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Original Research Article

Histomorphological spectrum of intracranial space occupying lesions: Experience at tertiary care centre

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ABSTRACT

Context: An "Intra-cranial space occupying lesion" (ICSOL) is defined as a mass in the cranial cavity with a diverse etiology like benign or malignant neoplasm, inflammatory or parasitic lesion, haematoma or arterio-venous malformation.

Aims: The aim was to study the histomorphological spectrum of intracranial space occupying lesions at a tertiary care centre hospital in order to give accurate pretherapeutic diagnosis to facilitate better therapeutic results.

Setting and Design: This prospective and descriptive type of study of two years duration was carried out from November 2017 to October 2019 in Govt. Medical College and Superspeciality Hospital, Nagpur in the Department of Pathology. A total of 300 samples were received from Department of Neurosurgery.

Materials and Methods: Detailed collection of clinical data was done in all patients regarding age, sex, clinical symptoms and radiological findings.

The samples were received in 10% formalin and subjected to routine histopathological processing. Slides prepared were stained with hematoxylin and eosin stain. Special stains were done wherever required.

Results: Total 300 cases were studied of which 261 cases (87%) were neoplastic in nature and 39 cases (13%) were non neoplastic. Amongst primary tumours, most common were gliomas (48%) followed by meningiomas (20%) and schwannomas (9%).

Conclusion: ICSOLs can present with nonspecific clinical features. Radio diagnostic investigations are helpful adjunct tools but cannot give exact diagnosis. Histopathological examination remains a gold standard for diagnosing and grading of tumours on which basis clinician can decide further line of management.

1. Introduction

An "Intra-cranial space occupying lesion" (ICSOL) is defined as mass lesion in the cranial cavity with a diverse etiology like benign or malignant neoplasm, inflammatory or parasitic lesion, haematoma or arterio-venous malformation.[1]

ICSOLs can be caused due to cysts, cerebrovascular disorders, infections, tumours.

The most common cause of ICSOL is neoplastic followed by non-neoplastic lesions.

CNS (central nervous system) neoplasms represent a unique, heterogenous population of neoplasms constituting 1.9% of all malignant tumors in India.

Tumours of CNS account for 2% of all cancers in adults and 20% in childhood.[2]

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Moreover, the CNS tumours that predominate in adults differ from those seen in children, in terms of frequency, histological type and location.[3]

ICSOLs can clinically present as headache, vomiting, seizures, behavioural problems, focal deficits and visual difficulties.[4]

Radiological assessment helps in diagnosing the presence of an ICSOL, its location and its nature- whether benign or malignant, changes in the lesion like necrosis, intratumoural haemorrhage, surrounding edema and mass effect caused by ICSOL.[5]

But radiological imaging cannot give exact diagnosis of the ICSOL.

For definitive diagnosis, histopathology remains the gold standard for diagnosis and grading of tumours, based on which treatment protocol of patient is determined.

In developing countries like India due to lack of complete registration of newly diagnosed cases, exact tumour burden goes unnoticed and is underestimated. Hospital based data, therefore, forms the basis for estimating the disease load.[6]

The present study attempts to provide information about the histopathological spectrum of ICSOL at a tertiary care centre/ hospital in order to give accurate pretherapeutic histomorphological diagnosis helping to facilitate better therapeutic results.

2. Materials and Methods

This prospective and descriptive type of study of two years duration was carried out from November 2017 to October 2019 in Govt. Medical College and Superspeciality Hospital, Nagpur in the Department of Pathology. A total of 300 samples were received from Department of Neurosurgery.

2.1. Inclusion criteria

All biopsy/ resected specimen of ICSOLs.

Presence of ICSOL in patients was confirmed on radiological imaging.

2.2. Exclusion criteria

1. Haematoma and arteriovenous malformations.
2. Bony lesions of skull.
3. Spinal cord lesions.

Detailed collection of clinical data was done in all patients regarding age, sex, clinical symptoms and radiological findings. Informed consent was obtained from patients.

The samples were received in 10% formalin in labelled containers which comprised of biopsies or resected specimens.

