Surgical Treatment of Symptomatic Acromioclavicular Joint Dislocation

Y W Lim, B K Chan

Department of Orthopaedic Surgery, Changi General Hospital Singapore

ABSTRACT

Acromioclavicular dislocation is a common injury affecting the young adult. Its sequalae range from an asymptomatic shoulder with good function to one that is painful has significant loss of strength in the affected upper limb. The management of acromioclavicular joint dislocation has revolved around expert neglect for asymptomatic low-grade dislocation to complex surgical reconstruction (which includes coracoclavicular ligament reconstruction and dynamic muscle transfers) for high-grade dislocation.

We present our experience with the use of a modified Weaver-Dunn procedure in the treatment of grade III-V ACJ dislocation in 10 patients between 1999 and 2001. The dislocation was reduced with a subcoracoid nylon sling through the clavicle and transfer of the acromioclavicular ligament. The mean follow-up period was 46.3 months. The shoulder function was assessed using the University of California Los Angeles (UCLA) shoulder score. The mean preoperative and post-operative UCLA score was 15.6 and 31.8 respectively ($p<0.05$). There was a mean reduction of 10.1mm in the distance measured from the superior border of the clavicle to the superior border of the acromion ($p<0.05$). All the patients returned to their previous occupation. Complications were few and include loss of reduction and keloid formation.

INTRODUCTION

The management of acromioclavicular joint dislocations has revolved around expert neglect to complex surgical reconstruction. To date, analysis of research papers has shown that grade I and II (according to the Rockwood classification) injuries [1, 2] yield good results with conservative treatment [1,3], whereas there is a general consensus that grade IV, V and VI injuries are best treated with surgery. [4,5,6]. The management of grade III injuries, however, remain controversial with proponents for and against surgical treatment.

Address for Correspondence:
Dr YW Lim
Department of Orthopaedic Surgery,
Changi General Hospital, 2 Simei Street 3, Singapore 529889
Fax: 65-62601712
Phone: 65-68503571
Email: yeow_wai_lim@cgh.com.sg

We present our experience with the use of the modified Weaver-Dunn procedure in the treatment of grade III, IV and V acromioclavicular dislocations.

MATERIALS AND METHODS

Between Oct 1999 and Aug 2001, 10 patients with symptomatic high grade (Grade III and above) acromioclavicular dislocations were treated using the modified Weaver- Dunn procedure. The average age of the patients is 35.9 years with a range from 24 to 64 years. There were 9 male and 1 female patients. Six of the operations were performed on the dominant side with four on the non-dominant side. Seven patients were manual workers, two were non-manual workers and one patient was a student. There were 5 patients with Grade III, 1 patient with Grade IV and 4 patients with Grade V acromioclavicular dislocation. The average interval from injury to operation for Grade III injuries was 22.4 weeks with a range of 13 to 36 weeks.

a. Surgical procedure

The patient is positioned supine with the head supported in a "horse-shoe" head holder. The patient is then prepped and draped so as to expose the shoulder up to the mid-clavicle. A tranverse incision centered over the lateral clavicle, acromioclavicular joint and deltoid is made. The trapezius and pectoralis major are then raised from the superior surface of the clavicle as posterior and anterior muscle flaps. Laterally, the anterior deltoid fibres are released from the superior surface of the acromion with a periosteal sleeve using a sharp osteotome. This facilitates the reattachment of the muscle to the acromion in the post-operative period. The coracoacromial ligament is exposed throughout its length and released (together with a piece of bone from the acromion) from the anterior edge of the acromion using a small oscillating saw. The ligament is isolated and freed to its attachment at the coracoid process. Resection of the distal 1.5 to 2.0 cm of the clavicle is then performed. (Diagram 1) The intramedullary cavity of the clavicle is cleared of fatty marrow and 2 drill holes are made in the superior cortex of the clavicle just 1 cm from the lateral edge. In addition, a larger hole is made in the superio-inferior direction using the 4.5 mm drill-bit in line with the coracoid process. (Diagram 2)

A nylon tape is then slung around the coracoid using a right-angled artery forceps. It is imperative to keep as close to the bone so as to avoid injury to the brachial plexus

