Thoracic Aortic Rupture

* Trauma is the primary cause of death in the pediatric age group < 18y
* Rupture of the thoracic aorta secondary to blunt chest trauma is an uncommon injury in pediatric patients (0.06% of non specific blunt trauma).
* This injury has been documented to have a catastrophic natural history with combined pre-admission and in hospital mortality rate of over 90%.

Cont.

4. There is much greater compliance of the thorax because the pliable bone and cartilage. Therefore, the chest can absorb high kinetic energy that is transferred to the intrathoracic structures.
5. The disproportionally small chest size compared to the abdomen or head causes multicavity and multiorgan involvement (in 50% of cases with thoracic trauma).

Children Vs. Adults

Pediatric thoracic trauma differs from the adult one.

1. The smaller body mass of the victim leads to greater force per unit of body area.
2. The body is less fat, with less elastic connective tissue and in closer proximity to the thoracic organs.
3. The blood volume is only 7-8% thus small blood loss leads to hypovolemic shock.

Management of Thoracic Aorta in general has evolved even in the pediatric age to include selective non-operative and endovascular stent graft approaches, however, operative repair still remains the standard.

Prior to 2008 – Mainly open surgery
After 2008 – Slow transition to EVT.
Trauma surgeons refrain from using EVT in the pediatric age group because of several factors:

- The fixed caliber of stent-grafts in relationship to the increasing diameter of the normally growing aorta
- The difficulties in introducing the devices through the narrow access arteries
- The unknown very long term results and side effects

Cross-clamp times exceeding 30 minutes and lack of partial or complete bypass independently predict an increased incidence of postoperative paraplegia.

Stent complications, including perforation, endovascular leak, stent migration, development of a pseudocoarctation have been all described.

**When is there no doubt in EVT?**

- In the absence of cardiothoracic surgeons
- In older children with larger vessels
- As a bridging intervention in the unstable pediatric patient


48 TAT in children
- 41 Open repair, 97% survival
- 7 Endovascular cases, most aged >15, 57% survival

Among non treated 60% mortality
The survivors had only small intimal tears

**Case**

12 y.o. girl
Auto-pedestrian accident
Coma with Glasgow Scale – 6
HR 153, BP 69/35, O₂ Sat 93% on FiO₂ 1.0
Brain CT – DAI
Total Body CT– Spleen & Lt Renal lacerations, humerus & pelvic fractures
CTA – Aortic transection 2cm distal to Lt SCA, contrast extravasation traumatic TAR
Thoracic Aortic diameter – 12mm
CFA diameter 3-4mm

**Case Cont.**

MANAGEMENT
Permissive hypotension
Transfemoral 14mm Atrium Advanta V12 covered stent.
No Heparin given.
4 year FU – normal (clinically & radiologically), with 20% difference between Aortic to SG diameters without endoleak.
No need for further SG expansion yet.
EV treatment in children has been described since 2008 but always with conventional self expandable nitinol stent-grafts with iliac extension limbs, thus facing problems with small access arteries, resulting in severe arterial damage or too short introducers in the tall child.
We also struggled to use them in rather older and bigger children.

However.....

Due to these above mentioned limitations we decided to use in our young girl a balloon mounted covered stent: Atrium Advanta V12.
1. It was introduced through a rather small 11 Fr. sheath. (Smaller stent size needs only 9Fr sheath)
2. It can be further dilated in the future, if or when needed.
3. Can be introduced even sheathless if needed.

Index Incident

3 year Followup

A Sagittal and 3D CT reconstruction
Three years later showing stent patency with a 20% difference between the aortic and stent diameter.

The Strategy

Treatment of injuries that are life threatening come first.

Treatments of injuries that are not life threatening are delayed until after definitive aortic repair

In patients with small (<1 cm) intimal flap injuries, we will consider nonsurgical medical management with β-blocker agents (to reduce wall stress) and other antihypertensive medications.

Fixation, Migration and Bird Beaking

Issues of dispute presented here might be:

1. The migration potential of a tubular hookless balloon mounted covered stent in the thoracic aorta
2. The bird beaking appearance in the aortic arch

These issues need to be also addressed when Nitinol SE limbs are used.
The bird beaking appearance can be treated by flaring the balloon mounted Atrium, similar to their flaring in other territories.

Conclusions

- TAT, although rare do occur in children
- High index of suspicion is needed
- EVT is an option even in young children
- “Normal” S.E. nitinol S.G. need large sheaths and can not undergo future dilatation
- Atrium and other covered stents (like Bentley) are good alternatives with possible future size adjustments.

Extra fixation and flaring issues need to be considered.

Thank You