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Original Research Article

Clinical Analysis and Outcome of Spinal Tumours

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Abstract: Spinal tumors comprise a minority of central nervous system tumors, Majority of cases presenting with significant neurological deficits. We analysed 60 cases of spinal tumors and their neurological outcome. The study was conducted in prospective and retrospective manner. It included 60 cases of spinal tumors managed in Gandhi hospital from May 2011 to April 2017. We analyzed age, sex, tumor location and its vertebral level, neurological status at the time of presentation, histology, and neurological outcome. We have examined 60 cases of spinal tumours presenting with neurological deficits. Among 60 cases, primary tumours were 57 (benign 51 and malignant tumors 6), metastatic tumors were 3. IDEM were 40, Intramedullary were 11, extradural intraspinal tumors were 9. Histological examination of these tumors showed Nerve sheath tumors in 28(Schwannomas 20, Neurofibromas 8), Meningiomas in 11, lipomas in 2, astrocytomas in 4, Oligodendrogliomas in 3, Ependymomas in 3, NHL in 3, Ewing's sarcoma in 1, Plasmacytoma in 1, Chordoma in 1, and metastatic tumors in 3 cases. Primary sites for metastatic tumors were Lung, Thyroid, and Prostate each in one case. Motor weakness, Pain, Bowel and bladder dysfunction were the most common presenting symptoms. Our study revealed that primary tumors were more in number than metastatic tumors, with a higher proportion of nerve sheath tumors. Rare histological variants like PNET tumors, plasma cell tumors should also to be considered in the differential diagnosis of spinal tumors. We observed good neurological outcome in benign tumors and poor neurological outcome in malignant tumors postoperatively. The poor neurological outcome in malignant tumors was attributed due to rapid growth of the tumor and delayed presentation to tertiary care center. Preoperative neurological status and rate of progression is the most important factor related to outcome in spinal tumors.
Keywords: spinal tumors, Schwannomas, Neurofibromas

INTRODUCTION

Primary tumors of spine, accounts for approximately 5-15% of all CNS tumors, most of them being benign. The incidence and prevalence of spinal tumors varies among different countries and population. This study is intended to augment the current literature by analyzing the data of spinal tumors, with relation to their functional outcome.

Surgery is the mainstay of the management of spinal tumors. In most of the spinal tumours outcome is excellent. Poor surgical outcomes and high recurrence rates in malignant tumors were initially secondary to difficulty in applying evidence based appendicular oncologic principles to these tumors. Delay in presentation and diagnosis adds to unfavourable neurological outcome in these patients. However, surgical management of these tumors evolved considerably over the past few decades, owing to improvement in imaging, technical and surgical expertise. Despite this, the inherent anatomy of the spine and its surrounding structures, coupled with the goal of maintaining stability and improving neurological outcome, resulted in surgery being demanding even in most experienced hands.

The primary aim of this study is to evaluate surgical outcomes of spinal tumors operated in our institution. Secondarily the clinical data was correlated with demographics, symptoms, location of tumors and its vertebral level and histological type, which could be helpful in decision-making regarding management and rehabilitation.

MATERIALS AND METHODS

This study includes 60 cases of spinal tumors operated in the department of Neurosurgery, Gandhi Hospital, Secunderabad, Telangana, between May 2011 and April 2017. Retrospectively from May 2011 to September 2015 and Prospectively from October 2015 to May 2017. Each patient's medical history, clinical findings, tumor characteristics were recorded. All patients were subjected to contrast enhanced MRI of whole spine preoperatively, and provisional diagnosis was made with clinical correlation. Patient's age, sex, neurological status at the time of presentation, duration of symptoms, tumor characteristics, its anatomical level, histological diagnosis, and surgical outcome were recorded and analysed..

Primary spinal tumors were defined using the International Classification of Diseases for Oncology (ICD-O) codes (primary sites): C70.1 (spinal meninges), C72.0 (spinal cord), and C72.1 (cauda equina) [1].

