TEVAR
(Thoracic Endovascular Aortic Repair)
for Aneurysm and Dissection

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Disclosures

- I have no relevant financial disclosures.
Definitions

- TEVAR
Definitions

- TEVAR – Thoracic Endovascular Aortic Repair
- Deploying an impermeable graft on a metal scaffold (stent-graft) inside the thoracic aorta to exclude a diseased segment of the aortic wall from arterial pressure and flow
Definitions

- **Aneurysm**
  - Dilation of an arterial segment to >150% of its normal size

- **Dissection**
  - Tear in the inner-most layer of the arterial wall (intima) allowing blood flow into a false channel (lumen) ➔ blood flow within the arterial wall
TEVAR for Aneurysm
Thoracic Aortic Aneurysms (review)

- Can be divided anatomically into aneurysms involving the ascending aorta, the transverse arch, or the descending aorta.

- In general, ascending aneurysms are treated by Cardiac surgeons.

- In general, arch and descending aneurysms may be treated by either Vascular or Cardiac surgeons.
Descending Thoracic Aortic Aneurysms

- Natural History
  - Risk of rupture directly related to size
    - 5cm = 5.5% risk of rupture or dissection within 1 yr
    - 5.5cm = 7.2% risk of rupture or dissection within 1 yr
    - 6cm = 9.3% risk of rupture or dissection within 1 yr
    - .........
TEVAR for Descending Thoracic Aortic Aneurysms

- Open Surgical Outcomes
  - Operative mortality 8.5%
  - Cardiopulmonary complications 44%
  - Permanent paraplegia 5%
  - 5 year survival 68%

- TEVAR Outcomes
  - Operative mortality 2%
  - Cardiopulmonary complications 16%
  - Permanent paraplegia 1.6%
  - 5 year survival 67%
1. Who to treat?
   - Size >6.0-6.5cm
   - Rapid growth (>1cm/yr)
   - Symptoms
     - Chest pain
     - Back pain
     - Compression of adjacent structures (airway)
TEVAR for Descending Thoracic Aortic Aneurysms

2. When to treat?

- **Immediately** for rupture
- **Urgently** for symptoms or rapid enlargement
- **Electively** for size criteria
TEVAR for Descending Thoracic Aortic Aneurysms

3. Goals of Repair

- Exclude the aneurysm
- Land in normal-sized aorta
- Minimize risk of spinal ischemia
TEVAR for Descending Thoracic Aortic Aneurysms

4. Technique

- Lumbar drain placed if possible (unless hostile back anatomy or rupture with major hemodynamic instability)

- Percutaneous approach usually (no incisions)

- Oversize device 10-20%

- If coverage of the LSA is required, it is usually performed only after a pre-emptive LSA revascularization (transposition or bypass)
TEVAR for Descending Thoracic Aortic Aneurysms

5. Complications

- Spinal Cord Ischemia
- Branch vessel coverage → end-organ Ischemia
- Stroke
- Endoleaks
- Retrograde Type A dissection
TEVAR for Dissection
Thoracic Aortic Dissections

<table>
<thead>
<tr>
<th>STANFORD Type A</th>
<th>DEBAKEY Type I</th>
<th>Type II</th>
<th>Type III</th>
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<tbody>
<tr>
<td>NORMAL</td>
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## Thoracic Aortic Dissections

<table>
<thead>
<tr>
<th><strong>Acute Dissections</strong></th>
<th><strong>Uncomplicated Dissections</strong></th>
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<tbody>
<tr>
<td>&lt; 2 weeks old</td>
<td>No evidence of end-organ ischemia or rupture</td>
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<table>
<thead>
<tr>
<th><strong>Subacute Dissections</strong></th>
<th><strong>Complicated Dissections</strong></th>
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<tbody>
<tr>
<td>2-12 weeks old</td>
<td>Evidence of end-organ ischemia or rupture</td>
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<tr>
<th><strong>Chronic Dissections</strong></th>
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<tr>
<td>&gt;12 weeks old</td>
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Pick one descriptor from each box.
TEVAR for Type B Dissections

- Difficult to summarize evidence, significant heterogeneity (acute, subacute, chronic, complicated, uncomplicated)

- But in summary
  - TEVAR is associated with better perioperative outcomes, similar long term survival, but increased need for reintervention compared to open surgery.
TEVAR for Type B Dissections

