International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

Original Research Article.

Clinical Analysis of Spinal Tumours at a Tertiary Care Center

Tushar V. Soni[1], Surender Singh[2*]

[1]Professor and Unit Head, [2*]Senior Resident, Department of Neurosurgery,
N. H. L. Municipal Medical College and Sheth V. S. Hospital, Ahmedabad, Gujarat, India.

ABSTRACT

Background: Tumours of the spinal cord have long been a welcome entity for the neurosurgeons because in contrast to the brain tumour, they are in majority benign, circumscribed & surgically accessible. The post-operative outcome of spinal cord tumours is good and gratifying for both patients and neurosurgeons in comparative to intracranial tumours.

Aim and Objectives: The aim of this research is to study incidence, clinical features, classification, histopathological findings, regional and compartmental distribution, with clinicopathological correlation of spinal tumours, to analyse the long term outcome following surgical excision and to methodically review our results and compare them with selected and recognised published series in word literature.

Methods and Materials: A prospective analysis of 50 cases of spinal cord tumours treated at the department of neurosurgery, Tertiary Care Hospital, Ahmadabad from April 2013 to January 2016. Detailed scrutiny and analysis of the patient's data with respect to the demographic features, clinical findings, investigative procedures, extent of surgical excision, intra and post-operative complications, efficacy of adjuvant therapy, clinicopathological correlation were done.

Results and Conclusion: In our study the males are more commonly affected as compared to females. (M:F i.e. 1.2:1). However for meningiomas it is reverse. (in our study; F:M, i.e. 7:1). The commonest tumour observed was schwannoma. (26%) and second most common tumour is meningioma (16%). Maximum incidence of spinal cord tumours is in the age group of 20- 40 yrs. Weakness and pain are the common complaints of patients presenting with spinal cord tumours. Motor weakness, sensory loss and reflexes are common preoperative clinical signs elicited. The operative results of spinal cord tumours are excellent in intradural extramedullary and extradural (except metastatic lesion) with minimal deficit who present early. Whereas they are not so gratifying in intramedullary tumours, who presents late and with severe preoperative neurological deficit, due to vascular insult developed.

Keywords: Spinal Tumours; Surgical Management; Outcome.

***Correspondence to:**

Dr. Surender Singh,
Department Of Neurosurgery,
N. H. L. Municipal Medical College,
Ahmedabad, Gujarat, India.

Article History:

Received: 10-05-2018, **Revised:** 03-06-2018, **Accepted:** 21-06-2018

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2018.4.4.042	

INTRODUCTION

Tumours of the spinal cord have long been a welcome entity for the neurosurgeons because in contrast to the brain tumour, they are in majority benign, circumscribed & surgically accessible.

The post-operative outcome of spinal cord tumours is good and gratifying for both patients and neurosurgeons in comparative to intracranial tumours.

In the earlier years, detailed neurological examination was the only method of localisation of such neoplasms. But nowadays accurate localisation is greatly aided by myelography, computerised tomography and magnetic resonance imaging scan.

Magnification & illumination offered by a surgical microscope greatly helps in finer dissection & excision of tumours. The early diagnosis and surgical removal and relieving pressure on the cord along with an intensive rehabilitation give excellent results with better outcome. The aim of this study is to analyse the incidence of different types of spinal tumours and correlation between clinical presentation and pathological findings of spinal tumours after it's surgical removal.

AIMS AND OBJECTIVES

The aim of this research is

- To study incidence, clinical features, classification, histopathological findings, regional and compartmental distribution, with clinicopathological correlation of spinal tumours treated at the Department of Neurosurgery, Tertiary Care Hospital, Ahmedabad from August 2013 to January2016.
- To analyse the long term outcome following surgical excision.
- To methodically review our results and compare them with selected and recognised published series in word literature.

MATERIALS AND METHODS

An analysis of 50 cases of spinal cord tumours treated at the department of neurosurgery, Tertiary Care Hospital, Ahmadabad from April 2013 to January 2016.

Detailed scrutiny and analysis of the patient's data with respect to the demographic features, clinical findings, investigative procedures, extent of surgical excision, intra and post-operative complications, efficacy of adjuvant therapy, clinicopathological correlation were done.

Operative Technique

Patients are prepared for surgery by steroid medication & preoperative antibiotics.

Skin marker X- rays are taken preoperatively in all cases except tumours in cervical region.

General anesthesia given to the patients, placed in prone position. The midline incision is given half above and half below the lesion. Subperiosteal separation of paraspinal muscle done.

Complete removal of spinal process & wide laminectomy is performed to expose the tumour adequetly. Over the tumour epidural fat may be thinned out or absent. After opening the dura in midline, the edges were reflected away and held with stay sutures.

The arachnoid of tumour is opened & capsule separated from all sides. The excision of tumour was done in a piecemeal fashion, preserving the nerve rootlets. The excision of tumour was subtotal to total.

Once the excision is complete, haemostasis achieved with help of bipolar cautary, abgel without stretching of cord and nerve rootlets, the dura was closed in a water tight manner with silk 4.0, paraspinal muscles with vicryl 1.0 and 1skin closed with ethilon 3.0.

