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Afonso Santos Salgado de Faria

As roturas do subescapular estão associadas a uma diminuição da distância coracohumeral: estudo de revisão sistemática e meta-análise

Subscapularis tears are associated with diminished coracohumeral distance: a systematic review and meta-analysis study

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DESIGNAÇÃO DA ÁREA DO PROJECTO

Ortopedia

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Subscapularis tears are associated with diminished coracohumeral distance: a systematic review and meta-analysis study.

ORIENTADOR

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Faculdade de Medicina da Universidade do Porto, 07/03/2020

Assinatura conforme cartão de identificação: Afonso Santos Salgado de Faria

Title

Subscapularis tears are associated with diminished coracohumeral distance: a systematic review and meta-analysis study

Running title: Radiological abnormalities in subscapularis tears

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Abstract

Background: Subcoracoid impingement is a syndrome characterized by anterior shoulder pain with narrowed subcoracoid space and rotator cuff pathology. Subscapularis tendon seems to be the most affected by this impingement. Some radiological measures have been studied to decide the best management of rotator cuff injuries. Coracohumeral distance (CHD) and coracoid overlap (CO) are the most used dimensions to characterize the subcoracoid space and to predict subscapularis lesions.

The objective of this study is to identify, select and resume all scientific evidence on the association between subscapularis tears and the variations in these two radiological measures, CHD and CO.

Methods: We performed a systematic review using the electronic databases PubMed, Scopus and Web of Science to obtain all studies that compare CHD and CO in patients with subscapularis tears vs controls without subscapularis tears. A meta-analysis was conducted with the random-effects model.

Results: From the 135 collected papers, 17 were selected for qualitative analysis and 12 of them were included in the meta-analysis. Twelve articles pointed to a significant decrease in CHD in patients with subscapularis tears. Heterogeneous results were achieved in the CO analysis with two studies showing a higher CO in subscapularis tears group, one paper revealing a lower CO in that group and two studies did not find significant differences. Pooled meta-analysis for CHD showed a significant lower CHD in subscapularis tears group (-1.49 [-2.07, -0.92], $p < 0.001$, n=12 studies). Due to the small number of studies and their heterogeneity, it was not possible to extract valid results from the meta-analysis for CO.

Conclusion: Diminished CHD is strongly related to subscapularis tears. The association between CO and subscapularis tears is not well established. The understanding of the dynamic mechanism of subcoracoid impingement will be crucial to reach a consensus about the best treatment. More studies need to be conducted to define the patients that benefit from subcoracoid space release with coracoplasty.

Level of Evidence: Level III; Systematic Review and Meta-Analysis

Key words: subscapularis tears; subcoracoid impingement; coracohumeral distance; coracoid overlap; shoulder; coracoplasty

Introduction

Subcoracoid impingement is increasingly known as a cause of shoulder pain. This condition is usually explained by the conflict produced by lesser tuberosity of the humeral head against the coracoid process. This impingement is characterized by a narrowed subcoracoid space, anterior shoulder pain and rotator cuff pathology. Rotator cuff lesions can go from a tendinosis to a massive rotator cuff tendon tear, and subscapularis tendon injury seems to be the most frequent condition associated with a diminished coracohumeral distance (CHD). (15, 16, 22) CHD is usually defined as the shortest distance from the coracoid process to the humeral head/minor tubercle. Beyond subscapularis, also the long head of biceps and the middle glenohumeral ligament can be under impingement in the subcoracoid space, and be affected by a diminished CHD. (15)

Isolated subscapularis tears are not common. According to Lafosse et al., the prevalence is 4.9% in patients submitted to shoulder arthroscopies. (14) However, associated with other rotator cuff tendons lesions, subscapularis tears acquire a more important role. The prevalence in these cases reaches 27% to 35%. (3, 7, 8).

Degenerative causes of subscapularis tears are typically associated with older people. They include the subcoracoid impingement and the intrinsic degeneration of the tendon. The conflict between the coracoid process and the lesser tuberosity is more prominent during flexion and internal rotation of the shoulder. Traumatic causes are less common and occur more frequently in younger patients, submitted to forced hyperextension and external rotation. (12, 22)

Physical examination tests, like the lift-off test, the belly press test, and the bear-hug test, are not sufficiently sensitive, so the diagnosis continues to be done with image methods. (7, 22) MRI is the actual gold-standard, but CT is also a reliable method to diagnose subscapularis tears and measure the CHD. (28)

Since the end of the last century, the influence of subcoracoid impingement and CHD in subscapularis lesions has been more investigated. Some studies also tried to find other radiological measures or angles that could be in the genesis of subscapularis tears. The distance from the glenoid to the tip of the coracoid process, the coracoid overlap (CO), is a frequent measure in those studies. However, there are no previous systematic reviews that resume evidence of the original studies about this subject. Consequently, systematized evidence on this association can be very helpful to define values of CHD and CO that indicate a higher risk of subscapularis lesion and, perhaps, to recommend a subcoracoid space release.

