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ABSTRACT

Background: When the acromion does not fully fuse during development, the resulting condition is known as os acromiale. Since the deltoid muscle, a key player in Reverse Shoulder Arthroplasty (RSA), attaches to the acromion, surgeons may be hesitant to implant an RSA in these patients. Hence, the aim of this study is to report the clinical and radiological outcomes, as well as safety and effectiveness of RSA in patients with os acromiale.

Methods: A systematic review of the literature was conducted to evaluate the outcomes of RSA in patients with os acromiale, according to PRISMA guidelines. Four studies with a total of 100 patients (103 shoulders) were reviewed. Data on clinical outcomes, range of motion, pain relief, and complications were reported.

Results: Patients with os acromiale undergoing RSA showed significant improvements in clinical outcomes. The mean weighted postoperative Constant-Murley Score was 69 points, with improved range of motion. In 38.8% of cases a postoperative acromial tilt was reported, however this did not significantly affect the outcome.

Conclusions: RSA can be considered a safe and reliable procedure for patients with os acromiale, offering improvements in both pain and function, similar to those observed in patients without os acromiale. More than one-third of patients (38.8%) experience os acromiale tilting, which did not show clinical relevance.

Level of Evidence: Level IV; Systematic Review

Keywords: Reverse Shoulder arthroplasty, Os acromiale, Acromion, Outcome, Complications

Os acromiale occurs when one or more ossification centers of the acromion fail to fuse[37]. Its prevalence has been reported to range from 0.7% to 15%[1,17,18,27,44]. Yammine et al suggested a genetic predisposition to acromion unfusion[43], and consequently, the prevalence of os acromiale varies depending on geographic origin of the population[9,18]. It can also be bilateral in 33 to 62% of cases[24,31,36]. Os acromiale is classified into three types based on its anatomical location,: pre-acromion, meso-acromion, and meta-acromion[44]. When the unfused segment is located anterior to the clavicle, it is termed os pre-acromiale and serves as the bony insertion for coracoacromial ligament and anterior deltoid muscle. If situated between the anterior edge of the clavicle and the acromial angle, it is classified as os meso-acromiale, corresponding to the middle deltoid muscle attachment. When positioned medial to the acromial angle, it is referred to as os meta-acromiale, where the posterior deltoid fibers originate [36] (Fig.1). Among these, os meso-acromiale is the most commonly reported variant[38] (Fig.2).

Several studies have identified os acromiale as a potential cause of shoulder pain[2,4,38], although most cases are asymptomatic and discovered incidentally[16,17,36]. Some authors have suggested that os acromiale may contribute to subacromial impingement, particularly when instability of the ossified segment allows it to be displaced inferiorly by deltoid contraction. This displacement can lead to compression of the subacromial bursa and the posterosuperior rotator cuff [4,5,42].

Over the last 30 years, Reverse Shoulder Arthroplasty (RSA) has become the gold standard for treating cuff tear arthopathy [6,14,22,25]. RSA functions by distalizing and medializing the glenohumeral center of rotation, which enhances the deltoid lever arm and restores muscle tension, allowing for active shoulder elevation even in the absence of a functional rotator cuff[33]. With the increasing

popularity of RSA, concerns have emerged regarding its suitability in patients with acromial impairments such as acromial fractures and os acromiale[12]. Given the relatively high prevalence of os acromiale in the general population[9,43], orthopedic surgeons are increasingly encountering this challenging scenario, despite the lack of clear evidence in the literature. Since no systematic review has yet been published on this topic, the aim of this study is to evaluate the clinical and radiological outcomes, as well as the safety and effectiveness, of RSA in patients with os acromiale.

MATERIALS AND METHODS

A systematic review was conducted to evaluate the outcomes of RSA in patients with os acromiale. The review was designed according to the PICO framework[32]. The Population was defined as patients with os acromiale, the Intervention as RSA, the Comparison as preoperative versus postoperative shoulder function, and, when available, RSA outcomes in patients with versus without os acromiale, and the Outcome as clinical scores and complications. The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[34].

Two independent reviewers conducted the systematic review in accordance with the PRISMA checklist, and the PRISMA flow diagram is presented in Figure 3. A comprehensive literature search was performed on June 30, 2024, using Medline via PubMed, applying the following Boolean search strategy: "'((os acromiale) OR (os acromial) OR (os acromion) OR (unfused acromion) OR (pre-acromion) OR (meso-acromion) OR (meta-acromion)) AND ((reverse) OR (arthroplasty) OR (prosthesis) OR (replacement))."' No restrictions were applied regarding the publication date. Additionally, reference lists of relevant articles were manually reviewed to identify any studies that may have been missed in the initial search. In cases where multiple studies reported overlapping patient populations, only the study with the largest cohort was included.