The samples received were usually in multiple tissue pieces, mostly grey white to grey black in colour which were then subjected to routine histopathological processing. Slides prepared were stained with hematoxylin and eosin stain. Special stains were done wherever necessary.

Histomorphologically, ICSOLs were classified as neoplastic and non neoplastic lesions. The tumours were classified according to the WHO classification of tumours of central nervous system.[7]

Statistical analysis was performed using Microsoft Excel software.

The study was approved by institutional ethical committee.

3. Results

A total of 300 resected tumours/ biopsies were studied. Radiological and histomorphological diagnosis was available in all 300 cases.

The most common age group affected was 31-40 years (23.68%) followed by 41-50 years of age group (20.33%). The average age was 36.33 years.

55 cases belonged to the paediatric age group.

Out of 300 cases, 169 (56%) were male and 131 (44%) were female. The male to female ratio was 1.3:1.

In males, 41 cases were seen in the age group 31-40 years followed by 35 cases in 41-50 years of age.

Similarly, in females, highest number of cases (30 cases) were seen in 31-40 years of age group followed by 26 cases in 41-50 years of age and 24 cases in 21-30 years of age. (Figure 1)

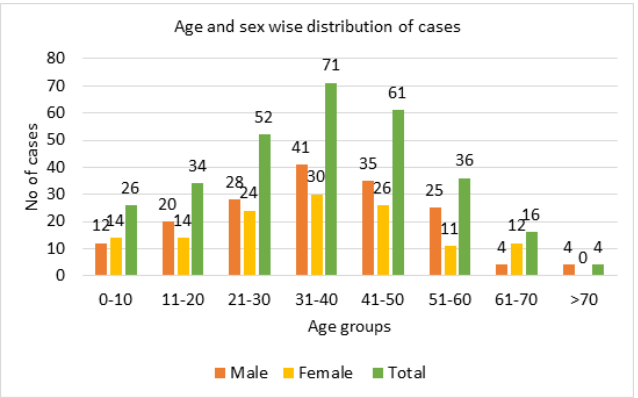

Fig. 1: Showing age and sex wise distribution of cases

The most common clinical presentation in patients was headache (78%) followed by vomiting (32%), loss of consciousness (22%), convulsions (17%) and diminution of vision (17%).

220 cases (73%) were located supratentorially and 80 cases (27%) infratentorially.

The distribution of ICSOLs in each compartment is given in Table 1.

Out of 300 ICSOLs, 261 cases (87%) were neoplastic in nature and 39 cases (13%) were non neoplastic.

Table 1: Distribution of ICSOL in each compartment

S. No	Location	No of cases	%
1	Supratentorial	220	73
	Frontal lobe	48	16
	Temporal lobe	23	7.7
	Parietal lobe	37	12.3
	Occipital lobe	4	1.3
	Multiple lobes	59	19.7
	Suprasellar & sellar region	34	11.3
	Corpus callosum	3	1
	Lateral ventricles	7	2.3
	Pineal region	1	0.3
	Thalamus	2	0.7
	Parasagittal region	2	0.7
2	Infratentorial	80	27
	CP angle	32	10.7
	Cerebellum	35	11.7
	Fourth ventricle	12	4
	Midbrain	1	0.3
	Total	300	100

Out of 261 neoplastic ICSOLs, 250 cases (96%) were of primary tumours and 11 cases (4%) were of metastatic deposits. Amongst primary tumours, 124 cases (48%) were of glioma followed by 51 cases (20%) of meningioma and 24 cases (9%) of schwannomas. Distribution of neoplastic ICSOLs is given in Table 2.

