13:30 - 15:00 SESSION 8 - TAVI (I)

TAVI & abords complexes

Cédric Delhaye

CHU Lille

CHU LILLE INSTITUT CŒUR POUMON

DÉCLARATION DE LIENS D'INTÉRÊT AVEC LA PRÉSENTATION

Speaker's name : Cédric DELHAYE, Lille

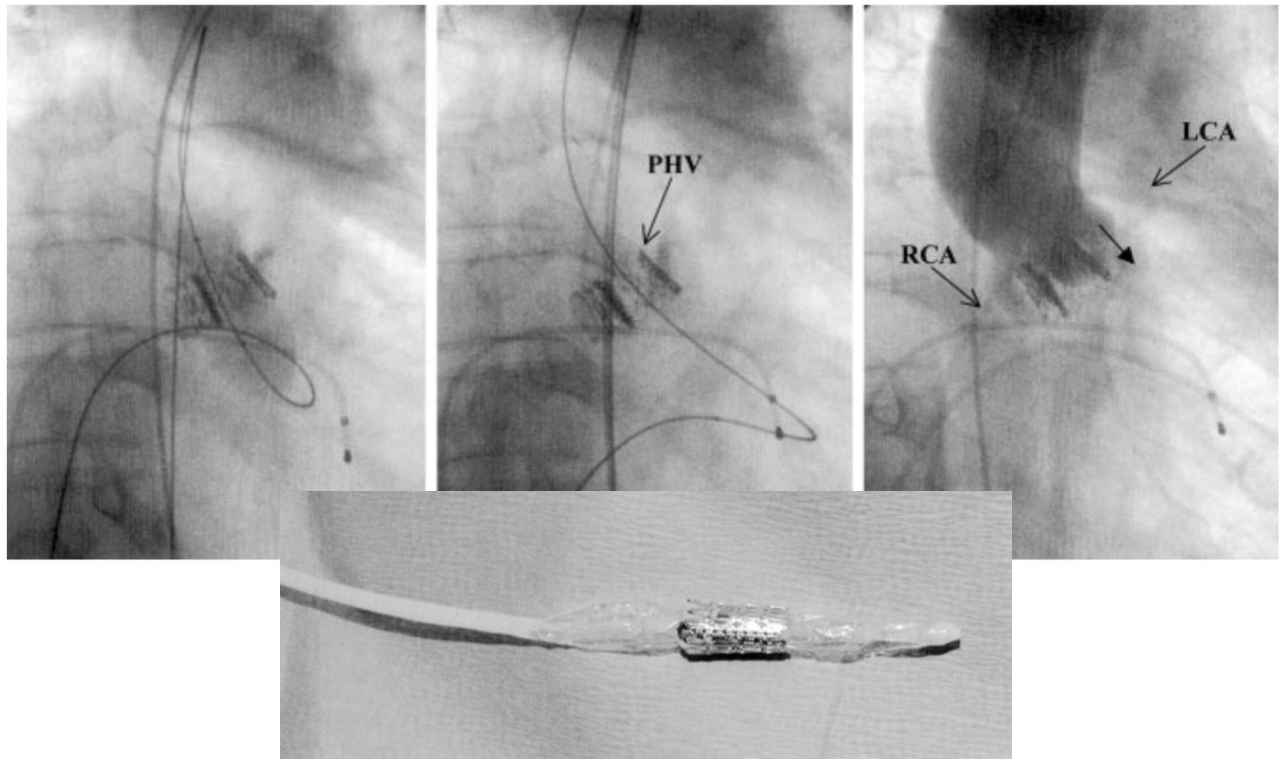
☑ Je déclare les liens d'intérêt potentiel suivants :

Consultant / Proctoring : Abbott, Asahi, Medtronic

Percutaneous Transcatheter Implantation of an Aortic Valve Prosthesis for Calcific Aortic Stenosis

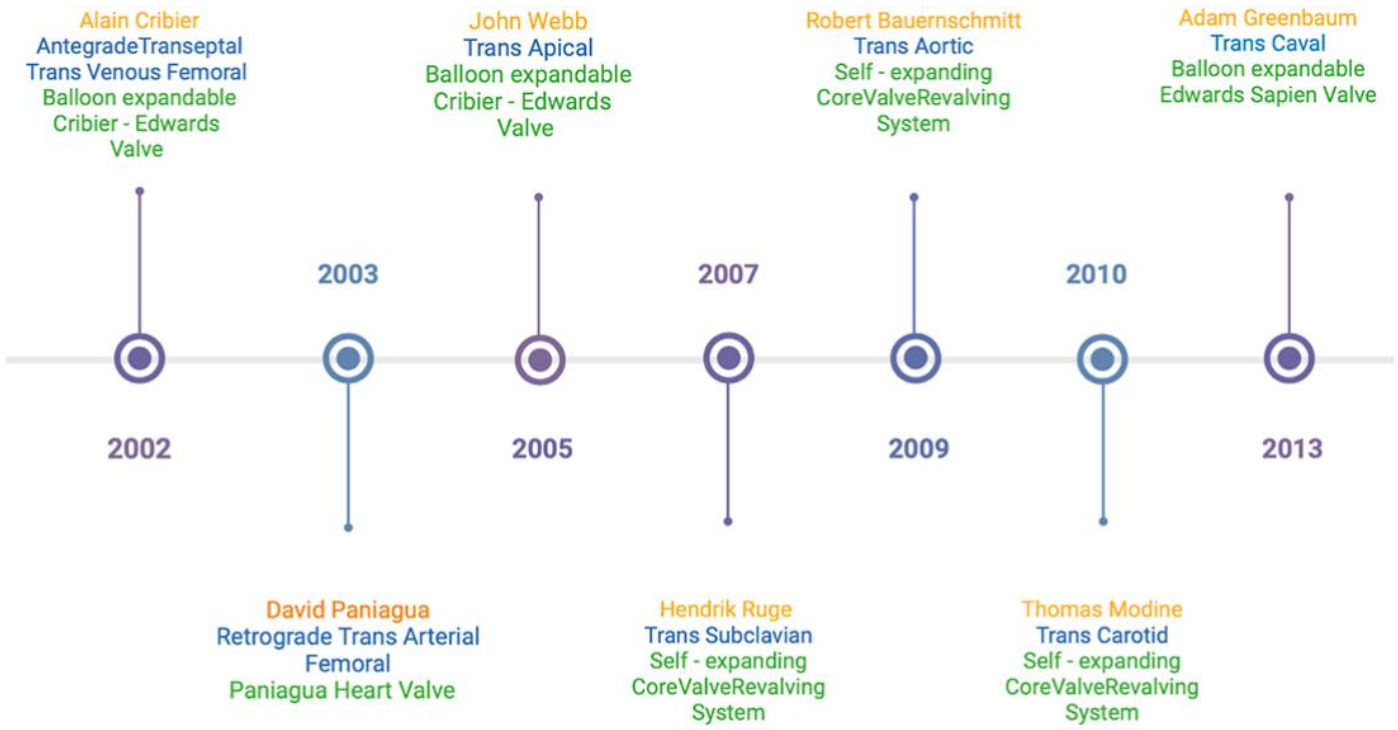
First Human Case Description

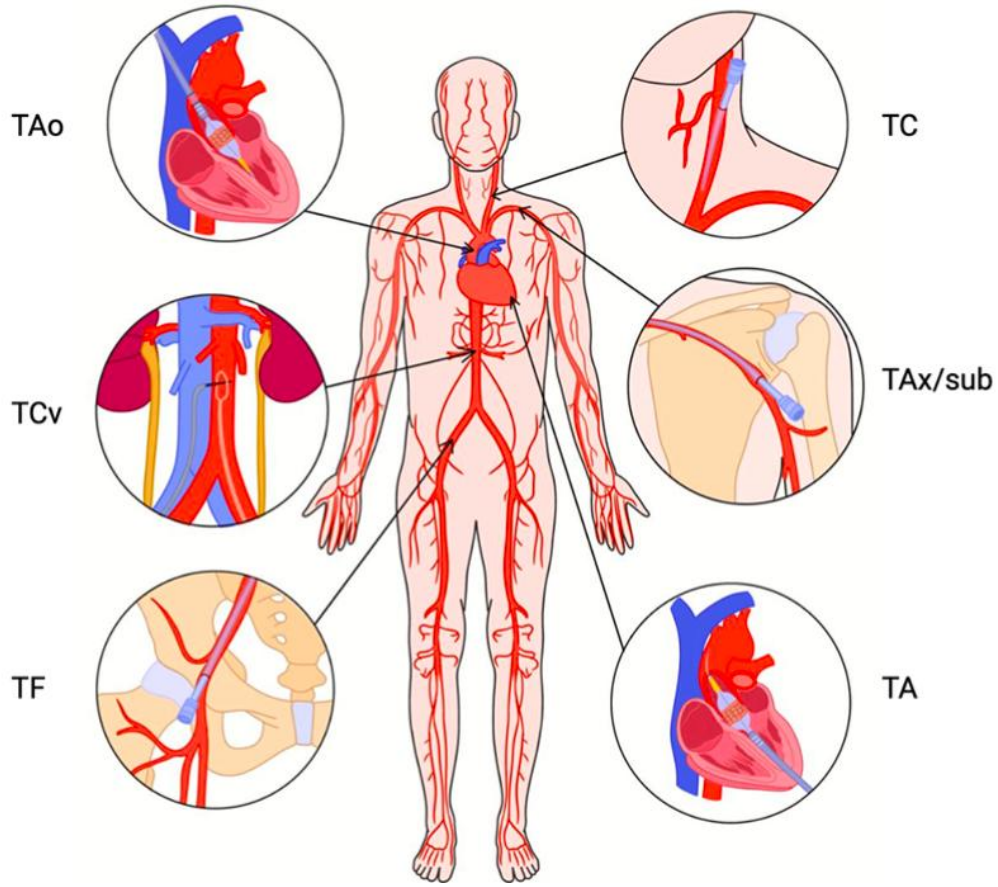
Alain Cribier, MD; Helene Eltchaninoff, MD; Assaf Bash, PhD; Nicolas Borenstein, MD; Christophe Tron, MD; Fabrice Bauer, MD; Genevieve Derumeaux, MD; Frederic Anselme, MD; François Laborde, MD; Martin B. Leon, MD



Circulation 2002; 106: 3006-3008

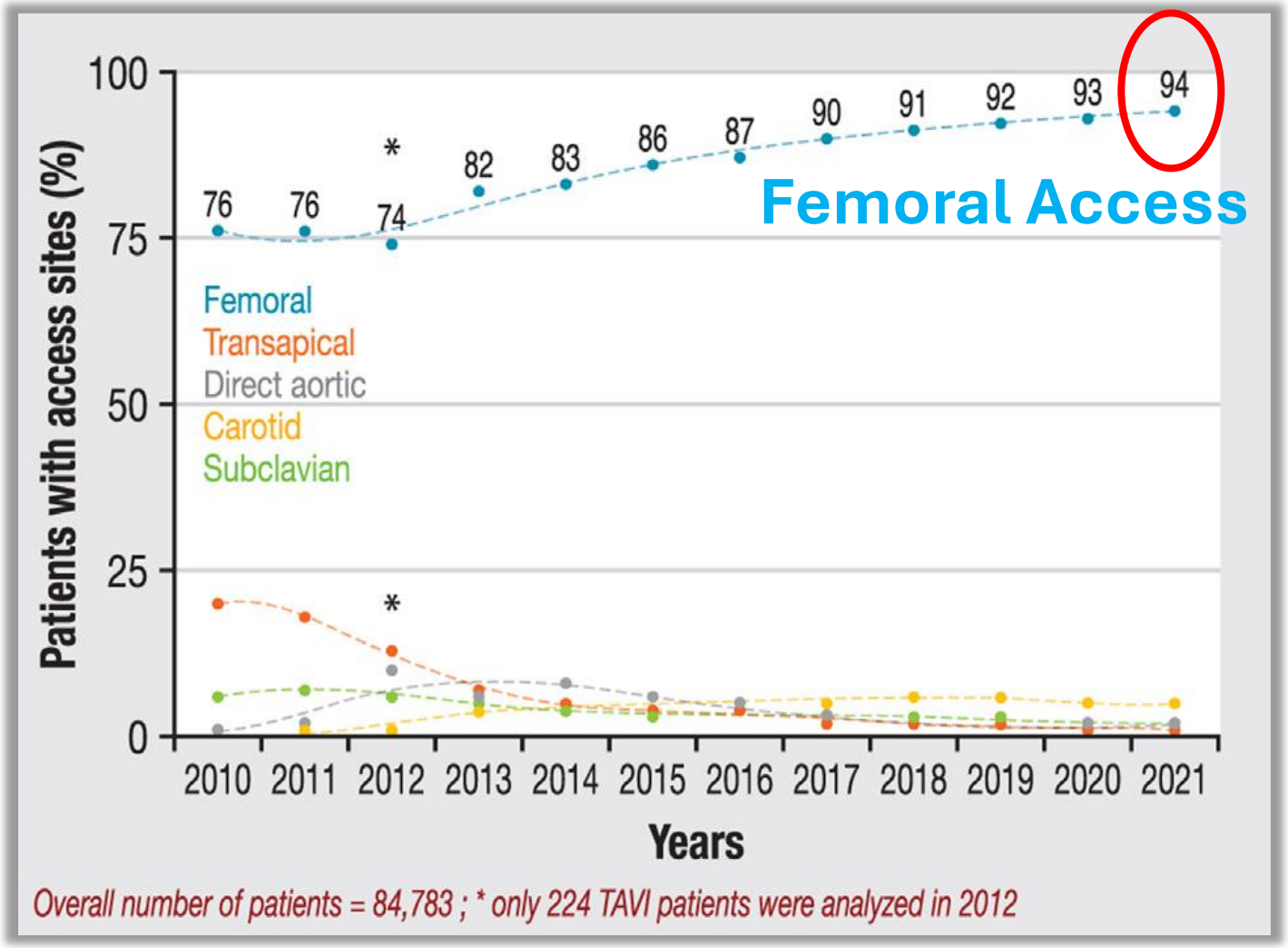
TAVR alternative Access: Evolution and Current Practice





Abdelnour MW et al. Front. Cardiovasc. Med. 2024, 11:1437626

Evolution of TAVI patients and techniques over the past decade: The French TAVI registries

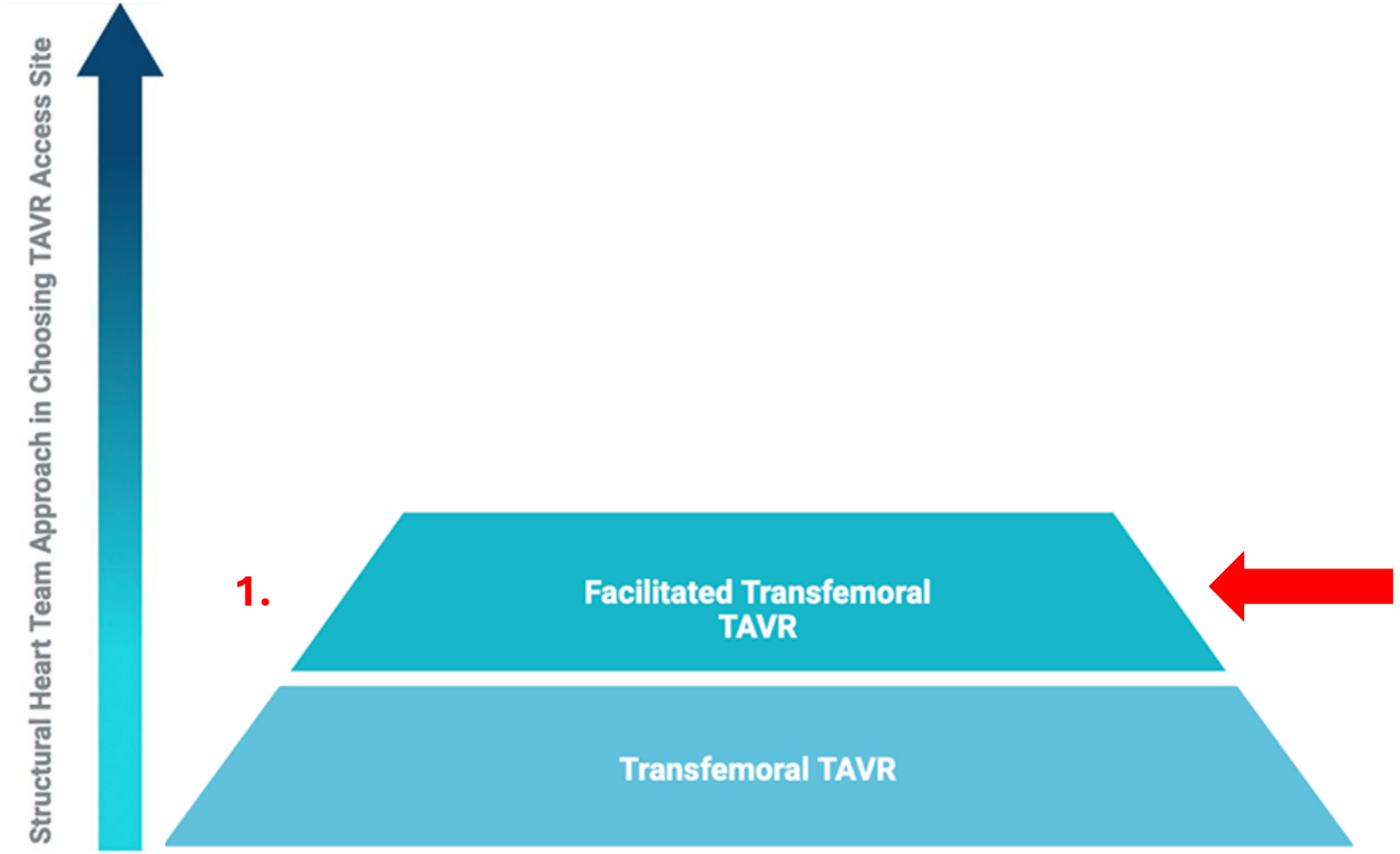


Didier R et al. Archives of Cardiovascular Disease 115 (2022) 206—213

Abords hostiles: quelles options ?