Studies were included based on the following criteria: (1) availability of full-text, and (2) clinical studies specifically addressing reverse shoulder arthroplasty in patients with os acromiale. Exclusion

criteria included: (1) case reports, (2) technical notes, (3) conference abstracts, (4) editorial commentaries, and (5) articles that completely lack distinction between os acromiale and other scapular diseases.

Two reviewers independently screened articles by title and abstract according to the inclusion and exclusion criteria. In cases of disagreement, the senior author was consulted to make the final decision.

The methodological quality of the included studies was assessed using the Methodological Index for Non-Randomized Studies (MINORS) score[35]. To ensure consistency in the evaluation of comparative and non-comparative studies, the scores were converted into percentages. The assessment was calculated by two independent reviewers, with the senior author consulted in case of disagreement.

Relevant data were extracted from each study: level of evidence, publication year, study type, demographic data, mean follow-up duration, preoperative diagnosis, intraoperative adjustments, postoperative care, type of os acromiale, implants details, clinical and functional scores, range of motion (ROM), os acromiale tilting, and MINORS score.

Continuous variables were reported as mean values along with range (minimum to maximum) and standard deviation (SD) where available, while categorical variables were expressed as frequencies and percentages. Statistical analysis was performed using Prism 9.4 (GraphPad Software, Boston, MA, USA).

RESULTS

Search Results

From the initial search, 26 published studies were identified. Following the screening process, 22 articles were excluded: 18 were not relevant, 2 were case reports, 1 manuscript lacked the distinction between os acromiale and other scapular diseases, and 1 article was based on the same population as one of the studies included in the review. As a result, four studies were ultimately included in the final

analysis [1,8,13,39], as detailed in the PRISMA diagram (Fig. 3). The average MINORS score, based on a 24-point scale, was 17.7 (range 15-20) (Table 1).

A total of 100 patients and 103 shoulders with os acromiale were treated with RSA across the selected studies. The weighted average age of the patient population was 73.4 ±1.4 years (71.8 – 74) and the mean follow-up duration was 41.7 ± 2.8 months (30.8 – 62.3) (Table 2). In 79.6% of cases, RSA was performed due to cuff tear arthropathy, in 10.7% after a failed rotator cuff repair, in 7.7% as a revision of previous failed prosthesis, in 1% for massive irreparable cuff tear, in 1% for fracture. Regarding surgical technique, the authors did not modify their standard surgical procedure and implant positioning for cases of os acromiale compared to routine cases, although Carpeggiani et al [8] recommended avoiding the placement of the Homan retractor over the acromion. Among the different types of os acromiale, meso-acromion was the most frequently observed, found in 83 cases (80.6%), followed by pre-acromion in 17 cases (16.5%), and meta-acromion in three cases (2.9%). Carpeggiani et al[8] found that patients with a meso-acromion experienced significantly higher pain levels, reporting 11 ± 4 points, compared to 14 ± 1 points in those with a pre-acromion, two years after surgery.

Various prosthesis models were used, including: Delta Xtend (DePuy, Warsaw, IN, USA), Aequalis (Stryker, Kalamazoo, MI, USA), Comprehensive (Zimmer-Biomet, Warsaw, IN, USA), RSP (DJO Surgical, Austin, TX, USA), and the Anatomical Shoulder Reverse System (Zimmer-Biomet, Warsaw, IN, USA) (Table 3).

Regarding clinical outcomes, the weighted mean postoperative Constant-Murley Score (CMS) was 69 ± 1.3 points (66.4 – 70). The weighted mean pain score, based on a 15-point scale (where 0 indicates severe pain and 15 represents no pain [30]) was 12.8 ± 0.5 points (12 – 13.2). The weighted average ROM was 121.8° ± 12.7° (109° – 141°) for flexion and 31° ± 10.3° (23° – 46°) for external rotation. All studies reported significant improvements in clinical scores and ROM following RSA in patients with os acromiale. Carpeggiani et al[8] also compared postoperative complications rate between cases and control founding no differences, particularly aseptic loosening (cases vs controls,

123 4.4% vs 4.5%, P > .99), scapular spine fractures (cases vs controls, 4.4% vs 3%, P > .99), acromial
124 fractures (cases vs controls, 0% vs 0.8%, P > .99), good-looking but painful RSA after excluding
125 aseptic or septic loosening (cases vs controls, 0% vs 1.6%, P > .99), and postoperative incomplete
126 plexus palsy after locoregional anesthesia with complete sensory-motor recovery (cases vs controls,
127 0% vs 0.8%, P > .99). All the results are summarized in Table 4.

128 When reviewing the comparison of RSA outcomes between patients with os acromiale and control
129 groups, the authors did not find statistically significant differences in CMS, QuickDASH, Subjective
130 Shoulder Value, pain levels, flexion, abduction, or external rotation (Table 5). However, Carpeggiani
131 et al [8] observed significantly higher 1-year flexion (104° vs 114°, p = 0.03) and 2-year abduction
132 (103° vs 121°, p = 0.02) in the control group, although final follow-up values were comparable (Table
133 5). This difference may be related to residual postoperative pain, as 12 patients (26.7%) reported
134 immediate postoperative pain, with eight of them (66.6%) experiencing pain relief over time (Table
135 6).

