

Spinal Neurosurgery

SPINAL METASTASES: Clinical Features, Imaging and Prognosis in 52 Patients

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ABSTRACT

Background and objective. To describe the clinical, imaging, pathological and prognostic features of spinal metastases managed at Blida University Hospital and examine the relevance of legacy survival scores.

Methods. This prospective, single-center descriptive study included 52 patients with a confirmed secondary vertebral tumor. Assessment comprised pain, Karnofsky Performance Status, Frankel/ASIA grades, computed tomography, magnetic resonance imaging, and revised Tokuhashi and Tomita scores. Analyses used aggregate data.

Results. Mean age was 54.7 ± 13.25 years (range, 16-82), with equal sex distribution. Breast cancer predominated among women (57.7%) and lung cancer among men (34%). Carcinomas, adenocarcinomas and multiple myeloma accounted for 42.3%, 25% and 15.4% of diagnoses. Pain, motor deficit and Frankel A/B grades were reported in 90%, 96% and 30.8%, respectively. Karnofsky status was favorable in 76.9%. Lesions were predominantly lytic (67.3%), with epidural extension in 67%. Tokuhashi groups 0-8, 9-11 and 12-15 comprised 42.3%, 38.5% and 19.2%. Six-month mortality was 45.5% for lung primaries and 20% for breast primaries. Six-month survival of 63% was reported in the Tokuhashi 0-8 group.

Conclusion. This series highlights severe neurological presentation and heterogeneous prognosis across primary tumors. Reported survival in the Tokuhashi 0-8 group suggests possible prognostic underestimation but does not constitute formal validation. Scores should inform multidisciplinary assessment; patient-level survival analysis and assessment of discrimination and calibration remain necessary.

Keywords: spinal metastases; metastatic spinal cord compression; spine surgery; Tokuhashi; Tomita; NESMS; survival; prognosis.

1. Introduction

Spinal metastases are a major cause of oncological morbidity, involving pain, bone destruction, pathological fracture, instability, and neurological compression. A systematic review highlights their clinical frequency and complications, particularly epidural compression and vertebral fractures [1].

The treatment strategy is based on neurological status, spinal stability, radiosensitivity, systemic disease extent, and general condition. In selected patients, decompression combined with radiotherapy may preserve or restore ambulation and improve pain [2-5]. Stabilization and reconstruction techniques are tailored to the spinal level and the goals of local and mechanical control.

Survival estimates should avoid both undertreatment resulting from pessimistic predictions and disproportionate intervention. The Tokuhashi and Tomita scores have provided a framework for this decision [6,7], but predate targeted therapies, immunotherapy, and stereotactic radiotherapy. More recent models, including the New England Spinal Metastasis Score (NESMS), place greater emphasis on functional status and biological parameters [13-15].

In a North African setting that is underrepresented in the literature, local data can characterize patterns of presentation and help examine the transportability of prognostic tools.

This study describes the epidemiological, clinical, radiological, histopathological, and prognostic characteristics of 52 patients managed at Blida University Hospital. It also explores the concordance between Tokuhashi categories and short-term survival, together with the potential contribution of contemporary prognostic factors.

2. Materials and methods

2.1. Study design and population

This prospective, single-center, descriptive study was conducted in the Department of Neurosurgery at Blida University Hospital. The reported period of clinical activity extended from 2022 to 2025; exact calendar dates of inclusion were not provided.

The reported inclusion criteria were age older than 16 years and a confirmed secondary vertebral tumor. The aggregate data did not specify the exclusion criteria, whether inclusion was consecutive, the methods used to confirm the primary tumor, or the number of patients initially assessed.

2.2. Clinical, radiological, and histopathological assessment

Variables included age, sex, time to consultation, pain assessed using a visual analog scale from 0 to 10, Karnofsky Performance Status, and Frankel/ASIA grades. The thresholds defining “good” or “intermediate” Karnofsky status were not specified.

Computed tomography (CT) distinguished lytic, mixed, and osteoblastic lesions. Magnetic resonance imaging (MRI) assessed vertebral involvement, deformities, dislocations, and epidural extension. Spinal level, Bilsky compression grade, and the Spinal Instability Neoplastic Score (SINS) were not available as aggregate data.

