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Management of Spinal Lymphomas: Spinal Instability Assessment Using the Spinal Instability Neoplastic Score and a Proposed Treatment Algorithm

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ABSTRACT

AIM: To propose a treatment algorithm and to assess spinal instability in patients diagnosed with spinal lymphoma.

MATERIAL and METHODS: Demographics, symptoms, tumor level and location, and presence of spinal instability were reviewed in 22 patients with spinal lymphomas. Each patient's neurological state was reviewed using the American Spinal Injury Association and modified McCormick scale scores, and spinal instability was assessed using the Spinal Instability Neoplastic Score (SINS).

RESULTS: Initially, percutaneous biopsy was performed in 16 patients, and open biopsy was performed in 6 patients. Eight of the patients who underwent percutaneous biopsy were followed up with hematological examination alone, as they had no additional complaints. The SINS was used to evaluate the presence of spinal instability, and the type of surgery to be performed was decided accordingly. In the second surgery, decompression and stabilization were performed in 5 of the remaining 8 patients, and only decompression was performed in 3 of them. Neurological improvement was observed in 6 of 7 patients with acute neurological deficit.

CONCLUSION: We concluded that percutaneous biopsy for tissue diagnosis is the first step in the management of spinal lymphomas. Patients without deficit should be referred for hematological examination. Those with acute neurological deficit require emergency surgery, and those with chronic symptoms must undergo operation for decompression and/or stabilization. This study confirmed the safety of the SINS in the evaluation of spinal instability in spinal lymphoma cases.

KEYWORDS: Management, SINS, Spinal instability, Spinal lymphoma

ABBREVIATIONS: ASIA: The American Spinal Injury Association; **CT:** Computed tomography, **MR:** Magnetic resonance, **NOMS:** Neurologic, oncologic, mechanical and systemic decision framework, **OB:** Open biopsy, **PB:** Percutaneous biopsy, **SINS:** The Spinal Instability Neoplastic Score, **SL:** Spinal lymphoma

INTRODUCTION

Spinal lymphomas (SLs) constitute 9%–10% of all epidural malignancies (2,4,17). They are localized in the paraspinal, vertebral, and epidural areas (13,15,19,25). Spinal cord compression due to SL is extremely rare and is found in approximately 0.1%–3.3% of SL cases (15,26). Although medical treatment is effective for most cases of SL, some cases may require surgical intervention for pain relief,

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decompression, and/or spinal reconstruction (1,3,10,11,16–18,20,21,23,32,34).

On the other hand, assessment of spinal instability is still controversial in patients with SL (7,16,18,21,28,31). The available literature indicates that the Spinal Instability Neoplastic Score (SINS) has the potential to be a valuable guide for the management of patients with spinal metastases (9,24). The purpose of this study was to review the treatment results of SL cases, present our treatment algorithm, and report the reliability of the SINS for the assessment of SLs.

MATERIAL and METHODS

Twenty-two patients who underwent surgery for SL in our clinic between 2011 and 2020 were retrospectively evaluated. The patient population consisted of 14 men and 8 women, with a mean age of 34.2 years (range: 15–81 years).

In this study, demographic characteristics, symptomatology (pain and neurological findings), level with respect to the spine segments, location with respect to the dura, biopsy results, and surgical procedures were reviewed. Patients who underwent an operation for SL in our clinic between 2011 and 2020 were included in the study. Radiological diagnoses were made using magnetic resonance (MR) imaging, computed tomography (CT), and positron emission tomography-CT. Furthermore, CBC, peripheral blood smear or bone marrow aspiration were performed in elective cases for differential diagnosis. The American Spinal Injury Association (ASIA) and modified McCormick scales were used to evaluate preoperative and postoperative neurological function (Table I), and the SINS score was used to evaluate the presence of spinal instability (5,8). Except for the patients who presented with neurological deficit, the treatments to be applied in the follow-up were decided together with the oncology council. At the decision of the oncology team, biopsy was performed both for staging and excluding a possible second metastatic tumor. Percutaneous biopsy specimens were obtained by Jamshidi needle and biopsy punch through the pedicle into the site of the disease using C-arm fluoroscopy.