The objective of the systematic review with meta-analysis is to identify, select and resume all scientific evidence on the association between abnormal CHD and CO, and the appearance of subscapularis tears. For this, was performed a systematic review with meta-analysis using case-control studies. The authors used a population with previous shoulder MRIs, to compare the CHD or the CO (outcome) in patients with subscapularis tears (study group) and without subscapularis tears (control group).

Material and Methods

Literature Search

We performed a systematic review according to the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The systematic search was made in PubMed, Scopus and Web of Science until the date of September 14, 2019. No restriction to the date of publication was introduced. The terms employed in the search were: ("subcoracoid impingement" OR ("coracohumeral" AND ("distance" OR "interval")) OR "coracoid overlap") AND ("subscapularis tear"). One additional study was identified by checking other studies' bibliography.

Eligibility criteria

The type of study included in this review were observational case-control studies. Case reports were excluded. The criteria to include the studies were: (1) participants of any age, who had a shoulder examination with a method of image; (2) patients with partial or full-thickness tears of the subscapularis tendon included in the study group; (3) patients without any lesion of subscapularis tendon included in the control group; (4) CHD or CO presented as one of the outcomes of the study; (5) CHD was measured at the shortest distance from the coracoid process to the humeral head/minor tubercle; (6) CO was measured from the glenoid to the tip of the coracoid process.

The study selection was conducted independently by two reviewers. Any disagreement on the inclusion of the study was discussed by the reviewers to achieve a consensus. When the full text was not available the authors were contacted for a copy. One study included in the qualitative analysis was only available in abstract format.

Data extraction

When available, the following data were collected in each study: authors, year of publication, sample size, age, patients' selection, characteristics of participants in study group, characteristics of participants in control group, radiological assessment, and CHD and CO mean in each group, with correspondent statistics.

One review author extracted the data from the selected studies and the second reviewer checked the extracted data. When some data was missing, corresponding author was contacted for additional information. Three studies were excluded from meta-analysis because of insufficient data.

Statistical analysis

The meta-analysis was conducted using Review Manager V. 5.3 and applying the random-effects model.

The outcome measured was the standard mean differences of CHD and CO, comparing patient groups with subscapularis tears and control groups without subscapularis tears. Several studies separated different types of tears in independent groups. In these cases, just the full tear data was analyzed in a subgroup of the meta-analysis.

The statistical significance was established with a p value <0.05.

Results

After duplicates removal, 135 papers were retrieved. Just 23 of them were eligible after title and abstract analysis. The inclusion criteria were applied and 17 studies were included in the qualitative analysis. Six studies were excluded: two studies without healthy subscapularis in the control group; three studies without tears including the subscapularis tendon in the study group; one study with the outcome presented in categorical variables. For the meta-analysis, five articles were excluded: in three studies the standard deviation data was not available and, in one of them, the number of patients was also unavailable; one study can have sample redundancy; one study may not include subscapularis tears in rotator cuff tears group. (Figure 1)

Study characteristics

Characteristics of the studies included in the qualitative analysis are presented in table 1.

The participant selection, in the majority of the studies, was based on patients with shoulder complaints, who underwent shoulder arthroscopy or had a shoulder MRI. Three of the four articles that compare the age between groups exhibit an older participant age in the lesion group than in the control group (1, 11, 25, 29).

All studies incorporated subscapularis tears, proven by MRI or arthroscopy, with or without additional rotator cuff injury. Four studies divided different types of injuries in independent groups. (9, 15, 21) The other 13 studies included all subscapularis lesions in the same study group. (1, 2, 4, 6, 10, 11, 17-19, 24-26, 29, 30) One of the articles only included isolated subscapularis tears (11) and, in another one, just the group of tears of all rotator cuff tendons includes subscapularis lesions (2).

