Traumatic forequarter amputation associated acute lung injury (ALI): report of one case

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Abstract. – One case of traumatic forequarter amputation associated acute lung injury (ALI) was presented. A discussion reviewing the treatment guidelines for this devastating injury, and pointing out the importance of supporting the lung and preventing the development of acute respiratory distress syndrome (ARDS) was included.

Key Words: Forequarter amputation, Trauma, Acute lung injury, Acute respiratory distress syndrome, ARDS.

Introduction

In 1737, Belchier reported the first case of traumatic forequarter amputation which was a rare and devastating injury1. Traumatic forequarter amputation occurs when tremendous traction force applied to the upper extremity resulting in the arm, scapula, shoulder girdle muscles being torn off from the trunk2. Acute lung injury (ALI) and its more severe form, the acute respiratory distress syndrome (ARDS) is syndrome of acute respiratory failure, which is defined by radiological (lung field infiltrates) and physiological criteria (the ratio of arterial oxygen pressure and the inspiratory oxygen concentration, PaO2/FiO2 ≤ 300 mmHg for ALI and ≤ 200 mmHg for ARDS)3. In this report, we present one case of traumatic forequarter amputation complicated with multiple rib fractures, hemopneumothorax, and ALI.

Case Report

A 40-year-old woman had her left arm caught in conveyor belts of brick molding machine, resulting in a forequarter amputation of her left extremity (Figure 1). She was rescued and transferred to the nearby hospital in approximately 1 hour. There, the wound was dressed and the blood pressure was stabilized by fluid resuscitation. On admission to our Hospital 5 hours after the injury, she was in mild shock but alert and oriented to time, place and person. Her blood pressure was 110/70 with a pulse of 110. Respirations were laborious and there was paradoxical motion of the chest wall. Oxygen saturation was 90% while breathing oxygen at FiO2 of 0.5. Arterial blood gas analysis showed hypoxemia with a PaO2/FiO2 score of 250 and the diagnosis of acute lung injury was given. Chest roentgenograms showed left hemopneumothorax and fracture of the 2-9 ribs (Figure 2). The left upper extremity was torn off from acromioclavicular joint, and the sternoclavicular joint was intact. Roentgenograms of the left extremity revealed no fractures. Shortly after admission she was taken to the operation room. Under general anesthesia the patient was intubated, an intercostals chest tube and wa tenseal drainage was instituted.

The wound was thoroughly debrided, the devitalized shoulder girdle muscles and contaminated tissues were excised and access gained to the axillary vessels. The pectoralis and latissimus dorsi were avulsed from their insertions. The muscles of the rotator cuff and the scapula were ripped off together. No active arterial bleeding was present but the pulsating stump of the subclavian artery was found to be in spasm and thrombosed and surrounded by avulsed nerve roots of the brachial plexus. The subclavian vessels were suture ligated at the level of the anterior portion of the first rib, nerve roots of the brachial plexus were severed proximally and embed in the surrounding muscles. About 1 centimeter of the distal clavicle was cut. The pectoralis and latissimus dorsi were sutured to the clavicle to counteract the upward force of the trapezius and sternocleidomastoid. The tension was approximately determined by placing the clavicle at the same level as its counterpart. Skin flaps were fashioned and loosely approximated to cover the defect. During the operation and the first...
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Figure 1. The left arm was torn off from the chest wall.

Figure 2. The radiograph showed multiple rib fractures, hemothorax, left lung field infiltrates, and that the left extremity was ripped off from the acromioclavicular joint.

Figure 3. Two weeks postoperatively, the stitches was removed and the wound healed primarily.

day postoperatively, up to 1800 cc. of red cell suspension and 800 cc. of plasma were given.

Twenty hours postoperatively, the patient’s temperature was 37.2°C, respiratory rate 41 breaths/minute, heart rate 115 beats/minute and blood pressure 118/75 mmHg. Oxygen saturation was 82% while breathing oxygen at FiO₂ of 0.5. Arterial blood gas analysis showed hypoxemia with respiratory alkalosis with a PaO₂/FiO₂ score of 110. Investigations showed hemoglobin of 8.8 g/dL. A central venous catheterization revealed a central venous pressure of 10 cm of normal saline. A diagnosis of ARDS was made and the patient was initiated on noninvasive ventilation with an inspiratory/expiratory positive airway pressure of 9/4 cm of H₂O with a FiO₂ of 0.5. Over the next hour, there was improvement in oxygen saturation, respiratory rate and arterial blood gas parameters. She was continued on the same settings with close clinical and laboratory monitoring. After staying in the surgical intensive care unit (ICU), the patient was gradually weaned off the ventilator after 5 days and transferred back to Orthopedic Department.

The chest tube was taken out 10 days postoperatively. The stitches was removed two weeks postoperatively and the wound healed primarily (Figure 3). The patient experienced severe phantom pain during the postoperative period and oral pain killer was needed to control the pain.

Discussion

Traumatic forequarter amputation is mutilating and life threatening injury. The initial management consists of rapid control of hemorrhage, prompt resuscitation, treatment of all life-threatening conditions, removal of all devitalized tissue, adequate coverage of the axillary vessel stumps and brachial plexus if at all possible, and shortest anesthesia time to minimize shock. Replantation of the extremity at this level has been reported. However, lack of bony fixation of the scapula, regeneration of avulsion damage of proximal brachial plexus presents an insurmountable problem. A free vascularized flap could be harvested from the amputated extremity to establish closure of the defect on the chest wall.

Among the 68 cases collected by Mosely, the traumatic forequarter amputation resulted most frequently from the entanglement of the arm in a me-
Table I. The patient’s arterial blood gas parameters at baseline and after application of noninvasive ventilation (NIV).

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<th>Baseline</th>
<th>1-Hour</th>
<th>2-Hour</th>
<th>4-Hour</th>
<th>12-Hour</th>
<th>24-Hour</th>
<th>48-Hour</th>
<th>72-Hour</th>
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<td>NIV</td>
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<td>15/5</td>
<td>15/5</td>
<td>15/5</td>
<td>15/5</td>
<td>10/5</td>
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EPAP: expiratory positive airway pressure; IPAP: inspiratory positive airway pressure; NIV: noninvasive ventilation.

Conclusions

Traumatic forequarter amputation is rare and devastating injury. The injury resulted most frequently from the entanglement of the arm in a mechanical device. The traction force tears the shoulder girdle off, while the counteracting force focusing on the stationary ipsilateral chest wall could result in multiple rib fractures and lung contusion. In treating traumatic forequarter amputation complicated with ALI, the focus should be put not only on debriding the wound and reconstructing the shoulder but also on supporting the lung and preventing the development of ARDS.

References

1) Belchier A. An account of the man whose arm with shoulder blade was torn off by a mill on 15th August 1737. Philos Trans 1737; 40: 313.