Surgical treatment for recurrent inferior shoulder dislocation with greater tuberosity fracture and rotator cuff tear: a case report

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Article info

Keywords:
Inferior shoulder dislocation
recurrent instability
greater tuberosity fracture
rotator cuff tear
surgery

Background

Inferior shoulder dislocation is a rare type of dislocation that constitutes approximately 0.5% of all cases of shoulder dislocation. Inferior shoulder dislocation is usually treated conservatively after closed reduction. However, the incidence of recurrent instability after initial dislocation remains unknown, and the factors affecting recurrent instability are also unclear. In addition, it is known that inferior shoulder dislocation is associated with a high incidence of concomitant greater tuberosity fracture and rotator cuff tear, but little has been reported on the treatment for inferior shoulder dislocation complicated with concomitant greater tuberosity fracture or rotator cuff tear.

Herein, we report a case of recurrent inferior shoulder dislocation with concomitant greater tuberosity fracture and rotator cuff tear. This case highlights that surgical restoration of the force couple toward the humeral head by reducing the greater tuberosity fracture and suturing the rotator cuff could improve inferior shoulder instability.

Case Presentation

A 63-year-old man fell from a height during carpentry work and presented to the emergency department of the hospital where this study was performed. No significant medical history was noted. Examination revealed that his right shoulder joint was locked in 150° of abduction; thus, it was difficult to move the shoulder. There were no findings suggestive of nerve or vascular injury. Plain radiographs revealed inferior dislocation of the right glenohumeral joint (Fig. 1, A). Inferior dislocation was reduced using Nho’s 2-step closed reduction maneuver, which involves conversion of the inferior dislocation to an anterior dislocation, followed by lateral or external rotation of the glenohumeral joint. Plain radiographs obtained after reduction revealed appropriate reduction of the dislocation; however, an avulsion fracture of the greater tuberosity of the humerus was identified (Fig. 1, B). After reduction, the arm was immobilized in a sling in adduction to the chest. During removing and putting on clothes, however, dislocation recurred 3 times within 2 weeks. Computed tomography performed at the dislocated position revealed inferior dislocation of the glenohumeral joint through the bone defect caused by the greater tuberosity avulsion fracture (Fig. 2). Physical examination 2 weeks after reduction showed negative anterior apprehension and relocation tests, as well as a negative sulcus sign. However, the patient experienced inferior instability of the shoulder joint when the shoulder was elevated to ≥90°. Magnetic resonance imaging revealed a greater tuberosity fracture at the insertion of the infraspinatus tendon (Fig. 3, A) and a full-thickness tear of the supraspinatus tendon (Fig. 3, B). Significant capsulolabral injury was not found (Fig. 3, C).

Because we considered that inferior glenohumeral instability was due to the bone defect caused by the greater tuberosity avulsion fracture and complete tear of the supraspinatus tendon, reduction and fixation of the greater tuberosity fracture and repair of the supraspinatus using suture anchors was planned 2 weeks after initial dislocation. When greater tuberosity fracture is fixed by suture anchors, the position of anchors is more inferior than rotator cuff repair, and anchor insertion involves the risk of causing iatrogenic fracture of the fractured greater tuberosity. Because an arthroscopic procedure would have been technically demanding, we decided to...
perform open surgery for secure fixation of the fracture. Through the deltoid-split approach, the complete tear of the supraspinatus tendon and avulsion fracture of the greater tuberosity were identified. After clearing the greater tuberosity bone fragments that were adherent to the infraspinatus tendon (Fig. 4, A), the greater tuberosity bone fragment was reduced and fixed back to its anatomic position through the infraspinatus tendon using suture anchors (Fig. 4, B). The completely torn supraspinatus tendon was also repaired using the suture bridge method (Fig. 4, C). Postoperatively, the patient was immobilized in an abduction brace for 6 weeks. Passive range-of-motion training was initiated 3 days after surgery, whereas active range-of-motion training was initiated 6 weeks postoperatively. No recurrent dislocation or instability was noted, and union of the avulsed greater tuberosity fragments was complete 10 months postoperatively. Active range of motion of the affected vs. unaffected side was 135° vs. 150° for elevation, thoracic vertebra 5 vs.

Figure 1 Plain radiographs of the right shoulder. (A) Initial radiographs showing inferior dislocation of the right shoulder. (B) Radiographs obtained after closed reduction showing successful reduction of the shoulder dislocation, with an avulsion fracture of the greater tuberosity.

Figure 2 Computed tomographic images obtained during shoulder dislocation showing that the avulsion fracture of the greater tuberosity became the dislocation pathway causing inferior dislocation of the humeral head (A and B).
thoracic vertebra 3 for internal rotation, and 40° vs. 40° for external rotation with the arm at the side.

