

Improvement of diagnosis and follow-up of patients with aortic disease with Artificial Intelligence

Clinical experience

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Disclosure

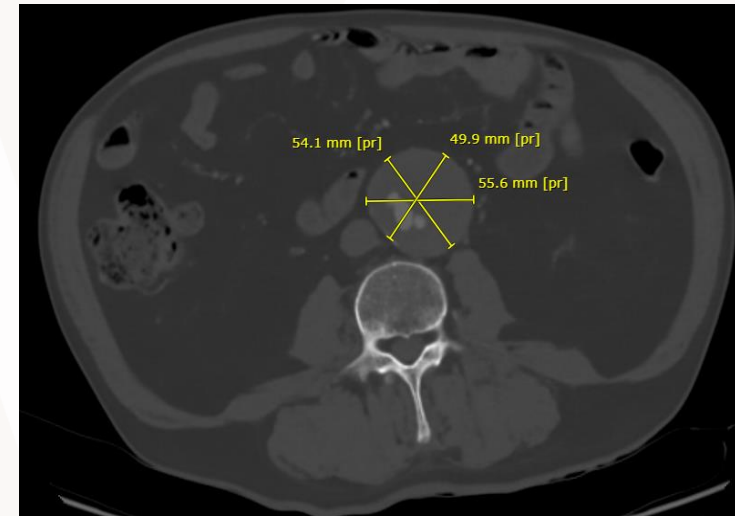
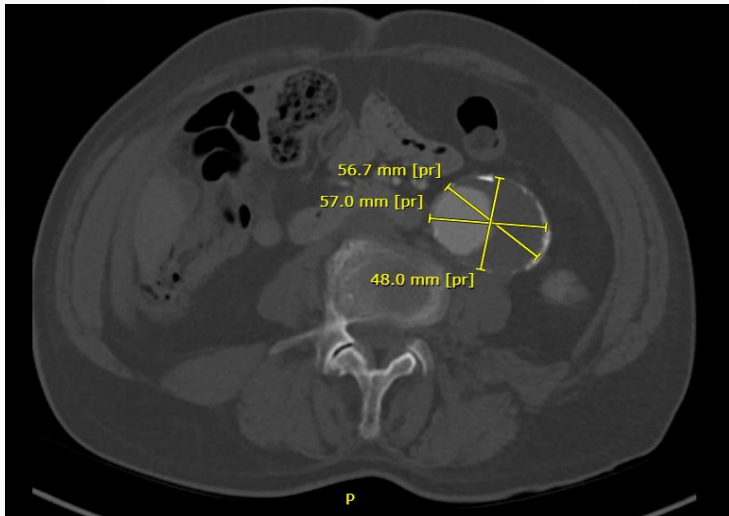
- None

Introduction

- ARVA is an AI tool for automatic measurements of the aorta.
- It enables standardization and time savings.
- Thanks to the radiology department, it is available in CHU of Liège since April 2024.
- ARVA needs computed tomography (CT) with contrast medium.
- Measurements provided are diameters and volumes at predefined levels.

Standardization

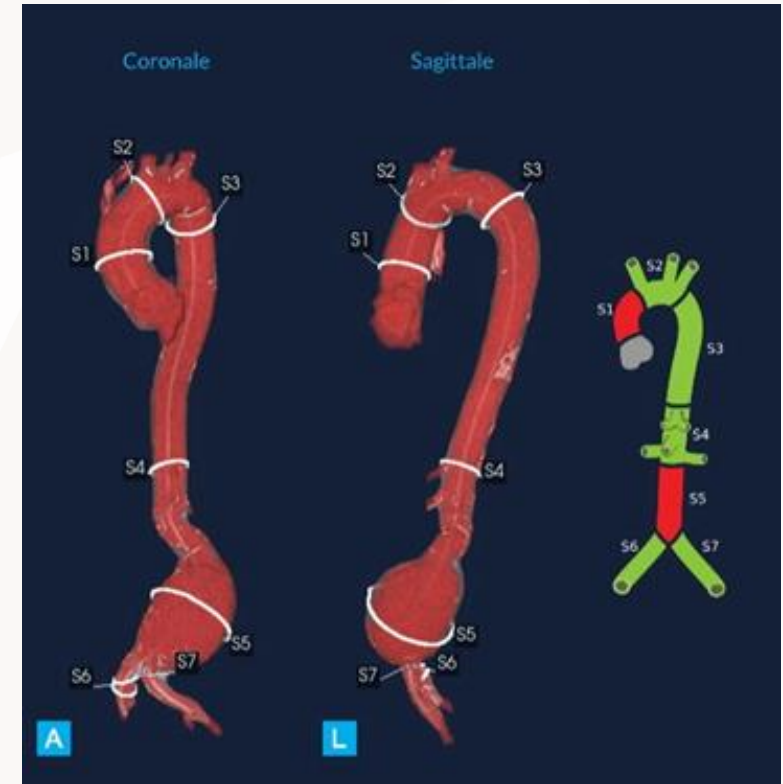
- Different physicians measure very often different diameters of the aorta
- Radiologists may measure the abdominal aorta diameter at ≤ 55 mm, while surgeons may measure the same diameter at ≥ 55 mm



