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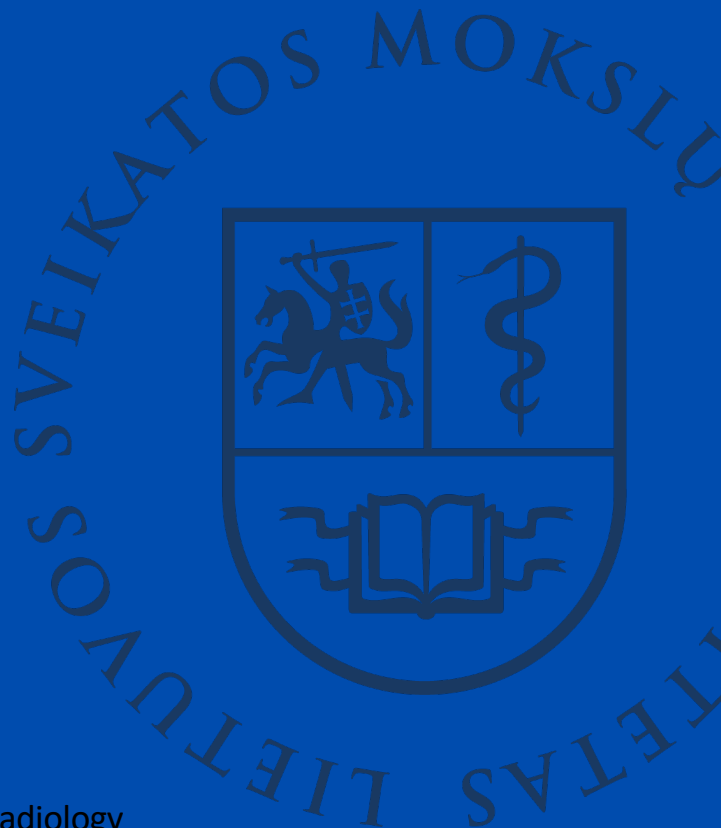


Aortic trauma

MD, PhD Lina Padervinskienė

Lithuanian University of Health Sciences

The Hospital of LUHS Kauno Klinikos



The 12th Nordic Course in Trauma Radiology

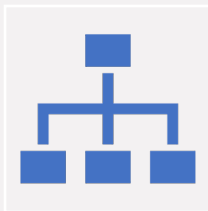
12/06/2024

Stocholm



I have nothing to declare.

Plan



Classification



Radiological
evaluation



Cases

Classification – based on trauma mechanism

Blunt

- High energy trauma



Penetrating

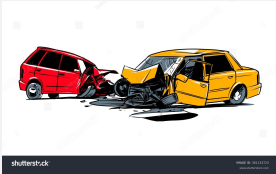
- Direct stab or cut



Classification – based on trauma mechanism

Blunt

- High energy trauma



Penetrating

- Direct stab or cut



Iatrogenic aorta injury

- During transcatheter interventions
- Vertebral transpedicular bone grafting

Foreign body in the oesophagus/trachea



Overview

Rare but lethal

Overall incidence - <1%

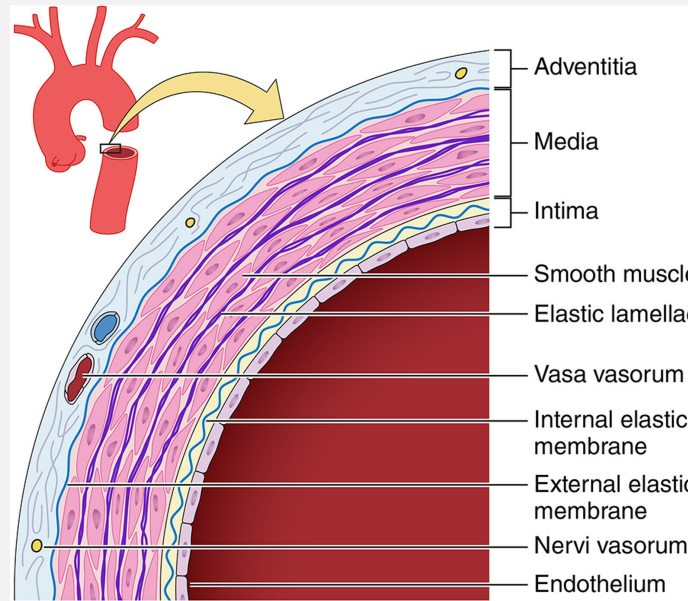
80–90% immediately fatal

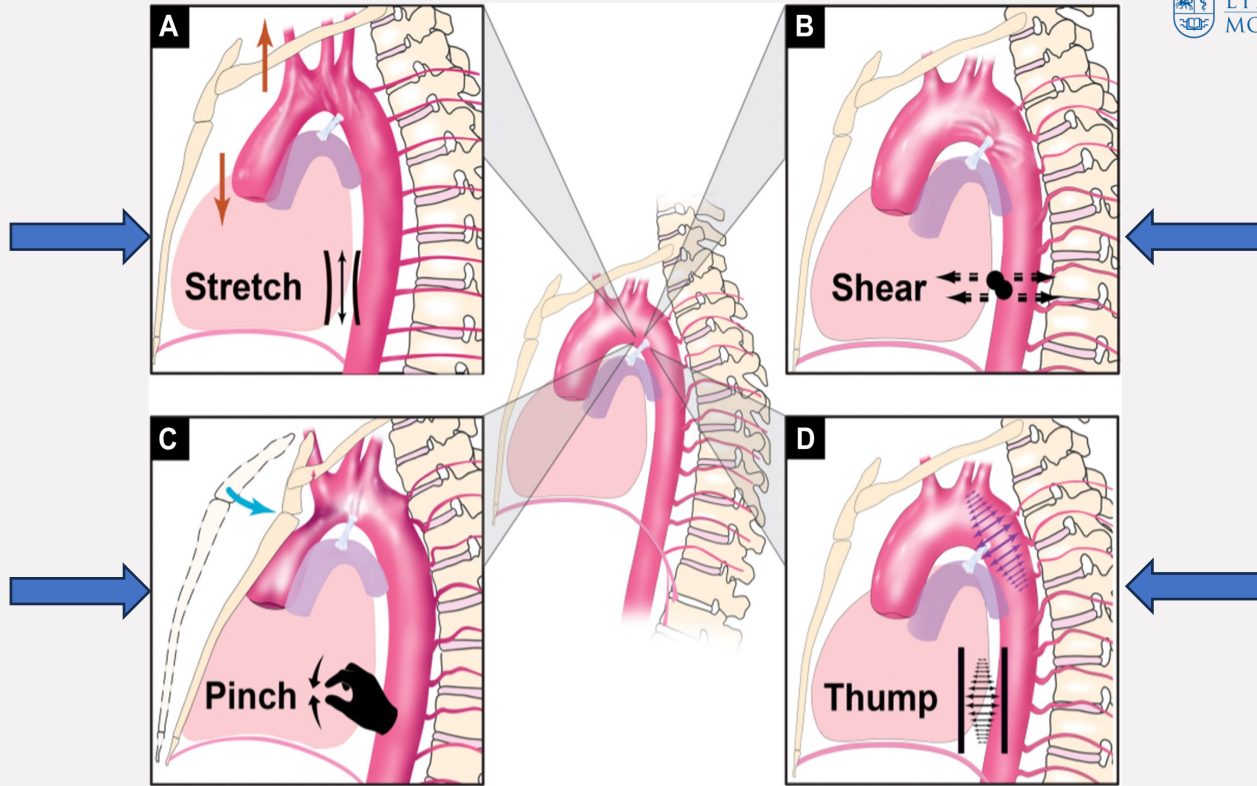
The second leading cause of death in blunt trauma

Mortality rate who were treated in the emergency department ~19%.

Often present with multiple associated injuries



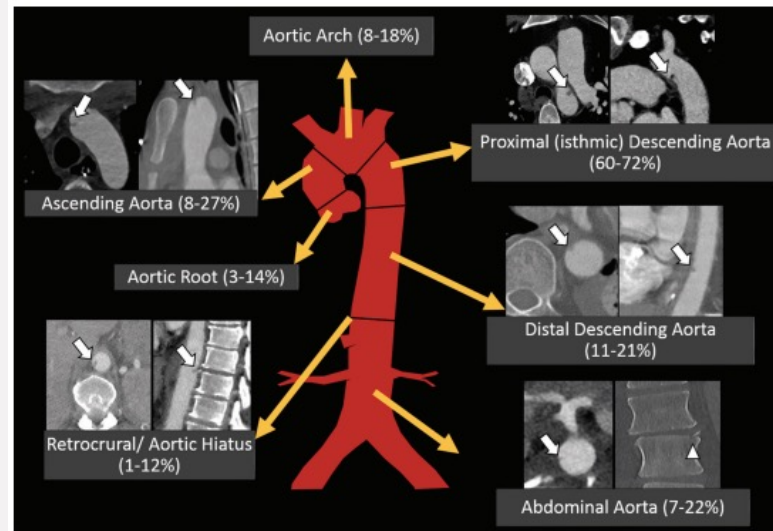




Classification – based on location

Thoracic

- More common (95%)



Abdomen

- Uncommon (5%)



