Endovascular Trauma Management

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Medtronic Symposium, LINC 2016
Disclosures

I have the following potential conflicts of interest to report:

Educational Program  W.L Gore & Associates
Stockholder         LeMaitre
Co-founder           Meliora-Vision
The Swedish September 11

- Swedish Foreign Minister Anna Lindh was stabbed at a department store in central Stockholm.
- She was rushed to Karolinska Hospital, where she underwent surgery and blood transfusions for over nine hours. Lindh reportedly experienced severe internal bleeding and liver damage.
- However, she suffered the trauma triangle of death with hypothermia, acidosis and coagulopathy and was pronounced death at 5.29 AM, Sept 11, 2003.
Concept from 1980s
Concept for the future
EndoVascular and Hybrid Trauma Management (EVTM)

- Based on the current Advanced Trauma Life Support protocol (ATLS)
- And our experiences from the 100% EVAR in ruptured AAA since 2009 in Örebro
How do we treat rAAA?

- Effective team work
- Permissive hypotension (passive/active)
- CTA (<15min)
- Angio table/C-Arm or Hybrid suite
- Local anaesthesia and percutaneous femoral access
- Aorta Balloon Occlusion (ABO) optional
- EVAR with adjunct techniques as chimneys and Onyx™ embolization
- Fascia suture for access closure
- Monitoring and early intervention of ACS

Primary Survey

- ATLS protocol
  - A = Airway and cervical control
  - B = Breathing
  - C = Circulation and bleeding
  - D = Disability
  - E = Exposure

- EVTM
  - F = Femoral access
EndoVascular and Hybrid Trauma Management (EVTM)

- Early multidisciplinary approach
- Permissive hypotension
- Early femoral access
- CTA
- Aortic balloon occlusion (ABO) or Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) if appropriate
- Hybrid OR
Endovascular bleeding control

• ABO or REBOA
  – Total/partial/intermittent
• Catheter embolization (gelfoam, coils, plugs, Onyx™)
• Stent-grafts (major vessels)
• The role of modern CTA imaging is crucial
Useful embolization materials for bleeding control

Onyx™ liquid embolic system
Concerto™ detachable coils system
MVP™ Microvascular Plug System (3-7 mm)
Endovascular bleeding control

Starts with femoral access in the emergency room!

Blind puncture or US or cut-down
How to perform ABO

- Seldinger method
- 11-12F introducer to deliver and support balloon from migration
- New 7F ABO devices under way
How to perform ABO

- Anatomical landmarks for blind insertion
- Ultrasound
- Fluoroscopy
- TEE
How to perform ABO

Partial, intermittent inflation - target the desired systemic BP!

Hold, adjust and control!
How to use ABO

Bridge to surgery
In combination with embolization
## Access closure

<table>
<thead>
<tr>
<th>Access</th>
<th>Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small bore (8F)</td>
<td>Compression</td>
</tr>
<tr>
<td></td>
<td>Closure devices (many)</td>
</tr>
<tr>
<td></td>
<td>External compression</td>
</tr>
<tr>
<td></td>
<td>Plug technology</td>
</tr>
<tr>
<td>Large bore (&gt;8F-25F)</td>
<td>Surgical cutdown</td>
</tr>
<tr>
<td></td>
<td>Suture mediated closure devices</td>
</tr>
<tr>
<td></td>
<td>Fascia suture</td>
</tr>
</tbody>
</table>
Prostar and Proglide
Prostar and Proglide

Needs pre-suturing!
The fascia suture

Limitations and possibilities of ABO

- Duration of aortic occlusion
- Reperfusion syndrome
- Metabolic effects of partial occlusion
- Hypothermia – maybe not an enemy
- Basic interventional competence necessary
- Logistics
EndoVascular and hybrid

Trauma Management

Emergency

CT

Hybrid

Access/ABO
Facilities

Mobile Suite or a Hybrid operating room
Case 1
Explosive trauma during acetylene welding

- 51-year old man
- Circulatory arrest at emergency dept
- Cardio-pulmonary resuscitation
- Transport to operating theatre
- Open exploration showed profuse bleeding from the iliac vein
- Access of common femoral vein
Stentgraft implantation in the iliac vein from the bifurcation to the access site
Damage Control concept with stapling of multiple lesions in the gut and a Bogota bag
Secondary survey and thrombectomy of common femoral artery due to a metallic fragment
Resection of gut and necrotic muscles
Musculocutaneous flap
Back in work after 8 months
Case 2
Motorcyclist accident

- 35-year old man
- Collision with car at velocity 100km/h. Motorcyclist was found some 20 meters from the car.
Motorcyclist accident

- On arrival, he was conscious and complained of central chest and abdominal pain
- GCS 15
- BP 115/95; HR 111/min
- CTA was performed within 15 min from arrival
Lacerations in both kidneys and lever
Ruptured spleen with some free blood
Multidisciplinary approach

- General surgeon (trauma leader) vascular/endovascular surgeon and thoracic surgeon
- How to gain proximal control
- Sternotomy → Open the pandora box!
Bleeding control

- Angioplasty balloon inserted from right brachial artery
- ABO from femoral access as a safety manner in case of visceral organ hemorrhage
Vessel repair

- Sternotomy
- Inflation of balloon to control bleeding during dissection
- Surgical clamps and patch arterioplasty
- Heparin was given
EVTM take home message

• Early multidisciplinary approach
• Liberal indication for femoral access
• Offers immediately access for ABO
• Hybrid OR for endovascular and/or open permanent bleeding control
• Many devices available for closure of small bore accesses and fascia suture well fitted for closure of large bore accesses (>8 F – 25F)
The Key to Success
The team is always stronger than the individual
EndoVascular/Hybrid Trauma Management (EVTM) Workshops in Örebro
# ABOTrauma Registry

## Patient History

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Gender</th>
<th>Age</th>
<th>Weight</th>
<th>Height</th>
<th>Date &amp; Time</th>
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</thead>
<tbody>
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<td>75</td>
<td>175</td>
<td>2014-07-26 19:50:23</td>
</tr>
</tbody>
</table>

### Photos

### Medical history

### Field information

### Hospital arrival status Emergency room (ER)

### Aortic balloon occlusion usage (ABO)

### Treatments/procedures

### Complications to ABO

### Complications

### Fluide resuscitation

### Outcome

### You own perspective (subjective data)
EndoVascular and Hybrid trauma management (EVTM) Symposium

Örebro, Sweden
3-5 February 2017

Main Topics:

**EVTM concept**, multidisciplinary approach

**ABO / REBOA issues** (Basic and advanced)
"What do we know" updates

**Vascular trauma access Issues**
Solutions by organs / body areas- cases- the options!

**Pre Hospital and Military Aspects**
Technical Aspects for Endo and hybrid solutions

Training Aspect

Complications, problems with EVT

Animal research issues/updates

Symposium chairs:
Tal Hörer (SW)
Joseph Dubose (USA)
Junichi Matsumoto (JP)
Jonny Morrison (UK)
Viktor Reva (RU)
Boris kessel (IS)
Lauri Handolin (FN)
George OOSthuzien (SA)
TBA

Faculty:

Partners: TBA
Cook medical, WI Gore, Philips, Siemens, Ziehm, Tokai, Mentece

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