136 Radiographic analysis revealed tilting of the os acromiale (Fig.4) in 40 of 103 cases (38.8%). In the
137 cohort analyzed by Walch et al[39], four cases with preoperative acromial tilt exhibited increased
138 displacement after RSA implantation. The degree of os acromiale mobilization was quantified by
139 Walch et al [39], who reported a mean tilt angle of 43.3° (referred to six patients with os acromiale and
140 three patients with preoperative acromial fragmentation), by Aibinder et al [1], with a mean tilt angle
141 of 32.3° (10°-64°), while Ersen et al [13], found an average acromiohumeral distance of 19.3 mm (16
142 mm-22 mm) in patients with os acromiale compared to 32.3 mm (20 mm-43 mm) in controls (p =
143 0.038). Aibinder et al[1] also compared outcomes between patients with and without tilted os acromiale
144 after RSA implantation, reporting no significant differences in American Shoulder and Elbow
145 Surgeons (ASES) score, pain, and ROM. (Table 6).

DISCUSSION

The main purpose of this review was to address to the question of whether it is safe to implant a RSA in a patient with an os acromiale. The analysis of the available literature indicates that RSA in these patients is a safe and effective procedure, leading to improvements in both pain and function similar to those observed in patients without os acromiale. However, a 38.8% risk of acromial tilt on postoperative X-rays has been reported, despite overall satisfactory clinical outcomes. Only a small portion of patients experienced persistent postoperative pain, with the majority achieving pain relief within two years.

The outcomes of RSA in patients with os acromiale were consistent with those reported in the literature for patients with an intact acromion. The mean CMS was 69 points, with an average pain score of 12.8, a mean flexion of 121.8°, and an external rotation of 31°. Galwin et al [15] reported a mean CMS of 69 points, flexion of 134°, and external rotation of 36°, while Lawrence et al [19] found a mean CMS of 65.5 points, a pain score of 12.2, flexion of 134°, and external rotation of 24°. Our findings also align with those of Werner et al [41], who conducted a matched case-control study comparing 11 RSA in patients with acromial compromise (os acromiale, acromial fragmentation, or severe thinning) to 33 controls. They reported no statistically significant differences in postoperative clinical outcomes, including ASES scores (68.9 ± 16.9 for cases vs. 72.7 ± 21.8 for controls, $p = 0.602$), patient satisfaction, or complication rates. Something worth considering is reported by Carpeggiani et al[8], regarding the fact that patients with os acromiale showed significantly lower flexion and abduction outcomes during follow-up, although they achieved comparable results to the controls at the end of the follow-up period. Moreover, in cases of residual pain, it regressed in 66.6% of patients within two years postoperatively. All of this suggests that patients with os acromiale may have a slower recovery process after reverse shoulder arthroplasty, although this has not been investigated by all authors. Future investigations are required to better understand this phenomenon.

Concerns regarding RSA in patients with os acromiale arise from the essential role of the deltoid muscle in prosthesis function[10,40]. One of the most significant complications of RSA is scapular spine or acromial stress fractures, which has been extensively discussed in the literature to better understand their impact on RSA performance[3,7,11,23,26,28,29].

Levy et al [21] initially proposed a classification system for post-RSA acromial fractures based on the deltoid muscle origin. They identified three subtypes: Type I, lateral to the acromial angle; Type II, medial to the acromial angle but lateral to the scapular spine insertion; and Type III, at the scapular spine insertion on the scapular body. Boltuch et al[7] later revised this classification, further subdividing Type II fractures into IIa, IIb, and IIc based on their location relative to the glenoid face. They found significantly worse outcomes in medial fractures (Levy types IIb, IIc, and III) compared to lateral fractures (Levy types I and IIa). These findings are relevant to the present study, as most cases of os acromiale in the analyzed cohort were meso-acromion, which represent an unfused segment anterior to the acromial angle and it is comparable to a Levy Type I fracture, generally clinically insignificant. Only three cases (2.9%) involved meta-acromion, which may have a greater impact on RSA function.

Although persistent postoperative pain is uncommon, it was reported in a total of 13 cases mostly managed non-operatively. In the majority of cases (eight patients, 61.5%), pain subsided over time. However, Aibinder et al[1] documented one case of painful os acromiale, which was successfully treated with excision. They suggested os acromiale excision as a possible solution for persistent pain following RSA in these patients. Walch et al[39] reported a case in which a tension band was applied to the os acromiale in conjunction with RSA, resulting in a nonunion with a 45° of acromial tilt. Despite this, the patient exhibited satisfactory clinical outcomes, with a CMS of 66 points and a forward flexion of 110°. Further research is needed to determine the best treatment approach for these rare cases.

