29th TCTAP2024

Alternative Access for TAVR : TC, TSC

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CVRF

Need For Alternative Access TAVR

Shockwave and Non-transfemoral Transcatheter Aortic Valve Replacement

Transcatheter aortic valve replacement (TAVR) has become a widely adopted treatment modality for the treatment of severe aortic stenosis. Successful implementation of TAVR requires vascular access that is suitable to accommodate the delivery systems. Advances in sheath and delivery system designs have led to smaller profile devices and expandable sheaths that can be successfully delivered via the transfemoral (TF) approach. The transfemoral TAVR approach, as compared with surgical aortic valve replacement (SAVR), has become the approach of choice for patients due to its ease of use, ability for early mobility, allowance of awake procedures and fast track protocols, and avoidance of surgical incisions. Its superiority as a first-line approach has been confirmed in numerous registries, and also in the PARTNER high-

However, it is estimated that one-quarter of the patients undergoing TAVR also have concomitant peripheral arterial disease.[5] Despite technological advances, a recent analysis of the Transcatheter Valve Therapy registry showed that 7.6 % of TAVR required non-transfemoral, alternative access.[6] Alternative access sites can be broadly categorized into transthoracic and peripheral approaches, facilitated by either surgical or percutaneous techniques. Transthoracic approaches include transapical, transaortic, and subclavian access. Peripheral options include transaxillary, transcarotid, and transcaval access (*Figure 1*). Current American and European guidelines both recommend TF approach as the access of choice, but do not provide guidance in choosing between various alternative access choices.[1,7] In this review, we discuss the technical details and clinical outcomes of various TAVR access approaches for patients with unfavorable transfemoral anatomy.

Transcatheter aortic valve replacement (TAVR) has revolutionized the treatment of aortic stenosis.[1] Despite advancements in TAVR technology, alternate access use is required in 5% to 6% of cases when transfemoral access is unsuitable.[2,3] Additionally, alternate

Comparison of Transfemoral versus Transsubclavian/Transaxillary access for transcatheter aortic valve replacement: A systematic review and meta-analysis

Femoral access is the gold standard for transcatheter aortic valve replacement (TAVR). Safe alternative access, that represents about 15 % of TAVR cases, remains important for patients without adequate transfemoral access. We aimed to perform a systematic review and *meta*-analysis of studies comparing transfemoral (TF) access versus transsubclavian or transaxillary (TSc/TAx) access in patients undergoing TAVR. We searched PubMed, Cochrane CENTRAL Register, EMBASE, Web of Science, Google Scholar and ClinicalTrials.gov (inception through May 24, 2022) for studies comparing (TF) to (TSc/TAx) access for TAVR. A total of 21 studies with 75,995 unique patients who underwent TAVR (73,203 transfemoral and 2,792 TSc/TAx) were included in the analysis. There was no

Transcatheter aortic valve replacement (TAVR) has become a reasonable alternative to surgical aortic valve replacement for patients with severe symptomatic aortic stenosis who are at intermediate-to-high/prohibitive surgical risk.[1–3] Although transfemoral access is considered the default access strategy, 10% to 15% of TAVR candidates do not have favorable iliofemoral anatomy for safe transfemoral access.[4] As experience with

4, 95 % CI
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0.53), and
F access is
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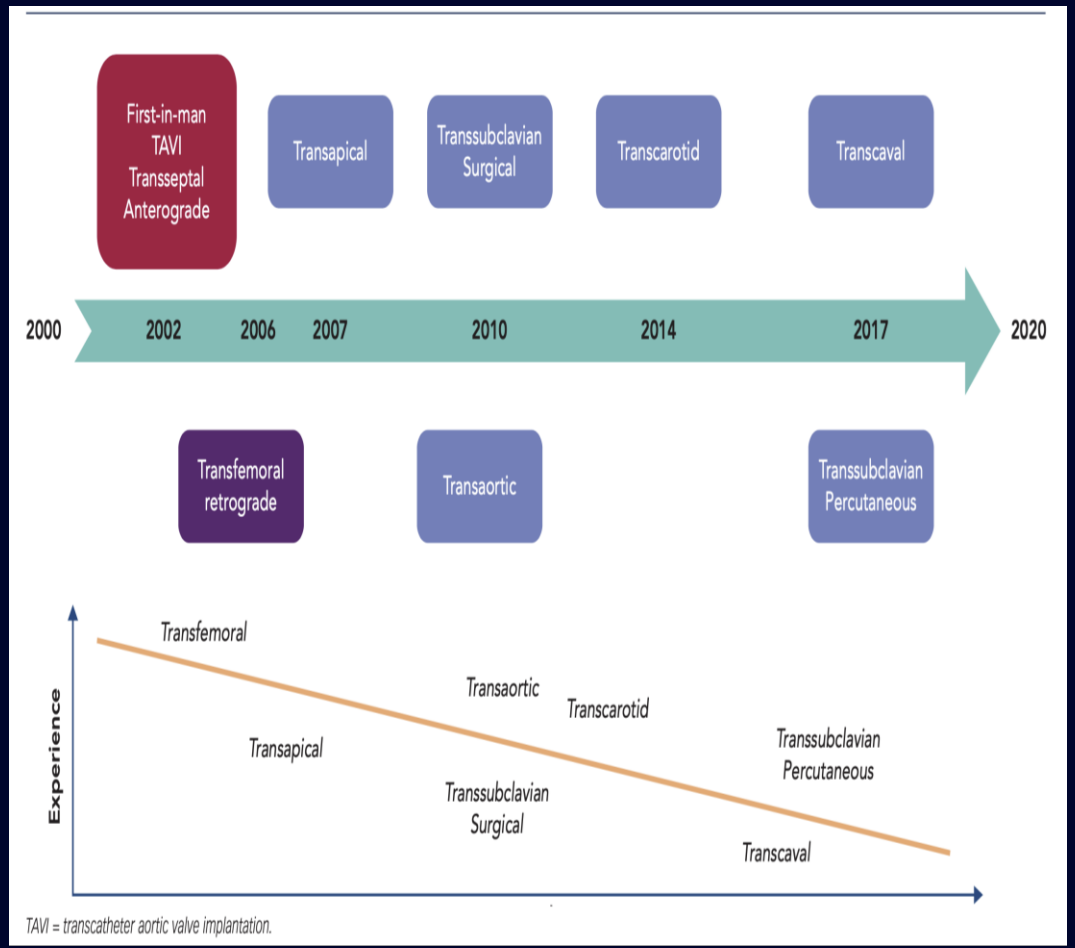
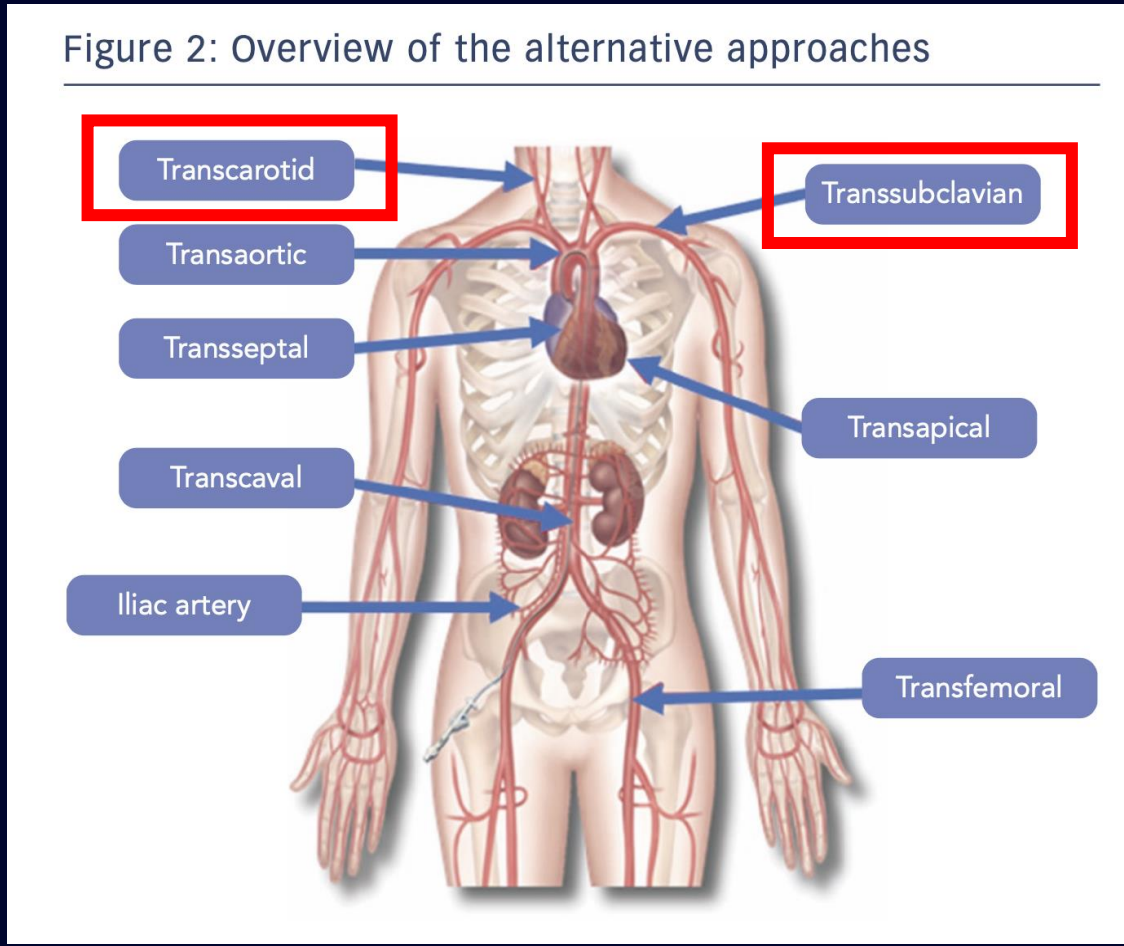
Sc/TAx is a
setting.

