



ADDIS ABABA UNIVERSITY
SCHOOL OF HEALTH SCIENCES

A Correlation study of imaging patterns and intra-operative findings with histopathology of spinal tumors at Tikur Anbessa Specialized Hospital and Zewditu Memorial Hospital, Addis Ababa University, Addis Ababa Ethiopia

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A thesis submitted to The Radiology Department, College of Health Science, Addis Ababa University in Preparation for Partial Fulfillment of the Requirements for the Post Graduate Study Completion in Radiology

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Abstract

Background: - Spinal cord tumors constitute 10-32% of all primary central nervous system tumors (1, 2). Spinal tumors are classified based on their location as extradural and intradural. Intradural tumors are classified as extra medullary and intramedullary depending on involvement of substance of the spinal cord. There are different radiological modalities used to evaluate spinal tumors but MRI is by far superior to all. Accurate radiologic and histopathology diagnosis is crucial in deciding the type of management a patient should undergo and to ensure a good prognosis. At times Intraoperative and histopathology finding of spinal lesions turn out to be different from the type diagnosed by radiologic investigation modalities. Therefore, this study aims to determine the correlation of imaging pattern of spinal tumors with that of intra-operative and histopathology findings.

Objective: The purpose of this study is to assess correlation between imaging pattern and intra-operative findings with histopathology of spinal tumors at Tikur Anbessa Hospital and Zewditu Memorial Hospital, Addis Ababa, Ethiopia.

Methods: A facility based retrospective cross-sectional study of 47 patients was done from May 2018 to October 2020. A structured questionnaire was used to collect data for analysis.

Results: - Out of the 47 cases, intradural extra medullary tumors constituted 37 cases (78%) followed by extradural tumors which constituted 6 cases (12.8 %) and the third being intramedullary tumors which constituted 4 cases (9.2%). Of all the cases the commonest pathology was schwannoma 13 cases (27.7%) followed by meningioma 12 cases (25.5%). Schwannomas were more common in males and meningioma was more common in females. Of all the 47 cases, 27 cases (57.4%) were located in the Thoracic level followed by cervical level 9 cases (19.1%). Among 17 cases for which bone involvement was mentioned in the report, 10 cases (21.3%) showed adjacent bone involvement with the commonest change being lytic changes seen in 4 cases (8.5%). Among 33 cases for which presence or absence of syrinx were mentioned on the report, 28 cases (59.6%) did not have syrinx.

Out of the 47 cases, 12 cases (25.5%) did not have a definite intraoperative diagnosis, and from the remaining cases with definite intra-operative diagnosis 21 cases (44.6 %) correlated with the imaging diagnosis and 14 cases (29.7%) were in a disagreement. The correlation of imaging diagnosis with that of histopathology diagnosis 61.7% were in agreement and 38.3 % were in disagreement. From the cases that had intra-operative diagnosis, 42.6 % were in agreement and 31.9 % were in disagreement with histo-pathology diagnosis.

Acknowledgements

I would like to appreciate the department of radiology, CHS, Addis Ababa University for giving me the chance to undertake this research.

I would like to express my deepest gratitude to my advisors Dr Amal Saleh and Dr Tesfaye Gizaw for their valuable and constructive comments during topic selection, proposal development, data collection and analysis.

I am grateful for Dr Mersha Abebe (MD, Neurosurgeon) and DR Kibruyesfaw Zewide (MD, Neurosurgeon), on their support in the making of this research.

I am also thankful to my families, colleagues and friends who helped me in searching and providing the necessary literatures and data for completing this study.

List of abbreviations

TASH: - Tikur Anbessa Specialized Hospital

ZMH: - Zewditu Memorial Hospital

CT: - Computed tomography

MRI: - Magnetic resonance imaging

HPE: - Histopathology examination

Intra-op: - Intraoperative

Chapter One: -Introduction

1.1 Background

Spinal cord tumors constitute 10-32% of all primary central nervous system tumors (1, 2). Spinal tumors are usually classified based on their location. Lesions which are located outside the dura are termed extradural and lesions located within the dura are termed intradural. Intradural tumors are further categorized into two based on their involvement of substance of the spinal cord. If the lesion involves substance of the spinal cord it is called intramedullary and if the lesion doesn't involve substance of spinal cord but located within the dura it is called extra medullary (1). Most of spinal tumors are mainly located in the thoracic region followed by cervical region. Lumbar region is the least likely location (1, 3).

Intramedullary tumors accounts for 10-15% of spinal tumors (1). Most intramedullary tumors are malignant (4). 80% of intramedullary tumors are made of gliomas which are further divided into astrocytoma and ependymoma which have about the same incidence (5). Astrocytoma is more common in adults whereas ependymoma is more common in children (3). Astrocytoma is commonly found in thoracic region whereas Ependymoma is more common in the cervical region (1). Non- glial intramedullary tumors are less common and consists of hemangioblastomas, paragangliomas, metastases, lymphoma, and primitive neuroectodermal tumors (PNETs) (6).

Extra medullary tumors account for 70-90% of spinal tumors and mainly consist of schwannomas which is commonly located in cervical and lumbar region followed by meningioma which is commonly located in the thoracic region. Extradural tumors accounts for 25% of spinal tumors and mainly includes meningioma and metastatic disease (1). Metastatic disease occurs very rarely and can occur as a result of hematogenous spread or direct extension from the leptomeninges. Primary extradural tumors are rare and the most frequent tumors are neurinoma followed by meningioma and lipomas are the third common extradural tumor (4).

Spinal tumor occurs predominately in the third decade and there is equal occurrence in male and females except meningioma which is more frequent in women. These tumors manifest with a spectrum of sign and symptoms depending on the level and plane of the lesions (5). Patients usually present with neurological dysfunctions including motor, sensory, sphincter function and balance. Clinical data like patient age, symptoms, and history and laboratory findings are helpful in making radiologic diagnosis (7).

There are many radiological modalities available for spinal pathology diagnosis. These include myelography, spinal arteriography, CT and MRI. Conventional radiological views are currently considered as traditional since they can't assess extent of the lesion. These conventional modalities are only able to detect extent of tumor growth after massive growth occurred (7). CT and MRI are most helpful for making early diagnosis of spinal tumors and MRI images are used as a primary imaging diagnostic modality and choice of preoperative assessment (5). MRI is also the best diagnostic modality for predicting neurological prognosis (8).

1.2 Statement of the problem

Spinal tumor can lead to serious neurological deficits and even death if not diagnosed and treated on time and accurately. Making a proper diagnosis is important in determining prognosis and directing treatment (5). These tumors are usually slow growing tumors which could benefit from surgical intervention if early and proper diagnosis is made (7).

Even after a radiological diagnosis is made a surgeon finds the unexpected during operation and at times the histopathology result which is a gold standard modality for final diagnosis turns out to be different from both radiological and intra-op diagnosis (5). Radiologists play an important role in evaluating lesion topography and extent and suggest a specific diagnosis which guides neurosurgeons in performing successful surgical interventions (9).

