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Review Article

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Floating Shoulder Review

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Introduction

Floating shoulders are a double disruption injury of the Superior Shoulder Suspensory Complex (SSSC) [1]. Traditionally, in a floating shoulder the neck of the scapula and the distal clavicle are fractured but the definition has evolved to include concurrent tears of the coracoacromial and acromioclavicular ligaments [2, 3]. This injury is very rare, with incidence having been defined as being roughly 0.1% [4, 5]. The majority of these injuries are often caused by a high energy trauma, usually motor vehicle crashes [6]. However, they may also be caused by other mechanisms, including fall from height, motorcycle accidents, bicycle accidents, and gunshot wounds [7].

Anatomy Of a Floating Shoulder and Injury Etiology

The Superior Shoulder Suspensory Complex (SSSC) is an osseous-ligamentous ring that is the sole articulation of the upper extremity with the axial skeleton and supports suspension of the upper extremity [1]. The ring is composed of the coracoclavicular ligament, coracoid process, glenoid process, acromial process, acromioclavicular joint, and the distal third of the clavicle [1]. This ring, along with the support of the coracoacromial ligament, permits movement and grants stability of the upper member [1]. Through the clavicle, it also serves as the sole articulation of the upper extremity to the axial skeleton [3]. Furthermore, its components serve as insertions and origins for various tendons and ligaments, as well as contributing the sole articulation of the upper extremity with the axial skeleton via the clavicle.

Fractures of the scapula can be sorted into 3 unique patterns: fractures of the surgical neck, fractures of the anatomical neck, and transspinous fractures of the scapular neck [8, 9]. Fractures of the surgical neck of the scapula are the most common fractures of the scapular neck [8, 9]. The fracture line travels from the scapular notch to the supraglenoid notch [8, 9]. Fractures of the anatomical neck of the scapula are very rare [8-10]. These fractures travel from the coracoglenoid notch to the inferior border of the glenoid fossa [8, 9]. Transspinous fractures of the scapular neck are fractures that travel from the lateral border of the scapula across the central part of the scapular spine towards the upper angle [11]. These fractures are a transition between scapular neck fractures and scapular body fractures.

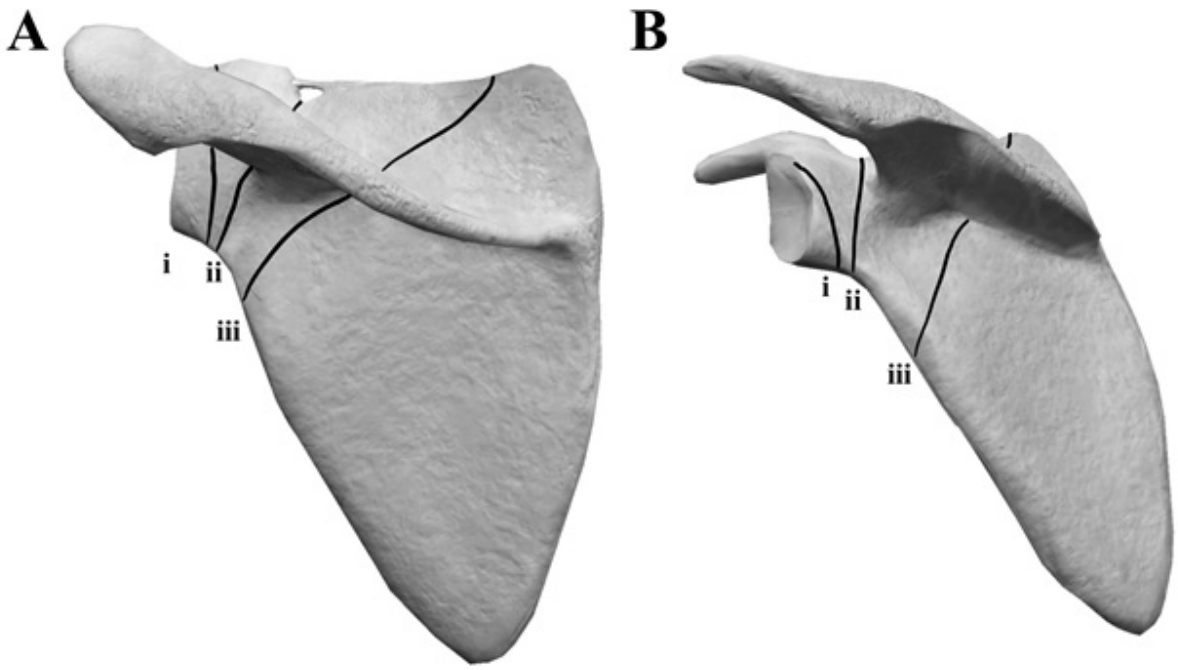

Figure 1: A) Image of scapular fractures from posterior view. B) Image of scapular fractures from oblique view. i) fracture of anatomical neck, ii) fracture of surgical neck, iii) transspinous fracture.

A double disruption of the SSSC is an injury that fractures or tears two of the above components [3]. Double disruption injuries often affect the stability of the shoulder, and are particularly important to treat [12]. A floating shoulder is a specific pattern of double disruption that involves fractures of the ipsilateral scapular neck and the distal third of the clavicle [13]. More recently, the definition has evolved to consider ligament compromise in addition to the aforementioned fracture pattern, namely the coracoacromial and acromioclavicular ligaments [3]. A floating shoulder is unstable and typically presents with a distally displaced and internally rotated shoulder [14].

