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Is arthroscopic decompression better than conservative management for shoulder impingement? A systematic review and meta-analysis

Shujing Liu
Logistics University of Chinese People's Armed Police Force
Yingying Yu
Logistics University of Chinese People's Armed Police Force
Guangxu Lu
Logistics University of Chinese People's Armed Force
Hui Dong
Logistics University of Chinese People's Armed Force
Wenliang Wang (sjl0507@foxmail.com)
Department of Orthopaedic Center,Characteristic medical center of Chinese People's Armed Police Force,Tianjin,China https://orcid.org/0000-0003-1366-3965

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Abstract

Background Arthroscopic decompression is commonly used to treat shoulder impingement, while the role of conservative treatment in these patients remains unclear. The objective of this paper is to synthesise available evidence regarding the effectiveness of subacromial decompression for shoulder impingement compared with conservative treatment to verify whether arthroscopic surgery is superior to conservative treatment.

Methods We systematicly retrieved the Cochrane databases, Embase as well as Pubmed (from inception to July. 02, 2019) for randomized controlled trials. Cochrane risk-of-bias tool was used to assess all referred studies' quality and we pooled outcomes with a random-effects model. We divided the outcomes into short-term subgroup(<2 years) and long-term subgroup (≥2 years).

Results 7 randomised controlled trials (RCTs) were included, involving a total of 607 patients, 297 patients operated arthroscopic decompression, compared to 310 patients treated with conservative management. We found no significant differences either in shoulder pain scores or shoulder function scores between arthroscopic decompression and conservative management wether in long-term or short-term follow-up subgroups.

Conclusion No significant difference was demonstrated on the treatment outcomes of shoulder impingement between arthroscopic decompression and conservative management in our meta-analysis. Thus, we suggested that conservative management should be chosen firstly for patients with shoulder impingement, when patients' symptom cannot be relieved from the conservative treatment, arthroscopic decompression should be taken into consideration.

Levels of Evidence Level-I study

Background

Shoulder impingement, or subacromial impingement is the narrowing of the subacromial space(ranges from 1.0–1.5 cm) and the attrition or rubbing of the rotator cuff against the anterior edge and undersurface of the anterior third of the acromion, the coracoacromial ligament, and at times, the acromioclavicular joint, rather than against the lateral acromion. This is the underlying rationale for the subaromial decompression or acromioplasty, which first described by Neer[1], and at the same time, Neer divided shoulder impingement into 3 stages: Hemorrhage and Edema(stage I), Fibrosis and Tendinitis (stage II), and Bone Spurs and Tendon Rupture (stage III)[2]. Bigliani *et al.* found that the acromion could be divided into three types, including flat, arc and hook acromion, and they pointed out that hook(type III) acromion increased the risk of rotator cuff tears[3].

Subacromial decompression was introduced in 1972 as a treatment for subacromial shoulder pain without high-level evidence and is now one of the most common surgical procedures in orthopaedics[1].

Recently the effectiveness of this procedure is questioned by some scientists, Some reports[4,5] suggested that surgery was no better than exercise therapy, whereas others[6–8] reported surgery benefited more.

There were several review papers[9,10] and meta-analyses[11–14] comparing different treatments of shoulder impingement, but meta-analyses of arthroscopic subacromial decompression and non-surgical treatment was not found. So we synthesised the most recent articles and conducted a meta-analysis to figure out if rthroscopic decompression is better than conservative management for patients with shoulder impingement. We hypothesized that arthroscopic decompression resulted in better shoulder function and pain relief than conservative treatment.

Methods

Search Strategy

The Pubmed, Cochrane Central Register of Controlled Trials (The Cochrane Library) as well as Embase were searched from their inception to July. 02, 2019. We used the following search strategy to search: ((shoulder[Title/Abstract] OR rotator cuff[Title/Abstract]) AND (impingement[Title/Abstract] OR pain[Title/Abstract])) AND (((((arthroscopic[Title/Abstract] OR surgery[Title/Abstract]) OR decompression[Title/Abstract]) OR physical therapy[Title/Abstract]) OR exercise[Title/Abstract]) OR non-surgery[Title/Abstract]) AND (Clinical Trial[ptyp] OR Randomized Controlled Trial[ptyp]). We also searched the references of each potentially eligible paper to identify additional information that may be missed in the database. Meanwhile, we showed the detailed search process in Fig.1.

Inclusion and Exclusion Criteria

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used as a direction for our research. Randomised controlled trials (RCTs) evaluating arthroscopic decompression versus conservative management for shoulder impingement were included. There were no restrictions on gender, race, etc. Studies were excluded if patients with full-thickness torn rotator cuff, fracture or calcified tendonitis were included.

Selection of studies

Two reviewers (*** and ***) independently screened the literature with standardized study selection forms. A third reviewer (***) would be consulted if there was any disagreement between the 2 reviewers (*** and ***).

