Luxatio Erecta: Case Series With Review of Diagnostic and Management Principles

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Abstract

We reviewed 11 cases of luxatio erecta (inferior shoulder dislocation) managed acutely at our institutions to gain insight into the diagnostic and management principles of this condition. We then compared our findings with those in the current literature.

Luxatio erecta requires careful clinical and radiographic evaluation and a high index of suspicion for associated injuries, as they occur frequently and can be significant given their tendency to be associated with higher energy trauma. Our results indicate that the majority of patients return to preinjury level of shoulder function, despite associated injuries. Closed reduction constituted definitive management in 100% of the cases in our series, and there was no recurrent instability at follow-up.

Shoulder dislocations account for almost 50% of all large joint dislocations; inferior subtypes account for less than 1% of all cases.[1-3] Inferior dislocations are often referred to as luxatio erecta because the arm is classically held upward or overhead and cannot be lowered, with any movement causing discomfort.[4] The most common mechanism of injury is hyperabduction of the arm that levers the proximal humerus against the acromion or, less common, direct axial load to an abducted extremity causing the humeral head to be driven through the inferior joint capsule.[5,6]

Given the low incidence of inferior shoulder dislocations, there is a paucity of detailed information about presentation, management, outcomes of treatment methods, and associated comorbidities. Inferior shoulder dislocations have been associated with vascular, neurologic, tendinous, and ligamentous injuries.[7,8] According to a meta-analysis of 80 cases of luxatio erecta, 80% of patients also sustained a fracture of the greater tuberosity or a rotator cuff tear, 60% had some degree of neurologic compromise (most commonly axillary nerve palsy), and 3.3% experienced significant vascular compromise.[9]

We reviewed the cases of patients whose inferior shoulder dislocations were managed acutely at our institutions to gain insight into the diagnostic and management principles of this condition. We then compared our findings with those in the current literature.

Materials and Methods

With approval obtained from an institutional review board, we conducted this retrospective investigation at 2 level I trauma centers within an urban university–based orthopedic department. Patients were identified on the basis of a diagnosis of acute, inferior shoulder dislocation, regardless of medical comorbidities and associated traumatic injuries. There were no exclusion criteria. In addition, there was no control group; historical data from other studies were used for statistical comparison of outcomes.

Between 2006 and 2009, 526 patients with acute glenohumeral dislocations presented to the emergency department at our institutions and were treated by an orthopedic consultant. Of these 526 patients, 11 (2%) presented with luxatio erecta. Mean age of the 11 (10 male, 1 female) patients at time of presentation was 44.8 years (range, 22-64 years). Each of these dislocations was managed acutely with closed reduction and the patient under local anesthesia and sedation (general anesthesia was not needed). No patient reported any preinjury shoulder pathology or history of surgical procedures on the injured side, and all 11 reported full active and passive range of motion before dislocation. In each case, standard shoulder trauma radiographs—anteroposterior, scapular lateral, and axillary—were obtained. When an associated fracture was present, computed tomography was performed to assess fracture morphology.

After being administered an intra-articular bolus of lidocaine, patients underwent 1 of 2 closed reduction maneuvers (traction–countertraction, 2-step maneuver). Three patients also received intravenous propofol for conscious sedation during reduction.

Traction–countertraction consists of providing axial traction in line with the humerus followed by a gradual decrease in shoulder abduction.[11] With the patient supine on a locked stretcher, 1 practitioner provides axial traction on the abducted humerus while another practitioner applies countertraction using a sheet

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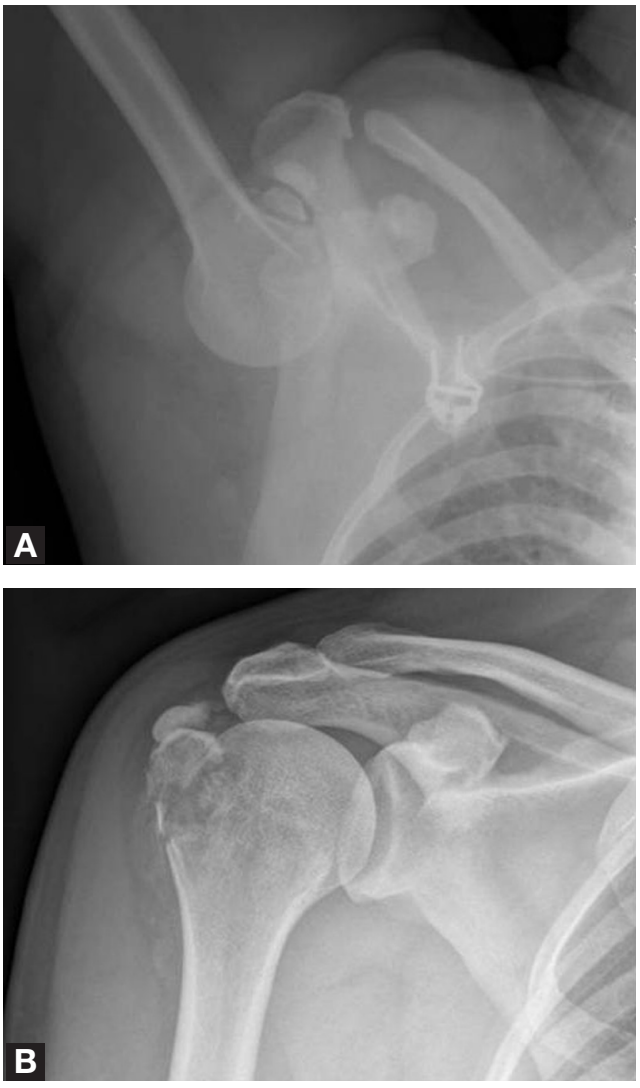

