



CLINICOPATHOLOGICAL STUDY OF INTRADURAL EXTRA MEDULLARY SPINAL TUMORS AND THEIR FUNCTIONAL OUTCOME

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ABSTRACT

AIM: Aim of our study to assess the clinical features of INTRADURAL EXTRA MEDULLARY (IDEM) SPINAL TUMORS.

OBJECTIVE: To access the functional outcome of postoperative patients and access the prevalence of various pathological variant of IDEM SPINAL TUMORS.

MATERIAL AND METHOD: In this study 50 diagnosed patients of IDEM tumor of any age group irrespective of sex and presented with progressive neurological deficit in form of weakness, sensory abnormality, autonomic abnormalities. These patients were investigated with MRI scan of the spine and if the cause of neurological deficit was found to be intradural extramedullary spinal tumor on MRI scan for which and surgical excision has planned are included in the study. And study the signs and symptoms, radiological features, treatment modalities, patients outcome and Histopathological diagnosis.

RESULT: Analysis revealed that IDEM present mostly in middle age group (20-49 yr) and more common in females (66%). The mean duration of symptoms of the patients was 21.85 ± 21.53 months with range 1-72 months. Pain was the most common presentation and in most patient course of pain was progressive 64% and in 36% it was stationary. This pain in IDEM tumors increases in lying down position in 76% of patients. Most patients were having severe pain at presentation (30%). Schwannoma was the most common tumor and then meningioma was the second most common tumor among the pathologies. There was no significant relationship of outcome after surgery of different histopathologies, all patients improved regardless of histopathological type.

CONCLUSION: So this conclusion can be made that patients preoperative functional status may depend on the duration of symptoms and site of tumor, but all patient of IDEM improves after surgery. So all patients should be offered surgical option regardless of functional status.

KEYWORDS: spine tumor, IDEM

INTRODUCTION: Spinal cord tumors accounts for 15% of central nervous system neoplasms¹. These neoplasms can be grouped in:

1. Extradural tumors (ED) [55%].
2. Intradural extramedullary tumors (IDEM) [40%]
3. Intramedullary spinal cord tumors (IM) [5%]².

Spinal intradural extramedullary tumors are mainly represented by meningiomas and Schwannomas, with the former accounting for the 25-46% of all primary intraspinal tumors.³ Other tumors⁴ could beependymomas, arachoid cyst⁵, dermoid, epidermoid, teratoma, neurenteric cyst, paragangliomas, dropmetastasis, granuloma.

Spinal Intradural extramedullary tumors account for two third of all Intraspinal neoplasms and are mainly represented by Meningiomas and Schwannomas, with the former accounting for the 25-46% of all primary Intraspinal tumors⁶. Other tumors could be – ependymomas, arachoid cyst⁵, dermoid, epidermoid, teratoma, neurenteric cyst, paragangliomas, dropmetastasis, granuloma. Some intradural tumors may have extradural extension such as nerve sheath tumors, meningioma, hamartomas, and sarcomas.⁵

Magnetic resonance imaging (MRI) is the diagnostic procedure of choice for all patients. In MRI, T1-weighted images with and without gadolinium (contrast) enhancement are essential to demonstrate the exact position of the tumor and its topographical relationship with the spinal cord. These patients usually managed surgically and goal of surgery is total excision as the outcome is good after surgery. In this study we investigate various pathology for Intradural Extramedullary region and functional outcome in patients after surgery.

MATERIAL & METHODS: After obtaining informed consent this non randomized prospective study was conducted in G.R. Medical College GWALIOR, M.P. during oct 2014 to dec 2016. In this study 50 diagnosed patients of IDEM tumor of any age group irrespective of

sex and presented with progressive neurological deficit in form of weakness, sensory abnormality, autonomic abnormalities. These patients were investigated with MRI scan of the spine and if the cause of neurological deficit was found to be intradural extramedullary spinal tumor on MRI scan for which and surgical excision has planned are included in the study.

- a) Displacement of the cord to the contralateral side of the thecal sac,
- b) Widening of the space available for the cerebrospinal fluid above and below the tumor,
- c) And a sharp demarcation between the tumor and the cerebrospinal fluid.

Exclusion criteria: Patient not willing for study or not willing for surgery and those who previously operated for spinal tumor and presented with recurrence are excluded from the study.

