Acromioclavicular joint dislocation: pathology, diagnosis and management

Kieran O’Sullivan

Summary

Dislocation is the most common injury affecting the acromioclavicular (AC) joint. Six grades of AC joint dislocation are currently described, based on the degree and direction, of displacement. Complete rupture of both the AC and coracoclavicular (CC) ligaments is considered to be necessary before complete grade 3 dislocation of the AC joint can occur. Diagnosis is made on the basis of the clinical history and examination, along with imaging results, with respect to the most common differential diagnoses. The literature indicates that conservative management is the most appropriate for grade 1 and 2 dislocations. Surgery, on the other hand, continues to be advocated for grades 4, 5, and 6. For grade 1 injuries, studies indicate that outcomes are similar for both conservative and surgical management. On this basis, conservative management is now also recommended as the preferred initial choice in grade 3 injuries. Further research is needed to clarify the type of conservative rehabilitation that results in the optimum outcome.

Keywords

Acromioclavicular, dislocation, shoulder, physiotherapy

Introduction

The acromioclavicular (AC) joint is a synovial joint between the posterolaterally-facing clavicle and the anteromedially-facing acromion. The relatively incongruent joint surfaces are variable in precise orientation between subjects and are lined with fibrocartilage in the mature adult. An intra-articular fibrocartilagenous disc, of marked variability in size and shape, may extend inferiorly from the capsule into the joint. The most common injury affecting the AC joint is dislocation, which accounts for approximately ten percent of all shoulder injuries. Twelve percent of shoulder dislocations are dislocations of the AC joint, with the proportion even higher in young athletic populations. However, the prognosis for most patients is considered to be positive.

The primary ligaments supporting the AC joint are the acromioclavicular (AC) and coracoclavicular (CC) ligament complexes. The AC ligaments are thickenings of the thin joint capsule, and have anterior, posterior, superior and inferior bands. The superior part is the strongest and this offers most of the stability to the AC ligament complex. This part is reinforced by fibers from both deltoid and trapezius muscles, and while the exact contribution of these muscle attachments to the dynamic stability is unclear, it is considered that they aid AC joint stability and help prevent dislocation. The CC ligaments, consisting of the postero medial conoid and the anterolateral trapezoid, are the more important stabilizers of the AC joint, and help couple glenohumeral abduction and flexion to scapular rotation, to allow full arm elevation. Approximately 40 to 50 degrees of clavicular rotation occurs during arm elevation, only five to eight degrees of this happens at the AC joint, with the rest of the rotation being combined with simultaneous scapular rotation via the CC ligaments. The CC ligaments provide mainly vertical stability, controlling superior glide, anterior translation and anterior axial rotation of the clavicle. The action of the CC ligaments has been compared to the cruciate ligaments of the knee. Anteroposterior dislocation may be possible if the CC ligaments are intact, however complete rupture of these ligaments appears necessary before superior dislocation of the AC joint can occur. The coracoacromial and sternoclavicular joint ligaments also appear to assist in stabilising the clavicle by constraining clavicular motion at either end.

The aim of this article is to consider all aspects of AC joint dislocation, including pathological, diagnostic and management issues. The current emphasis on evidence-based practice means that physiotherapists must be able to demonstrate diagnostic expertise and to identify the most effective management strategies for each individual patient presentation.

Aetiology

AC joint dislocation occurs as a result of acute direct trauma, especially if the impact is on the point of the shoulder while the arm is adducted. This produces displacement of the acromion medially and inferiorly in relation to the lateral portion of the clavicle. This in turn results in a relative superoposterolateral displacement of the lateral portion of the clavicle. This can occur due to a direct anterior, posterior or lateral blow, a fall onto the outstretched hand or elbow, or rarely as a result of a traction injury of the arm. Inferior dislocation of the distal clavicle is rare. It usually occurs due to a hyperabduction and lateral rotation injury, combined with scapular retraction.

