Optimised management of type A aortic dissection with visceral malperfusion – concept to reconsider

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Malperfusion in Acute Aortic Dissection

Malperfusion – case examples
- Cerebral
- Peripheral

Potential end-organ ischemia
- Cerebral
- Heart
- Spinal cord
- Visceral
- Renal
- Extremities
Malperfusion syndrome is defined as the loss of blood supply to a vital organ caused by branch arterial obstruction secondary to the dissection.

Deeb et al, J Thorac Cardiovasc Surg. 2010
# Malperfusion – Static / Dynamic Obstruction

<table>
<thead>
<tr>
<th>Type of malperfusion</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static obstruction</td>
<td>dissection intersects the vessel origin and the aortic hematoma has propagated into the vessel wall stenosing the side branch lumen</td>
</tr>
<tr>
<td>Dynamic obstruction</td>
<td>dissection spares the vessel but the dissection flap is positioned across the vessel origin like a curtain</td>
</tr>
</tbody>
</table>

*Erbel et al, EHJ 2001*

*Yang et al, ACS 2016*
# Surgical Risk of Malperfusion Syndromes in Acute Type A AD

<table>
<thead>
<tr>
<th>Study</th>
<th>Mortality (%)</th>
<th>Without Malperfusion (%)</th>
<th>With Malperfusion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girdauskas et al, 2009</td>
<td>52/276 (19)</td>
<td>25/183 (14)</td>
<td>27/93 (29)</td>
</tr>
<tr>
<td>Patel et al, 2008</td>
<td>39/196 (20)</td>
<td>12/126 (10)</td>
<td>27/70 (39)</td>
</tr>
<tr>
<td>Geirsson et al, 2007</td>
<td>28/221 (13)</td>
<td>10/162 (6)</td>
<td>18/59 (31)</td>
</tr>
<tr>
<td>Fann et al, 1990</td>
<td>46/198 (23)</td>
<td>30/130 (23)</td>
<td>16/68 (24)</td>
</tr>
</tbody>
</table>

~ 21%  ~ 16%  ~ 32%
Incidence & Mortality of Malperfusion in Acute Type A AD (Kobe 1999 – 2015)

Okita et al., Ann Cardiothorac Surg 2016;5:368-76
Classic treatment = Proximal Ao. repair first

Onset of symptom to diagnosis / Proximal aortic repair / Re-evaluation of malperfusion / Malperfusion treatment

Classic treatment may lead to:
- delayed detection and treatment of peripheral malperfusion
- increase ischemic injury (preop. ischemia + CPB + HCA)
- severe end-organ ischemia and failure
The Essen Concept in Acute AD (since 2005)
Diagnostics + Treatment at the Hybrid OR

The Rational behind the Hybrid OR Concept

- Immediate angiography for on time detection of dissection extent and malperfusion [coronary, cerebral, visceral, peripheral]
- Evaluation of coronary artery disease
- Endovascular TL stabilization and restoration of organ perfusion
- Guide wires placement to secure FET
- Control angiography postop if required
Algorithm of the Essen Hybrid Concept

Direct admission to Hybrid-OR with the ‘Aortic-Team’ waiting

Anesthesiologic monitoring + TEE + preparation for surgery

Aortic rupture, CPR

Tamponade

Stable hemodynamics

Sternalomy/ pericardial drainage

Invasive diagnostics ± malperfusion repair by EVAR

Aortic surgery

TEE

Optional angiographic control ± malperfusion repair with EVAR

Tsakakis et al., EJCTS 2013
Hybrid Concept in Acute Type I AD

Case Example

67yrs, female, cardiac tamponade, TL collapse, visceral and peripheral malperfusion

Pericardial drainage + EVAR prior to surgery

5 years FU
Bentall + subtotal arch replacement + EVAR
Is EVAR the Solution in Visceral Malperfusion?