Table 2: Distribution of neoplastic ICSOLs based on histomorphology

S. No	Histomorphological subtypes	No cases	%
1	Glioma	124	48%
2	Meningioma	51	20%
3	Schwannoma	24	9%
4	Pituitary adenoma	18	7%
5	Craniopharyngioma	12	5%
6	Hemangioblastoma	6	2%
7	Medulloblastoma	4	1.1%
8	Choroid plexus papilloma	3	1%
9	Central neurocytoma	2	0.7
10	Cavernous angioma	2	0.7
11	Germ cell tumour	2	0.7
12	Pineoblastoma	1	0.4
13	Non Hodgkin's lymphoma	1	0.4
14	Metastatic tumour	11	4
	Total	261	100

In gliomas, the most common type was glioblastoma (51 cases, 41.1%) followed by astrocytomas (22 cases, 18%). Out of 51 cases of glioblastomas, 35 cases (68.6%) belonged to age group 31-60 years. (Figure 2)

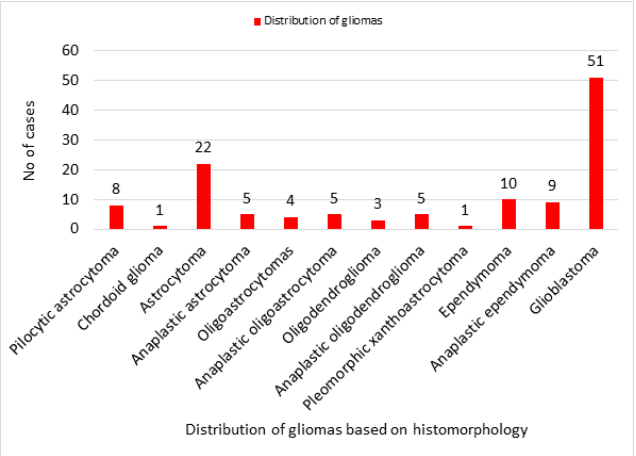

Fig. 2: Distribution of gliomas based on histomorphology (n=124 cases)

Amongst meningiomas, the most common subtype was meningothelial meningioma (25 cases, 49.03%). (Table 3)

Table 3: Distribution of meningioma variants based on histomorphology

S. No	Histopathological diagnosis	No of cases	%
1	Meningothelial	25	49.03
2	Transitional	6	11.76
3	Angiomatous	4	7.84
4	Fibrous (Fibroblastic)	3	5.88
5	Clear cell	2	3.92
6	Psammomatous	2	3.92
7	Chordoid	1	1.96
8	Atypical	8	15.69
	Total	51	100

Female preponderance of 29 cases (57%) was noted in meningiomas.

Tumours were graded according to WHO criteria.[7]

Out of 250 primary tumours, pituitary adenomas, lymphomas, cavernous angiomas and germ cell tumours were not assigned grades.

Grade I tumours were in majority (41%) followed by grade II and IV tumours which were 24% each and grade III tumours (11%). (Figure 3)

Out of 39 cases of non neoplastic ICSOL the most common was abscess (16 cases, 41.02%) closely followed by epidermoid cyst (15 cases, 38.46%). Other non neoplastic lCSOLs encountered were tuberculomas (12.82%), hydatid cyst (5.14%) and Rathke's cleft cyst (2.56%).

4. Discussion

The present study is an attempt to assess the histomorphological spectrum of ICSOLs at a tertiary

Table 4: Comparison of histomorphological subtypes of neoplastic ICSOLs with other similar studies

S. No	Author	Year	Gliomas	Meningiomas	Schwannomas
1	Butt et al	2005	43%	25.8%	12%
2	Kothari et al	2014	40%	22%	6%
3	Lakshmi et al	2015	50.7%	23.6%	5.5%
4	Dogar et al	2015	46%	13%	–
5	Anadure et al	2016	50%	12.5%	14%
6	Adnan et al	2017	35.4%	22.9%	8.6%
7	Kaki RR et al	2017	28%	-	6%
8	Shihora et al	2020	33.3%	25.5%	21.57%
9	Khonglah et al	2020	27.8%	20.97%	18.4%
10	Present study	2019	47.5%	19.5%	9%

