Emergency Bulletin
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A hidden lethal injury

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A 69-year-old male pedestrian was hit by a minibus and thrown away by 3-meter. He sustained head injury and was semi-conscious on scene.

On arrival, his vital signs were:
- BP 90/64mmHg, pulse 135bpm
- GCS: E1M4V2
- Pupils were equal and reactive

Patient was intubated for airway protection, and was given fluid resuscitation. Secondary survey and investigations showed

- A 6cm laceration over occipital region and a 10cm laceration over right back
- Abdomen soft, FAST scan negative for intra-peritoneal free fluid
- No deformities over 4 limbs
- CXR and X-ray pelvis was taken (Figure 1 and 2)

Could there be any hidden injuries?

The patient suffered from a high-energy blunt trauma. It is crucial to look for any severe associated injuries, such as lung contusion, intra-abdominal haemorrhage, diaphragmatic rupture or aortic injury etc.

Figure 1: Chest x-ray: Multiple bilateral ribs fracture, no pneumothorax with endotracheal tube in-situ

Figure 2: X-ray pelvis: Vertical shear of right hemi-pelvic with diastasis of right sacroiliac joint and displaced fracture of right superior and inferior pubic rami

Computed tomography of whole body showed (Figure 3 and 4)

1. Traumatic subarachnoid haemorrhage with contusion over right temporal lobe
2. Multiple ribs fracture with bilateral lung contusion
3. Blunt traumatic aortic injury (BTAI) over aortic isthmus with pseudoaneurysm and peri-aortic haematoma
4. Multiple pelvic fractures with diastasis of right sacroiliac joint and associated pelvic haematoma

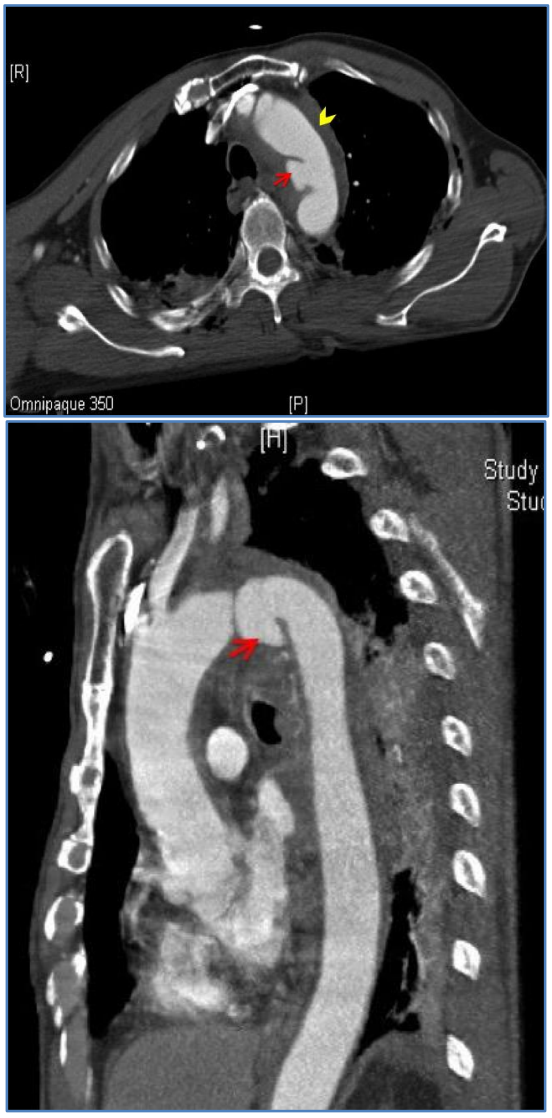

Figure 3 and 4: CT of the patient showing blunt traumatic aortic injury (red arrow: pseudoaneurysm; yellow arrowhead: periaortic haematoma)

What is blunt traumatic aortic injury (BTAI)?

Blunt traumatic aortic injury is the second most common cause of death in blunt trauma. In an autopsy analysis of fatal traffic injuries in the United States, BTAI was identified in 33% of cases.

However, majority of victims suffered from BTAI would be found death at the scene, only 20% of cases could reach hospital.

The single most important risk factor for BTAI is rapid deceleration, such as in high speed motor vehicle collision (70% of cases), motorcycle collision, falls from a significant height, auto-mobile-pedestrian crash, and thoracic crush injuries.

Majority of the BTAI (>70%) occur at the aortic isthmus just distal to the left subclavian artery (the attachment site of ligamentum arteriosum). This is because

- The isthmus is a transition zone between the more mobile ascending aorta and arch and the relatively fixed descending thoracic aorta (Figure 5)
- Aortic isthmus is intrinsically weaker; its tensile strength is only 63% of that of proximal aorta
- Increased intrathoracic pressure and rotational forces exert a highly focus stress at the isthmus

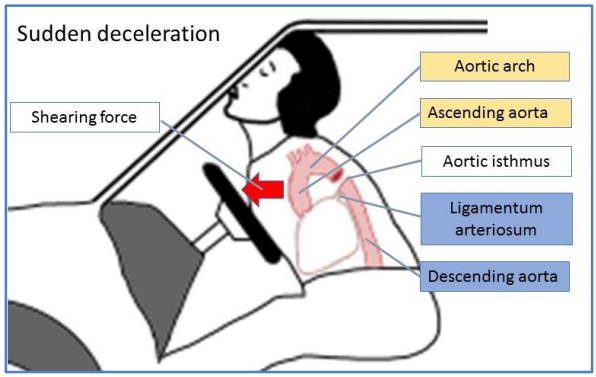

Figure 5: Aortic isthmus is the transition zone between the more mobile aorta (yellow box) and relatively fixed aorta (blue box)

How could we confirm the diagnosis of BTAI?