79y/o, female, 8h after onset of symptoms

Procedure: fenestration + proximal aortic repair
Operative times: Cross clamp 68min, SACP+HCA distally 21min
Outcome: death - metabolic disorder and acute cardiac failure
**Decision Making in Visceral Malperfusion**

- **TL collapse**
  - no symptoms
  - dynamic malperfusion
  - static malperfusion

- **Malperfusion duration**
  - < 6 hours
  - > 6 hours

1. EVAR to restore Perfusion ± ICU-Delay ± Laparotomy
2. Surgery

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*Tsagakis et al., EJCTS 2013*
Prolonged Static Visceral Malperfusion

Case Example - ICU Controlled Delay

68y/o, male, 12hrs post AAD

Abdominal pain, vomiting, hematochezia

- EVAR thoracoabdominal aorta + SMA

- Transfer to ICU after EVAR
- Intubated + sedated
- TEE in place
- 3 sites RR-monitoring
- RR<120mmHg

1st day post. EVAR:
Small bowel 2/3 resection + hemicolecotomy

3rd day post. EVAR:
Second look and additional small bowel resection + Aortic repair (E-vita open)

Tsagakis et al, Thorac Cardiovasc Surg. 2008
Prolonged Static Visceral Malperfusion Case Example – ICU controlled Delay

3 months postop

5 years FU
# Essen Experience in acute Type A 2005 - 2018

<table>
<thead>
<tr>
<th>Patients</th>
<th>N=352</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean±SD)</td>
<td>60 ± 13</td>
</tr>
<tr>
<td>Male</td>
<td>224 (64)</td>
</tr>
<tr>
<td>Type I</td>
<td>257 (73)</td>
</tr>
<tr>
<td>Type II</td>
<td>95 (27)</td>
</tr>
<tr>
<td>Penn A, %</td>
<td>128 (36)</td>
</tr>
<tr>
<td>No circulatory collapse + No malperfusion</td>
<td>128 (36)</td>
</tr>
<tr>
<td>Penn B, %</td>
<td>109 (31)</td>
</tr>
<tr>
<td>Malperfusion</td>
<td>109 (31)</td>
</tr>
<tr>
<td>Penn C, %</td>
<td>51 (15)</td>
</tr>
<tr>
<td>Circulatory collapse</td>
<td>51 (15)</td>
</tr>
<tr>
<td>Penn BC, %</td>
<td>64 (18)</td>
</tr>
<tr>
<td>Circulatory collapse + Malperfusion</td>
<td>64 (18)</td>
</tr>
</tbody>
</table>
# Mortality at 30d / Penn-Class

<table>
<thead>
<tr>
<th>Acute Type A AD</th>
<th>N=352</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality @ 30d</td>
<td>14%</td>
</tr>
<tr>
<td>Penn A, %</td>
<td></td>
</tr>
<tr>
<td>No circulatory collapse + No malperfusion</td>
<td>6%</td>
</tr>
<tr>
<td>Penn B, %</td>
<td></td>
</tr>
<tr>
<td>Malperfusion</td>
<td>12%</td>
</tr>
<tr>
<td>Penn C, %</td>
<td></td>
</tr>
<tr>
<td>Circulatory collapse</td>
<td>20%</td>
</tr>
<tr>
<td>Penn BC, %</td>
<td></td>
</tr>
<tr>
<td>Circulatory collapse + Malperfusion</td>
<td>30%</td>
</tr>
</tbody>
</table>
### Results in Hybrid OR Concept Era

<table>
<thead>
<tr>
<th>Univariate analysis</th>
<th>HR Concept (N = 268)</th>
<th>No HR Concept (N = 84)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAAD</td>
<td>12.7%</td>
<td>19.0%</td>
<td>.154</td>
</tr>
<tr>
<td>Malperfusion</td>
<td>14%</td>
<td>33%</td>
<td>.013</td>
</tr>
<tr>
<td>Penn B</td>
<td>9%</td>
<td>25%</td>
<td>.060</td>
</tr>
<tr>
<td>Penn BC</td>
<td>23%</td>
<td>47%</td>
<td>.191</td>
</tr>
</tbody>
</table>
Survival

Overall survival

Malperfusion vs. no malperfusion

No malperfusion

Malperfusion

P = 0.066

Survival

Pts

352 172 126 66 39 19

0.0 2.0 4.0 6.0 8.0 10.0

Survival

No Malperfusion

180 91 66 31 19 8

Malperfusion

172 81 60 35 21 11

0.0 2.0 4.0 6.0 8.0 10.0
Summary

- Malperfusion syndromes in acute aortic dissection are associated with increased mortality
- Proximal aortic repair may resolve malperfusion but not in all patients – increases end-organ ischemia
- Additional tools may improve treatment of malperfusion syndromes
  - HYBRID-OR
  - PRE/POST ANGIOGRAPHY
  - EVAR
  - ANGIOSCOPY
  - FET
- In selected cases a controlled (ICU-) delay between EVAR and open surgery may improve the prognosis
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www.aortic-live.com