

Different Modalities of Surgical Management of Acute Acromioclavicular Joint Dislocation

A.M.Lotfy, S.A. Khalil, A. M.Halawa and M.I.Kandil

Orthopedic Surgery, Dept., Faculty of Medicine, Benha Univ., Benha, Egypt

E-mail: Lotfy@YAHOO.COM

Abstract

Background: Acute acromioclavicular (AC)-joint dislocations are common injuries of the shoulder girdle. Surgical repair is indicated for acute high grade (Rockwood types IV, V, and VI) of (AC)-joint injuries. There are many large number of surgical technique that used in treatment of (AC) – joint dislocation. The best surgical technique remains controversial which can group into two groups. The aim of this work was to systematically review the different modalities of surgical management of acute acromio-clavicular joint dislocation. **Methods:** This systemic review was done using standard methodology outlined in the Cochrane Handbook and reported the findings in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement guidelines. The Cochrane Central Register of controlled trials, PubMed, JBJS, and MEDLINE as database for search. **Results:** Success rate marked increase in patients underwent anatomical CC reconstruction; compared to other techniques. Failure rate that happened in patients and complications rate marked decrease in patients underwent anatomical technique. The complication that happened in patients are loss of reduction and recurrence of deformity, coracoid fracture, clavicle fracture (some studies come over on this fracture by using single tunnel in clavicle, coracoid or both), infection, adhesive capsulitis, graft failure, clavicular or coracoid osteolysis, hypertrophic distal clavicle, brachial plexopathy, hardware complications (broken hardware and symptomatic hardware), and osteoarthritis of (AC) – joint. **Conclusion:** This systemic review documented that the anatomic (CC) - ligament reconstruction technique has better than other techniques for the treatment of acute (AC) – joint dislocation & The studies that use (CC) - Fixation by Tight Rope device fixation (by Arthrex) Is less failure rate and complication rate in patients underwent other techniques.

Key words: Modalities, Surgical Management, Acute Acromioclavicular Joint Dislocation.

1. Introduction:

Acute acromioclavicular (AC)-joint dislocations are common injuries of the shoulder girdle. Surgical repair is indicated for acute high grade (Rockwood types IV, V, and VI) of (AC)-joint injuries¹.

Acute (AC)-joint separation is diagnosed by clinical examination and radiography. Vertical translation anteroposterior stress views with a (10)kg load are used to grade the injuries. Bilateral lateral views are used to evaluate dynamic horizontal translation qualitatively¹.

Many non anatomic procedures for the operative treatment of acute (AC)-joint dislocation have been proposed, including Bosworth screw or pin fixation. However, these procedures are performed less frequently than they had been in the past because of their high complication rates².

The best treatment for type III is still controversial, but young and active patients with this type of injury might benefit from a surgical (AC) - joint stabilization. Surgery should be performed within the first 3 weeks after the injury since the biological healing potential decreases with time¹.

More recently, anatomic coracoclavicular(CC)-ligament reconstruction has become popular in the hope of decreasing complication rates and improving patient outcomes. Some studies have demonstrated higher clinical success rates and superior biomechanical outcomes when(CC)- ligament reconstruction has been compared with other techniques³.

However, the detailed operative techniques, complication rates, and follow-up periods have differed among studies⁴.

An anatomic (CC)-ligament reconstruction technique involving the use of artificial ligaments for the treatment of

acute high grade (AC)- joint dislocation and unstable distal clavicular fractures⁵.

The aim of this work was to systematically review the different modalities of surgical management of acute acromio-clavicular joint dislocation.

2.Methods

This systemic review was done using standard methodology outlined in the Cochrane Handbook and reported the findings in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement guidelines⁶. The Cochrane Central Register of controlled trials, PubMed, JBJS, and MEDLINE as database for search.

Search key words was All, All anatomy, All biomechanics, All ligament reconstruction techniques, Acromioclavicular joint dislocation, and All surgical outcome.

Criteria of accepted studies:

- Clinical studies.
- Recent papers and researches published after the year of 2012.
- English literatures only.

Exclusion criteria:

- Non-human studies.
- Review of literatures- case reports.
- Paper and researches published before the year of 2012.

