

Original Article

The Outcome of Multidisciplinary Treatment of Spinal Tumors: Institutional Experience of a Tertiary Care Hospital

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ABSTRACT

Objective: Spinal metastatic tumors are mostly extradural. Intradural extramedullary tumors include neurofibromas and meningiomas while intramedullary tumors are mostly astrocytoma and ependymoma. The purpose of this study was to share the experience of managing these patients as a multidisciplinary team (neurosurgeons, general surgeons, thoracic surgeons, ENT surgeons, plastic surgeons, and oncology) in selected cases where the tumors grow into the surrounding structures.

Material and Methods: This study was conducted at the Neurosurgery Department at Jinnah hospital Lahore from January 2021 to September 2022. 50 patients admitted to the Neurosurgery Department from OPD/emergency with the diagnosis of a spinal tumor confirmed on MRI were included in the study. Those patients who were unfit for surgery were not included in the study. Data was analyzed for gender, region, and location of the tumor, histopathological diagnosis, and multidisciplinary team involvement.

Results: Out of 50 patients, 28 (56%) patients were male and 22 (44%) patients were female while ages ranged from 14 to 63 years. Extradural location was the most frequently encountered location, i.e., 50%. Metastatic tumors were the commonest. A multidisciplinary treatment board was conducted in 31 (62%) patients whereas adjuvant treatment was done in 15 (30%) patients.

Conclusion: Multidisciplinary treatment of spinal tumors should be encouraged at tertiary care hospitals and routine multidisciplinary treatment boards conducted before and after surgical excision.

Keywords: Spinal Tumor, Intradural Extramedullary Tumor (IDEM), Intramedullary Tumor, Cavitron Ultrasonic Surgical Aspirator (CUSA), Multidisciplinary treatment (MDT).

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INTRODUCTION

Spinal tumors are considered a unique entity among nervous system tumors. Spinal tumors are classified into three categories according to the location in the spine. Spinal metastatic tumors usually involve posterior spinal elements and vertebral bodies and the spine is the most documented location of metastasis in patients with the oncological disorder.^{1,2} Among spinal tumors, spinal intradural extramedullary tumors are 2/3rd of all primary spinal tumors, Neurofibromas and meningiomas being the most common.^{3,4} 20% of all spinal tumors are intramedullary, ependymoma being the most common.^{5,6,7}

The advancement in Diagnostic Technology has led to early and accurate diagnosis of all kinds of spinal tumors and Magnetic Resonance Imaging is considered gold standard imaging⁸. Worldwide accepted treatment of choice for all kinds of spinal tumors is gross total excision whereas en bloc excision of intradural extramedullary tumors provides favorable outcomes.⁹ A multidisciplinary treatment approach is needed not only for treating intramedullary spinal tumors and spinal metastasis but also for intradural extramedullary tumors which extend and invade silently and enormously into nearby anatomical structures which warrant the involvement of general, vascular and thoracic surgeons.

Multidisciplinary teams are basically for organizing health care services to meet the need of individuals with complex care needs and coordinating them. These teams bring together the skills and expertise of different professionals to assess, plan and manage the patients jointly. Based on the community and networked with primary care, MDTs are expected to work proactively to support individuals' care goals. Through accessing a range of health, social care, and other community services, MDTs focus on keeping people well and independent, delivering

the right care at home or in the community to prevent unnecessary hospital care.

High-definition microscopes and Cavitron Ultrasonic Aspirators (CUSA) are routinely used in most tertiary care hospitals in Pakistan. Although the use of intraoperative neuromonitoring is recommended by various authors its impact on long-term functional outcomes of patients is still undefinable.¹⁰⁻¹² Although the location of the intradural extramedullary is thought to be favorable for its safe resection still the morbidity is high.¹³ Standard management of spinal metastasis is still debatable despite the advancements in diagnostic and surgical techniques.¹⁴⁻¹⁶ The objective of this study was to find the outcome of multidisciplinary treatment of spinal tumors in patients presenting to Jinnah Hospital Lahore.

METHODOLOGY

Study Setting

This study was conducted at the Neurosurgery Department at Allama Iqbal Medical College/ Jinnah Hospital Lahore, from January 2021 to September 2022.

Inclusion Criteria

All patients admitted to the Neurosurgery Department from OPD/emergency with the diagnosis of a spinal tumor confirmed on MRI were included in the study.

Exclusion Criteria

Those patients who were unfit for surgery were excluded from the study.

