A Review of Common Shoulder Injuries: Clavicular Fractures and Anterior Dislocations

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The shoulder complex is an intricate combination of bones, muscles, and ligaments allowing for movement of the arm. The configuration of the shoulder allows it to be very mobile in all planes but due to the complexity of its moving parts as well as their sheer abundance, it is not an apparatus known for stability (Prentice, 2017). The shoulder complex consists of four bones: the clavicle, sternum, humerus and scapula (Prentice, 2017). The accompanying joints and ligaments serve to secure the clavicle to the various processes of the scapula, and the humerus to the glenoid cavity. Sternoclavicular ligaments anchor the clavicle to the manubrium of the sternum via the sternoclavicular joint (Prentice, 2017). Muscles supporting the shoulder complex include the deltoid, latissimus dorsi, pectoralis major, coracobrachialis, and muscles of the rotator cuff (Prentice, 2017). These muscles can contribute to shoulder injuries if they lack strength and range of motion or if they have not been warmed up before engaging in physical activity (Prentice, 2017).

Two of the most common shoulder injuries are clavicular fractures and anterior shoulder dislocations. When assessing these injuries, it is important that the inner workings of the shoulder complex as well as the mechanism of injury are known in order to properly treat the individual and provide sufficient rehabilitation.

Making up 44% of shoulder girdle injuries and 2.6% of all bodily fractures, a broken clavicle is one of the most common fractures an individual can sustain (Postacchini et al., 2002). While there is stipulation regarding the most common incidence of injury, most studies consistently include clavicular fractures in sport/recreation settings in their exploration of the subject (DeFroda et al., 2019; Postacchini et al., 2002). Postacchini et al. (2002) reported traffic accidents to account for 47.5% of clavicular fractures. Typically, a fracture is sustained midshaft but fractures to the distal and medial aspects of the bone have also been seen (Stanley, Trowbridge, & Norris, 1988). 18.9% of cases show that midshaft clavicular fractures also have the potential of being comminuted (Postacchini et al., 2002). Postacchini et al. (2002) suggested that 64.7% of all types of clavicle fractures are displaced, meaning the two separated aspects of the bone are not aligned. The location and type of the fracture, however, is predominantly determined by the mechanism of injury.

In the general population, it is widely believed that the standard mechanism of injury for a clavicular fracture is a fall onto an outstretched hand. While this is the case in some instances, Stanley et al. (1988) show the most common mechanism of injury to be direct trauma sustained in the coronal plane by the ipsilateral shoulder. This mechanism directs compressive force through the acromion process towards the sternum, resulting in a fracture and, in many cases, subsequent displacement (Stanley et al., 1988). Additionally, the S-shape of the clavicle does not aid in efficiently dispersing compressive force and instead weakens the stability of the bone in this motion (Stanley et al., 1988). In rare cases, the direct compressive force is so great that it can cause the coracoclavicular ligament, which functions to secure the clavicle to the coracoid process of the scapula, to rupture while simultaneously causing a fracture (Allman, 1967). When this occurs, the proximal aspect of the fractured clavicle becomes displaced, greater than it would have been, based on compressive force alone. This severe displacement could consequently result in a compound fracture of the clavicle (Allman, 1967). Another common mechanism of injury for clavicle fractures is acute force directed at a specific point of the bone, rather than towards the sternum (Hill et al., 1997). This mechanism would likely result in a transverse, comminuted, or oblique fracture, rather than a compression fracture caused by lateral trauma on the ipsilateral shoulder.

Other mechanisms of force that commonly cause fractures, such as bending and torsion, prove less likely to break the clavicle when compared to compression (Stanley et al., 1988). The likelihood of bending as a mechanism of injury is reduced due to the mobile gilding surface of the sternoclavicular joint in all planes (Stanley et al., 1988). Rotational mobility, up to 50 degrees both anteriorly and posteriorly, limits the amount of excessive torque produced on the clavicle and consequently reduces the likelihood of torsion as a mechanism for injury (Stanley et al., 1988).

The location of a clavicular fracture plays a significant role in determining the best method of treatment. Immediate treatment, however, remains the same regardless of location. According to St. John Ambulance (2019), immediate treatment involves keeping the shoulder as still as possible in a position that is comfortable for the individual, then immobilizing the joint in that position. Immobilization can be accomplished by using a tubular sling technique (St. John Ambulance, 2019). Contrary to a traditional sling, a tube sling allows the individuals' head and chin to be kept in a comfortable position. The body position that a traditional sling encourages stretches the muscles surrounding and attaching to the clavicle, such as the platysma, pectoralis major, and sternocleidomastoid (McKinley et al., 2017). Stretching of these muscles can cause excessive movement and further displacement of the clavicle as well as increased discomfort for the individual. Ice can be applied to the area to help reduce pain until a physician can be seen (St. John Ambulance, 2019). Once the extent of the fracture has been diagnosed by a physician, there are a variety of treatment methods that can be recommended based on the injury's severity.

