

Nottingham Surgilig - A Novel Device for the Surgical Treatment of Acromioclavicular Dislocation

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Abstract

Acromioclavicular injuries result from a fall onto the point of the shoulder which produces a downward force on the acromion. We describe here the different grades of ACJ disruption together with a concise overview of the current clinical treatment for such injuries. The indications and role of the Nottingham Surgilig prosthetic ligament in the operative treatment of severe ACJ dislocation is discussed. In addition, we present the medium-term clinical outcomes in a local cohort of patients.

We reserve the Nottingham Surgilig as a treatment for severe acute (Rockwood Type 5) ACJ injuries and chronic ACJ separations (Rockwood Type 3 & 5), but particularly for revision reconstruction when the coracoacromial ligament is no longer available.

Acromio-clavicular injuries are common sequelae of falls on to the point of the shoulder and comprise 3-5% of all shoulder girdle injuries¹. Such trauma may tear the acromioclavicular ligaments as well as result in apparent superior subluxation of the clavicle (in fact it is the acromion which displaces downwards).

The forces from the fall can lead to rupture of the coracoclavicular ligaments leading to complete dislocation of the joint. The latter injuries may be classified by severity with a view to guiding treatment, both operative and non-operative. We use Rockwood's classification to facilitate understanding of the indications for surgical treatment². This classification can be applied to both the acute dislocations and those which are old and chronically unreduced³.

The original classification of ACJ injury severity proposed by Tossy et al⁴ comprised grades I-III as determined by the individual structures damaged. Rockwood's classification (Type I-VI) expanded on the latter by further sub-classifying Grade III injuries into types III-VI (See Figure 1).

Type I injuries result from minor strains of the acromioclavicular ligament and joint capsule with minimal displacement. These produce minimal pain and joint stability is preserved. Larger forces may cause a Type II injury involving rupture of the acromioclavicular ligament and joint capsule thereby compromising joint stability predominantly in the anteroposterior plane.

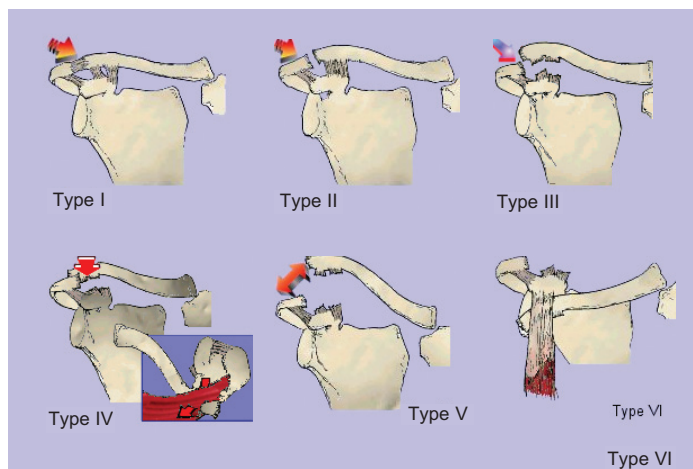


Fig. 1: The Rockwood Classification of Acromioclavicular Injuries (Drawings adapted from Campbell's Operative Orthopaedics⁴)

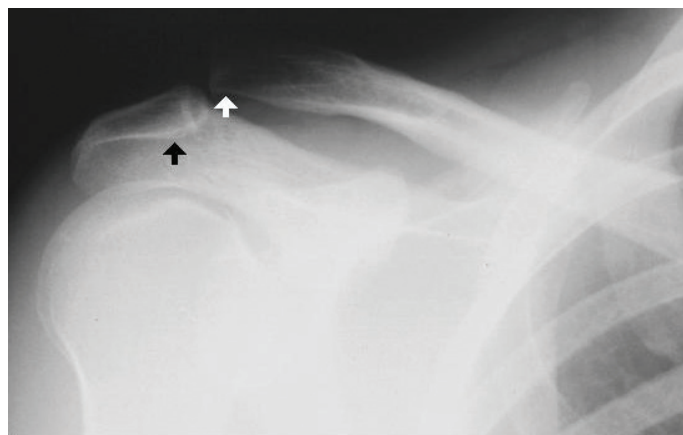


Fig. 2: An AP stress view of the acromioclavicular joint illustrating a Rockwood Type II injury involving subluxation⁵

As illustrated in Figure 1, Type II injuries are essentially limited to subluxation of the ACJ – about half its vertical height and may be apparent radiologically with a stress view being the investigation of choice (see Figure 2). The latter injuries are most often treated conservatively with analgesia, immobilisation in a broad arm sling followed by early mobilisation.

