

Management of Benign Spinal Cord Tumours: A Prospective Study

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ABSTRACT

Introduction: Spinal cord tumors account for about 15% of central nervous system neoplasm. According to their location, spinal tumors are conveniently classified as extradural and intradural, although some can be both inside and outside the dura. Intradural tumors can be intramedullary (intramedullary spinal cord tumor [IMSCT]) or extramedullary (intradural extramedullary [IDEM]).

Methods and Materials: This study was designed as a prospective cross-sectional observational study of a cohort of 71 patients who underwent surgery in the Tertiary Care Hospital, Ahmedabad, from August 2013 to December 2016 for —Benign spinal cord tumors.

Results: Our study shows incidence of benign spinal tumor was maximum in age group of 21 to 30 year. Patients presented with weakness as the most common complain followed by walking difficulty. Most common location of tumor is in dorsal region. Most common tumors are nerve sheath tumors. Most common location of tumor is in Intradural Extramedullary (IDEM) and then Intradural Intramedullary (IDIM).

Conclusion: Tumour type and biology plays an important role, with benign IDEM tumours displaying the best prognosis for long term survival after complete excision. The pretreatment

neurological status of the patient is important in determining outcome after treatment. Delayed presentation is the main reason for poor preoperative neurologic status, leading to poor outcome in the management of spinal tumors. A high level of suspicion and acknowledging the classical symptoms of cord compression are the most important factors in shortening the time to diagnosis of spinal tumors.

Keywords: Spinal Cord Tumours, Intramedullary, Extramedullary, Intradural.

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INTRODUCTION

Spinal cord tumors account for about 15% of central nervous system neoplasm. There are few organs in the human body in which neoplastic disease occurs in a more benign form, and the results of surgery are more brilliant than in the spinal cord and its membranes. At the same time, there is no organ in which total restoration of function following the removal of the neoplasm is so completely dependent on an early diagnosis.¹

Benign and malignant neoplasms can arise from intraspinal structures such as meninges, spinal cord, nerve roots, blood vessels and other tissues. These are 10 times less frequent than intracranial tumors with majority of them being benign. According to their location, spinal tumors are conveniently classified as extradural and intradural, although some can be both inside and outside the dura. Intradural tumors can be intramedullary (intramedullary spinal cord tumor [IMSCT]) or extramedullary (intradural extramedullary [IDEM]).²

Space occupying lesions in the spinal canal cause compression of the structures with resultant neurological deficits. Rapidly growing lesions cause severe loss of function as there is no time for the spinal cord to adjust itself. The presence of a tumor interferes with the normal movements of the cord, which occur during movements of the spinal column. Such impairment contributes to cord damage.

In long standing tumors, there may be gliosis in the spinal cord due to ischemia and recovery may be incomplete despite complete removal of the tumor. Initial assessment of the patient with a primary spinal tumor requires meticulous application of common clinical tools including a detailed history and clinical examination. Clinical presentation usually relates to pain, varying degrees of motor sensory deficits as well as bowel bladder symptoms in some, which may be due to either mass effect or neurological compression.³

Spinal tumors are rare and potentially devastating lesions that threaten the patient's mobility or even life. Despite their rarity, every neurosurgeon in clinical practice has to deal with them regularly. With modern imaging, microsurgical technique and improved understanding of spinal biomechanics and modern instrumentation system, the fate of complete paraplegia can be avoided if therapy is instituted in time. In this study, we analyzed 71 cases of benign spinal cord tumors which was surgically managed by us, to see the trend of spinal tumors in our institute. The cases were evaluated with regard to the pathological diagnosis, preoperative medical history, clinical symptoms, Radiology, surgical treatment, outcome and complication. Observations have been made from the above study and compared with those available in literature. Patients studied were those who were admitted directly as well as those referred from the departments of medicine, pediatrics and the department of neurology.

AIMS AND OBJECTIVES

In this prospective and observational study of 71 patient who Underwent surgery in the Tertiary Care Hospital, Ahmedabad, from August 2013 to December 2016 for benign spinal cord tumors. Following aims and objectives were kept as the bases for this study:

1. To study various clinical presentation and radiological correlation of benign spinal tumors.
2. To identify pathological nature of these tumors.
3. To study various surgical approaches pertaining to the management of these tumours.
4. To study morbidity and mortality in the surgical management of these tumours.
5. To study the recovery and improvement in follow up of patients operated for —Benign spinal tumors.

MATERIALS AND METHODS

This study was designed as a prospective cross-sectional observational study of a cohort of 71 patients who underwent surgery in the Tertiary Care Hospital, Ahmedabad, from August 2013 to December 2016 for benign spinal cord tumors. These patients were direct admissions from the OPD of the department as well as those referred from the departments of pediatrics, medicine, and neurology and pediatric surgery.

Inclusion Criteria

- Intradural extramedullary benign spinal tumors.
- Extradural benign spinal tumors extending into intradural compartment.
- Intradural Intramedullary benign congenital tumor.

