IMAGING OF INTRACRANIAL SPACE OCCUPYING LESIONS- A PROSPECTIVE STUDY IN A TERTIARY CARE CENTRE- GGH, KAKINADA, A.P.

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ABSTRACT

BACKGROUND

The high morbidity and mortality associated with ICSOLs necessitates their early diagnosis so as to plan the required intervention. An analysis of 50 cases of Intracranial Space Occupying Lesions (ICSOL) including neoplastic and non-neoplastic masses diagnosed and treated at GGH, Kakinada, over a period of one year is presented. CT scan and MRI were used for the diagnosis.

MATERIALS AND METHODS

In this prospective cohort study, 50 patients with ICSOL were studied predominantly by MRI and also by CT and MRS (wherever necessary). Imaging findings were evaluated, tabulated and correlated with histopathological findings and also clinical findings (wherever available). The findings were statistically analysed.

RESULTS

Most patients were in age range of 50-60 years. Male:female ratio was 2:3. Most common presenting symptom was headache associated with vomiting. Predominantly, solitary lesions were present in 47 patients (94%) and multiple lesions in three patients (6%). 39 cases were supratentorial, 10 cases were infratentorial and one lesion was both supra and infratentorial in location. 40 patients were having neoplastic lesions (80%) and 10 had non-neoplastic lesions (20%). In our study, meningiomas were the most common neoplastic lesion while among non-neoplastic lesions, arachnoid cysts were the most common. Of the neoplastic cases, 12 cases (30%) were malignant and 28 (70%) cases were benign mass effect was the most common associated imaging finding. For neoplastic lesions, the imaging sensitivity was 92.5%, specificity was 70%, accuracy was 88%, positive predictive value was 92.5% and negative predictive value was 70%. While for the non-neoplastic lesions, imaging sensitivity was 70%, specificity was 92.5% and accuracy was 88%.

CONCLUSION

Neuroimaging in combination with clinical findings can be helpful in early diagnosis and localisation of ICSOL and for proper management of the patient. The neurosurgeon, neuroradiologist and neuropathologist form a triad that is essential for diagnosis, management and follow up of these cases.

KEYWORDS

ICSOL, Neoplastic, Non-Neoplastic, CT, MRI.

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BACKGROUND

The term "intracranial space occupying lesions" is defined as any neoplasm, benign or malignant, primary or secondary as well as any inflammatory or parasitic mass lying within the cranial cavity. It also includes haematomas, different types of cysts and vascular malformations.[1]

Different authors have reported that majority of patients of ICSOL had neoplasms followed by infective and traumatic aetiology.[2,3] Gliomas are more common followed by meningiomas, abscesses, pituitary tumours and tuberculoma.[4] Intracranial lesions can present with seizures, focal neurological deficits, raised ICP or endocrine dysfunction or can be incidental findings.[5] Neurological symptoms produced by brain tumours are general and focal. Increased intracranial pressure produces headache, vomiting, impaired vision and changes in consciousness.[6]

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The goals of diagnostic imaging in the patient with suspected intracranial masses include detection of the presence of a mass, localisation of the extent of the mass (including definition of involvement of key structures and assessment of the presence and severity of secondary changes, e.g., oedema, herniation, haemorrhage) - characterisation of the nature of the process.[7]

A larger number of patients treated here belong to the poor and low economic strata of the society. All intracranial space occupying lesions diagnosed and treated over the past 1 year were studied prospectively and are presented. This study was undertaken to assess the imaging findings in patients with ICSOL along with histopathological, surgical correlation and also clinical correlation (wherever available/necessary).

MATERIALS AND METHODS

This prospective cohort study was conducted from October 2015 to October 2016 and included 50 patients referred by various clinical departments with clinical suspicion of intracranial space occupying lesions and all cases were evaluated by computed tomography and magnetic resonance imaging (spectroscopy also wherever necessary) with relevant history and clinical examination.

Inclusion Criteria

- Presence of ICSOL on neuroimaging (CT/MRI).
- Histopathological, surgical and clinical correlation (wherever available).

Exclusion Criteria

- Paediatric cases.
- Traumatic and non-traumatic intracranial haematoma.
- Infarct and demyelinating lesions.
- Bony lesions of skull.
- Postoperative recurrent/residual lesions.