Parameters to be studied:

- i. To study in detail the patient in terms of symptoms and signs according to questionnaire.
- ii. To study the radiological features.
- iii. To study treatment modality.
- iv. To follow up the patients and outcome.
- v. And study the signs and symptoms, radiological features, treatment modalities, patients outcome and Histopathological diagnosis

Statistical Analysis was performed with help of Epi Info™ 3.5.3 Software. Descriptive statistical analysis was performed to calculate the means with corresponding standard errors (S.E.). $p < 0.05$ was taken to be statistically significant.

RESULTS AND ANALYSIS:

Age distribution:-

Table-1

Age distribution of the patients

Age Group(in years)	Number	%
<20	3	6
20-29	12	24
30-39	8	16
40-49	15	30
50-59	6	12
≥60	4	8
Total	50	100

Common age group for IDEM tumor was 20-49 years.

Sex distribution:-

Table-2 Gender distribution of the patients

Gender	Number	%
Female	33	66
Male	17	34
Total	50	100

Test of proportion showed that the proportion of females (66%) were significantly higher than males ($\chi^2 = 3.12; p < 0.023$). IDEM was more common in female patients.

Table-3

Age and sex distribution in different pathologies:-

	Age (avg. yr)		Sex	
	M	F	M	F
Schwannoma	35	43	10	12
Meningioma	-	45	2	8
Neurofibroma	38	49	4	4
Ependymoma	-	31	0	6
Dermoid	20	18	1	1
Hematoma	60	-	1	0
Paraganglioma	24	-	1	0
Total			19	31

- Average age for the IDEM tumor was 33 years and average age for male was 27 years and for female was 39 years.
- Average age for schwannoma was 39 years, for male average age group was 35 years and for female it was 43 years, schwannoma was equally distributed in male and female. Meningioma was most common in females and almost all patients were female and average age was 45 years.
- For Neurofibroma they were equally distributed in male and female and average age in male was 38 years and in female was 49 years.
- Average age group for ependymomas was 31 years and female were most commonly involved.
- There were two patients of Dermoid one male and one female and average age group was 19 years.
- There was one patient of Hematoma of 60 year age and was male and one male patient of Paraganglioma of 24 years age

Duration of Symptoms

Table-4 Distribution of duration of symptoms of the patients

Duration of symptoms (in months)	Number	%
<1	4	8
1 – 12	24	48
13- 24	7	14
25 – 36	4	8
> 36	11	22
Total	50	100

The mean duration of symptoms (mean ± s.e) of the patients was 21.85±21.53 months with range 1-72 months and the median was 12 months.

Test of proportion showed that the number of the patients with

duration of symptoms 1-12 months (48%) were significantly higher ($\chi^2 = 27.80; p < 0.000014$) followed by more than 36 months (22%).

Duration of symptom in various pathologies:-

Table-5

	Schwannoma	Meningioma	Neurofibroma	Ependymoma	Dermoid	Hematoma	Paraganglioma
Avg duration (mth)	21	14	30	6	1	1	4

This table showing that average duration of symptom of IDEM tumors is 17.25 months and for schwannoma, meningioma, neurofibroma, ependymoma, dermoid, hematoma, paraganglioma 21mth, 14 mth, 30 mth, 6mth, 1mth, 4 mth respectively. Out of these maximum of duration of symptom is for neurofibroma.

Table-6

Distribution of patients according to their course of pain

Course of pain	Number	%
Progressive	32	64
Stationary	18	36
Regressive	0	0
No	0	0
Total	50	100

64% of the patients had progressive pain ($\chi^2 = 57.84; p < 0.00001$) followed by stationary pain (35%)($Z = 3.35; p < 0.01$).

Table-7

Distribution of patients according to their aggravation of pain

Aggravation of pain	Number	%
Lying	30	60
Lying + Other	5	10
Other	10	20
No	5	10
Total	50	100

Test of proportion showed that there was increase in pain on lying down position which was statistically significant ($\chi^2 = 34; p < 0.0001$).

Table-8 Distribution of onset of pain of the patients

Onset of pain	Number	%
Acute	8	16
Insidious	42	84
Total	50	100

Test of proportion showed that proportion of patients with onset of pain as insidious was significantly higher ($\chi^2 = 23.12; p < 0.00002$).

