

Functional Outcome of Modified Weaver Dunn Technique for Acromioclavicular Joint Dislocation

Abstract

Background: The debate about the ideal surgical procedure for acromioclavicular joint (ACJ) dislocation is still unresolved and newer techniques are being evolved continuously. The present study evaluates functional outcome of ACJ reconstruction using the modified *Weaver Dunn* procedure. **Materials and Methods:** 35 patients (26 males, 9 females) with ACJ dislocation, between the age group of 18–48 years (mean age 31 years), were operated using modified *Weaver Dunn* procedure at our center from May 2005 to June 2010. The dominant side was involved in 25 patients (22 right, 13 left). The mean period from the time of injury to the surgery was 14 days (range 4–26 days). All the patients were assessed with Oxford shoulder score and the time required to return to preinjury level was recorded. **Results:** At the mean followup of 95 months (range 72–120 months), the mean Oxford Shoulder Score improved from 25 ± 7.2 to 43 ± 6.9 . 85% (30 out of 35) patients had satisfactory results, while 15% (5 out of 35) had mild shoulder dysfunction using this scoring system. Five patients had radiological evidence of Grade 2 ACJ subluxation. Out of these five patients, two developed ossification around the coracoclavicular ligament. Three patients had intermittent mild pain without any functional disability, and one had a moderate restriction of shoulder movements. **Conclusion:** ACJ reconstruction, using the modified *Weaver Dunn* procedure in ACJ dislocation, is a reproducible procedure and provides a good functional outcome.

Keywords: *Acromioclavicular joint dislocation, modified Weaver Dunn procedure, oxford shoulder score*

MeSH terms: *Acromioclavicular joint, dislocations, surgery, orthopaedic*

Introduction

Acromioclavicular joint (ACJ) dislocation accounts for 40% of all shoulder injuries in athletes and high demand professionals.¹⁻³ The majority of these injuries are low grade (Grade 1, 2) and the good functional outcome can be expected with nonoperative management. However, higher grade injuries (Grade 3–6) may require surgical intervention, especially in high demand professionals and athletes requiring overhead abduction activities.^{4,5}

Commonly used techniques for management of ACJ dislocation include: (1) fixation of ACJ using wires/screw/sutures/hook plate, etc., which can be done along with repair of ligaments, (2) coracoclavicular fixation using screw/anchors/free tendon graft with ACJ reconstruction, and (3) excision of distal part of clavicle along with coracoclavicular ligament reconstruction,

especially in arthritic joint.⁵⁻⁹ However, the best operative treatment for ACJ reconstruction remains debatable.^{5,9-11}

In the recent literature, open or arthroscopic fixation of coracoclavicular construct using synthetic loops, flip buttons, tendon autografts or allografts has been advocated but with mixed results.¹²⁻¹⁶ These newer techniques have often been compared with modified Weaver-Dunn procedure which has given consistently reproducible and satisfactory results.^{14,17-19}

The literature is scanty on functional outcome of surgical management of ACJ reconstruction available from India. After a thorough search on PubMed, we could find only one original paper from India showing functional outcome at mean followup of 22 months after the ACJ reconstruction using arthroscopic technique.²⁰ The present study is first of its kind, which is evaluating long term functional results of ACJ

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reconstruction using the modified Weaver-Dunn procedure from India.

Materials and Methods

The present study is a retrospective case series of patients with ACJ dislocation operated with the modified Weaver-Dunn reconstruction technique at our center between May 2005 and June 2010. Patients with acute injury (less than 4 weeks) were included while those with chronic injury, preexisting shoulder problem or cervical degeneration were excluded. Out of these 42 patients, 35 were available for the final followup. These patients were classified on the basis of Rockwood classification,⁵ out of these 35 patients, seven were Grade 3, 12 were Grade 4 while 16 Grade 5.

Operative procedure

Surgery was performed under general anesthesia in the beach chair position. A “strap” incision was made starting 2–3 cm medial and posterior to the ACJ, extending toward the tip of the coracoid process [Figure 1]. The lateral end of clavicle and ACJ were exposed. The resection of 1 cm of the lateral end of the clavicle was performed. The direction of resection of distal end of clavicle was from posterosuperior and lateral to anteroinferior and medial. The coracoacromial ligament was identified and its boundaries were defined [Figure 2a]. The coracoacromial ligament was detached from its attachment on the acromion with a small piece of bone to enhance bone to bone healing [Figures 2b and 3]. A small curette was used to open the medullary canal from the lateral end of the clavicle. Two drill holes were made 5–6 mm apart and 5–7 mm from the edge of lateral end of the clavicle. Care is taken, that the drill holes are neither too near to the resected end of the clavicle nor too near to each other. A double loop no. 2 PDS (polydioxanone sutures, Ethicon, Inc., Johnson and Johnson, Somerville, NJTM) was passed underneath the coracoid for future use as a coracoclavicular



