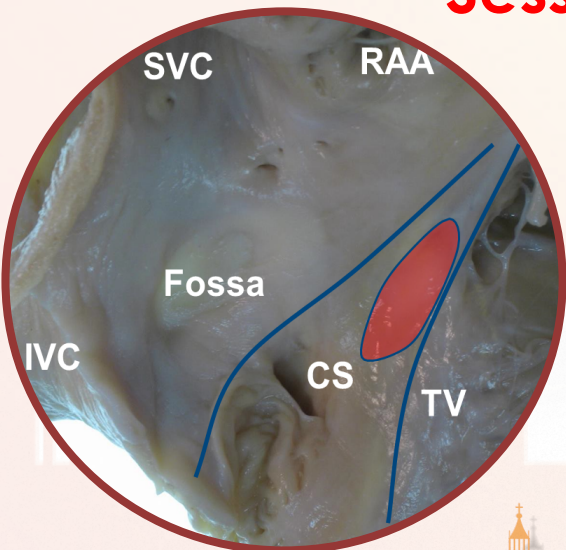


Sessione: SICUREZZA E OTTIMIZZAZIONE DELLE PROCEDURE D'ABLAZIONE DELLA FA

**Ottimizzazione dell'accesso transettale:
tecniche per migliorare l'efficienza
procedurale**



Dott. MAZZONE Patrizio

MD, FESC, FANMCO, FAIAC

Direttore della Cardiologia 3, Aritmologia ed Elettrofisiologia,
De Gasperis Cardio Center,
Grande Ospedale Metropolitano Niguarda,
Milano

Complications: 1% of procedures

De Ponti R, Cappato R, Curnis A, et al. Trans-septal catheterization in the electrophysiology laboratory: data from a multicenter survey spanning 12 years. J Am Coll Cardiol 2006;47:1037–42.

Box 1 Complications of transseptal puncture

- ▶ Pericardial effusion or tamponade
- ▶ Aortic root needle puncture
- ▶ Right or left atrial wall needle puncture
- ▶ Pleuritic chest pain
- ▶ Stroke/transient ischaemic attack
- ▶ Transient ST elevation of inferior leads
- ▶ Persistence of atrial septal defect
- ▶ Death

How to perform a transseptal puncture. Heart 2009;95;85-92. Mark J Earley



1960

Left Heart Catheterization by the Transseptal Route

A Description of the Technic and Its Applications

By JOHN ROSS, JR., M.D., EUGENE BRAUNWALD, M.D.,
AND ANDREW G. MORROW, M.D.

Circulation, 1960

1955

The use of simultaneous left heart pressure pulse measurements in evaluating the effects of mitral valve surgery.

By MOSCOVITZ, H. L., GORDON, A. J., BRAUNWALD, E., AMRAM, S. S., SAPIN, S. O.,

LASSER, R. P., HIMMELSTEIN, A., & RAVITCH, M. M.

Am J Med. 1955

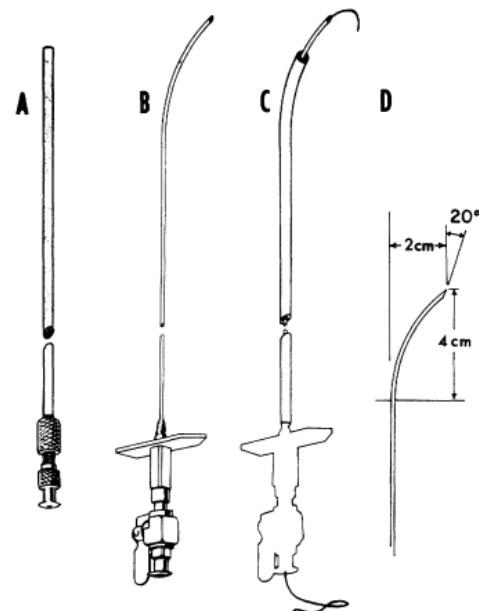
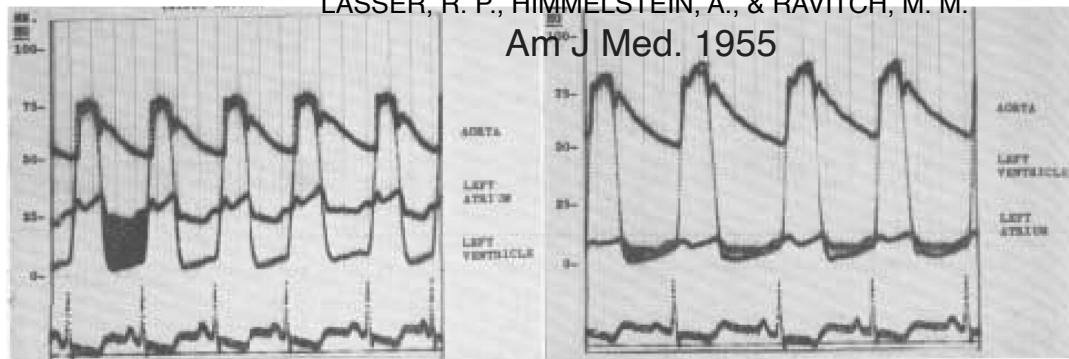


Figure 1

A. Shortened no. 8 Aorto-catheter and removable adapter. B. Transseptal needle. C. The transseptal needle has been extended beyond the tip of the catheter and the polyethylene catheter has been passed through the needle. D. Scale drawing of the curved distal end of the needle.



29/05/2026



ESC

Europace (2026) 28, euag021
<https://doi.org/10.1093/europace/euag021>

EHRA DOCUMENT



EHRA
European Heart
Rhythm Association

Transseptal puncture in cardiovascular interventions: a clinical consensus statement of the European Heart Rhythm Association, the Heart Failure Association, the European Association of Percutaneous Cardiovascular Interventions, the European Association of Cardiovascular Imaging of the ESC, and the Association for European Paediatric and Congenital Cardiology

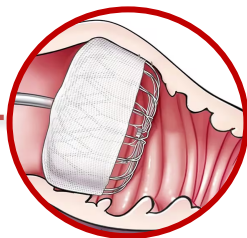
Isabel Deisenhofer ^{1*}, (EHRA), Magdy Abdelhamid ², (HFA), Marianna Adamo ³, (HFA), Nina Ajmone Marsan ⁴, (EACVI), Nicolas Amabile ⁵, (EAPCI), Caterina Bisceglia ⁶, (EHRA), Lucas Boersma ⁷, (EHRA), Belen Cid Alvarez ^{8,9,10}, (EAPCI), Stefano Cornara ^{11,12}, (EHRA), Victoria Delgado ¹³, (EACVI), Dhiraj Gupta ^{14,15}, (EHRA), Ulrich Krause ¹⁶, (AEPC), Philipp Sommer ¹⁷, (EHRA), Stylianos Tzeis ¹⁸, (EHRA), Dan Wichterle ^{19,20}, (EHRA), and Marta de Riva ^{21,22}, (EHRA)





Electrophysiology Procedures

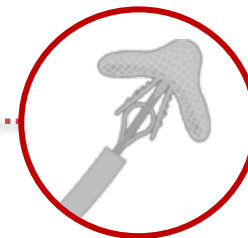
- Pulmonary vein isolation (PVI)
- Left atrial tachycardia ablation
- Left-sided accessory pathway ablation
- Left ventricular mapping/ablation



Left atrial appendage closure (pLAAC)

Advantages of TSP over retrograde aortic access:

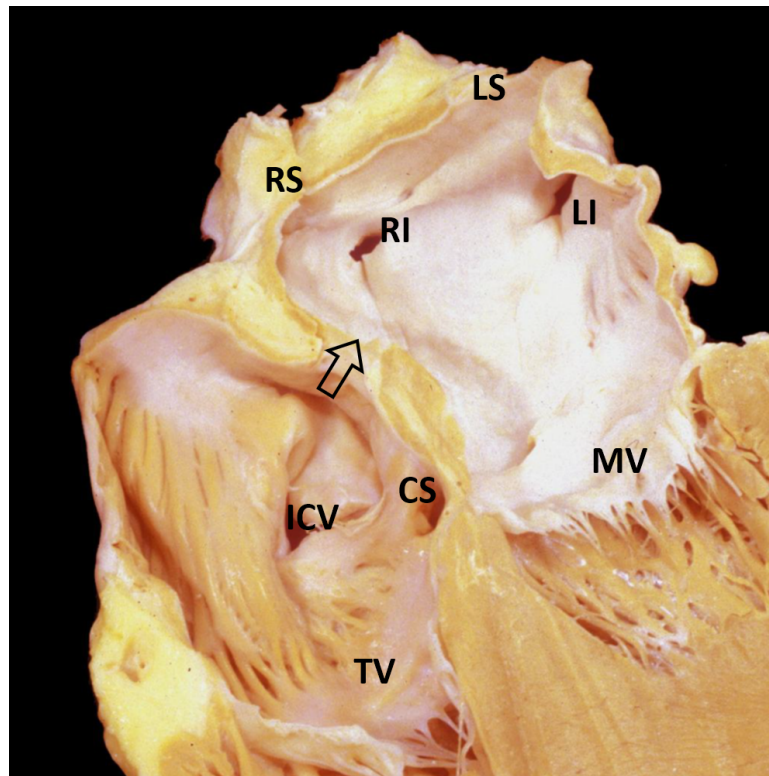
- Improved catheter stability
- Lower vascular complication rates
- Feasibility in patients with mechanical aortic valves or circulatory support device



Structural Heart Interventions

- Mitral transcatheter edge-to-edge repair (mTEER)
- Percutaneous mitral commissurotomy (PMC)
- Transcatheter mitral valve replacement (ViV/ViR)





*From Yen Ho, Professor and Head of
Cardiac Morphology, Royal Brompton Hospital, London, UK*

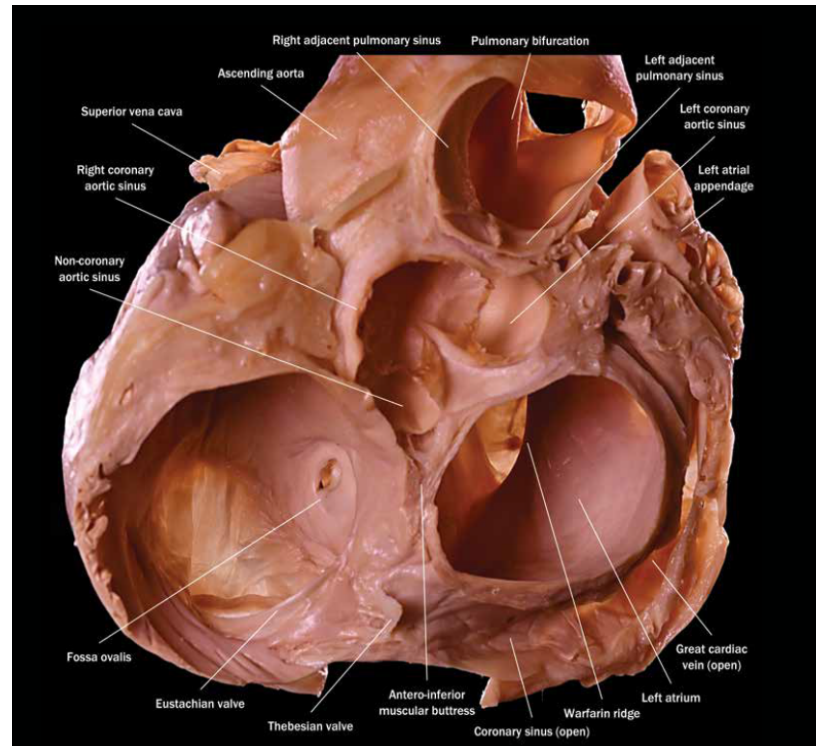
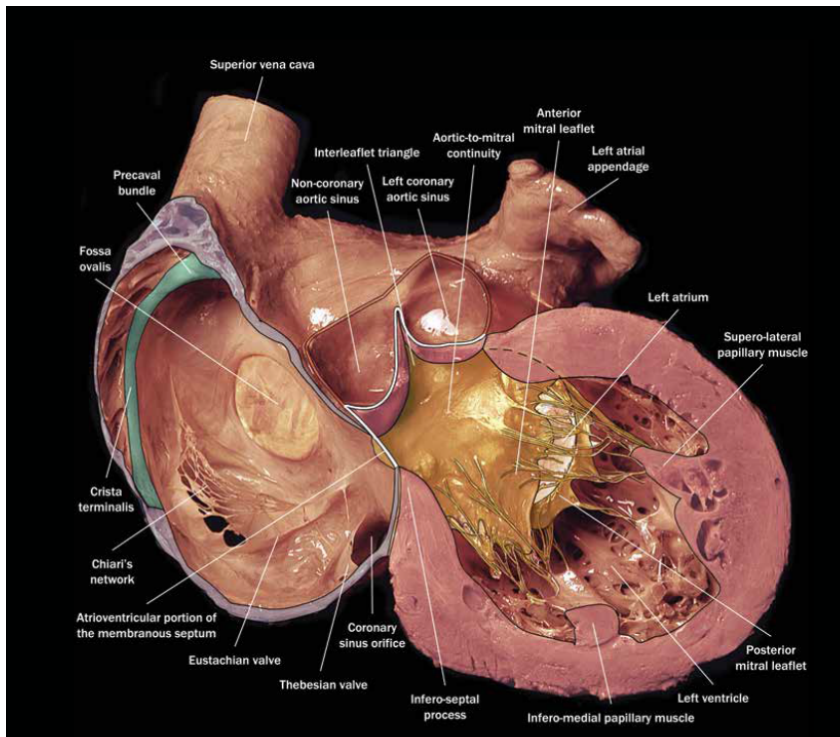
Common wall between right and left atria is approximately 2 by 3 cm in the average heart

Oval Fossa is located at the center of the atrial septum, bounded by:

- Superiorly, limbus of the oval fossa
- Supero-anteriorly, aortic root
- Infero-anteriorly, coronary sinus
- Posteriorly, right atrial free wall
- Anteriorly, tricuspid annulus and appendage

The thin membrane of the Oval Fossa is the optimal site for transseptal puncture

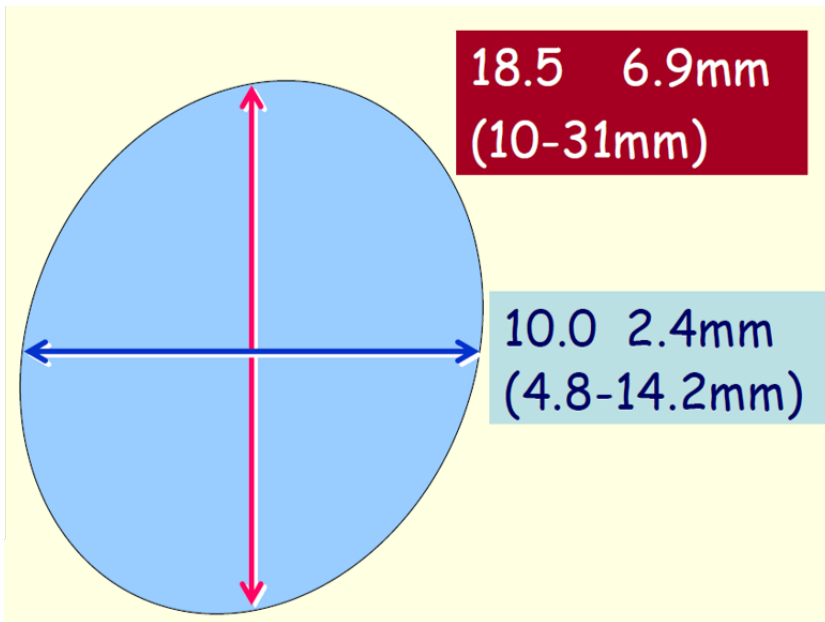




Fossa ovalis is a relatively small target surrounded by “hazards”



Fossa Ovalis Dimensions



- **Mean fossa ovalis thickness: 1.8 ± 0.7 mm**
- Greater thickness in patients with significant valvular heart disease (2.0 ± 0.6 mm)
- Age, atrial fibrillation, and atrial septal defects (ASD) do not significantly affect fossa ovalis thickness

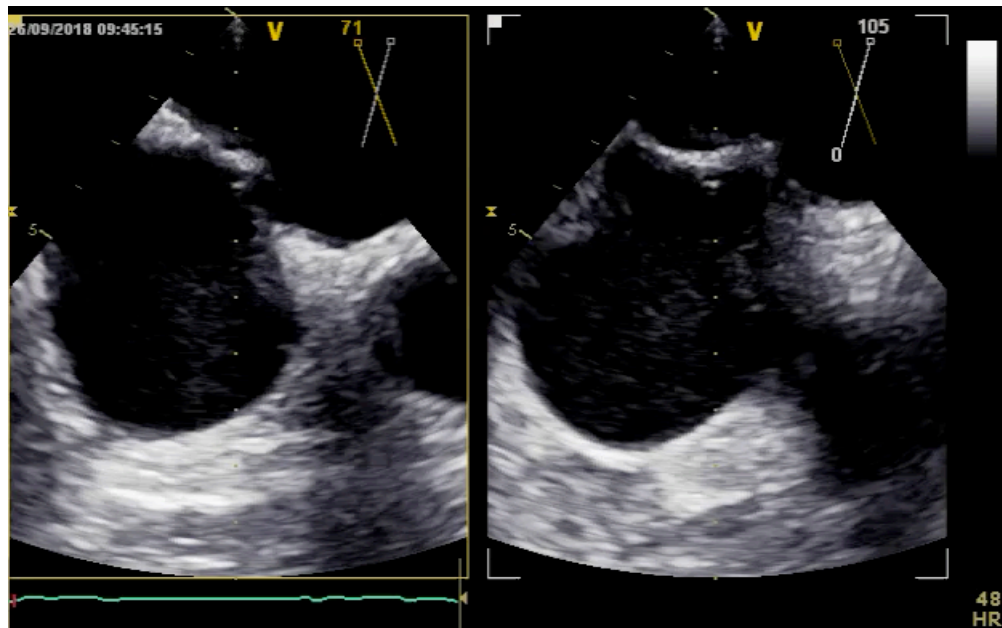
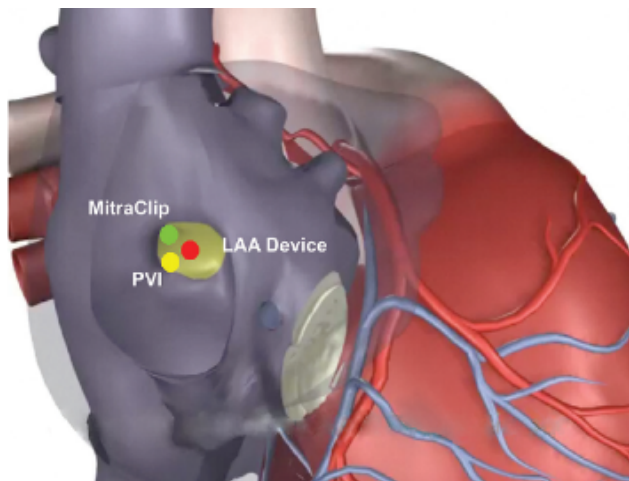
The anatomy of the interatrial septum: A transesophageal echocardiographic study Matthew E. Schwinger, Aaron J. Gindea, Robin S. Freedberg, Itzhak Kronzon. *Am Heart J* 1990.

