patients reported with CT findings concerning liver AE in the veterinary field, lacking a detailed description.

Methods:
The aim of this study is to describe the CT findings of hepatic lesions in a retrospective series of 12 patients diagnosed with AE.

Results:
All cases showed well marginated cavitary lesions with minimal to no contrast uptake in the periphery, no contrast uptake centrally, and an irregular internal wall. 11/12 Patients had soft tissue septa within the lesions. 7/12 showed large cavitary masses (mean max. diameter 18,7cm) with thick wall and hazy mineralisation. 3/12 Patients had multiple smaller (mean max. diameter 8,4cm) thin walled cavitary lesions without mineralisation; In 2/12 cases, lesions of both types were detectable.

Discussion / Conclusion:
The findings of this study suggest, that there are two typical CT-appearances associated with AE – large thick walled and smaller thin walled lesions. Those two groups may show different stages of an AE, where smaller ones progress into bigger ones. In contrast to other hepatic masses, there was no significant contrast uptake, obvious cavitation, irregular internal margination, septation and constant mineralisation in large ones. These findings can help to differentiate AE from other hepatic masses.

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Topic: Biliary Imaging
Poster Number: 23

IMAGING FINDINGS AND PROGRESSION OF CONGENITAL INTRAHEPATIC BILE DUCT ECTASIA (CAROLI'S DISEASE) IN 2 CATS FROM THE SAME LITTER

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Keywords:
Congenital, Cats, Caroli disease, Imaging.

Introduction / Purpose:
Congenital intrahepatic bile ducts ectasia results from in utero malformation of the ductal plate, being a rare inherited disorder characterised by cystic dilatation (or ectasia) of the bile ducts. In veterinary literature few case reports have been published. This report describes imaging findings (ultrasonography and CT) and follow up examinations of congenital intrahepatic bile ducts ectasia in 2 cats.

Methods:
2 sibling DSH with similar clinical signs (lethargy, gastrointestinal signs and jaundice), underwent diagnostic imaging with regular follow up examinations.

Results:
Distended and tortuous structures (5-7 mm) within all liver parenchyma were observed ultrasonographically. CT revealed branching large tubular structures, non-enhancing and hypoattenuating to the surrounding parenchyma. A 9 mm pancreatic cyst was noted in one of the patients. A diffusely enlarged liver and multiple small contrast enhancing vessels have been also observed.

Discussion / Conclusion:
Imaging findings in Caroli's disease are tubulo-saccular rather than fusiform, a feature that might aid diagnosis. Intraductal bridging, echogenic septae formation, gallbladder wall oedema, thickening of the intrahepatic duct walls, intraluminal portal vein sign was recorded with ultrasonography. PW Doppler recorded turbulent flow, follow up examinations showed normal velocity of the portal vasculature, possibly related with adaptative physiological mechanisms. The CT sign-central dot sign was not visualised. Differential diagnosis includes isolated choledochal cysts, polycystic liver disease and biliary obstruction. Even though biopsy is required to confirm the diagnosis, imaging findings can be supportive for description of congenital malformations along with isolated cysts in other organs and similar imaging findings in siblings, ultrasonography being more accessible in monitoring the disease.

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Topic: Biliary Imaging
Poster Number: 24

IMAGING DIAGNOSIS - SPONTANEOUS DUODENOBILIARY REFLUX IN DOG

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Keywords:
dog, duodenobiliary reflux, pancreas, duoden

Introduction / Purpose:
Reflux of barium sulfate into the biliary tree from the duodenum is a rare condition reported in human medicine, being associated with choledochoenterostomy, Oddi sphincter incompetence, or duodenal fistulae/ulcer. Duodenobiliary reflux has been reported once in a dog secondary to duodenal resection and anastomosis due to duodenal ulceration. In our case duodenobiliary reflux happened spontaneously during contrast evaluation of the GIT as consequence of an abscessing pancreatitis.

Methods:
Case presentation: A 3 years old, neutered male Yorkshire Terrier was referred to the radiology service for GIT evaluation due to inappetence and vomiting. After evaluation of the patient, a Barium study was performed.

Results:
Two hours after barium sulfate administration, the contrast was visible in the biliary tree and persisted radiographically for at least 3 days. The condition was also detected in a CT scan performed 2 days after the initial procedure. Abdominal ultrasound showed multiple focal hypoechoic lesions in the pancreas, duodenal inflammation, and adhesions. These findings were confirmed by laparotomy.

Discussion / Conclusion:
In this case spontaneous duodenobilliary reflux (SDBR) may be a result of severe duodeno-pancreatic adhesions which in turn determine an abnormal response of cholecystokinin, influencing the opening of duodenal papilla.
In this case SDBR most probably represented a complication of severe pancreatitis. The shown reflux could provide an explanation for retrograde biliary infections.

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Topic: Biliary Imaging
Poster Number: 22

MULTI-PHASE MULTIDETECTOR-ROW COMPUTED TOMOGRAPHIC FEATURES AND LABORATORY FINDINGS IN DOGS WITH GALLBLADDER RUPTURE

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Keywords:
gallbladder, CT, dog

Introduction / Purpose:
Gallbladder rupture is a life-treating condition in dogs. In human medicine, multidetector-row computed tomography (MDCT) is considered the best modality for the diagnosis of gallbladder rupture. The aims of the study were to describe MDCT features of gallbladder rupture in dogs and to determine the CT findings and laboratory data that differ between dogs with ruptured biliary tree and dogs with biliary disease with no rupture.

Methods:
For this single-center, cross-sectional study were considered for inclusion dogs presented from May 2010 to September 2020, with surgical diagnosis of gallbladder rupture or integrity, who underwent MDCT examination and with CBC and biochemistry results available for review.

Results:
Forty-seven dogs with different diseases of the biliary tract were included. Seventeen dogs with confirmed gallbladder rupture and 30 dogs with intact gallbladder were included. Multiple MDCT findings showed statistical significance in distinguish dogs with gallbladder rupture: irregular contours of the gallbladder ($p < 0.0001$), discontinuation of the gallbladder wall ($p = 0.0005$), adhesions with adjacent organs ($p = 0.005$), heterogeneous enhancement of the gallbladder wall ($p = 0.01$), pericholecystic effusion ($p = 0.001$) and pericholecystic peritonitis ($p = 0.001$). The presence of three or more of these findings was highly indicative for gallbladder rupture (AUC = 0.921).

Discussion / Conclusion:
In this study, MDCT proved to be useful in differentiating dogs with gallbladder rupture from dogs with biliary disease without rupture.

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Topic: Equine Distal Limb
Poster Number: 25

FEASIBILITY OF STANDING ROBOTICS-CONTROLLED CONE BEAM COMPUTED TOMOGRAPHY OF THE DISTAL TARSAL AND PROXIMAL METATARSAL AREA

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Keywords:
standing - CBCT - tarsus - metatarsus III

Introduction / Purpose:
Equine standing cone beam computed tomography (sCBCT) is a recent modality, with most research focusing on the distal extremity and head.[1] This pilot study was intended to determine feasibility for sCBCT of the proximal metatarsal suspensory enthesis.

Methods:
Eight horses presented for advanced standing imaging have been subjected, under owner consent, to robotic sCBCT of the distal tarsal/proximal metatarsal area using a patented motion-correction sleeve. Restraint and imaging protocols were optimized continuously.

Results:
Bilateral imaging was performed in 2/8, giving a total of 10 scans performed. An acepromazine-detomidine-morphine cocktail provided adequate sedation in 9/10. Additional blinding and ear-plugging were necessary in 1/10. The optimized protocol included a 210° pulsed acquisition (with 240mm FOV, 120kVp-0.3mA parameters and 0.45mm voxel resolution) and imaged the region from the tarsocrural joint to the middle 3rd metatarsus. Rescans were performed in 2/10 due to excessive patient movement. After retrial, motion correction was successful in 10/10. Post-processing beam-hardening, streak and cone-beam artefacts were most prominent at the distal tarsal joints. Overall image quality was deemed sufficient, with high trabecular and cortical bone detail, but general low soft tissue contrast.

Discussion / Conclusion:
Standing CBCT is a feasible modality for detailed bone imaging of the proximal metatarsal suspensory enthesis. However, the technique remains susceptible to artefacts and dedicated software was necessary for sufficient image quality. The inherent low soft tissue contrast of CBCT was confirmed and further studies on the feasibility of combined sCBCT and sMRI are needed to fully evaluate diagnostic performances.