Data extraction and quality assessment

Two authors (***, ***) extracted all data from included RCTs independently. Data extracted included diagnosis of shoulder impingement, sample size, age, strategies prescribed without operation, operative interventions, randomisation and recruitment ways, the results of clinical and complication rate and follow-up period. If standard deviation (SD) values were not presented, we attempted to contact the authors to get the data. Finally, all of the data was synthesized into an accordant data extraction table. Outcome measures included shoulder pain and shoulder function. We evaluated the study 's methodological quality according to Cochrane Handbook 5.1.0[15] and it was performed by 2 reviewers (*** and ***) independently. The researching process was involved sequence generation, allocation concealment, participants' blinding, assessors' blinding, incomplete data, selective reporting and other bias.

Statistical analysis and assessment of risk of bias

In order to improve the results' generalizability, we used a random effects model to combine data. When the measurement instruments were different, we used standardized mean differences(SMDs) to measure similar constructs. Statistical analyses were done through employing the procedure Review Manager software (RevMan5.3, Cochrane Collaboration, http://www.cochrane.org/). Consequences were divided into short-term(<2 years) and long-term subgroup(≥2 years) data. Estimating pooled mean difference between arthroscopic decompression and conservative treatment by calculating SMD (standardized mean differences) and 95%CI (confidence interval). Statistical heterogeneity was quantitatively evaluated by Chisquare test with important set P <0.10 or I^2 > 50%. Because of the small number of studies included, we did not construct funnel plots to assess the publication bias. 2 reviewers (*** and ***) assessed the risk of bias by using the Cochrane Collaboration's tool for risk of bias assessment in an independent way.

Results

Literature search and Study Characteristics

After primary screening, there were 3080 studies related to the theme. Meanwhile, after excluding duplicate and obviously irrelevant reports, 20 articles were retained. By carefully reading the full text, it was found that: 3 articles[16–18] were just study protocol, 1 article[6] we couldn't extract the data we need, 2 article[19,20] were not randomized controlled trial, 3 articles[21–23] were based on the comparison of other surgical method and conservative management. 11 studies met our inclusion and exclusion criteria, and among these studies, 5 studies[24–28] published by Ketola *et al.* described the same clinical study and the follow-up time of these studies all belonged to our long-term subgroup, so we only included as one. 7 eligible RCTs[4,5,28–32] were included eventually in our meta-analysis. Table 1 was the detailed characteristics of the referred studies.

Risk of Bias Assessment

3 referred[5,28,30] studies showed a low-risk bias, yet at the same time 2 studies[31,32] showed a high- risk bias. It was found that the most common bias was blinding of participants and personnel, no study clearly pointed out the methods for controlling performance bias. We showed the risk of bias assessment in Fig.2 and Fig.3.

Results of meta-analysis

Shoulder pain

All 7 studies reported shoulder pain scores. Short-term subgroup included 3 studies[5,30,32] and long-term subgroup included 4 studies[4,28,29,31]. Significant differences were not found in shoulder pain scores between the arthroscopic decompression group and the conservative management group either in short-term subgroup(standard mean difference[SMD] = −0.06; 95% confidence interval [CI] = −0.28–0.17; P = 0.62; I^2 = 0%) or long-term (standard mean difference[SMD] = −0.12; 95% confidence interval [CI] = −0.39–0.15; P = 0.38; I^2 = 49%). (Fig. 4).

Shoulder function

After data extraction, 6 studies[4,5,29–32] reported shoulder function scores. Short-term subgroup included 3 studies[5,30,32] and no significant differences was found in this subgroup(standard mean difference [SMD] = 0.12; 95% confidence interval [CI] = −0.18–0.43; P = 0.42; I^2 = 49%). Long-term subgroup included 3 studies[4,29,31] and there was no significant differences either (standard mean difference [SMD] = 0.03; 95% confidence interval [CI] = −0.53–0.59; P = 0.92; I^2 = 81%). (Fig. 5).

Sensitivity analysis

A sensitivity analysis was performed in the long-term follow-up subgroup of shoulder function scores by removing the study [31] which showed a high- risk bias. The results were insignificant (SMD = 0.30, 95% CI = −0.06–0.66), while the heterogeneity was decreased to a lower level (p = 0.20; I^2 = 40%).

