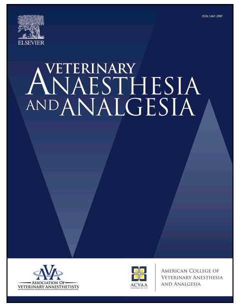
Journal Pre-proof



Comparative study between lateral *versus* latero-ventral quadratus lumborum block for perioperative analgesia in canine laparoscopic ovariectomy

Massimiliano Degani, Andrea Paolini, Amanda Bianchi, Roberto Tamburro, Lorenzo Di Matteo, Charlotte Sandersen, Angela Briganti

PII: S1467-2987(24)00167-3

DOI: https://doi.org/10.1016/j.vaa.2024.09.001

Reference: VAA 992

To appear in: *Veterinary Anaesthesia and Analgesia*

Received Date: 12 May 2024

Revised Date: 1 August 2024

Accepted Date: 5 September 2024

Please cite this article as: Degani M, Paolini A, Bianchi A, Tamburro R, Di Matteo L, Sandersen C, Briganti A, Comparative study between lateral *versus* latero-ventral quadratus lumborum block for perioperative analgesia in canine laparoscopic ovariectomy, *Veterinary Anaesthesia and Analgesia*, https://doi.org/10.1016/j.vaa.2024.09.001.

FULL RESEARCH STUDY

Comparative study between lateral *versus* latero-ventral quadratus lumborum block for perioperative analgesia in canine laparoscopic ovariectomy

Massimiliano Degani[a], Andrea Paolini[b], Amanda Bianchi[b], Roberto Tamburro[b], Lorenzo Di Matteo [b], Charlotte Sandersen[a] and Angela Briganti[c]

[a] Department of Clinical Sciences, Faculty of Veterinary Medicine, University of Liège, 4000, Liège, Belgium.

[b] Department of Veterinary Medicine, University of Teramo, 64100 Teramo, Italy.

[c] Department of Veterinary Sciences, Veterinary Teaching Hospital "Mario Modenato", University of Pisa, 56122 Pisa, Italy

Correspondence:
Amanda Bianchi, Department of Veterinary Medicine, University of Teramo, 64100 Teramo, Italy. Email: abianchi@unite.it

ORCID: https://orcid.org/0000-0002-4375-8407

Author Contributions: MD, AP: study design, data analysis and writing of the manuscript. AB (Angela Briganti): study design, data analysis and review of the manuscript. AB (Amanda Bianchi), RT, LM, CS: data analysis and review of the manuscript.

Funding: This research received no external funding.

Acknowledgements: The authors thank all the staff involved and students of the Veterinary Teaching Hospital of the University of Teramo, for the technical support during the realization of this study.

Institutional Review Board Statement: The study was conducted and approved by the Scientific Ethics Committee of the University of Teramo (protocol number 2727, 29/01/2024).

Informed Consent Statement: By signing the informed consent, owner agreed that data from their animal can be used for the purpose of this study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

Abstract

Objective To compare the perioperative analgesic effect of lateral *versus* latero-ventral quadratus lumborum block (QLB) in dogs undergoing laparoscopic ovariectomy.

Study design Randomised, blinded clinical study.

Animals A total of 15 client-owned female dogs undergoing laparoscopic ovariectomy.

Methods Animals were randomly assigned to receive a bilateral QLB, performed with 0.3 mL kg^{-1} ropivacaine 0.5%, either with lateral [group L_{QLB} ($n = 7$)] or latero-ventral approach [group LV_{QLB} ($n = 7$)]. Dogs were premedicated intramuscularly with methadone 0.2 mg kg^{-1} and dexmedetomidine 3 μg kg^{-1}. General anaesthesia was induced intravenously (IV) with propofol and maintained with isoflurane. Cardiovascular and respiratory variables were continuously monitored and recorded every 5 minutes during surgery. Fentanyl 3 μg kg^{-1} was administered IV if there was a 20% increase in heart rate and/or mean arterial pressure from previous values recorded 5 minutes before. Meloxicam 0.2 mg kg^{-1} was administered IV to all dogs during recovery. The Short-Form of the Glasgow Composite Pain Scale was used hourly for 8 hours post-QLB. Methadone 0.2 mg kg^{-1} was administered IV when pain score was ≥ 6/24. A Chi-square test compared the number of dogs requiring intraoperative rescue fentanyl. A Friedman test with a Dunn's *post hoc* was used to evaluate the trend in postoperative pain scores within each group, and a Mann-Whitney test compared scores between the groups at each time point; $p < 0.05$.

Results Significantly fewer dogs required intraoperative rescue fentanyl in group L_{QLB}, than in group LV_{QLB}. No dog required postoperative rescue methadone and there were no significant differences in pain scores.

Conclusions and clinical relevance Bilateral QLB performed with lateral approach reduced the number of dogs requiring intraoperative rescue analgesia in comparison with the latero-ventral approach. No differences were detected postoperatively, possibly due to the confounding effects of methadone, dexmedetomidine, and meloxicam.

Keywords analgesia, dogs, inter-fascial plane block, laparoscopic surgery, ropivacaine, ultrasound-guided locoregional anaesthesia.

