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A Study of Clinical, Radiological And Pathological Correlation of Intraspinal Compressive Lesions

Dr.Joel Dhanapandian S[1].,Dr.Johnsy Merla J [2].,
([1]Associate Professor, Department Of Neurosurgery, Tirunelveli Medical College.
[2]Assistant Professor, Department Of Pathology, Tirunelveli Medical College.
The Tamilnadu Dr.M.G.R Medical University, India)

Abstract: *Spinal cord compression may occur due to a variety of causes and neoplasms are one among them. Spinal cord compression due to tumors may be either intradural or extradural. In spinal cord compressive lesions even after clinical examination and radiological investigations the surgeon does encounter surprises in the operative field. Hence an attempt was made to find the correlation between clinical ,radiological, peroperative and pathological diagnosis of intraspinal compressive lesions of 50 patients over a period of 2 years.With regard to the level of lesion 50% of clinical diagnosis correlated with the radiological finding. However, in analyzing the clinical and radiological correlation of level with regard to different pathologies the correlation in schwannoma was better (71 %) . On analyzing the correlation with regard to different levels of lesion the correlation of level in lumbar tumors was 80 % and regarding the plane of lesion the clinical and peroperative correlation was 78%, whereas radiological and peroperative correlation was 94% . This shows the advantage of MRI in locating the plane of the lesion. With regard to the pathology of the lesion, the clinical and histopathological examination (HPE) correlation was 42%, the radiological and HPE correlation was 60% and the peroperative and HPE correlation was 68% showing that the peroperative gross appearance was better than radiological finding in correlating with the histopathology. The peroperative and HPE correlation was 85% with intradural extramedullary tumors. Awareness of the variegated presentation of these spinal cord tumors is important in forming a differential diagnosis and planning surgical resection.*
Keywords*: Histopathology, Intraspinal Lesion, Radiology, Spinal Compression.*

I. Introduction

Spinal cord compression may occur due to a variety of causes and neoplasms are one among them. Spinal cord compression due to tumors may be either intradural or extradural. Intradural tumors are further categorized as intra or extramedullary. The ratio of intradural to extradural tumors is 3:2. The ratio of intramedullary tumors is higher in children (50%) than in adults (30%).

These tumors occur predominantly in the middle decades and except for the unusually high incidence of meningiomas in females, the sex ratio is about equal. The most common location is the thoracic region, the cervical is the next most likely location and the lumbosacral region the least likely. The most common intradural extramedullary tumors are the nerve sheath tumors, which constitute approximately 30% and the meningiomas 25%. The most common intramedullary tumors having about equal incidence are the astrocytomas and ependymomas. A variety of other intramedullary tumors, including hemangioblastomas, epidermis and mixed tumors are common. The ependymomas beside being intramedullary has a predilection for occurrence at the Conus medullaris, where it may be both intra and extramedullary with an exophytic component extending into the cauda equina.

Intraspinal tumors produce a spectrum of signs and symptoms depending on the level and plane of the lesion and these help in clinical localization of these tumors. But this clinical localization does not always correlate with radiological findings and in spite of modern investigations like MRI the surgeon not infrequently finds surprises in the operative field and in the histopathological examination. Hence an attempt has been made to study the clinical, pathological and radiological correlation in compressive intraspinal mass lesions and to analyze the various factors affecting this correlation.

II. Materials and Methods

This study is a prospective study conducted in the Institute of Neurology, Government General Hospital, Chennai, Tamilnadu, India, on 50 patients with intra spinal compressive lesions over a period of 2 years.

2.1 Inclusion Criteria

- All cases with Intraspinal compressive lesions
- All tumors and inflammatory lesions occurring within the spinal canal.

2.2 Exclusion Criteria

- Discogenic compressive lesions
- Post traumatic compressive lesions
- Vertebral body pathology causing compression.

All the clinical , radiological , operative and pathological details were analysed.

2.3 Clinical Criteria For Detecting The Level Of Lesion

After complete clinical examination the sensory level, the motor level and reflex level was found and the highest level was taken as the level of spinal cord lesion and the corresponding vertebral level was noted .