Abdelnour MW et al. Front. Cardiovasc. Med. 2024, 11:1437626

Abords hostiles: quelles options ?



Abdelnour MW et al. Front. Cardiovasc. Med. 2024, 11:1437626

Pourquoi challenger la voie fémorale ?

- ✓ Eviter l'AG
- ✓ Installation plus pratique en salle de KT
- ✓ Moins d'irradiation pour l'opérateur
- ✓ Prothèses TAVI plus adaptées à la voie fémorale
- ✓ **Meilleur pronostic neurologique que les voies non-fémorales (pas de RCT)**

Risque d'AVC post-TAVI selon la voie d'abord

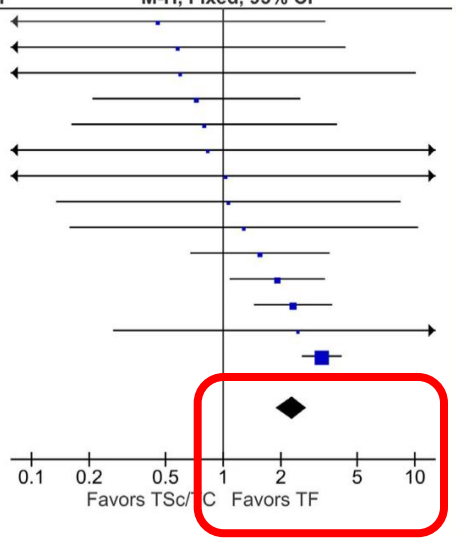
Femoral Vs Subclavian/Carotid Arterial Access Route for TAVR

Systematic Review & Meta-analysis

Studies (n=16)
without propensity-score matching

Study or Subgroup	TSc/TC Events	TSc/TC Total	TF Events	TF Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Watanabe et al. 2018	1	83	17	643	3.8%	0.46 [0.06, 3.38]
Muensterer et al. 2013	1	40	13	301	2.9%	0.58 [0.08, 4.31]
Paone et al. 2018	0	32	9	373	1.5%	0.60 [0.04, 10.02]
Junquera et al. 2020	3	127	13	399	6.1%	0.73 [0.21, 2.50]
van Wely et al. 2018	5	91	2	29	2.9%	0.80 [0.16, 3.89]
Eltchaninoff et al. 2010	0	12	7	161	1.1%	0.83 [0.05, 13.75]
Saia et al. 2013	0	12	2	66	0.8%	1.03 [0.05, 20.25]
Petronio et al. 2010	1	54	8	460	1.6%	1.06 [0.14, 8.35]
Adamo et al. 2015	1	32	6	246	1.3%	1.28 [0.16, 10.30]
Fröhlich et al. 2015	6	188	58	2828	7.0%	1.56 [0.68, 3.56]
Gilard et al. 2012	13	184	87	2361	12.2%	1.92 [1.09, 3.37]
Folliguet et al. 2019	19	435	200	10598	15.3%	2.31 [1.46, 3.67]
Taramasso et al. 2011	1	19	3	140	0.7%	2.46 [0.27, 22.43]
Dahle et al. 2019	74	1249	1049	57889	42.9%	3.27 [2.60, 4.11]
Total (95% CI)		**2558**		**76494**	**100.0%**	**2.28 [1.90, 2.72]**
Total events	125		1474			

Heterogeneity: Chi² = 22.46, df = 13 (P = 0.05); I² = 42%
Test for overall effect: Z = 9.01 (P < 0.00001)

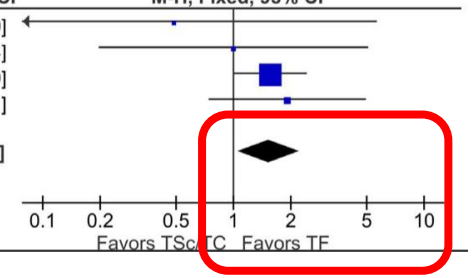


Favor Femoral
RR=2.28

Studies (n=4)
with propensity-score matching

Study or Subgroup	TSc/TC Events	TSc/TC Total	TF Events	TF Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Villecourt et al. 2020	1	40	2	40	4.3%	0.49 [0.04, 5.60]
Petronio et al. 2012	3	141	3	141	6.5%	1.00 [0.20, 5.04]
Beurtheret et al. 2019	54	1613	35	1613	74.7%	1.56 [1.01, 2.40]
Gleason et al. 2017	13	202	7	202	14.5%	1.92 [0.75, 4.91]
Total (95% CI)		**1996**		**1996**	**100.0%**	**1.53 [1.05, 2.22]**
Total events	71		47			

Heterogeneity: Chi² = 1.34, df = 3 (P = 0.72); I² = 0%
Test for overall effect: Z = 2.23 (P = 0.03)



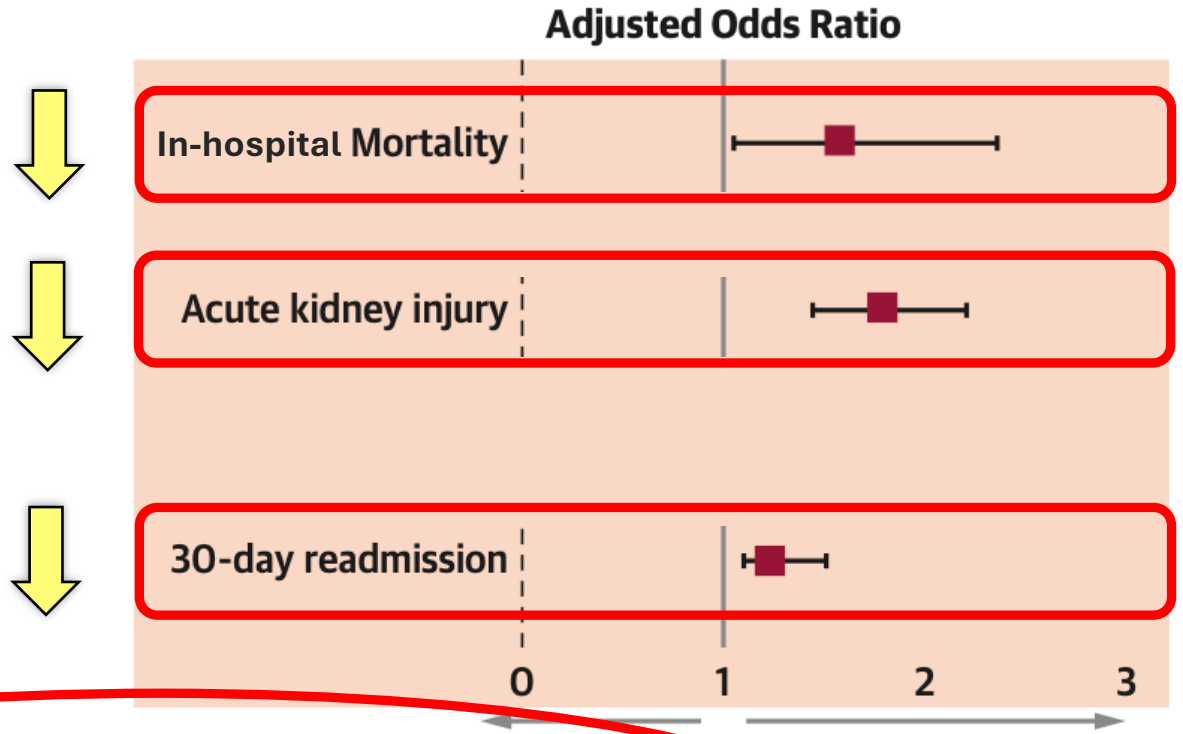
Favor Femoral
OR=1.53

Faroux L et al. J Am Heart Assoc. 2020

Pronostic du TAVI fémoral chez les patients artéritiques ?

US Nationwide Database, 2016-2017

TAVI fémoral + angioplastie périphérique Vs. TAVI non fémoral



TAVI fémoral + angioplastie périphérique
Chez les patients artéritiques (n=2669)

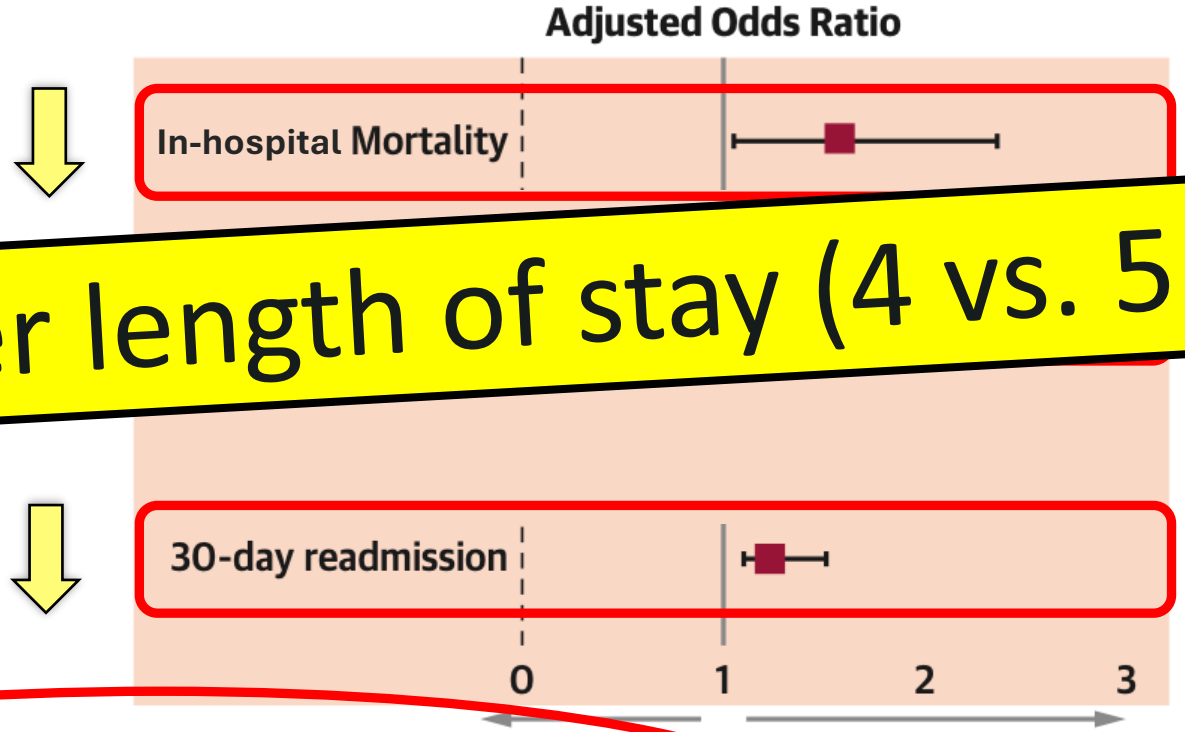
TAVI non fémoral
(n=2538)

Bansal A et al. J Am Coll Cardiol Intv 2021;14:2572–2580

Pronostic du TAVI fémoral chez les patients artéritiques ?

US Nationwide Database, 2016-2017

TAVI fémoral + angioplastie périphérique Vs. TAVI non fémoral



Shorter length of stay (4 vs. 5 days)

TAVI fémoral + angioplastie périphérique Chez les patients artéritiques (n=2669)

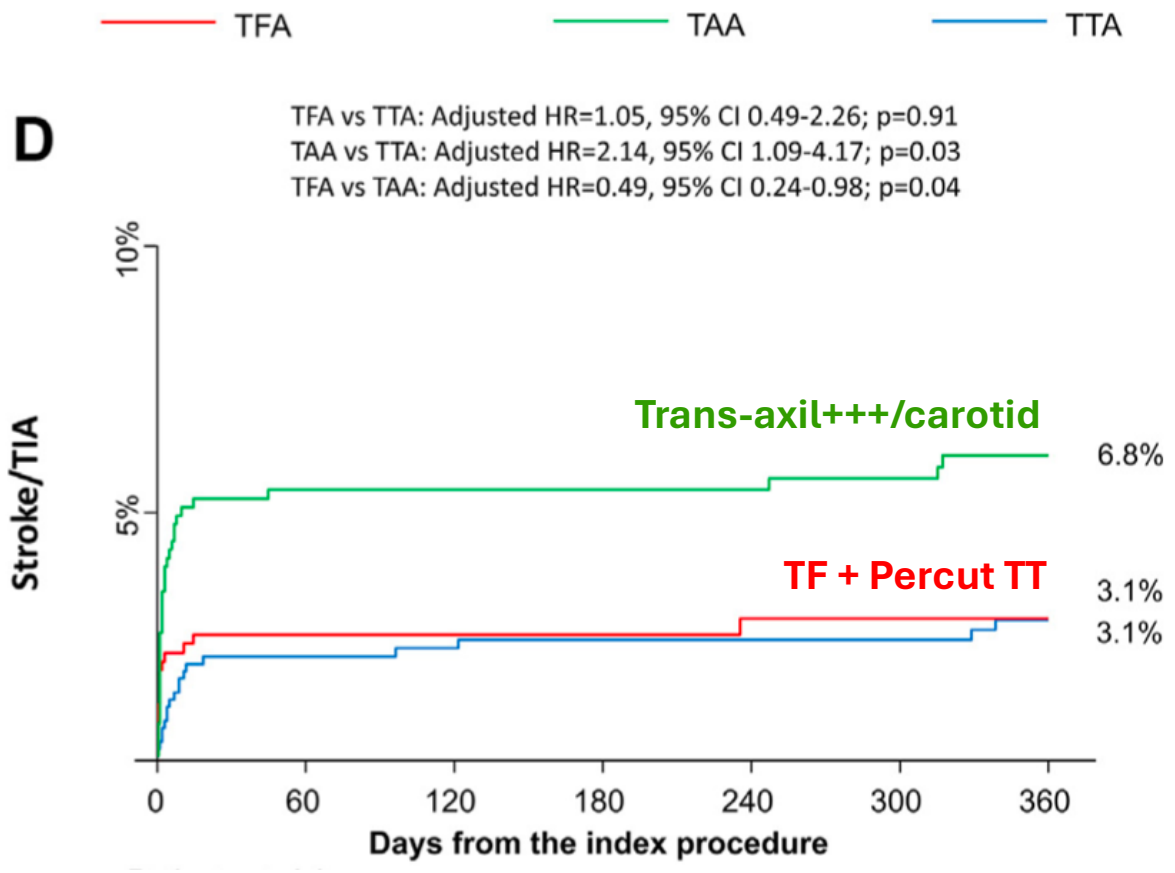
TAVI non fémoral (n=2538)

Bansal A et al. J Am Coll Cardiol Intv 2021;14:2572–2580

TAVR in patients with PAD: The Hostile registry

Patients (n=1707) with PAD and hostile femoral access undergoing TAVR

(TFA impossible, or possible only after percutaneous treatment)

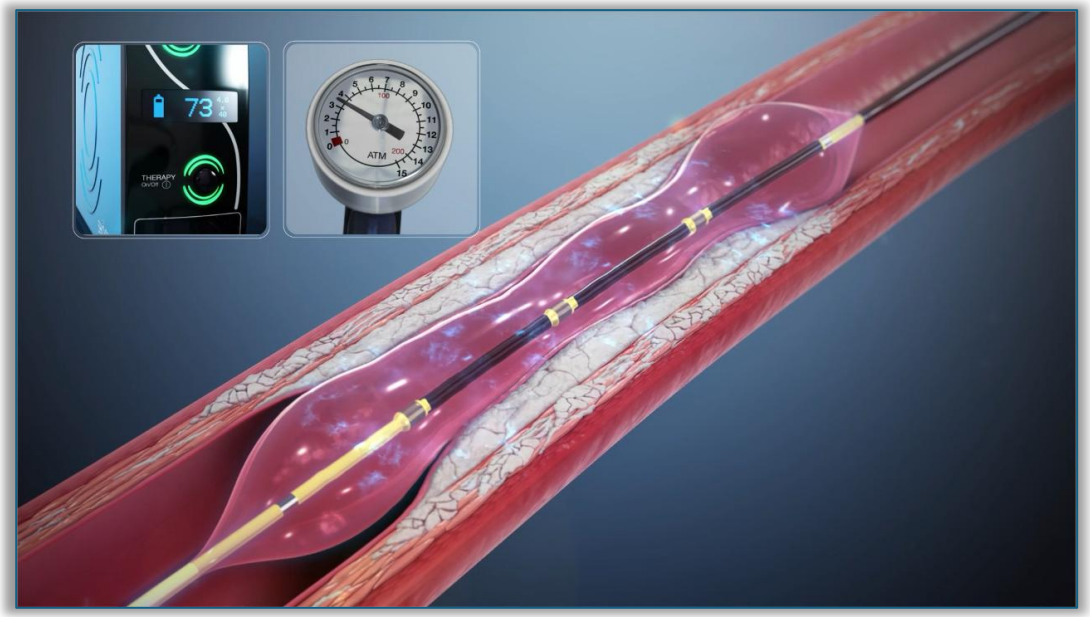


Palmerini T et al. J Am Coll Cardiol Intv 2023;16:396–411.

Pourquoi challenger la voie fémorale ?

