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Trauma Case Reports

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Low-energy suspiciously open proximal humerus fracture management in older adult patient: A case report

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ARTICLE INFO

Keywords:

Open proximal humerus fracture
Low-energy fracture
Geriatric trauma
Orthopaedic trauma

ABSTRACT

Although fractures of the proximal humerus are common among older adults, open fractures following low-energy trauma are exceptionally rare. Prior studies have alluded to the existence of this injury, but there are no detailed reports on its presentation, management, or long-term follow-up. We present the case of a 78-year-old man that sustained a suspiciously open proximal humerus fracture of the dominant hand following a fall down a few stairs. Management consisted of early intravenous antibiotics followed by open reduction and internal fixation with irrigation and debridement. Intraoperative soft tissue assessment revealed a wound extending from bone to skin. The patient suffered no complications, regained full function of his arm, and is pain free. Considering the rarity of this injury and its potential for highly morbid complications, this case serves as a reminder that we should continue to have a low suspicion threshold for open fracture when punctures or lesions are present around proximal humerus fractures, even for low-energy injuries. Prompt and thorough examination, initiation of antibiotics, and surgical intervention are keys to providing best care for this uncommon injury.

Introduction

Proximal humerus fractures account for 5 % of all fractures and are increasing in frequency [1]. Older adult patients are especially at increased risk for this specific fracture given osteoporosis and diminished bone quality. The proximal humerus has a muscle and soft tissue envelope that naturally provides a layered barrier to open fracture, with studies reporting an incidence of just 0.2–0.5 % [2,3].

To our knowledge, there are no detailed reports on low-energy open proximal humerus fractures in older adult patients. We present a case of a suspiciously open, two-part proximal humerus fracture resulting from a mechanical fall down a few stairs, a mechanism of injury of relatively low energy. The patient provided consent for publication of this case report of his injury.

Case description

A 78-year-old left-hand dominant male with a history of cerebrovascular accident, hypertension, chronic kidney disease, and osteoporosis presented to the emergency department following a mechanical stairway fall at home. The patient reported going up a set

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<https://doi.org/10.1016/j.tcr.2022.100686>

Accepted 30 July 2022

Available online 1 August 2022

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of carpeted stairs with a glass of wine when he fell backwards. There was no loss of consciousness or direct head trauma. However, the patient reported pain and bleeding from a wound on the left shoulder, which he supposed was due to the broken wine glass. On physical examination, a 2 mm non-bleeding wound was noted 3 cm distal to the tip of the acromion along the lateral aspect of the proximal humerus (Fig. 1). The left upper extremity was neurovascularly intact and there were no additional injuries.

Anteroposterior and lateral radiographs of the left shoulder revealed a two-part proximal humerus fracture with advanced glenohumeral arthritis (Fig. 2). They also revealed locules of air within the sub-acromial space around the area of the shoulder wound. Due to possibility of an open fracture, the patient was started on 2 g of intravenous (IV) cefazolin and received a tetanus toxoid/diphtheria toxoid (Tdap) booster injection. He was admitted to the hospital, and orthopaedic surgery was consulted for further evaluation. Given the rarity of open proximal humerus fractures, as well as the extensive musculature and overlying soft tissues of the proximal humerus relative to the minute size of the lesion, an open fracture was in low suspicion. Regardless, treatment options for a comminuted proximal humerus fracture with possibility of an open wound were discussed in detail with the patient, and the decision was made to proceed with surgical intervention.

Informed consent for an open reduction internal fixation (ORIF) of the proximal humerus fracture with possible irrigation and debridement was obtained. The patient received general anesthesia and was positioned in beach chair position. The left upper extremity and shoulder were prepped and draped in usual sterile fashion. A standard deltopectoral approach was undertaken. While the fracture was void of any apparent debris, a rent in the deltoid and overlying soft tissue that tracked to the “poke-hole” in the shoulder wound was identified, thus suggesting a Gustilo-Anderson Type I open fracture (Fig. 3) [4]. At 36 h after injury, the skin edges surrounding the “poke-hole” lesion and underlying soft tissue were excised. Debridement of all fracture edges, muscle fascia, and adipose tissue tracking from the lateral aspect of the fracture to the “poke-hole” cutaneous lesion was completed. The wound was then irrigated with 9 l of normal saline. Attention was directed to reduction and fixation of the two-part proximal humerus fracture. Once anatomical



Fig. 1. Photograph of the anterolateral aspect of the patient's left shoulder taken at the time of presentation to the emergency department.

