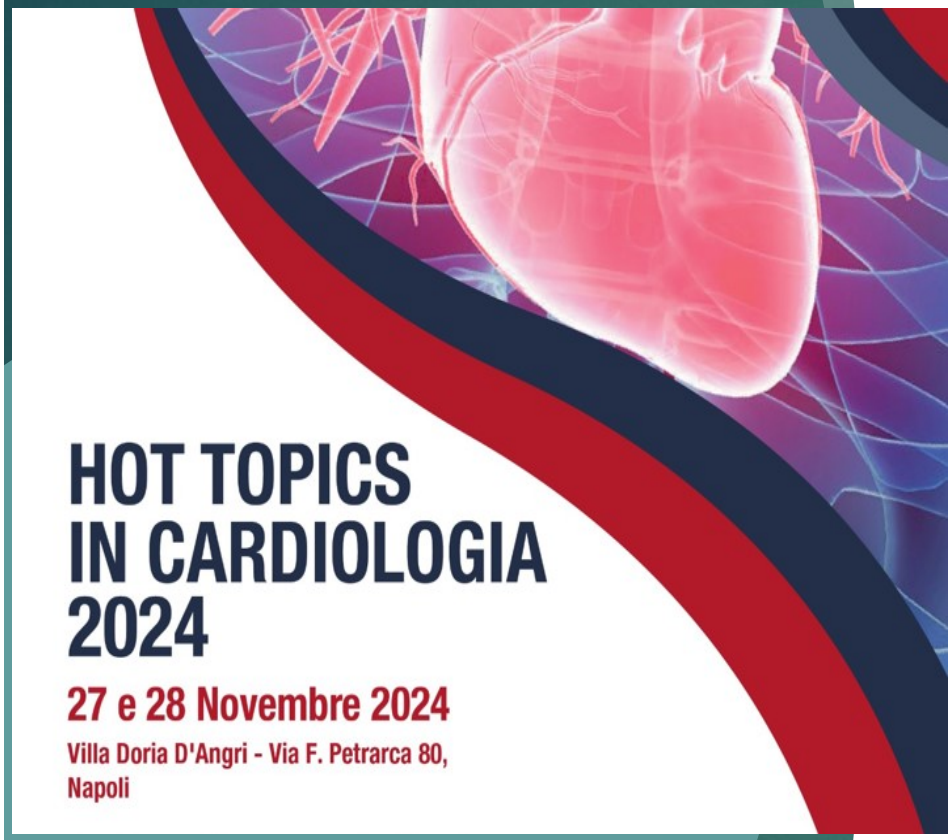
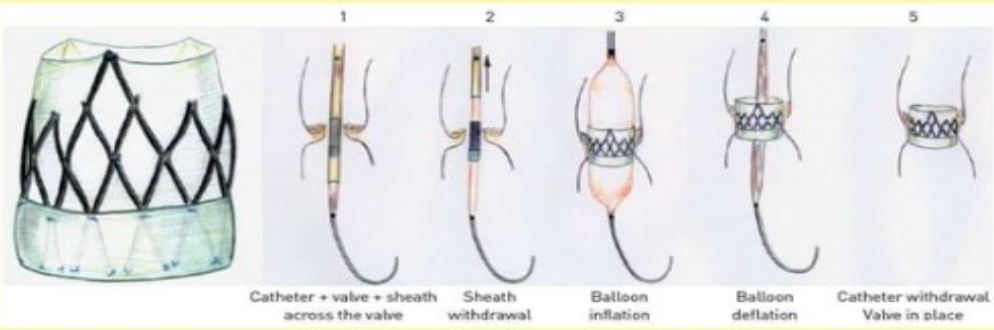


Ruolo della Cardiochirurgia nella TAVI in paziente con accessi femorali non percorribili

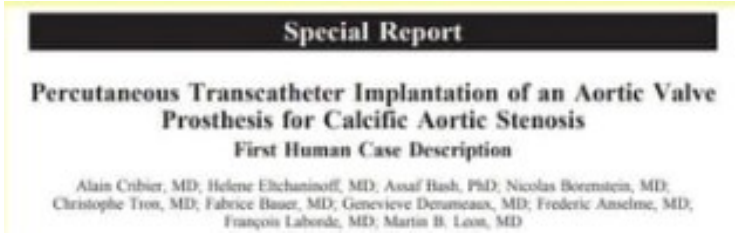
Brenno Fiorani
Direttote UOC
Cardiochirurgia
Moscati Avellino

HISTORY OF TAVI

- FIRST BALLOON AORTIC VALVOTOMY – 1988 DR ALAIN CRIBIER
- **1993**: Dr CRIBIER DEMONSTRATED IN CADAVERIC HEARTS THAT A STENT ACROSS THE AORTIC VALVE WAS WELL ANCHORED WITHIN THE AORTIC ANNULUS
- **1994:**



- **2002: FIRST HUMAN IMPLANTATION IN A 56 YEARS OLD PATIENT IN CARDIOGENIC SHOCK (COMPASSIONATE BASIS)**



Special Report

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

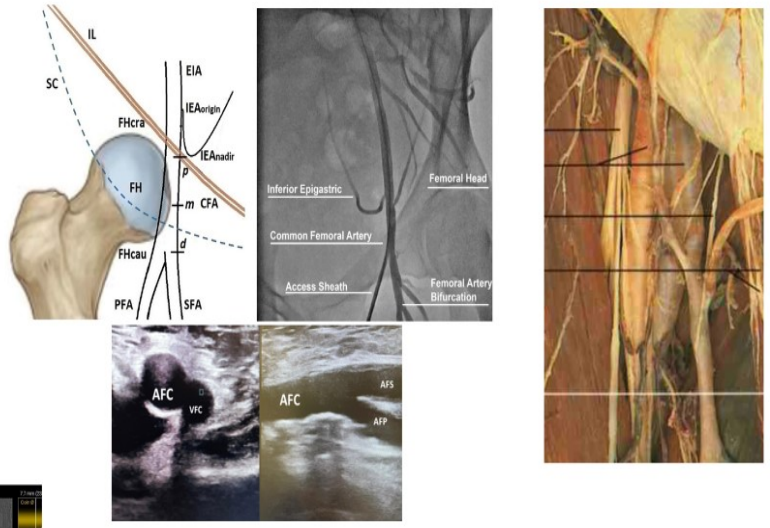
First Human Case Description

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

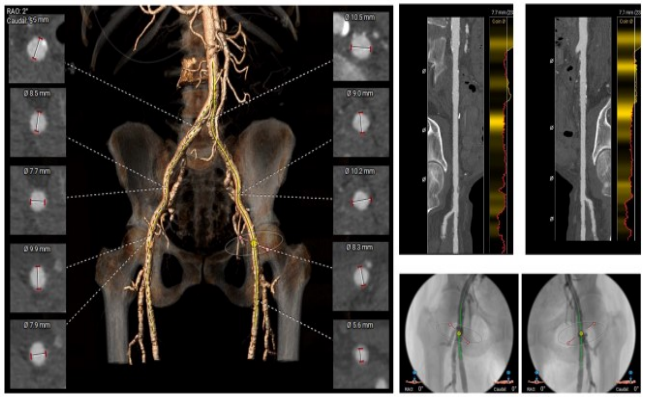
Femoral access

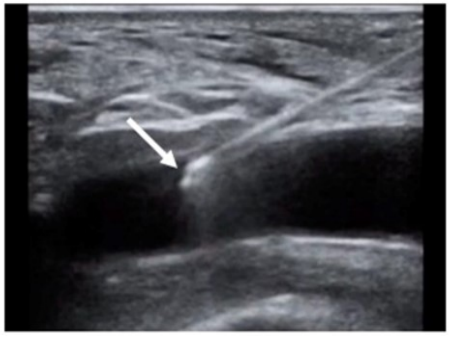
- First choice
- Local anaesthesia/conscious sedation
- Fully percutaneous/surgical cut-down
- Angiographic/US puncture
- Femoral/Radial Pigtail
- IVP (shockwave)

