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Pathology

MORPHOLOGICAL SPECTRUM OF INTRACRANIAL SPACE OCCUPYING LESION AT TERTIARY CARE HOSPITAL-A CLINICOPATHOLOGICAL STUDY

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ABSTRACT **Introduction:** The annual incidence of CNS tumors ranges from 10 to 17 per 1,00,000 persons for intracranial tumors, the majority of these are primary tumors.[1]An "Intra-cranial space occupying lesion" (ICSOL)is defined as a mass lesion in the cranial cavity with a diverse etiology like benign or malignant neoplasm, inflammatory or parasitic lesion, hematoma, or arterio-venous malformation.[3] Many non-neoplastic CNS lesions can clinically & radiologically simulate brain tumors. In such cases, histopathological examination (HPE) can be helpful in differentiating between neoplastic and non-neoplastic etiologies.[5] Aims and Objectives: This studywas undertaken to analyse theincidence and frequency of intracranial space occupying lesions, age and sex wise distribution, associated clinical symptoms and histopathological spectrum. **Materials and Methods:** Intracranial space occupying lesion biopsies of 108 cases received indepartment of pathology, B.J. Medical College, Ahmedabad, during the period of March 2021 to August 2021. All specimens were preserved in 10% formalin and allowed to fix for 24 hours, paraffin embedded sections of 5 microns were cut. The hematoxylin and eosin stained sections of the CNS lesions were studied. **Result:** One Hundred and Eight cases of Intracranial Space Occupying lesions were studied, of which 8 (7.4%) cases were non neoplastic with 6 (75%) being cystic lesions and 2 (25%) were cerebral abscess. The neoplastic lesions comprised of 100 (92.6%) cases, which included 99 (99%) primary and 1 (1%) metastatic lesions. The most frequent type of CNS tumor was astrocytoma and oligodendroglioma (23 cases, 23%) followed by Meningioma (18 cases, 18%), pituitary adenoma (17 cases, 17%), Ependymoma(13 cases, 13 %) and metastatic tumor (1 case, 1%). **Conclusion:** The surgical pathologist plays an important role in accurate diagnosis of various Intra Cranial Space Occupying lesions which will be of immense help for patient prognosis and treatment.[3]

KEYWORDS : ICSOLs, Astrocytoma, Meningioma, Pineal Parenchymal tumor

Introduction:

The CNS is composed of neurons, neuronal processes, supporting cells of the CNS (glial cells), blood vessels and invested with meninges.[1] Classification of the tumors of the CNS is one of the arts of the pathology, drawing on long recognized histologic and biologic features and newer molecular analysis.[2]

The annual incidence of CNS tumors ranges from 10 to 17 per 1,00,000 persons for intracranial tumors, the majority of these are primary tumors.[1]An "Intra-cranial space occupying lesion" (ICSOL)is defined as a mass lesion in the cranial cavity with a diverse etiology like benign or malignant neoplasm, inflammatory or parasitic lesion, hematoma, or arterio-venous malformation.[3]Many non-neoplastic CNS lesions can clinically & radiologically simulate brain tumors. In such cases, histopathological examination (HPE) can be helpful in differentiating between neoplastic and non-neoplastic etiologies.[5]

The CNS space occupying lesions cause life threatening outcome irrespective of their nature. Reason behind this is because lesions grow in a confined space and are present close to vital structures. Hence it is of great importance to establish the accurate diagnosis for proper and timely neurosurgical intervention.[6]

Aims and Objectives:

i)To study the histopathological pattern of the Intra Cranial Space Occupying Lesions.
ii)To study age and sex wise distribution of the Intra Cranial Space Occupying Lesions.
iii)To study the frequency of ICSOLs according to WHO classification.

MATERIALAND METHOD:

The present study was carried out in the Department of Pathology, tertiary care teaching hospital, Ahmedabad over a period of six months from March 2021 to August 2021. Cases of Intra Cranial Space Occupying Lesions were sent for histopathological examination. Information regarding the age, clinical history and clinical diagnosis were obtained. All specimens were processed by routine histopathologic procedure in which all specimens were preserved in 10% formalin and allowed to fix for 24 hours, paraffin embedded sections of 5 microns were cut. The hematoxylin and eosin stained sections of the CNS lesions were studied and the results were analysed.

