Isolated Radial Nerve Palsy After Glenohumeral Dislocation in a Collegiate Athlete: A Review of the Literature

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Case Report

Shoulder dislocations are extremely common injuries that present to the emergency department, with an estimated incidence rate of 24 per 100,000 person-years. Although the initial management of these dislocations is well documented, neurologic complications of these injuries are rare and should prompt consultation by a hand specialist. These complications can range from single nerve lesions to brachial plexopathies and are of variable duration. Isolated radial nerve injuries are extremely rare, with the literature consisting of singular case reports with variable follow-ups. Here, we present a case of a young man who sustained a football-related shoulder dislocation and an isolated radial nerve palsy with complete resolution at 1-year follow-up.

Case Report

A 19-year-old male college football player presented to the emergency department after tackling another player and sustaining a left shoulder injury during a football game. The patient had no prior medical history other than 2 prior left-sided shoulder dislocations, with magnetic resonance image (MRI) findings consistent with an anteriorinferior labral tear and posterior extension (humeral avulsion of the glenohumeral ligament lesion), as well as a chronic superior labral tear. The patient was taken immediately to the emergency department due to persistent left arm pain and numbness after inability to reduce the shoulder on the field. On examination, the left shoulder appeared grossly dislocated and wrist and finger extension weakness were noted, along with generalized numbness throughout the arm. He could not actively flex or extend his left elbow. Imaging revealed an anterior shoulder dislocation, as well as a nondisplaced fracture of the left coracoid and a Hills Sach lesion (Fig. 1). Vascular examination of his upper extremity was normal. Approximately 4 hours after the injury, conscious sedation was able to be administered, and the shoulder dislocation was reduced. On waking up, the patient’s diffuse arm weakness and numbness had improved, but he still had nonregional tingling in his fingertips and 0/5 weakness of elbow, wrist, and finger extension. The patient was discharged in a sling with a plan for clinic follow-up.

By 1 month after the injury, the patient regained triceps function, followed quickly by extensor pollicis longus (EPL) and wrist extension function. At the 2-month follow-up visit, he had 5/5 strength of all muscles (including the rotator cuff, latissimus dorsi, and deltoid), except for 0/5 strength of his triceps, wrist, and finger extensors. There was numbness over the left first dorsal web space in the radial nerve distribution. An MRI of the brachial plexus and an EMG were performed 2 weeks after the injury. The MRI revealed no detectable damage to the plexus or the radial nerve, which was noted to be in continuity (Fig. 2), yet the EMG demonstrated fibrillations in the radial nerve muscles, including triceps, but was normal elsewhere. The decision was made to observe for nerve recovery, and hand therapy was started.

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triceps strength as well as 5/5 extensor carpi radialis longus and extensor carpi radialis brevis strength. His EPL was 4/5; interestingly, the extensor carpi ulnaris (ECU), extensor digitorum communis (EDC), and extensor digiti minimi (EDM) were 3/5. He continued to recover his radial nerve power, with EDM and ECU strength eventually reaching 4/5 by 6 months after the injury. Since he desired to return to play, he underwent arthroscopic instability repair, labral repair, rotator cuff repair, and capsular tenodesis approximately 5 months after the injury. Given the nerve injury, a peripheral nerve block was not performed, and general anesthesia was used with standard patient positioning for arthroscopic repair. After the arthroscopic surgery, he recovered his motion well, with no new nerve issues after surgery.

Upon final follow-up, the patient was 16 months out from the initial injury. He had regained full 5/5 strength of all of his wrist and finger extensors. The difficulty he had with overhead activities from his labral tear had resolved after his surgery and subsequent therapy. He only reported occasional numbness in the arm with collisions during football practice, which he had resumed several months prior.

Discussion

Isolated radial nerve palsies are rare complications associated with glenohumeral dislocations. Robinson et al.⁴ found that 13.5% of dislocations were accompanied by a persistent neurologic deficit, and 90.5% of these were mononeuropathies. Of these, the axillary nerve was most commonly damaged (66.9%), whereas the radial nerve (1.8%) and musculocutaneous nerve (1.2%) were the least commonly damaged. This distribution of nerve injury is consistent with the anatomy of the glenohumeral joint and brachial plexus.

Figure 1. Anteroposterior and scapular-Y radiographs of the left shoulder demonstrate A anteroinferior dislocation of the humeral head with associated Hills Sach lesion and nondisplaced fracture of the coracoid and B interval reduction of the humeral head.

Figure 2. Coronal T2 fat-saturated images from a brachial plexus MRI: A brachial plexus cords at the level of the second part of the axillary artery (dotted circle) and B magnification of same image demonstrating the anatomic relationship of cords relative to the axillary artery (star), with the posterior cord (arrow) located medial, the lateral cord located lateral (arrowhead), and the medial cord located medial (curved arrow).
times as close to the humeral head as the radial nerve, which explains its higher injury rate with shoulder dislocations.\(^7\)

The posterior cord of the brachial plexus is named for its location, which is posterior in relation to the second part of the axillary artery. It typically divides into its terminal branches at the lateral border of the pectoralis minor muscle. However, some variations of posterior cord anatomy in relation to the axillary artery have been described.\(^6\) In our patient, an MRI showed an anatomic variation to the posterior cord in that it was located medial to the second part of the axillary artery and divided into axillary and radial branches behind the pectoralis minor, rather than lateral to it (Fig. 2). It is possible that this variant anatomy accounts for the mechanism of our patient’s isolated radial nerve palsy if it resulted in more tension being placed upon the nerve at the time of dislocation.