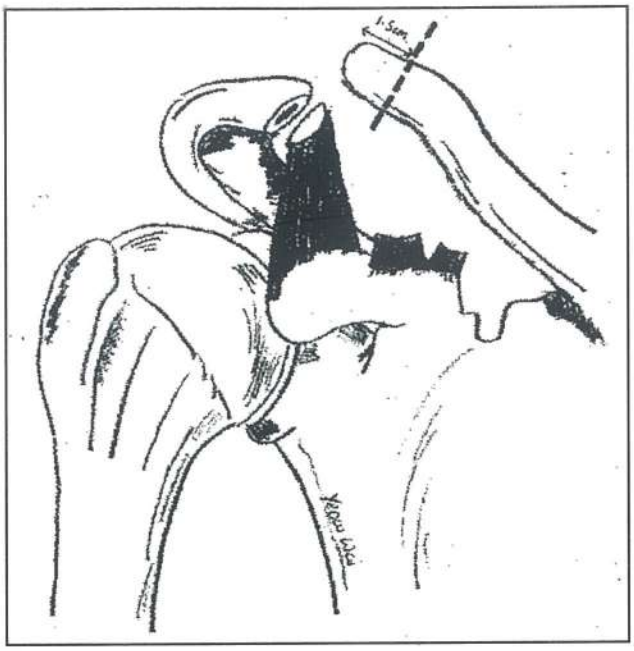


Diagram 1

Diagram 2

medially. The acromion is reduced to the clavicle and the tape is tied down onto the clavicle with one end through the 4.5mm drill hole and the other end passing anterior to the clavicle. The knot of the tape is secured with Ethibond 2/ 0sutures to prevent unravelling and loss of reduction. The coracoacromial ligament is passed in to the intramedullary cavity at the lateral end of the clavicle and secured in place with Ethibond sutures tied over the 2mm drill holes. (Diagram 3) In this way the acromioclavicular joint is stabilized in the coronal plane by the former and sagittal plane by the latter. The trapezius and pectoralis muscle flaps are repaired using PDS II. The anterior deltoid is reattached to the anterior acromion using transosseous Ethibond 0 sutures. No drains were used in the 10 patients.

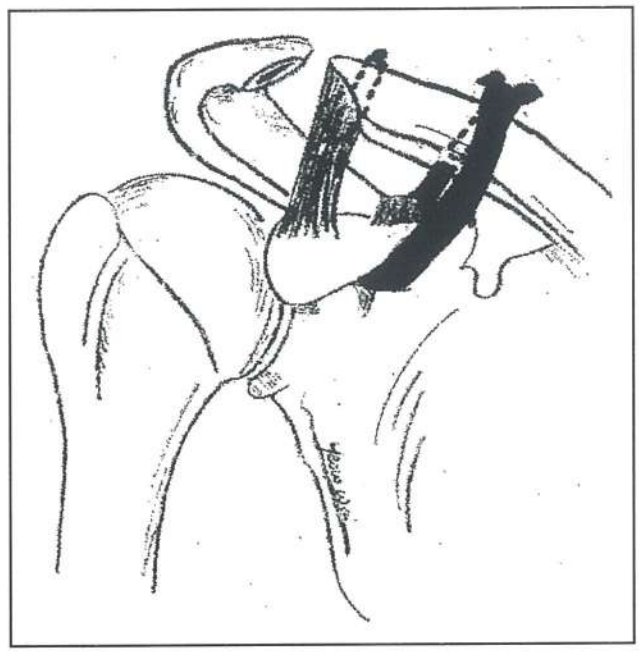


Diagram 3

Postoperatively, the patient's arm is put in a sling for six weeks and gentle pendular exercises are started on the first post-operative day. Passive forward flexion and external rotation of the shoulder are encouraged for the first 4 weeks. At 6 weeks, the sling is discarded and the patient is started on a graduated strengthening program. Heavy lifting and contact sports are avoided for 6 months. These patients are reviewed regularly with radiographs of the affected shoulder.