Inclusion Criteria:

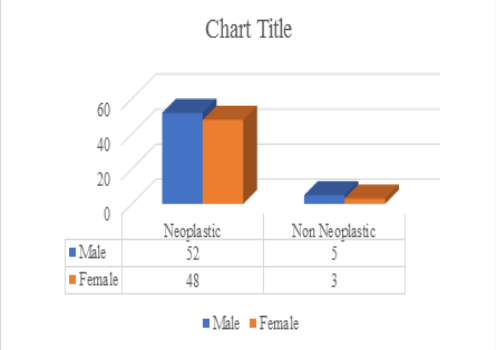
All Intra Cranial Space Occupying Lesions

Exclusion Criteria:

Improperly preserved specimen, hematoma, traumatic lesions, bony lesions of skull, spinal cord lesions and the cases of Mucormycosis during post covid period were excluded.

Results:

Out of total 108 cases, 100 were neoplastic lesions and 8 were non – neoplastic lesions. The ratio of number of Male (n=57) and female (n=51) patients was (57/51) 1.12:1 (Graph 1). Out of total 57 biopsies from male patients, 52 turned out to be neoplastic and 5 were non-neoplastic. Of the total 51 biopsies from female patients, 48 turned out to be neoplastic and 3 were nonneoplastic.



Graph-1: Distribution of biopsies in male and female patients.

Table: 1 Age and Sex wise distribution of ICSOL

Neoplastic lesions (ICSOL)	Age and Sex wise distribution							
	0-10 years	11-20 years	21-30 years	31-40 years	41-50 years	51-60 years	>60 years	Total
	M/F	M/F	M/F	M/F	M/F	M/F	M/F	
Diffuse Astrocytoma & Oligodendroglioma		1/1	1/1	7/5	0/2	2/0	2/1	13/10
Meningioma			0/1	3/4	3/4	1/1	1/0	8/10
Ependymoma	4/0	0/5			1/1	1/0	1/0	7/6
Medulloblastoma	0/1	0/4		0/1	0/1			0/7
Mixed Glioma						1/0	1/0	2/0
Neurocytoma		0/1	1/1					1/2
Ganglioglioma	0/1							0/1
Pituitary Adenoma			1/1	4/3	1/3	1/1	2/0	9/8
Craniopharyngioma	0/1	2/0						2/1
Embryonal Tumor	1/0							1/0
Pineal Parenchymal tumor		0/1				1/0		1/1
Schwannoma		1/0			0/1	1/0	1/0	3/1
Atypical Teratoid/Rhabdoid tumor	2/0							2/0
Moderately Differentiated SCC							1/0	1/0
Hemangioblastoma		0/1			1/0			1/1
AV malformation		1/0						1/0
Total	7/3	5/13	3/4	13/13	6/12	8/2	10/1	52/48

Non-Neoplastic lesions	Age and sex wise distribution							
	0-10 years	11-20 years	21-30 years	31-40 years	41-50 years	51-60 years	>60 years	Total
	M/F	M/F	M/F	M/F	M/F	M/F	M/F	
Koch's abscess				1/0	0/1	1/0		2/1
Arachnoid cyst				1/0				1/0
Epidermoid cyst	0/1					1/0		1/1
Hydatid cyst		1/0						1/0
Benign cystic Lesion							0/1	0/1
Total	0/1	1/0		2/0	0/1	2/0	0/1	5/3

Table 2. The relative frequencies of CNS tumors

Histological Types	No. of cases	% of total cases
Diffuse Astrocytoma & Oligodendroglioma	23	23
Meningioma	18	18
Ependymoma	13	13
Medulloblastoma	7	7
Mixed Glioma	2	2
Neurocytoma	3	3
Ganglioglioma	1	1
Pituitary adenoma	17	17
Craniopharyngioma	3	3
Embryonal tumor with multilayered rosettes	1	1
Pineal parenchymal tumor	2	2
Schwannoma	4	4
Atypical teratoid/Rhabdoid tumor	2	2
Moderately differentiated SCC	1	1
Hemangioblastoma	2	2
AV malformation	1	1
Total	100	100

A total of 100 CNS tumors were diagnosed during six months period. Of these, 99 (99%) were primary, and 1 (1%) were metastatic.The most frequent type of CNS tumor was astrocytoma (23 cases, 23%) followed by Meningioma (18 cases, 18%) and metastatic tumor (1cases, 1%).