Table-9 Pain in different pathologies:-

	Onset		Course		Aggravation		VAS		
	Acute	Insidious	Progressive	Stationary	lying	else	0-3	4-6	6-10
Schwannoma	2	20	16	6	16	6	4	8	10
Meningioma	4	6	8	2	10	0	0	4	6
Neurofibroma	0	8	4	4	8	0	2	3	3
Ependymoma	0	6	4	2	2	4	0	4	2
Dermoid	1	1	0	2	1	1	1	1	0
Hematoma	1	0	0	1	0	1	0	0	1
Paraganglioma	0	1	0	1	1	0	0	1	0
Total	8	42	32	18	38	12	7	21	22

This table is showing that insidious onset of pain was the most common presentation and in most patient course of pain was progressive 64% and in 36% it was stationary. This pain in IDEM tumors increases in lying down position in 76 % of patients. Most patients were having severe pain at presentation (30%).

This table showing that schwannoma, meningioma, neurofibroma and ependymomas all having commonly insidious onset of pain 95%, 66%, 100% and 100% respectively, and course was progressive in 80%, 80%, 50% and 75% of patients respectively. Pain increases on lying down position in both schwannoma, meningioma and neurofibroma (80%, 100% and 100% respectively). But ependymoma was associated with other aggravating factors as movement, coughing, sneezing and walking etc. Out of two patients of tuberculosis one patient had insidious onset of pain and other patient had acute onset of pain, and both patient had stationary course of pain. Hematoma presented with acute onset of pain but paraganglioma presented with insidious onset of pain.

Table-10 Distribution of location of tumor

Location of tumor	Number	%	Site of pain	Number	%
Cervical	10	20	Cervical	10	20
Cervicodorsal	4	8	Dorsal	26	52
Dorsal	22	44	Lumber	9	12
Dorsolumber	5	10	Dorsolumber	5	10
Lumber	9	18	Other	0	6
Total	50	100	Total	50	100

Test of proportion showed that proportion of patients with location of tumor at dorsal was significantly higher ($\chi^2=20.60$; $p<0.0003$).

Site of pain was more or less at the same level where the pathology was present Histopathology:-

Table 11 Distribution of histopathological diagnosis

Histopathological Diagnosis	Number	%
Schwannoma	22	44
Meningioma	10	20
Neurofibroma	8	16
Ependymoma	6	12
Dermoid	2	4
Hematoma	1	2
Paraganglioma	1	2
Total	50	100

Test of proportion showed that proportion of patients with schwannoma was significantly higher ($\chi^2=46.62$; $p<0.0001$).

schwannoma was the most common tumor and then meningioma was the second most common tumor among the pathologies.

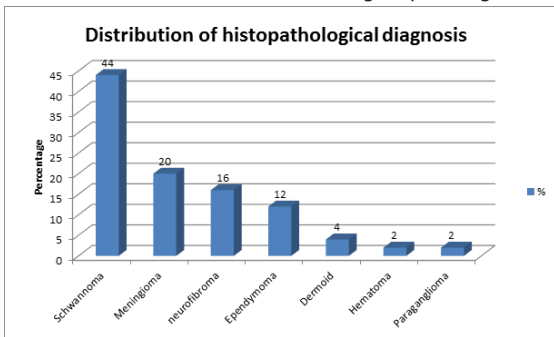


Table-12 Histopathology and location of tumor of the patients

Histopathology	Location of tumor					Total
	Cervi cal	Cervico dorsal	Dorsal	Dorsolu mber	Lumber	
Ependymoma	0	0	0	3	3	6
Hematoma	0	1	0	0	0	1
Paraganglioma	1	0	0	0	0	1
Meningioma	0	0	8	2	0	10
Neurofibroma	3	0	4	0	1	8
Schwannoma	6	3	8	0	5	22
Dermoid	0	0	2	0	0	2
Total	10	4	22	5	9	50

$\chi^2=51$ ($p < 0.0001$), Chi-square test showed that there was significant association between location of tumor and histopathology ($p<0.0001$).

FOLLOW UP DATA

Table-13 Distribution of Nurick's functional status of the patients

Nurick's Grade	Number	%
1	2	4
2	2	4
3	12	24
4	17	34
5	17	34
Total	50	100

The mean Nurick's grade (mean \pm s.e) of the patients was 3.82 ± 1.10 with range 1 - 5 and the median was 4. Test of proportion showed that proportion of patients with Nurick's Grade ≥ 3 was significantly higher ($\chi^2=20.20$; $p<0.00456$).

