

Arthroscopic Management of Acromio-Clavicular Dislocations in High Demand Professionals.

Lt Col Ravindra Chauhan¹, Parikshat Gopal², Col Amresh Ghai³, Nikhil Sood⁴,
Sunil Thakur⁵, Munish Sood⁶

¹Classified Specialist Orthopaedics, Department of Orthopaedics, Base Hospital Delhi Cantt, New Delhi

²Associate Professor, Department of Orthopaedics, ACMS & Base Hospital Delhi Cantt, New Delhi

^{3*} Head of department, Department of Orthopaedics, Base Hospital Delhi Cantt, New Delhi

⁴Classified Specialist Orthopaedics, Department of Orthopaedics, Base Hospital Delhi Cantt, New Delhi

⁵Post graduate Resident Department of Orthopaedics, Base Hospital Delhi Cantt, New Delhi

⁶Classified Specialist Orthopaedics, Department of Orthopaedics, Command Hospital (WC), Chandimandir.

ABSTRACT

Background: Acromio-clavicular joint (ACJ) dislocations are the commonly encountered injuries by the orthopaedic surgeon but the debate about the ideal management of the ACJ injuries is unresolved.

Aim: To evaluate mid-term results of functional outcome of ACJ reconstruction using the arthroscopic technique in high demand professionals.

Methods: 25 patients with ACJ dislocations who underwent ACJ reconstruction surgery using arthroscopic tightrope techniques. 23 patients meeting the inclusion criteria were evaluated while 02 were lost to follow-up. The outcome was assessed clinically, radiologically, and with the Disabilities of the Arm, Shoulder and Hand (DASH) scores preoperatively and at the final follow-up

Results: The mean age of the patients was 31.56±5.98 years (range 20-48 years). All were male. The mean follow-up was 15.26 months (range 8 - 24 months). The mean coraco-clavicular distance preoperatively was 23.9 mm (range 17- 32mm) while at the final follow-up distance was 17.54mm (range 11-22) mm. 10 patients showed loss of reduction. DASH scores improved significantly from 45.36 ± 11.06 (range, 31.13-66.66) preoperatively to 7.26±9.12 (range, 0-29.15) at the final follow-up (p-value<0.001). 82% (19 out of 23) returned to the pre-injury level.

Conclusion: Arthroscopic management of the ACJ dislocation is associated with higher implant and technical failure because of inadequate stability.

Key words: acromioclavicular joint dislocations, shoulder arthroscopy.

Introduction

Acromioclavicular joint (ACJ) dislocation are the common injuries in the high demand professionals like athletes, military personnel, manual workers etc., and ACJ injuries represent 40% to 50% of the shoulder injuries in them [1-4].

Rockwood et al classified injuries of the ACJ into six types.

Address for correspondence

Parikshat Gopal, Department of Orthopaedics, ACMS & Base Hospital Delhi Cantt, New Delhi -110010, India
Email : docpgopal@gmail.com
Phone : +91-9811114752

Received: 02.03.17

Accepted: 09.03.17

Grade I and II injuries are the low grade injuries and non-operative treatment has a good functional outcome. Grade III- VI are the high grade injuries, which require surgical intervention especially in athletes and high demand professionals [5].

There are various techniques for the management of the high grade ACJ injuries described in the literature which use different mode of fixation methods like ACJ fixation with wires, coraco-clavicular fixation using screws and ACJ reconstruction and excision of distal part of clavicle along with coraco-clavicular ligament reconstruction, especially in arthritic joint [6-11]. However, there is no consensus as far as the best treatment modality for ACJ reconstruction is concerned [1,12,13].

With the advent of shoulder arthroscopic techniques, the trend is shifting towards mini-open or arthroscopic fixation of coraco-clavicular construct using loops, flip buttons, tendon autografts. However, results of the arthroscopic technique are variable[14-20]. There have been various studies about ACJ reconstruction using the Arthroscopic technique available worldwide. The present study has evaluated mid-term results of functional outcome of ACJ reconstruction using the arthroscopic technique in high demand professionals.

Material and Methods

In the present study, patients (military personnel) with ACJ dislocation, who met the inclusion criteria were evaluated prospectively. These patients were operated with Arthroscopic ACJ fixation at our centre between December 2014 and December 2015.