Discussion

The most meaningful findings of our systematic review and meta-analysis were that patients with shoulder impingement improved after treatment both in the arthroscopic decompression and conservative treatment groups, while no signifcant differences were found between the two groups either

in short-term or long-term. Thus, it's not necessary to choose the arthroscopic decompression firstly for the treatment of shoulder impingement. This result reinforces previous evidence of research on the same problem. One CSAW study[5] firstly set up three control groups to study the treatment of shoulder impingement, which included arthroscopic decompression, investigational arthroscopy (placebo) and conservative treatment. The results showed that the patients' condition improved significantly after treatment, whether by arthroscopic decompression, investigational arthroscopy or conservative treatment. However, compared with conservative treatment, surgical treatment had statistical significance but no clinical significance, at the same time, they found that arthroscopic decompression had no advantage over investigational arthroscopy either. So, they believed that relieved impingement on the underlying tendons during movement of the arm may not be the factor of therapeutic effect. A similar FIMPACT study[4] conducted by Paavola *et al.* yielded the same conclusion. Ketola *et al.* conducted a study[24–28] to compare arthroscopic acromioplasty with conservative treatment for shoulder impingement and the follow-up time lasted for more than 10 years, the results revealed that there were no significant differences in the changes of the rotator cuff between the two groups at the five-year follow-up, and they also conducted a detailed subgroup analysis, while no significant difference was found in the subgroup analysis either. The study[21] conducted by Rahme *et al.* compared open surgery with conservative treatment for shoulder impingement, and the results showed that open surgery achieved better clinical results than conservative treatment, and they believed that shoulder impingement was caused by subacromial capsular compression, which was in conflict with previous studies. Mark *et al.*[33] compared the advantages and disadvantages of open surgery and arthroscopic surgery for shoulder impingement, the results showed that there was no significant difference between open surgery and arthroscopic surgery after 1 year. Some literature[34–38] reported a variety of conservative treatment methods, and the results showed that conservative treatment could alleviate pain and improve shoulder function in patients with shoulder impingement. Despite so many studies on shoulder impingement, the specific mechanism of pain in patients with shoulder impingement remained a puzzle and great efforts should be done by etiology or other studies.

Strengths and limitations

We conducted a rigorous review of the relevant literature. The included literature was high-quality randomized controlled trials. Before our study, only one meta-analysis[13] compared the clinical effects of surgical and non-surgical treatment. However, no meta-analysis had been done to compare arthroscopic decompression with conservative treatment so far. Several limitations of the present study should be considered. Firstly, there were some differences in the follow-up time of the included studies, which may lead to increasing clinical heterogeneity. Secondly, the shoulder pain and shoulder function scores we extracted were not entirely consistent, which may result in a change in the magnitude of the merger effect. Thirdly, conservative treatment methods and the different treating time may lead to increasing clinical heterogeneity. The above limitations would evaluate the results of the system strength of

argument matters. Considering all above situation, if quality of this study was supposed to be improved, further inclusion of more and better quality randomized clinical control studies were required.

Conclusion

No significant difference was demonstrated on the treatment outcomes of shoulder impingement between arthroscopic decompression and conservative management in our meta-analysis. Thus, we suggested that conservative management should be chosen firstly for patients with shoulder impingement, when patients' symptom cannot be relieved from the conservative treatment, arthroscopic decompression should be taken into consideration.

Declarations

Abbreviations

Not applicable

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and material: All data generated or analysed during this study are included in this published article and its supplementary information files.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: LSJ was responsible for the design, conception and writing of the paper. LSJ and YYY were responsible for the extraction and analysis of literature data. DH and LGX were responsible for literature retrieval and selection, WWL was responsible for reviewing the quality of articles.

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Reference

1.Neer CS, 2nd. Anterior acromioplasty for the chronic impingement syndrome in the shoulder: a preliminary report. *The Journal of bone and joint surgery. American volume.* Jan 1972;54(1):41–50.

2.Neer CS, 2nd. Impingement lesions. *Clinical orthopaedics and related research.* Mar 1983(173):70–77.

3.Bigliani LU, Ticker JB, Flatow EL, Soslowsky LJ, Mow VC. The relationship of acromial architecture to rotator cuff disease. *Clinics in sports medicine.* Oct 1991;10(4):823–838.

4.Paavola M, Malmivaara A, Taimela S, et al. Subacromial decompression versus diagnostic arthroscopy for shoulder impingement: randomised, placebo surgery controlled clinical trial. *Bmj.* Jul 19 2018;362:k2860.

5.Beard DJ, Rees JL, Cook JA, et al. Arthroscopic subacromial decompression for subacromial shoulder pain (CSAW): a multicentre, pragmatic, parallel group, placebo-controlled, three-group, randomised surgical trial. *Lancet.* Jan 27 2018;391(10118):329–338.

6.Peters G, Kohn D. [Mid-term clinical results after surgical versus conservative treatment of subacromial impingement syndrome]. *Der Unfallchirurg.* Aug 1997;100(8):623–629.

7.Jarrett CD, Schmidt CC. Arthroscopic treatment of rotator cuff disease. *The Journal of hand surgery.* Sep 2011;36(9):1541–1552; quiz 1552.

8.Speer KP, Lohnes J, Garrett WE, Jr. Arthroscopic subacromial decompression: results in advanced impingement syndrome. *Arthroscopy: the journal of arthroscopic & related surgery: official publication of the Arthroscopy Association of North America and the International Arthroscopy Association.* 1991;7(3):291–296.