The radiological assessment was made with MRI in every study except one, performed with Arthro-CT (19). The CHD and CO evaluation was conducted in 16 and five studies, respectively. (Table 1)

Subscapularis tears and coracohumeral distance

Twelve papers included in the qualitative analysis (1, 2, 4, 6, 15, 17-19, 25, 26, 29, 30) pointed to a significant difference that favors lower CHD in at least one study group. In Nové-Josserand et. al. study (19) just in large rotator cuff tears group were obtained differences and in Balke et. al. study (6) just the degenerative tears were associated with a smaller CHD. In the other four studies (9, 10, 21, 24), the decrease of CHD was not statistically significant.

Concerning to meta-analysis, four out of 16 studies that analyzed CHD were excluded because the SD data was unavailable (9, 24) and one study included all rotator cuff tears without obligatory inclusion of subscapularis (26). Within the 12 included studies, the same variable of interest was measured in different ways or in different groups of patients with subscapularis tears. To obtain the forest plot, the groups and results selected were: the axial view results in Cetinkaya et. al. and Watson et. al. (10, 30); the average distance measure in Abdrabou et. al. (1); the degenerative subscapularis tears group in Balke et. al.(6); the MRI values in Oh et. al. (21); the large rotator cuff tears group in Nové-Josserand et. al. (19).

Pooled meta-analysis for CHD showed an association between subscapularis tears and lower CHD, with statistical difference (-1.49 [-2.07, -0.92], $p < 0.00001$; $Tau^2 = 0.91$, $Chi^2 = 183.22$, $df = 11$ ($p < 0.00001$), $I^2 = 94\%$). Both subgroups of all tears and only full tears reveal a similar tendency. (Figure 2) Excluding the study with less precision, the standard mean difference decrease to 1.28 (-1.83, -0.73) but with little impact on heterogeneity (I^2 = 94%).

Subscapularis tears and coracoid overlap

Two of the five articles included in the CO qualitative analysis show a higher CO in the subscapularis tears group, with statistical difference (10, 15). In reverse, one study reported a lower CO in the subscapularis group, with statistical significance (30). The other two studies did not obtain statistically significant differences (11, 29).

Two studies that compared CO were excluded from the quantitative analysis: one study to prevent sample redundancy (11); one study did not mention any of the CO results and the authors just referred that no significant difference was found between the two groups (29). Due to the scarcity of studies and the high heterogeneity between them (I^2 = 97%) was decided not to present the forest plot and meta-analysis results for CO.

Discussion

There are no previous published reviews that evaluate the correlation between radiological measures and subscapularis tears. Therefore, this is the first systematic literature review that associates abnormal CHD and CO with subscapularis lesions.

We excluded from meta-analysis one study in which rotator cuff tears may not include subscapularis tendon (26), and other study where the sample redundancy is possible, although not guaranteed (11). This option was taken to restrict the study to subscapularis lesions and reduce bias. However, this lead to a reduction of the number of trials included in the review. In a subgroup of studies, we also decided not to include in the meta-analysis tendinopathies and partial tears, and we only used the full tears group. It would be interesting to analyze these results but we found it impossible without redundancy in the control group.

We chose CHD and CO to analyze because these were the most prevalent measures in the literature and we found them the most relevant to the clinical practice. Some articles included other distances or angles yet not assessed in additional studies.

Interpreting our meta-analysis results, we can conclude that diminished CHD has a significant association with subscapularis tears. About CO, just a small number of heterogeneous studies were available and no conclusion can be formed at the moment. However, we can question if the subcoracoid space narrow is a cause of subscapularis tears or it is a consequence of a rotator cuff lesion.

Balke et. al. (6) demonstrated that only degenerative tears, and not traumatic tears, were associated with diminished CHD. This finding indicate that it is not probable that subscapularis tears are the only cause of diminished CHD.

Nové-Josserand et. al. (19, 20) discussed that an abnormal CHD may be a consequence of anterior subluxation of the humeral head and it is a sign of poor prognosis. They concluded that humeral dislocation only occurs when the subscapularis tear is associated with lesions of the infraspinatus. This hypothesis was not yet confirmed by other studies because most of the authors did not divide subscapularis tears with and without associated rotator cuff injury. For a better understanding of this mechanism, additional studies need to be done, comparing isolated subscapularis tears and subscapularis tears associated with additional muscle tears.

Some authors defend that subcoracoid impingement is a dynamic mechanism and measure CHD with static imaging modalities may be limited. Oh et. al. (21) showed, with ultrasonography, that CHD is narrowest in shoulder internal rotation and that must be the pathogenic position. They had not found a correlation between CHD and subscapularis tears. However, patients with CHD lower than 6 mm in internal rotation had a higher proportion of subscapularis tears than others without stenosis in that position.