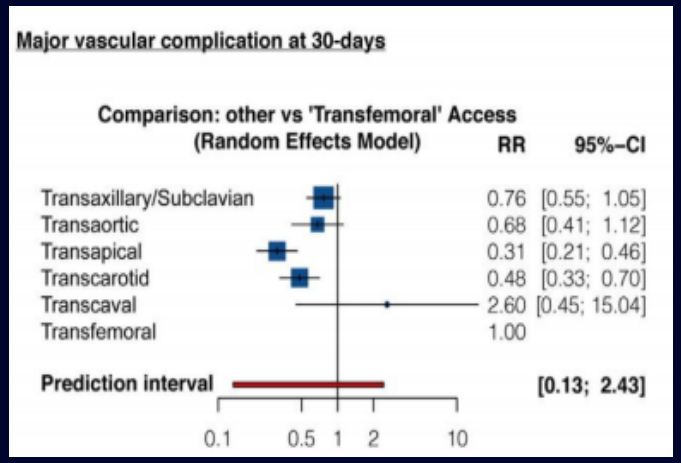
History of Alternative Access

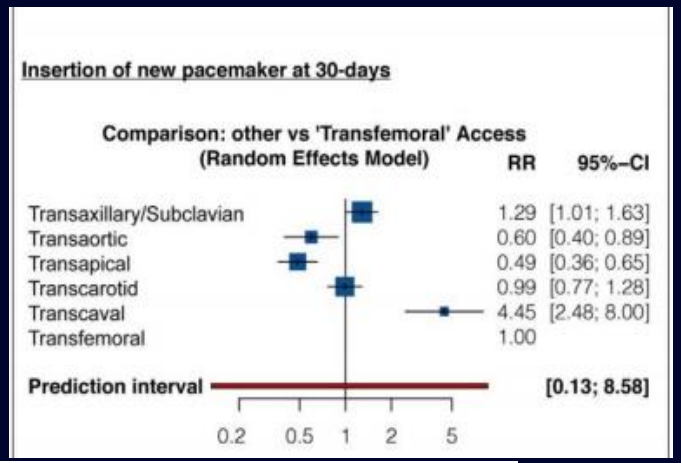


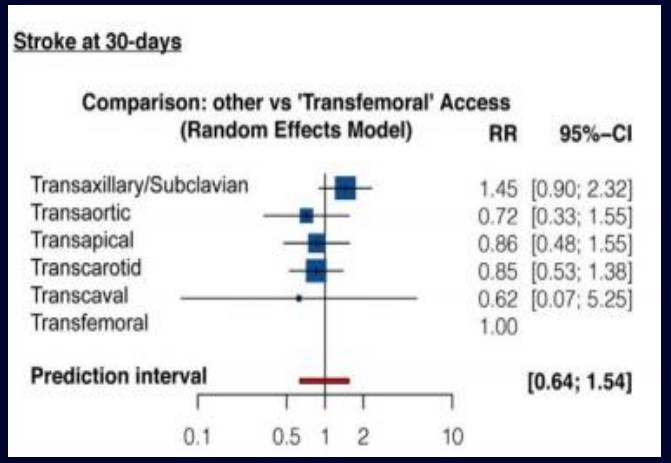


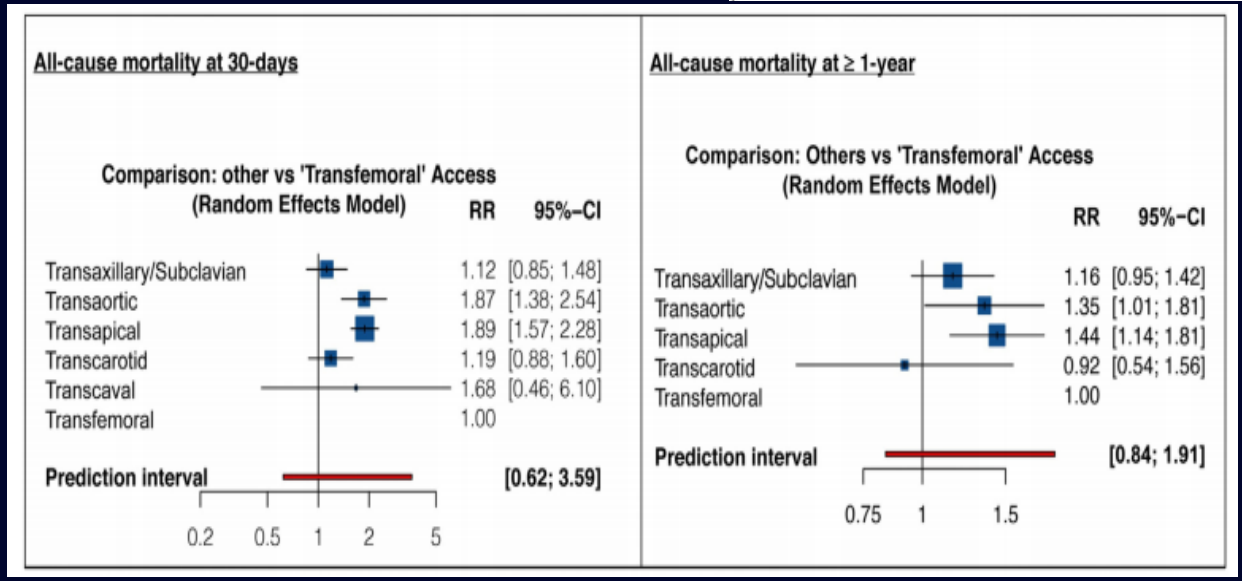
Interventional Cardiology Review 2018;13(3):145–50

Alternative Access Replace The Femoral Access?







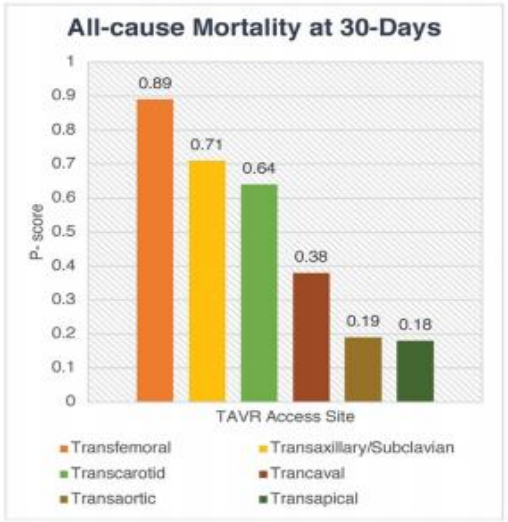


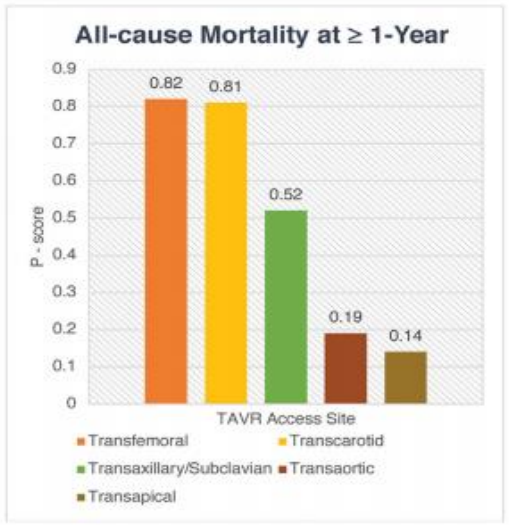
Overall, the group found that extrathoracic TAVR was associated with a significantly lower risk of in-hospital all-cause mortality, 30-day all-cause mortality and one-year all-cause mortality. Extrathoracic TAVR was also linked with lower rates of life-threatening bleeding events, 30-day new-onset atrial fibrillation or atrial flutter and 30-day acute kidney injury leading to renal replacement therapy.

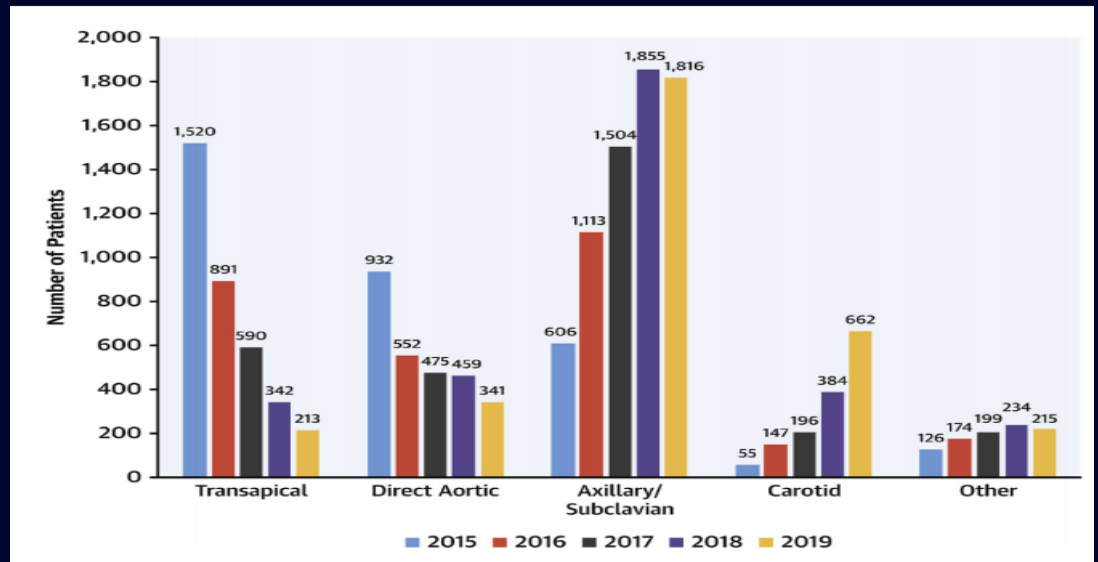
Alternative Access Replace The Femoral Access?

Network Meta-Analysis Comparing the Short- and Long-Term Outcomes of Alternative Access for Transcatheter Aortic Valve Replacement

Sagar Ranka [a], Shubham Lahan [b], Adnan K. Chhatriwalla [c], Keith B. Allen [c], Michael Chiang [d], Brian O'Neill [d], Sadhika Verma [e], Dee Dee Wang [d], James Lee [d], Tiberio Frisoli [d], Marvin Eng [f], Rodrigo Bagur [g], William O'Neill [d], Pedro Villablanca [d,*]