Inclusion criteria

1. Age 18-60 years
2. ACJ injuries Type III, IV and V

Exclusion criteria

1. ACJ injuries Rockwood Type I, II and VI
2. Compound ACJ Injuries.
3. Other associated injuries in the same limb, cerebral trauma.
4. Systemic disease affecting the scoring process and rehabilitation.
5. Prior pain/pathology in the shoulder joint.

Twenty-three cases were studied prospectively. Patients were classified on the basis of Rockwood classification [5], out of the 23 patients, 12 were grade III, 02 were grade IV while 09 grade V. The outcome was assessed clinically, radiologically, and with the Disabilities of the Arm, Shoulder and Hand (DASH)scores²¹ at the final follow-up.

Surgical Technique

All the patients were operated under general anesthesia in the lateral decubitus. A standard posterior viewing portal was established and diagnostic shoulder arthroscopy was performed. Antero-superior working portal was established and undersurface of coracoid exposed (figure 1a). A 2-cm incision was made over the lateral clavicle, perpendicular to the superficially palpable coracoid. The drill guide was inserted through the anterosuperior portal, and the guide tip was positioned under the coracoid base. The guidewire was passed from clavicle to the coracoid. Drill hole with 4.5 mm cannulated drill bit was drilled over the guide wire (figure 1b). A sufficient bone bridge of at least 4-mm was ensured around the reamed tunnel. The guide wire was then removed, and the drill was left in situ. A nitinol suture passing wire was passed through the drill (figure 1c) and taken out through the anterosuperior portal using an arthroscopic grasper. The drill was then removed leaving the wire in position. The two white traction sutures of Acromioclavicular Tightrope [Arthrex, Naples (FL), USA] button were passed through the wire loop, and the button was then flipped to pass through the drill hole. Once the tightrope button was seen under the coracoid, the trailing suture was used to flip it, and locking it under the bone (figure 1d). The clavicle was then reduced by the assistant. The reduction was assessed clinically with palpation of the acromioclavicular joint and once satisfactory reduction was achieved, the tightrope device was knotted securely over the clavicle. The clavicular wound was closed in layers and the portals were closed in standard fashion. Sutures were removed after 10-14 days.

Postoperative Rehabilitation

Postoperatively, the shoulder was protected in a sling for

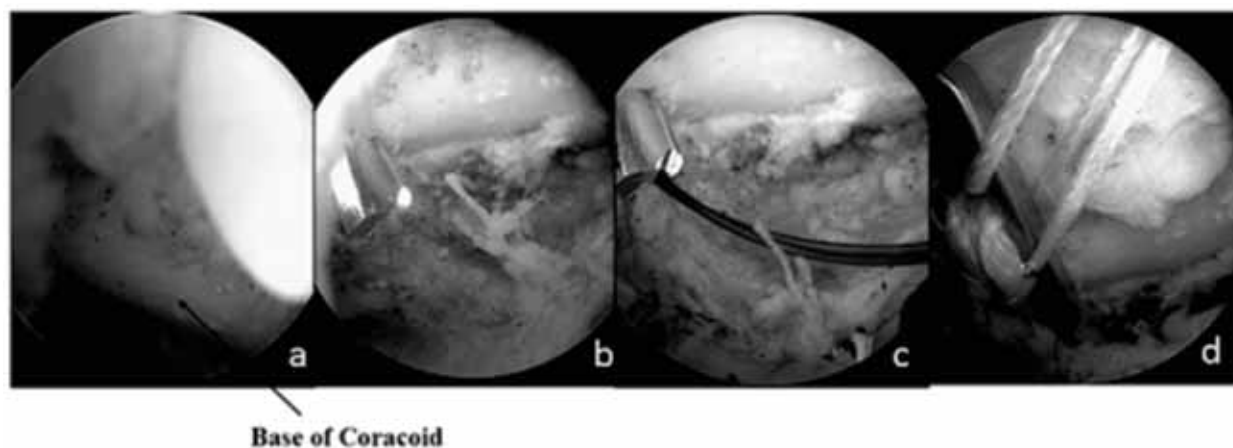


Figure 1(a-d): Arthroscopic view showing exposure of coracoid (1a), drilling of coracoid base (1b), wire passed through drill bit (1c), Tight rope at the base of coracoid (1d)

