IX Congresso
Novas Fronteiras em Medicina Cardiovascular
22 a 24 de Fevereiro 2019
The Village Praia D'El Rey - Óbidos

Our experience in the management of traumatic aortic rupture.

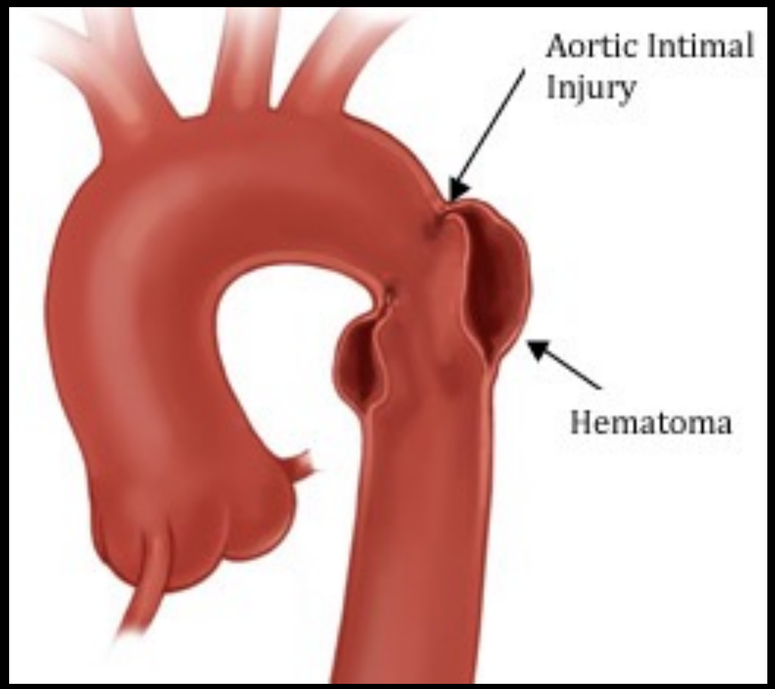
Ruy Fernandes e Fernandes MD, FEBVS

Academic Department of Vascular Surgery, Hospital de Santa Maria – CHLN, Faculty of Medicine, University of Lisbon, Lisbon Academic Medical Centre
Lisbon Cardiovascular Institute

CENTRO ACADÉMICO DE MEDICINA DE LISBOA

Blunt trauma of the aorta

- Occur in less than 1% of car accidents, 8000 cases/yr in the USA.
- 2nd cause of death in car accidents (1st cause: head trauma)
- In 85% to 90% located in the aortic isthmus.



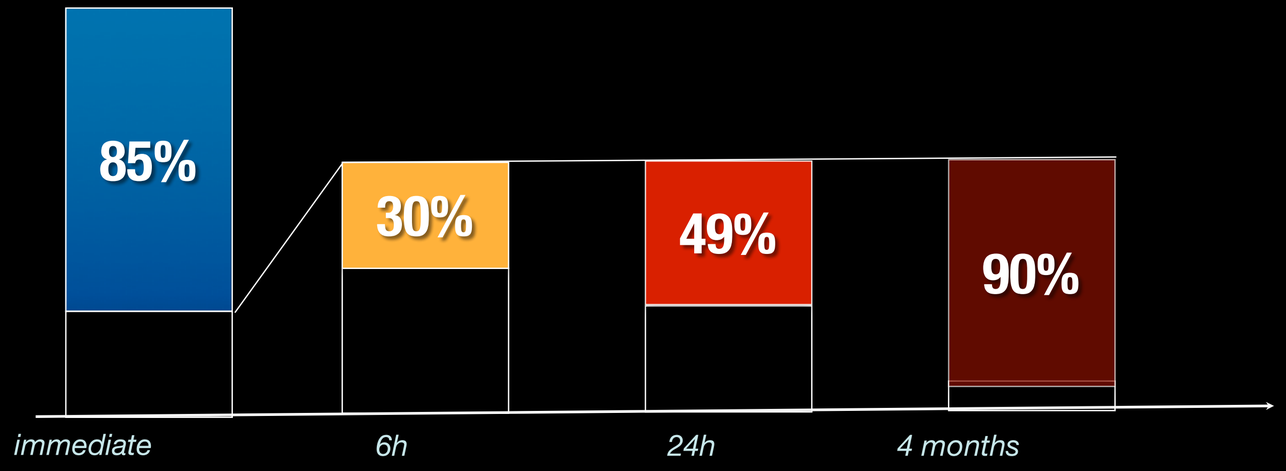
- ***Trauma mechanisms:***
  - **Motor vehicles accidents.**
  - *Height falls.*
  - *Explosions.*
  - *Ski accidents*
  - *Horse riding accidents*
  - *...*

Blunt trauma of the aorta

Parmley study

- 1957: revision of 296 postmortem exams of cases of death by blunt aortic injury.

Mortality and time:



Intimal hemorrhage.

Intimal laceration with hemorrhage.

Medial laceration.

False aneurysm

Complete laceration of the aortic wall.

Mediastinic hematoma.

