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MRI EVALUATION OF INTRACRANIAL MENINGIOMAS

Radiodiagnosis

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ABSTRACT

OBJECTIVE: To study magnetic resonance (MR) imaging findings of 62 patients diagnosed with meningioma. **METHOD:** The study was done on 62 patients with histological proven intracranial meningioma and their imaging findings were studied. The study included 33 female and 29 male patients using the standard protocol MR imaging examination with a 1.5-T MR imaging unit. **RESULTS:** Iso-intense signals are noted in most of the cases, 61% on T1 (n=38) and 54% on T2 (n=34) respectively. However, hypointense signals were noted in 21% (n=13) cases on T1 images and hypointense signal on T2 weighted images in 1.6 % (n=1). After contrast administration, 58% (n=36) showed homogenous enhancement and 42% (n=26) showed heterogenous enhancement. **CONCLUSION:** Intracranial meningiomas usually show heterogeneous low signal on T1- weighted and high signal on T2-weighted and FLAIR images, with intense enhancement after contrast administration.

KEYWORDS

meningioma, magnetic resonance imaging, brain tumors.

INTRODUCTION

During the last few years, the role of magnetic resonance imaging (MRI) as a diagnostic tool in neuroradiology has been well-established. Definitive diagnosis among the various kinds of intracranial extra-axial lesions can be complicated in some cases. However, with advanced MRI techniques such as perfusion, diffusion and spectroscopy, it is now possible to differentiate between these lesions. Meningiomas are the most common benign intracranial neoplasms 1,2. Meningiomas are also the most common primary non-galieal intracranial tumors3,7,22. This neoplasm affects more frequently patients in middle and late decades of life, with a strong female prediction (2:1)1,3,22. The classical appearance on the computed tomography (CT) scans and magnetic resonance (MR) imaging usually leads to a correct diagnosis of meningiomas. The CT scan usually demonstrates an extra-axial mass hypo- or isodense, with intense enhancement after contrast administration[1,4,20].

On MR imaging the signal intensity of the tumour mass may be rather variable on both T1-, T2-weighted and FLAIR images 4,7,21. The tumor has variable signal, being most commonly iso-intense on T1-weighted images and T2-weighted images. However, the lesions may present heterogeneous signal on T1- and more evident on T2-weighted images. After gadolinium administration, meningiomas show intense enhancement, which may be heterogeneous in some cases 3,4,7,22. Other findings such as adjacent edema, cystic foci, calcifications and hyperostosis are also demonstrated in some cases.

We present the MR imaging findings of 62 patients with meningiomas diagnosed in a single institution.

OBJECTIVE:

To study magnetic resonance (MR) imaging findings of 62 patients diagnosed with meningioma.

MATERIALS AND METHOD

This study was carried out with due approval from the ethics committee. Total 62 patients were selected in the study who were sent to the Department of Radio diagnosis at Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik with varying clinical symptoms and suspicion of an intracranial pathology. The demographic profile and clinical features were obtained after due consent to correlate the findings. The patients who underwent any previous intra-cranial surgery or had any history of trauma were not included in this study.

Follow up was obtained for histopathological diagnosis, laboratory investigations and follow up imaging studies wherever possible except for some cases where follow up could not be obtained due to migratory rural population and where diagnostic findings were confirmatory and additional supportive diagnostic test was not required.

MRI TECHNIQUE

All the MRI scans were done on 1.5-T magnet MR system (Siemens Magnetom Essenza). Patients were made to lie supine for the scan and a dedicated head coil was used. The exact MR imaging pulse sequences vary among different institutions. MRI by multiplanar T1- and T2-weighted, FLAIR, diffusion, gradient images, using spin echo sequences, was obtained in all the patients. Proton magnetic resonance spectroscopy on single and multivoxels chemical shift imaging was done wherever indicated.

Usually, a field of view (FOV) of 200-300, 512 x 512 matrix sizes and 3-4 mm slice thickness was applied. For evaluation of tumours, administration of intravenous Gadolinium was given. Pre and post contrast images were taken in sagittal, axial and coronal orientation. Three-dimensional (3D) sequences with isotropic resolution were also taken that provided thinner sections and reduced partial volume averaging.

METHOD

This retrospective study included 62 patients with histological proven intracranial meningioma, which were diagnosed between 2017 and 2019. There were 33 female and 29 male patients, with ages raging between 23 and 81 years (median=56 years, standard deviation=12.7). All patients underwent surgical biopsy or resection of the tumors, and the histological diagnosis of meningioma was defined based on the World Health Organization criteria6.

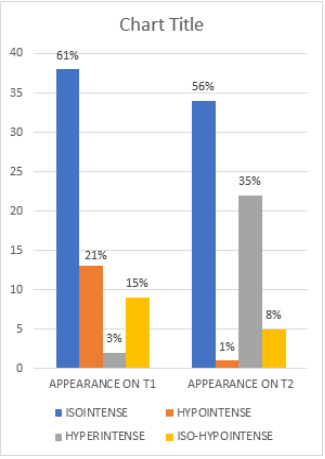
RESULTS

Considering the signal intensity on T1-weighted images Iso-intense signals are noted in most of the cases, 61% (n=38) and 54% on T2 (n=34) respectively.

However, T1 images show hypointense signals in 21% (n=13) cases and in 1.6 % (n=1) out of 62 cases was shown to have hypointense signal on T2 weighted image.

