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Conservative management *vs.* surgical repair in degenerative rotator cuff tears: a systematic review and meta-analysis

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Abstract. – OBJECTIVE: To analyze the available evidence comparing the clinical and functional outcomes of physiotherapy vs. surgical repair in the management of degenerative rotator cuff tears (RCTs), and to perform a meta-analysis to clarify the possible superiority of one approach vs. the other.

MATERIALS AND METHODS: A literature search was carried out on the PubMed, Scopus and Web of Science databases on May 30th 2020, to identify all the randomized trials comparing surgery to conservative management of degenerative rotator cuff tears. The following data were extracted from each included study: patients' demographics, study design and level of evidence, follow-up times, treatment groups, evaluation scores adopted, overall clinical findings. The quality of the trials was assessed using the Cochrane Risk of Bias Assessment.

RESULTS: A total of 7 studies, including 326 patients and dealing with conservative treatment *vs.* surgical repair for rotator cuff tears, were included in this study. Although surgery provided superior results both in terms of VAS (p=0.017) and Constant score (p<0.0001) compared to conservative management at 1 year follow-up, this superiority did not reach the "minimal clinical important difference". Otherwise, a few data are available about long-term outcomes, thus there is insufficient evidence about the role of surgery to prevent the progression of tendon wear.

CONCLUSIONS: A proper rehabilitation program is able to provide similar results compared to surgery at a short term follow-up in degenerative RCTs. Further long term data are necessary to understand if tendon repair might have a protective role towards worsening of degeneration thus providing better clinical outcome than conservative management.

Key Words:
Rotator cuff tears, Cuff degeneration, Cuff wear, Shoulder, Repair, Physiotherapy, Conservative, Meta-analysis.

Introduction

Rotator cuff tears (RCTs) are frequent cause of shoulder pain and functional limitation. RCTs affect approximately 30% of the population over 60 years[1-5] and the incidence increases with aging[6,7]. Numbers are dramatically increasing worldwide: 4.5 million patients refer to an orthopedic surgeon due to shoulder pain every year in the United States[8], and a 141% increase in rotator cuff repairs has been recorded from 1996 to 2006[9]. In the UK the rate of shoulder pain accounts for 2.4% of all general practice consultations[10], while in Italy 62 rotator cuff surgeries every 100,000 Italians are performed[11].

Given the increase of retirement age, and considering that people over 60 years are more and more fit and active, RCTs are increasing their socio-economic costs, especially in terms of loss of quality of life, loss of working days, and public healthcare costs[12,13].

It was demonstrated that some individual anatomical factors are capable of influencing the development of RCTs, such as the inclination of the glenoid and the lateral extension of the acromion[14]. A meta-analisys by Sayampanathan et al[15] in 2017 summarized the most relevant risk factors for RCTs, inferring that age older than 60 years and hand dominance are the most relevant risk factors associated with RCTs. BMI, female gender, tobacco smoking, hypertension, and diabetes are also mentioned as relevant risk factors.

Although treatment of acute traumatic RCTs in young patients is generally surgical, treatment for degenerative cuff tears remains a challenge for the orthopedic surgeon, and no gold standard has been defined[16,17]. Non-operative management of rotator cuff tears is often advocated for patients

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with partial-thickness or small full-thickness tears, especially in subjects with lower functional demands, while operative management is preffered in active patients, with high demanding functional requests. Conservative management generally consists of some combination of rest, NSAIDs, corticosteroid injections, and physical therapy, while operative management almost always consists of arthroscopic suture.

Recent trials[3,18-21] have shown that both conservative treatment and surgical repair have improved clinical and functional outcomes in subjects suffering from this disorder. Not only the superiority of operative *vs.* non-operative management is uncertain, but also the factors that could affect the success of the treatment are not clarified; despite a huge number of papers focused on RCTs, current literature has not been able to draw proper conclusions[22,23].

Another aspect of relevance is about predictors of poor surgical outcome. Some authors[24-27] have suggested that patient's age, fatty infiltration and tears size are important predictors of a poor outcome after surgical. Nevertheless, literature is currently not able to draw proper conclusions.

While two systematic reviews[1,28,29] and a meta-analysis by Schemitsch et al[22] showed that surgical treatment significantly improves outcomes compared to conservative treatment for degenerative rotator cuff tears, a meta-analysis by Ryösä et al[23] in 2017 concluded that there is limited evidence that surgery is not more effective in treating rotator cuff tear than conservative treatment alone and thus a conservative approach is advocated as the initial treatment modality. Further doubt regarding surgical repair of the rotator cuff derives from the meta-analysis by Russel et al[30], according to which there is no strong correlation between the function of shoulder and rotator cuff structural integrity after surgery.