Figure 1. (A) Anteroposterior radiograph of shoulder before reduction shows associated greater tuberosity fracture of humerus. (B) Anteroposterior radiograph of shoulder after closed reduction with associated reduction of greater tuberosity fracture.

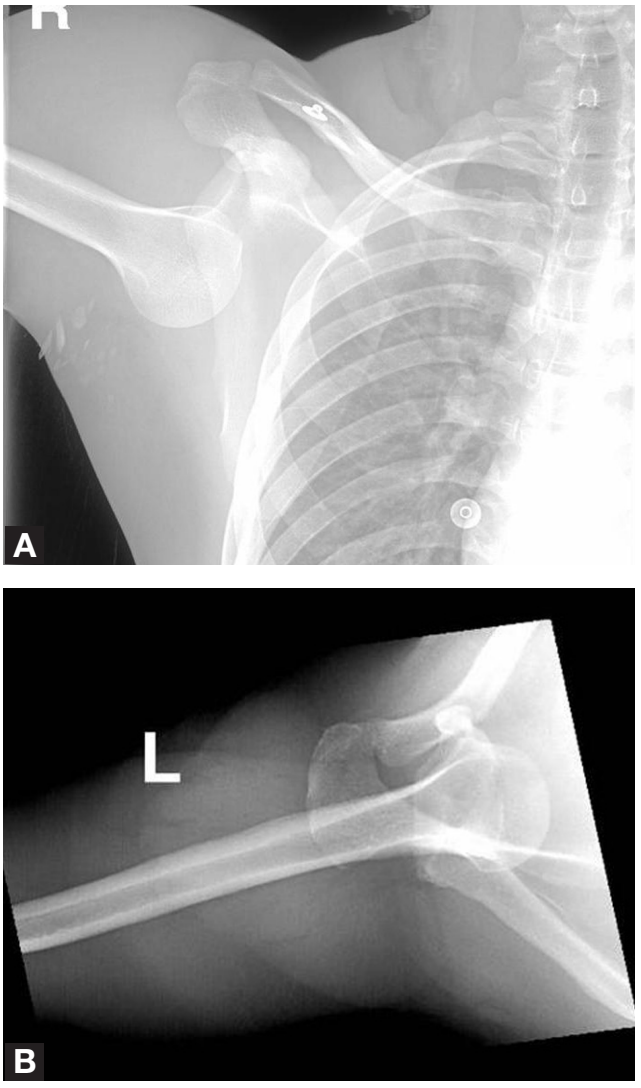

Figure 2. (A) Anteroposterior radiograph of shoulder shows inferior translation of humeral head resting below glenoid. (B) Axillary radiograph of glenohumeral joint with overlap of humeral head over glenoid fossa.

wrapped around the patient's upper torso, such that the force is directed opposite to the traction vector. Slight lateral traction may be applied on the upper humerus to facilitate reduction.[7]

The 2-step maneuver involves converting the humeral head from an inferior dislocation to an anterior dislocation and then reducing the humeral head into the glenoid.[3,12] Initially, 1 hand is placed on the shaft of the humerus and the other hand on the medial condyle. An anteriorly directed force is then applied to the humeral shaft, translating the humeral head from an inferior position to an anterior position, followed by external rotation and traction to reduce the humeral head into the glenoid fossa.[12]

In all cases, radiographs were obtained to confirm glenohumeral reduction and to further evaluate associated fractures. Each patient was placed in an arm sling. Follow-up data were collected by telephone and/or chart review. Patients were asked to report on redislocations, surgical interventions, range of motion, and pain level (satisfactory, unsatisfactory). Two patients were lost to follow-up, and 1 patient expired from pulmonary complications during hospitalization. Mean follow-up for the remaining 8 patients was 16.3 months (range, 1-33 months).