Technique

Requested neuroimaging was done with prior explanation of the radiological investigation and informed written consent of the patient/relatives. CT was performed on Siemens Somatom dual slice spiral CT unit with axial, coronal and sagittal reconstructions of desired thickness of acquired data. MRI scans were performed on 1.5T GE with acquisition of spin echo T1, T2, T2 flair, SWI in desired planes and axial EPI- DWI and ADC maps. CE MRI was done post IV gadolinium (dose 0.1 mmol/kg) injection with acquisition of TIW scans in three orthogonal planes. Imaging findings were evaluated and tabulated and correlated with the clinical findings and histopathological findings (wherever available) subsequently.

RESULTS

Out of total 50 patients enrolled for study, most patients were in age range of 50-60 years. 23 (46%) patients were male and 27 (54%) patients were females. The main presenting symptoms was headache and the most common clinical signs were altered sensorium. Predominantly, solitary lesions were present in 47 patients (94%) and multiple lesions in three patients (6%). 39 cases were supratentorial, 10 cases were infratentorial and one lesion was both supra and infratentorial in location. Most common supratentorial location in adults was frontoparietal lobe in 22% (and among those, parietal region was most common site) followed by posterior fossa (20%). 40 patients were having neoplastic lesions (80%) and 10 had non-neoplastic lesions (20%). 54% lesions were intra-axial and 46% extra-axial in location. In our study, meningiomas were the most common neoplastic lesion while among non-neoplastic lesions, arachnoid cysts were the most common.

Neoplastic lesions included meningiomas (32%), glial tumours 28% (GBM-18%, anaplastic astrocytomas-8%, cystic glioma 2%), metastases 6%, pituitary macroadenoma 6%, Schwannomas 6%, haemangioblastomas 2%, non-neoplastic lesions included arachnoid cyst 8%, tuberculoma 4%, abscess 4% and colloid cyst 4%.

For neoplastic lesions, the imaging sensitivity was 92.5%, specificity was 70%, accuracy was 88%, positive predictive value was 92.5%, negative predictive value was 70%, while for the non-neoplastic lesions imaging sensitivity was 70%, specificity was 92.5% and accuracy was 88%.

Age	Male	Female	Total	Percentage
10-19	1	4	5	10%
20-29	3	3	6	12%
30-39	4	3	7	14%
40-49	3	5	8	16%
50-59	5	9	14	28%
60-69	6	3	9	18%
70-79	1		1	2%

Table 1. Age and Sex Distribution

Neoplastic	40
Non-Neoplastic	10

Table 2. Distribution of ICSOL on the Basis of Radiological Diagnosis (N=38)

Extra-axial tumours	19
Intra-axial tumours	31

Table 3. Distribution of ICSOL on the Basis of Anatomical Location

1.	Meningiomas (extra-axial)	16	32%
2.	Gliomas (intra-axial)-GBM- -Anaplastic astrocytomas -Cystic glioma	9 4 1	18% 8% 2%
3.	Arachnoid cyst (intra-axial)	4	8%
4.	Pituitary macroadenoma (intra-axial)	3	6%
5.	Schwannomas (extra-axial)	3	6%
6.	Metastasis (intra-axial)	3	6%
7.	Tuberculomas (intra-axial)	2	4%
8.	Abscess (intra-axial)	2	4%
9.	Colloid cyst (intra-axial)	2	4%
10.	Haemangioblastoma (intra-axial)	1	2%
	Total	**50**	

Table 4. Incidence of Different Lesions

Out of 40 neoplastic lesions on imaging, 37 were correlating with histopathology. One case which was diagnosed as metastasis on imaging turned out to be cystic glioma. Two case diagnosed as meningioma and metastasis on imaging turned out to be GBM. Sensitivity was 92.5%, specificity was 70%, accuracy was 88%, positive predictive value was 92.5% and negative predictive value was 70%.

		Histopathological	
		Neoplastic	**Non-Neoplastic**
Imaging	Neoplastic	37	3
	Non-Neoplastic	3	7

Table 5. Statistical Analysis of Radiopathological Concordance in Neoplastic Lesions

Out of 10 non-neoplastic lesions on imaging, 7 were confirmed on histopathological findings. One case which was diagnosed as inflammatory/neoplastic lesion turned out to be grade-3 astrocytoma and another case diagnosed as multiple granulomatous lesions turned out to be multiple abscesses. One case diagnosed as infective/metastasis on imaging turned out to be tuberculoma on HPE. Sensitivity was 70%, specificity was 92.5% and accuracy was 88%.