Given the socio-economic impact of RCTs, and the absence of globally accepted guidelines for the best management, the purpose of the present systematic review was to provide an updated and comprehensive insight of the current state of art, comparing the clinical and functional outcomes of conservative management of degenerative RCTs *vs.* surgical repair. To this purpose, data from randomized controlled trials were extracted and pooled in order to perform a meta-analisys to clarify the possible superiority of one approach compared to the other.

Materials and Methods

Systematic Review

The present systematic review was performed according to "PRISMA guidelines" [Preferred Reporting Items for Systematic Reviews and Meta-analyses][31]. A literature search was performed on the PubMed, Scopus, and Web of Science databases, on May 30th, 2020, using the following key words, that were combined together to achieve maximum search strategy sensitivity: (Rotator cuff OR supraspinatus OR shoulder) AND (repair OR reconstruction OR suture OR arthroscopic OR conservative OR physical therapy OR rehabilitation OR exercise OR acromioplasty OR subacromial decompression) AND (randomized OR RCT OR comparative OR *vs.* OR).

A PRISMA flowchart[31] of the selection and screening method is provided in Figure 1.

Firstly, articles were screened by title and abstract, using the following inclusion criteria for article selection: 1) clinical reports with randomized design (level I or II) comparing conservative management to surgery; 2) written in the English language; 3) published from 1990 to 2020; 4) dealing with treatment of patients affected by rotator cuff tears. "Treatment" meant both surgery and conservative management, including exercise and physical therapy. Exclusion criteria were: 1) non randomized trials; 2) papers written in other languages than English; 3) data not dealing with the treatment of degenerative rotator cuff tears. Conference presentations, reviews, non peer reviewed journals, editorials and expert opinions were also excluded.

Two investigators (EM, DA) extracted relevant data independently from each paper, and collect them in a Microsoft Excel sheet. The following data were extracted from each included study: demographic data, study design and level of evidence, follow-up times, treatment groups, evaluation scores adopted, overall clinical findings. The quality of the randomized controlled trials (RCTs) included was assessed independently by two reviewers (EM, RG) using the Cochrane Risk of Bias Assessment. Risk of bias was assessed as a judgment (high, low, or unclear) for individual elements from seven domains, as detailed in Table I. Discrepancies between the two reviewers were resolved by discussion and consensus, and the final results were reviewed by the senior investigators.

Statistical Methods for Meta-Analysis

The standardized mean difference (SMD), expressed together with its 95% confidence interval,