AAST Injury Scoring Scale

Thoracic Vascular Injury Scale

Grade*	Description of injury
I	Intercostal artery/vein
	Internal mammary artery/vein
	Bronchial artery/vein
	Esophageal artery/vein
	Hemizygous vein
	Unnamed artery/vein
II	Azygos vein
	Internal jugular vein
	Subclavian vein
III	Innominate vein
	Carotid artery
	Innominate artery
IV	Subclavian artery
	Thoracic aorta, descending
	Inferior vena cava (intrathoracic)
	Pulmonary artery, primary intraparenchymal branch
V	Pulmonary vein, primary intraparenchymal branch
	Thoracic aorta, ascending and arch
	Superior vena cava
	Pulmonary artery, main trunk
VI	Pulmonary vein, main trunk
	Uncontained total transection of thoracic aorta or pulmonary hilum
	hilum

Abdominal vascular injury scale

Grade*	Description of injury
I	Non-named superior mesenteric artery or superior mesenteric vein branches
	Non-named inferior mesenteric artery or inferior mesenteric vein branches
	Phrenic artery or vein
	Lumbar artery or vein
	Gonadal artery or vein
	Ovarian artery or vein
	Other non-named small arterial or venous structures requiring ligation
II	Right, left, or common hepatic artery
	Splenic artery or vein
	Right or left gastric arteries
	Gastroduodenal artery
	Inferior mesenteric artery, or inferior mesenteric vein, trunk
III	Primary named branches of mesenteric artery (e.g., ileocolic artery) or mesenteric vein
	Other names abdominal vessels requiring ligation or repair
	Superior mesenteric vein, trunk
	Renal artery or vein
IV	Iliac artery or vein
	Hypogastric artery or vein
	Vena cava, infrarenal
	Superior mesenteric artery, trunk
V	Celiac axis proper
	Vena cava, suprarenal and infrahepatic
	Aorta, infrarenal
	Portal vein Extraparenchymal hepatic vein
VI	Vena cava, retrohepatic or suprahepatic
	Aorta suprarenal, subdiaphragmatic

Diagnosis

- Mechanism
 - MVC
 - Fall

Clinical presentation

- Shock
- Normal hemodynamics
- Chest pain
- Asymptomatic
- Other injuries symptoms

GUIDELINES

ACC/AHA CLINICAL PRACTICE GUIDELINE

2022 ACC/AHA Guideline for the Diagnosis and Management of Aortic Disease: A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines

Developed in collaboration with and endorsed by the American Association for Thoracic Surgery, American College of Radiology, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Thoracic Surgeons, and Society for Vascular Surgery

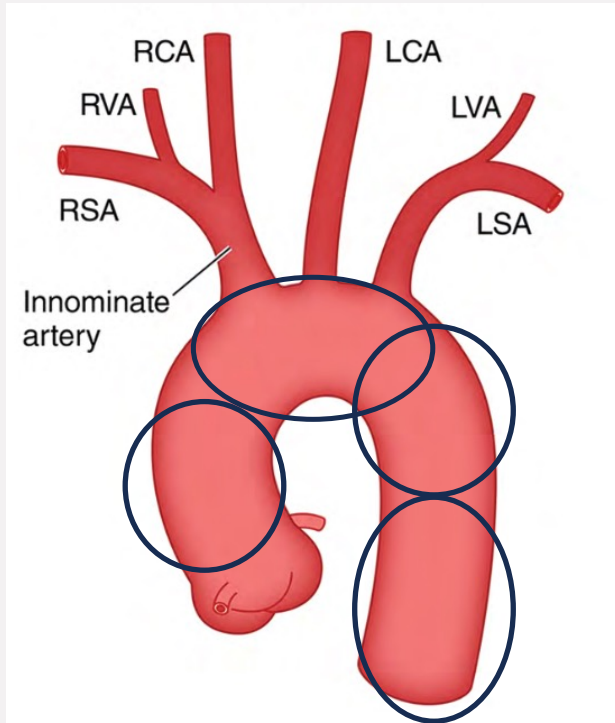
Endorsed by the Society of Interventional Radiology and Society for Vascular Medicine

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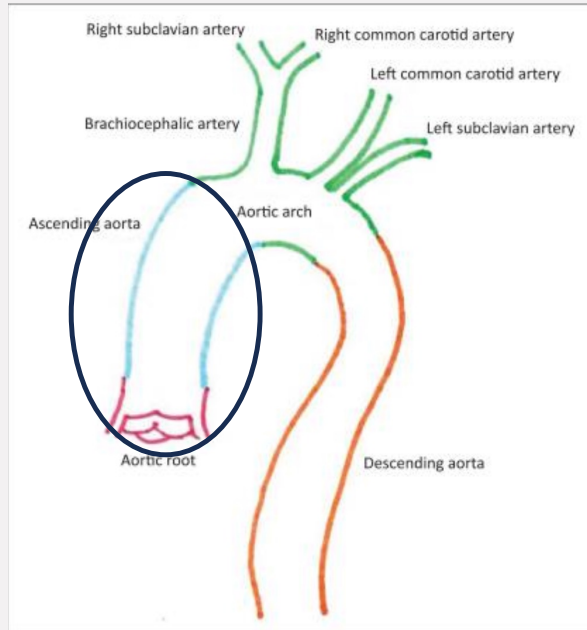
Location



- 60–90% aortic isthmus
- 8–27% proximal ascending aorta
- 8–18% - aortic arch
- 11–21% distal descending thoracic aorta

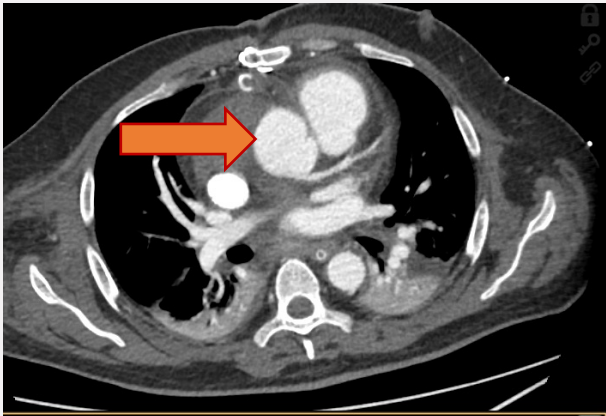
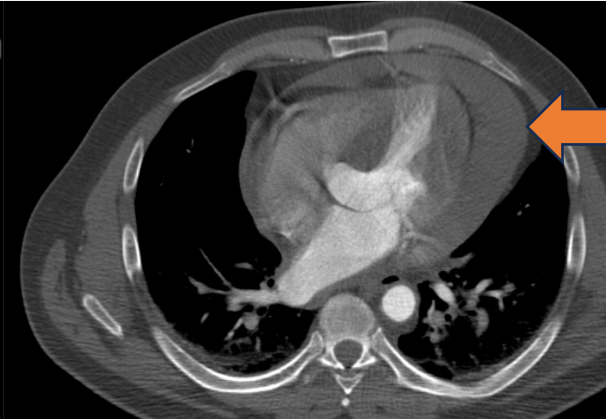
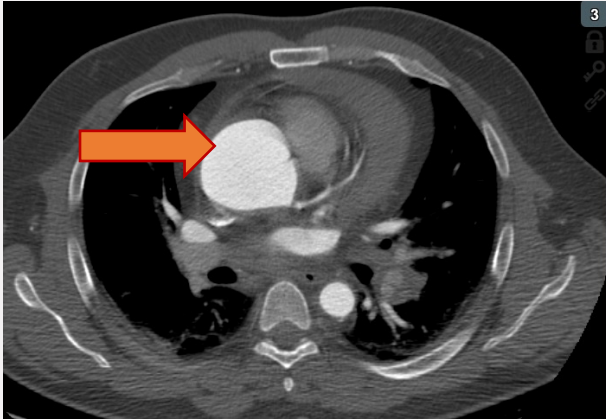


Thoracic aorta segments

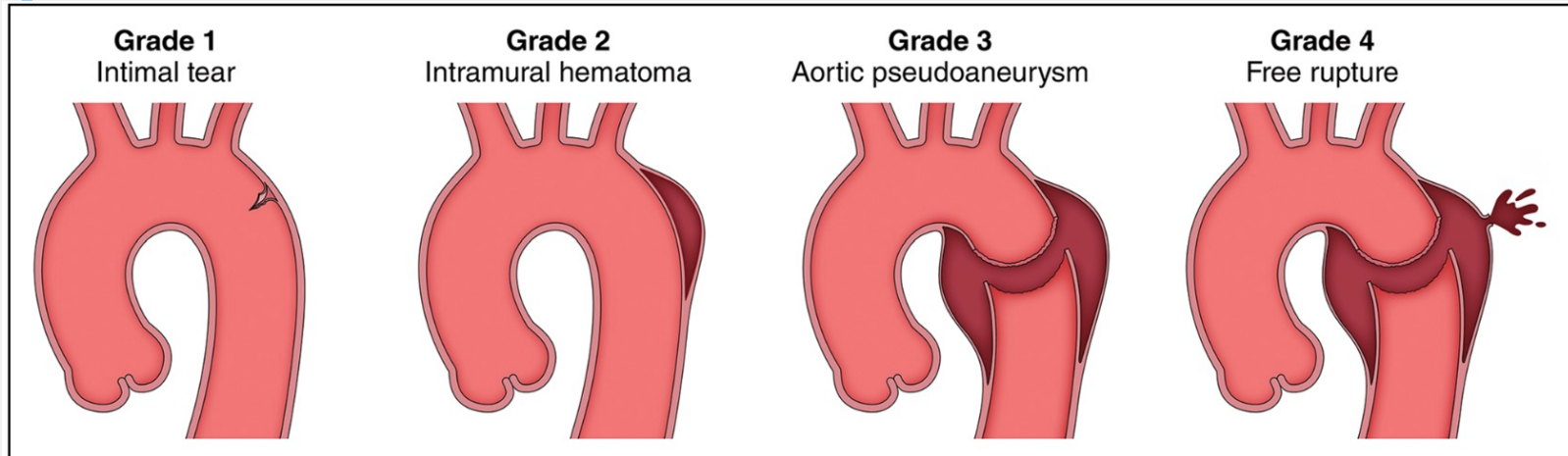


- **Parts**
 - Intrapericardial
 - Extrapericardial

Source: Adapted from Yahia AA, Bouvier A, Nedelcu C, et al. Imaging of thoracic aortic injury. *Diagn Interv Imaging*. 2015;96(1):79–88. <https://doi.org/10.1016/j.diii.2014.02.003>