9.Gebremariam L, Hay EM, Koes BW, Huisstede BM. Effectiveness of surgical and postsurgical interventions for the subacromial impingement syndrome: a systematic review. *Archives of physical medicine and rehabilitation.* Nov 2011;92(11):1900–1913.

10.Page MJ, Green S, McBain B, et al. Manual therapy and exercise for rotator cuff disease. *The Cochrane database of systematic reviews.* Jun 10 2016(6):CD012224.

11.Dong W, Goost H, Lin XB, et al. Treatments for shoulder impingement syndrome: a PRISMA systematic review and network meta-analysis. *Medicine.* Mar 2015;94(10):e510.

12.Chahal J, Mall N, MacDonald PB, et al. The role of subacromial decompression in patients undergoing arthroscopic repair of full-thickness tears of the rotator cuff: a systematic review and meta-analysis. *Arthroscopy: the journal of arthroscopic & related surgery: official publication of the Arthroscopy Association of North America and the International Arthroscopy Association.* May 2012;28(5):720–727.

13.Saltychev M, Aarimaa V, Virolainen P, Laimi K. Conservative treatment or surgery for shoulder impingement: systematic review and meta-analysis. *Disability and rehabilitation.* 2015;37(1):1–8.

14.Dorrestijn O, Stevens M, Winters JC, van der Meer K, Diercks RL. Conservative or surgical treatment for subacromial impingement syndrome? A systematic review. *Journal of shoulder and elbow surgery.* Jul-Aug 2009;18(4):652–660.

15.Higgins JPT, Green S, Cochrane Collaboration. *Cochrane handbook for systematic reviews of interventions.* Chichester, England; Hoboken, NJ: Wiley-Blackwell; 2008.

16.Beard D, Rees J, Rombach I, et al. The CSAW Study (Can Shoulder Arthroscopy Work?) - a placebo-controlled surgical intervention trial assessing the clinical and cost effectiveness of arthroscopic subacromial decompression for shoulder pain: study protocol for a randomised controlled trial. *Trials.* May 9 2015;16:210.

17.Dorrestijn O, Stevens M, Diercks RL, van der Meer K, Winters JC. A new interdisciplinary treatment strategy versus usual medical care for the treatment of subacromial impingement syndrome: a randomized controlled trial. *BMC musculoskeletal disorders.* Feb 22 2007;8:15.

18.Paavola M, Malmivaara A, Taimela S, Kanto K, Jarvinen TL, Investigators F. Finnish Subacromial Impingement Arthroscopy Controlled Trial (FIMPACT): a protocol for a randomised trial comparing arthroscopic subacromial decompression and diagnostic arthroscopy (placebo control), with an exercise therapy control, in the treatment of shoulder impingement syndrome. *BMJ open.* Jun 6 2017;7(5):e014087.

19.Bhattacharyya R, Edwards K, Wallace AW. Does arthroscopic sub-acromial decompression really work for sub-acromial impingement syndrome: a cohort study. *BMC musculoskeletal disorders.* Sep 29 2014;15:324.

20.Farfaras S, Sernert N, Hallstrom E, Kartus J. Comparison of open acromioplasty, arthroscopic acromioplasty and physiotherapy in patients with subacromial impingement syndrome: a prospective randomised study. *Knee surgery, sports traumatology, arthroscopy: official journal of the ESSKA.* Jul 2016;24(7):2181–2191.

21.Rahme H, Solem-Bertoft E, Westerberg CE, Lundberg E, Sorensen S, Hilding S. The subacromial impingement syndrome. A study of results of treatment with special emphasis on predictive factors and pain-generating mechanisms. *Scandinavian journal of rehabilitation medicine.* Dec 1998;30(4):253–262.

22.Henkus HE, de Witte PB, Nelissen RG, Brand R, van Arkel ER. Bursectomy compared with acromioplasty in the management of subacromial impingement syndrome: a prospective randomised study. *The Journal of bone and joint surgery. British volume.* Apr 2009;91(4):504–510.

23.Kolk A, Thomassen BJW, Hund H, et al. Does acromioplasty result in favorable clinical and radiologic outcomes in the management of chronic subacromial pain syndrome? A double-blinded randomized clinical trial with 9 to 14 years' follow-up. *Journal of shoulder and elbow surgery.* Aug 2017;26(8):1407–1415.

24.Ketola S, Lehtinen JT, Arnala I. Arthroscopic decompression not recommended in the treatment of rotator cuff tendinopathy: a final review of a randomised controlled trial at a minimum follow-up of ten years. *The bone & joint journal.* Jun 2017;99-B(6):799–805.

25.Ketola S, Lehtinen J, Rousi T, et al. No evidence of long-term benefits of arthroscopicacromioplasty in the treatment of shoulder impingement syndrome: Five-year results of a randomised controlled trial. *Bone & joint research.* 2013;2(7):132–139.

26.Ketola S, Lehtinen J, Rousi T, Nissinen M, Huhtala H, Arnala I. Which patients do not recover from shoulder impingement syndrome, either with operative treatment or with nonoperative treatment? *Acta orthopaedica.* 2015;86(6):641–646.