Methods of the review:

Locating and selecting studies:

Abstracts of articles identified using the search strategy above were viewed, and articles that appear to fulfill the inclusion criteria were retrieved in full data.

Each article identified was reviewed and categorized into one of the following groups:

Included: clinical trials, comparative studies, case studies and observational retrospective studies that meets the described inclusion criteria.

Excluded: non-clinical trials, non-human studies or systematic reviews.

When there was a doubt, a second reviewer was assessing the article and a consensus was reached.

Data extraction:

Data were independently extracted by two reviewers and cross-checked.

Study Selection:

The database searches are identified 166 records; 72 of them unique records identified (duplicate removed) by it; 94 were excluded based on title and abstract review; 72 articles were searched for eligibility by full text review; 21 articles could not be accessed or obtain full text; 15 studies were reviews and case reports; 12 were not describing functional outcome; the desired procedure not used in 16 studies leaving 8 studies that met all inclusion criteria Fig. (22).

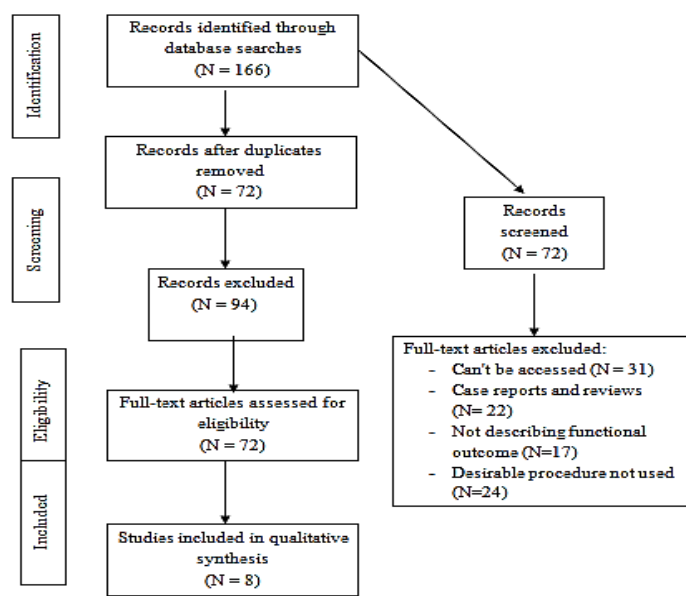


Fig. (1): PRISMA flow chart for study selection.

The included studies published between 2013 and 2021. Regarding the type of surgical procedure. ⁷

3. Results

Table (1) Summary of patients and study characteristics.

N	Author	Type of study	Type of surgical procedure	Number of patients	Mean age (year)	Sex
1	Beris A. et al., 2013 ⁽⁸⁾	Trial	Non-anatomical	12	27.5	9M-3F
2	Loriaut P. et al., 2015 ⁽⁹⁾	Trial	Non-anatomical	39	35.7	26M-13F
3	Lu, D. et al., 2016 ⁽¹⁰⁾	Comp.	Non-anatomical	80	33.9	55M-25F
4	Mori D. et al., 2017 ⁽⁵⁾	Trial	Anatomical	19	32.3	18M-1F
5	Moura D.L. et al., 2017 ⁽¹¹⁾	Observe	Non-anatomical	153	29.2	140M-13F
6	Cetinkaya E. et al., 2017 ⁽¹²⁾	Observe	Non-anatomical	32	45.5	25M-7F
7	Shui X. et al., 2017 ⁽¹³⁾	Trial	Non-anatomical	48	41.75	43M-5F
8	Zhu Y. et al., 2018 ⁽¹⁴⁾	Trial	Anatomical	18	51	15M-3F

#Studies were arranged according to year of publication. NM: not mentioned, M: male, F: female, Trial: clinical trial, Comp: comparative study, Observe: observational retrospective study.

Regarding the type of included studies; 5 studies (out of 8 studies) were clinical trials; while only 2 studies were observational retrospective studies and one study was comparative study.