The decision to proceed to a coracoplasty to augment the subcoracoid space is the most relevant clinical matter on this topic. Ayanoğlu et. al. (5) and Kim et. al. (13) concluded that in the treatment of isolated subscapularis tears, concomitant arthroscopic coracoplasty may not provide better clinical outcomes than the surgical repair without coracoplasty. Park et. al. (23) studied operated patients due to subcoracoid impingement syndrome with and without associated rotator cuff tear. They concluded that arthroscopic coracoplasty results in a significant increase in internal rotation, especially in patients with large rotator cuff tear and in patients with anterior shoulder symptoms without tear. In other functional values and shoulder scales, differences were not statistically significant. In 2000, Suenega et. al. (27) reported complete pain relief in nine patients submitted to a coracoplasty due to the persistence of symptoms after a first rotator cuff tear repair without coracoplasty.

According to the current evidence, it looks like coracoplasty surgery is only justified in patients with massive rotator cuff tears, or in patients with symptoms but without tears or with corrected tears. However, stronger evidence needs to be collected to achieve a consensus about the best treatment for a determined group of patients.

Limitations

Our study have some limitations that we cannot ignore. Ideally, the control group would be composed by completely healthy shoulders, but that was not possible in any of the studies. Consequently, some variety in control groups is a possible cause of bias in our meta-analysis. The measurement of CHD and CO was done in different arm rotations depending on the studies, and some of them reported that could have been variation in patient positioning during the exam. Although all studies reported similar methods to measure CHD and CO, we cannot exclude some variability between observers. All these factors could contribute to the high meta-analysis heterogeneity we obtained.

Future research is essential to clarify if the relationship between subscapularis tears and abnormal subscapularis space is valid to isolated tears. CO still a measure that needs more evidence to define if it is related to subscapularis tears or not. Additionally, more trials need to be conducted to obtain an orientation on the cases that benefit from coracoplasty.

Conclusion

This study concludes that diminished CHD is strongly related to subscapularis tears. The association between CO and subscapularis tears is not well established. The understanding of the dynamic mechanism of subcoracoid impingement will be crucial to reach a consensus about the best patient treatment. More studies need to be performed to define the patients that benefit from subcoracoid space release with coracoplasty.

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Legends

Table I. Data of individual studies; CHD and CO differences between study and control group

Figure I. PRISMA flow diagram

Figure II. Forest plot of the Coracohumeral Distance in subscapularis tears vs no subscapularis tears

Table 1

Radiological abnormalities in subscapularis tears

ID	N (Study/ Control)	Age (Mean ± SD)	Patients selection	Study group - N	Control group - N	Radiological assessment	Coracohumeral distance	Coracoid overlap
Nové-Josserand 1999 (19)	206	NA	NA	Isolated lesions of the subscapularis - 57; large cuff tears involving also the subscapularis - 90	Supraspinatus +/- infraspinatus tears - 59	Arthro-CT (CHD)	ISL: ↔ LRCT: ↓	NA
Richards 2005 (25)	70	S: 61.9 ± 8.7 C: 36.9 ± 12.1	Had a preoperative MRI	Subscapularis tear- 35	No rotator cuff tear - 35	MRI (CHD)	↓	NA
Bergin 2006 (9)	142	57	Full-thickness supraspinatus tendon tears	Subscapularis tendinosis, subscapularis partial tear and subscapularis full tear- NA	Normal subscapularis - NA	MRI (CHD)	↔	NA
Millett 2009 (17)	94	48.4	Consecutive patients who underwent arthroscopic shoulder surgery	Complete and partial rotator cuff tear - NA	No rotator cuff tear - NA	MRI (CHD)	SPT: ↓* SFT: ↓*	NA
Aktas 2014 (2)	62	S: NA for the sample in study C: 40.0 ± 13.8	Patients who applied to the unit with the complaints of shoulder pain between June 2013 and October 2013	Tear of all rotator cuff tendons - 4	No rotator cuff tear - 58	MRI (CHD)	↓	NA
Balke 2015 (6)	103	D: 63 ± 9.6 T: 55 ± 10.4 NST: 52 ± 13.8	Patient files with preoperative MRI	Degenerative subscapularis tears- 44; traumatic subscapularis tears- 39	Normal subscapularis - 20	MRI (CHD)	D: ↓ T: ↔	NA
Porter 2015 (24)	100	39	100 consecutive shoulder MR arthrograms	Subscapularis tendinopathy or tear - 42	No subscapularis tendinopathy - 58	MRI (Axial CHD, CTGT,oblique tip to SGT)	↔	NA

