

Humeral Shaft Fractures in Overhead Throwing Athletes

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Introduction

Goals/Objectives

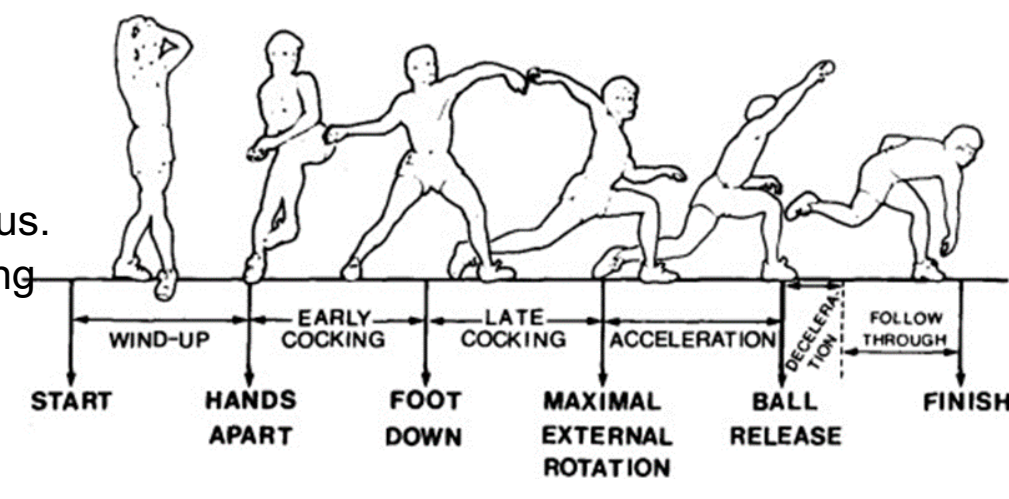
Review the biomechanics leading to fracture, discuss current management principles, address common complications, and examine the author's treatment of these rare cases

Throwing related fractures have occurred in both athletes and non-athletes but have not been well-studied. These types of fractures have been demonstrated in diverse patient populations as well as in biomechanical studies. These fractures have been traditionally treated by functional bracing with a Sarmiento brace. However more recent data accumulated through systematic reviews, retrospective cohort studies and meta analyses indicate that surgical intervention with open reduction and internal fixation may benefit younger, more active patients by reducing dangerous sequelae such as radial nerve palsy.

Theories Explained

There are several theories as to why this injury occurs in this demographic. The first theory attributes this type of fracture to the violent biomechanics that come with forcefully throwing an object. The throwing cycle is broken down into 6 phases: wind-up, stride, arm-cocking, arm acceleration and follow-through (Image 1). The humerus is subjected to a large amount of torsional stress during the late cocking and early acceleration phase however this theory fails to explain why these fractures can occur with minimal throwing force.

An alternative explanation proposed by a number of papers posits that these fractures occur because of deconditioning of the humerus. This explanation is compelling as it has been shown that thrower's fracture are more likely to occur in amateur athletes with improper



conditioning and a lesser degree of cortical adaptation, compared to those with an increase in bone mass when throwing is performed regularly. This could better explain fractures that occur with minimal throwing force.

Methods

Design: Retrospective Case Series

The patients in this study are residents of North Philadelphia who sought care at the Temple Emergency Department. All three patients were seen, evaluated and consented for surgery by the attending physician. Data including pre and post operative radiographs were acquired from the Temple EMR. Follow-up time for each patient was variable but occurred as early as 3 weeks and as late as 3 months. This study was conducted over a time span of a year and a half.