RESULTS

The tumors were located in the lumbar spine in 15 patients, in the thoracic spine in 5 patients, and in the sacral spine in 2 patients. The vertebral body was involved in all the cases. Whereas the tumors were purely vertebral in 2 cases, extension was observed to the paraspinal area in 3 cases, to the epidural area in 2 cases, to the paraspinal and epidural areas in 6 cases, to the prevertebral and epidural areas in 1 case, and to the prevertebral, vertebral, epidural, and paraspinal areas in 8 cases. Only 2 patients had a hematologically confirmed SL before diagnosis, and 20 patients were admitted with an undiagnosed spinal tumor. Seventeen patients were admitted with spine-related pain, and 7 patients had neurological complaints, such as neuropathic pain, numbness, and neurological deficit.

In the preoperative neurological evaluation, the neurological function was ASIA grade B in 2 patients, ASIA grade C in 3 patients, ASIA grade D in 4 patients, and ASIA grade E in 13 patients. In the postoperative neurological evaluation, 1 patient had ASIA grade C, 5 patients had ASIA grade D, and 16 patients had ASIA grade E neurological function.

The preoperative modified McCormick scale score was grade 1 in 15 patients, grade 2 in 2 patients, grade 3 in 3 patients, and grade 4 in 2 patients. Grade 1 became grade 3 in 1 patient soon after percutaneous biopsy (PB), so decompression surgery was performed (Patient no. 18). The postoperative modified McCormick evaluation results were as follows: grade 1 in 17 patients, grade 2 in 3 patients, and grade 3 in 2 patients. The preoperative SINS score was 6 points in 1 patient, 7–12 points (potentially unstable) in 14 patients, and >12 points (unstable) in 7 patients.

A PB was performed in 16 patients, and open biopsy (OB) was performed in 6 patients. Of the 16 patients who underwent PB, 8 who had neither severe pain nor neurological deficit were referred to the hematology department for further treatment of lymphoma (Figure 1). 13 patients with ASIA E were diagnosed by PB to confirm the pathological diagnosis. Of these 13 patients' 6 were operated because of potential instability (high SINS score), and two sacral lesions for relieving urinary retention of acute onset (patient no. 12 and 22).

A decompression procedure was performed in 3 of the 16 patients who underwent PB (Figure 2), and stabilization and decompression were performed in the remaining 5 cases (Figure 3). OB of 6 patients was performed during decompression procedure. 4 of these cases underwent only decompression, and 2 underwent stabilization and decompression. In total, 7 patients underwent decompression (3 after PB and 4 after

Table I: Preoperative and Postoperative Modified McCormick Scale Scores

Total no of patients = 22		Postoperative Modified McCormick Scale				
		I	II	III	IV	V
Preoperative Modified McCormick Scale	I	14				
	II	2				
	III		2	2		
	IV	1	1			
	V					