Introduction

The quadratus lumborum block (QLB) is an ultrasound (US)- guided inter-fascial plane (IFP) block used to promote somatic and visceral analgesia to the abdomen (Garbin et al. 2020a, b; Alaman et al. 2022; Viscasillas et al. 2021a, b; Marchina-Gonçalves et al. 2022; Marchina-Gonçalves et al. 2023; Degani et al. 2023). It consists of the injection of local anaesthetic in the thoracolumbar fascia surrounding the *quadratus lumborum* muscle, aiming to desensitise the ventral rami of the spinal nerves (VRSNs) and the sympathetic trunk. Cadaver studies evaluated the spread of injectate using different approaches (Garbin et al. 2020a, b; Alaman et al. 2022; Viscasillas et al. 2021a; Marchina-Gonçalves et al. 2022; Marchina-Gonçalves et al. 2023). Garbin (2024) recently proposed a nomenclature for their classification, based on the position of the needle tip during injection: trans-muscular, when it is positioned between the *quadratus lumborum* and *psoas* muscles (Garbin et al. 2020a, Viscasillas et al 2021a); dorsal, between the body of the first lumbar (L1) or second lumbar (L2) vertebrae and the *quadratus lumborum* muscle (Alaman et al. 2022, Marchina-Gonçalves et al. 2022); lateral, between the lateral aspect of the *quadratus lumborum muscle* and the transverse process of L1 (Garbin et al. 2020b). Overall, the QLB resulted in a consistent staining of the VRSNs between L1 and the third (L3) lumbar vertebrae, with maximal spreading observed between the thirteenth thoracic (T13) and fourth lumbar (L4) vertebrae, as well as around the sympathetic trunk between T13 and L3 (Garbin, 2024).

The QLB can be challenging to perform, especially when deep injection targets are selected, such as with the approaches described by Garbin et al. (2020a), Alaman et al. (2021) and Marchina-Gonçalves et al. (2022). At this level, the vicinity of aorta, caudal vena cava, and abdominal organs can pose some difficulties in performing the block. Recently, a novel latero-ventral approach for the QLB has been described, in which the injection site is more superficial and away from important anatomical structures (Marchina-Gonçalves et al. 2023). According to the authors of that study, this approach might be safer and easier to perform. However, the latero-ventral approach failed to produce a consistent spread of injectate towards the sympathetic trunk, suggesting that it might not provide visceral pain relief to the abdomen (Marchina-Gonçalves et al. 2023).

According to the results of the latest systematic reviews and metanalysis published in human medicine, it remains unclear whether the injection position of the needle affects the analgesic efficacy of the QLB (Kim et al. 2020; Uppal et al. 2020; Korgvee et al. 2021). Furthermore, the exact mechanism of action of the IFP blocks is still the subject of debate. Several authors hypothesised that the analgesic effect of these locoregional anaesthesia techniques could be produced not only by direct blockade of peripheral nerve fibres, but also by the systemic effect secondary to the vascular absorption of local anaesthetic (Lönnqvist et al. 2019, Chin et al. 2021). Evidence demonstrating the analgesic efficacy of the QLB in dogs is described in one case-series and one randomised clinical trial (RCT) (Viscasillas et al. 2021b; Degani et al. 2023). In a previous study, the lateral approach described by Garbin et al. (2024) was found to be effective in reducing the perioperative opioid consumption when compared with a systemic fentanyl-based protocol, in female dogs undergoing laparoscopic ovariectomy (Degani et al. 2023). To the best of our knowledge, studies comparing the analgesic effect of different approaches for the QLB in dogs undergoing abdominal surgery are lacking in literature.

This RCT aimed to compare the perioperative analgesic efficacy of a bilateral QLB performed using two different approaches (lateral or latero-ventral) in female dogs undergoing laparoscopic ovariectomy. We hypothesised that the lateral approach would result in fewer dogs requiring perioperative rescue analgesics in comparison with the latero-ventral approach.

Materials and Methods

This blinded RCT was approved by the Scientific Ethics Committee of the University of Teramo, protocol number 2727 with the date 29/01/2024. The Consolidated Standards of Reporting Trials

(CONSORT) guidelines have been followed (Schulz et al. 2010). By signing the informed consent document, owners agreed to enrol their dog in the study. A total of 15 female dogs with an American Society of Anesthesiologists (ASA) status I, undergoing laparoscopic ovariectomy, were enrolled. Prior to anaesthesia, each dog underwent a complete physical examination, including body condition score (BCS) on a nine-point scale evaluation (Laflamme 1997), and routine blood tests screenings (haematology and serum biochemistry). Exclusion criteria included age of less than 6 months, aggressive behaviour, skin infection at the site of the QLB, and administration of corticosteroids or non-steroidal anti-inflammatory drugs (NSAIDs) within 24 hours prior to surgery.

Preoperative management

Pain assessment was performed using the Short Form of the Glasgow Composite Measure Pain Scale (SF-GCMPS) (Reid et al. 2007) on admission, to obtain baseline values. Premedication consisted of an intramuscular injection of methadone 0.2 mg kg^{-1} (Semfortan 10 mg mL^{-1}, Eurovet Animal Health, Bladel, the Netherlands) and dexmedetomidine 3 µg kg^{-1} (Dextroquillan 0.5 mg ml^{-1}, Dextroquillan; Fatro, Bologna, Italy). Approximately 15 minutes later, a 20-gauge intravenous (IV) catheter was aseptically inserted into one of the cephalic veins and lactated Ringer's (RL) solution at 5 mL kg^{-1} $hour^{-1}$ was initiated. After 5 minutes of pre-oxygenation by mask (SurgiVet Pet Oxygen Masks, Tri-Med Medical Supplies, Plymouth, UK), general anaesthesia was induced with propofol (Propovet 10 mg mL^{-1}, Zoetis, Rome, Italy) IV to effect, until endotracheal intubation (Rusch, The Sheridan, NC, USA) was feasible. The endotracheal tube was connected to an anaesthetic workstation (Fabius, Dräger, Italy) via a circle breathing system (Flextube, Intersurgical, UK), and anaesthesia was maintained with isoflurane (Isoflo, Zoetis, Rome, Italy) delivered in oxygen–air mixture with a fraction of inspired oxygen (F_IO_2) of 60%.