Os acromiale displacement following RSA is the most frequently reported radiographic complication (38.8%), although it appears to have minimal impact on clinical function. Aibinder et al[1] found an

195 average os acromiale tilt of 32.3° after RSA and reported no significant differences in clinical
196 outcomes or ROM between patients with displaced and nondisplaced os acromiale. Lee [20] conducted
197 a biomechanical study on human specimen scapulae to evaluate the impact of the acromial tilting on
198 RSA function. They demonstrated that an acromial tilt of 20° or more can significantly reduce
199 impingement-free ROM. These findings support the hypothesis that the location of os acromiale is a
200 key factor in RSA outcomes. In Lee et al study, the simulated acromial osteotomy was performed at
201 the glenoid face level, resembling a Levy IIb fracture. In contrast, in the present cohort, where no
202 such complications were observed, the os acromiale was typically located at the meso-acromion,
203 corresponding to a Levy I fracture. This difference in the location of acromial compromise may
204 explain why a displaced os acromiale does not affect RSA impingement-free ROM in most cases.

205 Several limitations must be considered in this systematic review. First, the existing literature on RSA
206 in patients with os acromiale consists of studies with small cohorts (fewer than 50 patients), limiting
207 the overall statistical power. Additionally, due to incomplete data reporting in the analyzed studies, a
208 meta-analysis could not be performed. Nevertheless, given the relative rarity of RSA with os
209 acromiale, a systematic review on this topic is still lacking. Future research should focus on the impact
210 of os acromiale located medial to the glenoid face, particularly in cases of very medial meta-acromion,
211 which may correspond to Levy Type IIb fractures or more severe subtypes and could have a greater
212 clinical impact. Fortunately, such cases are extremely rare.

213

214 **CONCLUSIONS**

215 The RSA can be considered a safe and reliable procedure for patients with os acromiale, providing
216 clinical improvements and complication rates comparable to those observed in patients with an
217 intact acromion. However, more than one-third of patients (38.8%) experience os acromiale tilting.
218 Despite this radiographic finding, even in cases of persistent postoperative pain, most patients
219 achieve progressive relief over time.

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FIGURE CAPTION

Fig.1: Topographic classification of os acromiale, green line= pre-acromion, blue line=meso-acromion, red line=meta-acromion**.**

Fig. 2: CT scan 3D reconstruction of a meso-acromion.

Fig. 3: PRISMA flowchart reporting the review process *(PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses)*

Fig. 4: X-ray showing a case of acromial tilt. The acromial tilt angle was represented as **Ω**.

TABLES LEGEND

Table 1 MINORS score *(MINORS: Methodological Index for Non-Randomized Studies).*

Table 2 Demographics and general data from the four articles involved in the systematic review. (*= data referred to the overall population of the article, not only the patients with os acromiale).

Table 3 Os acromiale classification, preoperative diagnosis, intraoperative surgical procedure tips, postoperative care, and implanted prosthesis.

Table 4 Analysis of the impact of the reverse shoulder arthroplasty on the patients with os acromiale, comparing preoperative and postoperative values.

Table 5 Comparison between reverse shoulder arthroplasty on patients with os acromiale and controls.

Table 6 Complications (*= data referred to the overall population of the article, not only the patients with os acromiale).

Variable	**Walch[40]**	**Aibinder[1]**	**Ersen[13]**	**Carpeggiani[8]**
1. A clearly stated aim	2	2	2	2
2. Inclusion of consecutive patients	2	2	2	2
3. Prospective collection of data	0	0	0	0
4. Endpoints appropriate for aim of study	2	2	2	2
5. Unbiased assessment of the study endpoint	1	0	1	0
6. Follow-up period appropriate for aim of the study	2	2	2	2
7. Loss of follow-up less than 5%	1	2	1	0
8. Prospective calculation of the study size	0	0	0	0
9. An adequate control group	*2*	-	*2*	2
10. Contemporary groups	2	-	2	2
11. Baseline equivalence groups	2	-	2	1
12. Adequate statistical analyses	2	-	2	2
MINORS SCORE	*20*	*12*	*18*	*15*

Author	*Year*	*Level of evidence*	*Study type*	*Patients*	*Shoulders*	*Gender (M/F)*	*Age (years)± SD (range)*	*Mean Follow-up (range)*
Walch[40]	2009	III	Retrospective case control study	23	23	6/35*	74.3 *	40 months (24-100)
Aibinder[1]	2017	IV	Retrospective analysis	25	25	17/8	72 (46-84)	30.8 months (24-81.4)
Ersen[13]	2019	III	Retrospective case control study	10	10	7/39*	71.8 (56-84)	62.3 months
Carpeggiani[8]	2020	III	Retrospective matched case control study	42	45	17/28	74 ±9	44 months (12-120)