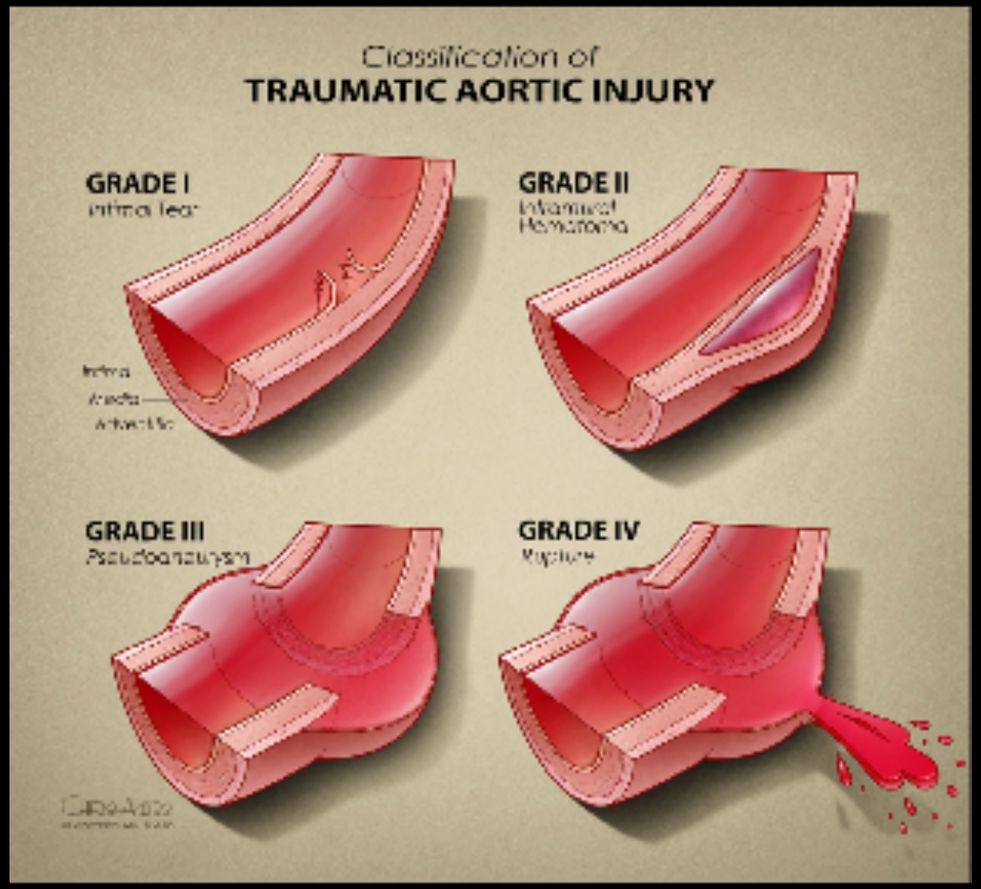
Free rupture.

Immediate surgery

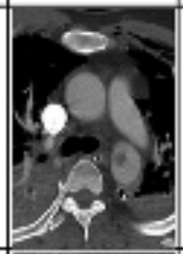
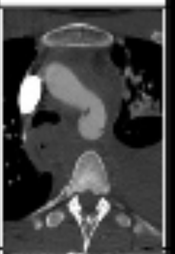
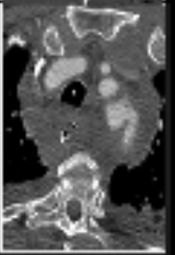
LOREN F PARMLEY LC, THOMAS W MATTINGLY BG, MANION WC, EDWARD J JAHNKE JM. Nonpenetrating Traumatic Injury of the Aorta. Circulation. Lippincott Williams & Wilkins; 1958 Jun 1;17(6):1086–101.

Blunt trauma of the aorta

Classification



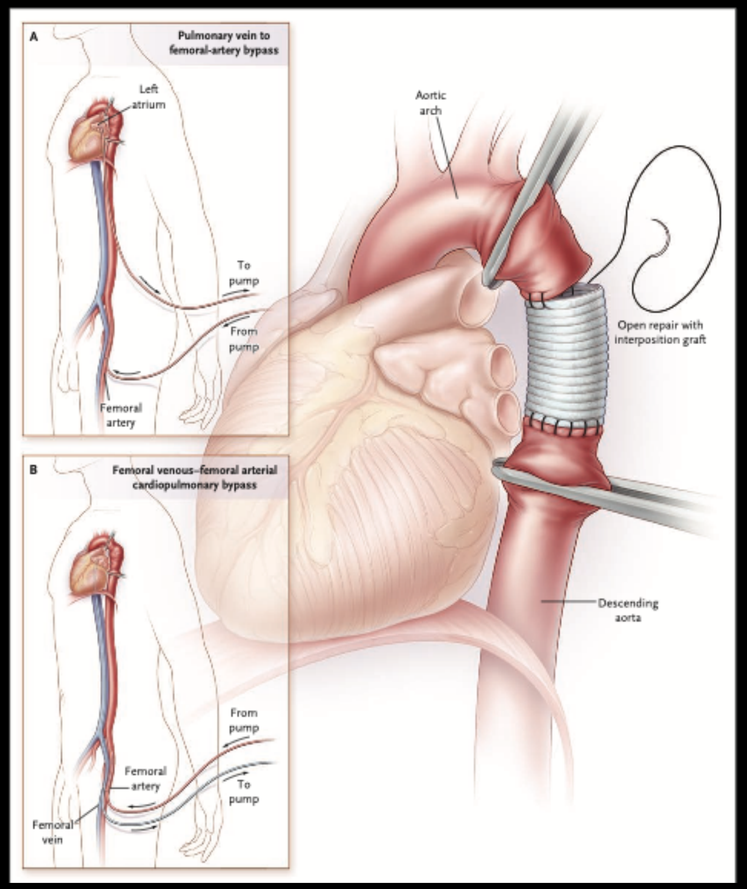
Azizzadeh A, Charlton-Ouw KM, Chen Z, Rahbar MH, Estrera AL, Amer H, et al. An outcome analysis of endovascular versus open repair of blunt traumatic aortic injuries. J Vasc Surg. 2013 Jan;57(1):108–14–discussion115.