The tumor histology and classification is consistent with World Health Organization categories for CNS neoplasms [2]. The tumors were classified into three groups based on the location of the tumor in relation to the thecal sac: *Intradural intramedullary*, *intradural extramedullary*, and *extradural.* And subcategorized based on their vertebral location in the spinal canal: *Cervical*, *Thoracic*, *Lumbar*, *Sacral*, and *Filum terminale*.

Patient's outcome was measured at 1 month and at 6 months postoperatively, and scored according to the modified criteria of Odom, *et al* (Table 1) [3].

Table 1

Excellent	Complete relief of pain and other symptoms, return to full activity
Good	Partial relief of pain and other symptoms, return to full activity
Fair	Improvement with persistent limitation of activities.
Poor	No improvement or further deterioration.

Note: other symptoms- paresthesias, paresis, sensory loss.

Exclusion criteria: Patients with infective pathologies, vascular tumors, and patients with < 1 month of follow up postoperatively or patients who died within 1 month postoperatively.

RESULTS

Among 60 cases, primary tumors were 57 (benign were 51 and malignant tumors were 6), metastatic tumors were 3. Among all patients men were 35, women were 25. Male predominance was noted in all tumors except for Meningiomas. IDEM were 40, intramedullary were 11, extradural intraspinal tumors were 9 (Table 2).

Histological examination of these tumors showed Nerve sheath tumors in 28 (Schwannomas 20, Neurofibromas 8), meningiomas in 11, lipomas in 2, Gliomas in 7 (Astrocytomas 4, Oligodendrogliomas 3), ependymomas in 3 (myxopapillary), NHL in 3, Ewing's sarcoma in 1, plasmacytoma in 1, chordoma in 1 and metastatic tumors in 3 cases. The primary sites for metastatic tumors were, lung, thyroid, prostate (Table 2).

Thoracic spine was the most common location (primary 31, metastatic 3), followed by lumbosacral region (16 cases) and Cervical region (10 cases). All Metastatic tumors showed predilection for thoracic spine (Table 3).

Most common presentation was significant motor weakness, out of 60 cases 55 patients presented with motor weakness. (in 55 cases, 5 cases presented with quadriparesis, 34 cases with paraparesis, 12 with flaccid paraplegia, 2 cases with lower limb spasticity, and 2 cases with foot drop). Both bowel and bladder

dysfunction was seen in 9 cases with only bladder incontinence in 5, and only constipation in 3 cases. 41 patients presented with pain (Table 4).

Outcome was assessed by using Odom's criteria; 28 patients showed excellent outcome, 11 patients had good outcome, 10 patients had fair outcome, and 11 had poor outcome (out of 11 cases 2 were died due to unrelated complications) (Table 6).

Table 2: Histological classification, incidence and sex distribution of spinal tumors in this study.

Tumor histological type	n	%	No. of men	No. of women
Schwannoma	20	33%	13	07
Meningioma	11	18%	07	04
Neurofibroma	08	13%	05	03
Lipoma	02	3%	01	01
Astrocytoma	04	6%	01	03
Oligodendroglioma	03	5%	02	01
Ependymoma	03	5%	01	02
NHL	03	5%	03	00
Ewing's sarcoma	01	1.6%	01	00
Plasmacytoma	01	1.6%	01	00
Chordoma	01	1.6%	01	00
Metastatic (Papillary adenocarcinoma)	03	5%	02	01