1.3 Significance of the study

This study aimed to assess the correlation between the radiological, intra-operative and histopathology diagnosis of spinal tumors at TAH and ZMH there by identifying where the gap is and to give recommendations on how to improve it. It also aimed to improve our radiological diagnostic modalities of spinal tumors. Since I didn't come across enough studies done on this topic in Ethiopia, this study aims to be used as a reference for future studies.

Chapter Two: - Literature review

As any tumor can occur in spinal cord, a broad list of differentials should be considered before reaching final diagnosis, as correct diagnosis helps in successful treatment and good prognosis.

In one study done in Tamilnadu Medical University, India, from 2014 to 2016 G.C on 50 patients, lesions with an enlargement of spinal cord and narrowing of CSF at the level of the lesion considered intramedullary lesions. And lesions with displacement of spinal cord and narrowing of spinal subarachnoid space on MR Myelography were considered extradural (5).

In a study done at Menoufia University, department of radiology Menoufia, Egypt in 2014 G.C on 50 patients with neurological deficit, five cases of astrocytoma were found which showed iso to hypo intensity on T1WI, and hyper intensity on T2WI with homogenous enhancement after contrast injection and 4 cases of ependymoma were found which showed iso to hypo intensity on T1WI, and hyper intensity on T2WI and these findings were well correlated with histopathology findings. Higher contrast resolution, multiplanar capability and choice of various pulse sequences make MRI a superior radiologic investigative modality to reach an accurate diagnosis of spinal tumors (8). Lesions with pseudo capsule and marked contrast enhancement were considered as ependymoma whereas lesions with eccentric location and patchy contrast enhancement were considered as astrocytoma. Hemangioblastomas was considered in a Cystic lesion with enhancing nodule (5).

Well circumscribed lesion which is isointense on T1 and iso to hyper intense on T2 with contrast enhancement were considered as Schwannomas. Meningioma were considered in a lesion with sharp margin which is postero-lateral to the cord and isointense on T1 and hyper intense on T2 with calcification (5).

With regards with radiological and perioperative correlation of plane or compartment of lesion 94% are in complete agreement. With regards to radiological and HPE correlation 60% are in agreement (5). With regards with perioperative and Histopathology correlation 68% are in agreement. In the cervical level, radiological and Histopathology correlation, 75% are in agreement and in preoperative and HPE correlation, 75% are in agreement. In the lumbar level, radiological and HPE correlation, 40% of them are in complete agreement and in preoperative and HPE correlation, 60% are in a complete agreement (5).

In another study done in Osmania medical college, Hyderabad, India from 2015 to 2017 G.C on 45 patients, tumors of spinal cord on which specimens were resected and biopsy were taken, out of 15 patients who were diagnosed as neurofibroma on MRI, 4 turned to be schwannomas on histopathology examinations (1).

In a study done in Department of Pathology, Ovidius University, Constanta, Romania between 2006 and 2009 G.C on 36 patients, intramedullary tumors diagnosed with MRI were in correlation with histopathology and intra-op findings. Three major MRI characteristics were used to differentiate one disease entity from another. The first is expansion of the spinal canal which is used to differentiate neoplastic from non-neoplastic entities. Absence of spinal cord expansion suggests a non-neoplastic entity. This differentiation is crucial for planning surgical intervention, if the lesion is diagnosed to be neoplastic, aggressive surgical intervention may be recommended and if the lesion is diagnosed to be non-neoplastic biopsy might be indicated sparing the patients from the trouble of going under surgery. The second is contrast enhancement, therefore in evaluating a patient suspected of spinal tumors it is mandatory to obtain contrast enhanced images. The third characteristic is cystic formation which is relatively common in intramedullary tumors. Of 36 patients with intramedullary tumors, MRI aspects were correlated with tumor pathology in 70% of cases (7).

In a study made at Faculty of Medicine, Toyama, Japan in 1998 G.C on 34 patients with intradural spinal cord tumors who underwent surgery, 20 patients were diagnosed with neurilemmoma, 3 with meningioma, 3 with lipoma and 3 with astrocytoma and 5 with other type of lesions based on radiologic evaluation. And of these patients who were diagnosed with cystic spinal tumors based on enhancement patterns on MRI, 6 were in correlation with the histopathology result (10).

In another study which is done on primary tumors of the spine, armed forces institute of pathology in Washington D.C in 2000G.C, strong correlation between radiologic and intra-operative diagnosis of most tumors were elicited (11).

Chapter Three: - Objectives

3.1. Study objectives

1.3.1 General objectives

To assess correlation between imaging pattern and intra-operative findings with histopathology of spinal tumors at Tikur Anbessa specialized Hospital and Zewditu Memorial Hospital, Addis Ababa, Ethiopia.

3.1.2 Specific objectives

- To describe imaging pattern of spinal tumors.
- To describe the correlation between imaging pattern and intra-operative finding of spinal tumors.
- To describe correlation between imaging diagnosis and histopathology diagnosis of spinal tumors.
- To describe intraoperative finding and histopathology diagnosis of spinal tumors.

Chapter Four: - Materials and Methods

This study was made at TASH, college of health sciences Addis Ababa University, Addis Ababa Ethiopia and ZMH, Addis Ababa Ethiopia. The study was conducted from May 2018 to October 2020 G.C on 47 patients with spinal tumors.

4.1. Study design

A Retrospective cross sectional study was employed.

4.2. Study population and unit

4.2.1. Study population

All patients with spinal tumor who were seen at the radiology and neurosurgery units.

4.2.2. Study unit

All patients with spinal tumor will be at radiology and neurosurgery units and meet the inclusion criteria.

4.2.3. Inclusion and Exclusion Criteria

4.2.3.1. Inclusion Criteria

- All masses occurring within the spinal canal.

4.2.3.2. 4.4.2 Exclusion Criteria

- Patients who have not undergone surgery.
- Patients who don't have histopathology results.
- Patients who don't have imaging.

4.3. Data collection

Information about the patients who met the inclusion criteria was collected from the medical record (chart).

4.4. Data quality control

Before actual data collection, pretest analysis of randomly selected patient chart was employed.

4.5. Data analysis and interpretation

The data was checked for clarity and completeness. Data was analyzed using non parametric statistical methods with the help of SPSS version 25. Then summarization and comparison of data was done.

4.6. Ethical consideration

Before data collection, ethical clearance was obtained from the Research Ethics Committee of department of Radiology, Addis Ababa University. Letters were written to medical directors, department heads and concerned authorities of respective hospitals.

Chapter Five:-Results

5.1. Age distribution

In our study, 22 patients (46.8%) were in the age group between 31-60 years, 14 patients (29.8%) were in the age group between 16-30 years, 8 patients (17%) were in the age group above 60 years, 2 patients were in the age group 0-5 years (4.3%) and 1 patient (2.1 %) was between 6-15 age group.