		Histopathological	
		Non-Neoplastic	**Neoplastic**
Imaging	Non-neoplastic	7	3
	Neoplastic	3	37

Table 6. Statistical Analysis of Radiopathological Concordance in Non-Neoplastic Lesions

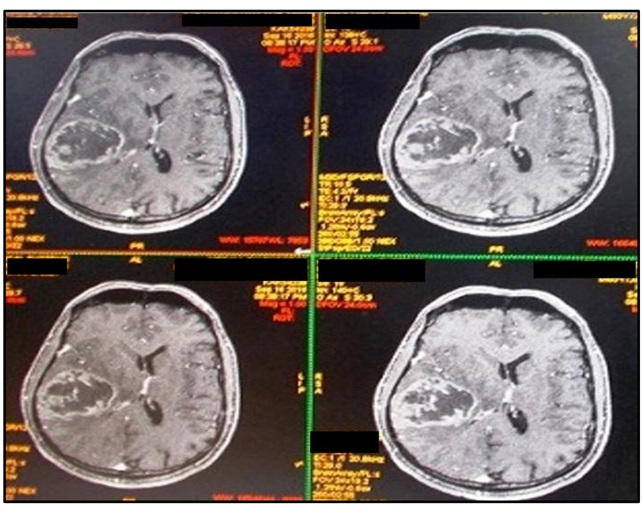

Figure 1. T1 Contrast Axial Images Showing Heterogeneously-Enhancing Mass Lesion in Rt. Temporoparietal Region - GBM