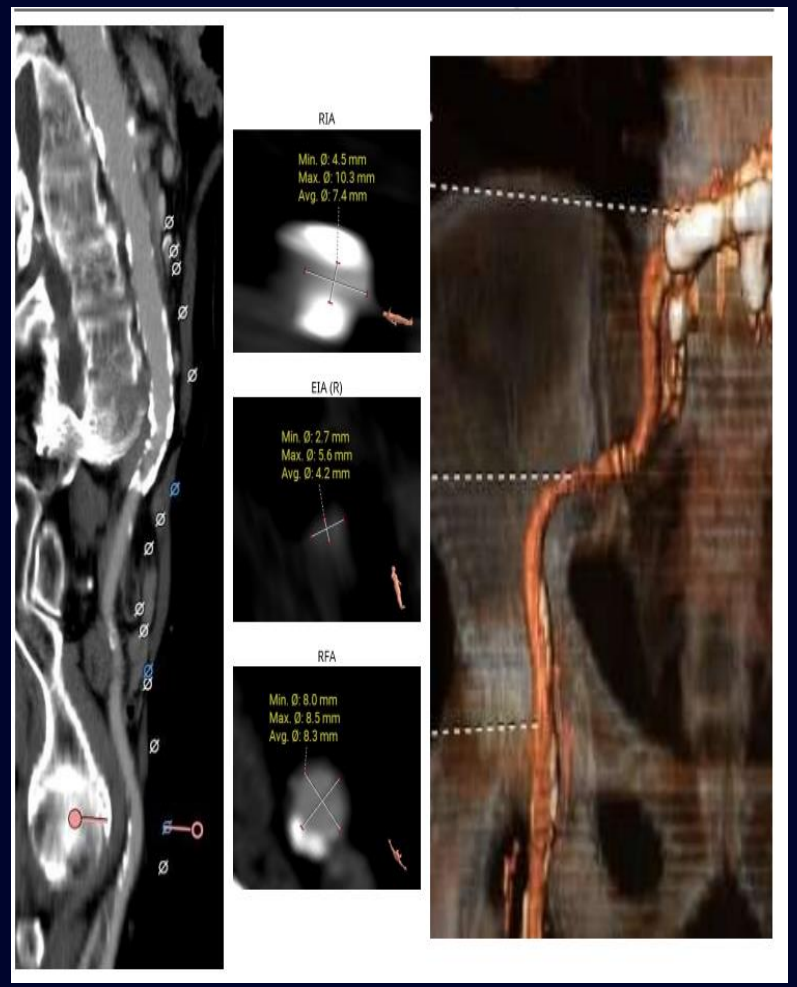


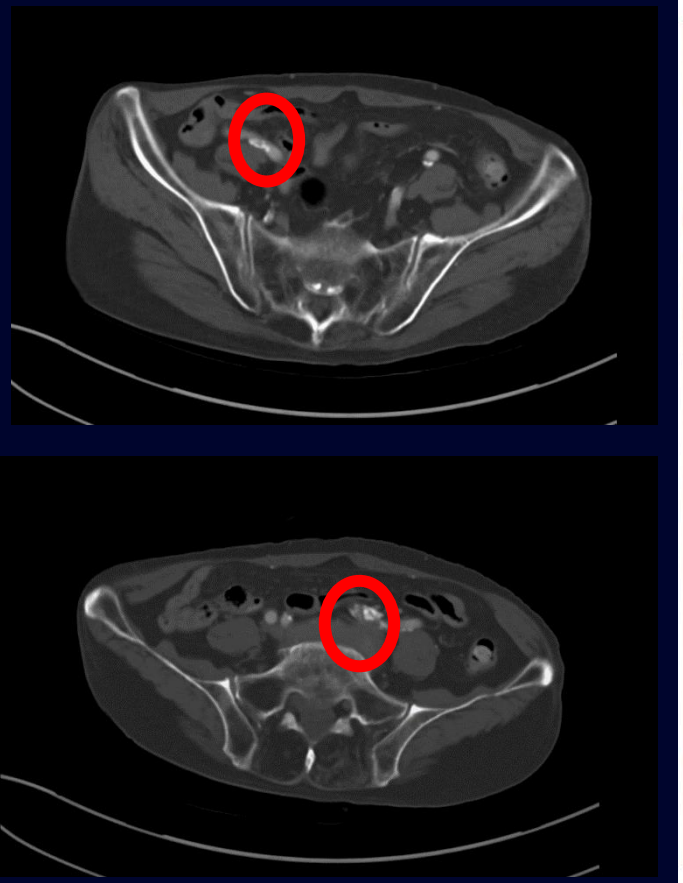
Non-thoracic alternative access routes (TC, TSA and TCV) are associated with a similar safety profile as compared to TF access with regarding the major complications of periprocedural mortality, stroke, and major bleeding following TAVR, while TA and TAO access are associated with increased short- and long-term mortality.

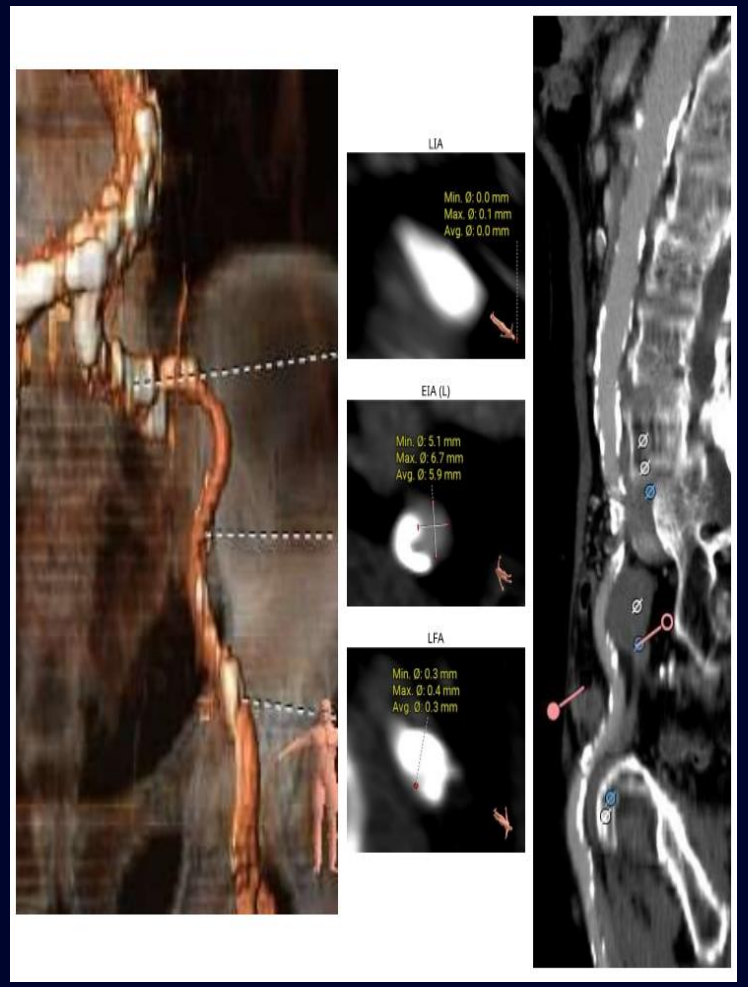
CASE 1.
Trans Carotid

- 86/M, 170cm, 56kg, BMI 19.4
- EOA (TTE) = 0.9cm^2
- Peak / Mean PG = 21.6 / 11.1 mmHg
- V max = 2.2m/s
- EF = 49.6%
- LVOT diameter = 18.1 mm
- SVi: 22.6 ml/m2
- STS score = 10.1%, Euroscore I = 21.24% , Euroscore II = 9.64 %

CASE 1.
Trans Carotid







Alternative Access
EPH Style

Ilio-femoral artery >5~6mm

No significant tortuosity, calcification, angulation

→ Yes → **TF TAVR**

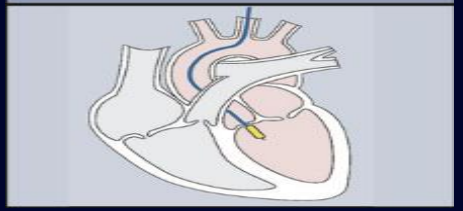
↓ No

Common carotid artery > 5~6 mm

No significant tortuosity, calcification, angulation

contralateral intaracranial blood supply (willis circle)

→ Yes → **TC TAVR**



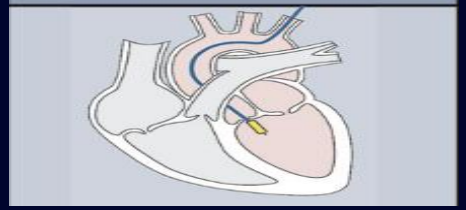
↓ No

SCA / Axillary artery > 5~6 mm

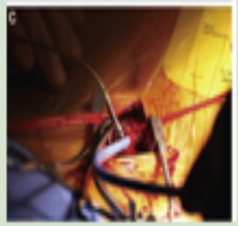
No significant tortuosity, calcification, angulation

No internal mammary artery graft (Rt or Lt)

→ Yes → **TS TAVR**



Alternative Access
EPH Style

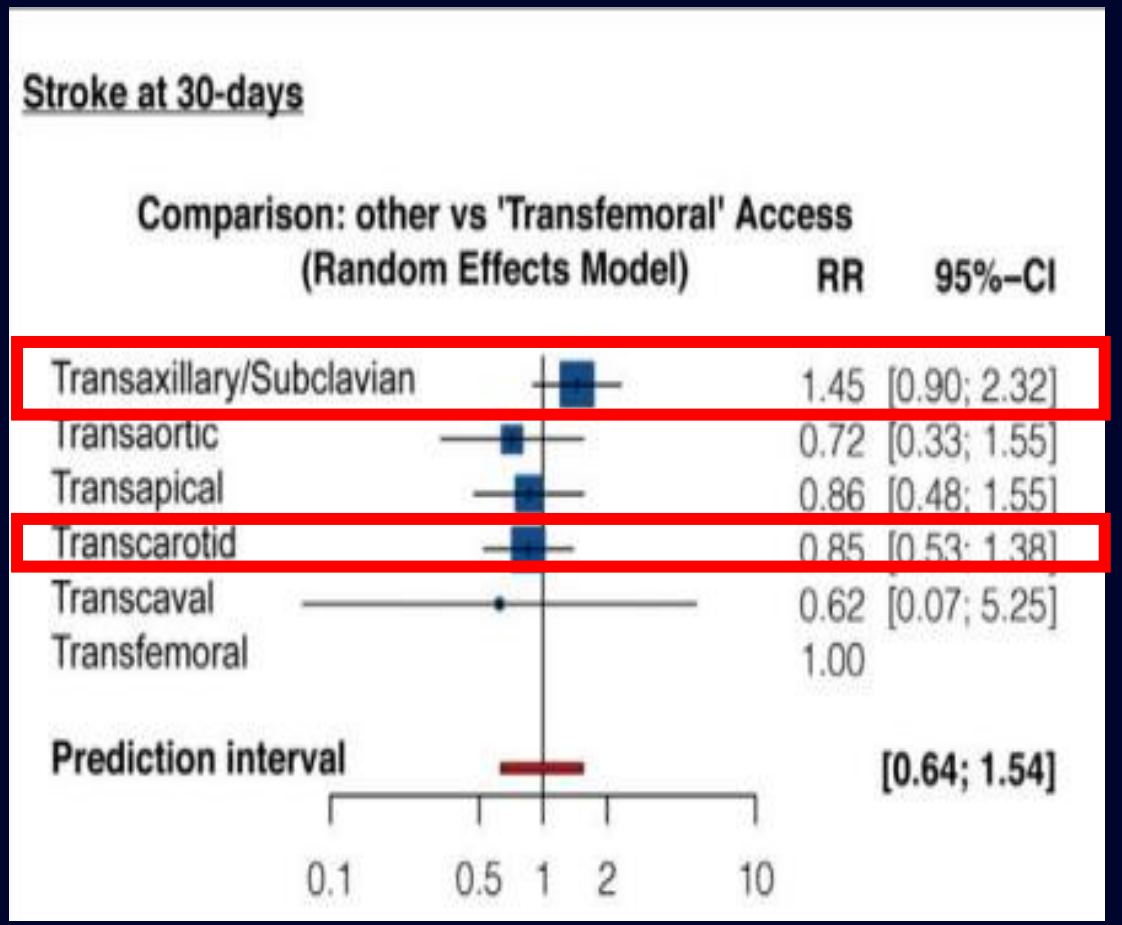
	Advantages	Disadvantages
Transcarotid 	• Possibility under sedation • Easy alignment with the aortic annulus • Shorter hospitalization time and early ambulation	• Potential risk of stroke (required comprehensive neurovascular evaluation including intact circle of Willis) • Surgical cut-down is necessary
Transaxillary/subclavian 	• Possibility under sedation • SC access is familiar to cardiac surgeons • Percutaneous option • Usually spared of atherosclerotic disease (more optional)	• Risk of vessel injury d/t arterial characteristics(thinner and more frail than femoral) • Consider vessel size, tortuosity, angulation, etc. • Relative contraindications with ipsilateral patent internal mammary arterial grafts • Alignment with aortic annulus more difficult • Bailout technically difficult if vascular complications