Cases

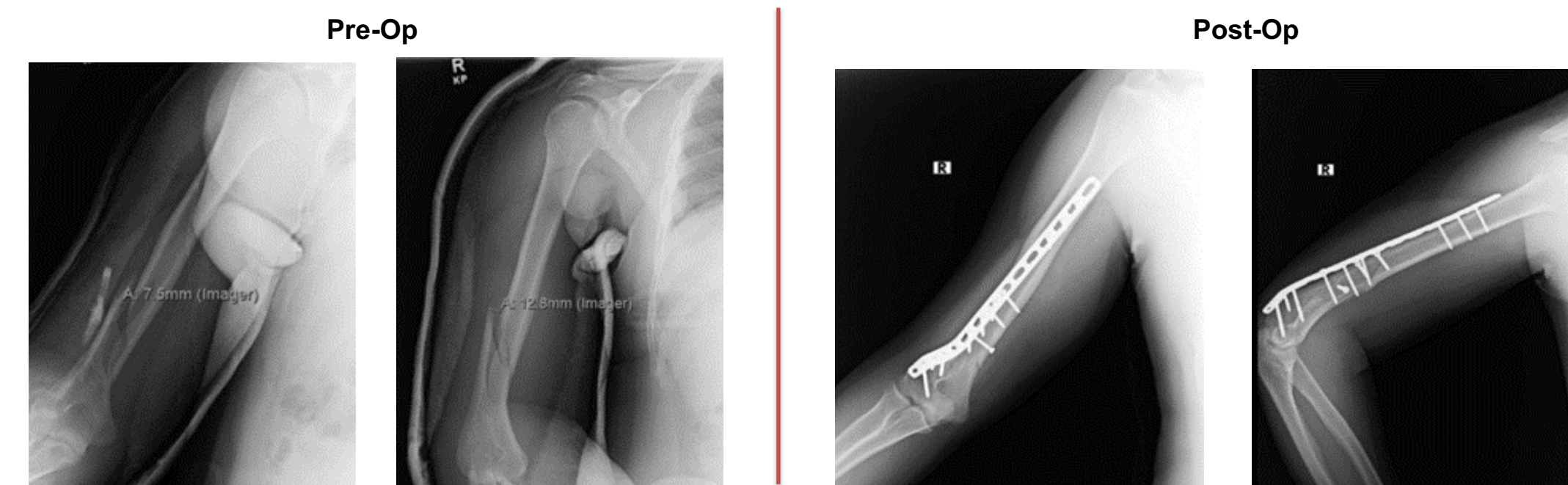
Case 1: 27-year-old right hand dominant male graphic designer presents with right arm pain after he felt a pop while throwing a baseball. He denied any prodromal pain. Post injury radiographs revealed distal third spiral humeral shaft fracture. He was neurovascularly intact on exam with no evidence of radial nerve palsy. Both nonoperative and operative management was discussed with the patient.

Case 2: 26-year-old right hand dominant male who presented to clinic with right arm pain after throwing a baseball and hearing a loud pop. He denied any prodromal arm pain but did start playing baseball a couple of months ago after a long hiatus. Radiographs demonstrated a spiral humeral shaft fracture. Patient was neurovascularly intact on exam.

Case 3: 26-year-old right hand dominant male barber presents to the emergency department with acute right arm pain after throwing a softball. He was found to have right humeral shaft fracture with a butterfly fragment. He had no neurological deficits and was placed in a coaptation splint

Results

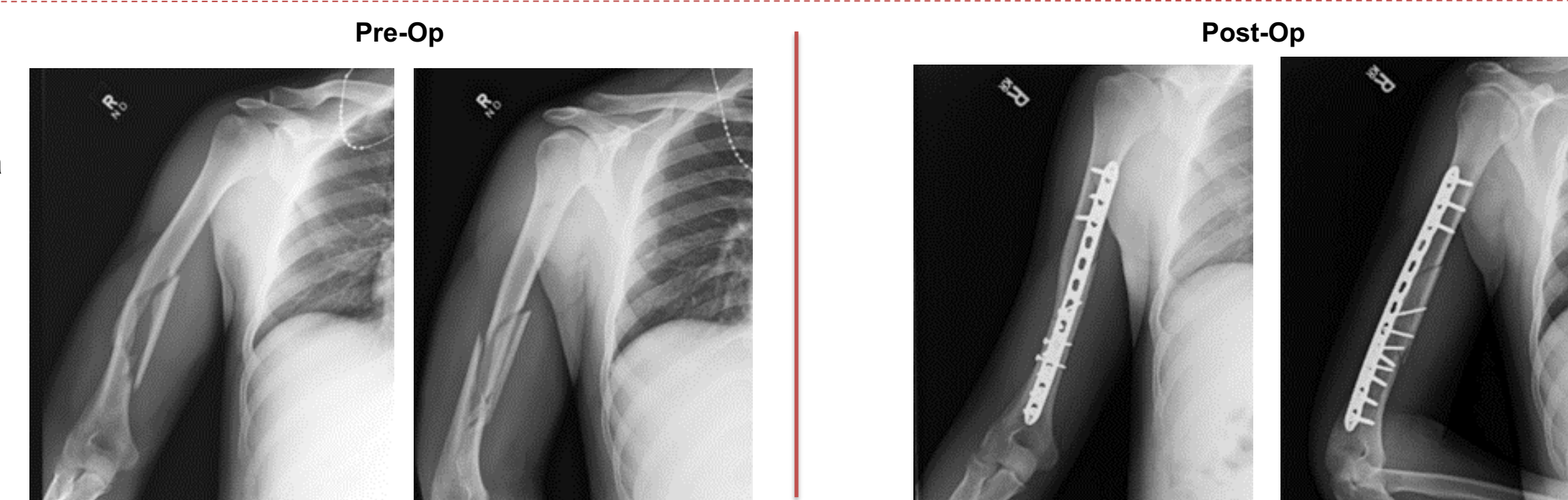
Case 1: This patient ultimately underwent open reduction and internal fixation using plate and screws through a posterior triceps sparing approach 8 days after injury. Post-operative course was uneventful at 6 weeks and was not seen again until 18 months after surgery for medial arm pain after working out. He was thought to have triceps tendonitis which was treated with anti-inflammatory medication and activity modification.



