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Original Research

Evaluation Of Posterior Segment Of Eye Lesions Using MRI

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ABSTRACT:
BACKGROUND: This study aims to evaluate the effectiveness of magnetic resonance imaging (MRI) in diagnosing and characterizing posterior segment eye lesions. The posterior segment, encompassing the vitreous, retina, choroid, and optic nerve, presents complex diagnostic challenges. MRI provides detailed soft tissue contrast and multiplanar imaging capabilities, offering advantages in assessing these structures.
AIMS AND OBJECTIVES:
1.To study the role of Magnetic resonance imaging in lesions of posterior segment of eye, optic nerve and its sheath.
2. To characterize the lesionsinvolving posterior segment of eye with respect to location, intensity, enhancement characteristics, adjacent soft tissue changes and neural involvement
MATERIALS AND METHODS:A prospective study was carried on 30 patients clinically suspected to have posterior segmental lesions.MRI of the orbit was performedin PHILIPS 1.5 tesla machine using T1 and T2 weighted sequences in multiple planes using quadrature coil. The orbits will be subsequently scanned using a high resolution small FOV sequence.
RESULTS: In our study vitreous was the most common location involved followed by optic nerve complex. The most frequent pathology was vitreous haemorrhage followed by retinal detachment and posterior vitreous detachment. The most common intra-ocular tumor noted in paediatric population was retinoblastoma and in adult age group was choroid melanoma. Thus, high-resolution MR imaging allowed for precise localization of lesions, while signal intensity variations helped distinguish between different tissue types and pathological processes.
CONCLUSION:MRI is a valuable tool in the evaluation of posterior segment eye lesions, providing detailed anatomical and pathological information. Its ability to differentiate tissue types and assess lesion extent makes it indispensable in the diagnosis and management of complex ocular conditions. This study supports the use of MRI as a primary imaging modality in cases where detailed assessment of the posterior segment is required.
KEYWORDS: Magnetic Resonance Imaging, Retina, Optic nerve.

INTRODUCTION:

Magnetic Resonance Imaging (MRI) is increasingly recognized as a vital tool in diagnosing and managing posterior segment eye lesions. The posterior segment of the eye includes structures such as the retina, choroid, optic nerve, and vitreous body. Lesions in these areas, including retinal detachments, choroidal tumors, and optic neuritis, often require advanced imaging techniques for accurate assessment and treatment planning.

Ultrasonography, although provides excellent spatial resolution owing to fluid contents of orbit, does not have such a deep tissue penetration when compared to cross sectional modalities like Computed tomography (CT) or Magnetic resonance imaging (MRI) and hence not very useful in diagnosing extra-orbital extensions of orbit [1] .

MRI provides signal intensity and vascular flow

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characteristics, enhancement patterns, location, and extent of orbital lesions. High-spatial-resolution, contrast-enhanced, and fat-saturated sequences are essential for evaluating the small anatomic spaces of the orbit. Apparent diffusion coefficient (ADC) values are particularly valuable for determining whether a lesion is benign or malignant and arterial spin labelling can provide important perfusion characteristics[2].

MRI is also crucial in the evaluation of optic nerve pathology. In cases of optic neuritis, often associated with demyelinating diseases like multiple sclerosis, MRI can detect inflammation of the optic nerve with high sensitivity. Gadolinium-enhanced MRI further improves diagnostic accuracy by highlighting active inflammatory processes, helping to distinguish acute from chronic conditions[3].

In summary, MRI has become an indispensable tool in the evaluation of posterior segment eye lesions. Its ability to provide detailed, high-contrast images in multiple planes without ionizing radiation makes it a preferred imaging modality in complex cases where other techniques may fall short. As technology advances, the role of MRI in ocular imaging will likely continue to expand, offering even greater diagnostic capabilities.

METHODS:

Source of data: The study was conducted on patients coming to the department of Radio-diagnosis at Basaveshwara Teaching and General hospital attached to Mahadevappa Rampure Medical College, Kalaburagi- 585105.

Study period: 1st AUGUST 2022 to JANUARY 31st 2024(18 months)

Study design: Prospective study

Sample size: 30 patients

Methodology: Patients of all age groups, referred to the department of Radio diagnosis, BTGH for imaging studies were included in the study after duly acquiring an informed consent.

MRI of the orbit was performedin PHILIPS 1.5 tesla machine using T1 and T2 weighted sequences in multiple planes using quadrature coil. The orbits will be subsequently scanned using a high resolution small FOV sequence.

All MR imaging examinations were performed on a PHILIPS 1.5-T magnet MR system. The sequences that were done include Axial T2 FSE/TSE, Coronal T2 FSE/TSE FS, Axial T1, Axial T1 + Contrast FS, Coronal T1+Contrast FS, Axial diffusion and ADC. 3mm slices were obtained using a high resolution small FOV sequence.Contrast agent: Gadolinium The patients were evaluated with MR using orbital protocol and contrast enhancement was obtained using gadolinium.

Inclusion criteria:

1.Patients with suspected lesions involving posterior segment, optic nerve and its sheath.
2.Patients of all age groups.

Exclusion criteria:

1.Patients with open globe rupture.
2.Patients with isolated lesions of anterior segment, extra ocular muscles and orbital bones.
3.Patients having history of claustrophobia.
4.Patients having history of metallic implants, metallic foreign body in situ or cardiac pacemakers.