Histopathology was described by histological type and primary tumor site. The categories “carcinoma” and “adenocarcinoma” were presented separately in the analyzed data.

2.3. Surgical strategy

Surgical approaches depended on the spinal level, compression, and instability. In the cervical spine, the options described were anterior corpectomy with an expandable cage and screw fixation plate, or posterior cervical/occipitocervical fixation. At the thoracic and lumbar levels, options included decompressive laminectomy, pedicle screw fixation, and, in selected situations, posterior retropleural or retroperitoneal approaches with vertebral body reconstruction.

The number of patients who underwent surgery, the distribution of techniques, perioperative data, complications, and adjuvant treatments were not specified. The figures therefore illustrate technical examples rather than the frequency of these procedures in the cohort.

2.4. Prognosis and statistical analysis

Revised Tokumashi and Tomita scores were reported for the cohort. The available outcomes were cumulative mortality at 3 and 6 months according to primary tumor site and 6-month survival in the Tokumashi 0-8 group. In the absence of individual serum albumin levels and ambulatory status, the NESMS was neither calculated nor validated in this series.

The analysis was descriptive: quantitative variables were expressed as mean $\pm$ standard deviation and range, and categorical variables as counts and percentages. Counts reconstructed from $N = 52$ and the reported percentages, rounded to the nearest compatible integer, are marked with †. No patient-level survival analysis, confidence intervals, or hypothesis tests were available.

2.5. Ethical considerations

Annotations that could identify an examination had been masked in the illustrations. Information on ethics approval, consent, and permission to publish the images was not provided in the available data.

3. Results

3.1. General characteristics and clinical presentation

The series included 52 patients, with a mean age of 54.7 ± 13.25 years (range, 16-82 years) and a male-to-female ratio of 1. Mean age was 57.7 years in men and 51.7 years in women (Table 1).

Time to consultation was ≤ 1 month in 23% of patients, 2-4 months in 46%, and >4 months in 30%. For lumbar lesions, 34% of patients presented after 6 months; 88% of cervical and thoracic lesions were assessed before 4 months.

Pain was reported in 90% of patients, motor deficit in 96%, and sensory deficit in 60%. Frankel grades A/B, C, and D accounted for 30.8%, 26.9%, and 42.3%, respectively.

Karnofsky status was favorable in 76.9% of patients and intermediate in 23.1%. Favorable status was reported in 84.6% of women and 69.2% of men, as well as in 80% of patients with breast primaries, 77.8% with hematological malignancies, and 63.6% with lung primaries.

Table 1. Demographic and clinical characteristics of the cohort (N = 52)

Variable	Result
Age, mean $\pm$ SD (range)	54.7 $\pm$ 13.25 years (16-82)
Men / women	26 / 26 (50% / 50%)†
Consultation within the first month	$\approx$ 12 (23%)†
Consultation at 2-4 months	$\approx$ 24 (46%)†
Consultation after 4 months	$\approx$ 16 (30%)†
Pain	$\approx$ 47 (90%)†
Motor deficit	$\approx$ 50 (96%)†
Sensory deficit	$\approx$ 31 (60%)†
Frankel A/B	16 (30.8%)†
Frankel C	14 (26.9%)†
Frankel D	22 (42.3%)†
Favorable Karnofsky status	40 (76.9%)†
Intermediate Karnofsky status	12 (23.1%)†

† Counts estimated from the percentages and N = 52. SD: standard deviation.

3.2. Primary tumor site and histopathology

Among women, primary tumors were predominantly breast cancer (57.7%), followed by hematological malignancies (15%), lung cancer, and thyroid cancer (7.6% each). Among men, lung cancer predominated (34%), followed by hematological malignancies (23%), prostate cancer (11.5%), gastrointestinal tumors, and thyroid cancer (7.6% each).

Carcinomas (42.3%), adenocarcinomas (25%), and multiple myeloma (15.4%) predominated in the histological distribution. The other categories and unknown diagnoses are detailed in Table 2; Figure 1 presents two histopathological examples.

Table 2. Reported histopathological distribution

Histological type	Estimated n†	%
Carcinomas	22	42.3
Adenocarcinomas	13	25.0
Multiple myeloma	8	15.4
Lymphomas	3	5.8
Liposarcomas	2	3.8
Neuroendocrine tumors	1	1.9
Unknown	3	5.8

† Counts reconstructed from the percentages.

