EFORT open reviews

EFORT Open Reviews (2025) **10** 141–150
https://doi.org/10.1530/EOR-2024-0077

SHOULDER & ELBOW

Surgical vs conservative: what is the best treatment of acute Rockwood III acromioclavicular joint dislocation? A systematic review and meta-analysis

Luca Bianco Prevot[1,2], Riccardo Accetta[1], Stefania Fozzato[3], Philipp Moroder[4] and Giuseppe Basile[1]

[1]Department of Trauma Surgery, IRCCS Ospedale Galeazzi - S. Ambrogio, Milan, Italy
[2]Residency Program in Orthopedics and Traumatology, University of Milan, Milan, Italy
[3]Department of Orthopedic Surgery, Presidio Ospedaliero di Rho - ASST Rhodense, Rho, Italy
[4]Department of Shoulder and Elbow Surgery, Schulthess Clinic, Zurich, Switzerland

Correspondence should be addressed to L Bianco Prevot: luca.bianco96@gmail.com

- *Purpose:* No literature consensus was found about the best treatment of acute Rockwood type III acromioclavicular joint (ACJ) dislocation. In particular, the advantages and disadvantages between conservative treatment and surgery are not sufficiently quantified in the current literature.
- *Methods:* A systematic literature search was conducted using PubMed, Web of Science and Embase in March 2024. We selected studies comparing surgical and conservative treatment in acute Rockwood III ACJ dislocations. The two treatment methods were compared in terms of Constant score; Disabilities of the Arm, Shoulder, and Hand (DASH); American Shoulder and Elbow Surgeons (ASES) score; Acromioclavicular Joint Instability Score (ACJIS); subjective shoulder value (SSV); radiographical findings; reported complications; and return to sports activity. The risk of bias and quality of evidence were assessed using Cochrane guidelines.
- *Results:* A total of 1844 articles were evaluated, and ten were included in the study for a total of 397 patients. The results of the meta-analysis showed no significant differences between the two groups in terms of Constant score (P = 0.31), DASH (P = 0.52), ASES (P = 0.66) and SSV (P = 0.21), while it highlighted a statistically significant difference in terms of ACJIS (P = 0.00) and acromioclavicular (P = 0.00) and coracoclavicular distance (P = 0.00).
- *Conclusion:* The results showed no significant differences in terms of patient-reported or objective functional outcomes between the two treatment groups. Nonetheless, it highlights a difference in terms of radiographical outcomes and type of complications. While surgical intervention is able to improve joint reduction, it adds the risk for surgical complications.

Keywords: rockwood III; surgical treatment; conservative treatment; acute acromioclavicular joint dislocation; meta-analysis

Introduction

Acromioclavicular joint (ACJ) dislocation typically occurs in young adult athletes and is one of the most common injuries in the shoulder region, with an incidence ranging from 4 to 12%. Its absolute incidence is approximately 3–4 cases per 100,000 people per year (1).

The classification most frequently used to describe this type of injury is the one proposed by Rockwood in 1984, which identifies six grades based on the severity of dislocation, the position of the clavicle and the ligaments involved in the trauma (2).

Published by Bioscientifica Ltd.
www.efortopenreviews.org

EFORT Open Reviews (2025) **10** 141–150
https://doi.org/10.1530/EOR-2024-0077

Rockwood type I and II injuries are characterized by the absence of complete dislocation of the joint and are therefore treated conservatively yielding excellent functional outcomes (3).

However, for Rockwood type IV, V and VI injuries, which involve complete dislocation of the ACJ with marked joint instability, surgical treatment is generally preferred (4).

Subject to debate is the most appropriate management of Rockwood type III dislocations. These injuries are characterized by complete rupture of the acromioclavicular (AC) and coracoclavicular (CC) ligament complex, causing instability of the ACJ in the vertical plane and potentially additionally the horizontal plane.

To date, the treatment of grade III dislocation is based on the preferences of the surgeon and the patient, and the age and level of sporting activity (5).

The scientific literature is controversial and does not highlight the superiority of one treatment over the other. Non-surgical approaches reduce postoperative complications and enable faster recovery and earlier return to work, but some patients may experience persistent pain and shoulder deformity with poor cosmetic results.

Surgery, on the other hand, has much higher complication rates but may allow for anatomic restoration of the shoulder girdle and may be more suitable for patients engaged in heavy manual labor or competitive sports (1).

The aim of this study was to evaluate and quantify the best treatment to propose to patients with acute type III ACJ dislocation, comparing conservative and surgical approaches in terms of clinical and radiographical outcomes and the incidence of complications.

Materials and methods

A systematic literature review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) guidelines (6). The systematic review was registered and allocated in the PROSPERO database (CRD42024536006), National Institute for Health Research, University of York, Center for Reviews and Dissemination. On March 27, 2024, a systematic literature search was performed using PubMed, Web of Science and Embase with the following search string: (acromioclavicular OR AC dislocation OR acromioclavicular dislocation) AND (Rockwood type-III OR Rockwood type 3 OR grade III OR III) AND (treatment). Duplicates were removed, and all records were assessed for eligibility based on title and abstract, followed by full-text analysis if necessary. Inclusion criteria comprised studies conducted on patients with acute Rockwood type III ACJ dislocations (surgery performed within three weeks of the trauma), studies comparing surgical and conservative treatment, comparative or randomized-controlled trials (RCTs), studies involving humans and studies published in English. Exclusion criteria included studies on subjects with Rockwood type I, II, IV, V and VI ACJ dislocations, preclinical or ex vivo studies, level IV evidence, meta-analyses, systematic literature reviews, articles written in other languages and paper with less than ten patients. Two independent authors (LBP and SF) selected articles meeting the inclusion criteria; in case of disagreement, a third author (RA) intervened to resolve it.