b. Assessment of function

All the patients were available for clinical, radiological and telephone review after an average follow up period of 46.3 months ranging from 32 to 54 months. Antero-posterior radiographs of the shoulder taken at 1 and 6 months post-operatively were compared to the pre-operative shoulder radiographs. We used the distance from the superior border of the clavicle to the superior border of the acromion to assess the degree of reduction. (Fig 1)

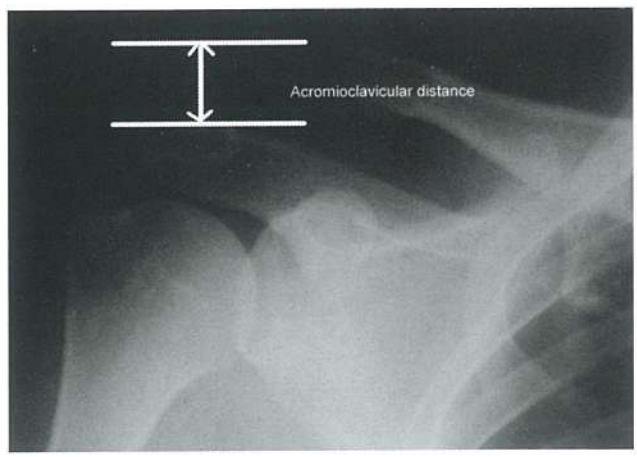


Figure 1

The University of California at Los Angeles Shoulder scoring system was used to compare the shoulder function. (Table 1) In addition, we asked the patients to grade their satisfaction of the surgical result (1-10, with 10 being extremely satisfied)

Table 1

The University of California at Los Angeles Shoulder score

PAIN	SCORE
Present all of the time and unbearable; strong medication frequently	1
Present all of the time but bearable; strong medication occasionally	2
None or little at rest, present during light activities; salicylates frequently	4
Present during heavy or particular activities only; salicylates occasionally	6
Occassional and slight	8
None	
	10
FUNCTION	
Unable to use limb	1
Only light activities possible	2
Able to do light housework or most activities of daily living	4
Most housework, shopping and driving possible; able to do hair, dress and undress	6
Slight restriction only and able to work above the shoulder	8
Normal activities	
ACTIVE FORWARD FLEXION	10
150 degrees or more	5
120 to150 degrees	4
90 to 120 degrees	3
45 to 90 degrees	2
30 to 45 degrees	1
Less than 30 degrees	
STRENGTH ON FORWARD FLEXION	0
Grade 5	5
Grade 4	4
Grade 3	3
Grade 2	2
Grade 1	1
Grade 0	
SATISFACTION OF THE PATIENT	0
Satisfied and better	5
Not satisfied and worse	0
TOTAL	**35**

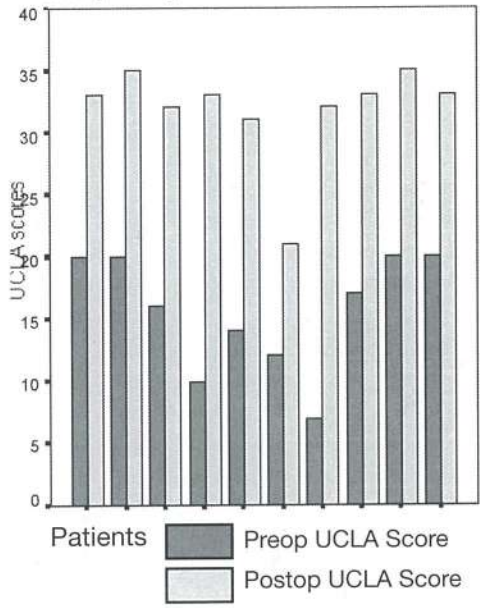
RESULTS

The mean time off work was 8 weeks with a range from 2 to 16 weeks. All the patients were able to return to their previous occupation. One patient, who was a student at the time of injury, went on to join the army (national service). (Table 1)

The average preoperative UCLA score was 15.6 with a range from 7 to 20. The average postoperative UCLA score was 31.8 with a range from 21 to 35. A paired sample T test was done to compare the means between preop and postop UCLA score: the result showed a 99% confidence interval of the difference (-21.0, -11.3). (Fig 2) .