Outils permettant de le faire en sécurité

Ballon de Lithotripsie Intra-vasculaire



Transformation d’une énergie électrique en énergie mécanique

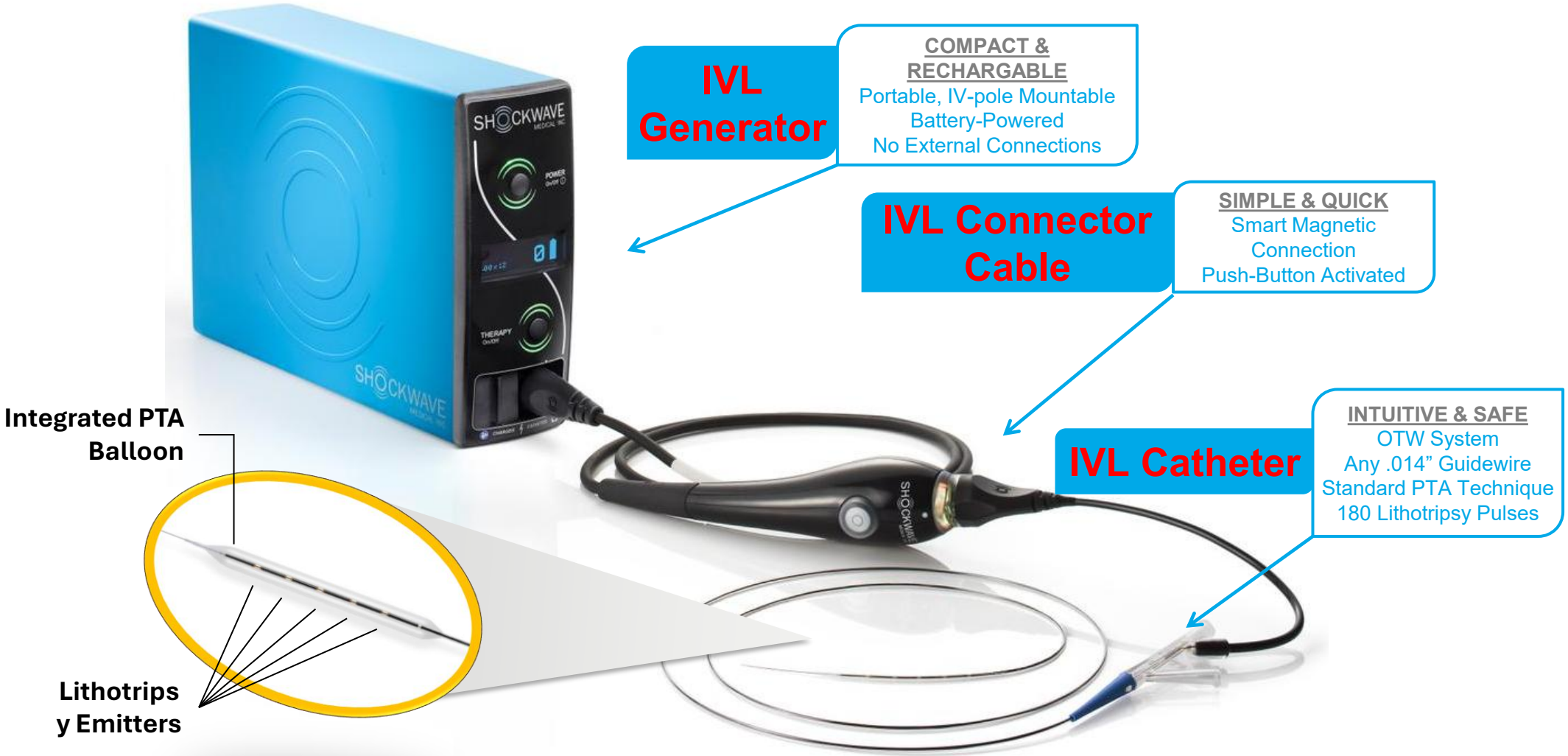
Modification architecturale de la plaque calcifiée:

- Micro-fractures calcaires
- Amélioration de la compliance du vaisseau
- Pas de lésion vasculaire
- Pas d’embolisation

SHOCKWAVE | M5

DIAMETER (mm)	LENGTH (mm)	Max Pulse Count	GUIDEWIRE COMPATIBILITY (in)	SHEATH COMPATIBILITY	WORKING LENGTH (cm)
3.5-6.0	60	300	0.014	6F	110
6.5-7.0	60	300	0.014	7F	110

Shockwave IVL System Components



- The Shockwave IVL System consists of an IV pole-mountable generator, a connector cable, and a catheter that houses an array of lithotripsy emitters enclosed in an integrated balloon.

CARDIOVASCULAR FLASHLIGHT

doi:10.1093/eurheartj/ehy021

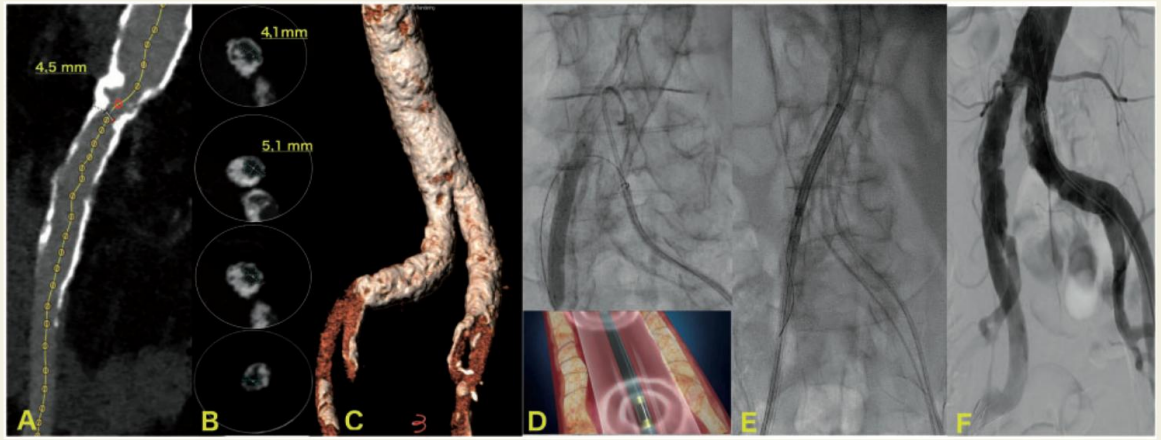
Lithotripsy-assisted transfemoral aortic valve implantation

Carlo Di Mario, Niccolò Chiriatti*, Miroslava Stolcova, Francesco Meucci, and Giovanni Squillantini

Division of Structural Interventional Cardiology, Careggi University Hospital, Florence, Italy

* Corresponding author. Tel: +393497067128, Email: niccochiriatti@hotmail.com

An 85-year-old man with previous left anterior descending and left circumflex stenting and low left ventricular ejection fraction (35%) developed acute pulmonary oedema because of severe aortic valve stenosis (0.7 cm^2). Computed tomography showed bilateral calcific atheromas of both external iliac arteries with circumferential thick calcium plates restricting the lumen diameter to 4.1 mm. The case was refused for surgery and initially discarded for transfemoral aortic valve implantation (TAVI) because of poor vascular access. After a new episode of pulmonary oedema refractory to medical treatment and requiring ultrafiltration, a transfemoral TAVI was attempted. The calcified stenosis of the right external iliac artery was dilated with a 7.0 mm lithotripsy balloon (Shockwave Medical, CA, USA). After six lithotripsy runs, there was good balloon expansion at low pressure (4–6 atm). Gentle twist and push over a Confida wire drove the 18 Fr delivery system of a 29 mm Evolut-R Medtronic valve through the narrowest segment of the iliac artery. After valve deployment half a diamond below the aortic



annulus, there was trivial aortic regurgitation with no ruptures or dissections at the access site. *Panel A*: Computed tomography longitudinal image of the severely calcified right external iliac. *Panel B*: Multiple cross-sections with near circumferential calcification and thick protruding nodules. *Panel C*: 3D image of the iliac bifurcation showing severe tortuosity and calcification of both iliac arteries. *Panel D*: Shockwaves delivered via a 7 mm lithotripsy balloon inflated at 4 atm. *Panel E*: 18 Fr delivery system of the Evolut-R Corevalve across the calcified segment. *Panel F*: Final aortogram with no dissection or extravasation.

Di Mario C, Eur Heart J 2018

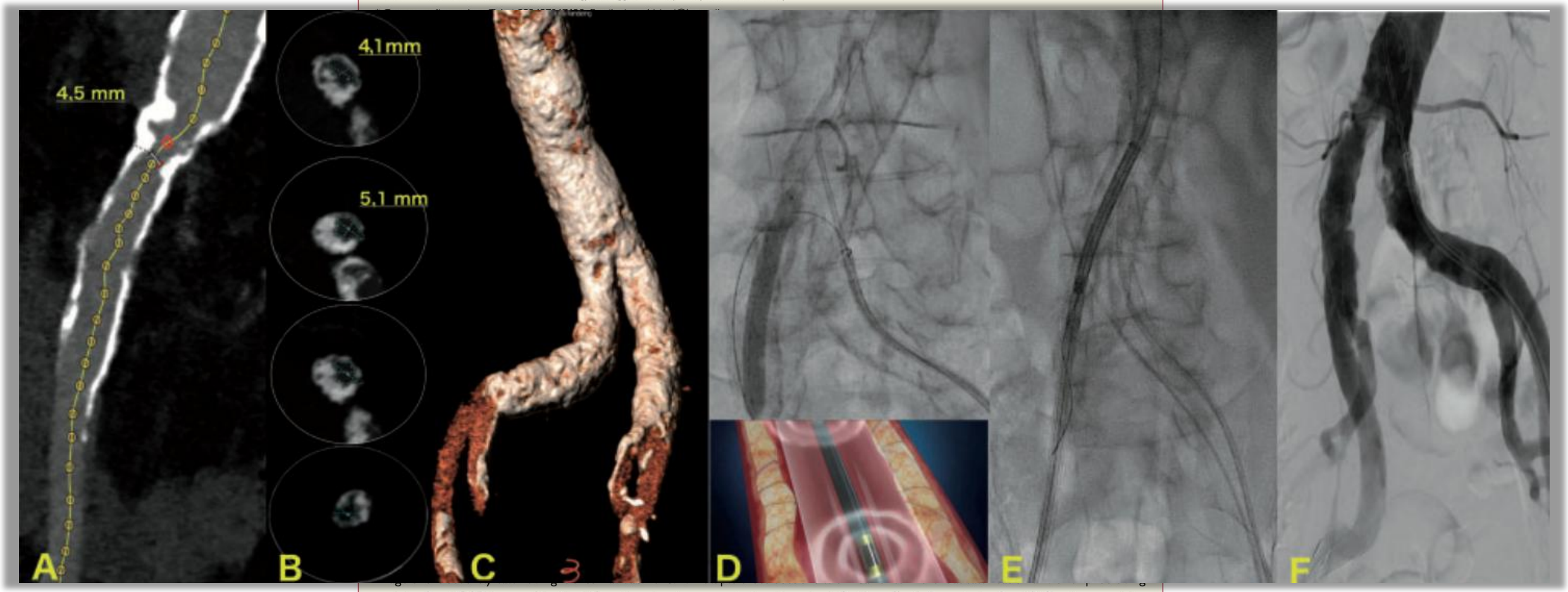
CARDIOVASCULAR FLASHLIGHT

doi:10.1093/eurheartj/ehy021

Lithotripsy-assisted transfemoral aortic valve implantation

Carlo Di Mario, Niccolò Chiriatti*, Miroslava Stolcova, Francesco Meucci, and Giovanni Squillantini

Division of Structural Interventional Cardiology, Careggi University Hospital, Florence, Italy



nodules. *Panel C*: 3D image of the iliac bifurcation showing severe tortuosity and calcification of both iliac arteries. *Panel D*: Shockwaves delivered via a 7 mm lithotripsy balloon inflated at 4 atm. *Panel E*: 18 Fr delivery system of the Evolut-R Corevalve across the calcified segment. *Panel F*: Final aortogram with no dissection or extravasation.

Di Mario C, Eur Heart J 2018

Peripheral intravascular lithotripsy of iliofemoral arteries to facilitate transfemoral TAVI: a multicentre prospective registry

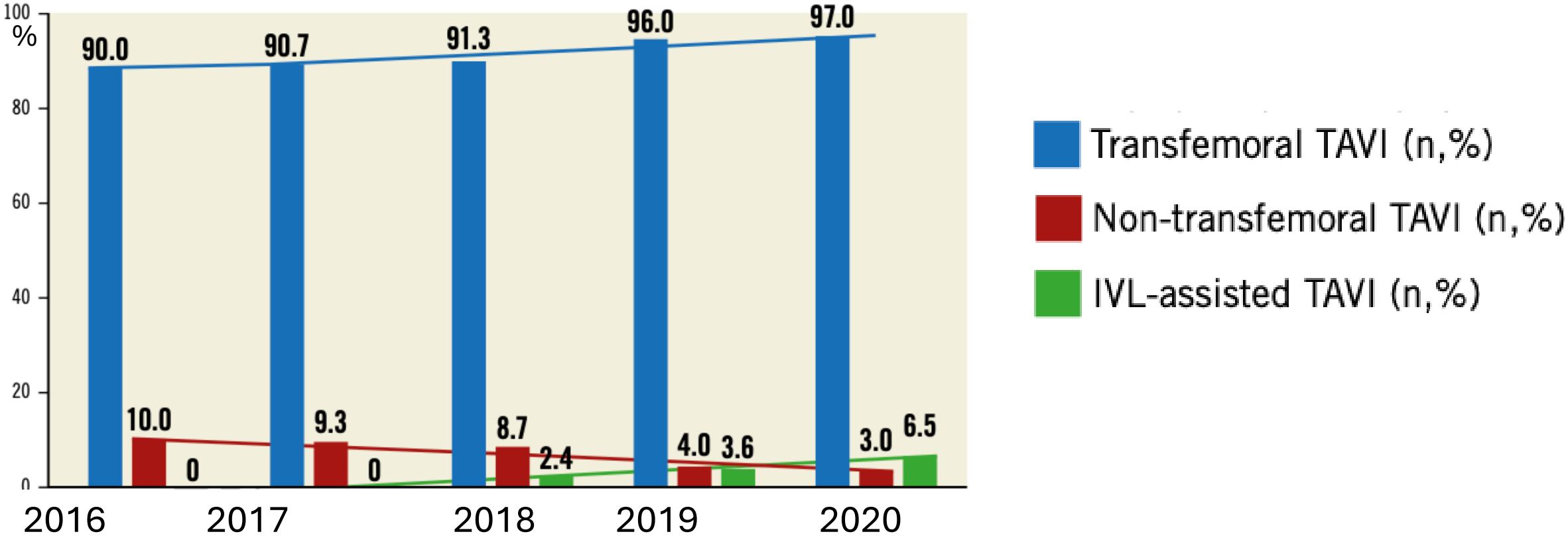
N=108 pts (2018-2020)
> 90% Iliaques Externes et/ou primitives
Diam. min= 4.6±0.9 mm; 318° of calcium arc
Succès de délivrance du TAVI: 100%

IVL-related vascular complications	
Perforation, n (%)	1 (0.9%)
Rupture, n (%)	0 (0.0%)
Minor dissection (type A-B-C), n (%)	4 (3.7%)
Major dissection (type D-E-F), n (%)	3 (2.8%)
Covered stent, n (%)	2 (1.8%)
Bare metal stent, n (%)	3 (2.8%)

Access-site-related complications	
Vessel perforation, n (%)	0 (0.0%)
Rupture, n (%)	1 (0.9%)
Dissection type, n (%)	2 (1.8%)
Stenosis, n (%)	3 (2.8%)
Distal embolisation, n (%)	0 (0.0%)
Closure device failure, n (%)	6 (5.9%)
Bleeding <BARC3a, n (%)	21 (19.4%)
Bleeding >BARC type 3b, n (%)	3 (2.8%)
Unplanned endovascular intervention (balloon dilatation or covered stent implantation)	13 (12.0%)
Balloon dilatation, n (%)	4 (3.7%)
Covered stent, n (%)	10 (9.3%)
Bare metal stent, n (%)	1 (0.9%)

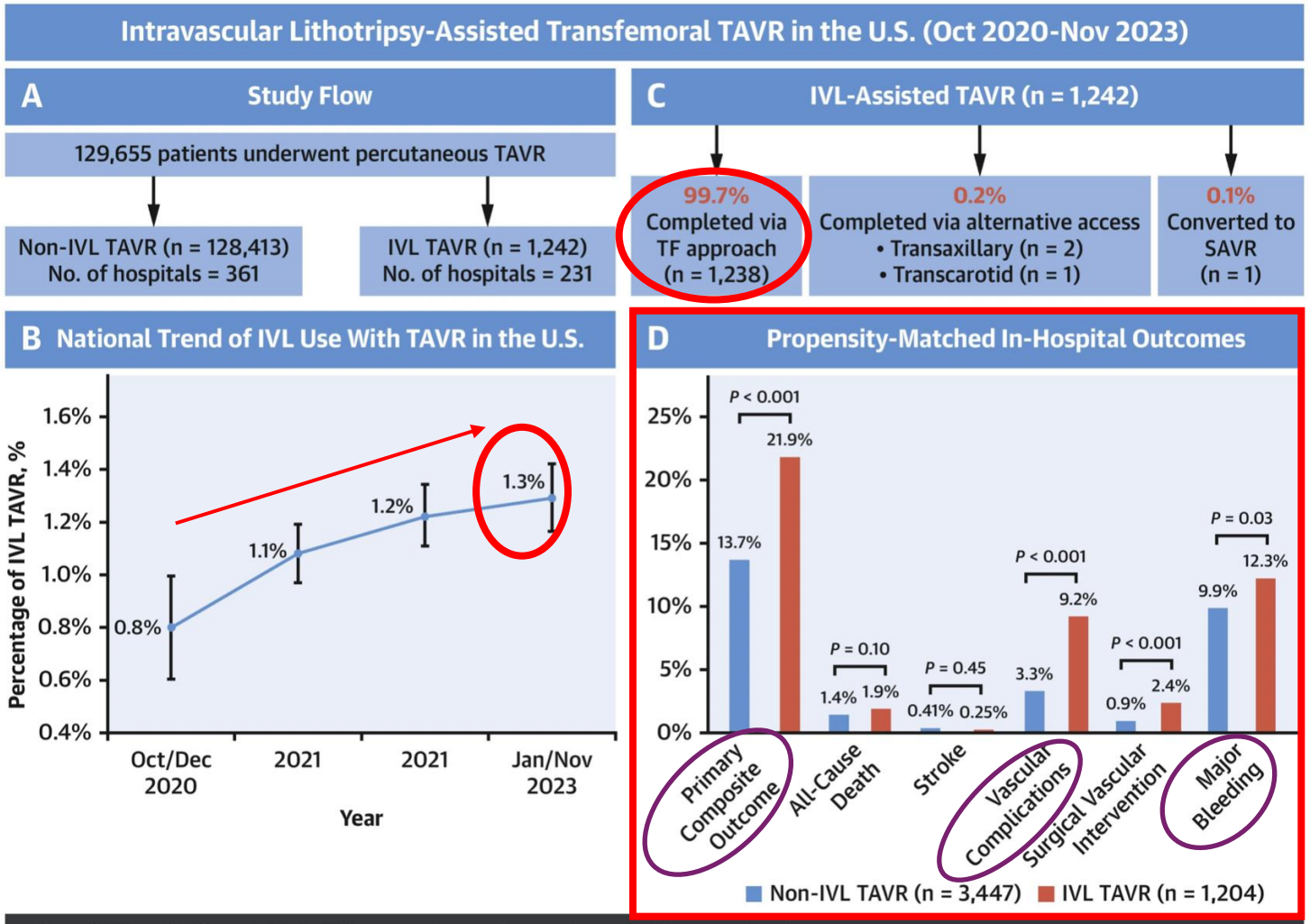
Nardi G et al. EuroIntervention 2022 17:e1397-e1406