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Topic: Equine Distal Limb
Poster Number: 27

PROTON MAGNETIC RESONANCE SPECTROSCOPY OF THE DISTAL METACARPUS OR METATARSUS IN THOROUGHBRED RACEHORSES WITH AND WITHOUT CATASTROPHIC FRACTURES

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Keywords:
Magnetic resonance imaging, computed tomography

Introduction / Purpose:
Fractures of the third metacarpal/metatarsal bone are common in racehorses. The aim of this study was to quantify the 1H spectra for the equine metacarpal/metatarsal bone and compare the fat content to bone mineral density (BMD) in racehorses with and without fractures.

Methods:
Cadaver limbs from Thoroughbred racehorses in training were recruited. Each limb underwent magnetic resonance imaging at 3T using a knee coil followed by single voxel magnetic resonance spectroscopy at 3 locations (lateral condyle, medial condyle, centre of the distal diaphysis of the third metacarpal/metatarsal bone). Percentage fat content (FC) was calculated at each location. Each limb underwent computed tomography using a helical 64-slice CT scanner and mean BMD was calculated at the same 3 locations. All images were subjectively graded for sclerosis on MRI and CT.

Results:
A statistically significant negative correlation was identified for mean BMD and percentage FC for all condyles and in the proximal bone marrow (correlation coefficient =-0.36; p=0.040). The median percentage FC in the bone marrow of the distal diaphysis was lower in horses with fractures (88%) compared to controls (91%)(p=0.02). Median BMD was significantly higher (p=0.0009 for MRI; p=0.0018 for CT) and FC was significantly lower (p=0.0003 for MRI and p=0.0012 for CT) in condyles with a higher sclerosis grade on MRI and CT.

Discussion / Conclusion:
Fat content decreases with an increase in BMD in trained racehorses. These findings suggest that fat and bone may be capable of mutual regulation in Thoroughbred racehorses.

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Topic: Equine Distal Limb
Poster Number: 26

7T MRI OF THE EQUINE CADAVER FOOT: PRELIMINARY RESULTS OF POTENTIAL SEQUENCES EVALUATING MORPHOLOGY

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Keywords:
ultra-high field, magnetic resonance, horse, hoof

Introduction / Purpose:
This pilot study evaluated the usability and quality of 8 sequences reported in ultra-high-field human musculoskeletal MRI for morphological examination of the distal equine cadaver limb.

Methods:
Sagittal 2D (T1wSE, T2wSE, PDw) and 3D (T1w-MP-RAGE, CISS, DESS, FLASH and SWI); dorsal and transverse T1w images were acquired with a 7T Siemens MAGNETOM in one frozen-thawed and one fresh, radiographically normal equine cadaver foot. Images were assessed for subjective image quality and compared to anatomical textbooks and corresponding anatomical cross-sections.

Results:
Overall, 7T images showed high resolution, with high contrast and detail. Many sequences showed chemical shift artifacts in P3 and the subchondral bone of the distal (DIPJ) and proximal interphalangeal joints (PIPJ) and magic angle artifacts in the impar ligament (IL), deep digital flexor tendon, collateral ligaments of the DIPJ and PIPJ, chondrosesamoidean and –coronal ligaments (CS-CCLs), distal branches of the distal digital annular ligament (DB-DDAL) and the palmar ligaments of the PIPJ. Trabecular bone was best observed in T1wSE, PD, FLASH, DESS sequences while articular cartilage was best seen on DESS, CISS and MP-RAGE. T1wSE more than CISS and DESS showed individual dorsal hoofwall lamellae. All sequences clearly delineated the larger ligaments and tendons, but DESS and T1wSE more than CISS, T2wSE or PD showed fibrillar structure, the DIPJ recesses in the impar ligament, the DB-DDAL and the CS-CCLs.

Discussion / Conclusion:
Overall, the small isotropic voxels (0.34 mm) in DESS allowed best visualization of both osseous and soft tissue structures within the hoof. Optimising the sequences will allow further image quality improvement.

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Topic: Equine Orthopaedic Imaging
Poster Number: 29

T2 MAPPING OF CARTILAGE IN THE EQUINE DISTAL INTERPHALANGEAL JOINT USING 0.27 T AND 3.0 T MRI

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Keywords:
Equine T2 mapping cartilage MRI

Introduction / Purpose:
Low field MRI is insensitive at detecting cartilage damage in the distal interphalangeal joint (DIPJ) however T2 mapping can detect damage before morphological change is apparent. Objectives**:** Evaluate the mean T2 relaxation time in sections of cartilage with varying levels of pathology using low and high field MRI and verify the low field measurements with the gold standard measurement at high field.

Methods:
0.27 T and 3.0 T MR systems were used to scan nine *ex vivo* DIPJs. After imaging, the DIPJs were disarticulated and samples collected for histology. Sections were graded using the OARSI scoring system and Fiji imageJ software with the MRIAnalysisPak plugin was used to calculate T2 maps and draw ROIs. Both analyses were repeated twice.

Results:
Low field mean T2 measurements for each OARSI grade were: grades (1):99±51, (2):87±33 (3):81±19 ms and high field: (1):84±58, (2):76±44, (3):73±30 ms, respectively. Spearman's rank correlation demonstrated significant positive correlation between low and high field T2 measurements, rho 0.644 ($p < 0.00002$). The intra-rater agreement for T2 measurements was excellent (ICC=0.99) and good for OARSI scores (κ=0.75). Main limitations: most histological samples had an OARSI grade 1 and there were no control samples with an OARSI grade 0.

Discussion / Conclusion:
There was a positive correlation between low and high field demonstrating that T2 measurements on low field MRI are comparable to high field. The findings suggest a higher mean T2 in pathological cartilage tissue examined in this study compared to normal equine cartilage which is reported to be 40-60 ms.

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Topic: Equine Orthopaedic Imaging
Poster Number: 30

HISTOLOGICAL CHARACTERIZATION OF THE PROXIMAL SUSPENSORY ENTHESIS IN THE NORMAL EQUINE HINDLIMB.

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Keywords:
histology - m. interosseus III - metatarsus III

Introduction / Purpose:
The entheseal morphology of the equine suspensory ligament (SL) origin has not been fully characterized. This experimental pilot study is intended to describe the preliminary results of histological evaluation of the proximal SL enthesis in the normal equine hindlimb.

Methods:
The enthesis of a hindlimb from a horse, euthanized for reasons other than the study, has been divided in 6 sagittal compartments based on prior CT examination (proximal-distal, each lateral-sagittal-medial). After freezing and cutting, the histological slices were decalcified, cut and prepared for hematoxyline-eosine and trichrome staining.

Results:
All slices passed histological quality control, although 1 slice did not contain the enthesis and was considered too distal. The remainder of the entheses revealed a 4-layered appearance, consisting of compact bone, calcified fibrocartilage (CF), uncalcified fibrocartilage (UF) and ligamentous collagen fibers. The fibrocartilage layer showed multiple aligned columns of chondrocytes, with a tidemark clearly separating CF and UF. Contrary to this rather smooth tidemark, the plantar cortical and/or dorsal ligamentous outline was markedly irregular with several variable interdigitations.

Discussion / Conclusion:
The preliminary results of the current study show that the equine hind proximal SL enthesis is predominately fibrocartilaginous in nature1. Such fibrocartilaginous entheses are often found in biomechanically complex structures and are considered to play a key role in stress dissipation2. The fibrocartilaginous nature of the enthesis may affect imaging criteria for the diagnosis of proximal SL enthesopathy in different imaging modalities.

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Topic: Equine Orthopaedic Imaging
Poster Number: 28

HOW IS BONE MINERAL DENSITY RELATED TO ULTRA-SHORT ECHO TIME MRI-DERIVED BONE POROSITY INDEX IN THE THOROUGHBRED METACARPAL CONDYLE?

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Keywords:
porosity index, bone mineral density, MRI, equine

Introduction / Purpose:
Bone porosity index (PI) has been correlated to bone composition and mechanical stiffness. The relationship between bone porosity and bone mineral density (BMD) has not been studied in equine bones and may be relevant for fracture propagation. Purpose of the study is to validate ultra-short echo-time MRI-derived PI measurements in the equine distal Mc/MtIII condyle and evaluate the relationship between PI and BMD.

Methods:
Five post-mortem equine Mc/MtIII (McIII; n=1/MtIII; n=4) were collected. All specimens underwent high-resolution peripheral quantitative computed tomography in a 64-slice CT scanner (Siemens, Somatom Definition AS). MR images were acquired using a 3T clinical scanner (MAGNETOM Skyra 3T, Siemens Healthcare, Erlangen, Germany). BMD and PI were calculated and corresponding images generated. BMD and PI images were co-registered in Elastix using a mutual information metric and a B-spline transform. Co-registered images were loaded into an open-source 3D imaging software and the volume of the distal condyle was defined manually (3D-ROI). Subsequently, BMD and PI values were plotted against each other for each pixel in the 3D-ROI.