Case 2: Patient underwent open reduction and internal fixation 3 days after injury. He did well post operatively and had follow up of 3 months. At that time, the fracture was completely healed with no hardware complication on radiographs. Patient developed shoulder soreness with overhead activities which was treated with steroid injection into proximal biceps tendon.



Case 3: Patient then underwent open reduction and internal fixation of humeral shaft fracture with plate and screws through a triceps split approach 10 days after injury. Patient was observed overnight in the hospital and was discharged postoperative day one in stable condition. He was seen in clinic 3 weeks postoperatively and was subsequently lost to follow up. At that visit, the incision was well approximated and he was neurovascularly intact.



Discussion

Overhead throwing is an uncommon mechanism for humerus fractures. In the cases presented above, all were recreational male athletes in their mid-20s who presented with thrower's fracture. None of the patients had prodromal symptoms. All were neurovascularly intact upon presentation and underwent open reduction and internal fixation within 2 weeks of injury.

As stated previously, a concerning complication associated with humeral shaft fractures is neurovascular injury. Though rare, there are case reports of radial nerve palsies secondary to humerus fractures caused by playing tennis, grenade throwing, javelin throwing, and dodgeball. The radial nerve has a propensity to be injured after a thrower's fracture because it wraps around the humerus in the spiral groove directly adjacent to the cortex, making it susceptible to traction, laceration, compression, or contusion by fracture fragments. The prevalence of radial nerve palsy increases as the fracture site moves distally in the humerus, with a prevalence rate of 1.8 % in the proximal third, 15.2 % in the middle third, and 23.6 % in the distal third. Typically, treatment of the fracture itself is generally all that is necessary for proper healing of the nerve. However, in cases of open fracture or where the nerve does not show recovery in 3-6 months, surgical exploration is indicated. In the cases presented in this paper, no radial nerve palsies were observed before or after surgery.

The traditional treatment option for humeral shaft fracture is functional bracing. Sarmiento et al demonstrated that bracing achieve good functional outcomes, similar to those treated surgically, with union rates approaching 96 percent without significant cosmetic deformity. Recent data has questioned this claim, and over the last decade, surgical management with open reduction and internal fixation has increased 13.1 percent. Surgical management is indicated in open fractures, vascular injury, or unacceptable alignment. The presence of radial nerve palsy is not an indication for open reduction and internal fixation. Many radial nerve injuries recover with time, however, several current studies have shown that surgical exploration after injury occurrence has a higher likelihood of regaining radial nerve function as compared to patients undergoing nonsurgical treatment.

Despite recent trends towards surgical fixation for humerus fracture in young and active males, operative intervention does not come without risks such as secondary radial nerve palsy. The incidence of iatrogenic nerve palsy has been reported between 6% and 32%. Higher rates are seen during the use of external fixators and the lateral approach during fracture fixation. All of the cases presented underwent open reduction and internal fixation with no apparent complications. We advocate for surgical fixation of thrower's fractures unless there are underlying medical conditions precluding the patient from surgery.

Conclusion

Humeral shaft fractures as a result of overhead throwing can be considered rare stress fractures which are often preceded by prodromal pain. Radial nerve palsy is a potential complication of humeral shaft fractures, although it is not an indication for surgical exploration and fracture fixation in the general population. Because the demographic of those with thrower's fractures tends to be young, active males, we advocate for exploration and fracture fixation in the setting of radial nerve injury. In the absence of radial nerve palsy, conservative treatment with functional bracing can be considered, however, we prefer open reduction and internal fixation in these cases as well.

References

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