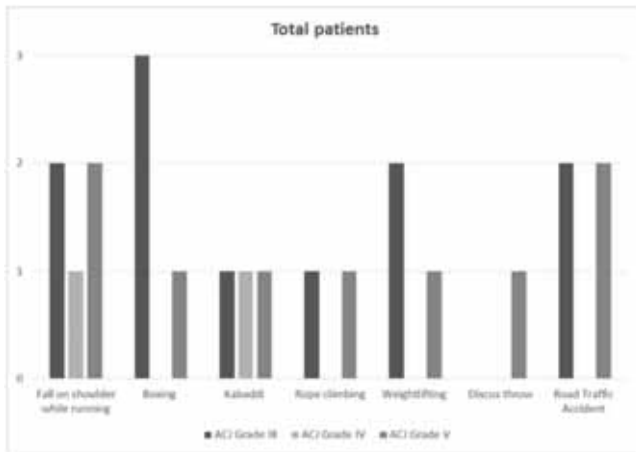


Figure 2: Mode of injuries in various ACJ grades

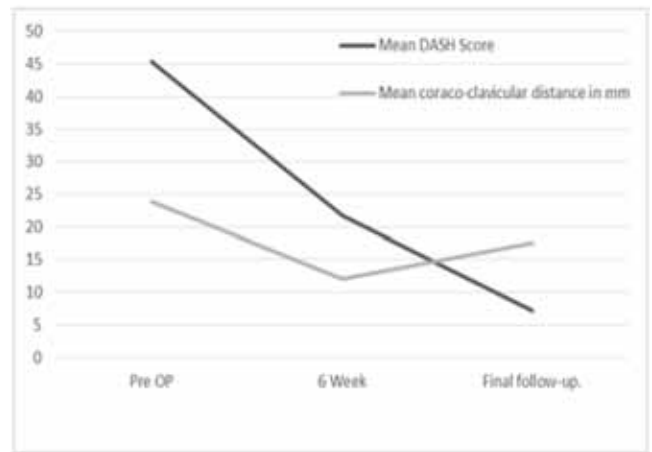


Figure 4: Mean DASH score and Coraco-Clavicular distance pre-operatively, at 06 weeks and at the final follow-up.

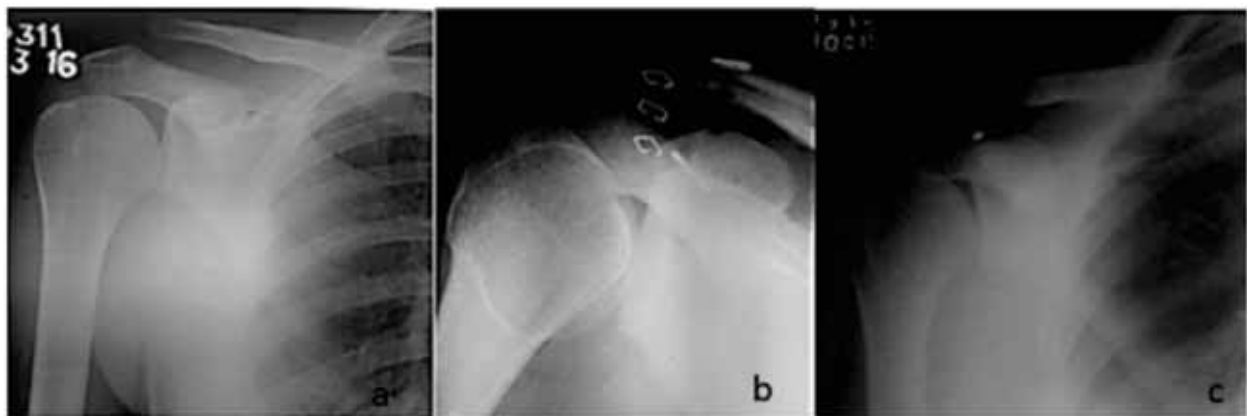


Figure 3 (a-c): Radiographs of ACJ: pre-operative (3a), post-operative (3b), implant failure at 6 months (3c)



Figure 5: Radiographs of ACJ: loss of reduction on 7th post-operative day

6 weeks. Gentle pendulum movements were started from 1st post-operative day. At 4 weeks, passive range of motion exercises of the shoulder were started, and active movements of the shoulder were advised after 06 weeks. Return to manual work or sporting activities was allowed after 16-20 weeks.

Ethical clearance and informed consent

Ethical clearance was obtained from the ethics committee of the hospital before the start of the study. Written informed consent was obtained from each patient before the conduct of the study.