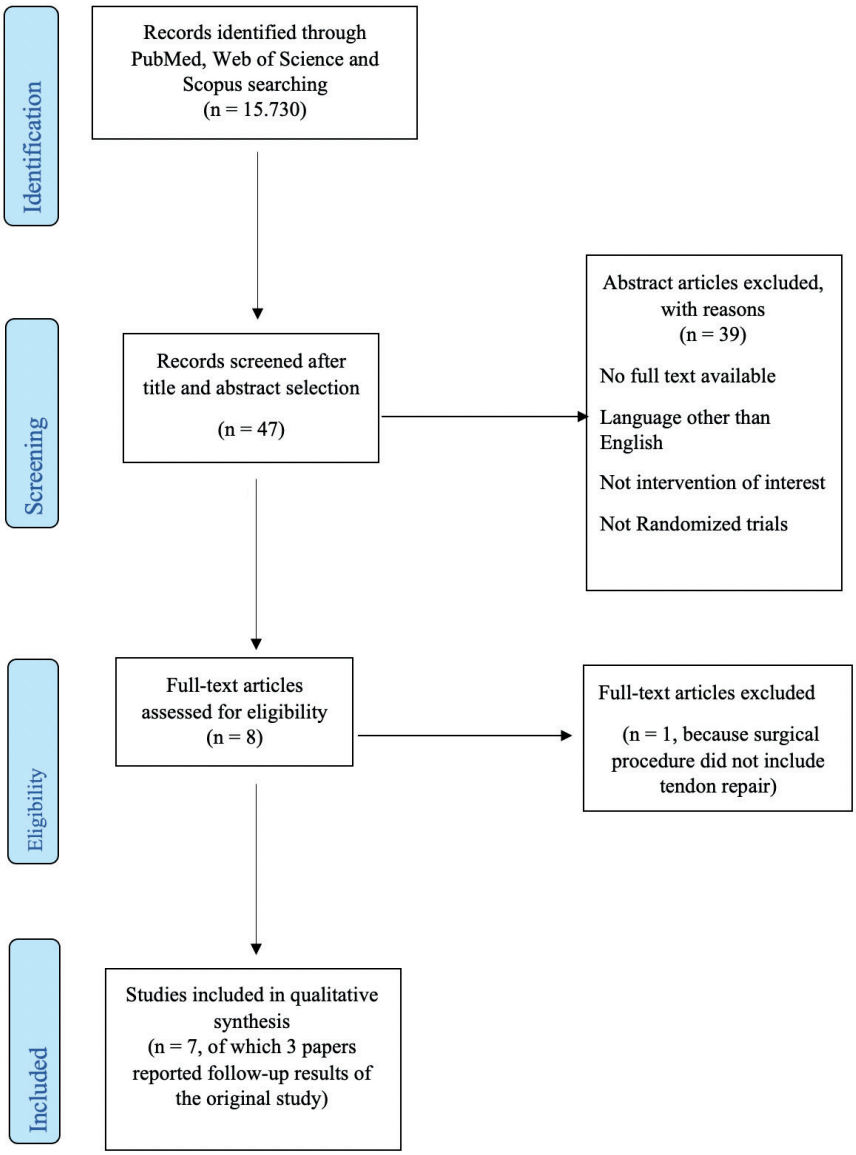

Figure 1. PRISMA Flowchart resuming the papers' selection process.

was calculated to assess the superiority of surgery or physiotherapy for each study. The final SMD was calculated with the Manthel-Haenszel method with a fixed-effects model. Heterogeneity between studies was tested by the I^2 statistic and heterogeneity was considered significant if $p<0.05$. The data were then represented through forest plots. All statistics were made through the Stata15 program (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX, USA).

Results

Identification of Studies

A total of 15.730 related articles were identified through databases' searching. After title and abstract screening, 47 studies were included.

As shown in Figure 1, 40 articles were excluded for not meeting the inclusion criteria and, ultimately, a total of 7 studies published from 2009 to March 2020 dealing with conservative treatment *vs.* surgical repair for rotator cuff tears were in-

Table I. Cochrane Risk of Bias assessment for all the included studies. + Low risk of bias; - High risk of bias.

	Selection bias Random sequence generation	Selection bias Allocation concealment	Reporting bias Selective reporting	Performance bias (participants and personnel)	Detection bias Blinding (outcome assessment)	Attrition bias Blinding outcome data	Incomplete Other bias
Moosmayer et al[17]	+	+	+	-	+	+	+
Moosmayer et al[32]	+	+	+	-	+	+	+
Moosmayer et al[33]	+	+	+	-	+	+	+
Kukkonen et al[2]	+	+	+	-	-	+	+
Kukkonen et al[26,34]	+	+	+	-	-	+	+
Lambers et al[3]	+	+	+	-	-	+	+
Ranebo et al[35]	+	+	+	-	+	+	+

cluded in this meta-analysis[2,3,17,32-35]. Actually, 3 papers reported results at a longer follow-up of the same groups of patients included in the original trials.

A synopsis of all the randomized trials included in the present meta-analysis is shown in Table II.

Study Design and Quality

The results of the assessment by the Cochrane Risk of Bias tool for RCTs are detailed in Table II. Overall, all the included studies revealed a good methodological quality. The only parameter which was not satisfied in any of the randomized trials was the blinding of patients, as largely expected considering that we included studies comparing surgical to conservative treatment, where ethical issues prevent from including sham surgery in the protocol. Furthermore, Kukkonen et al[2,34] and Lambers et al[3] presented a detection bias related to the subjects involved in the evaluations of the treated patients.

Patients and Evaluation Methods

Seven studies involving a total of 326 patients with rotator cuff tears were included in the present systematic review. A synopis of the relevant features and findings of the included studies has been reported in Table II.

The mean age ranged from 59.9 yy (Moosmayer[17,32,33]) to 65 yy (Kukkonen[2,34]). All studies were conducted in Europe and only one of them was a multicenter study[35].

In six papers the efficacy of rehabilitation alone was compared to surgical treatment[2,17,32-35].

In one study, also a subacromial steroid infiltration was associated to the rehabiliation[3].

Baseline and follow-up assessments were based on different clinical scores: shoulder pain was evaluated using Visual Analog Scale (VAS), Constant subscore for pain, and Numerical Rating Scale for pain (Pain-NRS), Pain-Free Abduction, Pain-Free Flexion.