In Type III injuries there is additionally rupture of the coraco-clavicular ligament and minor disruption of the distal clavicular attachment of the deltoid. Here the ACJ is dislocated, with the distal clavicle displaced superiorly relative to the acromion by at least the height of the ACJ, thought to be secondary to depression of the acromion¹. Here, there is more tenderness over the joint and a prominent 'step' in the contour of the clavicle clinically.

Injuries meeting Type IV criterion must include posterior displacement of the clavicle toward or through the trapezius muscle. In this injury the AP radiograph may be remarkably normal but the patient can be very disabled with an inability to raise the arm above shoulder level. More severe trauma may lead to a Type V injury comprising extensive displacement of the clavicle from the acromion together with detachment of both the trapezius and deltoid attachments at the distal half of the clavicle and resulting in the lateral end of the clavicle lying subcutaneously and easily palpable clinically.

Finally, the rarely seen type VI injuries produce gross inferior displacement of the clavicle, which subsequently resides under the coracoid and deep to the conjoined tendons of biceps and coracobrachialis (See Figure 1).

Treatment of the ACJ dislocation present in Rockwood Type III injuries has been a contentious issue and practice varies across centres and individuals. Increasingly, injuries tend to be treated conservatively in the first instance with late reconstruction if required⁴. This method is favoured in our department. Conversely, there is a general consensus that type IV-VI injuries have a poor outcome if managed conservatively and open reduction and internal fixation are required.

Surgical intervention is favoured as it allows an anatomical reduction of the joint and secure fixation permitting earlier shoulder mobilisation over closed techniques. Recognised operative techniques in use can be categorised into several groups and here we list examples within each (See Table 1).

Table 1:
Operative techniques for ACJ reduction with examples

Group	Example
ACJ reduction and fixation	<p><i>Modified Phemister</i>⁶</p> <ul style="list-style-type: none"> • Internal fixation with unthreaded Kirschner-wires followed by mobilisation at 2 weeks. • Carries risk of wire loosening and migration until removed ~8 weeks post-operatively when sufficient time for healing has passed
ACJ reduction, coraco-clavicular ligament repair/reconstruction and coraco-clavicular fixation	<p><i>Modified Bosworth</i>⁴</p> <ul style="list-style-type: none"> • Fixation achieved by drilling a Bosworth screw from clavicle, inferiorly into base of coracoid followed by coraco-clavicular ligament repair with sutures. • Again there is risk of migration and the necessity of a second procedure to remove the screw. Gentle mobilisation after 1 week and screw removal at 8 weeks comprise aftercare.
Distal clavicular excision	<p><i>Mumford & Gurd</i>³</p> <ul style="list-style-type: none"> • Indicated for symptomatic unreduced type II unreduced subluxations. The acromion is sutured to raw end of the clavicle followed by prompt mobilisation after 1 week
Distal clavicular excision with coraco-clavicular ligament reconstruction	<p><i>Weaver-Dunn</i>⁴</p> <ul style="list-style-type: none"> • Coraco-acromial ligament is freed from the acromion and sutured to the remaining end of the clavicle through its intra-medullary canal to achieve reduction. • This procedure relies on a viable coraco-acromial ligament and unavoidably disrupts the coraco-acromial arch. Patient may mobilise after one week in a sling.
Muscle transfers	<ul style="list-style-type: none"> • Coraco-clavicular ligament reconstruction using various soft tissue e.g. free tendon grafts, long head of biceps tendon, fascial grafts⁴
Coraco-clavicular ligament reconstruction with prosthetic ligament	<p><i>The Nottingham Surgilig</i> –</p> <ul style="list-style-type: none"> • Reconstruction achieved using a braided polyester ligament indicated for Rockwood Type V injuries and some Type 3 injuries. With a loop at each end, the prosthetic ligament is looped around the coracoid process, threaded through itself, then passed through around the posterior aspect of the clavicle and anchored with a cortical screw • Immobilisation in a sling for 10-14 days then mobilise as tolerated



Figure 3: The Nottingham Surgilig

The Nottingham Surgilig is specifically indicated as a device for the operative treatment of Rockwood Type V acute acromio-clavicular joint injury and Type III chronic injuries which have failed to settle clinically. The Nottingham Surgilig is particularly appropriate in cases of previously failed ACJ stabilisation, for instance, a failed Weaver-Dunn operation or similar procedure⁷.