J Thorac Cardiovasc Surg 2021;-:1-12 *US Cardiology Review 2021;15:e25* *Cardiovascular Revascularization Medicine 40 (2022) 1–10*

Alternative Access
EPH Style

Stroke Risk By Alternate Access (30-Day)

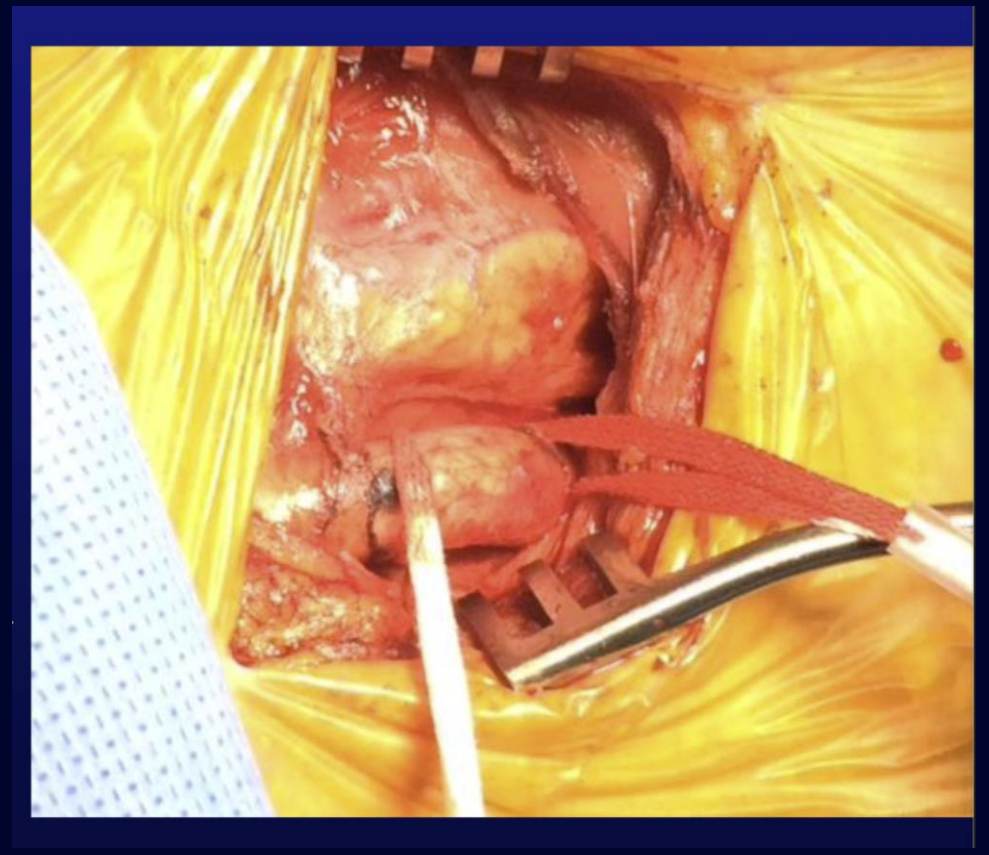
Transcarotid	Transcaval	Transaxillary	Transaxillary
Allen, et al. Annals Thorac Surg 2019 Allen, TVT 2019	Greenbaum, et al. JACC 2017	Dahle, et al. JACC Inter 2019	Gleason, et al. Ann Thorac Surg 2018 Petronio, et al. J Am Coll Card
2.4% - 4.3%	5.0%	6.1%	6.5% - 7.5%



Keith B. Allen, TCT 2019

CASE 1.
Trans Carotid

- Required the vascular surgeon
- CT scan for supra-aortic anatomy
- 4 vessel angiography, US Doppler
- Intraoperative EEG monitering



Ann Thorac Surg 2022;114:e475-7

CASE 1.
Trans Carotid

CASE 1.
Trans Carotid

Ilio-femoral artery >5~6mm

No significant tortuosity, calcification, angulation

→ Yes → **TF TAVR**

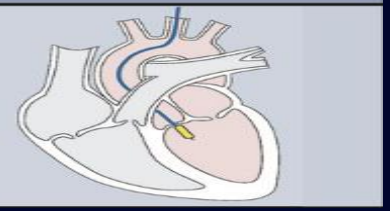
↓ No

Common carotid artery > 5~6 mm

No significant tortuosity, calcification, angulation

contralateral intaracranial blood supply (willis circle)

→ Yes → **TC TAVR**



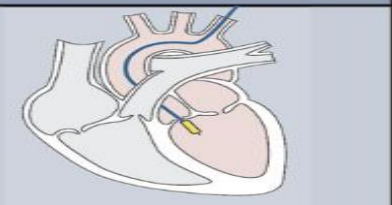
↓ No

SCA / Axillary artery > 5~6 mm

No significant tortuosity, calcification, angulation

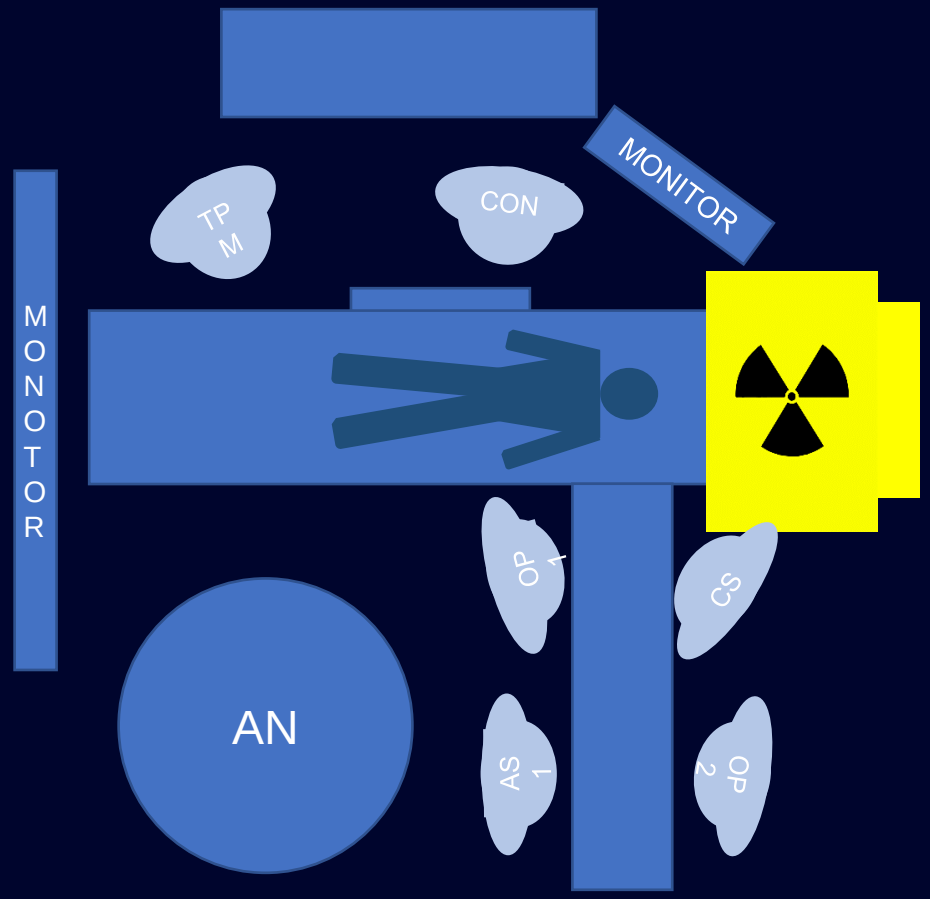
No internal mammary artery graft (Rt or Lt)

→ Yes → **TS TAVR**

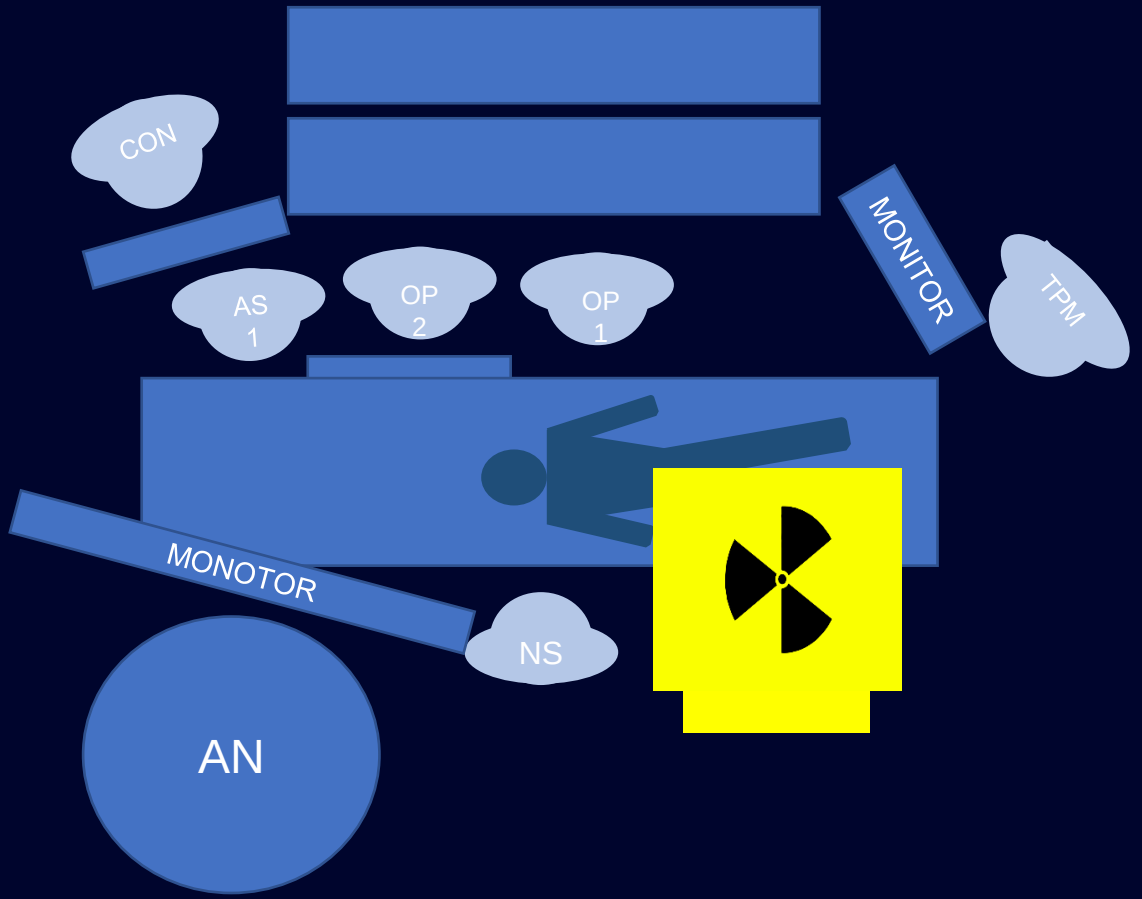


CASE 1.
Trans Carotid

Setup 1.