Immediately after induction, dogs were connected to a multiparametric monitor (M3046-M2, Philips, Italy) and the following physiological variables were continuously monitored and recorded every 5 minutes, during anaesthesia: heart rate (HR), peripheral arterial haemoglobin saturation (SpO_2), respiratory rate (f_R), and systolic, mean, and diastolic arterial blood pressures (SAP, MAP, DAP), measured invasively via a 20-gauge peripheral catheter placed in one of the dorsal pedal arteries. The end-expiratory carbon dioxide concentration ($P_E'CO_2$) and the end-tidal isoflurane concentration ($F_E'Iso$) were monitored with an infrared gas analyzer (M3016 Measurement Server Extension, Philips, Milan, Italy), that was calibrated in accordance with the manufacturer instructions, before each anaesthesia. The hair on the abdomen and flank of each dog was clipped and the skin was aseptically prepared. All dogs received a bilateral QLB with 0.3 mL kg^{-1} of ropivacaine (Ropivacaine hydrochloride 10 mg mL^{-1}, Galenica Senese, Italy) 0.5% per side (3 mg kg^{-1} in total). Dogs were randomly allocated into two groups using block randomization (https://www.random.org, accessed in October 2023): dogs in group L_{QLB} received the QLB performed as described by Garbin et al. (2020b), while dogs in group LV_{QLB} received the block described by Marchina-Gonçalves et al. (2023). All blocks were performed by the same anaesthetist (M.D.), equally trained in both techniques. A 100 mm insulated needle for nerve blocks (Stimulplex, B Braun, Milan, Italy) and a 14 MHz high-frequency linear transducer (L7HD3VET; Clarius Mobile Health, BC, Canada), connected to a touchscreen tablet (iPad Air, fifth generation; Apple, CA, USA) were used. The anaesthetist in charge of intraoperative monitoring (A.P.), as well as the surgeon (A.Bi) were blinded to group allocation. Time to perform the block, considered as the interval between the start of the scanning and the end of injection, as well as time from the block to starting of surgery, were recorded**.**

Intraoperative management

Dogs were moved to the operating room and volume-controlled ventilation was initiated to maintain PE'CO_2 between 35 and 45 mmHg (4.6-5.9 kPa). All dogs were operated on by the same surgeon, using a modified Hasson technique (Bianchi et al. 2021). FE'Iso was initially set at 1.3% and decreased by 0.05% every 5 minutes. Isoflurane was reduced if HR and MAP remained within 20% of baseline (Mosing et al. 2010; Tayari et al. 2022), and the surgical anaesthetic plane was maintained (absence of palpebral reflex and voluntary movements, and mild jaw tone) (Grubb et al. 2020). Animals were positioned in dorsal recumbency, and a Trendelenburg position was applied. Pneumoperitoneum was obtained by mechanical insufflation between 8 and 10 mmHg**.** During surgery, dogs were laterally tilted to improve the visualisation of the ovaries. A 5-minute interval in the surgical procedure followed, to ensure an eventual haemodynamic stabilisation and not to interfere with the assessment of nociception. A 20% increase in HR and/or MAP from the previous value recorded 5 minutes before was considered to be a sign of nociception and a bolus of 3 μg kg^{-1} of fentanyl was administered IV. In case the variables were not restored within 5 minutes, fentanyl infusion was started at an increasing rate between 2 and 10 μg kg^{-1} hour^{-1} until return to pre-nociception values. The time of administration of fentanyl, if necessary, and the surgical phase during which nociception was detected, were recorded. The following surgical phases of laparoscopic ovariectomy were considered: P_1, skin incision and first port insertion; P_2, insufflation of the abdomen; P_3, second port insertion; P_4, traction and cauterization of the first ovary; P_5, traction and cauterization of the second ovary; P_6, deflation of pneumoperitoneum and extraction of the trocars; P_7, suturing of the skin. In case of hypotension (MAP < 60 mmHg), FE'Iso was reduced by 0.1%, every minute. If hypotension persisted despite FE'Iso of 0.8%, a bolus of 10 mL kg^{-1} of lactate Ringer's solution was administered over 10 minutes. If hypotension persisted, noradrenaline (Noradrenaline sulfate, 2 mg mL^{-1}, Galenica Senese, Italy) infusion was started at 0.05 μg kg^{-1} minute^{-1} and increased by 0.05 μg kg^{-1} minute^{-1} every 5 minutes until MAP ≥ 60 mmHg. In presence of bradycardia (HR < 60 beats minute^{-1}) causing concurrent hypotension, atropine 20 μg kg^{-1} (Atropine sulfate 1 mg mL^{-1}, ATI, Italy) was administered IV. At the end of surgery, administration of isoflurane was interrupted, and mechanical ventilation was stopped once the dog returned to spontaneous breathing. Each animal was then moved to the recovery room and tracheal extubation was performed when the swallowing reflex was restored. Duration of anaesthesia and surgery were recorded. Meloxicam 0.2 mg kg^{-1} (Meloxidolor 5 mg mL^{-1}; Le Vet Beheer, the Netherlands) was administered IV during recovery to all dogs.

Postoperative management

An hour after extubation, pain assessment was started by a third investigator blinded to the group allocation (L.D.M), using the SF-GCMPS. Evaluations were performed every hour up to 8 hours starting from the QLB execution. In case of a score ≥ 6/24, methadone 0.2 mg kg^{-1} was administered IV, and the postoperative pain monitoring for the purposes of this study was interrupted. Time from the block to the first postoperative methadone administration, if necessary, was recorded and compared between groups.