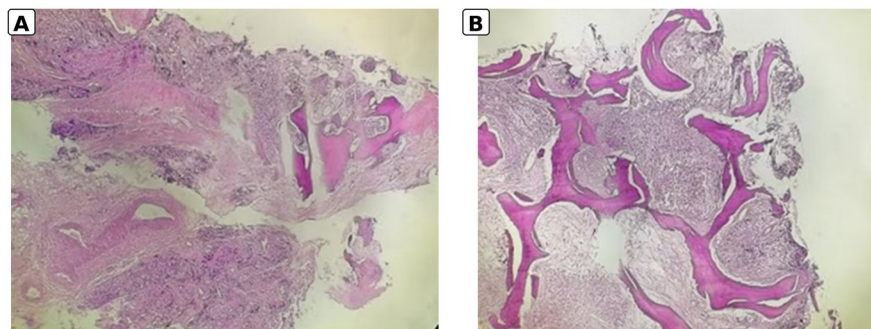


Figure 1. Histopathological examples of secondary vertebral lesions in the series. (A) Spinal involvement by breast carcinoma. (B) Diffuse large B-cell lymphoma involving the L3 vertebra.

3.3. Radiological characteristics

Lesions were predominantly lytic on CT (67.3%), with epidural extension on MRI in 67% of cases (Table 3; Figure 2). Deformities were reported in 93.3% of patients with breast primaries, 75% with lung primaries, and 33% with prostate primaries. The reported dislocations involved the cervical spine (75%) and lower thoracic spine (25%). Denominators for these subgroups were unavailable.

Table 3. Radiological phenotype of vertebral lesions

Characteristic	Estimated n†	%
Lytic lesion on CT	35	67.3
Mixed lesion on CT	14	26.9
Osteoblastic lesion on CT	3	5.8
Epidural tumor extension on MRI	≈ 35	67.0

† Counts estimated from the percentages and N = 52.