Radiological abnormalities in subscapularis tears

ID	N (Study/ Control)	Age (Mean ± SD)	Patients selection	Study group - N	Control group - N	Radiological assessment	Coracohumeral distance	Coracoid overlap
Cetinkaya, 2016 (10)	219	57.01 ± 10.95	Patients who underwent shoulder arthroscopy between February 2004 and June 2015	Subscapularis tendon injury - 141	Normal subscapularis - 78	MRI (tCHD; sCHD; CO; CGD; CBA; STSN)	↔	↑
Wan 2016 (29)	133	S: 58.8 ± 17.6 C: 51.6 ± 13.8	Patients with a shoulder MRI in 2011	Subscapularis complete tear, partial tear or abnormal signal over the subscapularis tendon - 13	No subscapularis lesion - 120	MRI (CHD, CO)	↓	↔
Nair 2016 (18)	24	52.83	Rotator cuff pathology	Subscapularis tear - 9; CHI ≤ 5.5	No subscapularis tear - 15; CHI > 5.5	MRI (CHD)	↓	NA
Oh, 2016 (21)	168	SFT: 64.6 SPT: 63.5 NST: 57.3 NRCT: 52	Rotator cuff tear in preoperative MRI and arthroscopic rotator cuff repair	Partial subscapularis tear - 60; full thickness subscapularis tear - 26	No subscapularis tear – 82; No rotator cuff tear - 23	Ultrasonography (CHD ER; CHD NR; CHD IR) and MRI (CHD)	SPT: ↔ SFT: ↔	NA
Abdrabou 2017 (1)	62	S: 46.36 ± 14.17 C: 37.30 ± 16.63	Patients with pre-operative MRI	Partial or full thickness subscapularis tendon tear proved via arthroscopy - 22	No arthroscopic evidence of SS tendon tear - 40	MRI (CHD)	↓	NA
Watson 2017 (30)	66	S: 55 C: 22	Patients with pre-operative MRI	Subscapularis tendon tear proven at arthroscopic repair - 33	Instability cases without associated rotator cuff tear - 33	MRI (Axial CHD, CSD, CO, CGA; Sagittal CHD, CSD, CGA)	↓	↓

Radiological abnormalities in subscapularis tears

Cetinkaya 2018 (11)	56	S : 48.71±9.66 C : 64.85±6.1	Patients who underwent shoulder arthroscopy between May 2011 and May 2017	Isolated subscapularis tears - 28	Isolated supraspinatus full thickness tear - 28	MRI (CO)	NA	↔

Radiological abnormalities in subscapularis tears

ID	N (Study/Control)	Age (Mean ± SD)	Patients selection	Study group - N	Control group - N	Radiological assessment	Coracohumeral distance	Coracoid overlap
Saygi 2018 (26)	150	NA	Shoulder and neck complains	Anterior instability - 50; rotator cuff tears - 50	Normal subscapularis - 50	MRI (CHD; CVA; CAW; LAD; GCH; GD; GCD; HAD; HCD; SAD)	↓	NA
Asal 2018 (4)	200	M: 51.1 ± 15.2 F: 52.6 ± 10.7	Have shoulder MRI	Subscapularis tendinosis – 23; subscapularis tears - 100	Normal subscapularis - 77	MRI (CM; CHD; CGA; CHA)	ST: ↔ SPFT: ↓	NA
Leite 2019 (15)	301	NA	Clinical files of all patients with degenerative rotator cuff pathology diagnosed between 2009 and 2018	Subscapularis tendinopathy - 46; partial tear - 63; full tear - 36	No subscapularis injury - 156	MRI (CHD, CO)	ST: ↓ SPT: ↓ SFT: ↓	ST: ↑ SPT: ↑ SFT: ↑