Setup 2.



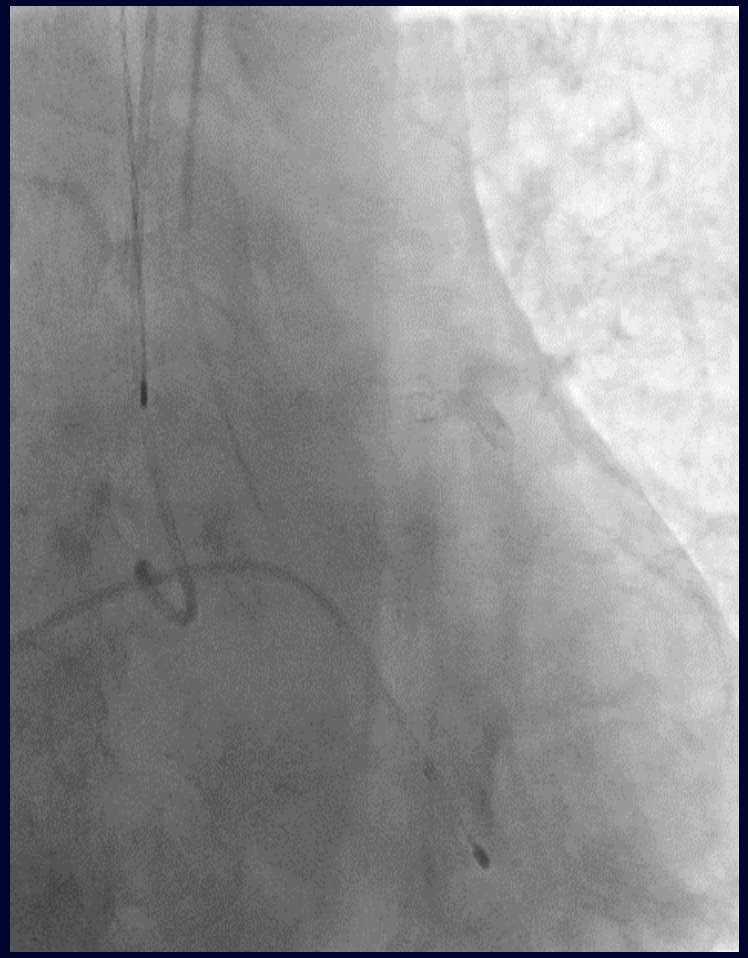
CASE 1.
Trans Carotid

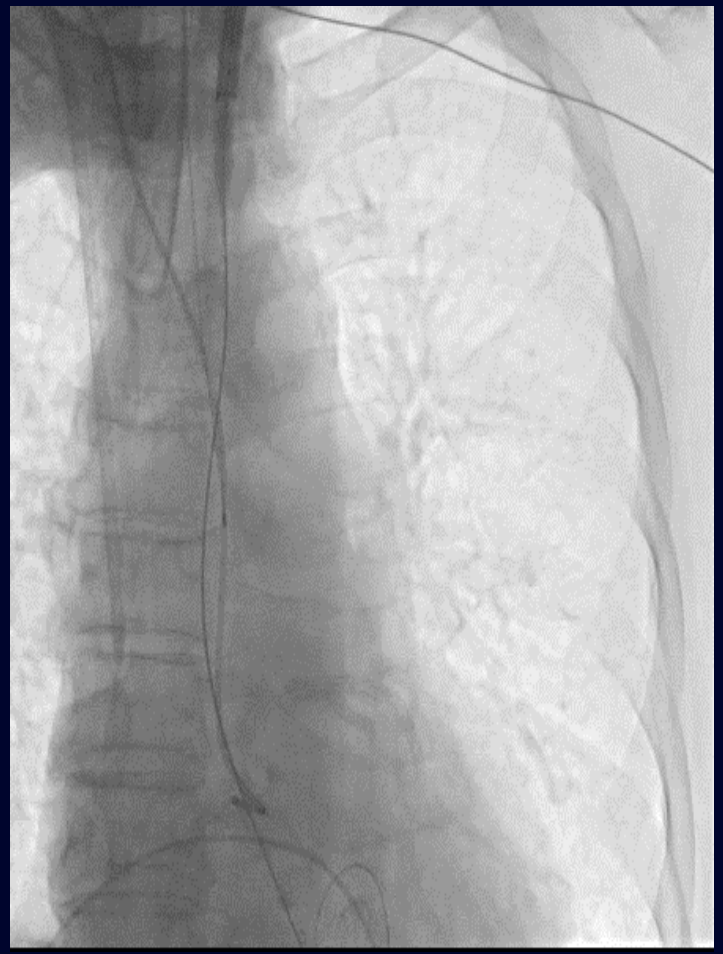
CASE 1.
Trans Carotid

After common carotid artery clamping, brain hypoxia is confirmed using a cerebral oximeter.

If there is no hypoxia, start the procedure.

CASE 1.
Trans Carotid





CASE 1.
Trans Carotid

CASE 2.
Trans Subclavian

- 78/M, 169.5cm, 54.1kg, BMI 18.8, BSA 1.6
- EOA (TTE) = 0.8 cm^2
- Peak/ Mean PG = 87.5/57.7 mmHg
- Vmax = 4.7 m/s
- EF= 63.4 %
- SV index= 47.6 ml/m^2
- LVOT diameter = 21.4 mm, Annulus diameter = 21.1 mm
-
- PFT: FEV1 81%, FVC 79%, FEV1/FVC 67(Pre만 시행)
-
- STS score = 3.12 % , Euroscore I = 10 %, Euroscore II = 6.38 %

CASE 2.
Trans Subclavian

[수술소견]

