

Complications and Instrumentation Failure after Total En Bloc Spondylectomy: A Systematic Review and Meta-analysis

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ADMINISTRATIVE INFORMATION**Support** - Nil.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202660061**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 14 June 2026 and was last updated on 14 June 2026.**INTRODUCTION**

Review question / Objective This systematic review and meta-analysis aimed to determine the pooled rates of complications, instrumentation failure, perioperative mortality, and local recurrence in patients undergoing total en bloc spondylectomy (TES) for spinal tumors, and to identify factors associated with instrumentation failure rate through meta-regression analysis.

P:Population Patients undergoing total en bloc spondylectomy (TES) for spinal tumors

I:Intervention Total en bloc spondylectomy

C:Comparator None (single-arm studies)

O:Outcomes Instrumentation failure rate, any complication rate, perioperative mortality, local recurrence rate, IF-related revision rate

S:Study design Retrospective and prospective cohort studies, case series.

Condition being studied Spinal tumors (primary benign, primary malignant, and metastatic) treated with total en bloc spondylectomy.

METHODS

Search strategy A systematic search was conducted in PubMed, Embase, OVID Medline, and Cochrane CENTRAL from database inception to June 2026. Search terms included combinations of: "lumbar", "thoracolumbar", "spine", "en bloc", "spondylectomy", "tumor", "tumour", "malignant", and "primary", applied to title and abstract fields. No language restriction was applied. Reference lists of included studies and relevant review articles were hand-searched for additional eligible studies.

Participant or population Patients of any age undergoing total en bloc spondylectomy (TES) for spinal tumors of the thoracic and/or lumbar spine, including primary benign tumors, primary malignant tumors, and spinal metastases. Studies reporting exclusively cervical or sacral TES were excluded.

Intervention Surgical – total en bloc spondylectomy (TES).

Comparator None (single-arm studies).

Study designs to be included Prospective and retrospective cohort studies and case series reporting surgical outcomes of total en bloc spondylectomy (TES) for thoracic and/or lumbar spinal tumors. A minimum sample size of 5 patients was required for inclusion. Case reports, review articles, editorials, letters, and conference abstracts were excluded.

Eligibility criteria Inclusion criteria: (1) studies reporting outcomes of total en bloc spondylectomy (TES) defined as en bloc removal of the entire vertebra with tumor-free margins; (2) tumors located in the thoracic and/or lumbar spine; (3) reporting at least one of the following: instrumentation failure rate, any complication rate, perioperative mortality, local recurrence rate, or revision surgery rate; (4) minimum sample size of 5 patients; (5) full-text available in English.

Exclusion criteria: (1) piecemeal or intralaminar resection; (2) exclusively cervical or sacral TES; (3) TES patients not separable from non-TES patients; (4) duplicate publications reporting the same cohort; (5) case reports ($n < 5$); (6) review articles, editorials, letters, and conference abstracts.

Information sources PubMed, Embase, OVID Medline, and Cochrane Central Register of Controlled Trials (CENTRAL), searched from January 1990 to June 2026. Hand-searching of reference lists of included studies and relevant systematic reviews was also performed.

Main outcome(s) Primary outcome: Instrumentation failure (IF) rate, defined as any mechanical failure of spinal implants including rod fracture, cage subsidence or displacement, screw failure, or construct failure, regardless of whether revision surgery was required.

Secondary outcomes: (1) any complication rate (per patient); (2) perioperative mortality rate; (3) local recurrence rate; (4) IF-related revision surgery rate. Meta-regression analysis was performed to explore the association between mean follow-up duration and instrumentation failure rate.

Quality assessment / Risk of bias analysis Methodological quality of included studies was assessed using the Methodological Index for Non-Randomised Studies (MINORS) instrument. Each study was scored on 8 items (maximum non-comparative score: 16). Two reviewers independently assessed risk of bias, with discrepancies resolved by consensus.

Strategy of data synthesis Pooled event rates were estimated using the DerSimonian–Laird random-effects model with logit transformation. A continuity correction of 0.5 was applied to studies with zero events. Between-study heterogeneity was assessed using Cochran's Q test and the I^2 statistic. Meta-regression analysis was performed to explore associations between study-level covariates (mean follow-up duration, proportion of combined surgical approach) and pooled outcome rates. Publication bias was assessed using Egger's regression test, Begg's rank correlation test, trim-and-fill analysis, and classic fail-safe N. All analyses were performed using Comprehensive Meta-Analysis software version 3 (CMA V3; Biostat, Englewood, NJ, USA).

Subgroup analysis Subgroup analyses were planned for tumor histology (primary vs. metastatic), surgical approach (posterior-only vs. combined anterior-posterior), and spine level (thoracic vs. lumbar). However, formal subgroup analyses were not feasible due to insufficient number of studies reporting outcomes separately by subgroup.

Sensitivity analysis Sensitivity analysis was performed by excluding studies with potential survival bias (studies that restricted inclusion to patients surviving beyond a predefined postoperative period). The impact of individual studies on the pooled estimate was also assessed using the one-study-removed method.

Language restriction No language restriction was applied during the literature search. However, only studies with full text available in English were included in the final analysis.

Country(ies) involved Taiwan.

Keywords Total en bloc spondylectomy; Spinal neoplasms; Instrumentation failure; Meta-analysis; Complications; Systematic review.

Contributions of each author

Author 1 - YEU CHYI LEONG - Author 1 drafted the manuscript.

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Author 2 - He-Tai Jheng - contributed to the development of the selection criteria, and the risk of bias assessment strategy reviewers screened titles and abstracts and subsequently evaluated full texts of potentially eligible records.

Author 3 - Jyun-Yuan Huang - author provided statistical expertise.

Author 4 - Jui-Sheng Chen - The author provided statistical expertise.

Author 5 - Hao-Kuang Wang - read, provided feedback and approved the final manuscript.