Legend: M=Male

F= Female

Author	*Os Acromiale Type*	*Diagnosis*	*Intraoperative adjustement*	*Post-operative Care*	*Implant*
Walch[40]	23 mesoacromion	1 MICT, 20 CTA, 2 revisions of a prior arthroplasty	The operative technique was not adjusted because of the presence of the os acromiale	Simple sling for of 1 month. Immediate passive range of motion. Active motion delayed 2 months after surgery.	Aequalis (Stryker, Kalamazoo, USA))
Aibinder[1]	• 3 preacromion • 20 mesoacromion • 2 metaacromion	CTA	The operative technique was not adjusted because of the presence of the os acromiale	The authors shared with the patients before the surgery the risk of post-operative os acromiale tilting in 30% of cases.	• 4 Delta Xtend (DePuy, Warsaw, USA) • 1 Aequalis (Stryker, Kalamazoo, USA) • 19 Comprehensive (Zimmer-Biomet, Warsaw, USA) • 1 RSP (DJO Surgical, Austin, USA)
Ersen[13]	10 mesoacromion	CTA	The operative technique was not adjusted because of the presence of the os acromiale	Sling for 6 weeks after surgery. Forward flexion and abduction were allowed after 3 days post-operative. Internal and external rotation were forbidden for 6 weeks. All motions were allowed after 6 weeks from surgery, after 12 weeks the muscle strengthening was started.	• Delta Xtend (DePuy, Warsaw, IN, USA) • Comprehensive (Zimmer-Biomet, Warsaw, IN, USA)
Carpeggiani[8]	• 14 preacromion • 30 mesoacromion • 1 metaacromion	• MICT or osteoarthritis 27 (60%) • Previous rotator cuff surgery 11 (24.5%) • Fracture 1 (2%) • Conversion from anatomical prosthesis 3 (7%) • Conversion from hemiprosthesis 3 (7%)	Standard techinique but the placement of the retractor on the acromion was avoided	Sling for a maximum of 6 weeks. Immediate passive external and internal rotation and active-assisted elevation were allowed assisted by a physical therapist.	Anatomical Shoulder Reverse System (Zimmer-Biomet, Warsaw, USA)

Legend: MICT= Massive Irreparable Cuff Tear

CTA= Cuff Tear Arthropathy

Author	*Clinical Outcome*	*Subjective outcome*	*Pain (15 points)*	*Forward Flexion*	*Abduction*	*External Rotation*
Walch[40]	**CMS**: Pre-op: 26.6 Post-op: 68.3	• 12 Very Satisfied • 9 Satisfied • 2 Uncertain •0 Disappointed	Pre-op: 4.3 Post-op: 13.1	Pre-op: 72.2° Post-op: 141°	-	
Aibinder[1]	**ASES**: 65.9 (46.7-85) **Modified Neer rating:** • 19 Excellent or satisfactory outcome; • 6 unsatisfactory	• 16 "Much better" • 5 "Better" • 3 "Same" • 1 "worse"	Pre-op: 8.25 Post-op: 12 P<.0001	Pre-op: 67° Post-op: 124° P<.001	-	Pre-op: 16° Post-op: 46° P<.001
Ersen[13]	**CMS**: Pre-op: 35.7 Post-op: 66.4 P<0.0001 **Quick DASH**: Pre-op: 62.3 Post-op: 22 P<0.0001	-	Pre-op: 4.95 Post-op: 13.2 P<0.0001	Pre -op: 72.8° (30-100) Post-op: 130° (90-170) P=0.26	Pre-op: 61.4° (30-80) Post-op: 103° (80-130) P=0.37	Pre-op: 24.3° (0-50) Post-op: 29.2° (20-40) P=0.41
Carpeggiani[8]	**CMS**: Pre-op: 39 Post-op: 70 ± 23	**SSV:** Pre-op: 30±20 Post-op: 72±30 P<0.01	Pre-op: 6 ±4 Post-op: 13 ±3 P<.01	Pre-op: 73° 1 year Post-op: 104° 2 years Post-op: 109° End follow-up Post-op: 109 P<.01	Pre-op: 64° 1 year Post-op: 98° 2 years Post-op: 103° End follow-up Post-op: 111° P<.01	Pre-op: 25° 1 year Post-op: 25° 2 years Post-op: 19° End follow-up Post-op: 23° P=.55

