Mobile or fixed imaging systems to perform aortic endografting

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Universitaire de Lille

Disclosure

- Research support
  - Cook Inc, General Electric
- Consulting, Travel Expenses
  - Cook Inc

H-OR requirements

OR

Mobile

Interventional Lab

Fixed

Sterility
Patient Access

Advanced
Imaging

Low Dose & contrast

Ease of installation
Comprehensive solution

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Advanced Endovascular Surgery
What Imaging System: mobile or fixed?

Surgical mobile C-arm

Unrestricted patient access

Fixed room comfort:

- motorized C-arm,
- free float surgical table,
- elaborate video distribution

Modular OR solution: mobile C-arm & table

Full clinical endo procedure coverage

Affordable / accessible

Fixed angio system

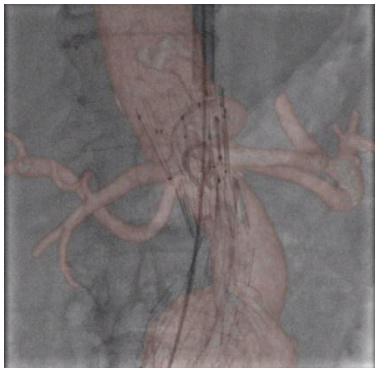
Total integration table & imaging

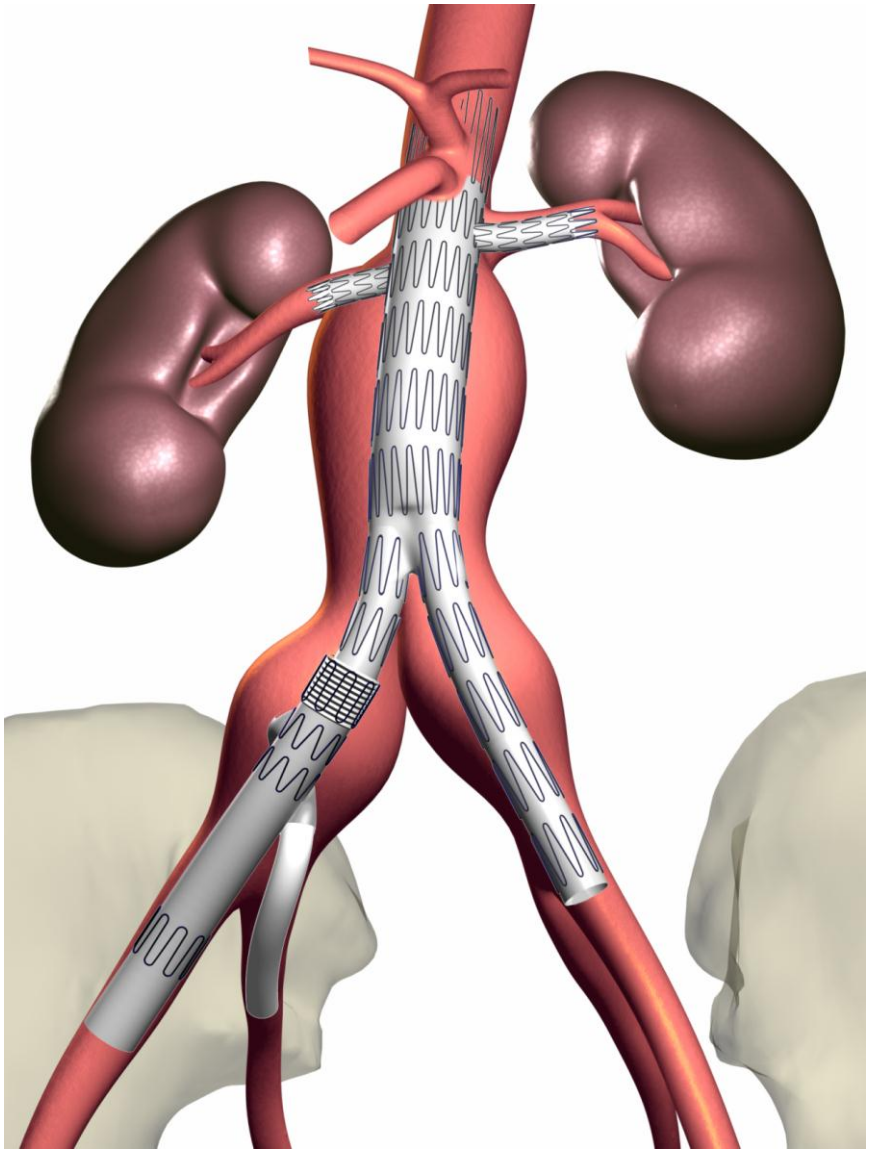
Advanced applications like 3D & Fusion

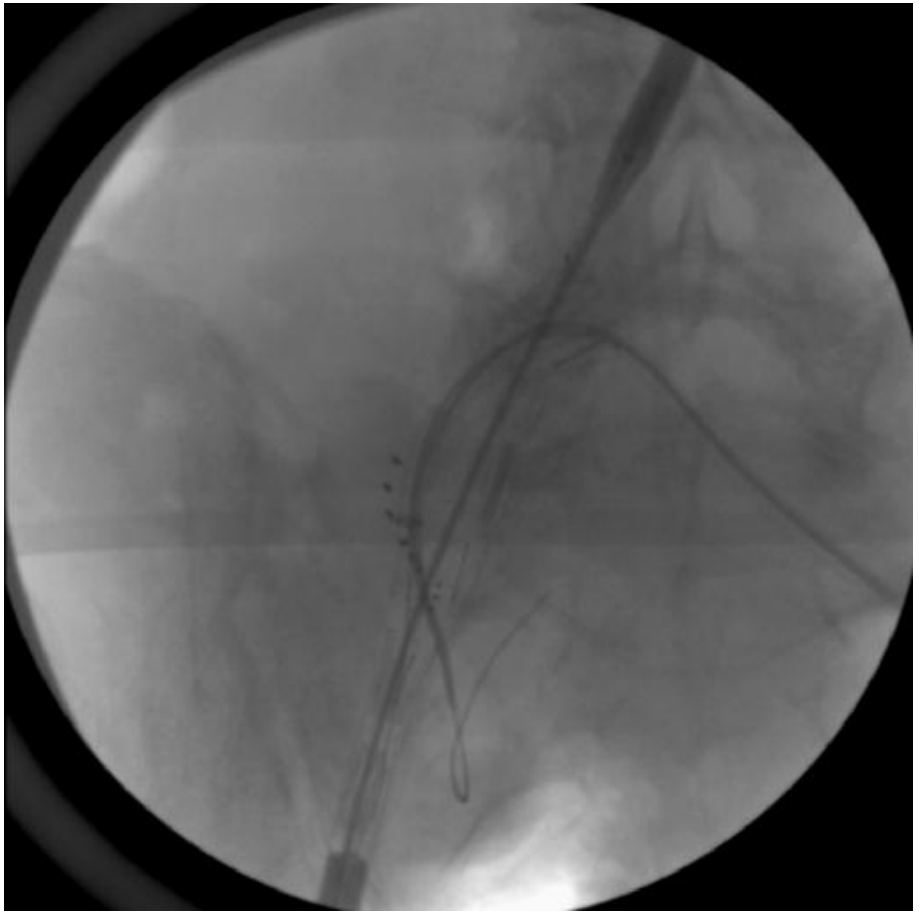
Optimal IQ incl. for obese patients

Long complex procedures on obese patients

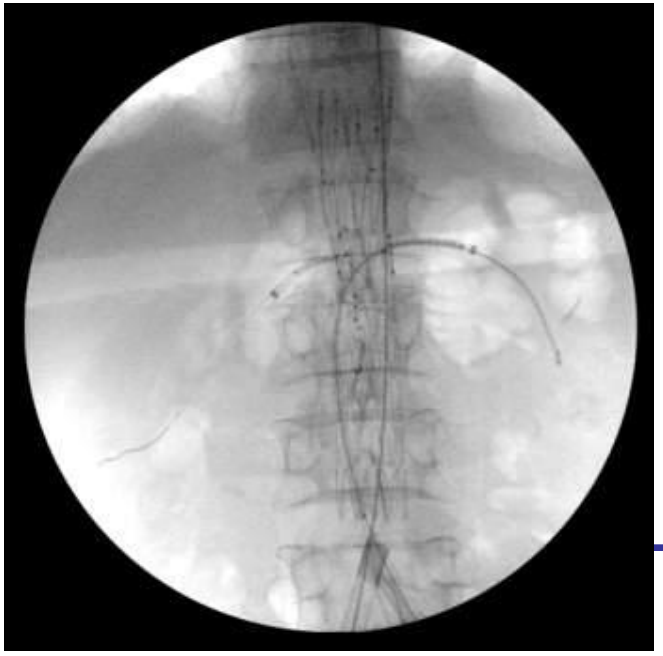
Premium pricing







Fenestrated and Branched Endografts

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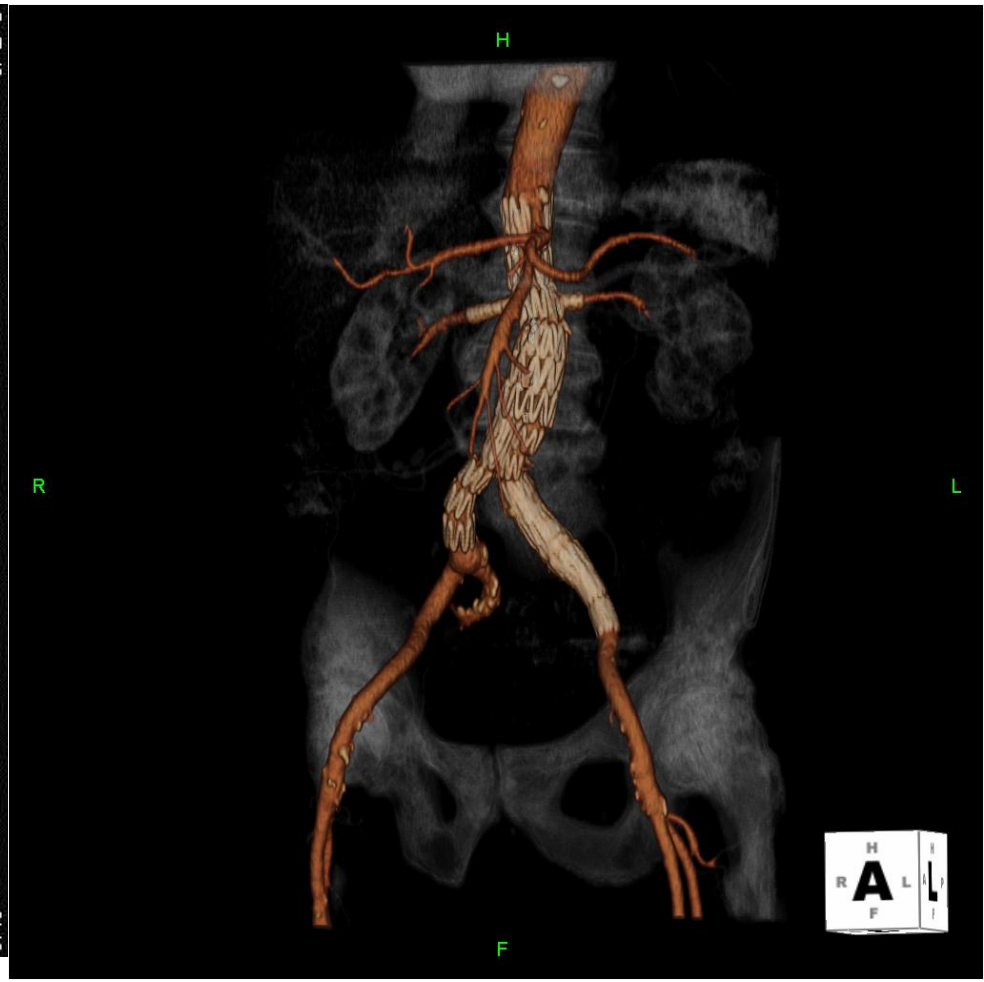
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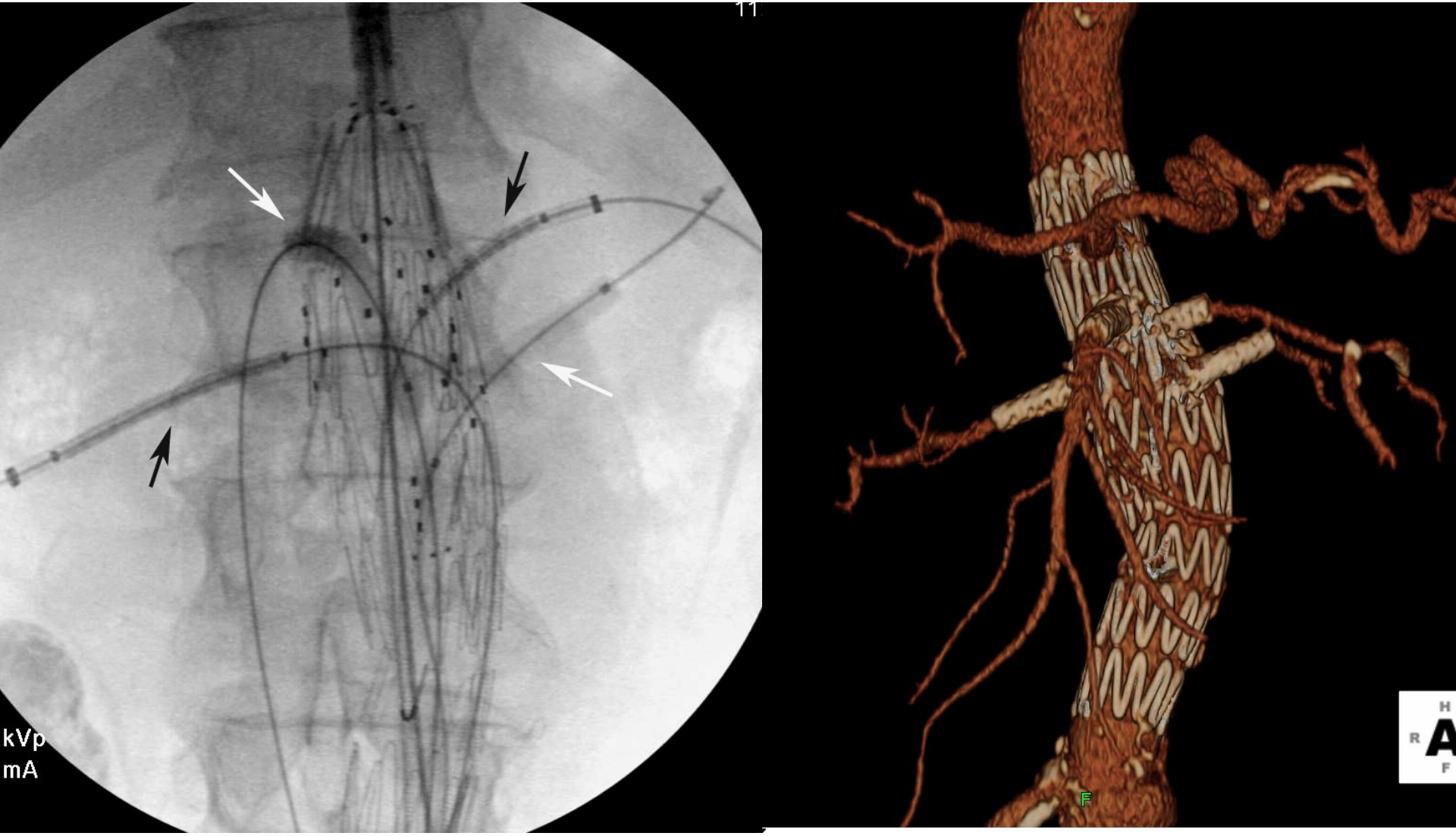
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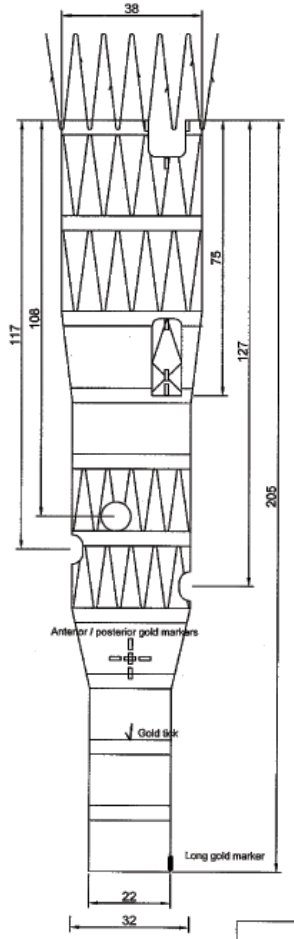
NON STANDARD DEVICE REQUEST



Reinforced Scallop

- Width: 10 mm
- Depth: 10 mm
- O'clock: 1.00
- Inner vessel diameter: 37 mm

Internal / External Low Profile Sidebranch

- Diamter: 8 mm
- Length: 21 mm
- O'clock: 1.00
- 75 mm from proximal graft edge
- Inner vessel diameter: 32 mm