RESULTS

25 patients with ACJ dislocation were operated between December 2014 and December 2015 at our centre using arthroscopic ACJ fixation, 02 were excluded from the study because of lost to follow-up. 23 patients were analyzed in this study. All were male. The mean age of the study population was 31.56±5.98 years (range 20-48 years). The mean follow-up was 15.26 months (range 8 - 24 months). Right side was involved in 14 (60.87%) patients and left side was involved in 09 patients (39.13%). The dominant arm was affected in 16 cases and the non-dominant arm was affected in 7 cases. The mechanism of injury in different patients was as per figure 2. According to Rockwood classification, 12 were grade III, 02 were grade IV while 09 were grade V. The average time from initial trauma to surgery was 10.78 ± 4.60 days (range 5-19 days).

The Disabilities of the Arm, Shoulder and Hand (DASH) scores [21] was 45.36 ± 11.06 (range, 31.13-66.66) preoperatively and it improved significantly (p-value < 0.001) to 21.77±14.59 (range, 0-49.17) and 7.26±9.12 (range, 0-29.15) at the 6 weeks, and final follow-up evaluations respectively. Seven patients achieved DASH Score of 0.

The mean coraco-clavicular distance preoperatively was 23.9 mm (range 17- 32mm). Postoperative radiographs showed good reduction in the majority of the patients (22 out of 23)(figure 3 a,b). The coraco-clavicular distance, postoperative and at the final follow-up was 12.1 mm (range 09-14) mm and 17.54mm (range 11-22) mm respectively(figure 4).

At the final follow-up, radiological evaluation showed that 13 (56.52%) out of 23 patients had maintained. One patient demonstrated the failure of fixation in the immediate post-operative period, he also had intra-operative breakage of the drill bit (figure 5). Another failure was noticed at the time of 6 weeks follow-up, and eight patients had loss of reduction after 6 weeks(figure 3c). 06 loss of reduction were in grade III injuries patients, while 04 were grade V injuries patients.

04 out of 10 patients in whom the loss of reduction was present, were satisfied with the functional outcome and they were not willing for the revision surgery. 03 patients were not satisfied with the surgery but they were not willing for the second surgery. 03 patients were re-operated for failed ACJ reconstruction. All the re-operated patients were grade V injuries at the time of initial trauma. 02 patients were operated with hook plate while in one patient revision arthroscopic ACJ fixation was done. However majority of the patients (19 out of 23) were satisfied and returned to pre-injury level of activity at the final follow-up (Table 1).

There was no neurovascular deficit or infection postoperatively. At the time of final follow-up, four patients had tenderness at the ACJ. While four patients reported tenderness superior to the clavicular flip button which was not limiting the patient's day to day activities of living or their sporting and recreational activities. Five patients were bothered about the prominence of ACJ.

Table 1: Various grades of ACJ dislocation operated, loss of reduction, cause of failure and return to preinjury level at the final follow-up

Total Patients				
ACJ dislocation	Operated	Loss of reduction at the final follow-up	Cause of failure	Return to pre-injury level
Grade III	12	6	04 Suture breakage 02 coracoid side failure	11
Grade IV	2	0	-	2
Grade V	9	4	02 Technical failure 03 Suture breakage 01 clavicular erosion	6

Discussion

ACJ dislocations injuries are the common injuries around the shoulder joint. These injuries are much more common than reported, as certain patient with low grade injuries like grade I and II may not consult the physician. ACJ injuries are commonly seen in males in the third decade of life, especially in individuals who are involved in athletic and high demand activities [22-24]. In this series, all the patients were male who were high demand professionals as the majority of clientele visiting our centre are involved in strenuous physical activities and training.

The treatment of Grade I and II injuries is conservative in the form of a period of rest to the part, analgesics and then gradual return to pre- injury activities. While treatment of the grade III injuries is debatable, as various studies document advantages of conservative treatment [25] while other studies documenting advantages of the operative method in these injuries especially in high demand professionals [26-27]. The treatment for higher grade (IV –VI) injuries is surgical intervention. In the present study, all the patients of grade III injuries (n= 12) visiting our centre were operated, as all of them were high demand professionals and the nature of the job they were involved in.