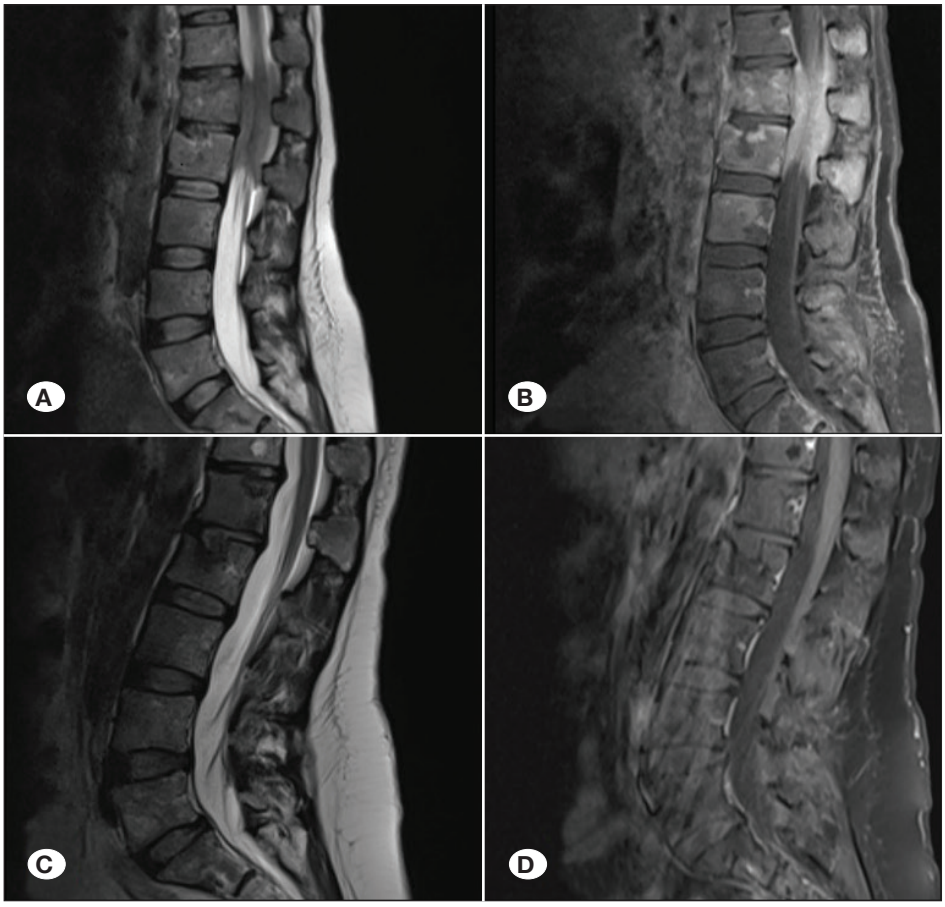

Figure 1: Sagittal T2 weighted **(A)** and post-contrast T1 weighted MR images **(B)** of a case with low back pain showed presence of tumor at the level of L1-2. PB confirmed presence of lymphoma and patient referred to the hematology. Five years later MR images showed no tumor at sagittal T2 weighted **(C)** and post-contrast T1 weighted MR images **(D)**.