Absent External Contour Abnormality			Present External Contour Abnormality		
Type of Aortic Injury	*Definition*	*Example*	*Type of Aortic Injury*	*Definition*	*Example*
Intimal Tear	No aortic external contour abnormality: tear and/or associated thrombus is < 10mm		Pseudoaneurysm	Aortic external contour abnormality: contained	
Large Intimal Flap	No aortic external contour abnormality: tear and/or associated thrombus is >10mm		Rupture	Aortic external contour abnormality: not contained, free rupture	

Starnes BW, Lundgren RS, Gunn M, Quade S, Hatsukami TS, Tran NT, et al. A new classification scheme for treating blunt aortic injury. J Vasc Surg. Elsevier Inc; 2012 Jan 1;55(1):47–54.

Therapeutic options

Convencional Surgery



Endovascular Surgery

Medical Therapy

Therapeutic options

Table 1. Comparison of Operative Approaches to Blunt Aortic Injury.

Variable	Relative Degree of Risk*		
	Clamp and Sew	Shunt–Bypass	Endovascular Repair
Complication			
Operative stress	High	Medium	Low
Blood loss	Medium	Medium	Low
Operative time	Medium	High	Low
Paraplegia	High	Medium	Low
Clinical scenario			
Patient with high surgical risk	High	Medium	Low
Patient with severe lung injury	High	Medium	Low
Patient with severe head injury	High	High	Low
Patient with challenging anatomy	Medium	Low	High

* Relative degree of risk refers to a general comparison among the three operative procedures.

Therapeutic options

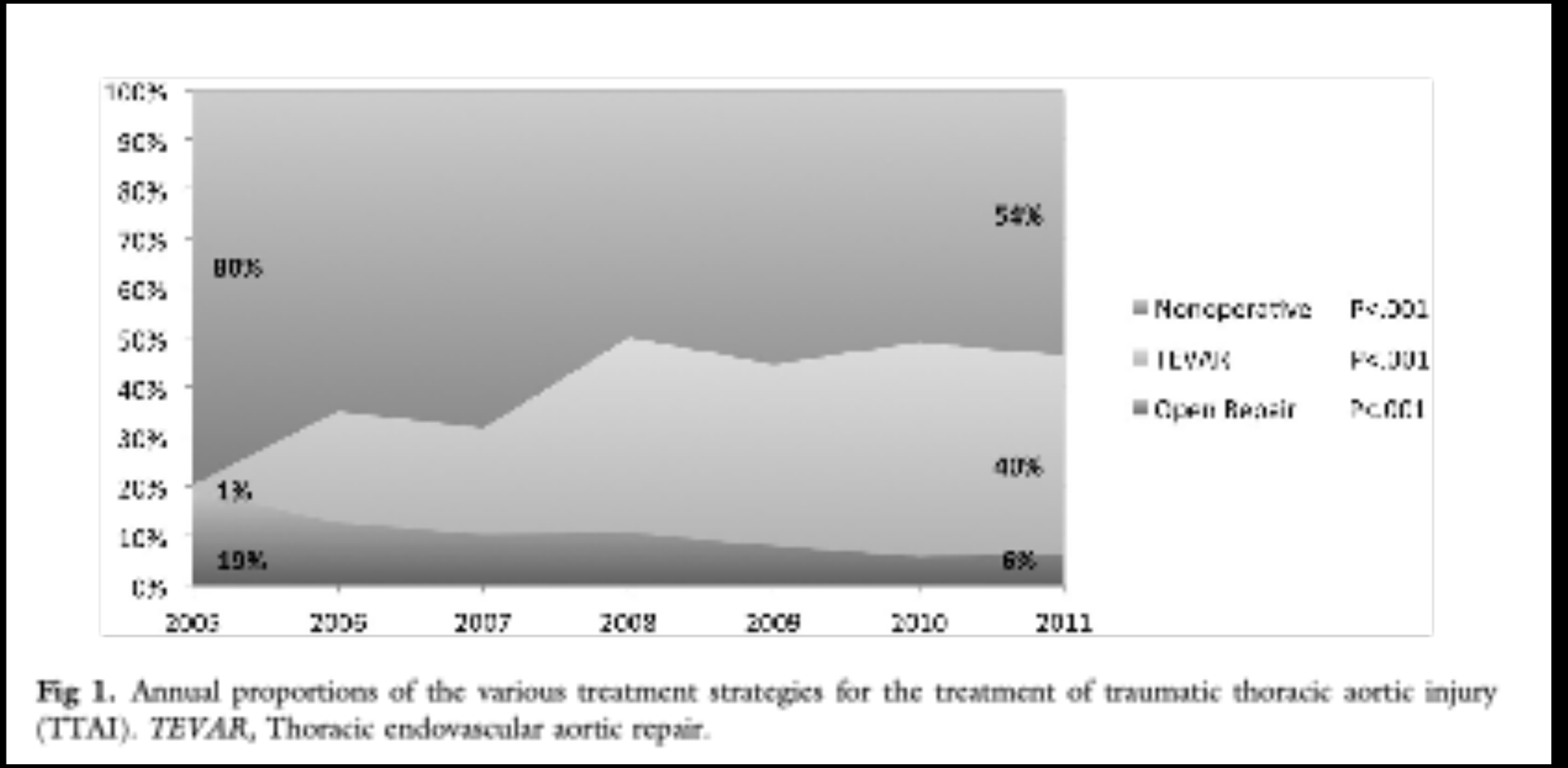


Fig 1. Annual proportions of the various treatment strategies for the treatment of traumatic thoracic aortic injury (TTAI). *TEVAR*, Thoracic endovascular aortic repair.