Results:
BMD and PI of the equine distal Mc/MtIII are inversely correlated with an average slope of -0.0163 in the scatterplot and an average correlation coefficient of 0.312.

Discussion / Conclusion:
BMD and PI are negatively correlated in the equine distal Mc/MtIII. Further work is needed to assess how correlation patterns behave in different areas of the bone and to evaluate PI in the presence of microcracks in horses with and without clinically relevant stress fractures of the parasagittal groove.

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Topic: Other Equid Species & Wildlife Imaging
Poster Number: 31

IMAGING DIAGNOSIS: MEDIAL OSTEOCHONDRAL FRAGMENTATION OF THE GLENOID CAVITY IN A MINIATURE DONKEY: A NOVEL FINDING

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Keywords:
Fragmentation, glenoid, scapulohumeral

Introduction / Purpose:

In equids, the shoulder region is challenging to investigate using conventional imaging modalities. Computed tomography (CT) is an established modality for detecting shoulder lesions in dogs and the normal CT anatomy of donkeys and horses has been described. The purpose of this study was to describe radiographic, ultrasonographic and CT findings of the scapulohumeral joint in a miniature donkey with bilateral medial osteochondral fragmentation of the scapula and propose a hypothesis for its occurrence.

Methods:

A 2-year-old miniature donkey presented with grade 4/5 right fore lameness (AAEP) of 6 months' duration. Clinical examination revealed muscle atrophy of the right shoulder region. Lameness was unaltered by a low 4-point nerve block but significantly improvement following intra-articular anesthesia of the shoulder joint. Radiographic, ultrasonographic and CT examination was performed of both shoulder joints.

Results:

Radiography revealed a misshapen caudal aspect of the glenoid cavity with a separate smooth, ovoid mineral opacity. Ultrasonography showed marked synovitis with moderate osteophytosis of the scapulohumeral joint. On CT images, the smooth, ovoid fragment at the caudo-medial margin of the glenoid cavity measured 1,2 x 2 x 0,8 cm. Moderately sized osteophytes were observed at the lateral margins of the joint. CT images of the contralateral scapulohumeral joint showed the presence of a similar, but smaller fragment with no other significant findings.

Discussion / Conclusion:

To the authors' knowledge this is the first description of medial osteochondral fragmentation of the glenoid cavity in equids. CT was essential for the definitive diagnosis. Potential etiologies include dysplasia, atypical osteochondrosis, or separate/ununited ossification centers.

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Topic: Other Equid Species & Wildlife Imaging
Poster Number: 33

ABDOMINAL ULTRASONOGRAPHIC EVALUATION OF THE URINARY TRACT, ADRENALS, SPLEEN, HEPATOBILIARY AND GASTROINTESTINAL TRACT IN JUVENILE EASTERN GREY KANGAROOS (MACROPUS GIGANTEUS)

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Keywords:
Kangaroo; ultrasonography; abdominal anatomy

Introduction / Purpose:

The purpose of this study was to describe a systematic approach to, and the ultrasonographic anatomy of the kidneys, urinary bladder, adrenal glands, spleen, liver, gall bladder and gastrointestinal tract in healthy juvenile eastern grey kangaroos (Macropus giganteus). Ultrasonographic descriptions are lacking in macropods despite challenges of urbanisation, disease, drought and wildfires. Therefore, preliminary quantitative and qualitative ultrasonographic references may be applied to rehabilitation efforts and the identification of underlying disease in compromised animals.

Methods:

Ten macropod cadavers (eight eastern grey kangaroos and two swamp wallabies) were used for initial dissections and preliminary ultrasonographic examinations. Seven eastern grey kangaroos (four females and three males; mean mass 18 kg (±4.5)) were ultrasonographically examined under heavy sedation in lateral recumbency.

Results:

The study developed gross and diagrammatic depictions of the left and right abdominal anatomy. Ultrasonographic landmarks, measurements, echogenicity and a systematic approach was determined. Differences in macropod anatomy was examined and a series of normal ultrasonographic images were taken.

Discussion / Conclusion:

Provisional standard ultrasonographic protocols and landmarks were assessed and adapted in the kangaroo due to their unique anatomy. Due to the large gaseous forestomach, an intercostal approach similar to a deep chested dog was required. Compared to domestic species, ultrasonographic differences in anatomy included the forestomach, hindstomach, liver orientation, distinguishable adrenal glands, splenic branching and epipubic bones. The study was limited by the small sample size (7) and weight range (14-25 kg). Future research may include larger kangaroos and the evaluation of the oesophagus, pancreas, lymph nodes and abdominal vasculature.

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Topic: Other Equid Species & Wildlife Imaging
Poster Number: 32

MRI FINDINGS IN A DONKEY WITH A DIFFUSE ASTROCYTOMA.

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Keywords:
MRI, donkey, diffuse astrocytoma

Introduction / Purpose:

The aim of our study was to describe the MRI findings of a diffuse astrocytoma in a donkey.

Methods:

A 23-year-old donkey gelding was presented for a two-months history of ataxia, apathy and behavioural changes. Discontinuation of initial treatment with corticosteroids resulted in an, acute deterioration of the clinical signs. Physical examination and blood analysis revealed no abnormalities. Neurological exam showed an apathy, vestibular ataxia, hypermetria, proprioceptive deficits and ambulatory tetraparesis with spontaneous overknuckling and crossing of the thoracic limbs. There was left sided facial nerve paralysis, bilaterally decreased menace response, decreased tone of the tongue and positional horizontal nystagmus. Findings were consistent with a lesion involving the left brainstem. A 3-Tesla MRI of the brain was performed.

Results:

MRI demonstrated multifocal and ill-defined PDw, T2w and FLAIR hyperintensities within the left rostral internal capsule, right and left thalamus, left reticular nucleus, left rostral colliculi, left hippocampus, left side of the brainstem, left hemisphere's white matter and mild bilateral peri-ventricular hyperintensities. These changes were T1w isointense without contrast enhancement. The radiographic diagnosis was a bilateral asymmetrical polioleukoencephalopathy involving the forebrain and brainstem. Main differentials included infectious or inflammatory encephalopathies, or diffuse infiltrative neoplasia (round cell neoplasia or diffuse glioma). Post-mortem histopathological diagnosis revealed a diffuse astrocytoma grade III extending from the medulla oblongatato the basal nuclei.

Discussion / Conclusion:

To the authors' knowledge, this is the first report describing the MRI findings of a diffuse astrocytoma in a donkey. The lesions resemble those previously described for canine diffuse astrocytoma and gliomatosis cerebri.

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Topic: Exotic Species Imaging
Poster Number: 35

IMAGING FINDINGS IN A GUINEA PIG WITH HYDRONEPHROSIS AND BILATERAL HYDROURETERS ASSOCIATED WITH KIDNEY, URETERAL, BLADDER AND URETHRAL CALCULI

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Keywords:
Diagnostic imaging, guinea pig, hydronephrosis

Introduction / Purpose:
Urolithiasis is a common health problem in female guinea pigs but etiopathogenesis is unknown.

Methods:
1.5 years-old, male guinea pig presented for polyuria/polydipsia and hematuria for 1 week. Abdominal radiographs (RX) and ultrasound (US) were performed. An abdominal computed tomography (CT) with intravenous contrast administration was also carried out to provide a detailed diagnosis.

Results:
RX revealed an ellipsoid well-defined mass in the projection of the left kidney (LK) and two tortuous tubular structures in the retroperitoneum being compatible with both ureters with several small mineral parts in its distal portions.
US showed an enlarged fluid-filled LK with loss of its normal anatomy. Right pelvis was slightly distended. Both ureters were severely dilated along their entire length, being the distal part of the left one with hyperecogenic content with acoustic shadow occluding the lumen. The right ureter showed no signs of obstruction. Two small irregular structures with acoustic shadow in the bladder trigone and urethra were also observed.
Abdominal CT scan also revealed the presence of mineral structures (450 UH) in the right pelvis. Late post-contrast study confirmed the complete obstruction in the left ureter.
Left nephrectomy was performed, and positive urine culture was obtained for Micrococcus luteus sensible to Pradofloxacine. Patient recovered without complications.

Discussion / Conclusion:
Uroliths in male guinea pigs are not as common as in females. Definitive diagnosis can be achieved with RX, US, excretory intravenous pyelography and CT. Having all this detailed information is mandatory to plan the right surgical treatment.