Current literature suggests more variance in treatment options for midshaft fractures as opposed to fractures of the distal or proximal shaft. Typically, midshaft fractures have been treated conservatively (without surgery) with positive results (Dhakad et al., 2016). The three common conservative treatment methods are a sling, a figure-eight bandage, or a combination of the two (Lenza et al., 2016). There has been some dissension among surgeons as to which method is best, however Lenza et al. (2016) conclude that both methods yield similar results. A sling, worn for four weeks, serves to immobilize the upper arm (Lenza et al., 2016). In this technique, it is suggested the sling should be removed three times per day to allow for movement of the elbow to reduce the likelihood of surrounding muscle atrophy and to prevent stiffness (Lenza et al., 2016). Similarly, the figure-eight bandage is worn for four weeks (Lenza et al., 2016). Unlike the sling, it allows the patient to have movement in the elbow, so the bandage does not have to be removed throughout the day (Lenza et al., 2016).

These conservative methods can also be useful for distal fractures if they have not been displaced or caused damage to the coracoclavicular ligaments (Paladini et al., 2012). Since proximal clavicle fractures are rare and unlikely to be displaced, conservative treatment methods could be used for these as well. In recent years, however, the notion that midshaft clavicular fractures regularly heal conservatively has been challenged, leading to the emergence of a variety of surgical techniques that have subsequently been put into practice (Paladini et al., 2012).

Multiple research studies claim that surgery should be performed if indications such as open fractures, displacement, neurovascular issues or symptomatic non-union are present (Fanter et al., 2015; Lenza et al., 2016; Paladini et al., 2012). Dhakad et al. (2016) recommend that comminuted fractures should also be treated surgically with a plate. Recent literature suggests that external fixation devices have been effective in providing quicker return to activity and pain relief by reducing the soft tissue damage that accompanies an invasive procedure (Lenza et al., 2016; Paladini et al., 2012; Rosu, 2018; Shukla et al., 2014).

Age and activity level also play a role in determining the best treatment method for clavicular fractures. In children, a fractured clavicle can almost always be treated conservatively due to the high healing ability of their younger bones (Fanter et al., 2015). Surgical treatment is becoming more common in active adolescents to unify the broken fragments sooner, allowing for a quicker recovery and a timelier return to play (Fanter et al., 2015; Paladini et al., 2012). Alternatively, conservative treatment measures are suggested for elder individuals who are less active and therefore impose less demand on the shoulder (Shukla et al., 2014).

The rehabilitation process following treatment of clavicle fractures, whether it be conservative or surgical, is focused on regaining function and range of motion of the joint. Lenza et al. (2016) suggest that when the injury is being managed conservatively, the individual should perform forward elevation and external rotation stretches for 30 minutes each day. Pendulum exercises, where the patient leans on a supporting surface with the injured arm hanging and allows the arm to swing forward and back, and side to side, have also been suggested (Lenza et al., 2016). Dhakad et al. (2016) emphasize that following surgery, the shoulder should be immobilized in a sling for two weeks. At the end of this period, passive exercises in the sling, such as the previously discussed pendulum exercises, can be performed. After four to six weeks, active range of motion exercises are allowed with the exception of abduction. After six to eight weeks, active range of motion is allowed in all planes (Lenza et al., 2016). After ten weeks, weight bearing is allowed and encouraged to further establish pain free range of motion (Lenza et al., 2016). It is suggested that athletes refrain from participating in a contact sport for 3 to 5 months following injury to avoid risk of recurrence (Burnham et al., 2016; Paladini et al. 2012). Additionally, throughout the healing process, Lenza et al. (2016) also recommend sleeping with a rolled towel in between the shoulder blades to keep the shoulder complex in a stable position during rest.

Prevention of a clavicular fracture is difficult as the injury is the result of sudden, rapid trauma to the shoulder (Dubowy, 2018). In order to manage the risk of injury, however, there are many precautions that can be taken. With regards to sporting situations, depending on the sport that is being played, proper padding should always be worn that will effectively absorb, dissipate, and reflect all impacts (Dubowy, 2018). Warm up of muscles specific to the sport should be done to increase blood flow and preparedness for the exercise that will occur (Dubowy, 2018). Strengthening of the clavicle's surrounding muscles such as the deltoid, pectoralis major, and trapezius is also important to increase both the strength and stability of the clavicle (Dubowy, 2018; McKinley et al., 2017). Resistance training will help increase the strength of these muscles and proper nutrition with high amounts of calcium and vitamin D will also be beneficial in strengthening the bone (Dubowy, 2018).