Most patients presented to us with grade 3 or more.

Histopathology and Nurick's grade:-

Table-14 Histopathology and Nurick's Grade of the patients

Histopathology	Nurick's Grade					Total
	1	2	3	4	5	
Ependymoma	0	0	0	4	2	6
Hematoma	0	0	0	1	0	1
Paraganglioma	0	0	0	0	1	1
Meningioma	0	0	2	4	4	10
Neurofibroma	1	1	4	1	1	8
Schwannoma	2	1	6	5	8	22
Dermoid	0	0	0	1	1	2
TOTAL	3	2	12	16	17	50

$\chi^2=30$ ($p < 0.186$)

Chi-square test showed that there was no significant association between Nurick's Grade and histopathology ($p<0.186$). But a higher percentage of patients had been observed in higher Nurick's Grade for all histopathology.

Table-15 Distribution of mean Nurick's Grade (mean \pm S. E) of the patients

Time	Mean \pm S.E
Pre Operative (n=37)	3.75 \pm 0.18
3 Month (n=37)	2.97 \pm 0.14
6 Month (n=37)	1.86 \pm 0.16
12 Month (n=37)	1.32 \pm 0.12

Table-16 Difference of means and level of significance for Nurick's Grade

Time	Difference of mean	Significance
PO Vs 3 rd Month	0.78	$p>0.05$ NS
PO Vs 6 th Month	1.89	$p<0.05$ S
PO Vs 12 th Month	2.43	$p<0.001$ S
3 rd Vs 6 th Month	1.11	$p>0.05$ NS
3 rd Vs 12 th Month	1.65	$P<0.05$ S
6 th Vs 12 th Month	0.54	$p>0.05$ NS

S – Significant NS- Not Significant, PO-Pre-operative

ANOVA showed that there was significant differences of Nurick's Grade of different time period ($F_{3,144}=48.92$; $p<0.0001$). As per the CD the values of Nurick's Grade decreased significantly in different months compared to PO.

DISCUSSION

Age and sex distribution

In our study the mean age (mean \pm s.e) of the patients was 37.85 \pm 13.89 years with range 1-65 years and the median age was 38 years. Test of proportion showed that the number of the patients in the age group 20-49 years (75.0%) were significantly higher than other age group ($Z=4.47$; $p<0.001$), and mean age for male was 27 year and for female it was 37 years.

Kenan Arnautovic et al⁷ the mean age of patients with Intradural extramedullary is 46 years and 54-57% of them are male.

Our study is also in accordance with Armando Alpizar-Aguire et al⁸ In our study average age for schwannoma for male was 37 years and for female it was 43 years but schwannoma was equally distributed in male and female there was no prediction for either male or female.

Jeon Ho Jeon et al⁹ average age of spinal schwannoma was 50.2 years and male cases were more than female, Alfred T. Ogden¹⁰ cited that men and women are equally affected and peak incidence is fourth to sixth decades, as in accordance to our result.

In our study there were 10 patients of meningioma and 8 were female and 2 male and average age was 45 years. It is commonly accepted that meningioma are more common in female and can develop in any age group but majority occurs in fifth and seventh decades of life, as in accordance to my result.

In our study there were six cases of Ependymoma and all were female but there is slight male preponderance.

Duration of symptoms

The mean duration of symptoms (mean \pm S. E) of the patients was 21.85 \pm 21.53 months with range 1-72 months and the median was 12 months. Test of proportion showed that the number of the patients with duration of symptoms 1-12 months (47.5%) were significantly higher ($Z=2.34$; $p<0.05$) followed by more than 36 months (22.5%). In my study that average duration of symptom of IDEM tumors is 17.25 months and separately for schwannoma, meningioma, neurofibroma, ependymoma, dermoid, hematoma, paraganglioma is 21mth, 14 mth, 30 mth, 6mth, 1mth, 4 mth respectively. Out of these maximum of duration of symptom is for ependymoma.

Dong-Ki Ahn, MD, Hoon-Seok Park et al¹¹ The mean duration of symptoms was 19.3 months, but very near and supporting my results. But in M. Nambiar¹² mean duration of symptom before presentation with IDSC was 37.8 wk (9.4 mth).