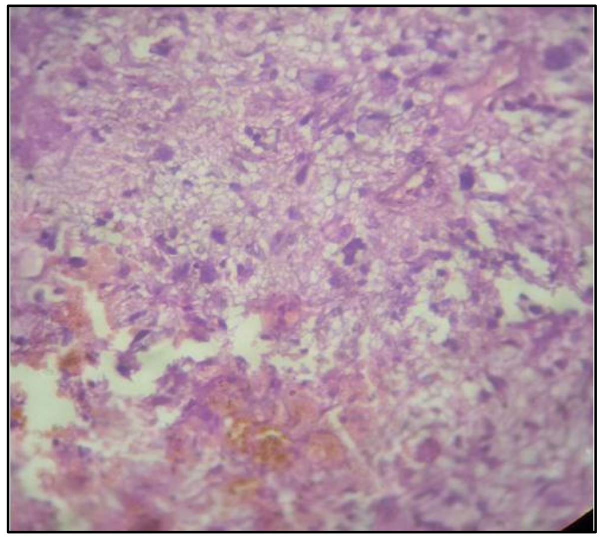

Figure 2. Histopathology of GBM

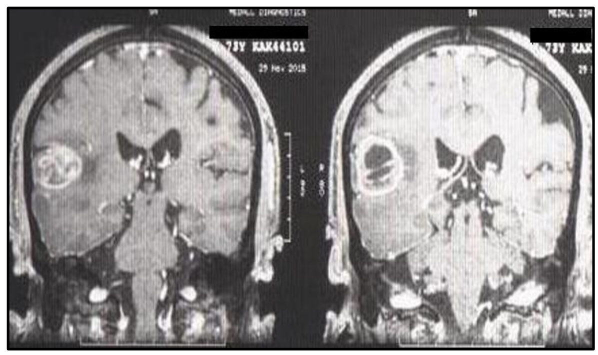

Figure 3. T1 Contrast Coronal Images - GBM

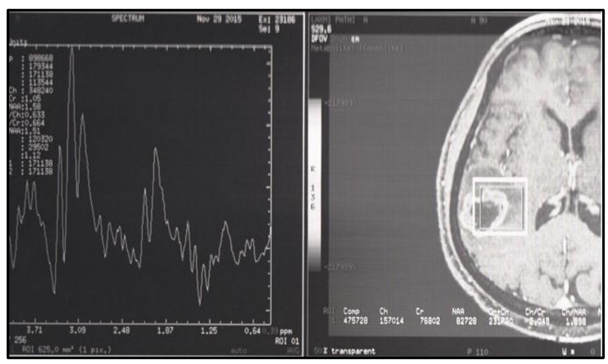

Figure 4. Spectroscopy Showing Elevated Choline Peak GBM

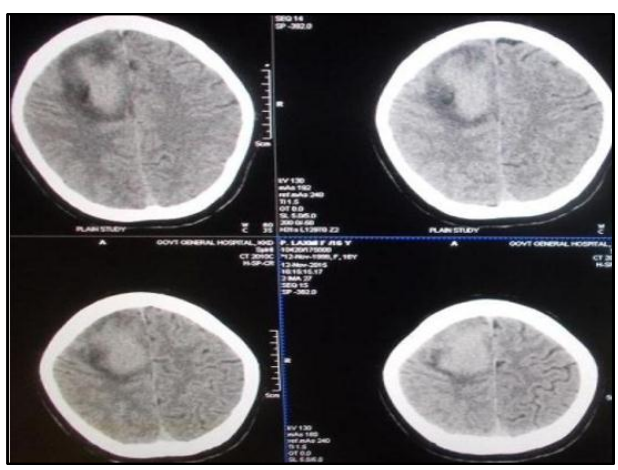

Figure 5. NECT showing Tumoural Bleed in High-Grade Glioma

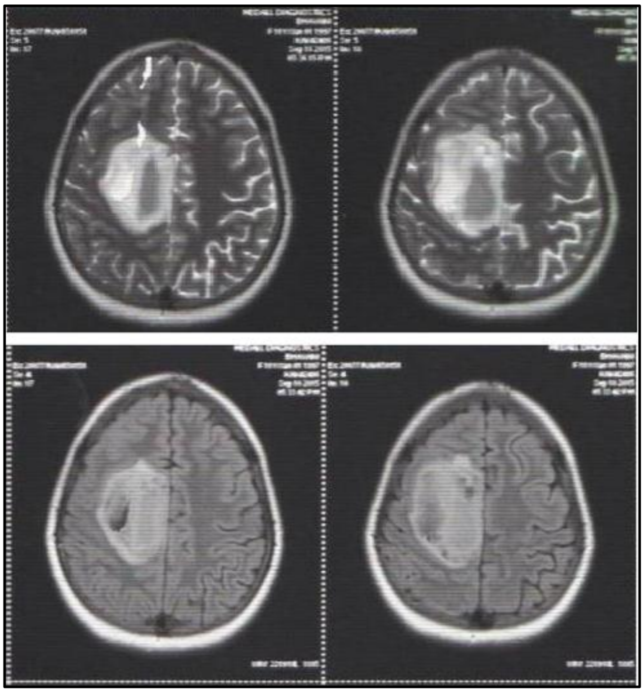

Figure 6. T2WI and Flair Images showing Well-Defined Altered Signal Intensity Lesion Seen in Rt. Parietal Cerebrum in Parafalcine Region with Internal Bleed - High-Grade Glioma

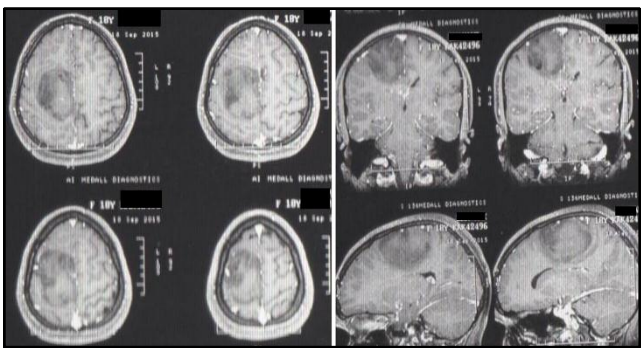

Figure 7. T1C Axial and Coronal Images showing Heterogeneously-Enhancing Mass Lesion in Rt. Parietal Region - High-Grade Glioma

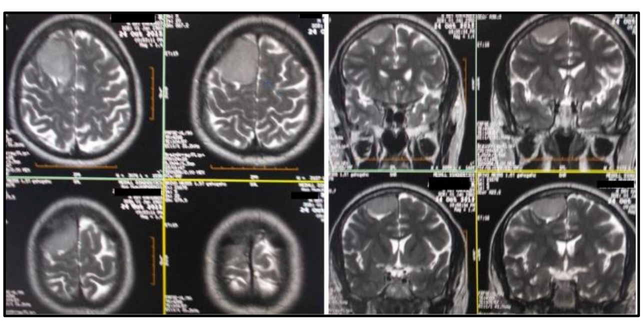

Figure 8. T2W Axial and Coronal Images showing Iso/Hyperintense Extra-Axial Mass Lesion in Rt. Frontal Convexity Meningioma