BS KHJU, MD PAS, MD VC, MD RPB, MPH SLZM, PhD HJMVM, et al. National trends in utilization and outcome of thoracic endovascular aortic repair for traumatic thoracic aortic injuries. J Vasc Surg. Society for Vascular Surgery; 2016 Jan 5;:1–9.

Therapeutic options

Table III. Postoperative outcomes

Outcome	Procedure			P value	
	TEVAR (n = 2492)	*Open repair (n = 848)*	*Nonoperative (n = 5044)*	*Overall*	*TEVAR vs open repair*
Death, %	7.8	12.7	24.2	<.001	<.001
Death surgery on day 1, %	8.5	13.4	—	—	.003
Complication, %					
Cardiac	4.1	8.5	13.0	<.001	<.001
Paraplegia[a]	0.8	0.5	0.6	.428	.480
Stroke	0.6	0.6	0.5	.711	.867
Acute renal failure	9.7	10.0	10.5	.584	.791
Respiratory	47.5	54.8	38.3	<.001	<.001
Wound dehiscence	1.2	1.2	0.9	.357	.974
Postoperative infection	1.8	2.8	1.8	.117	.070
Length of stay, mean (SD), days	18.4 (18.6)	20.2 (18.1)	14.8 (18.8)	<.001	.012
Discharge to home, %	64.0	65.8	68.5	<.001	.336
Total hospital charges, $	279,828	238,392	182,403	<.001	<.001

SD, Standard deviation; *TEVAR*, thoracic endovascular aortic repair.
[a]Excluding patients admitted with spinal involved vertebral fractures.

BS KHJU, MD PAS, MD VC, MD RPB, MPH SLZM, PhD HJMVM, et al. National trends in utilization and outcome of thoracic endovascular aortic repair for traumatic thoracic aortic injuries. J Vasc Surg. Society for Vascular Surgery; 2016 Jan 5;:1–9.

Guidelines SVS

Table II. Summary of guidelines for thoracic endovascular aortic repair (*TEVAR*) in traumatic thoracic aortic injuries

Guideline	*Consensus*	*Grade of recommendation 1—strong 2—weak*	*Quality of evidence A—high B—moderate C—low or very low*
Choice of treatment	We suggest that endovascular repair be performed preferentially over open surgical repair or nonoperative management.	2	C
Timing of repair	We suggest urgent (<24 hours) repair, and at the latest prior to hospital discharge.	2	C
Management of minimal aortic injury	We suggest expectant management with serial imaging for type I injuries.	2	C
Type of repair in the young patient	We suggest endovascular repair regardless of age if anatomically suitable.	2	C
Management of left subclavian artery	We suggest selective revascularization of the left subclavian artery.	2	C
Systemic heparinization	We suggest routine heparinization but at a lower dose than in elective TEVAR.	2	C
Spinal drainage	We do not suggest routine spinal drainage.	2	C
Choice of anesthesia	We suggest general anesthesia.	2	C
Femoral access technique	We suggest open femoral exposure.	2	C

Blunt trauma of the aorta

HSM recent experience

2009-2019

15 cases

Age: 36.0 yrs (17-52)

14♂ 1♀

AIS Score	Injury
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Unsurvivable

Injury Severity Score (ISS)

New Injury Severity Score (ISS)

SAPS-II

Patients

	Sex	Age	Location	Grade	Cause	Other Traumatic Lesions (AIS)						Scores		
						head	*neck*	*thorax*	*abdomen*	*column*	*limbs*	*ISS*	*NISS*	*SAPS II*
1	♂	21	**Isthmus**	III	Car accident	1	-	5	4	2	2	54	66	14
2	♂	21	**Isthmus**	III	Car accident	5	-	5	2	-	2	31	66	ND
3	♂	41	**Isthmus**	II	Car accident	-	-	4	-		2	24	25	21
4	♂	49	**Isthmus**	I	Fall/hanging	5	-	3	-	4	2	50	50	35
5	♂	48	**Isthmus**	III	Car accident	-	-	5	5	3	4	66	66	60
6	♂	41	**Isthmus**	III	Motorcycle acc.	-	-	5	-	-	4	42	45	15
7	♂	50	**Isthmus**	III	Motorcycle acc.	3	5	4	-	-	-	59	59	31
8	♂	20	**Isthmus**	III	Motorcycle acc.	1	-	4	2	1	3	35	35	19
9	♀	52	**Isthmus**	III	pedestrian crash	5	-	5	5	-	4	75	75	70
10	♂	50	**Isthmus**	III	pedestrian crash	-	-	5	4	-	4	66	66	39
11	♂	**17**	**Isthmus**	I	Fall	4	-	4	2	-	3	41	41	22
12	♂	**39**	**Isthmus**	III	Fall	-	-	5	4	-	5	66	66	39
13	♂	**17**	**Isthmus**	III	pedestrian crash	3	-	5	5	-	3	54	54	ND
14	♂	**26**	**Isthmus**	III	Motorcycle acc.	-	-	5	4	-	4	66	66	ND