Exclusion Criteria

- Intramedullary malignant tumor like astrocytoma and ependymoma
- Vascular malformations
- Infective pathologies including tuberculoma, hydatid cyst etc
- Primary bony spinal tumor.
- Tumor like conditions like eosinophilic granuloma, Histiocytosis X, aneurysmal bone cyst.

OBSERVATIONS AND RESULTS

In this study, (Table 1) shows incidence of — Benign spinal tumor was maximum in age group of 21 to 30 year with 21.12 % , 41-50

year age with 19.71 % and 31-40 year age with 15.49 % while minimum in older age group more than 70 with 1.40 % , 51-60 year age with 8.45 % and 61-70 year age with 9.85 % . Benign spinal tumor was also frequent in pediatric age group in first and second decade.

In our series, sex incidence of “Benign spinal tumors” in male is 49.29% and 50.70 % in female which was almost equal.

In our series of “ Benign spinal tumors” , patients presented with weakness (74.64 %) as the most common complain followed by walking difficulty (71.83%), back pain (67.60%), tingling (32.39%), numbness (33.80%), radiating pain (36.61%), limb pain (9.85%), spine deformity(2.81%), back swelling (1.4%).

In our study the most common bowel-bladder symptom was urinary retention which was present in 11.26 % of patients, followed by constipation in 8.45 % and urinary and fecal incontinence in 4.22%.

Out of the 71 patients in our study 67.60 % had weakness in lower limbs, 8.45 % had weakness in upper limbs, 4.22 % had weakness in both and 19.71 % patients had no weakness. 54.92 % of our patients presents with hypertonia, 5.63 % with hypotonia and 39.43% with normal tone. 30.98 % of patients presents with impaired touch, pain and temperature sensation and 45.07 % with impaired joint and position sensation.

In our study of “Benign spinal tumors”, most common location of tumor is in dorsal region (57.74%). Next common location is cervical region (16.90%), followed by lumbar region (14.08%). Some tumor extends in junction area of nearby regions like Dorsolumbar (8.45%), Cervicodorsal (2.81%), but no tumor found in Lumbosacral and sacral region.

In our study of benign spinal tumors, most common location of tumor is in intradural extramedullary (IDEM) and then intradural intramedullary (IDIM).Least common site for tumor is extradural extramedullary (EDEM).

In our study majority of the tumors are located posterolateral, (53.52%). Next most common location is anterolateral (14.08) and within the cord (14.08) followed by posterior (8.45%), anterior (5.63%) and others (4.22%).

In our study effect on spinal cord by Benign spinal tumor shows displacement of the cord in 23.94 % of patient, compression in 45.07 % of patients, enlargement of the cord in 14.08 % and no effect in 16.90 % of patients. In our series two patients has associated anomaly of spine, showing dorsal kyphoscoliosis.

In our study complete tumor removal was achieved in 94.36 % of patients, while in 5.63% near total removal was done. Out of the total 71 patients, in 66 patients dura was closed primarily, while in 5 patients fascia lata graft was used for dural repair.

In our study 4.22% of patients develops CSF collection in wound which was treated with repeated aspirations and antibiotics, none of the patients required re-exploration. 1 patient develops local wound hematoma, which was treated conservatively. 1 patient develops pulmonary infection secondary to leak of neuroenteric cyst content into chest. In 2.81 % of the patients in our study there was transient deterioration of power which gradually improved over time and one of them having deterioration of power due to spine instability by lysis after 3month of post op.

In our study, most common tumors are nerve sheath tumors, accounts for 43.66% of the total tumors. Next most common tumor is meningioma, which accounts for 33.80% of the tumors and epidermoid is 8.45%.Other least common tumour are arachnoid

cyst and neuroenteric cyst are 2.81% and dermoid, hemangioblastoma, lipoma, teratoma, meningeal cyst and simple cyst are 1.40%. In our series of 71 patients of "Benign spinal

tumors" 85.91 % of patients improved neurologically while 2.81 % patients deteriorated neurologically and 11.26 % of patients remain same as preoperative status of neurology.

Table 1: Age Distribution

S.N.	Age Group (Yr)	Total No. Patient	Percentage %
1.	1-10	7	9.85
2.	11-20	10	14.08
3.	21-30	15	21.12
4.	31-40	11	15.49
5.	41-50	14	19.71
6.	51-60	6	8.45
7.	61-70	7	9.85
8.	≥ 71	1	1.40

Table 2: Sex Distribution

Sex	Total No. Patient	Percentage %
Male	35	49.29
Female	36	50.70

Table 3: Clinical Symptoms

Symptom	No. of Patients	Percentage (%)
Back pain	48	67.60
Radiating pain	26	36.61
Limb pain	7	9.85
Numbness	24	33.80
Tingling	23	32.39
Weakness	53	74.64
Walking difficulty	51	71.83
Back swelling	1	1.40
Spine deformity	2	2.81

Table 4: Bowel and Bladder Involvement

Symptom	No. Of Patients	Percentage (%)
Urinary Retention	8	11.26
Symptoms Incontinence	3	4.22
Bowel Constipation	6	8.45
Symptoms Incontinence	3	4.22