Data extraction

Two independent authors (LBP and SF) extracted data from full-text versions or supplementary data. Information on study methodology, including study type, level of evidence and year of publication, was collected. Patient characteristics and treatment outcomes were also collected, including the number of patients included and evaluated at follow-up, gender, age, Rockwood classification of the dislocation, type of intervention received by patients, duration of follow-up, postsurgical clinical scores (Constant score, Disabilities of the Arm, Shoulder, and Hand (DASH); American Shoulder and Elbow Surgeons (ASES) score; Acromioclavicular Joint Instability Score (ACJIS); and subjective shoulder value (SSV)), radiographical findings (AC distance and CC distance), reported complications and return to sports activity. The collected outcomes were included if acquired at least 12 months of follow-up, considering this time frame as sufficient for stabilizing postoperative results. Missing or unextractable data due to heterogeneity among clinical studies and the population sample analyzed in the various studies were considered in the presentation of results. In cases where data were only available graphically, extraction was performed using the WebPlotDigitizer tool, which has been shown in previous studies to accurately extract numerical data from graphical representations (7, 8).

Quality and risk of bias evaluation

Risk of bias and quality assessment were performed by two separate authors (LBP and SF), and discrepancies were resolved through discussion and consensus with a third author (RA). Reviewers evaluated the studies considered in the meta-analysis using the revised tool for Risk of Bias in randomized trials (RoB 2.0) for randomized studies and the Risk of Bias In Non-randomized Studies of Interventions (ROBINS) tool for non-randomized clinical studies, as recommended by Cochrane (9).

The overall quality of evidence for each outcome was classified as high, moderate, low or very low according to GRADE (Grading of Recommendations Assessment, Development, and Evaluation) guidelines (10).

EFORT Open Reviews (2025) **10** 141–150
https://doi.org/10.1530/EOR-2024-0077

Statistical analysis

A meta-analysis was conducted on clinical and radiographical postoperative outcomes and complication rate regarding conservative versus surgical treatment of acute Rockwood III ACJ dislocation. Variables including Constant score, DASH, ASES, ACJIS, SSV, AC distance and CC distance were assessed using the inverse variance method and expressed as mean differences (MD) for continuous variables. Statistical analysis was performed using the PythonMeta package (version 1.26; https://pypi.org/project/PythonMeta/) in Python (version 3.9; https://www.python.org/downloads/release/python-390/). The I^2 metric was used to assess heterogeneity and was considered significant when I^2 > 25% (11).

According to the proposal by Borenstein *et al*. (12) the meta-analysis was conducted implementing a random-effects model based on the assumption that significant differences between studies could not justify a fixed-effects model. When a value of I^2 < 25% was observed, the meta-analysis was re-implemented using a fixed-effects model. A *P* value of 0.05 was set as the significance level for two-tailed tests. For calculating standard deviations (SDs) not available from full-text articles, the sample interval was used in accordance with Walter and Yao's recommendation (13).

Article selection

The PRISMA flowchart for article selection is presented in Fig. 1. The literature search yielded 702 articles from PubMed, 785 articles from Embase and 375 articles from Web of Science. After removing 470 duplicates, 1344 articles were eliminated following screening of titles and abstracts. Among the remaining 30 articles, a further 20 articles were excluded as they did not meet the inclusion criteria. At the end of the process, ten articles remained for the final analysis (14, 15, 16, 17, 18, 19, 20, 21, 22, 23).

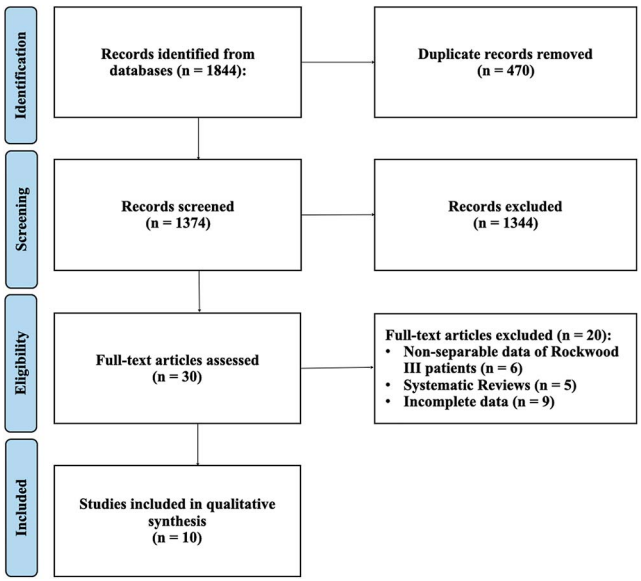


Figure 1

PRISMA flowchart of the article selection process.

Among the analyzed studies, seven were retrospective comparative studies and three were randomized-controlled trials. In total, a population of 397 patients with Rockwood type III ACJ dislocation was analyzed, with 180 undergoing conservative treatment and the remaining 217 undergoing surgical intervention. The analyzed sample consisted of 7.3% females and 92.7% males.

Results

The surgically treated patients had a mean age of 35.6 years (range: 19–68 years), while conservatively treated patients had a mean age of 36.5 years (range: 18–72 years). Conservative treatment involved the use of a sling for a variable period ranging from 2 to 4 weeks or until pain subsided, followed by muscle strengthening and range of motion (ROM) recovery physiotherapy.

Surgical treatment involved the implantation of a hook plate in 69 patients, reduction and fixation with Kirschner wires in 36 patients, Bosworth screw implantation in 16 patients, suture–button system implantation in 76 patients and reduction and implantation of absorbable sutures or synthetic ligaments in 20 patients. Postoperative management included the use of a brace for a period ranging from a minimum of one week to a maximum of six weeks, followed by muscle strengthening and ROM recovery physiotherapy.

Surgically treated patients had a mean± SD Constant score of 90 ± 8.3, a DASH score of 9.6 ± 3.9, a ASES of 93.6 ± 3.2, a ACJIS of 89.7 ± 3.7, and a SSV of 86.9 ± 11. Regarding radiographical evaluations, surgically treated patients had a mean postoperative AC distance of 4.3±2.6 mm, and a mean postoperative coracoacromial distance of 10.9± 2.3 mm. Surgically treated patients reported complications such as wound infection, hardware intolerance or mobilization and hematoma with a percentage of 9.2% and took an average of nine weeks to return to sports activity.