Figure 2

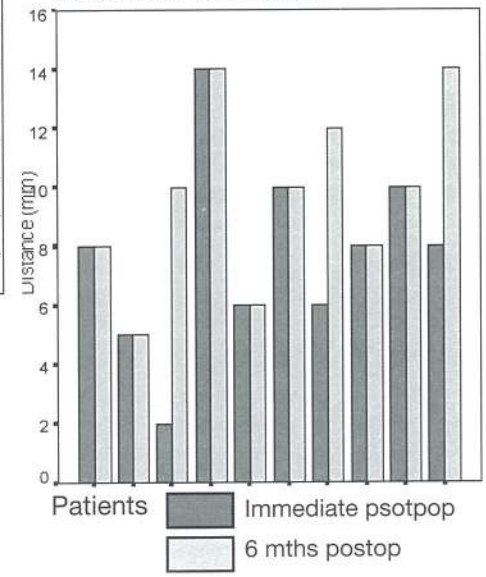
Bar chart comparing the preop and postop UCLA score



The mean reduction in the distance between the superior border of the clavicle to the superior border of the acromion was 10.1 mm with a range from 0 mm to 17mm. On follow-up after 6 months only 3 patients had a loss of reduction of between 6mm to 8mm, with a mean of 6.6mm. There is a 99% confidence interval of the difference in the mean of the preop and postop acromio-clavicular distance (4.9 , 15.3). (Fig 3)

Figure 3

The acromio-clavicular distance measured immediately postop and 6 months postop



The mean score for "pain reduction" was 8.2 with a range from 7 to 10. The mean score for "range of motion" was 9.8 with a range from 8 to 10. The mean score for "strength" was 7.8 with a range of 6 to 10. In terms of "postoperative satisfaction", the mean score was 7.7 with a range from 6 to 9. When asked about their "Functional Activities", nine patients felt that they could do "most" activities and one felt that he could do "all" activities. (Table 2)

Table 2

Patient	Sex	Age	Grade	F/U (mths)	Reduction in distance(mm)	Preop UCLA	Postop UCLA
1	M	31	3	43	12	20	33
2	M	24	3	37	6	17	33
3	M	24	5	54	10	7	32
4	M	27	3	46	13	20	35
5	M	32	5	46	13	10	33
6	M	31	4	51	6	20	33
7	F	53	5	50	15	20	35
8	M	25	3	50	0	16	32
9	M	48	3	32	9	14	31
10	M	64	5	54	17	12	21
Mean		35.9		46.3	10.1	15.6	31.8
Std Dev					5.04		

Patient	Hosp Leave (weeks)	Satisfaction score	Stength score	Range of Motion	Pain Reduction Score	Level of Activity
1	4	7	7	10	8	MOST
2	16	8	9	10	8	MOST
3	2	9	8	10	8	MOST
4	4	9	10	10	10	ALL
5	8	8	7	10	7	MOST
6	12	8	8	10	9	MOST
7	8	8	8	10	8	MOST
8	16	8	8	10	8	MOST
9	2	6.5	6	8	8	MOST
10	8	6	7	10	8	MOST
Mean	8	7.7	7.8	9.8	8.2	
Std Dev		0.98	1.13	0.63	0.79	

c. Complications

3 patients had a loss of reduction of between 6 to 8 mm. There was one patient who was noted to have keloid formation. However, none of the patients complained of an unsightly prominence or worsening of shoulder function. There were no neurovascular injuries, postoperative infection, prominent knots or iatrogenic fractures of the clavicle.

DISCUSSION

Patients with acromio-clavicular injury often suffer from pain especially during performing heavy labour (i.e. pushing a wheelbarrow, swinging a sledge hammer and digging work) and repetitive stresses. They often complain of a fatiguing, dull ache in the shoulder after few hours of heavy work. In the long term, these patients may develop degenerative arthritis. This occurs even in low-grade dislocations of the joint.

