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Tranexamic acid for reducing blood transfusion and blood loss in elderly patients with hip fracture: a systematic review and meta-analysis of randomized controlled trials

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ADMINISTRATIVE INFORMATION

Support - No specific funding was received for this review.

Review Stage at time of this submission - Formal screening of search results against eligibility criteria.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 28 August 2026 and was last updated on 28 October 2026.

INTRODUCTION

Review question / Objective The aim of this systematic review is to compare tranexamic acid (TXA) versus placebo or no TXA in terms of reducing the proportion of patients requiring blood transfusion and reducing perioperative blood loss in elderly patients (≥60 years) undergoing surgery for hip fracture. To this end, the proposed systematic review will address the following questions: (1) Does perioperative TXA reduce the rate of allogeneic blood transfusion in elderly patients with hip fracture? (2) Does TXA reduce total, hidden, estimated, or intraoperative blood loss? (3) Do the effects differ by surgical procedure, fracture type, or timing of TXA administration?

Rationale Hip fracture surgery in elderly patients is associated with substantial perioperative bleeding and frequent need for allogeneic transfusion. TXA is an antifibrinolytic agent that has shown promise in reducing bleeding in orthopaedic surgery; however, prior systematic reviews and meta-analyses on TXA in hip fracture were largely limited to studies published up to 2023 and did not include Chinese-language evidence. Updated evidence including recent RCTs and Chinese-language trials is needed to provide a comprehensive and current assessment to inform clinical practice.Hip fracture surgery in elderly patients is associated with substantial perioperative bleeding and frequent need for allogeneic transfusion. TXA is an antifibrinolytic agent that has shown promise in reducing bleeding in orthopaedic surgery; however, prior systematic reviews and meta-analyses on TXA in hip fracture were largely limited to studies published up to 2023 and did not include Chinese-language evidence. Updated evidence including recent RCTs (2024–2026) and Chinese-language trials is needed to provide a comprehensive and current assessment to inform clinical practice.

Condition being studied Hip fracture in elderly patients (age ≥60 years), including femoral neck

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fracture and intertrochanteric (pertrochanteric) fracture. The condition of interest includes perioperative blood loss and the requirement for blood transfusion after surgical treatment.

METHODS

Search strategy PubMed: ("tranexamic acid"[Title/Abstract] OR TXA[Title/Abstract]) AND ("fracture"[Title/Abstract] OR "fractures"[Title/Abstract] OR "bone"[Title/Abstract]) AND ("randomized controlled trial"[Publication Type] OR "RCT"[Title/Abstract])
Web of Science: TS=(("tranexamic acid" OR TXA OR "antifibrinolytic*") AND ("hip fracture*" OR "femoral neck fracture*" OR "intertrochanteric fracture*" OR "trochanteric fracture*" OR "proximal fem* fracture*" OR "femoral intertrochanteric fracture*") AND ("randomized controlled trial*" OR RCT OR "randomised" OR "randomized" OR "placebo controlled" OR "clinical trial*"))
CNKI: SU=('氨甲环酸'+'TXA'+'止血环酸'+'传明酸')*('髋部骨折'+'髋骨折'+'股骨颈骨折'+'股骨转子间骨折'+'股骨粗隆间骨折'+'转子间骨折'+'粗隆间骨折')*('随机'+'RCT'+'随机对照'+'对照试验'+'临床试验')
Wanfang: 主题:("氨甲环酸" OR "TXA" OR "止血环酸" OR "传明酸") AND 主题:("髋部骨折" OR "股骨颈骨折" OR "转子间骨折" OR "股骨粗隆间骨折" OR "股骨转子间骨折") AND 主题:("随机" OR "RCT" OR "随机对照" OR "对照")
Databases: PubMed/MEDLINE, Web of Science, CNKI, Wanfang; additional sources: reference lists, ClinicalTrials.gov for ongoing/unpublished trials. Databases were searched from inception to 2026-06-30 without language restriction.
Search interfaces: PubMed (NCBI), Web of Science (Clarivate), CNKI (own interface), Wanfang (own interface).

Participant or population Inclusion: elderly patients (age ≥ 60 years) with hip fracture (femoral neck or trochanteric/pertrochanteric) undergoing surgical treatment (internal fixation or arthroplasty). Exclusion: patients with pathological fractures; patients with contraindications to TXA (e.g., history of thromboembolic events, renal dysfunction, coagulopathy). Studies with mixed populations will be included only if data are reported separately for the eligible population.