Conservatively treated patients had a mean ± SD Constant score of 89.5 ± 8.1, a DASH score of 11.8 ± 8.4, a ASES of 92.8 ±4.8, a ACJIS of 78.2 ± 4.6, and a SSV of 77.8 ± 22.3. Regarding radiographical evaluations, conservatively treated patients had a mean post-treatment AC distance of 9.4 ± 3.8 mm, and a mean postoperative coracoacromial distance of 15 ± 1.5 mm. In six studies, the number of patients treated conservatively who required subsequent surgical intervention was reported. 22.3% of patients

EFORT Open Reviews (2025) **10** 141–150
https://doi.org/10.1530/EOR-2024-0077

initially treated conservatively were later subjected to surgical intervention.

Conservatively treated patients took an average of 7.7 weeks to return to sports activity. All study details are further reported in Table 1.

Meta-analysis outcomes: Constant score, DASH, ASES, ACJIS and SSV

The Constant scores were reported in seven studies. The analysis found no statistically significant difference between the two groups, with an MD of −0.87 (95% CI: −2.54, 0.8; *P* = 0.31).

The DASH score was reported in two studies. The analysis of DASH score did not find a statistically significant difference between the two types of management with MD 1.65 (95% CI: −3.45, 6.75; *P* = 0.52).The ASES was reported in four studies. The analysis found no statistically significant difference between the two groups, with a MD 1.29 (95% CI: −4.57, 7.15; *P* = 0.66). The SSV was reported in two studies. The analysis of SSV did not find a statistically significant difference between the two types of management with MD −4.84 (95% CI: −12.38, 2.70; *P* = 0.21).

The ACJIS was reported in three studies. A statistically significant difference was found between the conservative and surgical treatment (MD: −11.93; 95% CI: −15.65, −8.20; *P* = 0.00), with surgery management demonstrating better result compared to conservative treatment (see Fig. 2).

Meta-analysis radiological outcomes

In four studies, postoperative CC distance was reported, while AC distance was reported in three studies.

A statistically significant difference was observed between conservative and surgical treatments in terms of CC distance (MD: 5.37; 95% confidence interval (CI): 4.76, 5.97; *P* = 0.00) and AC distance (MD: 5.77, 95% CI: 4.89, 6.65; *P* = 0.00); surgical management showed lower AC and CC distances compared to conservative treatment (see Fig. 3).

Risk of bias and quality of evidence

The evaluation using the RoB 2.0 tool showed an overall heterogeneous quality of the studies, with three papers falling in the 'Some concerns' category, while the evaluation using the ROBINS-I tool showed an overall heterogeneous quality of the studies, with five papers falling in the 'Moderate' category and two papers falling in the 'serious' category.

Detailed results are shown in Figs 4 and 5.

Discussion

This systematic literature review and meta-analysis compared the outcomes of surgical management with those of conservative management for Rockwood type III ACJ dislocations. It did not demonstrate significant relevant differences in patient-reported outcomes, functional outcomes and the incidence of postoperative complications. However, significant differences were identified in terms of radiographical outcomes.

Currently, the treatment of Rockwood type III ACJ dislocation is subject to controversies in the literature. In the past, conservative treatment was the main approach; although it results in incomplete restoration of AC joint anatomy, it allows for reasonably good functional recovery. Surgical treatment may be used to achieve complete anatomical restoration, minimize the risk of shoulder deformity and prevent the occurrence of inadequate shoulder kinematics, such as scapular dyskinesis and malposition, due to chronic dislocation, as highlighted by Gumina *et al*. (24).

This meta-analysis provided important insights into which therapeutic option is more suitable between surgical and conservative treatment. Regarding functional indices of the operated limb, there was conflicting evidence. In particular, regarding Constant score results, no statistically significant difference was found in favor of either approach. Similarly, DASH, ASES and SSV did not show significant differences. However, the analysis concerning ACJIS showed a statistically significant difference in favor of surgical approach with an average of 11.93 points higher for the latter technique. This difference could be attributed to the different aspects evaluated by the different clinical scores. While Constant score, DASH, ASES and SSV mainly consider pain and limb functionality, (25, 26), ACJIS is a score where radiographical evaluation accounts for 35% and cosmetic evaluation accounts for 10% (27) variables that are worse in patients treated conservatively.

Therefore, this result should be interpreted critically, stating that there is no definite superiority between the two treatment methods in terms of functionality but that both techniques produce good outcomes in terms of functional outcomes. However, it must be underlined that only the ACJIS is specific to the ACJ, unlike the others which analyze the function of the shoulder in a more transversal manner.

Another interesting aspect that emerged from this meta-analysis is the data regarding radiological outcomes, particularly regarding AC and coracoacromial distances. The conducted analyses demonstrated a statistically significant difference in both AC and CC distance values, with significantly lower values favoring surgical treatment. In the literature, there is no certainty about the role of the AC joint anatomy restoration in terms of clinical results. In fact, several studies demonstrated that restoring normal ACJ anatomy results in better shoulder kinematics,

Table 1 Characteristics of the articles included in the study.

