INPLASY

Incidence and Modifiable Risk Factors for Surgical Site Infection After Surgery for Spinal Metastases: An Updated Systematic Review and Meta-Analysis

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ADMINISTRATIVE INFORMATION

Support - Nil.

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

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 16 April 2026 and was last updated on 16 April 2026.

INTRODUCTION

Review question / Objective The primary objective of this systematic review and meta-analysis is to determine the pooled incidence of surgical site infection after surgery for spinal metastases.

Secondary objectives include: (1) determining the pooled incidence of deep SSI and wound-related reoperation; (2) identifying and quantifying independent risk factors for SSI through pooled odds ratios from multivariate analyses; (3) categorizing risk factors into modifiable (preoperative optimization targets) vs. non-modifiable categories; and (4) evaluating the impact of SSI on overall survival and readmission when sufficient data are available.

Rationale Surgical site infection (SSI) is the most common surgical complication following surgery for spinal metastases and represents the leading cause of unplanned reoperation and a significant driver of hospital readmission in this population. Unlike degenerative spine surgery, patients undergoing metastatic spine surgery face a unique constellation of risk factors including cancer-related immunosuppression, malnutrition from tumor cachexia, prior or planned radiation therapy, chemotherapy-induced myelosuppression, and often multi-level instrumented constructs.

Individual studies report SSI rates ranging from approximately 5% to 18% in this population, but no meta-analysis has specifically pooled SSI incidence and quantitatively analyzed risk factors exclusively in metastatic spine surgery patients. The closest existing systematic review (Vetter et al., Spine, 2020) combined primary and metastatic spinal tumor patients and searched only through 2019, while Tarawneh et al. (European Spine Journal, 2021) performed a descriptive synthesis without quantitative risk factor pooling. Since these reviews, several major publications have become available, including a Korean national database study of over 3,000 patients and multiple institutional series reporting biomarker-based risk factors.

Understanding the pooled incidence and identifying modifiable risk factors is critical for

preoperative optimization and shared decision-making. This systematic review aims to address these gaps by providing an updated, population-specific, quantitative synthesis with a focus on actionable, modifiable risk factors.

Condition being studied The major operaiton in these patient might cause severe complication incluldling wound infection, and if we can know more about the risk factors of the complication, and we can reduced some kinds of problems that patient suffered.

METHODS

Search strategy A systematic literature search will be conducted across the following electronic databases from inception to the search date (April 2026): PubMed/MEDLINE, Embase, Cochrane Central Register of Controlled Trials (CENTRAL), and Scopus. No date or language filters will be applied at the search level (English-language restriction applied at screening). The complete, database-specific search strategies are provided below and are designed to be copy-paste executable.

Participant or population Adult patients (≥18 years) who underwent open or minimally invasive surgical intervention for spinal metastases (any primary tumor histology, any spinal level). Excludes: primary spinal tumors (unless data separable), vertebroplasty/kyphoplasty-only, pediatric patients.

Intervention Surgical intervention for spinal metastases, including posterior decompression ± stabilization, corpectomy, separation surgery, MIS/percutaneous fixation, and combined approaches.

Comparator For incidence: not applicable (single-arm pooling). For risk factors: patients with SSI vs. without SSI, or high-risk vs. low-risk groups as defined by each study.

Study designs to be included Original research: retrospective/prospective cohort, case-control, RCT.

Eligibility criteria Reviews, meta-analyses, case reports, case series <30, conference abstracts without full text, editorials, letters.

Information sources A systematic literature search will be conducted across the following electronic databases from inception to the search date (April 2026): PubMed/MEDLINE, Embase, Cochrane Central Register of Controlled Trials (CENTRAL), and Scopus. No date or language filters will be applied at the search level (English-language restriction applied at screening). The complete, database-specific search strategies are provided below and are designed to be copy-paste executable.

Main outcome(s) Pooled incidence of surgical site infection (any SSI, including superficial and deep) with 95% confidence interval.

Additional outcome(s) (1) Pooled incidence of deep SSI; (2) Pooled incidence of wound-related reoperation; (3) Pooled odds ratios for independent risk factors (from multivariate analyses); (4) Impact of SSI on overall survival; (5) Impact of SSI on readmission.

Quality assessment / Risk of bias analysis Risk of bias will be assessed independently by two reviewers using the Newcastle-Ottawa Scale (NOS) for cohort and case-control studies. All three NOS domains (Selection, Comparability, Outcome/Exposure) will be evaluated. Studies scoring 7–9 stars will be classified as low risk of bias, 4–6 as moderate risk, and 0–3 as high risk. For any RCTs identified, the Cochrane Risk of Bias tool 2.0 (RoB 2) will be used. Disagreements will be resolved by discussion. A risk of bias summary table and traffic light plot will be produced.

Strategy of data synthesis Risk of bias will be assessed independently by two reviewers using the Newcastle-Ottawa Scale (NOS) for cohort and case-control studies. All three NOS domains (Selection, Comparability, Outcome/Exposure) will be evaluated. Studies scoring 7–9 stars will be classified as low risk of bias, 4–6 as moderate risk, and 0–3 as high risk. For any RCTs identified, the Cochrane Risk of Bias tool 2.0 (RoB 2) will be used. Disagreements will be resolved by discussion. A risk of bias summary table and traffic light plot will be produced.

Subgroup analysis Pre-specified subgroup analyses for pooled incidence: (a) SSI depth (superficial vs. deep); (b) SSI timing (early <30 days vs. late); (c) data source (national database vs. single-institution); (d) study period (pre-2015 vs. post-2015); (e) surgical approach (MIS vs. open), if sufficient studies are available.

Sensitivity analysis The following sensitivity analyses will be performed: (a) leave-one-out analysis; (b) exclusion of national database studies (coding-based SSI definitions vs. clinical definitions); (c) exclusion of studies with high risk of bias (NOS <5); (d) comparison of DerSimonian-

Laird vs. REML vs. Paule-Mandel estimators; (e) separate analysis of multivariate vs. univariate risk factor estimates.

Language restriction English.

Country(ies) involved Taiwan.

Other relevant information Nil

Keywords Spinal metastases; Surgical site infection; Wound complication; Meta-analysis; Systematic review; Risk factors.

Contributions of each author

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