Classification System for BTTAIs



Intimal tear, intimal flap, or both

Contained hemorrhage into the aortic wall without an intimal tear

Contained ruptures, aortic wall breached, and luminal blood held by a rim of the remaining wall or adventitia

All the layers of the aorta wall tear, causing blood to leak out



BTTAI High-Risk Imaging Features

Posterior mediastinal hematoma >10 mm

Mediastinal hematoma causing mass effect

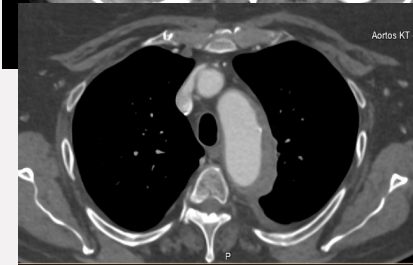
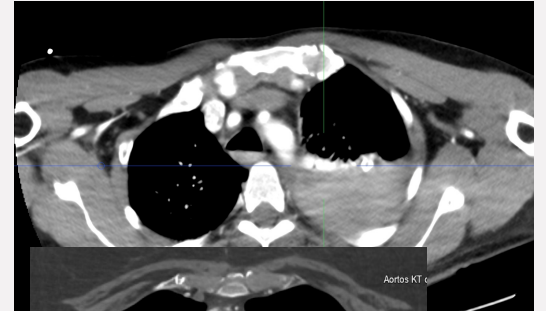
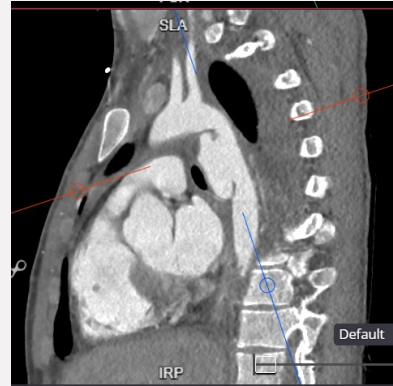
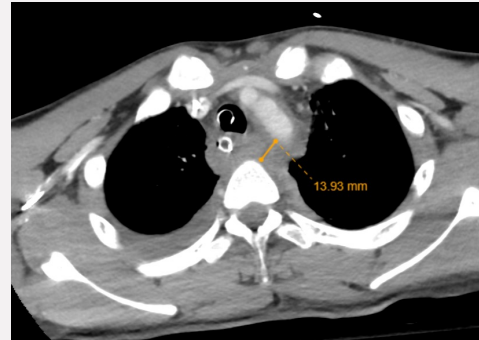
Lesion to normal aortic diameter ratio >1.4

Pseudocoarctation of the aorta

Large left hemothorax

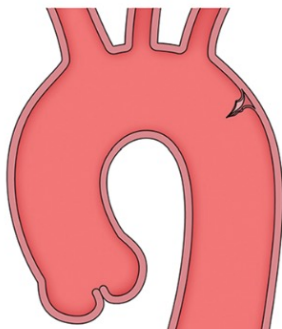
Ascending aortic, aortic arch, or great vessel involvement

Aortic arch hematoma



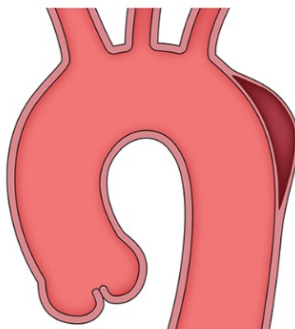
BTTAIs Classification System

Grade 1
Intimal tear



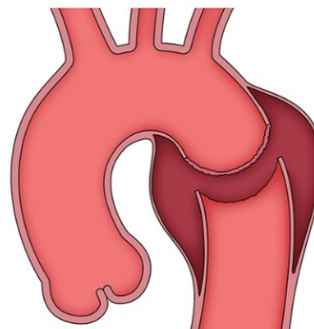
Nonoperative and follow-up imaging

Grade 2
Intramural hematoma



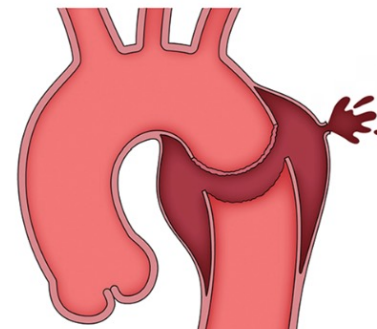
High-risk imaging features

Grade 3
Aortic pseudoaneurysm



Aortic intervention

Grade 4
Free rupture



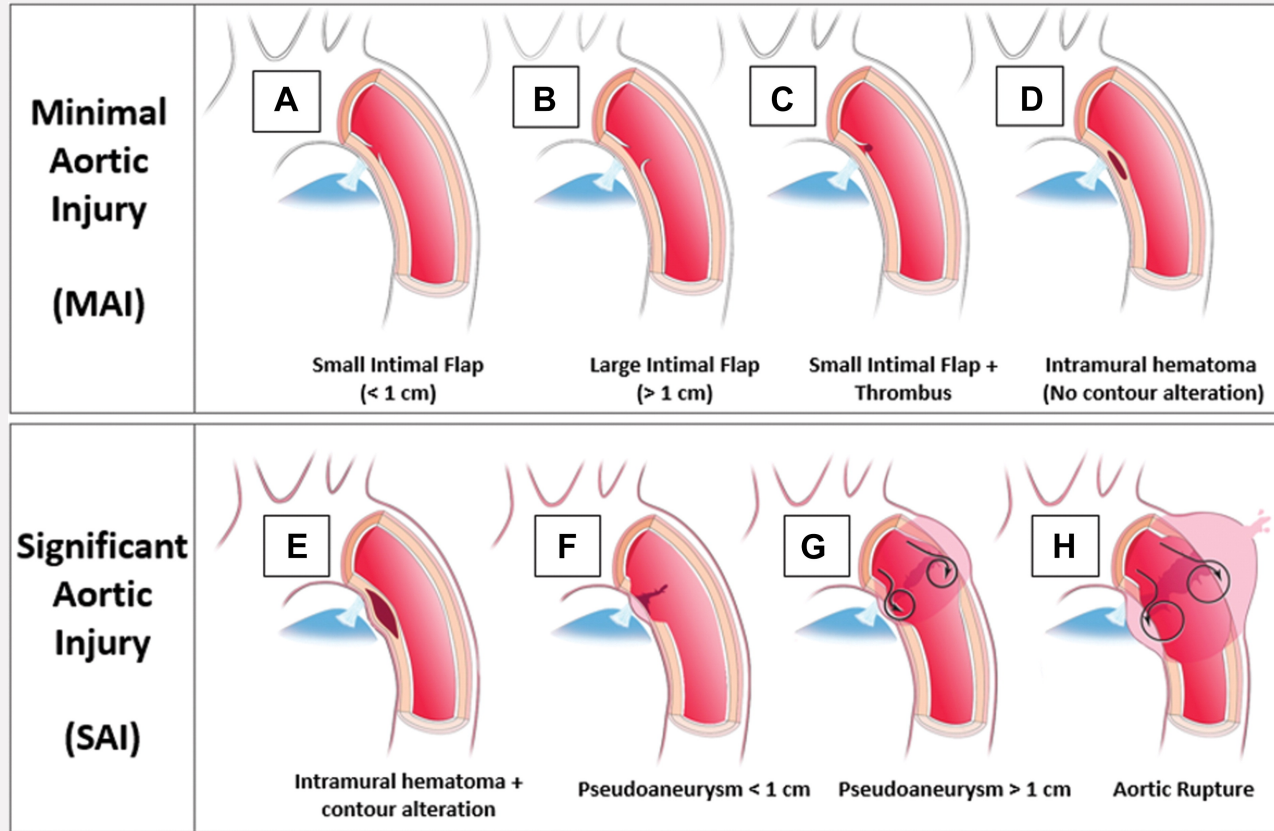
-

Nonoperative and follow-up imaging may be reasonable.