- This systematization is even more important for the follow-up of patients with small aneurysm or after EVAR

Time and diagnosis savings

- Measurements are automatically and immediately brought with the CT images.
- At all the predefined levels.
- Too large diameters are emphasized in red color and normal diameters in green.
- This systematization of measurements avoid missing aneurysm diagnosis, especially in non-vascular contexts.



Real Life

The interface displays a multi-view CT scan of the chest. The top row shows coronal views (H) and axial views (A). The bottom row shows another axial view (A) and a 3D reconstruction of the vessel. A central table provides quantitative data for the vessel segments.

Position duplicate F-IP	Diex	IR	IR%	IR%	CTD _{max} mGy	DUP	T ₁	CDL
Topogramme	1	120	35 mAs	8.88 L	4.7	1.4	0.6	
Topogramme	2	120	35 mAs	8.88 L	4.4	4.3	0.6	
Procedura	3	100	23	8.81 L	3.4	0.34	10.0	
Contraste	4	100	23	8.81 L	4.8	0.28	10.0	
Angiographie	10	120	37.118	24.88 L	15.7	5	0.28	0.6

Moje	Type	Concentration en ioh	Volum	Date/FacteurPAC
Contraste HC		383	88	3.0 183%
NaCl			48	3.0

INCEPTO JARVIS interface showing 3D vessel reconstruction with a '1 de 2' indicator.

Real life

INCEPTO - ARVA

Date: 04 avr. 2024
Age: 62
Sex: M
Série Selectissime AngioAorte/ECG 1.0 Br38 3 BestDlast VOL 60 %

Coronale **Sagittale**

- S1 > 40mm
- S2 < 40mm
- S3 < 40mm
- S4 < 40mm
- S5 > 40mm
- S6 < 20mm
- S7 < 20mm

La fiabilité des mesures dans le segment 1 nécessite une acquisition avec synchronisation ECG.

- Résultats automatiques, voir le rapport radiologique fait liv.
- La qualité du montage de segmentations doit être systématiquement vérifiée sur la série appelée "Checkup".
- Les mesures doivent être systématiquement confirmées et complétées par le clinicien.
- La fiabilité des mesures nécessite des images de bonne qualité.

A **L**

S1 Dmax 41mm Volume 984.4	S2 Dmax 39mm Volume 454.4	S3 Dmax 36mm Volume 207.4	S4 Dmax 30mm Volume 37.4	S5 Dmax 68mm Volume 210.4	S6 Dmax 17mm Volume 11.4	S7 Dmax 17mm Volume 14.4
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INCEPTO - ARVA

04 avr. 2024
Coronale

A

S1 Dmax 41mm
Volume 984.4

S5 Dmax 68mm
Volume 210.4

A **L**

S1 Dmax 41mm Volume 984.4	S2 Dmax 39mm Volume 454.4	S3 Dmax 36mm Volume 207.4	S4 Dmax 30mm Volume 37.4	S5 Dmax 68mm Volume 210.4	S6 Dmax 17mm Volume 11.4	S7 Dmax 17mm Volume 14.4
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Case example 1

- 62-year-old ♀
- Transferred from another hospital where CT angiography was performed, for type B acute aortic dissection
- Right kidney hypoperfusion and oliguria
 - right renal artery stenting at D1
- Thoraco-abdominal CT angiography with ARVA at D5
 - ascending aorta aneurysm about we were not really aware
 - cardiologist and cardiac surgery evaluation
 - moderate aortic valve insufficiency, to follow

Case example 1

The interface displays a multi-panel view of medical data. The top-left panel shows a coronal CT scan of the thorax with labels 'PHL', 'AFR', 'A R H', and 'P L F'. The top-right panel shows a sagittal CT scan with labels 'PHL', 'AFR', 'L A', and 'R P'. The bottom-left panel shows an axial CT scan of the spine with labels 'A', 'R', and 'L'. The central panel contains patient information and a table of scan parameters.