Legend: C, Control group; CBA, Coracocoracoid base angle; CGA, Coracoglenoid Angle; CGD, Coracoglenoid distance; CHA, Coracohumeral angle; CHD, Coracohumeral Distance; sCHD, sagittal Coracohumeral Distance; tCHD, transverse Coracohumeral Distance; CM, Coracoid Morphology; CO, Coracoid Overlap; CSD, Coracosubscapular Distance; CT, Computerized Tomography; CTGT, vertical distance between the coracoid tip and the supra-glenoid tubercle; D, Degenerative; ER, External Rotation; F, Female; GAW, Glenoid axial width GD, Glenoid depth; GCD, Glenoid Coronal Diameter; GCH, Glenoid coronal height; GVA, Glenoid version angle; HAD, Humerus axial diameter; HCD, Humerus coronal diameter; IR: Internal Rotation; ISL, Isolated Subscapularis Tears; LAD, Labral axial diameter; LRCT, Large Rotator Cuff Tears; M: Male; MRI, Magnetic Resonance Imaging; N, Number of Participants; NA: Not Available; NR, Neutral Rotation; NRCT, No Rotator Cuff Tear; NST, No Subscapularis Tear; Oblique tip to SGT, oblique distance between the coracoid tip and the supra-glenoid tubercle; S, Study group; SAD, Subacromial distance; SD, Standard Deviation; SFT, Subscapularis Full Tears; SPT, Subscapularis Partial Tears; SPFT, Subscapularis Partial and Full Tears; ST, Subscapularis Tendinosis; STSN, Subscapularis tendon slip number; T, Traumatic

Symbols: ↑ significant increase; ↔ no significant change; ↓ significant decrease; *no sufficient data to ensure a statistical significant difference

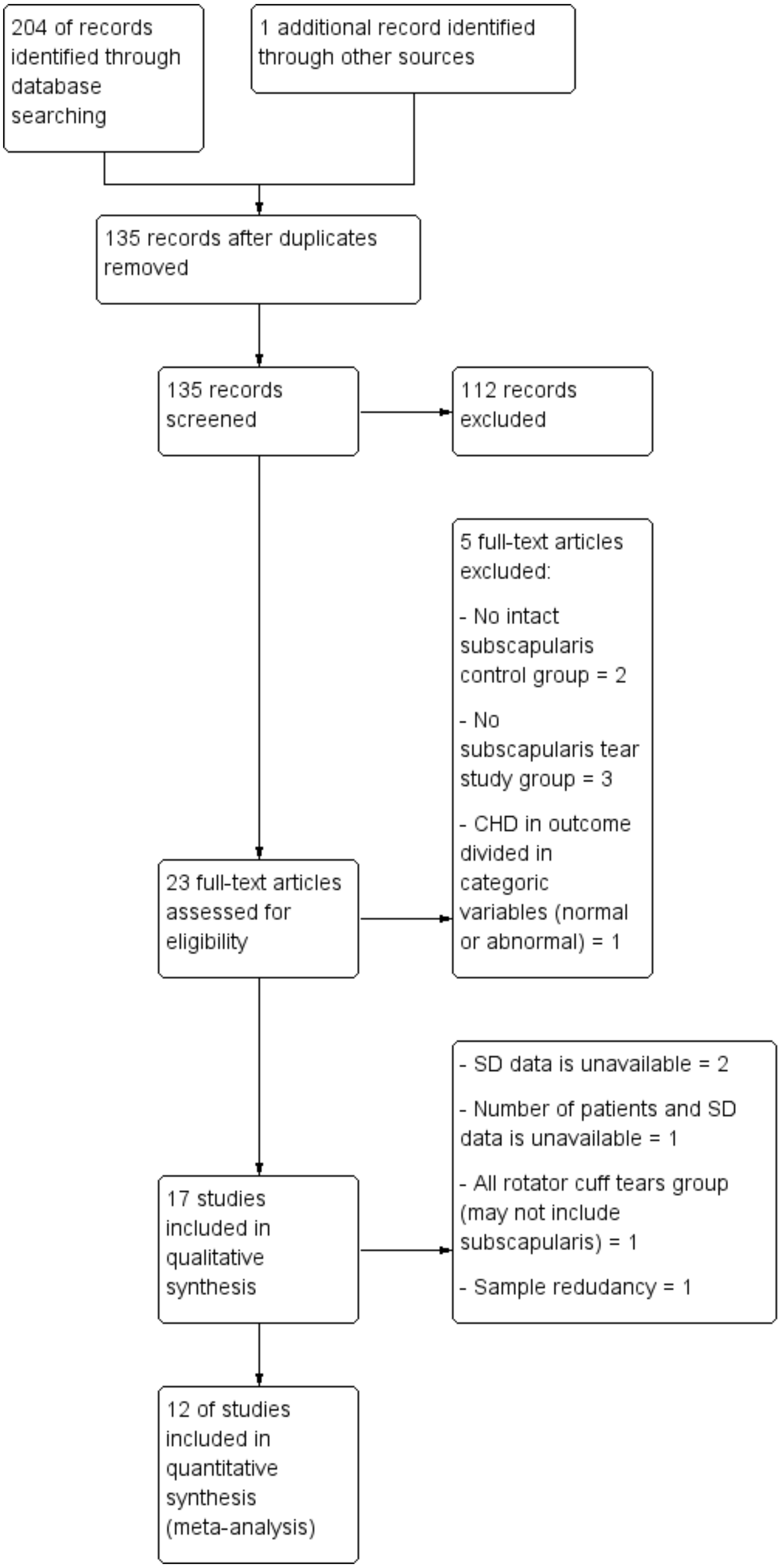
204 of records identified through database searching
1 additional record identified through other sources
135 records after duplicates removed
135 records screened
112 records excluded
5 full-text articles excluded:
- No intact subscapularis control group = 2
- No subscapularis tear study group = 3
- CHD in outcome divided in categoric variables (normal or abnormal) = 1
23 full-text articles assessed for eligibility
- SD data is unavailable = 2
- Number of patients and SD data is unavailable = 1
- All rotator cuff tears group (may not include subscapularis) = 1
- Sample redudancy = 1
17 studies included in qualitative synthesis
12 of studies included in quantitative synthesis (meta-analysis)

