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Radiology

ROLE OF ULTRASONOGRAPHY AND MAGNETIC RESONANCE IMAGING IN EVALUATION OF ORBITAL AND RETRO-ORBITAL LESIONS

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ABSTRACT **Background and aims** In this study,we aimed to correlate the USG and MRI findings of various orbital and retro-orbital lesions, prevalence of orbital and retro-orbital lesions in various age and sex groups, evaluation of orbital and retro-orbital space to assist in the diagnosis of proptosis and assessing orbital lesion's location, configuration, extent, and relationship to adjacent structures **Materials and methods** In this cross-sectional study, 56 patients referred from various departments of Silchar Medical College and Hospital to the department of Radiology for various orbit and retro-orbital lesions have undergone orbital B-scan examination using SAMSUNG PRESTIGE RS-80A via high frequency probes. On the revelation of the lesion in B- scan, these patients were subjected to MRI examination of the orbit. MRI evaluation was carried out on SIEMENS TIM AVANTO 1.5T Scanner.Patients with ocular trauma and periorbital injuries, metallic implants ,ocular foreign bodies and hypersensitivity to contrast agents were excluded. **Results:** Out of 56 patients, 25cases(44.6%) were benign and 19 cases (33.9%) were inflammatory and 12 cases were malignant(21.5%). The most common age group was in the range 0-10 years (62.5% cases) with male preponderance (55.3%). Out of 19 inflammatory lesions, the most common was combined preseptal and postseptal cellulitis (31.5%). The most common benign lesion was Dermoid (84%).Retinoblastoma was the most common malignant tumor (83.33%). The most common clinical presentation was proptosis (48.2%). **Conclusion:** USG B scan should be used as the initial examination as the primary modality since it is readily available at a reasonable price. USG is advised if there are any MRI contraindications. MRI is considered the imaging modality of choice for assessing the spread of the disease, describing the exact location, and making an accurate diagnosis. We found that the sensitivity and specificity of MRI is higher than USG for the detection of orbital and retro-orbital lesions.Keywords: MRI, USG, Orbital B-scan, Lesions.

KEYWORDS :

INTRODUCTION:

The assessment of orbital pathology has been done using plain radiography, ultrasonography, computed tomography, magnetic resonance imaging (MRI), fluoroscopy, and nuclear medicine. Orbital X Rays are used to examine the surrounding structures containing the eye. It is helpful for detecting fractures of the nearby bone, and radio-dense foreign bodies in the eye, However, it has a very limited role.

Ultrasonography is considered the first imaging modality to detect any orbital lesions, as it is widely available without any risk of any ionizing radiations, inexpensive and quick to perform and allows dynamic studies. Drawbacks of USG is in defining origin, extension, bony extension and characterizing the masses. Advantages of MRI are high contrast resolution, the ability to obtain image in any plane and lack of ionizing radiation.

MATERIALS AND METHOD

In this cross-sectional study, 56 patients referred from various departments of Silchar Medical College and Hospital to the department of Radiology for various orbit and retro-orbital lesions have undergone orbital B-scan examination using SAMSUNG PRESTIGE RS-80A via high frequency probes. On the revelation of the lesion in B- scan, these patients were subjected to MRI examination of the orbit with brain sections for further characterization of the lesion. MRI evaluation was carried out on SIEMENS TIM AVANTO 1.5T Scanner. The study was conducted from the time period of 1st of June 2021 to the 31st of May 2022 in the department of Radiology, Silchar Medical College and Hospital after taking approval from the ethical committee.

RESULTS

The most common age group in our study was in the range 0-10years (62.5% cases). In our study, male preponderance (55.3%) was seen as compared to females (44.7%) with a sex ratio of 1.2:1.

The most common presentation in our study was Proptosis (48.2%) followed by Palpable mass (32.4%). In our study out of 56cases, 25cases(44.6%) were benign and 19 cases (33.9%) were inflammatory and 12 cases were malignant(21.5%).

Out of 56 cases,19 cases were inflammatory lesion. Most common was preseptal and postseptal cellulitis (31.5%) ,followed by Post-septal cellulitis(21.1%) and Optic neuritis(21.1%).

Out of 56 cases, 25 cases are benign lesions. In our study, the most common benign lesion was Dermoid (84%), followed by Vascular Malformation(8%)

Out of 56 cases, 12 cases were malignant. Retinoblastoma was the most common malignant tumour (83.33%).

Out of 56 cases,49 cases are orbital lesions(87.5%) and 7 cases are Retro-orbital lesions(12.5%).

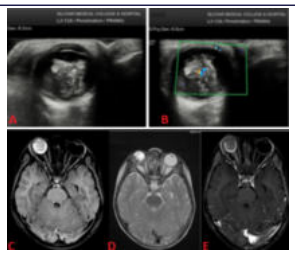
The overall sensitivity, specificity, and Positive predicted Value and Negative predictive value of USG for inflammatory lesions are 84.21%,94.59%,88.89% and 92.11% respectively. Accuracy of ultrasonography was 91.07% for detection of inflammatory lesions on USG B-Scan.