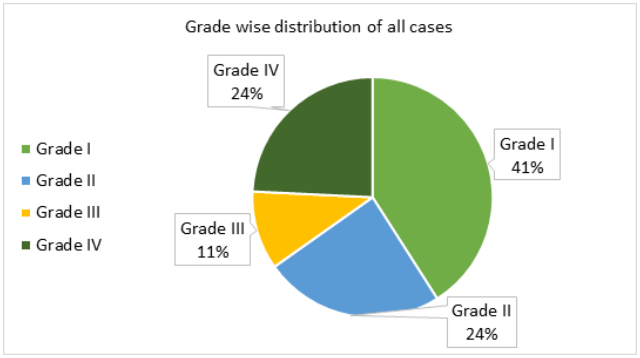

Fig. 3: Showing grade wise distribution of all cases

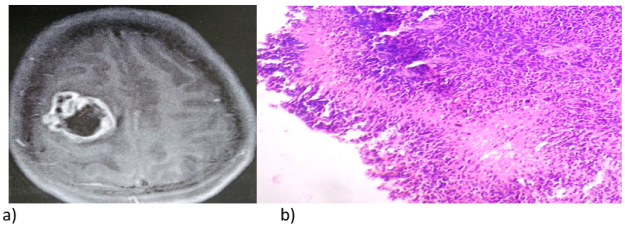

Fig. 5: a): MRI of glioblastoma (GBM) showing an irregularly shaped SOL with ring enhancement in temporoparietal lobe; **b):** Photomicrograph of glioblastoma showing pseudopalisading necrosis surrounded by tumour cells. (HE, 4x)

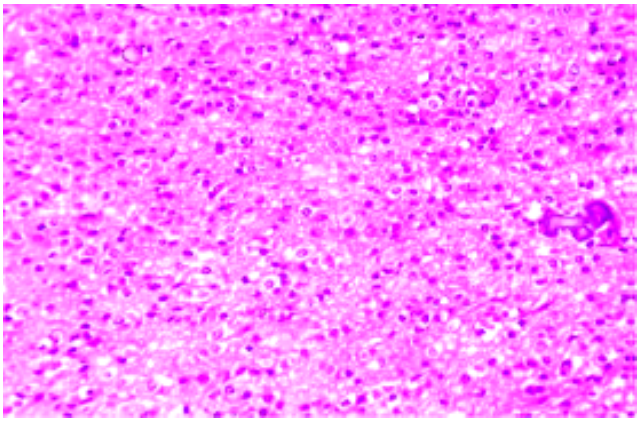

Fig. 4: Photomicrograph of oligidendroglioma showing cells in sheets with perinuclear haloes (Fried egg appearance) and foci of calcification. (HE, 40x)

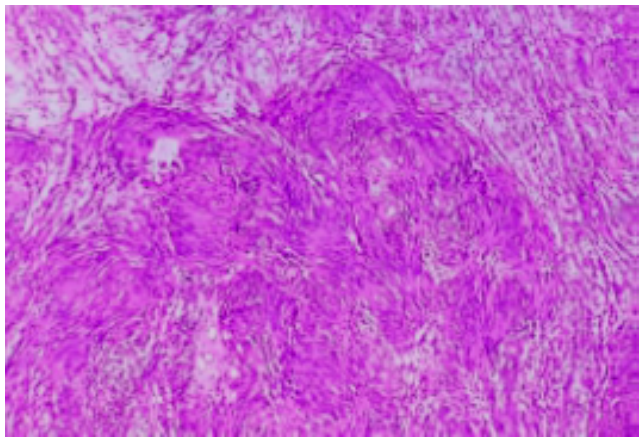

Fig. 6: Photomicrograph of schwannoma showing Antoni A areas of compactly arranged tumours and Verocay bodies with loosely arranged Antoni B areas. (HE,10x)

care centre/ hospital.