Results

All 11 patients in this series presented with a visually hyperabducted extremity and shoulder pain that did not extend past the distal humerus. Radiographs confirmed inferior glenohumeral dislocation in each patient. The right shoulder was injured in 6 patients and the left shoulder in 5 patients. One patient simultaneously sustained a contralateral anterior dislocation. In 7 patients, high-energy mechanisms of injury were

Table I. Patient Demographics, Range of Motion Data, Neurovascular Examination

Patient	Age, y	Sex	Mechanism of Injury	Follow-Up, mo	Range of Motion, °			Neurovascular Examination
					FE	Abd	ER	
1	46	M	Low-energy fall	NA	NA	NA	NA	Intact
2	47	M	High-energy fall	16	135	90	45	Intact
3	33	M	Motorcycle accident	1	135	90	60	Intact
4	60	M	Pedestrian struck	12	90	75	45	Intact
5	22	M	Motor vehicle collision	2	135	90	45	Intact
6	28	M	Motor vehicle collision	NA	NA	NA	NA	Intact
7	64	M	Low-energy fall	18	180	90	75	Intact
8	38	M	High-energy fall	18	135	90	60	Out
9	64	F	Low-energy fall	NA	NA	NA	NA	Intact
10	55	M	Low-energy fall	30	135	90	75	Out
11	36	M	High-energy fall	33	135	90	75	Intact
Mean	44.8	—	—	16.3	135	88	60	—

Abbreviations: Abd, abduction; ER, external rotation; FE, flexion-extension; NA, not applicable.

Table II. Reduction Method, Pain Level, Redislocation Rate

Patient	Reduction Method	Pain[a] at Recent Follow-Up	Redislocation
1	Traction–countertraction	NA	NA
2	Traction–countertraction	Satisfactory	No
3	Two-step maneuver & conscious sedation	Satisfactory	No
4	Traction–countertraction	Unsatisfactory[b]	No
5	Two-step maneuver	Satisfactory	No
6	Traction–countertraction	Satisfactory	NA
7	Traction–countertraction & conscious sedation	Satisfactory	No
8	Traction–countertraction	Satisfactory	No
9	Traction–countertraction	Satisfactory	NA
10	Traction–countertraction & conscious sedation	Satisfactory	No
11	Traction–countertraction	Satisfactory	No

Abbreviation: NA, not applicable.
[a]For all patients, pain decreased immediately after reduction.
[b]Global pain with restricted motion; patient elected nonsurgical intervention.

involved; in the other 4 patients, comparatively minor trauma occurred (Table I). Before reduction, 9 of the 11 patients were neurovascularly intact. Of the other 2 patients, 1 presented with muscle weakness (C5–T1 nerve distribution) and decreased sensation along the entire upper extremity, with numbness extending distally to the fingertips, and 1 presented with complete paralysis and paresthesias of the upper extremity as well as diminished radial and ulnar pulses ipsilaterally (Table I).

All 11 patients sustained at least 1 additional injury. Six patients had upper extremity fractures, 2 had Hill-Sachs lesions, 1 had a rotator cuff tear, and 2 had neurovascular compromise. The patients with high-energy dislocations ultimately experienced additional injuries, most commonly fractures. There were 4 associated fractures in the 4 patients with low-energy dislocations and 18 associated fractures in the 7 patients with high-energy dislocations. Two of these 22 associated fractures required operative fixation. Ten patients were discharged in improved condition; 1 patient expired in the hospital as a result of concomitant thoracic injuries resulting in cardiopulmonary arrest. All associated injuries about the shoulder were managed nonoperatively (Tables II–IV).

All 11 patients reported immediate pain relief, specifically in the shoulder girdle, after reduction and immobilization. The 9 patients (82%) who were neurovascularly intact before reduction remained so afterward. Of the 2 patients (18%) with neurovascular injuries, 1 regained stronger pulses and motor function after reduction, and 1 experienced improved sensation with resolving numbness and tingling. All patients reported normal sensation and motor function at follow-up. Any motion limitations at most recent follow-up were most notable in abduction (mean, 88°) and external rotation (mean, 60°). Range-of-motion data are summarized in Table I. None of the associated shoulder injuries required operative management, but the concurrent injuries on the ipsilateral shoulder delayed recovery of shoulder function in comparison with patients who had isolated inferior shoulder dislocations.

One patient died of pulmonary causes, and 2 were not available for long-term follow-up. Of the 8 patients we contacted for this study, none reported residual or recurrent instability of the involved shoulder, and none underwent surgical intervention on the affected upper extremity.