For intramedullary tumours after opening of the dura, the thickened and dilated cord is visualised. Midline small vessels were coagulated with bipolar cautary & midline myelotomy is carried out.

The pial surfaces are gradually separated from tumour surface by use of dissector & bipolar cautary and patties. Internal decompression of tumour followed by a complete excision of tumour is done without injuring the cord. Dura closed in water tight manner with silk 4.0.

For tumour extension to thorax, antro-lateral thoracotomy performed & complete excision of tumour is done.

Postoperative neurological status and complications were studied. Postoperative physiotherapy was given to all patients. The patients were evaluated on daily basis and regularly in follow-up.

Follow up was obtained either by clinical records or by personal communication through telephonically. Patients with subtotal excision & malignancy were subjected to adjuvant radiotherapy.

Radiotherapy was deferred in those patients where complete tumour excision was performed and the patients were closely observed. All such patients were monitored with serial MRI scans to detect any recurrence during subsequent follow up visits.

Table 1: Incidence of benign spinal tumour is in relation to malignant spinal tumours.

Total no. of spinal cord tumours	Benign Spinal cord tumours	Malignant Spinal cord tumours	Percentage of malignant tumours
50	39	11	22%

Table 2: Incidence of spinal tumours as age and sex

Age (years)	Males	Females	Total	Percentage
0-10	-	4	4	8%
11-20	5	2	7	14%
21-30	8	2	10	20%
31-40	6	5	11	22%
41-50	6	3	9	18%
51-60	2	4	6	12%
61 onwards	1	2	3	6%
Total	28	22	50	100%

Table 3: Duration of symptoms

Duration of symptoms	No. Of cases	Percentage
0–1 month	03	6%
1–3 month	08	16%
3–6 month	20	40%
6–12month	10	20%
1–2 year	07	14%
More than 2year	02	4%

RESULTS

The present study is an analysis of spinal cord tumours, which were managed at our institute from April 2013 to January 2016.

We have analysed 50 cases of spinal cord tumours in respect to age, sex, duration of symptoms, clinical features, radiological investigations, surgical procedures, pathological diagnosis, outcomes and complications and follow up.

Out of 50 spinal cord tumours, 39 were benign and 11 were malignant spinal cord tumours, as per our study 78% of

spinal cord tumours are benign. Benign spinal cord tumours occur predominantly in third and fourth decade of life.

In our study youngest patient was three years old and oldest patient was 68 years old. There was male preponderance over females (male: female- 1.2:1) The tumours were commonly found in third and fourth decades and the incidence gradually decreased thereafter. Only a single tumour, meningioma has female preponderance over males and commonly occur in 5th - 6th decade.

The duration of symptoms varied from seven days to more than two years. Maximum number of cases presented within six month, initiation of symptoms. Out of 50 cases thirty one cases (62%) presented within six months.

Out of 50 cases of spinal cord tumours, the commonest site of lesion was Dorsal spine (40%cases) next to it was cervical spine (32%). Maximum number of cases occurred in cervical and dorsal region, in our study 82% cases occurred in these two regions.

88% patients presented with motor weakness of which 32 % having weakness in upper limbs and all patients had lower limb weakness. About 96% patients having pain, tingling and numbness and paresthesia. Only 16% patients having sphincters disturbances. In which 08% having both sphincters (rectal & urinary) involved.

78% patients having spastic paresis and 10% had flaccid paresis, 12% patients having no motor weakness but slight spasticity present in one case without motor weakness. 38% patients having power grade 3. 34% patients had power grade 4. 72% patients having power more than grade 3. 08% patients had impaired per anal sensation and they also suffered from rectal incontinence. 78% patients had preoperative exaggerated deep tendon reflexes while spasticity present in 80% casesOut of fifty cases of spinal cord tumours, schwannoma is most common tumours which accounts 26% of all spinal cord tumours and second most common is meningioma(16%).

Schwannoma, menigioma and neurofibroma constitute more than 50% spinal cord tumours. Other like lipoma, epidermoid cyst, metastatic lesion, neurentric cyst, astrocytoma, ependymomma constitutes rest 50% of spinal cord tumours.In our study maximum number of cases is intradural extramedullary in location (50%).

As compared to other published data, in our study intramedullry tumours are more common which constitutes 28% of all spinal cord tumours.