+

Aortic intervention is reasonable





NO
Contour deformation

YES
Contour deformation

Aortic injury CT signs

Direct signs:

- Intraluminal filling defect (intimal flap or clot)
- Abnormal aortic contour (mural hematoma)
 - sudden change in and/or decreased diameter
- Pseudoaneurysm
- Extravasation of contrast

Undirect signs:

- Mediastinal hematoma
- Periaortic fat stranding
- Other chest injuries

Aorta Intimal injury

- Strands of tissue or tissue flaps within the lumen
- Eccentric thrombus

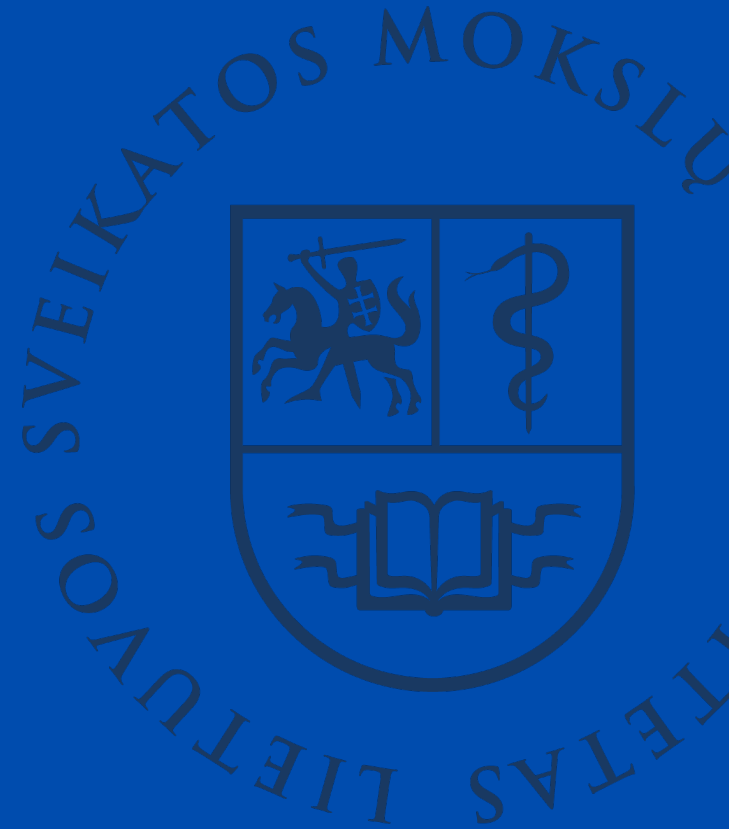




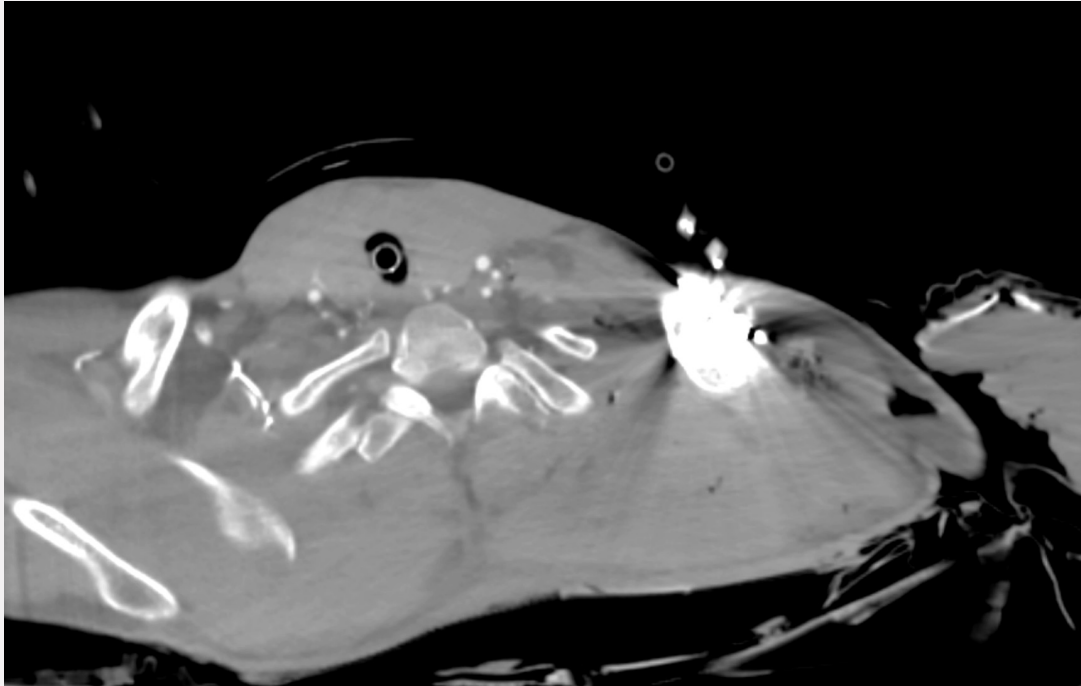
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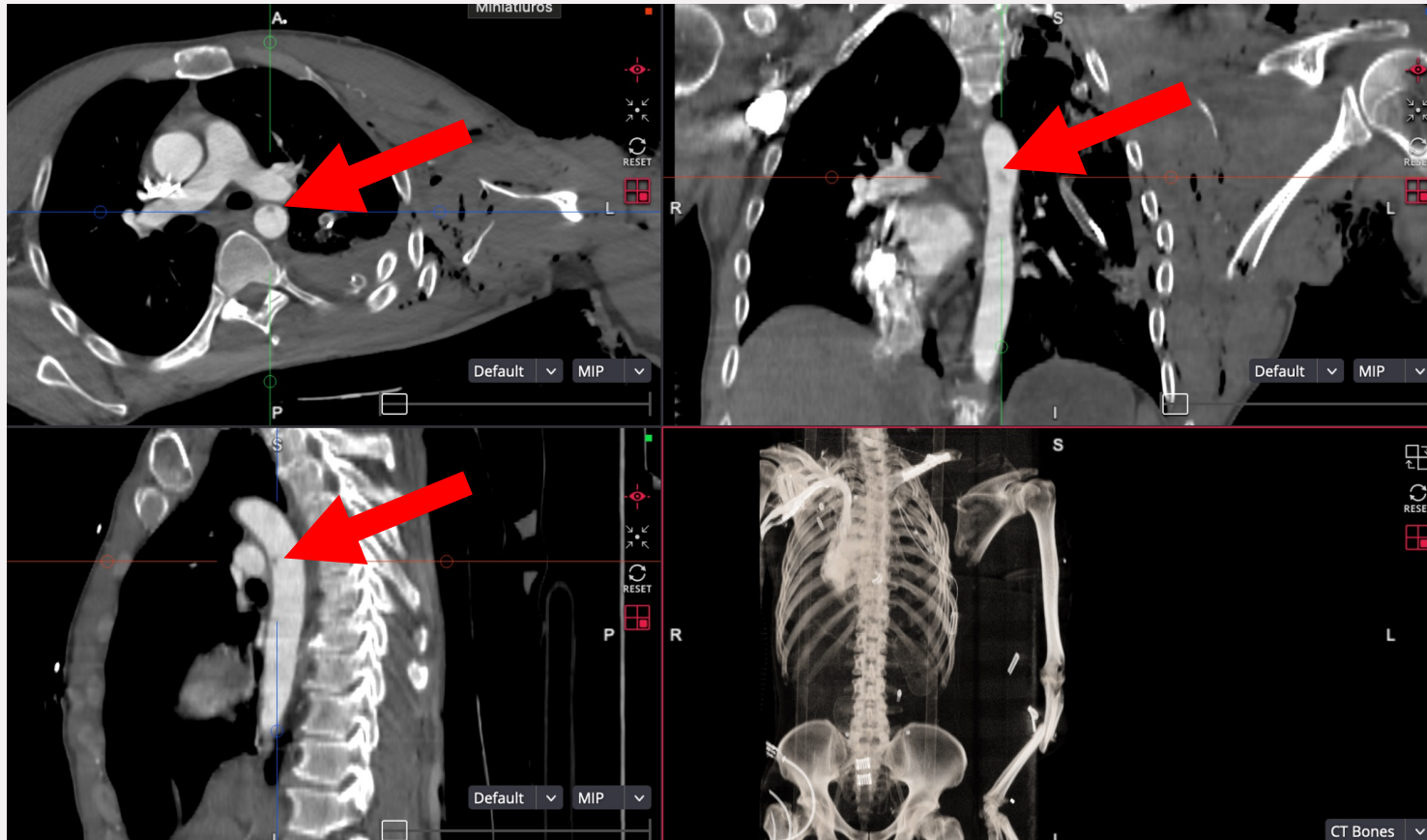
Cases