Large Reinforced Fenestration

- Diameter: 8 mm
- O'clock: 11.30
- 108 mm from proximal graft edge
- Strut free
- Inner vessel diameter: 31 mm

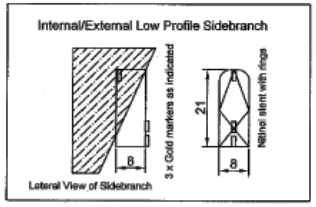
Small Reinforced Fenestration # 1

- Width: 6 mm
- Height: 8 mm
- O'clock: 9.00
- 117 mm fromproximal graft edge
- Inner vessel diameter: 28 mm

Small Reinforced Fenestration # 2

- Width: 6 mm
- Height: 8 mm
- O'clock: 3.00
- 127 mm from proximal graft edge
- Inner vessel diameter: 25 mm

- Single reducing tie
- Seam @ 1.00
- Indwelling wire guide & catheter for internal / external sidebranch



LDH / 17-10-06

Sheath Size:	24 Fr VRTS
O.D.:	9.5 mm
Description:	Fenestrated Thoraco-abdominal Graft with Sidebranch

ALL DIMENSIONS IN mm | NOT to scale if faxed | Date: 23/3/06

NON STANDARD DEVICE REQUEST

PATIENT ID: [redacted]
DOCTOR: Stephan Haulon
HOSPITAL: Chru de Lille
DATE OF PROCEDURE:

DRS SIGNATURE:

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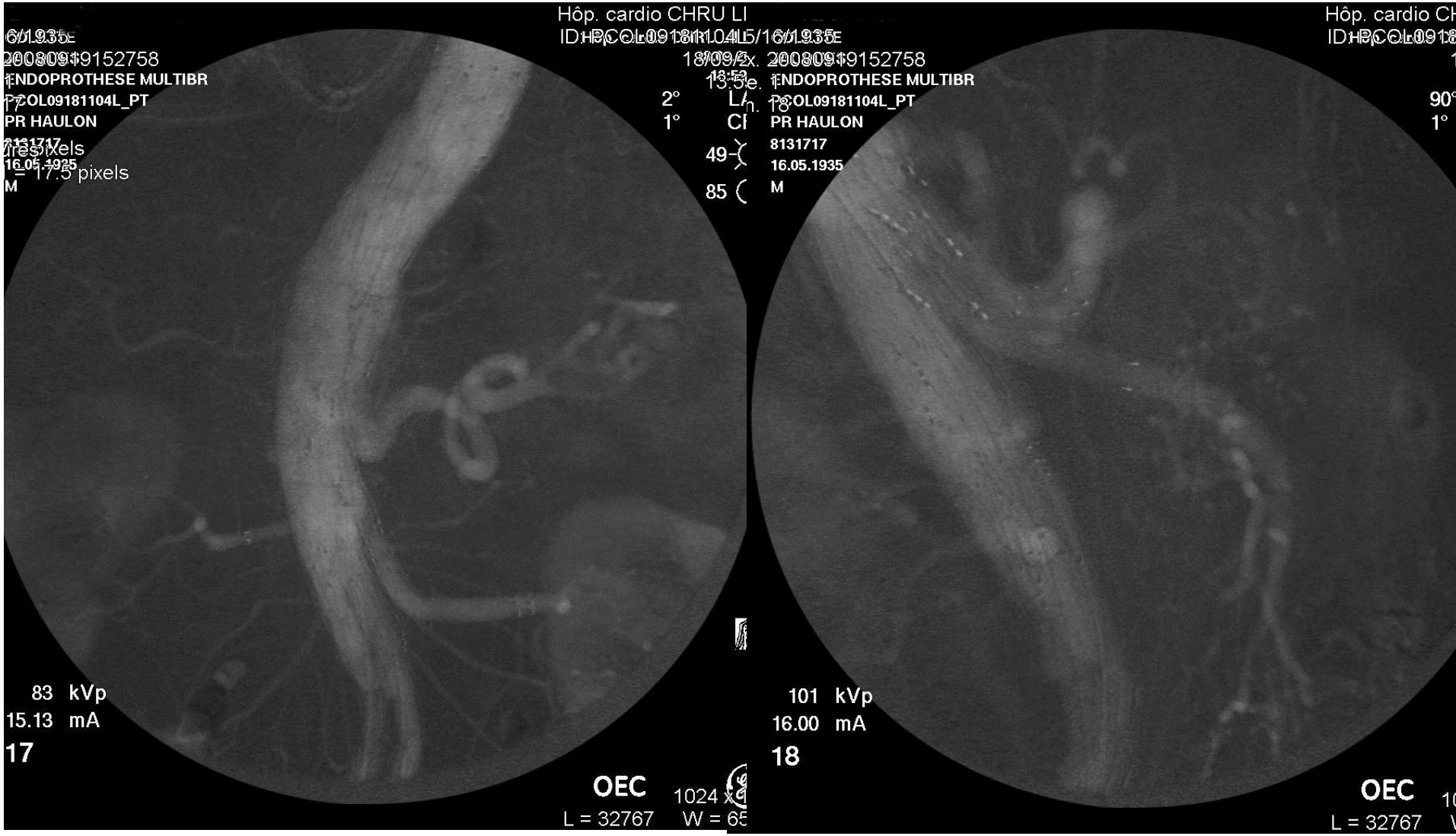
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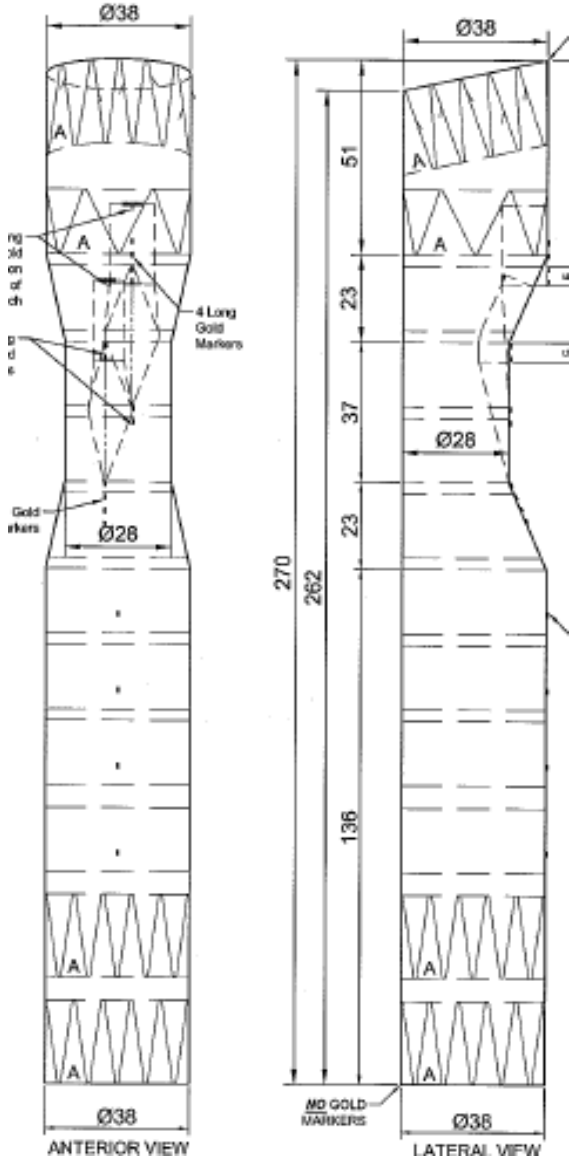