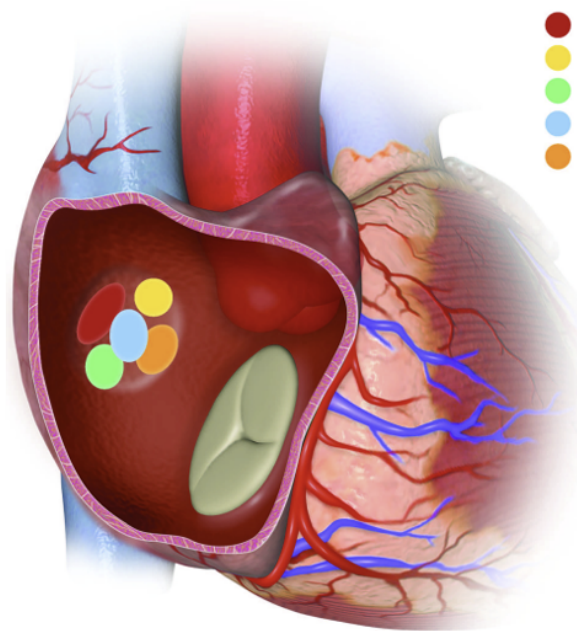


Different transseptal puncture for different procedures: Optimization of left atrial catheterization guided by transesophageal echocardiography

Andrea Radinovic¹, Patrizio Mazzone¹, Giovanni Landoni^{2,3}, Eustachio Agricola¹, Damiano Regazzoli¹, Paolo Della Bella¹

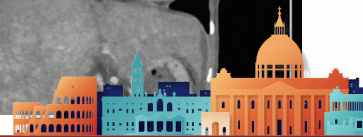
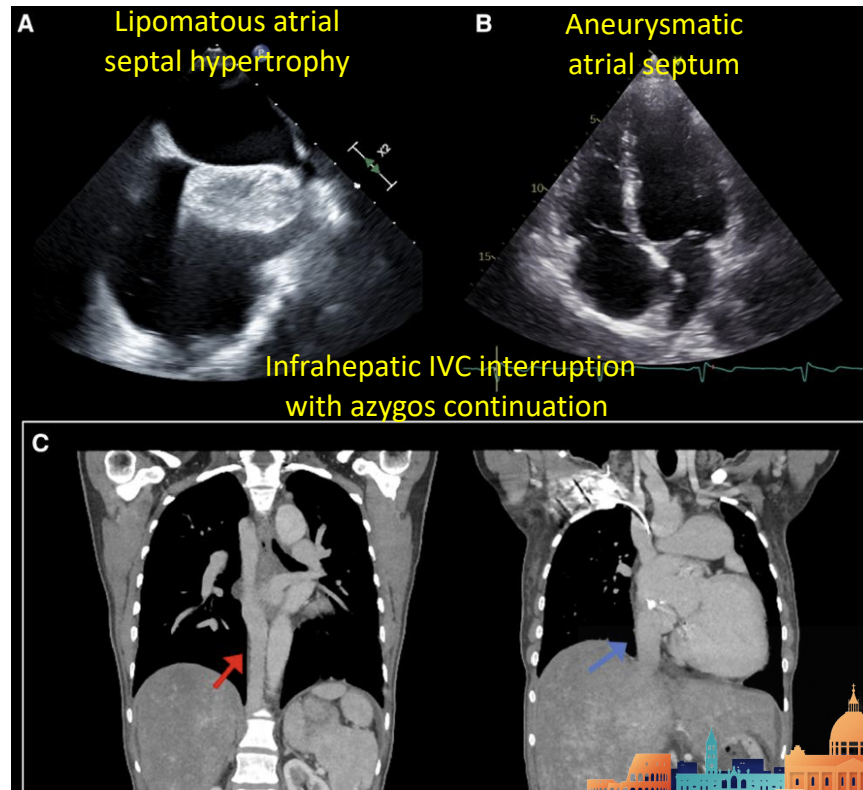
¹Department of Arrhythmology and Cardiac Pacing Unit, IRCCS San Raffaele Scientific Institute, ²Department of Anesthesia and Intensive Care, IRCCS San Raffaele Scientific Institute, ³Vita-Salute San Raffaele University, Milan, Italy





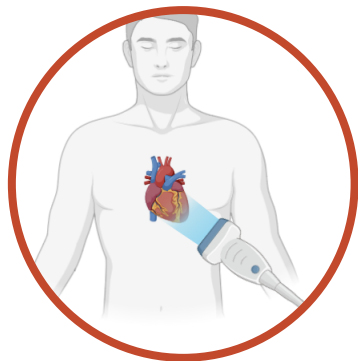
- Mitraclip, paravalvular leak
- PFO/transseptal closure of PFO
- LAAC
- PVI/LA ablation
- LV ablation

Anatomical variants affecting TSP



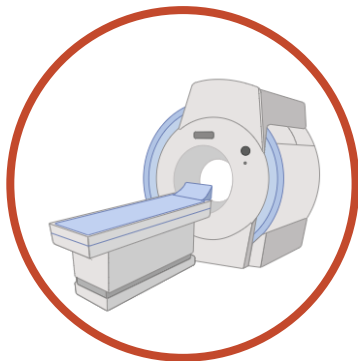
Deisenhofer I, et al. Transseptal puncture in cardiovascular interventions: a clinical consensus statement of the EHRA, HFA, EAPCI, EACVI, and AEPC. Europace. 2026

PRE-PROCEDURAL IMAGING



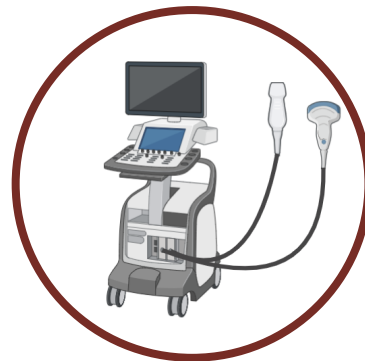
TTE

Identifies cardiac structural and functional abnormalities



CT/RMN

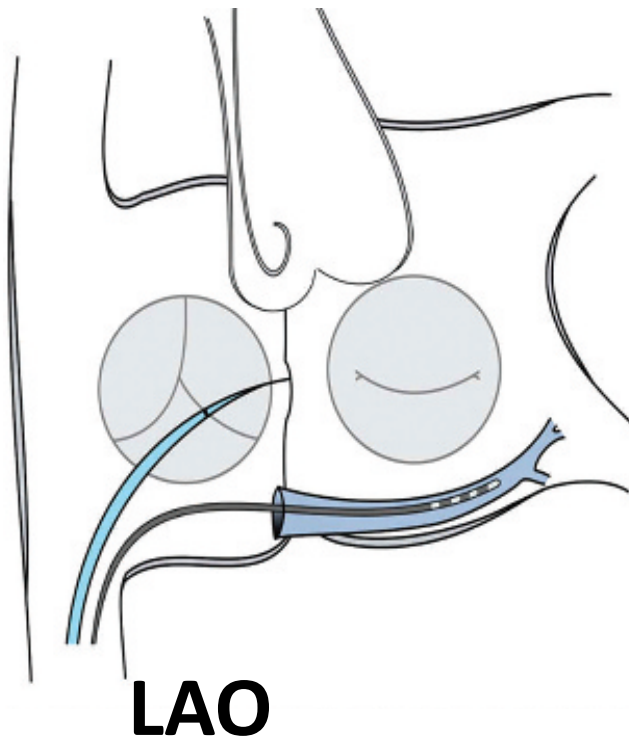
Identifies anatomical hurdles to access the RA or at the septum or an anomalous position of the heart in the thorax



TOE/ICE

Facilitates IAS visualization, optimal puncture site selection, and safe LA access





How to perform a transseptal puncture. Heart 2009;95;85-92. Mark J Earley



○ **Step 1:**

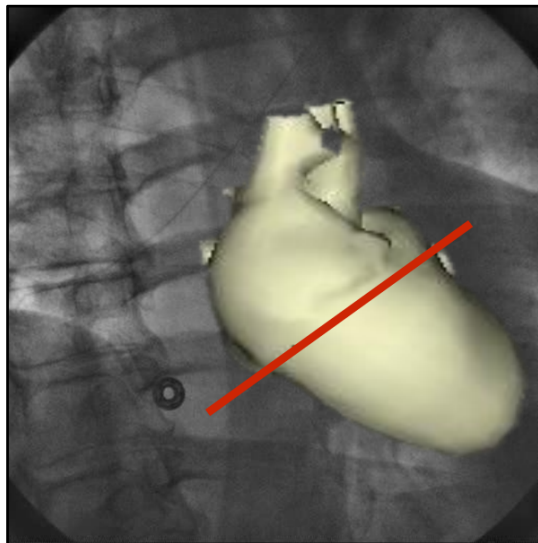
- **Relational anatomy**
- Understanding the relative positions of the structures surrounding the fossa ovalis

○ **Step 2:**

- **Fluoroscopic “registration”**
- Figuring out where you are when you cannot see

○ **Additional Techniques**

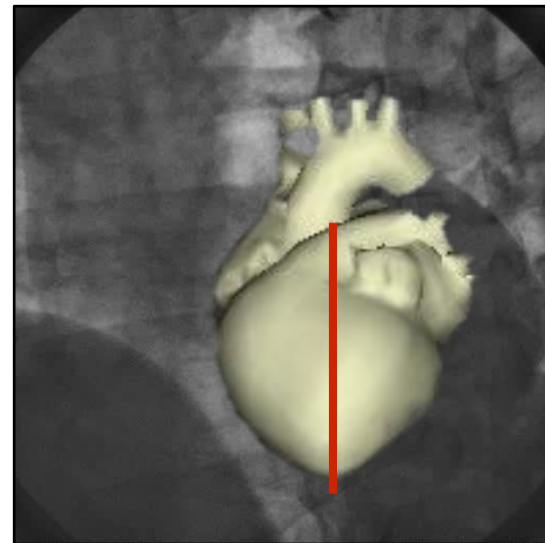
- Pressure measurement
- Dye staining of the septum
- Echo (transesophageal / intracardiac)



RAO defines the A-V plane.

The CS catheter lies in the AV groove.

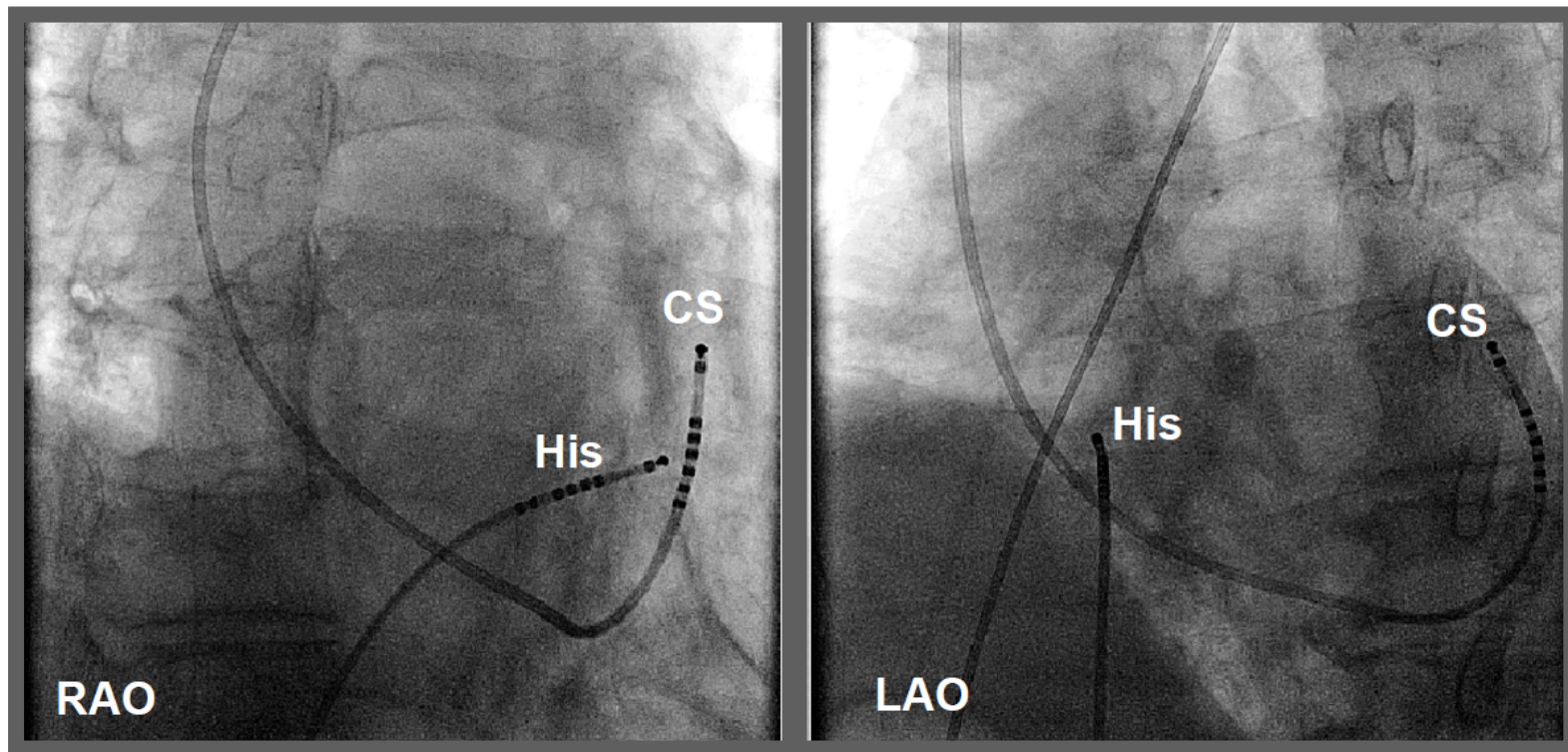
Lining up the RAO camera to foreshorten the CS catheter therefore defines the AV plane