Currently, we advise early reconstruction of the acromioclavicular joint in high-grade injuries (IV and above). For types I and II injuries, the treatment is still conservative with the affected arm in a sling for 6 weeks, followed by mobilisation exercises. Results of conservative treatment for these low-grade injuries have been good.[1,3] The treatment of type III dislocations is still controversial. A recent metaanalysis study have shown that type III dislocations tend to do well with conservative treatment.[4] As such, we do not routinely perform reconstructive surgery on these patients. These patients are allowed to have a trial of conservative treatment of about 3 months, at the end of which they are reviewed at our outpatient clinic. The patients who still have significant pain and loss of function will be advised regarding reconstruction of the acromioclavicular joint. In our study, we had 5 patients with grade III injuries on whom we performed the modified Weaver-Dunn procedure after failure of conservative treatment of at least 3 months. In these 5 patients, there was a significant improvement in their shoulder scores post-operatively. Although these figures are small in number, it suggests that the modified Weaver-Dunn procedure is an effective treatment option for patients with grade III injuries who do not respond to conservative treatment.

The surgical approach we utilise is not commonly used. The transverse skin incision is along the length of the lateral half of the clavicle and curving it slightly anteriorly over the anterolateral fibres of the deltoid. Although this incision does not conform to the Langer's lines, we did not have any complaints of unsightly scars except for 1 patient who developed keloid. This approach gives us easy access to the attachment of the coracoacromial ligament laterally as well as the middle third of the clavicle to drill the 4.5 mm hole. With the elevation of the pectoralis muscle from the clavicle anteriorly, access to the base of the coracoid is obtained.

Currently there are four main surgical treatment options for the dislocated acromioclavicular joint:

1. Primary acromioclavicular joint fixation with pins, screws, suture wires, plates etc with or without ligament repair/ reconstruction [7,8,9]
2. Primary coracoclavicular ligament fixation with screw, wire, fascia, conjoint tendon or synthetic sutures with or without incorporation of acromioclavicular ligament repair / reconstruction [10,11,12,13]
3. Excision of the distal clavicle with or without coracoclavicular ligament repair with fascia or suture, or coracoacromial ligament transfer [14,15,16,17]
4. Dynamic muscle transfers with or without excision of the distal clavicle. [18,19,20]

We have not opted to use metal implants for the repair/ reconstruction for fear of migration of metal implants. [21,22,23] Muscle transfers are technically demanding and these procedures do not address the problem of instability of the joint. They serve to dynamically pull the clavicle downwards through the action of the coracobrachialis and the biceps muscles. However, in dislocation of the acromioclavicular joint the problem is one of a "sagging" upper limb and not a high riding clavicle. Hence, the pathology is still not addressed by these muscle transfer procedures. Furthermore, these procedures carry significant of injury to the musculocutaneous nerve, failure of the coracoid to heal to the clavicle or loss of screw fixation / screw breakage.

The Weaver-Dunn procedure that we currently use includes 2 minor modifications: a transclavicular-subcoracoid nylon tape and suturing of the tape to prevent unravelling of the knot. In previous reports, the nylon tape is passed from the base of the coracoid around the width of the clavicle and tied. With only soft tissue to secure the position of the tape on the clavicle, the tape may slide sideways medial or laterally along the clavicle, leading to loss of reduction. There had also been concerns that the tape may function as an "internal saw" and lead to an iatrogenic fracture of the clavicle. With the use of a transclavicular route, the sling is prevented from sliding. Even if the sling does cut through the clavicle anteriorly, the posterior cortex of the clavicle still remains intact. The use of non-absorbable sutures to further secure the nylon tape knots does help to prevent unravelling of the knot and loss of reduction.

There are 3 patients who had a loss of reduction observed in the 6 months follow-up. Two of these patients had good to excellent postoperative UCLA scores. All three had good to excellent reduction in pain. All these 3 patients had grade 5 dislocations. The associated muscle injuries and severity of the dislocation may explain the loss of reduction. None of the 10 subjects complained of their scar or unsightly prominence.

In summary, we feel that there is a place for surgical treatment in Grade III injuries if patients are still symptomatic after 3 months of conservative treatment. Modified Weaver Dunn with a transclavicular – subacromial nylon tape and suturing the knot is an effective and relatively risk-free operation for Grade III and higher injuries.

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