Studies of isolated radial nerve palsies after a shoulder dislocation primarily consist of singular case reports. Al-Khateeb et al\(^1\) reported a case of an isolated radial nerve injury in an elderly woman who, after shoulder dislocation, had severe weakness in the radial nerve distribution and no motor function return after 1 year of follow-up. Kastanis et al\(^2\) reported a 56-year-old man with a radial nerve palsy following shoulder dislocation; however, no follow-up beyond 3 weeks after the injury was available. In fact, the rare reports of neurapraxias in the current literature consist of older adults after a low-energy fall, as opposed to our case of a young athlete who sustained a high-impact collision, yet who made a full recovery. The nerve injury could theoretically have occurred from the direct trauma of the collision instead of the dislocation; however, we would expect damage to other aspects of the brachial plexus with such a high-energy trauma.

There is a known decline in peripheral nerve regeneration as patients age and Wallerian degeneration is delayed. Thus, older patients should be counseled that their nerve function may not return as well in that a younger patient.\(^7\) Work-up of these patients should include electrodiagnostic testing such as an EMG. While classic teaching is to wait 3 to 4 weeks after an injury to detect abnormalities, recent literature has shown that these changes are apparent as soon as 1 week after an injury, depending on the injury.\(^8\) With our patient, we decided 2 weeks was appropriate given his examination.

The progression of motor recovery in our patient was unusual as well. A study has determined the typical order of radial nerve muscular branching from proximal to distal to be brachioradialis, extensor carpi radialis longus, extensor carpi radialis brevis, supinator, EDC, ECU, EDM, abductor pollicis longus, extensor pollicis brevis, EPL, and extensor indicis.\(^9\) Although there is certainly variability in this order, the progression of our patient’s motor recovery (EPL before EDC, ECU, and EDM) is unusual, yet serves to remind hand surgeons that nerve damage and recovery should be treated on a case-by-case basis. An additional explanation is that there was likely more damage to the fibers destined for these muscles in the original injury.

Fortunately for this patient, he recovered his triceps and some wrist and hand radial nerve function by 1 month after the injury. Had the patient not recovered any triceps function by 3—4 months after the injury, a surgical exploration of the radial nerve would have been considered. Neurolysis or grafting can be performed if a focal area of nerve injury is discovered. Alternatively, nerve or tendon transfer could be performed in the absence of satisfactory nerve recovery. In order to regain wrist extension, several possible tendon transfers have been studied, the most common being a pronator teres to extensor carpi radialis brevis transfer. For the restoration of thumb extension, palmaris longus or ring finger flexor digitorum superficialis transfers are used most often. In order to regain finger extension, the flexor carpi radialis or flexor carpi ulnaris may be transferred to the EDC.\(^10\) With respect to triceps function, tendon transfers are less successful. Various nerve transfers involving branches of the medial and ulnar nerves have been attempted; however, reports are limited to single-digit case series with limited follow-ups. Fortunately, full recovery did eventually occur in our case, and nerve transfers were not considered. Therapy did help maximize his motion and strength, but in the absence of nerve recovery, hand therapy has limited efficacy.

Summary

In summary, we report a traumatic shoulder dislocation complicated by a high radial nerve palsy, including triceps, in a young football player. The nerve recovered fully by 1 year after the injury without intervention other than therapy, and he was able to return to playing football. The pattern of recovery was somewhat unusual, with the EDM and ECU lagging behind. Isolated radial nerve palsies are rare after glenohumeral dislocations; this case report and review of the literature should help guide treatment in the future.

References

1. Zacchilli MA, Owens BD. Epidemiology of shoulder dislocations presenting to emergency departments in the United States. J Bone Joint Surg Am. 2010;92(3):542–549.
2. Al-Khateeb H, Naser M, Selvanayagam N, Rahman A, Basheer S. Isolated radial nerve injury following anterior shoulder dislocation: case report and literature review. OROAJ. 2017;7(1):33–36.
3. Kastanis G, Kapsetakis P, Velivasakis G, Spyrantis M, Pantouvaki A. Isolated radial nerve palsy as a complication after anterior dislocation of the glenohumeral joint: a case report and clinical review. J Investig Med High Impact Case Rep. 2019;7:2324709619844289.
4. Robinson CM, Shur N, Sharpe T, Ray A, Murray IR. Injuries associated with traumatic anterior glenohumeral dislocations. J Bone Joint Surg Am. 2012;94(1):18–26.
5. Bono CM, Grossman MG, Hochwald N, Tornetta P III. Radical and axillary nerves. Anatomic considerations for humeral fixation. Clin Orthop Relat Res. 2000;370:259–264.
6. Rastogi R, Budhiraja V, Bansal K. Posterior cord of brachial plexus and its branches: anatomical variations and clinical implication. ISRN Anat. 2013;2013:501813.
7. Verdú E, Ceballos D, Vilches JJ, Navarro X. Influence of aging on peripheral nerve function and regeneration. J Peripher Nerv Syst. 2000;5(4):191–208.
8. Mills KR. The basics of electromyography. J Neurol Neurosurg Psychiatry. 2005;76(suppl 2):ii32–ii43.
9. Abramins RA, Ziets RJ, Lieber RL, Botte MJ. Anatomy of the radial nerve motor branches in the forearm. J Hand Surg Am. 1997;22(2):232–237.
10. Sammer DM, Chung KC. Tendon transfers: part I. Principles of transfer and transfers for radial nerve palsy. Plast Reconstr Surg. 2009;123(5):169e–177e.