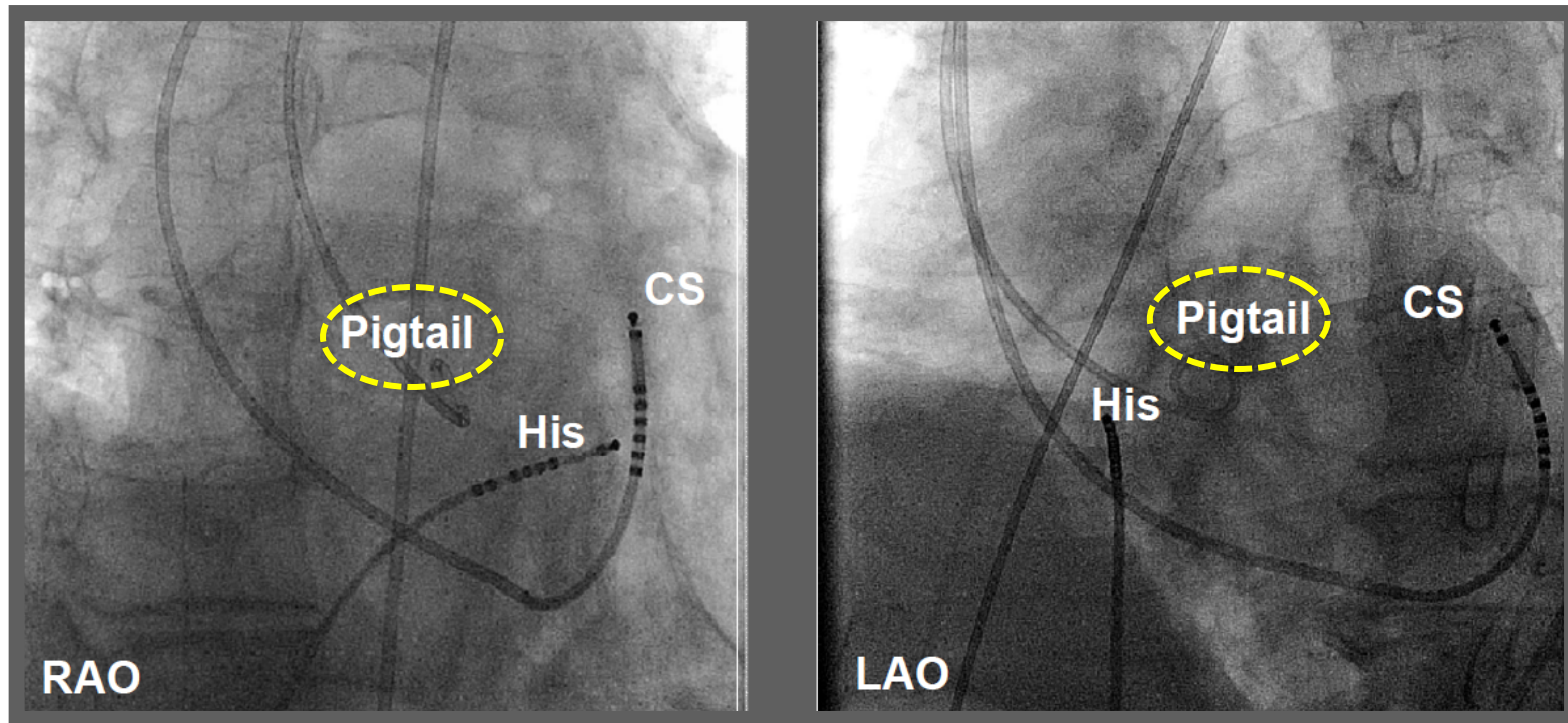


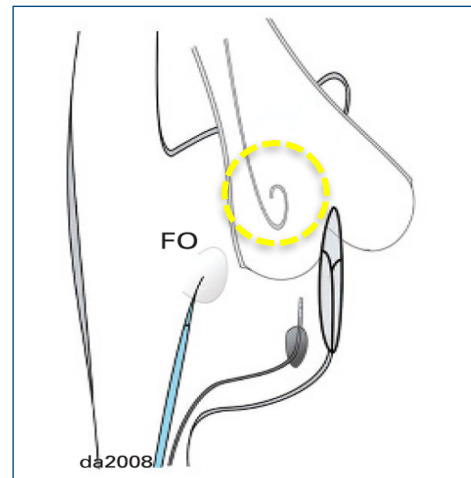
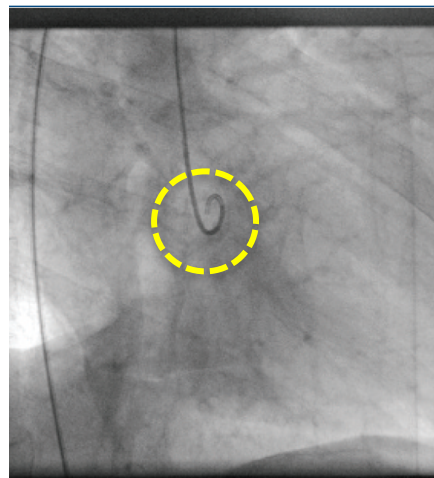
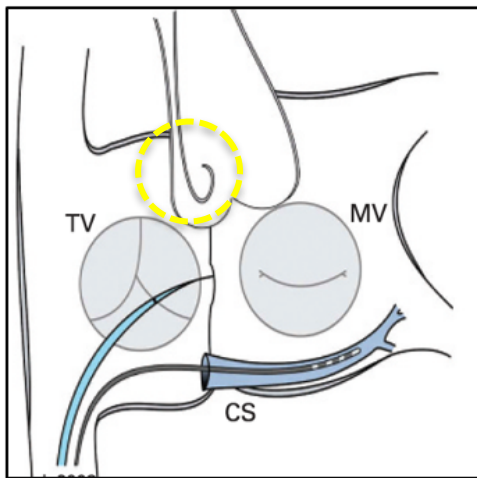
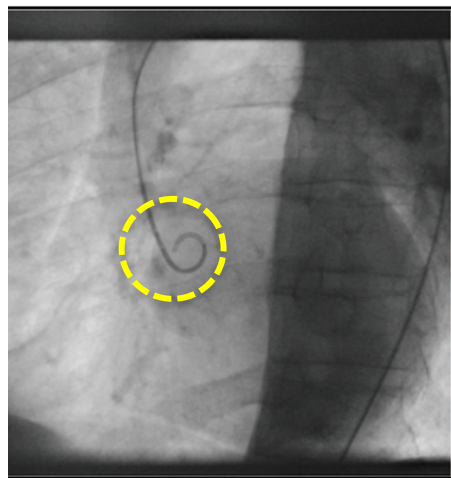
LAO defines the left-right plane.

Lining up the LAO camera to foreshorten the His catheter therefore defines the Left-Right plane





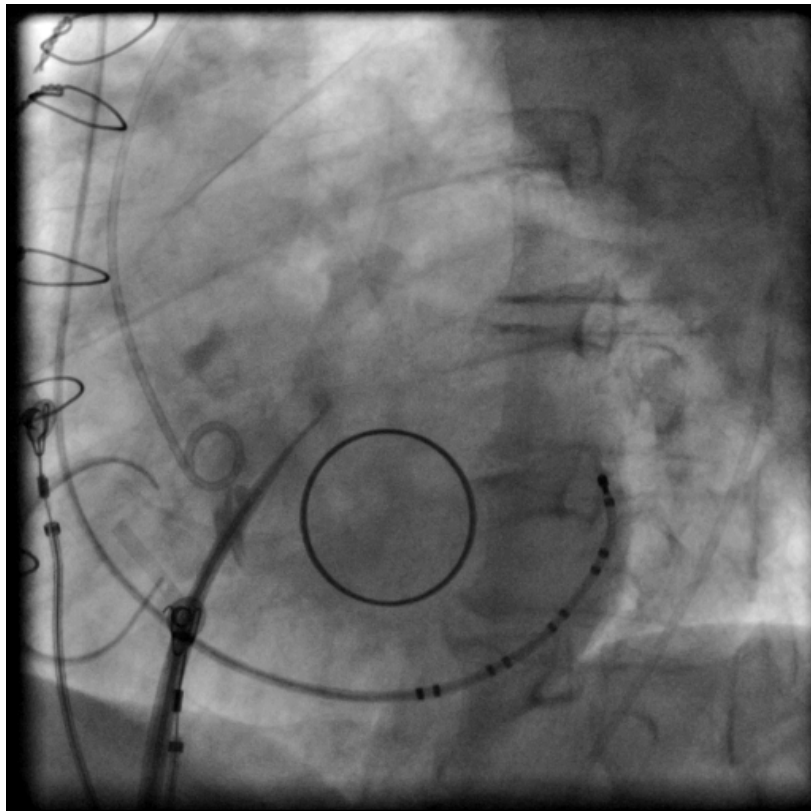


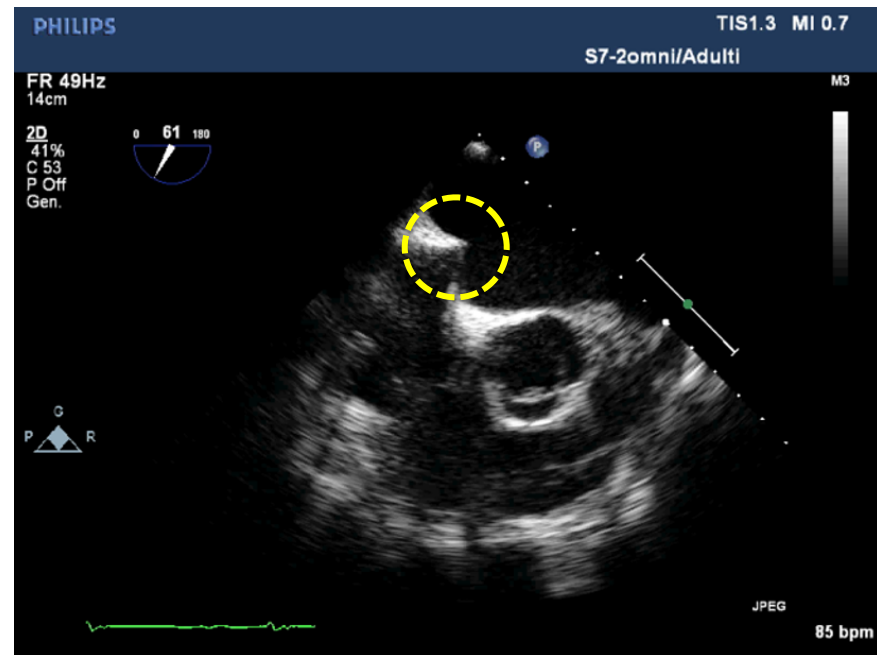
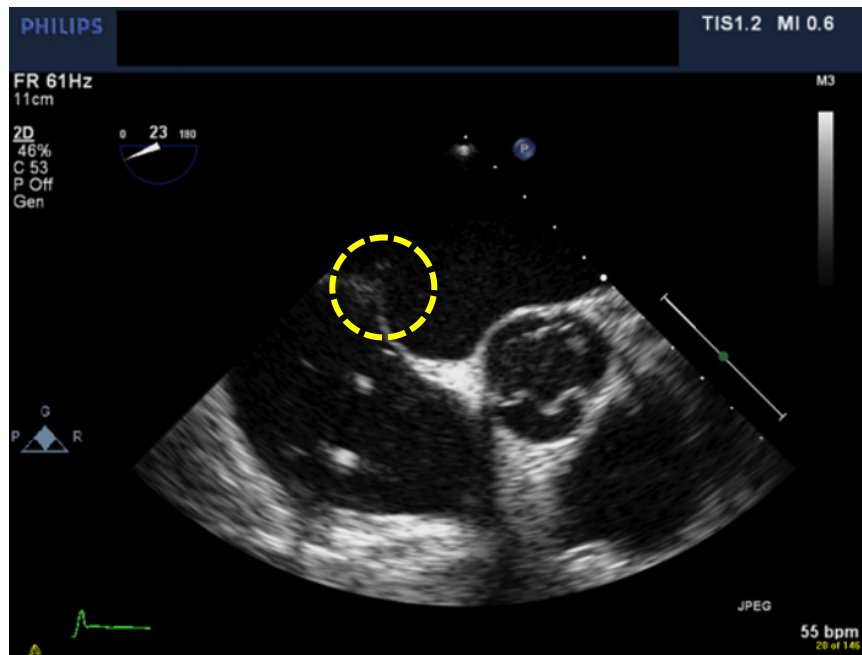


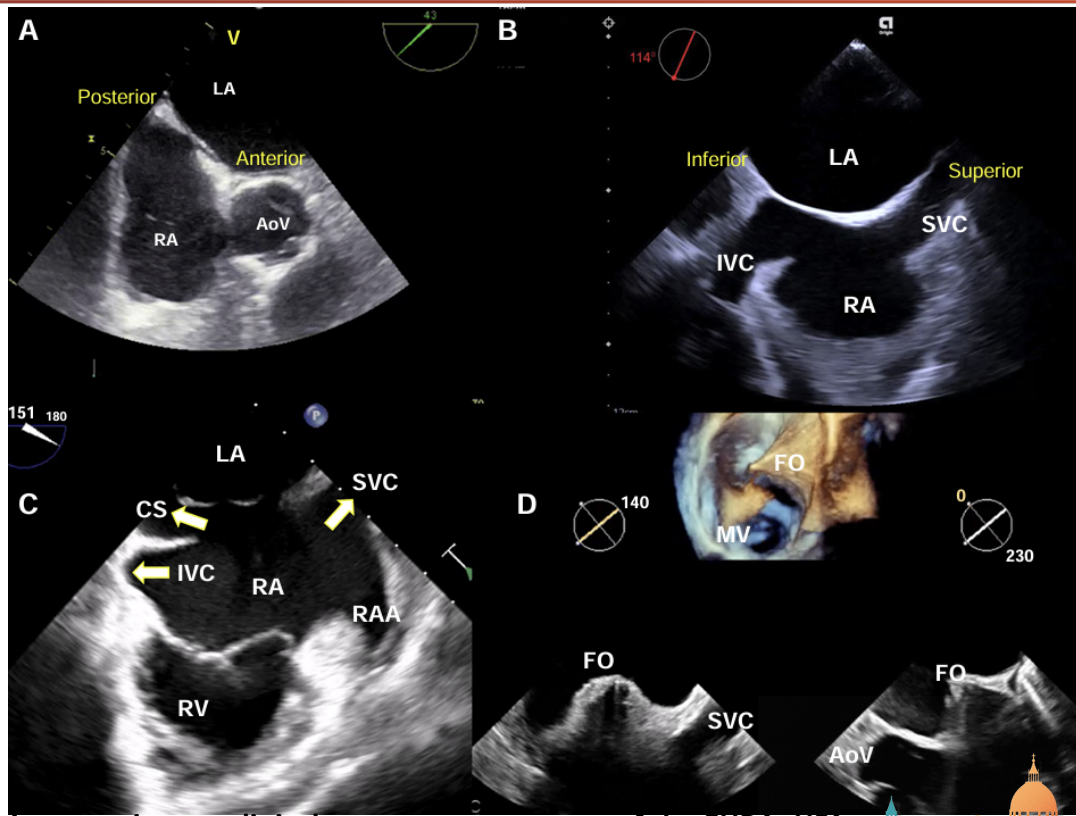
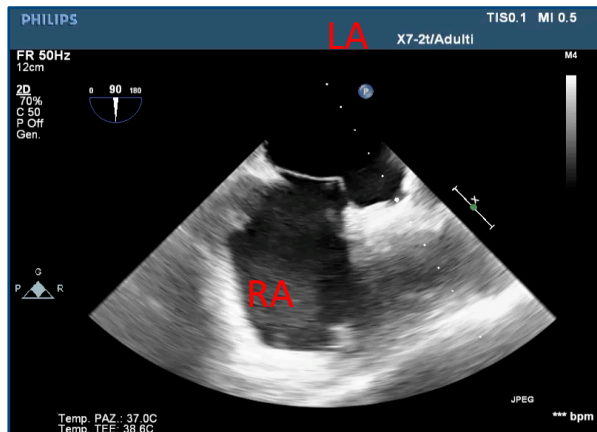
Pigtail catheter in the
non-coronary sinus of Valsalva,
a useful marker. (30° 50° LAO view)

Pigtail catheter in the
non-coronary sinus of Valsalva,
a useful marker. (30° RAO view)



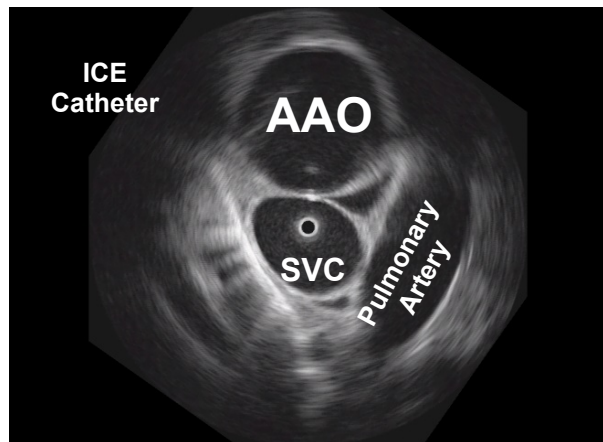




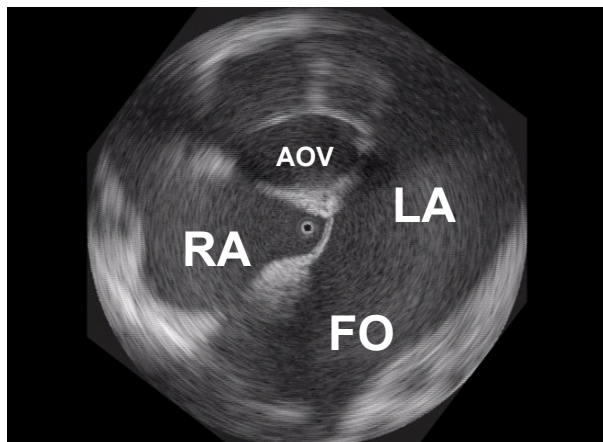


Deisenhofer I, et al. Transseptal puncture in cardiovascular interventions: a clinical consensus statement of the EHRA, HFA, EAPCI, EACVI, and AEPC. Europace. 2026