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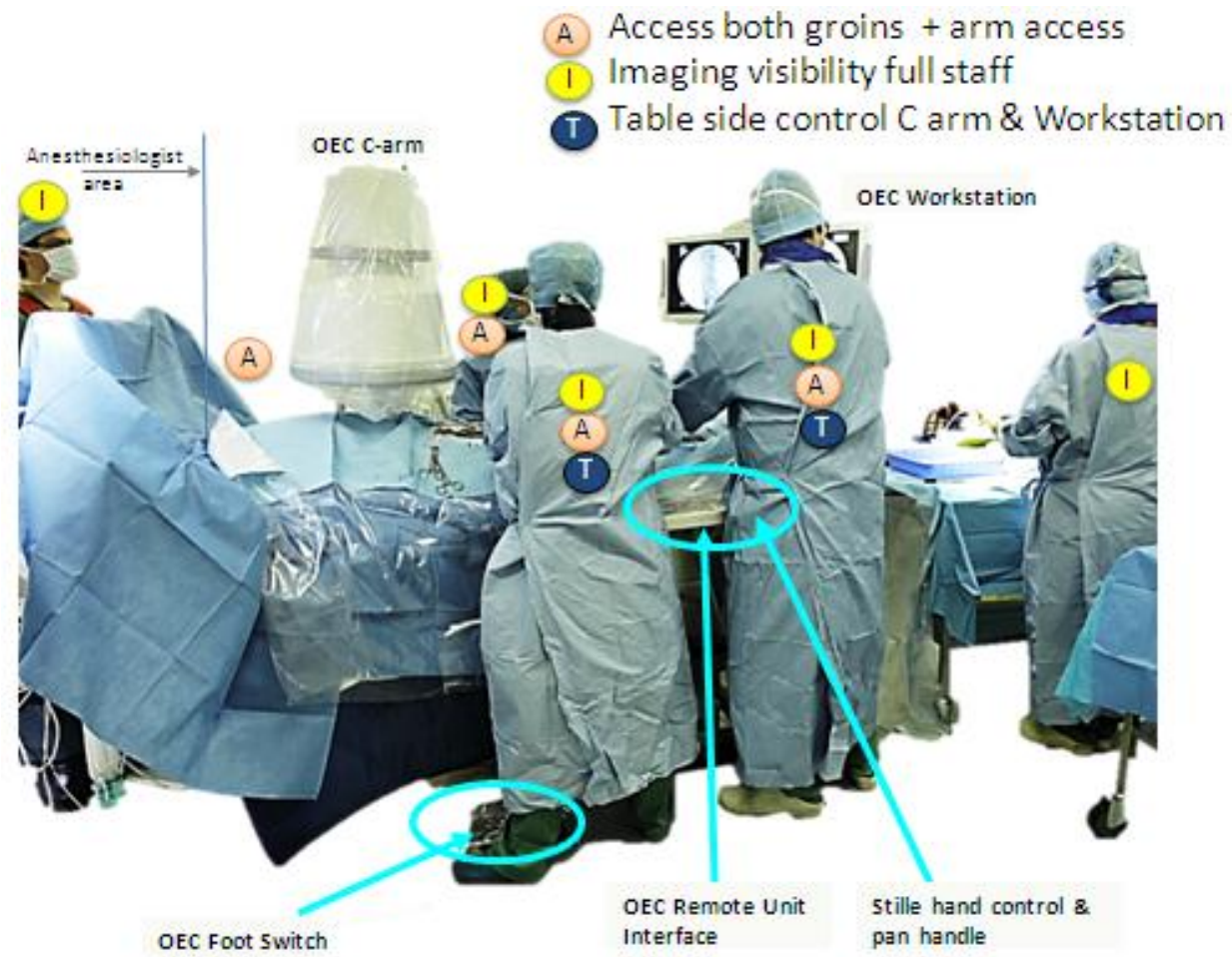
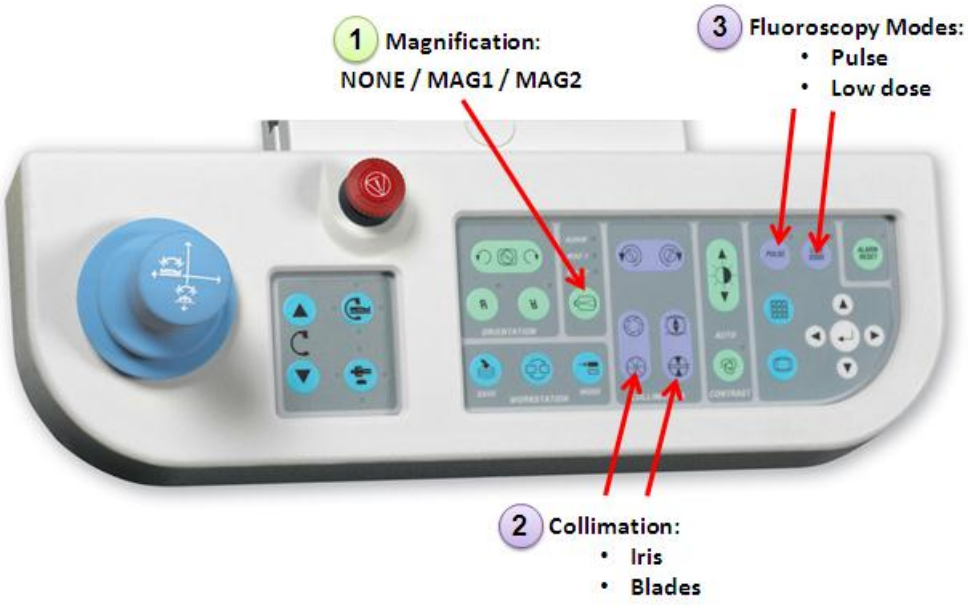
Patient access



Ease of use

Mobile



Fixed

Full surgeon control:
Table side accessibility to all system & table functions
Surgeon control C-arm positioning (time, contrast media, dose saving)

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Advanced Endovascular Surgery: Methods

- 301 patients
- 21/04/2008 to 21/10/2010
- 14 Aorto-Uni-Iliac
- 209 Bifurcated (including Iliac branch)
- 39 Fenestrated
- 15 Branched
- 24 Thoracic

Indirect dosimetric information recorded for each patient:

> Cumulated Dose, **Dose Area Product (DAP)**, calculated from imaging protocol – Estimator of energy imparted to the patient during the treatment

> **Fluoro time** & **contrast media volume**

Proportional to procedure complexity

Endograft	Procedure (min)	Fluoro (min)	DAP ($mGy.m^2$)	Contrast Media (cc)
Bifurcated (209)	100 (40-270)	10.2 (2.2-50.3)	3.1 (1-25)	93 (15-260)
Thoracic (24)	120 (50-240)	8.2 (1.2-19.1)	2.0 (0.3-6)	95 (24-304)
Aorto-Uni-ILiac (14)	138 (90-150)	9.1 (4.2-36.3)	2.6 (1-4.9)	92 (35-200)
Fenestrated (39)	155 (90-255)	32.8 (11.1-69.1)	7 (2-20)	135 (64-200)
Branched (15)	212 (150-335)	43 (17.6-77.2)	15.3 (7-30)	200 (80-466)