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Topic: Exotic Species Imaging
Poster Number: 34

ACCURACY OF THE MODIFIED VERTEBRAL HEART SCORE AND THE CARDIO-VERTEBRAL RATIO FOR RADIOGRAPHIC EVALUATION OF CARDIOMEGALY IN FERRETS

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Keywords:
Exotics, Xray, Cardiovascular

Introduction / Purpose:
Thoracic radiography is commonly used to assess the size of the heart and diagnose cardiac disease in pet ferrets. Several standardized radiographic heart size indicators have been introduced in this species and values in healthy ferrets have been reported. To date, none of these indicators has been tested in ferrets with cardiac disease. The aim of this prospective and retrospective, analytical observational design study was to assess the accuracy of the modified vertebral heart score (mVHS) and the cardio-vertebral ratio (CVR) in the radiographic detection of cardiomegaly in ferrets.

Methods:
Thoracic radiographs of 24 ferrets with confirmed heart diseases, 22 ferrets with non-cardiac diseases and normal-sized hearts on echocardiogram, and 24 healthy ferrets were mixed and examined by three independent and blinded radiologists who measured mVHS and CVR in right lateral (RL) and ventrodorsal (VD) radiographs.

Results:
For all readers, ferrets with cardiac diseases had significantly higher mVHS and CVR than ferrets with normal-sized hearts. Optimal cut-points were 6.25 vertebrae and 7.25 vertebrae for RL-mVHS and VD-mVHS, and 1.58 and 1.80 for RL-CVR and VD-CVR, respectively. Using these cut-points, the accuracy was good for indicators measured in RL radiographs (92.9% for RL-mVHS; 91.4% for RL-CVR) and moderate for indicators measured in VD radiographs (88.6% for VD-mVHS; 85.7% for VD-CVR).

Discussion / Conclusion:
Findings supported the use of mVHS and CVR for evaluating the size of the heart in diseased ferrets, with caution in values interpretation when pericardial fat prevents precise delineation of the cardiac silhouette contour especially on VD radiographs.

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Topic: Exotic Species Imaging
Poster Number: 36

FIELD-BASED RADIOGRAPHY AND ULTRASONOGRAPHY OF EMYS ORBICULARIS.

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Keywords:
Exotics, turtles, diagnostic imaging.

Introduction / Purpose:

The European pond turtle (*Emys orbicularis*) is an endangered species in Switzerland. A national program has promoted breeding and release of individuals into suitable habitats since 2010. Radiography and ultrasonography allow evaluation of chelonians' skeletal system and internal organs. Aim of this prospective study was to determine the feasibility of radiography and ultrasonography for health assessment before reintroduction.

Methods:

Radiography was performed in 84 animals, using three projections and evaluated for changes of the skeletal, respiratory, gastrointestinal, and urogenital systems. In 45 of them, ultrasonography was performed using the cervicobrachial and prefemoral acoustic windows. For each window, visualization of the liver, gallbladder, gastrointestinal tract, urogenital tract, heart and lung as well as abnormal findings were reported.

Results:

Skeletal changes were observed in 19/84 (22.6%) turtles. Two showed marked moth-eaten osteolysis. Increased opacity of the lung was present in 9/84 (10.7%), three of them were positive for *Mycoplasma* spp. by means of polymerase chain reaction. Ultrasonographically, the liver was visible in all individuals. From the right prefemoral window, most structures could be identified: the liver 45/45 (100.0%), the stomach 36/45 (80.0%), the heart 33/45 (73.3%), the duodenum 32/45 (71.1%), the gallbladder 18/45 (40.0%). No abnormalities were reported.

Discussion / Conclusion:

Despite the small size of this species and the unexperienced examiner, radiography and ultrasonography showed to be feasible techniques that provide good evaluation of both skeletal structures and internal organs. In general, the background prevalence of disease was low. Therefore, imaging for health assessment before reintroduction may mainly be indicated in case of suspected disease.

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Topic: General Abdominal Imaging 1
Poster Number: 38

RADIOGRAPHIC EVALUATION OF FELINE ABDOMINAL ORGANS IN DIFFERENT RADIOGRAPHIC PROJECTIONS

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Keywords:
Radiography, Abdominal organs, Visibility, Project

Introduction / Purpose:
Two orthogonal radiographic projections, right or left lateral recumbency and a ventrodorsal (VD) are often used as a first line imaging modality for abdominal diseases. In dogs, the dorsoventral (DV) projection is not considered reliable because of crowding of the abdominal organs, but this has not been evaluated in cats. We hypothesised that in cats the DV projection would provide similar information to the VD.

Methods:
Prospective descriptive study. Right lateral recumbent (RLR), left lateral recumbent (LLR), VD and DV feline abdominal radiographs were independently reviewed by two board-certified radiologists blinded to the cat's position. The visibility, location and size of the major abdominal organs were recorded. Overall subjective preference for RLR or LLR and DV or VD was also noted. The data were statistically analysed.

Results:
65 cats met the inclusion criteria. Statistical analysis showed no significant difference in the visibility of individual structures between DV and VD views or RLR and LLR, except for the pylorus (significantly more visible in the VD than the DV view), and the tail of the spleen (more visible in the RLR than the LLR view). Visibility of the abdominal organs improved with increasing intra-abdominal fat. The agreement of the reviewers on their preferences for the RLR vs LLR views, and for the DV vs VD views, was good.

Discussion / Conclusion:
Comparison between the different projections of the abdomen shows that they provide very similar anatomical information and generally can be used interchangeably. However, the DV and the RLR projections were preferred overall.

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Topic: General Abdominal Imaging 1
Poster Number: 39

CT IMAGING REVEALS INVOLUTION OF SEVERE PROSTATIC CHANGES IN DOGS WITH PERINEAL HERNIA THREE MONTHS AFTER CASTRATION

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Keywords:
Computed tomography, Perineal hernia, Prostate

Introduction / Purpose:

In dogs with perineal hernia (PH), the prostate is typically large, cystic, and often caudally displaced. The effect of castration and herniorrhaphy on the prostate of PH dogs has not been previously studied. Our objective was to assess whether prostatic changes on CT images resolve within three months after castration.

Methods:

Prospective single-centre study. Client-owned male dogs with PH underwent CT imaging on the day of PH surgery and castration, as well as three months after. Previously castrated or hormonally treated dogs were excluded. Prostate volume, intra- and paraprostatic cysts as well as location were assessed using OsiriX® DICOM viewer. Statistical analyses were as follows: a paired samples t-test for continuous variables, Wilcoxon signed rank test for categorical variables, as well as McNemar's chi-squared for binary variables.

Results:

Altogether 38 dogs were included in the study. The mean volume of the prostate three months after castration was significantly lower than on the day of surgery ($P < .001$). In addition, the amount of intraprostatic cysts was significantly reduced ($P < .001$), however, amount of paraprostatic cysts wasn't. Additionally, prostate location at three months remained similar to the preoperative position, with 21.1% caudally displaced.

Discussion / Conclusion:

In dogs with PH, prostatic size as well as intraprostatic cysts significantly decreased three months after PH surgery and castration, but location remained caudal. CT is an excellent tool for assessing morphological changes of the prostate over time. Additionally, castration is an effective treatment for prostatic changes in dogs with PH.

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Topic: General Abdominal Imaging 1
Poster Number: 37

ANATOMICAL POSITION VARIANTS OF THE CANINE PANCREAS ASSESSED BY COMPUTED TOMOGRAPHY

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Keywords:
dog, pancreas, ct

Introduction / Purpose:
The study aims to describe anatomical position variants of the normal canine pancreas with the use of Computed Tomography (CT)

Methods:
The database was searched for dogs that underwent CT evaluation of the abdomen for causes unrelated to pancreatic disease. The position of each pancreatic part was evaluated and associated with body weight (>20kg vs <20kg) and chest type (barrel vs deep-chested breeds, considering only dogs with a known breed) with chi square test. A $p<0.05$ was considered significant.

Results:
Two-hundred-sixty-three dogs were evaluated (mean age 9.5 years ±3.8). The body of the pancreas was adjacent to the portal vein and the pyloric-duodenum junction in the vast majority. The right lobe was adjacent to the ascending colon in 75.4% of cases. In 20% of dogs, it was not in apposition to the duodenum. The contact with the ascending colon was most frequent in dogs weighted <20kg. The left lobe was in connection with the descending colon in 75%. In 30% of cases, it was adjacent to the left kidney, and this position was most frequent in dogs weighted <20kg. In 18.5% of dogs, at least one part of the pancreas was located in the retroperitoneal space, in contact with the left adrenal gland, caudal vena cava, celiac artery or kidneys. The retroperitoneal position was more frequent in deep-chested dogs.