Peripheral intravascular lithotripsy of iliofemoral arteries to facilitate transfemoral TAVI: a multicentre prospective registry



Nardi G et al. EuroIntervention 2022 17:e1397-e1406

CENTRAL ILLUSTRATION: Trends and Outcomes of Intravascular Lithotripsy-Assisted Transfemoral Transcatheter Aortic Valve Replacement in the United States

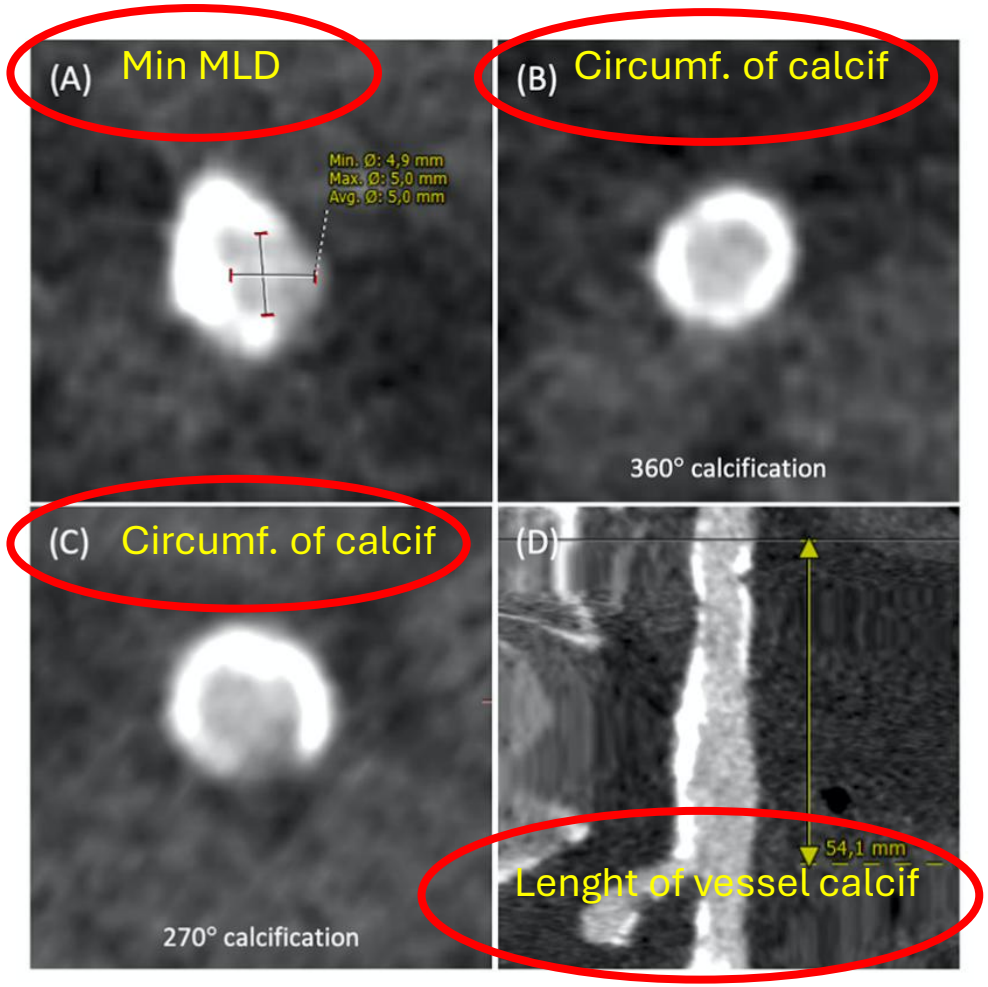


- Use of IVL to facilitate TF-TAVR increased over the study period but remains low
- TAVR was completed via a TF approach in 1,238 (99.7%) IVL TAVR patients
- IVL TAVR is associated with a higher primary composite outcome rate compared with non-IVL TAVR ($P < 0.001$), driven by higher rates of vascular complications, surgical vascular intervention, and major bleeding

Imran HM, et al. JACC Cardiovasc Interv. 2024;17(20):2367-2376.

Comment sélectionner les patients ?

Algorithme de Copenhague



Shockwave-facilitated TF-TAVR is considered in case of:

For calcified stenosis < 20 mm lenght:

- 100% calcified circumference with minimun diameter ≥ 4mm
- 75% calcified circumference with minimun diameter ≥ 3mm

For more diffuse calcified stenosis > 20 mm lenght:

- 100% calcified circumference with minimun diameter ≥ 4.5mm
- 75% calcified circumference with minimun diameter ≥ 3.5mm

Sawaya FJ et al. Front Cardiovasc Med. 2021

IVL en pratique

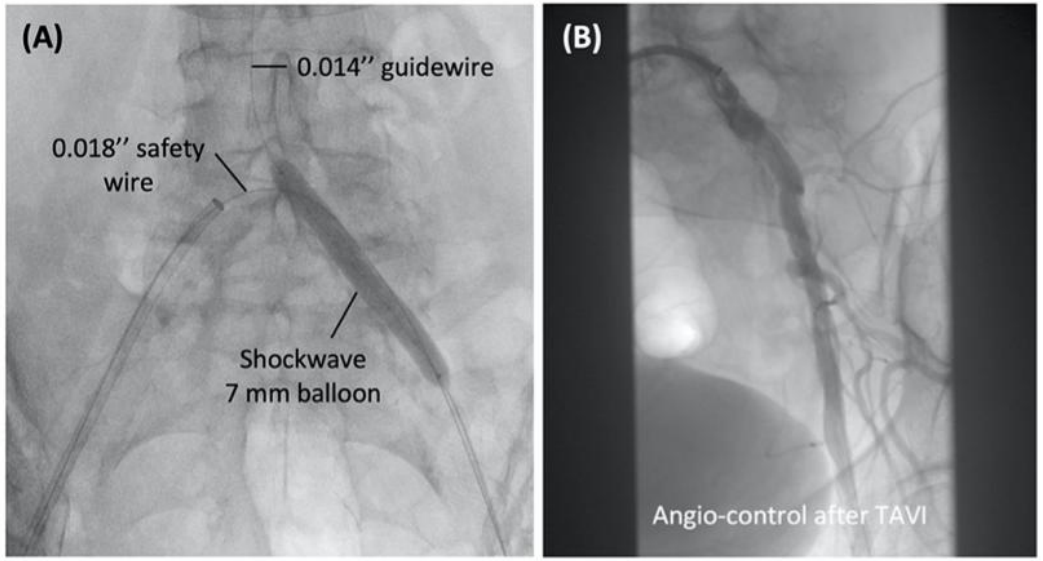


FIGURE 4 | Step-by-step guide. **(A)** Treatment of a stenotic calcified common iliac artery with a 7 mm Shockwave IVL catheter. The use of a contralateral or ipsilateral 0.018" safety wire is strongly recommended. **(B)** Angiographic control with contrast injection is recommended after withdrawal of the large bore introducer sheath and vascular closure. IVL, intravascular lithotripsy; TAVI, transcatheter aortic valve implantation; TF, transfemoral.

IVL-assisted TF-TAVI – Step-by-step instructions

(1) Arterial puncture + skin incision
(2) Insert a **7F sheath**
(3) Deploy 2x ProGlide vascular closure device(s)
(4) Re-insert a 7F sheath
(5) Introduction of **0.014" guidewire** (e.g., Extra Support coronary wire) V14 300cm
(6) Prepare Shockwave balloon with 50%/50% saline/contrast solution and ensure balloon is free of air bubbles!
(7) OTW insertion of **Shockwave M5 catheter** Ballon M5 7mm
(8) Use marker bands to align with lesion

(9) **Inflation** of Shockwave balloon to **4 atm**
(10) Apply one **cycle of 30 IVL pulses**
(11) **Increase inflation** of Shockwave balloon to **6 atm**
(12) **Deflation** of the Shockwave balloon

Repeat
Max. 10 cycles

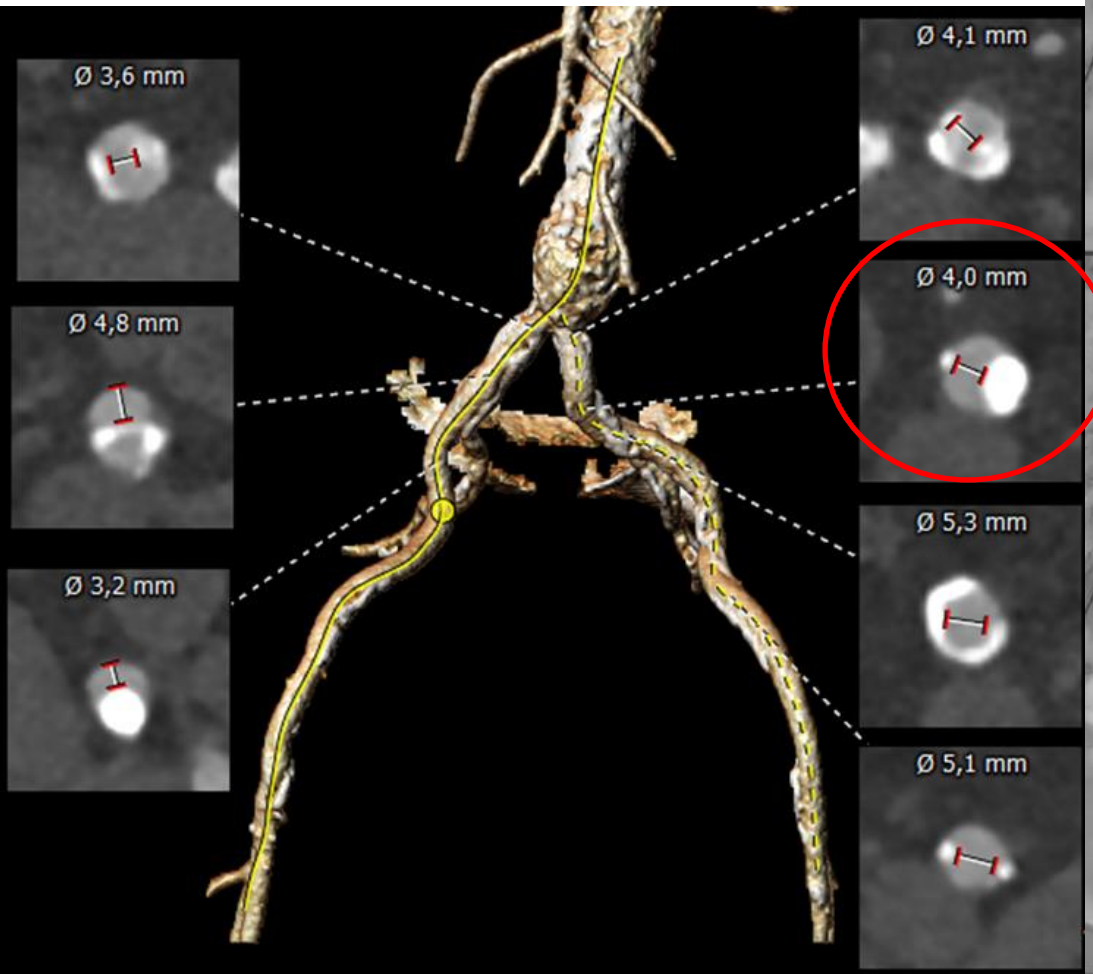
(13) Remove the Shockwave M5 catheter
(14) Exchange the 0.014'' guidewire for a **stiff guidewire** 0,035 stiff type back-up meier
(15) Additional PTA with a **non-compliant balloon**, if needed Ballons NC de 6, 7 ou 8 mm (Mustang, Charger, Z-Med)
(16) Insert the **large bore TAVI introducer sheath**

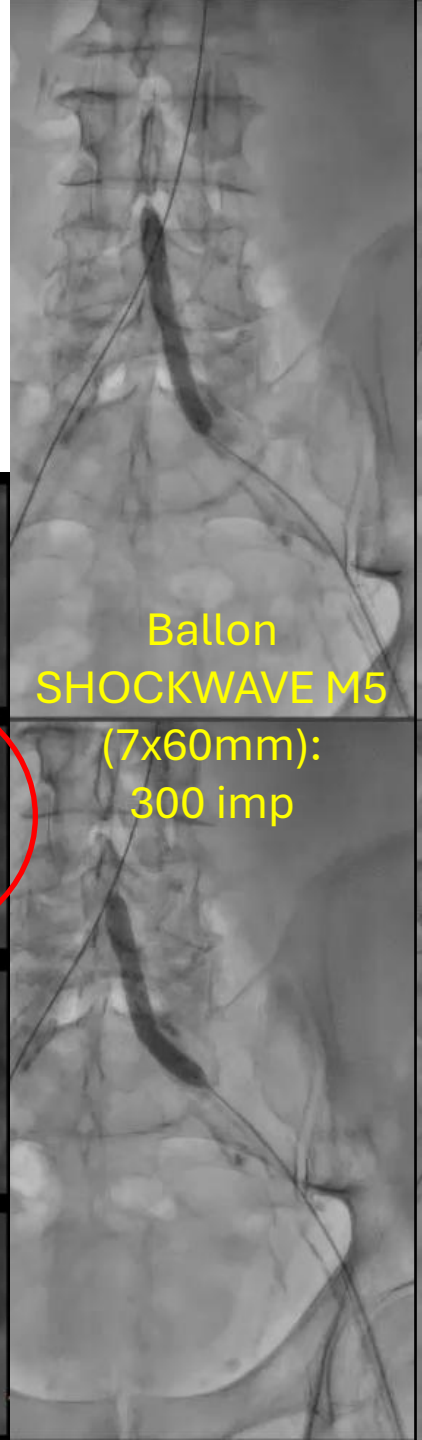
IVL, intravascular lithotripsy; OTW, over-the-wire; PTA, percutaneous transluminal angioplasty; TAVI, transcatheter aortic valve implantation; TF, transfemoral.

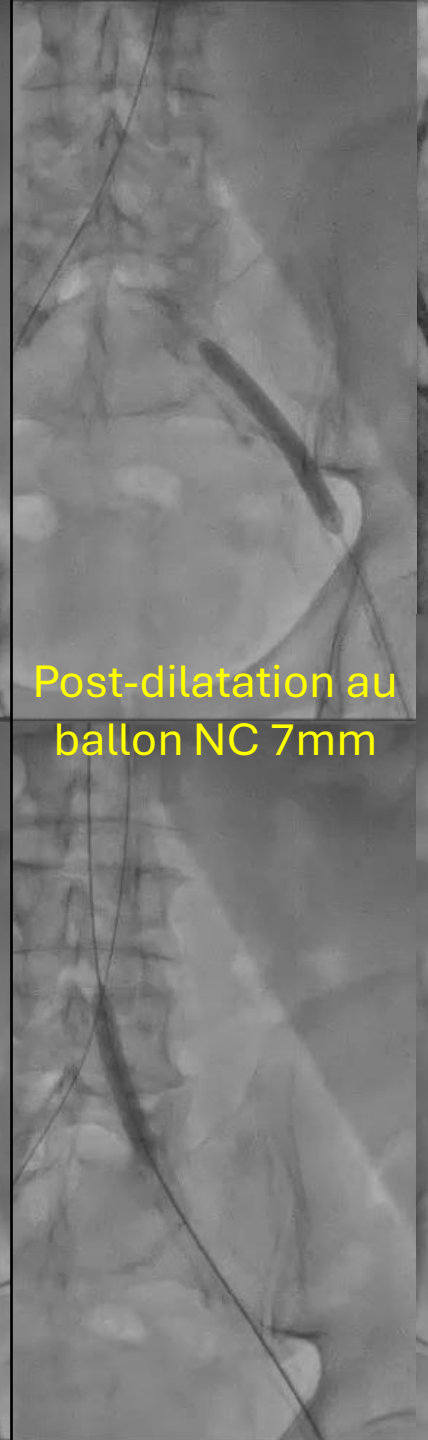
Sawaya FJ et al. Front Cardiovasc Med. 2021