Shoulder function was evaluated using the following items: Western Ontario Rotator Cuff (WORC) score, Constant score, American Shoulder and Elbow Surgeon (ASES) score, Short Form-36 Health Survey (SF-36), Dutch Simple Shoulder Test (DSST).

In all the studies, patients were evaluated at the last follow-up performing also an MRI to assess the status of the rotator cuff.

Surgical Treatments

Kukkonen et al[2,34] divided patients into 3 groups: physiotherapy (group 1), arthroscopic acromioplasty and physiotherapy (group 2) and rotator cuff repair, acromionplasty and physiotherapy (group 3). All operations (group 2 and 3) were performed arthroscopically in a standardised manner by 4 senior surgeons. For the purposes of the present meta-analysis only the data of the rotator cuff repair group were considered.

Lambers et al[3] proposed an anterolateral miniopen approach performed by 2 qualified and experienced surgeons.

Moosmayer et al[17,32,33] used a mini-open or open approach.

An arthroscopically assisted mini-open approach was used by Ranebo et al[35].

Rehabilitation Protocols

The physical therapy protocols adopted in the different trials were the following:

– Kukkonen et al[2,34]: a physiotherapist trained in shoulder therapy provided the patient with written information and guidance for exer-

Table II. Synopsis of all the articles included in the present systematic review.

Study	Study Design	Treatment Groups	Mean Age (Range)	Gender (M:f)	Site of Tear	Outcome Measures	Follow-Up	Rehabilitation Program	Main Results	Comments On Results
Moosmayer et al [17,31,33]	Randomized Controlled Trial	Tendon repair (n=52) *vs.* Physiotherapy (n=51)	Tendon repair 59 (44-75) Physiotherapy 61 (46-75)	Tendon repair 37:15 Physiotherapy 36:15	Symptomatic small and medium-size, traumatic or atraumatic tears of: **Supraspinatus** 37 (Tendon repair) 40 (Physiotherapy) **Supraspinatus and infraspinatus** 14 (Tendon repair) 10 (Physiotherapy) **Supraspinatus and subscapularis** 1 (Tendon repair) 1 (Physiotherapy)	CMS ASES score Pain-free abduction (deg) Pain-free flexion (deg) Strength (kg) VAS pain (cm) SF-36 VAS for patient satisfaction (cm) MRI and Ultrasound	Baseline, 6 months, 12 months, 2 years, 5 years, 10 years	12 weeks (session of 40 minutes, 2 times per week)	Better statistically significant results for the majority of outcome scores for tendon repair at all follow-ups.	Both groups improved during the first 1 to 2 years. Thereafter, shoulder function remained stable in the surgical group but declined in the physiotherapy one, leading to increasing between-group differences. A possible explanation for this functional decline is the deterioration of tear anatomy that has been reported to develop in unrepaired tears over time. The findings support a primary surgical approach for this type of rotator cuff tear in younger and active patients.
Kukkonen et al [2,26,34]	Randomized Controlled Trial	Physiotherapy (n=55) *vs.* Rotator cuff repair + acromioplasty + physiotherapy (n=54) *	Physiotherapy 65 (55-79) Rotator cuff repair + acromioplasty + physiotherapy 65 (55-81)	Physiotherapy 24:31 Rotator cuff repair + acromioplasty + physiotherapy 26:29	Atraumatic symptomatic isolated supraspinatus tendon tear	CMS VAS pain MRI Patient satisfaction	Baseline, 3 months, 6 months, 12 months, 2 years	12 weeks (written information and guidance for exercises to do at home + 10 sessions of physiotherapy in an outpatient health care facility	No significant difference outcome between the 2 interventions at any follow-up.	In contrast to their hypothesis, this study claims that surgical repair of supraspinatus tears did not result in a significantly better Constant score compared with conservative treatment. According to the MRI findings, the mean size of the supraspinatus tear increased slightly in the non-repaired group. On the basis of their findings, conservative treatment is a reasonable option for the primary initial treatment for isolated, symptomatic, nontraumatic, supraspinatus tears in older patients.
Lambers et al [3]	Randomized Controlled Trial	Rotator cuff repair (n=25) *vs.* Physiotherapy + subacromial steroid infiltration + analgesic medication (n=31)	Rotator cuff repair (60,8 +- 7,2) Physiotherapy + subacromial steroid injection (60,5 +- 7,0)	Rotator cuff repair 15:10 Physiotherapy + subacromial steroid infiltration + analgesic medication 20:11	Degenerative nontraumatic full-thickness tears of: **Supraspinatus** 24 (Rotator cuff repair) 26 (Physiotherapy) **Supraspinatus and infraspinatus** 0 (Rotator cuff repair) 1 (Physiotherapy) **Supraspinatus and subscapularis** 1 (Rotator cuff repair) 4 (Physiotherapy)	CMS VAS pain VAS disability DSST MRI	Baseline, 6 weeks, 3 months, 6 months, 12 months	12 weeks (after 12 weeks patients could start strength training).	No significant differences in functional outcome (Constant score) between groups at 1 year follow-up. Significant differences in pain and disabilities in favor of surgical treatment.	Best outcomes in function and pain were seen in surgically treated patients. The results of this study need to be viewed in light of certain limitations. Despite randomization, the number of patients with a larger cuff tear was higher in the group of conservatively treated patients. Additional research is needed to establish whether successful surgery can be predicted in patients with a degenerative rotator cuff tear.
Ranebo et al [35]	2-center Randomized Controlled Trial	Surgical repair (n=32) *vs.* Physiotherapy (n=26)	Surgical repair 58 (44-77) Physiotherapy 62 (46-77)	Surgical repair 18:14 Physiotherapy 14:12	Symptomatic traumatic supraspinatus tendon tear	CMS NRS WORC MRI EQ-VAS	12 months	16 weeks (a total of 10 supervised sessions: weekly for the first 4 weeks and then every other week over the following 12 weeks)	No significant differences in clinical outcome between surgical repair and physiotherapy, at 12 months follow-up.	Approximately one third of unrepaired patients had a tear enlargement of more than 5 mm, in a 12-month perspective, but the increase was small. Considering the results from the present study, small cuff tears may be treated nonoperatively in a short term perspective.