Pathology

The AC ligaments are the main restraint to horizontal translation and posterior axial rotation of the clavicle. In contrast they play only a minimal role in preventing superior translation. Interestingly, suggested that the AC ligaments might be particularly important at small degrees of displacement, with the contribution of the CC ligaments increasing with further displacement. The CC ligaments, especially the conoid...
Clinical tests
There are numerous special tests described as being useful in the assessment of AC joint dysfunction, including the cross-body adduction 'scarf' test, the resisted extension test, O'Brien's 'active compression' tests, and Paxinos sign (figures 1-4). Most research indicates, however, that any of these tests performed in isolation as a stand-alone assessment tool are of limited use. Their reliability is unclear and of greater significance is the fact that they appear to be either highly sensitive but poorly specific (e.g. tenderness on joint palpation, Paxinos sign) or highly specific but poorly sensitive (e.g. O'Brien's test). Instead, it would appear that the most accurate diagnosis is based on evaluation of multiple tests, which appears to increase diagnostic accuracy, as part of the overall subjective and physical examination. Diagnostic accuracy is further improved when these clinical tests are considered in combination with imaging results. Clinicians may consider these clinical tests along with an appropriate outcome measure.

Investigations

X-Ray
X-Ray is the most commonly used modality for assessment of the AC joint, and is used to grade the degree of dislocation. The oblique joint line and the fact that the AC joint requires only half the X-Ray penetration of the glenohumeral joint, can pose difficulties. The injured arm should be unsupported, while comparison with the other side is recommended. Almost 100% of grade 3 injuries have abnormal X-Rays, demonstrating a 25-100% increase in the CC distance (normally approximately 1.3cm) compared with the other side. The examination ideally includes the following:

- 15 degree cephalad anteroposterior (AP) view (avoids the clavicle and acromion being superimposed on the spine of the scapula)
- lateral and axillary views (for AP displacement)
- There is very little evidence to support the use of stress, or weighted, X-Rays, since they do not appear to affect treatment prescription. The relationship between clinical tests results and investigations, including X-ray, has been studied previously and has shown clinical tests to be useful.

MRI (Magnetic Resonance Imaging)
MRI allows detailed evaluation of the AC joint soft tissue structures, particularly the extent of ligamentous damage. Magnetic Resonance Imaging may aid in clarifying prognosis and the differential diagnosis of other pathologies. The relative clinical significance of findings, such as reactive bone oedema compared with degenerative changes, is not fully understood. Although MRI is very sensitive, it is not very specific and its questionable reliability in the evaluation of AC joint pathology, along with the cost involved, limit its use in clinical practice.

Computed Tomography
Computed Tomography facilitates accurate diagnosis of clavicle fractures, with or without joint involvement, as well as joint malalignment, however it is not commonly used currently for assessment of AC dislocations due to problems of availability, cost and radiation exposure.

Other investigations
Bone scans are of use in assessment of AC joint disorders, but are not a first-line imaging tool in AC joint dislocation. Ultrasound can be used in the evaluation of the superficial aspect of the AC joint, and may be helpful in the assessment of the integrity of the fascial attachments. Other investigations occasionally used are arthrography, arthroscopy and injection of local anaesthetic into the AC joint, however the latter is often performed inaccurately and may lead to misdiagnosis.

Management
The management of grade 1 and 2 injuries is well established, with the literature broadly in agreement that conservative management is the most appropriate choice. As regards grade 3 injuries, there has been considerable debate as to whether surgical or conservative treatment results in better outcomes. For grades 4 to 6, surgical repair, rather than conservative management, continues to be advocated due to the severity of the tissue damage and the nature of the displacement. The methodological quality, the populations studied and the outcome measures used vary significantly across trials. These trials will be further discussed separately under the headings of conservative and surgical rehabilitation.