27.Ketola S, Lehtinen J, Elo P, Kortelainen S, Huhtala H, Arnala I. No difference in long-term development of rotator cuff rupture and muscle volumes in impingement patients with or without decompression. *Acta orthopaedica.* Aug 2016;87(4):351–355.

28.Ketola S, Lehtinen J, Arnala I, et al. Does arthroscopic acromioplasty provide any additional value in the treatment of shoulder impingement syndrome?: a two-year randomised controlled trial. *The Journal of bone and joint surgery. British volume.* Oct 2009;91(10):1326–1334.

29.Haahr JP, Andersen JH. Exercises may be as efficient as subacromial decompression in patients with subacromial stage II impingement: 4–8-years' follow-up in a prospective, randomized study. *Scandinavian journal of rheumatology.* May-Jun 2006;35(3):224–228.

30.Haahr JP, Ostergaard S, Dalsgaard J, et al. Exercises versus arthroscopic decompression in patients with subacromial impingement: a randomised, controlled study in 90 cases with a one year follow up. *Annals of the rheumatic diseases.* May 2005;64(5):760–764.

31.Brox JI, Gjengedal E, Uppheim G, et al. Arthroscopic surgery versus supervised exercises in patients with rotator cuff disease (stage II impingement syndrome): a prospective, randomized, controlled study in 125 patients with a 2 1/2-year follow-up. *Journal of shoulder and elbow surgery.* Mar-Apr 1999;8(2):102–111.

32.Brox JI, Staff PH, Ljunggren AE, Brevik JI. Arthroscopic surgery compared with supervised exercises in patients with rotator cuff disease (stage II impingement syndrome). *Bmj.* Oct 9 1993;307(6909):899–903.

33.Spangehl MJ, Hawkins RH, McCormack RG, Loomer RL. Arthroscopic versus open acromioplasty: a prospective, randomized, blinded study. *Journal of shoulder and elbow surgery.* Mar-Apr 2002;11(2):101–107.

34.Crawshaw DP, Helliwell PS, Hensor EM, Hay EM, Aldous SJ, Conaghan PG. Exercise therapy after corticosteroid injection for moderate to severe shoulder pain: large pragmatic randomised trial. *Bmj.* Jun 28 2010;340:c3037.

35.Bennell K, Wee E, Coburn S, et al. Efficacy of standardised manual therapy and home exercise programme for chronic rotator cuff disease: randomised placebo controlled trial. *Bmj.* Jun 8 2010;340:c2756.

36.Ekeberg OM, Bautz-Holter E, Tveita EK, Juel NG, Kvalheim S, Brox JI. Subacromial ultrasound guided or systemic steroid injection for rotator cuff disease: randomised double blind study. *Bmj.* Jan 23 2009;338:a3112.

37.Engebretsen K, Grotle M, Bautz-Holter E, et al. Radial extracorporeal shockwave treatment compared with supervised exercises in patients with subacromial pain syndrome: single blind randomised study. *Bmj.* Sep 15 2009;339:b3360.

38.Holmgren T, Bjornsson Hallgren H, Oberg B, Adolfsson L, Johansson K. Effect of specific exercise strategy on need for surgery in patients with subacromial impingement syndrome: randomised controlled study. *Bmj.* Feb 20 2012;344:e787.

Table 1

Table. 1 Study Characteristics

Figures

Study	Country	Number of Patients Enrolled		Age (mean)	Female n(%)	Final follow-up number	Included Outcome
		Surgical	Non-surgery				
Paavola 2018	Finland	59 ASD	71 physiotherapy	50.5/50.4	42(71)/ 47(66)	59/68	VAS on arm activity, Constant-Murley score at 2y
Beard 2018	UK	106 ASD	104 No treatment	52.9/53.7	54(51)/ 52(50)	88/84	Oxford Shoulder Score, pain DETECT score at 1y
Ketola 2009	Finland	70 ASD	70 Supervised exercise	46.4/47.8	41(59)/ 47(67)	68/66	VAS at 2y
Haahr 2005	Denmark	41 ASD	43 physiotherapy	44.3/44.5	29(70.7)/ 29(67.4)	41/43	Constant score, Average pain and discomfort in past 3 months at 1y
Haahr 2006	Denmark	41 ASD	43 physiotherapy	44.4	58(69)	39/40	Average pain and discomfort in past 3 months at 4-8y
Brox 1999	Norway	45 ASD	50 physiotherapy	48/47	16(36)/ 28(56)	39/45	Neer shoulder score, pain on activity at 2.5y
Brox 1993	Norway	45 ASD	50 physiotherapy	48/47	16(36)/ 28(56)	41/49	Neer shoulder score, pain on activity at 0.5y