*one-third of patients (n=58) received physical therapy and subacromial decompression without rotator cuff repair and were excluded from this study; **CMS**, Constant Murley score; **ASES**, American Shoulder and Elbow Surgeons score; **VAS**, visual analog scale; **SF-36**, Short Form 36 Health Survey; **MRI**, magnetic resonance imaging; **DSST**, Dutch Simple Shoulder Test; **NRS**, Numerical Rating Scale; **WORC**, Western Ontario Rotator Cuff index; **EQ-VAS**, Euro quality-of-life visual analog scale; **SD**, standard deviation.

cises to be carried on at home. The exercise aimed at improving glenohumeral motion and active scapular retraction for the first six weeks. Subsequently static and dynamic exercises for the glenohumeral and scapular muscles were gradually increased from six weeks to 12 weeks, after which the participant increased resistance and strength training up to six months. In addition to written instructions, the patient was referred for ten sessions of physiotherapy in an outpatient health care facility where their progress was monitored.

– Lambers et al[3]: in addition to explaining the cause of the symptoms and the rehabilitation protocol, the physiotherapist advised about activities of daily living (ADL). Passive glenohumeral and scapulothoracic movements were performed, and static and dynamic exercises were started. These exercises aimed at improving glenohumeral and scapulothoracic musculature. In weeks 4 to 6, exercises were gradually increased, and deltoid training was started. In weeks 6 to 12, rehabilitation was aimed at further optimization of mobility and strength regeneration of the remaining cuff and deltoid. Physical therapy was continued until patients reached an optimum range of motion and an improvement in strength.
– Moosmayer et al[17,32,33]: local glenohumeral control was addressed by exercises to centre the humeral head in the glenoid cavity. Isometric exercises and exercises against eccentric and concentric resistance for shoulder rotators were given. When local glenohumeral control was achieved, exercises were given with increasing loads and progressed from neutral to more challenging positions. During all exercises, scapular stability had to be maintained. Additional exercises were given for specific demands in work, sports and leisure activities[22,23,27]. Patients who did not improve after at least 15 sessions of physiotherapy were re-examined by an orthopaedic surgeon, and additional testing with outcome scores was performed. If inadequate improvement was confirmed, secondary surgical treatment was offered. After secondary surgical treatment these patients were followed as a separate secondary surgery group.
– Ranebo et al[35]: the rehabilitation program consisted of 3 phases. The first training session for the nonoperative group was scheduled as soon as possible after the inclusion. Each phase contained several recommended exercises from which the physiotherapist could choose, with respect to restrictions. The physiotherapist decided when the patient was ready to move on to the next phase, considering quality of motion and pain. Phase 1 included standardized information about the condition and exercises aimed at promoting good posture and stabilization of the scapula. Initially, range of motion exercises unloading the rotator cuff were used, such as the wall slide and supported active flexion on a table using a ball, and active assisted exercises in elevation, abduction, and external rotation. Phase 2 included active unloaded exercises in elevation, external, and internal rotation as well as isometric strengthening exercises. Phase 3 included dynamic strengthening exercises for the rotator cuff and scapula stabilizers according to a previously published exercise program. Supervised physiotherapy sessions were held weekly for the first 4 weeks and then every other week over the next 12 weeks (a total of 10 visits). In between these sessions, patients performed home exercises, and a maximum of 3-4 exercises were recommended. In a subset of patients (n=34), adherence was recorded in an exercise diary.