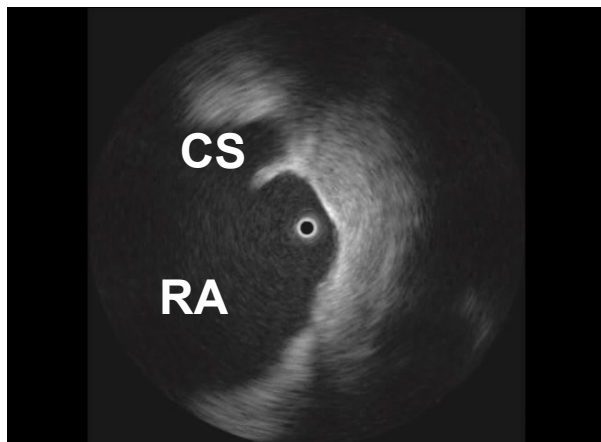




SVC

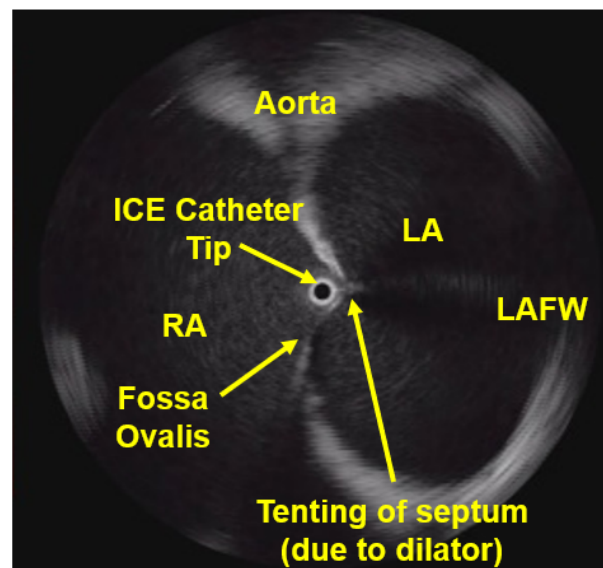
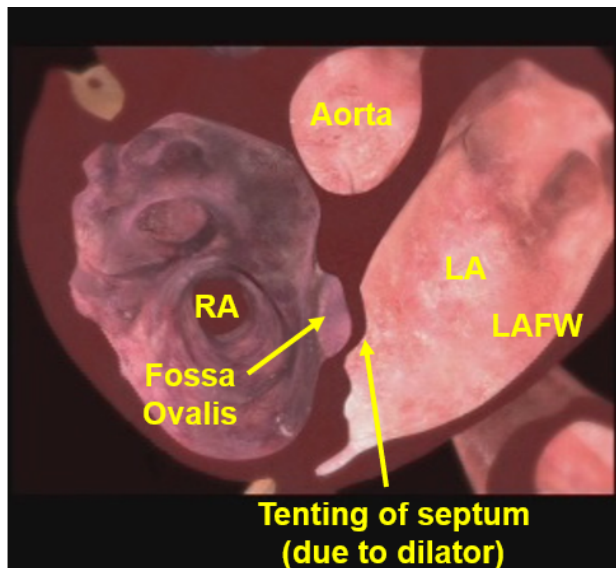
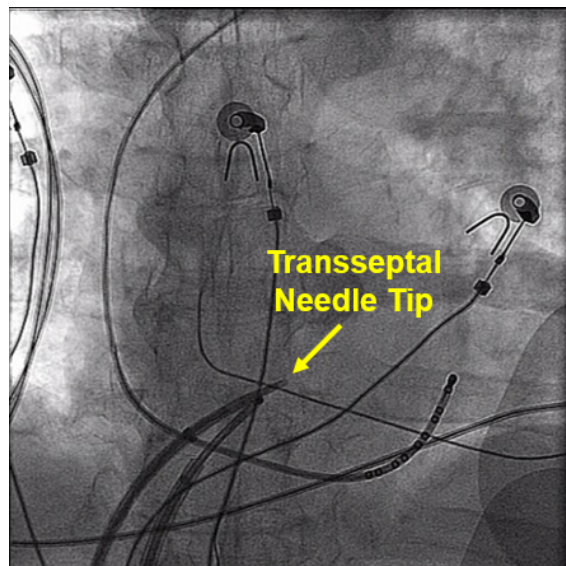


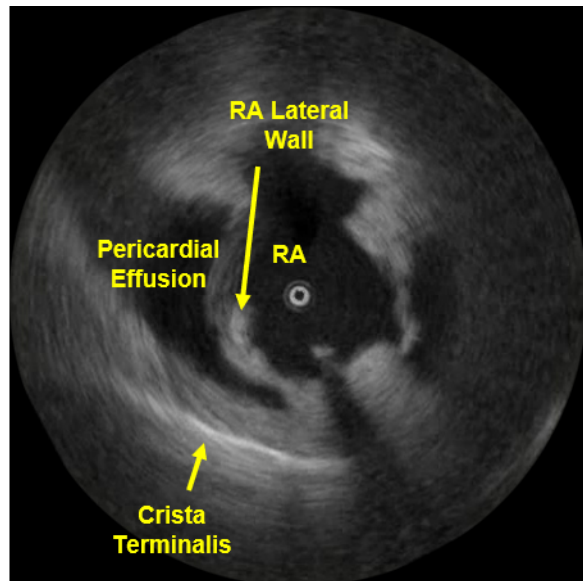
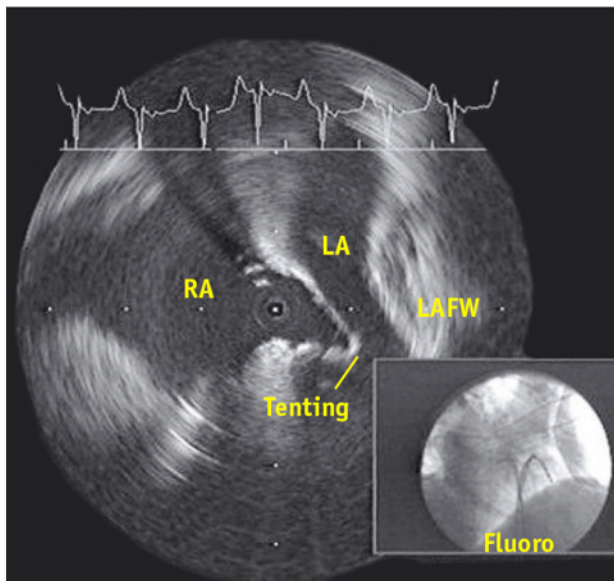
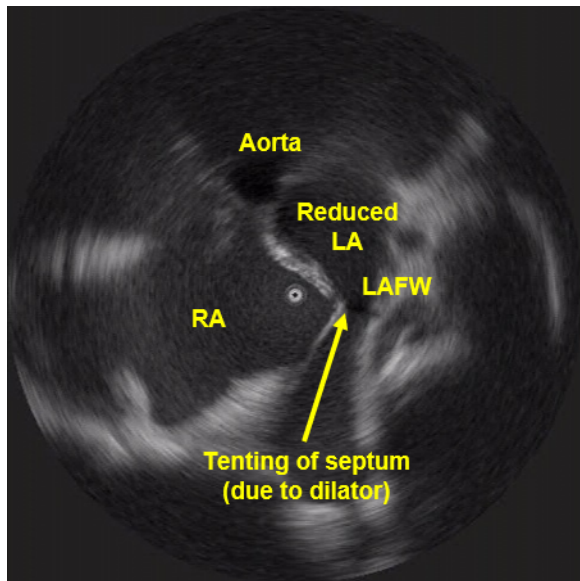
Mid-RA

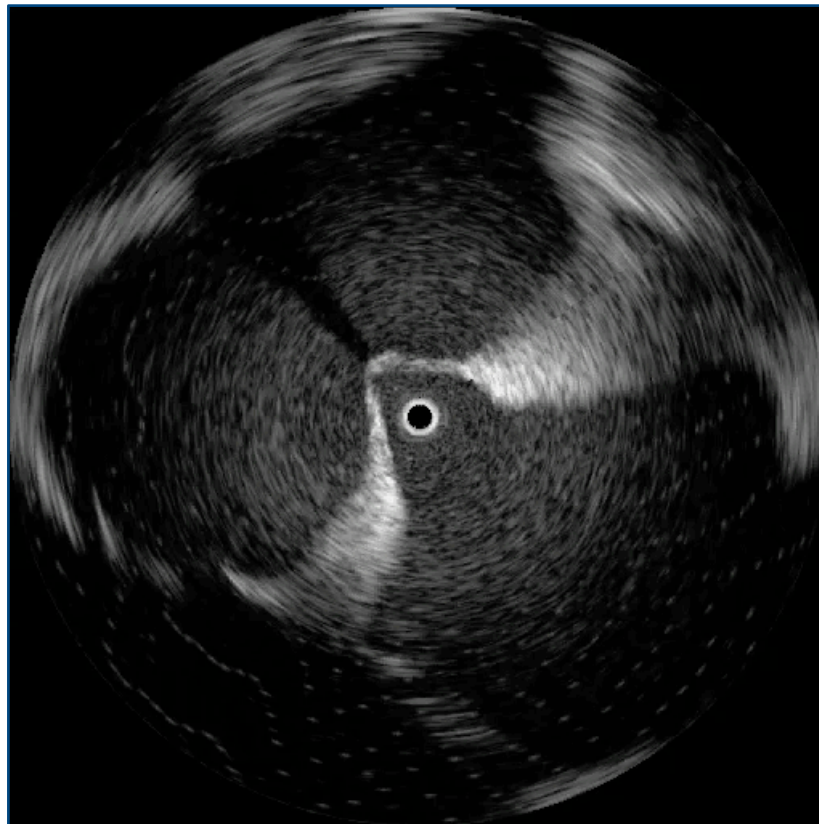


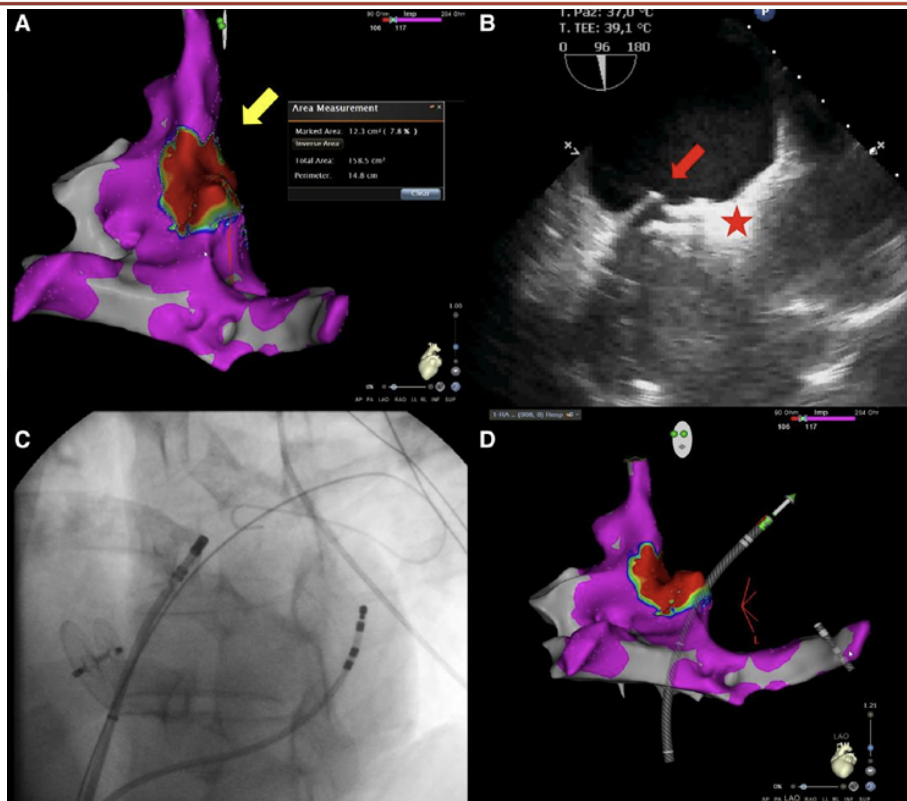
RA





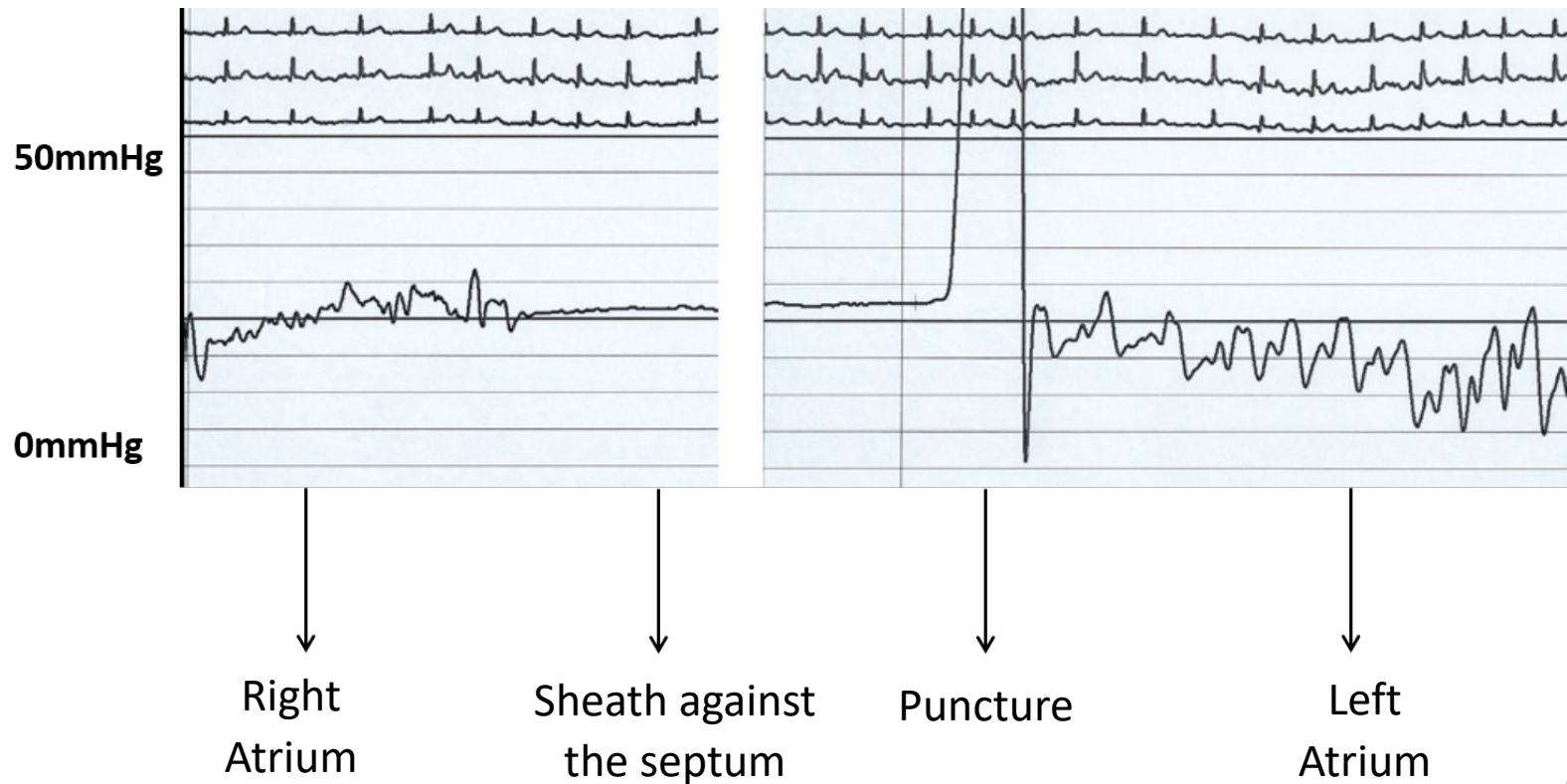






Deisenhofer I, et al. Transseptal puncture in cardiovascular interventions: a clinical consensus statement of the EHRA, HFA, EAPCI, EACVI, and AEPC. Europace. 2026



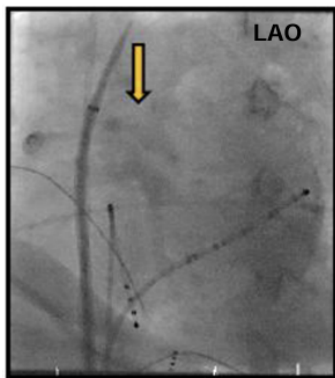
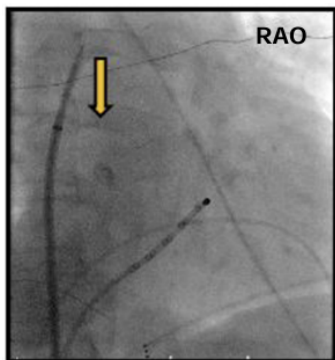