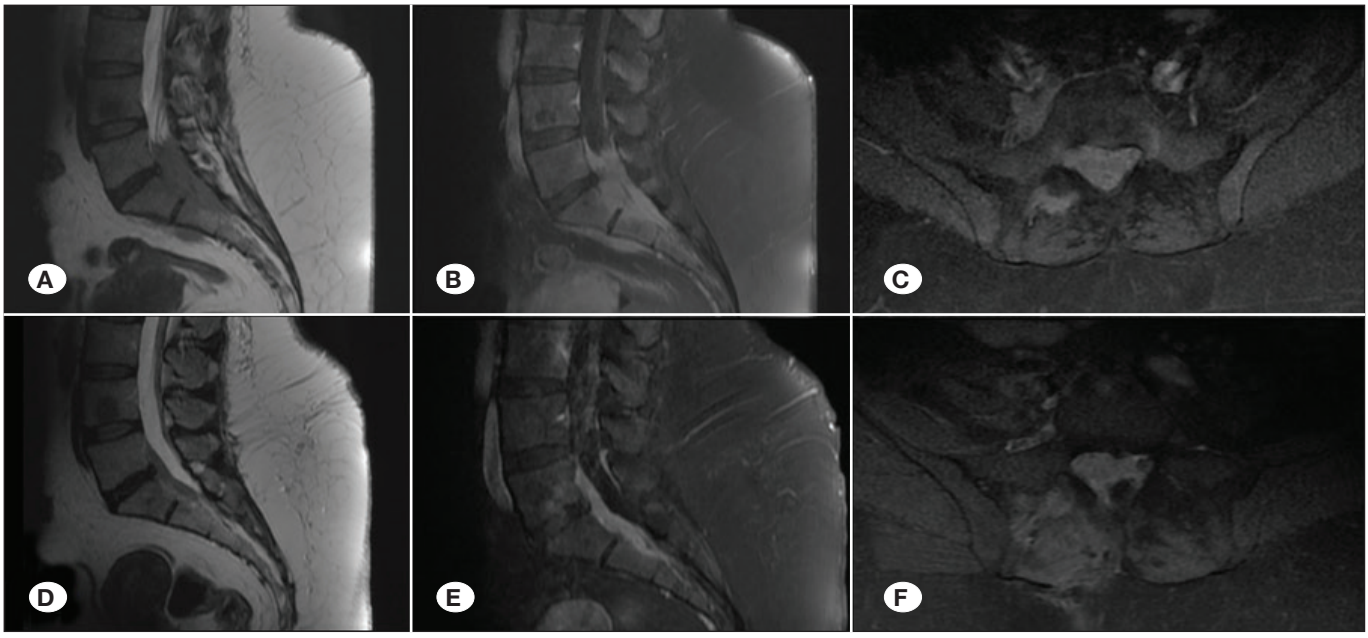

Figure 2: Sagittal T2 weighted **(A)**, sagittal postcontrast T1 weighted **(B)** and axial postcontrast T1 weighted **(C)** MR images of a case with low back pain and presence of tumor compressing the spinal cord at the level of sacrum. Decompression surgery performed after PB. One year later MR images showed decrease in compression at sagittal T2 weighted **(D)**, sagittal post-contrast T1 weighted **(E)** and axial post contrast T1 weighted **(F)** MR images.

