Temporary Extra-Anatomical Bypasses as Perfusion Alternatives in The Treatment of Complex Thoracoabdominal Aortic Disease.

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Disclosures

• The authors have no conflict of interest in this case.

• The patient consented to the use of their information and images in the presentation after being adequately informed.

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General aspects of TAAA open repair

- **Long-term results:**
  - Freedom from repair failure at 5 (97.9%), 10 (95.3%) and 15 (94.1%) years.

- **Low rates of complications:**
  - Low incidence of graft infection at long-term follow-up.

- **In-hospital mortality of 7.5%.

Main challenge: Ischemia

Risk of ischemic damage to:
- Visceral organs
- Limbs
- Spinal cord

Risk factors for mortality and/or ischemic injury include:
- Age
- COPD
- Kidney disease
- Urgent or emergent repair

<table>
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<th>Strategy for prevention of ischemic injury</th>
<th>Approach</th>
<th>2010 AHA/ACC guideline (14)</th>
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<tr>
<td>Distal perfusion (left heart bypass or CPI)</td>
<td>Open</td>
<td>COR 2A, LOE B</td>
<td>No recommendation</td>
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<td>Reimplantation of segmental arteries</td>
<td>Open</td>
<td>No recommendation</td>
<td>No recommendation</td>
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<td>Moderate systemic hypothermia</td>
<td>Open</td>
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<td>CSF drainage</td>
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<td>Preservation of left subclavian and internal iliac arteries</td>
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<td>No recommendation</td>
<td>No recommendation</td>
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<td>Staged repair</td>
<td>Open and Endo</td>
<td>No recommendation</td>
<td>No recommendation</td>
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<td>Preoperative segmental artery embolization</td>
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<td>Neuromonitoring</td>
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<td>Intrathecal papaverine</td>
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<td>Optimize spinal cord perfusion (CSF drainage, deliberate hypertension, anemia and hypoxemia)</td>
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<td>COR 1, LOE B-NIR</td>
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<td>Epidural irrigation with hypothermic solutions</td>
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<td>High-dose glucocorticoids</td>
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<td>Osmotic diuresis (mannitol)</td>
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<tr>
<td>Preoperative hydration</td>
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<td>No recommendation</td>
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<td>COR 1, LOE A</td>
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<tr>
<td>Blood perfusion</td>
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<td>COR 1, LOE A</td>
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<tr>
<td>Intraoperative mannitol administration</td>
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<td>COR 2B, LOE C</td>
<td>No recommendation</td>
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<tr>
<td>Furosemide, mannitol, or dopamine for renal protection</td>
<td>Open and Endo</td>
<td>COR 3, LOE B</td>
<td>No recommendation</td>
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</tbody>
</table>
Which techniques can be used for open TAAA repair?

Different techniques have been proposed:
- Clamp and sew
- Left heart bypass

Temporary extra-anatomical bypass (EAB) can be an option when extracorporeal circulation is not an option.

These procedures should only be performed in a specialized center.
Case 1: Initial assessment

**Age:** 64 y/o  
**Sex:** Male

**PMH:** HTN, smoker

**HPI:** Back pain, pulsating mass, abdominal discomfort.

**Surgical plan:**  
- Initial type 2 TAAA open repair with EAB.
Case 2: Initial assessment

Age: 59 y/o
Sex: Male

PMI: HTN, Chronic stanford type B dissection.

Previous surgeries: EVAR + bilateral iliac stenting at another institution.

HPI: Tender abdomen over the segment of the aneurysm.

Surgical plan:
- Initial type 3 TAAA open repair with EAB.
- Staged TEVAR.
Surgical procedure

EABs.

**Right axillo-bifemoral bypass**
- Right axillar anastomosis to PTFE graft.
- Bilateral femoral anastomosis.

**Left axillo-visceral bypass**
- Left axillar anastomosis to PTFE graft.
- Creation of subcutaneous pocket for later perfusion of Celiac artery and SMA.
Surgical procedure
Thoracic aorta repair

TAAA repair (Thoracic segment)
• Proximal thoracic anastomosis.

Perfusion (Through the right EAB)
• Lower extremities had antegrade perfusion.
• CT, SMA, renal and lumbar arteries had retrograde perfusion.

Case 1 remarks.
• Lung deflation
• No reattachment of intercostal arteries
Surgical procedure
Abdominal aorta repair

TAAA repair (Abdominal segment)
• Interval clamp moved distally.
• Cannulation.
• Cold kidney perfusion.
• Carrel patch (CT, SMA and right renal artery).

Perfusion
• Lower extremities \textit{antegrade} prefusion through the right EAB.
• CT, SMA \textit{antegrade} perfusion through the left EAB and cannulas.

Case 2 remarks.
• EVAR explant.
Surgical procedure

Abdominal aorta repair

- Interval clamp moved distally.
- Cannulation.
- Cold kidney perfusion.
- Carrel patch (CT, SMA and right renal artery).

Perfusion
- Lower extremities antegrade prefusion through the right EAB.
- CT, SMA antegrade perfusion through the left EAB and cannulas.

Case 2 remarks.
- EVAR explant.
Outcomes:

Both patients experienced transitory lower extremity weakness, that resolved completely.

Special remarks:
  Case 1: No post operatory complications, discharge at day 16.

Case 2: At POD 10, experienced chest pain. New CT showed increased size of the upper thoracic segment. (PMH: Chronic Stanford B dissection)  
   **TEVAR:** Gore cTAG thoracic aortic graft 34 x 15.
Can EAB be also useful in aortic arch repairs?

Age: 36 y/o
Sex: Male
HPI: MVA car vs moped

Initial diagnosis:
• Traumatic pseudoaneurysm of the aortic arch
• Multiple intracranial hemorrhages
  - Contraindication for extracorporeal circulation.
  - Deemed as “no surgical candidate” by cardiac surgery.
Surgical procedure

- Left femoral to bilateral carotid extra-anatomical and extracorporeal bypass to ensure cerebral perfusion.
- Endovascular coverage of the aortic arch
- In situ laser fenestration of the innominate artery
- Right to left carotid-carotid-subclavian bypass.
- Proximal ligation of the left common carotid artery.

Discharged with no complication.
Take home messages

• The standard of care traditionally involves a joint effort between cardiothoracic and vascular surgeons.

• However, EAB can be a life-saving alternative to traditional open repair protocols.

• EAB should be present in the vascular surgeon’s available techniques in cases when cardiac bypasses are not an option.

• In the future, newer devices may become widely available to treat these complex patients.
Thank you

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