Discussion / Conclusion:
CT was useful to describe anatomical position variants of the pancreas in dogs. Bodyweight and chest type may be related to different positions of the pancreatic lobes.

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Topic: General Abdominal Imaging 2
Poster Number: 41

CORRELATION OF MAGNETIC RESONANCE CHOLANGIOGRAPHY WITH FLUOROSCOPIC RETROGRADE CHOLANGIOGRAPHY AND CORROSION CASTING IN DOGS– A POST-MORTEM PILOT STUDY

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Keywords:
Cholangiopancreatography, MRC, MRI, Dog

Introduction / Purpose:
In human medicine, magnetic resonance cholangiography (MRC) has replaced endoscopic retrograde cholangiography when diagnosing biliary tract disorders. This post-mortem study aimed at assessing the feasibility of MRC for dogs by comparing its images with fluoroscopic retrograde cholangiography (FRC) and corrosion casting.

Methods:
Bodies of eight donated pet dogs (age: 9–15 years) underwent MRC, FRC and autopsy with corrosion casting of the biliary tract with vinyl polysiloxane. The diameters of gallbladder (GB), cystic duct, and common bile duct (CBD) were measured in MRC and FRC images and corrosion casts. Spearman correlation coefficient (r) was calculated to evaluate the relationship between MRC and FRC or casts.

Results:
Autopsy revealed normal biliary systems in seven dogs, and acute extrahepatic cholestasis and focal destructive cholangitis in one dog. MRC presented the same biliary structures as FRC or corrosion casting. Diameters measured in MRC had strong to very strong positive correlations with FRC at GB neck (r: 0.85, p: 0.011), and with corrosion casts for cystic duct (r: 0.76, p: 0.037) and CBD at papilla (r: 0.86, p: 0.008).

Discussion / Conclusion:
MRC can be regarded as a diagnostic modality that in comparison to FRC and corrosion casting allows an accurate imaging and measurement of the biliary duct system in dogs. Larger clinical studies, including dogs without and with biliary tract disorders are warranted to assess the diagnostic value of MRC.

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Topic: General Abdominal Imaging 2
Poster Number: 40

ACCURACY OF COMPUTED TOMOGRAPHY ATTENUATION VALUES IN THE CHARACTERIZATION OF ASCITES IN DOGS – A PRELIMINARY STUDY

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Keywords:
Ascites, Computed tomography, Hounsfield unit, Dog

Introduction / Purpose:
To evaluate computed tomography (CT) attenuation values in the characterization of canine ascites.

Methods:
Between January/2012–March/2022, 498 ascitic dogs underwent CT examination. Based on pathogenesis, ascites was categorized into: exudate, transudate, haemoabdomen and uroabdomen. Four round regions of interest (ROIs) were drown for each effusion and mean attenuation value (in HU) for each ROI was acquired. Mean of the four ROI mean values (mean of the means) were compared between types of ascites (Kruskal-Wallis, pairwise comparison Bonferroni-adjusted). Cut-off values for discriminating type of ascites were determined (ROC-curve analysis). Significance was set to $\alpha=0.05$.

Results:
88 dogs met inclusion criteria: exudate (n=26), transudate (n=25), haemoabdomen (n=25), and uroabdomen (n=12). Median (IQR) of the mean of the means attenuation values were significantly different (P<0.001) between exudate=15.12 HU (13.87–18.31), transudate=6.25 HU (4.75–8.50), haemoabdomen=32.50 HU (26.59–37.75), and uroabdomen=12.25 HU (10.31–15.06). Post-hoc analysis showed significant differences between exudate/transudate, exudate/haemoabdomen, transudate/haemoabdomen, haemoabdomen/uroabdomen (P<0.001, for all comparisons), transudate/uroabdomen (P=0.007), but not between exudate/uroabdomen (P=0.369). The area under the curve ([AUC] i.e., accuracy) of the attenuation values to discriminate haemoabdomen from all other types of ascites was 95.5%(P<0.001; 95%CI=91.5–99.4%; Youden Index≥18.5 HU, sensitivity=100%, specificity=85.7%). The AUC of the attenuation values to discriminate transudate from all other types of ascites was 95.1% (P<0.001; 95%CI=91.0–99.3%; Youden Index<11 HU, sensitivity=90.5%, specificity=88%). Attenuation values between 11–18.5 HU were less informative on the nature of the ascites.

Discussion / Conclusion:
CT attenuation values were excellent in discriminate haemoabdomen and transudate from other types of ascites.

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Topic: General Abdominal Imaging 2
Poster Number: 42

ULTRASONOGRAPHIC MEASUREMENT OF ADRENAL GLAND-TO-AORTA RATIO AS A METHOD OF ESTIMATING ADRENAL SIZE IN YORKSHIRE TERRIERS.

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Keywords:
Adrenal size, US, aorta, York Shire Terrier

Introduction / Purpose:
Previous studies established ultrasound adrenal gland to aorta ratio (AG/Ao) values in normal dogs based on body weight. However, to the authors' knowledge, these ratios have not been determined in specific breeds. The aim of the present study was to establish the reference values for the AG/Ao ratio in Yorkshire Terriers, as this is a breed in which pituitary-dependent hyperadrenocorticism is common.

Methods:
Fifty-three client-owned non-adrenal diseased Yorkshire Terriers (21 males, 32 females, 36 entire and 17 castrated) were included in this study. The animals were divided into two groups by body weight: <3.5 (36) and >3.5 (17) kg; and three age groups: < 5 (19), 6 -10 (20), and >11 years (14). The maximum thickness of both AGs and the maximum aortic luminal diameter, both in longitudinal plane were measured. The AG/Ao ratio for the left (LA/Ao) and right (RA/Ao) glands were obtained. Descriptive statistics and the influence of weight, age, sex, and reproductive status were calculated.

Results:
The RA thickness (4.38 mm) and RA/Ao ratio (0.87) were greater ($p<0,05$) than LA thickness (4.21 mm) and LA/Ao ratio (0.83). Both AG thickness and Ao diameter increased ($p<0.05$) with animal body weight. All parameters evaluated increased with age, but significant differences were only found between the ≤ 5- and 6-10-years groups. Body weight, sex and reproductive status did not influence on the AG/Ao ratio.

Discussion / Conclusion:
Our results suggest that only age influences the ultrasonographic measurement of the AG/Ao ratio in non-adrenal gland diseased Yorkshire Terriers.

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Topic: Thoracic Vascular Imaging
Poster Number: 45

IMAGING FINDINGS IN A CAT WITH A PULMONARY THROMBOEMBOLISM AND CONCOMITANT FLUDT AND PYOTHORAX

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Keywords:
Pulmonary thromboembolism, CT, emergency, imaging

Introduction / Purpose:
Diagnosis of acute pulmonary thromboembolism (PTE) is still a challenge in small animals. Many medical conditions can be associated with PTE.

Methods:
A 4-year-old, neutered male European cat was admitted with FLUDT and treated accordingly. Following a clinical improvement, acute severe dyspnoea started four days after hospitalisation.

Results:
T-FAST-scan revealed severe pleural effusion and dorsocaudal lobe lung consolidation. Thoracocentesis and fluid analysis showed pyothorax. The animal did not improve and developed marked cyanosis. Mechanical ventilation was started in ICU with FiO2=1. A radiological study was performed and showed pneumothorax, a marked alveolar pattern in the cranial, middle and caudal lobe, and severe enlargement of the pulmonary arteries. After draining the air, control radiographs were performed, showing a severe worsening of the alveolar pattern, occupying the entire right hemithorax and left caudal lobe. Blood gas analysis showed a PaO2 of 54 mmHg despite continuing with mechanical ventilation. Following suspicion of PTE, a pulmonary angiography CT scan was carried out, which revealed a filling defect compatible with an embolus in the right pulmonary artery. The animal was euthanised due to a poor prognosis.

Discussion / Conclusion:
The incidence of PTE in cats is unknown; however, it is likely to be underdiagnosed. Approximately half of the cats with PTE have multiple concomitant pathologies, as in our case. Although many patients with PTE present with normal thoracic radiographs, they are indicated in any patient suspected of having PTE. CT angiography scans are particularly good at detecting main, lobar, or segmental pulmonary arterial thrombi in humans.