Figure 1: Clinical peroperative photograph showing incision for the procedure

reinforcement. The detached coracoacromion ligament along with the bones piece is pulled into the medullary canal of the clavicle using two no. 5 Ethibond sutures (Ethicon, Inc., Johnson and Johnson, Somerville, NJTM) through the two holes already drilled in the lateral end of the clavicle [Figure 2b and c] and repaired with the clavicle. This reconstruction was reinforced by the double loop no. 2 PDS (Ethicon, Inc., Johnson and Johnson, Somerville, NJTM) already passed underneath the coracoid process and tied over the clavicle [Figures 2d and 4].

The arm was placed in a sling for 6 weeks. Suture removal was done at 10–14 days. During this phase, active movements of the elbow, wrist and fingers were allowed. From 6 to 12 weeks, exercise regimen to mobilize the shoulder joint and to attain full range of movements was followed. Patients were advised not to lift heavy weights during these 12 weeks and gradually return to preinjury level in the next 4–6 weeks. Oxford shoulder score²¹ was used to assess the functional outcome and the time to return to preinjury level was recorded.

Results

The average age of patients was 31 years (range 18–48 years). There were 26 males and nine females, 22 patients sustained injury to the right shoulder and 13 patients injured their left shoulder. Dominant side was involved in 25 patients while in 10 patients non-dominant side was involved.

According to Rockwood classification, seven were Grade 3, 12 were Grade 4 while 16 Grade 5. The mean period from the time of injury to the surgery was 14 days (range 4–26 days). The mean followup was 95 months (range 72–120 months).

At the final followup, the mean Oxford Shoulder Score improved from 25 ± 7.2 (range 9–32) to 43 ± 6.9 (range 21–48) in our case series. The improvement in Oxford Shoulder Score is statistically significant ($P = 0.0001$). About 85% of the patients (30 out of 35) had satisfactory results, while 15% (5 out of 35) had mild shoulder dysfunction using this scoring system.

Five patients had radiological evidence of Grade 2 ACJ subluxation at the time of final followup. Out of these five patients, two developed ossification around the coracoclavicular ligament. Three patients had intermittent mild pain without any functional disability, and one had a moderate restriction of shoulder movements.

Discussion

ACJ dislocation injuries constitute 9%–12% of the injuries around the shoulder joint.^{22,23} These injuries are common in males, especially athletes and high demand professionals requiring overhead abduction^{24,25} and are commonly seen in the second and third decade of life.^{24,25}