Statistical Analysis

The number of dogs enrolled in the study was based on the incidence of rescue analgesia administration, using an online sample size calculator (ClinCalc.com). Considering an incidence of rescue analgesia of 10% in group L_{QLB} (Viscasillas et al. 2021b) and a clinically significant difference of a 70% between the two groups, the minimum number of animals per group was seven. This calculation utilised an α of 0.05 and a power of 80%.

Data were analysed for distribution with a D'Agostino-Pearson test. Data were expressed as either mean and standard deviation, or median and range for BCS and SF-GCMPS. A Student's T-test was used to compare age, weight, duration of anaesthesia and surgery, and time from the block to starting of surgery between groups. An analysis of variance (ANOVA) test for repeated data was used to evaluate the trend within each group for HR, f_R, SAP, MAP, and F_E´Iso. BCS was compared between groups using a Mann-Whitney test. A Chi-square test was used to compare the number of dogs requiring rescue fentanyl and vasoactive drugs between groups. A Friedman test with a Dunn's *post hoc* was used to evaluate the trend in postoperative pain scores within each group, while a Mann-Whitney test compared the scores between the two groups at each time point. Statistical difference was considered significant for $p < 0.05$. Prism Version 6.0 (GraphPad Software Inc., CA, USA) was used to analyse data.

Results

A total of 15 dogs were enrolled but 14 concluded the study uneventfully: one dog from group LV_{QLB} was excluded because of conversion of the surgery into a laparotomic ovariectomy, due to intraoperative haemorrhage. No significant statistical differences were found regarding demographic data, duration of anaesthesia, and duration of surgery (Table 1). BCS was 5/9 (3–5) in group L_{QLB} and 5.5/9 (4–8) in group LV_{QLB}. Time to perform the block was 170 ± 39 seconds in group L_{QLB} and 165 ± 44 seconds in group LV_{QLB}, without statistically significant difference. The intraoperative values of HR, MAP [Figs. 1(a), (b)], f_R, FE'Iso (Fig. 2) did not differ significantly between the two groups. Bradycardia was recorded in 1/7 dogs in group LV_{QLB} which was corrected with one bolus of 20 μg kg^{-1} of atropine administered IV. No hypotension was recorded in dogs included in this study.

A significant difference between groups ($p = 0.02$) was detected regarding the number of dogs requiring at least one bolus of rescue fentanyl, during the intraoperative period. One bolus of fentanyl was administered to 2/7 dogs in group L_{QLB} and in 7/7 dogs in group LV_{QLB}. No dogs in group L_{QLB} and LV_{QLB} required fentanyl infusion. Data regarding the distribution of intraoperative rescue fentanyl administration in the two groups are summarised in the Table 2. No dogs required rescue methadone during the 8 hours after the QLB was performed, and no differences were found regarding postoperative pain scores between the two groups, and within each group at the different time points (Fig. 3).

Discussion

In this study, a significantly smaller number of dogs receiving a QLB performed with the lateral approach (Garbin et al. 2020b) required rescue analgesia during surgery, compared with those receiving the latero-ventral approach (Marchina-Gonçalves et al. 2023), Therefore, our initial hypothesis was confirmed.

Surgical manipulation of the ovaries produced nociception in all dogs in group LV_{QLB}, and in none of dogs in group L_{QLB}. The QLB performed with latero-ventral approach did not produce a substantial spread of injectate to sympathetic trunk spread (Marchina-Gonçalves et al. 2023), responsible for the visceral innervation of the abdomen, while this occurred for the lateral approach (Garbin et al. 2020b). We hypothesized that this difference in outcome was caused by the thoracolumbar fascia surrounding the *quadratus lumborum* muscle, which might have prevented the spread of solution towards the sympathetic trunk. Positioning the needle tip latero-ventrally to the *quadratus lumborum* muscle, below the aponeurosis of the *transversus abdominis* muscle, does not mean that the thoracolumbar fascia has been perforated. The results of our study suggest that the direct blockade of nerves fibres from the sympathetic trunk could be involved in the abdominal visceral analgesic effect of the QLB in dogs. However, the mechanism of action of this IFP block is still unclear (Lönnqvist et al. 2019, Chin et al. 2021).

In the present study, 2/14 dogs (14.2%) required intraoperative rescue analgesia during P_1, P_2 and P_3. In a previous RCT, 9/16 dogs (56.2%) receiving the same block experienced nociception during the same surgery phases (Degani et al. 2023). This discrepancy can be attributable to the different premedication protocol used in these studies (methadone 0.2 mg kg^{-1} and dexmedetomidine 3 μg kg^{-1} IM *versus* fentanyl 5 μg kg^{-1} IV). The inclusion of an opioid and an α_2-adrenoceptor agonist in this study aimed to replicate clinical practice. Combinations of analgesics and sedatives drugs are often administered in premedication, in clinical settings.

The reported injectate volume for the QLB ranges between 0.3–0.6 mL kg^{-1} per side (Garbin et al. 2020a, b; Alaman et al. 2022; Viscasillas et al. 2021b; Marchina-Gonçalves et al. 2022; Marchina-Gonçalves et al. 2023). None of the approaches previously described produced a consistent cranial dispersion of injectate towards the VRSNs between T9 and T13, regardless of the volume used. Taking into account these findings, we decided to use 0.3 mL kg^{-1} to avoid excessive dilution of the ropivacaine concentration, which could have affected the quality and duration of the block (Tayari et al. 2017; Degani et al. 2023).

The QLB performed with the latero-ventral approach could be considered as a variation of the transversus abdominis plane (TAP) block, providing similar analgesic effect. Our results, compared with those from previous studies, where the TAP block was evaluated in dogs submitted to laparoscopic ovariectomy (Paolini et al. 2022; Espadas-González et al. 2022), seem to corroborate this hypothesis. Despite controversy in literature regarding the efficacy of the TAP block on visceral pain (Freitag et al. 2018; Paolini et al. 2022; Espadas-González et al. 2022), this technique has been demonstrated in cadaver studies to stain only the VRSNs and their branches, involved in the innervation of the abdominal wall (Castañeda-Herrera et al. 2017; Drozdzynska et al. 2017; Romano et al. 2021). Further RCTs are necessary, to compare the analgesic effect of QL and TAP blocks in dogs undergoing abdominal surgery.

