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Association between Sex and All-Cause Mortality Risk Following Hip Fracture Surgery in Older Adults: A Systematic Review and Meta-Analysis

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ADMINISTRATIVE INFORMATION

Support - No support.

Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202690019

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 3 September 2026 and was last updated on 3 September 2026.

INTRODUCTION

Review question / Objective This systematic review aims to evaluate the association between sex (male vs. female) and all-cause mortality following hip fracture surgery in older adults (≥60 years). Using the PICOS framework: Population: older adults undergoing surgery for low-trauma hip fracture; Prognostic factor: sex; Comparison: male vs. female; Outcome: all-cause mortality at 30-day, 6-month, and 1-year postoperatively; Study designs: prospective/retrospective cohort studies and nested case-control studies reporting multivariable-adjusted effect estimates.

Rationale Hip fracture is a devastating injury in older adults, with 20-30% mortality within one year postoperatively. Sex differences in mortality remain controversial. While many studies suggest higher mortality in males, whether this association is independent of confounders such as age, comorbidities, and surgical factors remains unclear. This systematic review will synthesize the best available evidence on sex as a prognostic factor for mortality, aiming to inform clinical risk stratification and personalized care pathways.

Condition being studied Hip fracture (including femoral neck and intertrochanteric fractures) in older adults (≥60 years). These fractures are predominantly low-energy fragility fractures requiring surgical intervention (internal fixation or arthroplasty). Hip fracture is associated with high mortality, functional decline, and loss of independence.

METHODS

Search strategy We will search CNKI, WanFang, VIP, CBM, PubMed/MEDLINE, Embase, Web of Science, CINAHL, and Cochrane Library from inception to August 21, 2025. Key terms: "hip fracture," "proximal femoral fracture," "surgery," "arthroplasty," "internal fixation," "mortality," "sex," "gender." Boolean operators (AND, OR) will be

used. Supplementary searches will include reference lists, grey literature, clinical trial registries, and forward citation tracking.

Participant or population Patients aged 60 years or older with a primary low-energy hip fracture (femoral neck or intertrochanteric) who underwent surgical management (internal fixation, hemiarthroplasty, or total hip arthroplasty).

Intervention Not applicable (prognostic factor review). The exposure of interest is sex (male vs. female).

Comparator Male sex compared to female sex as the reference group.

Study designs to be included This review will include prospective and retrospective cohort studies, as well as nested case-control studies. These designs are best suited for investigating prognostic factors as they establish a clear temporal sequence between exposure and outcome. Randomized trials will be considered only if they report observational (non-randomized) analyses of prognostic factors within their cohorts.

Eligibility criteria Inclusion: (1) age ≥60 years; (2) hip fracture surgery; (3) multivariable-adjusted effect estimate (aHR/aOR, 95% CI) for sex and all-cause mortality; (4) follow-up ≥30 days. Exclusion: pathological/periprosthetic fractures, high-energy trauma, non-surgical management, univariate analysis only, non-original studies, non-Chinese/English without translation.

Information sources CNKI, WanFang, VIP, CBM, PubMed/MEDLINE, Embase, Web of Science, Cochrane Library. Supplementary: reference lists, conference proceedings, ProQuest Dissertations, ClinicalTrials.gov, WHO ICTRP.

Main outcome(s) All-cause mortality at defined postoperative time points (30-day, 6-month, 1-year). Effect measures: adjusted hazard ratios (aHR) or adjusted odds ratios (aOR) with 95% confidence intervals from multivariable models.

Additional outcome(s) None.

Data management Records will be managed using EndNote for deduplication and Rayyan for screening. Two reviewers will independently screen titles/abstracts and full texts. A standardized data extraction form in Excel will be used, with independent extraction by two reviewers and verification for accuracy.

Quality assessment / Risk of bias analysis Risk of bias will be assessed using the Quality In Prognosis Studies (QUIPS) tool, evaluating six domains: Study Participation, Study Attrition, Prognostic Factor Measurement, Outcome Measurement, Study Confounding, and Statistical Analysis and Reporting. Each domain will be rated as "Low," "Moderate," or "High" risk of bias. Two reviewers will independently assess each study.

Strategy of data synthesis Meta-analysis will be considered if ≥2 studies report compatible adjusted estimates. The primary effect measure is aHR; aOR will be used if HR is unavailable. A random-effects model will be used. Heterogeneity will be quantified using I^2 statistic. Subgroup analyses will be performed by follow-up duration, study design, and geographic region if ≥3 studies per subgroup. Sensitivity analyses will include one-study-removed and excluding high-risk-of-bias studies.

Subgroup analysis Planned subgroup analyses for meta-analyses with ≥3 studies: (1) follow-up duration (30-day, 6-month, 1-year, ≥2 years); (2) study design (prospective vs. retrospective); (3) geographic region (East Asia, North America, Europe); (4) mean age (<80 vs. ≥80 years); (5) study quality (low vs. moderate/high risk of bias).

Sensitivity analysis (1) One-study-removed analysis; (2) excluding studies with high risk of bias; (3) fixed-effect vs. random-effects model comparison; (4) analysis restricted to adjusted effect estimates only. If ≥10 studies are included, publication bias will be assessed using funnel plots and Egger's test.

Language restriction Yes, to Chinese and English only.

Country(ies) involved China.

Other relevant information All analyses will be performed using R software (version 4.4.4 or later). The results will be disseminated through peer-reviewed publication and conference presentations. Data extraction forms and analysis codes will be available upon reasonable request.

Keywords hip fracture; aged; prognostic factors; systematic review; mortality; activities of daily living; observational study.

Dissemination plans Findings will be submitted to a peer-reviewed international journal and presented at relevant national and international conferences. A plain-language summary will be

disseminated through institutional channels and social media to reach clinicians, policymakers, and the public.

Contributions of each author

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