ASD: Arthroscopic subacromial decompression; VAS: visual analogue scale; y: year

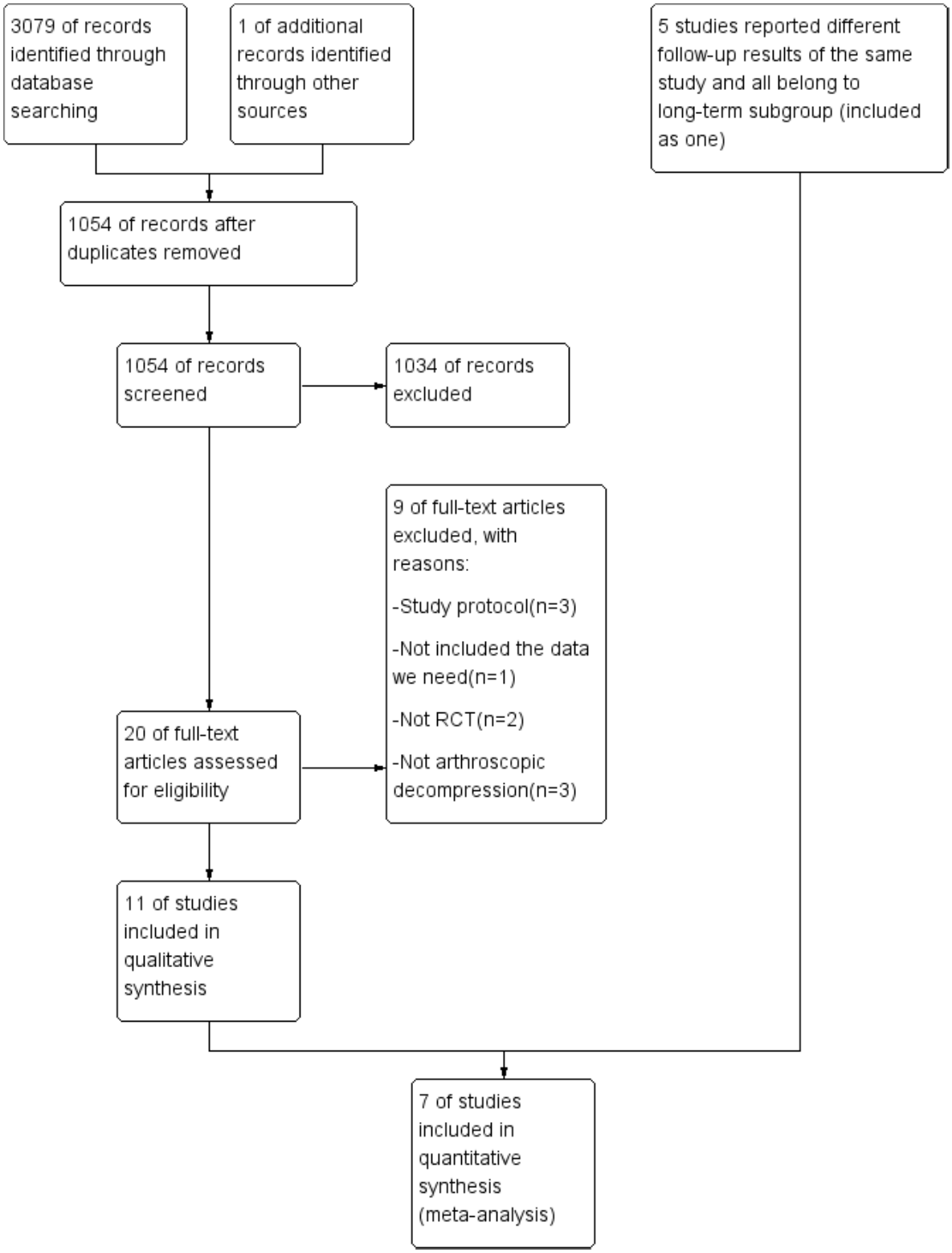


Figure 1

search process

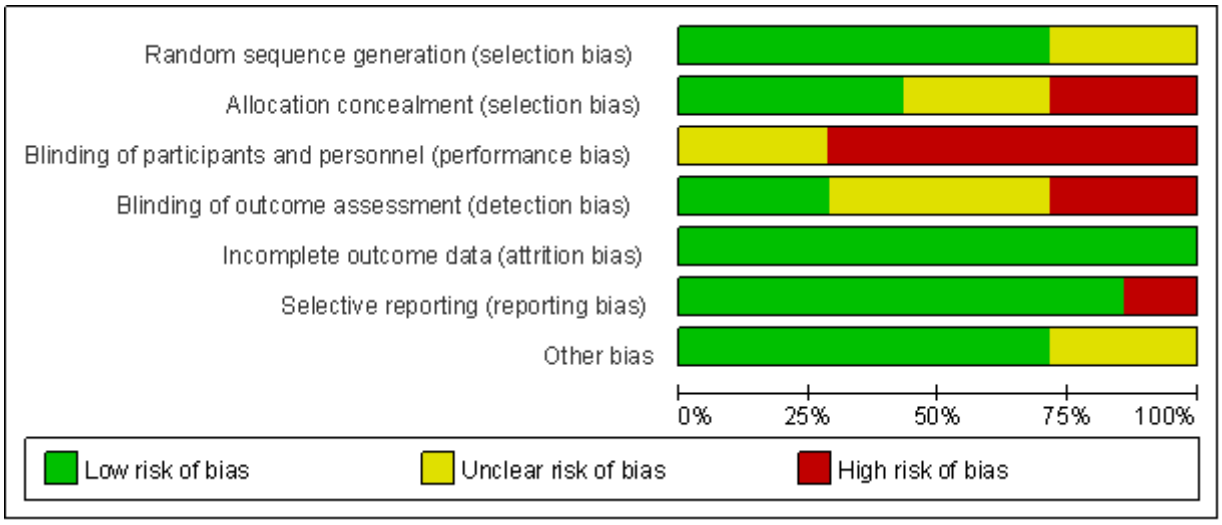


Figure 2

Risk of bias summary

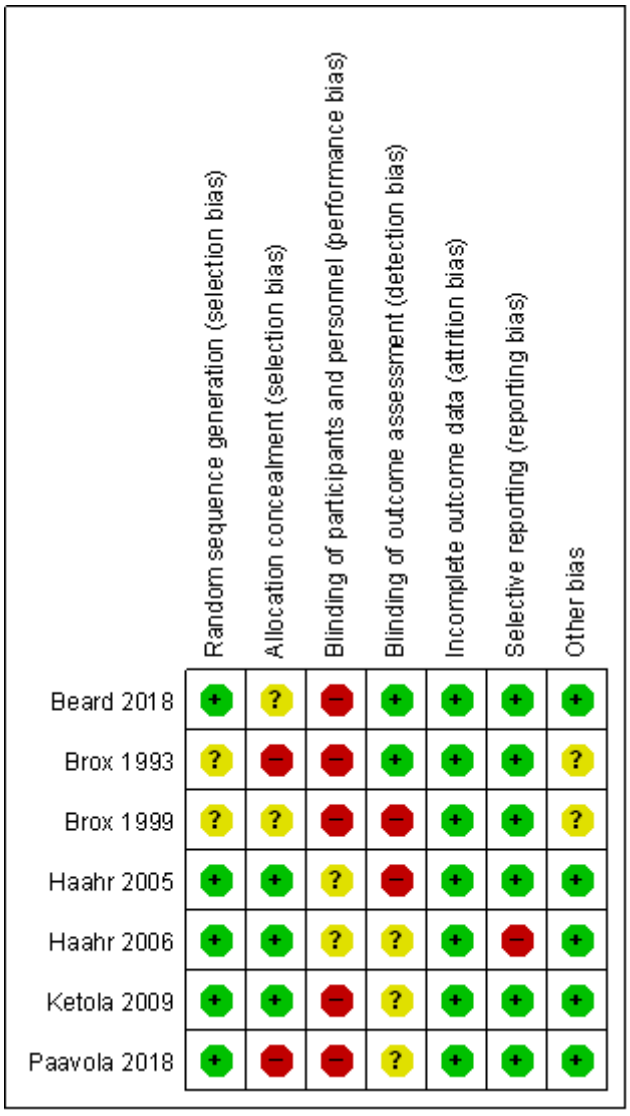