Table 4: Level of lesion

Level	No. Of cases	Percentage
Cervical	16	32%
Cervicodorsal	05	10%
Dorsal	20	40%
Dorso-lumbar	07	14%
Lumbar	02	04%

Table 5: Signs and Symptoms

Symptoms & sign	No. Of cases	Percentage
Motor symptoms (weakness & wasting)	44	88%
Sensory symptoms (pain, tingling,	48	96%
Spincter disturbance		
Urinary	08	16%
Rectal	04	08%
Both involvement	04	04%
Higher function & cranial nerves	00	00%
Tone		
Increased	40	80%
Decreased	05	10%
Normal	05	10%
Power Grade		
0	02	04%
1	02	04%
2	04	08%
3	19	38%
4	17	34%
5	06	12%
Sensation		
Exteroceptive	47	94%
Proprioceptive	19	38%
Perianal	04	08%
Reflexes:		
Exaggerated	39	78%
Depressed	05	10%
Normal	06	12%
General examination		
Cutaneous neurofibroma	02	04%
Cafe-au-lait spot	01	02%

Table 6: Pathological diagnosis

Diagnosis	No. Of cases	Percentage
Schwannoma	13	26%
Meningioma	08	16%
Neurofibroma	03	06%
Lipoma	02	04%
Epidermoid cyst	03	06%
Neuroentric cyst	03	06%
Dermoid cyst	01	02%
Synovial cyst	01	02%
Ependymomma	02	04%
Astrocytoma	04	08%
Ewing's sarcoma	01	02%
Malignant Spindle cell tumour	01	02%
Capillary Haemangioma	01	02%
Tubercular lesion	01	02%
Malignant Melannoma	01	02%
Metastatic lesion	04	08%
Cystic lesion	01	02%

Table 7: Location of tumour

Location	No. Of cases	Percentage
Intramedullary	14	28%
Intradural extramedullary	26	52%
Extradural	10	20%

Table 8: Presenting symptoms with pathological diagnosis

Symptoms	No. Of cases	Nerve Sheath tumour (schwannoma & Neurofibroma)	Meningioma	Ependymomma	Lipoma
Radicular pain	35	14	06	00	00
Paraesthesia	48	12	08	02	02
Weakness Of limbs	44	10	08	02	02
Bladder & Bowel symptoms	08	O2	01	02	00

Table 9: Complications

Type of complication	No. of cases	Percentage
CSF leakage	04	08%
Wound infection	02	04%
Bed sore	01	02%

Table 10: Outcome

Type of recovery	No. of cases	Percentage
Good	35	70%
Moderate	11	22%
Minimal	02	04%
No recovery	01	02%
Deterioration	01	02%

In our study nerve sheath tumours (86%) cause radicular pain while 75% meningioma cause radicular pain.

Intramedullary tumours such as ependymoma, astrocytoma other intramedullary tumours cause radicular pain but less than intradural extramedullary tumours, while they mainly cause local axial pain. 96% spinal cord tumours cause paresthesia, this is the commonest presenting symptom of spinal cord tumours in our study. Weakness of limbs is second presenting symptom in our study. This may be due to more awareness about sensory symtoms.

Sphincter disturbance is only present in 16%cases mainly in intramedullary and cauda equine tumours.

Urinary sphincter involved in all 16% cases while rectal sphincter only in 08% cases, they are also common with urinary sphincter

involvement. In our study, no single mortality seen, while 12 % patients having some complication mainly post-operative CSF leakage. Infection occurred in 2 patients and wound infection associated with bedsore in one patient. So out of 50, only six patients have postoperative complications.

In our study group thirty five patients (70%) near about completely. Eleven patients (22%) having moderate recovery. They improved as compared to preoperative status but having some residual deficit. Most of them able to perform their daily routine activities independently.

Two patients (04%) having some improvement but not so much that they can perform their daily routine activities. All these two patients presents very late after appearance of symptoms.

One patient having Ewing's sarcoma in dorsal spine deteriorated postoperatively. Recurrence was noted in one patient who had anaplastic ependymoma grade 3. Follow up radiological study showed recurrence of tumour with multiple site metastases even patient completed post-operative radiotherapy. Results of extradural and intradural extramedullary tumours generally are excellent. Results of intramedullary tumours in our surgery are not so excellent but very encouraging. This corresponds well with duration and extent of preoperative neurological status.

DISCUSSION

Historical Review

Mogagni, the founder of modern pathological anatomy referred in 1769 to the occurrence of spinal cord paralysis due to compression by tumour.1 Victor Housley, First intradural spinal cord tumor was removed by him in 1887.[2] Harvey Cushing – successfully removed intramedullry ependymoma by myelotomy in 1905.[3] Walter Dandy – First described gas myelography in1921. Sicard has invented oil based contrast myelography in 1923.[4] Elseberg - Refined the diagnosis & the management of spinal cord tumour in 1925 and first who described a two -stage strategy for removal of intramedullary tumours.[5] James Greenwood & Malis, used bipolar diathermy for spinal surgery; Reported large series of patients who were operated for intramedullary tumours in 1950.[1] Kruze discovered the operating microscope in 1964. Hounsfield & Ambrose introduced CT myelography for identifying & localisation of spinal cord tumour in 1970.

Sonneland et al – presented the largest series of myxopapillary ependymomas of 77 cases in 1985.[6] Kothbaur et al-showed the relationship of intra-operative changes in motor-evoked potentials to post-operative function in 1998. These findings were confirmed by Sala et al in 2006. Thus minimally invasive neurosurgical microscopic techniques (lasers and CUSA) improved surgical outcome of spinal cord tumours.