2.4 Clinical Criteria For Assessing The Plane Of Lesions

2.4.1 Clinical Criteria For Intramedullary Lesions

- Dissociated sensory loss
- Suspended sensory loss with sacral sparing
- Descending sensory loss/motor weakness
- Early sphincter involvement

2.4.2 Clinical Criteria For Intradural Extramedullary Lesion

- 1.Radicular pain
- 2.Ascending type of sensory loss /motor weakness
- 3 Late sphincter involvement

2.5 Clinical Criteria For Assessing The Pathology

Lesions with intradural extramedullary features and prominent root symptoms for schwannomas. Dorsal cord Lesions with intradural extramedullary features and female sex for meningioma.
Although it is difficult to differentiate astrocytoma from ependymoma clinically younger age group (children) and dorsally located intamedullary tumors were grouped as ependymomas and cervical and lumbar (conus) intramedullary lesions and higher age group favoured astrocytoma.Extradural lesions with marked tenderness , gibbus, paravertebral swelling and spasm, tuberculosis was favored and others considered as metastasis and past history of TB and primary tumors were also taken into account.

2.6 Radiological Criteria For Plane Of Lesion

Intramedullary – Lesions showing enlargement of the spinal cord and MR myelography showing narrowing of CSF at the level of lesion were considered intramedullary. Extradural- MR myelography showing the displacement of the spinal cord and narrowing of the spinal subarachnoid space and compete block showing the brush border appearance were considered extradural.Intadural extramedullary – Lesions showing widening of subarachnoid space on the side of tumor and meniscus sign were considered intradural extramedullary.

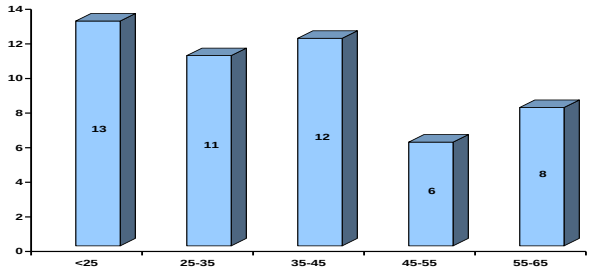
2.7 Radiological Criteria For The Pathology Of The Tumor

Ependymoma –Intramedullary lesions with pseudocapsule and marked contrast enhancement were considerd as ependymomas.Astrocytoma –intramedullary lesions eccentric in location and patchy contrast enhancement were considered as astrocytomas.Hemangioblastoma –cystic lesions with enhancing nodule were considered as hemangioblastomas.Schwannoma-intradural extramedullary well circumscribed lesions iso intense on T1 isointense or hyperintense in T2 enhancing with contrast were considered as schwannomas. Neurofibroma -same as schwannoma along with a central low density area within the mass.Meningioma-intradural extramedullary with sharp margins and situated posterolateral to cord , isointense to cord in T1, hyper in T2 with calcification and intense contrast enhancement and dural tail were taken as meningiomas.TB Granuloma-rim enhancing epidural lesion with paraspinal extension.

Statistical analysis of all data was done with SPSS 11.0 (Statistical package of social science) and by using Microsoft excel 2003.Base line statistics, Correlation agreement (r^2) and Student t- test have been used for analysis.

III. Results

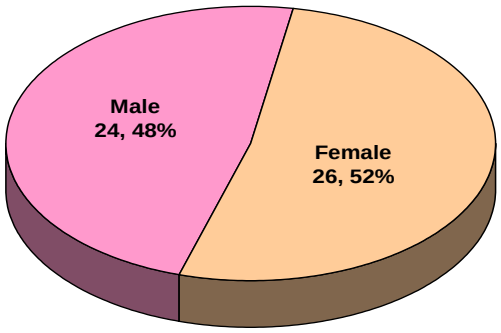
3.1 Age Distribution



Graph1: Age Distribution

Maximum incidence was seen in the <25 age group and minimum incidence was seen in the 45-55 age group.