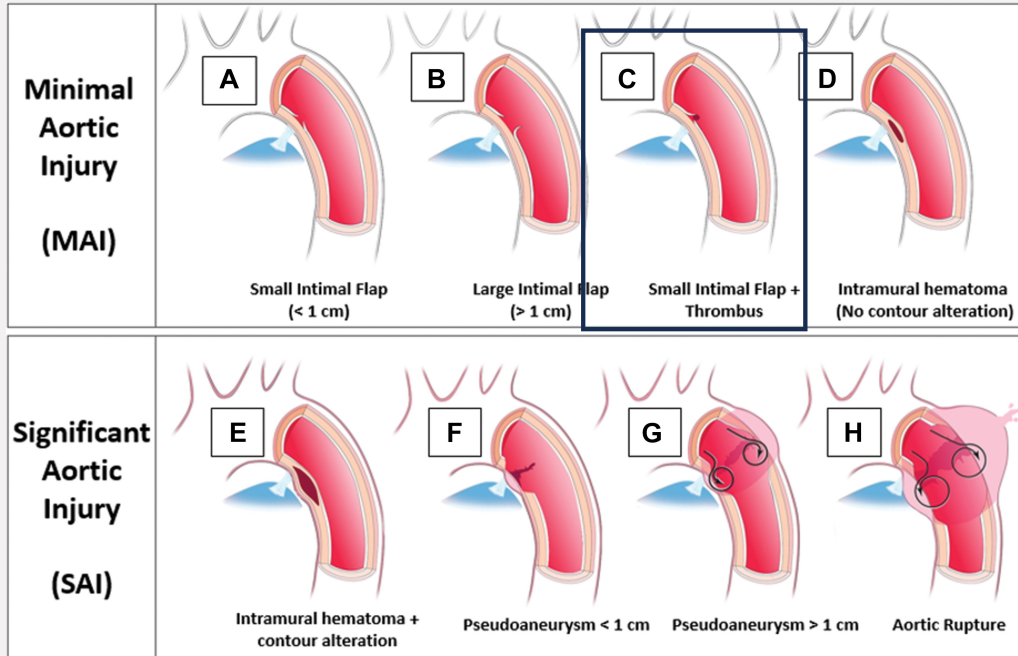
Motorcyclist/M45



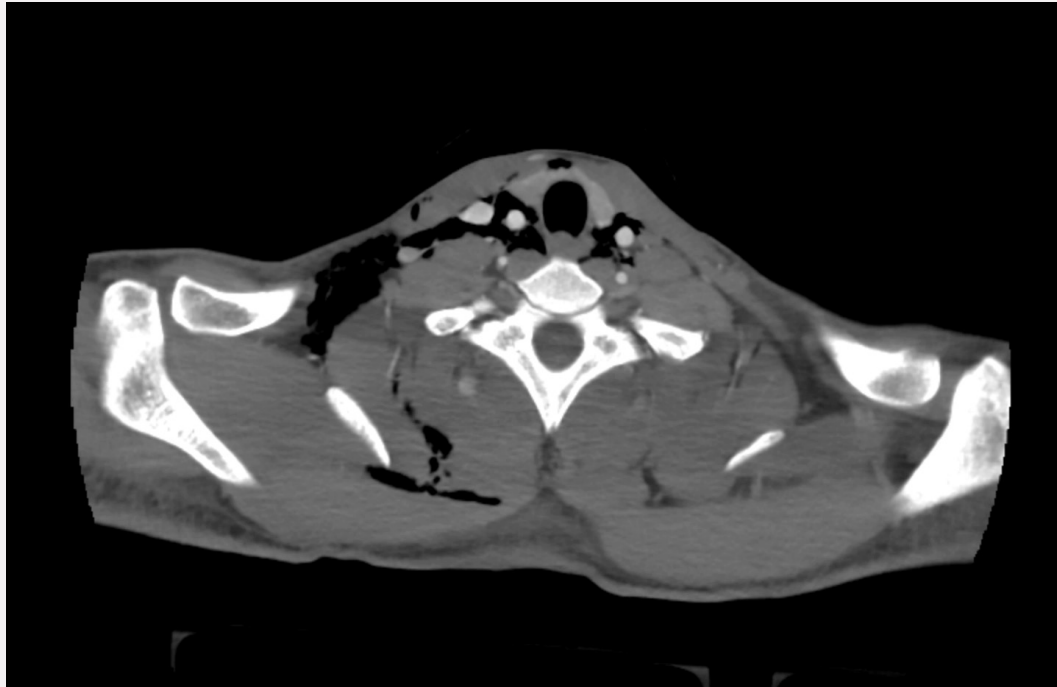
Motorcyclist/M45



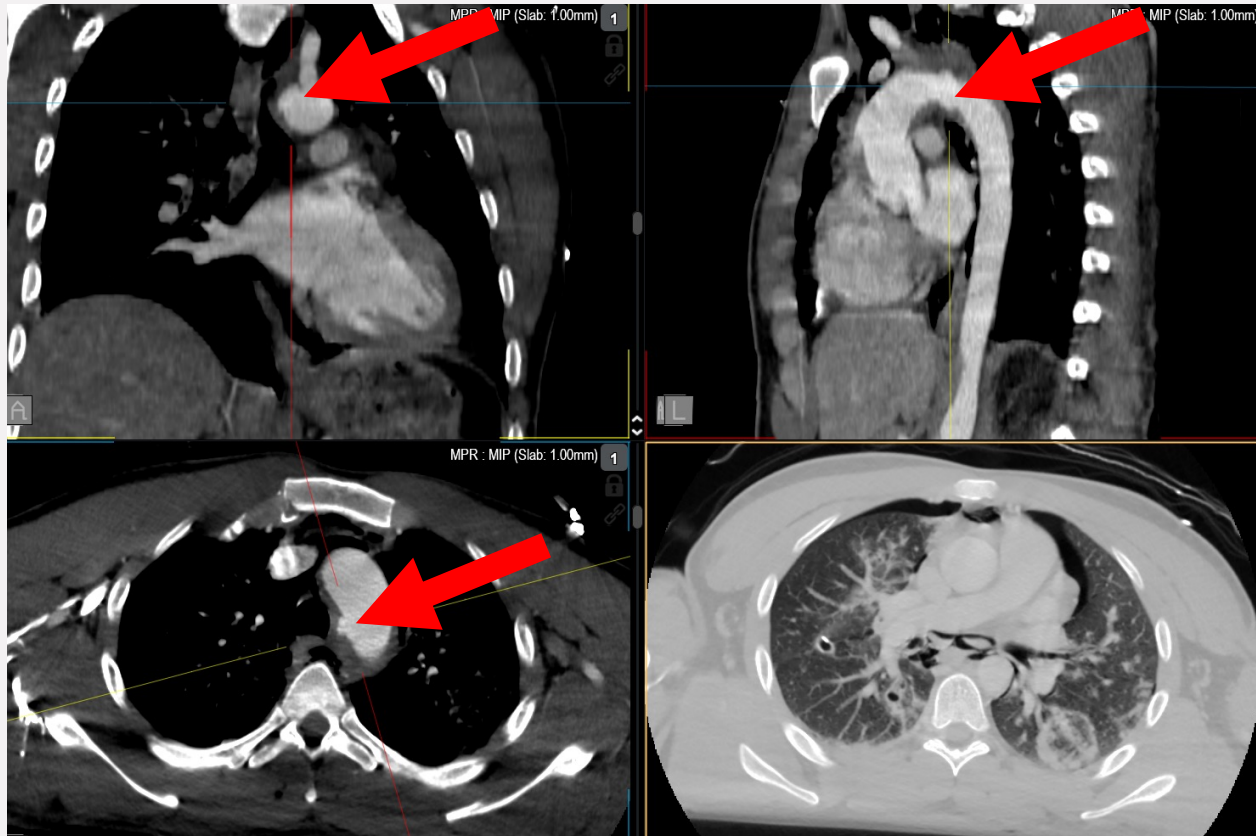
Motorcyclist/M45



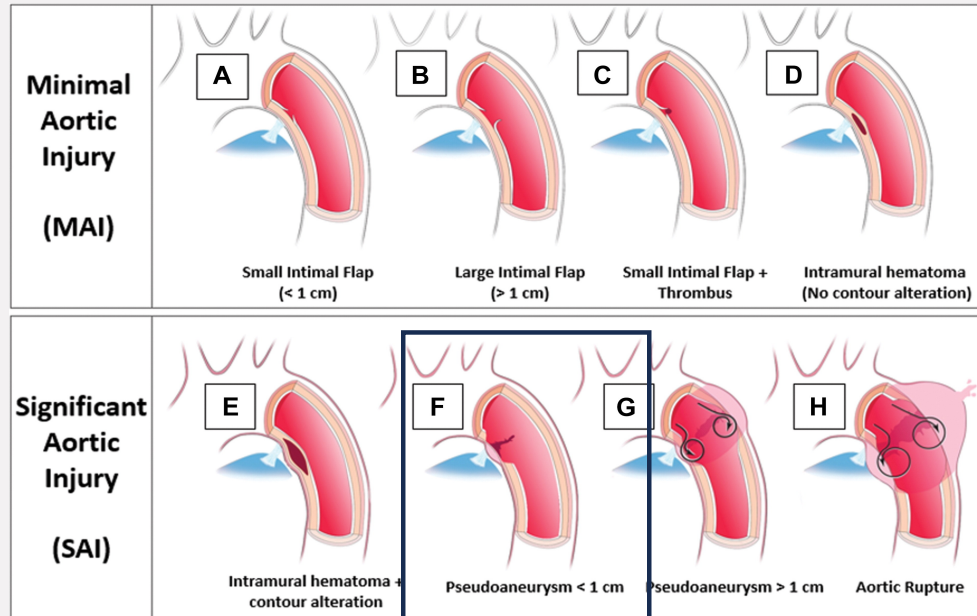
Fall/M25



Fall/M25



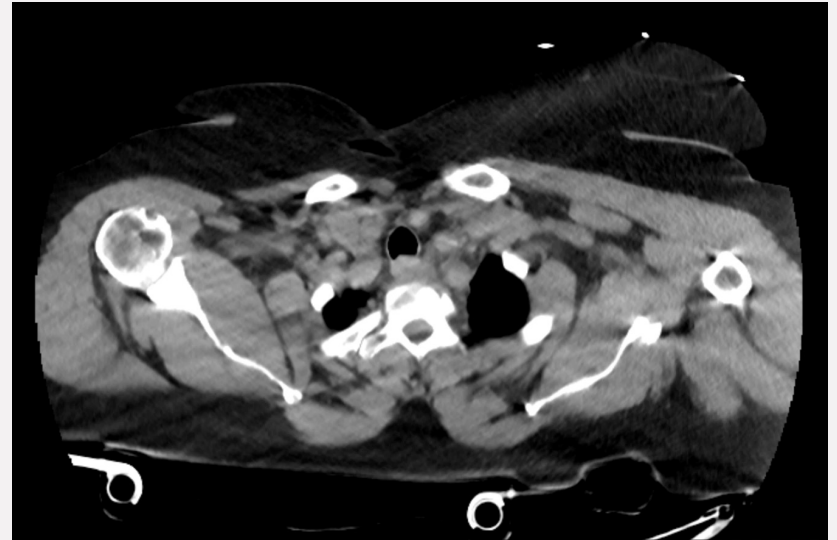
Fall/M25



Fall/F54 - Trauma surgeon steps

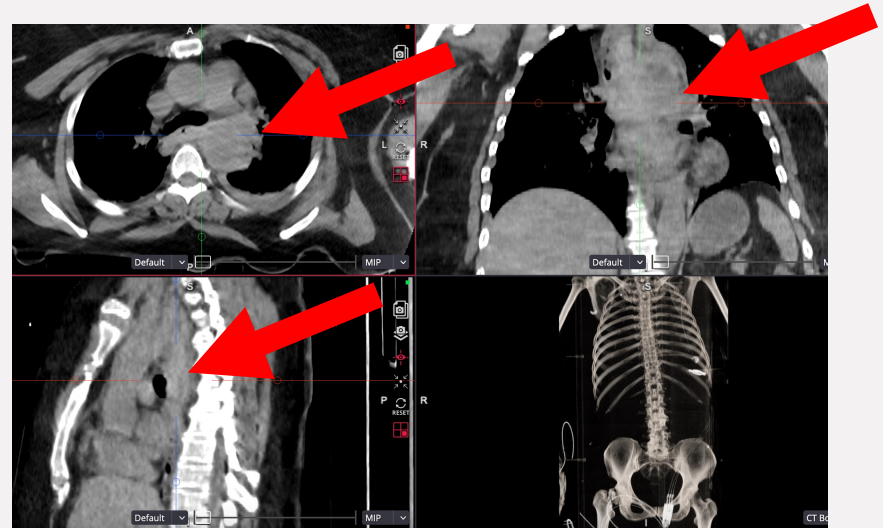