Legend: CMS= Constant-Murley Score

ASES= American Shoulder and Elbow Surgeons score

DASH= Disability of the arm, shoulder and hand

SSV= Subjective Shoulder Value

Pre-op= preoperative

Postop= postoperative

Author	*Clinical Outcome*	*Subjective outcome*	*Pain (15 points)*	*Forward Flexion*	*Abduction*	*External Rotation*
Walch[40]	**CMS:** Case: 68.3 pts Control: 57.5 pts P=.05	-	Case: 13.1 pts Control: 12.1 pts	Case: 141° Control: 123.8°	-	-
Aibinder[1]	-	-	-	-	-	-
Ersen[13]	**CMS:** Case: 66.4 pts Control 69.1 pts P=0.24 **Quick DASH:** Case: 22 pts Control: 27 pts P=0.38	-	Case: 13.2 pts Control: 13.65 pts P=0.61	Case: 130° (90-170) Control: 138° (90-170) P=0.26	Case: 103° (80-130) Control: 104° (70-160) P=0.37	Case: 29.2° (20-40) Control: 28.3° (15-40) P=0.41
Carpeggiani[8]	**CMS:** Case: 70 ±23 pts Control: 76±21 pts P=.15	**SSV:** Case: 70 %±30 Control: 73 %±24 P=.52	Case: 13 ±3 pts Control: 13 pts P=.15	Case 1 year post-op: 104° Case 2 years post-op: 109° Case end follow-up post-op: 107° Control 1 year post-op: 114°±33 Control 2 years post-op: 123° Control end follow-up post-op: 119° 1 year P=.03 Overall P=.08	Case 1 year post-op: 98° Case 2 years post-op: 103°±37 Case end follow-up post-op: 111° Control 1 year post-op: 107° Control 2 years post-op: 121°±38 Control end follow-up post-op: 124° 2 years P=.02 Overall P=.19	Case 1 year post-op: 25° Case 2 years post-op: 19° Case end follow-up post-op: 23° Control 1 year post-op: 26° Control 2 years post-op: 26° Control end follow-up post-op: 24° Overall P=.13

Legend: CMS= Constant-Murley Score

ASES= American Shoulder and Elbow Surgeons score

DASH= Disability of the arm, shoulder and hand

SSV= Subjective Shoulder Value

Pts= points

Pre-op= preoperative

Post-op= postoperative

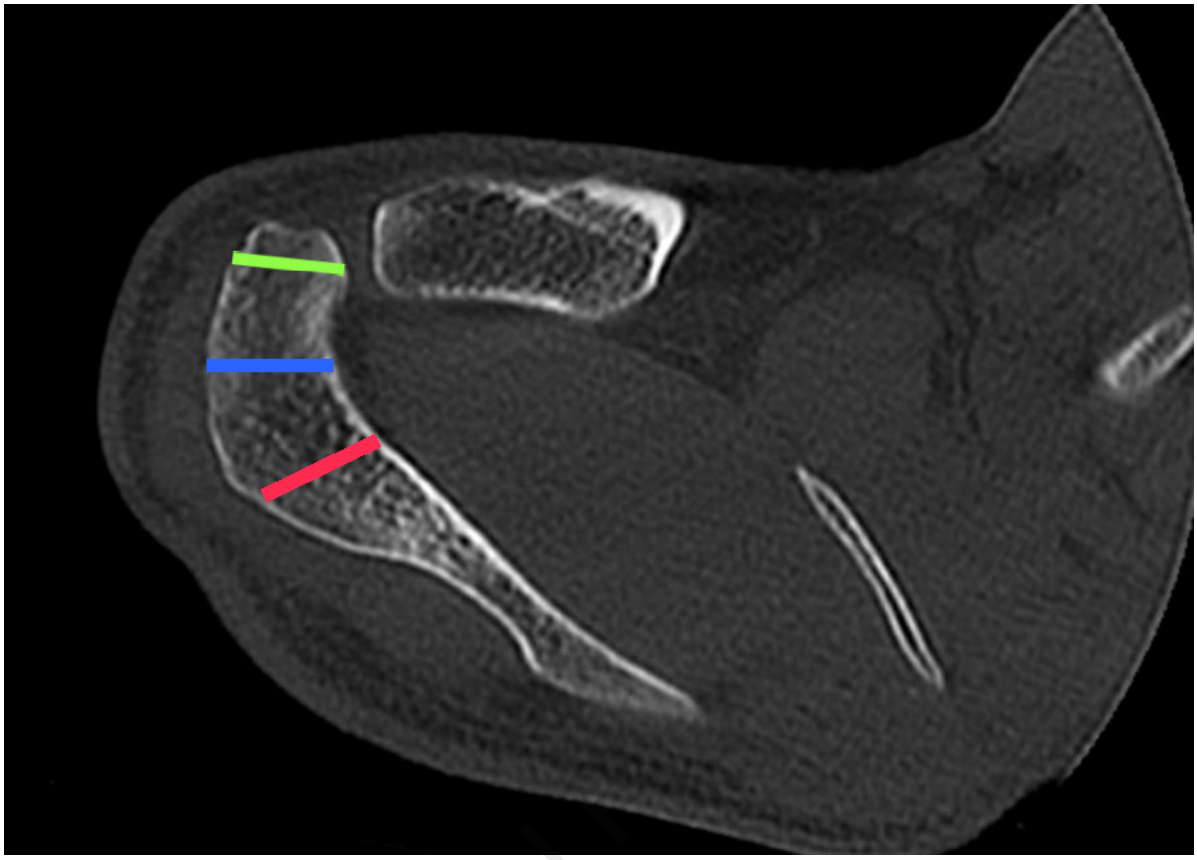
Author	*Os acromiale related pain*	*Tilt vs no tilt*	*Os Acromiale Tilting*	*Tilt measurement*
Walch[40]	-	**CMS: *** Tilt: 62.47 pts No tilt: 55.2 pts **Flexion**:* Tilt: 128 pts No tilt: 119 pts	6 shoulders (26%)	**Mean tilt*:** 43.3°
Aibinder[1]	1 (4%): pain localized to the unfused acromion. (treated with os acromiale excision)	**ASES:** Tilt: 65.3 pts (±14.8) No tilt: 66.2 pts (±13.1) P=0.88 **Pain**: Tilt: 12 pts (± 2.1) No tilt: 12.15 pts (± 1.8) P=.97 **Elevation:** Tilt: 117° (±39) No tilt: 127 (±39) P=.39 **Improved elevation:** Tilt: 64° (±57) No tilt: 69° (±62) P=.76 **Exernal Rotation**: Tilt: 46° (±28) No tilt: 46° (±27) P=1 **Improvement ER:** Tilt: 34° (±18) No tilt: 28° (±31) P=.86	7 shoulders (28%)	**Mean tilt:** 32.3° (10°-64°).