Table 5: Neurological Examination

Examination	No Of Patients	Percentage	
Decreased Power	Upper Limbs	6	8.45%
	Lower Limbs	48	67.60%
	Both	3	4.22%
	None	14	19.71%
Tone	Increased	39	54.92%
	Decreased	4	5.63%
	Normal	28	39.43%
Impaired Sensation	Touch, Pain & Temperature	22	30.98%
	JPS	32	45.07%

Table 6: Radiological Location of Tumor (Vertical)

LOCATION	Total	Percentage (%)
Cervical	12	16.90%
Cervicodorsal	2	2.81%
Dorsal	41	57.74%
Dorsolumbar	6	8.45%
Lumbar	10	14.08%
Lumbosacral	0	0%
Sacral	0	0%
Total	71	100%

Table 7: Location of Tumor

LOCATION	EDEM	(%)	IDEM	(%)	IDIM	(%)
Cervical	1	1.40	9	12.67	2	2.81
Cervicodorsal	0	0	1	1.40	1	1.40
Dorsal	6	8.45	33	46.47	2	2.81
Dorsolumbar	0	0	4	5.63	2	2.81
Lumbar	0	0	7	9.85	3	4.22
Lumbosacral	0	0	0	0	0	0
Sacral	0	0	0	0	0	0
Total	7	9.85	54	76.05	10	14.08

Table 8: Radiological Location of Tumor (Horizontal)

Location	Number of Patients	Percentage (%)
Anterior	4	5.63
Anterolateral	10	14.08
Posterolateral	38	53.52
Posterior	6	8.45
Within The Cord	10	14.08
Others	3	4.22

Table 9: Effect on the Cord by Tumors

S.N.	Feature	Total No. Patient	Percentage (%)
1	Compressed	32	45.07
2	Displaced	17	23.94
3	Enlarged	10	14.08
4	None	12	16.90

Table 10: Associated Anomaly of Spine

	Patient	Percentage
Total No. of Patients	71	100
Kyphoscoliosis	2	2.81%
None	69	97.18%

Table 11: Extent of Tumor Removal

Tumor Removal	Total	Percentage (%)
Complete	67	94.36%
Near total	4	5.63%
Total	71	100

Table 12: Dura Closure

CLOSURE	TOTAL	PERCENTAGE (%)
PRIMARY	66	92.95 %
FLG	5	7.04 %

Table 13: Postoperative Complication

Complication	No. Of Patients	Percentage
CSF Collection	3	4.22%
Wound Hematoma	1	1.40%
Pulmonary Infection	1	1.40%
Deterioration Of Power	2	2.81%
Spine Instability	1	1.40%

Table 14: Histopathological Incidence

S.N	Diagnosis	Patients	%
1	Meningioma	24	33.80%
2	Nerve Sheath Tumor	Schwannoma 23 Neurofibroma 8	31 43.66%
3	Arachnoidcyst	2	2.81%
4	Neuroenteric/Enterogeneous Cyst	2	2.81%
5	Epidermoid	6	8.45%
6	Dermoid	1	1.40%
7	Hemangioblastoma	1	1.40%
8	Lipoma	1	1.40%
9	Teratoma	1	1.40%
10	Meningeal Cyst	1	1.40%
11	Simple Cyst	1	1.40%

Table 15: Follow Up For Weakness

Status Of Weakness	No. Of Patients	Percentage
Improved	61	85.91%
Deteriorated	2	2.81%
Same	8	11.26%

DISCUSSION

In this study, (Table 1) shows incidence of benign spinal tumor was maximum in age group of 21 to 30 year with 21.12 %, 41-50 year age with 19.71 % and 31-40 year age with 15.49 % while minimum in older age group more than 70 with 1.40%, 51-60 year age with 8.45% and 61-70 year age with 9.85%. Benign spinal tumor was also frequent in pediatric age group in first and second decade. We have compared our study age group with study of Linh Duong et.al⁴ and Kyu Jung et.al.⁵

Tumors of the central nervous system are common in the pediatric population and constitute the second most prevalent tumor type of childhood. Within this group, spinal cord tumors are a relatively rare diagnosis and account for 1% to 10% of all pediatric central

nervous system tumors.⁶⁻⁸ Spinal cord tumors and masses are a rare diagnosis in the pediatric population. The types of tumors seen in children tend to be different than the adult types. In evaluating the trends seen in this population, we had a large percentage of developmental tumors (dermoid, epidermoid, and teratomas) which differs from other, similar reports on tumors in this population.⁸⁻¹¹ This does, however, counter a report by Townsend et al in a small case series of 10 patients.¹²

Our study (Table 2) shows sex incidence of —Benign spinal tumors in male is 49.29% and in female is 50.70 % which was almost equal. . We have compared our study sex group with study of Linh Duong et al⁴ and Kyu Jung et al.⁵

