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Association between external fixator pin site overlap and postoperative infection in staged management of tibial plateau and pilon fractures: a protocol for a systematic review and meta-analysis

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ADMINISTRATIVE INFORMATION

Support - This study received no specific financial support.

Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202670030

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 11 July 2026 and was last updated on 11 July 2026.

INTRODUCTION

Review question / Objective To systematically evaluate whether overlap between temporary external fixator pin sites and definitive internal fixation implants is associated with an increased risk of postoperative infection in adult patients undergoing staged surgical treatment for tibial plateau and tibial pilon fractures. Secondary outcomes will include superficial infection, reoperation due to infection, nonunion, implant failure, and time to fracture union.

Rationale Staged management with temporary external fixation followed by definitive internal fixation is widely used for high-energy tibial plateau and tibial pilon fractures to allow soft-tissue recovery before definitive surgery. However, whether overlap between temporary external fixator pin sites and definitive implants increases the risk of postoperative infection remains controversial. Individual observational studies have reported conflicting results, with some suggesting

an increased risk of deep infection and others finding no significant association. To date, no systematic review and meta-analysis has specifically synthesized the available evidence addressing this clinical question. A comprehensive synthesis of the current evidence may help guide pin placement during temporary external fixation and optimize surgical planning to reduce postoperative infectious complications.

Condition being studied High-energy tibial plateau and tibial pilon fractures managed with staged treatment using temporary external fixation followed by definitive internal fixation. The review will focus on the association between overlap of temporary external fixator pin sites and definitive implants and the occurrence of postoperative infectious complications.

METHODS

Search strategy A comprehensive literature search will be conducted in PubMed/MEDLINE, Embase, Scopus, Web of Science, and the

Cochrane Library from database inception to the date of the final search. No initial restrictions on language or publication date will be applied. The search strategy will combine controlled vocabulary (MeSH and Emtree terms, when applicable) and free-text terms related to tibial plateau fractures, tibial pilon fractures, external fixation, pin sites, pin overlap, staged fixation, definitive internal fixation, and postoperative infection. The reference lists of all included studies and relevant review articles will also be manually screened to identify additional eligible studies.

Participant or population Adult patients (≥ 18 years) with tibial plateau or tibial pilon fractures managed with staged treatment consisting of temporary external fixation followed by definitive internal fixation. Studies including mixed fracture populations will be eligible only if data for tibial plateau or tibial pilon fractures can be extracted separately.

Intervention Overlap between temporary external fixator pin sites and definitive internal fixation implants during staged surgical management of tibial plateau or tibial pilon fractures.

Comparator No overlap between temporary external fixator pin sites and definitive internal fixation implants.

Study designs to be included Comparative observational studies, including prospective and retrospective cohort studies and case-control studies, evaluating the association between temporary external fixator pin site overlap and postoperative infection following staged management of tibial plateau or tibial pilon fractures. Randomized controlled trials, if identified, will also be considered for inclusion.

Eligibility criteria Studies will be eligible if they include adult patients (≥ 18 years) with tibial plateau or tibial pilon fractures treated with staged management using temporary external fixation followed by definitive internal fixation. Studies must compare patients with overlap between temporary external fixator pin sites and definitive implants versus patients without overlap and report postoperative infectious outcomes. Studies involving pediatric populations, case reports, case series without a comparison group, reviews, editorials, conference abstracts without full text, biomechanical studies, cadaveric studies, animal studies, and studies without extractable outcome data will be excluded. When multiple publications report overlapping patient populations, the most complete or most recent study will be included.

Information sources Electronic searches will be performed in PubMed/MEDLINE, Embase, Scopus, Web of Science, and the Cochrane Library from database inception until the date of the final search. The reference lists of all included studies and relevant review articles will be manually screened for additional eligible studies. When necessary, corresponding authors may be contacted to obtain missing or unclear data.

Main outcome(s) The primary outcome will be the occurrence of deep postoperative infection (including fracture-related infection or deep surgical site infection, according to each study's definition) after definitive internal fixation. The longest available postoperative follow-up reported by each study will be considered. Effect estimates will be extracted as odds ratios (ORs), risk ratios (RRs), or hazard ratios (HRs), with corresponding 95% confidence intervals. When appropriate, pooled effect estimates will be calculated using a random-effects meta-analysis.

Additional outcome(s) Secondary outcomes will include superficial surgical site infection, reoperation due to infection, implant removal, nonunion, delayed union, implant failure, fracture union time, and any additional postoperative complications reported by the included studies. Where available, subgroup analyses according to fracture type (tibial plateau or tibial pilon) and fracture classification (open versus closed) will be performed.

Data management Records retrieved from the electronic databases will be imported into a reference management software for duplicate removal. Eligible studies will be managed using Rayyan for title/abstract and full-text screening. Data will be extracted using a standardized data extraction form developed by the review team. Extracted data will include study characteristics, patient demographics, fracture characteristics, surgical details, overlap status, postoperative outcomes, and risk of bias assessments.

Quality assessment / Risk of bias analysis The methodological quality and risk of bias of the included observational studies will be independently assessed using the Newcastle–Ottawa Scale (NOS). Studies will be evaluated according to participant selection, comparability of study groups, and outcome assessment. Any disagreements will be resolved through discussion, and, when necessary, consultation with a second reviewer.

Strategy of data synthesis A qualitative synthesis will be performed for all included studies. When at least two studies are sufficiently homogeneous regarding study design, population, intervention, comparator, and outcomes, a meta-analysis will be conducted using a random-effects model. Effect estimates will be pooled as odds ratios (ORs), risk ratios (RRs), or hazard ratios (HRs), with corresponding 95% confidence intervals. Statistical heterogeneity will be assessed using the I^2 statistic and Cochran's Q test. If substantial heterogeneity precludes quantitative synthesis, findings will be summarized narratively.

Subgroup analysis If sufficient data are available, subgroup analyses will be performed according to fracture type (tibial plateau versus tibial pilon), fracture status (open versus closed), type of definitive fixation, definition of postoperative infection, and study quality. Additional subgroup analyses may be conducted if clinically relevant differences are identified across the included studies.

Sensitivity analysis Sensitivity analyses will be performed by excluding studies at high risk of bias and, where appropriate, by excluding studies with markedly different methodological characteristics or outcome definitions. The robustness of the pooled estimates will be assessed by comparing the results before and after these exclusions.

Language restriction No language restrictions will be applied.

Country(ies) involved Brazil.

Keywords Tibial plateau fracture; Tibial pilon fracture; External fixation; Pin site overlap; Staged fixation; Postoperative infection; Systematic review; Meta-analysis.

Dissemination plans The findings of this systematic review will be submitted for presentation at national and international scientific meetings and for publication in a peer-reviewed orthopedic journal.

Contributions of each author

Author 1 - Glendha Bastos Pontes - Author 1 conceived the study, designed the protocol, performed the preliminary literature search, developed the methodology, and drafted the manuscript.

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