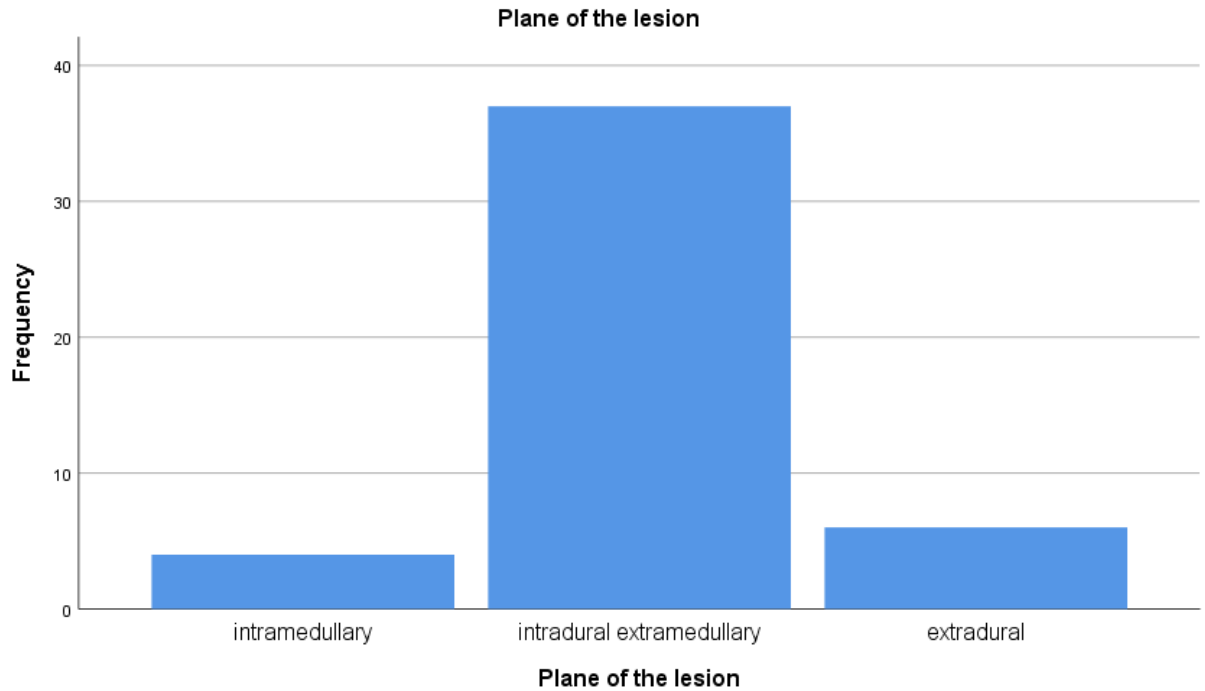
5.2. Gender Distribution

Males constitute 29 cases (61.7%) in this study and the females constituted the remaining 18 cases (38.3%).

5.3 Distribution of age according to gender

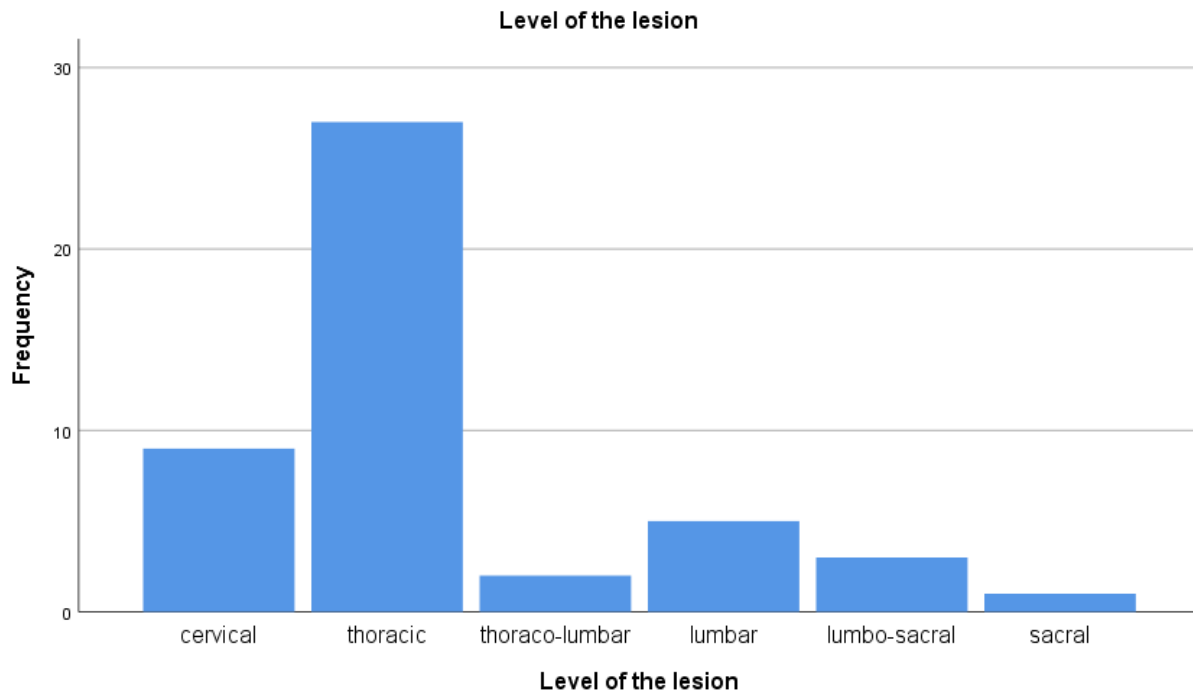
Males constitute 10 cases (34.5%) in 16-30 age group, 11 cases (38%) in 31-60 age group and 6 cases in > 60 (20.8%) age group. Females constitute 4 cases (22.2%) in 16-30 age group, 11 cases (61.1%) in 31-60 age group and 2 cases (11.8%) in > 60 age group.

5.4 Distribution of spinal cord among various planes (sites)



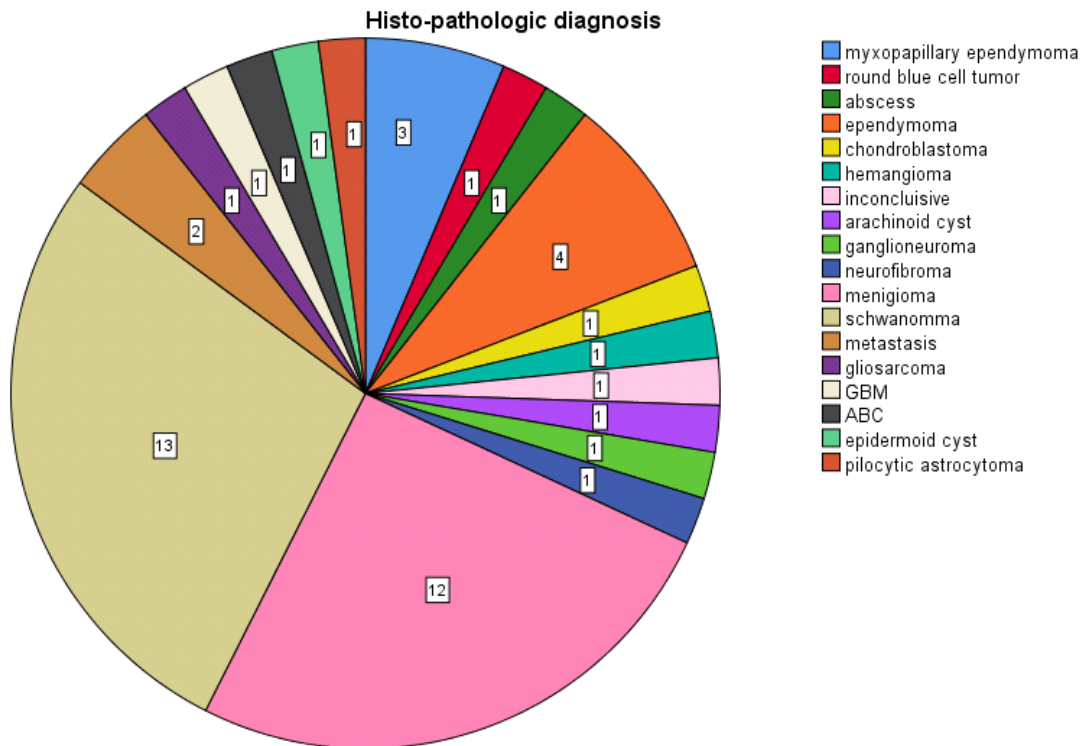
The Intradural extra medullary tumors constituted 37 cases (78.7%) of the spinal tumors followed by extradural tumors which constituted 6 cases (12.8%) and intramedullary tumors which constituted 4 cases (8.5%).

