TAVR technique:
Fundamental steps, Tricks & Secrets

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3 principles for successful TAVI:

- Patient selection
- Teamwork = Heart Team
- Attention to the technical details of the procedure
The procedure overview

- Fundamentals steps:
  - Obtain vascular access
  - Cross stenotic native valve and position LV stiff wire
  - Balloon aortic valvuloplasty
  - Transcatheter heart valve deployment
  - Assess results: haemodynamics / TEE / angio
The procedure overview

- Before the procedure:
  - Anesthesia / sedation > “this is not cardiac surgery !!!”
  - Monitor ECG and hemodynamics
  - Review TEE findings
  - Insert and test pacemaker – IJV for CoreValve
    - FV for Sapien XT
  - Essential material on table (sheaths, guidewires, catheters)
  - Check contrast volume on power injector (50/50 saline and contrast) and define who is responsible for specific actions (pacing, injectors)
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Determine size for femoral, external iliac and common iliac arterial access.

Basic Guidelines
Arterial Access

Basic Guidelines

Focus on calcification, especially at bifurcations

( CTA or CT w/o contrast very helpful )
Arterial Access

Basic Guidelines

Be extremely cautious with circumferential calcium
Evaluation of tortuousity

Choose side with larger caliber and less tortuousity

Vessels can be straightened with a stiff wire...
Arterial Access

Basic Guidelines

... But not always!
Arterial Access

Rules for a Perfect Puncture

Landmarks for puncture from prior angiogram

- Inferior epigastric
- Inguinal ligament
- Superficial femoral
- Profunda femoris

Locate puncture site before 16-18F sheath (contralateral injection)
Contralateral injection to achieve anterior wall puncture
Arterial Access

Perfect Puncture

Investigate arterial access before preclosure

(Proglides or Prostar)
Placing Large Sheath

• **Option 1:**
  – 6F-7F sheath: 2 Percloses, place stiff wire in descending aorta with JR
  – 16-18 F sheath: cross valve, get gradients, place stiff wire in LV, perform BAV and Sapien XT or CoreValve implantation

• **Option 2:**
  – 7 F or 8 F sheath: 2 Percloses, cross valve, get gradients, place stiff wire in LV
  – 18 F sheath: BAV and Sapien XT or CoreValve implantation
16-18 F sheath advancement

Always on fluoroscopy … Look to guide wire in LV, too.
16-18 F sheath advancement

Stop if a calcified vessel moves while you are pushing the sheath...
Positioning of Pigtail

All 3 sinuses and valve cusps should be in same plane.
All 3 sinuses and valve cusps on the same plane
Finding the “working projection”

Intraoperative rotational angiography with 3-D reconstruction (Dyna CT, Siemens)

CT Angiography
All 3 sinuses and valve cusps on the same plane

“Manual” rotational aortography
Positioning of Pigtail

Incorrect position

Correct position
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Crossing the Stenotic Aortic Valve

You can see where your target is...!!!

• Locate the aortic valve orifice:
  - *Calcified leaflet movement*
  - “Jet” movement
  - Aortography
Crossing the Stenotic Aortic Valve

Cross in LAO

Check wire orientation in RAO
(avoid inferior wall)
Crossing the Stenotic Aortic Valve

- Use both LAO and RAO projection
- Left Amplatz catheter (5F AL 1 & 2)
- 0.35” regular, straight wire
  (Terumo hydrophilic RADIFOCUS in difficult cases)
- Control movement
  - Catheter counterclockwise
  - Wire protrusion
- Avoid coronaries and SVG
- Cross and advance wire into LV
Crossing the Stenotic Aortic Valve

After crossing with AL diagnostic catheter, exchange straight wire for a long (260 cm) J wire carefully in RAO
Wire Shape and Position

Use pig-tail to positioned extra-stiff or super-stiff wire (in RAO projection)
Place 0.035” extra-stiff or super-stiff guidewire with soft tip via the pigtail into LV (RAO projection)

- Shape the distal tip with a broad curve
Poor orientation of pig-tail = Dangerous guide position

Use pig-tail to positioned extra-stiff or super-stiff guide wire (RAO projection)
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Rapid pacing during BAV

- Extremely cautious with PM placement / positioning
- Prefer to use balloon-tipped 4 or 5F pacemaker
- Use LAO projection to ensure septal orientation
Rapid pacing during BAV

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Rapid pacing during BAV

RV temporary pacing lead - via FVein or IJVein sheath

If 1:1 capture does not occur at 180-200 BPM, then initiate pacing at 100 BPM (after 1:1 capture increase to 180)
Have valve crimped and ready to go before BAV
Especially important for decompensation after BAV
Contrast injection during BAV to assess coronary occlusion
Differential diagnosis of persistent hypotension after TAVI
(preferable to have portable echo in room)

- Acute LV systolic failure (patients with severe baseline LV dysfunction)
- LV perforation with tamponade
- Ruptured AV annulus with aortic dissection and/or severe AI
- Blood loss from expanding hematoma or retroperitoneal bleed
- Vagal mediated hypotension (can be sustained)
- Heart block
- Disrupted submitral apparatus and severe MR
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SAPIEN XT (Edwards Lifesciences Inc.)
Implantation steps
**Sapien XT Transcatheter Heart Valve**

**Balloo-expandable system**

- **Cobalt-chromium frame with high radial strength**
- **Frame height designed to respect the surrounding cardiac anatomy**
- **Bovine pericardial tissue leaflets**
Sapien XT Implantation steps

Valve alignment

Balloon

Bioprosthesis

Distal Valve Alignment Marker

Proximal Valve Alignment Marker

DEFAULT POSITION

VALVE ALIGNMENT POSITION
Sapien XT Implantation steps
Valve alignment
Sapien XT Implantation steps