Anatomical Reveiw

To understand anatomy of spinal cord it is the necessary to know the embryological development. We shall discuss in short the embryological development, followed by the anatomical details.

Embryology

The spinal cord is the least modified portion of the embryonic neural tube and the only part of the adult nervous system in which primitive segmental arrangement is clearly preserved. In the early fetal life, the spinal cord is as long as the vertebral canal and each spinal nerve arises from the cord at the level of corresponding intervertebral foramen.

In subsequent development the spinal cord does not grow as much as the vertebral column at its lower end. It therefore gradually ascends to reach the level of third lumber vertebra at the time of birth, and to the lower border of the first lumber vertebra in adult. As a result of upward migration of the cord, the rootlets of spinal nerves have to follow an oblique downward course to reach the appropriate intervertebral foramen. This makes rootlets longer.

The obliquity and length of the rootlets is most marked in lower nerves and many of these rootlets occupy the vertebral canal below the level of the spinal cord. The tapered terminal portion of spinal cord forms the conus medullaris and the rootlets constitute the cauda equina.[7]

Gross Anatomy

The spinal cord originates at the level of foramen magnum and extends to conus medullaris, which terminates at the L1- L2 vertebra body junction in adults. The cord is continous cranially with the medulla oblongata and narrows caudally to the conus medullaris from whose apex a connective tissue filaments, the filum terminale descends to the dorsum of the first coccygeal vertebral segment.[8]

There are two enlargements:

Superior: In cervical region from C4 to D1 at vertebral level.

Inferior: From D9 to D12 spinal cord segments at vertebral level.

The spinal nerves with ventral & dorsal roots are arranged in 31 pairs:

8 cervical; 12 thoracic; 5 lumber; 5 sacral & 1 coccygeal. Dorsal roots ganglions are present on each side of dorsal roots.

Important cord levels

Cord segments	Vertebral level
C7	C6
D4	D2
D8	D5
D12	D9
S1	L1

The spinal cord is surrounded by pia, arachnoid & durameter. Dura form a sheath around the cord & cauda equina by loose areolar tissue adherent to endosteum of vertebral body. Beneath the dura, arachnoid is separated from the piamater by subarachnoid space containing CSF. The longitudinal fibres midway between ventral and dorsal roots extends laterally from piamater to duramater and suspended the cord laterally . These ligaments are called dentate ligaments. Due to these ligaments, which grows in antreolateral or posteriolateral aspect of cord, may press upon ventral or dorsal roots before appearance of symptoms of pressure upon cord itself.

Branches of thirty –one pairs of radicular arteries enter vertebral columns through intervertebral foramen.

They are of three types:

1. Proper radicular branches, which ends within roots or on duramater before reaching the spinal cord.
2. Piamater radicular branches.
3. Spinal branches.

Out of 31 branches seven or eight really participate in vascularisation of the spinal cord.

The spinal cord is also supplied by large three arteries:

One anterior spinal artery.

Two posterior spinal arteries.

The anterior spinal artery is formed by the union of two spinal branches of the right & left vertebral arteries in the upper cervical canal. It runs caudally in the anterior median fissure of spinal cord and terminates along the filum terminale.

There are two posterior spinal arteries each arising as small branch from either the vertebral or posterior inferior cerebellar arteries. Each posterior spinal artery runs down on the posterolateral aspects of the cord in the posterolateral sulcus along the line of the attachment of the posterior nerve roots and usually divided into two collateral arteries along the medial and lateral sides of the posterior nerve roots. Thus, there are five longitudinal arteries around the spinal cord.

The anterior spinal artery supplies the anterior two third of the spinal cord, while two posterior spinal arteries together supply the posterior one third of the spinal cord.[9] The venous drainage of the spinal cord is capillary plexuses to the periphreral venous plexuses that correspond to the arterial supply. The major portion of the venous drainage takes places through the intervertebral foramen into the veins of the thoracic, abdominal & pelvic veins, but the spinovertebral plexuses also continue upward into the intracranial veins and venous transport of tumour cells & other emboli of the brain.[10]

Internal Structure of Spinal Cord

The spinal cord is composed of the grey matter and white matter. Grey matter is composed of cell bodies (neurons) and their process while white matter is composed of myelinated & nonmyelinated nerve fibres.

Grey matter of the spinal cord, on each side, is subdivided into anterior (ventral), posterior (dorsal), and lateral grey column (horns). The anterior, posterior and lateral grey columns lie anterior, posterior and lateral to the transverse band of grey commissure.

The anterior grey column contains cell bodies of motor neurons (alpha & gamma) the cells of this column gives origins of axons, which forms ventral roots of the spinal nerve.

Posterior grey column contains somatic & autonomic sensory neurons and receives the central process of pseudo-unipolar cells of dorsal root ganglion. This column gives origins of axons, which forms the ascending tract of the white matter.

The lateral grey columns are present between the anterior & posterior column on each side. These columns extend from T1 to L2 and S2 to S4 spinal segments. They contain the preganglionic autonomic motor neurons that carry nerve impulses for the regulation of activities of smooth muscle, cardiac muscle, and glands.