5.5 Distribution of spinal cord lesions among different levels of the spine



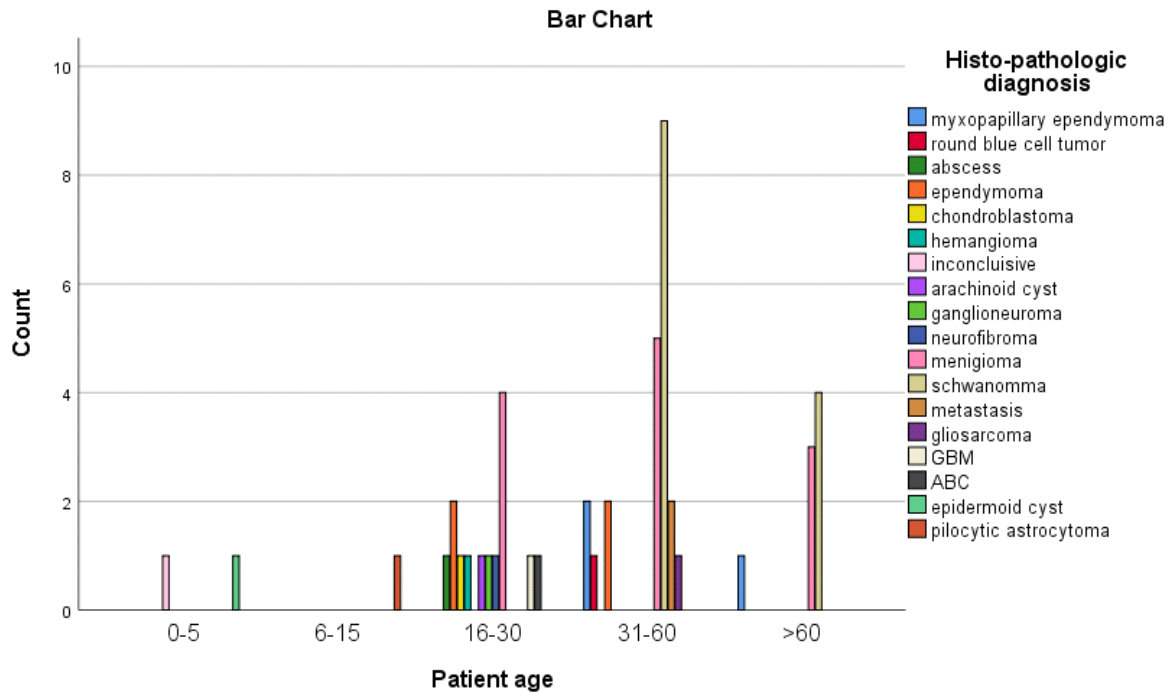
In distribution of spinal cord lesions among level of spine , 27 cases were located in the thoracic level (57.4 %) , 9 cases were located in the cervical level (19.1 %), 5 cases were located in the lumbar level (10.6 %) , 3 cases were located in the lumbo-sacral level and one case was located in the sacral region (2.1%).

5.6 Pathological distribution of spinal cord lesions



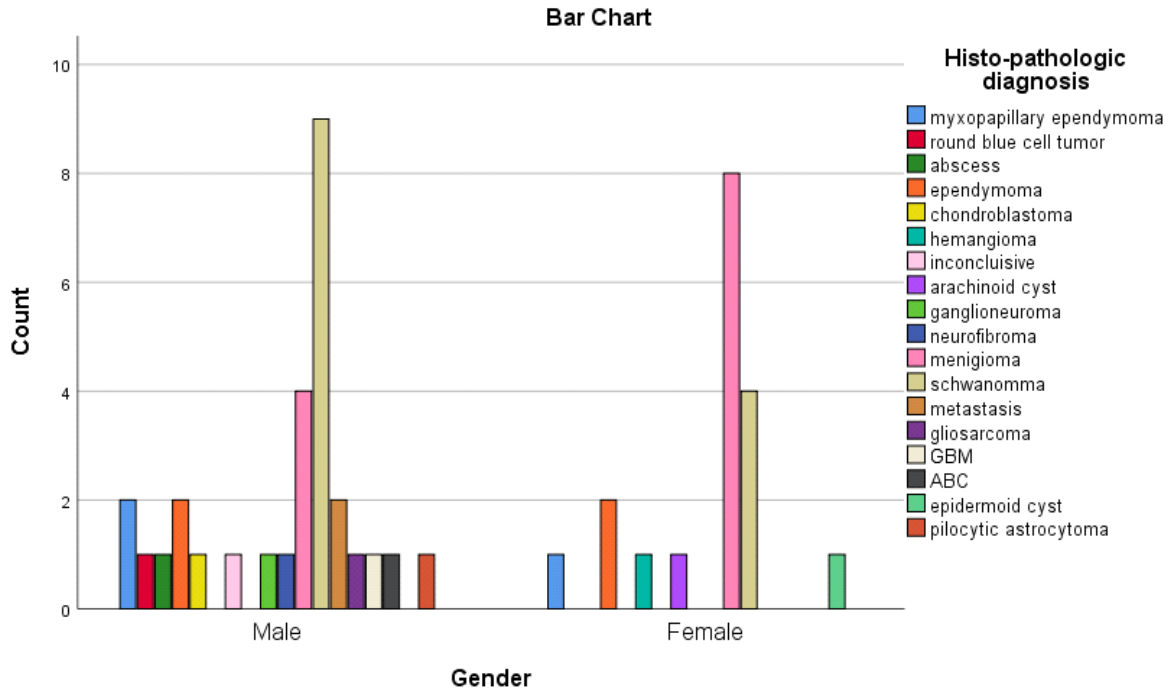
Schwannoma constitutes 13 cases of spinal tumor in our study (27.7 %), meningioma constitutes 12 cases (25.5 %), Ependymoma constitutes 4 cases (8.5%), metastasis constitutes 2 cases (4.3%) and the remaining pathologies constitutes 1 case each.