Patient Information:
 22 Jun 2024 11:44
 Service: +16
 Médic: MONDEL, Gerson D
 Opérateur:
 n° de table 7427 DLP table 1028 mAsym

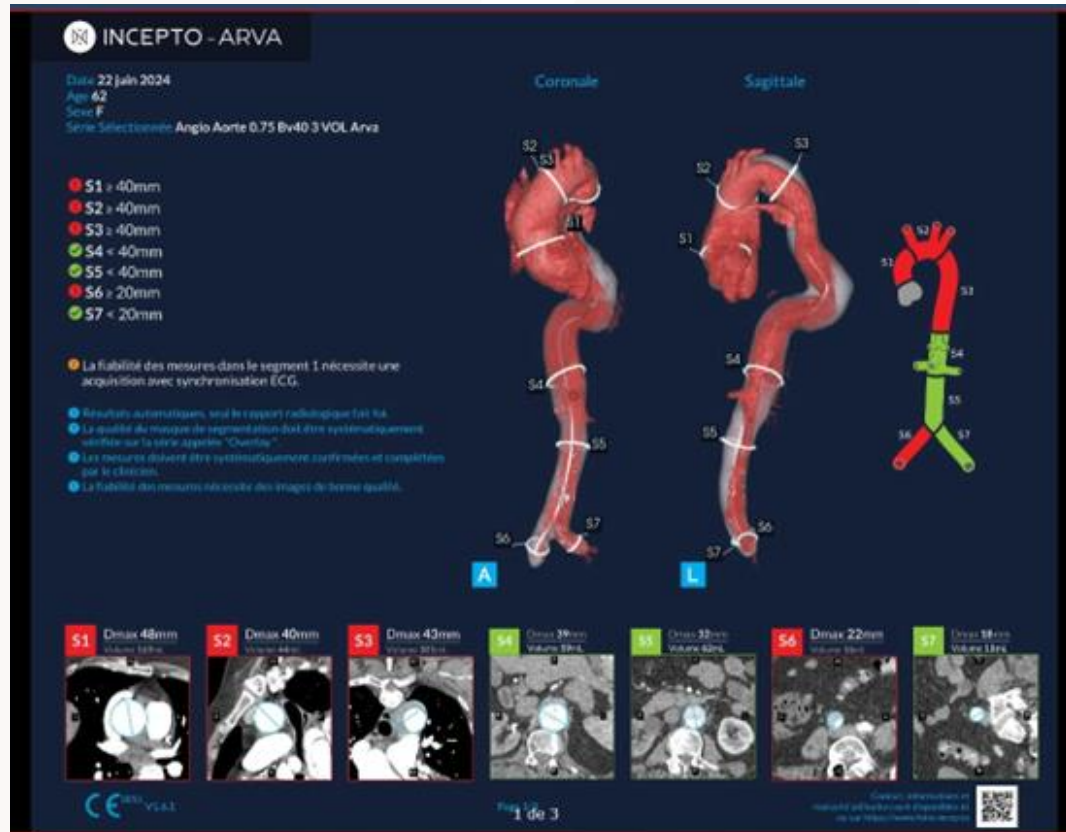
Scan	kV	mAs	Filtre	CTDIvol mGy	DLP mAs/cm	Ti s	isL ml
Profil du patient F-AP							
Topogramme	1	120	35 mA	0.08 L	6.2	4.6	8.4
Topogramme	2	120	35 mA	0.08 L	6.6	4.3	8.4
Protocole base	3	120	20	1.19 L	7.2	8.5	14.8
Contraste							
Webcam	4	120	20	0.02 L	5.9	0.5	18.8
Angio Aorte	5	130	204	1188	10.41 L	865.2	0.5
Angio Aorte	10	130	237	1188	9.36 L	301.9	0.5

Mean Type Concentration en iode mg/ml Volume ml Dose/Passant PnC ml/s

Contraste Omnipaque		0	90	4.3	100%
NaCl		0	40	4.5	

SE: 11 2 mm (top-left), SE: 12 1 mm (top-right), SE: 3402 mm (bottom-left), SE: 502 mm (central table), SE: 502 mm (bottom-right).
 86 de 173 (top-left), 1 de 384 (top-right), 1 de 123 (bottom-left), 1 de 3 (bottom-right).
 * L = 32cm, S = 16cm