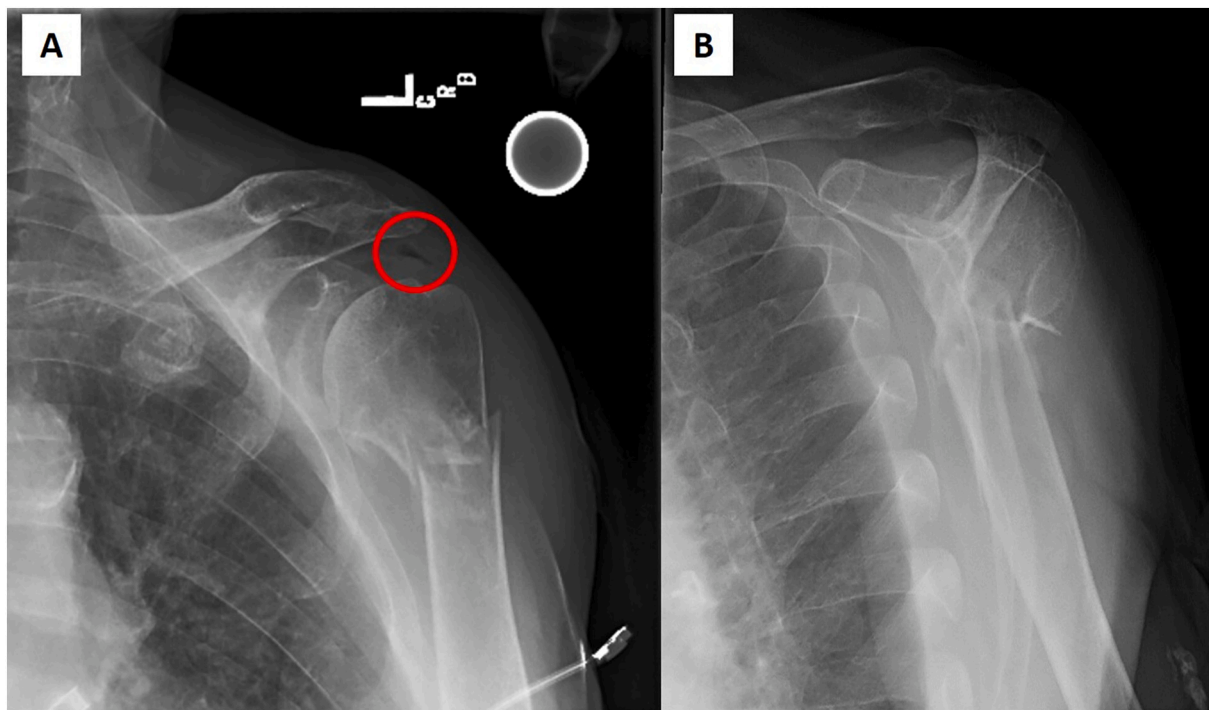


Fig. 2. Anteroposterior (AP) (A) and lateral (B) radiographic images of the left shoulder revealing two-part proximal humerus fracture. Radiology reported foci of air (red circle) in the soft tissue near the fracture around the subacromial space. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

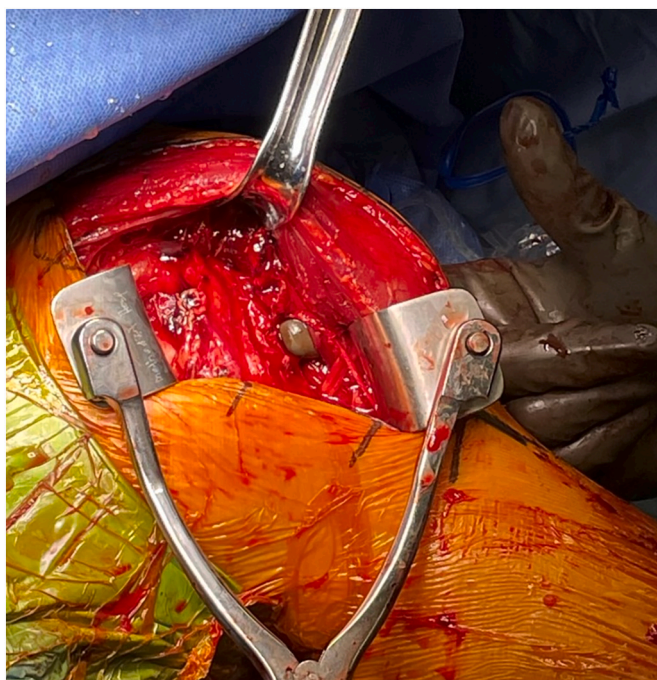


Fig. 3. Intraoperative photograph of the anterior aspect of the left shoulder depicting the rent in the deltoid and soft tissue tracking to the skin, thus suggesting the presence of an open fracture of the proximal humerus. The operating surgeon's finger is illustrating the rent in the soft tissue from the skin wound down to the fracture.