The total number of patients in all the included studies was 401 patients. The average age of all patients was (36.9 ± 7.59 years); with youngest mean age of 27.5 years in *Beris et al.*, ⁽⁸⁾ study; and oldest mean age of 51 years in *Zhu Y. et al.*, ⁽¹⁴⁾ study.

Regarding gender distribution, 331 patients were males; while 70 were females. Their average age was (38.21 ± 8.59) years.

Table (2) Summary of mechanism of injury in the studies.

N	Author	Type of injury		
		Fall	Sport	RTA
1	Beris A. et al., 2013 ⁽⁸⁾	3	3	6
2	Loriaut P. et al., 2015 ⁽⁹⁾	3	15	21
3	Lu, D. et al., 2016 ⁽¹⁰⁾	30	0	50
4	Mori D. et al., 2017 ⁽⁵⁾	1	14	4
5	Moura D.L. et al., 2017 ⁽¹¹⁾	90	45	18
6	Cetinkaya E. et al., 2017 ⁽¹²⁾	NM	NM	NM
7	Shui X. et al., 2017 ⁽¹³⁾	NM	NM	NM
8	Zhu Y. et al., 2018 ⁽¹⁴⁾	4	14	0

RTA: road traffic accidents.

The average time between injury & surgery was (1.85 ± 0.3) weeks. Regarding injury type, (131) patients had falls; (73) had sports injuries; and (99) had RTA injuries while two studies didn't mention the mechanism of injury .

Table (3) Summary of dislocation injury grading

N	Author	Rockwood grading			Side of dislocation	
		III	IV	V	Rt	Lt
1	Beris A. et al., 2013 ⁽⁸⁾	8	4	0	8	4
2	Loriaut P. et al., 2015 ⁽⁹⁾	28	11	0	NM	NM
3	Lu, D. et al., 2016 ⁽¹⁰⁾	66	11	3	50	30
4	Mori D. et al., 2017 ⁽⁵⁾	2	2	15	10	9
5	Moura D.L. et al., 2017 ⁽¹¹⁾	113	11	29	NM	NM
6	Cetinkaya E. et al., 2017 ⁽¹²⁾	32	0	0	NM	NM
7	Shui X. et al., 2017 ⁽¹³⁾	35	0	13	23	25
8	Zhu Y. et al., 2018 ⁽¹⁴⁾	4	4	10	17	1

Regarding dislocation side, (108) patients had Rt-sided dislocation; and (69) had Lt-sided dislocation, while three studies didn't mention the side of injury .

Regarding Rockwood grades, (288) patients had grade-III; (43) had grade-IV; and (70) had grade-V dislocations.

Table (4): Summary of Interval between injury & surgery data in all studies.

N	Author	Interval between injury & surgery	Follow up time
		(weeks)	(month)
1	Beris A. et al., 2013 ⁽⁸⁾	0.8	18.25
2	Loriaut P. et al., 2015 ⁽⁹⁾	0.5	42.3
3	Lu, D. et al., 2016 ⁽¹⁰⁾	0.7	26.5
4	Mori D. et al., 2017 ⁽⁵⁾	1.4	151.8
5	Moura D.L. et al., 2017 ⁽¹¹⁾	2	55.41
6	Cetinkaya E. et al., 2017 ⁽¹²⁾	NM	96
7	Shui X. et al., 2017 ⁽¹³⁾	NM	13
8	Zhu Y. et al., 2018 ⁽¹⁴⁾	2	12

The average time between injury & surgery was (1.85 ± 0.3) weeks, while there were two studies didn't mention the data about interval between injury and surgery.

The average follow up time was (41.91 ± 30.79) months.