Figure 3

Risk of bias graph

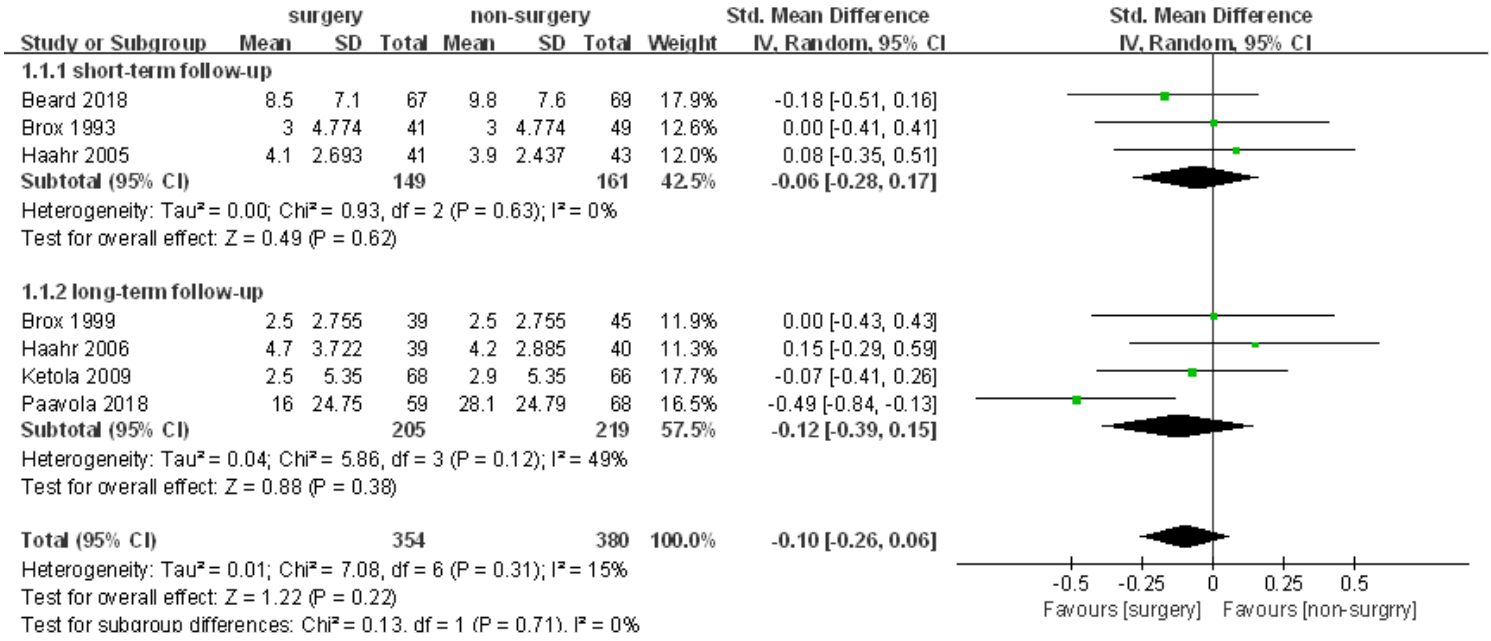


Figure 4

Forest plot of shoulder pain scores of randomized controlled trials between arthroscopic decompression and conservative management groups.