In traffic accidents, the most common incidences of clavicle fractures outside of sports, the risk of injury can also be reduced. Wearing a seatbelt will harness the bone and help prevent direct contact with the steering wheel in the event of an accident (“Clavicle Fracture”, 2017). Cars equipped with airbags in the steering wheel and side windows are also beneficial in preventing contact with the wheel or the window, which could cause the compressive force necessary for a fracture (“Clavicle Fracture”, 2017). The precautions given for both sports and non-sports settings will not prevent a clavicular fracture but have the potential to reduce their likelihood. In both sport and everyday settings, full prevention of clavicular fractures is difficult given the mechanism of injury needed to sustain them and the general unpredictability of incidence.

Another common shoulder injury is a dislocation. Shoulder dislocations account for 45% of all dislocations, with anterior shoulder dislocations being the most common (Khiami et al., 2015). Examples of common incidences of anterior shoulder dislocation include: an improper backstroke in swimming, bench pressing, or preventing a backward fall by outstretching the arms (Choulapalle et al., 2015). The similar movements performed in all three activities include arm abduction and external rotation, which are the critical movements required to sustain an anterior shoulder dislocation (Vasiliadis et al., 2019). Additionally, joints can loosen and become unstable due to intrinsic factors such as gender and age. Consequently, rates of recurrence increase and can range from 4 - 96% (Vasiliadis et al., 2019).

The mechanism of an anterior shoulder dislocation forces the humeral head into displacement, which causes the acromion to protrude (Khiami et al., 2015). This leaves the glenoid cavity empty, causing a loss of the shoulder’s round contour (Khiami et al., 2015). Those with hypermobile joints, who can subluxate their humeral heads voluntarily, may have similar looking features in their shoulders as their joint capsules and surrounding ligaments are naturally looser and malleable (Prentice, 2017). Despite the comparable appearance, the displacement of the humeral head in an anterior dislocation is more extreme, with it typically resting slightly inferior to the coracoid process of the scapula while protruding severely (Prentice, 2017).

An initial assessment is required for all injuries and is usually executed by an athletic therapist. For an anterior shoulder dislocation, the first step in treatment is for the individual to place their arm in a comfortable position. A sling is not necessary unless it provides comfort. The purpose of a sling, along with padding under the arm, is to hold the arm in place to avoid movement (St. John Ambulance, 2019). Ice application is also recommended, as it can be a crucial step to “diminish pain, metabolism and muscle spasm, minimizing the inflammatory process and thereby aiding recovery” (Bleakley et al., 2004, p. 251). This initial treatment allows the injury to be more manageable for a physician and reassures the patient when the shoulder is being attended to.

Once the patient is brought to an emergency room, multiple assessments are done to test for increased or decreased sensation in the affected arm, the patient’s capability of performing motor functions, and the colour and temperature of the skin (Khiami, et al., 2015). Following these tests, an X-ray is done to test for any tissue damage or fractures, along with determining the direction of dislocation (Khiami et al., 2015). Afterwards, there are various methods that can be used to reduce the dislocation (return the humeral head to the glenoid cavity). A common procedure to reduce an anterior dislocation is the Milch technique. This procedure involves applying slight traction on the axilla while the arm is externally rotated and abducted (Johnson, Hulse & McGowan, 1992). The final step in treatment is immobilization of the arm in an internally rotated position, which is held in a sling for approximately 3 weeks (Khiami et al., 2015).

After the injury has been assessed by a physician, rehabilitation and reconditioning should begin as early as possible to limit atrophy of the surrounding muscles (Gaballah et al., 2017). Initially, isometric strengthening exercises should be performed to strengthen muscles that function to internally and externally rotate the shoulder. While these exercises are done, the shoulder should rest in a sling comfortably in a fixed position that is relaxed, adducted, and internally rotated (Athwal & Elliott, 2017; Gaballah et al., 2017). An example of isometric shoulder rotation exercises includes using a doorway as an immovable surface with the elbow bent to 90 degrees exerting force into the wall. Surgical tubing, dumbbells and other heavier objects could be incorporated to replace isometric exercises when pain does not impede the movement. This should not take place until later stages of rehabilitation, however, as during the initial stages, internal and external rotational strength should never be greater than 20% of the performer's own body weight (Athwal & Elliott, 2017).