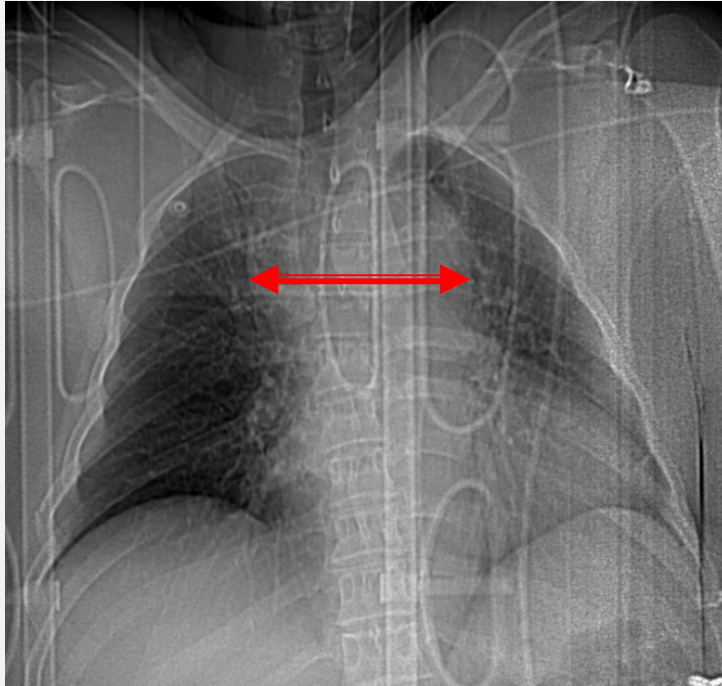
Whole body CT without contrast

- No abdominal organs traumatic injury or free blood
- Recommendations: treat in orthopedics or admit for other injury



Fall/F54

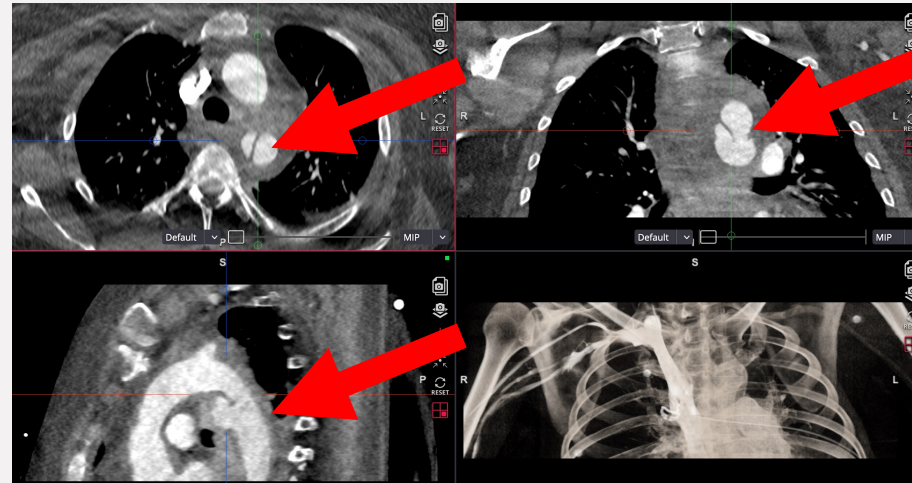
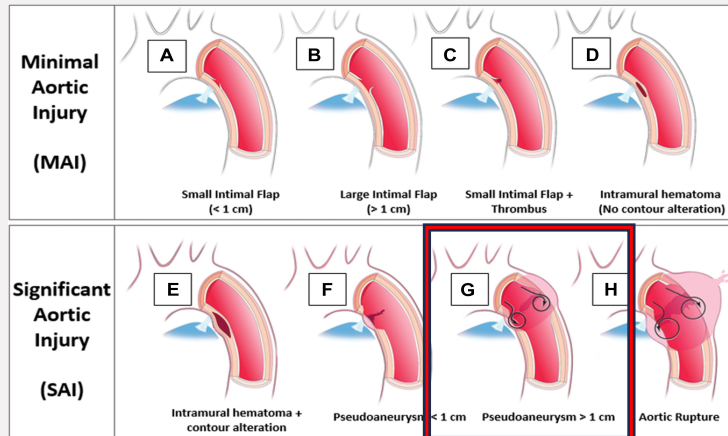
What do we see?



Fall/F54 - Radiologist steps

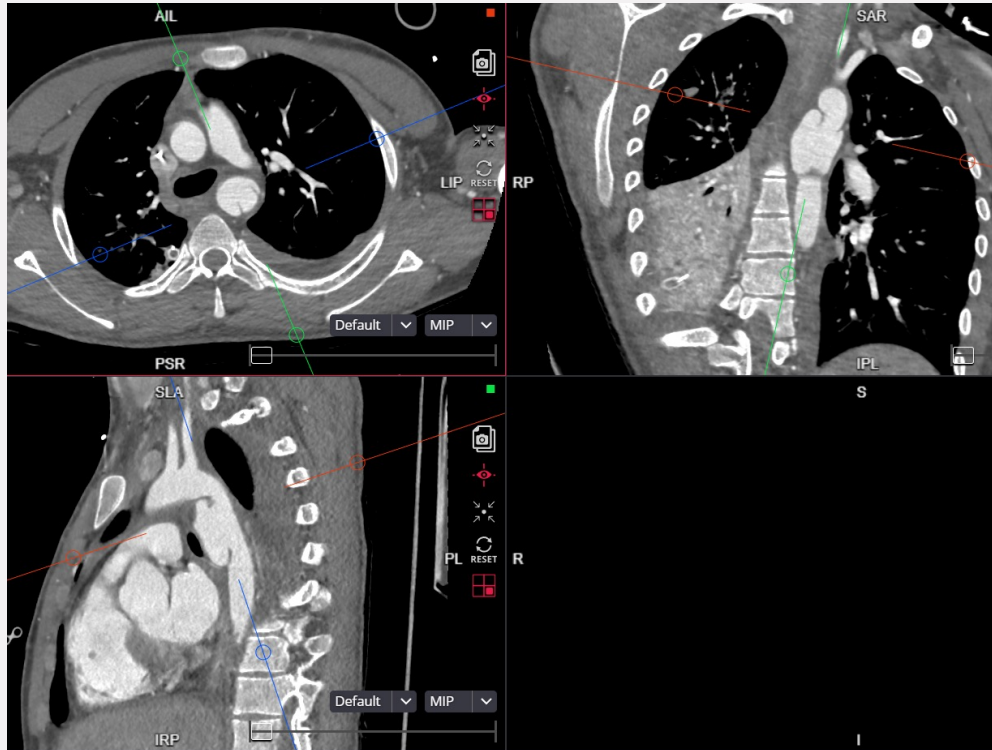
SOS !!!!!