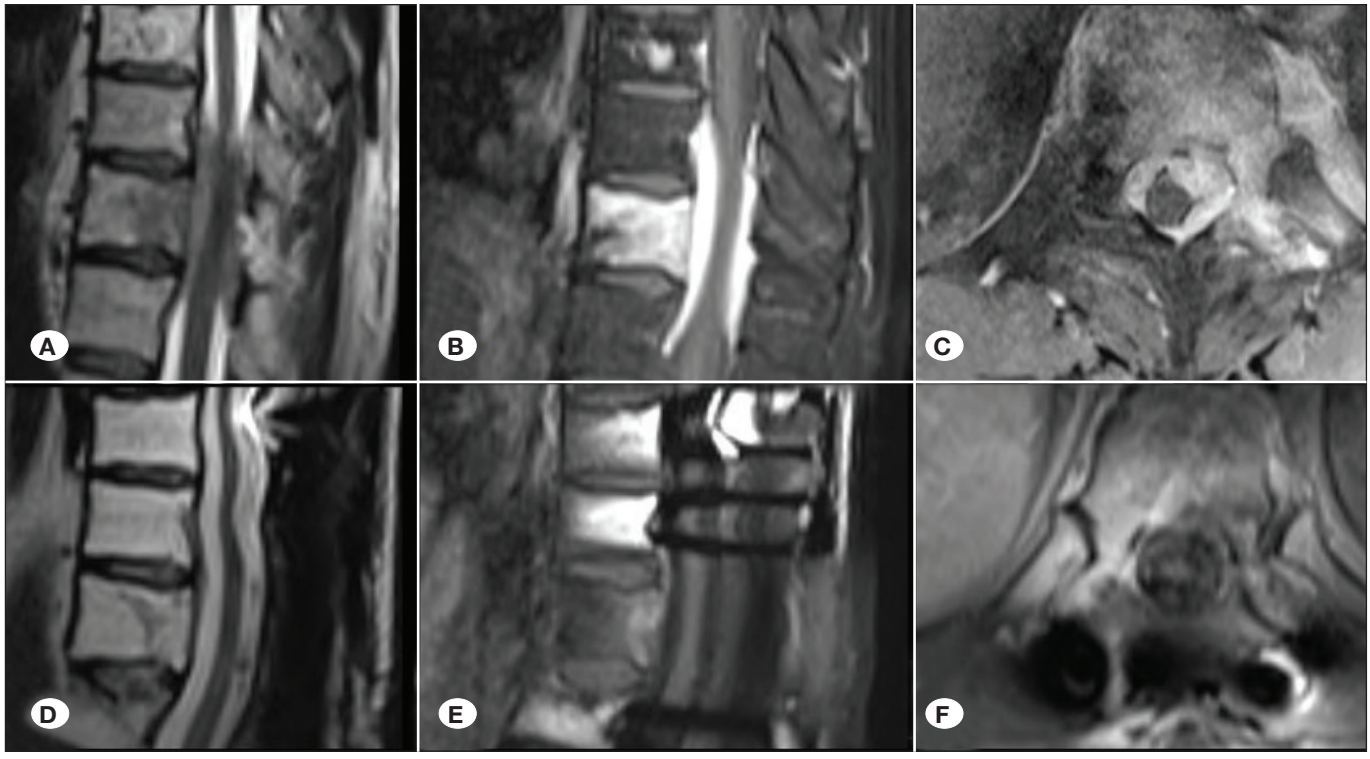

Figure 3: Sagittal T2 weighted **(A)**, sagittal postcontrast T1 weighted **(B)** and axial postcontrast T1 weighted **(C)** MR images of a case with low back pain and progressive paraparesis showed presence of tumor compressing the spinal cord circumferentially at level of T11-12. Open biopsy, decompression and stabilization performed to the patient. The patient improved neurologically and referred to the hematology. One year later, sagittal T2 weighted **(D)**, sagittal post-contrast T1 weighted **(E)** and axial post contrast T1 weighted **(F)** MR images showed no tumor.

OB), and 7 patients underwent stabilization and decompression (5 after PB and 2 after OP).

Neurological improvement was observed in 6 of the 7 patients with acute neurological deficit.

DISCUSSION

This study demonstrated that PB for tissue diagnosis should be the first step in the management of SL with or without minor symptoms. Patients with major symptoms, such as severe pain and neurological deficit, may require OB with decompression and/or stabilization. Although there is a known pathological diagnosis in patients with spinal metastases, the possibility of a second pathological origin should be considered for synchronous or metachronous tumor (27).

Evaluation of spinal instability for non-spine surgeon clinicians is not easy. This study demonstrates the reliability of the SINS in evaluating spinal instability in SLs. Neurologic, oncologic, mechanical, and systemic (NOMS) decision framework is a classification that has been used for more than two decades and examines spinal metastases in detail (14). The SINS has been used for evaluation of M section (mechanical) of NOMS.

According to the World Health Organization, lymphomas can be basically classified as Hodgkin and non-Hodgkin lymphomas (29). SLs, with or without extravertebral extension, should be classified as bone lymphomas. SLs are commonly non-Hodgkin lymphomas, with a predominance of diffuse large B-cell lymphomas (50%-80%) (33). The cases presented here are non-Hodgkin lymphomas.

Most (90%) spinal tumor cases treated surgically in our clinic are metastatic cancers, followed by hematological malignancies such as multiple myeloma, plasmacytoma, and SL. SLs account for 40% (22 cases) of the 55 hematological malignancies involving the spine in our spine tumor series, and epidural extension was detected in 68% of the 22 cases.

The management of SL is still controversial (Table II). Whereas some authors recommend medical treatment, others recommend surgery for decompression and stabilization. Another controversy concerns the assessment of spinal instability, which is relatively difficult for non-spine surgeons.

The effectiveness of chemotherapy and radiotherapy has been reported by many authors (1,23,32,34). As in other neoplastic spinal cord compressions, the presence of progressive acute neurologic deficit and/or spinal instability indicates the need for acute surgery for biopsy, decompression, and stabilization. The importance of early surgery in neurologically involved SL cases was reported by Han et al. in 37 cases and by Chang et al. in 11 cases (3,11). Acute surgery was performed in 7 of the 22 cases in the present series, all except 1 of which improved significantly. Therefore, we agree with the aforementioned

Table II: Level, Localization, SINS, Type of Surgery, and Pathological Results of the Cases