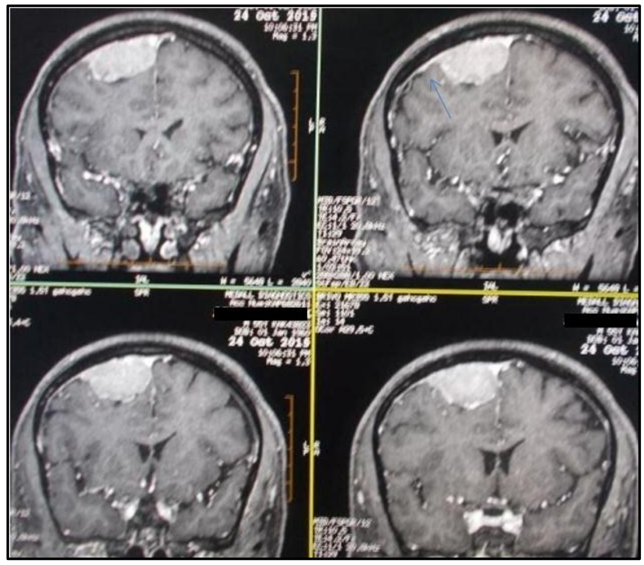

Figure 9. T1 Contrast Coronal Images showing Intensely-Enhancing Extra-Axial Mass Lesion in Rt. Frontal Convexity with Dural Tail Sign - Meningioma

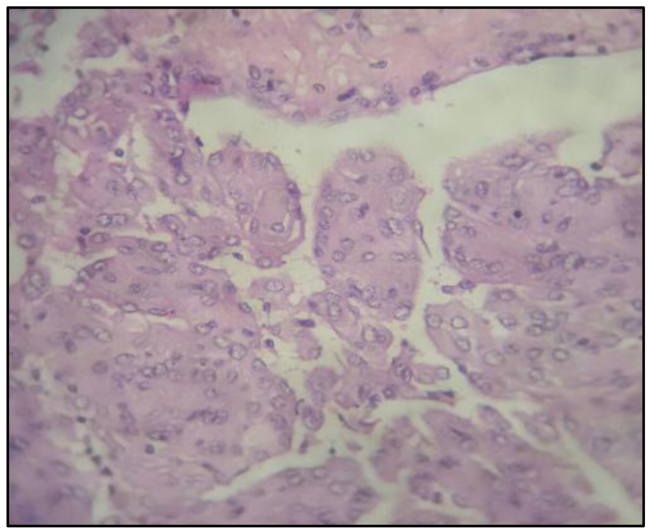

Figure 10. Histopathology of Meningothelial Meningioma

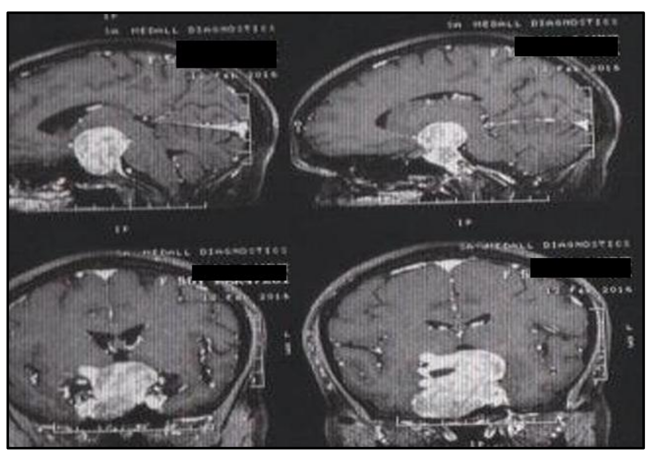

Figure 11. T1 Contrast Coronal Images showing Intensely-Enhancing Mass Lesion in Sellar Region with Suprasellar Extension - Pituitary Macroadenoma

