Meta-analysis

Arthroscopic Versus Mini-Open Rotator Cuff Repair: An Up-to-Date Meta-analysis of Randomized Controlled Trials

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Purpose: The aim of this meta-analysis was to compare the clinical outcomes of arthroscopic and mini-open rotator cuff repairs based on recently published Level I randomized controlled trials (RCTs). **Methods:** We systematically searched electronic databases to identify RCTs that compared arthroscopic and mini-open rotator cuff repairs from 1980 to October 2013. The clinical outcome scores, including the University of California, Los Angeles score and the Constant-Murley score, were converted to a common 100-point outcome score for further analysis. The results of the pooled studies were analyzed in terms of surgery time, weighted 100-point score, pain on a visual analog scale (VAS), and range of motion. Study quality was assessed and relevant data were extracted independently by 2 reviewers. **Results:** Five RCTs, including 166 patients in the arthroscopic repair group and 163 patients in the mini-open repair group, were included in this meta-analysis. The results of the meta-analysis showed that there were no significant differences in surgery time ($P = .11$), weighted 100-point score ($P = .65$), VAS pain score ($P = .87$), or range of motion ($P = .29$ for forward flexion and $P = .82$ for external rotation). **Conclusions:** On the basis of current literature, no differences in surgery time, functional outcome score, VAS pain score, and range of motion were found at the end of follow-up between the arthroscopic and mini-open rotator cuff repair techniques. In addition, there was no significant difference in VAS pain score in the early phase between the 2 repairs. **Level of Evidence:** Level I, meta-analysis of Level I studies.

Mini-open repair has been regarded as the gold standard for rotator cuff tear repair for decades; it has been proved to achieve good to excellent results in 90% of patients.[1-6] It has been many surgeons' first choice because of its stronger suture fixation and shorter learning curve.[7-9] However, with the evolution of instrumentation and techniques, there has been a shift from mini-open to arthroscopic repair with satisfactory outcomes.[10-13] Decreased postoperative pain, faster recovery, and better cosmetic results have led to a tendency for surgeons to prefer an arthroscopic approach according to emerging comparisons of these 2 techniques.[9,14,15] However, despite the popularity of the procedures, there remains a considerable amount of controversy over the selection of these 2 techniques.[11,16]

Several systematic reviews and meta-analyses conducted years earlier found no significant differences in midterm and long-term outcomes between arthroscopic and mini-open repairs.[7,17] Their results and conclusions were relatively compromised by the limited availability of high-quality trials. A number of new, well-designed randomized controlled trials (RCTs) have been published recently, some of which have shown a shorter surgery time and greater range of motion at the end of follow-up,[18,19] as well as reduced pain on a visual analog scale (VAS) during the midterm period of postoperative rehabilitation.[20] The purpose of this meta-analysis was to compare the clinical outcomes of arthroscopic and mini-open rotator cuff repairs based on recently reported RCTs. We hypothesized that arthroscopic rotator cuff repair had a shorter surgery time and better functional outcomes than mini-open repair.

Methods

Search Strategy

We searched the following electronic databases: PubMed (1980 to October 31, 2013), Embase (Ovid)

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(1988 to October 31, 2013), Scopus (1980 to October 31, 2013), Cochrane Central Register of Controlled Trails (until October 31, 2013), and Cochrane Database of Systematic Reviews (2005 to October 31, 2013). According to the search strategy of the Cochrane Collaboration, the search algorithm was "rotator cuff" combined with "arthroscopic" and "open." Published studies in all languages were included for review. The full text was reviewed if the abstract indicated that the article might be an RCT between arthroscopic and mini-open rotator cuff repair. The references of the articles were also reviewed to identify potential additional publications.

Study Selection

The eligibility criteria were as follows: (1) RCT, (2) patients with a minimum age of 18 years, (3) patients with various rotator cuff tear sizes, and (4) patients who underwent postoperative rehabilitation and had a minimum of 6 months' follow-up. The exclusion criteria were (1) patients with degenerative arthritis, rheumatoid arthritis of the glenohumeral joint, adhesive capsulitis, or shoulder fractures and (2) patients with previous shoulder surgery.

Data Extraction

Data were extracted independently from each eligible study by 2 reviewers (X.J., C.B.) using a pre-developed data extraction table. Any discrepancies between the extracted data were resolved by discussion, where necessary, in consultation with a third author (F.W.). Where required, the corresponding authors were contacted for additional data. The following data were extracted from all eligible studies: study design, country in which the study was performed, year in which the trail was conducted, number of patients in each group, mean age of each group's patients, duration of follow-up, surgery time, functional outcome scores, pain scores on a VAS in the early phase and at the end of follow-up, and range of motion. Validated functional outcome scores included the rating scale of the University of California, Los Angeles (UCLA); American Shoulder and Elbow Surgeons shoulder index score; Constant-Murley score; and Simple Shoulder Test score. For further meta-analysis, the different outcome scores were converted to a common 100-point outcome score by using a multiplication factor, as performed by Romeo et al.[21] and Morse et al.[17] Range of motion included abduction, forward flexion, and external rotation.

Assessment of Study Quality

Two investigators (X.J., C.B.) independently graded the methodologic quality of each eligible study using the Cochrane Collaboration's tool for assessing risk of bias recommended in the *Cochrane Handbook for Systematic Reviews of Interventions*, version 5.1.0.[22] All disagreements were resolved by discussion, where necessary, by recourse with a third author (F.W.). The following domains were assessed: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other bias. The risk of bias for each domain was judged as either low, high, or unclear; the latter indicated either a lack of information or uncertainty over the potential for bias.

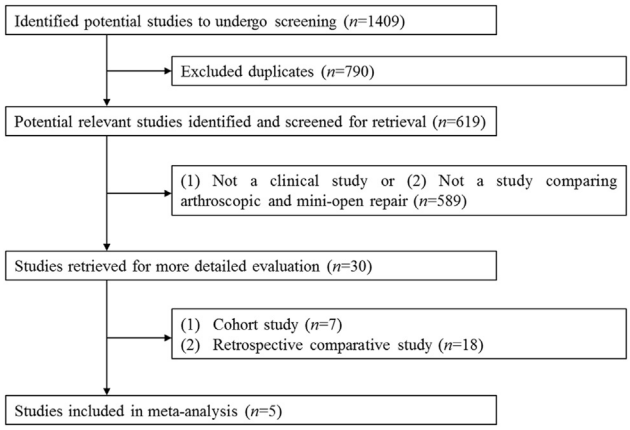

Fig 1. Selection process for meta-analysis of trials to compare arthroscopic and mini-open repairs.

Data Analysis

Data analysis was performed with RevMan software, version 5.1 (Cochrane Collaboration, Oxford, England). The mean difference was used to analyze continuous variables and is reported with the 95% confidence interval (CI). A P value of .05 was used as the level of statistical significance. Statistical heterogeneity between trials was evaluated by the χ^2 and I^2 tests, with significance set at $P < .10$. A random-effect method was adopted for comparisons of statistical heterogeneity, and a fixed-effect method was adopted for the other comparisons. To assess publication bias, a funnel plot was constructed for each outcome to examine the relation between sample size and the magnitude of effect.

Results

Literature Search

Our literature search generated 619 relevant citations after exclusion of the duplicates (n = 790) (Fig 1). Subsequent reviews of the title/abstract produced 30 articles that were retrieved for more detailed evaluation. Seven studies were excluded because they were cohort studies. Eighteen studies were excluded because they were retrospective comparative studies. Therefore 5 RCTs, including 166 patients in the arthroscopic repair group and 163 patients in the mini-open repair