Patient no	Tumor Level	Localization	SINS	1st surgery	2nd surgery	Pathological Diagnosis	Preoperative Neurological Examination
1	T10	PV+ V + E + PS	14	PB	D + I	Anaplastic large T cell lymphoma	McCormick 1; Unable to walk associated with dysesthesia.
2	L2–3	PV+ V + E	13	PB	D + I	High-grade B cell	McCormick 1
3	L5	V + PS	6	PB		High-grade B cell	McCormick 1
4	L5	PV+ V + E + PS	10	PB		B cell	McCormick 1
5	L1	PV+ V + E + PS	10	PB		T cell	McCormick 1
6	T 11–12	V + E + PS	13	PB	D + I	Non-Hodgkin	McCormick 3 (chronic)
7	L4	V + E + PS	14	D + I		Large B cell	McCormick 4
8	L4	V + PS	9	PB		Low-grade B cell	McCormick 1
9	T11-L3	V + PS	9	D		High-grade B cell	McCormick 3
10	L1–2	V + E + PS	10	PB		B cell	McCormick 1
11	C6-T1	V + E	10	D		B-cell prediagnosis	McCormick 4
12	Sacrum	PV+ V + E + PS	9	PB	D	B cell	McCormick 1
13	L5	V	10	PB		B cell	McCormick 1
14	L5	PV+ V + E + PS	15	PB	D + I	B cell	McCormick 1
15	L5	PV+ V + E + PS	14	PB	D + I	Non-Hodgkin	McCormick 1
16	L1	V	8	PB		B cell	McCormick 1
17	L1–4	PV+ V + E + PS	8	D		Diffuse large B cell	McCormick 2
18	T6	PV+ V + E + PS	10	PB	D	Diffuse large B cell	McCormick 1; 1 week after PB McCormick 3
19	L5	V + E + PS	10	PB		B-cell prediagnosis	McCormick 1
20	L5-Sacrum	V + E	8	D		Low-grade B cell	McCormick 2
21	L2–3–4	V + E + PS	13	D + I		Diffuse large B Cell	McCormick 3
22	Sacrum	V + E + PS	9	PB	D	Plasmablastic lymphoma	McCormick 1

***E:** Epidural, **V:** Vertebral, **PV:** Prevertebral, **PS:** Paraspinal, **PB:** Percutaneous biopsy, **D:** Decompression, **I:** Instrumentation.*

authors on the importance and effectiveness of emergency surgery in SL cases with acute neurological deficit. Neurological deficit in such cases is not only due to epidural tumor compression. Spinal instability and kyphotic changes also cause neurological deficit, as well as pain. Therefore, clinicians should evaluate neoplastic spinal instability. SINS system is effective and provides easy assessment of neoplastic spinal instability. It was first introduced for the assessment of instability in spinal metastasis, particularly by non-surgeon clinicians (6). Its reliability and effectiveness in spinal metastasis have been reported by many authors (5,6,8,22). To the best of our knowledge, this is the first study to address the assessment of spinal instability in SL using SINS. Our study demonstrated that patients with scores > 12 have potential or overt neoplastic instability and are candidates for stabilizing surgery.

This study introduces the treatment algorithm we developed for patients with SL (Figure 4). On the basis of the results of 22 SL cases, we recommend PB for patients with or without minor symptoms. PB should be performed to confirm the diagnosis of SL and exclude other primary and metastatic tumors. These cases are referred to the hematology department for hematological treatment, including chemotherapy and radiotherapy. Although some reports on the use of vertebroplasty in the treatment of SLs, no vertebroplasty was performed in the present series (12,30).

The limitations of the study are that it is retrospective and the number of patients is small, however, larger case series are needed in future studies.

Patients with acute progressive deficit should undergo operation as soon as possible, as mentioned previously.