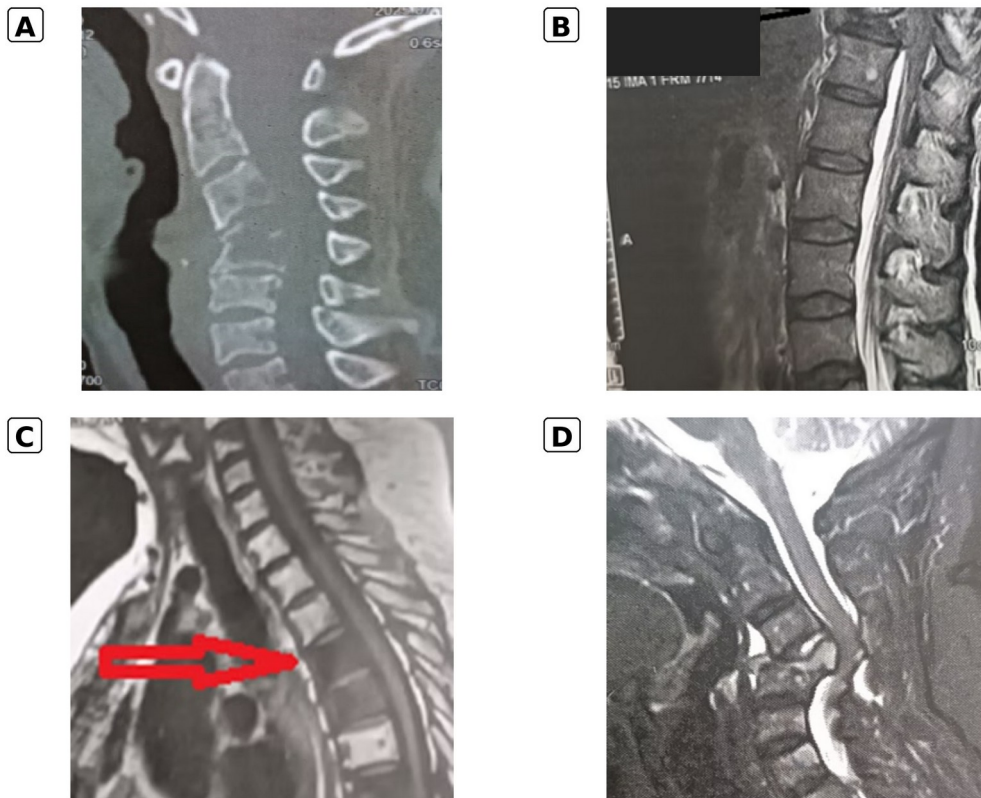


Figure 2. Radiological illustrations of spinal metastases in the series. (A) Sagittal CT showing cervical bone destruction. (B-D) Sagittal MR images illustrating different patterns of vertebral involvement, deformity, and epidural extension.

3.4. Decompression and stabilization: illustrations

Figures 3 and 4 illustrate anterior cervical reconstruction with a cage and plate, posterior cervical stabilization, and thoracolumbar pedicle screw fixation. The frequency of these techniques was not provided.

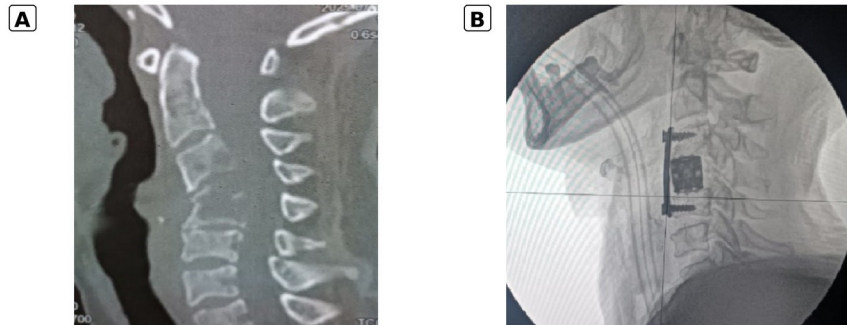


Figure 3. Example of anterior cervical management. (A) Sagittal CT showing a destructive cervical vertebral lesion. (B) Lateral fluoroscopic image following corpectomy and anterior reconstruction with a vertebral body implant and screw fixation plate.

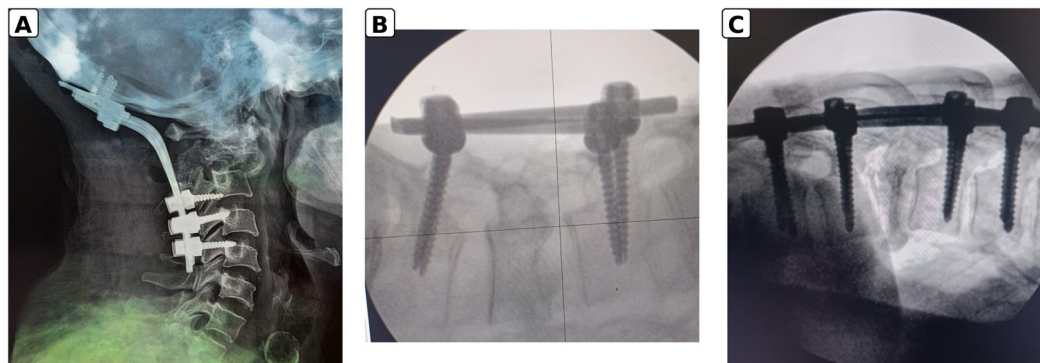


Figure 4. Examples of posterior stabilization in the series. (A) Postoperative radiograph of cervical/occipitocervical instrumentation. (B-C) Intraoperative fluoroscopic images of posterior thoracolumbar fixation with pedicle screws and rods.

3.5. Prognostic scores and short-term survival

The Tokuhashi 0-8, 9-11, and 12-15 groups accounted for 42.3%, 38.5%, and 19.2% of the cohort, respectively. The 0-8 group historically corresponds to an expected survival of less than 6 months. According to the Tomita score, 73.1% of patients belonged to the unfavorable group (Table 4).

Cumulative mortality at 3 and 6 months was 18.2% and 45.5% for lung primaries, compared with 6.7% and 20% for breast primaries. Six-month survival of 100% was reported for prostate, thyroid, muscle, and bladder primaries, although these subgroups were probably small.