The overall sensitivity, specificity, and Positive predicted Value and Negative predictive value of USG for benign lesions are 92%%, 87.1%, 85.19% and 93.1% respectively. Accuracy of ultrasonography was 89.3% for detection of benign lesions on USG B-Scan.

The overall sensitivity, specificity, and Positive predicted Value and Negative predictive value of USG for malignant lesions are 83.3%, 90.9%, 71.4% and 95.2% respectively. Accuracy of ultrasonography was 89.3% for detection of malignant lesions on USG B-Scan

In our study out of 27 cases presented with proptosis, most common cause was inflammation(40.7%).In inflammatory causes most common was orbital cellulitis.

Figure 1: Retinoblastoma involving right eye



(A) USG showing heterogenous echogenic soft tissue intra-ocular mass with variable shadowing due to calcifications involving the right eye (B) the lesion shows internal vascularity on colour Doppler study. (C) Axial T1WI shows mildly hyperintense intraocular mass with underlying subretinal haemorrhage involving the right eye and (D) Axial T2WI shows hypointense intraocular mass relative to the vitreous (E) T1 FS+ GD showing mild heterogeneous enhancement on post contrast study.

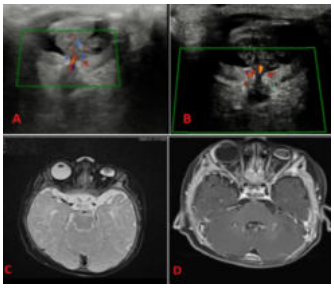


Figure 2: Persistent hyperplastic primary vitreous with pthsis bulbi.

(A) and (B) USG shows an echogenic lesion in the retrolental region of left eye which is connecting to the optic nerve head showing vascularity in colour Doppler study.© Axial T2WI shows triangular hypointensity noted in the left retrolental region connecting the posterior surface of the lens to the optic nerve head with a small deformed globe showing (D) T1+C no enhancement on post contrast study.

Figure 3-Orbital cellulitis.

(A)Ultrasonography of patient with orbital cellulitis, showing thickening and increase echogenicity of preseptal region left orbit.(B)Axial T2 WI showing thickening and hyperintensity in left preseptal region.

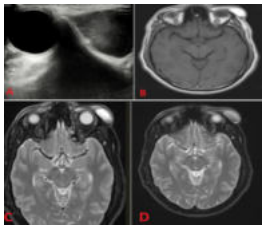


Figure 4: Angular dermoid cyst

(A) Ultrasonography of patient with angular dermoid cyst showing a well defined hypoechoic lesion in supero-lateral aspect of left orbit. (B) Axial T1W and (C)Axial T2W shows hyperintense cystic lesion involving the superolateral aspect of the left orbit and on (D) Axial T2FS shows suppression on fat suppressed image.

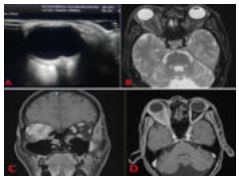


Figure 5:Optic neuritis with retrobulbar inflammation

(A)Ultrasonography of right orbit showing choroidal thickening and thickening of optic nerve head. (B)Axial T2W and (C) Coronal T1FS+C Ill-defined T2 hypointensity was noted involving the right retrobulbar region causing replacement of the retrobulbar fat. Mild flattening of the post sclera was noted with thickening of the optic nerve head. (D) Axial T1FS+C shows moderate enhancement.

Table 1- Distribution of patients according to the type of lesion

Type of Lesion	Frequency (n)	Percentage (%)
Inflammatory	19	33.9 %
Benign	25	44.6 %
Malignant	12	21.5 %
Total	56	100%

In our study out of 56 cases, 25 cases (44.6%) were benign and 19 cases (33.9%) were inflammatory and 12 cases were malignant (21.5%).

Table 2: Overall Diagnostic power of USG versus MRI

	Inflammatory lesion	Benign lesion	Malignant lesion
Sensitivity%	84.21%	92%	83.3%
Specificity%	94.59%	87.1%	90.9%
PPV%	88.89%	85.19%	71.4%
NPV%	92.11%	93.1%	95.2%
Accuracy	91.07%	89.3%	89.3%

The overall Sensitivity, Specificity, Positive predicted value(PPV), Negative predicted value(NPV), Accuracy of MRI is more than USG to detect orbital and retro-orbital lesions

Table 3 Distribution of patients according to the location of lesion.

Location of lesion	Frequency (n)	Percentage (%)
Extraconal lesion	27	48.2%
Intraconal lesion	7	12.5%
Globe	12	21.5%
Preseptal lesion	2	3.5%
Panorbital	8	14.3%
Total	56	100%

In our study out of 56 cases, 27 are extraconal lesion (27%), 7 are intraconal lesion (12.5%), 12 are global lesion (21.5%), 2 are preseptal lesion (3.5%), 8 are panorbital lesion (14.3%).

