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Eleven Internal Fixations for young vertical femoral neck fractures: a protocol for systematic review and network meta-analysis

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202460017

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 06 June 2024 and was last updated on 06 June 2024.

INTRODUCTION

Review question / Objective To evaluate the efficacy of eleven internal fixations for young patients with vertical femoral neck fractures (VFNFs).

Condition being studied Femoral neck fractures in young patients are mostly due to high-energy injuries, resulting in vertical femoral neck fractures (VFNFs), and leading to greater biomechanical instability. Reduction and internal fixation are the most commonly used treatment methods in clinical practice. Unfortunately, the most appropriate internal fixation configurations remain controversial.

METHODS

Participant or population Our systematic review will include young patients diagnosed with VFNFs by X-ray plain film or CT scan, regardless of country,

race, and sex. The elderly femoral neck fracture (age ≥ 60 years) or patients with pathological femoral neck fractures will be excluded.

Intervention In the experimental group, more than one form of internal fixations for young VFNFs will be included, such as 1) three parallel screws with an inverted triangular construction (ITR); 2) three parallel screws with a triangular construction (TRI); 3) three inverted parallel screws plus one Pauwel screw, arranged in an "alpha" configuration (ALP); 4) four parallel screws arranged in a "rhomboid" configuration (RHO); 5) three inverted parallel screws plus one buttress plate strengthening the calcar (BUT); 6) biplane double-supported screw fixation (F-technique); 7) dynamic hip screw fixation without anti-rotation screws (DHS); (8) dynamic hip screw fixation with anti-rotation screws (DHS+); 9) femoral neck system (FNS); 10) cephalomedullary nails (CMN); 11) proximal femoral plates (PFP).

Comparator The patients who received another form of internal fixation treatment will be included as a contrast group in this systematic review.

Study designs to be included Only randomized controlled trials (RCTs) published will be included.

Eligibility criteria The following types of papers will be excluded: qualitative studies, editorials, reviews, opinion papers and case reports. Non-experimental studies such as cohort and case-control studies will also be excluded. Interventions with hemiarthroplasty or total hip arthroplasty, free vascularized fibula grafting, valgus osteotomy will be excluded, regardless of cement or noncement. There will be no restriction on reduction methods (close vs open), surgical approaches (later vs anterior vs anterolateral).

Information sources The following databases will be comprehensively searched: Embase, PubMed, Cochrane Library, Web of Science, China National Knowledge Infrastructure, Wanfang Database, and Chinese Biomedical Literature Database from the database inception through May 2024. The reference lists from eligible studies and relevant systematic reviews will be searched manually.

Main outcome(s) The types of outcome measures included were: surgery duration, intraoperative blood loss, Harris Hip Score (HHS), hospital stay, reoperation, mortality, and postoperative complications such as deep vein thrombosis, hematoma, infection, intraoperative fracture, failure, avascular necrosis of the femoral head (ANFH), dislocation, and nonunion. "Failure" was defined as different types of osteosynthesis failure and loosening.

Data management All retrieved studies will be imported into Zotero 6.0, and duplicates will be removed. Titles and abstracts will be screened through an initial search by two reviewers independently. After excluding irrelevant publications, another two reviewers will download the full text of all potentially relevant studies for further independent assessment. We will review the full text of the remaining publications against the same eligibility criteria.

Quality assessment / Risk of bias analysis Based on the revised Cochrane risk-of-bias tool for randomized trials (ROB 2.0), the methodological quality of each included study will be assessed independently by two reviewers. This tool consists of five domains including the randomization process, deviations from intended interventions, missing outcome data, measurement of the

outcome and selection of the reported result. Each domain is classified as low risk, some concerns, and high risk. Finally, each study will be given an overall grade of high risk, moderate risk or low risk of bias. A third reviewer will resolve any disagreement through discussion if necessary.

Strategy of data synthesis 1. Pairwise meta-analysis

We will perform the pairwise meta-analysis on direct comparisons with R 4.1.2 software using the meta package. The mean difference (MD) or standardised mean difference (SMD) with 95% confidence intervals (CIs) will be calculated for continuous data. Odds ratio (OR) with 95% CI will be calculated for dichotomous data. The statistical heterogeneity across studies will be assessed using the I^2 statistics. I^2 values over 50% will indicate considerable heterogeneity, and then a random-effects model will be used. Otherwise, a fixed-effect model will be applied.

2. Network meta-analysis

We will perform network meta-analysis on direct and indirect comparisons with R 4.1.2 software using GeMTC and ggplot2 package. Random-effects models will be adopted in this network meta-analysis, as they are considered to be the most conservative approach to dealing with between-study heterogeneity. MD or SMD and 95% CI will be calculated for continuous variables, while OR with 95% CI will be calculated for dichotomous outcomes. We will use Markov chain Monte Carlo simulations with 50 000 iterations in which the first 20 000 iterations will be abandoned as burn-in. The model convergence will be examined with the Gelman-Rubin-Brooks diagnostic plots and potential scale reduction factor (PSRF). Afterward, in the case of closed loops of interventions, the node-splitting method will be used to estimate the inconsistency by comparing the direct evidence with the indirect evidence. Meanwhile, the surface under the cumulative ranking curve (SUCRA) will be calculated to obtain the ranking probability of the different interventions. We report SUCRA as percentages, where a score closer to 100% represents a greater chance of that treatment being the best among all treatments studied for that outcome.

Subgroup analysis If heterogeneity among the studies is detected, subgroup analysis will be performed according to the reduction methods, surgical approaches, and other relevant parameters.

Sensitivity analysis We will also conduct sensitivity analyses by removing each study 1 at a

time to evaluate the stability of the results. If sensitivity analysis shows a fundamental change in the heterogeneity or the findings of meta-analysis, then the stability of the meta-analysis will be determined as poor.

Country(ies) involved China.

Keywords vertical femoral neck fractures, internal fixation, network meta-analysis, randomized controlled trials, protocol.

Contributions of each author

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