The most common age group affected was 31-40 years (23.68%) followed by 41-50 years of age group (20.33%). Studies by Hema et al, Masoodi et al, Dogar et al, Pachori et al, Khonglah et al and Shihora et al also showed maximum cases in the age group 31-40 years.[2,8–12]

The male to female ratio was 1.3:1. Our finding was similar to studies by Chawla et al, Nibhoria et al, Rathod et al, Butt et al, Adnan et al, Joshi et al.[4,6,13–16]

The most common clinical presentation was headache (78%). Hema et al, Masoodi et al, Khonglah et al, Rathod et al, Joshi et al, Kaki RR et al and Datta et al also reported similar observation.[2,8,11,13,16–18]

Out of total 300 cases, 220 cases (73%) were located supratentorially and 80 cases (27%) infratentorially. These findings were seen to correspond with studies by Jamjoom et al, Masoodi et al, Pachori et al and Kaki RR et al.[1,8,10,17]

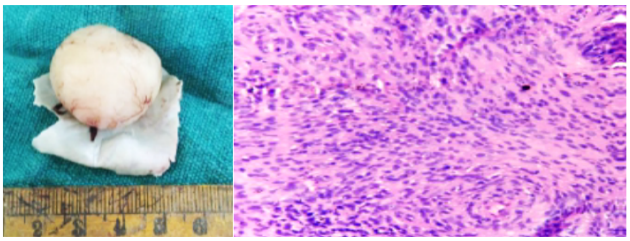

Fig. 7: a): Gross specimen of meningioma which is firm, round, well circumscribed with attached dura; **b):** Photomicrograph of meningothelial meningioma showing uniform cells with oval nuclei and abundant eosinophilic cytoplasm. (HE, 40x)

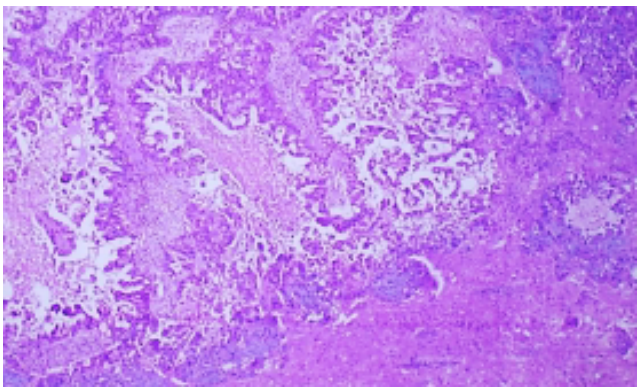

Fig. 8: Photomicrograph of metastatic deposits of adenocarcinoma showing tumour arranged in papillary pattern with necrotic glial tissue. (HE, 10x)

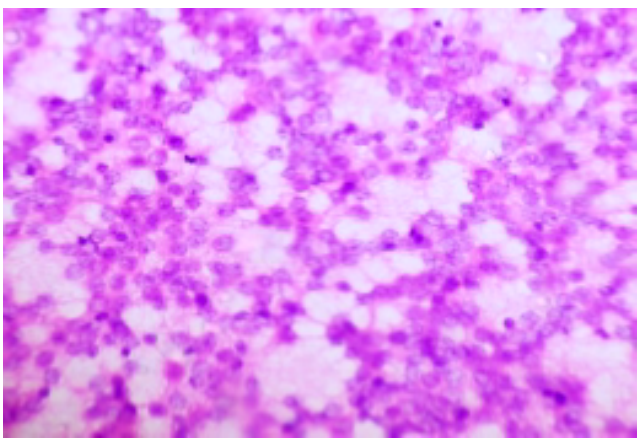

Fig. 9: Photomicrograph of pituitary adenoma showing tumour arranged in sheets. Cells show round to oval nuclei with fine granular chromatin. (HE, 40x)

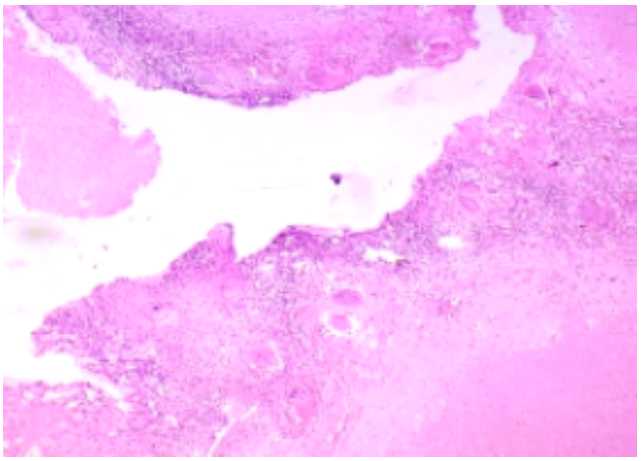

Fig. 10: Photomicrograph of tuberculoma showing caseous necrosis, Langhans giant cell surrounded by lymphocytes and reactive glial tissue. (HE, 10x)