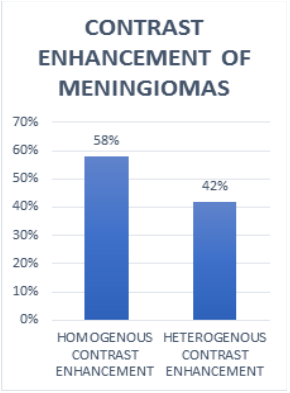
About 15% (n=9) of cases were described as Iso to Hypointense on T1 weighted images and about 8% (n=5) on T2 weighted images

However, T1 images show hyperintense signal in a few cases 3% (n=2). On T2 weighted images, hyperintense signals are noted in 35% (N=22) of cases.



After contrast administration, 58% (n=36) showed homogenous enhancement and 42% (n=26) of the tumors showed heterogenous enhancement.

The tumors were located in the frontal lobe in 39% of the cases, in the parietal lobe in 35%, the occipital lobe in 19% and the temporal lobe in 12% of the patients.



Areas of vasogenic edema around the tumors were seen in 90% (n=56) of the cases. The edema was considered discrete in 50% (n=31) of the cases, moderated in 37% (n=23) and severe in 23% (n=8) of the patients. Foci of hemorrhage were observed only in three tumors, and areas suggestive of cystic components in six cases. Foci of calcification were observed also in six patients and evidence of bone infiltration in 26% (n=20) of the patients. The dural tail sign was seen in 74% (n=46) of the tumors.

DISCUSSION

Meningiomas are the most common benign intracranial neoplasms1,2. Meningiomas are benign, slow growing, well-localized lesions.

They commonly occur after 5th decade, and are roughly twice more common in females 3,4.

Meningiomas are extra axial lesions seen along the external surfaces of the brain as well as within the ventricular system. Parasagittal aspect of the cerebral convexity, lateral hemispheric convexity, sphenoid wing, middle cranial fossa, and the olfactory groove are the common sites5. They are the second most common CP angle masses. Less common sites include the optic nerve sheath, the lateral ventricles and the sella turcica [4,5].

On T1, most tumors are isointense to the cortical grey matter (from 56% to 94%). Hypointense meningiomas account from 20% to 48%, and hyperintense tumors on T1-weighted images are rare. On T2-weighted images, about 50% of the tumors remain isointense with the brain cortex. (Figure 1a & 1b). Hypointense tumors are less common, from 4% to 18%, whereas hyperintense lesions account for 35% to 44% 4,7.

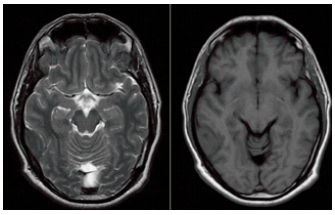


Figure 1a Figure 1b

Axial T2W (Figure 1a) and axial T1W (Figure 1b) images show isointense signal in a case of meningioma. (yellow arrows).

On CEMR Meningiomas characteristically show intense enhancement after contrast administration both on CT scans and MR imaging4,7,8 (Figure 2a & 2b). Occasionally they may have areas of necrosis and calcific foci4. Cystic foci, hemorrhage and calcifications may be seen in approximately 20% of the patients with meningiomas7. In the present study, cystic components and foci of calcification and hemorrhage were seen in 8%, 8% and 4% of the patients, respectively.

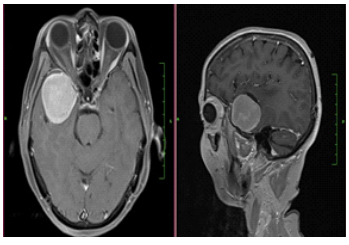


Figure 2a. Figure 2b.

Axial T1W post contrast image (Figure 2a.) showing intense homogeneous contrast enhancement (blue arrow) and Sagittal T1W (Figure 2b) post contrast homogenous enhancement. (green arrow) in a case of sphenoid wing meningioma.

They suggested that tumor cell nests in the dura mater of those patients, making the surgical resection of these areas mandatory. Almost 35% of the patients with meningiomas may present the dural tail signal on post-contrast T1-weighted images 7. In the present series this sign was seen frequently, being identified in 59% of the patients.

On CEMR imaging an interesting finding: the dural tail or "dural flair" can be demonstrated (Figure 3). The dural tail is a curvilinear region of dural enhancement adjacent to the bulky hemispheric tumour.

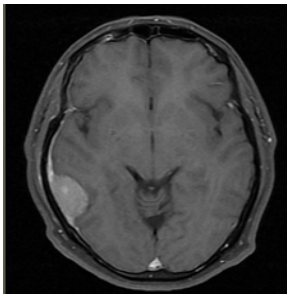


Figure 3.

Figure.3: Axial T1 post contrast image showing-dural tail sign (yellow arrow).

It is now well known that though specific for meningioma, dural tail sign can also be seen in many other lesions [6,20,21].

Another imaging finding is a "CSF cleft", which is seen as a cleft of CSF between tumour and adjacent brain cortex, which is suggestive of extra-axial nature of the lesion. Cortical vessels can be seen within the CSF cleft. Bony changes like hyperostosis can be seen in approximately 20% of cases.

CONCLUSION

- Meningiomas are the most common benign intracranial neoplasms.

- Meningiomas are also the most common primary nongalieal intracranial tumors.
- This neoplasm affects more frequently patients in middle and late decades of life, with a strong female prediction (2:1).
- Pattern of signal intensity tumor mass may be rather variable on both T1-, T2-weighted and FLAIR images.
- After gadolinium administration, meningiomas show intense enhancement.
- MRI plays a vital role in management by aiding in the correct diagnosis based characteristic findings on imaging.

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