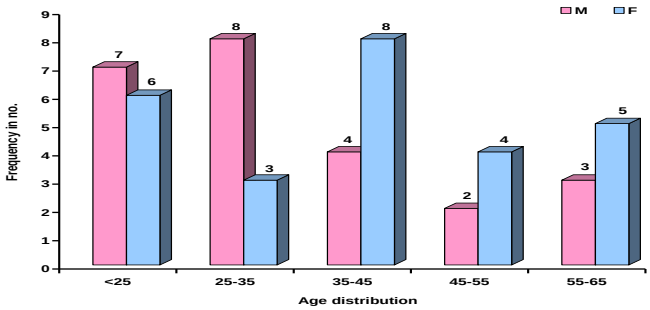
3.2 Sex distribution



Graph 2: Sex distribution

Sex distribution was nearly equal with slight female predominance

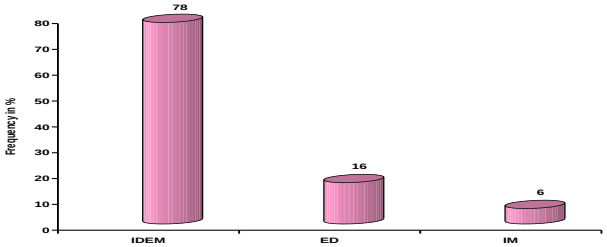
3.3 Distribution of age according to gender



Graph 3: Distribution of age according to gender

Male predominance seen in the < 35 age group and female predominance seen in the higher age groups.

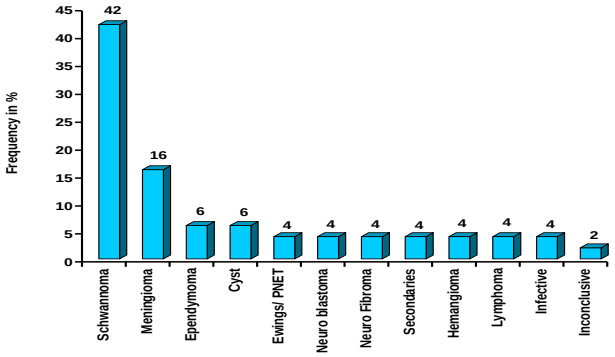
3.4 Distribution of spinal cord tumors among various Planes



Graph 4: Distribution of spinal cord tumors among various Planes

IDEM –Intaduralextramedullary -39 cases , ED-Extradural-8 cases, IM-Intramedullary -3 cases. Intradural extramedullary lesions were the commonest followed by extradural and intramedullary lesions in that order.

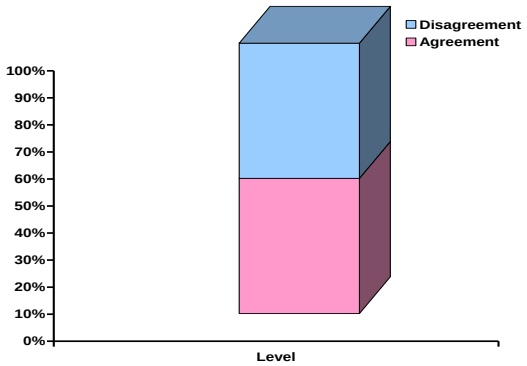
3.5 Pathological distribution of spinal cord compressive lesions



Graph 5: Pathological distribution of spinal cord compressive lesions

Schwannoma formed the largest number of cases followed by meningioma.

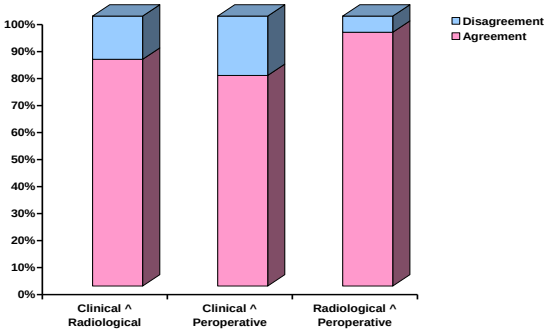
3.6 Clinical and Radiological correlation of level of lesion



Graph 6: Clinical and Radiological correlation of level of lesion

In clinical and radiological correlation of level of lesion 50% of them are completely in agreement, (student t-test) P value = 0.000 (P value< 0.05) it is statistically significant .

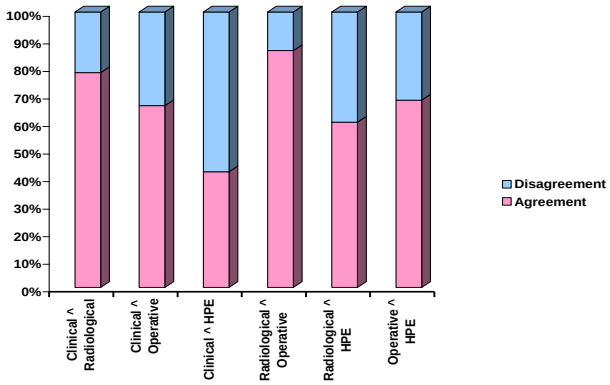
3.7 Correlation of plane of lesion



Graph 7: Correlation of plane of lesion

In clinical and radiological correlation of plane of lesion 84% of them are in agreement, P value = 0.001 (P value< 0.05) it is statistically significant. In clinical and peroperative of correlation of plane of lesion 78% of them are completely in agreement, P value = 0.008 (P value< 0.05) it is statistically significant. In radiological and peroperative correlation of plane of lesion 94% of them are completely in agreement, P value = 0.000 (P value< 0.05) it is statistically significant.