There are no symptoms or clinical signs that are reliable in diagnosing BTAI.

On chest X-ray
- Widened mediastinum
- Obscured aortic knob
- Left hemothorax

may prompt the diagnosis of BTAI, but it is important to note that BTAI could still be present in the absence of positive X-ray findings.

Contrast-enhanced CT of the thorax should be arranged for patient with suspected BTAI after stabilization of his condition. It has a sensitivity and negative predictive value approaching 100% in diagnosing BTAI. Transesophageal echocardiography (TEE) could be used in patients who cannot be transferred for CT scan.

How to classify BTAI?

Traumatic aortic injury is classified into 4 categories (Figure 6)

- Grade 1: Intimal tear
- Grade 2: Intramural haematoma
- Grade 3: Pseudo-aneurysm
- Grade 4: Rupture

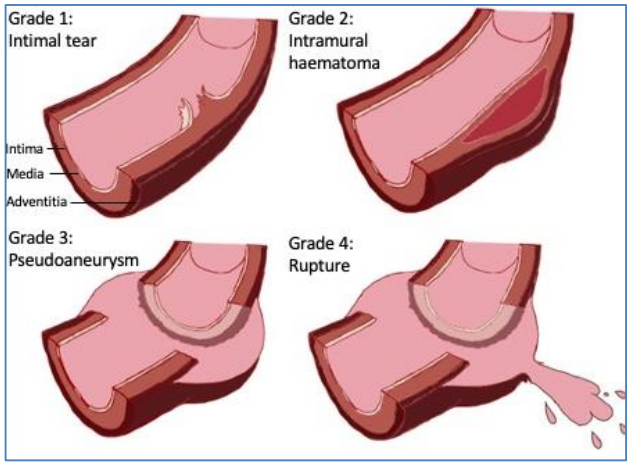

Figure 6: Classification of BTAI

Patient with tear of intima and media could progress to rupture of adventitia and free rupture if left untreated. 30% of BTAI patients reaching hospital will die within 24 hours if untreated.

How should we manage patient with suspected BTAI?

Initial management

Like managing every trauma case, initial management should always start with resuscitation, primary and secondary survey according to the Advanced Trauma Life Support program.

Isolated BTAI is rare. Associated injuries are very common as it is a high energy trauma. The mechanism of injury and the presence of injuries like fracture pelvis should raise the suspicious of BAI.

Most of the trauma victims with BTAI that can reach hospital have contained aortic injury. For patients with hemodynamic instability, other life-threatening injuries or bleeding should be first treated, unless there is active bleeding from the aorta.

In BTAI, overaggressive fluid resuscitation could lead to progression of aortic injury and even free rupture.

Therefore, in patients with suspected BTAI, the aim of systolic blood pressure should be approximately 100mmHg. Early initiation of pharmacologic blood pressure control, such as short acting beta blocker like esmolol, with restrictive fluid resuscitation decreases wall stress in the region of the injury and reduces the risk of rupture to approximately 1.5%.

However, permissive hypotension must be considered carefully and on a case-by-case basis. It is not recommended in patients with traumatic brain injury as a mean arterial pressure (MAP) of greater than 80mmHg (cerebral perfusion pressure of about 60mmHg) is required in order to maintain cerebral perfusion.

Treatment of BTAI

Prompt diagnosis, stabilization and prevention of free rupture are of utmost priority. More than 90% of ruptured occur within the first 24 hours of injury without aggressive blood pressure control.

For Grade 1 injury (intimal tear), repair is usually not needed. Patient should be put on non-operative management with blood pressure control and serial imaging until the injury heals. Intervention is indicated if there is progression of the aortic injury.

For Grade 2 or above injury, surgical repair is recommended. Thoracic endovascular aortic repair (TEVAR) has now become the treatment of choice for most cases with suitable anatomy.

Patient treated with TEVAR has better short term outcomes (significantly lower blood transfusion requirement, fewer complications, shorter hospital stays, and lower mortality) when compared to open repair, and it remains a durable option at midterm follow-up.

Progress of patient

The patient was sent to operating theatre after CT scan. External fixation of pelvis with anterior frame and posterior C-clamp, pre-peritoneal pelvic packing and angioembolization of internal iliac arteries were performed.

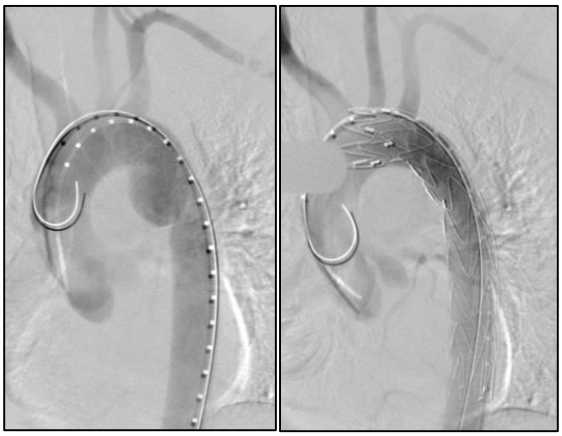

Figure 7: Left: Aortogram of the patient showing Grade 3 BTAI; Right: Pseudoaneurysm excluded after TEVAR

Thoracic endovascular aortic repair (TEVAR) was then performed using a 34x200mm stent graft. (Figure 7)

Post-operatively, he was sent to Intensive Care Unit for further care. With subsequent operations for his pelvic fracture and rehabilitation, he gradually recovered.

Reference

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