How to perform a transseptal puncture. Heart 2009;95;85-92. Mark J Earley

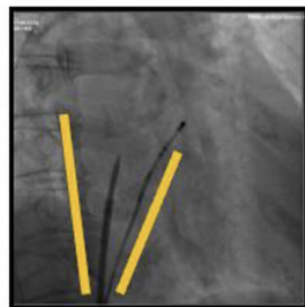
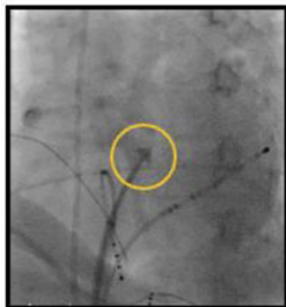
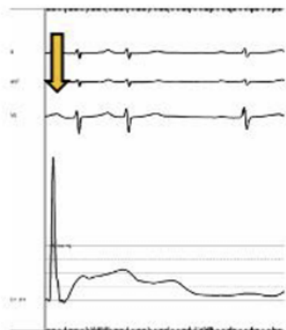




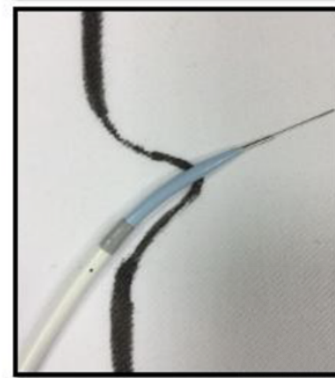
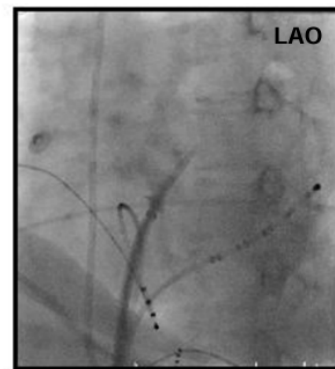
1. Pull



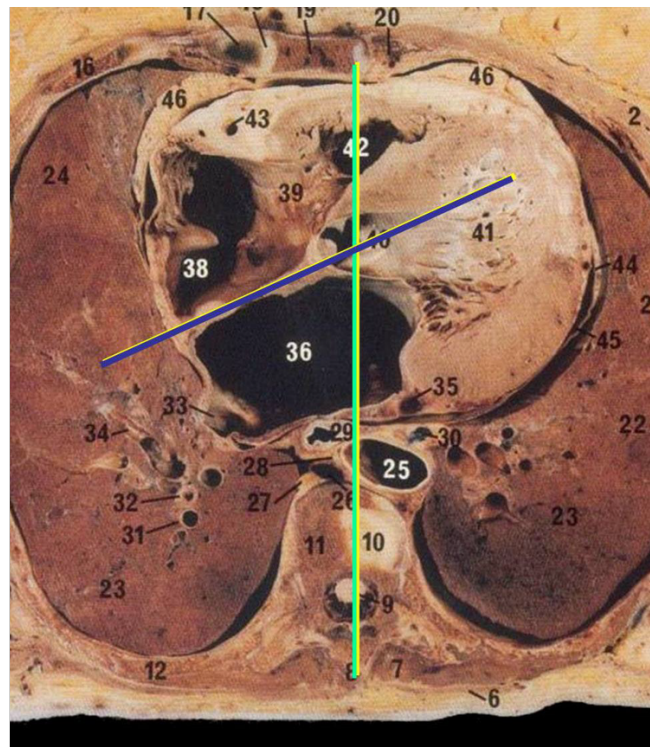
2. Confirm



3. Advance



ANTERIOR

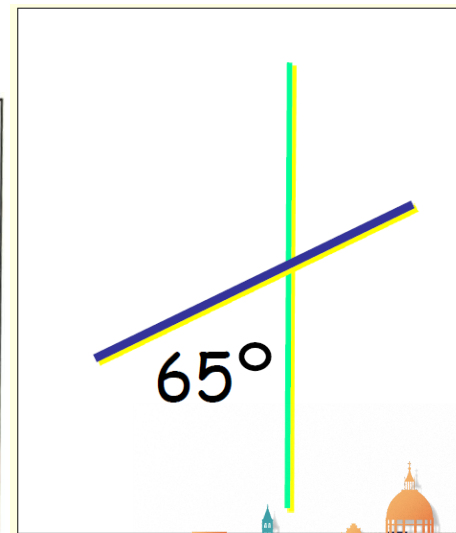
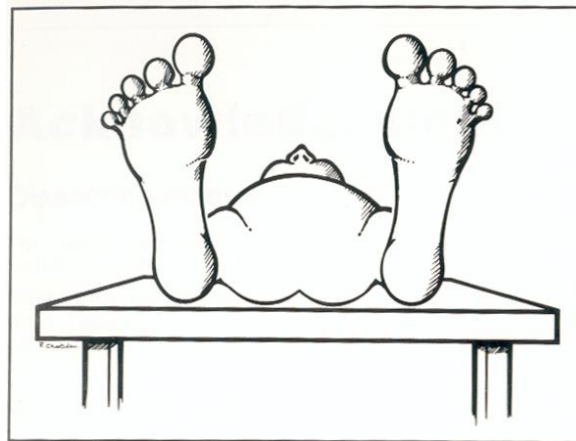


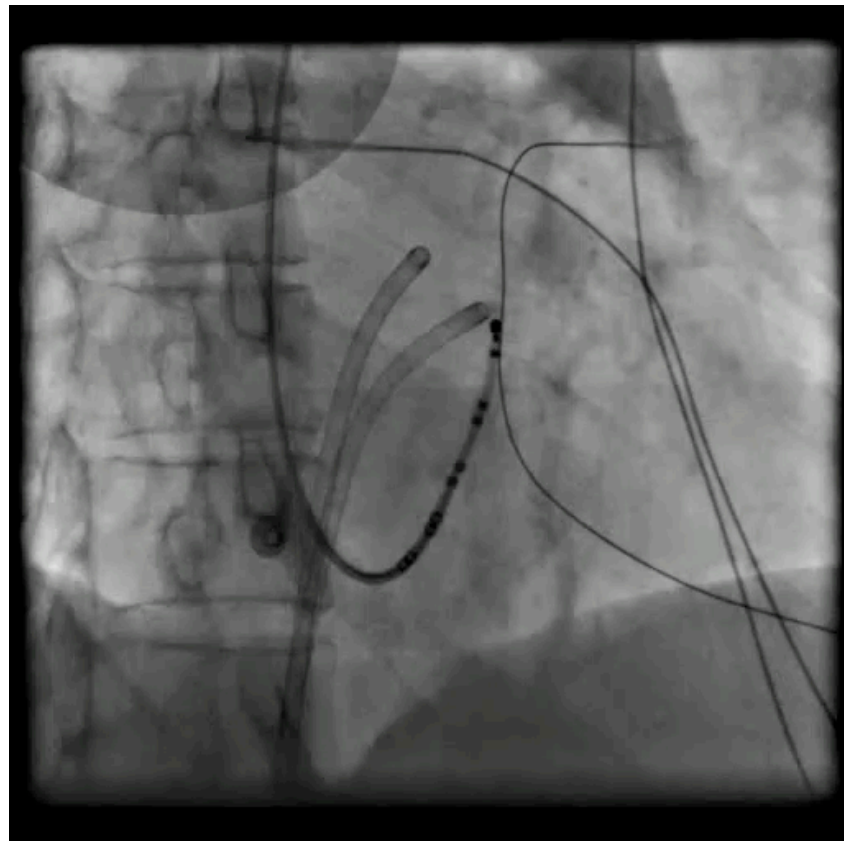
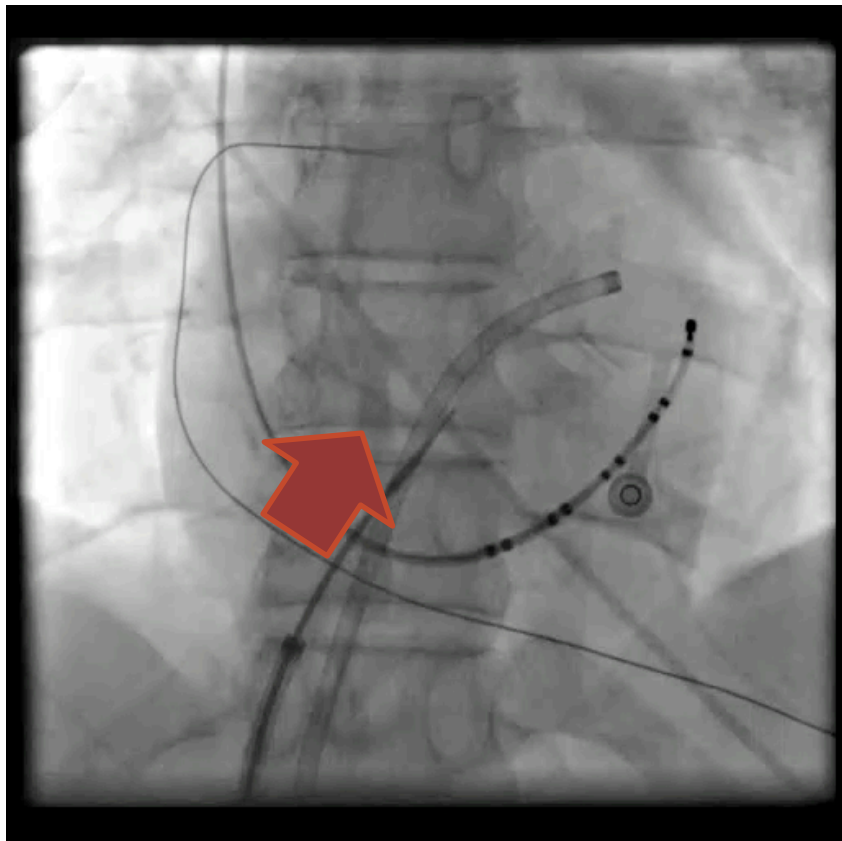
POSTERIOR

Why should the needle be oriented posteriorly?

The 4-5 o'clock position

LEFT





Journal of the Society for Cardiovascular Angiography & Interventions 5 (2026) 104190

JSCAI

The official journal of the Society for
Cardiovascular Angiography & Interventions



March 2026

Proceedings

Transseptal Puncture for Left Atrial Appendage Closure: A Consensus Document From the Second European Left Atrial Appendage Club

Liesbeth Rosseel, MD, PhD^{a,*}, Nina C. Wunderlich, MD^b, Sergio Berti, MD^c,
Adel Aminian, MD^d, Jens Erik Nielsen-Kudsk, MD, DMSc^e, Ignacio Cruz-Gonzalez, MD^f,
Lorenz Räber, MD, PhD^g, Luis Nombela-Franco, MD^h, Mony Shuvy, MDⁱ,
Xavier Freixa, MD, PhD^j, Philippe Garot, MD^k, Ole De Backer, MD, PhD^l

^a Hartcentrum Aalst, AZORG, Aalst, Belgium; ^b Department of Cardiology and Angiology, Asklepios Klinik Langen, Langen, Germany; ^c Ospedale del Cuore, Fondazione C.N.R. Regione Toscana G. Monasterio, Pisa, Italy; ^d Division of Cardiologie, Centre Hospitalier Universitaire de Charleroi, Charleroi, Belgium; ^e Department of Cardiology, Aarhus University Hospital, Aarhus, Denmark; ^f Hospital Universitario de Salamanca, IBSAL, CIBER-CV, Salamanca, Spain; ^g Department of Cardiology, Bern University Hospital, Inselspital, University of Bern, Bern, Switzerland; ^h Cardiovascular Institute, Hospital Clinico San Carlos, IdISSC, Madrid, Spain; ⁱ Jesselson Integrated Heart Centre, Shaare Zedek Medical Center and Faculty of Medicine, Hebrew University, Jerusalem, Israel; ^j Cardiovascular Institute, Hospital Clinic, Barcelona, Spain; ^k Institut Cardiovasculaire Paris Sud (ICPS), Hôpital Privé Jacques Cartier, Ramsay-Santé, Massy, France; ^l The Heart Centre, Rigshospitalet, Copenhagen University Hospital, Copenhagen, Denmark

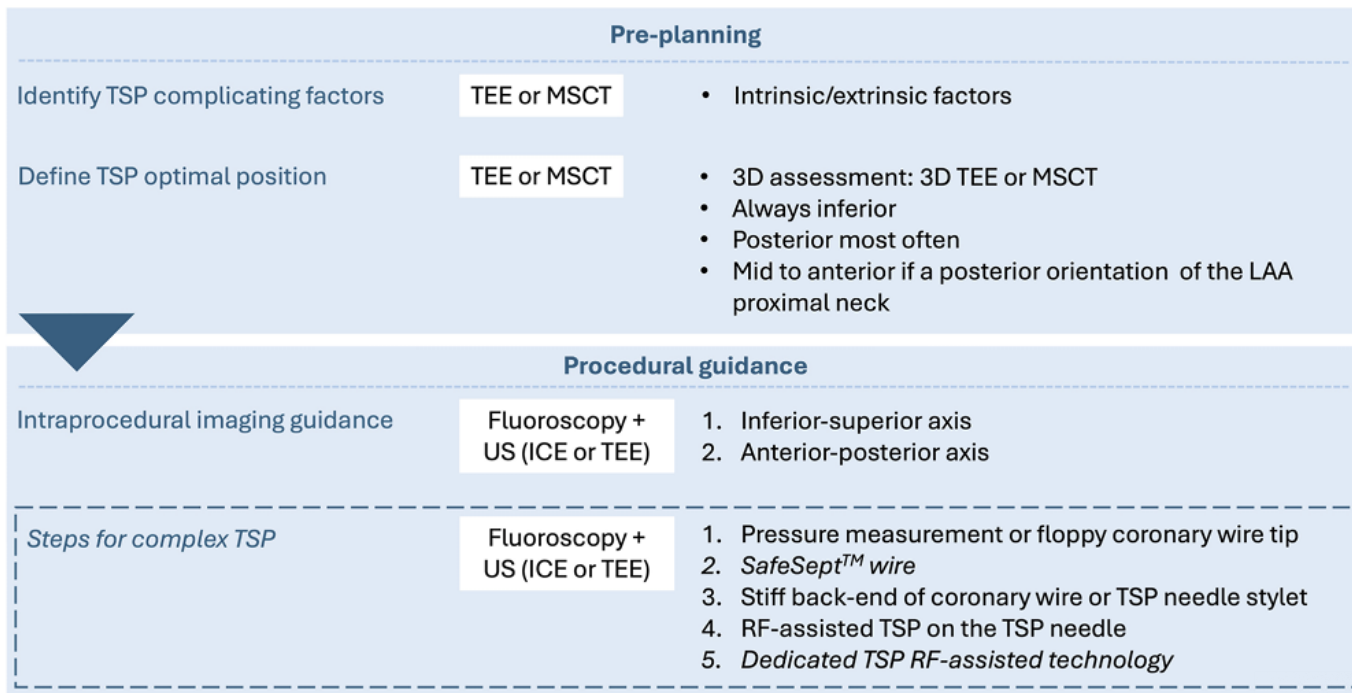


Table 1. Intrinsic and extrinsic factors that can complicate transseptal puncture.

Intrinsic factors	Extrinsic factors
- Thickness - Fibrosis - Mobility, eg, aneurysmal, floppy IAS - Left to right septal protrusion - IAS orientation - Previous instrumentation - Septal patches or devices - Small fossa $\pm$ lipomatous septum	- COPD or pulmonary disease - Diaphragmatic elevation - Sternal deviation - Musculoskeletal abnormalities - Vascular tortuosity - Spine tortuosity - Aortic aneurysm - Pronounced eustachian valve/Chiari network - Presence of pacemaker leads - Large left/right atrium - Venous access anomalies: eg, vena azygos with absent IVC; IVC thrombosis; extrinsic IVC obstruction, etc.

COPD, chronic obstructive pulmonary disease; IAS, interatrial septum; IVC, inferior vena cava.

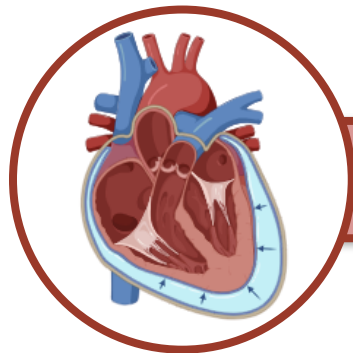




Central Illustration.