Table 3: Relative frequency of Diffuse astrocytoma and Oligodendroglioma according to WHO grading

WHO grading	No. of cases	% of total cases
Grade 1	4	17.4
Grade 2	10	43.5
Grade 3	2	8.7
Grade 4	7	30.4

Tumor of neuroepithelial tissue

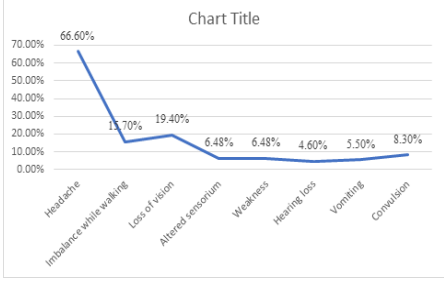
Among the 72 tumors of neuroepithelial tissue, the astrocytic tumors were the most common histologic type (23 cases, 23%) followed by ependymoma (13 cases, 13%), medulloblastoma(7 cases, 7%) Mixed glioma (2 cases , 2 %) Neurocytoma (3 cases, 3%), Pinal parenchymal tumor (2 cases, 2 %), Atypical teratoid/Rhabdoid tumor(2 cases, 2 %), ganglioglioma(1 cases, 1 %) and Embryonal tumor with multilayered rosettes (1 cases, 1 %)The most common type of astrocytoma was WHO grade IV type (Table 3).

Tumor of non-glial tissue

Of the 18 cases of meningeal tumor, there was 5 case of atypical meningioma, WHO grade 2 (69.4%). The remaining meningiomas were WHO grade 1 with low risk of recurrence and aggressive growth. The nerve sheath tumors consisted of schwannoma (4 cases, 4%). Pituitary adenoma (17 cases, 17%), Craniopharyngioma (3 cases, 3%), Hemangioblastoma (2 cases, 2 %), AV malformation (1 case, 1%).

Metastatic tumor

There was only one case of metastatic tumor which is Moderately differentiated squamous cell carcinoma.



Graph 2: Presentation of symptoms of ICSOL

Majority of the patients presented with headache (66.6%) followed by loss of vision, imbalance while walking, convulsion, altered sensorium, weakness, vomiting and hearing loss (Graph 2).

Discussion:

These study shows that these 108 cases of ICSOLs share several features common with other published series. Many reports have suggested that incidence and pattern of intracranial space occupying lesions are subjected to considerable geographic and racial variation.

In thisstudyICSOLs occurred mostly during third and fourth decade of life which was consistent with most reported series. The percentage of pediatric brain lesions occurring below the age of 20 years in the present study was 28 % which was comparatively lower than Hema et al.,(32.2%) and higher than other observation of Rathod et al.,(18%), Butt et al.,(16%),kothari et al.,(11%) and Gunge et al.,(21%).[3,4,7,8,10]

The male to female ratio of 1.12:1 in the present series of 108 cases showed that there is male predominance. This trend is similar to that observed by Kothari et al., Gunge et al., and Joshi et al., [5,8,10]

Table 4:Comparison of Histological type of CNS Neoplasms

Sr No.	Lesions	Present study (2021)	Butt et al (2005)	Hema et al (2016)	Shivraj et al., (2017)	Gunge et al (2018)
1	Neuroepithelial tumor	54(54%)	41(41%)	27(56.3%)	13(34.1%)	20(52%)
2	Meningeal tumor	18(18%)	23(23%)	6(12.5%)	15(39.47%)	7(18%)
3	Schwannoma	4(4%)	11(11%		7(18.42%)	3(8%)
4	Pituitary adenoma	17(17%)	2(2%)	1(1%)	1(2.63%)	1(3%)
5	Craniopharyngioma	3(3%)				
6	Hemangioblastoma	2(2%)	1(1%)	2(4.2%)		1(3%)
7	AV malformation	1(1%)	1(1%)			
8	Metastatic tumor	1(1%)	6(6%)		2(5.27%)	2(5%)
	Total	100	85	36	38	34

As regard to age distribution of tumors, neuroepithelial tumors occurred at a significantly third and fourth decade of life in the present study. These findings were comparable to that Shivraj et al., who also reported that majority of the neuroepithelial tumors were found in third and fourth decade as well as in fifth decade.[11]

The relative frequency of meningiomas in this series was 18 % of all primary tumors. This view is supported by other studies which reported 23%(Butt et al.,)6%(Hema et al.,)15% (Shivraj et al.,) and 18%(Gunge et al.,)[3,4,8,11]

Among the 8 cases of nonneoplastic intracranial lesions the present study encountered 5 cases of cystic lesions which include 2 cases of epidermoid cyst and each case of hydatid cyst,arachnoid cyst and benign cystic lesion and 2 cases of cerebral abscess.