5.7 Distribution of different spinal tumors among age groups



In the age group between 16-30 years, 4 cases of meningioma and no cases Schwannoma were seen. In the age group 30-60 years 9 cases of schwannomas and 5 cases of meningioma were seen. In the age group above 60 years 4 cases of schwannomas and 3 cases of meningioma were seen.

5.8 Distribution of spinal tumors according to gender



Out of our 29 male patients, schwannomas constitute 9 cases (31.1 %) and out of 18 female patient’s meningioma constitutes 8 cases (44%).

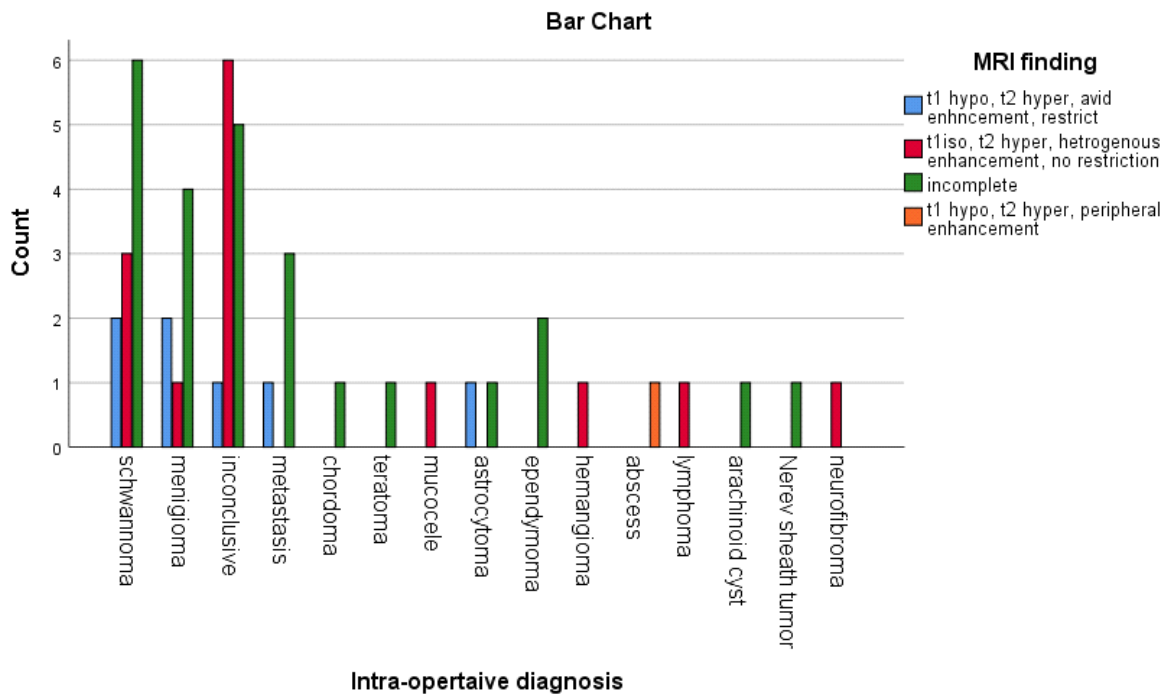
5.9 Distribution among consultants who reported the image

Neuroradiologists read and reported 26 MRIs (53.2%) out of the 47 images and general radiologists read and reported 21 MRIs (46.8%).

5.10 Distribution among the institutions where the images were seen and reported

In distribution of cases where the images were seen and reported 34 cases (72.3%) were seen and reported in non-teaching institutions outside Black lion hospital, 11 cases (23.4%) were seen and reported in Black lion specialized hospital and 2 cases (4.3%) were seen and reported in teaching Intuitions outside Black lion hospital.

5.11 Distribution among imaging patterns



The imaging patterns for schwannomas were not stated completely in 8 cases (61.5%) out of the 13 cases. The imaging patterns for meningioma were not stated completely in 7 cases (58.3%) out of 12 cases.

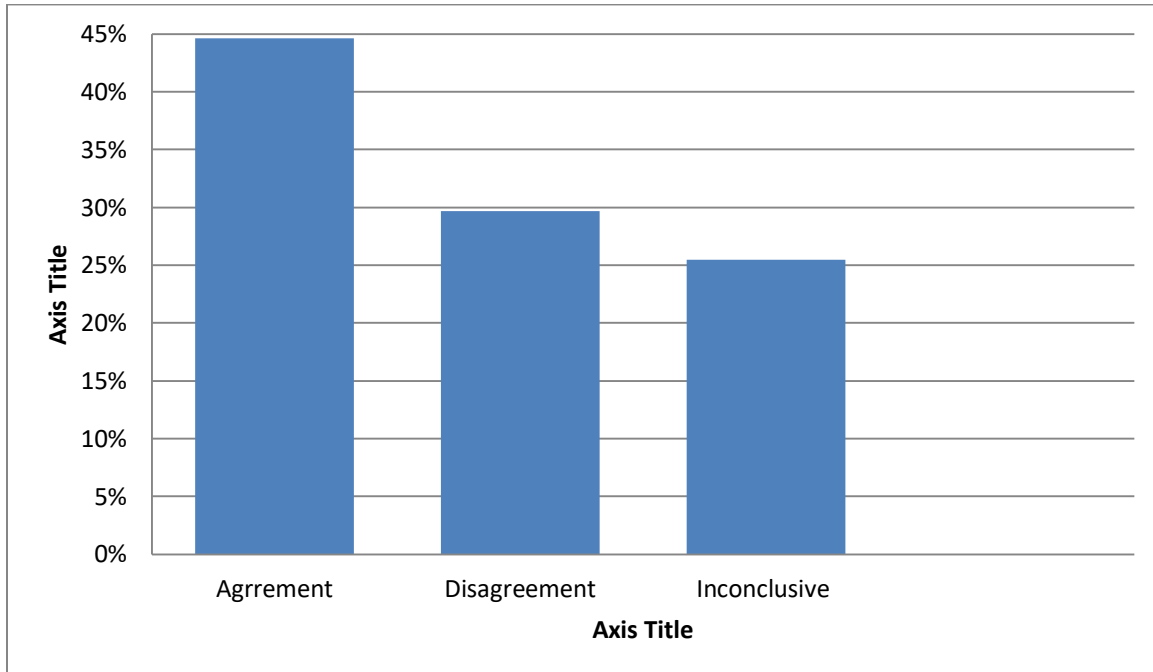
5.12 Involvement of bony structures

Out of the 47 cases the bony involvement was not mentioned on the imaging report for 30 cases(63.8%), no change were seen in 10 cases (21.3%), lytic lesions were seen in cases (8.5%), mixed sclerotic and lytic lesions were seen in 2 cases (4.3%) and sclerotic lesion was seen on1 case (2.1%).