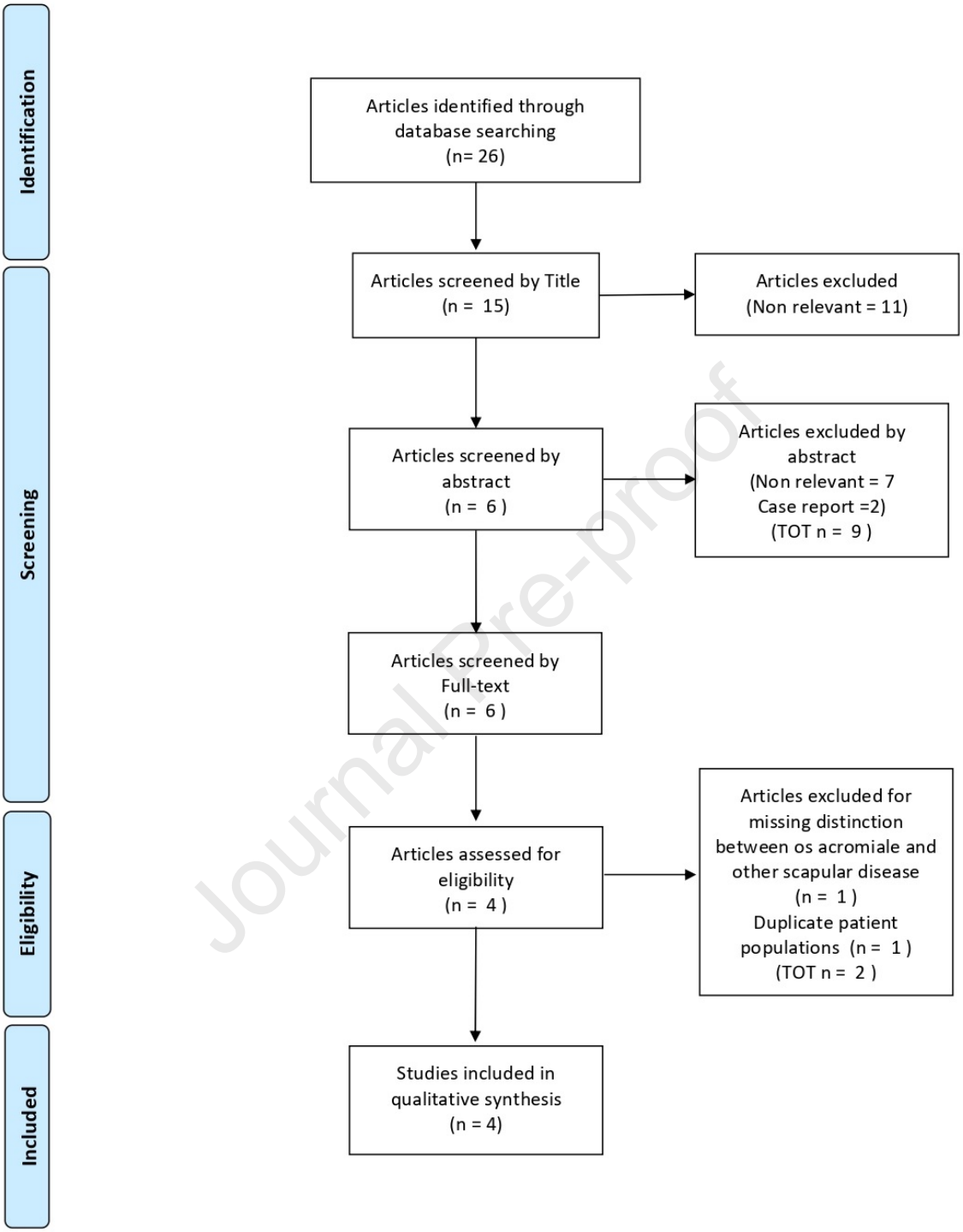
Ersen[13]	None	-	-	**Acromiohumeral distance (mm)** pre case 4.93 (4-7) post case 19.3 (16-22) post control 32.3 (20-43) post case vs control p=0.038
Carpeggiani[8]	• 12 (26.7%) cases of immediate postoperative pain • 4 (8.9%) cases of residual pain after 33 months -8 (66.6%, 8 out of 12) of pain relief over time, p=0.4	-	27 shoulders (60%) (8 preacromion 29.6%, 19 mesoacromions 70.4%)	-