Risk Factors

Because of how rare floating shoulders are, the indications for how to treat a floating shoulder are not definitive [15]. Often, the indication for surgery depends on the patient's state, and the severity of the fracture [16]. One factor regarding the severity of a floating shoulder is the glenopolar angle (GPA) [17]. The GPA is the angle between 2 lines; a line from the most inferior point on the glenoid cavity to the most superior point on the glenoid cavity, and a line from the most superior point on the glenoid cavity to the inferior angle of the scapula, with a normal value between 30 and 45 degrees [18]. Multiple studies have concluded that a GPA of less than 20 degrees was associated with more pain for patients and had worse long term functional outcomes [9]. Morey et al. is a comprehensive literature review that investigated the differences in operative and conservative treatments of a floating shoulder [19]. This review concluded that correction of the GPA, especially when greater than 20 degrees, is critical in achieving beneficial long-term outcomes, and suggested that surgical treatment should be preferred if the GPA is outside of the normal range [19].

Additionally, the displacement of the scapular neck is another important factor in determining the severity of the injury. However, it is unclear what the cutoff for displacement is in severe injury. Dombrowsky et al. conducted a systematic review of the literature and concluded that in minimally displaced scapulas, conservative treatment is very effective [7]. Additionally, surgery of the clavicle and scapula yielded better outcomes than conservative treatment when there was a significant displacement of the scapula greater than 20-25 mm [7]. However, this study was unable to identify a definitive cutoff for significant displacement [7].

Treatment of Floating shoulders

The treatment of floating shoulders is determined by both the GPA and the severity of displacement [19]. In cases with a minimally displaced surgical neck, patients frequently receive conservative treatment [20]. In fractures with a significantly displaced surgical neck or with an abnormal GPA, surgical fixation is often performed [19]. In many cases, internal fixation of the clavicle alone is sufficient to correct the abnormal GPA and reduce the displacement of the scapular neck [21]. However, if normal scapular anatomy is not restored with fixation of the clavicle, scapular surgery is also required [19]. Of note is that fixation of the clavicle provides earlier stability to the shoulder and allows the patient to begin physical therapy more quickly than in conservative treatment [20]. This

might contribute to patients treated surgically having better long-term outcomes [7, 20, 22].

Complications

Floating shoulders are complicated injuries that are frequently associated with neurovascular damage of the axillary artery and brachial plexus [23-25]. In cases of significant displacement, complications with healing, functional deficits, and degenerative joint disease may arise [12]. Surgical treatment of floating shoulders is much more likely to yield better functional outcomes overall [7, 12]. Although the most common complication of surgical fixation of a floating shoulder is infection, the surgery rarely has any complications [26-27].

Guidelines for a significant displacement

Recently, many cases have been published that suggest that the size of a significant displacement should be 10-15 mm rather than 20-25 mm. Vidovic et al. also established that in floating shoulders, surgery was indicated when displacement of the scapular neck was greater than 10 mm [26]. Additionally, Chapus-Reyna et al. presented a case study of a patient with a floating shoulder injury that featured a 13mm who received surgical treatment and had favorable functional outcomes 8 weeks after treatment [28].

Larger studies have also been conducted with indications for surgery including the scapular neck displacement is greater than 10 mm rather than 25 mm. Gaurav et al. was a retrospective observational study of 20 patients with displaced floating shoulders [29]. These patients were treated with fixation of both the clavicle and scapula with scapular neck displacement greater than 10 mm and GPA less than 30 degrees [29]. After at least 9 months of follow up, 15 of these patients had Oxford Shoulder scores of greater than 40, indicating satisfactory function, and 2 patients had scores under 30, which indicates moderate to severe arthritis [29]. They concluded that surgical fixation of the clavicle and scapula in significantly displaced floating shoulder injuries resulted in favorable long-term outcomes [29].

Shaik et al. studied 15 patients with floating shoulders [30]. 12 were treated surgically with methods ranging from fixation of just the clavicle, just the scapula or both [30]. Surgical indications included a displacement of a scapular neck fracture greater than 10mm [30]. Additionally, they conclude that patients undergoing conservative treatment may experience complications of muscle disuse atrophy and shoulder joint adhesions, and that surgery is always preferred if the patient can tolerate it [30].

Biradar et al. aimed to determine the functional recovery of patients undergoing both surgical and conservative treatment by following 24 patients with floating shoulder injuries in a retrospective study.31 Surgical treatment was used on patients with a scapular neck displacement greater than 10 mm, ligament involvement, or if the GPA was less than 20 degrees [31]. Their findings show that there were significantly improved outcomes for the 13 surgical cases than in the 11 non-operative cases.31 They did not find any statistical difference in outcomes between clavicle fixation only, scapula fixation only, or both clavicle and scapula fixation [31]. However, they did find improved range of motion in patients who underwent surgery compared to those who underwent conservative treatment [31].

Conclusion

A floating shoulder is a rare injury that does not have definitive treatment guidelines [15]. Many recent studies define a significant scapular neck displacement as greater than 10 mm. This is in contrast to a recent literature review by Dombrowsky et al. which suggested that a significant scapular neck displacement is greater than 20-25 mm [7]. Further studies are required to establish a more accurate standard of care.

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