: severe AS

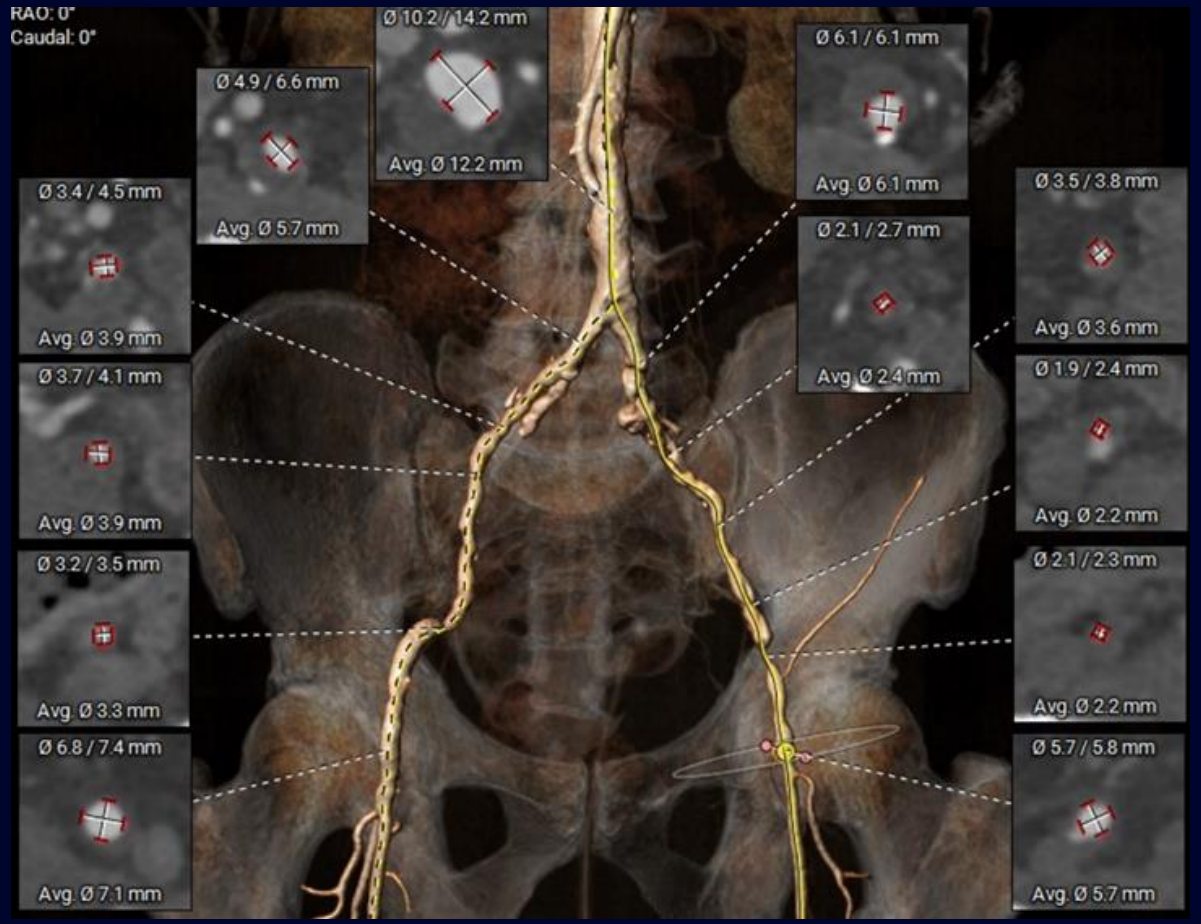
severe aortic calcification : ACC 불가

LAD critical stenosis

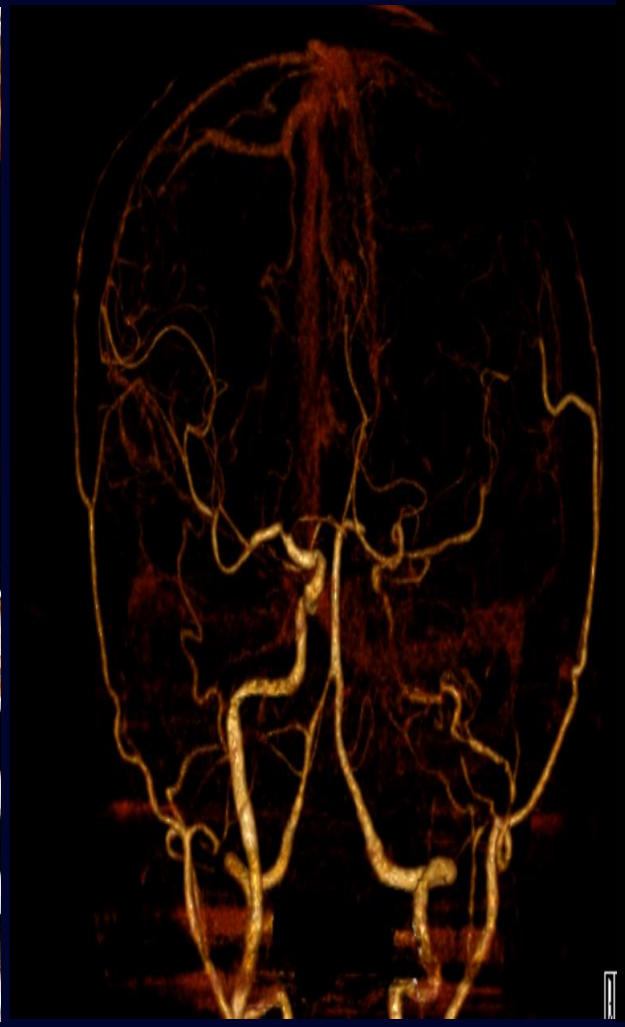
LAD : 1.5 mm

LIMA to LAD : excellent result of flow-meter

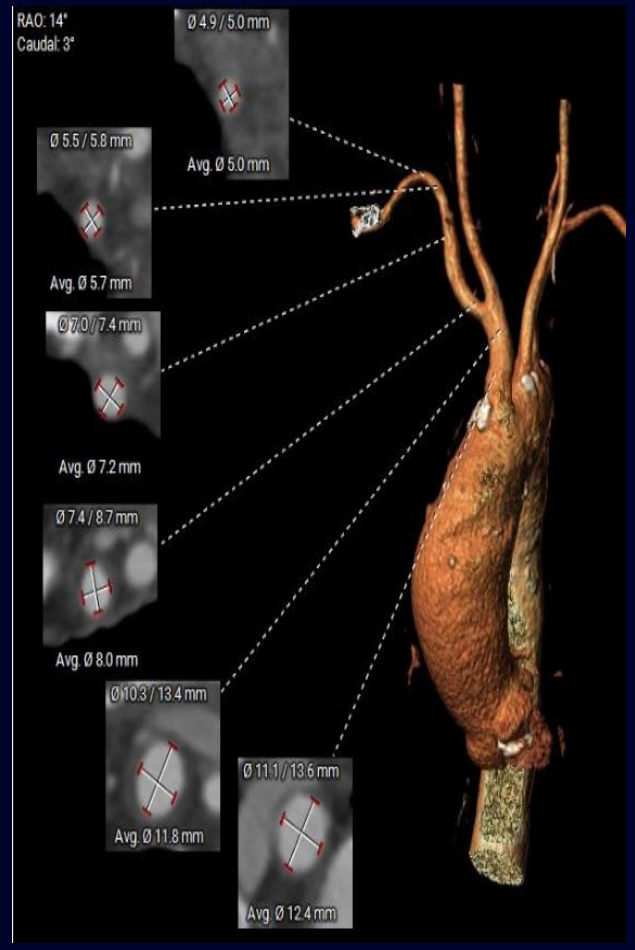
* severe aortic calcification : high risk of complication for aortic procedure
  내과와 상의후 TAVR 시행하기로 결정



CASE 2.
Trans Subclavian



CASE 2.
Trans Subclavian



CASE 2.
Trans Subclavian

Ilio-femoral artery >5~6mm

No significant tortuosity, calcification, angulation

— Yes → **TF TAVR**

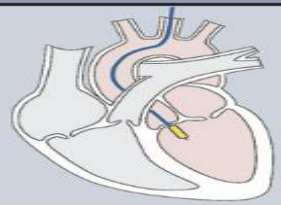
↓ No

Common carotid artery > 5~6 mm

No significant tortuosity, calcification, angulation

contralateral intaracranial blood supply (willis circle)

— Yes → **TC TAVR**



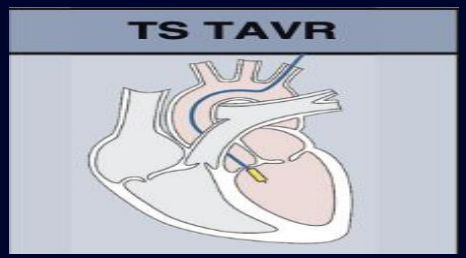
↓ No

SCA / Axillary artery > 5~6 mm

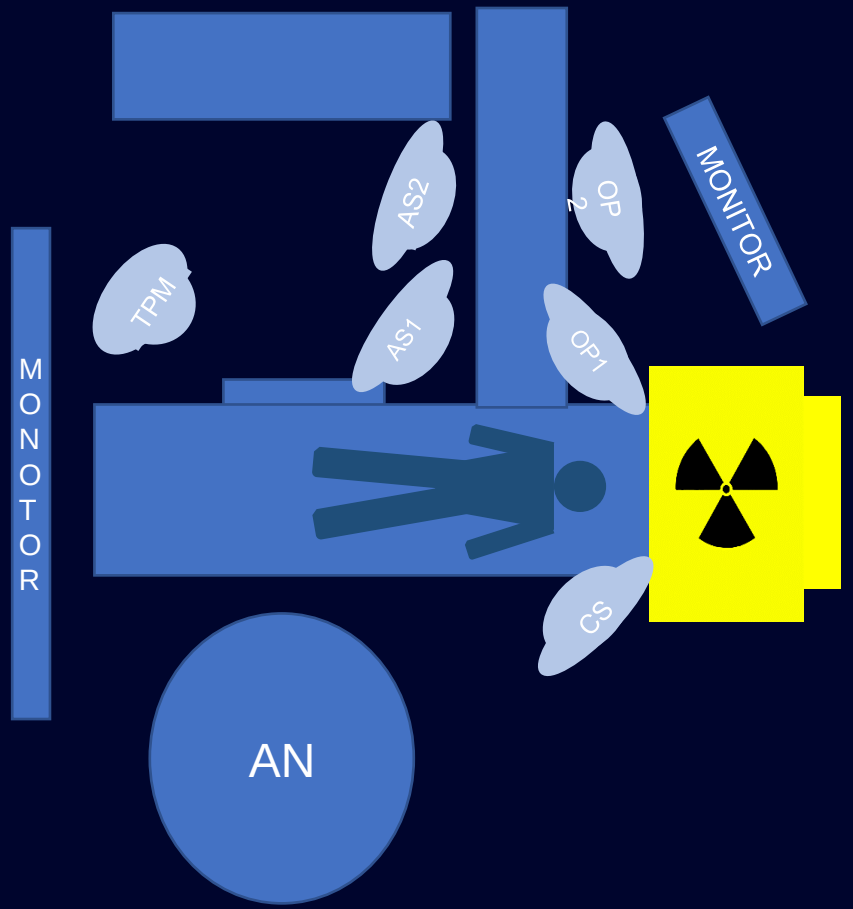
No significant tortuosity, calcification, angulation

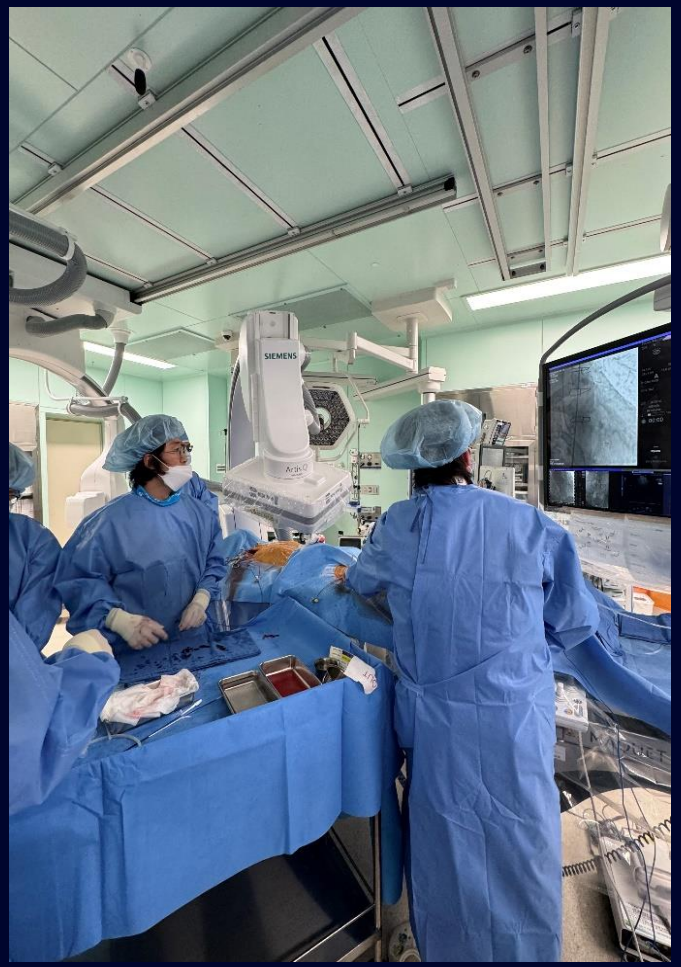
No internal mammary artery graft (Rt or Lt)

