Case report

Axillary arterial entrapment and brachial plexus injury due to proximal humeral fracture

Denada Sharra Palmَا,  پrita P. Parikhَا,  براندي Schoonoverَا,  داميان Lebamoffُ,  ماري C. McCarthyَا ٢

َا Department of Surgery, Wright State University, Boonshoft School of Medicine, Miami Valley Hospital, One Wyoming Street, CHE 7000, Dayton, OH 45409, United States
ُ ٢Dayton Surgeons Inc., United States

ARTICLE INFO

Article history:
Accepted 11 May 2013

Keywords:
Axillary artery fracture
Humeral fracture
Brachial plexus injury

ABSTRACT

Proximal humeral fractures are an exceedingly rare cause of axillary arterial and brachial plexus injury. Neurovascular damage due to these injuries may threaten limb loss. Clinical presentation of these injuries may vary, therefore, a high index of suspicion is essential. The following case report describes a patient involved in a motor vehicle crash with an occult presentation of axillary arterial entrapment and associated brachial plexus trauma due to a proximal humeral fracture. The patient underwent prompt surgical intervention.

© 2013 Elsevier Ltd. Open access under the Elsevier OA license

1. Introduction

Fractures of the proximal humerus account for 4–5% of all fractures seen in the emergency department [6,7]. Only 15% of these fractures show significant displacement; rarely is the axillary artery affected. Brachial plexus injury may occur secondary to direct trauma or oedema and compression due to haemorrhage from an injured artery. Proximally, the plexus and the artery share a common fascial sheath [3,6]. Damage to the axillary artery and brachial plexus can present with a variety of neurovascular signs and symptoms—coldness, pallor, pulselessness, extremity, delayed or absent capillary refill and others. Impaired upper extremity function may occur with paresthesias or complete paralysis.

Diagnosing injury to the axillary artery after trauma to the shoulder can be difficult since patients may have palpable pulses and normal capillary refill due to the network of collateral vessels around the shoulder. A missed or delayed diagnosis may be fatal if an aneurysm created by the injury expands and ruptures [6]. Prompt diagnosis and treatment is essential in the restoration of blood supply and motor function. The following case report describes the presentation and treatment of an occult axillary arterial and brachial plexus injury due to a proximal humeral fracture.

2. Case presentation

A 38-year-old woman involved in a motor vehicle crash presented to the emergency department with severe pain in her right shoulder. She was confused and had amnesia to events. She was a restrained front seat passenger who was ejected from the vehicle, landing on her right side. Physical examination revealed soft-tissue swelling, tenderness, and deformity of the right shoulder. The hand, forearm, and arm were warm, pink, and dry with capillary refill <2 s. There was a palpable brachial pulse in the right arm, but no radial or ulnar pulses were felt. There was a monophasic Doppler signal over the right radial artery. She displayed severe hypoesthesia in the medial and ulnar nerve distributions along with decreased sensation in the radial and axillary nerve distributions. There was complete motor function loss in the fingers, wrist, and elbow.

Her blood pressure, taken in the left arm, was 110/60; heart rate was 90. She developed increased pain in the right arm, and a pulse discrepancy was noted, with a BP of 60/0 on the right side. Radiography and CT scan disclosed a comminuted right humeral head and neck fracture without evidence of a glenoumeral joint dislocation. There was mild anterior displacement of the right humeral shaft relative to the humeral head, and the acromioclavicular joint was widened to 5 mm. An arteriogram revealed slower than expected flow within the right subclavian artery and entrapment of the right axillary artery in the fracture site (Fig. 1). Furthermore, at the fracture site, the right subclavian artery took a cephalad turn, abruptly terminating in a tapered configuration, with the brachial artery fully reconstructed distally via collateral circulation. MRI revealed symmetrical nerve roots and sleeves...
without any extradural defects and a CT myelogram confirmed the lack of cervical root avulsion on the right side, consistent with a brachial plexus injury.