Pain

64% of the patients had progressive pain ($Z=5.06$; $p<0.001$) followed by stationary pain (36%) ($Z=3.35$; $p<0.01$). There was increase in pain on lying down position which was statistically significant ($Z=2.68$; $p<0.01$). Most of patient presented patients with VAS \geq 4 was statistically significantly higher ($Z=6.12$; $p<0.001$). Patients with onset of pain as insidious was significantly higher ($Z=6.42$; $p<0.001$). So the conclusion is that most patient of IDEM present with insidious onset and progressive course which increases on lying down position, other variable presentation may be there. Table – 10 shows that site of pain corresponds with the site of tumor.

Dong – ki Ahn MD¹¹ found that most common symptom was pain that tends to increase during walking rather during rest and sitting.

Mithun Nambiar et al¹² pain was the most common symptom at presentation among the patient with IDSC (60%) as well as IMSCT (75.5%) and EMSCT (55.2%). In my study pain was the most common presentation along with neurological deficit.

J.W.M. van Goetham¹³ cited that pain typically increases in night specifically for schwannoma.

Histopathological diagnosis:-

Test of proportion showed that proportion of patients with schwannoma was significantly higher ($Z=2.38$; $p<0.05$), followed by meningioma.

In our study most common pathological diagnosis is schwannoma (44%) and next most common pathological diagnosis is meningiomas (20%).

Albanese V et al⁶ series in which they found Spinal intradural extramedullary tumors account for 2/3 of all intraspinal neoplasms and are mainly represented by meningiomas and schwannomas, with the former accounting for the 25-46% of all primary intraspinal tumors⁵. But in my study schwannoma and meningiomas account 64% of all intradural extramedullary spinal tumors. In my study other pathological diagnosis was neurofibroma, ependymoma, dermoid, paraganglioma and hematoma. Other tumors could be – ependymomas, arachnoid cyst¹², dermoid, epidermoid, teratoma, neurenteric cyst, paragangliomas, drop metastasis, granuloma. I did not find any case of arachnoid cyst, drop metastasis, teratoma.

With this discussion this conclusion can be made that most pathological cause of intradural extramedullary spinal tumor is nerve sheath tumors and meningioma.

Location of tumor

Test of proportion showed that proportion of patients with location of tumor at dorsal was significantly higher ($Z=2.81$; $p<0.01$).

In my study most common site was dorsal spine (~50%) then cervical spine (~20%) then lumbar spine (~15%).

Jeon Ho Jeon et al¹⁴ found most common site lumbar then dorsal and then cervical which is reverse to me. But Youman's neurological surgery¹⁵ writes that nerve sheath tumors equally distributed in the spine, but 80% of meningioma occurs at thoracic spine.

In our study schwannoma was most common at dorsal region then cervical and then lumbar. But meningioma was most common at dorsal region. They also writes that meningioma is more common in female and dorsal spine is the most common site.

In our study other tumors as ependymomas their most common site was dorsolumbar/ lumbar spine and for dermoid it was dorsal spine.

Alfred T Ogden¹⁰ writes that ependymoma arises within the filum terminale most in its proximal intradural portion and are slight more common in men than in women. Because sample size for tuberculoma, lipoma, and hematoma was very small so generalization of the result cannot be done.

This conclusion can be made that most common IDEM tumor is schwannoma which commonly located at dorsal spine though it may present anywhere in the spine. Second most common tumor was meningioma and most common site for development of meningioma is dorsal spine.

Histopathology and Nurick's grade:-

Chi-square test showed that there was no significant association between Nurick's Grade and histopathology ($p<0.88$). But a higher percentage of patients had been observed in higher Nurick's Grade for all histopathology

Surgical procedure:-

All patients were operated from posterior approach laminectomy and tumor removal, all tumors were accessible from posterior approach. In two patient after laminectomy, laminoplasty was done as it was involving long segment.

Post operative improvement in Nurick's grade and power:-

ANOVA showed that there was significant differences of Nurick's Grade of different time period ($F_{3,144}=48.92$; $p<0.0001$).

These result results shows that there was significant improvement in post operatively compare to preoperative Nurick's grade and these results are comparable with other. In my study all patients improved after surgery in post operative period in respect of functional Nurick's grade regard less of duration of symptoms.

CONCLUSION :

this conclusion can be made that patients preoperative functional status may depends on the duration of symptoms (when deficit develop) and site of tumor, but all patient of IDEM improves after surgery. So all patients should be offered surgical option regardless of functional status.

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