— Yes → **TS TAVR**

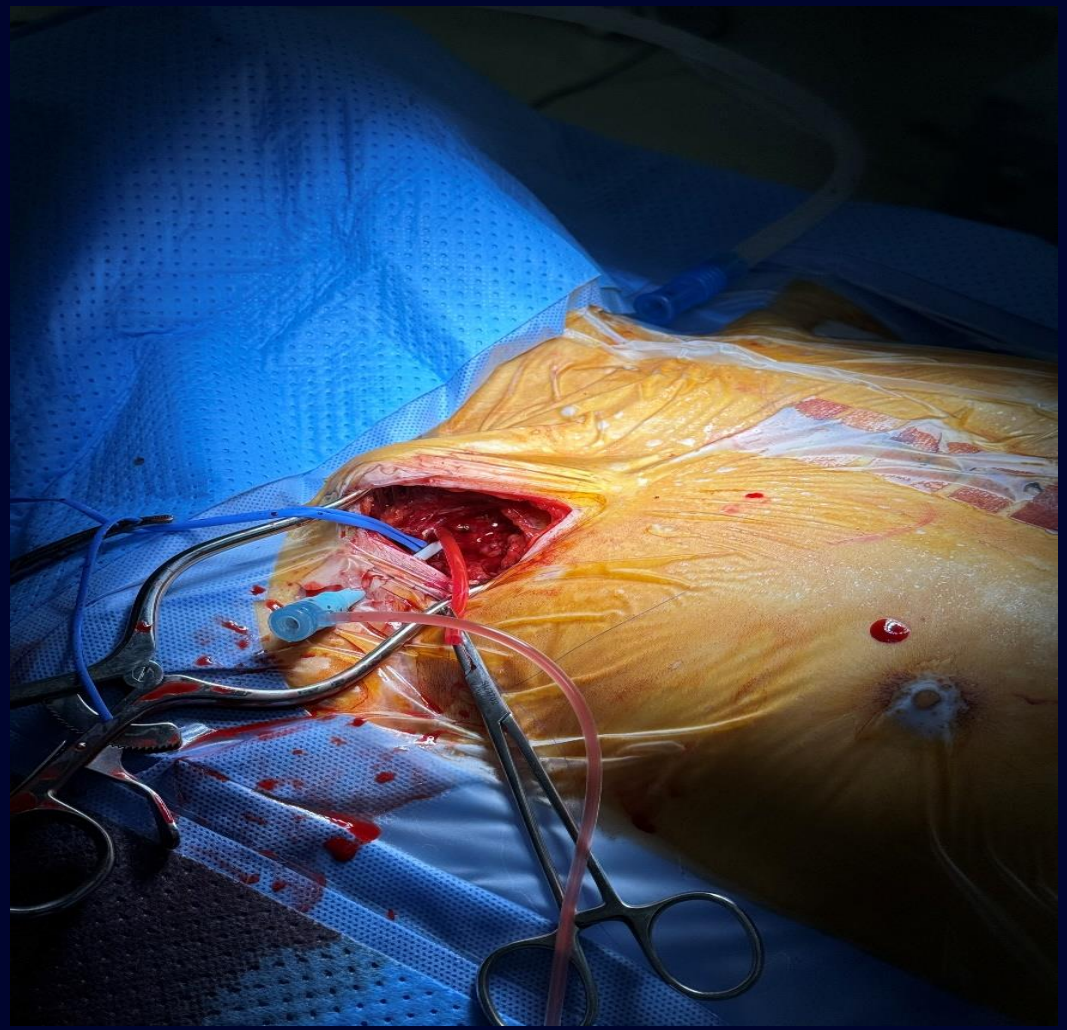


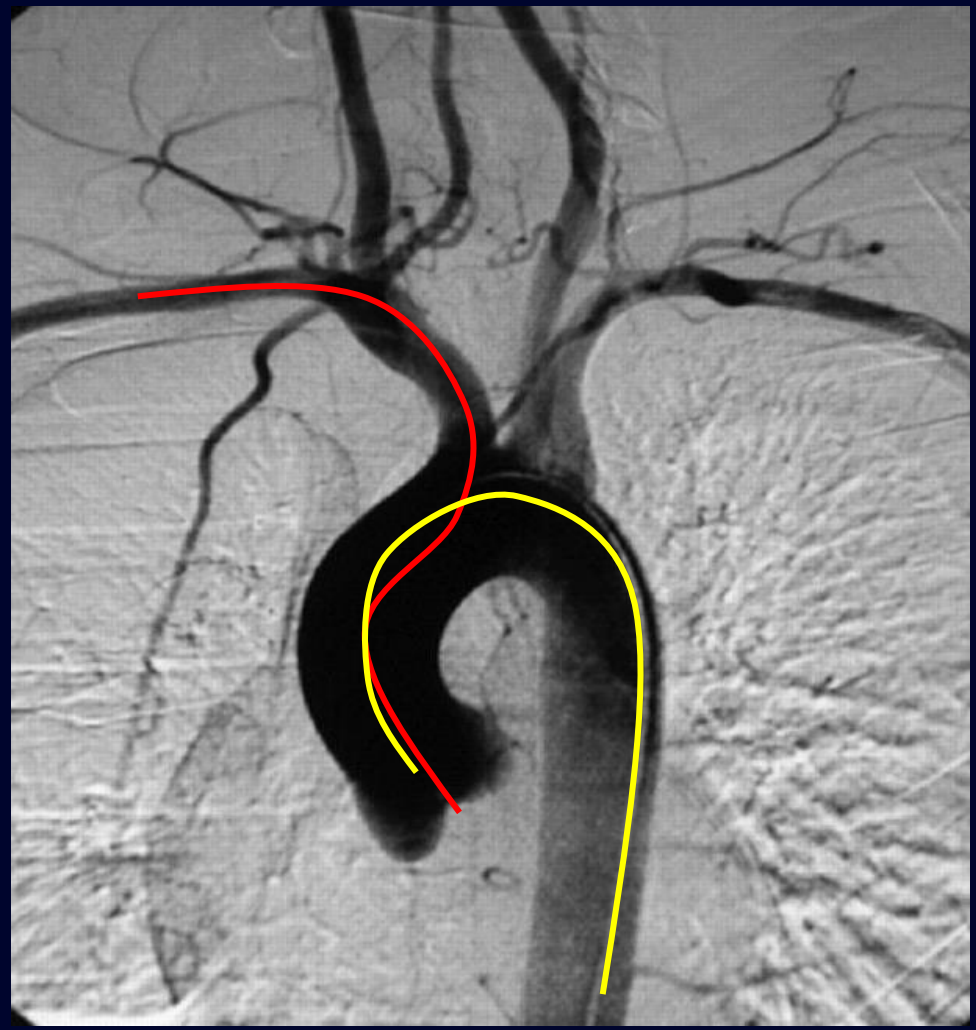
CASE 2.
Trans Subclavian



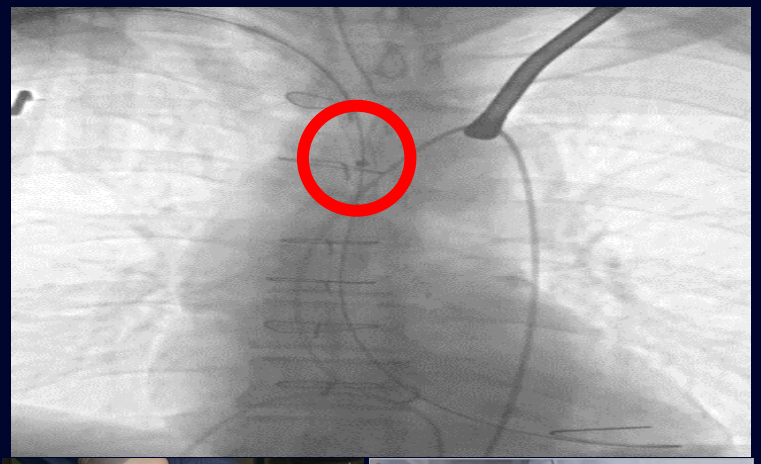


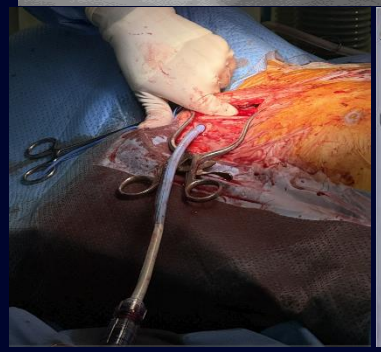
CASE 2.
Trans Subclavian

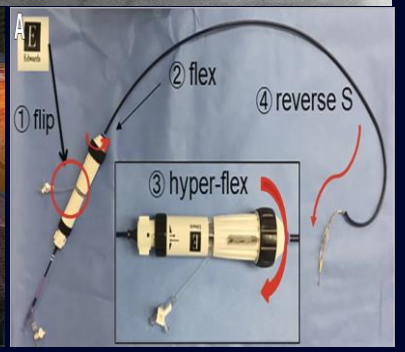


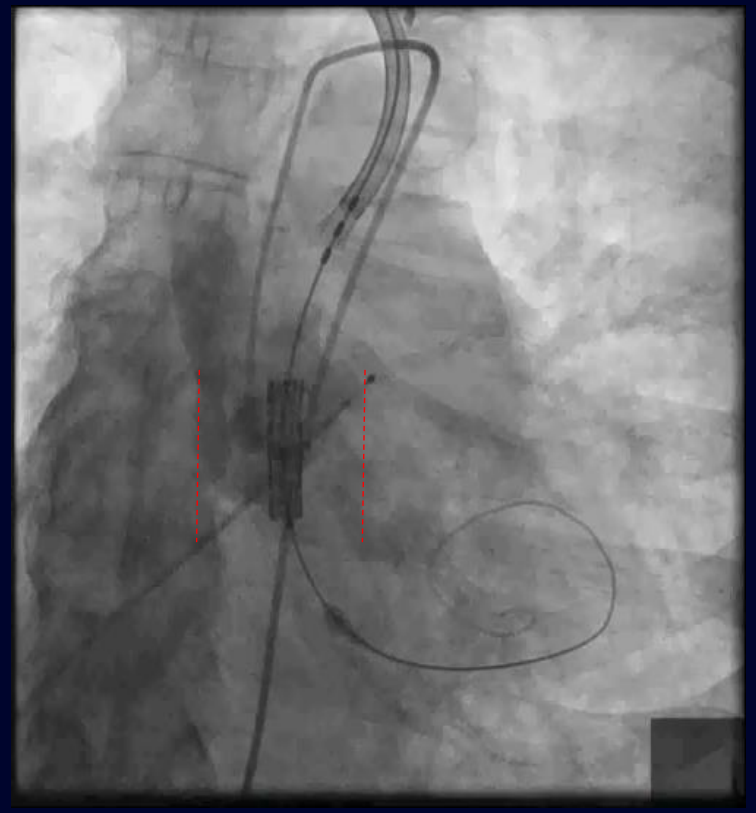


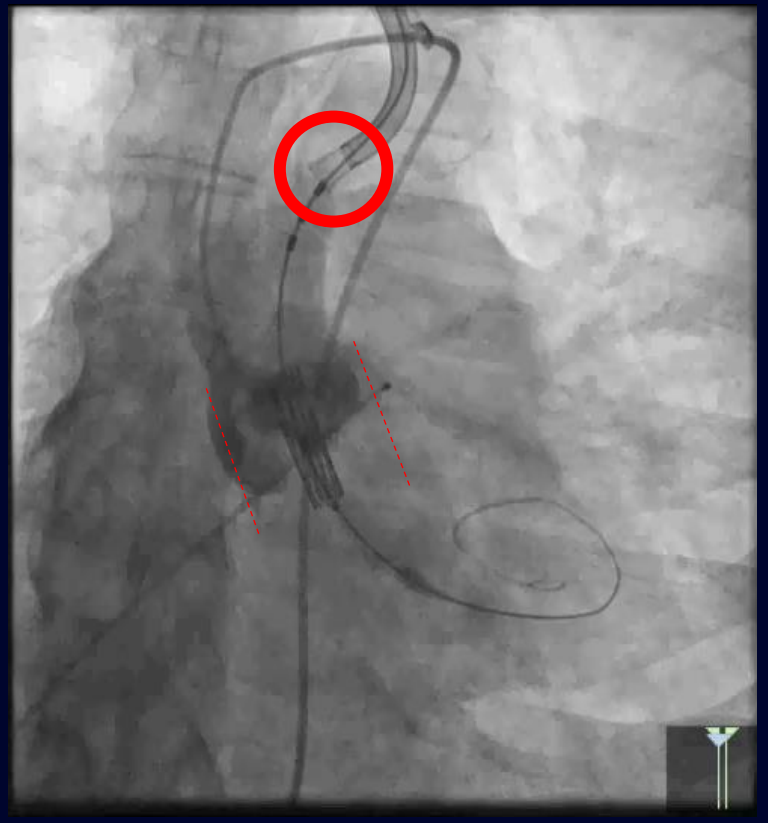
CASE 2.
“flip-n-flex” technique







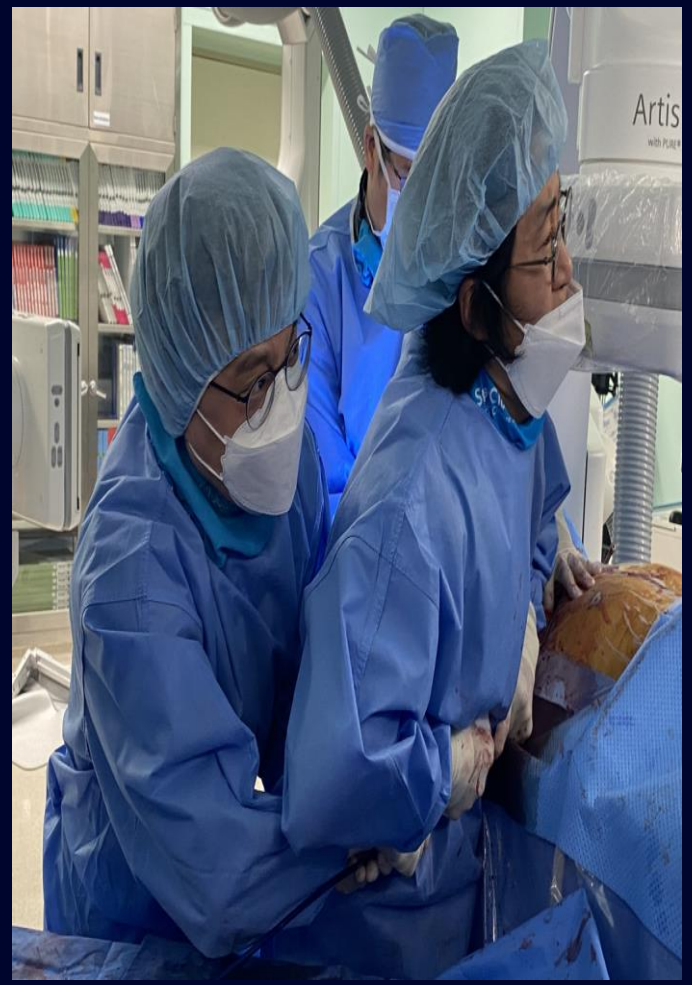


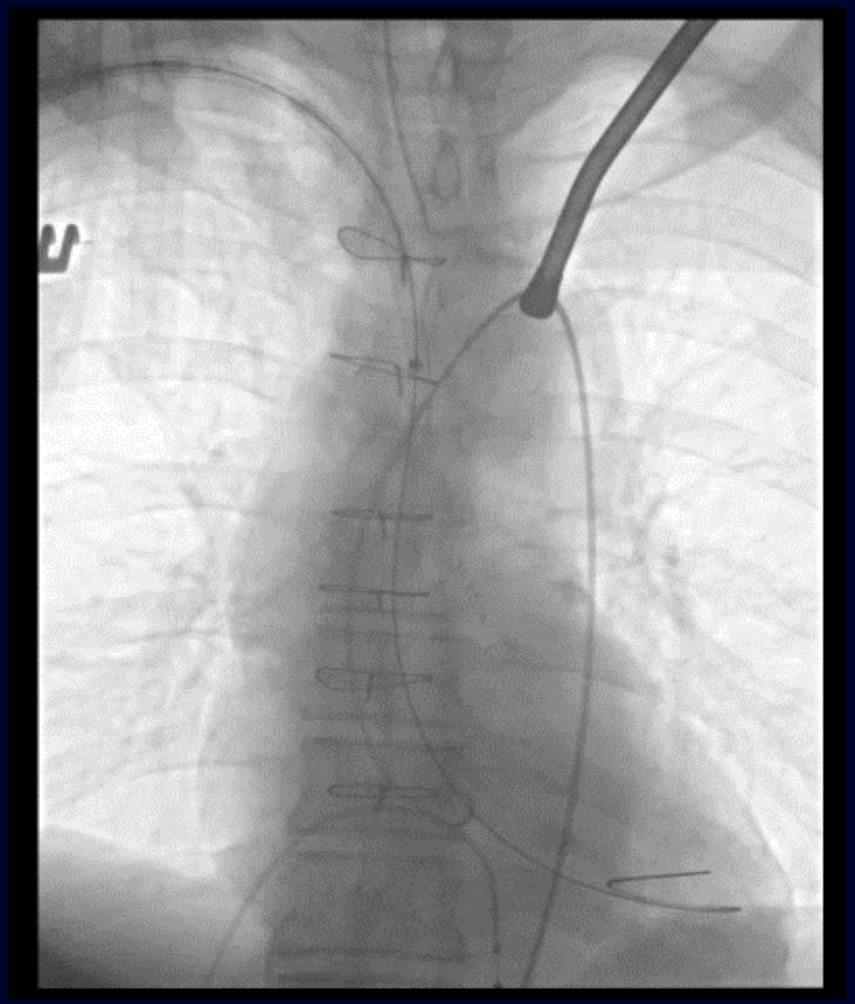


SAPIEN 3 delivery system was rotated 180° and advanced with the Edwards logo facing downwards (step ①, “flip”), as opposed

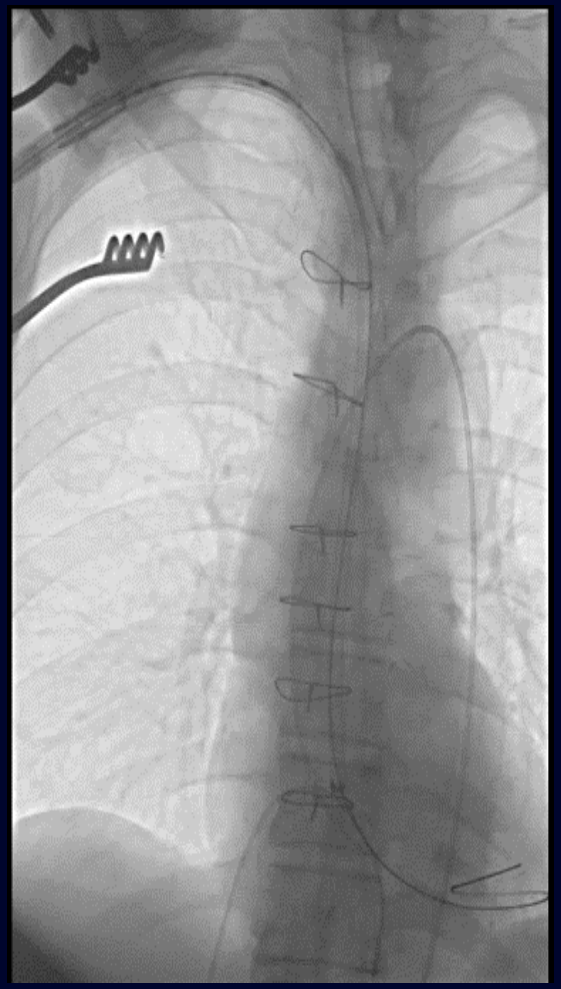
image 3). Therefore, we modified the procedure by hyper-flexing the device and configuring the wire against the greater curvature of the aorta (step ③, “flex”). Gentle torque of the device and fine