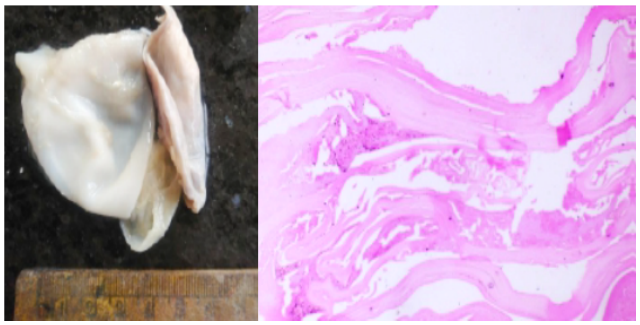

Fig. 11: a): Gross specimen of hydatid cyst showing smooth, glistening, whitish appearance. **b):** Photomicrograph of acellular, lamellated eosinophilic hydatid cyst wall. (HE, 10x)

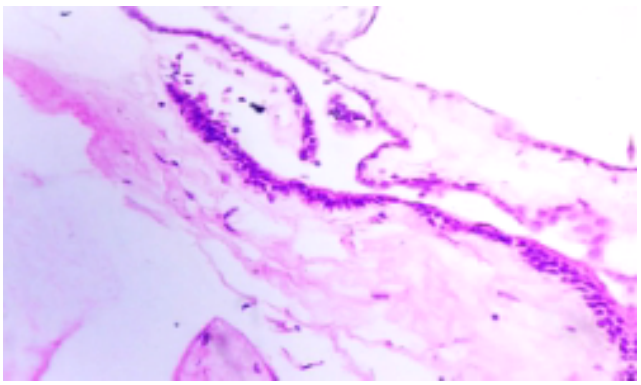

Fig. 12: Photomicrograph of Rathke's cleft cyst lined by cuboidal to columnar epithelium

In supratentorial compartment, majority (19.7%) of cases showed multiple lobe involvement followed by 48 cases (16%) involving frontal lobe. Masoodi et al and Shashidhar et al reported 21.7% and 30% of multiple lobe involvement respectively in their study.[8,19] 20.7%, 23%, 10%, 15.5% of ICSOLs were located in frontal lobe in studies by Masoodi et al, Shashidhar et al, Lakshmi et al and Thambi et al respectively.[8,19–21] These findings correlated well with our study.

In infratentorial compartment, 35 cases (11.7%) showed involvement of cerebellum followed by 32 cases (10.7%) involving cerebellopontine angle (CP) angle. Suprasellar and sellar region, cerebellum and CP angle showed variable distribution across multiple studies.[8,12,19–21]

Out of 300 cases, 261 cases (87%) were neoplastic in nature and 39 cases (13%) were non neoplastic. Jamjoom et al, Dogar et, Khonglah et al, Butt et al and Adnan et al reported 87%, 89%, 86.13%, 89% and 77.8% of neoplastic ICSOLs and 13%, 11%, 13.86%, 11% and 22.2% of non neoplastic ICSOLs respectively.[1,9,11,14,15]

250 cases (96%) were of primary tumour and 11 cases (4%) were of metastatic deposits. These findings were in agreement with studies by Hema et al, Nibhoria et al,Khonglah et al, Shihora et al, Butt et al,Joshi et al, Kaki RR et al, Lakshmi et al and Kanthikar et al.[2,6,11,12,14,16,17,20,22]