5.13 Presence of adjacent syrinx

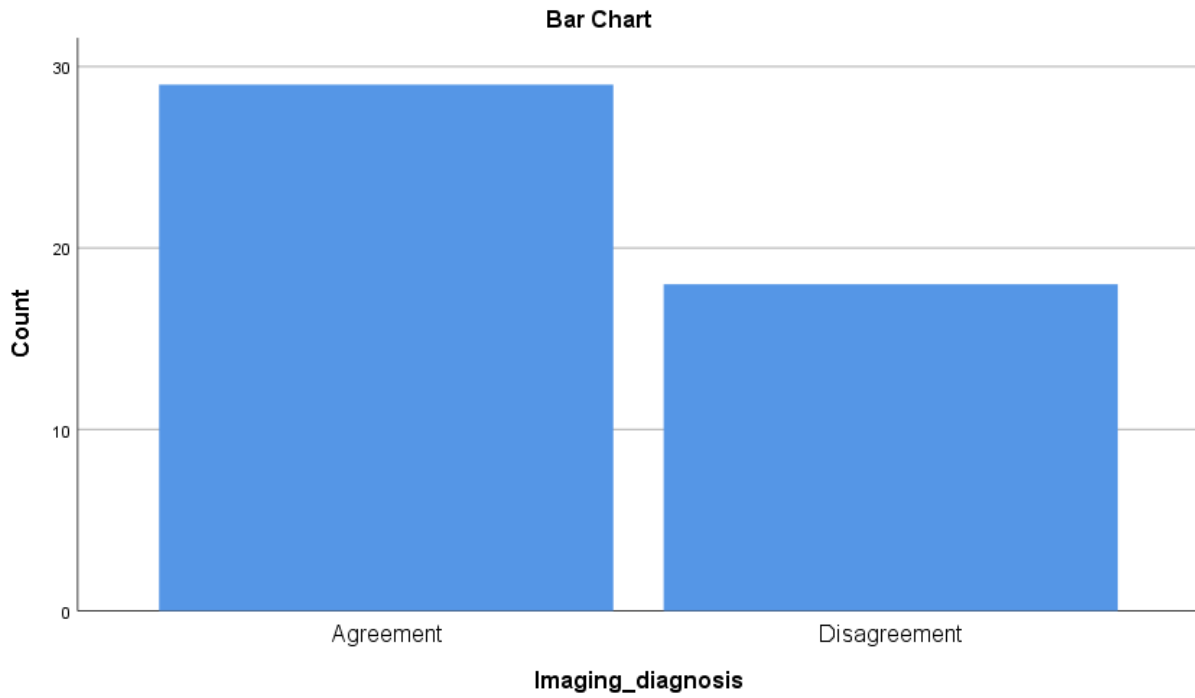
In the MRI reports the presence or absence of syrinx were not mentioned in 14 cases (29.8%), there was no syrinx seen in 28 cases (59.6%) and syrinx was present in 5 cases (10.6%).

5.14 Correlation of imaging diagnosis with intraoperative diagnosis



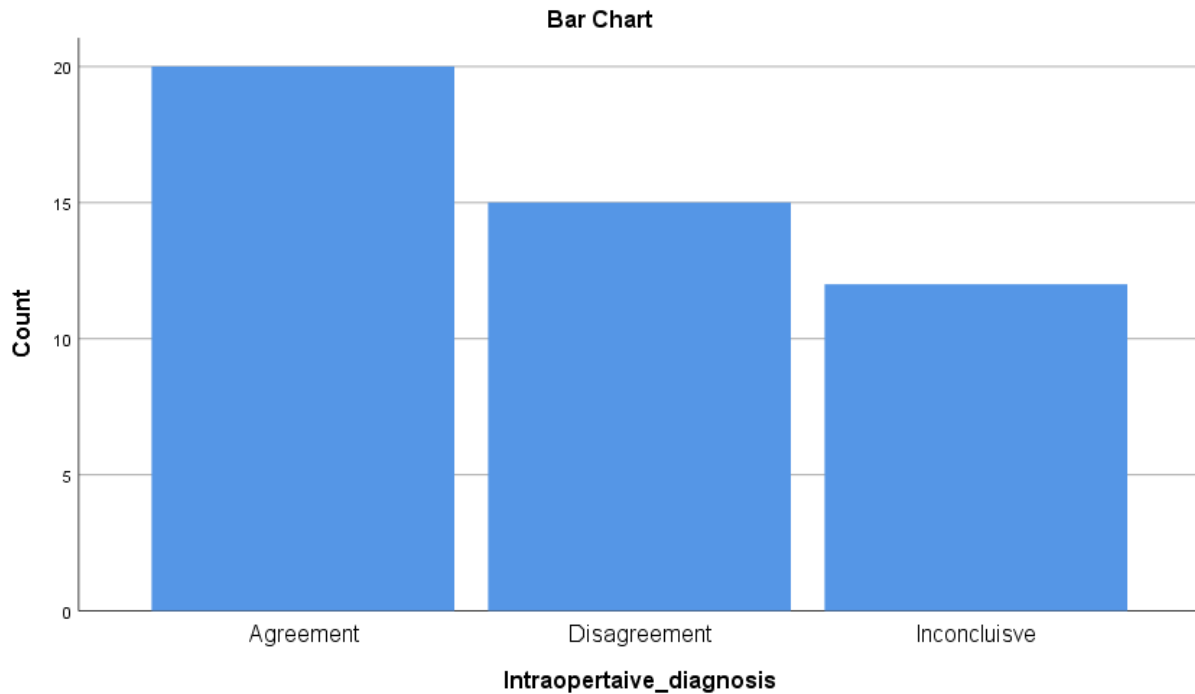
In our study 12 of the cases (25.5 %) did not have a definite intra-operative diagnosis. The remaining cases with definite intra-operative diagnosis 14 cases (29.7 %) were in disagreement and 21 cases (44.6%) are in correlation with the imaging diagnosis with P value of 0.04 which is statistically significant.

5.15 Correlation of imaging diagnosis with histopathology diagnosis



In correlation of imaging diagnosis with that of histo-pathologic diagnosis 38.3 % are in disagreement and 61.7 % are in agreement with P value of 0.006 which is statistically significant.

5.16 Correlation of intra-operative diagnosis with that of histo-pathologic diagnosis



In correlation of intraoperative diagnosis with that of histo-pathologic diagnosis 12 cases (25.5 %) did not have a definite intra-operative diagnosis, 15 cases (31.9 %) were in disagreement and 20 cases (42.6 %) were in agreement, with P value of 0.01 which is statistically significant.