There are various operative interventions described for the management of ACJ injuries. However, the gold standard technique for the management of injuries has not been defined. But none of these techniques has been found to be superior to other. Furthermore, these techniques have their own disadvantages. K-wires and tension band wiring commonly used for fixation of ACJ reconstruction. However, these techniques are associated with complications like increased incidence of ACJ arthritis, breakage or migration of the pins into the lung, the heart, and vessels [28-29]. The Hook Plate is commonly used for ACJ dislocation, requires a second surgery for the implant removal and can be associated with complications like fracture of the acromion, ACJ arthritis [8]. ACJ Stabilization with a coraco-clavicular construct like screw between clavicle and Coracoid [34], prevents movements between the clavicle and coracoid leading to complications like fatigue and failure of the implant, and early joint degeneration, while the transfer of coraco-acromial ligament to substitute the torn coraco-clavicular ligament as in weaver dunn procedure [33] is considered as a weak construct.

With the advancement of shoulder arthroscopic technique and knowledge about the shoulder pathologies, many newer arthroscopic or arthroscopically assisted techniques have evolved in the past decade. These

techniques are minimally invasive techniques and have advantages of providing better intra-articular visualization of the shoulder joint and its pathologies [14-19,30-32]. In the present case series, all of the patients were managed with arthroscopic ACJ fixation using tightrope.

The postoperative radiographs showed the good reduction in the majority of the patients (22 out of 23). But, at the final follow-up, 10 (43.48%) out of the 23 patients had loss of reduction. 8 out of these 10 patients had loss of reduction after 6-week follow-up. One patient demonstrated a failure of fixation in the immediate post-operative period (at 7th day) because of tunnel blowout from corocoid side probably due to the eccentric drilling of the tunnel, he also had breakage of the drill bit at the time of surgery. Another failure noticed at the 6 weeks follow-up, was also due to eccentric drilling of the tunnel. Therefore, 02 radiological failure which occurred before 06 weeks were the technical failure, while 08 delayed radiological failures which occurred after 06 weeks were implant failures. Thus, this arthroscopic technique of fixation requires a learning curve, good technical skill and precise instrumentations. Furthermore, we feel that tightrope construct though considered to have biomechanical properties similar to the native coraco-clavicular ligaments [35,36] but being of a non-biological and non-anatomical nature, this construct is a weak construct. It provides stability in superior- inferior plane and not in the anterior-posterior plane and the implant is likely to fail if the healing of the local tissue is delayed. Even the modifications of tightrope technique (use of double tightrope or a dogbone) are associated with complications like residual deformity or coracoid fracture [32-37].

Despite the high rate of failure 10 out of 23, The DASH scores improved significantly (p-value < 0.001) from preoperatively 45.36 ± 11.06 (range, 31.13-66.66) to 7.26 ± 9.12 (range, 0-29.15) at the final follow-up. These results are similar to the results of other studies which have also documented satisfactory functional outcome even though the radiological failure was significantly higher [17,35,36,38]. 19 out of the 23 patients were able to return to the pre-injury level at the final follow-up.

6 out of the 10 radiological failure were in grade III injury and 83% (5 out of 6) of these patients (grade III injuries) were able to return back to the pre-injury level of activity. Therefore, inspite of the high percentage of radiological failure in grade III injuries, the majority of the patients were able to return back to the pre-injury level of activities and they were not keen for the re-surgery for the cosmetic correction. However, 03 patients with grade V injuries at the time of initial trauma who had

radiological failure opted for the surgery. We feel that in such a scenario, the conservative treatment for the grade 3 injuries still remains a good option even in the high demand professionals

Conclusion

Arthroscopic management of the ACJ injuries using tightrope is a minimally invasive and safe technique but has higher implant and technical failure because of its non-biological and non-anatomical nature.

Conflict of interest:	All authors declare no COI
Ethics:	There is no ethical violation as it is based on voluntary anonymous interviews
Funding:	No external funding
Guarantor:	Dr Lt Col Ravindra Chauhan will act as guarantor of this article on behalf of all co-authors.