CTA – severe traumatic aortic injury

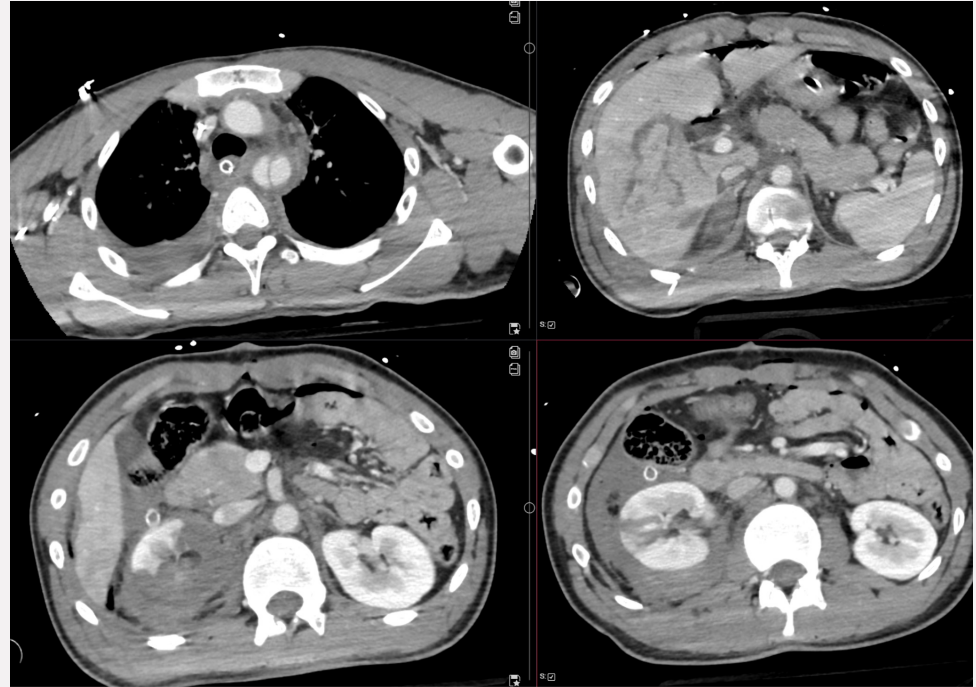
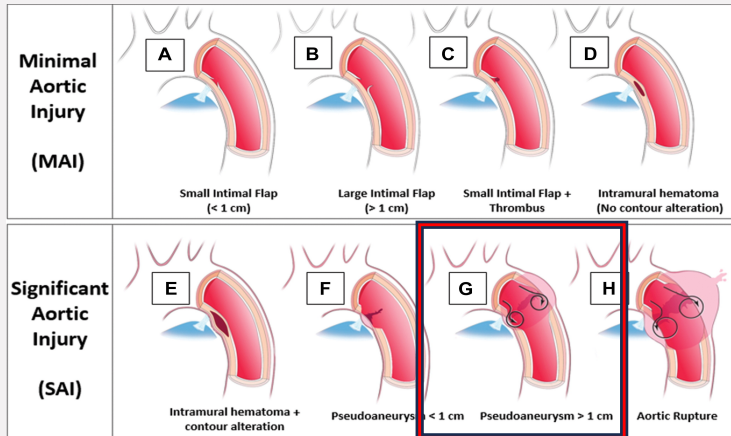


**Treatment -
endovascular
stents**

MVH driver/M21



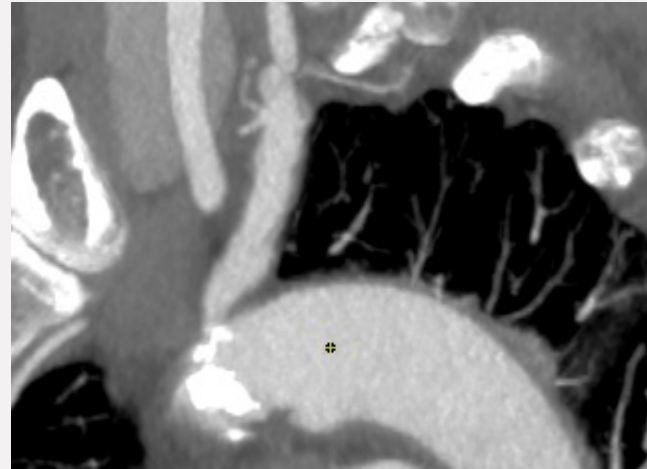
MVH driver/M21



False positive findings

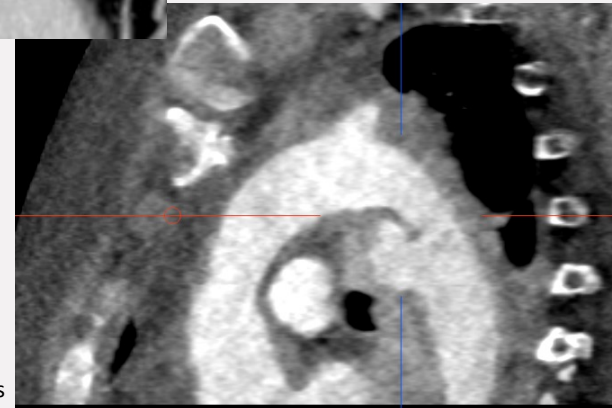
Ductus diverticulum:

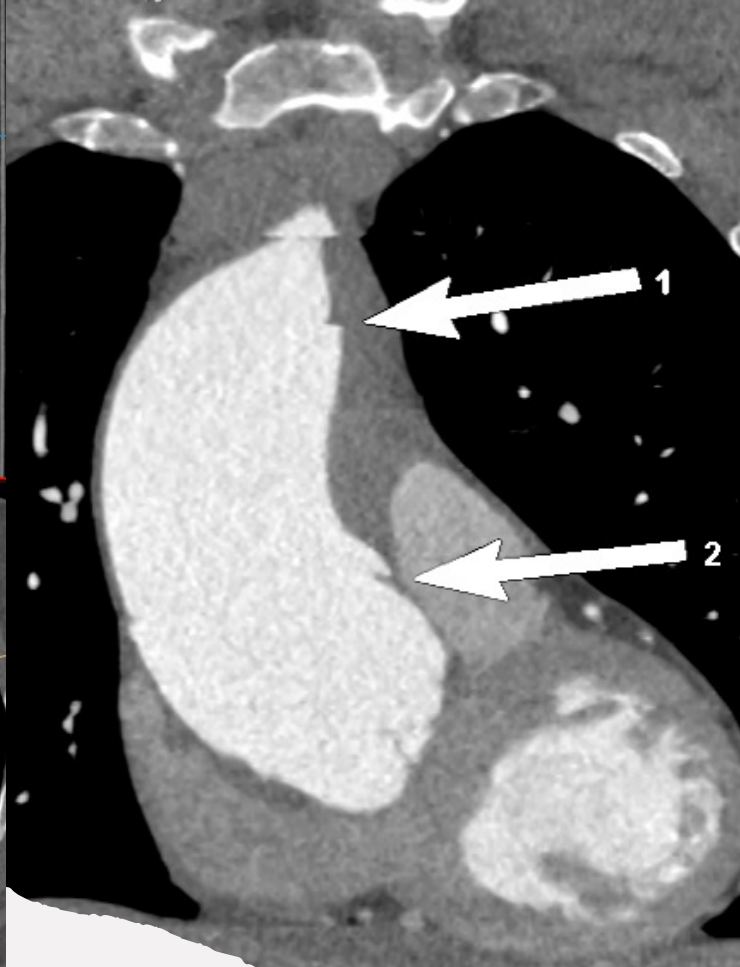
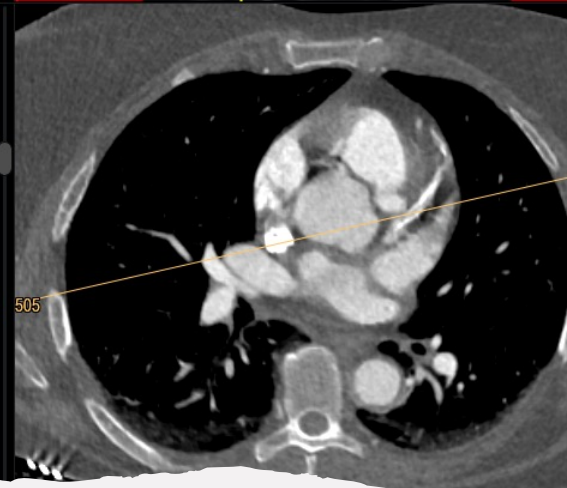
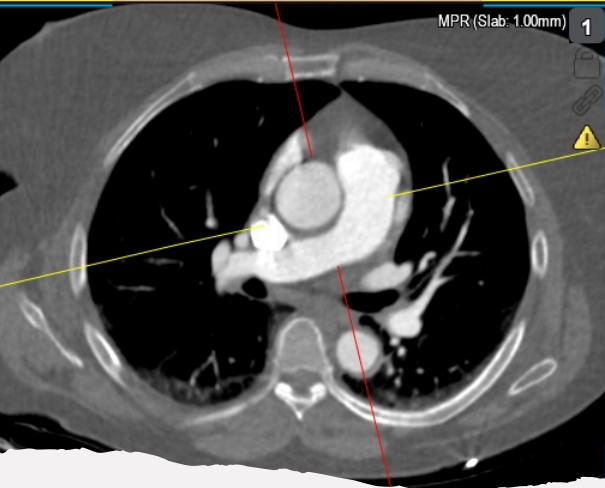
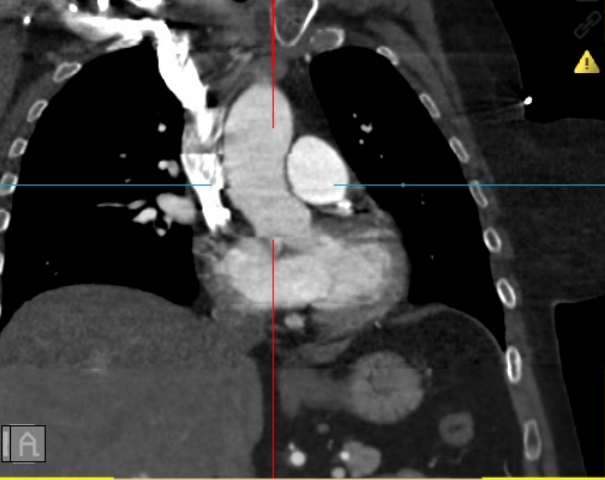
- smooth bulge
- inferior aortic arch
- level of the aortic isthmus.