S.N.	Age Group (Yr)	Our Study	Linh Duong et.al U.S 2012	Kyu Jung et.al Korea 2014
1.	1-10	9.85	1.5	1.0
2.	11-20	14.08	3.3	3.2
3.	21-30	21.12	6.0	6.7
4.	31-40	15.49	10.4	13.2
5.	41-50	19.71	17.0	22.4
6.	51-60	8.45	20.6	22.9
7.	61-70	9.85	17.2	18.8
8.	≥ 71	1.40	15.4	10.0

SEX	OUR STUDY	Linh Duong et.al U.S 2012	Kyu Jung et.al Korea 2014
MALE	49.29	38.1	42.2
FEMALE	50.70	61.9	57.8

The literature indicates that in western populations, the primary spinal tumors occur more frequently in females, whereas Asian studies show a slight male preponderance.^{13,14} We had a male to female ratio of 1:1 among our patients. Similar male to female ratio has been reported by other studies from India.^{15,16} Our study (Table 3) shows In series of — Benign spinal tumors, patients presented with weakness (74.64 %) as the most common complain followed by walking difficulty (71.83%), back pain (67.60%), tingling (32.39%), numbness (33.80%), radiating pain (36.61%), limb pain (9.85%), spine deformity (2.81%), back swelling (1.4%). We have compared our study clinical symptoms with study of Rajnish kumar et al.¹⁷ Our study (Table 4) shows the most common bowel-bladder symptom was urinary retention which was present in 11.26 % of patients, followed by constipation in 8.45 % and urinary and fecal incontinence in 4.22%. We have compared our study bladder and bowel involvement with study of Rajnish kumar et al.¹⁷ North India 2015.

Our study (Table 5) shows Out of the 71 patients in this study 67.60 % had weakness in lower limbs, 8.45 % had weakness in upper limbs, 4.22 % had weakness in both and 19.71 % patients had no weakness. 54.92 % of our patients presents with hypertonion, 5.63 % with hypotonia and 39.43% with normal tone. 30.98 % of patients presents with impaired touch, pain and temperature sensation and 45.07 % with impaired joint and position sensation. We have compared our study clinical examination with study of Rajnish kumar et al.¹⁷ North India 2015.

Our study (Table 6) shows most common location of tumor is in dorsal region (57.74%). Next common location is cervical region (16.90%), followed by lumbar region (14.08%). Some tumor extends in junction area of nearby regions like Dorsolumbar (8.45%), Cervicodorsal (2.81%), but no tumor found in Lumbosacral and sacral region. We have compared our study of tumor location with study of Rajnish kumar et al.¹⁷ North India 2015.

SYMPTOM	OUR STUDY	Rajnish kumar et.al North India 2015
Pain	67.60	41.44
Parasthesias	33.80	18
Motor weakness	74.64	70.27
Walking difficulty	71.83	70.27
Spine deformity	2.81	1.8

Symptom	Our Study	Rajnish kumar et.al North India 2015
Bladder	15.49	34.23
Bowel	12.67	8.1

Examination	Our Study	Rajnish kumar et.al North India 2015
Decreased Power	74.64 %	70.27 %
Tone	Increased	70.27 %
	Decreased	9.1 %
Impaired Sensation	45.07 %	49.54 %

LOCATION	Our study	Rajnish kumar et.al North India 2015
Cervical	16.90%	18.91
Cervicodorsal	2.81%	9.1
Dorsal	57.74%	34.23
Dorsolumbar	8.45%	13.51
Lumbar	14.08%	10.81
Lumbosacral	0%	5.40
Sacral	0%	6.30

Our study (Table 7) shows most common location of tumor is in Intradural Extramedullary (IDEM) and then Intradural Intramedullary (IDIM). Least common site for tumor is Extradural Extramedullary (EDEM). We have compared our study of tumor location with study of Rajnish kumar et.al¹⁷ North India 2015 and Kenichi Hirano et.al¹⁸ Japan 2012. Our study results are almost same with japan study.

Primary spinal cord tumors account for 4–10% of all central nervous system tumors and are characterized based on their location as intramedullary (IDIM), IDEM, and extradural.¹⁹ Totally, 2/3 of all spinal tumors are said to be IDEM and 10% IDIM Spinal cord tumor (SCT)²⁰ but we had nearly equal incidence of IDEM (76.05 %) and IDIM SCTs (14.08%) in our series. This difference

may be due to tertiary referral at our institute or this may represent the epidemiological trend of a developing country. Our study (Table 8) shows majority of the tumors are located posterolateral, (53.52%). Next most common location is anterolateral (14.08) and within the cord (14.08) followed by posterior (8.45%), anterior (5.63%) and others (4.22%). Our study (Table 9) shows effect on spinal cord by benign spinal tumor causes displacement of the cord in 23.94 % of patient, compression in 45.07 % of patients, enlargement of the cord in 14.08 % and no effect in 16.90 % of patients. Our study (Table 10) shows two patients has associated anomaly of spine, showing dorsal kyphoscoliosis (2.81%). We have compared our study with study of Rajnish kumar et.al¹⁷ North India 2015 in which it is about 1.8%.