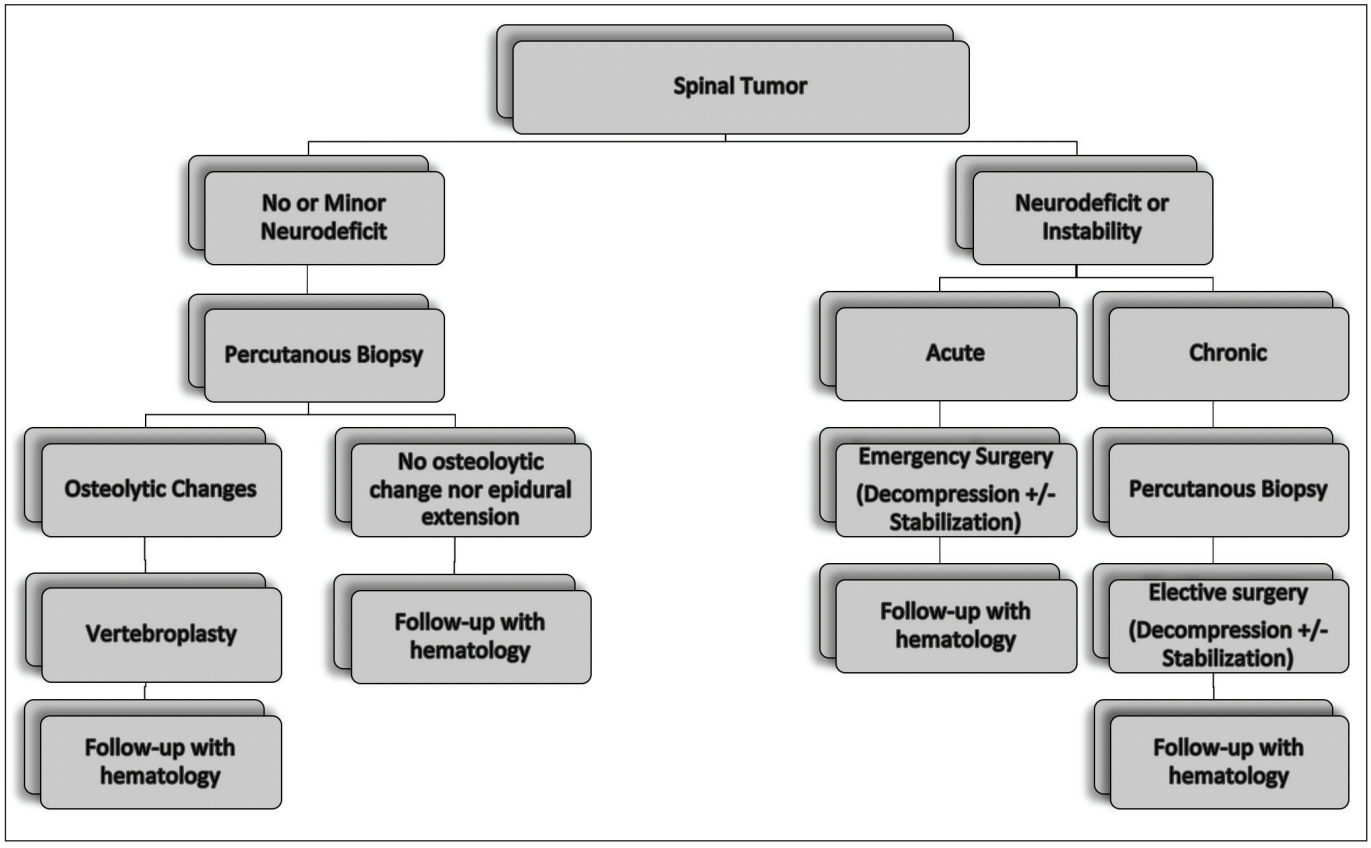

Figure 4: Proposed treatment algorithm for spinal lymphomas.

Patients with spinal instability and chronic deficit should undergo operation for elective decompression and stabilization after PB. This group requires a multidisciplinary approach for determining the appropriate timing of surgery.

CONCLUSION

We conclude that patients with SL who have minor neurological deficit require PB for tissue diagnosis. The presence of chronic neurological deficit and spinal instability may require surgery for elective decompression and stabilization. Patients with acute deficit due to tumor or instability-related compression require emergency decompression and stabilization. The use of SINS system facilitates the assessment of spinal instability by non-surgeon clinicians.

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AUTHORSHIP CONTRIBUTION

Study conception and design: AFR, MUE, SN

Data collection: CS, MUE

Draft manuscript preparation: AFR, MUE

Critical revision of the article: SN

Other (study supervision, fundings, materials, etc...): AHK, MRO

All authors (AFR, MUE, CS, MRO, AHK, SN) reviewed the results and approved the final version of the manuscript.

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