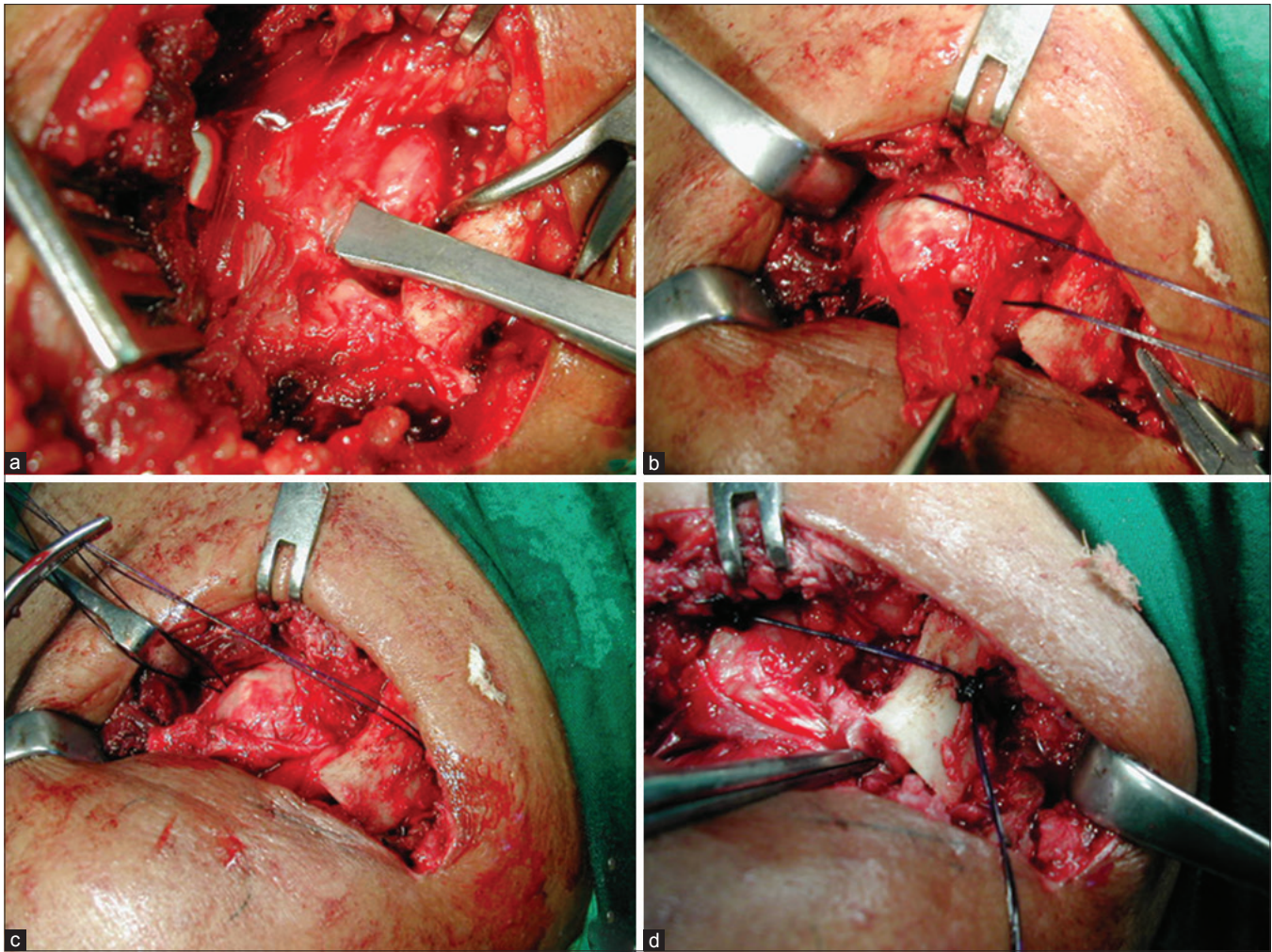


Figure 2: Peroperative photographs showing (a) Identification of coracoacromial ligament. (b) Detached coracoacromial ligament and PDS loop around the coracoid. (c) Reconstruction of coracoacromial ligament with lateral end clavicle. (d) Reinforcement of construct with PDS Loop

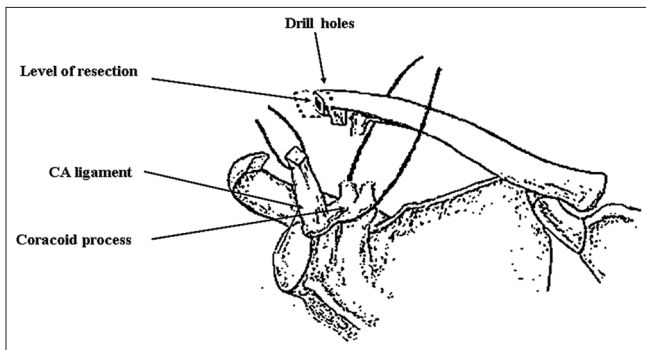


Figure 3: Line diagram with resection of lateral end of clavicle and PDS loop underneath the coracoid

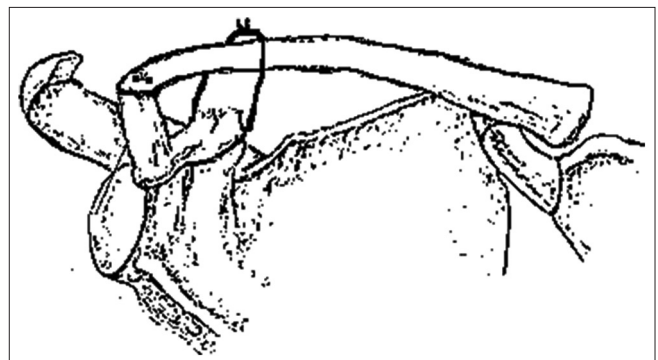


Figure 4: Line diagram after the modified Weaver Dunn procedure

Rockwood classified injuries of the ACJ into six grades which have been useful in terms of prognosis and treatment.^{4,5,10,11} Most of the studies agree that the treatment of incomplete injuries to the ACJ (Grade 1 and 2) should be nonoperative.^{10,11} The treatment options for these injuries include a period of rest, analgesics and return to activity after symptoms subside. Management of the Grade 3

injuries is still debatable, with various studies documenting no difference in results between nonoperative and operative methods.¹⁰⁻¹² However, other studies advocate surgical intervention in Grade 3 injuries in sportspeople and high demand professionals.^{3,14,17} The patients of Grade 3 injuries in our series ($n = 7$) were symptomatic patients who were either sportspeople ($n = 5$) or laborers ($n = 2$).

