Surgical management of subclavian and proximal axillary artery injuries

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Surgical Management of Subclavian and Proximal Axillary Artery Injuries

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ABSTRACT
Subclavian and proximal axillary arterial injuries are rare and difficult to manage. Eight patients were managed from January 2008 to December 2018 at The Aga Khan University Hospital, Karachi, Pakistan with mean age of 36.13 ± 14.48 years. All patients had penetrating injuries, from gunshot in 5 (62.5%), bomb blast in 2 (25%), and stab wound in 1 (12.5%) case. Six (75%) patients presented in haemodynamically stable condition. The mean time between the injury and patient presentation was 28 ± 8.39 hours. The injuries were approached via supraclavicular incision in 3 (37.5%) patients, infraclavicular incisions in 2 (25%) patients and median sternotomy in 2 (25%) patients. Three (37.5%) patients had false aneurysm, while 5 (62.5%) had transected artery. Primary repair was performed in 2 (25%) cases, while 6 (75%) patients were treated with interposition graft with polytetrafluoroethylene (PTFE). All patients have salvaged limbs with good functional outcomes.

Key Words: Subclavian artery, Penetrating injury, Vascular trauma, Vascular repair.

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Three patients had false aneurysm, while others had transected artery. Primary repair was performed in 2 (25%) cases, while 6 (75%) patients were treated with interposition graft with PTFE. Two patients (25%) had also concomitant brachial arterial injuries and underwent brachial arterial exploration. One (12.5%) patient had ruptured left hemidiaphragm and ruptured spleen.

All patients’ limbs were salvaged with good functional outcomes; and were followed for immediate postoperative period for at least 30 days.

Trauma to subclavian and axillary arteries poses a unique challenge in part due to proximal anatomical structures; and in part, due to difficult vessel exposures. This case series showed that patients presenting to a trauma centre in a low-to-middle income country with subclavian and axillary artery injuries were young, had penetrating injuries and were haemodynamically stable. All patients presented with active bleeding. Repair with interposition PTFE grafting was the most common treatment strategy. Multiple approaches were used to access and deal these injuries. Limb salvage rate was 100%.

The incidence of subclavian artery injuries remains unclear. Kou et al. found the incidence rate of subclavian injuries to be 0.05% in all trauma hospitalised patients. The clinical diagnosis of subclavian injury is still challenging because of various presentations. The most frequent manifestation is the ischemia, resulting from arterial occlusion, such as diminished or absent pulses in the upper arm. Gill et al. surgically managed 68 patients with axillary artery after penetrating trauma. They performed primary repair in 60% of the patients; and performed ligation as a life-saving maneuver for critically ill patients. They also noted associated brachial plexus injury as cause of long-term morbidity. Aksoy et al. managed 38 patients subclavian-axillary artery injuries over 13 years surgically; and found surgical revascularisation effective in salvaging the limbs. They also found that final functional outcome of limbs depends on associated neurological, orthopaedic and soft tissue injuries. The surgical approach described by them is almost like ours. Endovascular methods offer an alternative to these injuries. Xenos et al. described seven patients managed with these injuries using Wallstent endoprosthesis. They also did comparative analysis with cohort of patients managed surgically during the same time duration. They noted that endovascular intervention was associated with shorter operative time (p=0.04) and less blood loss (p=0.01), compared to surgical managed patients. One-year patency was similar in both surgical and endovascular group. They concluded that covered stents are a feasible alternative to open repair in properly selected patients. Over the last two decades, endovascular technique and experience have matured, but surgery remains effective and practical treatment options in centres where endovascular facilities are lacking or still developing.

Management of the concomitant subclavian and brachial artery injury is challenging. The hand is more ischemic in case of both injuries than in patients with isolated brachial or subclavian artery injuries and warrants urgent revascularisation. Both injuries need to be treated to maintain good inflow and outflow. The approach was to repair subclavian and axillary arteries followed by brachial artery in the same setting.

Limitations of this study include a retrospective design with limited number of patients and from a single centre. It missed patients who did not reach hospital. This does not represent the true spectrum of subclavian and axillary artery injuries.

These findings can help improve the quality of care in patients receiving treatment for axillary and subclavian artery injuries in Pakistan and abroad.

CONFLICT OF INTEREST:
The authors declared no conflict of interest.

AUTHORS’ CONTRIBUTION:
ZUR: Study design, data collection, data analysis, writing 1st draft, critical analysis and review, literature review, approval of final draft, and responsibility of all aspects of work.

Table I: Perioperative patients’ characteristics and outcomes.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Gender</th>
<th>BP at arrival</th>
<th>Presented to hospital</th>
<th>Mechanism of injury</th>
<th>CTA done on arrival</th>
<th>Method of surgical approach</th>
<th>Pathology</th>
<th>Reconstruction</th>
<th>Additional injuries/ procedures</th>
<th>Outcomes limb salvaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>M</td>
<td>121/71</td>
<td>&lt;24 hours</td>
<td>Gunshot injury</td>
<td>No</td>
<td>Supraclavicular incision only</td>
<td>-</td>
<td>Interposition grafting</td>
<td>Fracture of 1st rib</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
<td>F</td>
<td>131/79</td>
<td>&lt;24 - 48</td>
<td>Bomb blast</td>
<td>No</td>
<td>Median sternotomy</td>
<td>-</td>
<td>Primary repair</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>M</td>
<td>120/70</td>
<td>&gt;48</td>
<td>Stab</td>
<td>Yes</td>
<td>Infraclavicular incision only</td>
<td>-</td>
<td>Interposition grafting</td>
<td>Brachial A injury</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>42</td>
<td>M</td>
<td>80/45</td>
<td>&gt;24</td>
<td>Gunshot injury</td>
<td>Yes</td>
<td>Infraclavicular incision only</td>
<td>-</td>
<td>Interposition grafting</td>
<td>Brachial A injury</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>65</td>
<td>M</td>
<td>154/92</td>
<td>&lt;24</td>
<td>Gunshot injury</td>
<td>No</td>
<td>Median sternotomy</td>
<td>False aneurysm</td>
<td>Primary repair</td>
<td>Head Injury auxiliary vein injury</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>M</td>
<td>40/42</td>
<td>&lt;24</td>
<td>Gunshot injury</td>
<td>No</td>
<td>Supraclavicular incision only</td>
<td>-</td>
<td>Interposition grafting</td>
<td>Hemidiaphragm rupture + splenic tear</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>24</td>
<td>M</td>
<td>100/65</td>
<td>&lt;24</td>
<td>Gunshot injury</td>
<td>Yes</td>
<td>Supraclavicular incision only</td>
<td>False aneurysm</td>
<td>Interposition grafting</td>
<td>Clavicular fracture</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>29</td>
<td>M</td>
<td>99/59</td>
<td>&lt;24</td>
<td>Bomb blast</td>
<td>Yes</td>
<td>Supraclavicular incision only</td>
<td>False aneurysm</td>
<td>Primary repair</td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>

A= Artery; CTA = Computed Tomography Angiography; Y = Yes.
SY, TA: Data collection, data analysis, approval of final draft, and responsibility of all aspects of work.

REFERENCES