Out of 261 neoplastic ICSOLs, majority belonged to gliomas (48%) followed by meningiomas (20%) and schwannomas (9%). (Table 4) Hema et al, Dogar et al, Khonglah et al, Butt et al, Adnan et al, Kaki RR et al, Lakshmi et al and Kothari et al reported 50%, 46%, 27.8%, 43%, 35.4%, 28%, 50.7% and 40% of glial tumours respectively in their studies.[2,9,11,14,15,17,20,23]

In case of meningiomas our findings were in agreement with studies by Khonglah et al, Shihora et al, Butt et al, Adnan et al, Joshi et al, Datta et al and Kothari et al.[11,12,14–16,18,23] Studies by Pachori et al (42.8%) and Kaki RR et al (32%) reported higher percentage of meningiomas.[10,17]

Studies by Hema et al (14%), Butt et al (12%), Adnan et al (8.6%), Kaki RR et al (6%), Datta et al (6.5%), Lakshmi et al (5.5%) and Kothari et al (6%) showed similar distribution of schwannomas as in present study.[2,14,15,17,18,20,23] A higher percentage of schwannomas was noted in studies by Khonglah et al (18.04%), Shihora et al (21.57%) and Joshi et al (22.6%).[11,12,16]

Amongst gliomas, in our study the most common type was glioblastoma (41.1%) followed by astrocytomas (18%). Our findings were concordant with studies by Masoodi et al, Pachori et al, Khonglah et al, Adnan et al, Thambi et al and Kakshapati et al.[8,10,11,15,21,24]

68.6% of glioblastomas belonged to age group 31-60 years. Masoodi et al reported that 75% of glioblastomas in age group 31-50 years and Khonglah et al observed a mean age of 42.38 years.[8,11] Adnan et al too reported most cases of glioblastoma above 40 years.[15]

In present study, the most common histologic subtype amongst meningiomas was meningothelial meningioma represented by 25 cases (49.03%) followed by 8 cases of atypical meningioma (15.69%) and 6 cases of transitional meningioma (11.76%). Other studies showed variable distribution of histomorphological subtypes of meningioma.[2,6,11,12,19,24–27]

Meningiomas showed female predominance of 29 cases (57%). Our findings were concordant with studies by Nibhoria et al, Khonglah et al, Adnan et al, Kakshapati et al and Priscilla et al.[6,11,15,24,26]

In our study, grade I tumours were in majority (41%) followed by grade II and IV tumours which were 24% each and grade III tumours (11%). Similar findings were also observed in studies by Shihora et al, Kakshapati et al, Jat et al, Priscilla et al and Jaiswal et al.[12,24–26,28]

Out of 300 ICSOLs, the most common non neoplastic ICSOL was abscess (5.3%) closely followed by epidermoid cyst (5%). Jamjoom et al, Hema et al, Shihora et al, and Joshi et al reported 6.6%, 6.5%, 3.07% and 8.3% of abscesses respectively, out of all ICSOLs.[1,2,12,16]

1.54%, 3.1%, 2.27% of epidermoid cysts out of all ICSOLs were observed in studies by Shihora et al, Joshi et al and Sunila et al respectively.[12,16,27]

In present study, 55 cases (18.33%) belonged to paediatric age group.

Similar findings were reported by Nibhoria et al– 12.3%, Khonglah et al (23.41%), Butt et al - 18% and Jaiswal et al – 16.2%.[6,11,14,28]

5. Conclusion

The present study gives a glimpse of histomorphological spectrum of ICSOLs which present with nonspecific and overlapping clinical features.

Radiodiagnostic investigations are helpful adjunct tool to diagnose ICSOL but cannot provide exact diagnosis.

In spite of availability of newer diagnostic techniques such as immunohistochemistry and molecular tests, histopathology remains a gold standard in establishing histomorphological diagnosis and grading of tumours.

In the end, clinical, radiological and histomorphological findings- all three must be taken into account before giving the final diagnosis which can help the clinician in deciding the line of management and improve patient healthcare.

Also developing countries lack a central cancer registry for brain tumours. Hence, such hospital based study attempts to give relative frequency of ICSOLs in a particular region.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare no conflict of interest.

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