Advanced Endovascular Surgery: Data Analysis

Comparison with literature - DAP values in mGy.m²

Ref# fixed room / mobile C arm	Procedure	DAP 3rd Quartile	Fluoro time (minute)	DAP Min	DAP Max	DAP mean	# cases
(1) Vom 22. Juni 2010 Im Auftrag, ***Dr D Nosske*** Reference level for diagnostic	adult PTCA[1]	6					
	adult PTA[2] illiac	5					
(2) Notice R-06-05 31.01.2008 ***OFSP*** - Reference level for diagnostic	PTA renal	20	20	Reference level for treatment			
	PTA illiac	20	20				
(3) ***D L Miller*** *et all, J Vasc Interv Radio 2003: 14:711-717*	Aortic Fenestration Illiac stent RA stent	Not Avail.	35.1 18.4 21.6	21.40 1.15 0,98	25.31 88.65 72.42	23,36 21,28 19,00	2 93 103
(4) ***B J McParland*** *et all – Br J Radiol 1998;71;175-185*	Abdominal therapeutic	19.10	18.4	4.20	60.90	16.80	16
(5) ***Weiss DJ*** *et all - Ann Vasc Surg. 2008 Nov;22(6):723-9.*	AAA repair	Not Avail.	20.6	5.21	24.54	15.17	12
(9) ***Geijer H*** *et all - Br J Radiol. 2005 Oct;78(934):906-12.*	AAA repair	Not Avail.	28.4	1.66	19.50	7.23	24
(10) ***Kalef-Ezra JA*** *et all - J Vasc Surg. 2009 Feb;49(2):283-7; discussion 287.*	AAA repair	3.74	22.6	0.90	13.90	4.25	62
(12) ***J Stratakis*** *et all - Eur Radiol. 2007 Sep;17(9):2359-67.*	Renal PTA Illiac PTA	Not Avail.	Not Avail.	Not Avail.	Not Avail.	17.60 12.70	24 56
(6) ***Olivier Bar*** *et all* ***-*** *EuroInterv, 2008; 3:593-599 GACI 2006*	PTCA CA	11 5.6	15 7	Not Avail.	Not Avail.	Not Avail.	Not Avail.
(7) EUR Radiol (2003) 13:2259-2263	PTCA CA	9.4 5.7	16 6	Not Avail.	Not Avail.	Not Avail.	Not Avail.

Dose on mobile C-arm

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Contents lists available at SciVerse ScienceDirect

European Journal of Vascular and Endovascular Surgery

journal homepage: www.ejves.com

- EVAR Database analysis
- Direct skin dose measurement
- Comparison to literature

Evaluation of Radiation during EVAR Performed on a Mobile C-arm

CME

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Department of Vascular Surgery and Radiology, Hôpital Cardiologique, CHRU de Lille, France

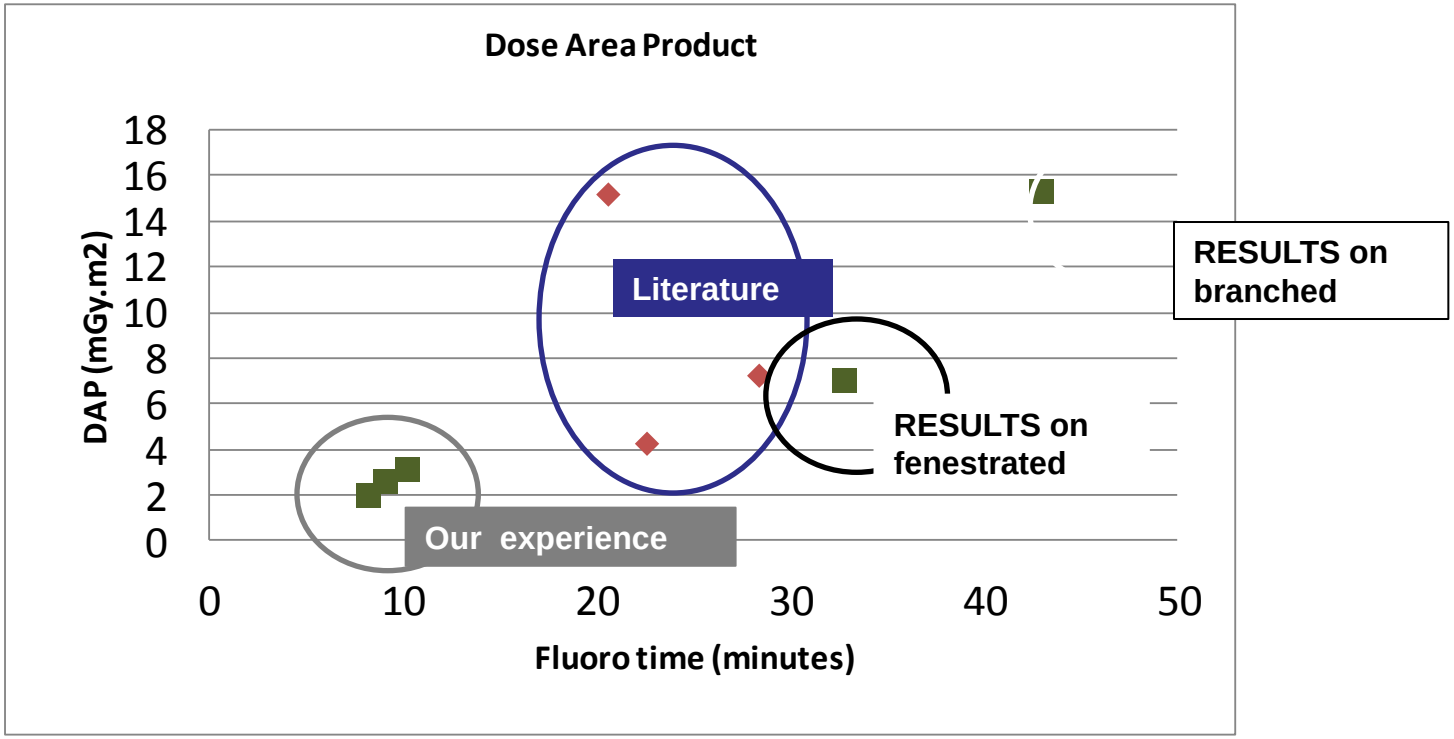
Table 4
Literature analysis.