Study	Patients, *n*	Mean age	Treatment	Complications	Constant scores	ASES	AJIS	Postoperative CC distance	Postoperative AC distance
Calvo *et al.* (14)	43	34.5 (18–63)	11 conservative	11 ACJ deformity 5 osteolysis of lateral clavicle	-	-	-	-	-
		39.6 (18–68)	32 Kirschner wires	1 wound infection 7 pin migration 14 osteolysis of lateral clavicle	-	-	-	-	-
Cardone *et al.* (15)	14	29 (22–41)	6 conservative	-	-	-	-	-	-
		26.7 (21–35)	8 open reduction and stabilization with absorbable suture	-	-	-	-	-	-
De Carli *et al.* (16)	55	28.5	25 conservative	12 poor cosmetic results	98 (3.2)	89.5 (1.6)	72.4 (1.8)	16.1 (0.5)	10.2 (2.2)
		29.2	30 suture–button systems	1 dislocation of TightRope 1 superficial wound infection 2 osteolysis	98.2 (2.8)	100 (0)	87.9 (2.2)	10.4 (0.2)	4.2 (4.2)
Saade *et al.* (17)	19	42.8	7 conservative	-	89 (3.8)	100 (3.2)	-	-	-
		37.1	12 synthetic ligament	-	90.4 (3.5)	90 (0.8)	-	-	-
Gstettner *et al.* (18)	50	36.2 (12.6)	22 conservative	0	80.7 (17.4)	-	-	15.9 (4.9)	9.9 (4.9)
		37.2 (10.6)	28 hook plate	1 hematoma 2 superficial wound infection 1 plate mobilization	90.4 (12.9)	-	-	12.1 (4.6)	5.3 (3.7)
Boström Windhamre *et al.* (19)	61	40 (18–63)	31 conservative	0	88.1 (11.1)	-	-	-	-
		39 (21–57)	30 hook plate	1 deep infection	91.1 (5.9)	-	-	-	-
Joukainen *et al.* (20)	11	-	7 conservative	-	87 (6.5)	-	-	13 (5.1)	8.1 (4.3)
		-	4 Kirschner wires	-	78 (21)	-	-	11 (3.4)	3.4 (2.9)
Tauber *et al.* (21)	78	36 (14)	31 conservative	8 persistent pain poor cosmetic results 2 posttraumatic ACJ osteoarthritis or distal clavicle osteolysis	92 (6)	91.5 (5)	83.2 (9)	15.2 (12.2–18.2)	-
		40 (14)	11 hock plate	1 superficial wound infection	92.8 (6)	96.5 (4)	90.1 (8)	10 (8–12)	-
			36 suture–button systems	8 posttraumatic ACJ osteoarthritis or distal clavicle osteolysis					
Feichtinger *et al.* (22)	29	49 (21–72)	19 conservative	-	92 (8.8)	90 (9.5)	79 (3)	-	-
		43 (19–55)	10 suture–button systems	-	89 (6)	88 (8)	91 (1)	-	-
Galpin *et al.* (23)	37	36.7 (16–66)	21 conservative	-	-	-	-	-	-
		28.9 (19–59)	16 Bosworth screw	2 deep infection 2 screw mobilization	-	-	-	-	-

DASH, Disabilities of the Arm, Shoulder and Hand; ASES score, American Shoulder and Elbow Surgeons score; ACJIS, Acromioclavicular Joint Instability score; SSV, subjective shoulder value; AC, acromioclavicular; CC, coracoclavicular, - missing data. We report, when available, standard deviations or range, expressed between the bracket (14, 15, 16, 17, 18, 19, 20, 21, 22, 23).

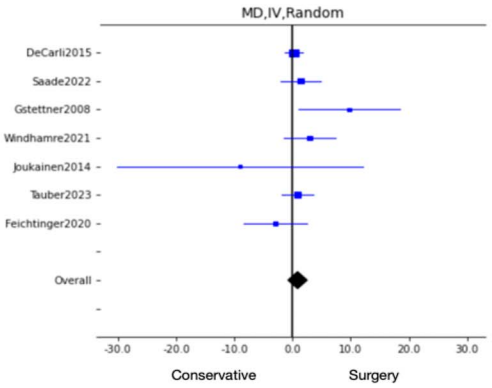
EFORT Open Reviews (2025) **10** 141–150
https://doi.org/10.1530/EOR-2024-0077

Constant score

MD,IV,Random

Study ID	n	Effect(95% CI)	Weight(%)
DeCarli2015	55	-0.20 [-1.81, 1.41]	36.92
Saade2022	19	-1.40 [-4.78, 1.98]	17.01
Gstettner2008	50	-9.70 [-18.40, -1.00]	3.46
Windhamre2021	61	-3.00 [-7.44, 1.44]	11.30
Joukainen2014	11	9.00 [-12.14, 30.14]	0.62
Tauber2023	78	-0.80 [-3.52, 1.92]	22.54
Feichtinger2020	29	3.00 [-2.41, 8.41]	8.15
Total	**303**	**-0.87 [-2.54, 0.80]**	**100.00**

7 studies included (N=303)
Heterogeneity: Tau²=1.299, Q=8.28 (p=0.221), I²=27.55%
Overall effect test: z=1.02, p=0.310

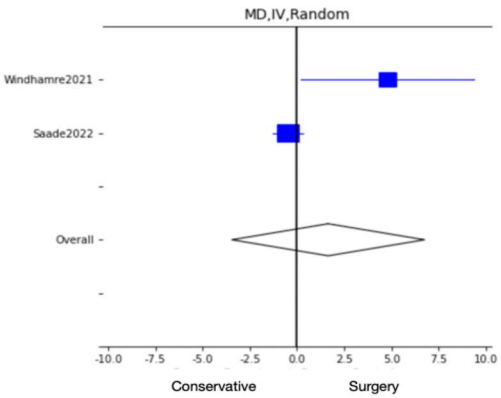


DASH score

MD,IV,Random

Study ID	n	Effect(95% CI)	Weight(%)
Windhamre2021	61	4.80 [0.23, 9.37]	40.62
Saade2022	19	-0.50 [-1.31, 0.31]	59.38
Total	**80**	**1.65 [-3.45, 6.75]**	**100.00**

2 studies included (N=80)
Heterogeneity: Tau²=11.237, Q=5.00 (p=0.026), I²=80.01%
Overall effect test: z=0.63, p=0.526

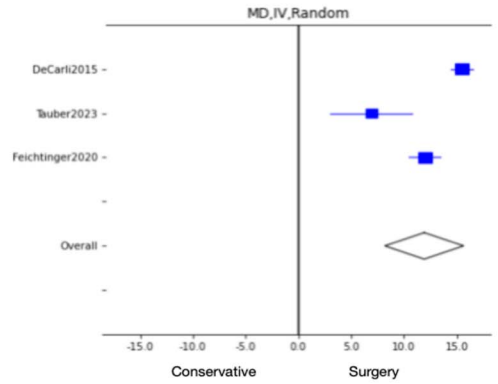


AJIS

MD,IV,Random

Study ID	n	Effect(95% CI)	Weight(%)
DeCarli2015	55	-15.50 [-16.56, -14.44]	37.07
Tauber2023	78	-6.90 [-10.81, -2.99]	26.90
Feichtinger2020	29	-12.00 [-13.48, -10.52]	36.03
Total	**162**	**-11.93 [-15.65, -8.20]**	**100.00**