**Discussion**

This case highlights 2 clinical issues. First, our case suggested that concomitant greater tuberosity avulsion fracture and rotator cuff tear may cause inferior instability of the glenohumeral joint after inferior dislocation. A meta-analysis of 80 cases of inferior dislocation reported that 80% of the patients presented with a rotator cuff tear or a greater tuberosity fracture.9 However, because of the rarity of inferior glenohumeral dislocation, the recurrent dislocation rate and the factors affecting recurrent instability remain unclear. Cift et al1 and Murray et al10 reported favorable results with early reduction and 3 weeks of Velpeau sling fixation, and Davids et al2 reported that recurrent episodes of inferior dislocation are extremely rare. However, a few other studies reported that recurrent instability was observed in 44%5 and 79%16 of the patients with inferior dislocation, suggesting that inferior shoulder dislocation is associated with poor prognosis. In the present case, inferior instability occurred when the affected shoulder was elevated to >90°, even after reduction. Computed tomography at the dislocated position revealed that the avulsion fracture of the greater tuberosity became the dislocation pathway causing inferior dislocation of the humeral head. This suggests that in patients with inferior shoulder dislocation, bone defects of the greater tuberosity could adversely worsen instability via a mechanism similar to a Hill-Sachs lesion observed in patients

![Figure 3](image1.png)

Figure 3 Magnetic resonance imaging of the right shoulder. Fat-suppressed T2-weighted images obtained in the oblique coronal plane showing (A) a fracture of the greater tuberosity at the insertion of the infraspinatus tendon and (B) a complete tear of the supraspinatus tendon. (C) Fat-suppressed T2-weighted image obtained in the axial plane showing no obvious capsulolabral injury.

![Figure 4](image2.png)

Figure 4 Intraoperative images showing findings of the right shoulder. The infraspinatus tendon (*) is observed to be continuous with the fracture fragment (→). (A) After the greater tuberosity bone fragments adherent to the infraspinatus tendon are cleared, (B) the infraspinatus tendon and the greater tuberosity bone fragments are reduced and fixed together using suture anchors (▶). (C) The completely torn supraspinatus tendon (**) is sutured using the suture bridge method.
Acknowledgment

Table I

Summary of previous studies describing the surgical treatment of inferior shoulder dislocation

| Author                        | Recurrent instability | Associated injury                  | Operation                             | Postoperative instability |
|-------------------------------|-----------------------|------------------------------------|---------------------------------------|---------------------------|
| Schai and Hintermann17 (1998) | +                     | GT fx                              | ORIF of GT fx                          | —                         |
|                               |                       | + Bankart lesion                   | + Bankart repair                       | (1 yr)                    |
|                               |                       | + SLAP                             | + SLAP repair                          |                           |
|                               |                       | Bankart lesion                     | Bankart repair                         | —                         |
|                               |                       | + SLAP                             | + SLAP repair                          |                           |
| Tracy and Myer14 (2009)       | +                     | 2 cases: none                      | Capsular reconstruction                |                           |
|                               |                       | 3 cases: nerve                     | Not described                          |                           |
|                               |                       | 1 case: nerve + GT fx               | Not described                          |                           |
| Groh et al (2010)             | +                     | 1 case: nerve + RC tear            | Capsular reconstruction + RC repair    |                           |
| Pandey et al12 (2015)         | Not described         | RC tear                            | A/S RC repair                          | —                         |
| Present case                  | +                     | + LHB subluxation                  | ORIF of GT fx + RC repair              | (13 mo)                   |

ND, not described; GT, greater tubercle; fx, fracture; SLAP, superior labral tear from anterior to posterior; RC, rotator cuff; LHB, long head of the biceps tendon; ORIF, open reduction internal fixation; A/S, arthroscopic; +, instability present; —, no instability.

with recurrent anterior dislocation. Moreover, the patient described in this report also sustained a rotator cuff tear. A previous report4 has described that a patient with a rotator cuff tear concomitant with inferior shoulder dislocation experienced recurrent shoulder instability, requiring rotator cuff repair. The compressive force applied to the glenoid by the rotator cuff tendon maintains the humeral head centered on the glenoid and ensures glenohumeral stability against inferior movement,15 which supports the hypothesis that a rotator cuff tear caused by inferior dislocation also may affect inferior instability.

Second, successfully restoring the force couple of the glenohumeral joint integrity improved inferior shoulder instability with rotator cuff repair and greater tuberosity fixation. Previous reports discussing surgical treatment for recurrent inferior shoulder dislocation are summarized in Table 1.5,6,12–14 These reports showed that repair of the concomitant rotator cuff tear, capsulolabral injury, and superior labral tear from anterior to posterior were associated with favorable outcomes. Groh et al5 reported that operative treatment is indicated in patients with associated displaced humeral head fractures or recurrent instability. Although capsulolabral injury was not detected on preoperative magnetic resonance images, we could not completely rule out the lesion in this case. During the surgery, however, inferior instability disappeared after fracture fixation and rotator cuff repair, and we did not perform additional intervention. Surgical reduction of the greater tuberosity fracture and repair of the rotator cuff tear could fortunately lead to good short-term results in this case, but further long-term follow-up is necessary and further studies are needed to clarify the proper treatment for inferior shoulder instability.

Conclusion

This case report described a patient with recurrent instability following inferior shoulder dislocation, which was treated surgically. This case highlights the fact that concomitant greater tuberosity fractures and/or rotator cuff tears following inferior glenohumeral dislocation may cause inferior instability, which needs surgical treatment.

Acknowledgment

Not applicable

Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

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