DISCUSSION

In our study we found that out of 56 patients, 31 males (55.3%) and 25 females (44.7%) had various orbital and retro-orbital lesions. Our study correlates with Alsalamah et al [2] where there was 60 males(54.5%) and 50 females (45.5%). In the study by Chawla et al [3] out of total 40 cases, total male cases were 23(57.5%) and female cases were 17(42.5%). Modi et al [4] conducted a study where out of 75 cases 41 cases are males (51.3%) and 34 cases were females (48.6%). Alkatan et al [5] conducted a study where they found 57.5% were males and 42.5% were females.

In our study, most common age group involved was between 0 to 9 years of age. Our study correlates with the study conducted by Ohtsuka et al [6] where they found a peak of age between 0 to 9 years. Chawla et al [3] conducted a study where it was found that most of patients were in the first decade of life.

In our study ,most common clinical presentation was proptosis(48.2%).It correlates with the study conducted by Alsalamah et al [2] where 64.5% cases presented with proptosis. Modi et al [4] conducted a study where 49.33% cases presented with proptosis. Alkatan et al [5] conducted a study where they found proptosis was the most common clinical presentation.

In our study. 44.6% presented with Benign lesions and 21.5% presented with malignant lesions. A study conducted by Seregard and Sahlin et al [7] presented with 54.3% and 29% presented with malignant lesions. Shields et al [8] conducted a study where he found 64% Benign lesions and 36% were malignant lesions. A study conducted by Bonavolanta et al [9] found that 68% were benign lesions and 32% were malignant lesions. A study conducted by Kennedy et al [10] found that 66% were benign and 34% were malignant.

The most common benign lesion in our study was Dermoid which accounted for 84% of all benign cases. A study conducted by Shields and Sheilds et al shows that Dermoid cyst comprises of 89% of all orbital cystic lesions of childhood. Similar study conducted by Bonavolanta et al [9] and Modi et al [4] shows Dermoid cyst is the most common benign lesion .The study conducted by Alkatan et al [5] shows Dermoid cyst is the most common benign cystic lesion.

In our study Retinoblastoma was the most common malignant lesion comprising of 83%. The study conducted by C.C.Annunobi et al [11] and Modi et al [4] shows Retinoblastoma is the most common malignant tumour comprising of 85% and 61.33% respectively.

In our study, 16.67% presented with Preseptal cellulitis,50% presented with Preseptal and Postseptal cellulitis and 33.33% presented with Post septal cellulitis. Our study correlates with Jyani et al [12] where 13.33% presented with Preseptal cellulitis,53.33% presented with preseptal and post septal cellulitis and 33.33% post septal cellulitis.

In our study,most of the lesion located in the extraconal region (48.2%) and 12.5% intraconal region. Our study correlates with Ohtsuka et al [6] study where 50% lesions located in the extraconal region and 15% lesions in the intraconal region.However,a study conducted by Alsalamah et al [2] showed majority of lesions in the intraconal region(57.4%) and 31.9% lesions in extraconal region.

The overall sensitivity, specificity, and Positive predicted Value and Negative predictive value of USG for inflammatory lesions are 84.21%,94.59%,88.89% and 92.11% respectively. Accuracy of ultrasonography was 91.07% for detection of inflammatory lesions on USG B-Scan.

The overall sensitivity, specificity, and Positive predicted Value and Negative predictive value of USG for benign lesions are 92%%, 87.1%, 85.19% and 93.1% respectively. Accuracy of ultrasonography was 89.3% for detection of benign lesions on USG B-Scan.

The overall sensitivity, specificity, and Positive predicted Value and Negative predictive value of USG for malignant lesions are 83.3%, 90.9%, 71.4% and 95.2% respectively. Accuracy of ultrasonography was 89.3% for detection of malignant lesions on USG B-Scan.

Limitations

There were a few inevitable limitations in the conduct of this research, like the small sample size and the fact that it is not a multicentric study. However, our research findings corroborated sufficiently with previous studies.

CONCLUSIONS

From the current study the following conclusion can be drawn: Male preponderance was seen as compared to females with a sex ratio of 1.2:1. Among the inflammatory conditions, preseptal and postseptal cellulitis were most common. Among the benign conditions, dermoid cyst was most common. Among malignant conditions, Retinoblastoma was most common.

USG B scan should be used as the initial examination as the primary modality since it is readily available at a reasonable price. USG is advised if there are any MRI contraindications. MRI is considered the imaging modality of choice for assessing the spread of the disease, describing the exact location, and making an accurate diagnosis. Analyzing the morphology, appearance, and signal intensity on various sequences, the pattern, and the degree of contrast enhancement are key to characterizing lesions on MRI. We found that the sensitivity and specificity of MRI is higher than USG for the detection of orbital and retro-orbital lesions.

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