Six-month survival of 63% was reported in the Tokuhashi 0-8 group. In the absence of numbers at risk, individual events, dates of death, censoring information, and a confidence interval, this discrepancy with historical expectations remains descriptive and does not constitute formal validation.

Table 4. Distribution of prognostic scores and survival data

Indicator	Result
Tokuhashi 0-8	22 patients (42.3%)†
Tokuhashi 9-11	20 patients (38.5%)†
Tokuhashi 12-15	10 patients (19.2%)†
Unfavorable Tomita	38 patients (73.1%)†
Intermediate Tomita (4-5)	11 patients (21.2%)†
Favorable Tomita (2-3)	3 patients (5.8%)†
Lung - mortality at 3 / 6 months	18.2% / 45.5%
Breast - mortality at 3 / 6 months	6.7% / 20.0%
Tokuhashi 0-8 - survival at 6 months	63%; denominator and CI not provided

† Count derived from the percentage and N = 52. CI: confidence interval.

4. Discussion

4.1. Main findings

This series describes a relatively young population with a substantial neurological burden at presentation and a predominance of lytic lesions and epidural extension. Breast cancer predominated among women and lung cancer among men. Survival varied according to the primary tumor; survival reported in the least favorable Tokuhashi group appeared better than historical expectations.

4.2. Tumor profile and relevance of the local setting

The distribution of primary tumors is consistent with that of cancers responsible for spinal metastases. However, Van den Brande et al. highlight the heterogeneity of estimates according to screening, oncological survival, and imaging practices [1]. The proportions in this series remain hospital-based and cannot be used to estimate incidence or prevalence in the general population.

Differences in Karnofsky status and survival according to the primary tumor should be interpreted in light of histological and molecular subtypes, visceral disease burden, lines of therapy, and response to systemic treatment. The absence of these data limits interpretation of oncological trajectories, particularly for breast, thyroid, prostate, and lung primaries.

The distinction between “carcinoma” and “adenocarcinoma” supports the use of a hierarchical nomenclature incorporating primary site, histological type, relevant molecular subtype, and confirmation status of the primary tumor.

4.3. Diagnostic delay and neurological severity

Nearly one-third of patients presented after four months, particularly those with lumbar lesions. The frequency of Frankel grades A/B and C suggests an already advanced presentation. Because pain may precede neurological deficit, a rapid referral pathway involving primary care, oncology, emergency medicine, radiology, and spine surgery is essential.

A study of surgical timing associated intervention within 48 hours with better neurological outcomes, without demonstrating an independent effect on survival [3]. The prospective AOSpine cohort also reported improvements in pain, function, and quality of life after surgery in selected patients [4]. These observations highlight the importance of the intervals between neurological deficit, MRI, corticosteroid therapy, multidisciplinary consultation, and surgery.

4.4. Imaging, epidural extension, and mechanical instability

Bone destruction, mechanical instability, and epidural compression should be distinguished. The SINS standardizes the assessment of neoplastic instability [8], whereas the NOMS framework integrates neurological, oncological/radiosensitivity, mechanical, and systemic considerations to guide irradiation, stabilization, decompression, and systemic treatments [9]. These dimensions complement the description of the lytic lesions and epidural extension observed here.

Location, mechanical pain, lesion type, alignment, vertebral collapse, and posterolateral involvement are required to calculate the SINS. The absence of these data and of the Bilsky grade limits standardized assessment of instability and epidural compression in this series.

4.5. Role and objectives of surgery

The illustrated reconstructions address the goals of decompression, stability, and reduction of mechanical pain while allowing oncological treatment to continue. However, they do not allow the surgical benefit specific to this cohort to be measured, because detailed postoperative outcomes are unavailable.

In selected patients, the trial by Patchell et al. demonstrated an improvement in ambulation with decompression followed by radiotherapy compared with radiotherapy alone [2]. Subsequent cohorts reported improvements in pain, Karnofsky status, and quality of life, with persistent vulnerability to systemic complications [4,5]. Surgery is therefore a component of a multimodal strategy rather than an exclusive treatment option.

Separation surgery aims to create a margin between the epidural tumor and the spinal cord to permit ablative irradiation, rather than extensive resection. The SC.24 trial reported a higher complete pain response with stereotactic radiotherapy in selected patients [17]; guidelines address postoperative contouring [18]. The absence of data on irradiation type, dose, and timing, as well as systemic treatments, limits analysis of the multimodal strategy in this series.