3 studies included (N=162)
Heterogeneity: Tau²=9.452, Q=27.39 (p=0.000), I²=92.7%
Overall effect test: z=6.28, p=0.000



ASES

MD,IV,Random

Study ID	n	Effect(95% CI)	Weight(%)
DeCarli2015	55	-1.50 [-2.22, -0.78]	27.19
Saade2022	19	10.00 [7.56, 12.44]	26.06
Tauber2023	78	-5.00 [-7.10, -2.90]	26.38
Feichtinger2020	29	2.00 [-4.54, 8.54]	20.37
Total	**181**	**1.29 [-4.57, 7.15]**	**100.00**

4 studies included (N=181)
Heterogeneity: Tau²=32.747, Q=94.37 (p=0.000), I²=96.82%
Overall effect test: z=0.43, p=0.668

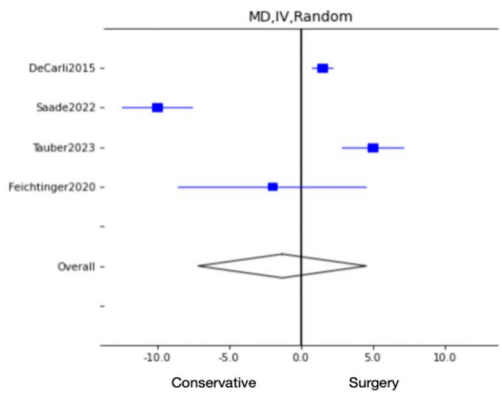
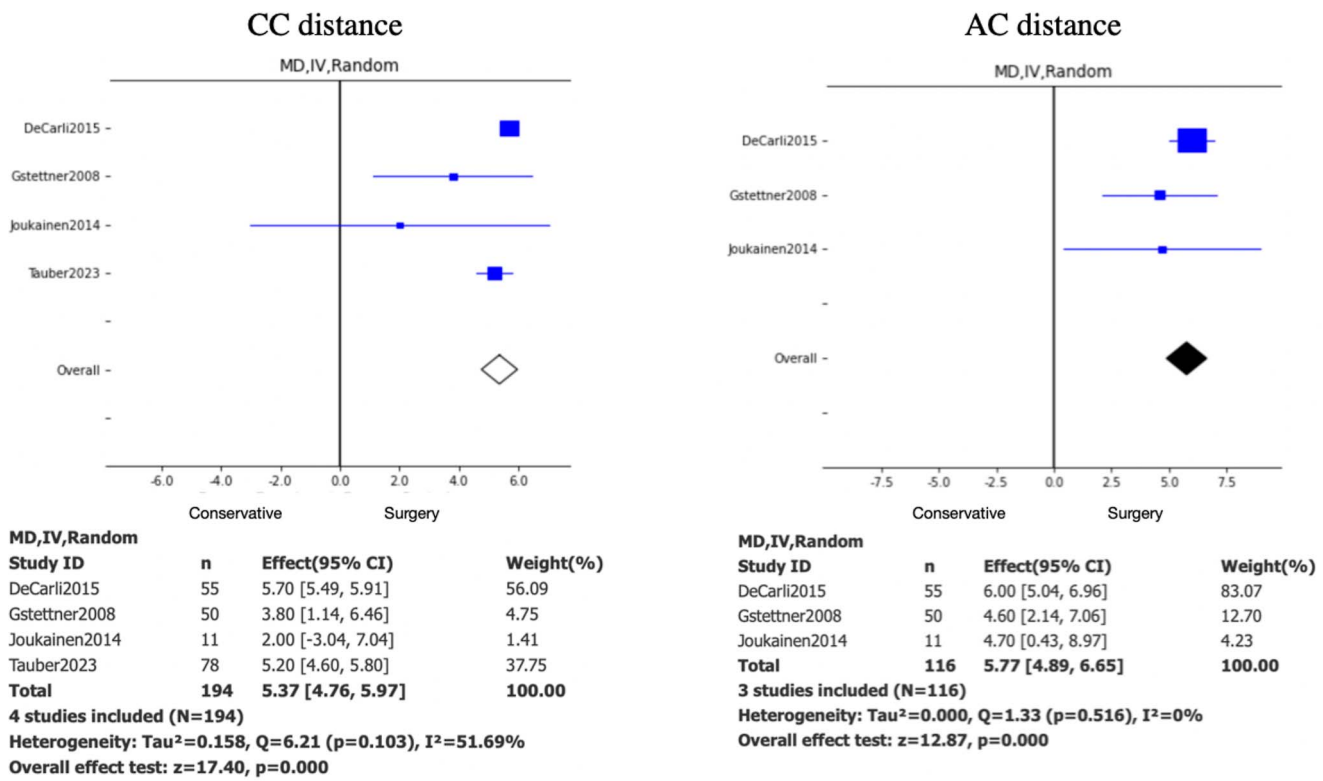


Figure 2

Forest plots for Constant score, DASH, ASES and ACJIS; CI, confidence interval; MD, mean difference; p, *P* value (16, 17, 18, 19, 20, 21, 22).

EFORT Open Reviews (2025) **10** 141–150
https://doi.org/10.1530/EOR-2024-0077



MD,IV,Random

Study ID	n	Effect(95% CI)	Weight(%)
DeCarli2015	55	5.70 [5.49, 5.91]	56.09
Gstettner2008	50	3.80 [1.14, 6.46]	4.75
Joukainen2014	11	2.00 [-3.04, 7.04]	1.41
Tauber2023	78	5.20 [4.60, 5.80]	37.75
Total	**194**	**5.37 [4.76, 5.97]**	**100.00**

4 studies included (N=194)
Heterogeneity: Tau²=0.158, Q=6.21 (p=0.103), I²=51.69%
Overall effect test: z=17.40, p=0.000

MD,IV,Random

Study ID	n	Effect(95% CI)	Weight(%)
DeCarli2015	55	6.00 [5.04, 6.96]	83.07
Gstettner2008	50	4.60 [2.14, 7.06]	12.70
Joukainen2014	11	4.70 [0.43, 8.97]	4.23
Total	**116**	**5.77 [4.89, 6.65]**	**100.00**

3 studies included (N=116)
Heterogeneity: Tau²=0.000, Q=1.33 (p=0.516), I²=0%
Overall effect test: z=12.87, p=0.000

Figure 3

Forest plots for radiological outcomes, CI, confidence interval; MD, mean difference; p, *P* value (16, 18, 20, 21).

reducing the risk of scapular dyskinesis (28, 29) but, at the same time, articles showed how patients that underwent surgery developed a progressive loss of reduction without worsening of clinical and functional results reached immediately after surgery (30, 31).