Conservative Rehabilitation
Conservative rehabilitation programmes must take into account the synergistic movement patterns of the AC, sternoclavicular, glenohumeral and scapulothoracic articulations. Type 3-6 dislocations have a significant negative impact on the kinematics and load bearing ability of the AC joint and upper limb, as a result of increased dynamic transitory instability and loss of simultaneous scapular rotation. Current rehabilitation programmes are however limited by the fact that AC joint arthrokinematics during shoulder movement are still not clearly understood and appear to be subject to large inter-individual variation. With this in mind, it is hardly surprising that there is very little evidence regarding the type of conservative management approach that is most effective. In general, a short period of immobilisation, followed by a graded, individualised, home exercise program aimed at restoring ROM, strength, normal patterns of muscle activation and full function is advocated.

Other short-term strategies used include appropriate use of medications, taping/strapping to support the injured area and pain-relieving modalities. The lack of more specific rehabilitation recommendations reflects the lack of appropriate trials comparing different conservative approaches. In patients that undergo surgery following failed conservative treatment, they will undergo postoperative rehabilitation, although existing postoperative protocols are ill-defined and inconsistent. In the past 30 years there has been a major swing from surgical to conservative management of grade 3...
element, provide mainly vertical stability. The trapezoid ligament also resists AC joint compression and may assist the AC ligament in resisting posterior translation. There is considerable debate in the literature as to the exact roles of each part of the CC ligament, and whether they act functionally as one ligament, or separately. Harris et al. stated that the conoid portion of the CC ligament was the main stabilizer during , 'physiologic loads', with the trapezoid portion acting as a secondary stabiliser in 'pathological loads'. Indeed, since the tensile strength of the total CC ligament is not significantly affected by rupture of one of either of the ligaments, their precise function is still queried. The majority of studies into ligamentous function at the AC joint have been undertaken using very small sample sizes and in cadaveric specimens. In addition, the importance of active elements such as the deltoid and trapezius fascial attachments has yet to be investigated.

Three grades of AC joint dislocation were classified by Allman. This has since been expanded to include three more severe injuries, making six grades of AC joint dislocation in total, based on the degree and direction, of displacement (Table 1). Complete rupture of both CC ligaments is considered to be necessary for complete dislocation to occur. While this is the generally accepted classification system, it is not without limitations, including the fact that some severe injuries have been described that did not involve the conoid portion of the CC ligament, indicating the need for better understanding of the nature of this injury.

<table>
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**Table 1. Classification of AC joint dislocation**

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**Table 2. Differential diagnosis of AC joint dislocation**

Glenohumeral dislocation/subluxation.

Os acromionale, where the ossification centres of the acromion and scapular spine fail to fuse.

Associated fracture of the clavicle, upper ribs or coracoid process.

Associated neurologic or vascular injury to the brachial plexus or subclavian vessels.

Rotator cuff or biceps tendon tears.

Distal osteolysis of the clavicle, which typically involves an insidious onset related to a history of prolonged heavy exercise (e.g. weight training).

Referred pain from another area, e.g. the cervical spine.

**Clinical Features**

The most predominant signs and symptoms from reviewing the literature include local shoulder pain along with tenderness over the joint line, the distal clavicle and in the CC space. Range of motion is painful, particularly cross-body adduction, as well as combined abduction and medial rotation. Finally, lying on the painful side, or any traction applied to the upper limb, increases pain. Similar symptoms are present in all injury grades, to a greater or lesser extent. The patient typically presents with the arm held in adduction, supported by the other arm. In milder type 1 and 2 injuries, the CC ligaments cannot adequately compensate for AC ligament rupture and the resultant anteroposterior translational instability, however vertical stability is relatively unaffected on palpation. Both horizontal and vertical instability are present in grade 3 or more severe injuries, allowing for increased passive accessory displacement of the distal clavicle. In grade 3 injuries, deformity is obvious due to the superior prominence of the distal clavicle and "tenting" of the skin may be observed occasionally. This relative superior displacement of the clavicle, in the acute stage, may be due to trapezius muscle spasm, but the main deformity is inferior displacement of the shoulder and arm due to the weight of the arm pulling the acromion inferiorly. Obviously, with grades 4 and 6 the direction of displacement differs.