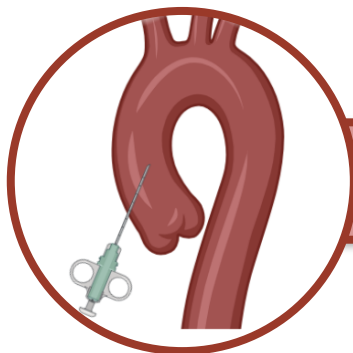
A stepwise algorithm to prepare and perform TSP in LAAC. LAA, left atrial appendage; MSCT, multislice computed tomography; RF, radiofrequency; TEE, transesophageal echocardiography; TSP, transseptal puncture.





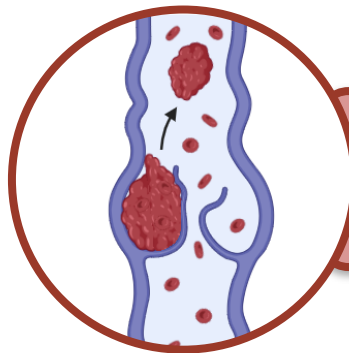
**Haemopericardium
and cardiac tamponade**

0,5-2%



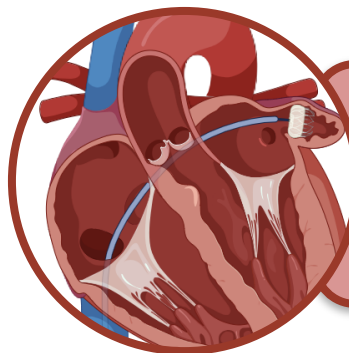
Aortic puncture

< 0,1%



**Embolism: air, blood clots
or solid particles**

Coronary or cerebral
thromboembolism



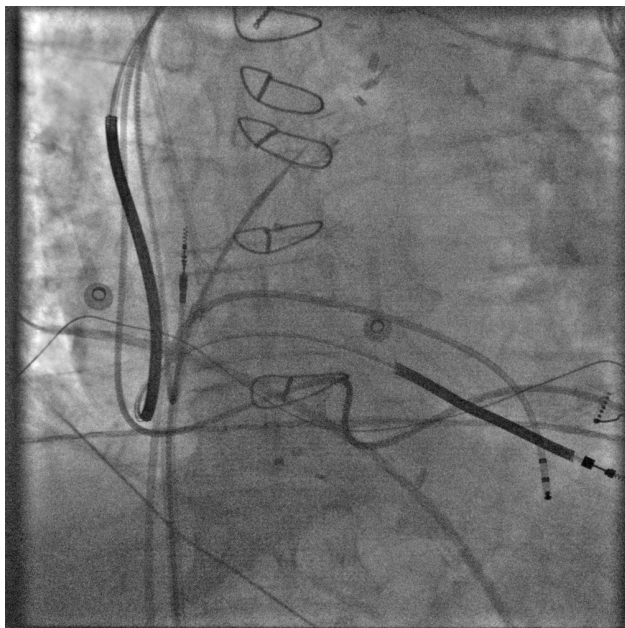
**Iatrogenic atrial
septal defects**

While most iASDs close
spontaneously, larger
sheath sizes increase the
likelihood of persistent
iASDs

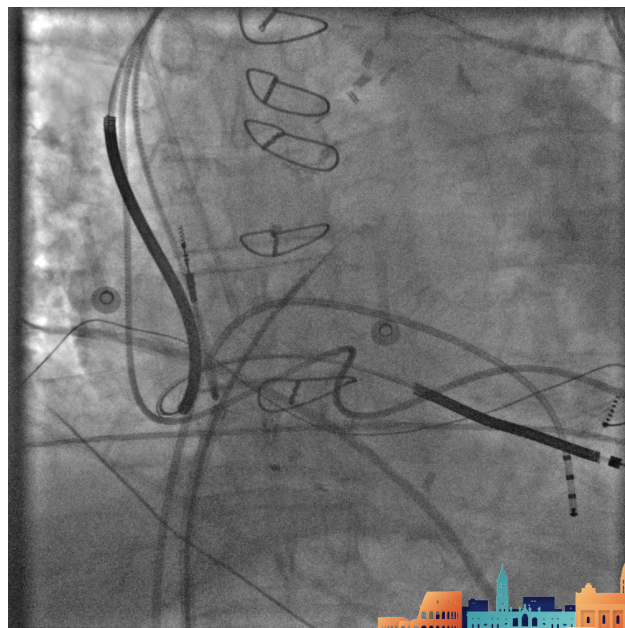
Deisenhofer I, et al. Transseptal puncture in cardiovascular interventions: a clinical consensus statement of the EHRA, HFA, EAPCI, EACVI, and AEPC. Europace. 2026



THE NIGHTMARE: AORTIC PUNCTURE

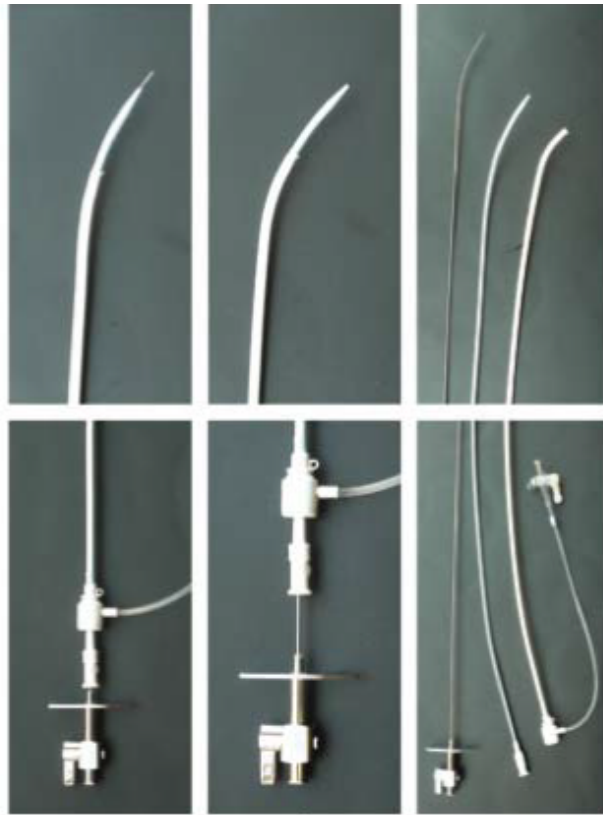


CORRECT PUNCTURE



The dilator or introducer sheath should never be advanced unless there is absolute certainty that the tip is within the left atrium.

In this way, the risk of cardiac tamponade is low, whether the puncture involves the right atrial wall or the aortic wall, as long as only the needle has crossed.



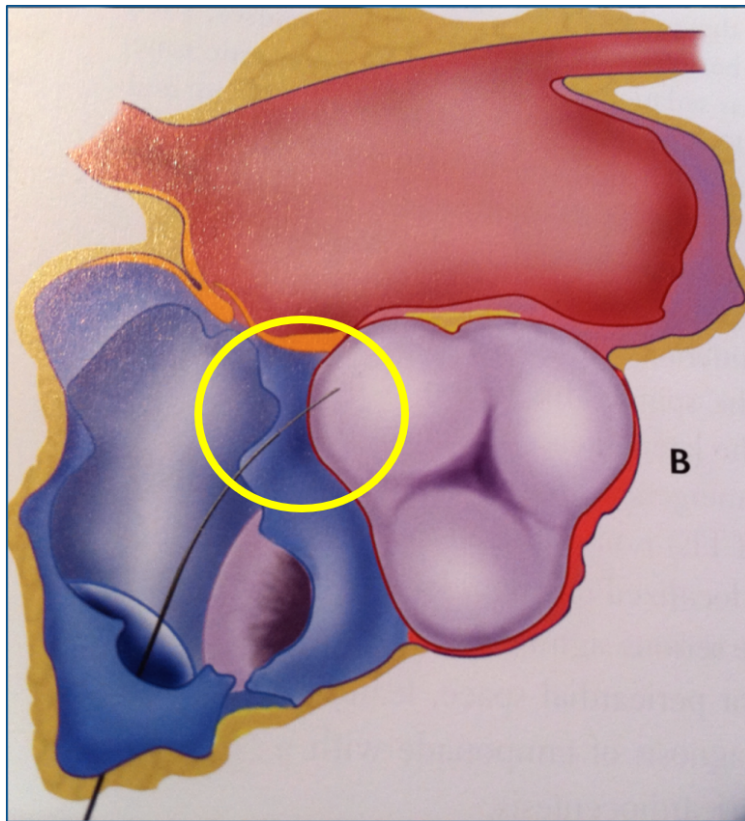
Key points for transseptal puncture, regardless of the technique used.

The risk of injury is minimized by:

- a) pressure monitoring during the puncture;
- b) advancing only 2–3 mm of the needle tip to enter the left atrium;
- c) advancing the sheath/dilator only after confirmation of left atrial access (pressure tracing and contrast injection);
- a) last but not least, always administer heparin after the dilator–sheath has crossed into the left atrium.

Be able to perform emergency pericardiocentesis.





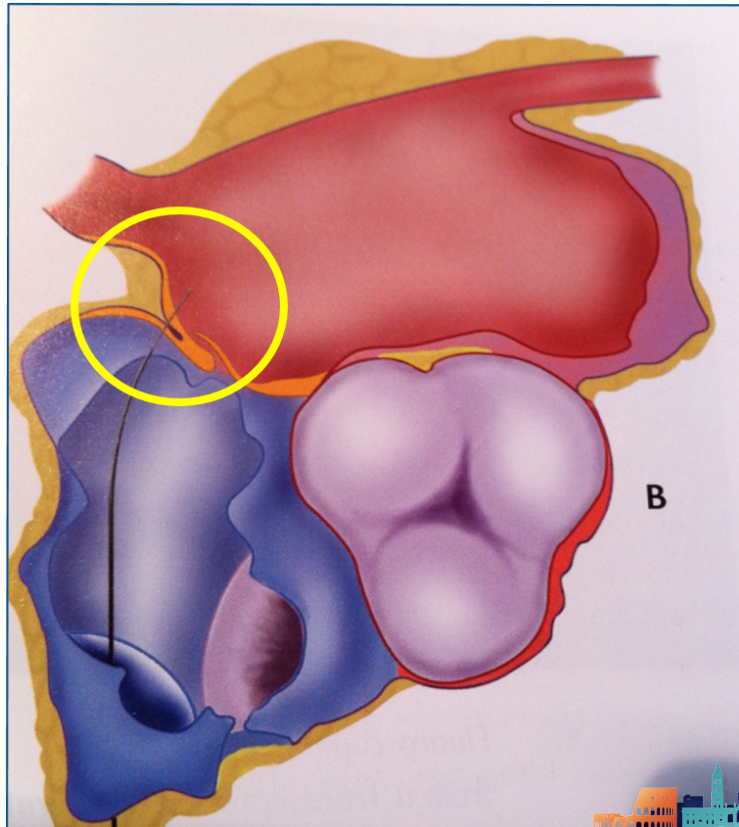
TOO ANTERIOR:

Will enter aortic root (non-coronary sinus of Valsalva.)
Easily recognized by systemic arterial pressure tracing.
Generally benign if acknowledged and followed by needle retraction – **DO NOT ADVANCE DILATOR/SHEATH ASSEMBLY!**

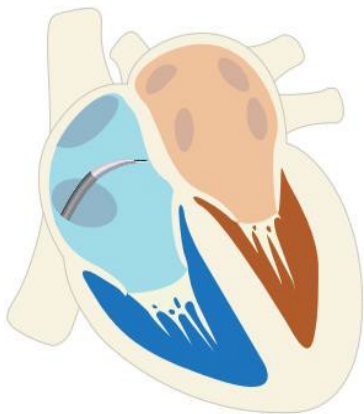


TOO POSTERIOR:

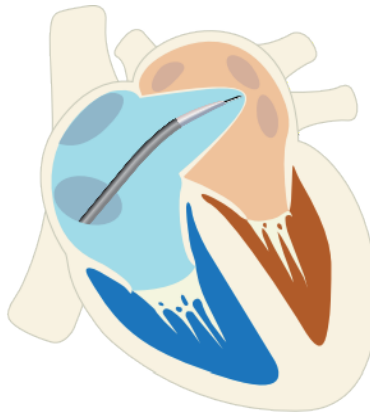
May “stitch through” the posterior pericardial fold and enter the left atrium by crossing through pericardial space. May cause immediate pericardial effusion or effusion/tamponade on retraction of sheath



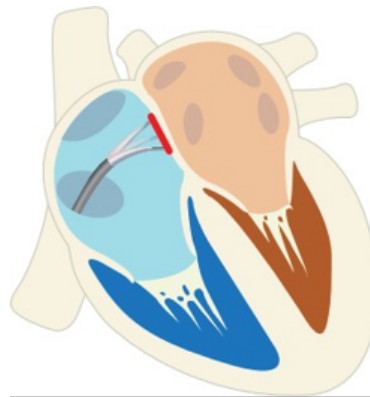
CHALLENGES OF TRADITIONAL TRANSSEPTAL PUNCTURE



Excessive Force



Excessive Tenting

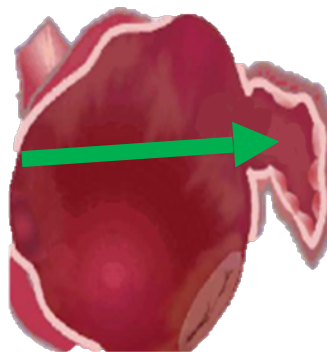
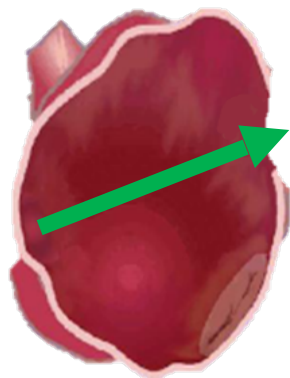


Lack of Precision



Aimed transseptal puncture for LAAO

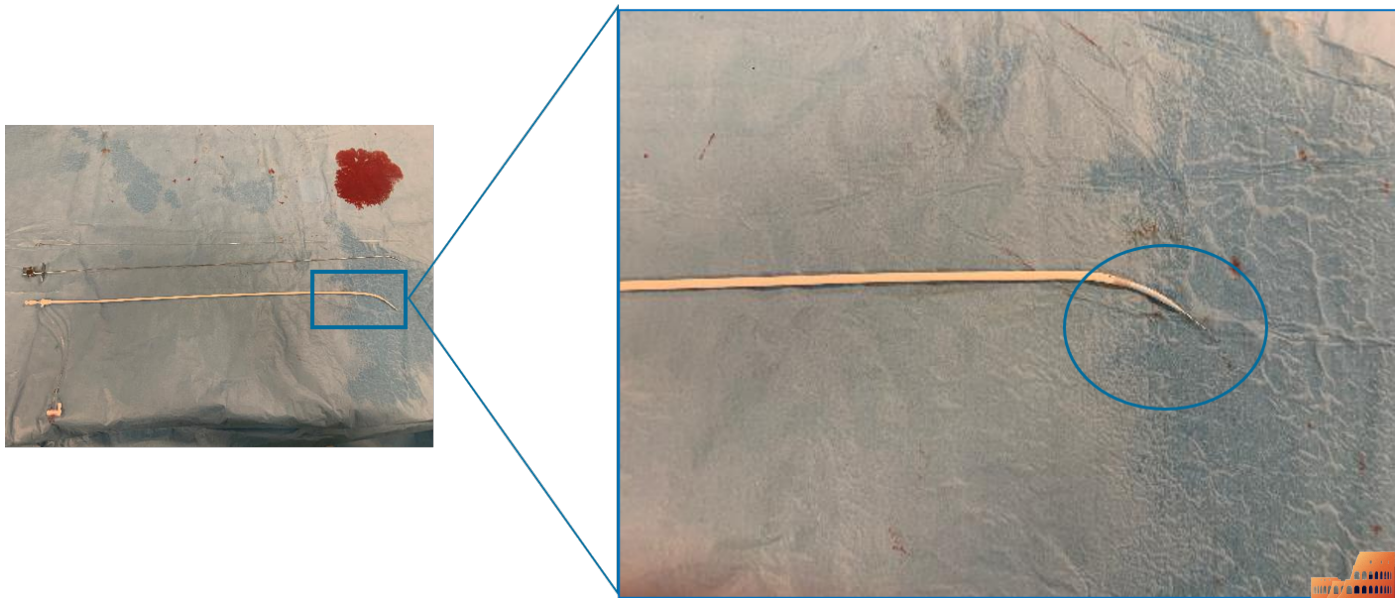
In order to facilitate the procedure the best solution is to perform an **aimed Transseptal Puncture** according with the **LAA main ostium** and **morphology**.