Anatomical Landmarks



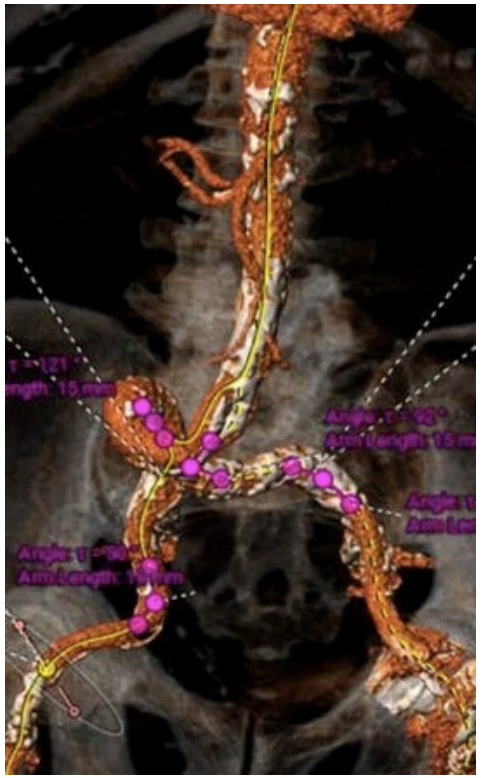
CT Planning





ACCESS ROUTE DECISION

- TRANSFEMORAL ACCESS IS THE PREFERRED ROUTE BECAUSE OF ITS MINIMAL INVASIVINESS AND IS FEASIBLE IN 90% OF CLINICAL CASE



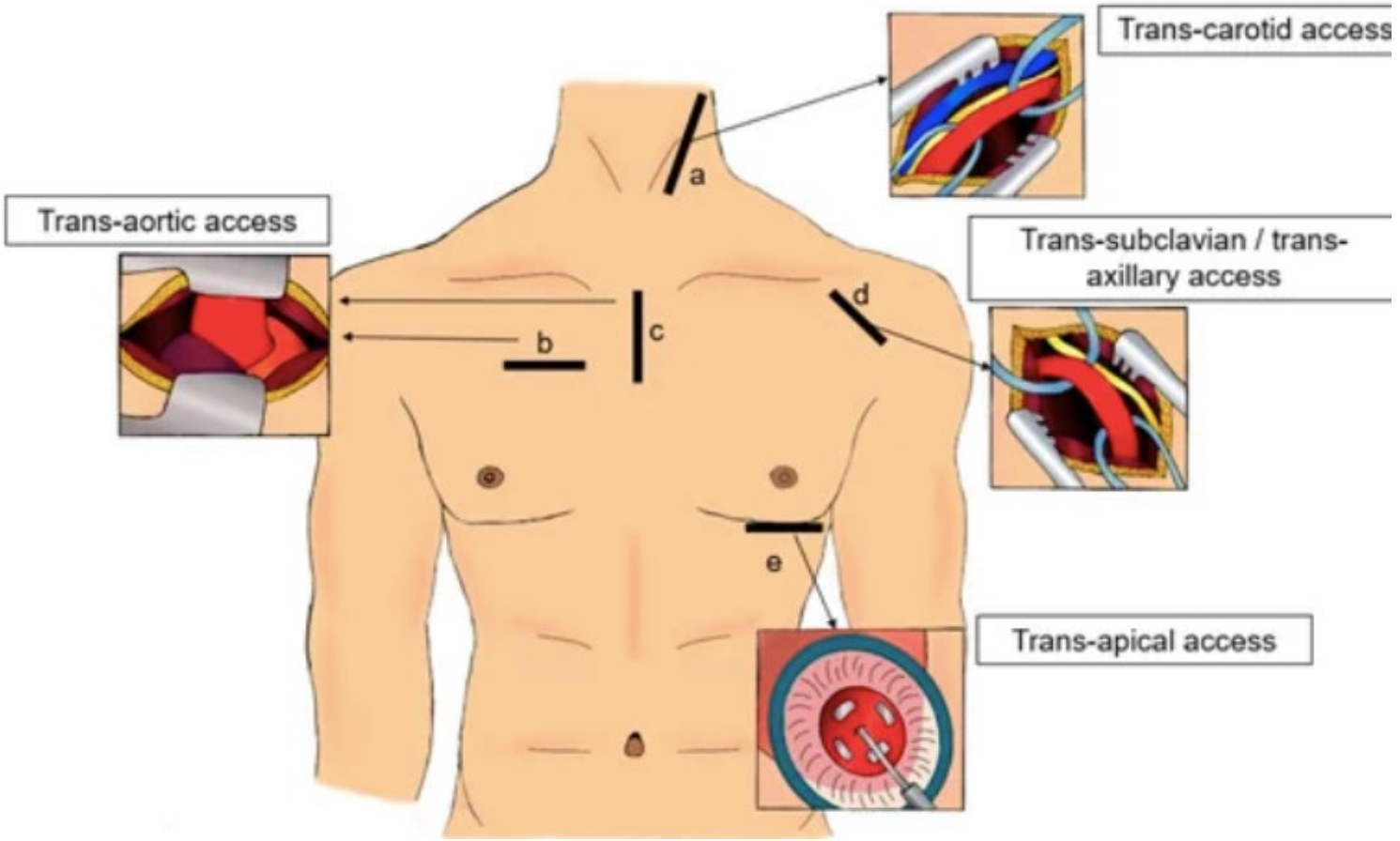
CONTROINDICATION FOR TRANSFEMORAL TAVI

1. SEVERE CIRCUMFERENTIAL CALCIFICATION
2. SEVERE TORTUOSITY OF THE FEMORAL A.
3. FEMORAL ANEURYSM
4. INSUFFICIENT DIAMETER
5. SEVERE ILIOFEMORAL DISEASE
6. CHRONIC TYPE B DISSECTION

RELATIVE CONTROINDICATION

1. PRESENCE OF IMPLANTED ARTERIAL GRAFT
2. PERIPHERAL BYPASSES (FEMORAL-POPLITEAL, FEMORAL-FEMORAL)
3. DACRON GRAFTS ATTACHED TO THE FEMORAL ARTERY