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Topic: Thoracic Vascular Imaging
Poster Number: 44

RADIOGRAPHIC PULMONARY VASCULATURE DIMENSIONS IN DRUG NAIVE AND MEDICALLY MANAGED DOGS WITH LEFT HEART FAILURE FROM CHRONIC MITRAL VALVE INSUFFICIENCY

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Keywords:
cardiac, edema, veins, arteries, canine

Introduction / Purpose:
Chronic mitral valve insufficiency (CMVI) is the most common acquired cause of cardiovascular overload in dogs. A diagnosis of ensuing left heart failure (LHF) is supported by pulmonary venous enlargement and edema on radiographs. However, the absence of venous enlargement has been anecdotally observed after initiation of therapy in dogs with LHF; therefore, we aimed to compare radiographic pulmonary vessel size in LHF patients with or without chronic +/- acute cardiac pharmaceutical support.

Methods:
Dogs with an echocardiographic diagnosis of CMVI and radiographic evidence of LHF were retrospectively selected. Objective measurements of the pulmonary vessels were obtained by a radiologist. Dogs were divided into 10 groups if drug naïve (control) or based on the type of chronic +/- acute cardiac pharmaceutics provided. Summary statistics were measured for all data and calculations of pulmonary vessel size ratios.

Results:
200 radiographic studies from 163 dogs, prevalently mixed breeds, were reviewed. The mean age was 11.7 years, and weight was 6.9 kg. In all dogs and dogs in the control group, the veins measured larger than the arteries in all lung lobes. Chronically untreated dogs who received furosemide immediately before radiographs had no venous enlargement. All other groups had vascular asymmetry or venous enlargement in at least two lung lobes. All control dogs with reoccurrence of LHF had absence of venous enlargement after initiation of therapy.

Discussion / Conclusion:
Dogs medically managed chronically for CMVI can decompensate into LHF without radiographic pulmonary venous enlargement. Normal vessel size may also be observed in dogs administered furosemide prior radiographic evaluation.

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Topic: Thoracic Vascular Imaging
Poster Number: 43

CIRCUMFLEX RETROESOPHAGEAL LEFT AORTIC ARCH AND RIGHT DESCENDING AORTA: A NEW VASCULAR RING ANOMALY IN A DOG

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Keywords:
Vascular ring anomaly

Introduction / Purpose:

This report describes the computed-tomographic findings of a dog with a circumflex retroesophageal left aortic arch, partially patent right patent-ductus-arteriosus and right-sided descending aorta, leading to severe oesophageal strangulation.

Methods:

A ten-month-old male entire crossbreed dog presented to the University Teaching Hospital for poor development, regurgitation, and post prandial neck swelling. A computed-tomographic-angiography (CTA) was performed. The dog was discharged with dietary management.

Results:

CTA demonstrated the presence of a left-sided circumflex aortic and dextro-positioned descending aorta. The aortic arch, brachiocephalic trunk and left subclavian artery exhibited normal morphology. The right subclavian artery exhibited a stenotic origin. The emergence of a right-sided patent-ductus-arteriosus was present originating from the descending aorta. The oesophagus and trachea, normally located in the cranial mediastinum, passed between the heart base and the aortic arch continuing caudally-to-the-left of the dextro-posed descending aorta. Oesophageal strangulation and dilatation were present cranially.

Discussion / Conclusion:

Vascular ring anomalies are well described in animals and humans. In the latter, a circumflex retroesophageal left aortic arch with right descending aorta is an extremely rare event, often associated with respiratory compromise and dysphagia. The presence of a right patent-ductus-arteriosus is not essential, albeit it usually complete the ring anomaly. It results from regression of the right fourth arch between the right common carotid artery and right subclavian artery, along with a right-sided descending aorta. Surgical division of arterial ligament or aortic arch uncrossing are performed in humans. We believe that this new variant should be included in the existing ring anomaly classification.

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Topic: General Thoracic Imaging
Poster Number: 46

PREVALENCE OF LUNG ATELECTASIS IN SEDATED DOGS EXAMINED WITH COMPUTED TOMOGRAPHY

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Keywords:
Atelectasis, sedation, computed tomography

Introduction / Purpose:

Development of lung atelectasis during thoracic computed tomography (CT)-scan can be problematic when interpreting diagnostic images. Previous studies on changes in lung density due to anaesthesia and recumbency have been conducted, but studies on sedated animals are scarce. The objective of this study was to investigate prevalence of lung atelectasis in intravenously sedated dogs, positioned in sternal recumbency, examined in CT.

Methods:

Twenty dogs without known lung pathology received intravenous sedation and underwent three consecutive thoracic CT-scans in sternal recumbency. Images were examined in an axial plane and lung density defined as a HU-value was manually measured in the ventral and dorsal part, and as a mean for each lobe. Values were then correlated to an established scale defining atelectasis and normally aerated lung tissue. Statistical analysis was conducted to examine any changes in lung density over time between the three scans.

Results:

Results showed that all measured areas were normally aerated during all three scans, hence no atelectasis was detected. Although none of the dogs developed atelectasis, a statistically significant increase in lung attenuation between the first and second scan ($p=0.0323$) and between the first and third scan ($p=0.00036$) was seen in the ventral part of the lobes.

Discussion / Conclusion:

Results from this study indicate that dogs, that receive rapid intravenous sedation and are kept positioned in a sternal recumbency, have a low risk of developing lung atelectasis. This could provide sedation as a cost effective and time efficient alternative to anaesthesia in dogs undergoing thoracic CT-scan.

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Topic: General Thoracic Imaging
Poster Number: 47

COMPUTED TOMOGRAPHY APPEARANCE OF THE NORMAL THYMUS IN DOGS: A DESCRIPTIVE AND ANATOMICAL STUDY

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Keywords:
Thymus, Computed Tomography, Dog

Introduction / Purpose:
The thymus is a lymphatic organ located in the cranial mediastinum, presenting a maximum development before the sexual maturity, followed by an involution phase where the glandular tissue is replaced by fat. This retrospective study was aimed to describe the CT appearance and involution rate of the normal thymus in dogs between 1 and 24 months of age.

Methods:
Dogs under 2 years of age with a normal CT scan of the thorax performed were included and grouped in 4 categories (0-6, 6-12, 12-18 and 18-24 months). Post-contrast CT images were analyzed using two approaches: 1. qualitative evaluation of the thymus shape, location, anatomical relationships and grade of involution/replacement of the thymic tissue with fat 2. quantitative assessment including the ratio between the fourth thoracic vertebra body volume and the volume of the thymus (T4/Thymus) and gland attenuation.

Results:
Forty-three dogs, 21 males and 22 females, were included. Age distribution was similar in the 4 groups. In most cases, a cranial part with rounded margins and a thinner triangular caudal part were distinguishable. The ratio T4/thymus, the attenuation and the grade of involution significantly correlated with the 4 groups ($p<0.0001$).

Discussion / Conclusion:
This is the first study providing information about the CT anatomy and normal involution of the canine thymus during growth. These data will be useful for the CT interpretation of the cranial mediastinum in young dogs.

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Topic: Neuroimaging
Poster Number: 50

CANINE JUGULAR FORAMEN SYNDROME DUE TO INTRA-CRANIAL LESIONS OF THE GLOSSOPHARYNGEAL, VAGUS AND ACCESSORY NERVE ROOTS DIAGNOSED WITH COMPUTED TOMOGRAPHY

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Keywords:
jugular foramen, intracranial tumor, cranial nerve

Introduction / Purpose:
Jugular Foramen Syndrome (JFS) or Vernet's Syndrome in humans is an uncommon condition reported to cause clinical signs associated with combined paresis of the glossopharyngeal (IX), vagus (X) and accessory (XI) cranial nerves traversing through the jugular foramen (JF).

Methods:
The aim of this retrospective multicentre descriptive study was to report four cases of canine JFS that presented with persistent coughing, gagging and/or retching and had computed tomography (CT) findings consistent with an intra-cranial mass lesion associated with the cranial nerve IX, X and XI roots through the JF, and secondary abnormalities in line with those identified with JFS in humans.

Results:
The consistent CT features included an intra-cranial extra-axial soft tissue attenuating, strongly enhancing mass, centred on the cerebellomedullary angle, entering the jugular foramen (4/4). Associated findings included smooth widening of the bony JF (4/4), mild hyperostosis of the petrous temporal bone (3/4), isolated severe atrophy of the ipsilateral sternocephalic, cleidocephalic and trapezius muscles (4/4), equivocal ipsilateral dropped shoulder (4/4) and suspected atrophy of the ipsilateral thyroarytenoideus and cricoarytenoideus muscles of the vocal fold (4/4). Positional variation of the patient in CT makes the dropped shoulder an equivocal finding.

Discussion / Conclusion:
The reported clinical signs and secondary CT features are consistent with those previously reported in human literature and reflect a unilateral paresis of the combined cranial nerves IX, X and XI. This uncommon syndrome will be important for clinicians to recognise during their justified CT investigations of older dogs with chronic cough, gag and/or retch that are unresponsive to conservative management.

