

AXILLARY ARTERY INJURY AFTER PROXIMAL HUMERUS FRACTURE: A REVIEW OF 2 CASES

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INTRODUCTION

Axillary artery injury secondary to proximal humerus fractures after low energy falls is an uncommon occurrence. Most of the reports in the literature consist of isolated case reports or case series with few patients^{1,2}. The optimal management of these injuries with regards to initial fracture and vascular management has not been well defined. We here describe two similar cases that presented to our institution within a 5 day period with different management strategies leading to favorable outcomes. Review of these cases in parallel is instructive for future management of these challenging injuries.

CASE REPORTS

CASE 1:

An 81 year old female on warfarin for a history of an unspecified clotting disorder sustained a mechanical fall onto a parked car striking her right shoulder. She suffered mild facial trauma but had no loss of consciousness. She presented to an outside hospital complaining of right shoulder pain was found to have a proximal humerus fracture in addition to a question of an associated gleno-humeral dislocation. She was found to have non-palpable and non-dopplerable distal pulses in that extremity. A head CT scan, chest X-ray and shoulder series was performed as part of her initial work-up. A closed reduction was attempted but was unsuccessful at improving distal perfusion and the patient was transferred to our institution for further evaluation and management.

On physical examination she was found to be hemodynamically stable. Her right upper extremity skin was intact without ecchymosis. She had a slight swelling around the upper arm with tenderness and a posterior sulcus sign. Her radial, ulnar, and brachial pulses were nonpalpable. Her hand was normothermic and light pink compared to the robust coloration of the contralateral limb and exhibited delayed capillary



Figure 1



Figure 2

refill of approximately 3 to 4 seconds. An oxygen saturation monitor on her right index finger measured 83% saturation compared to 98% on the uninjured side. Sensation to light touch was grossly intact in the axillary, median and ulnar nerve distributions, but decreased in the radial nerve distribution. She had no motor function in her EPL, no wrist extension and no finger extension. The motor function of the median and ulnar nerves was intact. Secondary survey revealed no other injuries. Review of the radiographs taken at the transferring institution revealed a 2-part proximal humerus fracture of the surgical neck with significant medial displacement of the humeral shaft. A scapular-Y view, albeit suboptimal, was indeterminate for an associated dislocation (Figures 1 & 2.)

The CT scan of the head was found to be negative for intracranial hemorrhage. The trauma team (emergency ward attending physician, the general surgical chief resident and the orthopaedic surgery resident) in accordance with ATLS protocols made the shared decision to perform a reduction attempt prior to further imaging studies. A discussion was had regarding consulting the vascular surgery team who was known to be in the operating room with a hemodynamically unstable patient undergoing repair of a ruptured aortic abdominal aneurysm.

A reduction was attempted by the application of longitudinal traction to the humerus and attempted lateral displacement of the humeral shaft with concomitant posterior pressure on the humeral head. Immediately post-reduction, a large hematoma rapidly expanded on the upper arm. Sudden ecchymosis and a palpable thrill were noted. The hand became progressively cooler with diminished capillary refill. A compression dressing was applied to the shoulder, a second large bore IV was placed and IV fluids were administered, and the patient was taken emergently to the operating room with the vascular surgery team and the orthopaedic trauma team.

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Figure 3

The patient was in the operating room within 41 minutes and was rapidly intubated. The vascular surgery team continued to have difficulties obtaining hemodynamic control and a secondary team was called in. The shoulder was imaged fluoroscopically and the humeral head was found not to be dislocated and the shaft was impacted into the head at that time. After discussion between the two surgical teams, the shoulder, neck, chest and arm were prepped and an incision was made 53 minutes later. A vascular interpositional graft with subsequent humeral open reduction and internal fixation performed (Figure 3).

Post-operatively the patient was hemodynamically stable, with a 2+ radial pulse and a warm and well perfused extremity. A residual radial nerve deficit was noted which slowly improved over the course of her admission.

CASE 2:

A 79 year old female, on warfarin for atrial fibrillation, sustained an injury to her right shoulder after tripping from a standing position. She sustained a minor facial abrasion but no loss of consciousness. She complained of isolated right shoulder pain and was initially evaluated at another institution where she was found to have a complex proximal humerus fracture. Radial and ulnar arterial pulses were weakly dopperable but nonpalpable. Aside from shoulder series x-rays a CT scan of her head was performed as well. The patient was transferred to our institution for further evaluation and management.

On physical examination she was found to be hemodynamically stable. Her right upper extremity skin was intact without ecchymosis. She had a slight swelling around the upper arm with tenderness. Her radial and ulnar artery pulses were nonpalpable but exhibited weak monophasic signal. Her hand was normothermic with robust coloration similar to the contralateral hand. Capillary refill was less than 2 seconds and an O2 saturation monitor measured 98%, equal to the uninjured extremity. Sensation to light touch was grossly intact in the axillary, median and ulnar nerve distributions, but decreased in the radial nerve distribution. She was unable to fire her EPL with absent wrist and finger extension. The motor function of the median and ulnar nerves was grossly intact. Secondary survey revealed no other injuries. Review of the AP radiographs taken at the transferring institution revealed a complex proximal humerus fracture with inadequately exposed axillary view.