ALTERNATIVE ROUTE ACCESS

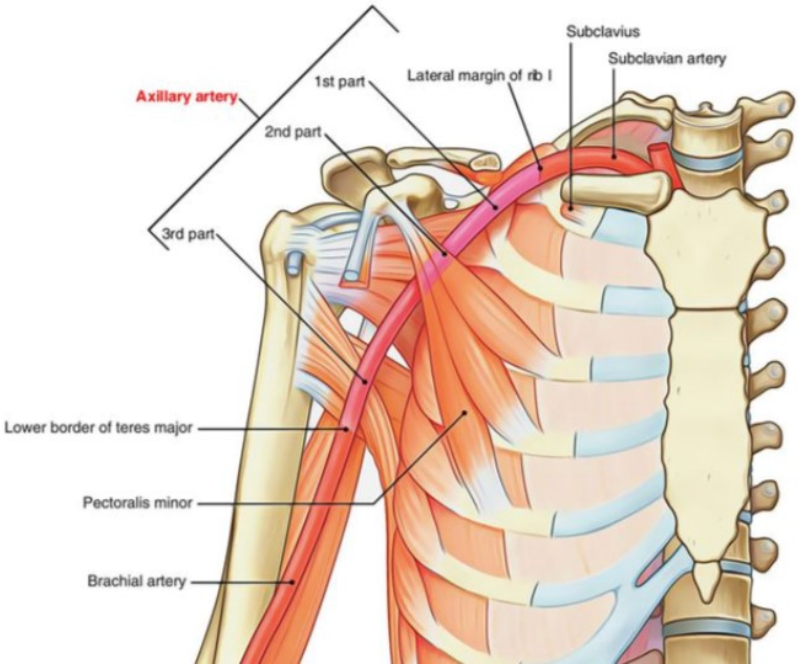


TRANSAXILLARY ACCESS FOR TAVI

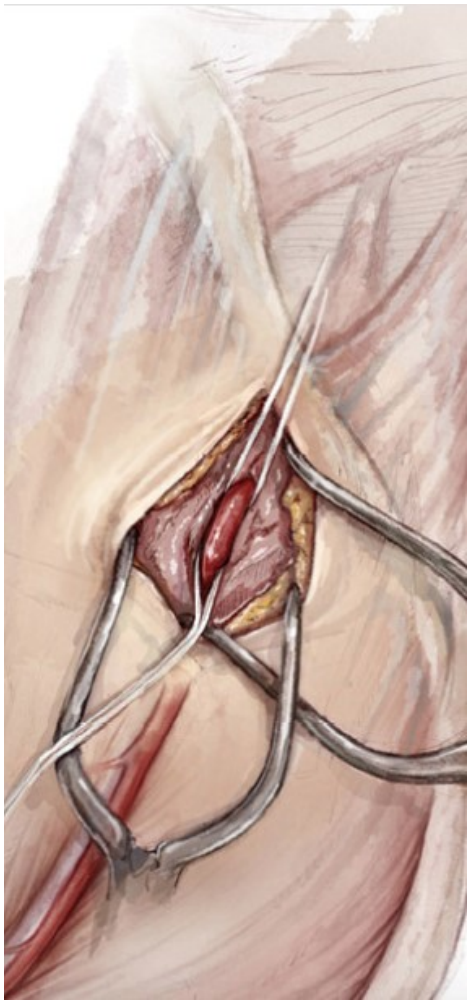
- IMPLANTATION IS ALWAYS DONE VIA THE AXILLARY ARTERY AND **NOT** VIA THE SUBCLAVIAN ARTERY
- BY TERMINOLOGY, THE AXILLARY ARTERY BEGINS AT THE LATERAL BORDER OF THE FIRST RIB AS A CONTINUATION OF THE SUBCLAVIAN ARTERY

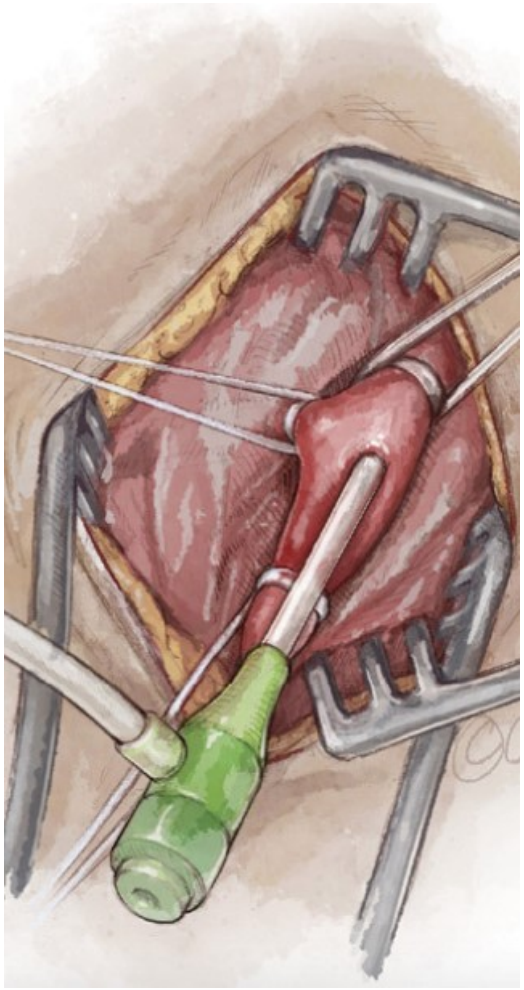
TARGET POPULATION

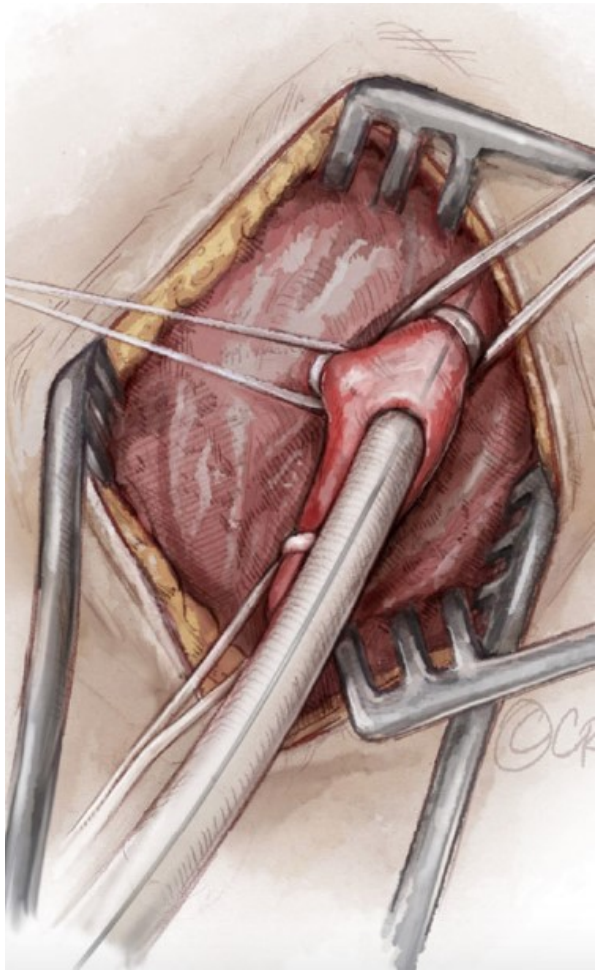
- NO TRANSFEMORAL ACCESS
- DIAMETER OF AXILLARY ARTERY ≥ 6MM (FOR A 18FR SHEATH)
- NO HEAVY CALCIFICATION OR KINKING
- NO PATENT LIMA/RIMA BYPASS GRAFT
- RIGHT/LEFT? LEAST DEGREE OF CALCIFICATION