Figure I

	Subscapularis tears			No subscapularis tears				Std. Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year
1.1.1 All subscapularis tears vs No subscapularis tear									
Nové-Josserand 1999	7.7	3.5	90	9	2	59	9.2%	-0.43 [-0.76, -0.10]	1999
Richards 2005	5	1.7	36	10	1.33	35	8.3%	-3.23 [-3.95, -2.52]	2005
Aktas 2014	6.625	1.394	4	9.352	2.521	58	7.3%	-1.09 [-2.12, -0.05]	2014
Balke 2015	8.6	2	44	10.4	1.8	20	8.8%	-0.92 [-1.47, -0.36]	2015
Nair 2016	5.33	0.43	9	10.48	0.87	15	3.9%	-6.71 [-8.95, -4.48]	2016
Wan 2016	6.24	2.18	13	9.95	3.9	120	8.7%	-0.98 [-1.56, -0.39]	2016
Cetinkaya 2016	8.22	3.29	141	8.65	2.51	78	9.3%	-0.14 [-0.42, 0.14]	2016
Watson 2017	8.11	0.45	33	9.05	0.31	33	8.5%	-2.40 [-3.05, -1.76]	2017
Abdrabou 2017	7.66	1.19	22	10.53	2.38	40	8.7%	-1.39 [-1.96, -0.81]	2017
Asal 2018	6	1.8	100	7.8	2.1	77	9.3%	-0.93 [-1.24, -0.61]	2018
Subtotal (95% CI)			**492**			**535**	**82.0%**	**-1.49 [-2.09, -0.89]**	
Heterogeneity: Tau² = 0.79; Chi² = 126.53, df = 9 (P < 0.00001); I² = 93%									
Test for overall effect: Z = 4.88 (P < 0.00001)									
1.1.2 Full subscapularis tears vs No subscapularis tear									
Oh 2016	9.3	2.9	26	10.1	2.3	82	9.0%	-0.32 [-0.77, 0.12]	2016
Leite 2019	5	1.7	36	10.3	2.2	156	9.0%	-2.49 [-2.94, -2.05]	2019
Subtotal (95% CI)			**62**			**238**	**18.0%**	**-1.41 [-3.54, 0.72]**	
Heterogeneity: Tau² = 2.30; Chi² = 46.23, df = 1 (P < 0.00001); I² = 98%									
Test for overall effect: Z = 1.30 (P = 0.19)									
Total (95% CI)			**554**			**773**	**100.0%**	**-1.49 [-2.07, -0.92]**	
Heterogeneity: Tau² = 0.91; Chi² = 183.22, df = 11 (P < 0.00001); I² = 94%									
Test for overall effect: Z = 5.08 (P < 0.00001)									
Test for subgroup differences: Chi² = 0.01, df = 1 (P = 0.94), I² = 0%									