Table (5): Summary of radiological and post-operative outcomes data in all studies:

N	Author	Average (CC) -	Constant	Success rate
		distance (mm)	Score	#Return to pre-injury activity
1	Beris A. et al., 2013 ⁽⁸⁾	12.1	94.8	11/12
2	Loriaut P. et al., 2015 ⁽⁹⁾	NM	94.7	35/39
3	Lu, D. et al., 2016 ⁽¹⁰⁾	12.5	93.5	30/80
4	Mori D. et al., 2017 ⁽⁵⁾	NM	97.1	15/19
5	Moura D.L. et al., 2017 ⁽¹¹⁾	NM	96.45	115/153
6	Cetinkaya E. et al., 2017 ⁽¹²⁾	NM	86	16/32
7	Shui X. et al., 2017 ⁽¹³⁾	NM	86.5	39/48
8	Zhu Y. et al., 2018 ⁽¹⁴⁾	11	93	8/18

(CC): coraco-clavicular distance

The average (CC) - distance was (11.88 ± 0.28) mm; and the average constant score was (91.99 ± 4.54); with success rate of (269) patients who achieved successful return to pre-injury activity

Table (6): Summary of post-operative complications in all studies:

N	Author	Procedure	Failure rate	Complications rate	Causes of failure
1	Beris A. et al., 2013 ⁽⁸⁾	Open double-button fixation	0	1/12	No failure reported
2	Loriaut P. et al., 2015 ⁽⁹⁾	Arthroscopically a double-button device	2	4/39	implant failure in 1 patient and tunnel misplacement in 2 patients
3	Lu, D. et al., 2016 ⁽¹⁰⁾	double Endobutton device (group A, 40) or by triple Endobutton device (group B, 40)	1 (gr. a) 1 (gr. b)	50/80	group A, redislocation confirmed by radiographs of the involved AC joint on the second postoperative day. In group B, coracoid fracture occurred
4	Mori D. et al., 2017 ⁽⁵⁾	single-bundle reconstruction	2	4/19	2 had posterior displacement of the AC joint (ullout of the coracoid button with reduction of the AC joint)
5	Moura D.L. et al., 2017 ⁽¹¹⁾	combined technique/ Coracoacromial ligament transfer	9	38/153	isolated CCL calcifications was the commonest, followed by residual deformity caused by slight loss of reduction (6 patients). Both complications occurred in 3 patients
6	Cetinkaya E. et al., 2017 ⁽¹²⁾	32 (CC fixation with Bosworth screw 16 (AC fixation using K-wires) reduction and fixation with Kirschner wires and cannulated screws	2 (gr 1) 1 (gr 2)	15/32	Arthrosis, ossification in the CC ligament after early removal of the hardware
7	Shui X. et al., 2017 ⁽¹³⁾	by percutaneous minimally invasive repair (gr 1) or ultrasound guidance (gr 2)	0	9/48	Failure of internal fixation and obvious re-dislocation after implant removal did not occur in any patient
8	Zhu Y. et al., 2018 ⁽¹⁴⁾	Reconstruction using an AHPLT graft	0	10/18	No incidence of failure

4. Discussion

Beris A. et al., describe a mini-open approach that can effectively restore the AC joint and CC ligament complex anatomy. The procedure is fast and relatively simple. Through 2 small skin incisions of 1 and 2.5 cm made over the top of the clavicle and the coracoid process, respectively, both bone tunnels can be drilled with minimal damage to the soft tissues surrounding the CC ligaments while allowing adequate visualization of the coracoid for accurate tunnel placement.⁽⁸⁾

According to Loriaut P. et al., investigating arthroscopic treatment of type 3 and 4 acute AC dislocation using the Tight Rope TM system, with medium-term clinical (clinical scores) and radiologic follow-up AC joint position on MRI, and ligament healing), with good correlation between clinical and radiological results. The CC ligaments are expected to heal along the tightrope, providing guided healing. Restoring accurate AC joint congruency, the AC and CC ligament remnants are brought into contact to facilitate healing.⁽⁹⁾

Furthermore, this arthroscopic procedure required no hardware removal in most cases and allowed treatment of concomitant shoulder injuries in the same step.⁽⁹⁾

According to Andreani et al., comparing the results of two techniques (Tight Rope TM and hook plate), mean Constant score was significantly higher in the Tight Rope TM group. Two the fixation system breakages were reported.⁽¹⁵⁾

Horst et al. compared the Tight Rope TM technique (TR) to K-wire (KW) fixation in a series of 41 patients with type ≥ 3 AC joint dislocation. The TR technique was associated with shorter surgery time and lower costs. Material costs were significantly higher for using the TR technique, but patients were discharged earlier.⁽¹⁶⁾

According to Scheibel et al., recurrent partial vertical instability was not associated with poorer clinical results. However, patients with recurrent horizontal instability did present significantly poorer results. It was concluded that the Tight Rope TM technique provides sufficient biomechanical stability at time zero but, in some cases, the healing potential of the ligaments seems to be limited, and

anatomic scar formation was not always possible, so that reduction depended on the implant, leading to failure either by initial migration or by suture breakage⁽¹⁷⁾.