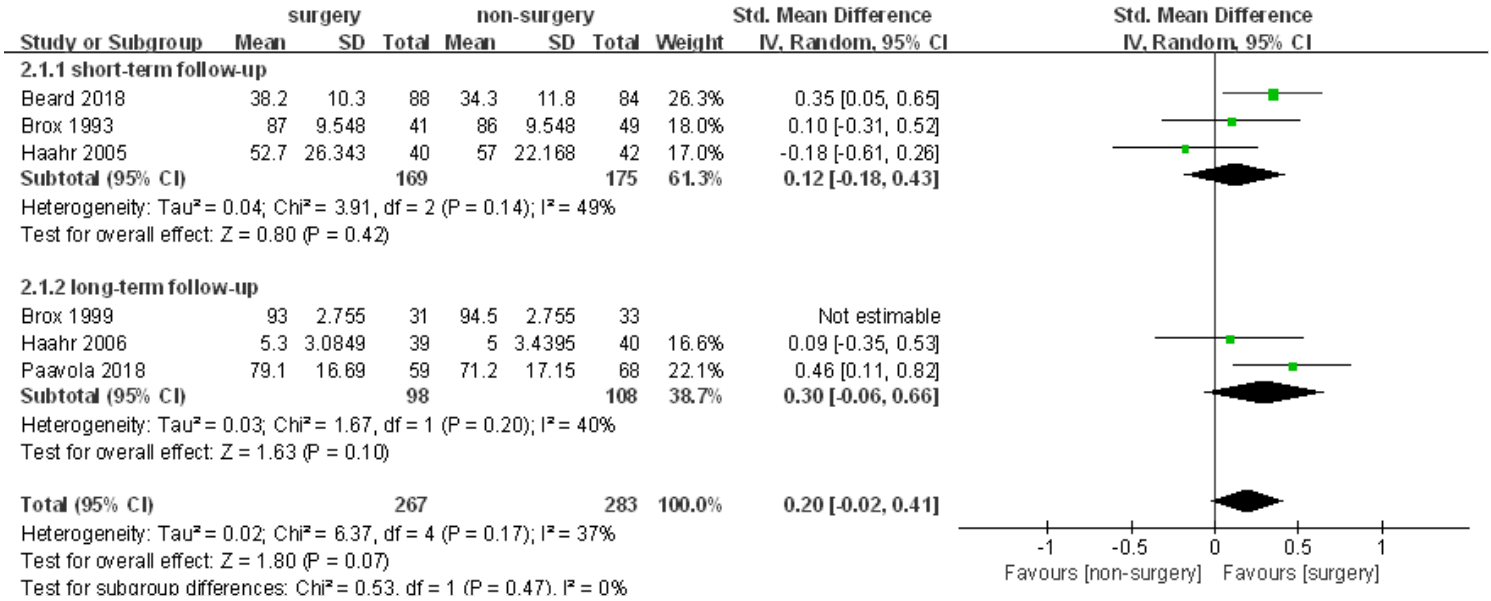


Figure 5

Forest plot of shoulder function scores of randomized controlled trials between arthroscopic decompression and conservative management groups.

Supplementary Files

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