Data Analysis

Data was analyzed for gender, educational status, region of the tumor, location of the tumor, and use of microscope and CUSA. Histopathological diagnosis, multidisciplinary team involvement,

and adjuvant therapy and follow-up were also documented on predesigned proforma. The neurological status of patients was documented pre-op, post-op at the time of discharge, and later on, at one month and 6months follow-up. On the Modified McCormick scale, a favorable outcome was labeled as an improvement of 1 grade, unfavorable for deterioration of grade 1 or more and steady outcome for no change in grade. Symptoms and signs were categorized according to the Modified McCormick scale. All patients had pre-op and post-op neuro rehab programs according to our ward Neurorehab. specialist's advice.

RESULTS

Gender & Age Distribution

Out of 50 patients included in the study, 28 (56%) were male and 22 (44%) were female. Age of the patients included in the study ranged from 14 to 63 years.

Region of the Spine Involved and the Location of the Tumor

The commonest region of the spinal column involved was thoracic (46%) followed by cervical (28%) (Table 1) while the most common location of the tumor was extradural (50%) (Table 2).

Table 1: Regional distribution of spinal tumors

Region	Frequency	Percentage
Cervical	14	28%
Thoracic	23	46%
Lumbar	10	20%
Sacral	03	06%
Total	50	100%

Table 2: Compartmental location of spinal tumors.

Location of Tumor	Frequency	Percent (%)
Intramedullary	9	18
Intradural extramedullary	16	32

Extradural	25	50
Total	50	100

Histological Diagnosis

There was a variety of histopathological diagnoses in the studied patients and among them, the metastatic spinal disease was the most common histopathological diagnosis (Table 3).

Table 3: Histopathological diagnosis of study patients with spinal tumors.

Histopathological diagnosis	Frequency	%age
Metastatic	12	24
Astrocytoma	6	12
Meningioma	5	10
Neurofibroma	3	6
Ependymoma	3	6
Chordoma	3	6
Plasma cell neoplasm	3	6
Large B cell lymphoma	3	6
Chondrosarcoma	2	4
Synovial sarcoma of the spine	1	2
Total	50	100

Management

Cavitron Ultrasonic Aspirator (CUSA) was used in 60% of patients whereas a microscope was used in 80% of patients. A multidisciplinary treatment board (MDT) was conducted in 31 (62%) patients (Table 4).

Table 4: No. of patients who underwent MDT.

MDT	No. of Patients (n)	Percent (%)
Yes	31	62%
No	19	38%
Total	50	100%

Assessment of neurological status

The neurological status of patients was assessed according to the Modified McCormick scale pre-operatively, and post-operatively at one month and 6 months (Table 5). 34 (68%) patients presented for follow-up.

Table 5: Pre-op and post-op neurological status of patients included in the study.

Modified McCormick Scale	Pre-op Neurological Status (n)	Postop-Neurological Status at 1 Month (n)	Post-op Neurological Status at 6 Months (n)	Percent (%)
Grade 1	7	13	14	41
Grade 2	4	3	5	15
Grade 3	8	5	5	15
Grade 4	7	8	7	21
Grade 5	8	5	3	8
Total	34	34	34	100

Outcome

It was found that 56% of patients had favorable outcomes while 36% of patients remained steady (Table 6).

It was observed that Meningioma and schwannoma had more favorable outcomes as compared with other pathologies (Table 7).

Table 6: Overall outcome of study patients.

Outcome	Frequency (n)	Percent (%)
Favorable	19	56
Steady	12	36
Unfavorable	3	8
Total	34	100

Table 7: Outcome of patients concerning histological diagnosis.

Histopathological Diagnosis	Outcome			Total
	Favorable	Steady	Unfavorable	
Schwannoma	3	1	0	4
Paraganglioma	1	0	0	1
Ganglioneuroma	0	1	0	1
Metastatic tumor	3	6	1	10
Neurofibroma	2	0	0	2
Astrocytoma	1	1	2	4
Plasma cell neoplasm	1	0	0	1
Meningioma	5	0	0	5
Ependymoma	1	1	0	2
Chordoma	0	1	0	1
Large B cell lymphoma	0	1	0	1
Synovial sarcoma	1	0	0	1
Chondrosarcoma	1	0	0	1
Total	19	12	3	34

DISCUSSION

Spinal tumors pose a challenge for operating neurosurgeons when compared to brain tumors irrespective of their location. The narrow diameter of the spinal canal and the presence of spinal tumors in the canal along with the spinal cord warrant experienced neurosurgical skills to avoid postoperative neurological deficits and ensure a speedy recovery. The advancement in modern

imaging and neurosurgical skills is leading to a favorable outcome for spinal tumors, especially for intramedullary spinal cord tumors which were previously considered to be poor prognostic tumors.^{17,18} Our sample size is comparable with the available studies whereas median follow-up is less¹⁹ which might be due to the low literacy rate and lack of educational motivation of patients and their attendants regarding disease and its

outcome.