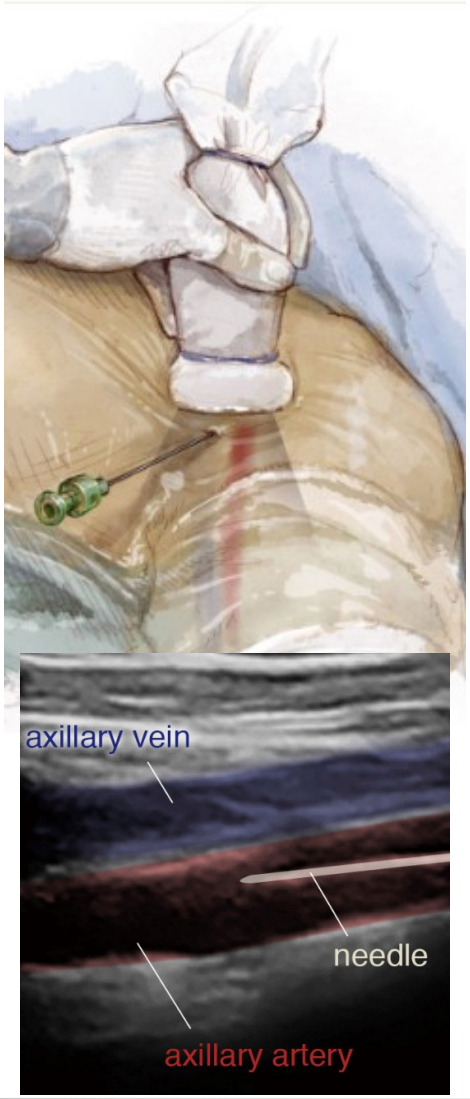
TRANSAXILLARY "OPEN" ACCESS

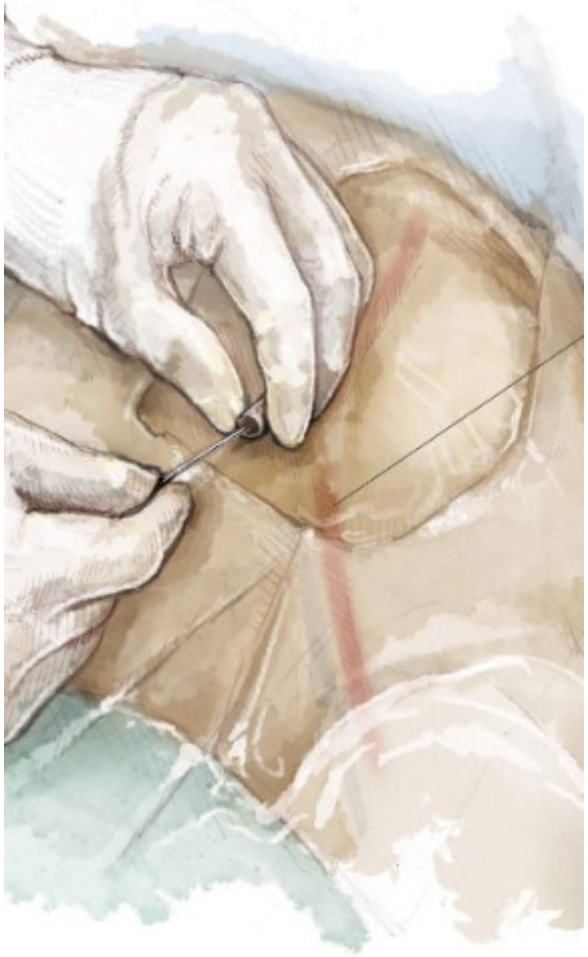






PERCUTANEOUS ACCESS





OPEN CUT-DOWN Vs PERCUTANEOUS ACCESS

	CUT DOWN	PERCUTANEOUS
Technical complexity	+	-
Duration of procedure	+	-
Control of access vessel	+	-
Secondary femoral access	+	-
Risk of plexus lesion	-	+
Blood loss	+	-
Invasiviness		+
Local anesthesia	-	+
Cost	+	-

Outcomes Following Subclavian and Axillary Artery Access for Transcatheter Aortic Valve Replacement

Society of the Thoracic Surgeons/American College of Cardiology TVT Registry Report

Thom G. Dahle, MD,[a] Tsuyoshi Kaneko, MD,[b] James M. McCabe, MD[c]

JACC cardiovascular Interventions

OBJECTIVES The aim of this study was to analyze the frequency and outcomes of patients who underwent trans-subclavian or transaxillary (TAx) transcatheter aortic valve replacement (TAVR) using the balloon-expandable SAPIEN 3 prosthesis compared with traditional alternative access, transapical (TA) and transaortic (TAo).

BACKGROUND The transsubclavian and TAx approaches for TAVR are rapidly growing alternatives in the setting of hostile iliofemoral arteries, yet few data exist.

METHODS The Society of Thoracic Surgeons/American College of Cardiology TVT (Transcatheter Valve Therapy) Registry was queried for all patients undergoing TAx TAVR with the SAPIEN 3 prosthesis from June 2015 to February 2018. Secular trends over time were evaluated. Logistic regression analyses used to assess risk-adjusted outcomes. Propensity score matching was used to compare TAx access with TA and TAo access.

RESULTS In total, 3,628 patients (5.7%) underwent nontransfemoral access with the SAPIEN 3. Overall, TAx TAVR accounted for 1,249 of these patients (34.4%). There has been rapid recent growth in TAx TAVR (from 20.2% in the third quarter of 2015 to 49.0% in the fourth quarter of 2017; $p < 0.001$ for trend) and a concomitant decrease in TA and TAo access (from 61.9% in the third quarter of 2015 to 35.3% in the fourth quarter of 2017; $p < 0.001$ for trend). The median number of TAx TAVR cases per hospital during the study period was 2, and 78.2% of centers performed ≤5 TAx TAVR procedures. The device success rate was 97.3%, and the major vascular complication rate was 2.5%. After propensity matching, TAx access had lower 30-day mortality (5.3% vs. 8.4%; $p < 0.01$), shorter lengths of intensive care unit and hospital stay, but a higher stroke rate (6.3% vs. 3.1%; $p < 0.05$) compared with TA and TAo access.

CONCLUSIONS TAx access has become the most frequent alternative access route for balloon-expandable TAVR procedures. Outcomes following TAx TAVR appear positive despite the relatively early experience of most centers performing these cases. (J Am Coll Cardiol Intv 2019;12:662–9)

TRANSCAROTID ACCESS

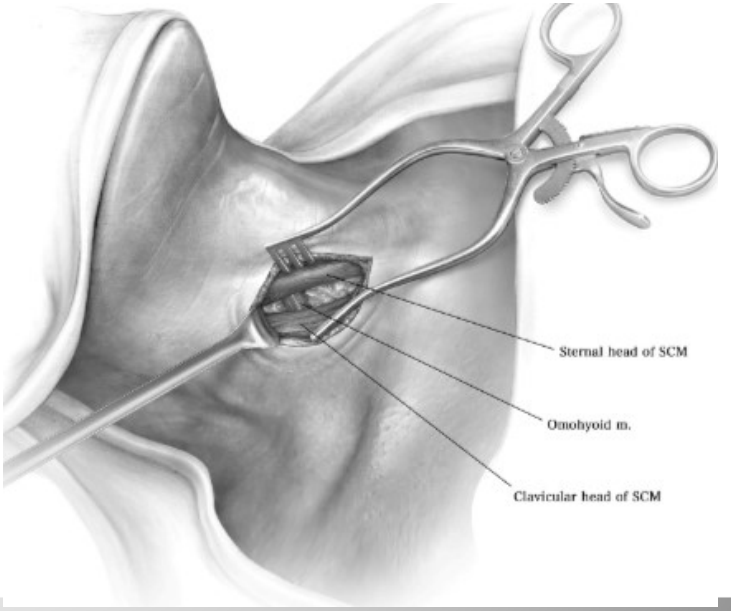
- DESPITE NEWER AND SMALLER DELIVERY SYSTEMS, APPROXIMATELY 5 PERCENT OF PATIENTS WILL REQUIRE ALTERNATIVE ACCESS FOR TAVR.

- THE CAROTID ARTERY IS MORE ROBUST THAN THE AXILLARY ARTERY AND BECAUSE IT IS MORE ACCESSIBLE IN THE NECK, THE DISSECTION REQUIRED FOR TCAR ACCESS IS CONSIDERABLY EASIER AND LESS EXTENSIVE.