The sensory neurons of the dorsal grey column are much smaller in size as compared to motor neurons of anterior grey column.[11]

The white matter of cord consists of mixture of nerve fibres, neuroglia& blood vessels. The nerve fibres are myelinated (high proportion) which gives white color. Fasciculus gracillus & fasciculus cuneatus convey information of proprioception & additional contribution of fine touch & pressure thus helps to cerebellum to control voluntary movements. The spinotectal tract provides ascending pathway for spinovisual reflexes. The corticospinal tracts supply the limbs.[12]

The anterior nerve roots are involved only in extradural tumours. The anterior horns may be involved in both intramedullary & intradural extramedullary tumours which produce progressive lower motor neurons paralysis (wasting & fasciculation of involved muscles with loss of reflexes).

Involvement of pyramidal tract results in loss of voluntary power, spasticity, exaggerated tendon reflexes & positive Babinsski's sign on the same side. Asymmetry in weakness, in spasticity & reflexes disturbance are characteristics of tumours.

The fibres originating from distal parts are situated centrally & fibres from proximal parts are situated peripherally in posterior column. This arrangement of the fibres in spinothalamic tracts is reverse which helps in differentiating extra & intramedullary tumours. In extra medullary tumours sensory disturbances is maximum in distal parts of body, minimal near the lesion. So the sensory disturbance in extra medullary, is ascending type while in intra medullary sensory disturbance is descending type, sparing the sacral dermatomes.

In intramedullary tumours, there may be dissociation of sensation. In both intra & extra medullary tumours loss of tactile sensation is less than that of pain & temperature because of the presence of dual pathway for touch,situated peripherally. Intramedullary tumours affect micturition early as the fibres of bladder lies deeper in lateral column & occupy an area nearer to central cord.[13]

Accurate localisation of lesion of cord is usually possible because of precise anatomical structures & function while in brain this localisation is not so accurate.

Histopathological Review

Before the time of Virchow, pathologists and surgeons described central nervous system tumours in great details according to external characterirstics . Bressler in 1839 tried to create order with categories such as blood tumour, bone tumour, fatty tumours. Glioma were known as "meduularry sarcoma "or fungus medullare.[14]

A new period began with discovery of the cell by schleiden and Schwann. The possibility of microscopic study caught the imagination of Johannes Muller,(1838) who was convinced that the development of the normal cell would repeat itself in pathological processes. Only with Virchow (1846) did the period of systemic classification of tumours begin. He recognized the supporting elements of the nervous glioma and used the theory of system, labeled them "neuroglia " and thus initiated the cytological approach to Classification thus Virchow created the term the glioma.[14] Ribbert (1918) further studied Cohnhein (1875) pertaining to development of tumours from embryonic rest. He thought that the morphological difference could be explained by comparing tumours cells with development stages of glia. This concept was the foundation for many classifications used until the present time

In the same period, new histological methods were developed in Spain by Ramon. Y. Cajal and del Rio Hertega. They used metallic impregnation on cells of the brain. This work had strong influence on many pathologists.[15]

Among this workers were Bailey and Cushing who later concentrated on comparing types of tumour cells with cells in normal stages of development and extensively used metallic

impregnation techniques. In 1926 Bailey and Cushing proposed a classification of glial tumours in 14 groups on histogenetic basis with correlated study of prognosis.

Kernohans and associates introduced a system of grading glioma based on theory that tumours were derived by differentiation of the mature cells. That means grading of tumours depending on degree of anaplesia.[17]

In the Cologne International Tumor Symposium in 1961, it was realised that there is necessity of coming to a common agreement and standardising the terminology of central nervous system tumours used by different schools.

A compromise has been offered by unio-internationalis contra cancrum (UICC) and the WHO classification. The classification has imperfections, but it is an attempt to obtain agreements on names used throughout the world.

Finally the concept of "Total Malignancy" suggested by Zuich, including not only the histological features but also the effect of location as in case of spinal cord tumours is of importance in the clinical use of any classification. The primary spinal cord tumours arise from different elements of central nervous system, including neurons, supporting glial cells, and meninges.

Anatomically, neoplasms of spinal cord may be classified according to compartment of origin.

- Extradural spinal cord tumour.
- Intradural extramedullary spinal cord tumour.
- Intramedullary spinal cord tumours.

Extradural spinal cord tumours: Metastatic lesions of the spine represent the large majority of spinal epidural tumours. It is likely to be increased in future due to prolonged life expectancy of cancer patient with advance cancer therapy. When a metastasis invades spinal canal, it is usually restricted to extradural space. The durameter is a barrier to penetration tumour cells to subdural or subarachnoid space. So intradural metastasis is uncommon. The onset of the symptom of spinal cord or nerve root compression may be acute or insidious. Local pain in the vertebral column is generally located close to the site lesion. Radicular pain is less common than local pain.