Meta-Analysis

After data extraction from all the randomized controlled trials, it was possible to pool data obtained from 3 different studies: Moosmayers et al[33], Kukkonen et al[34] and Lambers et al[3]. In particular, NRS for pain and Constant score were reported by all the aforementioned authors at the same evaluation of 12 months' follow-up: therefore, a meta-analysis could be performed for those 2 scores at the 12 months' timepoint.

Heterogeneity tested by I^2 was not significant for both evaluations.

As shown in Figure 2 and Figure 3, surgical repair provided overall significantly superior results both in terms of NRS for pain (p=0.017) and Constant score (p<0.0001) compared to conservative management, at 1 year follow-up.

Conversion from Physiotherapy to Surgery

Only the trials by Moosmayer et al[17,32,33] and Kukkonen et al[2,34] reported data concerning the conversion rate from rehabilitation to surgery. Moosmayer et al[17] had 9 "cross-over" patients

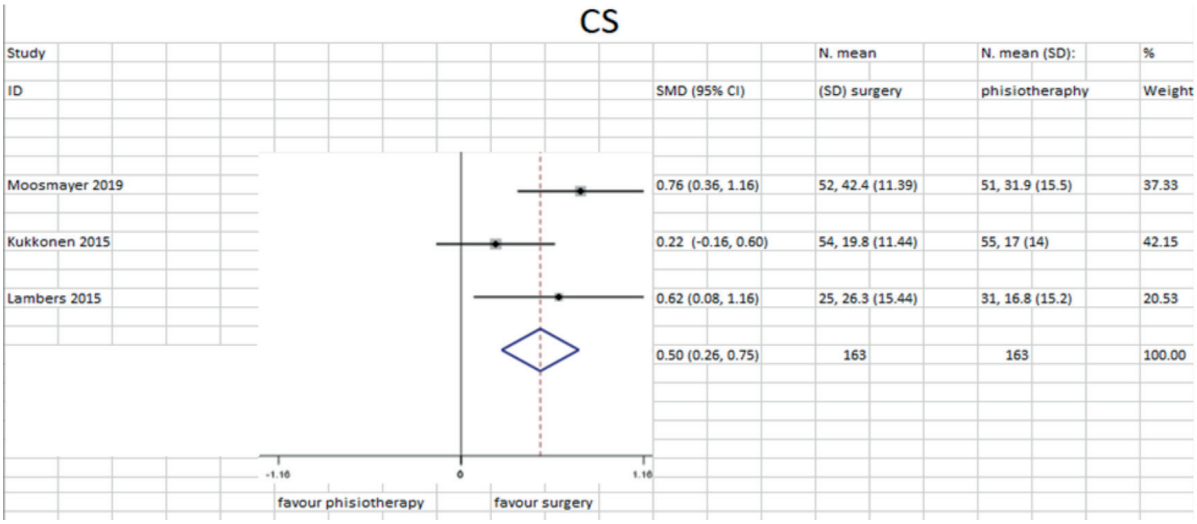

Figure 2. Forest plot showing the results in terms of Constant Score.