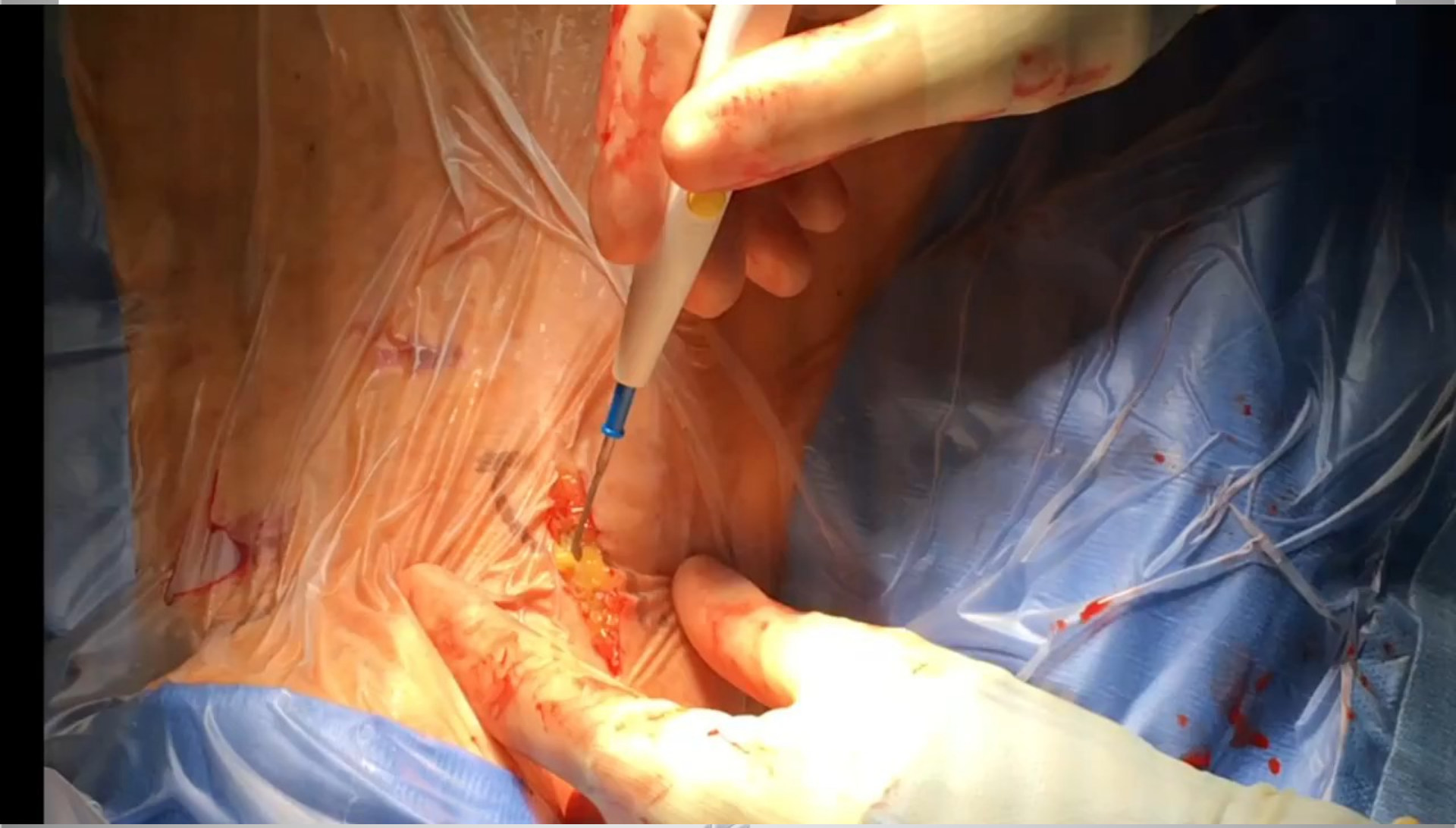
- TRANSCAROTID ACCESS OFFERS A SAFE AND REPRODUCIBLE TECHNIQUE FOR ALTERNATIVE ACCESS FOR TRANSCATHETER AORTIC VALVE DELIVERY.

TCAR TAVI CONTROINDICATIONS

1. Heavy calcification
2. Significant tortuosity
3. Carotid diameter < 5.5 mm



TRANSCAROTID ACCESS

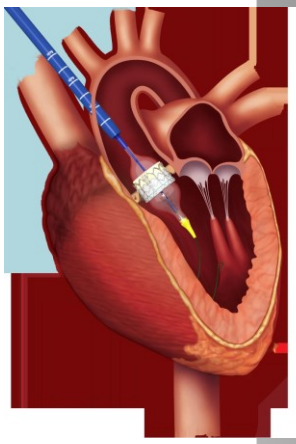


NO VASCULAR ACCESS?
TRANSAPICAL AND TRANSAORTIC APPROACHES

- **TRANSAORTIC TAVI** OFFERS AN ALTERNATIVE IN PATIENTS WITH SEVERELY CALCIFIED VESSELS AND, SPECIFICALLY, A DISEASE AORTIC ARCH
- IT ALLOWS PARTIAL STERNOTOMY OR RIGHT ANTERIOR THORACOTOMY
- RAPID CONVERSION TO A FULL STERNOTOMY IF NEEDED
- LESS APICAL BLEEDING AND MYOCARDIAL DAMAGE COMPARED TO THE TRANSAPICAL APPROACH.
- METICULOUS ASSESSMENT OF THE AORTIC WALL QUALITY WHERE PURSE STRING SUTURES WILL BE PLACED IS ESSENTIAL, WITH A REQUIREMENT FOR AN AREA FREE OF CALCIUM SPANNING AT LEAST 1 CM^2
- AN ASCENDING AORTA WITH A HORIZONTAL ORIENTATION, CHARACTERISED BY AN ANGLE EXCEEDING 70°, MAY NECESSITATE INCREASED MANIPULATION OF THE DELIVERY SYSTEM, HEIGHTENING THE RISK OF VALVE MISALIGNMENT
- THE DISTANCE BETWEEN THE AORTIC ENTRY AND THE AORTIC ANNULUS SHOULD BE AT LEAST 6 CM

NO VASCULAR ACCESS?
TRANSAPICAL AND TRANSAORTIC APPROACHES

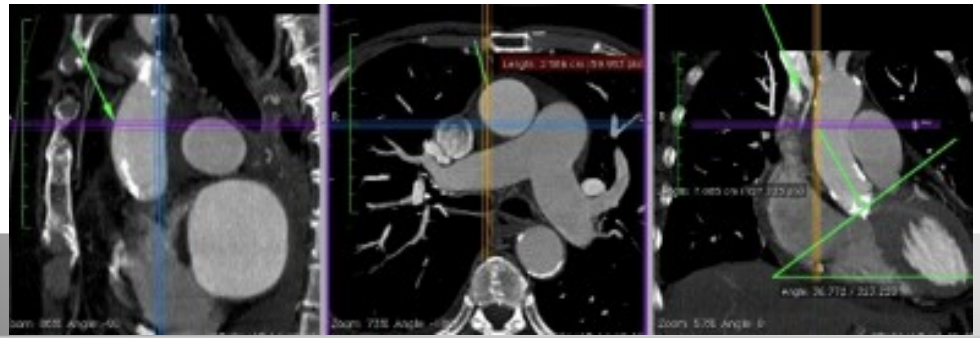
TRANSAORTIC TAVI CONTROINDICATION:

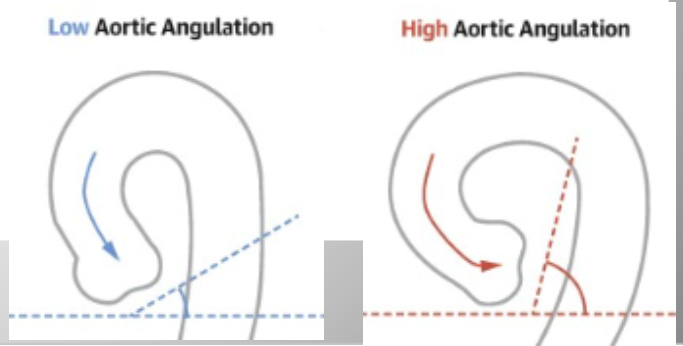


1. HEAVY CALCIFIED OR ATHEROMATOUS ASCENDING AORTA
2. VEIN GRAFTS WITH VERY HIGH ORIGIN
3. VARIATION PREVENTING A GOOD COAXIAL PROSTHESIS DEPLOYMENT (PECTUS EXCAVATUM=

CT ANALYSIS

1. **AXIAL VIEW:** EVALUATE RIGHT ANTEROLATERAL ASPECT OF THE AORTA / MEASURE AORTA-CHEST WALL DISTANCE (>6 CM, CHALLENGING APPROACH) / IF AORTA IS ON THE RIGHT OF THE STERNUM OR HORIZONTAL (ANGLE>45°) MINITHORACOTOMY IS SUGGESTED.
2. **CORONAL VIEW:** ANGLE OF AORTIC ANNULUS : CHECK THE HORIONTAL AORTA ANGLE / DISTANCE BETWEEN AO ANNULUS AND PUNCURE SITE / IF THE HORIZONTAL ANGLE IS > 75%, TRANSAPICAL APPROACH MAY BE PREFERRED