1. Who to treat?

- Medical therapy for uncomplicated dissections
- TEVAR for complicated dissections
- TEVAR for uncomplicated dissections with high-risk features
  - Any aortic diameter >44mm
  - False lumen diameter >22mm
  - Age >60
  - Borderline malperfusion (chronic n/v, ileus, fluctuating pulse exams, refractory pain, refractory HTN)
TEVAR for Type B Dissections

2. When to treat?

- **Immediately** for acute complicated with malperfusion or rupture

- **After 2 weeks** for acute uncomplicated dissections with high risk features (allows septum to thicken, aorta to stabilize)

- **As needed** for chronic dissections that degenerate into aneurysms, rupture, or develop late malperfusion
3. Goals of Repair

- Close proximal entry tear
- Land in normal aorta proximally
- Improve true lumen flow / decrease false lumen flow
- Promote aortic remodeling
- Address malperfusion – fasciotomies, ex-lap, etc.
TEVAR for Type B Dissections

4. Technique

- Lumbar drain placed if possible (unless hostile back anatomy or concern about severity of malperfusion makes it too time-intensive)

- Percutaneous approach usually (no incisions)

- Intravascular ultrasound to determine location of tear and aid in sizing

- Minimize device oversizing proximally

- Don’t hesitate to cover LSA / down to diaphragm / cover celiac if needed in order to treat the malperfusion in complicated cases

- If required in acute dissections, coverage of the LSA is usually performed without revascularization during that same operation – patients are followed postop to determine the need for LSA bypass / transposition
5. Complications

- Retrograde Type A dissection
  - More likely in acute dissections, large aortas, larger proximal landing zones, bare metal stents proximally, ballooning

- Stent-graft Induced New Entry (SINE) tears – tear at trailing edge of stent-graft leading to more false lumen flow at that location – may require extension or fenestration

- Spinal Cord Ischemia

- Branch vessel Ischemia

- Stroke

- Endoleaks

- Persistent False Lumen Flow
References


http://www.surgery.usc.edu/cvti/graphics/aorticdissection01.jpg


http://circ.ahajournals.org/content/132/17/1620


http://www.internationaljournalofcardiology.com/article/S0167-5273(17)34002-0/pdf

Case #1

- A 56 year-old man presented with an acute complicated TBAD with visceral and left lower extremity malperfusion.

- Medical Therapy?
- Open Surgery?
- TEVAR?
- Treated with TEVAR.

- The pre-TEVAR images demonstrate poor filling of the mesenteric vessels, while the post-TEVAR images show brisk filling throughout the reno-visceral segment as well as through both iliac arteries.

- Mild preop lactic acidosis resolved. No laparotomy required.
Case #2

- A 55 year-old woman initially presented with acute uncomplicated TBAD. She was managed medically, but developed renal malperfusion during the subacute phase, mandating repair. Left subclavian through retrograde vertebral flow, exclusion of the diseased aorta, and brisk distal true lumen filling. She was followed expectantly, and did not require left subclavian revascularization.
Case #2

- TEVAR

- During TEVAR, angiography revealed interval development of a contained rupture (left image). IVUS confirmed the dissection extended into the distal aortic arch.
Case #2

- The operative plan was modified, and an endograft was deployed with intentional left subclavian artery coverage. Completion angiogram revealed adequate filling of the left subclavian through retrograde vertebral flow, exclusion of the diseased aorta, and brisk distal true lumen filling (right image). She was followed expectantly, and did not require left subclavian revascularization.
Case #2

- The operative plan was modified, and an endograft was deployed with intentional left subclavian artery coverage. Completion angiogram revealed adequate **filling of the left subclavian through retrograde vertebral flow**, exclusion of the diseased aorta, and brisk distal true lumen filling (right image). She was followed expectantly, and did not require left subclavian revascularization.
Case #3

- 67M w/ Symptomatic Descending Thoracic Aortic Aneurysm beginning at the distal edge of the left subclavian artery.

- Prior EVAR with bilateral internal iliac artery occlusions.

- Medical therapy?

- Open surgery?

- TEVAR with LSA coverage alone?

- TEVAR with LSA coverage and revasc?
Case #3

- TEVAR w/ LCC $\rightarrow$ LSA bypass and plug
Case #4

- 85F w/ descending thoracic aortic aneurysm - ?world record?
Case #4

- TEVAR w/ extensive spinal coverage – no spinal ischemia – LD removed POD#1 – d/c’d home.


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https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5634245


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Thank You