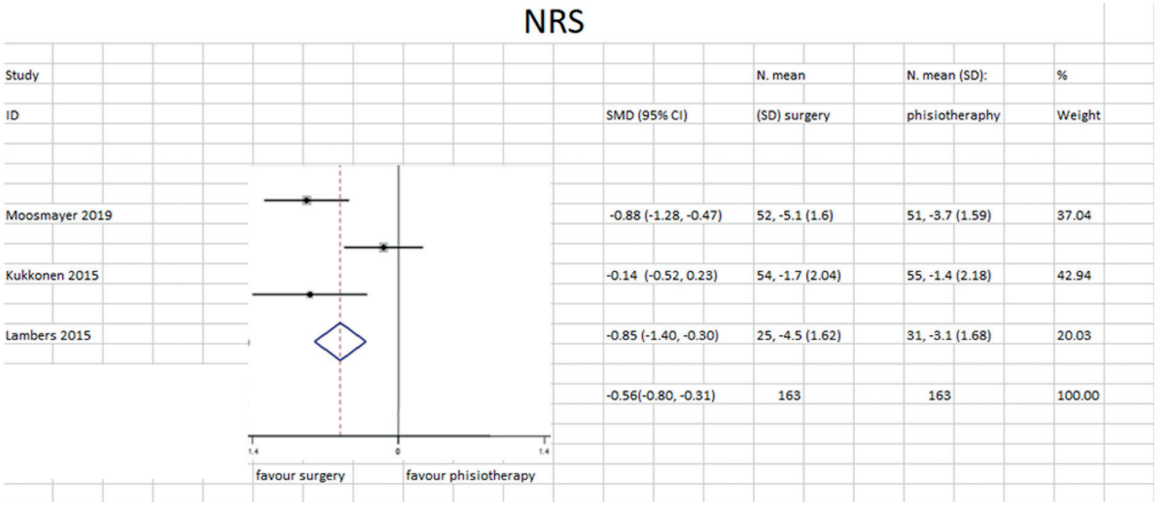

Figure 3. Forest plot showing the results in terms of NRS for pain.

within the first year (17% of the total) and 14 patients (27,4%) at the final 10-year evaluation[33].

Kukkonen et al[2] documented instead 4 patients (7.4% of the total) who required surgical treatment during the first year.

Retear Rate

All the studies reported the retear rates of the surgical group. Moosmayer et al[17,33] documented 10 patients (19%) who suffered retear within the first 12 months, with a slight increase to 16 (29%) at the final long-term evaluation performed at 10 years. Kukkonen et al[34] described 15 cases (27,8 %) of retear within 24 months, whereas Ranebo et al[35] had just 2 re-injuries (6,25%) after one year from the treatment. Differently from the previous trials, the one by Lambers et al[3] showed a much higher retear rate, which occurred in 14 out of 25 patients (56%) within the 12 months' evaluation.

Progression of Lesion's Size

In the physioterapy group, an increase of lesions' size occurred over time: Kukkonen et al[34] found that no patient showed more than 5 mm increase in the RCT up to 2 years' evaluation; Ranebo et al[35] found that 7 patients (27% of the total) had an in-

crease of more than 5 mm in the tear; Moosmayer et al[32,33] reported data after 5 years from surgery, revealing that 24 patients (47%) presented an enlargement less than 5 mm, with a further increase to 32 (62,7%) at the final 10 years' follow-up.

Adverse Events

Data concerning adverse events following surgical repair were reported only by Ranebo et al[35], who registered two cases of post-op infection.

Discussion

The main findings of the present systematic review and meta-analysis are: 1) the paucity of high level trials comparing surgical and conservative management of degenerative RCTs, with only a few data at long-term evaluation; 2) both surgical and conservative management are able to provide simptomatic relief and improved function at short term-evaluation (one year after treatment); 3) despite the meta-analysis showed statistically significant superior results in favour of surgical management, a real clinical impact could not be detected since the difference between treatments is inferior to the minimally clinical important difference (MCID) both in terms of NRS for pain and Constant Score.

The aforementioned findings should be weighted against some limitations in the available evidence. In fact, although the overall quality of the trials was satisfactory based upon the Cochrane Risk of Bias Assessment tool, some shadow zones should be considered. First of all, surgical approaches were not the same among the studies analyzed, since both arthroscopic and mini-open techniques were adopted and concurrent procedures, such as biceps tenotomy and subacromial decompression, were performed at the discretion of the different authors. Although this could represent a bias, we believe that the impact is not such to impair the overall evaluation because, as shown by other studies[36-38], mini-open approach has limited invasiveness and similar outcomes compared to all-arthroscopic procedures. Another counfounding factor is that in some studies "post-traumatic" degenerative RCTs were included together with pure degenerative RCTs, and also some trial included isolated supraspinatus tears whereas others even subscapularis and infra-spinatus tears. The mean age of the patients included in the trials supports the presence of tendon degeneration but the specific mechanism of injury and the involvement of one or more tendons are factors that should be carefully considered. The concept of "tendon wear"[39] in this setting is perhaps more correct than "tendon tear" and reflects the fact that concurrent alterations may be present, such as tendon retraction, muscle athrophy and fatty infiltration[40,41].