Procedures

	Sex	Age	Endovascular procedure	[ ] Trauma-Interv.(h)	Timing	Other Interventions			
						Neurocir.	*Thoracic*	*Abdominal*	*Orthopedics*
1	♂	**21**	**TEVAR**	**36**	deferred	-	-	+	+
2	♂	**21**	**TEVAR**	**5**	immediate	+	-	-	+
3	♂	**43**	**TEVAR**	**10**	immediate	-	-	-	+
4	♂	**49**	**TEVAR**	**17**	immediate	-	-	-	+
5	♂	**48**	**TEVAR**	**7**	immediate	-	-	+	+
6	♂	**41**	**TEVAR**	**12**	immediate	-	-	-	+
7	♂	**50**	**TEVAR (LSA coverage)**	**19**	immediate	-	-	-	-
8	♂	**20**	**TEVAR (LSA coverage)**	**22**	immediate	-	-	-	+
9	♀	**52**	**TEVAR**	**5**	immediate	-	-	+	+
10	♂	**50**	**TEVAR (LSA coverage)**	**5**	immediate	-	-	+	+
11	♂	**17**	**TEVAR (LSA coverage)**	**10**	immediate	+	-	-	+
12	♂	**39**	**TEVAR**	**6**	immediate	-	+	-	+
13	♂	**17**	**TEVAR**	**30**	immediate	-	-	-	+
14	♂	**26**	**TEVAR (LSA coverage)**	**4**	immediate	-	-	-	+
15	♂	**43**	**TEVAR (LSA coverage)**	**24**	immediate	+	-	-	-

Procedures

- Characteristics of stentgrafts:
  - *Mean diameter - 27mm (22-36)*
  - *Mean length - 106.7cm (80-155)*
  - *Mean oversize - 31.6%*

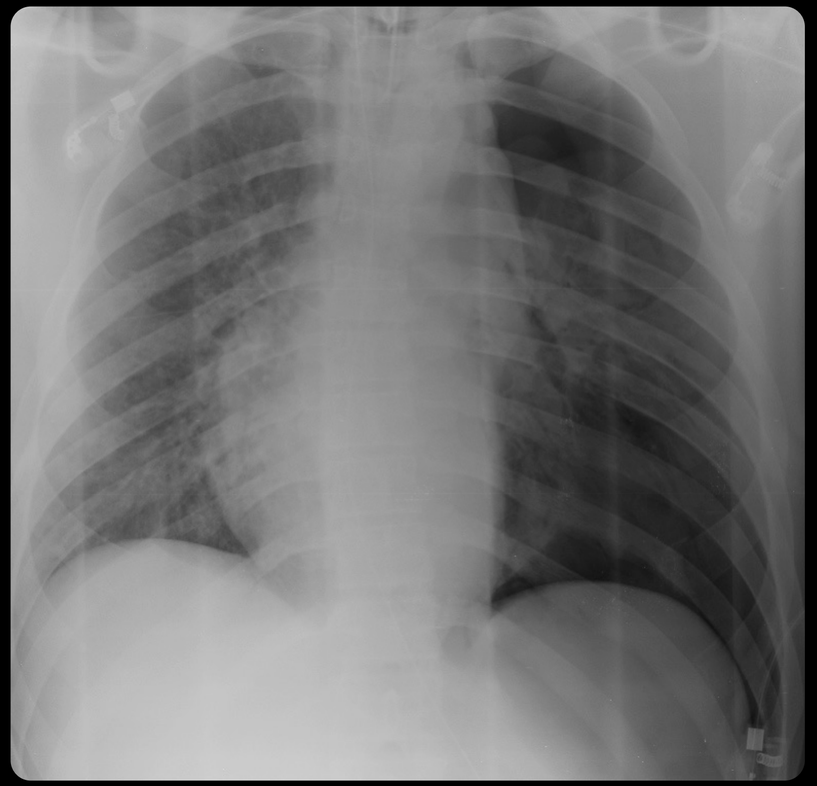
Stentgrafts	*N*
Cook Zenith TX2	6
Cook Zenith Alpha	7
Medtronic Valiant	2

D.F.I., ♂, 21 yrs

4th August 2009

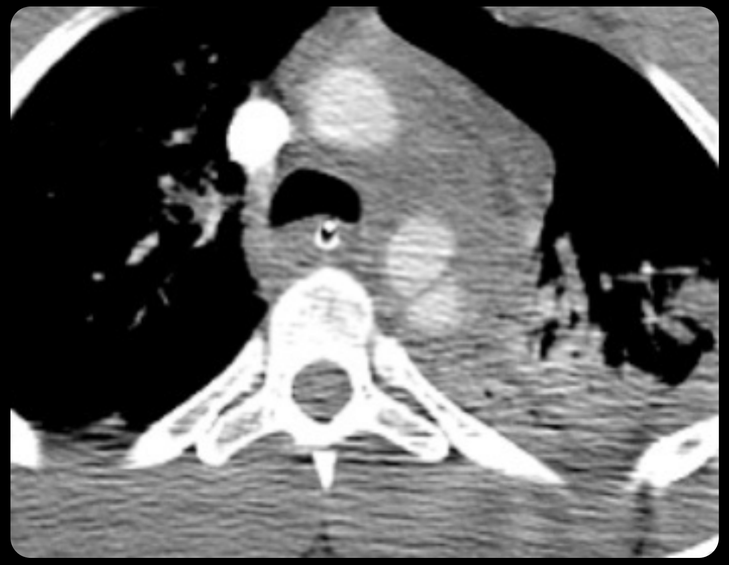
Car crash - head-on impact, no seat belt, @ 80 km/h.