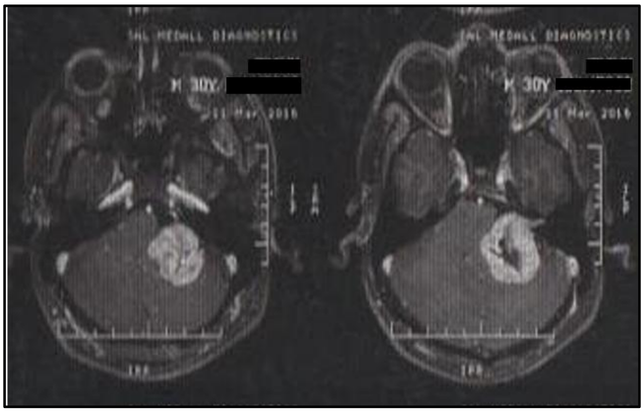

Figure 12. T1 Contrast Axial Images showing Heterogeneously-Enhancing Extra-Axial Mass Lesion in Lt. CP Angle - Schwannoma

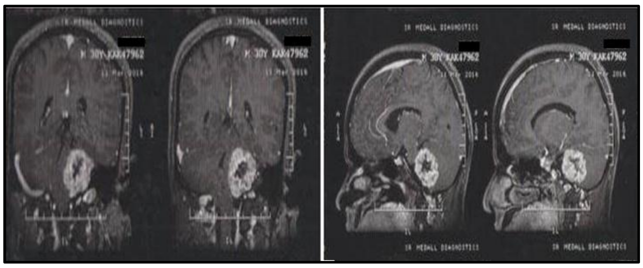

Figure 13. T1 Contrast Coronal and Sagittal Images showing Heterogeneously-Enhancing Extra-Axial Mass Lesion in Lt. CP Angle - Schwannoma

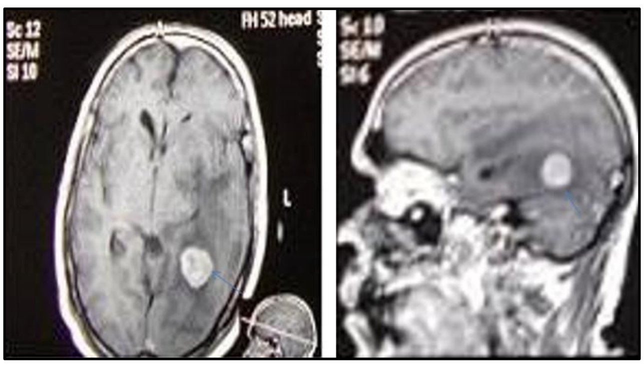

Figure 14. T1 Contrast Images showing Nodular-Enhancing Lesion with Extensive Perilesional Oedema in Lt. Temporoparietal Region - Metastasis

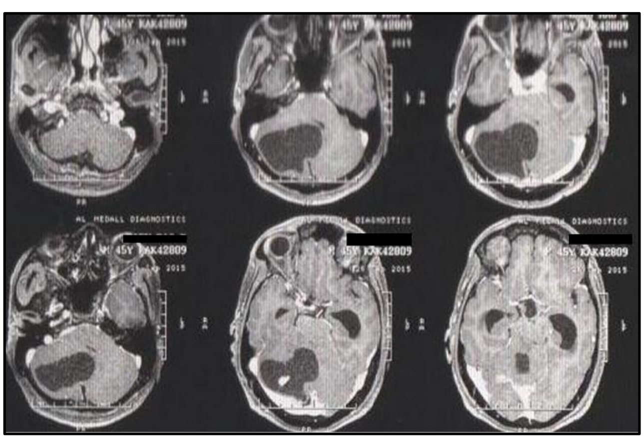

Figure 15. T1 Contrast showing Large Cystic Lesion with Enhancing-Mural Nodule in Posterior Fossa Haemangioblastoma

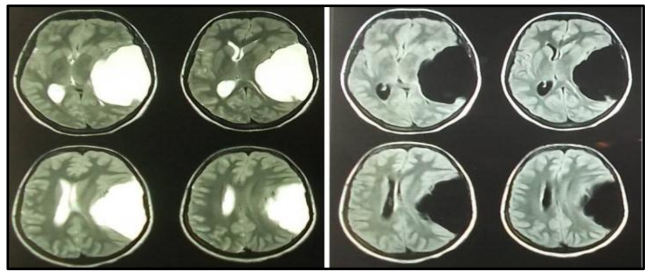

Figure 16. T2WI and Flair Images showing Extra-Axial Cystic Lesion in Middle Cranial Fossa with CSF Signal Intensity in all Sequences - Arachnoid Cyst