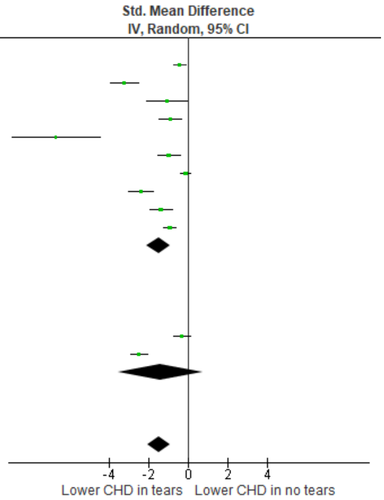

Figure II

PRISMA 2009 Checklist

✓ Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2; 3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4; 5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	NA
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	6; Table 1
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	6
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6; Figure 1
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7

Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	NA
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	7
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	7
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	NA
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	8; Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	8; 9; Table 1
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	NA
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	9; 10; Table 1; Figure 2
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	10; Figure 2
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NA
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11; 12; 13

Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	13
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	14
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	NA

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Legend: NA, Not applicable

INFORMATION FOR AUTHORS

PURPOSE AND POLICIES

The *Journal of Shoulder and Elbow Surgery* is a scientific medical journal containing information relative to the investigation of the development, preservation, and restoration of the form and function of the shoulder girdle, arm, elbow, and associated structures by medical, surgical, and physical means.

The objectives of the *Journal* are to enhance the professional study and practice of shoulder and elbow surgery, to act as a stimulant to research by providing a forum for discussion of new scientific advances, and to further international cooperation among shoulder and elbow societies by serving as an official publication for recognized societies.

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Anexo

Type of Study	Treatment Study	Prognosis Study	Study of Diagnostic Test	Cost Effectiveness Study
LEVEL I	Randomized controlled trials with adequate statistical power to detect differences (narrow confidence intervals) and follow up >80%.	High-quality prospective cohort study with >80% follow-up, and all patients enrolled at same time point in disease	Testing previously developed diagnostic criteria in a consecutive series of patients and a universally applied "gold" standard	Reasonable costs and alternatives used in study with values obtained from many studies, study used multi-way sensitivity analysis
LEVEL II	Lower quality randomized trials (follow up <80%, improper randomization techniques, no masking Prospective comparative study	Lower quality prospective cohort study (<80% follow-up, patients enrolled at different time points in disease) Retrospective study Untreated controls from a randomized controlled trial	Development of diagnostic criteria in a consecutive series of patients and a universally applied "gold" standard	Reasonable costs and alternatives used in study with values obtained from limited studies, study uses multi-way sensitivity analysis
LEVEL III	Case-control study Retrospective comparative study	Case-control study	Study of nonconsecutive patients and/or without a universally applied "gold" standard	Analyses based on a limited section of alternatives and costs, or poor estimates of costs
LEVEL IV	Case series with no comparison group	Case series with no comparison groups	Use of a poor reference standard Case control study	No sensitivity analysis
LEVEL V	Expert opinion	Expert opinion	Expert opinion	Expert opinion

Treatment Studies investigate the results of treatment on patient outcomes and complications.

Prognosis Studies investigate the natural history of a disease or disorder, and evaluate the effect of a patient characteristic on the outcome of the disease.

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Retrospective Study-Defined is a study in which the research question was determined after the data was collected (even for studies where the authors collected general data prospectively).

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The second cover letter, **the conflict of interest (CoI) statement**, must deal with disclosures and must be signed and dated by all authors. This second cover letter must also be submitted online during the article submission process. Individual CoI statements may also be uploaded. All CoI statements should be in a pdf format.

This second letter must first list any conflicts of interest for the authors, their immediate families, and any research foundation with which they are affiliated, including receiving royalties, stock or stock options, consultant agreements, or ownership from or with any commercial entity related to the subject of this work. This information must be described for all authors listed on the paper, and should be provided in the form of a list of the authors. If no such conflict of interest exists for an author, please state the following after the authors' name: "This author, their immediate family, and any research foundation with which they are affiliated did not receive any financial payments or other benefits from any commercial entity related to the subject of this article."

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For full research articles, include the Level of Evidence of the study performed (see above) and Keywords at the end of the abstract. The authors should assign their own Level of Evidence although this will be reviewed by the *Journal*'s Editorial Staff and should also list 6-8 Keywords that highlight the topic of the article, allowing for easier electronic retrieval.

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The text of observational and experimental articles is divided into 5 sections with the headings: Introduction; Materials and Methods; Results; Discussion; and, Conclusions. Each section should start on a new page. Longer articles may need subheadings within headings to clarify their content. Other articles, such as reviews, case reports and editorials need not take the form of manuscripts describing observational or experimental studies. A case report should include Keywords at the end of the Introduction.

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