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Total shoulder arthroplasty versus hemiarthroplasty in patients with shoulder osteoarthritis: A meta-analysis of randomized controlled trials

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ABSTRACT

Objectives: Total shoulder arthroplasty (TSA) and hemiarthroplasty (HA) are treatment choices for end-stage shoulder osteoarthritis. The decision of whether to use TSA or HA is controversial. The objective of this study was to compare the effects of TSA and HA for shoulder osteoarthritis.
Methods: We conducted a search for clinical studies that had been published in any language in December 2012 or before. We searched the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, and several other databases. Randomized and quasi-randomized controlled clinical studies that evaluated different methods were included. At least two review authors independently performed the study selection, data collection, and data extraction. The software Revman 5.1 was used for the statistical analysis.
Results: This study included 4 clinical trials. Two of the trials were published clinical trials, and the other 2 clinical trials were presented as unpublished abstracts. A total of 146 patients with 153 shoulders were included in the trials. Compared with HA, TSA presents with a higher UCLA shoulder scale (MD 3.10, 95% CI 1.13–5.08) and a higher ASES (MD 10.17, 95% CI 1.40–18.87). There was no significant difference between TSA and HA for revision (RR 0.35, 95% CI 0.10–1.19), WOOS (MD 9.10, 95% CI −2.72 to 20.92), and incidence of instability (RR 0.88, 95% CI 0.19–3.98). HA had a lower operation time (MD 39.00, 95% CI 17.05–60.95).
Conclusion: The available evidence suggests that TSA is more effective than HA for patients with shoulder arthritis.

Introduction

Also known as degenerative joint disease of the shoulder or glenohumeral osteoarthritis, shoulder osteoarthritis involves a gradual, progressive, mechanical, and biochemical breakdown of the articular cartilage and other joint tissues, including bone and joint capsule [1]. The loss of shoulder function can lead to depression, anxiety, activity limitations, and job performance problems [2].

Shoulder arthroplasty has been applied in clinical practice for more than 100 years [3]. With advancements in prosthesis technique and extensive research on the anatomy of the glenohumeral joint, functional outcomes have substantially improved. Currently, shoulder arthroplasty represents the treatment of choice for most patients with end-stage glenohumeral osteoarthritis [4]. Several concerns about the consequences of total shoulder arthroplasty (TSA) remain. TSA may result in the loss of bone stock, polyethylene wear debris, and loosening of the glenoid component, which may cause pain and loss of function [5]. Hemiarthroplasty (HA) can result in glenoid erosion, which is the main cause of clinical deterioration and short- and medium-term revisions [6]. A study with a follow-up of 4.8 years found no clinical differences between the two procedures, but there was a higher complication rate after total arthroplasty compared to after hemiarthroplasty [7,]. For glenohumeral osteoarthritis, some studies reported superior mid-term to long-term results for TSA compared with HA [9,10]. Therefore, the decision of whether to use TSA or HA is controversial.

The objective of this study was to compare the effects of TSA and HA for shoulder osteoarthritis.

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Methods

This study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [11].

Randomized and quasi-randomized (a method of allocating participants to a treatment that is not strictly random, such as by date of birth, hospital record number, or alternation) controlled clinical trials that compared TSA and HA for shoulder arthritis in adult patients (> 18 years old) were included. All patients underwent primary shoulder arthroplasty.

We conducted an electronic search for relevant studies that had been published in any language. We searched the Cochrane Central Register of Controlled Trials (CENTRAL; Wiley Online Library, to December 2012), PUBMED (to December 2012), and EMBASE (1980 to December 2012). We also searched for relative abstracts of recent orthopedic meetings. The search strategy is presented in Table 1. There were no restrictions on language, and the search only included studies on human subjects.

The outcome measures were the University of California at Los Angeles (UCLA) shoulder scale, the American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES), the Western Ontario osteoarthritis of the shoulder index (WOOS), revision, shoulder instability, and operation time.

Eligible trials were selected by two authors (WZ and XD). The initial decisions of trial eligibility were based on citations and abstracts. Full-text versions of the articles were obtained when study eligibility was uncertain. Studies were included when all reviewers agreed. The data extraction was conducted independently by two authors (XXD and WZ), and the interventions and outcomes were recorded. A development of the Cochrane Bone, Joint and Muscle Trauma Group quality assessment tool was used to evaluate the included trials. Evaluated measures included adequate sequence generation, allocation concealment, blinding, incomplete outcome data addressed, selective reporting etc. [12]. After the included trials were identified, the software Revman 5.1 (Version 5.1, Copenhagen: The Nordic Cochrane Centre, the Cochrane Collaboration, 2011) was used for the statistical analysis. When considered appropriate, the results of comparable groups of trials were pooled by a Mantel–Haenszel test for dichotomous outcomes and an Inverse Variance test for continuous outcomes. Initially, we used a fixed-effect model and 95% confidence intervals (CIs); when there was heterogeneity, we used the random-effects model.

For dichotomous outcomes, the treatment effects were expressed as risk ratios (RRs) with 95% confidence intervals. For continuous outcomes, the treatment effects included mean differences (MDs) and 95% CIs for single studies or for two or more studies with comparable outcome measures. Heterogeneity was assessed by visual inspection of the forest plot (analysis), and heterogeneity and an I^2 statistic were considered [13]. Significance was set at $P < 0.05$. Sensitivity analyses that examined various aspects of the trial and review methodology were used to explore the robustness of the evidence, which examined the effects of excluding trials that were only reported in abstracts.

Results

The selection flow is shown in Fig. 1. Four trials [7,14–16] matched the inclusion criteria, and all of the trials were

Table 1
Search strategies

CENTRAL	PubMed	EMBASE
#1 MeSH descriptor shoulder, this term only	#1 shoulder [mh]	1. shoulder/
#2 MeSH descriptor shoulder joint, this term only	#2 shoulder joint [mh]	2. shoulder joint/
#3 (glenohumeral joint*)	#3 glenohumeral joint [tw]	3. glenohumeral joint$.tw
#4 (#1 or #2 or #3)	#4 #1 or #2 or #3	4. 1 or 2 or 3
#5 MeSH descriptor arthroplasty, this term only	#5 arthroplasty [mh]	5. arthroplasty/
#6 MeSH descriptor arthroplasty, replacement, this term only	#6 arthroplasty, replacement [mh]	6. arthroplasty, replacement/
#7 (replacement*)	#7 replacement [tw]	7. replacement$.tw.
#8 (#5 or #6 or #7)	#8 #5 or #6 or #7	8. 5 or 6 or 7
#9 (#4 and #8)	#9 #4 and #8	9. 4 and 8
#10 (shoulder arthroplasty or shoulder replacement* or total shoulder arthroplasty* or total shoulder prosthesis* or total shoulder replacement* or humeral hemiarthroplasty* or hemiarthroplasty* or humeral head replacement* or humeral head arthroplasty* or humeral surface replacement* or surface replacement arthroplasty*)	#10 glenohumeral osteoarthritis [tw]	10. glenohumeral osteoarthritis$.tw
#11 (#9 or #10)	#11 arthritis [mh]	11. arthritis/
#12 (glenohumeral osteoarthritis*)	#12 osteoarthritis [tw]	12. osteoarthritis.tw
#13 MeSH descriptor arthritis explode all trees	#13 #11 or #12	13. 10 or 11 or 12
#14 (osteoarthritis*)	#14 #13 and #4	14. 9 and 13
#15 (#13 or #14)	#15 #14 or #10	15. Clinical trial/
#16 (#15 and #4)	#16 randomized controlled trial [pt]	16. Randomized controlled trial/
#17 (#16 or #12)	#17 controlled clinical trial [pt]	17. Randomization/
	#18 randomized [tiab]	18. Randomi?ed controlled trial$.tw
	#19 placebo [tiab]	19. Rct.tw
	#20 randomly [tiab]	20. Random allocation.tw
	#21 trial [tiab]	21. Randomly allocated.tw
	#22 groups [tiab]	22. Allocated randomly.tw
	#23 #16 or #17 or #18 or #19 or #20 or #21 or #22	23. (allocated adj2 random).tw
	#24 humans [mh]	24. Prospective study/
	#25 #23 and #24	25 or/15–24
		26. Case study/
		27 Case report.tw
		28. or/26–27
		29. 25 not 28
		30. limit 29 to human
		31. 9 and 13 and 30