Case example 1



Case example 2

- 71-year old ♂
- EVAR in 2017
- Type 2 endoleak
- Follow-up discontinuation during Covid pandemic
- Comeback in 2023 : persistent type 2 endoleak
- CT angiography with ARVA in 2024
 - diameter follow-up

Case example 2

The screenshot displays a medical software interface with several panels:

- Top Left:** Coronal CT scan of the abdomen. Time: 9:31. SE: 605. 3.00000039 mm. 44.28522. 52 de 131.
- Top Middle:** Sagittal CT scan of the abdomen. Time: 9:31. SE: 606. 3.00000039 mm. -2.77978. 69 de 134.
- Top Right:** Injection Report table. Time: 9:33. SE: 996 mm.
- Bottom Left:** Dose Report table. Time: 9:32. SE: 999 mm.
- Bottom Middle:** Axial CT scan of the abdomen. Time: 9:31. SE: 3402 mm. 107.
- Bottom Left (Inset):** A smaller window showing a 3D reconstruction of the abdominal vasculature. Time: 9:31. 1 de 4.

Injection Report Table:

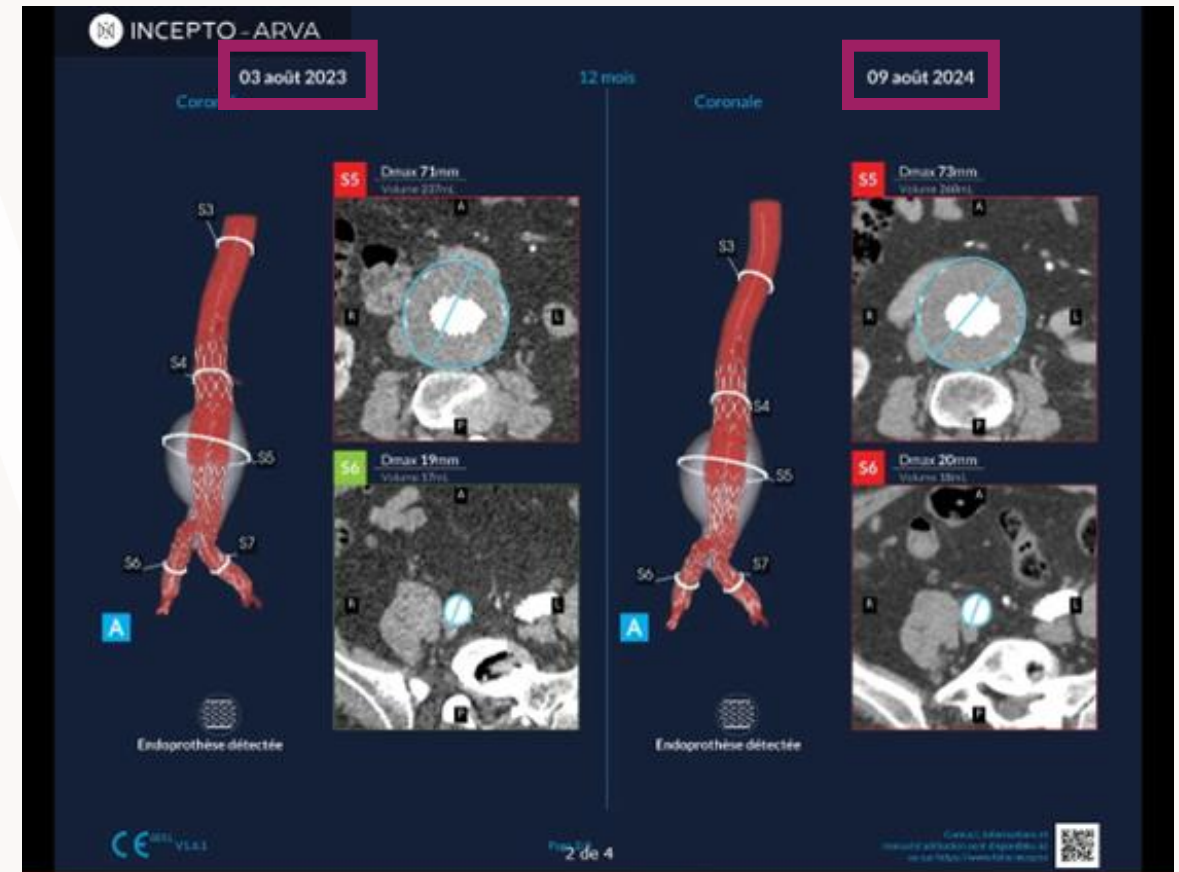
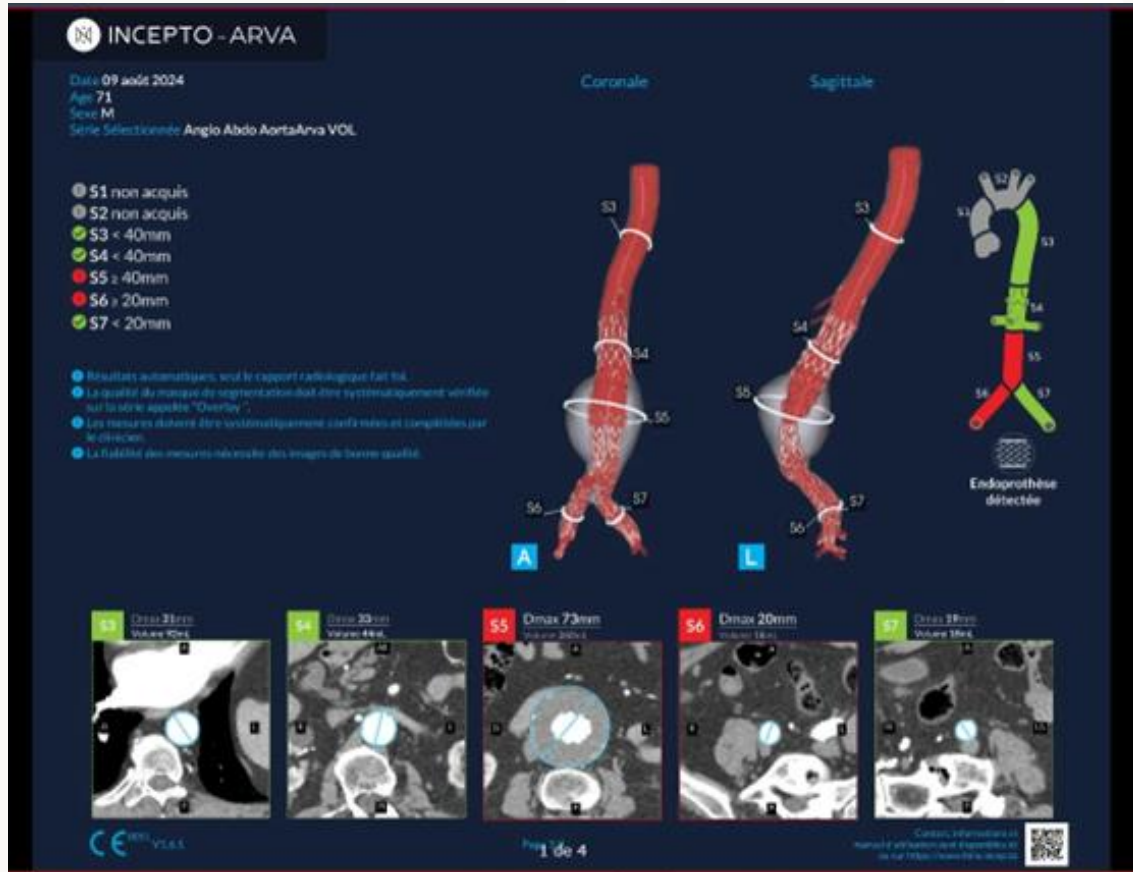
Series	Inj. #/ba	Delay (s)	Type	Rate	Volume (ml)	Dist. (cm)	Agent
201	1/1	0	C	4.8	30	22.6	
201	1/2	0	S	4.8	48	18.1	
Total Exam Vol. for (CM prod): 30							

Injection information sent from the injector prior to the selection of End Exam is included in this report. Any information sent after End Exam is not included.

Dose Report Table:

Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy*cm)	Position (cm)
SCOUT					
1	Scout	58.058	8.82	8.97	Body 32
1	Scout	58.058	8.86	3.11	Body 32
ABDOMEN - C					
2	Helical	183.75-838.75	15.26	548.58	Body 32
ARTERIEL/ PORTAL					
3	Helical	183.75-838.75	14.53	864.81	Body 32
3	Helical	183.75-838.75	15.36	534.43	Body 32

Case example 2



comparison of diameter on the right figure

Case example 2



diameter



volume

Conclusions

- Advantages are multiple :
 - to *avoid missing diagnosis*
 - to get quick measures → *time saving*
 - with systematization between physicians
for the follow-up → *accuracy*
 - through automation and availability with the CT images,
it is very *easy to use*
- It is only the beginning of AI and ARVA