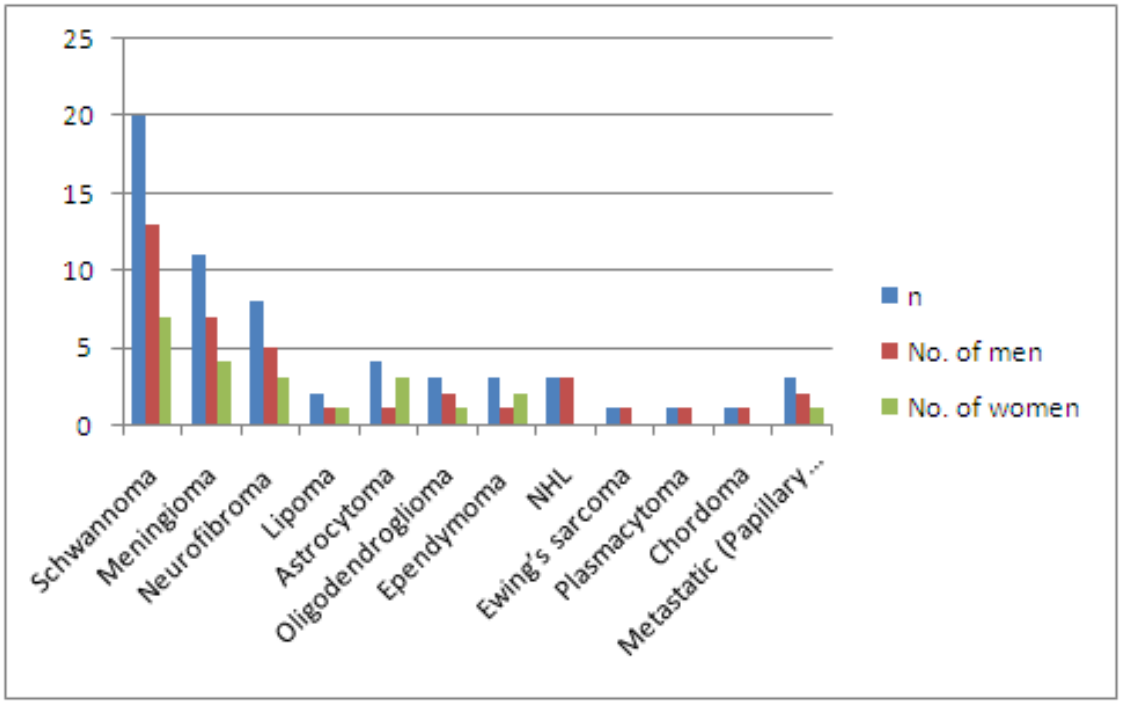

Fig-1: Histological classification, incidence and sex distribution of spinal tumors in this study

Table 3: Location of spinal tumors.

S. No	Type of Tumour	n	Cervical	Thoracic	Lumbosacral
1	Schwannoma	20	05	10	05
2	Meningioma	11	00	09	02
3	Neurofibroma	08	01	02	05
4	Lipoma	02	00	02	00
5	Astrocytoma	04	01	03	00
6	Oligodendroglioma	03	01	02	00
7	Ependymoma	03	00	01	02
8	NHL	03	01	02	00
9	Ewing's sarcoma	01	00	00	01
10	Plasmacytoma	01	00	01	00
11	Chordoma	01	00	00	01
12	Papillary adenocarcinoma (Metastatic)	03	00	03	00