**Differential Diagnosis**

Diagnosis of AC joint dislocation is made on the basis of the injury history, painful area, asymmetry, local palpation, range of motion (ROM) and imaging studies. Differential diagnosis must include consideration of other conditions or pathologies that may mimic AC joint dislocation, as outlined in Table 2.
clinical tests

There are numerous special tests described as being useful in the assessment of AC joint dysfunction, including the cross-body adduction 'scarf' test, the resisted extension test, O'Brien's 'active compression' tests, and 'Paxinos sign' (figures 1-4). Most research indicates, however, that any of these tests performed in isolation as a stand-alone assessment tool are of limited use. Their reliability is unclear and of greater significance is the fact that they appear to be either highly sensitive but poorly specific (e.g. tenderness on joint palpation, Paxinos sign) or highly specific but poorly sensitive (e.g. O'Brien's test)28. Instead, it would appear that the most accurate diagnosis is based on evaluation of multiple tests, which appears to increase diagnostic accuracy, as part of the overall subjective and physical examination. Diagnostic accuracy is further improved when these clinical tests are considered in combination with imaging results. Clinicians may consider these clinical tests along with an appropriate outcome measure.24,35.

investigations

X-Ray

X-Ray is the most commonly used modality for assessment of the AC joint, and is used to grade the degree of dislocation. The oblique joint line and the fact that the AC joint requires only half the X-Ray penetration of the glenohumeral joint, can pose difficulties.20,36. The injured arm should be unsupported, while comparison with the other side is recommended. Almost 100% of grade 3 injuries have abnormal X-Rays, demonstrating a 25-100% increase in the CC distance (normally approximately 1.3cm) compared with the other side.2 The examination ideally includes the following: 2,38;

1. 15 degree cephalad anteroposterior (AP) view (avoids the clavicle and acromion being superimposed on the spine of the scapula)
2. lateral and axillary views (for AP displacement)

There is very little evidence to support the use of stress, or weighted, X-Rays, since they do not appear to affect treatment prescription.2,12,38,41. The relationship between clinical tests results and investigations, including X-ray, has been studied previously and has shown clinical tests to be useful.

MRI (Magnetic Resonance Imaging)

MRI allows detailed evaluation of the AC joint soft tissue structures, particularly the extent of ligamentous damage.20,34,44. Magnetic Resonance Imaging may aid in clarifying prognosis and the differential diagnosis of other pathologies.25,45. The relative clinical significance of findings, such as reactive bone oedema compared with degenerative changes, is not fully understood. Although MRI is very sensitive, it is not very specific and its questionable reliability in the evaluation of AC joint pathology, along with the cost involved, limit its use in clinical practice.15-48.

Computed Tomography

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management

The management of grade 1 and 2 injuries is well established, with the literature broadly in agreement that conservative management is the most appropriate choice.9,53. As regards grade 3 injuries, there has been considerable debate as to whether surgical or conservative treatment results in better outcomes. For, grades 4 to 6, surgical repair, rather than conservative management, continues to be advocated due to the severity of the tissue damage and the nature of the displacement. The methodological quality, the populations studied and the outcome measures used vary significantly across trials. These trials will be further discussed separately under the headings of conservative and surgical rehabilitation.

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Other short-term strategies used include appropriate use of medications, taping/strapping to support the injured area and pain-relieving modalities.10,62,63. The lack of more specific rehabilitation recommendations reflects the lack of appropriate trials comparing different conservative approaches. In patients that undergo surgery following failed conservative treatment, they will undergo postoperative rehabilitation, although existing postoperative protocols are ill-defined and inconsistent.

