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Case Report

Isolated right subclavian artery injury with fractured right first rib following blunt trauma chest

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ABSTRACT

Blunt chest trauma uncommonly results in subclavian artery injuries which are protected by subclavius muscle, clavicle, first rib and deep cervical fascia. Subclavian artery injury presents early after trauma. It may rupture to cause haemorrhage, pseudo-aneurysm and brachial plexus compression. Careful physical evaluation of the upper limb is warranted to look for skin colour, temperature, sensation, motor function and radial artery pulses. Serious vascular injury should be suspected if there is presence of large hematomas or pulsatile mass in supraclavicular region. Contrast-CT represents a key diagnostic investigation, while arteriography offers both a diagnostic a therapeutic approach in case endovascular stenting could be contemplated. But surgical repair is preferred mode of management over endovascular stenting in children as it is difficult to manoeuvre a stent in small children and also because stent does not grow with the vessel leading to size mismatch. We report a case of traumatic 2nd part of right subclavian arterial rupture after blunt trauma chest with fracture involving right first rib following a 10 meters fall from height, treated by open surgical repair of injured right subclavian artery with an interposition 5 mm PTFE graft.

Keywords: Subclavian artery injury, First rib fracture, Blunt trauma chest, Open surgical repair

INTRODUCTION

Traumatic subclavian arterial rupture represents an uncommon complication of blunt chest trauma as it is protected by subclavius muscle, clavicle, first rib, deep cervical fascia and associated ligaments. Since the first rib is protected very well by the overlying soft tissue and bones, its fracture is a major injury and a considerable force is required to do it. Therefore, a fracture of the first rib is a hallmark of severe trauma and the condition without associated complication is unusual. Traumatic fracture of the first rib is often associated with serious intra-thoracic, head, cervical spine, intra-abdominal injuries and fracture of multiple ribs. Its presence should alert the clinician to:

- Generalized massive trauma with abdominal, chest, and cardiac injuries
- Local injury to the subclavian artery and brachial plexus, and
- Necessity of long-term follow-up for late-developing sequelae. The mortality associated with this injury is high

CASE REPORT

We report a case of traumatic subclavian artery injury after blunt trauma chest and fractured first rib involving a 7 years old male child with alleged history of fall from height who attended the emergency of PGIMER and Dr RML Hospital, New Delhi, India.

He reported a blunt chest trauma and a cranial trauma with temporary loss of consciousness.

Figure 1: Digital subtraction angiography (DSA) showing contrast extravasation from 2nd part of subclavian artery with right internal mammary artery distal to extravasation site and right vertebral artery arising from the injury site.

Patient was conscious and well oriented though irritable and physical examination revealed patent airways. Patient was comfortable with respiratory rate of 20 per minute, no signs of mediastinal shift, trachea was central. The jugular veins were not distended; vesicular sounds were bilaterally present but where decreased on right side at the bases. The patient was hemodynamically stable, the skin was warm and dry, blood pressure was 120/90 mmHg with a 100 bpm heart rate. He underwent focused assessment with sonography for trauma (FAST), which showed no signs of active abdominal bleeding. There were no evidence of any neurological signs, his Glasgow coma scale (GCS) was 15, pupils were bilaterally isochoric, isocyclic, and reactive to light, and he was able to move the four limbs. The right hemothorax had multiple abrasions and was tender to palpation, while the left one was normal. There was no subcutaneous crepitation. The abdomen was flat, with physiologic respiration- associated mobility, there was no rebound tenderness, and peristalsis was present. The pelvis was stable.

Examination of right upper limb suggested absent right radial, brachial and axillary pulses. Limb was viable with no evidence of neurological deficits. There was a round, soft, tender swelling of size 2x2 cm in right supraclavicular region.

Contrast enhanced computed tomography (CECT) neck/thorax showed an area of contrast extravasation in the neck on the right side measuring 2.6x2.1cm, adjacent to brachiocephalic artery and lateral to the right common carotid artery. Right sided neck hematoma extending from the skull base down to the mediastinum. Right 1 to 3 ribs fractured. Right hemothorax was present. Non contrast computed tomography (NCCT) head was suggestive of small tentorial sub-dural hemorrhage. Digital subtraction angiography (DSA) showed contrast extravasation from 2nd part of subclavian artery with right internal mammary artery distal to extravasation site and right vertebral artery arising from the injury site

Subdural hematoma and was managed conservatively, but the risk of intra/post-operative intracranial bleed was explained following heparinisation.

Midline sternotomy was done with incision extending into right supraclavicular region. Brachiocephalic artery, right common carotid artery and 1st part of right subclavian artery were looped and proximal control achieved. Clavicle was divided in mid-segment for better exposure. Injection Heparin 1 mg/kg i/v was administered. Proximal subclavian artery clamped. Hematoma was explored and shattered anterosuperior wall of 2nd part of right subclavian artery was identified and vessel distally clamped. Distal back bleed was good. Vertebral artery was clipped. Involved vascular segment was resected and repaired with 5 mm PTFE interposition graft.

RESULTS

Patient had an uneventful recovery. Right radial pulse was palpable; limb was warm with no sensory/motor deficit. Arm sling was used to limit movement at shoulder joint. Midline wound was healthy and sternum stable. Patient was discharged on 4th post-operative day.

DISCUSSION

First rib fracture is the rarest among all rib fractures.[1] The first rib is deeply placed and protected by the shoulder girdle and muscles, thus a great force is required to fracture it. Therefore first rib fracture is usually associated with a large number of other rib fractures and severe or fatal injuries and is a hallmark of severe trauma. Isolated fracture of this rib is unusual.

Several mechanisms have been cited in the literature regarding causation of first rib fracture, including;

- First direct trauma
- Violent muscular contraction of scalenus anterior or serratus anterior, and
- Chronic stress.[2]

Arterial rupture usually causes life-threatening haemorrhages, and must be carefully ruled out by physical examination as well as diagnostic imaging. Physical examination of the upper limb must focus on

skin colour, temperature, sensation, hand motility well as radial pulse.[3] In an article by Rulliat and Coll. The incidence of subclavian arterial rupture among 1181 thoracic traumatic injuries was 0.4%; a recent study by Shalhub and Coll. Reported a 47% incidence of subclavian arterial rupture above all the blunt thoracic outlet arterial injuries.[4,5]

Contrast-CT represents a key diagnostic investigation, while arteriography offers both a diagnostic a therapeutic approach. Woodring et al found an incidence of vascular injury of 8% in first rib fractures. According to Gupta et al in a review of 730 cases of first rib fractures, specific indications for subclavian artery and aortic arch arteriography in trauma patients include widened mediastinum on chest radiography, upper-extremity pulse deficit, posteriorly displaced first rib fracture, anterior subclavian groove fracture, brachial plexus injury and expanding hematoma.[6,7]

Open surgery represents the classical management of subclavian rupture. In recent years endovascular stent grafting has become an optional therapeutic approach to such kind of injuries.[8]

CT angiography is an important diagnostic tool while DSA offers both diagnostic accuracy and an operative approach. Exposure to obtain proximal control requires either a median sternotomy for the innominate and proximal right subclavian artery or a high anterolateral thoracotomy with potential clavicular resection for the proximal left subclavian artery. Endovascular stenting is an option in management of vascular injuries with contained rupture. Points that go against endovascular stenting in this case are;

- It is difficult to manoeuvre a stent in small children
- Stent does not grow with the vessel leading to size mismatch
- Proximity of injury to origin of vertebral artery
- Surgical repair is always preferred in children

To conclude, high index of suspicion is the key to diagnosis of such a rare vascular injury following blunt trauma to the chest.

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