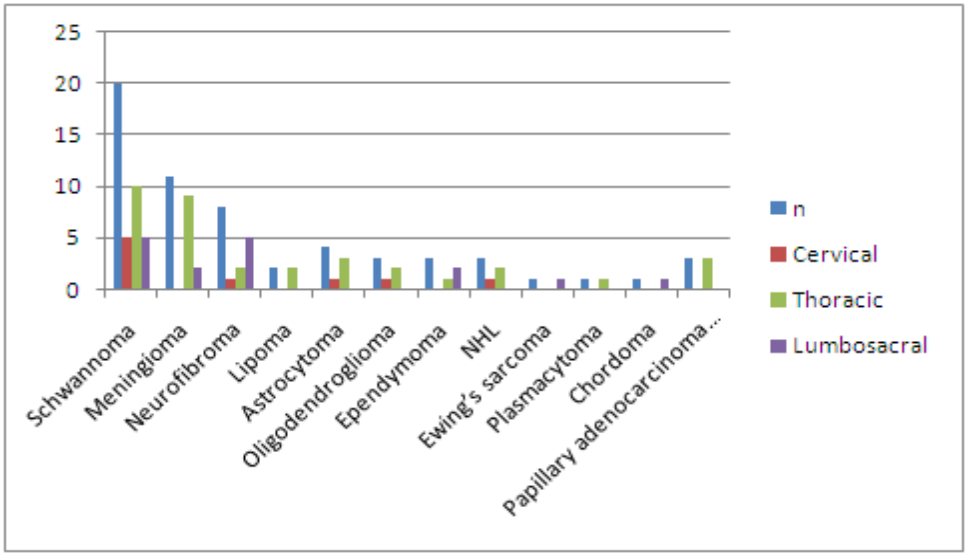

Fig-2: Location of spinal tumors

Table 3: Clinical presentation

Tumor type	n	Motor weakness	Sphincter dysfunction	Pain	Radicular pain	Sensory disturbance
Schwannoma	20	17	05	16	09	07
Meningioma	11	11	02	07	04	06
Neurofibroma	08	07	01	06	04	02
Lipoma	02	02	00	00	00	01
Astrocytoma	04	04	02	02	02	02
Oligodendroglioma	03	03	02	02	01	02
Ependymoma	03	03	01	02	01	01
NHL	03	03	01	02	02	03
Ewing's sarcoma	01	01	00	01	01	00
Plasmacytoma	01	01	01	00	00	01
Chordoma	01	00	00	01	01	00
Papillaryadenocarcinoma (Metastatic)	03	03	02	02	01	01

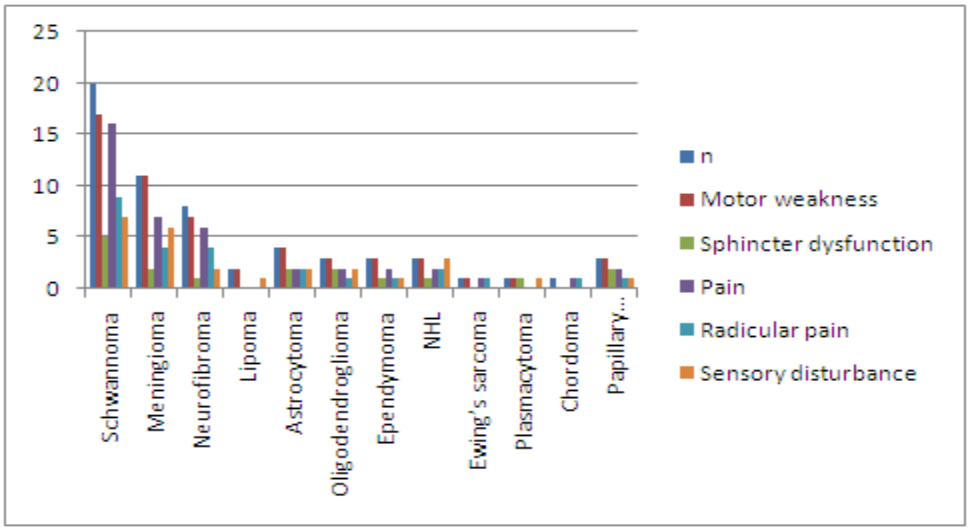

Fig-3: Clinical presentation

Table 4: Tumor incidence by age (years) group

S. No	Type of Tumour	n	< 40	40-60	> 60
1	Schwannoma	20	09	10	01
2	Meningioma	11	03	08	00
3	Neurofibroma	08	02	04	02
4	Lipoma	02	01	01	00
5	Astrocytoma	04	04 (<20)	00	00
6	Oligodendroglioma	03	01	02	00
7	Ependymoma	03	01	01	01
8	NHL	03	01	02	00
9	Ewing's sarcoma	01	01	00	00
10	Plasmacytoma	01	00	00	01
11	Chordoma	01	00	01	00
12	Papillary carcinoma (Metastatic)	03	00	01	02