In the past 30 years there has been a major swing from surgical to conservative management of grade 3...
dislocations. This change in clinical practice has been based on a number of high quality clinical trials involving large numbers of subjects with clearly defined AC joint dislocations. Conservative treatment does not restore normal anatomy or appearance, but it allows the patient to adapt and rehabilitate more quickly than surgery (figure 5). In many high quality clinical trials comparing surgical and conservative management, the positive outcomes and reduced risks of the conservative approach are consistently evident. A number of existing systematic and literature reviews similarly conclude that conservative management is indicated in the management of grade 3 injuries. Their results indicate that conservative management results in similar (or better) clinical outcomes in pain, ROM and strength, a shorter time to return to work and premorbid functions/activities, less complications and less need for further surgery.

Surgical Rehabilitation

Surgery is no longer advocated in the management of isolated type 1 and 2 injuries. Some authors still claim that surgical repair results in better outcomes in type 3 injuries, however even the studies used to back up this claim found no statistically significant difference in outcome between conservative and surgical approaches, similar to almost all other similar trials. Surgical repair continues to be advocated for grades 4 to 6 due to the severity of the injury. There is some evidence that more severe displacements (greater than 2 cm on x-ray) have a better outcome with surgical repair. There have been, however, very few trials comparing outcomes between conservative and surgical management in these more severe injuries and it would appear to have been assumed that the severity of these dislocations requires surgical intervention. It has yet to be investigated whether, in the absence of significant neurovascular compromise, conservative management may have a role to play in these more severe injuries.

While previously it was thought that surgical fixation would result in reduced overall shoulder ROM due to loss of the normal and necessary clavicular rotation, it now appears that overall ROM is relatively unaffected by surgery. Timing may be important however, in terms of deciding when to opt for surgical repair, if the conservative outcome is sub-optimal. Some authors advocate surgery only in patients with ongoing pain and disability who have already had 3-6 months of conservative rehabilitation. This has to be weighed up against research showing poorer surgical outcomes if the repair is delayed, however this may reflect the fact that the delayed surgery may be used with the more severely disabled patients.

It is difficult to determine clear evidence of the superiority of any one surgical technique over another, with each having their individual advantages and limitations. The suitability of the individual patient presentation is to be considered. Both open and arthroscopic procedures appear to be successful, with arthroscopic possibly affording earlier return to full function and a better cosmetic appearance. Many different surgical approaches are used, with the choice varying between surgeons and the individual patient presentation. Fixation of the clavicle to the coracoid by temporary, short-term (6-8 weeks usually) insertion of screws and/or the use of various synthetic devices is commonly used due to positive outcomes and less complications. Reconstruction (or replication) of the CC ligament, for example by excision of the distal clavicle and transfer of the coracoclavicular ligament is particularly recommended for chronic, painful situations. Transferring tendons and/or muscles (e.g. biceps, coracobrachialis, pectoralis minor, semitendinosus) to reconstruct the CC ligament is only occasionally used, due to the higher complication rate reported in the literature. Finally, procedures aimed at fixing the AC joint, for example with Kirschner wires and occasional suturing of the damaged ligaments, were popular in the past, but recent evidence of high complication rates now limits their use. Complication rates are a significant concern, as research indicates almost 50% of surgical repairs may develop complications aside from visual deformity e.g. pin migration, degenerative arthritis and infection.

Surgical procedures that only minimally disrupt the posterior and superior joint capsule have been advocated by some researchers, as these are the strongest parts of the capsule. Further research comparing the success rates of these surgical approaches is ongoing, but since the evidence for conservative management is so convincing, it is suggested by the author that these trials should perhaps increasingly focus on examining surgical approaches for grades 4-6.

