

INPLASY202640004

doi: 10.37766/inplasy2026.4.0004

Received: 1 April 2026

Published: 1 April 2026

Li, YC; Li, CY; Huang, SH; Wang, HK; Chen, KH; Lu, YJ.

Corresponding author:

Ying-Ching Li

johnhunter0823@gmail.com

Author Affiliation:

Department of Neurosurgery, Chang Gung Memorial Hospital, Taoyuan, Taiwan; Chang Gung University College of Medicine, Taoyuan, Taiwan.

ADMINISTRATIVE INFORMATION**Support** - Nil.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202640004**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 1 April 2026 and was last updated on 1 April 2026.**INTRODUCTION**

Review question / Objective What is the prognostic value of preoperative nutritional and inflammatory biomarkers (serum albumin, PNI, NLR, PLR, mGPS, SII, CAR) for clinical outcomes following open surgery for spinal metastases?

Rationale Spinal metastases develop in up to 40% of cancer patients during advanced malignancy, with surgical decompression remaining integral to management. Current prognostic scoring systems (revised Tokuhashi, Tomita, NESMS, SORG) do not incorporate preoperative nutritional and systemic inflammatory status. Biomarkers including serum albumin, prognostic nutritional index (PNI), neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), modified Glasgow Prognostic Score (mGPS), systemic immune-inflammation index (SII), and C-reactive protein/albumin ratio (CAR) have been individually evaluated in several spine oncology studies, but evidence remains fragmented with no prior

quantitative synthesis. This systematic review and meta-analysis aims to comprehensively evaluate the prognostic value of these biomarkers for clinical outcomes following open surgery for spinal metastases.

Condition being studied Spinal metastases; metastatic spine disease; spine oncology surgery.

METHODS

Search strategy Five electronic databases will be searched from January 2010 to April 2026: PubMed/MEDLINE, Embase, Cochrane CENTRAL, Scopus, and Web of Science. The search strategy comprises three Boolean concept blocks: (A) population—spinal metastases (spine OR spinal OR vertebral) AND (metastas* OR secondary OR tumor OR neoplasm); (B) surgical intervention (surgery OR surgical OR decompression OR corpectomy OR laminectomy OR stabilisation OR instrumentation); (C) biomarkers (albumin OR PNI OR "prognostic nutritional index" OR NLR OR "neutrophil-to-lymphocyte" OR PLR OR "platelet-

to-lymphocyte" OR mGPS OR "Glasgow Prognostic Score" OR SII OR "systemic immune-inflammation" OR CAR OR "C-reactive protein/albumin" OR nutrition* OR inflammatory OR biomarker). Full search strategies are provided in Supplementary Appendix A. Supplementary searches include backward and forward citation screening of included studies and relevant review articles, and grey literature searching. No language restrictions will be applied.

Participant or population Adults (≥ 18 years) with histologically or radiologically confirmed spinal or vertebral metastases (any primary tumour) who underwent open surgical treatment (decompression, corpectomy, separation surgery, en bloc resection, or instrumented stabilisation).

Intervention Preoperative measurement of one or more nutritional and/or inflammatory biomarkers: serum albumin, PNI, NLR, PLR, mGPS, SII, CAR, Nutritional Risk Index (NRI), Controlling Nutritional Status (CONUT), or Patient-Generated Subjective Global Assessment (PG-SGA).

Comparator Patients with normal vs abnormal biomarker values (dichotomised at study-defined cutoffs) or continuous biomarker association with outcomes.

Study designs to be included 1. At least one preoperative nutritional or inflammatory biomarker measured; 2. At least one postoperative clinical outcome reported; 3. Published January 2010 onward; 4. Original research (retrospective or prospective cohort, case-control, or clinical trial).

Eligibility criteria Inclusion criteria:

(1) Adults ≥ 18 years; (2) Histologically or radiologically confirmed spinal/vertebral metastases (any primary tumour); (3) Open surgical treatment (decompression, corpectomy, separation surgery, en bloc resection, instrumented stabilisation); (4) At least one preoperative nutritional or inflammatory biomarker measured; (5) At least one postoperative clinical outcome reported; (6) Published January 2010 onward; (7) Original research (retrospective or prospective cohort, case-control, or clinical trial).