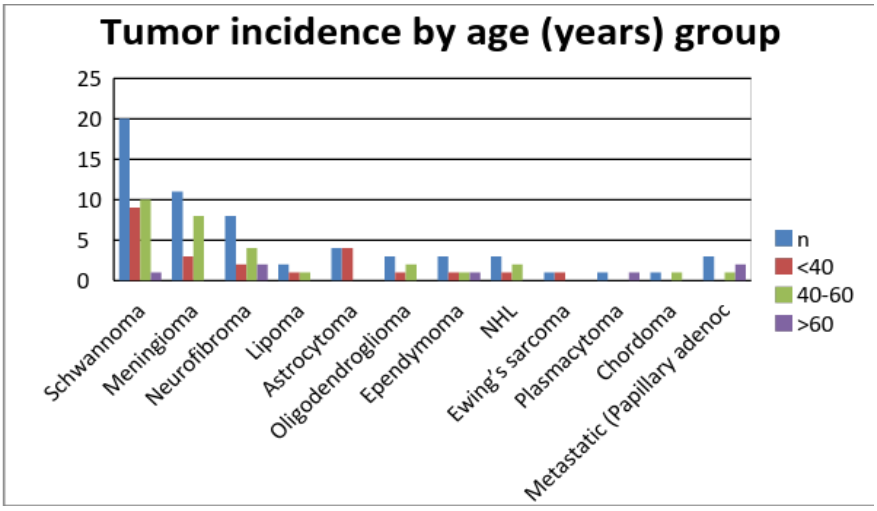

Fig-4: Tumor incidence by age (years) group

Table 6: Neurological outcome- Odom's criteria

S.No	Type of Tumour	n	Excellent	Good	Fair	Poor
1	Schwannoma	20	13	05	02	00
2	Meningioma	11	05	01	03	02
3	Neurofibroma	08	05	03	00	00
4	Lipoma	02	01	01	00	00
5	Astrocytoma	04	01	00	01	02
6	Oligodendroglioma	03	00	00	00	03
7	Ependymoma	03	02	00	01	00
8	NHL	03	00	01	01	01
9	Ewing's sarcoma	01	01	00	00	00
10	Plasmacytoma	01	00	00	00	01
11	Chordoma	01	01	00	00	00
12	Papillary adenocarcinoma	03	00	00	01	02

DISCUSSION

Spinal tumors accounts for 5-15% of CNS neoplasms, most of them being benign. Of these intradural extramedullary (IDEM) tumors account for two-third of cases. These tumors were classified into three groups based on the location of the tumor in relation to the thecal sac: *Intradural intramedullary*, *intradural extramedullary* (IDEM) and *extradural.*

Most common intradural spinal tumors are Meningiomas, followed by intramedullary ependymoma or Nerve Sheath Tumors (Schwannoma and Neurofibroma) [4, 5]. Whereas in our study nerve sheath tumors [schwannomas 20 (33%) and neurofibromas 8 (13%)] were more in number than meningiomas [11 (18%) cases] (Table 2). Spinal meningiomas accounts for approximately 12% of all meningiomas, with higher incidence in women, and peak incidence in sixth to eighth decade of life [5, 6]. NF2 or prior radiation exposure are the predisposing factors in younger patients with spinal meningiomas.

Schwannomas are far more common among nerve sheath tumors, estimated to be 0.3 to 0.4 per 1,00,000 population, in fourth and fifth decade, with equal incidence in men and women [7]. Schwannomas occur sporadically, but rarely seen in conjunction with syndromes like NF2, schwannomatosis, or Carney's complex [8]. MRI is the imaging modality of choice in all IDEM tumors, as it visualises all three planes and delineates the relationship of pathology to the spinal cord and nerve roots. These lesions enhance with contrast, and meningiomas typically show a dural tail.

For intradural nerve sheath tumors, standard posterior midline surgical approach is opted. For small tumors complete resection is aimed, and it is important to identify afferent and efferent nerve roots before resection. Uninvolved nerve root should be preserved in cervical and lumbosacral region, whereas dorsal roots can be sacrificed if necessary without deficit. For large tumors, internal decompression is sufficient. For resection of dumbbell tumors and extradural nerve sheath tumors, additional bone removal is necessary. In spinal meningiomas, dural resection and reconstruction is specially considered. All benign tumours in our study, were resected completely (fig-6). In our study excellent to good functional outcome was observed in benign tumours, especially in IDEM tumours (Table 6).