First author (year)	Procedure (N cases)	Fluoro time (minutes)	DAP Min ($mGy.m^2$)	DAP Max ($mGy.m^2$)	DAP mean ($mGy.m^2$)	Mode
Geijer[17] (2005)	BIF (24)	28.4	1.66	19.50	7.23	low dose
Weiss[18] (2008)	BIF (12)	20.6	5.21	24.54	15.17	
Weerakkody[20] (2008)	BIF (96)	*not available*	9	65.9	15	
Kalef-Ezra[19] (2009)	BIF (62)	22.6	0.90	13.90	4.25	low dose
Panuccio[9] (2011)	MB		*not available*	*not available*		pulsed
	–29 type IV	81.9			64.25	
	–18 type I, II, III	140.7			100.67	
Our study	BIF (188)	11.2	0.43	28	4.05	low dose pulsed
	FEN (54)	29.2	1.16	29	8.6	
	MB (20)	46.5	2.98	77.7	18.9	

BIF: bifurcated endograft; THO: thoracic endograft; AUI: aorto-uni-iliac endograft; FEN: fenestrated endograft; MB: multi-branched endograft; type IV: type IV thoraco-abdominal aortic aneurysm; type II III: type II or III thoraco-abdominal aortic aneurysm.

Advanced Endovascular Surgery: Data Analysis

Results

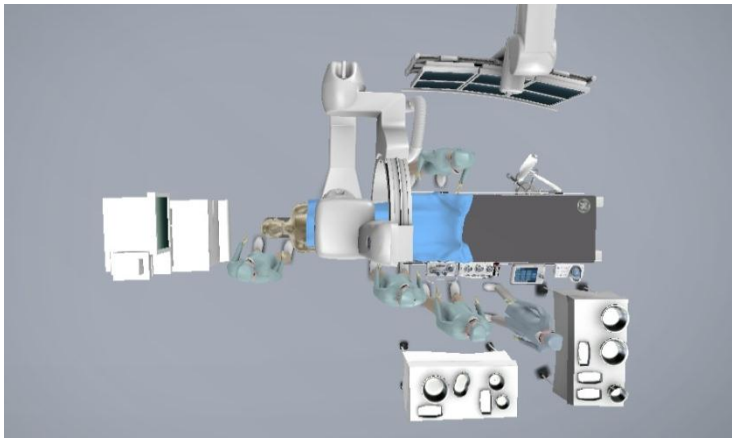


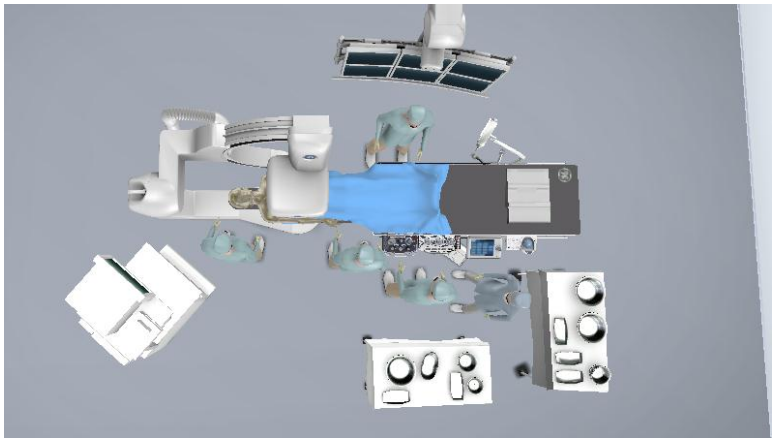
Sterility

No suspension above the patient to limit the risk of contamination with dust falling from the ceiling

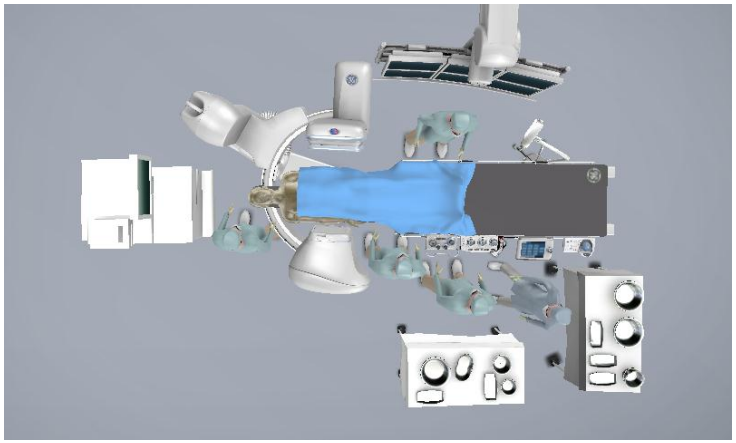
For both mobile and fixed C-arms
Sterile drapes to cover C-arm

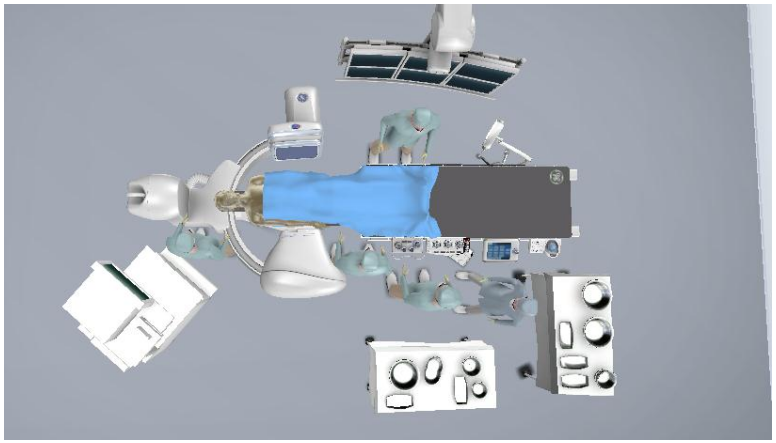
Simulate anesthesia positioning





Frontal





Lateral

Anesthesia at patient's head

Anesthesia on the side

Small floor footprint

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Reduce overall dose & contrast to the EVAR patient using 3D Fusion with pre-operative CT

Leverage this ….

	Pre-op CT	Intra-op	Post-op	Total
Dose	15 mSV ACR	10-120 mSV*	15 mSV ACR	**40-150 mSv**
Contrast	90 ml	50-350 ml ?	90 ml	**230-380 ml**

*

J Vasc Surg. 2011 Apr;53(4):885-894.e1. Epub 2011 Feb 2.

Comparison of indirect radiation dose estimates with directly measured radiation dose for patients and operators during complex endovascular procedures.

Panuccio G, Greenberg RK, Wunderle K, Mastracci TM, Eagleton MG, Davros W.

Department of Vascular Surgery, Cleveland Clinic Foundation, Cleveland, Ohio.