Conclusion

The surgical pathologist plays an important role in accurate diagnosis of various Intra Cranial Space Occupying lesions which will be of immense help for patient prognosis and treatment.This study gives the spectrum of various neoplastic and non-neoplastic Intracranial space occupying lesions and gives us relative frequency of various CNS lesions in a tertiary care hospital. It was seen that neoplastic lesions were commoner in ICSOLs than non-neoplastic entities and most of the former occur in 'adolescence and above' age group. Overall male preponderance was documented. Amongst the neoplastic entities, Astrocytoma and Oligodendrogliomawas the commonest.

Figure 1: Right fronto parietal SOLshowing a moderately cellular tumor composed of uniform neoplastic fibrillary astrocytic cells-Diffuse Astrocytoma (WHO Grade 2)(H&E,40 x)

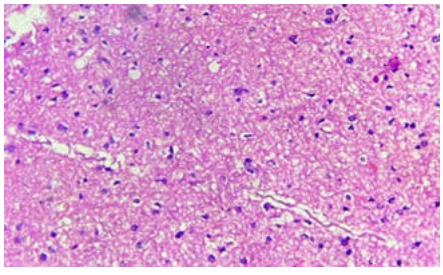


Figure 2: Left thalamic SOLshowing a moderately cellular with marked nuclear atypia and mitosis- Anaplastic astrocytoma (WHIO Grade 3)(H&E, 40 x)

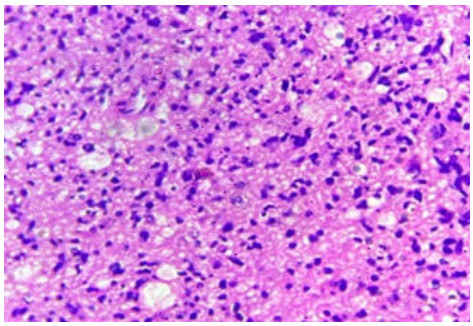


Figure 3: Basifrontal SOLshowing a focus of ischemic necrosis (NE) is surrounded by palisading tumor cells and hyalinized vascular proliferation-Glioblastoma(WHO Grade 4). (H&E ,10 x)

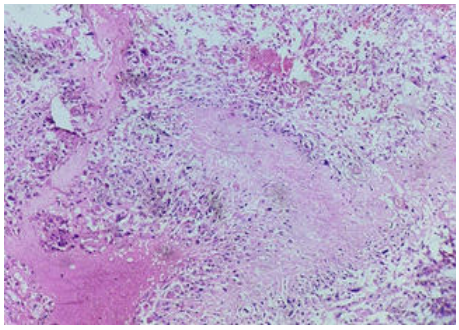


Figure 4:Posterior fossa SOLshowing marked anaplasia and mitotic activity with large cells/anaplastic cells-Medulloblastoma(WHO grade 4) (H&E, 40 x)

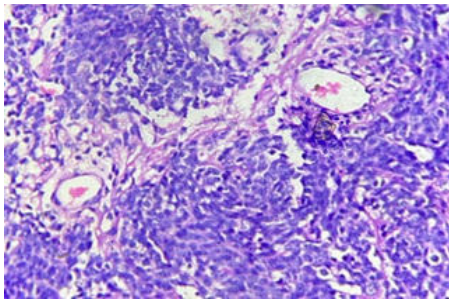


Figure 5:Posterior fossa SOL showing- Meningothelial Meningioma 1 with lobular growth pattern(H&E,40 x)

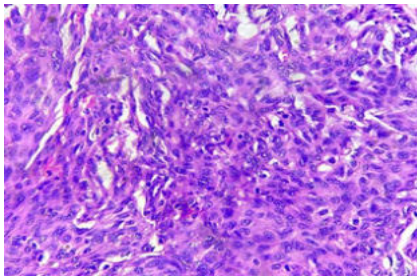


Figure 6: Left frontal convexity SOL stained with H&E showing Increased mitotic activity- Atypical Meningioma (WHO Grade 3)(H&E, 10 x)

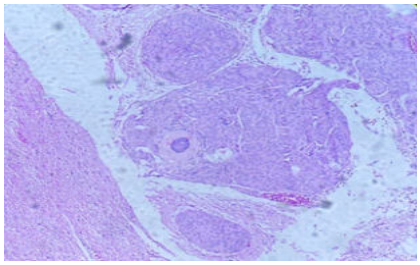


Figure 7: Suprasellar SOL stained with H&E showing monomorphic cells in a sheet like growth pattern without acinar architecture- Pituitary adenoma(H&E, 10 x)