Transcatheter Aortic Valve Replacement Using Transaortic Access

Experience From the Multicenter, Multinational, Prospective ROUTE Registry

Vinayak Bapat, MD,[a] Derk Frank, MD,[b] Ricardo Cocchieri, MD,[c] Dariusz Jagielak, MD,[d] Nikolaos Bonaros, MD,[e] Marco Aiello, MD,[f] Joel Lapeze, MD,[g] Mika Laine, MD,[h] Sidney Chocron, MD,[i] Douglas Muir, MD,[j] Walter Eichinger, MD,[k] Matthias Thielmann, MD,[l] Louis Labrousse, MD,[m] Kjell Arne Rein, MD,[n] Jean-Philippe Verhoye, MD,[o] Gino Gerosa, MD,[p] Hardy Baumbach, MD,[q] Peter Bramlage, MD,[r] Cornelia Deutsch, MD,[r] Martin Thoenes, MD,[s] Mauro Romano, MD[t]

JACC cardiovascular Interventions

OBJECTIVES The Registry of the Utilization of the TAo-TAVR approach using the Edwards SAPIEN Valve (ROUTE) was established to assess the effectiveness and safety of the use of transaortic (TAo) access for transcatheter aortic valve replacement (TAVR) procedures (NCT01991431).

BACKGROUND TAVR represents an alternative to surgical valve replacement in high-risk patients. Whereas the transfemoral access route is used commonly as the first-line approach, transapical access is an option for patients not suitable for transfemoral treatment mainly due to anatomic conditions. TAo-TAVR has been shown to be a viable alternative surgical access route; however, only limited data on its effectiveness and safety has been published.

METHODS ROUTE is a multicenter, international, prospective, observational registry; data were collected from 18 centers across Europe starting in February 2013. Patients having severe calcific aortic stenosis were documented if they were scheduled to undergo TAo-TAVR using an Edwards SAPIEN XT or a SAPIEN 3 valve. The primary endpoint was 30-day mortality. Secondary endpoints were intraprocedural or in hospital and 30-day complication rates.

RESULTS A total of 301 patients with a mean age of 81.7 ± 5.9 years and an Society of Thoracic Surgeons score of 9.0 ± 7.6% were included. Valve success was documented in 96.7%. The 30-day mortality was 6.1% (18/293) (procedure-related mortality: 3.1%; 9 of 293). The Valve Academic Research Consortium-2 defined complications included myocardial infarction (1.0%), stroke (1.0%), transient ischemic attack (0.3%), major vascular complications (3.4%), life-threatening bleeding (3.4%), and acute kidney injury (9.5%). In 3.3% of patients, paravalvular regurgitation was classified as moderate or severe (10 of 300). Twenty-six patients (8.8%) required permanent pacemaker implantation.

CONCLUSIONS TAo access for TAVR seems to be a safe alternative to the transapical procedure.

(J Am Coll Cardiol Intv 2016;9:1815–22)

NO VASCULAR ACCESS?
TRANSAPICAL AND TRANSAORTIC APPROACHES

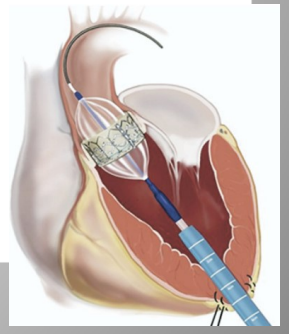
- **TRANSAPICAL TAVI** INTRODUCED IN 2005, THE TRANSAPICAL APPROACH OFFERS A VALUABLE ALTERNATIVE FOR TAVI IN CASES OF UNFAVOURABLE PERIPHERAL VASCULAR ANATOMY.

- IT ALLOWS FOR BYPASSING THE COMPROMISED VASCULAR TREE ENTIRELY, PROVIDING EXCELLENT CONTROL OVER CATHETER AND PROSTHESIS PLACEMENT DUE TO THE SHORT DISTANCE BETWEEN ACCESS AND TARGET

- DESPITE ITS HISTORICAL PROMINENCE, THE TRANSAPICAL APPROACH NOW SERVES AS THE **THIRD CHOICE** ACCESS ROUTE AFTER TRANSFEMORAL AND TRANSAXILLARY APPROACHES IN MANY CENTRES.

- **THIS SHIFT CAN BE MOSTLY ATTRIBUTED TO THE TECHNOLOGICAL ADVANCEMENTS**: THERE HAS BEEN A REDUCTION IN THE INCIDENCE OF PERIPHERAL VASCULAR COMPLICATIONS ASSOCIATED WITH TRANSFEMORAL ACCESS, FURTHERMORE CATHETER SIZE HAS DECREASED AND FLEXIBILITY HAS IMPROVED, ENABLING THE TREATMENT OF PATIENTS WITH SMALLER VESSEL CALIBRES.

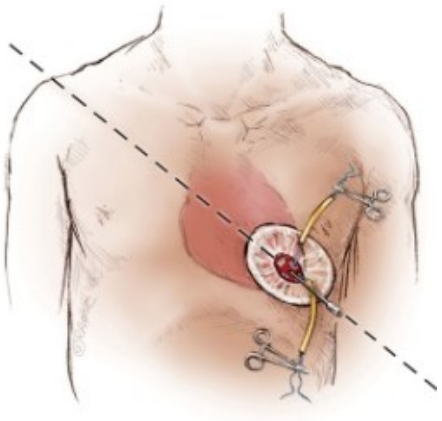
- ACCORDING TO THE 2024 NICOR DATA, THE INCIDENCE OF TRANSAPICAL TAVI PROCEDURES HAS SIGNIFICANTLY DECLINED **FROM 13.56% IN 2013/2014 TO 0.43% IN 2022/2023**[1]

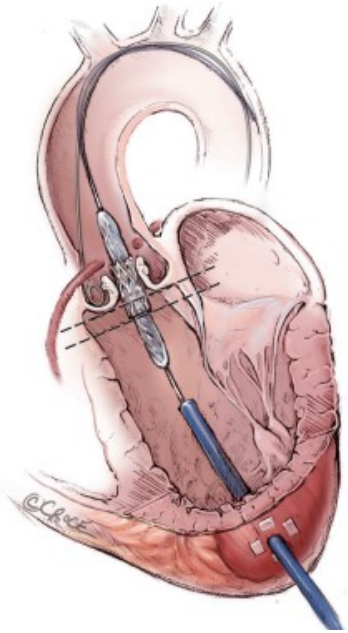


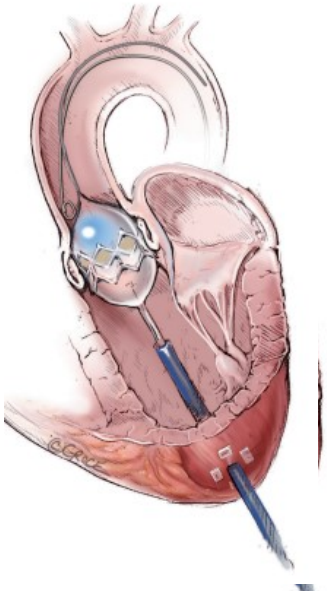
1.NICOR. Transcatheter Aortic Valve Implantation (TAVI). 2024. Available online: https://www.nicor.org.uk/national-cardiac-audit-programme/transcatheter-aortic-valve-implantation-tavi#:~:text=The%20UK%20TAVI%20program%20was (accessed on 2 June 2024).