Study	EDEM (%)	IDEM (%)	IDIM (%)
Our Study	9.80	76.05	14.08
Rajnish kumar et.al North India 2015	27.02	36.03	36.93
Kenichi Hirano et.al Japan 2012	4.0	77.6	18.3

Our study (Table 11) shows complete tumor removal was achieved in 94.36 % of patients, while in 5.63% near total removal was done. A posterior approach using standard microsurgical techniques was performed in all cases, and this was irrespective of the location of a tumor. We did not require instrumentation in any case. We have compared our study of tumor location with study of Rajnish kumar et.al¹⁷ North India 2015.

Tumor Removal	Our Study	Rajnish kumar et.al North India 2015
Complete	94.36%	51.35
Neartotal	5.63%	19.81
Subtotal	0%	27.02

Our study (Table 12) shows Out of the total 71 patients, in 66 patients dura was closed primarily, while in 5 patients fascia lata graft was used for dural repair. Out of which two (4.22%) duroplasty was having CSF leak in which one is FLG and one is primary dural repair. Both of which was treated by conservative management like repeated aspiration, antibiotic and tab Diamox. In study of Bokhari et al²¹ 2016 Karachi incidence of CSF leak was 2.36 %. Our study (Table 13) shows about 4.22% of patients develops CSF collection in wound which was treated with repeated aspirations and antibiotics, none of the patients required re-exploration. 1 patient develops local wound hematoma, which was treated conservatively. 1 patient develops pulmonary infection secondary to leak of neuroenteric cyst content into chest. In 2.81 % of the patients in our study there was transient deterioration of power which gradually improved over time and one of them having deterioration of power due to spine instability by lysis after 3month of Postoperative. We have compared our study Complication with study of Rajnish kumar et.al¹⁷ North India 2015 in given below table. Our study (Table 14) shows most common tumors are nerve sheath tumors, accounts for 43.66% of the total tumors. Next most common tumor is meningioma, which accounts for 33.80% of the tumors and epidermoid is 8.45%. Other least

common tumour are arachnoid cyst and neuroenteric cyst are 2.81% and dermoid, hemangioblastoma, lipoma, teratoma, meningeal cyst and simple cyst are 1.40%. We have compared our study of tumor Histopathology with study of Rajnishkumar et.al¹⁷ North India 2015 and Kenichi Hirano et.al¹⁸ Japan 2012. The incidence of primary spinal cord tumors in various series is listed in below Table. Compared with reports from other parts of the world, there are evident differences in the frequencies of nerve sheath cell tumors (NSCTs: schwannomas and neurofibromas) and meningiomas. In Asian countries,²²⁻²⁵ including what we found in the current study, the frequency of NSCTs is higher than that of meningiomas. This tendency is even stronger in eastern Asia.^{22-24,26} On the other hand, the incidence of meningiomas in non-Asian countries (USA, Europe, Australia), is equal to or higher than that of NSCTs²⁷⁻³¹ with the exception of only one report.³² In the series from Germany,³² authors counted multiple tumors in one patient (probably, neurofibromatosis or schwannomatosis). Therefore, NSCTs outnumbered meningiomas in their series. Neuroepithelial tumors seem to occur less frequently in Asian countries than in non-Asian countries. The frequency of vascular tumors seems to vary less among countries studied. Our results confirm previous reports^{22,24,26} which demonstrate different frequencies of NSCTs, meningiomas, and neuroepithelial tumors between Asian countries and other parts of the world.

Meningiomas account for 25-46% of all primary intraspinal neoplasms and spinal meningiomas are only 7.5-12.5% of all meningiomas because most meningiomas are found in the brain.³⁶ Spinal meningiomas are mostly located in the thoracic vertebra and they are more common in females, which is presumably due to the influence of female hormones.³⁶ In this study, 33.8% meningiomas were also found in the thoracic vertebra of female patients. With regard to the treatment of the dural attachment of a meningioma, there are three common procedures: 1) some portion of the dura mater is resected with the tumor to remove any residual tumor cells and then duraplasty is performed, 2) some of the internal dura mater is peeled off and the rest of it is sutured, or 3) the dural attachment is cauterized.³⁷ In this study, the closures

were performed without additional procedures because all the tumors were easily separated from the dura mater and no recurrence was observed at the last follow-up.

As mentioned above, there are dissimilarities in the relative frequencies of spinal cord tumors among various reports in above table. While some of these discrepancies are due to differences in the actual rate of occurrence of these tumors, others might result from different ways in which data are obtained. For various reasons, the comparison of data from different sources in various communities might not reveal real differences among the communities. Moreover, the diversity in the types of tumors

included, and the classification used in different series further complicates the collation of statistics. However, despite dissimilarities in the materials and methods, comparing these series might reveal important points on the relative frequency of spinal cord tumors in different parts of the world, suggesting the possible roles of environmental, genetic, and hormonal factors in the etiology of spinal cord tumors. For surgeons, it is very useful to recognize what type of tumor is likely to be encountered, based not only on preoperative imaging characteristics such as magnetic resonance imaging (MRI), but also on the reported incidence of the various tumors in each country or region.