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Topic: Neuroimaging
Poster Number: 48

MAGNETIC RESONANCE IMAGING AND HISTOPATHOLOGICAL FEATURES OF A BUTTERFLY GLIOBLASTOMA IN A TWO-YEAR OLD DOG

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Keywords:
MRI, butterfly glioblastoma, brain, dog

Introduction / Purpose:
This report describes the clinical, MRI and post-mortem findings of a unique, rarely reported presentation of a butterfly glioblastoma in a young dog.

Methods:
A two-year-old female neutered Cockapoo was presented with lethargy and abnormal neurological episodes including obtunded mentation and behaviour, as well as generalised epileptic seizures. A brain MRI was performed using a 1.5T scanner, which included T2-weighted, T1-weighted pre- and postcontrast, T2 FLAIR, T2-GE and DWI sequences. The patient was euthanised, and post-mortem examination and histopathology were performed.

Results:
The MRI showed a bi-hemispheric, intra-axial, contrast-enhancing mass lesion within the forebrain that was extending across the corpus callosum and was mimicking an intraventricular bilateral symmetrical lesion. Post-mortem examination demonstrated a symmetrically effacing, infiltrative neoplasm that was replacing approximately 75% of the neuropil at the centre of the forebrain and midbrain. Histopathological assessment of this lesion was consistent with a high-grade astrocytoma such as glioblastoma multiforme. Given the bi-hemispheric, wing-like appearance on MRI and histopathological features, this lesion has been further classified as a butterfly glioblastoma.

Discussion / Conclusion:
The MRI and histopathological findings of this case are consistent with a butterfly glioblastoma, which is a rare condition in human and veterinary medicine, and the first case reported in a young dog. Butterfly glioblastoma, although rare, should be considered in bilateral symmetrical lesions that could mimic an intraventricular neoplasia.

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Topic: Neuroimaging
Poster Number: 49

A CASE OF SUSPECTED FOREBRAIN GLIOMA WITH SPINAL CORD DROP METASTASIS, SUCCESSFULLY TREATED WITH RADIATION THERAPY.

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Keywords:
Oncology, Radiation Therapy, Glioma, Metastasis

Introduction / Purpose:
A 7-year old female neutered French Bulldog presented with acute left thoracic limb monoparesis. Twelve months earlier, the dog had been treated with 3D conformal radiotherapy (20 fractions of 2.5 Gy, total dose 50 Gy prescribed to the planning target volume - PTV) for a well-defined intra-axial right piriform lobe mass (suspected glioma), T2W hyperintense, T1W hypointense, non-contrast enhancing, that had almost completely resolved following RT treatment.

Methods:
MRI revealed an intramedullary, well demarcated T2W hyperintense, T1W hypointense lesion with an equivocal ring enhancement, at the level of C3-C4 vertebrae, suspected to be drop metastasis. This lesion was treated with intensity modulated radiotherapy (10 fractions of 3.6 Gy, total dose 36 Gy prescribed to the PTV).

Results:
Three months after treatment, the dog's left thoracic limb paresis had nearly resolved. MRI at 3-, and 12-months post-RT showed partial response of the spinal lesion, and the primary lesion was static. The dog is doing well 12 months following treatment of the suspected drop metastasis, and 2 years after treatment of the suspected piriform lobe glioma, with an unremarkable neurological examination.

Discussion / Conclusion:
Metastases from glioma have become increasingly recognised. They typically occur months after treatment, caudal to the mass, following cerebrospinal fluid flow. Ante-mortem diagnosis is typically imaging based, and appearance and location of drop metastases varies widely. This is the first report to describe the successful treatment of suspected drop metastasis with radiation therapy in the spine, when the primary mass had already been successfully treated with the same modality.

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Topic: Imaging of the Head
Poster Number: 51

IMAGING FINDINGS IN A CAT WITH AN INTRACRANIAL ABSCESS SECONDARY TO A TEMPOROMANDIBULAR JOINT PENETRATING WOUND

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Keywords:
Diagnostic imaging, intracranial abscess, cat

Introduction / Purpose:
Intracranial abscessation are infrequently seen in cats and arise because of bacterial infection.

Methods:
Rescue adult male cat presented with poor body condition, suppurative mass ventral to the left zigomatic arch, left eye (LE) exophthalmos and difficulty opening the mouth. A head computed tomography (CT) with contrast administration was performed to provide an appropriated diagnosis.

Results:
CT revealed a big subcutaneous ill-defined heterogeneous soft tissue (50 UH) mass with multiple hypoattenuating areas (28 UH) and moderate contrast enhancement, ventral and lateral to the zygomatic arch and medial to the left mandible. The mass was also invading the retrobulbar space, shifting rostrally the LE. An intracranial extra-axial round soft tissue lesion (37 UH) ventral and lateral to the left temporal lobe with a gas bubble (-500 UH) in the center and mass effect was also observed. After contrast administration a moderate ring enhancement was visualized.
Because of CT findings, and patient poor condition and prognosis, it was euthanatized. Necropsy was carried out and a penetrating wound was found at the level of the left temporomandibular joint with acute suppurative myositis of the left temporal muscle. The lesion was in direct contact with the left temporal bone, but no destruction was appreciated. Intracranial extra-axial abscess with an intact brain was also observed. All these findings confirmed that the most likely origin was a bite.

Discussion / Conclusion:
Intracranial abscess should be considered as a differential diagnosis in cats with penetrating skull injuries or infections of structures adjacent the brain.

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Topic: Imaging of the Head
Poster Number: 52

COMPUTED TOMOGRAPHY (CT) ZYGOMATIC SALIVARY GLAND ANATOMY IN BRACHYCEPHALIC DOGS

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Keywords:
zygomatic gland, brachycephalic

Introduction / Purpose:

The zygomatic salivary gland (ZG) is located in the pterygopalatine fossa. In the authors' experience, in brachycephalic breeds, the ZG can extend rostrally through the maxillary foramen, or lateral and dorsally to the zygomatic arch. The aim of this study is to describe the CT anatomical landmark variability of ZG in brachycephalic dogs.

Methods:

Head CT studies of brachycephalic dogs were retrospectively included if the ZG parenchyma could be completely evaluated. A control group with non-brachycephalic breeds was also included. Transverse images in soft tissue window were evaluated.

Results:

Forty two brachycephalic dogs met the inclusion criteria including 21 French Bulldogs, 7 Boxers, 3 Pugs, 8 English Bulldogs and 3 Shih-tzu. Finally, a total of 82 ZG were examined. The control group included 18 dogs. Fourteen dogs showed a normally positioned ZG (26 ZG). Fifteen dogs presented one abnormal positioned ZG being the left involved in eight of them. In thirteen dogs both ZG presented a variable anatomical location related to the pterygopalatine fossa. Of all ZG evaluated 50% were abnormally positioned; in 30,9% of the dogs both ZG showed an anatomical variation. None of the included dogs presented any associated clinical signs related to this variable positioning of the ZG. All the ZG in the control group were in the pterygopalatine fossa.

Discussion / Conclusion:

This study demonstrated that 50% of the zygomatic salivary glands in brachycephalic dogs were in an abnormal position related to the pterygopalatine fossa due to the anatomical conformation of the skull in these breeds without any pathological cause.

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Topic: Mixed Imaging 1
Poster Number: 54

ASSESSMENT OF SURVEY RADIOGRAPHY AS A METHOD FOR DIAGNOSIS OF BILATERAL LARYNGEAL PARALYSIS IN DOGS

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Keywords:
Larynx, Ventricle, Ventricular dilation, Canine

Introduction / Purpose:

Laryngeal paralysis is a potentially life-threatening upper airway obstructive disease caused by neuromuscular dysfunction. Investigation usually involves thoracic radiographs, and definitive diagnosis requires laryngoscopy under light anesthesia. The aim this cross-sectional study was to determine whether radiographic assessment of the larynx could represent a noninvasive tool for the diagnosis of laryngeal paralysis, as laryngeal ventricles may appear wider in affected animals.

Methods:

The aspect of the laryngeal ventricles was evaluated on a lateral radiograph of the larynx of non-sedated dogs, including 25 dogs with a normal respiratory examination and 18 dogs affected by bilateral paralysis diagnosed either by laryngoscopy or ultrasonography. Three observers measured the ratios of maximal ventricular length on C3 vertebral body length (MVL/LC3) and of ventricular surface on C3 vertebral body length (VS/LC3), and subjectively assessed ventricular shape as either normal or rounded.

