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Systematic review

# Salvage of failed internal fixation of intertrochanteric hip fractures: clinical and functional outcomes of total hip arthroplasty versus hemiarthroplasty

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ABSTRACT

*Background:* Failed internal fixation of intertrochanteric (IT) hip fractures presents a significant challenge in the elderly, osteoporotic population. Conversion total hip arthroplasty (cTHA) and hemiarthroplasty (cHA) are both accepted salvage operations for failed IT fracture fixation, though limited clinical data exist regarding the optimal treatment between these procedures.

*Methods:* A systematic review of 3 databases (PubMed, Cochrane, and Embase) was performed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Inclusion criteria were English-language studies that compared clinical or functional outcomes after failed fixation of IT fractures with total hip arthroplasty and hemiarthroplasty in adult subjects (>18 years of age). Data regarding research design, surgical technique, and clinical or functional outcomes were obtained and analyzed from eligible studies using a Mantel-Haenszel random-effects analysis model.

*Results:* Six studies with 188 patients (100, total hip arthroplasty; 88, hemiarthroplasty) met inclusion and exclusion criteria. There was no significant difference between cTHA and cHA for postoperative dislocation, reoperation, infection, intraoperative fractures, postoperative fractures, or stem subsidence. The mean change in Harris Hip Scores was significantly higher ($P < .001$) in the cTHA group ($47.5 \pm 4.9$) than that in the cHA ($38.9 \pm 7.2$) group at minimum 14-month follow-up.

*Conclusions:* Despite potential advantages of cTHA or cHA for failed IT fractures, there were no differences in complications between either of the salvage procedures. Our analysis found a slight advantage in functional outcomes (Harris Hip Score) for cTHA at a minimum 14-month follow-up. Our study suggests that cTHA and cHA are both effective salvage procedures. Additional prospective studies are warranted to further delineate outcomes after salvage arthroplasty performed for failed IT fracture fixation.



## Introduction and background

Internal fixation with a compression hip screw or cephalomedullary nail is considered the standard of care for most intertrochanteric (IT) proximal femur fractures [1]. However, internal fixation is often associated with failure in elderly, osteoporotic patients who comprise a significant portion of the affected population. Overall, failure rates of osteosynthesis have been cited between 3% and 12% [2-4]. IT fractures may fail to heal for a variety of reasons, including the stability of initial fracture pattern, extent of comminution, quality of the reduction and fixation, and bone quality. Failed treatment of IT fractures can lead to significant disability, pain, and need for revision procedures [1].

Revision osteosynthesis and salvage treatment with hip arthroplasty are the 2 mainstays of treatment for failed internal fixation of IT fractures. Both conversion total hip arthroplasty (cTHA) and conversion hemiarthroplasty (cHA) are generally accepted salvage options for failure of these fixation devices in older patients [5,6]. Several technical hurdles to successful

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arthroplasty in this setting include poor bone stock, residual bone deformity, altered soft tissue anatomy, and retained hardware [1,2]. Owing to these challenges, conversion arthroplasty has been associated with increased risk of perioperative morbidity—prolonged operative times, increased blood loss, intraoperative fracture, and early dislocation [7-9]. Currently, no established guidelines exist regarding conversion arthroplasties after failed internal fixation of IT fractures. Given such limited existing clinical data, the purpose of this systematic review and meta-analysis was to compare functional outcomes and complications of total hip arthroplasty to those of hemiarthroplasty after fixation failure of IT fractures.

## Material and methods

### *Search strategy*

A systematic literature search was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and Cochrane Handbook (Fig. 1). Two reviewers independently searched 3 online databases (PubMed, Cochrane, and EMBASE) using the following keywords and their combinations: salvage total hip arthroplasty, IT fracture, hemiarthroplasty, hip, conversion, and failed fixation. Articles published between 2000 and 2017 were included in our literature search and were limited to studies in human subjects published in English. Reference lists of included studies were cross-referenced for supplementary eligible studies. The search terms and inclusion/exclusion criteria were established a priori.

### *Eligibility criteria*

Eligible studies were included based on the following criteria: (1) level I to III evidence, (2) articles published in the English language, (3) human studies, (4) failed IT fractures, (5) studies reporting clinical outcomes, and (6) full-text availability. Exclusion criteria were as follows: (1) basic science articles, (2) studies on primary hip arthroplasty, and (3) potential overlap of patient populations when study was by same author or institutions.

### *Literature appraisal*

Two of the authors screened all titles, abstracts, and full text of retrieved studies to determine eligibility. Disagreements were resolved by discussion between the 2 authors, and if a consensus could not be reached, the senior reviewer resolved the discrepancy. The final decision on inclusion was made on the basis of the full text of the article.

The Methodological Index for Non-Randomized Studies (MINORS) criteria were used for grading the methodological quality of selected studies. MINORS is a validated scoring tool to assess internal and external validity for nonrandomized studies [10]. Studies are assigned 0, 1, or 2 with a maximum of 24 for comparative studies and 16 for noncomparative studies. Although each

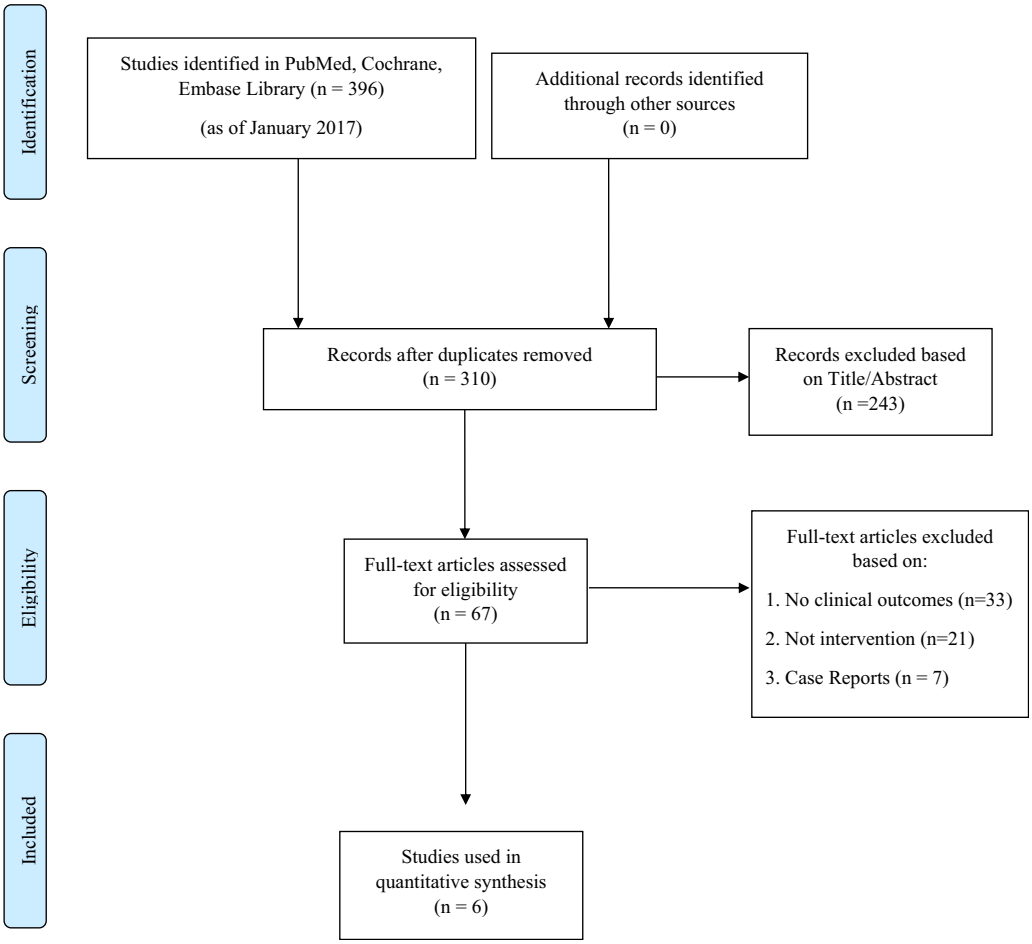


**Figure 1.** PRIMSA diagram: Flowchart of systematic search strategy.