The results regarding the postoperative period in this study are consistent with those from previous research (Degani et al. 2023), in which the time to the first postoperative methadone administration in dogs receiving the QLB with ropivacaine 0.5% was 10.2 ± 2.5 hours, even without any anti-inflammatory drug administration. In that study, both approaches resulted in an opioid-free postoperative period for at least 8 hours, despite differences were found in the intraoperative period in terms of rescue fentanyl administered (Degani et al. 2023). However, it is possible that the administration of meloxicam could have masked differences in postoperative analgesic effect between the two approaches used in this study.

Studies in human medicine assessed whether there is indeed a difference in postoperative analgesic effect related to the approach used to perform the QLB in humans. Kim et al. (2020) found that targeting a more superficial injection point would result in lower postoperative pain scores. On the other hand, evidence from Uppal et al. (2020) suggested that the trans-muscular approach might be more effective compared with the posterior approach. However, Korgvee et al. (2021) found no differences in their systematic review. To our knowledge, this study is the first in comparing the analgesic effects of different QLB approaches in dogs undergoing abdominal surgery. Further studies are thus needed to determine and compare the analgesic effect of different approaches for the QLB in the canine species.

Although no statistically significant differences were found regarding intraoperative physiological variables monitored during anaesthesia, some data are worthy of discussion. Even though no differences in HR between groups, MAP in dogs in group LV_{QLB} was slightly lower than in those in group L_{QLB} [Fig 1(b)]. In the authors' opinion, lower MAP was more likely to occur in group LV_{QLB}, because a higher number of dogs required rescue fentanyl in this group (Table 2). Opioids can produce enhancement of the parasympathetic tone and cause changes in cardiac output, systemic vascular resistance, and blood pressure (Keating et al. 2013). However, it is important to highlight that this study was not sufficiently powered to detect differences in these variables.

The present study has several limitations. Firstly, a small sample of dogs was included in this RCT. Therefore, studies with larger numbers of animals are needed to confirm these results. Secondly, dogs included in this study received a premedication consisting of an opioid and an α_2-adrenoceptor agonist, as well as a NSAID during recovery. It is quite likely the administration of these drugs influenced the analgesic effect of the QLB and masked any postoperative difference between the two approaches evaluated in this study. Furthermore, the possibility to assess postoperative pain for 8 hours after the QLB execution did not allow us to measure the exact duration of the postoperative analgesic effect of the block and detect any difference between the two approaches. However, postoperative hospitalisation is not always considered essential after laparoscopic ovariectomy (Wormser & Runge, 2016). In our institutions, for instance, dogs are usually discharged between 8 and 12 hours after surgery. Finally, the same anaesthetist performed all blocks, possibly biasing the results. As US-guided locoregional anaesthesia techniques are considered operator-dependent, it is not possible to exclude that different results could have been obtained by involving multiple operators with different levels of experience.

Conclusions

In conclusion, the QLB performed with the lateral approach is a valuable adjunct to a multimodal analgesic protocol for dogs undergoing laparoscopic ovariectomy, as it reduces the need for intraoperative rescue analgesia. Further research is needed to confirm the results of this study.

References

Alaman M, Bonastre C, de Blas I et al. (2022) Description of a novel ultrasound-guided approach for a dorsal quadratus lumborum block: a canine cadaver study. Vet Anaesth Analg, 49, 118–125. Doi: 10.1016/j.vaa.2021.09.002

Bianchi A, Collivignarelli F, Vignoli M, et al. (2021) A comparison of times taken for the placement of the first portal and complication rates between the Veress needle technique and the modified Hasson technique in canine ovariectomy laparoscopic surgery. Animals, 11(10):2936. https://doi.org/10.3390/ani11102936

Castañeda-Herrera FE, Buriticá-Gaviria EF, Echeverry-Bonilla DF (2017) Anatomical evaluation of the thoracolumbar nerves related to the transversus abdominis plane block technique in the dog. Anat. Histol. Embryol, 46, 373–377. https://doi.org/10.1111/ahe.12279

Chin KJ, Lirk P, Hollmann MW, Schwarz SKW (2021) Mechanisms of action of fascial plane blocks: a narrative review. Reg Anesth and Pain Med, 46 (7), 618–628. https://doi.org/10.1136/rapm-2020-102305

Degani M, Di Franco C, Tayari, H et al. (2023) Postoperative analgesic effect of bilateral quadratus lumborum block (qlb) for canine laparoscopic ovariectomy: comparison of two concentrations of ropivacaine. Animals, 13, 3604. https://doi.org/10.3390/ ani13233604

Drozdzynska M, Monticelli P, Neilson D, Viscasillas J. (2017) Ultrasound-guided subcostal oblique transversus abdominis plane block in canine cadavers. Vet Anaesth Analg 44, 183–186. https://doi.org/10.1111/vaa.12391

Espadas-González L, Usón-Casaús JM, Pastor-Sirvent N, et al. (2022) Evaluation of the two-point ultrasound-guided transversus abdominis plane block for laparoscopic canine ovariectomy. Animals 12, 3556. https://doi.org/10.3390/ ani12243556

Freitag FA, Bozak VL, do Carmo MP, et al. (2018) Continuous transversus abdominis plane block for analgesia in three dogs with abdominal pain. Vet Anaesth Analg, 45 (4), 581–583. https://doi.org/10.1016/j.vaa.2018.02.003