reduction was obtained and confirmed by intraoperative fluoroscopy, a 5-hole proximal humeral locking plate was applied just posterior to the bicipital groove and secured with nine proximal locking screws in the humeral head and four non-locking screws in the shaft (Fig. 4). The incision was closed in a layered fashion with 2–0 Vicryl and 3–0 Monocryl. The debrided “poke-hole” wound was approximated with two interrupted 3–0 nylon sutures, and a sterile dressing was applied. The patient tolerated the procedure well and was transported to the post-anesthesia care unit (PACU) without complication.

The patient's post-operative course was unremarkable. IV antibiotics were continued for an additional 48 h. Patient education on non-weight bearing of the left upper extremity and range of motion and stretching exercises was provided. At the patient's 10-day post-operative clinic visit, follow-up radiographs and physical exam revealed no concerning findings. To date, one year after surgery, the patient's clinical course has progressed well with appropriate healing, minimal pain, and return to baseline function.

Discussion

To our knowledge, this is the first detailed report of a low-energy likely open proximal humerus fracture. The patient's exam was unsurprising except for a small, 2 mm wound on the shoulder. Radiographs were consistent with a low-energy proximal humerus fracture in an older adult patient. Although open fracture diagnosis was not confirmed via visualization of gross contamination or microbial analysis of superficial and/or deep tissue cultures, the wound's proximity to the underlying fracture and radiographic findings prompted consideration for a potential open fracture and triggered the immediate administration of IV antibiotics prior to surgical intervention with irrigation and debridement.

Open fractures generally occur as a result of high-energy injury mechanisms [5]. Few reports in the literature describe open fractures of the proximal humerus. One study evaluating 1582 proximal humerus fractures over a two-year period reported a 0.2 % incidence of open fracture. Another study identified that just 0.5 % of 2386 open fractures over a 15-year period were of the proximal humerus [3]. One case report discussed an open proximal humerus fracture in the setting of a high-energy motor vehicle accident [5]. Although uncommon, suspicion for an open fracture of the proximal humerus must be entertained anytime there is an acute wound adjacent to an underlying fracture. Moreover, the surgical team should be cognizant of any skin dimpling, tenting, and puckering, as any of these could suggest soft tissue compromise and a concomitant open fracture.

Appropriate management of open fractures requires prompt identification, immediate antibiotic administration, and debridement of contaminated and devitalized tissues at the time of surgery. The infection rate among open fractures is 2 % to 50 % [6]. With high rates of bacterial contamination found in open fractures, the timely administration of antibiotics has been shown to serve a therapeutic rather than prophylactic purpose [4,6–9]. Gosselin et al. performed a meta-analysis validating the effectiveness of pre- and intra-operative antibiotic therapy in the prevention of infection in open fracture management [10]. In addition to expedient antibiotic administration, surgical irrigation and debridement has long been considered essential in preventing infection and promoting healing [6]. Although the timing of surgical intervention has been debated, studies have reported a similar rate of acute infections in patients with open fractures who received antibiotic therapy on presentation, but underwent surgery at different time periods [6]. Despite the importance of surgical debridement, the early management of a proximal humerus fracture associated with a wound in an older adult patient should focus primarily on elevated suspicion, thorough injury assessment, and early IV antibiotic administration.