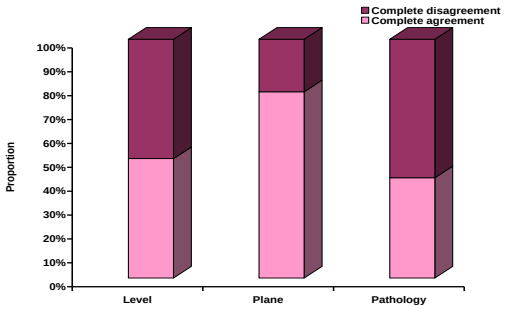
3.7 Correlation of Pathology



Graph 8: Correlation of Pathology

In clinical and radiological correlation of pathology 78% of them are completely in agreement, P value = 0.000 (P value< 0.05) it is statistically significant. In clinical and peroperative correlation of pathology 66% of them are completely in agreement, P value = 0.000 (P value< 0.05) it is statistically significant. In clinical and histopathological(HPE) correlation 42% of them are completely in agreement, P value = 0.000 (P value< 0.05) it is statistically significant. In radiological and peroperative correlation of pathology 86% of them are completely in agreement, P value = 0.000 (P value< 0.05) it is statistically significant. In radiological and HPE correlation 60% of them are completely agreement, P value = 0.000 (P value< 0.05) it is statistically significant. In peroperative and HPE correlation 68% of them are completely in agreement, P value = 0.000 (P value< 0.05) it is statistically significant.

3.9 Correlation Of Level, Plane And Pathology



Graph 9: Correlation of level, Plane and Pathology

Correlation of level in different pathology and different levels
Correlation of level in Schwannoma was 71% (P value = 0.000< 0.05), Meningioma was 50% (P value = 0.001< 0.05), in dorsal tumors was 46% (P value =0.000<0.05).Correlation of level in cervical tumors was 50% (P value =0.360<0.05).Correlation of level in lumbar tumors was 80% (P value =0.000<0.05).

3.9.1 Dorsal – Level

In clinical and radiological correlation of plane 89% of them are in complete agreement, P value = 0.000 (P value< 0.05) it is statistically significant. In clinical and peroperative correlation of plane 81% of them are in complete agreement, P value = 0.001 (P value< 0.05) it is statistically significant. In radiological and peroperative correlation of plane 92% of them are in complete agreement, P value = 0.000 (P value< 0.05) it is statistically significant. In clinical and histopathological examination(HPE) correlation 41% of them are in complete agreement, P value = 0.000 (P value< 0.05) it is statistically significant.In radiological and HPE correlation 59% of them are in complete agreement, P value = 0.000 (P value< 0.05) it is statistically significant.
In peroperative and HPE correlation 65% of them are in complete agreement, P value = 0.000 (P value< 0.05) it is statistically significant.

3.9.2 Cervical – Level

In clinical and radiological correlation of plane 75% of them are in complete agreement, P value = 0.081 (P value> 0.05) it is not statistically significant.In clinical and peroperative correlation of plane 75% of them are in complete agreement, P value = 0.081 (P value> 0.05) it is not statistically significant. In clinical and HPE correlation 50% of them are in complete agreement, P value = 0.002 (P value< 0.05) it is statistically significant.

In radiological and HPE correlation 75% of them are in complete agreement, P value = 0.002 (P value< 0.05) it is statistically significant. In peroperative and HPE correlation 75% of them are in complete agreement, P value = 0.001 (P value< 0.05) it is statistically significant.

3.9.3 Lumbar – Level

In clinical and peroperative correlation of plane 60% are in complete agreement.In clinical and HPE correlation 40% of them are in complete agreement, P value = 0.097 (P value> 0.05) it is not statistically significant. In radiological and HPE correlation 40% of them are in complete agreement, P value = 0.125 (P value> 0.05) it is not statistically significant. In peroperative and HPE correlation 60% of them are in complete agreement, P value = 0.062 (P value> 0.05) it is not statistically significant.

