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Retrospective protocol for the PRISMA-guided literature synthesis of spinal, craniovertebral junction, and osseous phosphaturic mesenchymal tumors

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Ye, J; Lin, H; Liu, H; Xu, W; Xiao, J.

Corresponding author:
haoran Lin

haoran_lin0112@163.com

Author Affiliation:
Department of Orthopedic Oncology, Shanghai Changzheng Hospital, Naval Medical University, Shanghai, China.

ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Completed but not published.

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 19 June 2026 and was last updated on 19 June 2026.

INTRODUCTION

Review question / Objective This review aims to identify and synthesize published patient-level evidence on spinal, craniovertebral junction, vertebral, sacral, and adjacent osseous phosphaturic mesenchymal tumors or tumor-induced osteomalacia. The objective is to summarize clinicopathological features, biochemical presentation, imaging localization, surgical management, resection strategy, postoperative phosphorus response, recurrence, complications, and follow-up outcomes, while avoiding duplicate counting of overlapping published cases. The literature synthesis is intended to complement a four-patient clinicopathologically adjudicated institutional case series and to support a diagnostic-surgical framework for this rare tumor entity.

Rationale Phosphaturic mesenchymal tumors are rare fibroblast growth factor 23-related neoplasms that may cause tumor-induced osteomalacia through renal phosphate wasting, hypophosphatemia, impaired mineralization, bone pain, muscle weakness, and fragility fractures. Spinal, craniovertebral junction, sacral, and adjacent osseous PMTs are especially difficult to diagnose and treat because culprit lesions may be small, symptoms are nonspecific, and surgery is constrained by the spinal cord, nerve roots, vertebral artery, dura, major vessels, and reconstruction requirements. The published evidence is dominated by case reports and small

case series. A PRISMA-guided literature synthesis with conservative duplicate-case adjudication is therefore needed to summarize diagnostic, pathological, biochemical, surgical, and outcome patterns.

Condition being studied The condition being studied is phosphaturic mesenchymal tumor, including cases associated with tumor-induced osteomalacia or oncogenic osteomalacia. The review focuses on spinal, craniovertebral junction, vertebral, sacral, and adjacent osseous PMT/TIO reports with extractable patient-level diagnostic, treatment, and outcome data.

METHODS

Search strategy PubMed/MEDLINE, Embase, Web of Science Core Collection, SinoMed/CDM, and the Cochrane Library were searched from inception to June 14, 2026. Search terms combined PMT/TIO terms with anatomical terms, including "phosphaturic mesenchymal tumor," "phosphaturic mesenchymal tumour," "tumor-induced osteomalacia," "tumour-induced osteomalacia," "oncogenic osteomalacia," "spine," "spinal," "vertebra," "vertebral," "cervical," "thoracic," "lumbar," "sacrum," "sacral," "craniovertebral," "osseous," "bone," "femur," "pelvis," and "pelvic." Google Scholar was used only for supplementary citation checking and was not included in formal PRISMA counts. Manual reference-list checking and citation chasing were performed for eligible reports and relevant reviews. Duplicate records were removed before title/abstract screening.

Participant or population Eligible participants were patients with reported phosphaturic mesenchymal tumor or tumor-induced osteomalacia involving the spine, craniovertebral junction, vertebrae, sacrum, occipital/CVJ-adjacent region, or adjacent osseous structures. Both adult and pediatric patients were eligible when individual-level diagnostic, treatment, and outcome information was extractable.

Intervention No experimental intervention is evaluated. The management strategy of interest is surgical treatment of PMT/TIO, including tumor resection, en bloc excision, piecemeal or intralesional resection, decompression, stabilization, reconstruction, and other operative approaches when reported. Medical therapy is recorded descriptively when relevant but is not the primary intervention.

Comparator No formal comparator is planned because the available evidence consists mainly of case reports and small case series. When data permit, surgical strategies, tumor locations, completeness of resection, postoperative biochemical response, recurrence, and follow-up outcomes will be compared descriptively.

Study designs to be included Case reports, case series, retrospective clinical reports, and observational studies reporting individual patients or cohorts with spinal, craniovertebral junction, sacral, vertebral, or adjacent osseous PMT/TIO will be included.

Eligibility criteria Inclusion criteria are: original reports of PMT or TIO with clinicopathological support; spinal, craniovertebral junction, vertebral, sacral, occipital/CVJ-adjacent, or relevant osseous anatomic involvement; extractable patient-level diagnostic, treatment, and outcome data; and sufficient information for duplicate-case adjudication. Exclusion criteria are: wrong anatomic scope, non-PMT diagnosis, review without original eligible cases, abstract-only report without sufficient individual data, unavailable full text, insufficient treatment or outcome data, and duplicate or overlapping reports when a more complete primary source is available.

Information sources Information sources include PubMed/MEDLINE, Embase, Web of Science Core Collection, SinoMed/CDM, Cochrane Library, and manual reference-list checking/citation chasing. Google Scholar was used only for supplementary citation checking and was not counted as a formal PRISMA database source. Search exports, screening records, PRISMA flow documentation, full-text eligibility decisions, and duplicate-case adjudication records were archived by the study team.