Open fractures generally should undergo surgical treatment and fixation regardless of wound size, contamination, or fracture pattern. This however may not always be an option. Alternative management in these circumstances may consist of nonoperative treatment, especially for fractures with limited contamination/exposure, minimal comminution, and reasonable alignment. This can consist of strategies such as IV antibiotics for 24 h with serial skin and soft tissue exams and serial radiographs of the proximal humerus over several weeks to ensure maintenance of fracture alignment, interval healing, and no manifestation of infection. Although our case may have been amenable to this treatment modality, surgery was chosen for multiple reasons. The patient's glenohumeral arthritis and subsequent vulnerability to stiffness warranted early shoulder movement and range of motion. Compared to nonoperative management, internal fixation provides a more stable proximal humerus amenable to immediate active and assisted range of motion. With a question of this being an open fracture, operative care allowed for soft tissue and fracture debridement at the open wound. While the role of surgery cannot be ignored, careful examination and timely IV antibiotics are still paramount in open fracture management.

Our patient experienced a rare variant of a common injury as well as an uncomplicated post-injury course. The optimal management of an open proximal humerus fracture begins with a meticulous examination of the extremity. Wounds in the vicinity of underlying fractures may communicate and provide a route for infection and contamination of the fractures. Prompt initiation of intravenous antibiotics, as well as surgical irrigation and debridement, are critical to preventing injury progression and complications. This case is a reminder for clinicians and surgeons to remain vigilant in the evaluation and examination of what might otherwise be considered a common closed injury.

CRedit authorship contribution statement

Dr. Julie A. Switzer is on the editorial board for Geriatric Orthopaedic Surgery & Rehabilitation. She is a committee member for American Academy of Orthopaedic Surgeons (AAOS), American Orthopaedic Association (AOA), and International Geriatric Fracture Society (IGFS). For all other authors, no conflicts or disclosures were declared. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

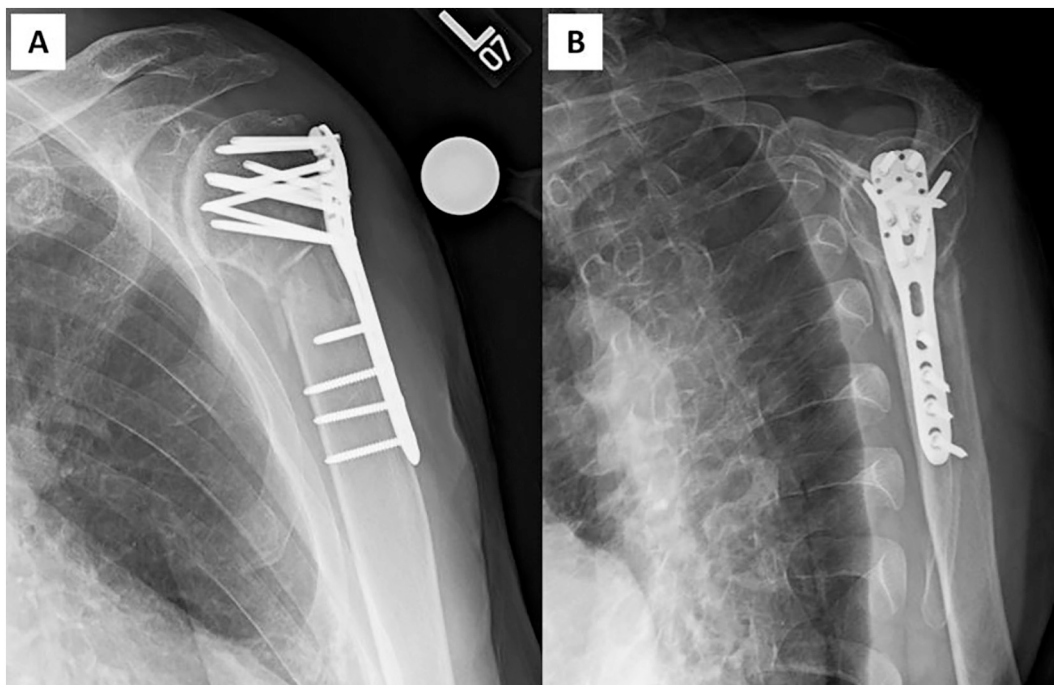


Fig. 4. AP (A) and lateral radiographic images (B) of left two-part proximal humerus fracture after undergoing open reduction and internal fixation (ORIF) with locking plate and screws.

Declaration of competing interest

JS is on the editorial board for Geriatric Orthopaedic Surgery & Rehabilitation. JS is a committee member for American Academy of Orthopaedic Surgeons (AAOS), American Orthopaedic Association (AOA), and International Geriatric Fracture Society (IGFS). For all other authors, no conflicts or disclosures were declared. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgements

All authors contributed to the conception, design, writing, and critical revision of the final manuscript. This work received no funding.

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