IV. Discussion

Spinal cord tumors are wide-ranging in their histologic appearance and have an even wider range of clinical symptoms and prognostic features. Intramedullary spinal cord tumors are rare central nervous system neoplasms (1). But if left untreated, can cause serious neurological deficits and disability. An accurate diagnosis is therefore crucial in determining prognosis and directing therapy. In cases of spinal cord compressive lesions even after clinical examination and radiological investigations the surgeon does encounter surprises in the operative field. Hence an attempt was made to find the correlation between clinical and radiological level of lesion, the correlation between clinical, radiological and intraoperative findings with regard to the plane of lesion, the correlation between clinical, radiological and histopathological findings in intraspinal compressive lesions, and the various factors which affect the correlation between clinical, radiological and histopathological diagnosis of intraspinal lesions.

Significant advances have occurred in radiological imaging of spinal cord tumors over the past 20 years. Imaging is now a crucial component of diagnosis and treatment planning. A variety of imaging modalities are widely available. Computed tomography (CT) and magnetic resonance (MR) are the most helpful imaging tools for the early detection of spinal cord tumors. MR images are often used as the primary diagnostic imaging tool and are the preoperative study of choice (2). With regard to the level of lesion 50% of clinical diagnosis correlated with the radiological finding. However, in analyzing the clinical and radiological correlation of level with regard to different pathologies the correlation in schwannoma was 71 %. On analyzing the correlation with regard to different levels the correlation of level in lumbar tumors was 80 %. This probably was due to predominant root involvement in these lesions helping to locate the correct level of these lesions.

De Verdelhan O et al, in his study of MR imaging features of spinal schwannomas and meningiomas (3) retrospectively reviewed the Magnetic Resonance Imaging (MRI) examinations of 52 spinal schwannomas and meningiomas and compared MRI features of schwannomas and meningiomas. On T1-weighted images, MRI signal intensity and heterogeneity were not statistically different between meningiomas and schwannomas. On T2-weighted images, the signal intensity appeared significantly hyperintense and heterogeneous for schwannomas and concluded that a diagnosis of schwannoma should be made when a spinal intradural extramedullary tumor shows hyperintensity on T2W images or intense enhancement without dural tail sign; otherwise meningioma is more probable.

In a study by Chung et al (2), 39 patients who had undergone MR imaging for preoperative evaluation of spinal cord tumors were analyzed and all patients also had laminoplastic tumor excision of spinal cord tumors, and the characteristics of MR images in patients with spinal cord tumors, were then verified at surgery or biopsy and HPE and found that maximum number of case was neurilemmoma(19 cases) followed by meningioma 5 cases. Thirty-five tumors showed contrast enhancement with Gd-DTPA. Heterogenic enhancement was detected on Gd-DTPA images in 9 cases, and rim enhancement was detected in 3 cases. All cases with rim enhancement had cystic changes, and 9 cases with heterogenic enhancement had focal hemorrhage, focal necrosis, and myxoid change on pathologic macroscopic examination. One case had combined cystic change and focal hemorrhage.In another study by Pourissa et al, on 50 cases of spinal tumors,on the usefulness of Magnetic Resonance Imaging in localizing and detecting the types of tumors (4) it was found that injection of a contrast media is considered the best neuroimaging tool for diagnosis of the types of spinal tumors with a sensitivity of 94%. In our study, the clinical and peroperative correlation of the plane of lesion is 78%, where as radiological and peroperative correlation is 94% . This shows the advantage of MRI in locating the plane of lesion and there is a 6% chance of encountering surprises in the operative field with regard to the plane of the lesion.

In a study by Shin DA, et al , the thoracolumbar junction accounted for 18% of all spinal cord tumors, schwannoma being the most common pathology(5). Jeon et al (6) has stated that spinal schwannomas account for about 25% of intradural spinal cord tumors in adults (7,8). Most are solitary schwannomas, which can occur throughout the spinal canal (8). In a study by Quigley et al, ependymomas are the most common neuroepithelial tumors, accounting for 50%–60% of adult spinal cord tumors (9). In our study, regarding the pathology of the lesion, the largest number of cases was Schwannoma (Fig.7) followed by meningioma (Fig.5) The clinical and Histopathological examination (HPE) correlation was 42%. Brotchi et al reported that MR images and histologic diagnoses are concordant 70% of tim e (10). In our study, the radiological and HPE correlation was 60%.The peroperative and HPE correlation was 68% showing that the peroperative gross appearance was better than radiological finding in correlating with the histopathology. The peroperative and HPE correlation was 85% with intradural extramedullary tumors.