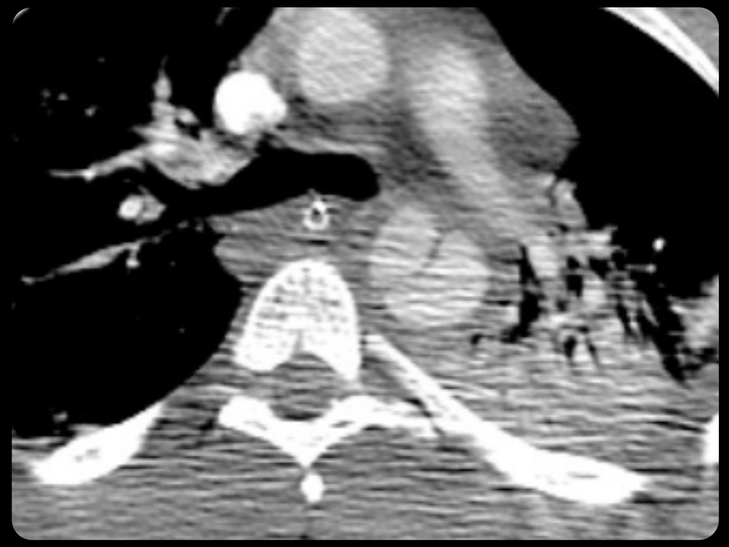
- **Traumatic contained rupture of the aortic isthmus.**
- 4-8th left ribs fractures.
- Left hypertensive pneumothorax.
- Bilateral pulmonary contusion.
- Hemoperitoneum.
  - *Spleen fracture*
  - *Laceration of liver (segment IV)*

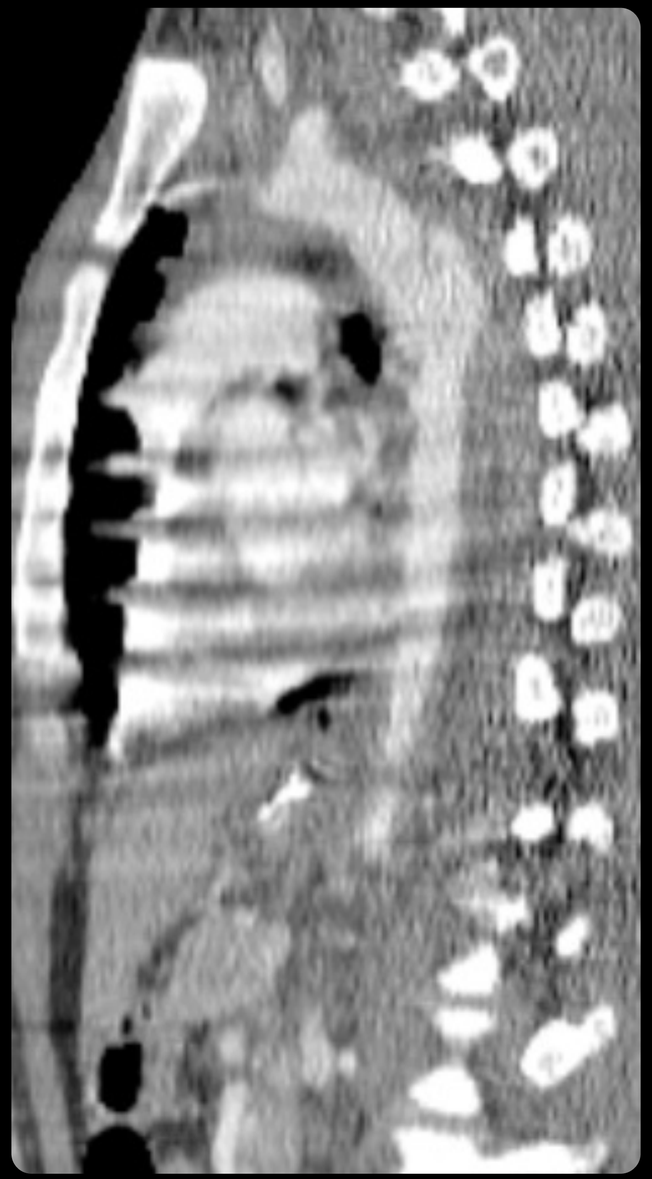


AngioCT

4.8.2009







D.F.I., ♂, 21 yrs

Immediate laparotomy

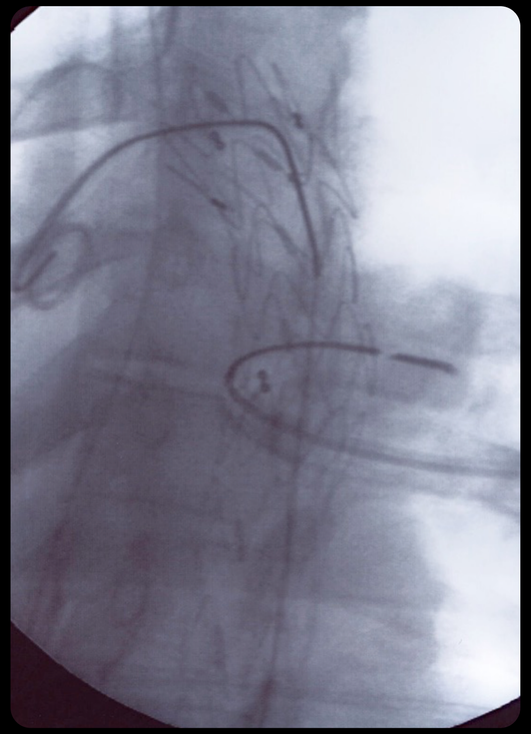
- Splenectomy.
- Hepatic packing.