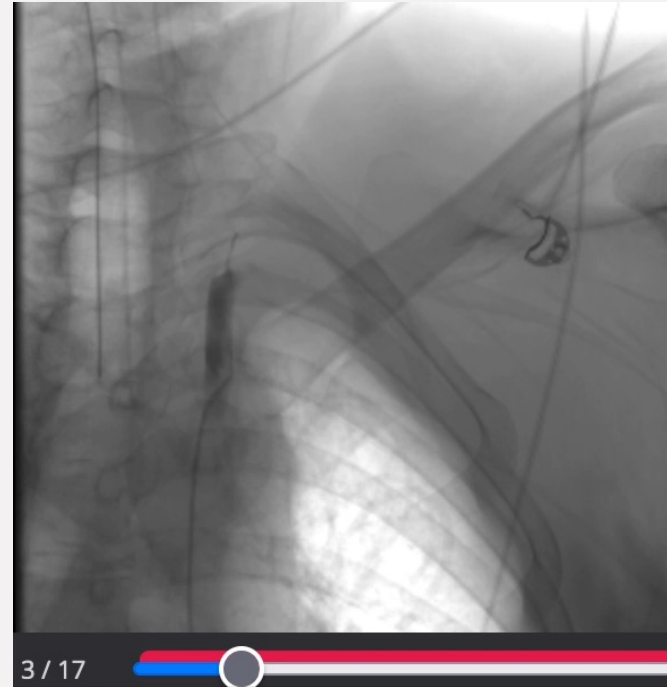
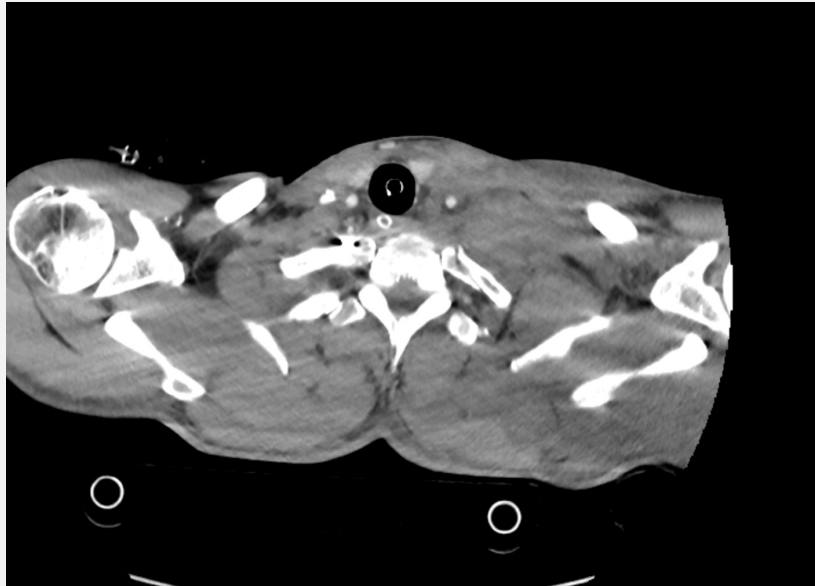
Traumatic pseudoaneurysm:

- narrow base,
- irregular margins,
- Acute angles

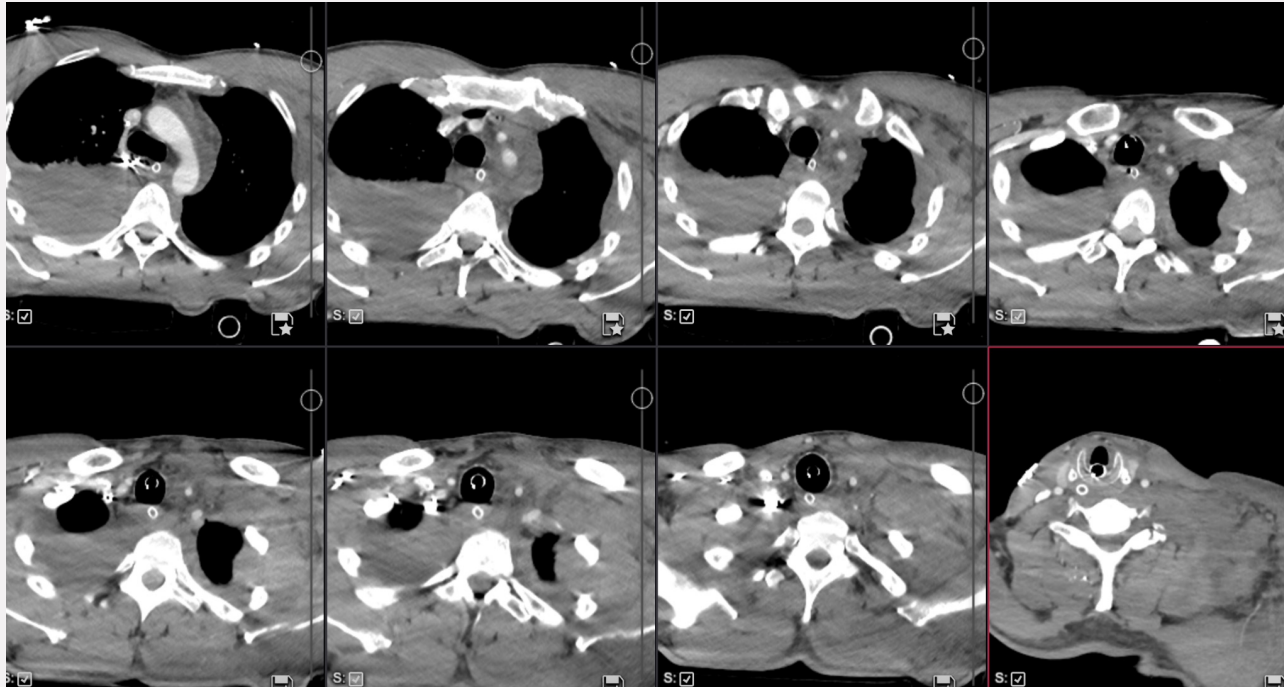




Motocyclist/M48



Motocyclist/M48



Conclusions

Four grades + High risk imaging features

Look for minimal aortic injuries

Major traumatic aortic injury **MUST BE** recognized ASAP

ALWAYS use **CONTRAST** in CT for severe trauma

Indirect signs (Mediastinal hematoma) – **need more imaging**

Literature

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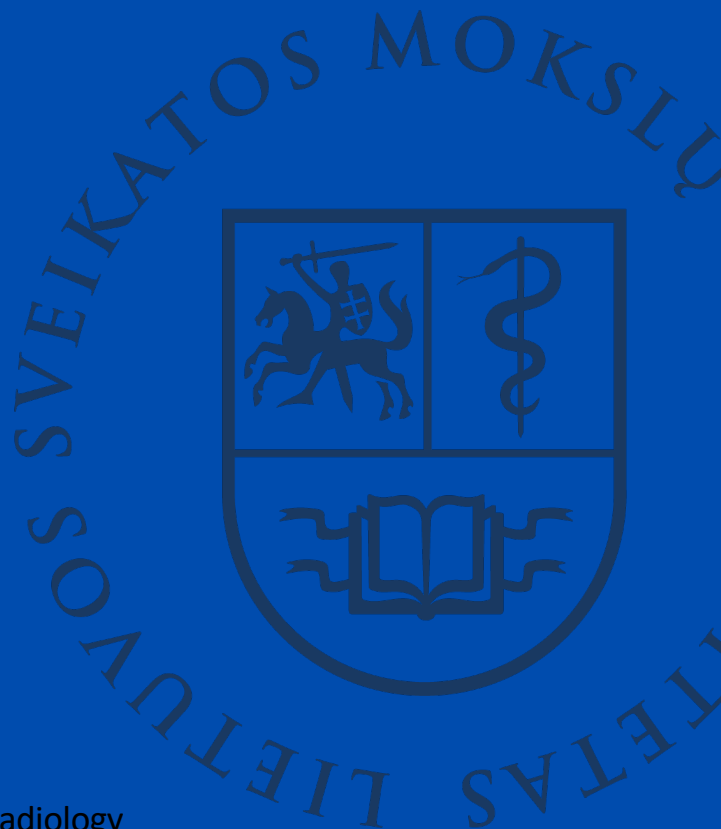


Aortic trauma

MD, PhD Lina Padervinskienė

Lithuanian University of Health Sciences

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Stocholm