Sudhansu Sekhar et al, has reported a case of intramedullary spinal Tuberculoma, where a diagnosis of intramedullary spinal cord tumor was made preoperatively on the radiological basis (11). In our study there was only 3 cases of intramedullary lesions and no case of Tuberculoma. With larger study and with more number of patients we will be able to conclude better in this group.

V. Conclusion

This study of clinical , radiological and pathological correlation on 50 cases of compressive Intraspinal lesion has revealed the facts that clinical and radiological correlation of level was better with the lower spinal cord and cauda equinal lesions, cervical lesions showed intermediate correlation and least correlation was seen in dorsal cord lesions and regarding the plane of lesion radiological examination showed better correlation than clinical examination and peroperative assessment of pathology was better than radiological diagnosis. Awareness of the variegated presentation of these spinal cord tumors is important in forming a differential diagnosis and planning surgical resection.

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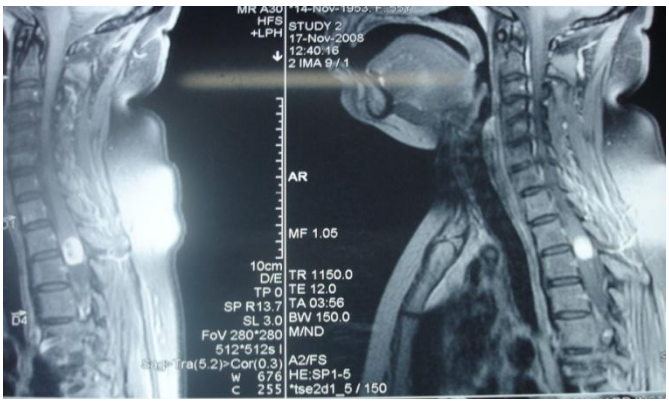

Figure 1: Clinical and radiological level of lesion was D2. The plane of lesion was IDEM clinically, radiologically and peroperatively. The clinical ,radiological ,operative and histopathological diagnosis was schwannoma .This case showed complete agreement in level , plane and pathology.

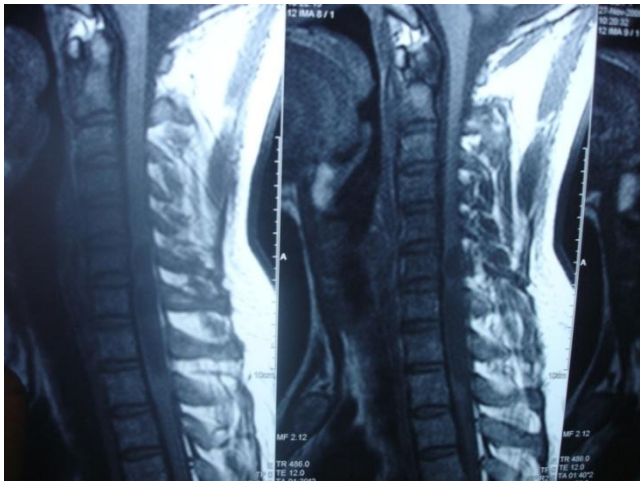

Figure 2: Clinically localised to D2, this lesion was peroperatively found to be a cystic lesion extending from C5 to D2.

Figure 3: This homogenously contrast enhancing lesion at L2 was radiologically diagnosed as schwannoma,per operatively also diagnosed as schwannoma as it was a smooth globular lesion with root attachement however histopathology revealed capillary hemangioma (Fig.6).