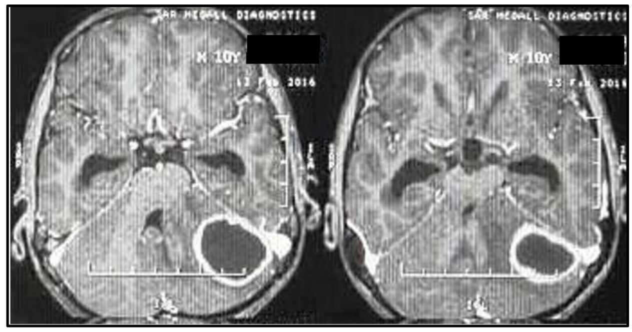

Figure 17. A Ring-Enhancing Lesion in Lt. Cerebellar Region - Abscess

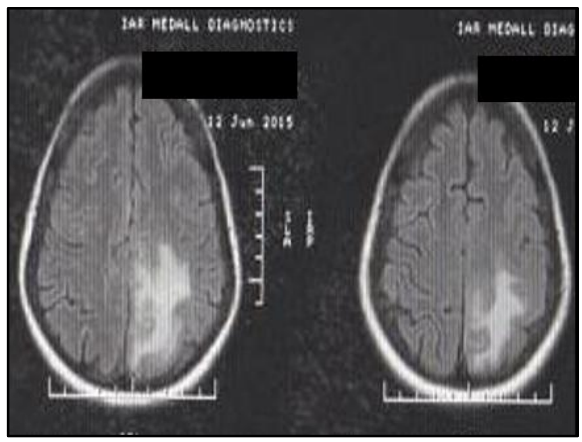

Figure 18a. T2 Flair Axial Images showing Iso/Hypointense Nodular Lesion with Significant Perilesional Oedema in Left Posterior Parietal Region

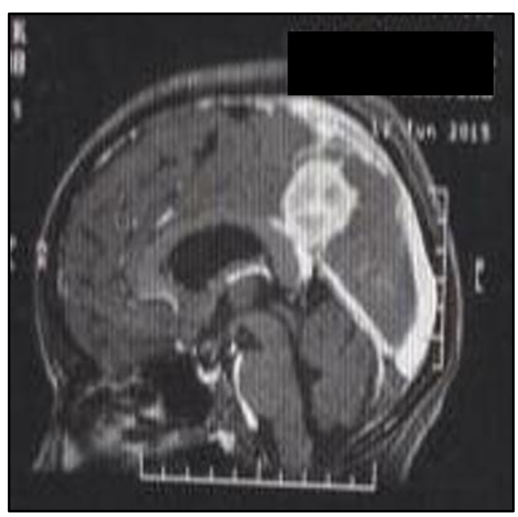

Figure 18b. T1C Sagittal Image showing Conglomerate Nodular-Enhancing Lesion in Lt. Parietal Region - Tuberculoma

DISCUSSION

The term ICSOL is generally used to identify any lesion whether neoplastic or inflammatory in origin, which increases the volume of intracranial contents and leads to a rise in Intracranial Tension (ICT). The presentation of ICSOL has changed radically with increased availability of modern imaging techniques like CT and MRI. The age ranges from 10-80 yrs. in present study. The peak incidence was in 50-60 yrs. (5th decade) (28%) followed by 4th decade (16%) with female predominance. Male-to-female ratio was 2:3, which was not correlated with Madan AH et al study.[8] Majority of lesions were detected in the 4th, 5th decade with male-to-female ratio of 1:1.5. The most common symptom was headache, the second common presenting complaint in our study was loss of consciousness.

39 cases (78%) were supratentorial, 10 (20%) cases were infratentorial and 1 (2%) lesion was both supra and infratentorial in location, which were corresponding to study by Chander R et al[9] having 79% supratentorial and 21% infratentorial lesions. Most common supratentorial location in adults was frontoparietal lobe in 22% (and among those parietal region was most common site) followed by posterior fossa 20%. Benjarge PV and Kulkarni AI[10] found parietal lobe 27.5% as most common location, which was well corresponding with our observation. In our study, 54% lesions were intra-axial and 46% extra-axial. Chander R et al[9] study concluded that 64% lesions were intra-axial and 15% extra-axial, which was corresponding to our study.