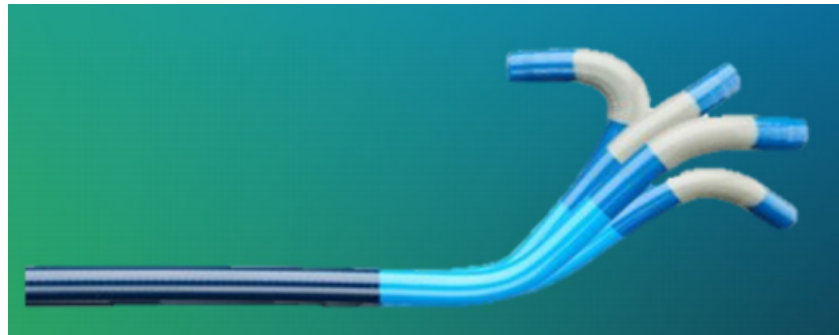
HOW TO OPTIMIZE TS PUNCTURE

Easy hand-made solution:

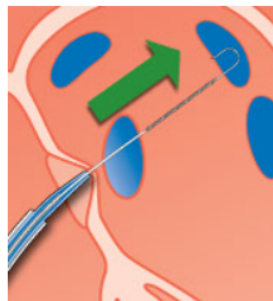
BRK needle with the **stilet** used for the Transseptal Puncture



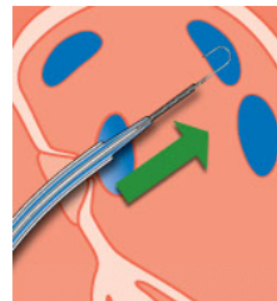
- Steerable sheaths
- SafeSept guidewire



Tenting the Interatrial Septum



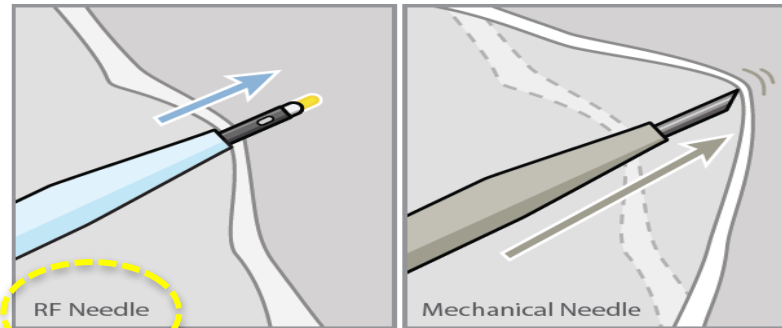
Advancing SafeSept into the Left Atrium



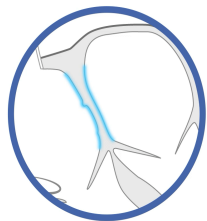
Needle, Dilator and Introducer Tracking over SafeSept



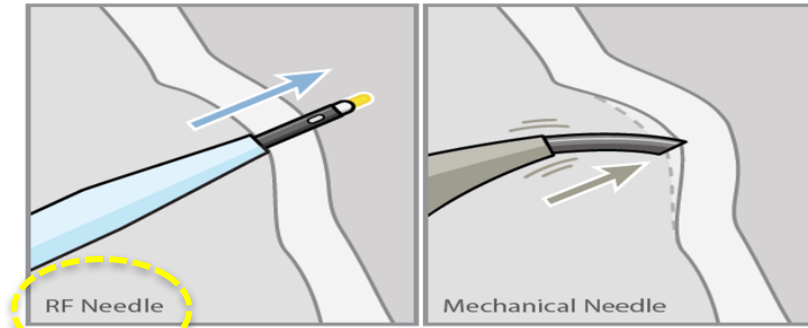
ANEURYSMAL (ELASTIC) SEPTUM



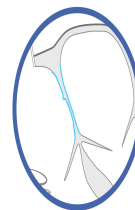
Aneurysmal Septum

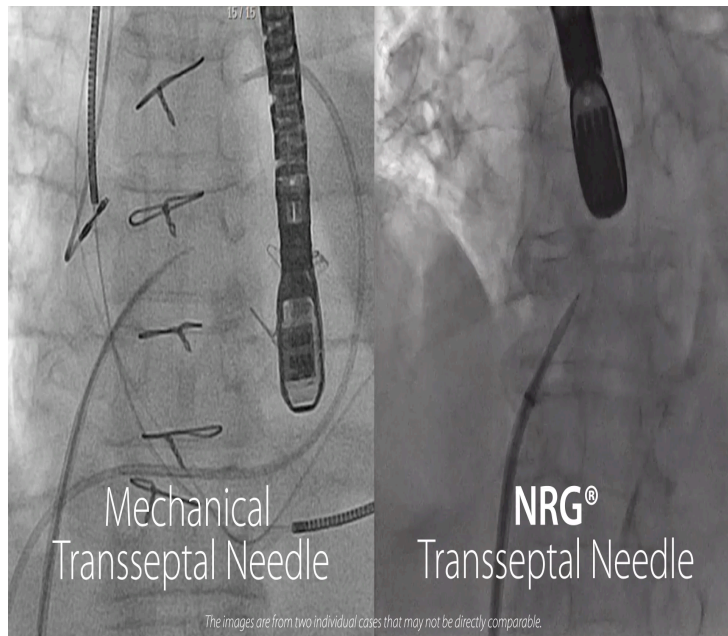


FIBROTIC (THICKENED) SEPTUM

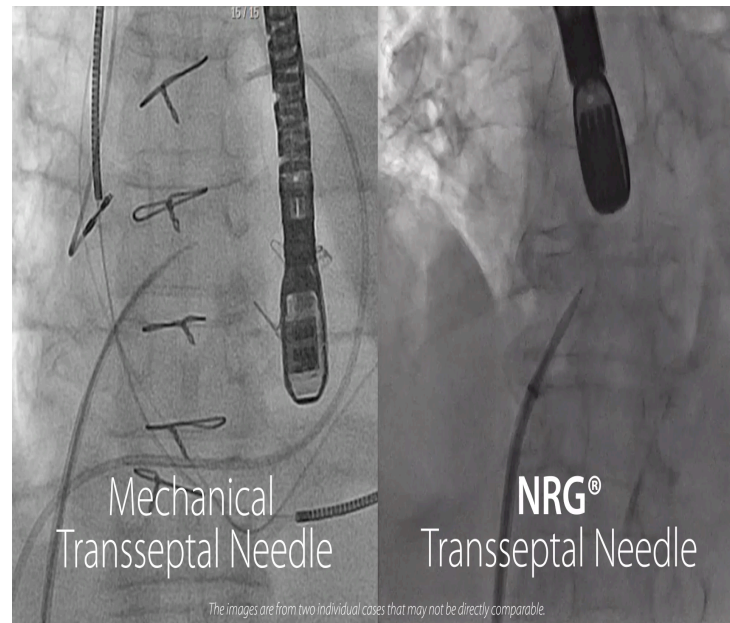


Fibrotic Septum



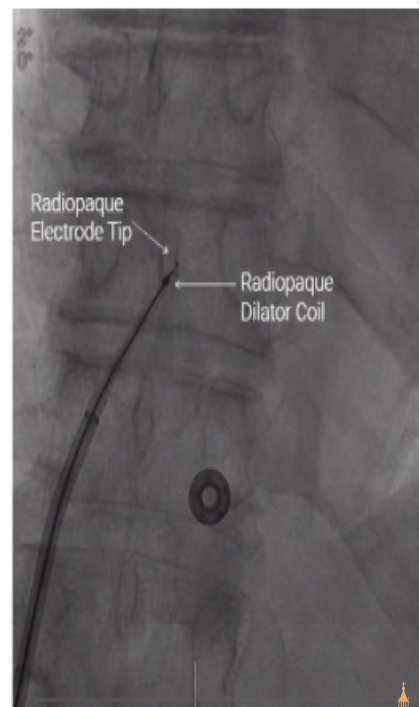
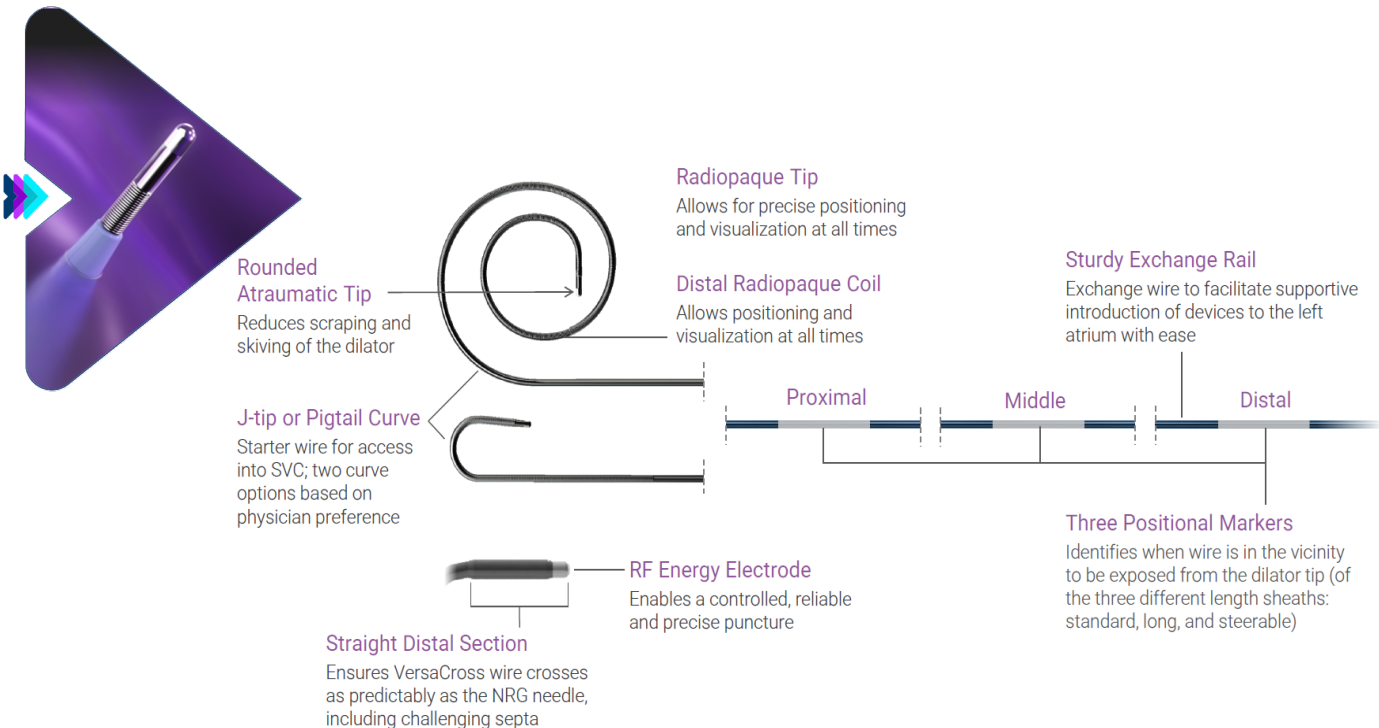


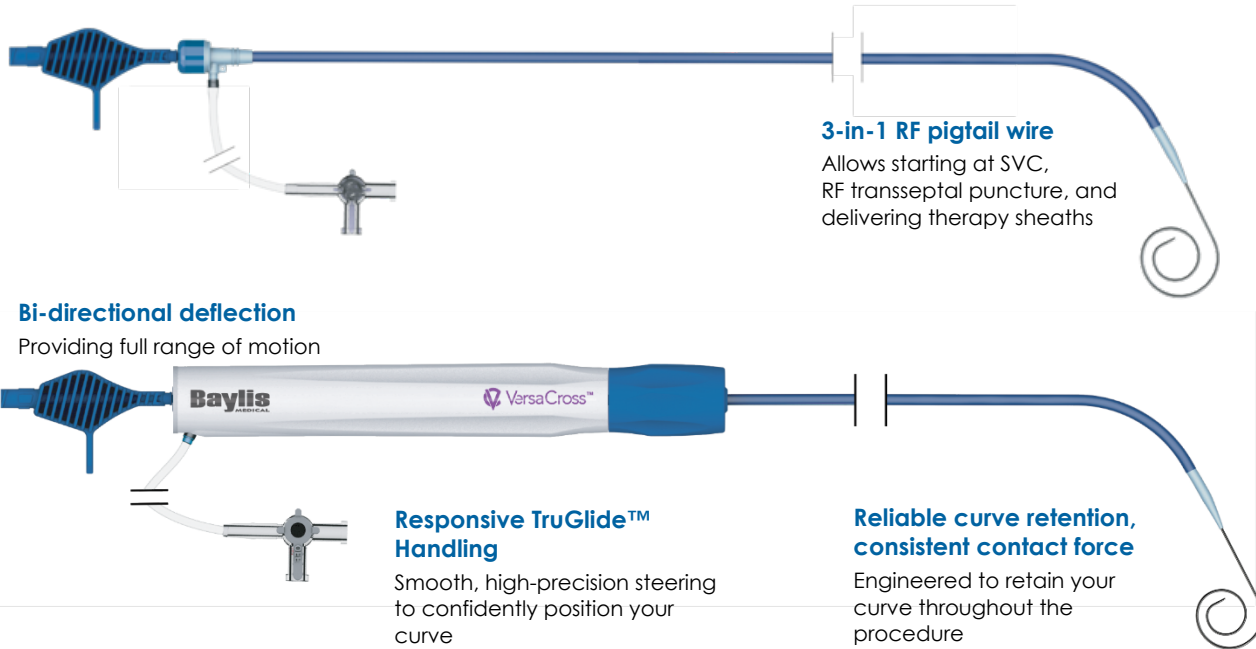
MECHANICAL TPS



RF TPS







VersaCross™
Transseptal Sheath

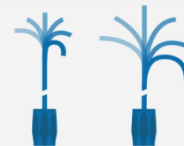
VersaCross™ RF Wire



J-tip
(9 mm)

Pigtail
(24 mm)

VersaCross™ Steerable Sheath

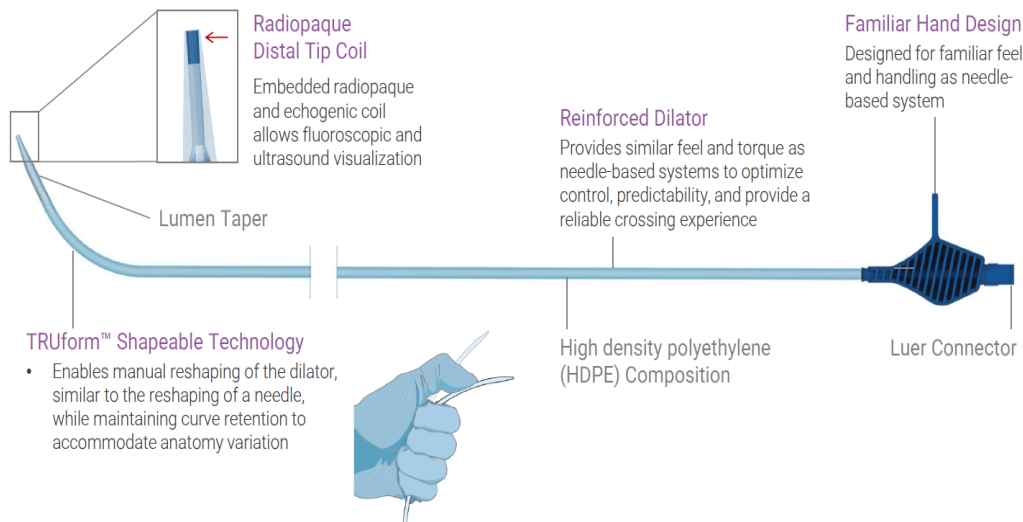


Dilator with TRUform™ shapeable technology



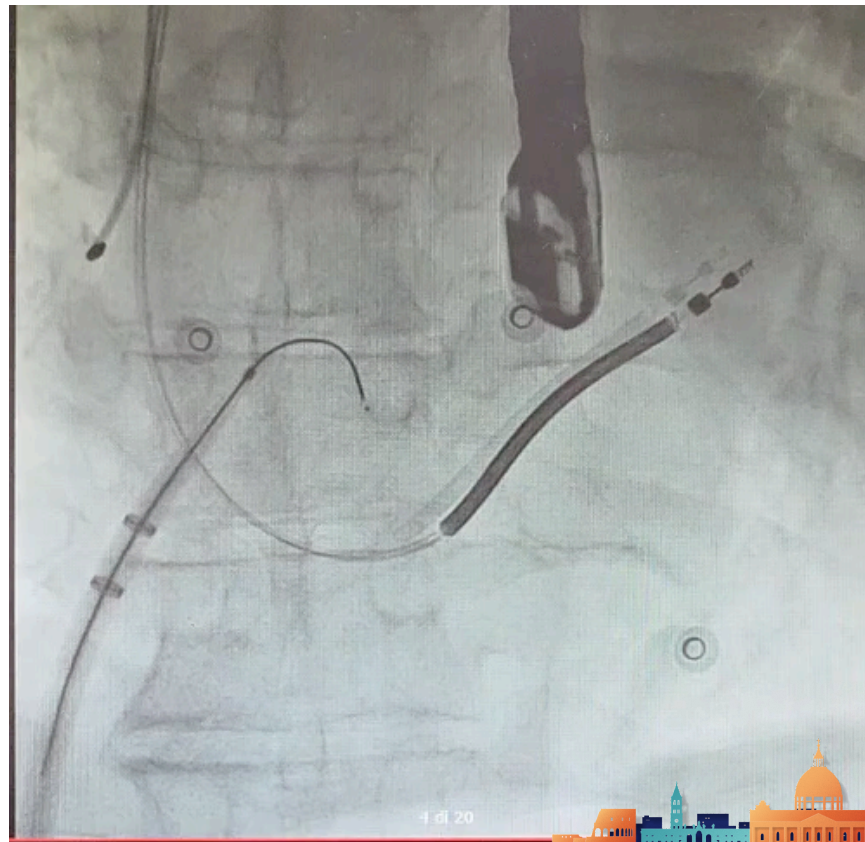
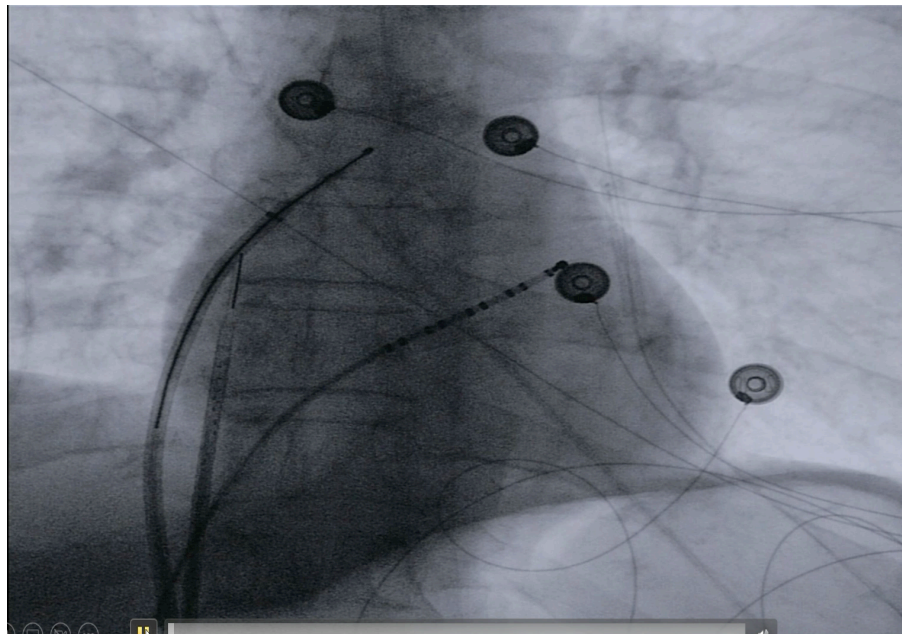
Manually re-shape with true-to-form curve retention