Intramedullary spinal cord tumors are known for postoperative neurological deterioration, as Matsuyama et al documented 31.5% neurological deterioration post-operatively whereas in our study the postoperative deterioration was observed in 33.3% of patients with intramedullary tumors which is comparable with Matsuyama et al.¹⁹

The majority of intradural extramedullary tumors are meningioma and neurofibroma. Meningiomas are more common in the thoracic region and female gender. Most of the meningiomas in our study were WHO grade 1 and all had a favorable outcome. As neurofibromas arise from the nerve root, they extend along the neural foramina, and in most cases, they already invade or displace critical nearby neurovascular structures of the neck, thorax, or abdomen at diagnosis which warrants the involvement of a multidisciplinary team.^{20,21}

Despite the advancements in the field of medical and radiation oncology, the decision regarding effective adjuvant treatment in terms of radiation and chemotherapy is still debatable and a few available studies suggest a limited role of adjuvant treatment for unresectable tumors.^{21,22} 75% of intramedullary tumors in our study underwent adjuvant therapy under the care of the oncology department of Jinnah hospital Lahore (ependymoma and astrocytoma) with consideration of gross total resection or subtotal resection.²²

The incidence of spinal metastasis has increased after the utilization of modern neuroimaging.²² The overall prognosis of spinal metastasis is not favorable (table:7) especially due to lack of education, patients usually present with advanced disease with grade IV or V Modified McCormick scale of spinal symptomology. In our study, the overall outcome (with limited follow-up) was favorable in 56% of patients whereas it was steady in 36.6% and unfavorable in 8%. It

needs further follow-up with larger data to infer results.

We introduced the concept of multidisciplinary treatment for all kinds of spinal tumors that were presented to the Neurosurgery department. We hold regular multidisciplinary meetings and involve the General Surgeon, Thoracic Surgeon, Plastic surgeon, ENT surgeon, Histopathologist, Oncologist, and rehabilitation specialist in the preoperative planning of the patient. One of our patients who was diagnosed with a case of Ganglioneuroma (Neurofibromatosis) had a Plastic surgeon intervention for his skin lump followed by excision of a spinal tumor in the same sitting (figure 1, 2). Another patient who was diagnosed with a case of cervical neurofibroma with foraminal extension into the neck displacing major neck vessels was operated on in a combined venture with an ENT surgeon with vast experience in head and neck surgery while that thoracic component of dorsal neurofibroma was excised by our fellow Thoracic surgeon in same anesthesia after excision of the spinal component. All patients who underwent multidisciplinary treatment had a favorable outcome and resulting in achieving better surgical satisfaction and enhanced patient safety. Those patients who were planned for adjuvant therapy in the multidisciplinary meeting were



Figure 1 (Left): Pre-operative picture.

Figure 2 (Right): Post-operative picture (pictures with permission).

referred to a fellow oncologist who gave ongoing treatment in terms of chemotherapy or radiotherapy.

Synovial sarcoma (table 7) of the spine is a rare entity and only a few case reports have been reported to date. We operated on a young female who presented with spastic quadriparesis and was diagnosed as a case of intradural extramedullary tumor (Figures 3, and 4). Her histopathology revealed synovial sarcoma as the final diagnosis. She made a good recovery and was followed by the oncologist. Plasmacytoma, another rare entity, was found in two of our cases and had a good recovery.