Fine adjustment
Sapien XT Implantation steps

Crossing the aortic arch

- Ensure optimum wire position
- Rotate Flex Wheel to track over aortic arch
- Use LAO 30 to 40 to provide view of aortic arch
- Observe navigation through aorta
Sapien XT Implantation steps

**Crossing the aortic valve**

- Pause before crossing
- Ensure optimum wire position
- Briefly assess the hemodynamics
Sapien XT Implantation steps

**Crossing the aortic valve**

- Ensure optimum wire position
- If it doesn’t cross, it won’t cross with sheer force

**Problem may be**
- Commisural location of the valve
- LV – Ao angle
- Inadequate valvuloplasty
- Severely tortuous unfolded aorta

**Readjust your approach**
- Readjust wire
- Try to change approach angle
- Buddy wire
- Valvuloplasty
- Alternate approach
Sapien XT Implantation steps

Retracting (pulling back) the Nova-Flex sheath

• Pull back the flex catheter just proximal to the double marker

• May need to unflex the catheter
Optimal landing zone for Sapien XT

The Edwards SAPIEN XT valve foreshortens approximately 3 mm for both size 23 and 26 mm.
Optimal Positioning of Sapien XT

- Confirm x-ray angles are correct
- Use calcified landmarks
- Small injections via pigtail
- TEE may help as adjunctive imaging
- Aortogram during rapid pacing can be useful
- Anticipate cranial motion
TAKE YOUR TIME !!!

- If the patient becomes hemodynamically unstable, pull the THV out of the LV and allow BP to recover

- Confirm that pigtail is located deeply in non-coronary sinus
Sapien XT Implantation steps

Sapien XT Implantation technique

2-step inflation:

- Rapid pacing
- Inflate 30%
- Angiography to ensure proper positioning
- Pull the pig tail
- Slow inflation, hold for 3 sec
Sapien XT Implantation steps

Sapien XT Implantation technique

- 1-step SLOW inflation:
- Rapid pacing
- Confirm uninterrupted capture
- Wait until BP drops
- Fully inflate for 3-5 seconds
- Stop pacing after complete deflation
- Remove the balloon from the LV
CoreVale (Medtronic Inc.)
Implantation steps
Prótese aórtica CoreValve®

Stent auto-expansível de nitinol
Válvulas de pericárdio porcino

3 níveis de força radial > aposição

Acesso aos óstios coronários
Bom acoplamento, impede a migração ou desposicionamento

Sistema de entrega
Optimal landing zone for Corevalve

Aortic annulus

Height of skirt 12 mm

12 mm

8 mm

4 mm
Optimal landing zone for Corevalve

CoreValve 26, 29 and 31 mm

Height of skirt 12 mm

Optimal landing zone
Deployment of Corevalve
First stage

At this stage, you have time…remember that AR or AV block post TAVI could impact prognosis.
Deployment of Corevalve
Second stage

Annulus contact, pressure will drop in a minute …
Slowly and coordinated, keep an eye on haemodinamics. Always on fluoro!
Now you have time again… Pressure returns to baseline.
Check position with pig tail injections.
Crossing the aortic valve with Corevalve

- Ensure optimum wire position
- Observe navigation through aorta
- Gentle push
- If it doesn’t cross, it won’t cross with sheer force
Optimal Placement of Corevalve

What to look for before starting...

No alignment

Good alignment
CoreValve implantation

1\textsuperscript{st} Step

Step 1:
Positionate the valve 4-6 mm below the annulus

(1\textsuperscript{st} and 2\textsuperscript{nd} radiopaque marker)
CoreValve implantation

2\textsuperscript{nd} Step

Step 2:

Unsheath the valve until 2\textsuperscript{nd} and 3\textsuperscript{th} radiopaque marker and perform angio

Valve is still in its vertical, collapsed shape

Not flared yet

Cranial and caudal adjustment permitted
CoreValve implantation
3rd Step

Step 3:

- Valve is flared
- When valve is 50% from touching the opposite wall, perform another angiogram

50% opened, not functioning

From Step 1 to step 3:

VERY SLOWLY
DEPLOYMENT
CoreValve implantation
4th Step

Step 4:
- After full contact, unsheath the valve until ¾
- Perform angiogram
- Pull the pig tail
Detachment of Corevalve
Extremely caution with nose cone...
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Assessment immediately after TAVI

- Assess
  - Valve location, expansion & movement
  - AR severity
  - Coronary patency
Assessment immediately after TAVI

- Assess BP waveform, gradient, diastolic pressure
- HR, PAP
- ECG, ST-T, conduction disturbances
Assessment immediately after TAVI

AR index – prognostic information

\[
\frac{\text{Aortic diastolic pressure} - \text{LVEDP}}{\text{Systolic aortic pressure}} \times 100
\]
Assessment immediately after TAVI

- By TEE, look for:
  - Valve location & movement
  - Leaflet motion
  - Para-valvular AR
  - Valvular AR (after removing stiff wire)
  - Mitral regurgitation
  - LV wall motion
  - Pericardium
  - Aortic wall (haematoma / dissection?)
Angiography after access closure

- Surgical cutdown with repair or
- Percutaneous closure (1 Prostar, 2 Proglides)
Many complications are detected after sheath removal
Many complications are detected after sheath removal and must be treated promptly.
The procedure overview

Conclusions

- Transcatheter AVI is a Unique Procedure:
  - Attention to the technical details of implantation is mandatory for a successful TAVI
  - Multiple people must act in perfect coordination during the crucial seconds
  - We should optimize the chances for success and mitigate against the risk of failure
  - Detailed post-op deconstruction of cases accelerates learning curve and improves team cohesion