Complication	Our Study	Rajnish kumar et.al North India 2015
CSF Collection	4.22%	0.9
Wound Complication	1.40%	1.8
Pulmonary Infection	1.40%	0
Deterioration Of Power	2.81%	5.41
Spine Instability	1.40%	0.9

Diagnosis	Our Study	Rajnishkumar et.al North India 2015	Kenichi Hirano et.al Japan 2012
1 Nerve Sheath Tumor	43.66%	22.52	60.6
2 Meningioma	33.80%	6.3	11.7
3 Arachnoid cyst	2.81%	0.90	-
4 Neuroenteric/E Neurogeneous Cyst	2.81%	1.80	-
5 Epidermoid	8.45%	6.30	-
6 Dermoid	1.40%	3.60	-
7 Hemangioblastoma	1.40%	0.90	3.4
8 Lipoma	1.40%	2.70	1.5
9 Teratoma	1.40%	0	-
10 Meningeal Cyst	1.40%	0	-
11 Simple Cyst	1.40%	0	-

References	Country	No. of cases	Date	NSCTs (%)	Meningioma (%)
Schellinger et al. [30]	USA	3,226	1998–2002	24.4	28.9
Preston-Martin [28]	USA	462	1972–1985	22.3	42.9
Engelhard et al. [31]	USA	430	2000	22.6	24.2

References	Country	No. of cases	Date	NSCTs (%)	Meningioma (%)
Klekamp and Samii [32]	Germany	1,081	1978–2003	26.9	16.7
Helseth et al. [33]	Norway	415	1955–1986	10.8	46.7
Kaye et al. [27]	Australia	266	1986–1988	32.3	29.7
Ardehali [34]	Iran	108	1962–1986	40.7	33.3
Lalitha and Dastur [25]	India	326	Before 1980	39.9	25.5
Shuangsh and Panyatha[23]	Thailand	120	1956–1973	65.8	14.2
Cheang et al. [24]	Taiwan	92	1988–1995	52.2	15.2
Wen-Qing et al. [26]	China	2,245	Before 1982	49.4	14.7
Cheng [22]	China	1,549	Before 1982	49.5	13.2
Suh et al. [35]	Korea	141	1997–1998	39.7	25.5

There were potential limitations in the current study. Since this was a non-population-based study, and we dealt only with surgical cases, we could not determine the actual frequency of spinal cord tumors occurring within the population.

That is, we did not include asymptomatic cases or cases in which the spinal cord tumors were diagnosed with imaging and treated conservatively. We learned the relative frequencies of different spinal cord tumors which were treated surgically with this study. A population-based study on primary spinal cord tumors should be planned in India, similar to broad-based studies from other countries.

Our study (Table 15) shows 71 patients of — Benign spinal tumors. 85.91 % of patients improved neurologically while 2.81 % patients deteriorated neurologically and 11.26 % of patients remain same as preoperative status of neurology. We defined "good outcome" as the improvement in patient's preoperative modified McCormick score, at the time of last follow-up. Those who had an improvement of ≥ 2 grades were labeled as having "significant improvement". The patients who either remained same or showed a deterioration of modified McCormick score were considered "poor outcome". We have compared our study outcome with study of Rajnish kumar et.al¹⁷ North India 2015.

OUTCOME	OUR STUDY	Rajnish kumar et.al North India 2015(17)
IMPROVED	85.91%	79.27
DETERIORATED	2.81%	5.41
SAME	11.26%	15.31

A delay in diagnosis or management of patients with mass lesions causing compression of neuronal tracts in the spinal cord may result in residual deficits and poor outcome.

Dutch investigators²⁷ collected a series of 108 patients with both intradural and extradural tumors. They found that 35% of patients were diagnosed more than 2 years after the onset of symptoms. Delayed presentation is one of the main factors leading to poor neurological grade at time of surgery/intervention. This affects the postoperative outcome.

The average preoperative duration of symptoms in our series was 15.17 months, with a range from 15 days to 10 years and a significant number of our patients were in poor neurological status at presentation (71.83%).

The long-standing compressive pathologies cause profound and irreversible neuronal degeneration due to destructive changes such as ischemic necrosis and neuronal loss in gray matter as well as demyelination in white matter and in posterior and lateral white columns.²⁸

The various series of spinal tumors had a good functional outcome in 15- 90% of patients.³²⁻³⁷ In our series, a total of 85.91% patients were mobile at last follow-up regardless of prognostic factors.

This compares favorably with another series. Similar observations also have been made by other authors. We recommend that surgical intervention if indicated should be considered for spinal tumors regardless of the prognostic factors. Even patients with poor neurological grade preoperatively may improve in their functional status.