References

- Li X, Ma R, Bedi A, Dines DM, Altchek DW, Dines JS. Management of acromioclavicular joint injuries. *J Bone Joint Surg Am.* 2014 Jan 1; 96(1):73-84.
- Bradley JP, Elkousy H. Decision making: operative versus nonoperative treatment of acromioclavicular joint injuries. *Clinics in sports medicine.* 2003; 22(2):277-290.
- Clayton RA, Court-Brown CM. The epidemiology of musculoskeletal tendinous and ligamentous injuries. *Injury.* 2008; 39 Dec: 1338-1344.
- Rios CG, Mazzocca AD. Acromioclavicular joint problems in athletes and new methods of management. *Clinics in sports medicine.* 2008 Oct 31; 27(4):763-88.
- Rockwood CA, Williams GR, Young DC. *Fractures in Adults: Acromioclavicular Injuries.* Philadelphia, PA: Lippincott-Raven; 1996:1341-1413.
- Bishop JY, Kaeding C. Treatment of the acute traumatic acromioclavicular separation. *Sports medicine and arthroscopy review.* 2006 Dec 1; 14(4):237-45.
- Mayr E, Braun W, Eber W, Rüter A. Treatment of acromioclavicular joint separations. Central Kirschner-wire and PDS-augmentation. *Der Unfallchirurg.* 1999 Apr; 102(4):278-86.
- Kienast B, Thietje R, Queitsch C, Gille J, Schulz AP, Meiners J. Mid-term results after operative treatment of rockwood grade III-V acromioclavicular joint dislocations with an AC-hook-plate. *European journal of medical research.* 2011 Feb 24; 16(2):52.
- Motamedi AR, Blevins FT, Willis MC, McNally TP, Shahinpoor M. Biomechanics of the coracoclavicular ligament complex and augmentations used in its repair and reconstruction. *The American journal of sports medicine.* 2000 May 1; 28(3):380-4.
- Tauber M, Gordon K, Koller H, Fox M, Resch H. Semitendinosus Tendon Graft Versus a Modified Weaver-Dunn Procedure for Acromioclavicular Joint Reconstruction in Chronic Cases A Prospective Comparative Study. *The American journal of sports medicine.* 2009 Jan 1; 37(1):181-90.
- Strauss EJ, Barker JU, McGill K, Verma NN. The evaluation and management of failed distal clavicle excision. *Sports medicine and arthroscopy review.* 2010 Sep 1; 18(3):213-9.
- Kim S, Blank A, Strauss E. Management of type 3 acromioclavicular joint dislocations: current controversies. *Bulletin of the NYU Hospital for Joint Diseases.* 2014 Jan 1; 72(1):53-59.
- Beitzel K, Cote MP, Apostolakis J, Solovyova O, Judson CH, Ziegler CG et al. Current concepts in the treatment of acromioclavicular joint dislocations. *Arthroscopy: The Journal of Arthroscopic & Related Surgery.* 2013 Feb 28; 29(2):387-97.
- Cohen G, Boyer P, Pujol N, Ferjani BH, Massin P, Hardy P. Endoscopically assisted reconstruction of acute acromioclavicular joint dislocation using a synthetic ligament. Outcomes at 12 months. *Orthopaedics & Traumatology: Surgery & Research.* 2011 Apr 30; 97(2):145-51.
- Cavinatto LM, Iwashita RA, Ferreira Neto AA, Benegas E, Malavolta EA, Gracitelli ME, et al. Arthroscopic treatment of acute acromioclavicular joint dislocation using suture anchors. *ActaOrtopédicaBrasileira.* 2011; 19(3):141-4.
- Porschke F, Schnetzke M, Aytac S, Studier-Fischer S, Gruetzner PA, Guehring T. Sports activity after anatomic acromioclavicular joint stabilisation with flip-button technique. *Knee Surgery, Sports Traumatology, Arthroscopy.* 2016 Aug 26:1-9.
- Gangary SK, Meena S. Arthroscopic stabilization of acute acromioclavicular joint dislocation with tightrope AC system: A tale of failures. *Journal of Arthroscopy and Joint Surgery* 2016;3(1):13-6.
- Gupta P, Kansal G, Srivastav S, Agarwal S. Arthroscopic fixation using TightRope device for acute acromioclavicular joint disruptions. *Journal of Arthroscopy and Joint Surgery* 2016;3(1):7-12.
- Gupta R. Editorial. *Journal of Arthroscopy and Joint Surgery* 2016;3(1):1-2
- Bjernelid H, Hovelius L, Thorling J. Acromioclavicular separations treated conservatively: a 5-year follow-up study. *ActaorthopaedicaScandinavica.* 1983 Jan 1; 54(5):743-5.
- Hudak PL, Amadio PC, Bombardier C, Beaton D, Cole D, Davis A, et al. Development of an upper extremity outcome measure: the DASH (Disabilities of the Arm, Shoulder, and Hand). *American journal of industrial medicine.* 1996 Jun 1; 29(6):602-8.
- Headey J, Brooks JH, Kemp SP. The epidemiology of shoulder injuries in English professional rugby union. *The American journal of sports medicine.* 2007 Sep 1; 35(9):1537-43.
- Fraser-Moodie JA, Shortt NL, Robinson CM. Injuries to the acromioclavicular joint. *Bone & Joint Journal.* 2008 Jun 1; 90(6):697-707.
- Pallis M, Cameron KL, Svoboda SJ, Owens BD. Epidemiology of acromioclavicular joint injury in young athletes. *The American journal of sports medicine.* 2012 Sep 1; 40(9):2072-7.
- Fremerey RW, Lobenhoffer P, Ramacker K, Gerich T, Skutek M, Bosch U. [Acute acromioclavicular joint dislocation—operative or conservative therapy?]. *Der Unfallchirurg.* 2001 Apr; 104(4):294-9.
- Gstettner C, Tauber M, Hitzl W, Resch H. Rockwood type III acromioclavicular dislocation: surgical versus conservative treatment. *Journal of Shoulder and Elbow Surgery.* 2008 Apr 30; 17(2):220-5.
- Rawes ML, Dias JJ. Long-term results of conservative treatment for acromioclavicular dislocation. *Bone & Joint Journal.* 1996 May 1;78(3):410-2.