Patient #1: Facilited TF-TAVR

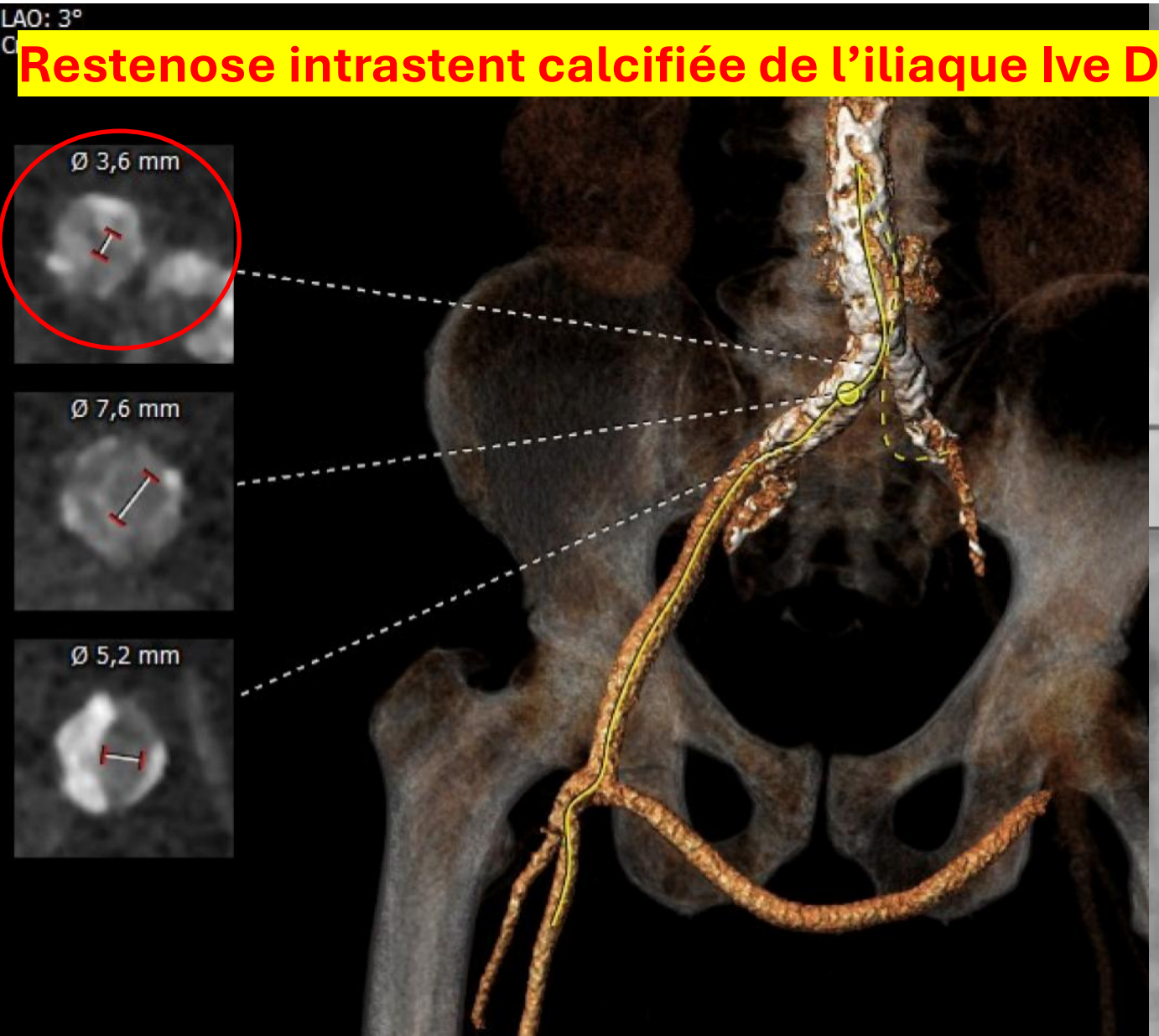
Voie principale Fem G 16F (2 Proglides)
Voie secondaire Fem D 6F
Ballon SHOCKWAVE M5 (7x60mm): 300 imp
Post-dilatation au ballon NC 7mm
Evolut R 34

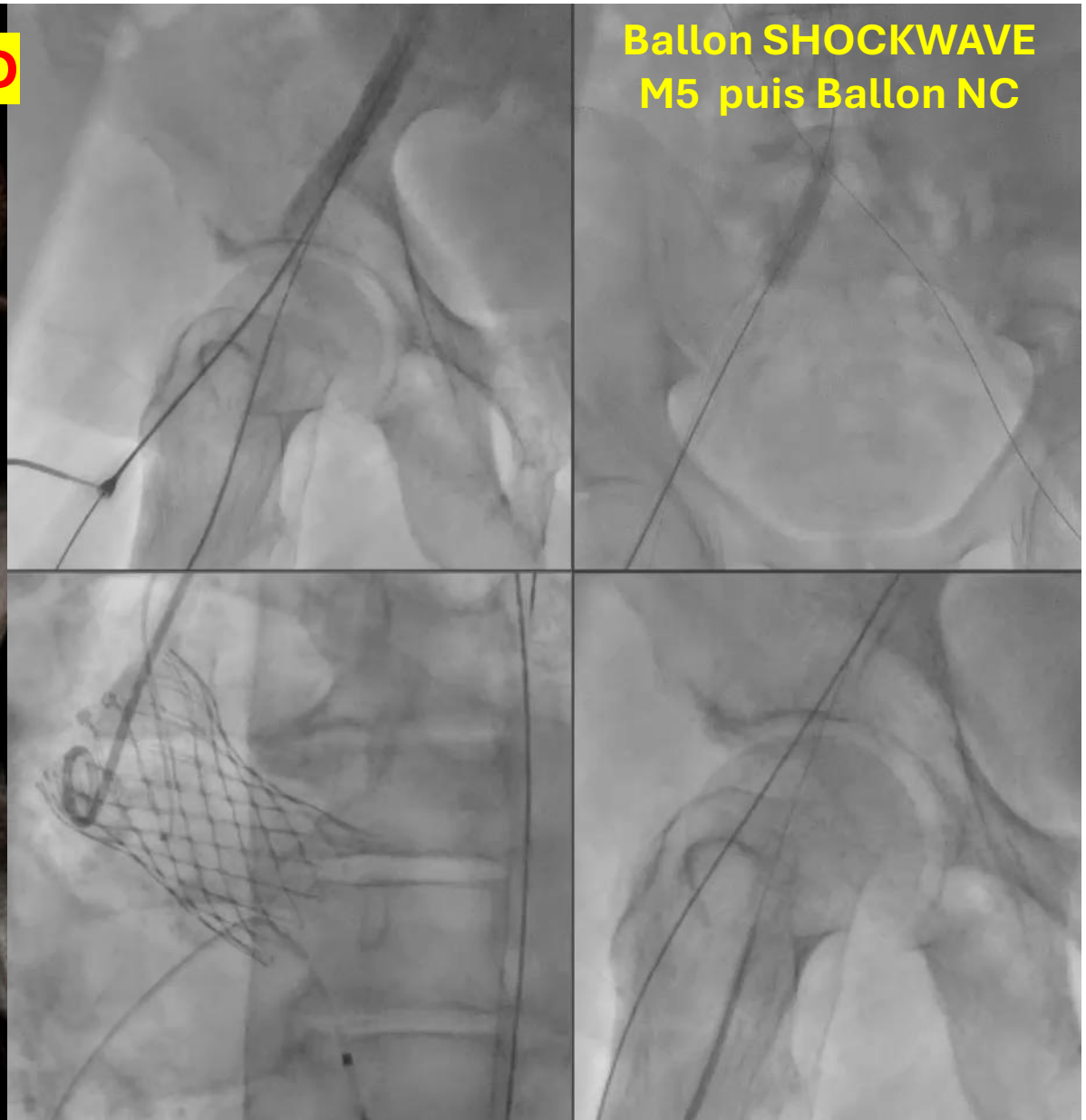






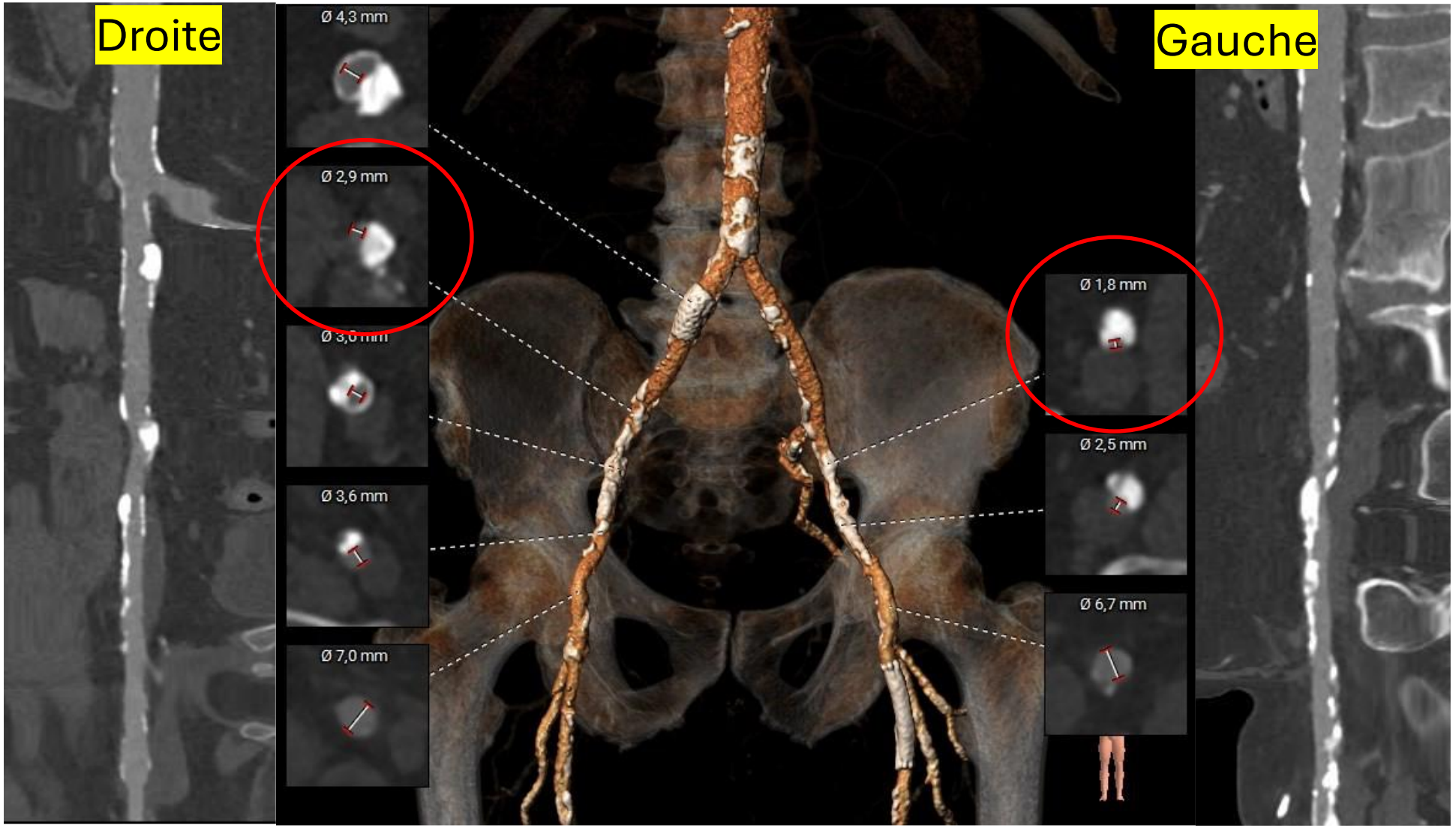
Patient #2: Shockwave-assisted TF TAVI





Patient #3

CT Scan: Voie basse

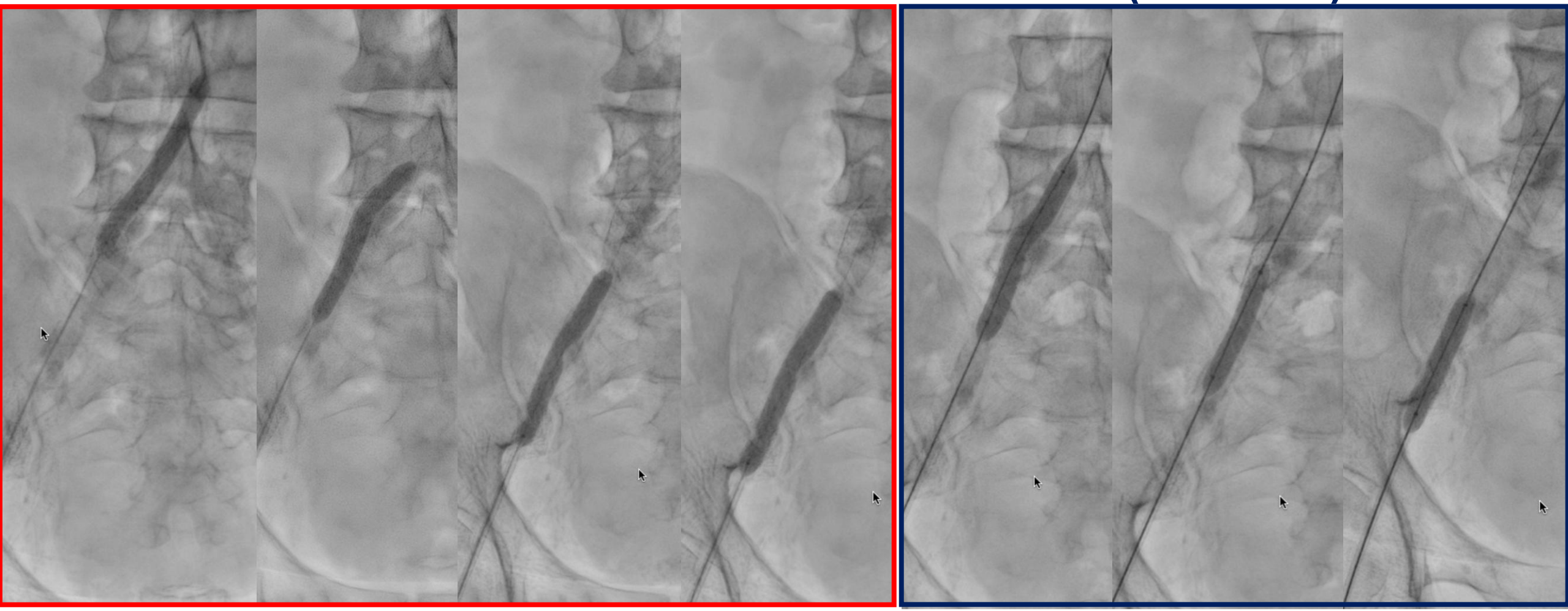


Patient #3

Procédure (1)

Angioplastie Ballon Shockwave (8 et 7mm) – 300 impulsions

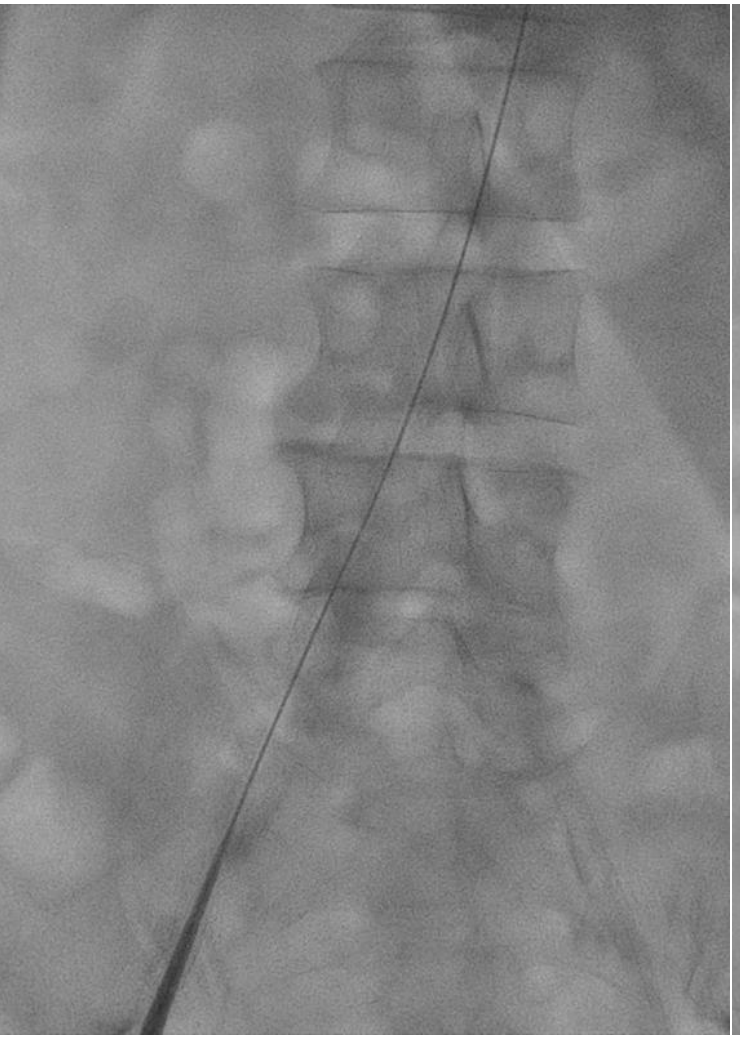
Angioplastie ballon NC (8 et 7mm)