According to **Lu et al.**, comparing double Endobutton and triple Endobutton techniques for acute acromioclavicular joint dislocation. There were no significant differences in the mean incision length, the operative and radiation time, blood loss, length of hospitalization between the two groups⁽¹⁰⁾.

Both triple Endobutton technique and double Endobutton technique were efficient methods with few complications for treating AC joint dislocations. Triple Endobutton technique did not show significant clinical advantages over double Endobutton technique.⁽¹⁰⁾

Regardless of using double or triple Endobutton technique, loss of reduction was still the most common complication.⁽¹⁰⁾

According to **Moura D.L. et al.**, attempting to restore normal anatomy, stability, strength and function of AC. their rationale was that arthropey with K-wires and coraco-clavicular loop suture provide stability of the ACJ granting adequate healing period (approximately 4–6 weeks) to the transferred coracoclavicular ligament, the repaired ACJ ligaments and the articular capsule. When the K-wires are removed, they are already able to bear some load while still 'protected' by the coracoclavicular stabilization loop suture. By the time coracoclavicular stabilizing suture is absorbed, the AC capsulo-ligamentar complex is already healed and able to tolerate load⁽¹¹⁾.

Advantages of their technique Include: early mobilization (90° elevation until K-wire removal and then more); fast return to work and sports; absence of pain; no reported re-dislocations; no acceleration of arthritis process; excellent clinical and functional outcomes.

Cetinkaya et al., believe both surgical techniques are reliable and provide adequate reduction and similar outcomes in terms of functionality and pain levels, following the reduction of Type 3 AC joint dislocations and that one has no significant superiority over the other.⁽¹²⁾

As it leads to lower rates of wound site infection in the early and AC arthrosis in the late postoperative period, they believe CC fixation method with the Bosworth screw is a better surgical option than AC fixation method with K-wires.⁽¹²⁾

The total number of patients in all the included studies was 503 patients; while their average follow up time was (46.18 ± 40.24 months); with longest follow up time of 151.8 months in **Mori et al.**,⁽⁵⁾ study; and shortest follow up time of 12 months in **Zhu Y. et al.**,⁽¹⁴⁾ study.

The average age of all patients was (36.9 ± 7.59 years); with youngest mean age of 27.5 years in **Beris et al.**,⁽⁸⁾ study; and oldest mean age of 51 years in **Zhu Y. et al.**,⁽¹⁴⁾ study.

Regarding anatomical methods of reconstruction, 91 patients were males; while 17 were females (gender was not mentioned in 1 study). Their average age was (38.21 ± 8.59) years; and their average follow up time was (50.46 ± 50.7) months.

Regarding non-anatomical methods of reconstruction, 298 patients were males; while 66 were females. Their average age was (35.59 ± 7) years; and their average follow up time was (41.91 ± 30.79) months.

Regarding anatomical group, the average (CC) - distance was (11.5 ± 0.7) mm; and the average constant score was (95.05 ± 2.89); and the average ASES score was (93.7 ± 3.72); with success rate of (106) patients who (achieved successful return to pre-injury activity).

Regarding non-anatomical group, the average (CC) - distance was (12.3 ± 0.28) mm; and the average constant score was (91.99 ± 4.54); while the ASES score was not mentioned in any non-anatomical study; with success rate of (264) patients who (achieved successful return to pre-injury activity).

5. Conclusion

This systemic review documented that the anatomic (CC) - ligament reconstruction technique has better than other techniques for the treatment of acute (AC) – joint dislocation & The studies that use (CC) - Fixation by Tight Rope device fixation (by Arthrex) Is less failure rate and complication rate in patients underwent other techniques.

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