Exclusion criteria:

1) Studies reporting only vertebroplasty or kyphoplasty (minimally invasive percutaneous procedures without decompression); (2) Sample size < 10 ; (3) Conference abstracts without full-text publication; (4) Case reports, editorials, narrative reviews, or expert opinion; (5) Studies of non-spinal bone metastases without separate spine-

specific data; (6) Duplicate or overlapping cohorts (the most comprehensive report retained).

Information sources PubMed/MEDLINE, Embase, Cochrane CENTRAL, Scopus, Web of Science. Supplementary: backward/forward citation searching, grey literature. No language restrictions. Search period: January 2010 to April 2026.

Main outcome(s) Primary: overall survival (OS).

Additional outcome(s) Secondary: perioperative complications (30-day or 90-day), mortality (30-day, 90-day, or 12-month), length of stay (LOS), non-routine discharge (NRD), wound-related complications, and postoperative functional status (ambulation).

Data management Two reviewers (YCL, CYL) will independently extract data using a pre-specified structured form. Extracted variables include: first author, year, study design, country, data source, sample size, patient demographics (age, sex), primary tumour distribution, biomarker(s) assessed, biomarker cutoff definitions, surgical procedures performed, covariate-adjusted effect estimates (hazard ratio [HR] or odds ratio [OR] with 95% confidence intervals), covariates included in multivariate models, outcome definitions, and follow-up duration. Discrepancies will be resolved by consensus with a third reviewer (SHH) arbitrating if needed.

Quality assessment / Risk of bias analysis

Methodological quality 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 quality; discrepancies will be resolved by consensus.

Strategy of data synthesis Random-effects meta-analyses will be performed using the DerSimonian-Laird method when ≥ 2 studies report comparable effect estimates for the same biomarker-outcome combination. Standard errors will be derived from reported 95% confidence intervals on the log scale. Heterogeneity will be quantified by Cochran's Q , I^2 , and τ^2 . Prediction intervals (95%) will be calculated for $k \geq 3$ studies. Leave-one-out sensitivity analyses will be conducted for all meta-analyses with $k \geq 3$ studies. Funnel plots will be visually inspected for asymmetry (formal tests not performed for $k \leq 3$ due to insufficient power). Certainty of evidence will be rated using the

GRADE framework, starting at LOW for observational studies. Biomarker–outcome combinations with only $k=1$ study will be narratively synthesized.

Subgroup analysis Planned subgroup analyses include: (1) by study design (prospective vs retrospective); (2) by surgical population (spine-only vs mixed bone metastases); (3) by geographic region. These are subject to sufficient data availability ($k \geq 3$ per subgroup).

Sensitivity analysis Leave-one-out sensitivity analysis for all meta-analyses with $k \geq 3$ studies. Sensitivity analysis excluding studies with high overall risk of bias.

Language restriction English.

Country(ies) involved Taiwan.

Keywords spinal metastases; metastatic spine surgery; prognostic nutritional index; serum albumin; neutrophil-to-lymphocyte ratio; platelet-to-lymphocyte ratio; modified Glasgow Prognostic Score; systematic review.

Contributions of each author

Author 1 - Ying-Ching Li - Manuscript.

Email: johnhunter0823@gmail.com

Author 2 - Cheng-Yu Li - The author provided statistical expertise.

Email: mick791212@hotmail.com

Author 3 - Sheng-Han Huang - The author contributed to the development of the selection criteria, and the risk of bias assessment strategy.

Email: suntoryer@gmail.com

Author 4 - Hong-Kai Wang - The author read, provided feedback and approved the final manuscript.

Email: cakekevin3211@hotmail.com

Author 5 - Kuan-Hung Chen - The author read, provided feedback and approved the final manuscript.

Email: khchenns@gmail.com

Author 6 - Yu-Jen Lu - Revised.

Email: alexlu0416@gmail.com