Operative exploration through an extended deltopectoral incision revealed no evidence of ecchymosis, haematomata, or thrombosis of the right subclavian artery. In the operating room, open reduction of the humeral fracture, mobilisation of the artery, and fracture fixation were performed. After surgery palpable radial and ulnar pulses were restored, and adequate capillary refill was observed. Neurolysis of the right axillary nerve was performed to alleviate pressure.

Post-operative treatment consisted of shoulder immobilisation with a sling and occupational therapy for activities of daily living. Initially, she had no motor function. On discharge she displayed full passive range of motion about the right elbow, wrist, and fingers, along with some supination. Light touch sensory in the right axillary distribution was restored. Additionally, sensation in the distribution of C6, C7, and C8 in the hand returned. Unfortunately, sensation of the lateral and medial forearm had not recovered at the time of discharge, 7 days post-admission.

3. Discussion

The majority of vascular injuries in the upper extremity are the result of penetrating trauma (almost 95% of cases) with a minority due to blunt trauma (5–10%) from motor vehicle injuries or falls [11]. Battiston and colleagues [1] studied 14 cases of combined upper extremity arterial and plexus injury, reporting 5 patients (36%) with an upper limb fracture. McLaughlin and colleagues [5] reviewed 19 proximal humeral fractures with associated arterial injury; 53% were coupled to a brachial plexus injury and 21% resulted in amputation.

Overall, the axillary artery is the least likely artery to be injured in these accidents, which is explained by its anatomical location [10]. The medial and anterior arm, and antecubital fossa are regarded as high-risk areas for upper extremity arterial injury due to the superficial location of the brachial arteries. The axillary artery has five major branches, providing excellent vascular supply and collateral circulation to the shoulder girdle, thereby explaining a non-ischaeamic presentation. This collateral circulation results in apparently adequate flow, even with complete arterial occlusion. Classic signs and symptoms of ischaemia may not be present. A high index of suspicion, with or without distal pulses, should be present. The most reliable and significant sign of compromise may be paresthesias, a common sign of nerve injury [5]. In our case a palpable brachial pulse was present, and the right arm appeared warm, pink and with normal capillary refill. There was, however, no radial or ulnar pulse and a neurological deficit was present in the right arm and hand.

The disastrous outcome of limb infarction and resulting amputation can be successfully averted with a strong suspicion for this rare diagnosis, repeated neurovascular exams, and prompt surgical treatment when the injury is recognised. It is imperative that revascularisation of the ischaemic limb be performed as soon as possible. The critical ischaemic time is 4 h for proximal and 12 h for more distal lesions [8]. In our case, open reduction of the fracture, freeing of the artery and fracture fixation was performed without requiring vascular repair, an instance seen in only two previous cases.

Traumatic injuries to the axillary artery are often associated with nerve injuries, the most common one being to the brachial plexus. Delayed diagnosis of such a neurological insult can cause long-term morbidity; hence, accurate diagnosis of patients with vague motor or sensory complaints is essential for timely repair. In our case, the patient presented with sensory deficits in the radial and ulnar distribution and motor function loss, which did not resolve despite prompt intervention.

Fracture of the neck of the humerus is a rare cause of injury to the axillary artery. It is useful to explore possible causative factors when such injuries do occur. Fabian [2] discussed anatomic and pathologic heterogeneity and causes for blunt cerebrovascular injuries. Seat belt injuries to major vessels during motor vehicle trauma have also been reported previously [4]. Nakagawa and colleagues [9] reported a case of carotid artery dissection as a result of a seatbelt injury in a motor vehicle crash. In our case, the patient was a restrained passenger when the vehicle was struck on the right side. Most likely, a direct blow resulting from another vehicle or ejection contributed to entrapment and compression of the axillary artery and injury to the brachial plexus.

4. Conclusion

In our case, a high index of suspicion and immediate operative intervention reduced the likelihood of severe complications. It is important to consider injury to the axillary artery and possible neural trauma when dealing with patients with blunt trauma to the shoulder. Prompt release of the axillary artery injury along with exploration and, if possible, repair of the adjacent brachial plexus is key in saving the limb and decreasing the probability of permanent neurological damage.

References