The major goal of rehabilitation is to re-establish the range of motion and strength of an injured joint within the pain tolerance of the athlete. (Miller & Armfield, 2019). Gaballah et al. (2017) examined several athletes with anterior shoulder dislocations and their rehabilitative techniques. The study utilized elastic bands to produce resistive loads and found that "the physical rehabilitation program proposed… was effective at improving strength and range of motion in the injured shoulder" (Gaballah et al., 2017, p. 357) and athletes were cleared to gradually return to play in six weeks.

Healing requires time, and athletes should be eased into full contact play upon their return. Murphy et al. (2019) observed several athletes' rehabilitation processes over eight weeks. Upon returning to play, the athletes were limited in their first game to 50% playing time to "avoid an acute: chronic workload ratio spike and to minimize [their] risk of soft-tissue injury" (Murphy et al., 2019, p.285). Following this initial game, the patients were allowed 75% and then 100% playing time over the next 2 weeks. Typically, between 6 and 8 weeks of management and rehabilitation are required for optimal healing and to prevent defects arising from dislocations such as Bankart, Hill-Sachs and superior labrum anterior/posterior lesions (D'Alessandro et al., 2000; "Gunderson Clinic," n.d.). These complications can arise from weakening of the joint capsule that leads to the creation of a space that the humeral head can slide into. It is also possible that the humeral head can flatten itself as a result of contact with the edge of the glenoid cavity during dislocation and reduce the force required to cause recurrent dislocations (D'Alessandro et al., 2000).

Techniques such as Latarjet stabilization may be used to accelerate recovery for athletes needing to return to play as early as possible. The procedure involves the removal of an area of the coracoid process and its transference to the anterior aspect of the glenoid. The coracoid process, therefore, prevents further dislocation to allow the joint to heal in a more stable position (Murphy et al., 2019). Additionally, ice and electrical stimulation may be used to reduce pain while low-intensity ultrasound can be applied to promote healing. Electrical stimulation also promotes muscle re-education that allows the individual to regain neuromuscular control (Doucet et al., 2012).

Due to the taxing process of shoulder dislocation and rehabilitation, steps should be taken to prevent dislocations or subluxations from ever occurring. However, like most injuries, anterior shoulder dislocations are accidental and unpredictable and as a result, difficult to prevent. The Mayo Clinic of Sports Medicine (2018) recommends three precautions to take to avoid dislocation: be cautious, exercise regularly to maintain both range of motion and strength of the joints and muscles, and wear protective equipment, such as a Duke-Wyre brace, while participating in activities where physical contact may occur.

According to Miller and Armfield (2019), glenohumeral dislocation and subluxation commonly recur in shoulders that have been poorly rehabilitated. Recurrent instabilities of the shoulder often occur after dislocations and “anterior instability accounts for 95% of all recurrent instabilities and usually results after an acute anterior dislocation” (Prentice, 2017 p. 691). Due to this high rate or recurrence, athletes should take steps to reduce risks such as: warming up their muscles adequately prior to activity, not participating if normal function is compromised and, wearing a brace in cases of recurrent shoulder instability (“Gunderson Clinic”, n.d.).

Dellabiancia et al. (2017) used VICON™ motion capture technology to measure the range of motion of the glenohumeral joint of athletes suffering from anterior shoulder instability with, and without, a brace being worn. The group concluded that “the immobilizer achieves the goal of preserving joint stability in the movements that are at risk of dislocation” (Dellabiancia, et al., 2019, p. S159) after observing reduced range of motion when the brace was worn. The previous discussion emphasizes that a suitable method of prevention for recurring anterior glenohumeral dislocations is proper rehabilitation which reduces risk of injury by restoring both range of motion and strength (Miller & Armfield, 2019; Gaballah et al., 2017; Vavken et al., 2014). Improper rehabilitation can exacerbate the likelihood of re-injury to the joint that has already naturally healed in a stretched and weakened position (Provencher et al., 2010).

The shoulder’s mobile nature increases its susceptibility to dislocations and fractures. Preventing shoulder injuries is nearly impossible, but there are many precautions individuals can take to reduce their risks of incidence. Wearing properly fitted equipment, strengthening the muscles of the shoulder, and maintaining a healthy diet and good conditioning can all serve to reduce the likelihood of common shoulder injuries (Dubowy, 2018). Both conservative and surgical methods are effective in treating shoulder injuries, depending on the severity of injury and activity level of the individual. If an injury is sustained, promoting early mobility is essential to regaining function and range of motion. The athlete must be mentally prepared, confident, and competent in performing skills pain-free in order to return to play in a timely manner or get back to performing their normal daily tasks.

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