This lack of reduction is generally affecting around 20–25% of surgically treated patients, according to the literature.

Therefore, it is not possible to state that AC and CC distance restoration directly improves the clinical outcomes.

In addition to the functional level, another crucial aspect should be considered when deciding the most appropriate therapeutic option for each patient: the risk of adverse events. This review provided important insights on this topic. We decided not to perform a quantitative analysis, as the complications that arise in one or the other method are not easily comparable. In particular, in surgically treated patients, complications appear related to the mobilization of the implanted devices such as their intolerance or their mobilization or linked to surgical

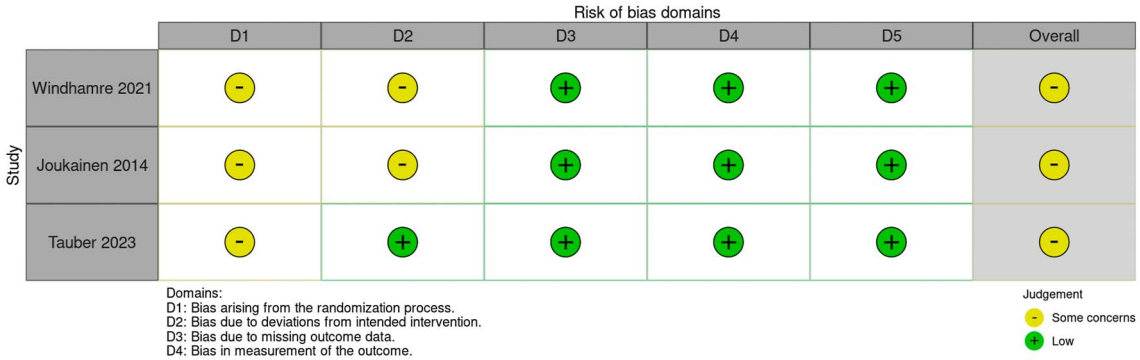


Figure 4

Risk of bias assessments according to RoB 2.0 tool (19, 20, 21).

EFORT Open Reviews (2025) **10** 141–150
https://doi.org/10.1530/EOR-2024-0077

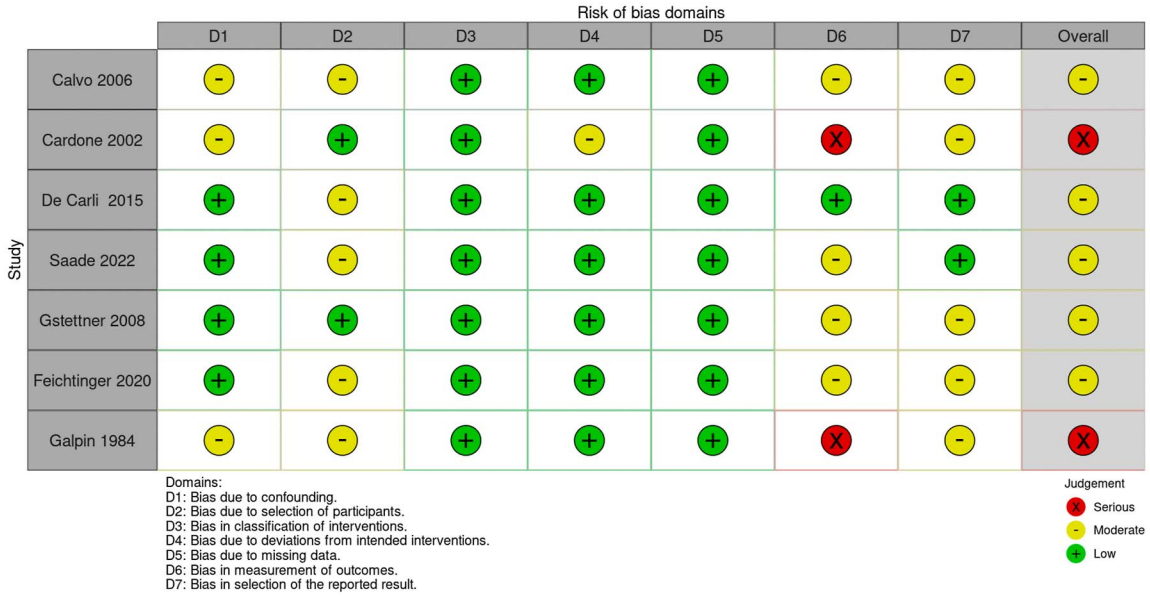


Figure 5

Risk of bias assessments according to ROBINS tool (14, 15, 16, 17, 18, 22, 23).

site infections with a percentage of these complications that was 9.2%. On the other hand, it could be considered that the conservative treatment is free from complications, but if the persistence of painful symptoms or the deformity of the ACJ which required surgery are considered as such, then the percentage found is 17.2%. From this, we can deduce how difficult it is to interpret the results, also in light of what is considered compliance and what is not. However, both procedures exhibit complications: on the one hand, the surgery, with the complication more closely related to the procedure itself such as infections or problems related to the implanted hardware, and on the other hand, the conservative treatment which, although does not expose the patient to a direct risk of complications, exposes it to the risk of unsatisfactory cosmetic or functional results requiring subsequent surgery.

Several analyzed studies highlighted the occurrence of CC ligament ossifications in the postoperative period. As reported in the literature, ossifications are more common in patients with good outcomes (32). The ossifications between the clavicle and the coracoid provide greater rigidity without altering shoulder kinematics and function (33).

In the meta-analysis conducted by Tang *et al*. (34), similar results to those of this study were reported in terms of clinical outcomes, but no radiographical parameter was analyzed, while in the meta-analysis conducted by Giai Via *et al*. (35), nonsignificance of the Constant score was reported, and a significant reduction in AC distance in favor of surgery was reported; however, the meta-analysis analyzed only three studies, making the considerations made weak.