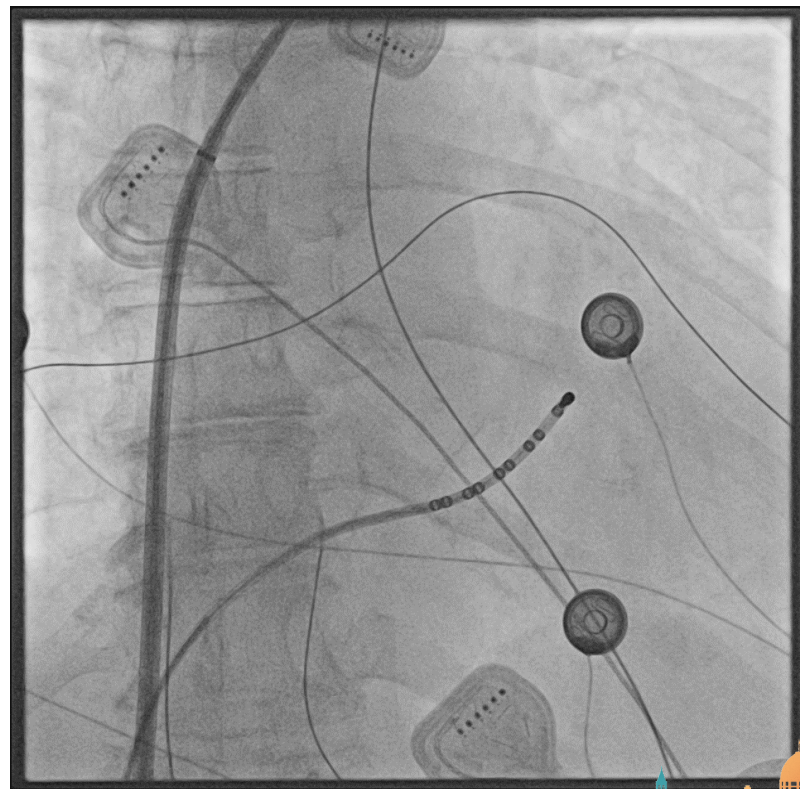
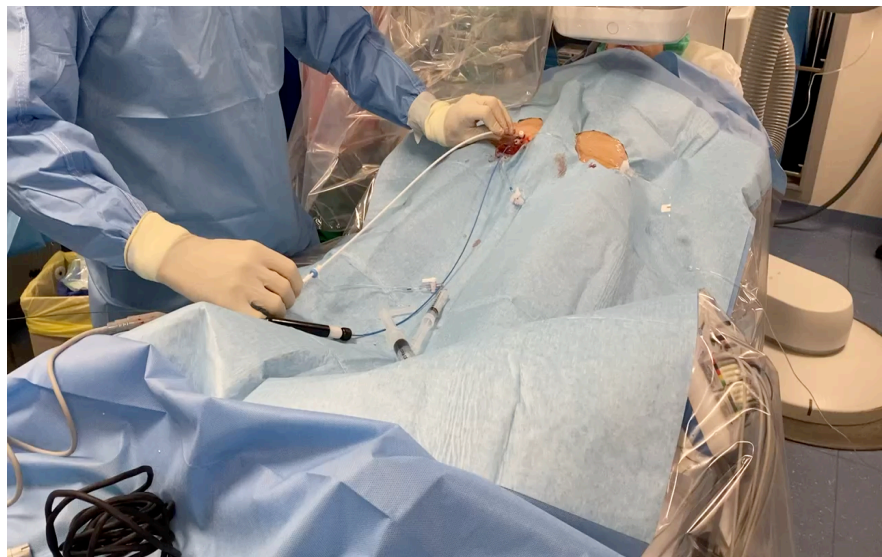


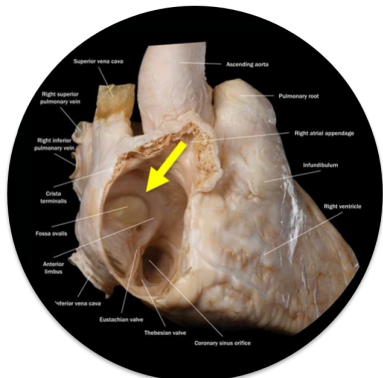
TRUform™ Shapeable Technology

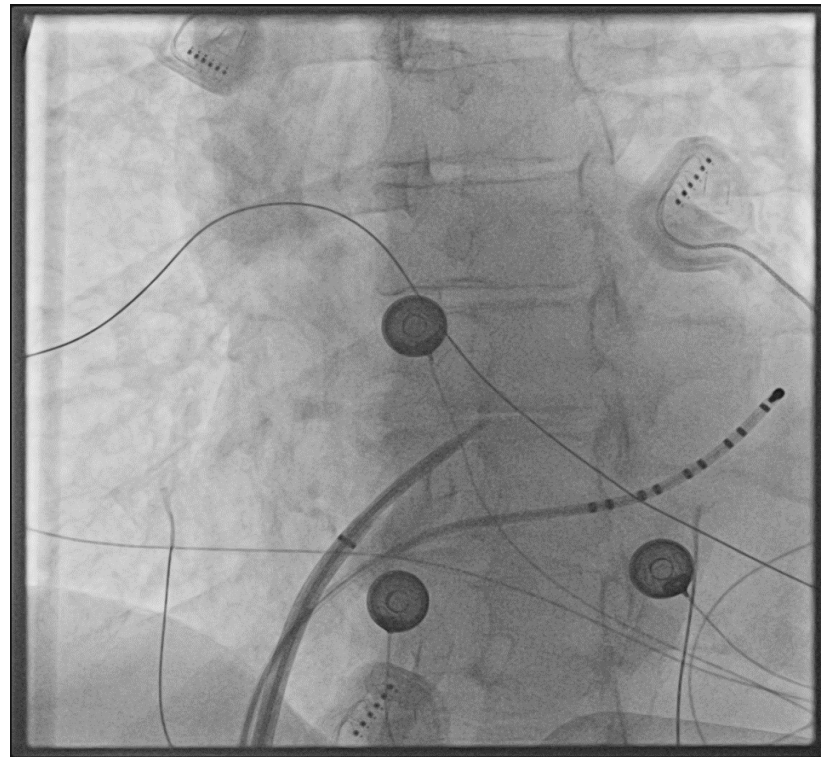
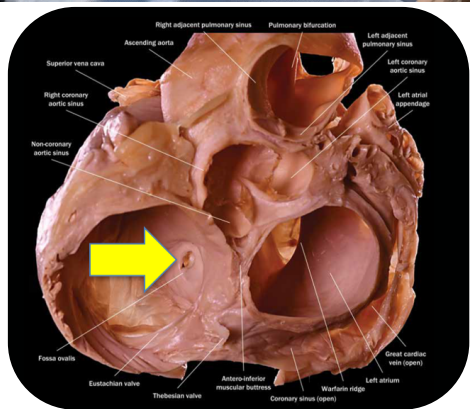
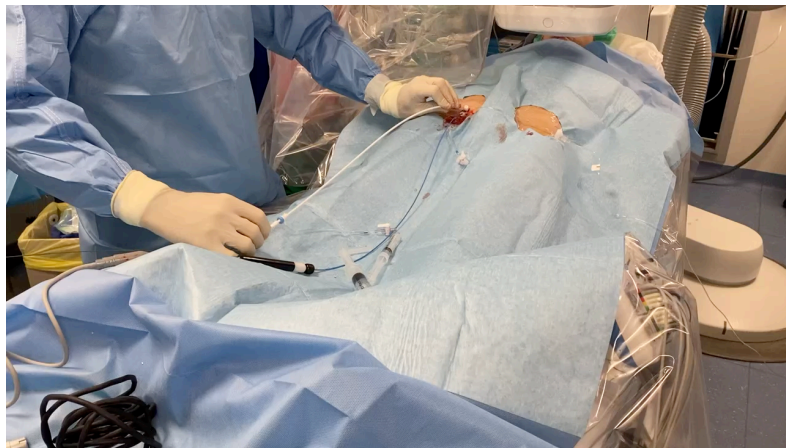






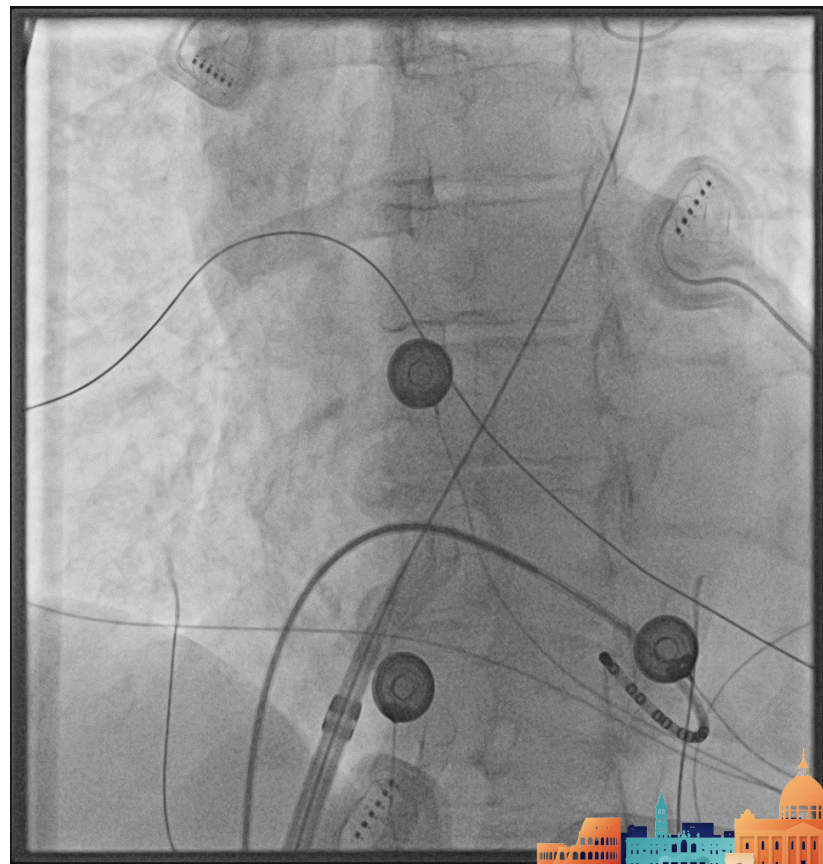


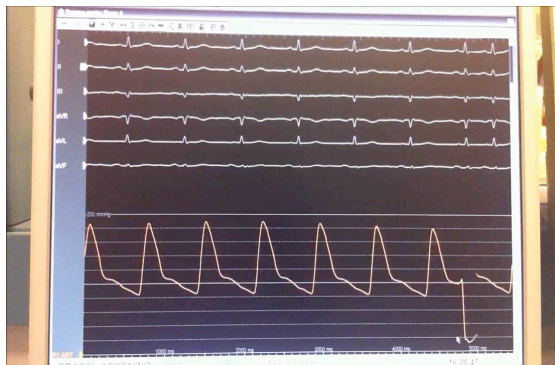
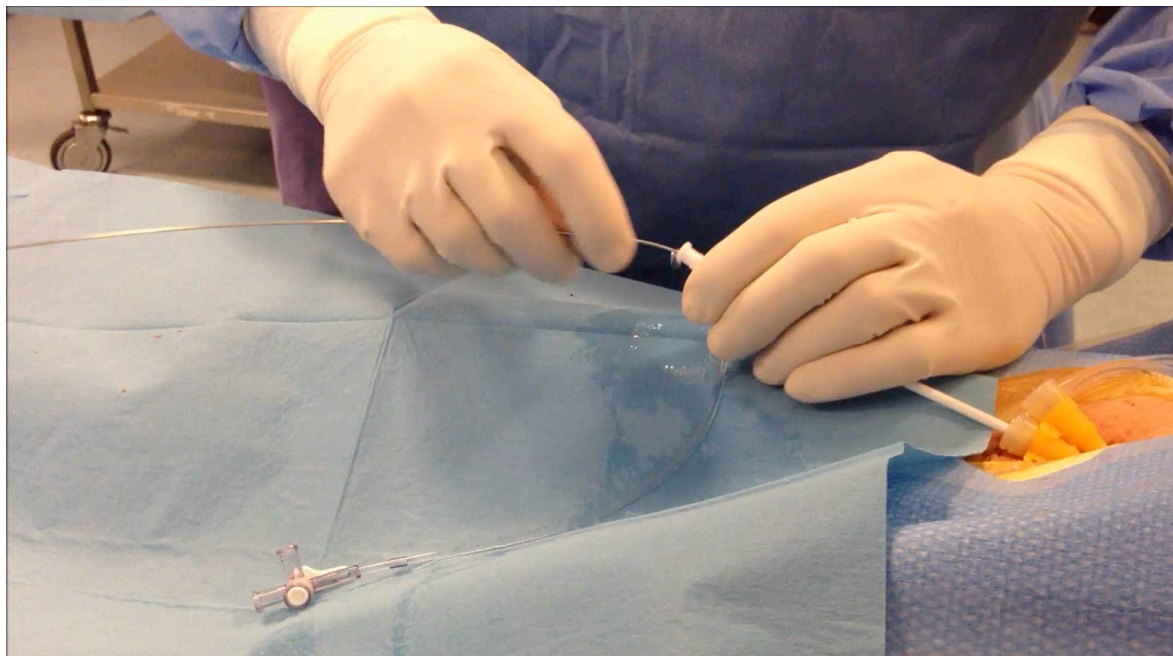
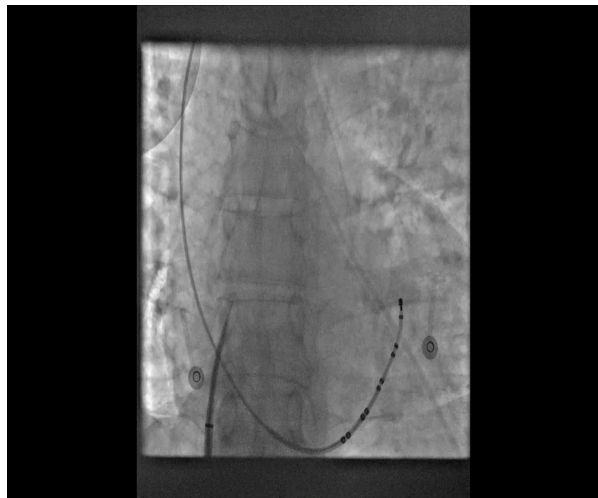












- Transseptal puncture is the main step for several procedures (Ablations, MitraClip, LAAO).
- The optimization of the Transseptal Puncture is necessary to obtain a successful procedure.
- Even in challenging cases a customized Transseptal Puncture will help reaching a good result more easily.



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