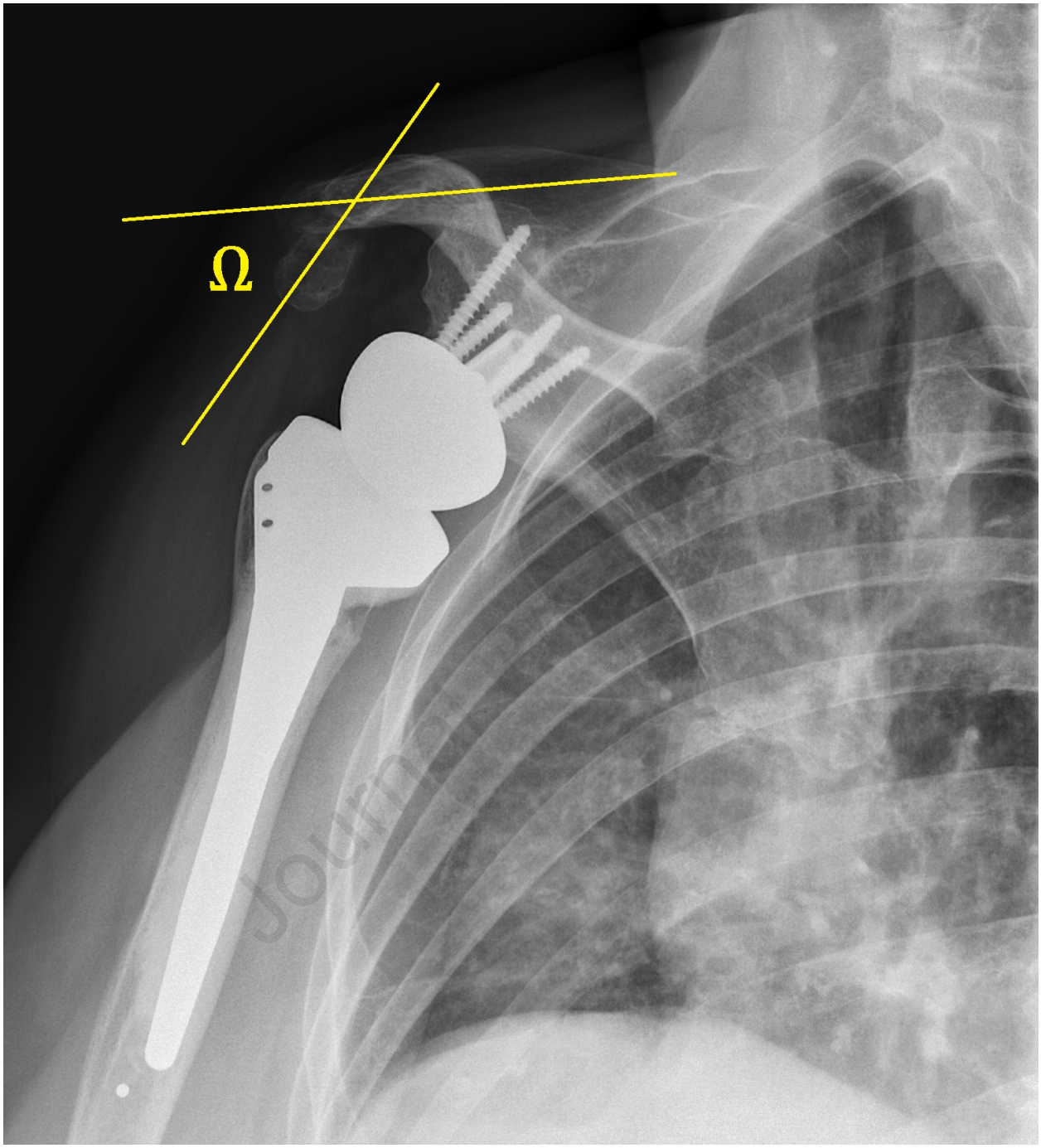
Legend:

CMS= Constant- Murley Score

ASES= American Shoulder and Elbow surgeons score



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