SUMMARY

- Our study shows incidence of — Benign spinal tumor was maximum in age group of 21 to 30 year with 21.12 % , 41-50 year age with 19.71 % and 31-40 year age with 15.49 % while minimum in older age group more than 70 with 1.40 % , 51-60 year age with 8.45 % and 61-70 year age with 9.85 % . Benign spinal tumor was also frequent in pediatric age group in first and second decade. In our study male is 49.29% and in female is 50.70 % which was almost equal.
- Patients presented with weakness (74.64 %) as the most common complain followed by walking difficulty (71.83%). Most common bowel- bladder symptom was urinary retention which was present in 11.26 % of patients, followed by constipation in 8.45 % and urinary and fecal incontinence in 4.22%. Out of the 71 patients in this study 67.60 % had weakness in lower limbs, 8.45 % had weakness in upper limbs, 4.22 % had weakness in both and 19.71 % patients had no weakness. 54.92 % of our patients presents with hypertonia. 30.98 % of patients presents with impaired touch, pain and temperature sensation and 45.07 % with impaired joint and position sensation.
- Our study shows most common location of tumor is in dorsal region (57.74%). Next common location is cervical region (16.90%), followed by lumbar region (14.08%).
- Our study shows most common location of tumor is in Intradural Extramedullary (IDEM) and then Intradural Intramedullary (IDIM). Least common site for tumor is Extradural Extramedullary (EDEM) with majority of the tumors are located posterolateral, (53.52%). Benign spinal tumor causes displacement of the cord in 23.94 % of patient, compression in 45.07 % of patients, enlargement of the cord in 14.08 % and no effect in 16.90 % of patients.
- Our study shows complete tumor removal was achieved in 94.36 % of patients, while in 5.63% near total removal was done. Out of the total 71 patients, in 66 patients dura was closed primarily, while in 5 patients fascia lata graft was used for dural repair. Out of which two (4.22%) duroplasty was having CSF leak in which one is FLG and one is primary dural repair. Both of which was treated by conservative management like repeated aspiration, antibiotic and tab Diamox. Other complications are local wound hematoma, pulmonary infection secondary to leak of neuroenteric cyst content into chest. In 2.81 % of the patients in our study there was transient deterioration of power which gradually improved over time and one of them having deterioration of power due to spine instability by lysis after 03 months of postoperative.
- Our study shows most common tumors are nerve sheath tumors, accounts for 43.66% of the total tumors. Next most common tumor is meningioma, which accounts for 33.80% of the tumors and epidermoid is 8.45%. Other least common tumour are arachnoid cyst and neuroenteric cyst are 2.81% and dermoid, hemangioblastoma, lipoma, teratoma, meningeal cyst and simple cyst are 1.40%.
- Our study shows 71 patients of — Benign spinal tumors 85.91 % of patients improved neurologically while 2.81 % patients deteriorated neurologically and 11.26 % of patients remain same as preoperative status of neurology.

CONCLUSION

This study of — Benign spinal cord tumors describing the demographic characteristics, histopathological features, anatomical location, and vertebral level of these tumors treated surgically. Similar to other reports from Asian countries, there is an equal male/female ratio for all benign spinal cord tumors in this study. There is also a higher proportion of NSCTs, and a lower proportion of meningiomas and neuroepithelial tumors as compared to NSCTs. Data in the current study represent the characteristics of primary spinal cord tumors in Asian countries. Tumour type and biology plays an important role, with benign IDDM tumours displaying the best prognosis for long term survival after complete excision. The pretreatment neurological status of the patient is important in determining outcome after treatment. Delayed presentation is the main reason for poor preoperative neurologic status, leading to poor outcome in the management of spinal tumors. A high level of suspicion and acknowledging the classical symptoms of cord compression are the most important factors in shortening the time to diagnosis of spinal tumors.