Beyond differences in surgical procedures, also obvious discrepancies in terms of rehabilation protocols, e.g. specific exercises, number of session per weeks, total duration of rehabilitation[42], were detected but we think that this could be a less relevant bias since rehabiliation strategies were mainly focused on a common "core" set of exercises that were proposed to patients, that could learn and practice them even outside the context of the physiotherapy-assisted sessions. The real influencing factor is actually the compliance of the patients toward the rehabilitation regimen and there is evidence that patients tend to shift to surgery earlier than completing the proposed exercise therapy, thus supporting the fact that other factors influence their choice and they even perceive surgery as a way to obtain superior and faster functional recovery[43]. To this purpose, the results of our study strenghten again the necessity of interpreting statistical data with a clinically-oriented view: in fact, statistical relevance does not always imply "clinical" relevance. When looking carefully at the data emerged from the meta-analysis, it will appear that the mean between-group difference in Constant Score and NRS for pain is modest and does not reach the threshold for a perceivable "clinical" difference[44,45]. Statistic is a powerful tool but managing numbers could mislead their practical interpreation. So, the difference between surgery and conservative management appears negligible at the 12 months' evaluation, which was the only timepoint feasible for comparing studies. What we really lack from the available studies is a longer-term analysis to understand the progression of the tear size[46,47] and the inherent functional limitation over time in non surgical patients, which is the most relevant aspect since surgery for degenerative RCTs may be basically meant as a "profilactic" approach to prevent further degeneration over years, that leads to an irreparable condition such as "cuff arthropathy" requiring often shoulder arthroplasty. The data coming from the present evaluation were not univocal: Kukkoned et al[34] reported minimal increase in the RCT size within the 24 months' follow-up, whereas Moosmayer et al[33] presented data up to 10 years' follow-up, revealing a significant percentage of patients (62%) with more than 5 mm RCT enlargement, thus leading the authors

to speculate that surgery might have a protective role in the long term. The choice of surgery is also based upon the understanding of the potential risks for the patients and the rate of failures, i.e. symptomatic re-tears of the repaired tendons. As largely demonstrated in literature, arthroscopic or mini-open surgery proved to be safe[48-50] and also in the present evaluation a very low rate of complications (mainly post-op infections) was documented. More complex is the issue regarding the re-tear rate, since variable data were reported among trials, but also recent systematic reviews showed a wide interval in terms of re-tear rate, from 15% to 50%[51], with age, duration of symptoms and number of tendons representing negative prognostic factors[52,53]. In last instance, until we collect further reliable comparative data at 5 to 10 years' evaluation, a full endorsement of the operative approach cannot yet be supported.

Recent litetature is increasingly focusing on the management of degenerative joints, due to the aging of the population associated to the will of maintaining an active lifestyle: in the last decade, many randomized trials have shown that degenerative meniscal injuries benefit from conservative management providing similar (or even better) results compared to arthroscopic surgery, which, therefore, should be considered as a second line option only in case of poor results following an appropriate rehabiliation program[54]. Similarly, "tendon wear" can be treated by physical therapy with encouraging outcomes in the short term but a fundamental aspect should be underlined: whereas in the case of menisci the common surgical procedure is arthroscopic partial meniscectomy/debridement, which inevitably has an impact on the knee cartilage status (increasing the risk of osteoarhritis)[55], in the case of rotator cuff, surgery aims at repairing the torn tendons, restoring (at least partially) its anatomical integrity. Therefore, shoulder surgery, beyond mitigating pain and restoring function, migh have a major impact in preventing joint degeneration progression in the long term, something that cannot be provided by arthroscopic meniscectomy which aims at eliminating symptoms but exposes the articular cartilage to mechanical and biologic overload.

Conclusions

Although the present systematic review and meta-analysis is not able to answer the question of which approach, surgical or conservative, is better in the long term, it provides relevant information for clinicians to perform adequate patients' counselling and orient their therapeutic decisions. In case of degenerative RCT, patients should be informed that: 1) a proper rehabilitation program is able to provide similar results compared to surgery in the short term; 2) an increase in tear size should be expected when conservative management is preferred, especially in the interval of 5-10 years from the diagnosis[56]; 3) surgical approach is safe and failure rate is variable, more likely in case of older patients with more tendons involved; 4) rotator cuff repair might contribute in slowing down the progression of degeneration and, therefore, prevent or delay further more invasive procedures in the long term.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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