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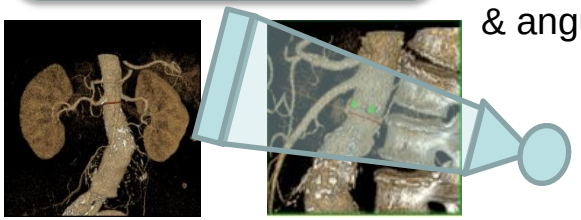
Guidance with AW
Fuse pre-op CT over live fluoro

Pre-op planning

Pre-op CT
Planning on GE AW

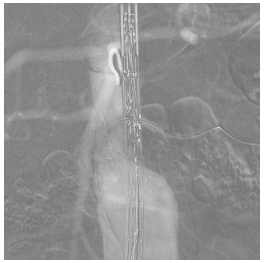


Saved CT
vessel model
& angulation

Intra-operative guidance

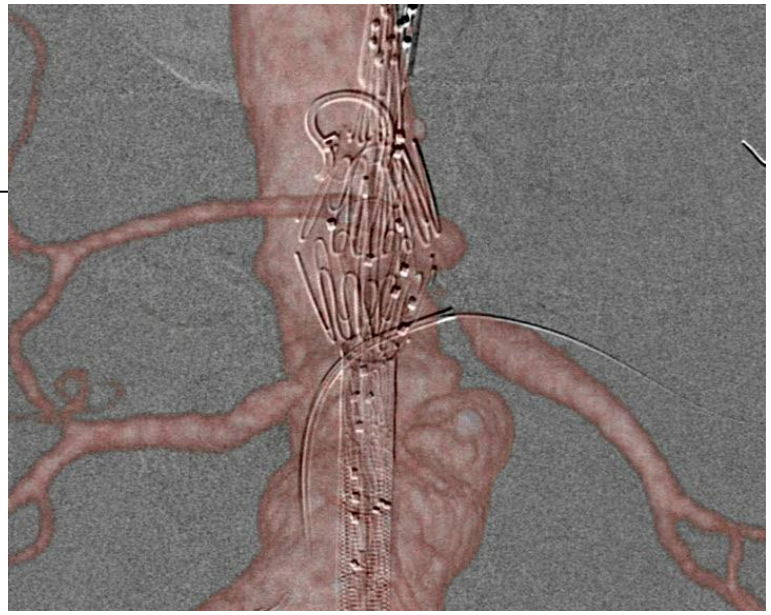
Load CT vessel model
& angulation
on Interventional AW

Register and Fuse pre-op CT
over live Fluoro



Use of pre-operative CT for 3D roadmap may help to reduce the need for additional dose and contrast during the intervention

Fused 3D imaging



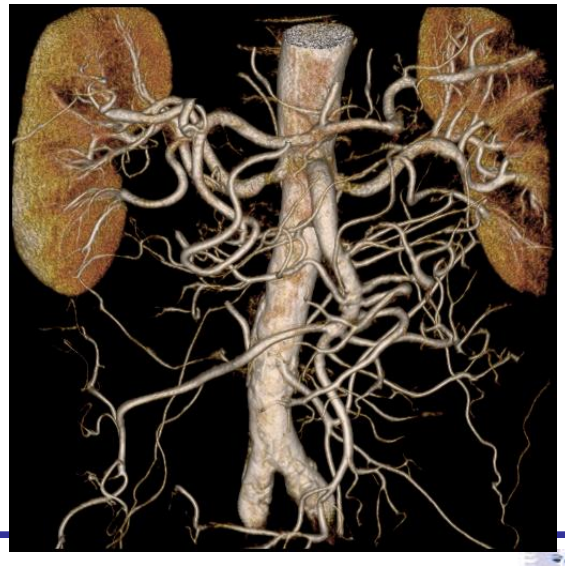
Benefits

- Roadmap to localize renals ostia and optimize positioning of the endograft
- Using pre-op CT can potentially reduce the need for fluoro, DSA and contrast

3D imaging

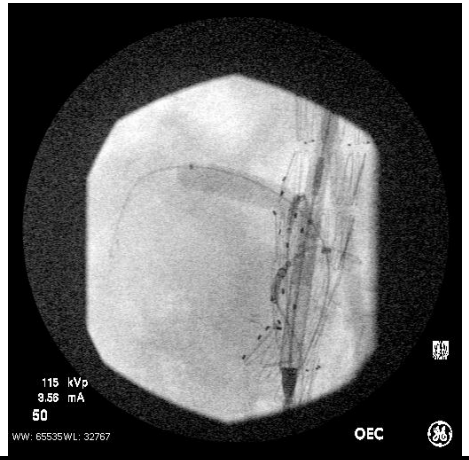
Innova 3D
Automated rotational acquisition

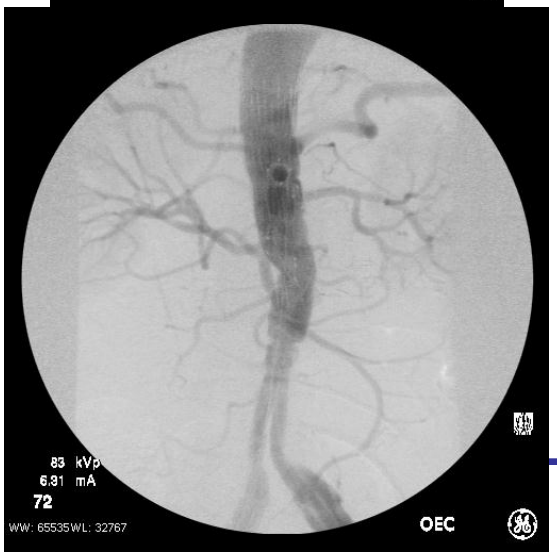
- Rotational imaging over 200˚
- 5-second acquisition time
- 30 images/second



Imaging

Mobile





Fixed

Intraoperative C-arm CT imaging & Fusion

IQ to visualize small vessels and guide wires

Leverage pre-operative imaging to reduce the dose and contrast during the procedure

Conclusion

- Sterility, ease of installation, patient access, user friendliness are key
- On mobile C-arms
  - Compact and affordable
  - Hybrid OR configuration: fixed lab comfort on a mobile
  - No limitation for full range from simple to complex cases
  - Dose conscious patient treatment and staff exposure

- On Fixed C-arms
  - New hybrid systems address patient access and sterility
  - Advanced imaging can leverage pre-operative imaging to help reduce dose and contrast during endovascular procedures
  - Modular configurations can address requirements of multi-disciplinary teams

Thank you!

Mobile

Fixed