4.6. Historical scores and prognostic discrepancy

Tokuhashi combines general condition, bone and visceral metastatic burden, primary tumor, and neurological deficit; the 0-8 category originally corresponded to an expected survival of less than 6 months [6]. Tomita emphasizes primary tumor growth and visceral and skeletal dissemination [7]. Their simplicity remains useful, but their calibration may change as oncological treatments evolve.

The reported 6-month survival of 63% in the Tokuhashi 0-8 group suggests possible underestimation, consistent with some discrepancies described in external validations [10-12]. It does not demonstrate that the score is invalid in Blida. Confirmation requires Kaplan-Meier curves, confidence intervals, analysis of censoring, and assessment of discrimination and calibration.

Six-month mortality was higher for lung than for breast primaries (45.5% versus 20%), but the small subgroups require caution. An observed survival of 100% for a rare primary tumor does not provide prognostic certainty: it may reflect the absence of an event in only a few cases.

4.7. Contemporary factors and the role of the NESMS

The NESMS combines the dichotomized modified Bauer score, serum albumin at a threshold of 3.5 g/dL, and independent ambulation [13].

Its prospective validation included both surgically and nonsurgically treated patients [14]. A prospective comparison reported 1-year c-statistics of 0.79 for NESMS, 0.69 for Tomita, 0.67 for Tokuhashi, and 0.54 for SINS [15]. A multicenter external validation in 2026 described increasing mortality with worsening NESMS [21]. These findings do not replace local validation.

In this cohort, the absence of serum albumin, independent ambulation, and the components of the modified Bauer score prevents calculation of the NESMS. Nutritional and inflammatory parameters, renal function, frailty, functional status, metastatic burden, and tumor and treatment characteristics offer avenues for a prospective extension. The importance of nutritional status is also supported by prospective data [19].

SORG-type tools and machine learning provide individualized estimates [16,20,22], without guaranteeing transportability. With 52 patients, the priority remains validation of existing models, using few predictors, penalization, and bootstrapping, rather than development of a complex model.

4.8. Limitations

The main limitations are the single-center design, small sample size, and use of aggregate data, without multivariable analysis or patient-level verification. Recruitment dates, inclusion flow, exclusions, Karnofsky thresholds, and histological nomenclature remain incomplete. Operative data, complications, changes in pain, ambulation, and neurological status, oncological treatments, follow-up duration, losses to follow-up, and censoring are not reported. The NESMS and SINS cannot be fully calculated.

These limitations restrict the prognostic scope without negating the descriptive value of the study. The discrepancy between the distribution of Frankel grades and the reported rate of motor deficit also limits the precision of the neurological description. A more complete assessment depends on the availability of standardized patient-level data, in accordance with the STROBE principles for reporting observational studies [23].

4.9. Practical implications

The proposed local algorithm sequentially assesses neurological urgency, instability, degree of compression and radiosensitivity, systemic and functional status, and then plausible survival according to the primary tumor, metastatic burden, serum albumin, and independence. Multidisciplinary consultation should involve neurosurgery, oncology, radiotherapy, radiology, pathology, anesthesiology and intensive care, and rehabilitation.

Tokuhashi may remain a common language, but should not be an automatic exclusion criterion. An unfavorable score despite preserved function, a controllable primary tumor, or a relevant therapeutic option warrants multidisciplinary reassessment.

5. Conclusion

This series of 52 patients from Blida University Hospital describes frequently advanced spinal metastases, dominated by pain, motor deficit, osteolysis, and epidural extension. The reported 6-month survival of 63% in the Tokuhashi 0-8 group raises, but does not establish, the possibility of prognostic underestimation.

Decompression and stabilization should be integrated into a multimodal oncological strategy. Assessment combines scores, functional and nutritional status, metastatic burden, and treatment options. A verified patient-level database and a complete survival analysis remain essential to confirm the findings and validate the models.

Ethics approval and consent to participate

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Consent for publication

Written informed consent was obtained from the patient's legal guardian for publication of this case report and any accompanying images.

Availability of data and materials

The data supporting the findings of this case report are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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