Intensive Care Unit

- Mechanical ventilation.
- Permissive hypotension.

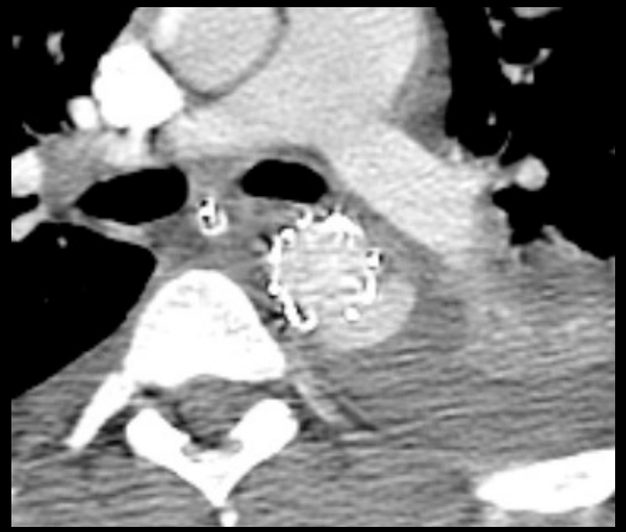
12h later - **TEVAR**

- Deployment of a Vailant (Medtronic®) 22 mm x 150 mm stentgraft distal to the L subclavian artery.