The available literature presented numerous limitations that inevitably reflected in this meta-analysis. Not only did we identify published RCTs comparing these two treatment modalities; most of the literature consisted of studies with a moderate risk of bias and low-quality evidence. In this light, future research efforts should focus on randomized studies comparing different treatment approaches, in order to provide higher quality evidence and minimize the risk of bias. Another limitation of this work is the heterogeneity of the surgical procedure implemented in the studies analyzed. Quantitative analysis of different surgical procedures was not possible because treatment protocols differed among the analyzed studies. In addition, different postoperative rehabilitation protocols and postoperative indications were employed in the various studies analyzed. In addition, the literature analyzed did not accurately report the number of patients who, after conservative treatment, presented symptoms of instability or residual pain requiring surgical intervention. This would be an interesting aspect to compare between the two treatment modalities.

However, the included patient group was homogeneous in terms of age and treatment, which strengthens the results and allows this meta-analysis to provide an effective and comprehensive overview of the subject. Although further high-level studies must be conducted, the results of this meta-analysis quantified the strengths and limitations of the current literature, highlighted areas for future research and provided important elements to guide surgeons and patients in choosing the most suitable treatment for Rockwood type III AC dislocation.

EFORT Open Reviews (2025) **10** 141–150
https://doi.org/10.1530/EOR-2024-0077

Conclusions

This systematic literature review and meta-analysis compared the outcomes of surgical management with those of conservative management of acute Rockwood III ACJ dislocations, showing no significant differences in patient-reported outcomes and functional outcomes. This meta-analysis highlights a significant difference in terms of radiographical outcomes with the AC distance and CC distance values smaller in the surgical group than in the conservative group. The surgical approach presents some complications, particularly wound infections and hardware mobilization/intolerance, with a rate of 9.2%; on the other hand, the conservative group presented a rate of failure of 22%, with risks of persistent instability and pain.

ICMJE Statement of Interest

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the work.

Funding

This work was supported and funded by the Italian Ministry of Health – 'Ricerca Corrente'. The APC was funded by the Italian Ministry of Health – 'Ricerca Corrente'.

Author contribution statement

LBP, GB and RA contributed to conceptualization. SF, LBP and RA helped in methodology. LBP and SF contributed to validation. LBP and GB performed the formal analysis. LBP, SF and GB helped in investigation. LBP, GB and RA performed the data curation. LBP, RA, PM and GB helped in writing of the original draft. LBP, PM and GB helped in writing, review and editing. LBP, GB and RA helped in project administration. All authors have read and agreed to the published version of the manuscript.

Acknowledgements

We thank Dott. Alberto Basso for the statistical analysis and for the graphic design.

References

1 Martetschläger F, Kraus N, Scheibel M, *et al.* The diagnosis and treatment of acute dislocation of the acromioclavicular joint. *Dtsch Arztebl Int* 2019 **116** 89–95. (https://doi.org/10.3238/arztebl.2019.0089)

2 Gorbaty JD, Hsu JE & Gee AO. Classifications in brief: Rockwood classification of acromioclavicular joint separations. *Clin Orthop Relat Res* 2017 **475** 283–287. (https://doi.org/10.1007/s11999-016-5079-6)

3 Verstift DE, Kilsdonk ID, van Wier MF, *et al.* Long-term outcome after nonoperative treatment for Rockwood I and II acromioclavicular joint injuries. *Am J Sports Med* 2021 **49** 757–763. (https://doi.org/10.1177/0363546520981993)

4 Nolte PC, Lacheta L, Dekker TJ, *et al.* Optimal management of acromioclavicular dislocation: current perspectives. *Orthop Res Rev* 2020 **12** 27–44. (https://doi.org/10.2147/orr.s218991)

5 Babhulkar A & Pawaskar A. Acromioclavicular joint dislocations. *Curr Rev Musculoskelet Med* 2014 **7** 33–39. (https://doi.org/10.1007/s12178-013-9199-2)

6 Page MJ, McKenzie JE, Bossuyt PM, *et al.* The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Syst Rev* 2021 **10** 89. (https://doi.org/10.1186/s13643-021-01626-4)

7 Drevon D, Fursa SR & Malcolm AL. Intercoder reliability and validity of WebPlotDigitizer in extracting graphed data. *Behav Modif* 2017 **41** 323–339. (https://doi.org/10.1177/0145445516673998)

8 Burda BU, O'Connor EA, Webber EM, *et al.* Estimating data from figures with a web-based program: considerations for a systematic review. *Res Synth Methods* 2017 **8** 258–262. (https://doi.org/10.1002/jrsm.1232)

9 Sterne JA, Hernán MA, Reeves BC, *et al.* ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. *BMJ* 2016 **355** i4919. (https://doi.org/10.1136/bmj.i4919)

10 Ryan R & Hill S. *How to GRADE the Quality of the Evidence*. Cochrane Consumers and Communication Group. (http://cccrg.cochrane.org/author-resources)

11 Higgins JPT & Thompson SG. Quantifying heterogeneity in a meta-analysis. *Stat Med* 2002 **21** 1539–1558. (https://doi.org/10.1002/sim.1186)

12 Borenstein M, Hedges LV, Higgins JP, *et al.* A basic introduction to fixed-effect and random-effects models for meta-analysis. *Res Synth Methods* 2010 **1** 97–111. (https://doi.org/10.1002/jrsm.12)

13 Walter SD & Yao X. Effect sizes can be calculated for studies reporting ranges for outcome variables in systematic reviews. *J Clin Epidemiol* 2007 **60** 849–852. (https://doi.org/10.1016/j.jclinepi.2006.11.003)

14 Calvo E, López-Franco M & Arribas IM. Clinical and radiologic outcomes of surgical and conservative treatment of type III acromioclavicular joint injury. *J Shoulder Elbow Surg* 2006 **15** 300–305. (https://doi.org/10.1016/j.jse.2005.10.006)