Garbin M, Portela DA, Bertolizio G et al. (2020a) Description of ultrasound-guided quadratus lumborum block technique and evaluation of injectate spread in canine cadavers. Vet Anaesth Analg 47, 249–258. doi: 10.1016/j.vaa.2019.12.005

Garbin M, Portela DA, Bertolizio G et al. (2020b) A novel ultrasound-guided lateral quadratus lumborum block in dogs: a comparative cadaveric study of two Approaches. Vet Anaesth Analg 47, 810–818. doi: 10.1016/j.vaa.2020.08.003

Garbin M (2024) Ultrasound-guided quadratus lumborum block. In: Small Animal Regional Anesthesia and Analgesia (2nd edn). Reid M, Campoy L, Fischer B (eds). Wiley Blackwell, USA. pp. 177-188

Grubb T, Sager J, Gaynor JS, Montgomery E et al. (2020) AAHA Anesthesia and monitoring guidelines for dogs and cats. J Am Anim Hosp Assoc. Available online: https://www.aaha.org/globalassets/02-guidelines/2020-anesthesia/anesthesia_and_monitoring-guidelines_final.pdf

Keating SCJ, Kerr CL, Valverde A, et al. (2013) Cardiopulmonary effects of intravenous fentanyl infusion in dogs during isoflurane anesthesia and with concurrent acepromazine or dexmedetomidine administration during anesthetic recovery. Amer. J Vet Res, 74(5), 672-682. https://doi.org/10.2460/ajvr.74.5.672

Kim SH, Kim HJ, Kim N, et al. (2020) Effectiveness of quadratus lumborum block for postoperative pain: a systematic review and meta-analysis. Min Anestest, 86(5), 554–564. https://doi.org/10.23736/S0375-9393.20.13975-0

Korgvee A, Junttila E, Koskinen H et al. (2021) M. L. Ultrasound-guided quadratus lumborum block for postoperative analgesia: A systematic review and meta-analysis. Eur J of Anaesth, 38(2), 115–129. https://doi.org/10.1097/EJA.0000000000001368

LaFlamme DP (1997) Development and validation of a Body Condition Score system for dogs. Canine Pract 22, 10-15.

Lönnqvist PA, Karmakar M. (2019) Close-to-the-nerve vs interfascial plane blocks: Sniper rifle vs shotgun-which will hit the target most reliably? Acta Anaesth Scand, 63(9), 1126–1128. https://doi.org/10.1111/aas.13438

Marchina-Gonçalves A, Gil F, Laredo FG et al. (2022) Evaluation of high-volume injections using a modified dorsal quadratus lumborum block approach in canine cadavers. Animals, 12, 18. doi: 10.3390/ani12010018

Marchina-Gonçalves A, Laredo FG, Gil F, et al. (2023) An ultrasound-guided latero-ventral approach to perform the quadratus lumborum block in dog cadavers. Animals, 13, 2214. https://doi.org/10.3390/ani13132214

Mosing M., Reich H., Moens Y (2010) Clinical evaluation of the anaesthetic sparing effect of brachial plexus block in cats. Vet Anaesth Analg**,** 37: 154–161. doi: 10.1111/j.1467-2995.2009.00509.x

Paolini A, Santoro F, Bianchi A, Collivignarelli F et al. (2022) Use of transversus abdominis plane and intercostal blocks in bitches undergoing laparoscopic ovariectomy: a randomized controlled trial. Vet Sci, 9, 604. https://doi.org/10.3390/ vetsci9110604

Reid J, Nolan AM, Hughes JML et al. (2007) Development of the short-form Glasgow Composite Measure Pain Scale (CMPS-SF) and derivation of an analgesic intervention score. Anim Welf 16, 97–104. doi: http://dx.doi.org/10.1017/S096272860003178X

Romano M, Portela DA, Thomson A, Otero PE (2021) Comparison between two approaches for the transversus abdominis plane block in canine cadavers. Vet Anaesth Analg, 48, 101–106. https://doi.org/10.1016/j.vaa.2020.09.005

Schulz KF, Altman DG, Moher D (2010) Consort 2010 statement: updated guidelines for reporting parallel group randomised trials. BMJ 340, c332. https://doi.org/10.1136/bmj.c332

Tayari H, Tazioli G, Breghi G, Briganti A (2017) Ultrasound-guided femoral and obturator nerves block in the psoas compartment in dogs: anatomical and randomized clinical study. Vet Anaesth Analg, 44 (5): 1216-1226. doi: 10.1016/j.vaa.2016.12.062

Tayari H, Otero PE, D’Agostino M et al. (2022) Epidural volume of injectate using a dose regimen based on occipito-coccygeal spinal length (OCL): randomized clinical study comparing different ropivacaine concentrations, with or without morphine, in bitches undergoing total unilateral mastectomy. Animals, 12, 587. https://doi.org/10.3390/ani12050587

Uppal V, Retter S, Kehoe E, McKeen DM (2020) Quadratus lumborum block for postoperative analgesia: a systematic review and meta-analysis. Can J of Anaesth, 67 (11), 1557–1575. https://doi.org/10.1007/s12630-020-01793-3

Viscasillas J, Terrado J, Marti-Scharfhausen R, et al. (2021a) A modified approach for the ultrasound-guided quadratus lumborum block in dogs: a cadaveric study. Animals, 11, 2945. doi: 10.3390/ani11102945

Viscasillas J, Sanchis-Mora S, Burillo P, et al. (2021b) Evaluation of quadratus lumborum block as part of an opioid-free anaesthesia for canine ovariohysterectomy. Animals, 11, 3424. doi: 10.3390/ani11123424