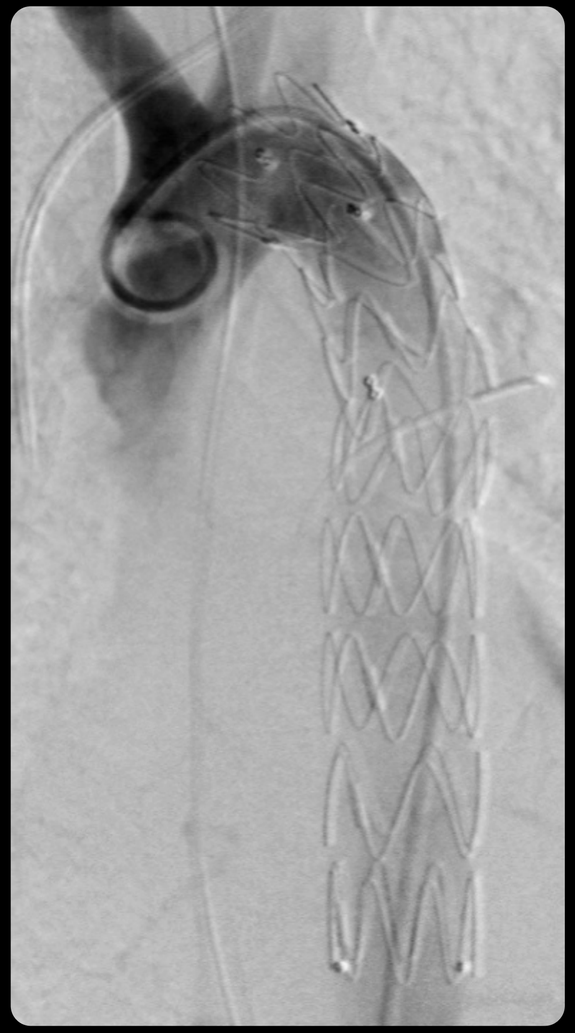
angioCT

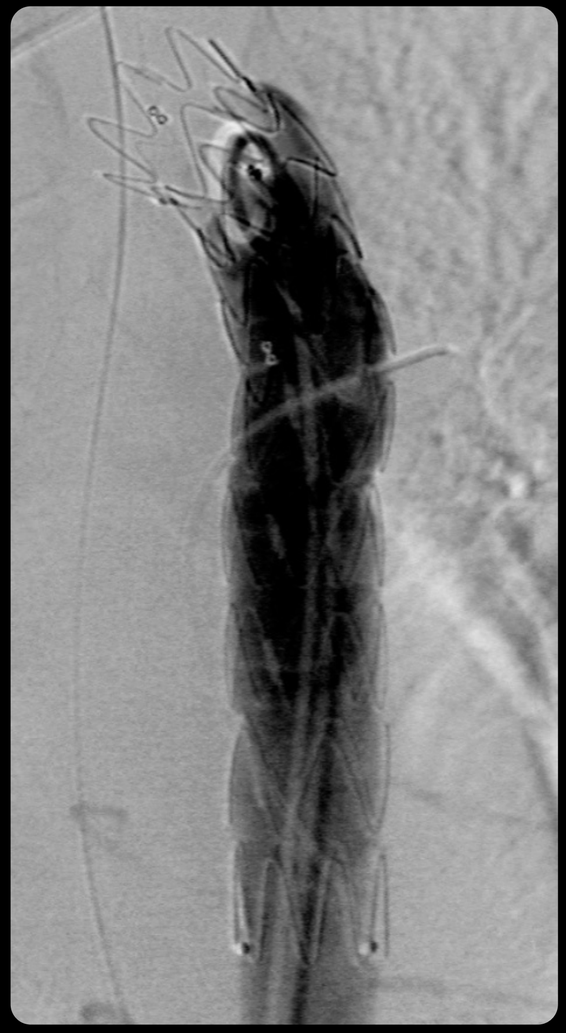
6.8.2009



Arteriography

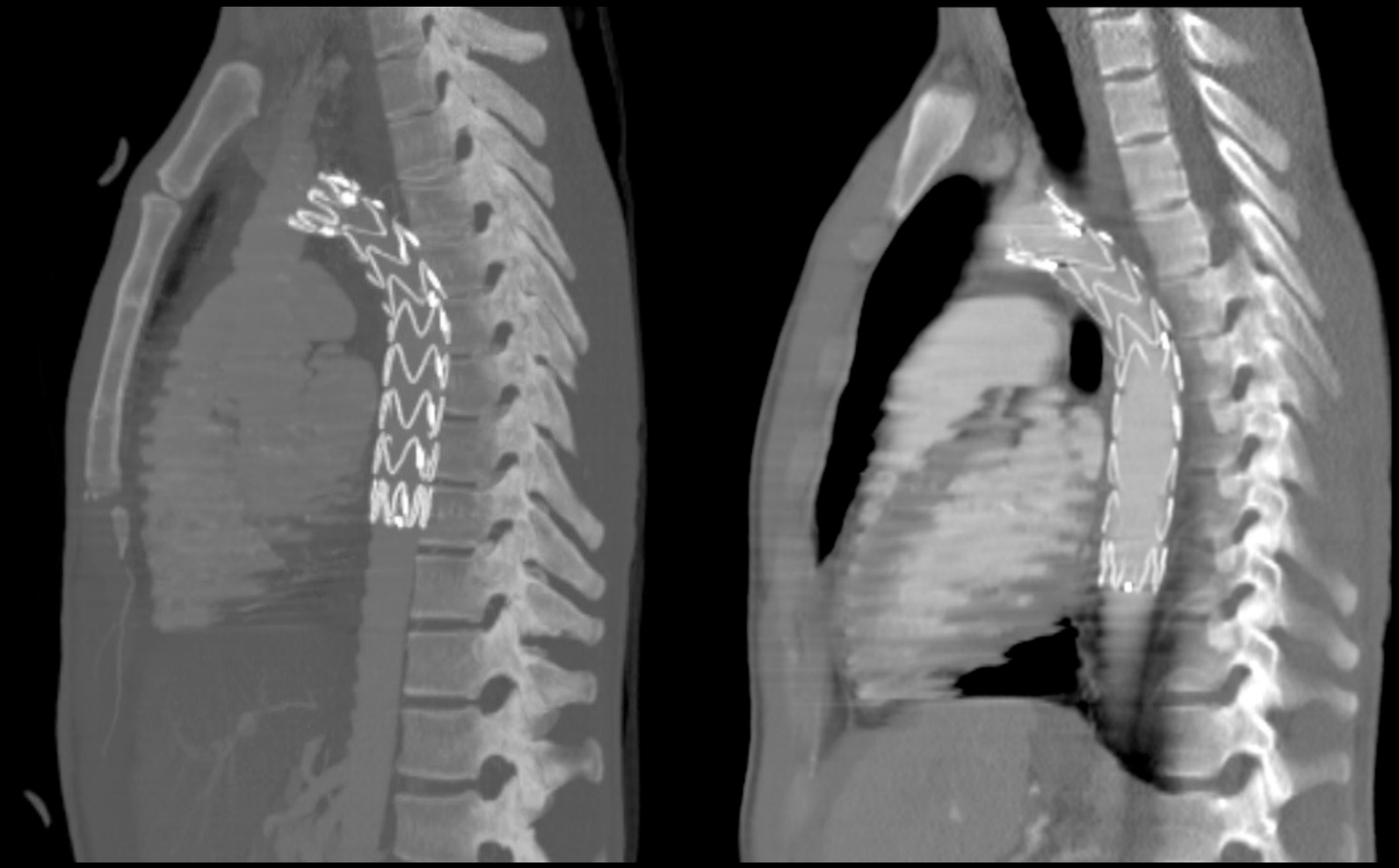
7.8.2009





Control AngioCT

1 mês



Control AngioCT

1 year

7 years

Results

	N (%)
Mortality	**1 (6.6)**
Paraplegia	**0**
Left arm ischemia	**0**
ICU stay *(media)*	**9**
Hospital stay *(media)*	**15**
Medical complications	
MOF	1 (6.6)
Pulmonary	6 (40.0)
Cardiac	2 (13.2)
Persistent shock	4 (26.7)
Renal	4 (26.7)
Neurologic	5 (33.3)
Re-intervention (Vascular)	**-**

Results

Follow-up

20 months (1-76)

12 patients (lost @ 1m, 1m, 13m)

	N (%)
Mortality	**0**
Paraplegia	**1 (8.3)***
TEVAR	
Endoleaks	0
Bird-beak	0
Stentgraft collapse	0

**- sequela de TVM*

Conclusions

- Blunt aortic trauma occurs in major politrauma patients with several potential life-threatening lesions that mandate a priority-based approach.
- Endovascular procedures provide a clear benefit in early mortality and morbidity in the treatment of aortic trauma.
- In our experience, immediate treatment of the aortic lesion didn’t have a negative impact on the patient outcome.
- Long-term results of TEVAR are still unknown and must confirm durability of devices and need for re-intervention.