Intervention Perioperative tranexamic acid (TXA) administered intravenously (or orally if specified) at any dose, frequency, or timing (before, during, or after surgery). Variations in dosing (e.g., single or multiple doses; 10 mg/kg to 1.5 g) are acceptable and will be explored in subgroup analyses.

Comparator Placebo (saline or equivalent), no treatment, or standard care without TXA. Trials comparing TXA with another active antifibrinolytic will be excluded unless a TXA-only arm can be isolated.

Study designs to be included Randomized controlled trials (RCTs), including double-blind, single-blind, and open-label designs. Quasi-randomized trials will be considered.

Eligibility criteria Inclusion criteria are based on PICOS: (P) elderly patients ≥60 y with hip fracture undergoing surgery; (I) perioperative TXA; (C) placebo/no TXA/standard care; (O) at least one of the following outcomes – transfusion or blood loss; (S) RCTs. Exclusion: pathological fractures, contraindications to TXA, topical TXA only, no usable outcome data, duplicate publications (most recent/comprehensive data retained). Language: no restriction. Time: no restriction (all databases searched from inception to 2026-06-30).

Information sources •PubMed/MEDLINE (NCBI)
•Web of Science (Clarivate)
•CNKI (China National Knowledge Infrastructure)
•Wanfang Data
•Additional sources: reference lists of included studies and relevant reviews; ClinicalTrials.gov; conference abstracts and dissertations (grey literature).

Main outcome(s) Primary outcome: proportion of patients requiring allogeneic blood transfusion after hip fracture surgery (dichotomous; effect measure: risk ratio [RR]).

Additional outcome(s) Total perioperative blood loss (continuous; mean difference [MD])
Hidden (occult) blood loss (continuous; MD)
Estimated blood loss (continuous; MD)
Intraoperative blood loss (continuous; MD)
Safety outcomes: incidence of venous thromboembolism (VTE), deep vein thrombosis (DVT), pulmonary embolism (PE), and mortality.

Data management One reviewer (Shiyi Liu) performed study selection, data extraction, and risk-of-bias appraisal, with an AI-based tool restricted to preliminary record sorting and structured summarisation; no eligibility decision relied on the tool, and every output was verified against the source reports. A second reviewer (Wenyuan Jia) subsequently and independently re-screened the full-text eligibility decisions for all included trials; disagreements were resolved by discussion. Extracted data were additionally cross-

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checked against the source reports with an AI-assisted verification tool, and any flagged discrepancies were reviewed and adjudicated by the authors. This amendment documents the workflow as executed and the deviation from the original plan.

Quality assessment / Risk of bias analysis Risk of bias: Cochrane Risk of Bias tool for randomized trials (RoB 2.0), assessed independently by two reviewers.
Publication bias: funnel plot, Egger's regression test; trim-and-fill method to adjust if asymmetry.
Certainty of evidence: GRADE framework (GRADEpro) for each outcome.

Strategy of data synthesis Dichotomous (transfusion): risk ratio (RR) with 95% CI; pooled using DerSimonian-Laird random-effects model (inverse-variance; Mantel-Haenszel as sensitivity).
Continuous (blood loss): mean difference (MD) with 95% CI; random-effects model.
Heterogeneity: I^2 statistic and Cochran's Q test (P).
Stata 19 (MP) with the meta suite will be used.

Subgroup analysis Pre-specified subgroup analyses by:
Surgical procedure (internal fixation vs. arthroplasty [hemiarthroplasty/THA])
Fracture type (femoral neck vs. trochanteric)
TXA administration timing (single-dose pre-/intraoperative vs. multiple-dose / postoperative continuation)
Subgroup-by-interaction P values will be reported.

Sensitivity analysis Leave-one-out (influence) analysis.
Fixed-effect vs. random-effects models.
By risk of bias (excluding high-risk studies).
By blood loss type (only total blood loss studies for the primary continuous analysis).

Language restriction No language restriction; searches include both Chinese and English databases. All retrieved records will be screened in their original language (with translation as needed).

Country(ies) involved China.

Keywords tranexamic acid; hip fracture; femoral neck fracture; intertrochanteric fracture; blood transfusion; blood loss; meta-analysis; randomized controlled trial.

Dissemination plans The final review will be submitted for publication in a peer-reviewed journal (target: orthopaedic or geriatric medicine), and findings will be presented at academic conferences. The protocol registration number will be cited in the final manuscript.

Contributions of each author
Author 1 - Shiyi Liu - conceptualization, methodology, search, screening, data extraction, analysis, writing.
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Author 2 - Wenyuan Jia - supervision, methodology, manuscript review and editing.
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