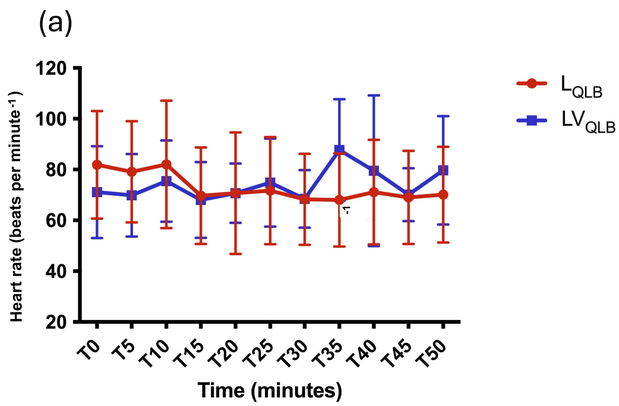
Wormser C, Runge J.J (2016). Advances in Laparoscopic Surgery. Vet Clin N Am Small Anim Pract, 46, 63–84. https://doi.org/10.1016/j.cvsm.2015.08.001

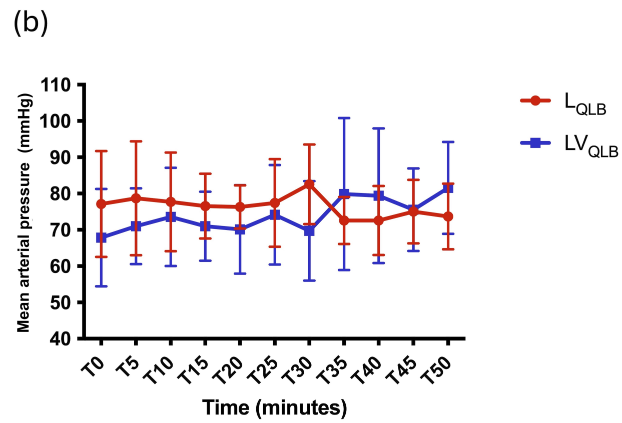
Table 1 Demographic data, duration of anaesthesia and surgery (minutes) and time from the block to the start of surgery (minutes) measured in the 14 dogs included in the study (*n* = 7 per group).L_{QLB}, lateral quadratus lumborum block; LV_{QLB}, latero-ventral quadratus lumborum block. Results are presented as mean and standard deviation.

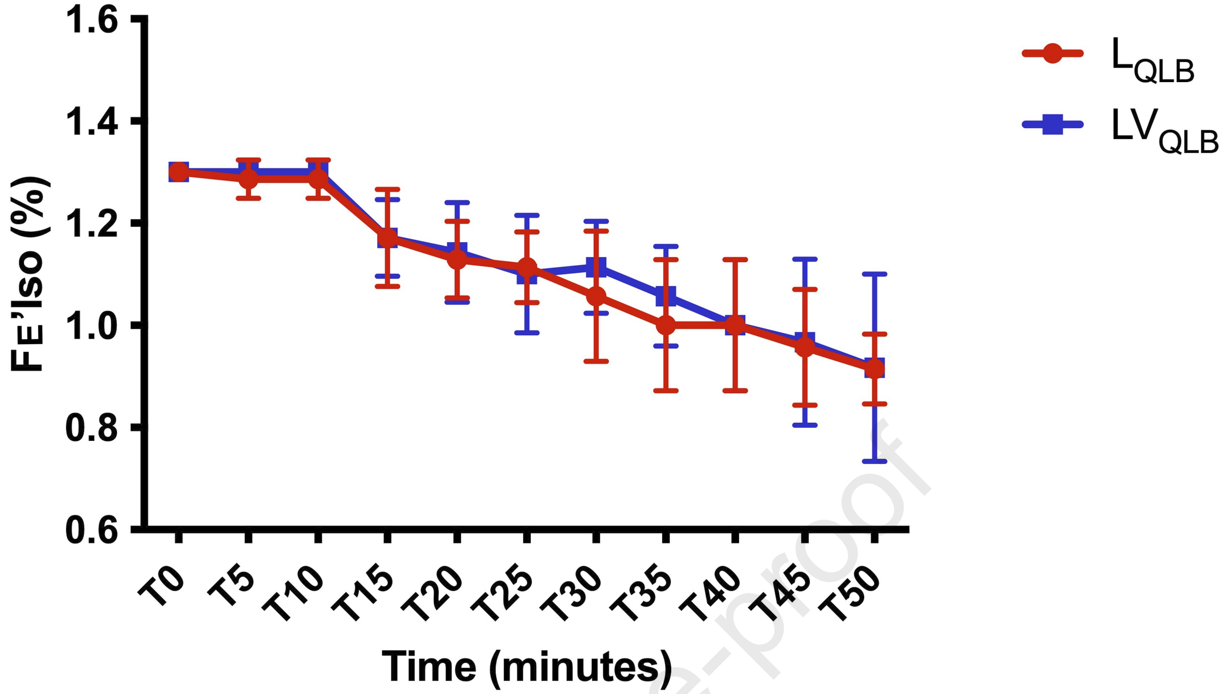
Group	**Age (months)**	**Weight (kg)**	**Duration anaesthesia (minutes)**	**Duration surgery (minutes)**	**Time from block to the starting of surgery (minutes)**
$\mathbf{L_{QLB}}$	19 ± 5	23 ± 8	108 ± 29	59 ± 24	27 ± 8
$\mathbf{LV_{QLB}}$	21 ± 6	20 ± 7	112 ± 31	64 ± 24	27 ± 6

Table 2: Distribution of intraoperative rescue fentanyl boluses (3 µg kg^{-1}), during specific surgery phases in the two groups of dogs (*n* = 7 per group) receiving the quadratus lumborum block., either as a lateral quadratus lumborum block (L_{QLB}); or a latero-ventral quadratus lumborum block (LV_{QLB}); P_1, skin incision and first port insertion ; P_2, insufflation of the abdomen; P_3, second port insertion; P_4, traction and cauterization of the first ovary; P_5, traction and cauterization of the second ovary; P_6, deflation of pneumoperitoneum and extraction of the trocars; P_7, suturing the skin.