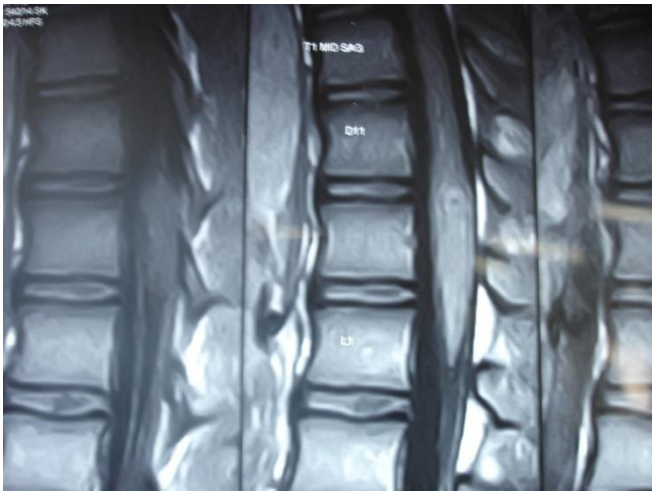

Figure 4: This intramedullary lesion diagnosed as ependymoma ,clinically, radiologically and peroperatively was a cavernous hemangioma histopathologically.The localisation of level and plane was in complete agreement.

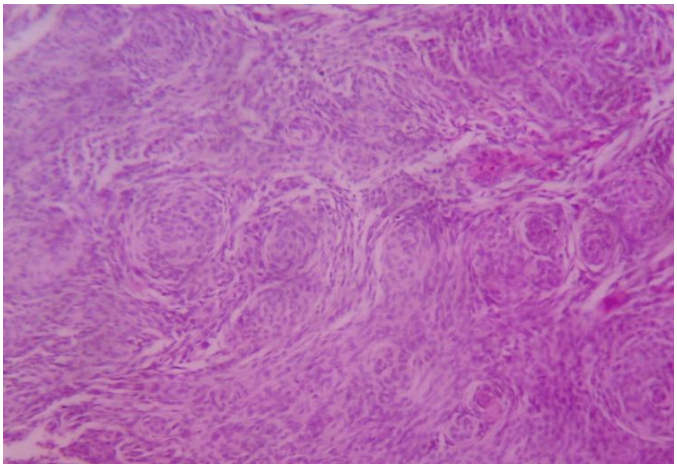

Figure 5: Meningioma. H&E (100X)

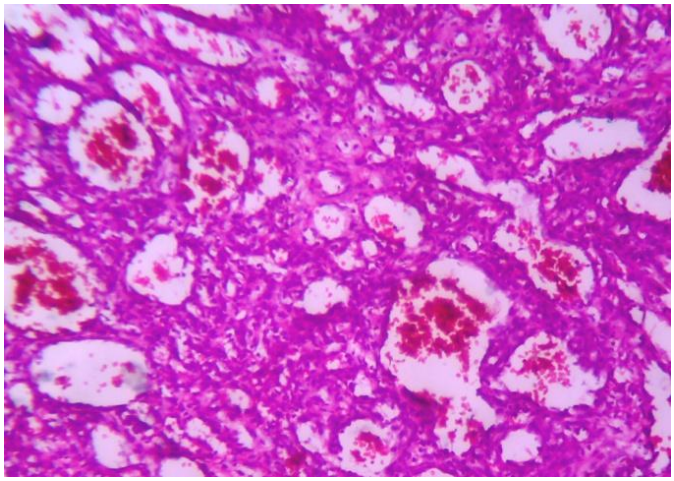

Figure 6: Capillary Hemangioma. H&E (100X)

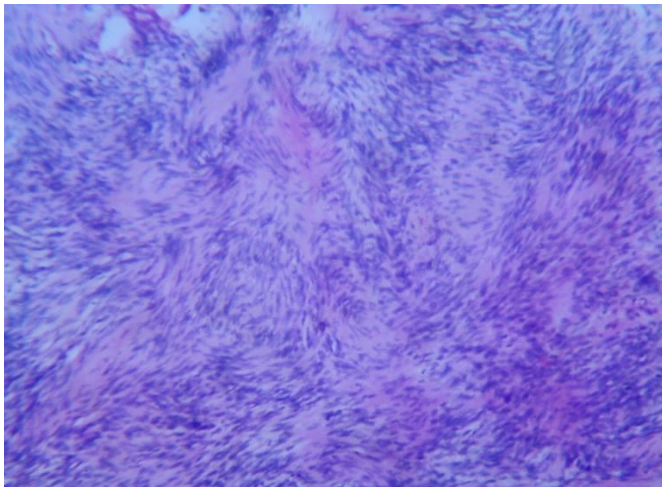

Figure 7: Schwannoma. H&E (100X)