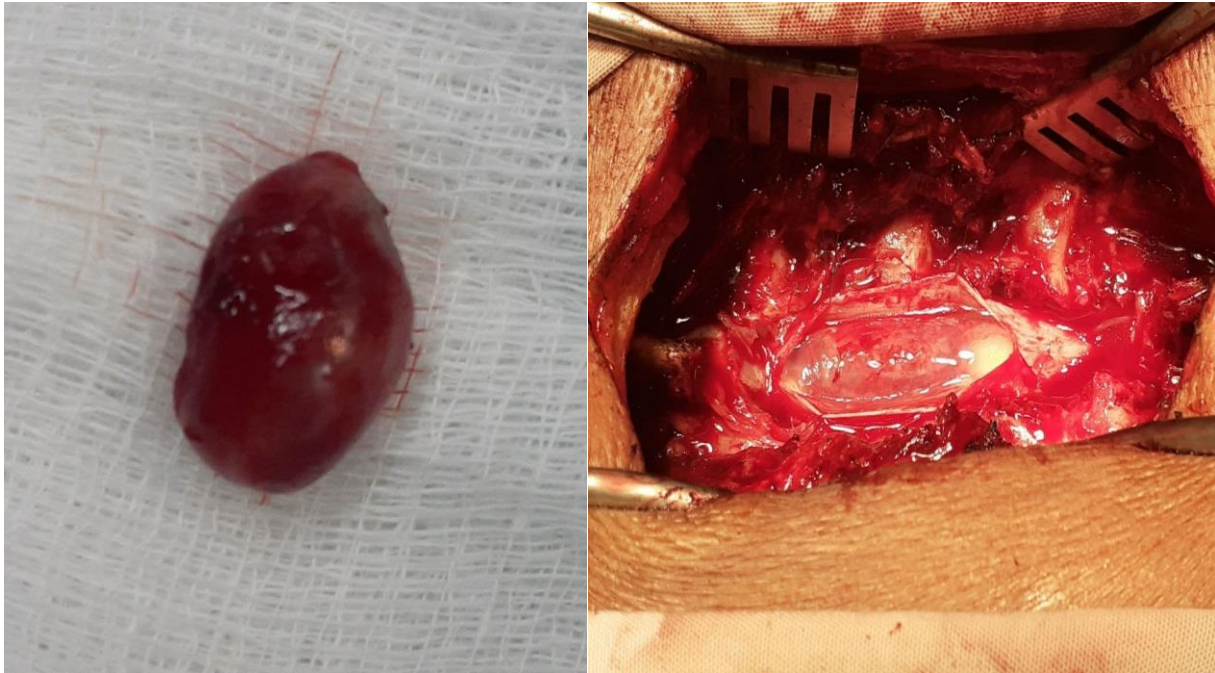
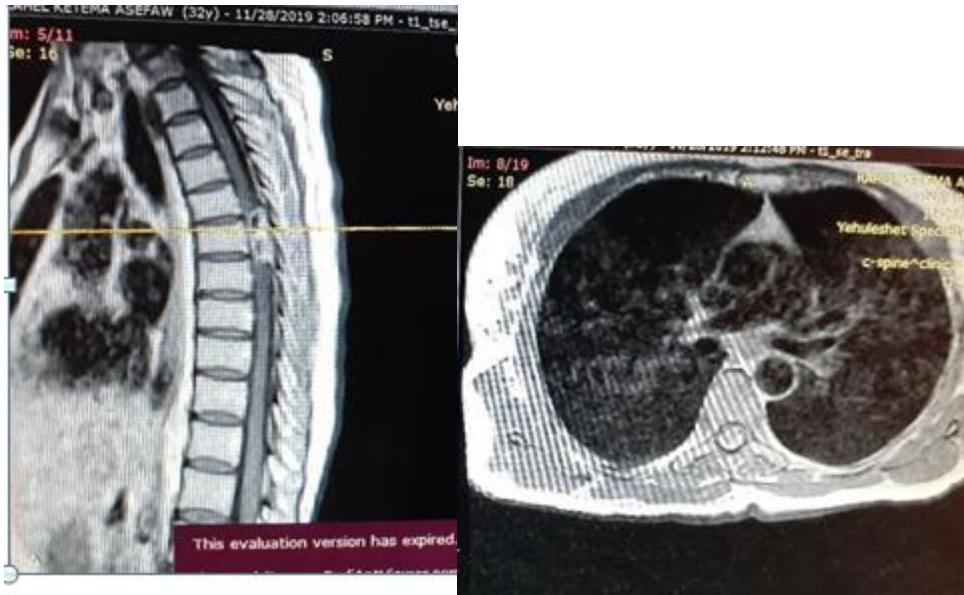


Figure: - Schwannoma

Chapter six: - Discussion. Conclusion and Recommendation

6.1. Discussion

In our study, we had 47 spinal tumors with males constituting 29 cases (61.7%) and females constituting 18 (38.3%). The commonest age group in our study was 31-60 years constituting 22 cases (46.8%) followed by 16-30 years constituting 14 cases (29.8%). The commonest pathology were schwannomas constituting 13 cases (27.7%) followed by meningioma constituting 12 cases (25.5%) which correlated with the study conducted in Hyderabad, India from 2015-2017 G.C on by Krishna Reddy et al at (1), Gudla Venugopal et al done at Hyderabad, Telangana, India in 2015 G.C on 32 cases (4). Schwannomas are more common in males constituting 9 cases (31.1%) out of 29 cases and meningioma are more common in females constitute 8 cases (44%) out of 18 cases. This is in correlation with a study made by Krishna Reddy et al at Hyderabad, India from 2015-2017 G.C on 45 patients (1).

Intradural extra medullary lesions constituted 37 cases (78.7%) and extradural lesions were found in 6 cases (12.8%) which makes the intra Dural, extra medullary site the commonest plane for the occurrence of spinal cord tumors and this finding correlated with a study made by Krishan Reddy et al in Hyderabad, India from 2015-2017 G.C on 45 patients (1)Gudla Venugopal et al done at Hyderabad, Telangana, India in 2015 G.C on 32 cases(4),Joel Dhanapandian et al done at Chennai, Tamilnadu, India, on 50 patients in 2015 G.C (5).

In one study made by Mohammed Yasin et al done at Menoufia University, Menoufia, Egypt on 50 patients in 2014G.C (8) they found that Lumbar spine was the commonest level for the occurrence of spinal tumors but thoracic level were found to be the commonest level for the occurrence of spinal tumors in our study constituting 27 cases (57.4%) followed by the cervical level constituting 9 cases (19.1%) and the least commonest level is the sacral region constituting 1 case (2.1%). And this correlated with a study done by Joel Dhanapandian et al done at Chennai, Tamilnadu, India, on 50 patients in 2015 G.C (5).

The imaging pattern for schwannoma's were not stated completely in 8 cases (61.5%) Out of the 13 cases and in the remaining 5 cases with a complete imaging pattern described in the report the commonest imaging pattern was T1 iso intense, T2 hyper intense lesion with heterogeneous enhancement and no restriction. The imaging pattern for meningioma was not stated completely in 7 cases (58.3%) out of 12 cases. In the remaining 5cases the commonest imaging pattern was T1 hypo intense, T2 hyper intense lesion with avid post contrast enhancement and with restriction. This finding correlates with a study made by Mohammed Yasin et al done at Menoufia University, Menoufia, Egypt on 50 patients in 2014G.C (8), by Joel Dhanapandian et al done at Chennai, Tamilnadu, India, on 50 patients in 2015 G.C(5). There was no mention of cap sign for ependymoma in the reports.