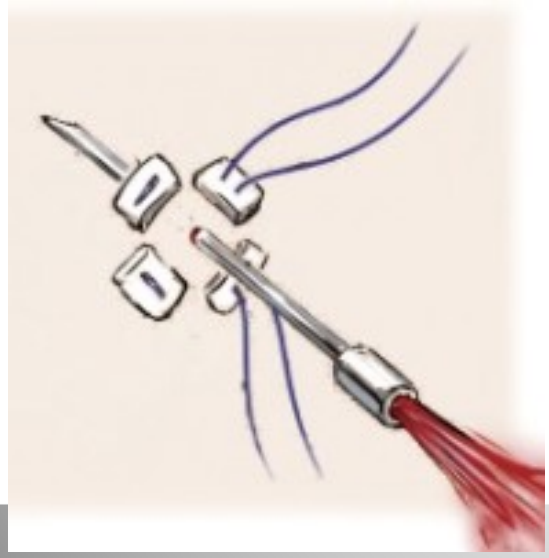
NO VASCULAR ACCESS?

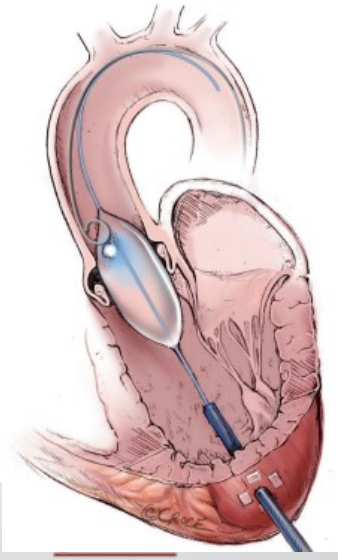
TRANSAPICAL AND TRANSAORTIC APPROACHES

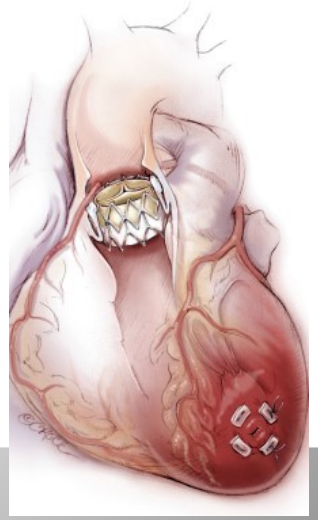








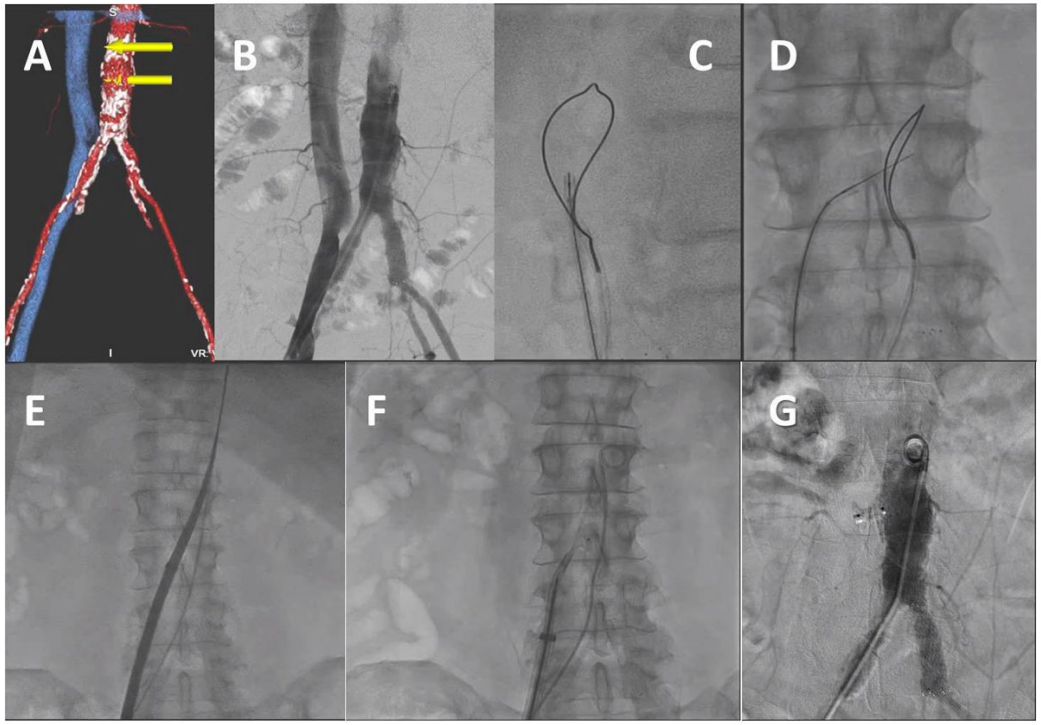




Transcaval access

- 2014: first report TA

«a proof of concept rather than as an effective alternative option to standard TAVI access routes»



Catheter Cardiovasc Interv. 2015 December

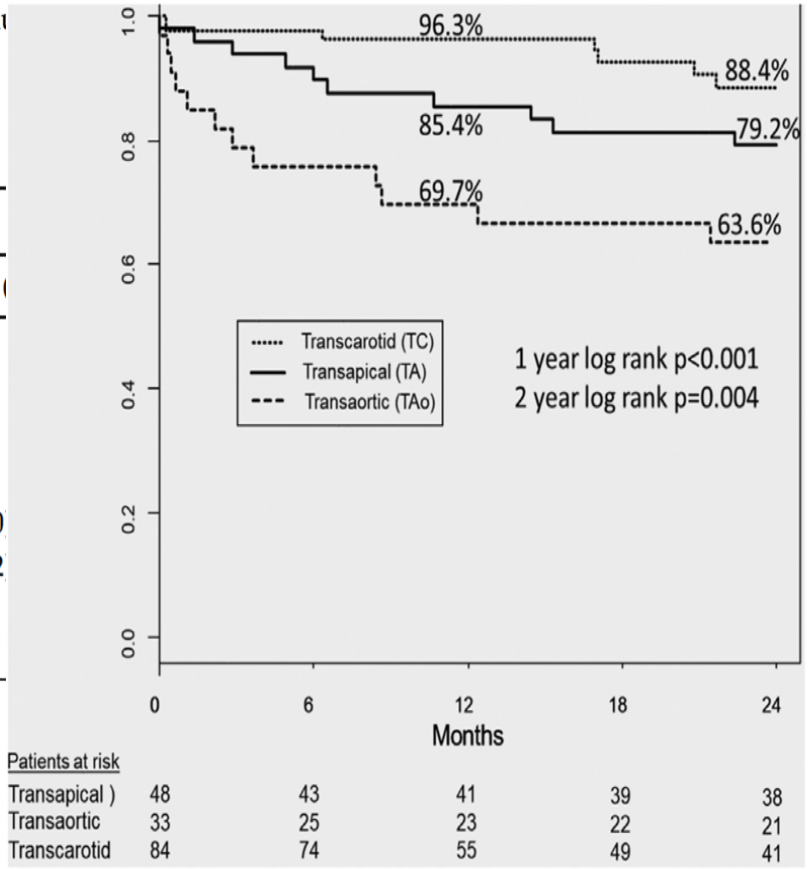
Transcarotid Versus Transapical and Transaortic Access for Transcatheter Aortic Valve Replacement

Keith B. Allen, MD, Adnan K. Chhatriwalla, MD, David Cohen, MD, John Saxon, MD, Zuhair Hawa, Kevin F. Kennedy, MS, Sanjeev Aggarwal, MD, Ru
Alex Pak, MD, and A. Michael Borkon, MD

Saint Luke's Mid America Heart Institute, Kansas City, Missouri

Table 2. Clinical Outcomes at 30 Days

Outcomes	Total (N = 165)	Transapical (
Mortality		
In hospital	5 (3.0)	1 (2.1)
In hospital or 30 days	11 (6.7)	3 (6.3)
Stroke (30 day)	4 (2.4)	1 (2.1)
Blood product transfusion (any)	24 (14.5)	12 (25.0
Discharged to home without home health care	120 (72.7)	26 (54.2
Median length of stay (IQR)	5.0 (2.0, 7.0)	6.5 (5.0,