Figure 4

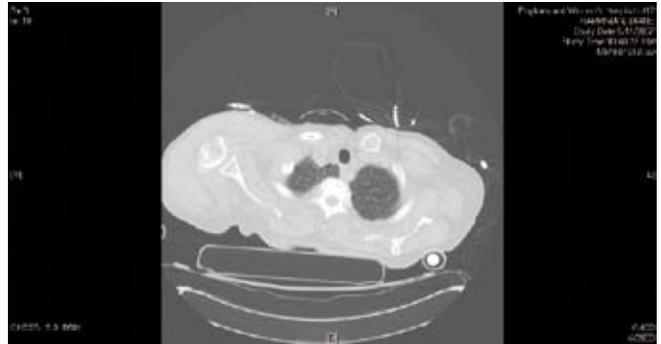


Figure 5

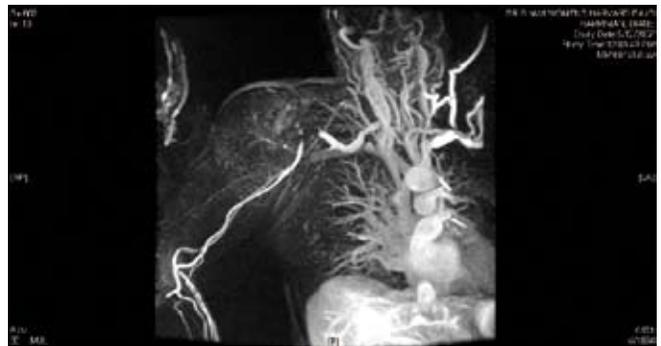


Figure 6

The vascular surgery team as well as the orthopedic surgery attending physician were notified immediately. Given the clinical evidence of a well-perfused extremity the decision was made to forgo any reduction attempt and to obtain further imaging studies. The AP shoulder X-ray revealed a 3 part proximal humerus fracture with wide medial displacement of the humeral shaft. (Figure 4). The single axial chest CT scan revealed the fractured humeral head to be grossly located within the glenoid. (Figure 5)

After review of the additional imaging studies which included shoulder series X-ray and CT scan of the head, c-spine and chest, it was decided that no reduction attempt would be made. The patient was placed in a sling, admitted to the surgery trauma service and a multiphase, multisequence MRA of the right upper extremity with gadolinium enhancement was performed the following day. The fractured shaft of the proximal humerus was noted to be compressing the right axillary artery causing focal short segment occlusion. Acute thrombus was seen both proximal and distal to axillary artery compression. (Figure 6 - arrow). Interestingly, distal perfusion was maintained by an



Figure 7



Figure 8

anomalous arterial variant branching from the cervical trunk of the subclavian artery (Figure 7- arrow).

Patient taken to the operating room 5/15 for vascular repair using an interposition hemashield graft and hemiarthroplasty and was found to have a well perfused hand with 2+ radial pulses and a viable extremity. A residual radial nerve deficit was noted which did not improve significantly over the course of her admission.

Figure 8 reveals a post-operative x-ray of the hemiarthroplasty. Figure 9 shows an intraoperative photograph of the interpositional graft underlying the pectoralis minor (large arrow) and the conjoint tendon (small arrow).

DISCUSSION

We present here two similar patients with proximal humerus fractures with associated axillary artery injuries who underwent different acute management strategies. Proximal humerus fractures, in particular in the aging population, are one of the most commonly sustained injuries from low-energy mechanisms such as falls. However, axillary artery injury from proximal humerus fracture is an uncommon event but with increasing reports in the orthopedic literature.

Traditional teaching and dictum of acute fracture management has been to acutely re-align and splint fractures, and reduce dislocated joints to re-establish distal perfusion. Advanced Trauma Life Support (ATLS) protocol describes this



Figure 9

in Chapter 8: Musculoskeletal Trauma Vascular injuries (pg. 253-254) by stating “An acutely avascular extremity must be recognized promptly and treated emergently...if there is an associated fracture deformity, it can be corrected quickly by gentle realigning and splinting the injured extremity” and “If an arterial injury is associated with a dislocation of a joint, a doctor, skilled in joint reduction, may attempt one gentle reduction maneuver. Otherwise, splinting of the dislocated joint and emergency surgical consultation is necessary. Arteriography must not delay reestablishing arterial blood flow.” However, we feel given the close proximity of the proximal humerus surgical neck to the axillary artery special considerations should apply to the acute management of these injuries Review of the literature and published case reports highlights the need for establishing protocol for these injuries.

Lim, EV, et al¹ described 3 similar cases with similarities to our case reports. All three were elderly patients who sustained proximal humerus fractures from falls with worrisome perfusion of the injured extremity. Out of the three cases reported, a reduction attempt of the proximal humerus fracture was performed in 2 cases prior to angiography and operative management.

Yagubyan et al.² described 4 similar cases and reviewed 24 additional cases from the English literature (Vascular and Endovascular Surgery; volume 38, number 2, 2004). In their description of 4 case reports with similar demographics, mechanisms and injury to our cases, there was no report of reduction attempt prior to vascular imaging or operative management. In their review they noted the predominance of low-energy mechanisms. Falls were the primary mechanism in 22 instances (79%). Similar to our case reports, neurologic deficit was noted in 13 patients (46%), 19 cases (68%) demonstrated acute limb ischemia clinically with a high sensitivity of clinical examination for arterial injury 27 cases (96%). The large majority presented with pulseless extremities 21 cases (75%) where angiogram was performed in 64% of cases. Intimal tears with secondary thrombosis made up 54% of the arterial injuries visualized.

References

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2. Yagubyan, M., and Panneton, J. M.: Axillary artery injury from humeral neck fracture: a rare but disabling traumatic event. *Vasc Endovascular Surg*, 38(2): 175-84, 2004.