28. Norrell H Jr, Llewellyn RC. Migration of threaded Steinmann pin from an acromioclavicular joint into the spinal canal: a case report. *J Bone Joint Surg Am* 1965;47:1024-6.
29. Mazet RJ. Migration of a Kirschner-wire from the shoulder region into the lung: report of two cases. *J Bone Joint Surg* 1943;25(2):477-483.
30. El Sallakh SA. Evaluation of arthroscopic stabilization of acute acromioclavicular joint dislocation using the tightrope system. *Orthopaedics*. 2012;35(1):e18–e22.
31. Thiel E, Mutnal A, Gilot GJ. Surgical outcome following arthroscopic fixation of acromioclavicular joint disruption with the tightrope device. *Orthopaedics*. 2011 Jul 1;34(7):e267-74.
32. Salzmann GM, Walz L, Buchmann S, Glabgly P, Venjakob A, Imhoff AB. Arthroscopically assisted 2-bundle anatomical reduction of acute acromioclavicular joint separations. *The American journal of sports medicine*. 2010 Jun 1;38(6):1179-87.
33. Harris RI, Wallace AL, Harper GD, Goldberg JA, Sonnabend DH, Walsh WR. Structural properties of the intact and the reconstructed coracoclavicular ligament complex. *The American Journal of Sports Medicine*. 2000 Jan 1;28(1):103-8.
34. Lin W, Wu C, Su C, Fan K, Tseng I, Chiu Y. Surgical treatment of acute complete acromioclavicular dislocation: comparison of coracoclavicular screw fixation supplemented with tension band wiring or ligament transfer. *Chang Gung medical journal*. 2006 Mar;29(2):182.
35. Lädermann A, Gueorguiev B, Stimec B, Fasel J, Rothstock S, Hoffmeyer P. Acromioclavicular joint reconstruction: a comparative biomechanical study of three techniques. *Journal of Shoulder and Elbow Surgery*. 2013 Feb 28;22(2):171-8.
36. Nüchtern JV, Sellenschloh K, Bishop N, Jauch S, Briem D, Hoffmann M, et al. Biomechanical evaluation of 3 stabilization methods on acromioclavicular joint dislocations. *The American journal of sports medicine*. 2013 Jun 1;41(6):1387-94.
37. Lee PY, Brock J, Woodford C, Robertson A. A Radiological and Clinical Evaluation of Acromioclavicular Joint Reconstruction Using Dog Bone Double Endobutton Technique. *Journal of Arthritis*. 2016 Jul 11.
38. Lim YW, Sood A, van Riet RP, Bain GI. Acromioclavicular joint reduction, repair and reconstruction using metallic buttons-early results and complications. *Techniques in Shoulder & Elbow Surgery*. 2007 Dec 1;8(4):213-21.