Results:

The most accurate criterion was found to be MVL/LC3. Areas under the ROC curves were of 0.96 (95% confidence interval [CI]: 0.95-0.97), 0.89 (95%CI: 0.87-0.91), and 0.80 (95%CI: 0.65-0.95) for MVL/LC3 ratio, VS/LC3 ratio, and ventricle shape evaluation, respectively. The ROC curve analysis allowed to set 2 thresholds of clinical interest for the MVL/LC3 ratio: a value under 0.3 excludes laryngeal paralysis and a value above 0.5 is in favor of bilateral laryngeal paralysis. Between these values, further diagnostic tests are necessary.

Discussion / Conclusion:

These findings support the use of a lateral radiograph of the larynx as a screening tool for the diagnosis of laryngeal paralysis before considering more invasive modalities.

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Topic: Mixed Imaging 1
Poster Number: 53

CT EVALUATION OF RETROBULBAR FILLING FOR ENTROPION RESOLUTION IN DOGS: A PRELIMINARY CADAVERIC STUDY

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Keywords:
computed tomography, eye, intraconal

Introduction / Purpose:

A new therapeutic approach for entropion may be retrobulbar filling using autologous adipose tissue. This prospective, exploratory study aims to standardize the modality of intraconal filling and evaluate the degree of eyeball displacement by computed tomography (CT).

Methods:

Skull CT was performed on six dog cadavers before and after intraconal injection of two 5% iodinated viscoelastic solutions (3% sodium hyaluronate and carmellose sodium gel with lidocaine 2,5%), one per eye, using an ultrasound-guided supratemporal approach. Eyeball displacement was estimated using two methods, named M_1 and M_2. In M_1, the rostro-lateral displacement was evaluated on dorsal plane tracing a line from the corneal surface to the optic canal. In M_2 the lateral displacement was assessed on the axial plane, drawing a line from the frontal to the zygomatic bone and then from this line to the corneal surface, while the rostral displacement was evaluated on the dorsal plane, drawing a line from the maxillary to the zygomatic bone and then from this line to the corneal surface.

Results:

For both eyeballs, the t-test revealed a significant rostro-lateral ($P = 0.003$) displacement (M_1) and rostral ($P < 0.001$) and lateral ($P < 0.001$) displacement (M_2). There were no differences between the two materials.

Discussion / Conclusion:

In the authors' opinion, although the slight eyeball displacement, the retrobulbar filling can lead to entropion resolution. Compared to M_1, M_2 has better defined anatomical landmarks and can assess simultaneously rostral and lateral eyeball displacement. Further, preclinical studies are needed to assess retrobulbar filling efficacy and safety.

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Topic: Mixed Imaging 1
Poster Number: 55

STUDY ON EXTEMPORARY CYTOLOGICAL EXAMINATION FROM IMAGE-GUIDED BIOPSY.

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Keywords:
ultrasound, computed tomography, cytology, biopsy

Introduction / Purpose:
Ultrasound (US) and Computed Tomograpghy (CT) -guided biopsies are essential in many diagnostic process of companion animals. The objectives of this study are: to evaluate whether extemporaneous cytology can give information whether the sample taken is diagnostic or not, and to compare the cytological diagnosis with the histological one.

Methods:
Biopsy samples were collected using Tru-cut (14-16 G) and Bone needle (8-10 G). The biopsy samples were rolled onto slides and then placed in 10% formalin for histological examination. The cytological examination was performed immediately and if cellular the procedure was suspended, otherwise other biopsies were performed.

Results:
Imaging-guided biopsies were performed in 70 subjects (65 dogs and 5 cats), 55/70 US-guided and 15/70 CT-guided. Histology was diagnostic in 69/70 cases (98.6%). The cytological examination was accurate for the presence of cells of the correct type in 54 cases out of 70 (77.1%), in 1 case in particular cytologically non-diagnostic even the histology was non-diagnostic. General accuracy for cytological diagnosis was 75.7% (53 cases out of 70). Among non-diagnostic, lesions more represented were carcinomas 3/16 (18.8%), followed by fibrosarcoma and hemangiosarcoma 2/16 each (12.5%).

Discussion / Conclusion:
The results of the present study demonstrates that the extemporary cytological examination can be useful in verifying the presence of cells and therefore to evaluate whether a biopsy is diagnostic or not. The cytological diagnosis, although less precise, is still relatively high with the advantage that it is immediate and it is not necessary to wait for the outcome of the histopathology.

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Topic: Mixed Imaging 2
Poster Number: 57

SENTINEL LYMPH NODE MAPPING WITH INDIRECT LYMPHOGRAPHY FOR CANINE MAST CELL TUMOR

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Keywords:
Mast Cell Tumor, Indirect lymphography, Lipiodol

Introduction / Purpose:
Mast cell tumor (MCT) is a common cutaneous and subcutaneous neoplasia in dogs. It can metastasize to lymph nodes (LNs) and this affects the prognosis and treatment. Sentinel lymph node (SLN) assessment is more specific to evaluate the draining LN compared to regional lymph node (RNL). A SLN different from a RLN has been reported in 27% - 40% of MCTs.The study aims to evaluate the SLN drainage mapping of MCTs with indirect lymphography.

Methods:
Dogs underwent clinical staging were prospectively enrolled. Survey radiographs followed by an indirect lymphography were obtained for SLN mapping. Contrast (Lipiodol) was injected around the MCT or the surgical scar. After 24h LNs that picked up contrast were radiographically assessed. MCTs were confirmed histologically and LNs either by cytology and/or histology.

Results:
26 dogs and 30 MCTs were included: 7 subcutaneous, 4 high-grade Kiupel and 19 low-grade Kiupel. SLNs were detectable in 24 dogs. Lymphatic vessels were visible in 18/30 MCTs. In 12/30 MCTs at least two LNs picked up contrast. Among them 4 MCTs involved three different LNs. In two cases the ipsilateral and contralateral LNs to the MCT were encompassed. In 8/30 MCTs the SLNs were metastatic.

Discussion / Conclusion:
This study indicates that the lymph drainage pattern of the MCTs may be different for each MCTs and more than one SLNs can be involved. Indirect lymphangiography with Lipiodol allowed to detect the SLN in 93% of MCTs. This would provide clinically relevant information to remove the LN and staging the patient.

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Topic: Mixed Imaging 2
Poster Number: 56

COMPARISON OF MANUFACTURER-PRESCRIBED AND PATIENT-CENTRIC CT-TABLE HEIGHTS FOR COMPUTED TOMOGRAPHIC BONE MINERAL DENSITY ASSESSMENT

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Keywords:
computer tomographic bone mineral denisity

Introduction / Purpose:
Computed tomographic bone mineral density (CT-BMD) protocols of CT-manufacturers include the use of a specific CT-table height setting. CT-BMD protocols can be used for the canine head. To integrate CT-BMD into a clinical CT study, it would be advantageous to use the table height setting optimal for the size of the dog. The aim of this study is to investigate the effect of table height changes in of CT-BMD measurements in dogs compared to the prescribed table height.

Methods:
The minimum and maximum table heights from 50 clinical canine head CT studies were recorded. Five canine cadaver heads were imaged with the manufacturer-prescribed table-height and patient-centric table-heights. CT-BMD values were obtained from the calvarium at the level of the temporomandibular joint. Calculared CT-BMD values were analysed using one-way ANOVA with Geisser-Greenhouse correction and Holm-Sidak's multiple comparisons test.

Results:
Minimum, maximum patient-height and cadaver-head-centric table heights were included (100, 223, 249, 268, 295mm) and compared to the manufacturer-prescribed table height (125mm) for CT-BMD values. Statistical analysis showed a significant difference between values obtained from manufacturer-prescribed and patient-centric table-height protocols ($p<0.0001$).

Discussion / Conclusion:
This study indicates that table-height changes influence CT-BMD values significantly in the canine head. Manufacturer-prescribed CT protocols are designed for a lumbar vertebra of a supine-positioned human in the CT-gantry isocentre. The head of a prone-positioned dog is usually in the CT-gantry isocenter at a different table height. Further studies are needed to establish optimal table height for maximal CT-BMD accuracy.

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EVDI (European Veterinary Diagnostic Imaging) has been formed to group information common to both EAVDI and ECVDI® under the same roof.

The EVDI acts as a portal to access both affiliated organizations, and to house information of interest to both groups including education, events, and careers.

EAVDI:
EAVDI (European Association of Veterinary Diagnostic Imaging): is a non-profit association encompassing all aspects of diagnostic imaging, including radiography, ultrasonography, CT, MRI and nuclear medicine.

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