Benign extradural tumours such as schwannomas, neurofibromas and meningiomas are generally intradural but occasionally have an extradural component or may be limited to extradural space. Schwannomas and neurofibroma are extradural in approximately 15percent of cases. A benign extadural tumour is likely to cause nerve root irritation with associated radicular pain or dysesthesia.[13]

Intradural extramedullary spinal cord tumours: Intradural extramedullary tumours most commonly found in adult. The most common intradural extramedullary tumours are the nerve sheath tumours, which constitute approximately 30 percent of spinal tumours and meningiomas are second around 25 percent of spinal cord tumours.[5]

Schwannomas

Schwannomas arises from support cells of nerve sheath and are most common intradural extramedullary spinal tumours. While they may occur in any spinal compartment, they are most commonly intradural extramedullary in location within the thoracic or lumbar spine.[18] The classic "dumbbell" lesion extending through the neural foramen is considered both intra- and extradural, occurring in 10-15% of cases. Most are solitary and sporadic. Syndromic associations include NF2, Carney complex, and schwannomatosis. Schwannomas are typically low grade (WHO grade I) tumors. Total resection of an intradural schwannoma is considered curative.[19]

Meningioma

Meningiomas are the second most common intradural extramedullry spinal neoplasm. They arise from arachnoid cap cells within the dura and are most commonly seen in females in the 5th-7th decades of life.[18] A broad Dural attachment, or "dural tail", was seen in 58% of meningiomas in one series, best demonstrated on post-contrast imaging.[19]

Neurofibroma

Neurofibromas are much less common than schwannomas within the spine. They are most commonly seen in the 3rd-4th decades of life and have no gender predilection. They can be intradural or extradural and can be seen at any spinal level. Neurofibromas are WHO grade I neoplasm. While total resection is considered curative, tumours with extensive paraspinal involvement and subtotal resection have a propensity to recur and require follow up imaging. It is often difficult if not impossible to distinguish solitary spinal neurofibromas from schwannomas based on imaging alone. Peripheral T2 hyperintensity, the "target sign," is more suggestive of neurofibroma but not pathognomonic. Cystic degeneration and haemorrhage are also less common than schwannoma. Involvement of a ventral nerve root is more suggestive of neurofibroma.[20]

Intradural Intramedullary Spinal Cord Tumours

Intramedullary tumours represent 5-10% of all spine tumors and are more common in children.[1] The most common primary intramedullary neoplasm are ependymoma, astrocytoma, and hemangioblastoma. Ganglioglioma, metastasis, and primary lymphoma are less common. Intramedullary neoplasm share many common imaging features. Abnormal cord signal intensity and expansion, whether from tumor itself or from cord oedema, commonly spans several spinal levels, and may involve the entire spinal cord. Contrast enhancement is the rule, and unlike most intracranial neoplasm, even low-grade spinal tumours characteristically enhance. Syringohydromyelia and cyst formation is common. The majority of intramedullary neoplasm are low grade and slow- growing. Therefore, patients typically have a prolonged clinical course extending over many years prior to diagnosis. Common symptoms include back pain and sensory disturbances. Intramedullary tumours present with a wide array of symptoms that vary in intensity and chronicity. The clinical features of each tumour are related to the growth rate, location, and longitudinal extent of the tumor.[21] The most common tumour presentation is back or neck pain. This is hypothesized to result from dural distension and irritation. The pain is of constant intensity and varies between individual patients; it is classically worsened in the recumbent position. Nerve root compression can produce weakness, and clumsiness.[22]

Ependymomas

Ependymomas are rare, unencapsulated glial tumours of the brain, but they represent the most common form of intramedullary spinal cord tumours in adults and account for approximately 50%– 60% of all intramedullary tumours.23 Ependymomas develop from ependymal cells, which are the epithelial-like cells lining the ventricles of the brain as well as

the central canal of the spinal cord. However, gross total resection is not achieved in most patients due to most ependymomas being located in areas that, if resected, would decrease neurological function.[24]

Recent studies suggest that radiotherapy is not associated with lower overall recurrence regardless of the extent of resection.[25]

Astrocytoma

Astrocytomas are red, gray, glossy tumours that are characterized by a poorly defined plane and are generally infiltrative in nature. Astrocytomas are the second most common intramedullary spinal cord tumour in adults at 30 to 35% of tumours and the most common in children at 90% of tumors.[26] Astrocytomas typically lack a clear plane of dissection and demonstrate a much more infiltrative nature than ependymomas. Karikari et al noted that 47.6% of patients with primary spinal cord astrocytomas had a recurrence, all of whom had originally underwent subtotal resection. This is much higher than the rate of recurrence for ependymomas of 7.3%.[27]

If recurrence of astrocytoma does occur, radiotherapy is the next course of treatment. Some studies have suggested a possible therapeutic value for the DNA-alkylating drug temozolomide. Chamberlain et al. showed that temozolomide treatment led to 27% progression- free survival at 2 years with a median survival of 23months.[28]

As temozolomide has shown some efficacy in treating intracranial astrocytomas, such as glioblastoma, it has been used in treating astrocytomas within the spinal cord as well.[29]