Prognosis

Long-term post-injury outcomes are positive for all grades of injury. The more minor grade 1 and 2 injuries, as expected, have the best prognosis. Residual symptoms and disability are common however, even with these relatively minor injuries, along with significant degenerative changes afterwards. The natural history of type 3 injuries appears to be gradual recovery of full ROM and strength, when compared with the uninjured arm, although residual muscle weakness may remain occasionally. The methods used to assess ROM and strength vary across trials, but the most commonly used include hand-held goniometry (ROM) and include isokinetic testing (strength). It is reported that for grade 3 injuries, 88% of surgical patients and 87% of those managed conservatively report an outcome that is deemed 'satisfactory', although what this constitutes across trials and between individuals is highly variable. There may be some residual clicking, pain on exertion and mild visual deformity. Calvo et al demonstrated that both conservative and surgical approaches to the management of grade 3 injuries resulted in similar clinical outcomes. In addition, the surgical group had a significantly higher incidence of osteoarthritic changes and CC ligament ossification radiographically at follow-up of a minimum of one year later. Based on these findings, they recommended conservative management in all subjects initially. Interestingly, even in the surgical group, only half of the
subjects regained normal anatomical alignment of the AC joint, even though this is mentioned as a major advantage of surgery over conservative management. This, in addition to the fact that the degree of residual displacement does not appear to influence outcome, again emphasises how surgical correction of the deformity may not always be necessary. Even when there clearly has been no difference in outcomes between surgery and conservative management, some authors have still suggested that in young, very active athletes surgery may be necessary. While this may seem appropriate intuitively, there is no evidence to suggest that young, active patients that are conservatively managed do not return to as high a level of function as those who undergo surgery. Instead, the evidence suggests conservative rehabilitation results in recovery similar to surgery and with reduced complications. Therefore it is difficult, based on the evidence, to justify the use of immediate surgery before conservative rehabilitation has been attempted in grade 3 injuries. Unfortunately, there is limited data available to discuss the prognosis after more severe grade 4-6 injuries.

Outcomes
Overall, in terms of return to sport or full function, no particular approach or set of guidelines currently exist on how soon is safe to return. This probably reflects the variety of influencing factors, including injury severity, hand dominance, type and level of sports participation, method of treatment and recurrence. Previous studies have mainly used outcomes relating to patient satisfaction, pain, strength, recurrence rate, ROM and radiographic appearance. The Imatani Score is designed specifically for AC joint injuries, and has been used in research trials, however its reliability and validity have not been established. Therefore, it may be better to use the DASH (Disabilities of the arm, shoulder and hand) score, as it has been proven to be reliable, valid and responsive to change in numerous upper limb disorders, despite not being specifically tested in AC disorders. Considering the young, sporting population affected by this type of injury, it may also be worth examining the length of time until return to sport, in future studies.

Further Research
There remain many unanswered questions as we attempt to understand how best to manage AC joint dislocations. These include getting a clearer understanding of ligamentous function, how the deltoid and trapezius fascial connections contribute to dynamic AC stability, improving the classification system used, improving diagnostic accuracy of clinical tests, evaluating the type of conservative rehabilitation program that is most effective, identifying the length of immobilisation that is optimal, identifying those most likely to require surgery, when a decision to perform surgery should be taken and details on the type and extent of the surgery required.

Conclusion
Acromioclavicular joint dislocations are usually the result of acute shoulder trauma, resulting in rupture of the CC and the AC ligaments. The primary clinical features that present with AC dislocation are obvious asymmetry, localised shoulder pain, pain and stiffness on active movement, weakness, as well as tenderness on palpation. Appropriate investigations, initially X-ray, may aid in accurate diagnosis. Conservative treatment appears to result in similar outcomes as surgical intervention, with reduced risks and complications and is therefore the recommended approach for grades 1-3. Grades 4-6 are currently recommended to undergo surgery. Reliable and valid outcome measures for AC disorders are needed. Further research into the nature of the conservative management that leads to the best outcomes is indicated.

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Figure 1: The cross-body adduction (Scarff) test

Figure 2: The resisted extension test
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