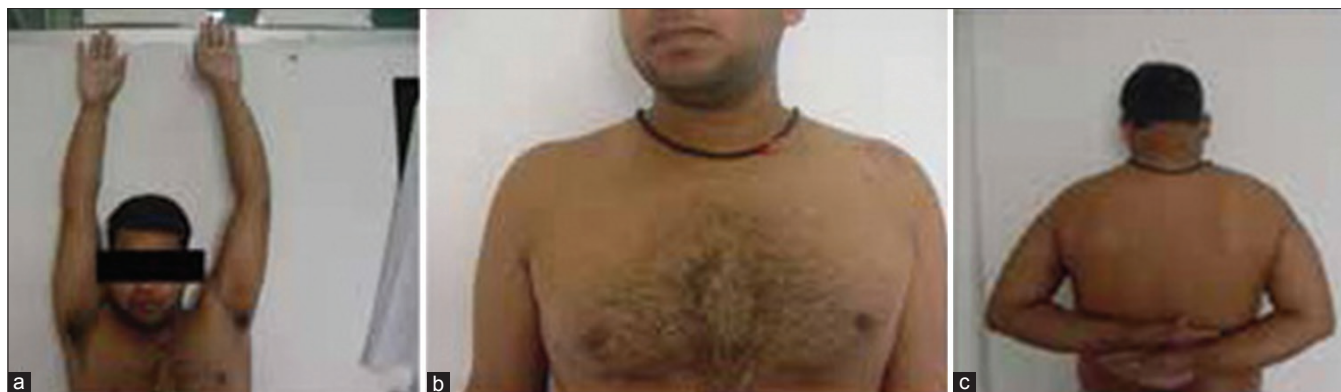


Figure 5: (a-c) Clinical photograph at final followup showing range of motion

There are numerous surgical techniques described for ACJ reconstruction.²⁶ However, consensus on the best treatment option for ACJ reconstruction is still not clear. The use of K-wires and tension band wiring has often been used for fixation of ACJ reconstruction. However, this technique is associated with complications such as increased incidence of degenerative ACJ disease, breakage of the pins and migration of the K-wires into the lung, the heart, and even large vessels.^{27,28} The hook plate though commonly used for ACJ dislocation, has been associated with complications such as acromial fractures, ACJ arthritis and a definite second surgery for plate removal.²⁹ ACJ stabilization with a screw between clavicle and coracoid is a rigid construct which prevents movements between the clavicle and coracoid leading to complications such as fatigue and failure of the implant, reduced joint motion, and early joint degeneration. This implant is also associated with higher failure rate.^{30,31}

Weaver-Dunn procedure⁷ was initially described in 1972; it utilizes the coracoacromial ligament to substitute the torn coracoclavicular ligament. However, biomechanical studies have revealed that this nonanatomic construct alone is only 30% as strong as the native ligaments and there is a tendency to displace the clavicle anteriorly and can often lead to a recurrent deformity.³² Therefore, several modifications of the Weaver Dunn procedure have been described. We in our case series have used reinforcement of conventional procedure using a double loop no. 2 PDS (Ethicon, Inc., Johnson and Johnson, Somerville, NJTM) sling passed underneath the coracoid process and tied over the clavicle. We feel that this reinforcement maintains the reduced position of the joint and prevents subluxation till the healing of the reconstructed ligament is complete. However, in five of our cases, we found radiological evidence of Grade 2 subluxation of ACJ. Two out of these five patients developed ossification around the coracoclavicular ligament. It could either be due to micromotion due to instability in the area leading to new bone formation or inadequate saline wash of the bone dust which was left after the resection of the lateral end of the clavicle. Now,

we have started using an adequate copious saline wash to remove bone dust in all of our cases.

In the recent literature trend is shifting towards arthroscopic fixation of coracoclavicular construct using synthetic loops, flip buttons, tendon autografts or allografts.^{12,13} However, the arthroscopic technique has a long learning curve, and higher cost of the implant is another issue.¹⁶ Furthermore, the current literature has mixed views about arthroscopic technique and flexible coracoclavicular constructs.^{15,16,33}

The mean Oxford Shoulder Score improved from 25 ± 7.2 to 43 ± 6.9 in our case series. 15% (5 out of 35) had mild shoulder dysfunction [Figure 5]. All the patients returned to preinjury level of function at a mean of 4.5 months (range 4–7 months) from date of surgery. The mean Oxford shoulder score and results in our case series are either similar or better to the recent newer techniques.^{34,35}

The strength of the present study is that it has a long term followup. However, being a retrospective case series, it has a relatively lower level of evidence.

Conclusion

ACJ reconstruction using the modified Weaver-Dunn procedure in ACJ dislocation still remains one of the gold standard and reproducible procedure in all the patients including sportspersons and high demand professionals.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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