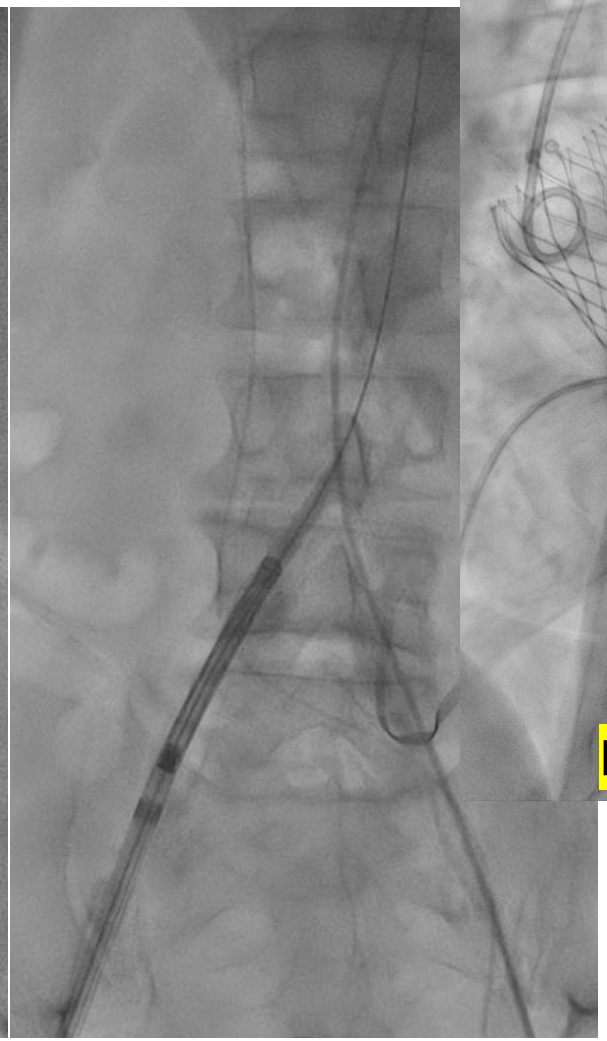
Patient #3

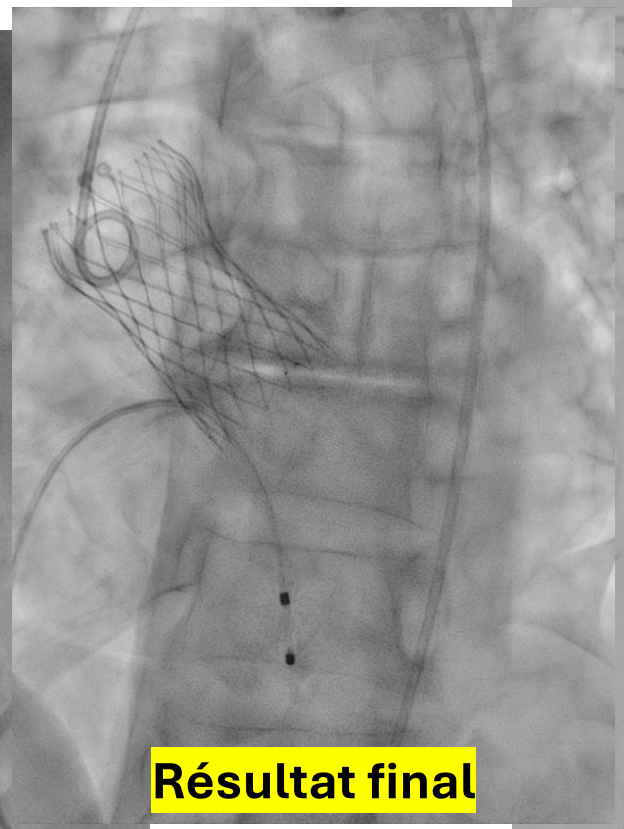
Procédure (2)

Dilatateur long 16 puis

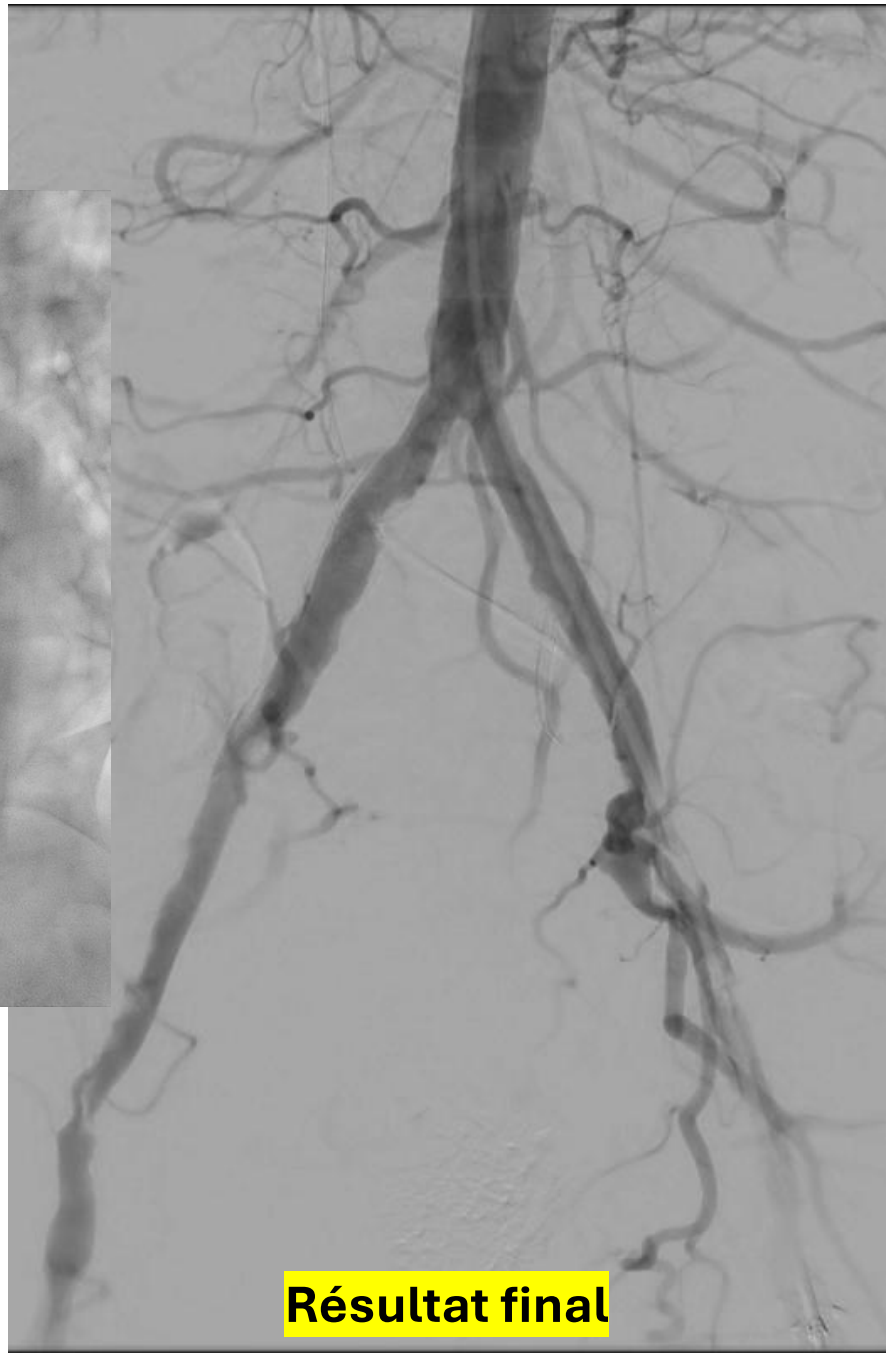


CDS Evolut FX 29





Résultat final

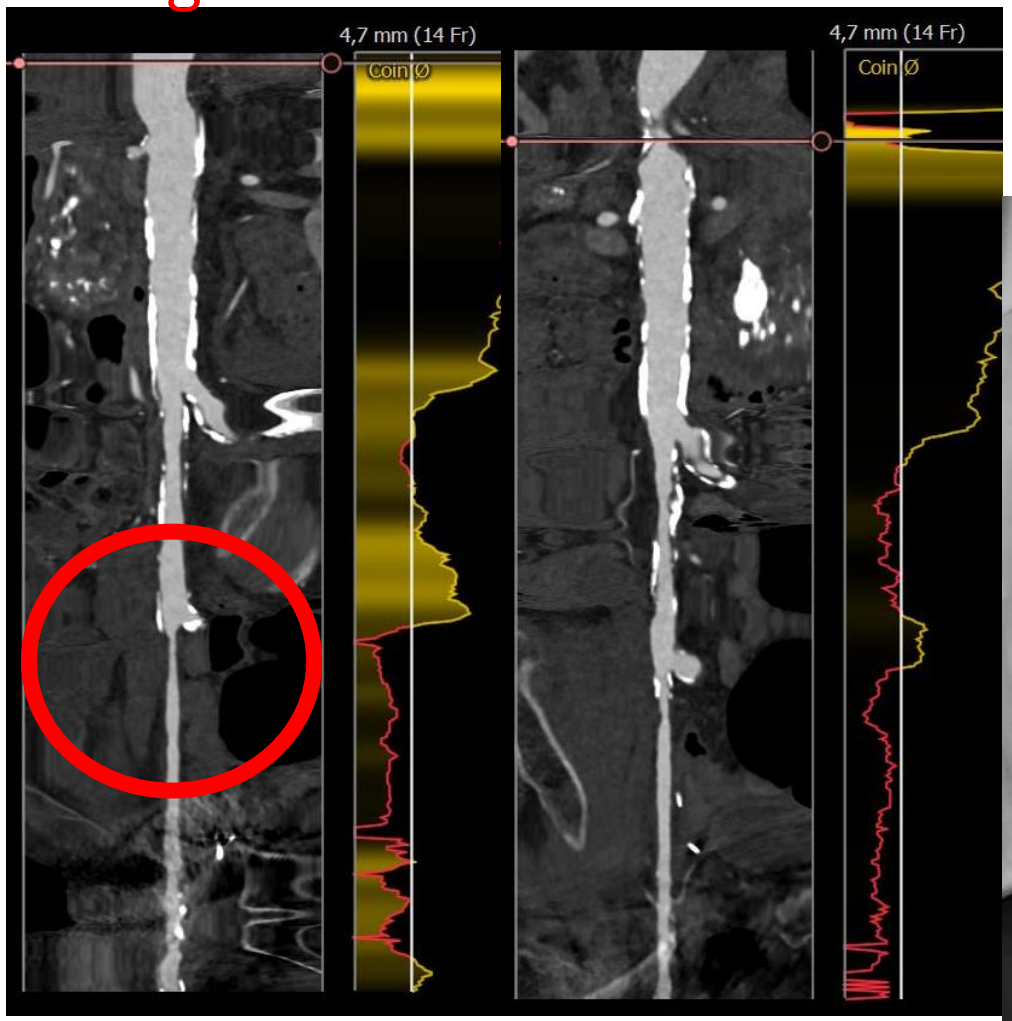


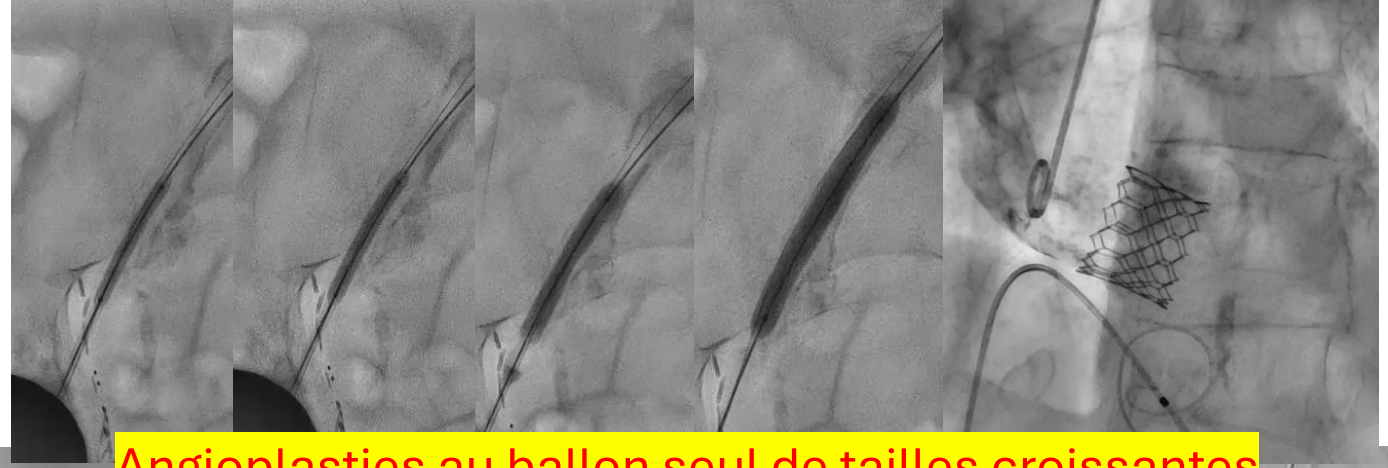
Résultat final

Patient #4: Facilited TF-TAVR

Right

Left





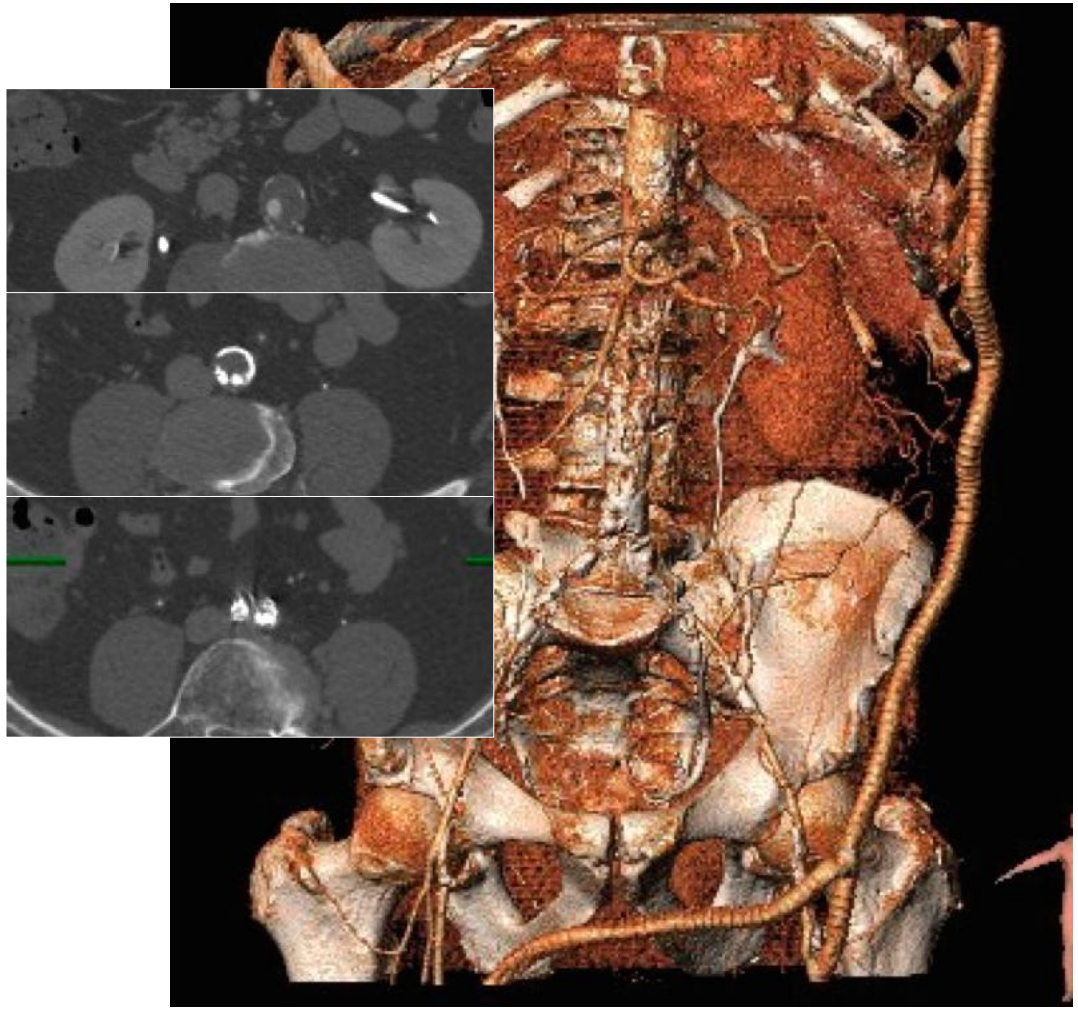
Angioplasties au ballon seul de tailles croissantes