In present study, the incidence of different lesions were as follows- meningiomas (32%), glial tumours 28% (GBM 18%, anaplastic astrocytomas 8% and cystic glioma 2%), metastases 6%, pituitary macroadenoma 6%, Schwannomas 6%, haemangioblastomas 2%, arachnoid cyst 8%, tuberculoma 4%, abscess 4% and colloid cyst 4%. The above findings of incidence were not corresponding to study of Goyani BR et al[11] that metastases were the most common single group of ICSOL (27%). In our study, 40 patients were having neoplastic lesions (80%) and 10 had non-neoplastic lesions (20%). 54% lesions were intra-axial and 46% extra-axial in location. In our study, meningiomas were the most common neoplastic lesion, which is extra-axial.

Salient features of extra-axial location being CSF cleft, displaced subarachnoid spaces, cortical gray matter between mass and white matter, broad dural base and adjacent bony reaction.

Classical features of malignant tumours being irregular, ill-defined outline, their invasive nature, contrast enhancement and metastasis.

Radiopathological Correlation

For neoplastic lesions, the imaging sensitivity was 92.5%, specificity was 70%, accuracy was 88%, positive predictive value was 92.5%, negative predictive value was 70%, while for the non-neoplastic lesions imaging sensitivity was 70%, specificity was 92.5% and accuracy was 88%. These findings are in partial agreement with Zacharaki EI et al study,[12] which concluded that imaging accuracy, sensitivity and specificity for brain masses were 85%, 87% and 79%, respectively.

CONCLUSION

Intracranial space occupying lesions comprise of a diverse group of lesions. With the introduction of CT and MRI scanning, imaging of lesions has acquired a new dimension whereby excellent anatomical detail in axial, sagittal and coronal planes as well as lesion characterisation has become possible. These modalities have helped in the early diagnosis and localisation of the SOL and in complement with advanced neurosurgical techniques have brightened the prognosis of mass lesions. MRI remains the first line investigation for diagnosing and evaluation of intracranial space occupying lesion with a reasonable degree of diagnostic accuracy and with the advent of newer modifications of MRI such as MR spectroscopy and newer techniques like MR perfusion.

REFERENCES

[1] Butt ME, Khan SA, Chaudhary NA, et al. Intracranial space occupying lesions a morphological analysis. E:/biomedica 2005;21:31-35. http://www.the biomedica pk.com/articles/31pdf.
[2] Rathod V, Bhole A, Chauhan M, et al. Study of clinico-radiological clinico-pathological correlation of intracranial space occupying lesion at rural center. The Internet Journal of Neurosurgery 2010;7(1):2.
[3] Mahmoud MZ. Intra cranial space occupying lesions in saudi patients using computed tomography. Asian J Med Radiol Res 2013;1(1):25-28.
[4] Irfan A, Qureshi A. Intracranial space occupying lesions- review of 386 cases. J Pak Med Assoc 1995;45(12):319-320.
[5] Leach J, Kerr R. Elective neurosurgery. In: Williams NS, Bullstrode CJK, O'Connell PR, eds. Bailey & Love's short practice of surgery. 25th edn. UK: Edward Arnold 2008:623-644.
[6] Miabi Z, Mashrabi O. Paediatric brain tumour. Res J Biol Sci 2009;(6):647-650.
[7] Kieffer SA, Brace JR. Intracranial neoplasms. In: Hagga JR, ed. CT & MRI of the whole body. 5th edn. Philadelphia: Mosby/Elsevier 2009:49-144.
[8] Madan AH, Chaurasia SB, Wankhede KU, et al. Clinical study of intracranial space occupying lesions & its ophthalmic manifestations. International Journal of Recent Trends in Science & Technology 2015;14(1):127-130.
[9] Chander R, Singh A, Singh S, et al. Multislice computed tomographic evaluation of intracranial space occupying lesions. J of Evolution of Med & Dent Sci 2014;3(64):14051-14067.
[10] Benjarge PV, Kulkarni A. Clinical profile of intracranial space occupying lesions of the brain. MedPulse-International Medical Journal 2014;1(6):288-292.

[11] Goyani BR, Ukani BV, Naik P, et al. A Study on role of MRI in intracranial space occupying lesions. Natl J Med Res 2015;5(1):18-21.

[12] Zacharaki EI, Wang S, Chawla S, et al. Classification of brain tumour type and grade using MRI texture and shape in a machine learning scheme. Magn Reson Med 2009;62(6):1609-1618.