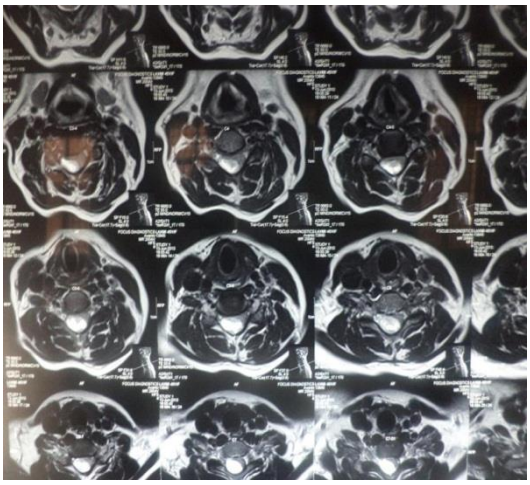

Fig-5: MRI spine in Schwannoma

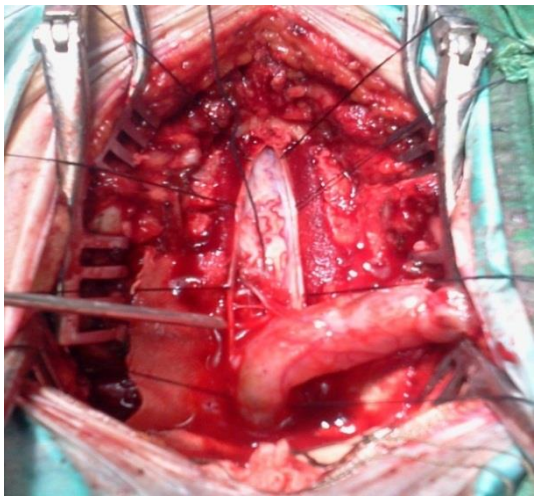

Fig-6: Intraop showing clear tumor margin, cord vascularity is preserved

Primary intramedullary tumors accounts for 5 to 10 % of spinal tumors in adults, and around 35% in children [9]. Of these, Glial tumors accounts for 80% and include astrocytomas, ependymomas, and less frequently gangliogliomas, oligodendrogliomas and subependymomas.

Ependymomas are the most common glial tumors in adults, followed by astrocytomas, whereas in children astrocytomas are the most frequent. Most of the spinal cord gliomas are low grade (WHO grade 1&2), 10% being malignant (WHO grades 3&4) [10]. Ependymomas are solid and fleshy tumors with minimal invasion, and are amenable for en bloc resection. In our study excellent functional outcome was observed in ependymomas, because of en bloc resection (fig-4, Table 6).

Spinal cord Astrocytomas account for 30-35% of all intramedullary tumours in adults, and 90% in children less than 10 years of age [10]. MR imaging in intramedullary astrocytomas typically appear as asymmetrical, and shows fusiform expansion of the cord. Pilocytic astrocytomas are often clearly delineated, and malignant lesions may be infiltrative with poorly defined margins [11]. Surgical management of malignant astrocytoma remains controversial, ranging from biopsy alone to partial or gross total resection. Unfortunately, total resection is not possible because of the tumor-spinal cord interface is indistinct.

Postoperatively radiotherapy is advised, due to high rates of local and distant recurrences [12, 13]. Role of chemotherapy is limited in malignant astrocytomas. Despite aggressive multimodality treatment, the prognosis and outcome remains very poor.

Intramedullary oligodendroglioma is extremely rare, and gross total resection is not possible because of infiltration of tumor into the surrounding spinal cord parenchyma [14]. Subtotal resection followed by adjuvant radiotherapy is best possible option in these tumors. Adjuvant temozolomide may be beneficial in patients whose tumors exhibit deletion of chromosome 1p/19q [15]. In our study poor outcome was observed in astrocytomas and oligodendrogliomas (Table 6).