Group	**Dog**	**Distribution of intraoperative rescue fentanyl boluses**						
L_{QLB}		**P_1**	**P_2**	**P_3**	**P_4**	**P_5**	**P_6**	**P_7**
	1		x					
	2							
	3		x					
	4							
	5							
	6							
	7							
LV_{QLB}								
	1				x	x		
	2					x		
	3				x	x		
	4					x		
	5					x		
	6				x			
	7					x		


(a)
120
100
80
60
40
20
Heart rate (beats per minute⁻¹)
T0
T5
T10
T15
T20
T25
T30
T35
T40
T45
T50
Time (minutes)
L_{QLB}
LV_{QLB}


(b)
110
100
90
80
70
60
50
40
Mean arterial pressure (mmHg)
T0
T5
T10
T15
T20
T25
T30
T35
T40
T45
T50
Time (minutes)
L_{QLB}
LV_{QLB}


1.6
1.4
1.2
1.0
0.8
0.6
FE'Iso (%)
T0
T5
T10
T15
T20
T25
T30
T35
T40
T45
T50
Time (minutes)
LQLB
LVQLB

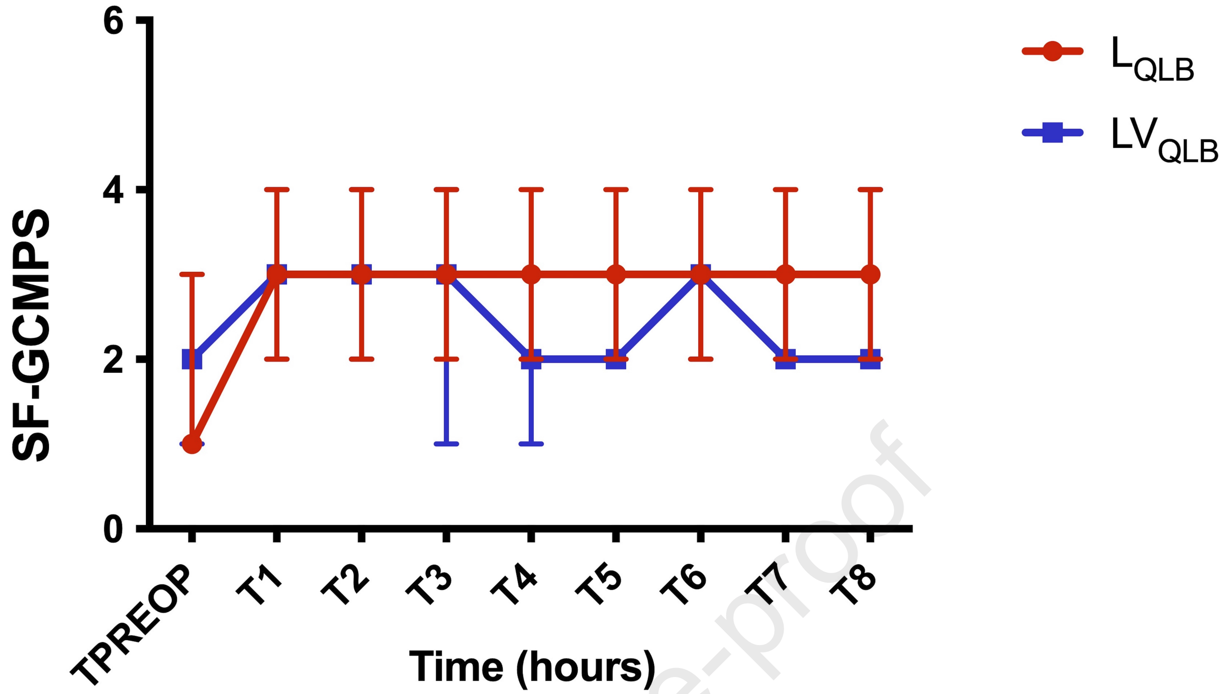

6
4
2
0
SF-GCMPS
TPREOP
T1
T2
T3
T4
T5
T6
T7
T8
Time (hours)
L$_{QLB}$
LV$_{QLB}$

Figure legends

Figure 1 (a), Intraoperative heart rate, (beats minute^{-1}); **(b)**, intraoperative mean arterial blood pressure (mmHg) measured in the 15 dogs enrolled in the study. Dogs were randomly allocated to one of two groups: L_{QLB}, receiving the lateral quadratus lumborum block (QLB); group LV_{QLB}, receiving the latero-ventral QLB. Data are shown as mean and standard deviation.

Figure 2 Intraoperative end-tidal concentration of isoflurane (FE'Iso) measured in the 15 dogs enrolled in the study. Dogs were randomly allocated to one of two groups: L_{QLB}, receiving the lateral quadratus lumborum block (QLB); group LV_{QLB}, receiving the latero-ventral QLB. Data are shown as mean and standard deviation.

Figure 3 Preoperative (Tpreop) and postoperative pain scores using the short-form Glasgow Composite Measure Pain Scale (SF-GCMPS) at 1, 2, 3, 4, 5, 6, 7, 8 hours after block execution in the 15 dogs enrolled in the study. Dogs were randomly allocated to one of two groups: L_{QLB}, receiving the lateral quadratus lumborum block (QLB); group LV_{QLB}, receiving the latero-ventral QLB. Data are shown as median and range.

Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: