

Timing of internal fixation of femoral neck fractures. A systematic review and meta-analysis of the final outcome



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ABSTRACT

The aim of the present study was to evaluate the effect of timing of internal fixation of intracapsular fractures of the neck of femur on the development of late complications, particularly osteonecrosis of femoral head (ONFH) and non-union. We undertook a systematic review of the literature adhering to the PRISMA guidelines. There were 7 eligible reports for the final analysis. The methodological quality of component studies was assessed with the Coleman Methodology Score (CMS). Each included study was assigned a score independently by the two reviewers. The final score of each individual study constituted the average value of the scores given by the two reviewers. The agreement between the two assessors was tested with intraclass correlation coefficient (ICC). The CMS ranged from 37 to 64 within component studies (mean: 46.5, SD: 10.8, median: 41). The ICC was 0.94 (95% CI: 0.69–0.99), implying a nearly perfect agreement between the two assessors. Based on the available data regarding the timing of operative fixation of the femoral neck fractures, 4 discreet pairs of comparison groups could be created: (1) fractures fixed within 6 h from injury versus fractures fixed after 6 h from injury; (2) fractures fixed within 12 h versus after 12 h; (3) fractures fixed within 24 h versus after 24 h; and (4) fractures fixed within 6 h versus after 24 h. Outcome measures were analyzed within each one of the above pairs of treatment groups. The following subgroups analyses were a priori decided: (1) initial fracture displacement (displaced vs. undisplaced fractures); (2) fixation method (cannulated screws vs. sliding hip screw); (3) quality of reduction (anatomic vs non-anatomic reduction). This study failed to prove any essential association between timing of NOF fracture internal fixation and incidence of AVN. With respect to non-union though, it indicated that delay of internal fixation of more than 24 h could increase substantially the odds of non-union.

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Introduction

The optimal treatment of displaced fractures of the femoral neck in the elderly population is the replacement of the femoral head by arthroplasty surgery [1–3]. This approach has been based on the reported results by several trials that have shown that prosthetic replacement of the femoral head in this patient group improves both functional outcomes and re-operation rates

[4–7]. For younger patients (less than 60 years of age) and even those older (over 60 years old), higher demand individuals without serious co-morbidities most authors agree that internal fixation constitutes the best treatment option [8–11]. Although there is general consensus in the literature that anatomical reduction and stable internal fixation should be the goal of treatment of these fractures, the exact role of timing of operative intervention is less clearly ascertained, as conflicting results have been reported so far [12,13].

The aim of the present study was to evaluate the effect of timing of internal fixation of intracapsular fractures of the neck of femur on the development of late complications, particularly osteonecrosis of femoral head (ONFH) and non-union.

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Materials and methods

Literature search and data extraction

We undertook a systematic review of the literature adhering to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [14,15]. Before commencing a comprehensive literature search for relevant studies, certain eligibility criteria were defined. Papers dealing with acute fractures of the femoral neck that had been treated operatively with internal fixation, which included different treatment groups with respect to timing of fixation and had complete description of at least one primary outcome of interest, were considered eligible for inclusion in the present study. Experimental or animal studies, case reports, letters to editor, papers containing less than 10 subjects, papers dealing with paediatric fractures, pathological fractures, neglected fractures of the neck of femur (treated beyond 3–4 weeks from the time of injury), ipsilateral fractures of femoral neck and shaft, as well as papers describing other types of treatment (hemi- total arthroplasties) or ancillary procedures (in addition to internal fixation, such as bone grafting or peritrochanteric osteotomies), were excluded. We performed a comprehensive electronic search of MedLine via the PubMed search machine, using the following search terms and Boolean operators: “Time to internal fixation” OR “timing of fixation” OR “early fixation” OR “delayed fixation” AND “femoral neck” OR “neck of femur” OR “intracapsular hip” OR “transcervical” AND “fracture”. The search was further extended to the Ovid MEDLINE, CINAHL, Cochrane Library, Embase, Google Scholar and Scopus databases. We limited our search to papers published in the English language. All potentially eligible articles as well as other relevant publications (such as reviews and meta-analyses) were retrieved and their bibliographies were manually searched for additional eligible papers. Any disagreement between the reviewers was resolved by discussion. From each eligible article certain demographic and baseline characteristics, follow up and outcome data were extracted.

Quality assessment

The methodological quality of component studies was assessed with the Coleman Methodology Score [16]. Its criteria were slightly modified to suit to the purpose of the present systematic review. Each included study was assigned a score independently by the two reviewers. The final score of each individual study constituted the average value of the scores given by the two reviewers. The agreement between the two assessors was tested with intraclass correlation coefficient (ICC).

Statistical analysis

Pooling of data was performed using the Mantel–Haenszel (M–H) statistical method and either a fixed or random effects model, depending on the degree of statistical heterogeneity present (when I^2 was above 50, a random effects model was used). Binary outcomes were summarized as odds ratios (ORs) with 95% confidence intervals (95% CI). The results of each primary study and the combined estimate of effect size were presented graphically as forest plots. Statistical heterogeneity was measured with the use of both Cochran’s X^2 (Q -test) and I^2 statistics [17,18]. Significance was set at 0.1 for the Q -test (as it is characterized by low sensitivity for detecting heterogeneity). An I^2 value $> 50\%$ was thought to represent significant heterogeneity. The RevMan (5.2) software (Review Manager, The Nordic Cochrane Centre, Copenhagen, Denmark) was used to present the study findings, produce pooled estimates of effect size and test the presence of statistical heterogeneity.

Subgroup analysis

The following subgroups analyses were a priori decided: (1) initial fracture displacement (displaced vs. undisplaced fractures); (2) fixation method (cannulated screws vs. sliding hip screw); (3) quality of reduction (anatomic vs. non-anatomic reduction).

Results

Search process

The initial electronic search retrieved 492 studies. After applying the eligibility criteria, there were 7 eligible reports left for final analysis (Fig. 1) [12,13,19–23]. All but one, (which was a prospective study) [22] were retrospective comparative studies.

Basic demographic, baseline characteristics and follow up details of the included studies are listed in Tables 1 and 2. Based on the available data regarding the timing of operative fixation of the femoral neck fractures, 4 discreet pairs of comparison groups could be created: (1) fractures fixed within 6 h from injury versus fractures fixed after 6 h from injury [16,19]; (2) fractures fixed within 12 h versus after 12 h [12,13,19,22,23]; (3) fractures fixed within 24 h versus after 24 h [20,21,23] and (4) fractures fixed within 6 h versus after 24 h [20,23]. Outcome measures were analyzed within each one of the above pairs of treatment groups.

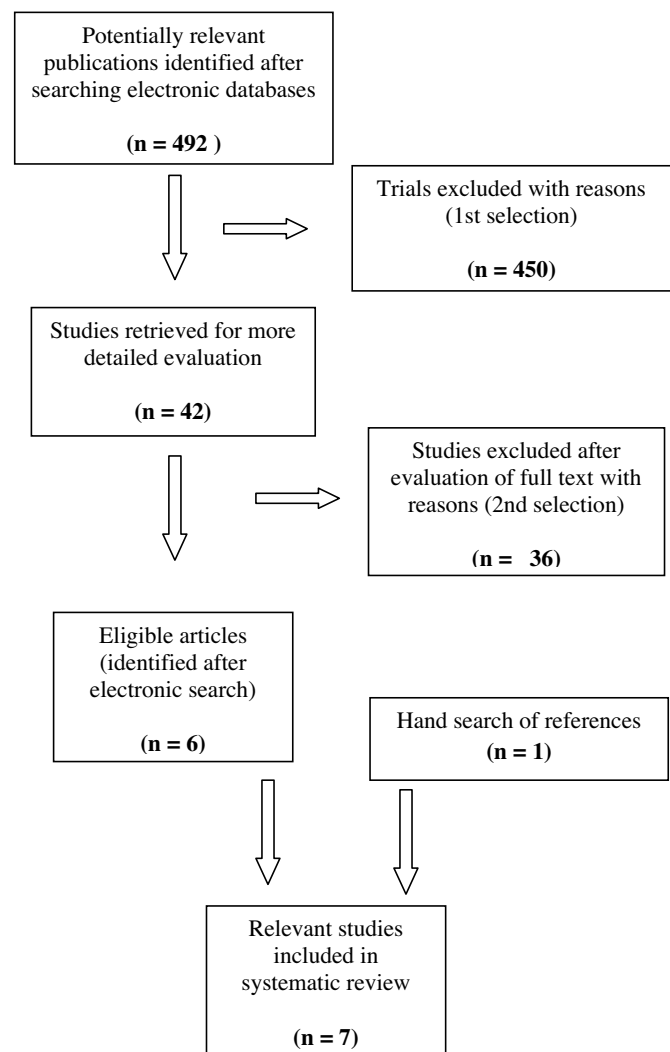


Fig. 1. Flowchart of literature review.

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