Surgical aortic valve replacement outcomes in the transcatheter era

Elisabeth Martin, MD, François Dagenais, MD, Pierre Voisine, MD, Eric Dumont, MD,
Eric Charbonneau, MD, Richard Baillot, MD, Dimitri

TABLE 1. Baseline patient characteristics

Variable	SAVR pre-TAVI (n = 529)	SAVR post-TAVI (n = 1064)	*P* value
Age (y)	68.3 ± 10.8	69.1 ± 10.2	.14
Male	302 (57.1)	624 (58.7)	.55
Active smoking	56 (11.2)	117 (11.0)	.93
Redo sternotomy	52 (9.8)	71 (6.7)	.03
Diabetes mellitus	116 (21.9)	282 (26.5)	.04
Hypertension	312 (59.0)	736 (69.2)	<.0001
Chronic obstructive pulmonary disease	70 (13.2)	126 (11.8)	.42
Obesity*	153 (28.9)	365 (34.3)	.03
Previous stroke	26 (4.9)	59 (5.6)	.64
Renal failure†	14 (2.7)	12 (1.1)	.03
Creatinine clearance‡	79.4 ± 22.6	89.0 ± 24.9	<.0001
Atrial fibrillation	64 (12.1)	168 (15.8)	.04
Permanent pacemaker/defibrillator	23 (4.4)	53 (5.0)	.62
Peripheral vascular disease	36 (6.8)	96 (9.0)	.15
Coronary artery disease	84 (15.9)	198 (18.6)	.19
Previous myocardial infarction	50 (9.5)	102 (9.6)	1.00
Recent myocardial infarction§	4 (0.8)	30 (2.8)	.01
Left ventricular ejection fraction (%)	59.3 ± 13.7	59.4 ± 10.5	.83
STS score (mean)	2.4 ± 2.4	2.2 ± 4.3	.29
STS score (median)	1.6 (1.1-2.8)	1.5 (1.0-2.4)	.03

TABLE 3. In-hospital outcomes

Outcome	SAVR pre-TAVI (n = 529)	SAVR post-TAVI (n = 1064)	*P* value
Mortality	19 (3.6)	19 (1.8)	.03
Stroke	13 (2.5)	30 (2.8)	.74
Sepsis	7 (1.3)	8 (0.8)	.28
Mediastinitis	2 (0.4)	8 (0.8)	.51
Pneumonia	48 (9.1)	77 (7.2)	.20
New-onset atrial fibrillation	214 (40.5)	376 (35.3)	.05
Permanent pacemaker insertion	18 (3.4)	31 (2.9)	.64
Acute renal failure	66 (12.5)	88 (8.3)	.01
Requiring hemodialysis	14 (2.7)	16 (1.5)	.12
Red blood cell transfusion	372 (70.3)	589 (55.4)	<.0001
Reexploration for bleeding	38 (7.2)	38 (3.6)	.01
Assisted ventilation > 48 h	20 (3.8)	26 (2.4)	.15
Length of hospital stay (d)	9.2 ± 9.8	8.6 ± 7.8	.19

There was a significant reduction in operative mortality of SAVR in the post-TAVI era despite greater severity of several markers of risk.

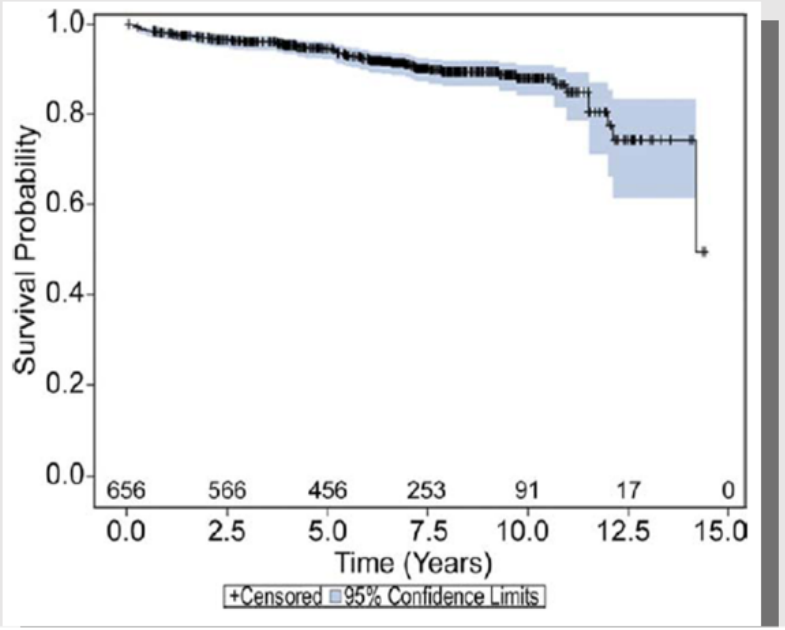
Surgical Valves Durability

Late Outcomes for Aortic Valve Replacement with the Carpentier-Edwards Pericardial Bioprothesis: Up to 17 years Follow-up in 1,000 Patients

R. Scott, Lawrence H. Cohn

Ann Thorac Surg 2010;89:1410-1416

Patient aged	between 65 - 75 yrs	Older than 75 yrs
Freedom from reop. due to SVD at 15 years	89.4%	99.5%

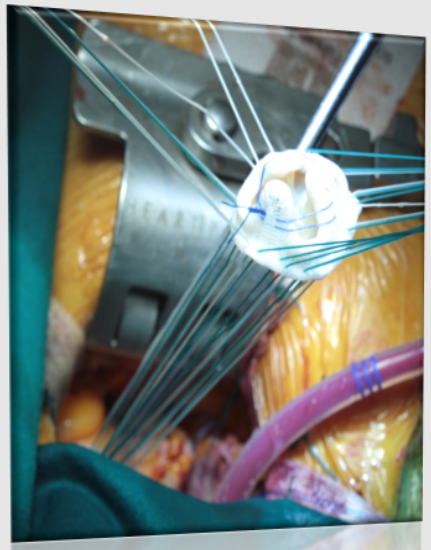


Overall freedom from any complication. Blue shade area indicates 95% confidence interval

CHIRURGIA DELLA VALVOLA AORTICA

FROM BIG…TO SMALL!!!

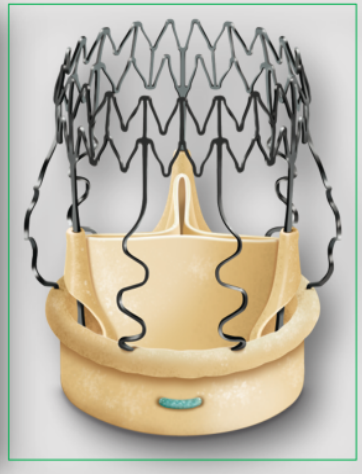
Standard vs Sutureless Aortic Valve prosthesis



VS

INTUITY

PERCEVAL



Do rapid deployment aortic valves **improve outcomes** compared with standard surgical aortic valve replacement**?**

CONCLUSIONS

THE CHOICE OF SURGICAL ACCESS FOR TAVI REPRESENTS A CRITICAL DECISION IN PATIENT MANAGEMENT, NECESSITATING A NUANCED UNDERSTANDING OF INDIVIDUAL PATIENT ANATOMY, COMORBIDITIES, AND PROCEDURAL REQUIREMENTS. WHILE THE TRANSFEMORAL APPROACH HAS BECOME THE PREFERRED METHOD DUE TO ITS MINIMALLY INVASIVE NATURE AND FAVOURABLE OUTCOMES IN MOST CASES, ALTERNATIVE ACCESS ROUTES SUCH AS TRANSAXILLARY, TRANS-CAROTID, TRANSAORTIC AND TRANSAPICAL APPROACHES OFFER VALUABLE OPTIONS FOR PATIENTS WITH ANATOMICAL CONSTRAINTS OR CONTRAINDICATIONS TO FEMORAL ACCESS

DONT FORGET SURGICAL OPTION