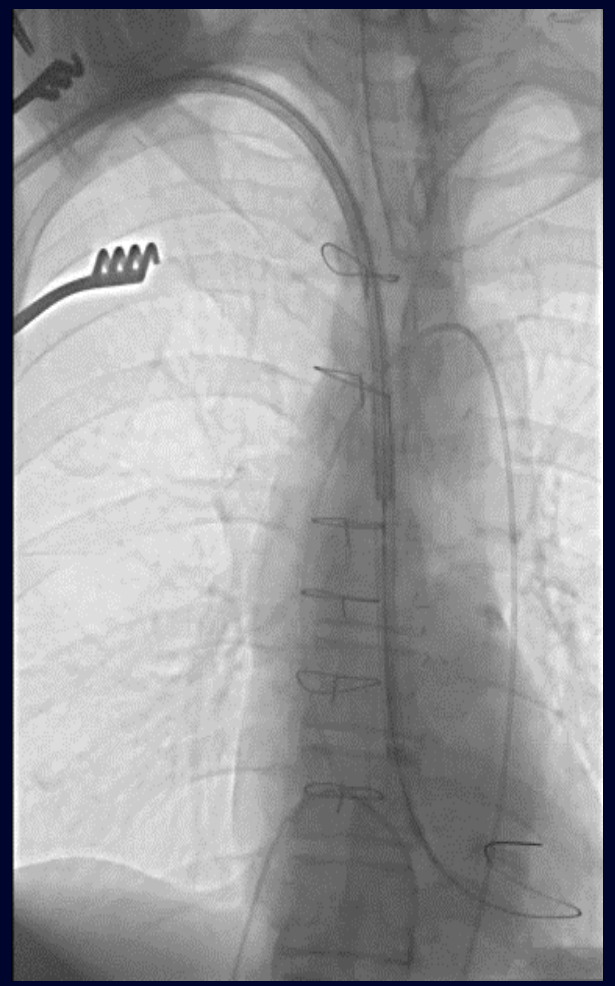
CASE 2.
Trans Subclavian

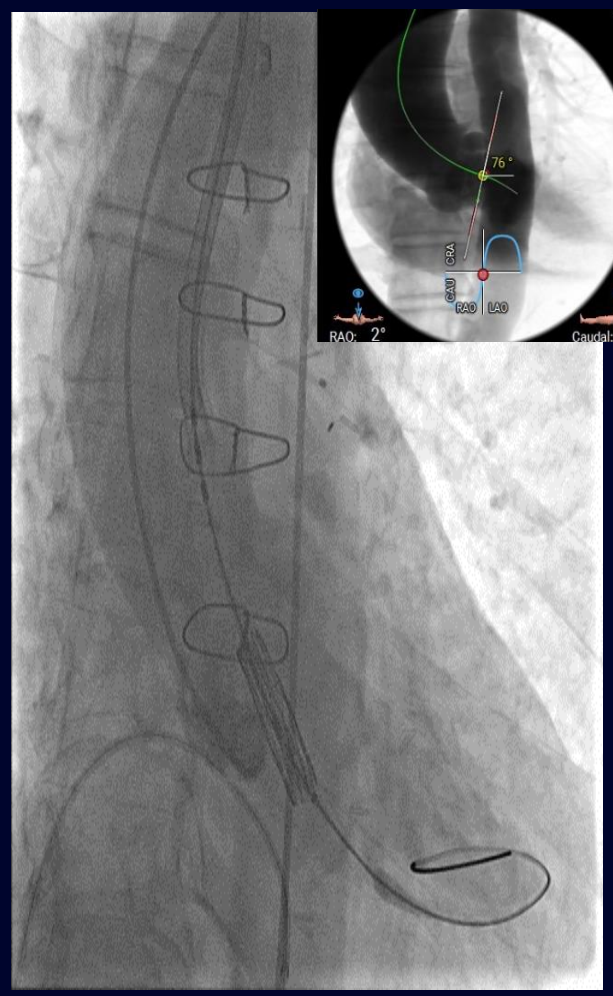




CASE 2.
Trans Subclavian







Conclusions

- Unsuitable iliofemoral anatomy no longer precludes patients from undergoing TAVI and alternative access routes and much of the published data on alternative access TAVI shows promising results.
- Initially, transthoracic approaches were most common, but recently, the trend has been toward alternative non-thoracic access due to superior outcomes.
- Existing access site does not allow TAVI operators to favor one access over another because all have specific strengths and weaknesses.

Thank you for your attention!