Other Tumours of Spinal Cord

Lipomas: Lipomas are rare congenital tumors that constitute 1% of intraspinal tumours. Commonly found in the cauda equina and conus medullaris. These tumours tend to violate the posterior cord and are usually extramedullary.[30]

Lipomas are commonly associated with spinal dysraphism and are thought to arise from premature disjunction of the cutaneous ectoderm from the neural ectoderm prior to neural tube closure, allowing mesenchymal cells to infiltrate into the neural groove.[31]

These tumours contain higher water content than other intramedullary tumours and tend to attach firmly to the dura; their cellular content is indistinguishable from normal adipose tissue.[30]

The acceptable surgical technique is subtotal removal as these are slow growing and unlikely to recur after a generous debulking has been performed.[32]

Developmentally, these tumours prevent normal maturation of the surrounding neural tissue.[30]

Epidermoid and Dermoid Cyst: Epidermoid and dermoid cysts are account for less than 2.5% of all central nervous system lesions, the cranial to spinal ratio being 6:1. The pathogenesis of spinal epidermoid and dermoid cysts, as mentioned by Dias and Walker, is mainly congenital, the origin being epithelial tissue displaced during closure of the neural tube between the 3rd and 5th weeks of gestation. The location of the epidermoid and dermoid cyst are variable, more common sites are lumbosacral and thoracic area. The ideal treatment of these lesions is the complete surgical excision including excisions of capsule. Spilling of contents into subarachnoid space leads to aseptic chemical meningitis and arachnoiditis. Perioperative use of steroids and intra operative use of steroid containing irrigation fluid is believed to help in alleviating the chemical irritation.[33]

Neurentric Cyst: Neurentric cyst reported in the literature by variable names as an entrogenous cyst ,entric cyst, gastrocytoma, split notochord syndrome, and teratoid cyst is an infrequently reported congenital anomaly believed to derived from an abnormal connection between the primitive endoderm and neuroectoderm during the 3rd week of gestation.

These may appear intradural extramedullary masses or rarely as intramedullary lesions. Pathologically these cysts vary in complexity and composition. Cysts wall lined by mucin secreting epithelium resembling that of gastrointestinal tract.[33]

Malignant Melanoma: Primary melanomas of the spinal cord are very rare and account for about 1% of all melanomas, with diagnosis dependent on the absence of melanoma outside of the CNS and histological confirmation of pigmented tumors.[34] Patients with primary intramedullary melanoma will experience similar symptoms as other intramedullary tumors. However, melanomas often develop more rapidly than other intramedullary spinal cord tumours, so the progression of symptoms will be rapid.[35]

In this study all cases were diagnosed clinically, radiologically and confirmed histopathologically after surgery. An analysis of clinical features and surgical outcome with pathological finding were discussed. Out of 50 cases of spinal cord tumours 39 cases were benign spinal cord tumours & 11 cases were malignant. In our study youngest case was of 3 yrs and oldest case was of 68 years, average age of presentation was 34.8years.There is male preponderance over female in ratio of 1.2:1. There are 28 male patients out of 50 cases. In our series 84% (11 out of 13) of schwannomas were intradural extramedullary tumours and other 2 cases also has extradural component and both are dumbbell schwannomas, one was located in thorasic region and second one in cervical region. Benign spinal cord tumours occur predominately in 3rd decades of life. In our experience also the benign intra-spinal tumours are commonly seen on 3rd and 4th decades. This matches with those in other series. Patients who are neurologically deficit especially the older people do not have satisfactory resolution of neurological deficits however in younger individuals with severe neurological abnormities may resolve slowly in the postoperative period. Spinal cord tumours are rare in children we found only 4 cases out of 50 cases those occurred in first decade. All four cases are female child and all tumours as per location are intramedullary. In a 25 year experience at the institute the neurology, Chennai there have been only three neurinomas and one meningioma in children below the age of 10years.4 While in our cases all tumours having different pathology such as pilocytic astrocytoma, dermoid cyst, epidermoid cyst and lipoma.

Because of relative bulk of cord substance most common location of spinal cord tumours is dorsal region, next is cervical region and lumbosacral region is least. In our series distribution was 40% in dorsal, 32% in cervical, 14% in dorsolumbars, 10% cervicodorsal, 4% in lumbar region. All meningiomas were intradural extramedullary lesion.

Astrocytomas and ependymomas were intramedullary. Duration of sign symptoms varied from 15 days to 2 years and mean presentation period was 6 months. Pain was found in 70%, motor deficits in 88%, sensory deficits in 96% and sphincter involvement in 16% of the patients with dual sphincter involvement in 8%. The previously reported incidence of primary spinal cord tumors, varies, there were evident differences in the

prevalence of nerve sheath cell tumours (schwannomas and neurofibromas) and meningiomas, which were the most common primary spinal tumors. The nerve sheath cell tumors were found more frequently than meningiomas in Asian countries.[36]

Including in our study (nerve sheath cell tumours 32.0%; meningiomas 16%), and this trend was more obvious in eastern Asia. Hirano et al reported that nerve sheath tumours accounted for 60.6% in their series of 678 cases of primary spinal tumour in Japan.