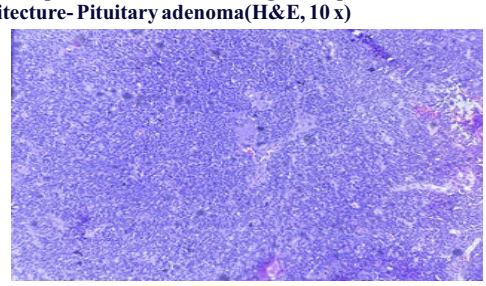


Figure 8:Posterior fossa SOL stained with H&E showing both true rosettes and perivascular pseudo rosettes -Ependymoma(H&E, 10 x)

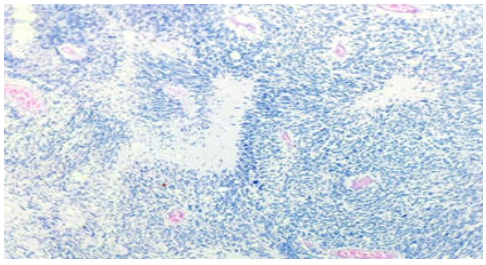


Figure 9:Intra ventricular SOL stained with H&E showing Round monomorphic cells and vascularized thin walled capillaries-Central Neurocytoma(H&E, 40 x)

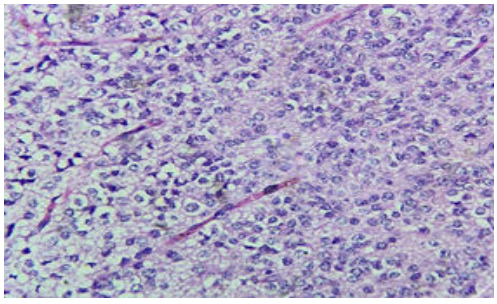


Figure 10: Lateral Ventricular SOL stained with H&E showing the typical biphasic pattern of irregularly oriented, dysplastic, and occasionally binucleated neurons and neoplastic glial cells-Ganglioglioma.(H&E, 40 x)

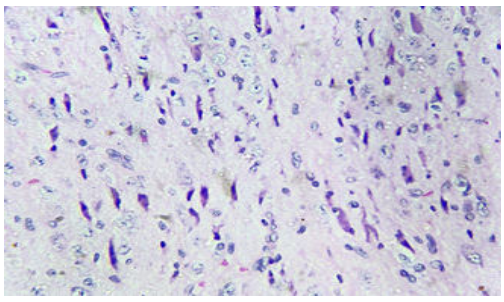


Figure 11: Pineal region SOL stained with H&E showing Neurocytoma-like appearance in a pineal parenchymal tumor of intermediate differentiation. Tumor with moderate cellularity and round nuclei harboring salt-and-pepper chromatin; the fibrillary background is characterized by small pseudo rosettes; larger pseudo rosettes- Pineal parenchymal tumor(H&E, 40 x)

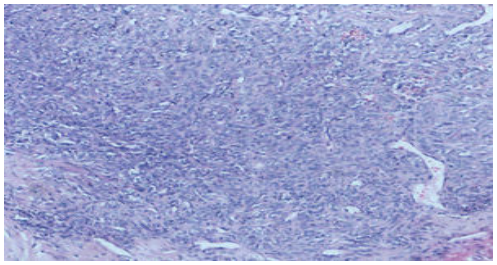


Figure 12: Right frontal SOL stained with H&E showing Multilayered rosette which is a key diagnostic feature of embryonal tumors with multilayered rosettes-Embryonal tumor with multilayered rosettes NOS-4(H&E, 10 x)

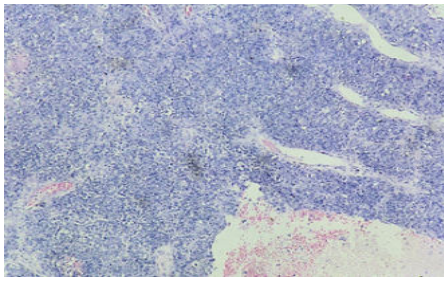
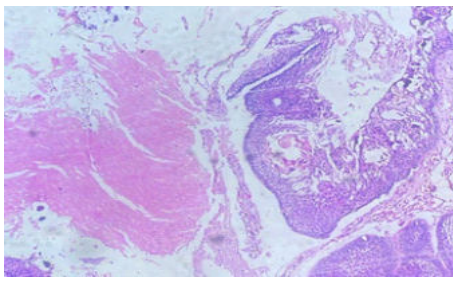


Figure 13:Suprasellar SOL stained with H&E showing compact wet lamellar keratin with cords of squamous epithelium with peripheral palisading- Adamantinomatous craniopharyngioma(H&E, 40 x)



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Conflicts of Interests:
The authors declare that they have no conflict of interest.

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