In our study, the involvement of adjacent bony structures were not mentioned in the MRI reports of 30 cases(63.8%), there were no adjacent bony change seen in 10 cases (21.3%) and the commonest bony change seen was lytic changes which were seenin4 cases (8.5%). There were no syrinx seen adjacent to the lesion in 28 cases (59.6%) and there were no mention of presence or absence of syrinx adjacent to the lesion in 14 cases (29.8%).

In our study 12 of the cases (25.5 %) did not have a definite intra-operative diagnosis. In correlation of the remaining cases with definite intra-operative diagnosis, 21 cases (44.6%) were in correlation with the imaging diagnosis and 14 cases (29.7 %) were in disagreement.

In correlation of imaging diagnosis with that of histo-pathologic diagnosis 61.7 % are in agreement and 38.3 % are in disagreement. This finding correlated with a study made by Joel Dhanapandian et al done at Chennai, Tamilnadu, India, on 50 patients in 2015 G.C (5).

In correlation of intraoperative diagnosis with that of histo-pathologic diagnosis 25.5 % did not have a definite intra-operative diagnosis, 42.6 % were in agreement and 31.9 % were in disagreement. In a study made by Joel Dhanapandian et al done at Chennai, Tamilnadu, India, on 50 patients in 2015 G.C (5) the intraoperative diagnosis and histo-pathologic diagnosis correlation were 68%.

6.2. Conclusion

In this study spinal tumors were commonly found in men and age group 30-60. Intradural extra medullary was the commonest plane for the occurrence of spinal tumors and Schwannomas were the commonest pathology followed by meningioma. Thoracic level is the commonest site followed by cervical level. Most of the MRI in our study was taken at non-teaching institution outside BLH and this might be due to the MRI machine in our institution was not working for a while and most images were seen and reported by neuroradiologists. A better correlation was found between the imaging diagnosis and histopathology diagnosis.

6.3. Recommendation

The imaging pattern were not described in all cases making it difficult to correlate the imaging patterns , therefore a complete imaging pattern description in the reports must be included. The intra-operative diagnosis is not mentioned in some of the cases and mentioning intra-operative diagnosis should be encouraged in the future.

Since the MRI machine in our institution was not working patients were getting scanned in non- teaching institutions outside BLH, if the machines could work properly, all patients would get a chance to be scanned in BLH, the images will be seen by neuroradiologists in BLH and a more complete report with a more accurate diagnosis could be achieved. Better quality MRI machine (high tesla) should also be used to improve the quality of the image.

The missing of imaging and biopsy reports from the patient charts impaired this research partly and a better way of keeping charts like electronic record keeping methods should be emphasized.

References

1. Krishna Reddy CH, Bheemavathi A, Durga K. Tumors of the Spinal Cord: Histopathological and Radiological Correlation with Review of Literature. *Scholars Academic Journal of Biosciences (SAJB)* vol 5(9), pp 674-681 2017; Osmania medical college, Hyderabad, India
2. Abdul Rashid Bhat ARK, Muhammed Afzal Wani, Mohammed Haneef Bhat. Incidence, histopathology, and surgical outcome of tumors of spinal cord, nerve roots, meninges, and vertebral column-Data based on single institutional (Sher-i-Kashmir Institute of Medical Sciences) experience. *SheriKashmir Institute of Medical Sciences*, vol.7, issue.3, 2019, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, Jammu and Kashmir, India
3. GurnamVirdi QEUHG. Intramedullary Spinal Cord Tumors: A Review of Current Insights and FutureStrategies. *IMedPub Journals*. Vol.3 No.2:13, August 11, 2017; Queen Elizabeth University Hospital, Glasgow, Scotland, UK.
4. Gudla Venugopal, A. Lakshmana Rao, Sangam M. Jyothi Clinico-pathological study of intradural extramedullary spinal tumors. *International Journal of Research in Medical Sciences*. Vol.3, issue 10 October 3, 2015 Hyderabad, Telangana, India
5. Dr. Joel Dhanapandian,Dr.Johnsy Merla J. A Study of Clinical, Radiological and Pathological Correlation of Intraspinal Compressive Lesions.*IOSR Journal of Dental and Medical Sciences* Vol 15, issue 5, pp 23-31, May 2016, The Tamilnadu Dr.M.G.R Medical University, India.
- 6.Kelly K. Koeller, R. Scott Rosenblum, Alan L. Morrison, Neoplasms of the Spinal Cord andFilum Terminale: Radiologic-Pathologic Correlation *RadioGraphics*, Vol 20, number 6, Dec 2000, The Departments of Radiologic Pathology, Washington, DC
7. Craciunas SC, M.R. Gorgan CMC, Aschie M. Intramedullary Tumors - Clinical, Radiological and Histological Correlations , Vol 2, 2011, Department of Pathology, Ovidius University, Constanta, Romania
8. Mohamed Yasin MS, Zeinab Abd Elaziz. Role of MRI in evaluation of intraspinal tumors. *Menoufia Medical Journal*, Vol 27, pp748-751, 2014,Radiology Department, Faculty of Medicine, Menoufia University, Menoufia, Egypt.

9. Mathieu H. Rodallec MAF, MD, PhD, Frederique, Larousserie MPA, MD, Raphael Campagna, MD , Antoine Babinet MMZ, MD , Jean-Luc Drape, MD, PhD. Diagnostic Imaging of Solitary Tumors of the Spine: What to Do and Say Oct 23, pp 1019-1041, 2008.
10. Hisao Matsui MK, Kazuo Yudoh 1, Kazuo Ohmori, Taketoshi, Cystic spinal cord tumors: Magnetic resonance imaging correlated to histopathological findings, Vol 21, 1998, Departments of Orthopedic Surgery and pathology, Toyama Medical and Pharmaceutical University, Faculty of Medicine, Toyama, Japan.
11. Mark Murphy CLA, Carol I Andrews, Donald J Fleming, H. Thomas, Temple. Primary tumors of the spine, radiologic-pathologic correlations. Radiographics Vol 16, 1131-1158, June 7 1996.

Appendix

Data Collection Format

1. Socio- demographic
 - a. Name
 - b. Age
 - c. Sex
 - d. Marital Status
2. Clinical history
 - a. Duration
3. Type of imaging modality
 - a. CT
 - b. MRI
 - c. CT&MRI
 - d. Others , specify
4. Imaging description
 - a. Location of the lesion
 - i. Intramedullary
 - ii. Intradural extra medullary
 - iii. Extradural
 - b. Signal intensity of the lesion
 - i. On T1
 - ii. On T2
 - iii. FLAIR
 - iv. T1+C
 - v. ADC/DWI:-
 - vi. Other sequence
 - c. Type of lesion
 - i. Cystic
 - ii. Solid
 - iii. Mixed

- d. Adjacent bone involvement
 - i. Lytic
 - ii. Sclerotic
 - iii. Mixed
 - e. Posterior element involvement
 - f. Extent of spinal involvement
 - g. Number of tumor found
 - h. Any adjacent syrinx
 - i. Any calcification
5. Does the patient have brain imaging?
- a. Yes
 - b. No
 - c. If yes please state the findings
6. Imaging Diagnosis
7. Intraoperative Diagnosis
8. Histopathology Diagnosis