REFERENCES

- Spurling RG, Mayfield FH. Neoplasms of the spinal cord—A review of forty-two surgical cases. *JAMA*. 1936;107:924–9.
- Ramamurthy R, Rao SM. Clinical features and diagnosis. In: Ramamurthy B, Tandon PN, editors. *Text Book of Neurosurgery*. 3rd ed. New Delhi: Jaypee Medical Publishers; 2012. p. 1181.
- Williams R, Foote M, Deverall H. Surgical treatment of 264 primary spinal tumors. *Global Spine J*. 2012;2:249–66.
- Linh Duong et al. Descriptive Epidemiology of Malignant and Nonmalignant Primary Spinal Cord, Spinal Meninges, and Cauda Equina Tumors, United States, 2004–2007.
- Kyu Jung et al. Incidence of Primary Spinal Cord, Spinal Meninges, and Cauda Equina Tumors in Korea, 2006–2010.
- Hardison HH, Packer RJ et al. Outcome of children with primary intramedullary spinal cord tumors. *Childs Nerv Syst*. 1987;3:89–92.
- Stiller CA, Nectoux J. International incidence of childhood brain and spinal tumours. *Int J Epidemiol*. 1994;23:458–464.
- Nadkarni TD, Rekate HL. Pediatric intramedullary spinal cord tumors. Critical review of the literature. *Childs Nerv Syst*. 1999;15:17–28.
- Constantini S, Epstein F. Pediatric intraspinal tumors. In: Choux M, Di Rocco E, Hockley A, Walker M, editors. *Pediatric Neurosurgery*. London, UK: Churchill Livingstone; 1999. pp. 601–602.
- Greenwood J., Jr. Surgical removal of intramedullary tumors. *J Neurosurg*. 1967;26:276–282.
- Malis LI. Intramedullary spinal cord tumors. *Clinical Neurosurg*. 1978;25:512–539.
- Townsend N, Handler M et al. Intramedullary spinal cord astrocytomas in children. *Pediatr Blood Cancer*. 2004;43:629–632
- Hirano K, Imagama S, Sato K, Kato F, Yukawa Y, Yoshihara H, et al. Primary spinal cord tumors: Review of 678 surgically treated patients in Japan. A multicenter study. *Eur Spine J*. 2012;21:2019–26.
- Wen-qing H, Shi-ju Z et al. Statistical analysis of central nervous system tumors in China. *J Neurosurg*. 1982;56:555–64.
- Bansal S, Ailawadhi P et al. Ten years' experience in the management of spinal intramedullary tumors in a single institution. *J Clin Neurosci*. 2013;20:292–8.
- Chandy MJ, Babu S. Management of intramedullary spinal cord tumours: Review of 68 patients. *Neurol India*. 1999;47:224–8.
- Rajnish Kumar Arora et al. Spinal tumors: Trends from Northern India. *Asian Journal of Neurosurgery*. Oct-Dec 2015; 10(4):291.
- Kenichi Hirano et al. Primary spinal cord tumors: review of 678 surgically treated patients in Japan. A multicenter study. *Eur Spine J*.

2012 Oct; 21(10): 2019–2026.

- Segal D, Lidar Z, Corn A, Constantini S. Delay in diagnosis of primary intradural spinal cord tumors. *Surg Neurol Int*. 2012;3:52.
- Chamberlain MC, Tredway TL. Adult primary intradural spinal cord tumors: A review. *Curr Neurol Neurosci Rep*. 2011;11:320–8.
- Bokhari et al 2016 karachi, *Journal of the College of Physicians and Surgeons Pakistan* 2016, Place and Duration of Study: Neurosurgery Department, JPMC, Karachi, from March 2011 to February 2014.
- Cheng MK. Spinal cord tumors in the People's Republic of China: a statistical review. *Neurosurgery*. 1982;10:22–24.
- Shuangsh S, Panyatha R. Neural neoplasms in Thailand—study of 2,897 cases. *Neurology*. 1974;24:1127–1134.
- Cheang CM, Hwang SL, Hwang SL. An analysis of intraspinal tumors in south Taiwan. *Kaohsiung J Med Sci*. 1997;13:229–236.
- Lalitha VS, Dastur DK. Neoplasms of the central nervous system— histological types in 2237 cases. *Indian J Cancer*. 1980;17:102–106.
- Wen-qing H, Shi-ju Z et al. Statistical analysis of central nervous system tumors in China. *J Neurosurg*. 1982;56:555–564.
- Kaye AH, Giles GG, Gonzales M. Primary central nervous system tumours in Australia: a profile of clinical practice from the Australian Brain Tumour Register. *Aust N Z J Surg*. 1993;63:33–38.
- Preston-Martin S. Descriptive epidemiology of primary tumors of the spinal cord and spinal meninges in Los Angeles County, 1972–1985. *Neuroepidemiology*. 1990;9:106–111.
- Helseth A, Mork SJ. Primary intraspinal neoplasms in Norway, 1955 to 1986. A population-based survey of 467 patients. *J Neurosurg*. 1989;71:842–845.
- Schellinger KA et al. Descriptive epidemiology of primary spinal cord tumors. *J Neurooncol*. 2008;87:173– 179.
- Engelhard HH et al. Clinical presentation, histology, and treatment in 430 patients with primary tumors of the spinal cord, spinal meninges, or cauda equina. *J Neurosurg Spine*. 2010;13:67–77.
- Klekamp J, Samii M. *Surgery of spinal tumors*. Heidelberg: Springer; 2006.
- Helseth A, Mork SJ, Johansen A, Tretli S. Neoplasms of the central nervous system in Norway. IV. A population-based epidemiological study of meningiomas. *APMIS*. 1989;97:646–654.
- Ardehali MR. Relative incidence of spinal canal tumors. *Clin Neurol Neurosurg*. 1990;92:237–243.
- Suh YL, Koo H, Kim TS et al. Tumors of the central nervous system in Korea—a multicenter study of 3221 cases. *J Neurooncol*. 2002; 56: 251–259.
- Solero CL, Fomari M, Giombini S, et al. Spinal meningiomas: review of 174 operated cases. *Neurosurgery*. 1989;25(2):153–160.
- Saito T et al. A novel technique for surgical resection of spinal meningioma. *Spine*. 2001;26(16):1805– 1808.

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