Avant

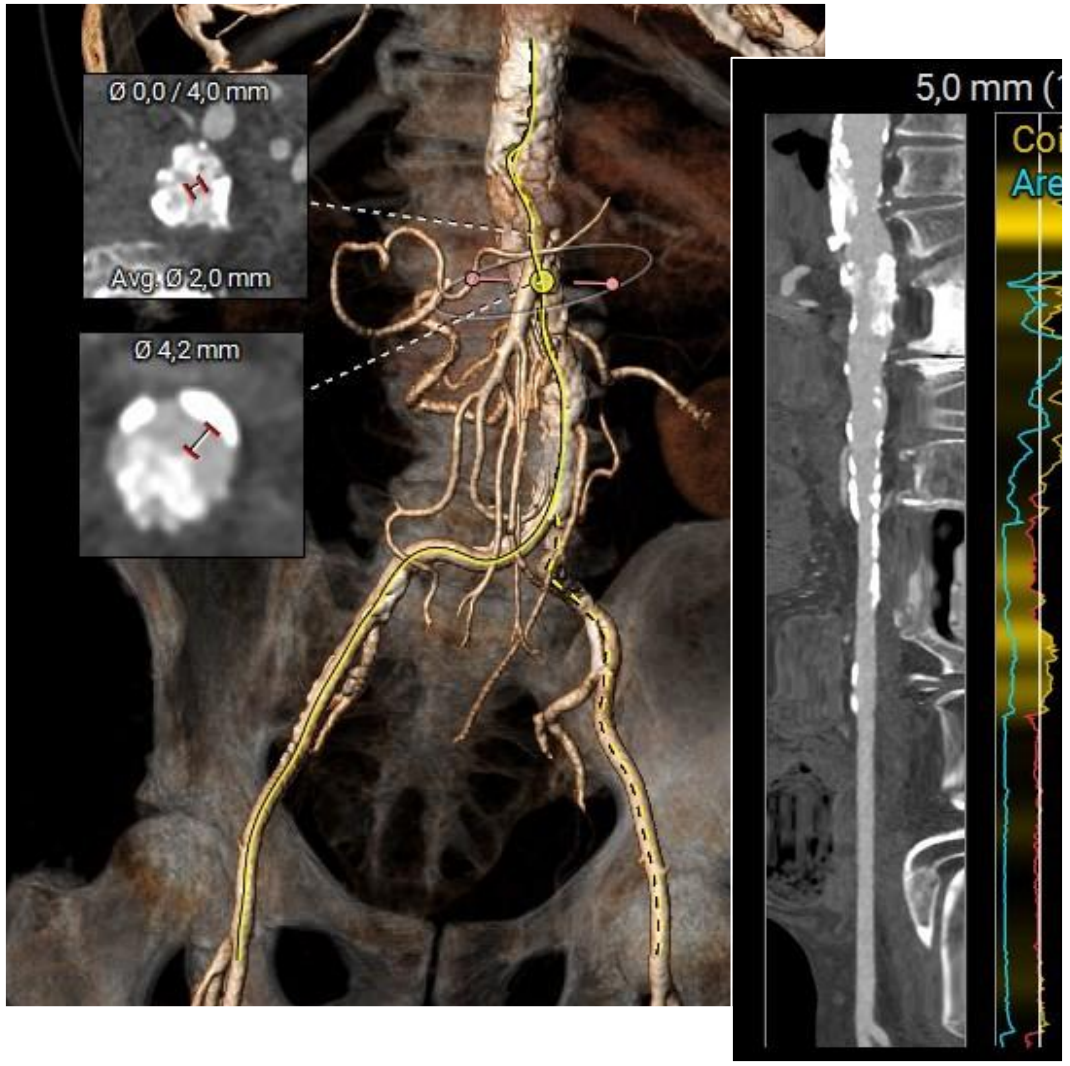
Après

Abords hostiles: Multiples phénotypes

Patient #5



Patient #6



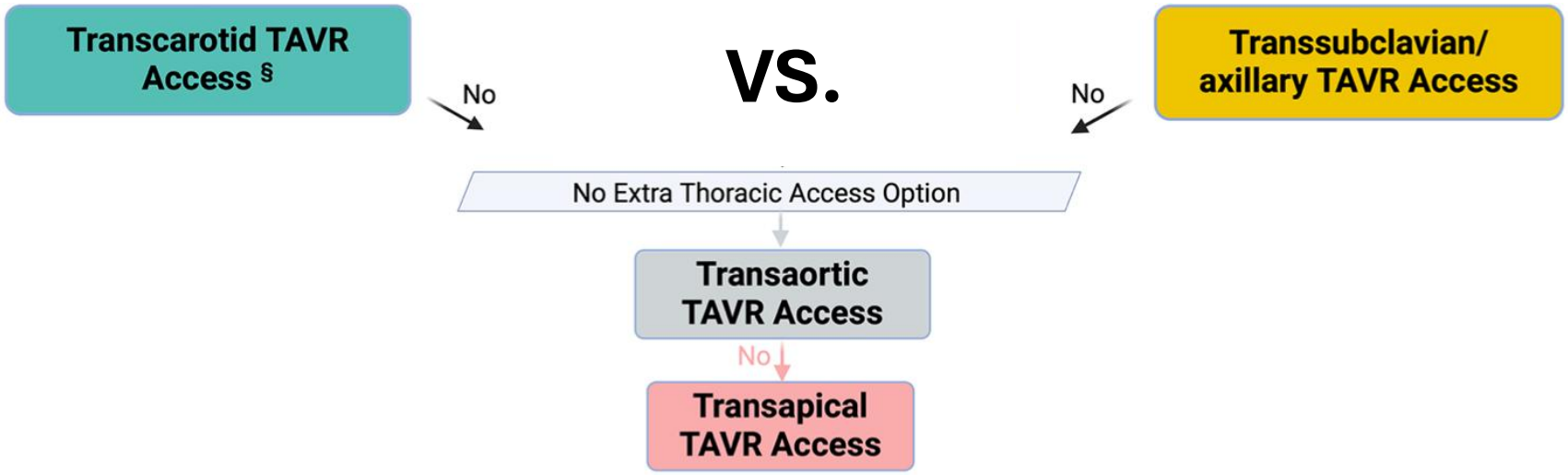
Anatomies et abords hostiles: quelles options ?

~~Facilitated Transfemoral TAVR Access *~~

Based on institutional Preference:

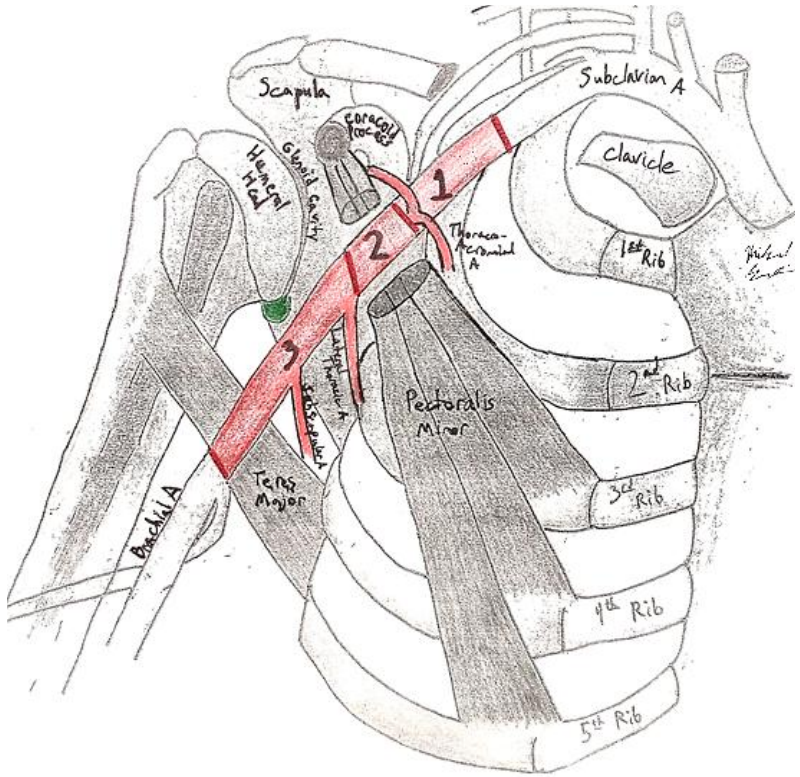
Patients anatomical assessment & Heart Team discussion

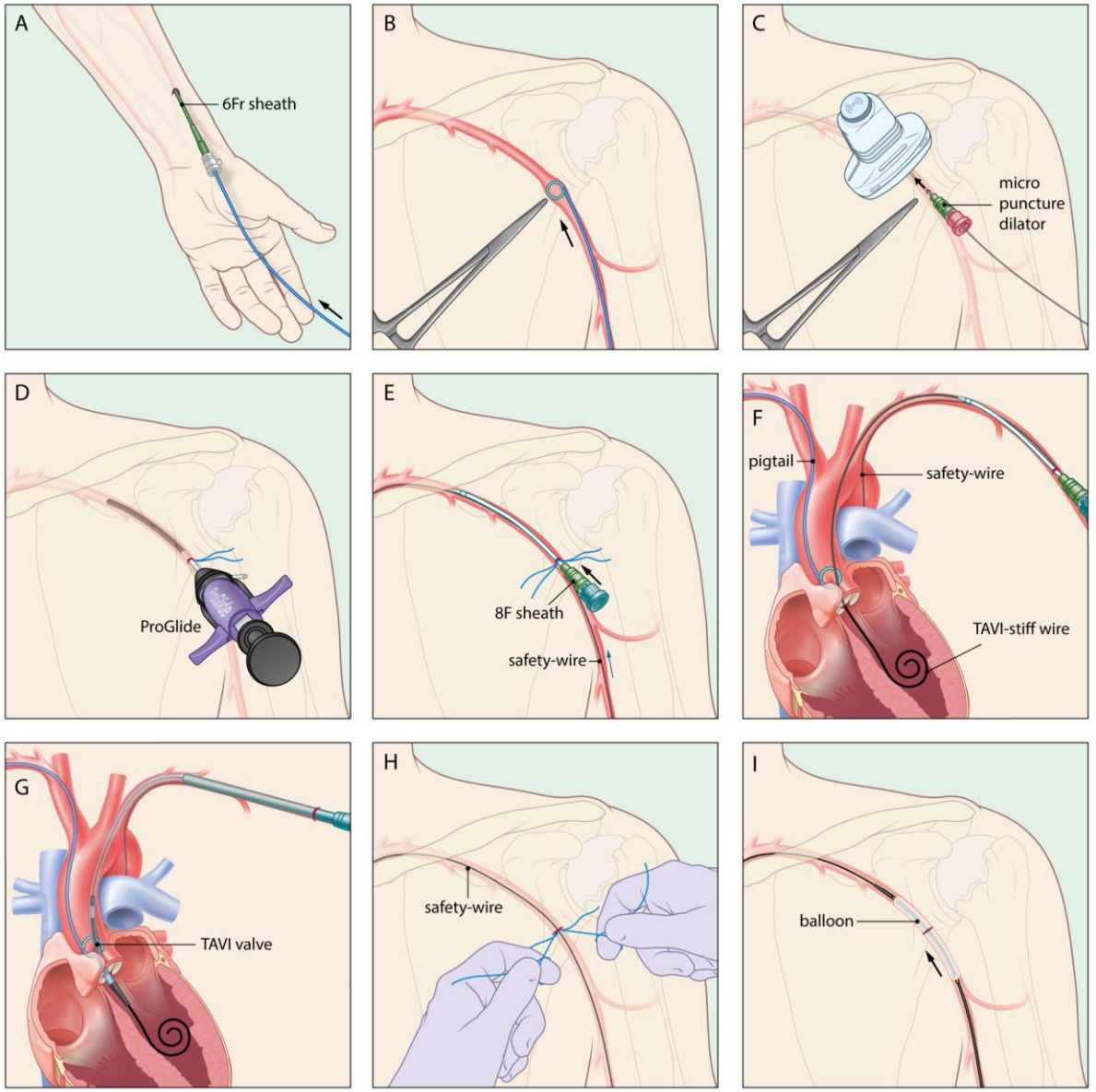
Case by Case approach



Abdelnour MW et al. Front. Cardiovasc. Med. 2024, 11:1437626

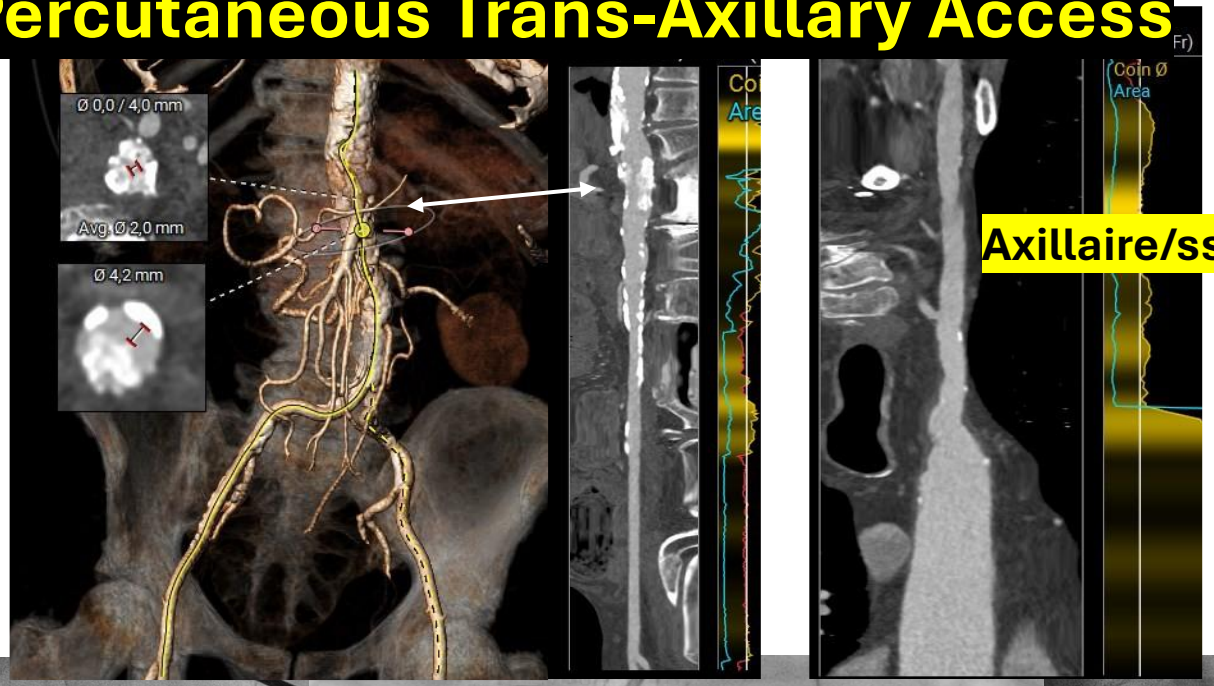
Transaxillary access for TAVR



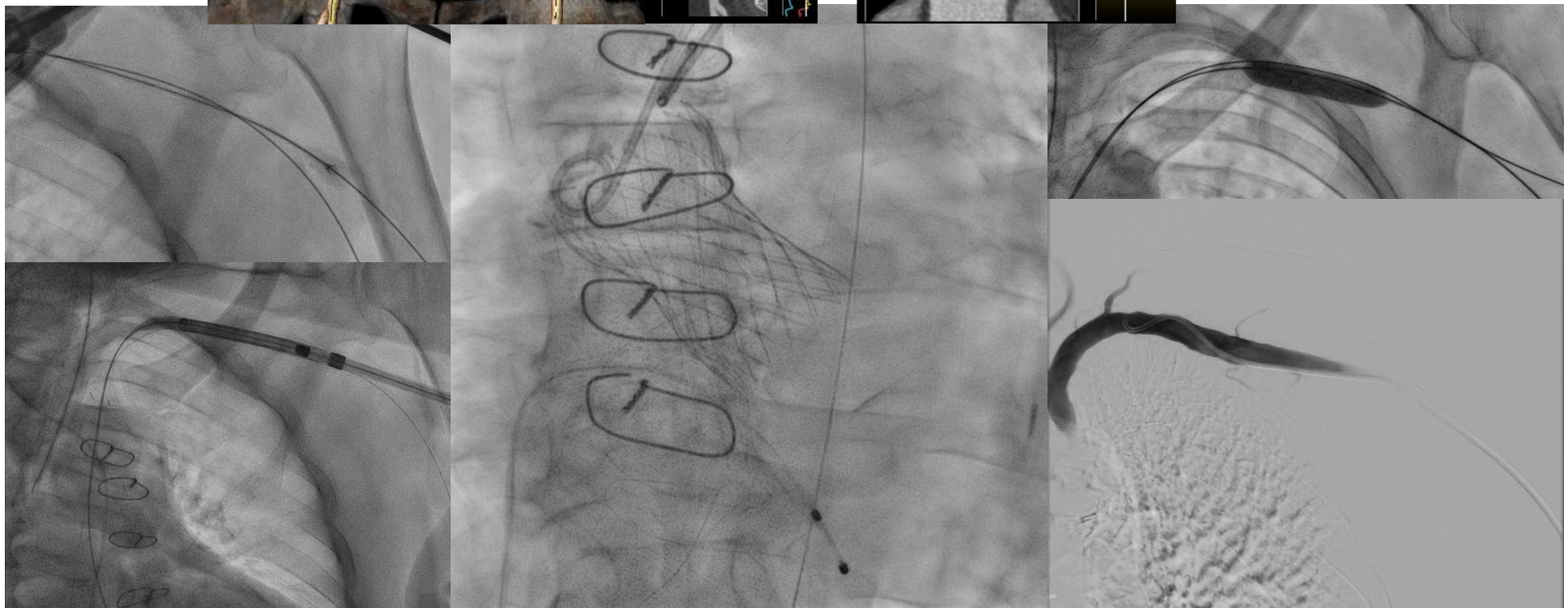


Wilkins et al. Structural Heart, 2020

Patient #7 Left Percutaneous Trans-Axillary Access



Axillaire/ss clav. G



Trans-axillaire/sous clavière vs. Trans-Carotide ?

Outcomes of transcarotid versus trans-subclavian transcatheter aortic valve replacement: A sys

Mostafa R. Amer[a], Wassim Mo

Transcarotid Versus Subclavian/Axillary Access for Transcatheter Aortic Valve Replacement With SA 3

Check for updates

nes, MD,

MD, and

Tendance à moins d'AVC avec la voie carotidienne ?

