Repair Of The First Segment Of Subclavian Artery Injury In A Trauma Patient Without Thoracotomy

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Abstract
Injuries to the subclavian artery are rare and associated with high morbidity and mortality rate regardless of the mechanism (1,2,3). Techniques for repair of the subclavian vessels and innominate artery vary and depend on type of injury. Several authors have reported success in treating such injuries with endovascular stents, but the long-term stability of the stents is yet unknown. (4).
We are reporting a case of injury to the first segment of subclavian artery in trauma patient and the appropriate surgical management without opening the chest cavity.

CASE HISTORY
A 20 year old white male that apparently was involved in a motorcycle accident and developed sustained injury to the right side of the neck, right upper chest and right leg. The patient was in severe pain, he could not move his right arm, and the pulse at brachial and radial arteries was absent. No sensation or movement was present at his right arm.

PHYSICAL EXAMINATION
Vital signs were within normal limits. The head was normocephalic, pupils were reactive to light with full accommodation, Ears canals and tympanic membranes were normal, no oral injury present.

Neck was supple with no obvious deformity, bleeding, hematoma or masses. Carotid pulse present bilaterally.

There were some abrasions on the right side of the upper chest wall and shoulder.

Heart sounds were regular in rhythm without any murmurs. The pulmonary sounds were clear bilaterally. The abdomen was soft, not tender without organomegaly and bowel sounds were positive. The back and spine appeared normal without tenderness or deformity. The genitals were those of normal adult male. Foley catheter was in place and urine was clear. The extremities show no pulse in the right arm, no sensation or feelings. The movements of left arm and leg were normal. The right thigh had some deformity and ecchymoses in addition to an open wound to the right femoral area.

Pulse present in left arm and both feet.

On chest X-ray, both lungs were expanded, and there were rib fractures of the right upper posterior side of the thorax.

Laboratory Tests: Complete blood count (CBC), Na, K, Cl, Urea, Cr, CO2, Blood Glucose, prothrombin time (PT), partial thromboplastin time (PTT), INR, arterial blood gas (ABG), liver function tests (LFT) and urine analysis (UA) were within normal limits.

Angiogram reveals occlusion of the right subclavian artery in about 3-4 cm.

STEPS OF SURGICAL TECHNIQUE
1. Incision will be performed from the suprasternal notch down to about 4-5 cm at the level of the first intercostal apace and transversely going through that space parallel to clavicle as much as needed.
2. Dissecting will continue through the subcutaneous tissue by using the electrical cautery in order to control the bleeding from small vessels.
3. The sternum will be freed from soft tissue and regional ligaments in upper lateral part.
4. Oscillating saw will be used to split the sternum in the upper part and at the level of the first
intercostal space. Then the cut will continue toward the right/ left depending on the side that had been explored, so the piece of sternum that is connected to Sterno-clavicular joint will be completely separated and elevated. Meanwhile, the major and minor pectoralis muscle must be cut at that level.

5. The separated sternal piece will be elevated and fine dissection will be continued with high caution for any contusion or ecchymosis.

6. Depending on the side of dissection, left or right, assure to identify the left innominate vein/right subclavian vein then to isolate the jugular vein.

7. Identify the innominate artery and isolate the carotid artery.

8. Upon control the large arteries, a 5000 units of heparin will be given intravenously.

9. Isolate the subclavian arteries, right or left vagal nerves, then preserve the extension of nerve branches that go around the right subclavian.

10. With high caution identify the damaged vessels (distal and proximal ends) and apply appropriate control.

11. It is very important to observe for hematoma at the damaged site.

12. Apply a vascular clamp on the innominate, carotid and subclavian arteries and control any bleeding at the surgical field.

13. Caution should be taken for any vascular anomaly, even if they are rare.

14. Arterial lumens should be clean with caution from blood clots.

15. Excise the damaged segment of the artery and replace it with appropriate arterial graft, either by patch angioplasty or graft interposition.

16. A 6-0 or 7-0 prolene sutures are appropriate to be used for vascular anastomosis.

17. For closure, the detached piece of sternum will be approximate by metal wires to the remaining sternum, follow by repairing muscle and soft tissue.

18. Clean the operating field, and insert a Jackson-Pratt drain into the soft tissue area from separate stab wound.

**DISCUSSION**

Neck and chest vascular injury is not uncommon in motorcycle accidents and most likely neurovascular brachial plexus is involved in this injury. Injury to the first segment of subclavian /innominate artery in trauma patient is rare accounting for only 3% of traumatic injuries of the upper extremity (5) and surgical repair may be technically challenging, hence the selective approach for such injury is important in regard to the recovery period, complications and outcome. Usually, complications are related to the hemodynamic status of the patient at the time of presentation, and not to mechanism of injury.

A low morbidity and mortality rate was achieved by aggressive initial resuscitation and early surgical intervention coupled with selective use of preoperative angiography in hemodynamically stable patients (6).

Most similar reviewed cases were managed either by using endovascular stent, balloon angioplasty or by thoracotomy (7) (8) (9) (10).

Some studies reported that covered stents are a feasible alternative to open repair in properly selected patients with subclavian or axillary artery injury and resulting in shorter procedure time and less blood loss, while exposure of these vessels is associated with significant morbidity, and mortality ranging from 5% to 30% (7) (8) (9) (10).

However, repairing such damage by cutting through the sternal piece and exploring the effected area can be applied not only in emergency situations of trauma patients, but also for other lesions at the same place such as; aneurysms and congenital malformations.

**ADVANTAGES OF THIS TECHNIQUE**

1. In both side procedure the internal thoracic arteries will be preserved and not scarified.

2. No need for thoracotomy.

3. Decrease the time of hospitalization and intensive care unit stay and eventually the patient will be discharged early.
4. Decrease surgical traumatization and risky patients.

5. Long term results of stent procedure are not established yet.

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References


8. Castelli P; Caronno R; Piffaretti G; Tozzi M; Laganà D; Carrafiello G; Cuffari S. Endovascular repair of traumatic injuries of the subclavian and axillary arteries. Injury. 2005; 36(6):778-82.


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