15 Cardone D, Brown JN, Roberts SN, *et al.* Grade III acromioclavicular joint injury in Australian Rules Football. *J Sci Med Sport* 2002 **5** 143–148. (https://doi.org/10.1016/s1440-2440(02)80035-4)

16 De Carli A, Lanzetti RM, Ciompi A, *et al.* Acromioclavicular third degree dislocation: surgical treatment in acute cases. *J Orthop Surg Res* 2015 **10** 13. (https://doi.org/10.1186/s13018-014-0150-z)

17 Saade F, Carminati F, Bouteille C, *et al.* Acromioclavicular joint separation: retrospective study of non-operative and surgical treatment in 38 patients with grade III or higher injuries and a minimum follow-up of 1 year. *Orthop Traumatol Surg Res* 2023 **109** 103405. (https://doi.org/10.1016/j.otsr.2022.103405)

18 Gstettner C, Tauber M, Hitzl W, *et al.* Rockwood type III acromioclavicular dislocation: surgical versus conservative treatment. *J Shoulder Elbow Surg* 2008 **17** 220–225. (https://doi.org/10.1016/j.jse.2007.07.017)

19 Boström Windhamre H, von Heideken J, Une-Larsson V, *et al.* No difference in clinical outcome at 2-year follow-up in patients with type III and V acromioclavicular joint dislocation treated with hook plate or physiotherapy: a randomized controlled trial. *J Shoulder Elbow Surg* 2022 **31** 1122–1136. (https://doi.org/10.1016/j.jse.2021.12.003)

20 Joukainen A, Kröger H, Niemitukia L, *et al.* Results of operative and nonoperative treatment of Rockwood types III and V acromioclavicular joint dislocation: a prospective, randomized trial with an 18- to 20-year follow-up. *Orthop J Sports Med* 2014 **2** 2325967114560130. (https://doi.org/10.1177/2325967114560130)

21 Tauber M, Hoffelner T, Lehmann L, *et al.* Prospective multicenter randomized controlled trial of surgical versus nonsurgical treatment for acute Rockwood type 3 acromioclavicular injury. *Orthop J Sports Med* 2023 **11** 23259671231190411. (https://doi.org/10.1177/23259671231190411)

EFORT Open Reviews (2025) **10** 141–150
https://doi.org/10.1530/EOR-2024-0077

22 Feichtinger X, Dahm F, Schallmayer D, *et al.* Surgery improves the clinical and radiological outcome in Rockwood type IV dislocations, whereas Rockwood type III dislocations benefit from conservative treatment. *Knee Surg Sports Traumatol Arthrosc* 2021 **29** 2143–2151. (https://doi.org/10.1007/s00167-020-06193-0)

23 Galpin RD, Hawkins RJ & Grainger RW. A comparative analysis of operative versus nonoperative treatment of grade III acromioclavicular separations. *Clin Orthop Relat Res* 1985 **193** 150–155. (https://doi.org/10.1097/00003086-198503000-00020)

24 Gumina S, Carbone S & Postacchini F. Scapular dyskinesis and SICK scapula syndrome in patients with chronic type III acromioclavicular dislocation. *Arthroscopy* 2009 **25** 40–45. (https://doi.org/10.1016/j.arthro.2008.08.019)

25 Ziegler P, Kühle L, Stöckle U, *et al.* Evaluation of the Constant score: which is the method to assess the objective strength? *BMC Musculoskelet Disord* 2019 **20** 403. (https://doi.org/10.1186/s12891-019-2795-6)

26 Baumgarten KM & Chang PS. The American shoulder and elbow surgeons score highly correlates with the simple shoulder test. *J Shoulder Elbow Surg* 2021 **30** 707–711. (https://doi.org/10.1016/j.jse.2020.07.015)

27 Kraus N, Hann C, Gerhardt C, *et al.* Dynamic instability of the acromioclavicular joint: a new classification for acute AC joint separation. *Obere Extrem* 2018 **13** 279–285. (https://doi.org/10.1007/s11678-018-0469-x)

28 Murena L, Canton G, Vulcano E, *et al.* Scapular dyskinesis and SICK scapula syndrome following surgical treatment of type III acute acromioclavicular dislocations. *Knee Surg Sports Traumatol Arthrosc* 2013 **21** 1146–1150. (https://doi.org/10.1007/s00167-012-1959-9)

29 Giuseppe LU, Laura RA, Berton A, *et al.* Scapular dyskinesis: from basic science to ultimate treatment. *Int J Environ Res Public Health* 2020 **17** 2974. (https://doi.org/10.3390/ijerph17082974)

30 Çarkçı E, Polat AE & Gürpınar T. The frequency of reduction loss after arthroscopic fixation of acute acromioclavicular dislocations using a double-button device, and its effect on clinical and radiological results. *J Orthop Surg Res* 2020 **15** 136. (https://doi.org/10.1186/s13018-020-01674-x)

31 Lee YS, Kim DS, Jung JW, *et al.* Risk factors of loss of reduction after acromioclavicular joint dislocation treated with a hook plate. *J Orthop Traumatol* 2023 **24** 10. (https://doi.org/10.1186/s10195-023-00685-8)

32 Ertogrul R, Sahin K, Celik H, *et al.* Is coracoclavicular ossification a complication or a good prognostic factor after surgical treatment of acromioclavicular joint injury? *JSES Int* 2022 **6** 769–774. (https://doi.org/10.1016/j.jseint.2022.04.009)

33 Motta P, Bruno L, Maderni A, *et al.* Acromioclavicular motion after surgical reconstruction. *Knee Surg Sports Traumatol Arthrosc* 2012 **20** 1012–1018. (https://doi.org/10.1007/s00167-011-1627-5)

34 Tang G, Zhang Y, Liu Y, *et al.* Comparison of surgical and conservative treatment of Rockwood type-III acromioclavicular dislocation: a meta-analysis. *Medicine* 2018 **97** e9690. (https://doi.org/10.1097/MD.0000000000009690)

35 Giai Via R, Bosco F, Giustra F, *et al.* Acute Rockwood type III ACJ dislocation: conservative vs surgical approach. A systematic review and meta-analysis of current concepts in literature. *Injury* 2022 **53** 3094–3101. (https://doi.org/10.1016/j.injury.2022.07.050)