Pas de RCT

Nicolas Debry[1,2,3]*, MD; Talel Raouf Trimech[4], MD; Thomas

Flavien Vincent[1,2], MD, Ph

Mohamad Koussa[1], MD; Fr

Max Pécheux[6], MD; Saïd

Eric Van Belle[1,2], MD, Ph

Cédric Delhaye[1], MD; Guillaume Cayla[7], MD, PhD;

Florence Leclercq[5], MD;

MD, PhD;

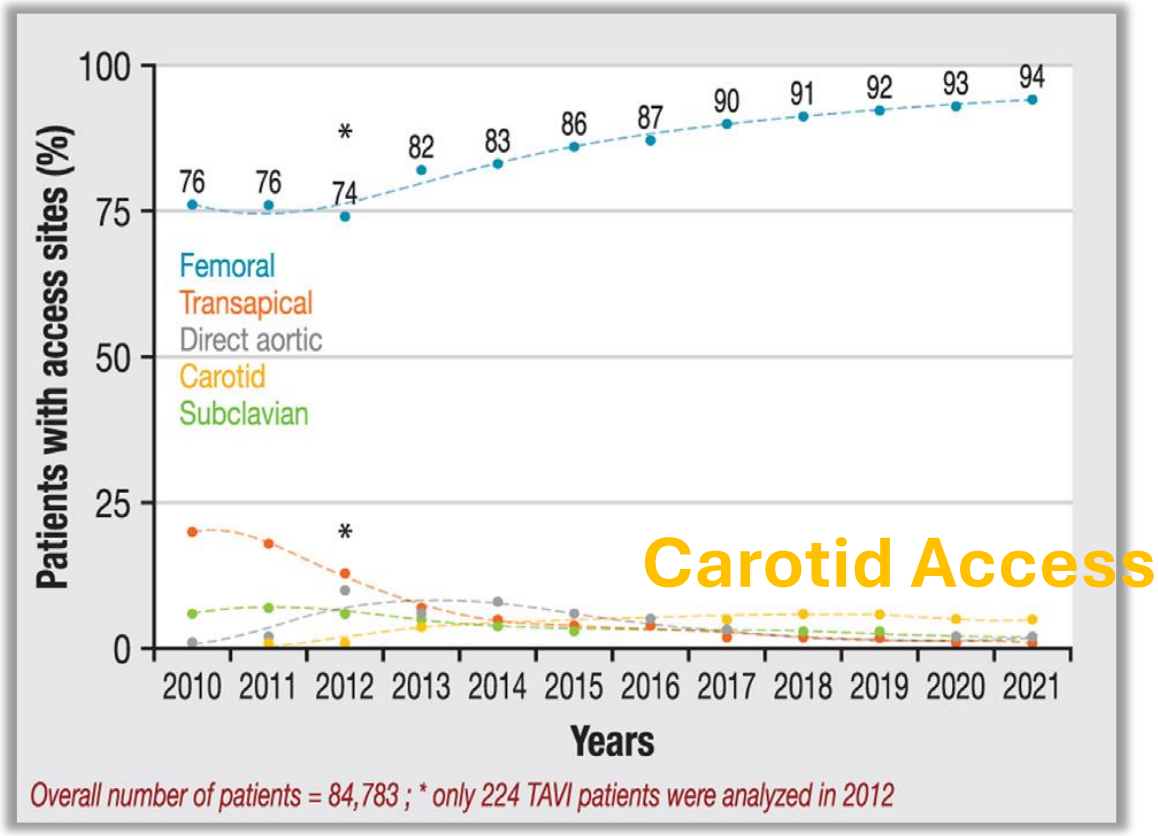
Transcarotid versus transaxillary access for transcatheter aortic valve replacement with a self-expanding valve: A propensity-matched analysis

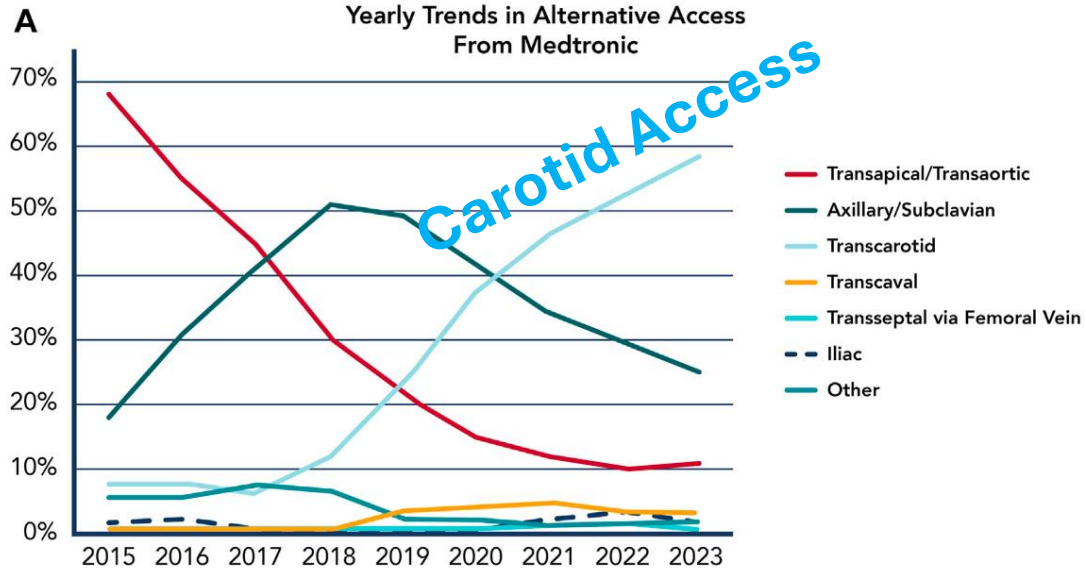
Check for updates

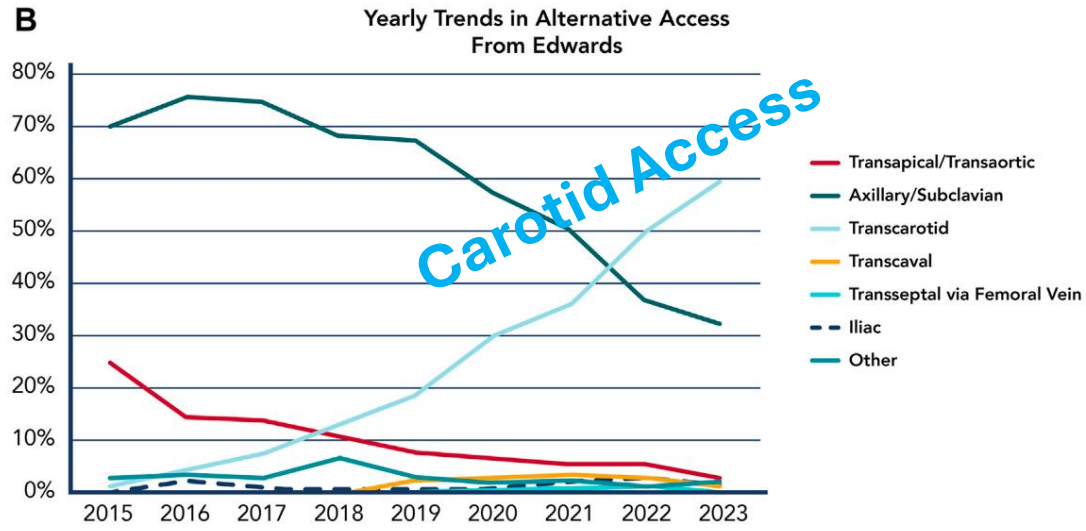
Keith B. Allen, MD,[a] Daniel Watson, MD,[b] Amit N. Vora, MD,[c] Paul Mahoney, MD,[d] Adnan K. Chhatriwalla, MD,[e] Jonathan G. Schwartz, MD,[f] Antoine Keller, MD,[g] Nishtha Sodhi, MD,[h] Daniel Haugan, MS,[i] and Michael Caskey, MD[j]

JTCVS Techniques 2023;21:45-55.
Ann Thorac Surg 2020;110:1892-7.
EuroIntervention 2020;16:842-849.
Cardiovasc Revasc Med. 2021, 33:20-25.

Yearly Trends in alternate access use for TAVR







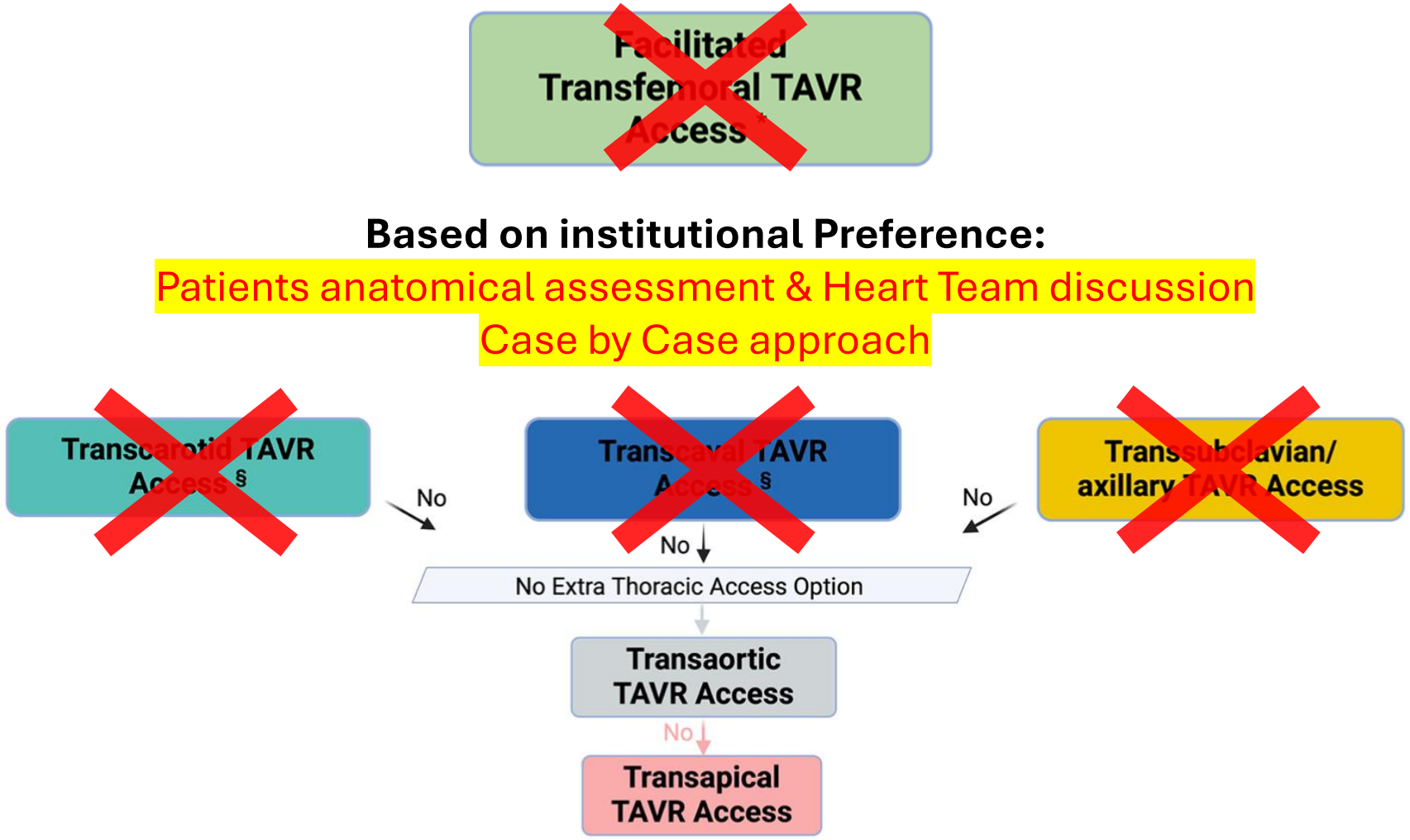
Didier R et al. Archives of Cardiovascular Disease 115 (2022) 206—213

Sherwood M et al. Journal of the SCAI 4 (2025) 102514

Nombreuses questions en suspens ?

- Trans Axillaire vs. Trans Carotide ?
- Trans Axillaire percutanée vs. Chirurgicale ?
- Coté droit ou Gauche ?
- Quelle prothèse pour les voies hautes ?
- Etc…

Anatomies et abords hostiles: quelles options ?

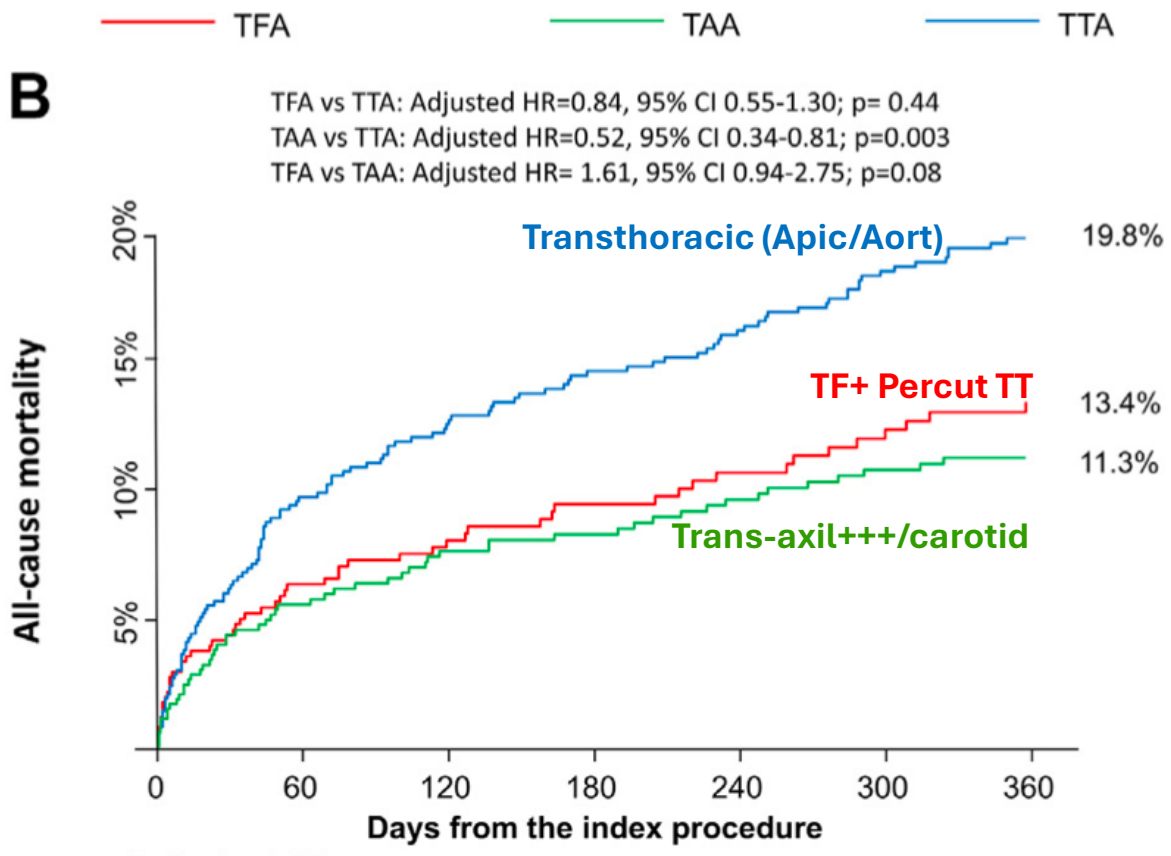


Abdelnour MW et al. Front. Cardiovasc. Med. 2024, 11:1437626

TAVR in patients with PAD: The Hostile registry

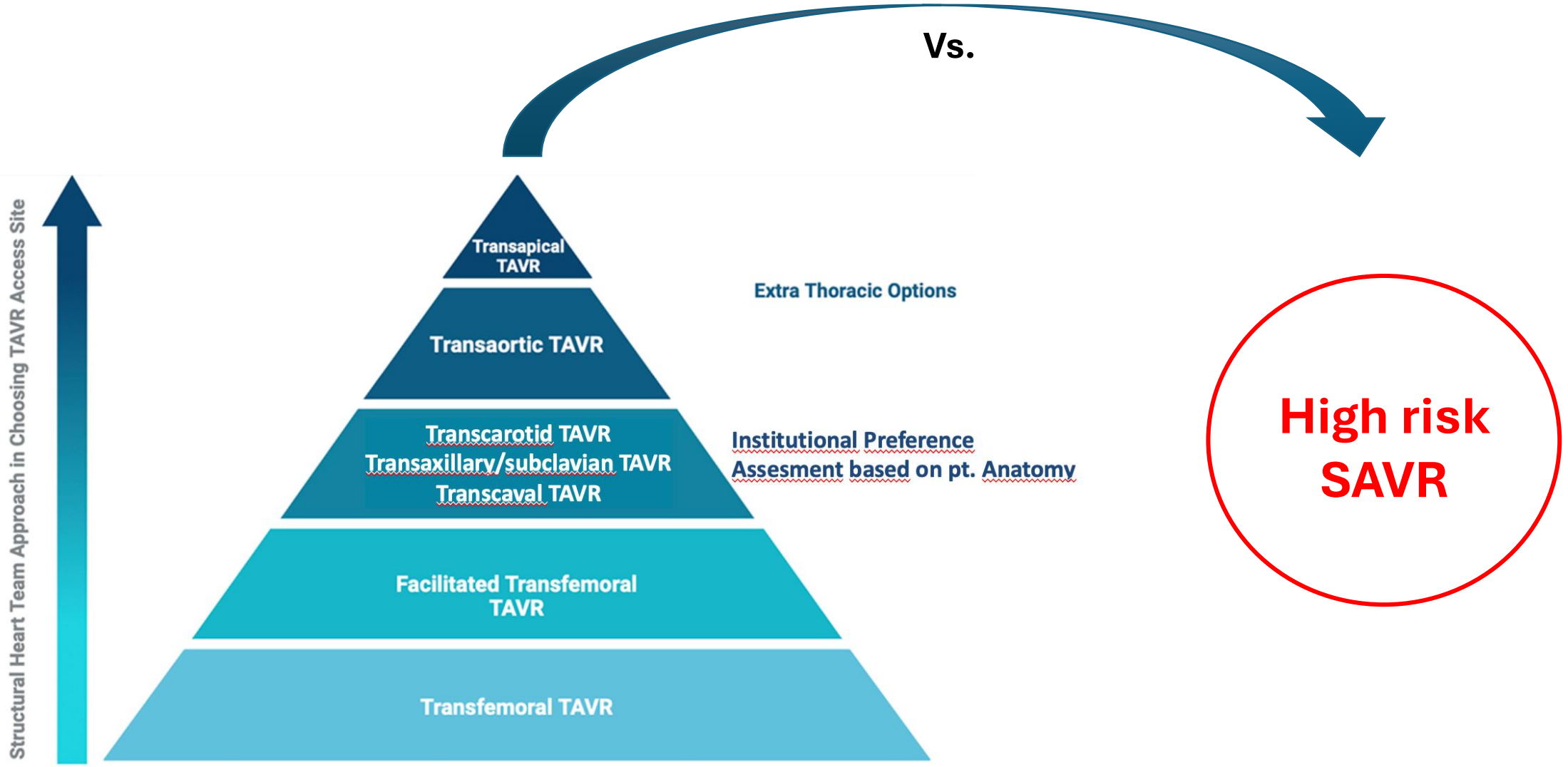
Patients (n=1707) with PAD and hostile femoral access undergoing TAVR

(TFA impossible, or possible only after percutaneous treatment)



Palmerini T et al. J Am Coll Cardiol Intv 2023;16:396–411.

Anatomies et abords hostiles: quelles options ?



Abdelnour MW et al. Front. Cardiovasc. Med. 2024, 11:1437626

TAVI & abords complexes
Take Home Message

- **Nombreux phénotypes d'abords hostiles +++**
- **Apprécier les possibilités de challenger la fémorale:**
  - Bien étudier le scanner pre-TAVI ++
  - Utiliser les outils modernes (IVL)
  - Anticiper les complications (guide de sécurité, stent couvert, être bien entouré…)
- **Ne pas être dogmatique, savoir envisager une voie alternative haute** qui dépendra de l'évaluation anatomique du patient et des habitudes locales (axillaire ou carotide).

Merci !

cedric.delhaye@chu-lille.fr