By contrast, the frequency of meningiomas in Western countries was equal to or higher than that of nerve sheath tumours. Neuroepithelial tumors occurred less frequently in Asian countries than in Western countries. The incidence of vascular tumours seems to very less among the studies. There were significant differences in the prevalence of schwannomas, meningiomas, and neuroepithelial tumours between Asian countries and non-Asian countries. [37,38]

Nerve sheath cell tumours were the most common primary spinal tumours in our study with significant difference in prevalence between men & women (ratio men to women5/3) However, the preponderance for spinal meningiomas in women is universal; in our study of patients, the ratio of men to women for meningiomas was1/7(0.14). There are 7 women out of 8 total meningioma patients. Only one case diagnosed meningioma in our study is male.

In previous studies, the ratio of men to women for patients with primary spinal tumours varied among Asian regions. There would be a slight male dominance for primary spinal tumours if meningiomas were not included.

Jinnai et al, collected data for 149 patients with spinal nerve sheath tumours and the symptoms at onset were motor weakness in 36 (24.2%) patients, pain in 55 (36.9%) patients, and paraesthesia and/or numbness in 53 (35.6%) patients.[39]

The presenting symptoms of spinal meningiomas include back pain, motor disturbance, sensory disturbance, and sphincter dysfunction. The initial presenting symptoms vary among patients because of the different levels and anatomic location of the tumour.[40]

The most common clinical presentations of primary spinal tumours in our study were sensory symptoms (48/50 patients; 96%). Nerve sheath cell tumours usually cause paraesthesia or a shooting pain and are sometimes found incidentally.

In our series, best surgical results were obtained after resection of nerve sheath tumours and meningiomas. Astrocytoma and ependymoma has unfavourable outcome. This evident lack of improvement may be attributable to the rapid growth of tumour which often causes significant compression of large part of cord and necessity of extensive resection to get tumour free margins. Astrocytoma is more infiltrative than ependymoma. The extent of tumour resection and decompression correlates directly with a good outcome. The period from the onset of first neurological symptoms till the diagnosis in more than 60% of our cases was 2weeks to 6 months. This period is long enough for the development of undesired factors influencing the outcome after surgery. This long duration in our study may be due to predominant presenting symptoms are sensory deficits.

The same was reported in the literature by Bauer, Brotchi, Dunn, Klekamp. That's why, from 33 cases of total tumour removal, only in 26 cases were registered full recovery 5 cases got partial recovery and 2 cases having no improvement in preoperative neurological deficit, both 2 cases discharged without improvement had metastatic lesions. This is because in our country we don't have yet a developed multidisciplinary approach and follow- up tools for patients suffering of this pathology.

In our study, 12% cases experienced postoperative complications. Most common complications in our cases are CSF leakage, bedsore and surgical site infection.

Wide range of mortality rate was reported from different authors- Cohen & Allen report a mortality rate 0-3%, Bilsky 13% and in our study 0.0 %.

Most of factors influencing surgical treatment and the outcome are well known. That's why through early diagnosis and proper treatment (surgery, radiation and Chemotherapy) the complications can be avoided or at least minimized.

CONCLUSION

Based on the results obtained in the present study of 50 cases of the spinal tumours, which are surgically treated in our institute from April 2013 to January 2016. The following conclusions are arrived:

The males are more commonly affected as compared to females. (M:F i.e. 1.2:1). However for meningiomas it is reverse. (in our study; F:M , i.e. 7:1).

The commonest tumour observed was schwannoma.(26%) and second most common tumour is meningioma(16%).

Maximum incidence of spinal cord tumours is in the age group of 20- 40 yrs. Weakness and pain are the common complaints of patients presenting with spinal cord tumours. Motor weakness, sensory loss and reflexes are common preoperative clinical signs elicited.

The operative results of spinal cord tumours are excellent in intradural extramedullary and extradural (except metastatic lesion) with minimal deficit who present early. Whereas they are not so gratifying in intramedullary tumours, who presents late and with severe preoperative neurological deficit, due to vascular insult developed.

We concluded from this study that excellent outcome obtained today are related to early diagnosis achieved with new neurodiagnostic studies and to improved surgical techniques, with use of sophisticated surgical tools like operative microscope, microdissectors, ultrasonic surgical aspirators, bipolar cautry etc.

The rate at which symptoms and signs progress correlate fairly well with grade of lesion. Symptoms from low grade spinal cord tumours may progress slowly over a period of years, whereas high grade tumours produce symptoms over a period of weeks or months. Otherwise site of tumour is more important to develop neurological symptoms.

However further studies & more varied series of the patients are indicated to further validate the conclusions arrived at from this study.

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Source of Support: Nil.

Conflict of Interest: None Declared.

Cite this article as: Tushar V. Soni, Surender Singh. Clinical Analysis of Spinal Tumours at a Tertiary Care Center. Int J Med Res Prof. 2018 July; 4(4):177-86.
DOI:10.21276/ijmrp.2018.4.4.042