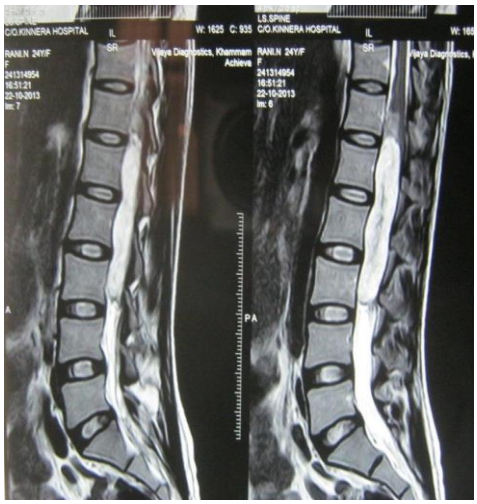

Fig-3: MRI of Ependymoma

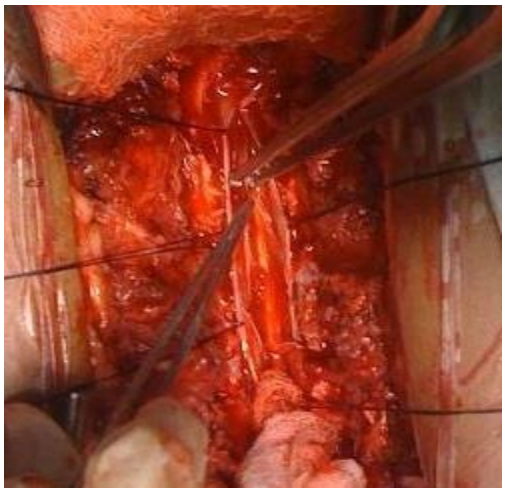

Fig-4: intraop image of ependymoma.

Primary extradural tumors are very rare, they are usually benign, but progressive and locally invasive. Malignant primary extradural tumors are even more rare, and include chordoma, chondrosarcoma, osteosarcoma, Ewing's sarcoma and plasmacytoma. In these patients MRI is the gold standard. In addition CT scan may show bony destruction, sclerosis, and remodeling [16]. Wide initial en bloc resection, followed by reconstruction and stabilisation is recommended in these cases. Adjuvant radiotherapy is often used, and role of chemotherapy is minimal. In our

study we observed good to fair functional outcome in these patients.

Metastatic lesions of the spine are the most dreaded complications of systemic neoplastic diseases in elderly with significant morbidity and mortality. These lesions show predilection towards thoracic spine (60-70%), followed by Lumbosacral spine (20-30%), and cervical spine (10%) [17, 18]. Vertebral body (80%) is involved more often than the posterior elements [19]. Prostate, breast, kidney, lung and thyroid are the most common primaries [17]. In our study metastatic tumors were more aggressive, and primaries were lung, thyroid and prostate. The goal of treatment in these patients is to improve quality of life by relieving pain and preserving neurological functions. Palliative neurological decompression followed by adjuvant radiotherapy is required in these patients. In our study these patients presented with very poor neurological status preoperatively, and showed poor functional outcome postoperatively (Table 6).

Majority of spinal tumors present with pain, sensory disturbance, motor weakness and sphincter dysfunction. However, some tumors are identified incidentally, and may present with nonspecific symptoms, and were wrongly diagnosed as degenerative disc disease or intervertebral disc herniation. Therefore MRI, especially contrast enhanced plays a crucial role in establishing the definitive diagnosis. In suspicious cases once the diagnosis of tumor is made with certainty, surgical treatment is the best option.

The goal of surgery is complete removal of tumor for IDEM and extradural tumors, and debulking of intramedullary tumors, while preserving the preoperative neurological status. Majority of patients improved neurologically after resection, few had residual sphincter dysfunction, which was present even preoperatively.

Overall, in this study we observed that the neurological improvement depends on tumor histology, the duration and severity of symptoms preoperatively.

CONCLUSION

Complete surgical excision is the main goal for IDEM and extradural tumors to achieve long term tumor control and cure. Excellent to good functional outcome was observed in benign tumors due to complete resection. Whereas in malignant and metastatic tumors, the poor outcome is mainly due to delayed presentation, rapid progression with tumor invasion, and poor neurological status at the time of presentation. A high level of suspicion, and aggressive management may improve functional outcome in these tumors.

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Conflicts of Interest- Nil

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