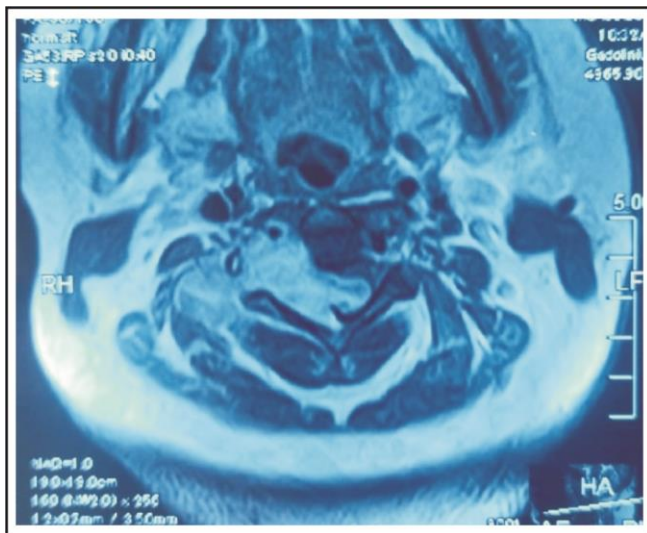


Figure 3: MRI of the patient with synovial sarcoma (image used with permission).

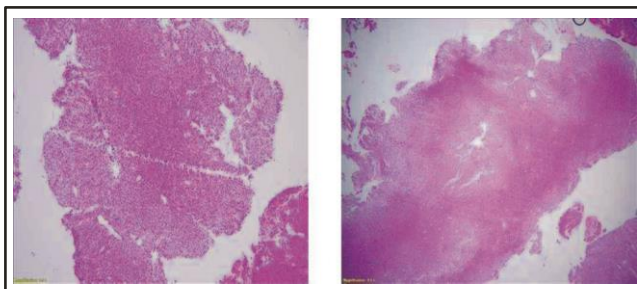


Figure 4: Malignant spindle cell neoplasm favoring monophasic synovial sarcoma (images used with permission).

The use of modern-day neurosurgical gadgets led to better patient safety. The neurosurgery department of Jinnah hospital Lahore has state-of-the-art modular operation rooms equipped with the latest Microscope, CUSA, and high-speed drill which are essential for safe and efficacious spinal tumor surgery. Although the use of intraoperative monitoring is advocated as an integral part of spinal tumor surgery.^{21,22} Enam et al documented in their results of intramedullary tumor excision that intraoperative monitoring did not prove efficacious for their patients. We don't have intraoperative monitoring at our institution but the results of our intramedullary spinal tumor outcome are comparable with both studies, i.e., post-op deterioration. Although the sample size of intramedullary tumors is not that significant in a resource-constrained situation, spinal tumors can be operated on without intraoperative monitoring and favorable results are anticipated. We used Microscope and CUSA in our 80% and 60% of cases respectively and achieved a favorable outcome.

Intradural extramedullary tumors are considered good tumors due to their extramedullary location. All patients with meningioma and neurofibroma had a favorable outcome which showed that their location and prompt treatment can result in a favorable outcome as compared to intramedullary tumors.^{23,24}

Chordomas arise from the remnants of the notochord and can arise along the whole spinal axis, predominant at the sacrum and clivus and their aggressive local infiltration makes them mostly unresectable. 3 cases in our study had steady outcomes and we achieved gross total clearance of the spinal canal patients who had adjuvant treatment which also has a limited role.

Diffuse large B cell lymphoma is the prevalent type of spinal lymphoma. Our patients remained at the steady outcome after follow up and they had adjuvant chemotherapy treatment under the

care of the oncology department but remained at steady outcome according to our scale.²³⁻²⁴

Plasma cell neoplasm had extensive workup to rule out multiple myeloma by our oncology colleagues and they remained under treatment of the oncology department for their spinal symptoms, they had a favorable outcome at routine follow-up. It indicates that histopathological diagnosis has a significant impact on the outcome of patients.²⁴

Limitations

The sample size of our study is small in all kinds of spinal tumors and relatively shorter follow-ups. We recommend multicenter studies to infer results with statistical significance and randomized trials should be conducted for spinal tumors.

CONCLUSION

Multidisciplinary treatment of spinal tumors should be encouraged at tertiary care hospitals and routine multidisciplinary treatment boards conducted before surgical excision and postoperatively, whereas the judicious use of micro neurosurgical gadgets can improve patients' outcomes. Neurorehabilitation specialist is an integral part of the Neurospinal team.

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Additional Information

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Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Usman Ahmad Kamboh	1. Study design and methodology
2.	Adeel Rauf, & Sana Jamal	2. Paper writing
3.	Aiqa Gulshan	3. Data collection and calculations
4.	Mahwish Manzoor	4. Analysis of data and interpretation of results
5.	Mehreen Mehboob, Sanaullah	5. Literature review and referencing
6.	Manzoor Ahmad	6. Editing and quality insurer