Table III. Immobilization Method, Associated Upper Extremity Injuries

Patient	Immobilization[a]	Associated Upper Extremity Injuries
1	Sling	NA
2	Sling	NA
3	Sling/swathe	Left scapula fracture, left clavicle fracture
4	Sling	NA
5	Sling	NA
6	Sling	Right greater tuberosity fracture, left glenoid fracture, left scapula fracture
7	Sling	Left anterior shoulder dislocation, right bony Bankart lesion
8	Sling	Left greater tuberosity fracture, left rotator cuff tear (partial supraspinatus)
9	Sling	Left greater tuberosity fracture, left Hill-Sachs lesion, left lateral epicondylar humerus fracture
10	Sling	Right greater tuberosity fracture, right acromioclavicular joint arthritis at follow-up
11	Sling	Left Hill-Sachs lesion

Abbreviation: NA, not applicable.
[a]No patient underwent shoulder surgery.

Table IV. Concomitant Injuries

Patient	Other Orthopedic Injuries	Other Nonorthopedic Injuries
1	Right thigh muscle contusion	NA
2	Left pelvic fracture, left rib fractures	Left renal laceration
3	NA	NA
4	Right open femur fracture, left tibia/fibula fracture, left pelvic fracture	Scrotal hematoma, right leg vascular injury, above-knee amputation
5	Bilateral tibia/fibula fractures	NA
6	Right rib fractures	Facial fractures, right pulmonary contusion, dilated pulmonary artery (inpatient mortality)
7	NA	NA
8	NA	NA
9	NA	NA
10	NA	Left orbital wall fracture, subdural hematoma
11	NA	NA

Abbreviation: NA, not applicable.

Discussion

We have presented a case series of 11 patients with luxatio erecta to better define associated injury patterns and natural history. On initial presentation, each patient had a visibly displaced shoulder with obvious deformity. The deformity, a shoulder with prominence of the acromion and a subacromial sulcus laterally, has been described as having a square appearance.[3,13] Before reduction, patients could not move the arm from its presenting position (flexed and abducted with forearm reaching toward the back). Patient and clinician attempts to lower the arm elicited severe pain. A minority of our patients (18%) reported of upper extremity paresthesias.

The mechanism of injury for a traumatic, acute, inferior shoulder dislocation has been described as a multistage process.[3,14] Initially, a hyperabduction force imparted to the upper extremity leads to a levering of the proximal humerus over the acromion and out of the glenohumeral joint. This is typically followed by impaction of the superolateral aspect of the humeral head against the inferior glenoid rim. Finally, with higher energy injuries, the humeral head can overcome the inferior glenoid rim and come to settle in the infraglenoid region. Given this injury pattern, it is not unusual for patients to sustain associated injuries to the inferior glenoid and humerus—specifically, superolateral humeral head impression fractures and bony Bankart lesions[3,9] (Figures 1A, 1B). In addition, most patients are likely to present after a higher energy mechanism of injury given the significant force required to lever the humeral head out of the glenohumeral joint in an inferior direction. This may lead to other orthopedic and nonorthopedic injuries causing associated morbidity and mortality.

Obtaining a complete radiographic shoulder trauma series is the most effective means of evaluating this injury pattern.[12,15,16] On anteroposterior radiograph, the humeral head is typically translated below the glenoid fossa, while the shaft of the humerus is pointed upward and rotated (Figure 2A). On axillary radiograph, the humeral head appears overlapping the glenoid (Figure 2B).

Recently, Groh and colleagues[17] evaluated 18 patients after traumatic inferior shoulder dislocation. Mean follow-up was 9 years. Eighty-three percent of the patients had good to excellent treatment outcomes, and none of the associated neurovascular injuries affected final outcomes. Only half of the patients required closed reduction for definitive care. In their meta-analysis of 80 cases, Mallon and colleagues[9] found that 80% of patients sustained a fracture of the greater tuberosity or a rotator cuff tear and 60% had some degree of neurologic compromise. Typically, however, these injuries resolved

within 1 year. Our study results support those of Groh and colleagues[17] and Mallon and colleagues.[9] Almost all patients achieved good strength and motion with nonoperative management, and associated neurologic and vascular injuries did not affect final outcomes. There was no direct association between age and comorbidities sustained during injuries.

Although all patients in our series were successfully treated with closed reduction, these techniques can be ineffective when the humeral head buttonholes through the inferior capsule and the soft-tissue envelope. In such cases, open reduction and repair of the injured structures would be required.[11]

In summary, luxatio erecta requires careful clinical and radiographic evaluation and a high index of suspicion for associated injuries, as they occur frequently and can be significant given their tendency to be associated with higher energy trauma. Our results indicate that the majority of patients return to preinjury level of shoulder function, despite associated injuries. Closed reduction constituted definitive management in 100% of the cases in our series, and there was no recurrent instability at follow-up.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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