Main outcome(s) Main outcomes include tumor location, clinical presentation, diagnostic delay, biochemical abnormalities including serum phosphorus and FGF23 when available, imaging and localization methods, pathological diagnosis, immunohistochemical or molecular findings when reported, operative approach, resection strategy, margin status, reconstruction or fixation, postoperative phosphorus response, recurrence or residual disease, complications, survival status, functional status, and final follow-up outcomes.

Additional outcome(s) Additional outcomes include duplicate-case status, same-team publication overlap, manual reference-list additions, nonretrieved full-text reports, exclusion

reasons, use of somatostatin receptor imaging, use of bone-protective or medical therapy, diagnostic uncertainty, PMT-spectrum or nonphosphaturic variants, and whether institutional and published-literature denominators are reported separately.

Data management Database search results were exported and deduplicated before screening. Titles and abstracts were screened according to predefined eligibility criteria, followed by full-text assessment. Extracted data were recorded in standardized tables, including bibliographic information, patient characteristics, tumor site, clinical presentation, biochemical findings, diagnostic tests, pathology, operative details, complications, recurrence, and follow-up. Potential duplicate cases were adjudicated by comparing authors, institutions, publication year, patient age, sex, tumor location, operative details, and clinical course. The most complete source was used as the primary data source when overlapping reports were identified.

Quality assessment / Risk of bias analysis Because the evidence base is expected to consist mainly of case reports and small case series, formal comparative risk-of-bias scoring was not planned. Study reliability will be assessed descriptively according to diagnostic support for PMT/TIO, availability of patient-level data, clarity of anatomic eligibility, completeness of treatment and outcome reporting, follow-up information, and risk of duplicate or overlapping publication. Reports with insufficient diagnostic, treatment, or outcome data will be excluded from the final synthesis.

Strategy of data synthesis A qualitative and descriptive synthesis will be performed. Published-literature cases and current institutional cases will be summarized using separate denominators. Continuous variables will be summarized using median and range when appropriate, and categorical variables will be summarized as counts and percentages when suitable. Formal meta-analysis is not planned because of the rarity of the condition, heterogeneous reporting, and predominance of case reports and small case series. Findings will be synthesized according to anatomic location, diagnostic evidence, surgical approach, resection strategy, biochemical response, recurrence, complications, and follow-up.

Subgroup analysis Formal subgroup analysis is not planned because of the rarity and heterogeneity of available reports. Descriptive comparisons may be performed according to anatomic location, spinal/CVJ versus other osseous involvement, primary versus recurrent disease, en bloc versus piecemeal/intralesional resection, margin status, biochemical remission, recurrence, and follow-up status when data are sufficient.

Sensitivity analysis Formal statistical sensitivity analysis is not planned because no quantitative meta-analysis is expected. Descriptive sensitivity checks will focus on the effect of duplicate-case adjudication, exclusion of overlapping reports, exclusion of reports with insufficient patient-level data, and separation of current institutional cases from previously published literature cases.

Language restriction No formal language restriction was applied during title/abstract screening; inclusion required retrievable full text with extractable patient-level data.

Country(ies) involved China.

Other relevant information This is a retrospective registration of the PRISMA-guided literature synthesis component of a manuscript that also includes a four-patient clinicopathologically adjudicated institutional case series. The literature search, eligibility criteria, duplicate-case adjudication definitions, screening process, data extraction, PRISMA flow documentation, and supplementary tables had been finalized before this registration. Registration was performed retrospectively in INPLASY because PROSPERO prospective registration was not available at this stage. No substantive methodological changes were made after finalization of the review procedures

Keywords phosphaturic mesenchymal tumor; tumor-induced osteomalacia; spine; craniovertebral junction; hypophosphatemia; PRISMA.

Dissemination plans The findings will be disseminated through submission to a peer-reviewed journal as part of a manuscript including a four-patient institutional case series, diagnostic-surgical algorithm, and PRISMA-guided literature synthesis.

Contributions of each author

Author 1 - Juelan Ye - Author 1 contributed to conceptualization, data curation, formal analysis, investigation, methodology, visualization, and drafting of the manuscript.
Email: juelanorthopedics@163.com
Author 2 - Haoran Lin - Author 2 contributed to conceptualization, formal analysis, investigation,

methodology, visualization, original drafting, review and editing, and submission coordination.
Email: haoran_lin0112@163.com
Author 3 - Hongyu Liu - Author 3 contributed to data curation, formal analysis, investigation, methodology, and visualization.
Email: lhy_spine@163.com
Author 4 - Wei Xu - Author 4 contributed to conceptualization, methodology, resources, supervision, funding acquisition, and manuscript review and editing.
Email: xuwei_spine@163.com
Author 5 - Jianru Xiao - Author 5 contributed to conceptualization, project administration, resources, supervision, funding acquisition, and manuscript review and editing.
Email: jianruxiao83@163.com