The Nottingham Surgilig's braided polyester material has been developed by Surgicraft UK and was launched over 10 years ago in collaboration with our department. The braided polyester material has been modified into a purpose built ligament to provide strong biocompatible fixation that develops good tissue ingrowth.

Clinical Outcomes

We have recently evaluated our medium term clinical outcomes in a local cohort of patients. Eleven male patients (mean age 39 years) have been followed up. Nine of these were classified as Rockwood type III, one as type IV and one as type V. Six were initially treated with a broad-arm sling, three had a failed Weaver-Dunn procedure and two no treatment at all. All patients presented to us with persistent shoulder pain, weakness or clicking and radiological evidence of ACJ dislocation and subsequently proceeded to surgery for insertion of the Nottingham Surgilig prosthetic ligament (See Table 1).

All eleven patients were followed up post-operatively for a mean interval of 55 months. In addition to clinical and radiological assessment, functional outcome was quantitatively assessed via use of the Constant⁸ and Imatani⁹ scoring systems. This cohort yielded a mean Constant scores of 92.3 (Range 64-100). Using the Imatani Score, seven patients were graded seven as excellent, three good and only one as poor. Pain was only an issue in this one "poor" patient who suffered a coracoid fracture associated with "cheese-wiring" of one of the early ligaments. This was sustained during the early recovery phase when, against medical advice, he undertook heavy lifting. This complication has been avoided subsequently by modifying the design of the loop at the coracoid end from a "hard" loop to a "soft" loop.

A completely normal range of motion was restored in nine of the 11 patients, with ten being able to return to their pre-morbid level of activity and employment at a mean time of five weeks. Nine of the 11 patients were completely satisfied with the post-operative improvement in strength and desire to undergo the same operation should a similar problem occur. Radiological assessment revealed minor subluxation in ten patients and moderate in the remaining one (with the coracoid fracture).

Conclusions

The small proportion of patients who have persistent symptoms following conservative treatment for AC dislocations have sparked debate amongst different surgical centres and individuals. Early operative intervention is advocated by some especially for manual workers and athletes since results of early repair have been reported to be superior to those carried out late¹⁰. Our favoured protocol involves initial non-operative treatment of Type III injuries with consideration of surgical options at a later stage should symptoms persist.

In summary, we have used a braided polyester ligament with loops on both ends that confer favourable prosthetic qualities such as mechanical strength and minimal tissue reaction. Reassuringly, independent biological testing has been proved that our ligament could endure enough mechanical strain to permit early postoperative mobilisation¹¹.

Among the multiple operative techniques in use for reducing ACJ dislocation, the Weaver-Dunn technique is widely used and efficacious since the position of the distal clavicle is usually well maintained by the coraco-acromial ligament transfer. Drawbacks however, include the delay in performing resistive shoulder exercises until soft tissue healing is sufficiently advanced at 10-12 weeks. Conversely, using the Nottingham Surgilig, patients are able to resume normal activities from 2 weeks without the need for medium term protection. Indeed, the functional outcome of our technique, 92/100 for the Constant score and 90% excellent or good results⁹, is comparable to other reports^{1,10}.

We conclude that insertion of the Nottingham Surgilig is a useful alternative for the treatment of chronic acromio-clavicular separation

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especially in revision reconstruction when the coraco-acromial ligament is no longer available. In addition, there may be a role for the technique in acute injuries with wide separation at the ACJ. Finally the Nottingham Surgilig was used to provide lateral stability in the world's first ever artificial Clavicle Replacement (Claviculoplasty) performed in Nottingham with a near perfect result at follow-up over two years later.

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