RESULTS:

Table 1: Age distribution of subjects:

Age Range	Number of Patients	Percentage
01 to 10	5	16.6%
11 to 20	4	13.3%
21 to 30	2	6.6%
31 to 40	8	26.6%
41 to 50	6	20.0%
51 to 60	3	10.0%
>60	2	6.6%
TOTAL	30	100%

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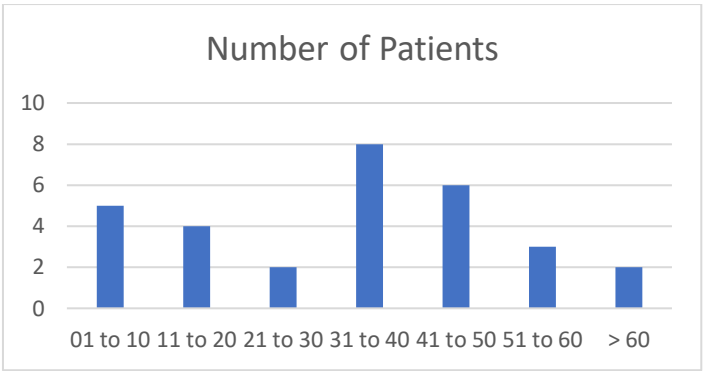
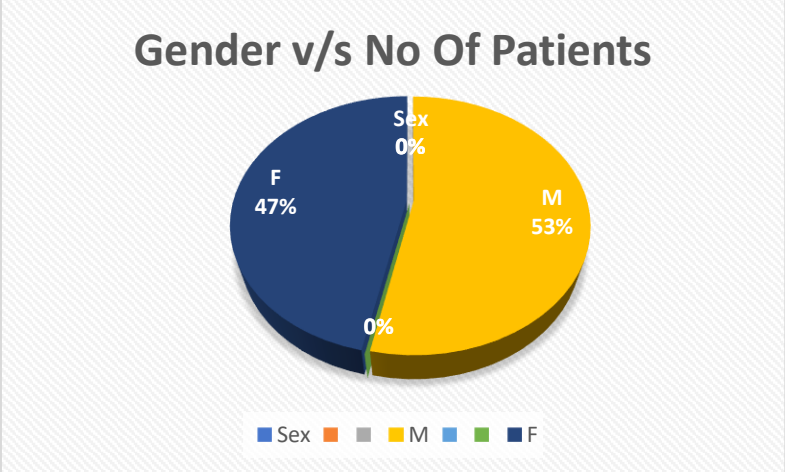


Thehighestnumberofpatientswereseen between 31 to 40 years. Minimum and maximum age in the present study were 9 months and 66 years respectively.

Table 2: Gender distribution

Sex	No Of Patients	Percentage
M	**16**	**53.3%**
F	**14**	**46.7%**
TOTAL	**30**	**100**



Outof30patients,16patientsweremalesand14patientswerefemales.There was predominant male affection.

Table 3: Eye Involvement Side

Laterality	No Of Patients	Percentage
R	**13**	**43.3%**
L	**9**	**30%**
B/L	**8**	**26.6%**
TOTAL	**30**	**100**

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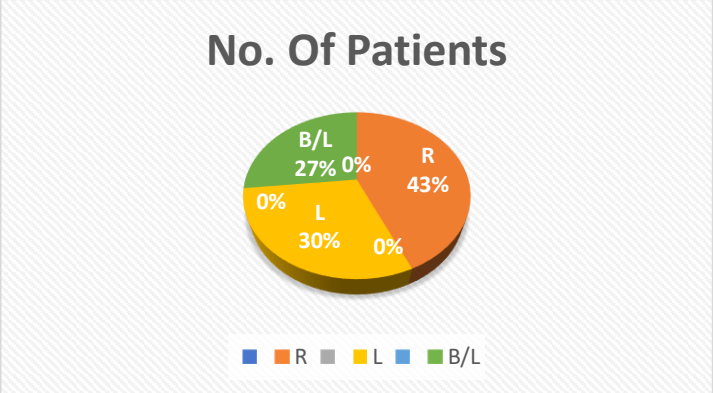
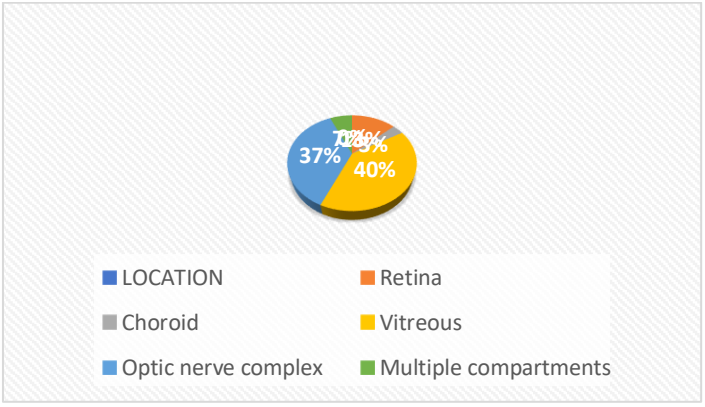


Presentstudyshowedinvolvementofrighteyein13outof30patientsandinvolvement of left eye in 9 out of 60 patients. 8 patients showed bilateral involvement.

Table 4: Distribution based on location

LOCATION	NO OF PATIENTS	PERCENTAGE
Retina	4	13.3%
Choroid	1	3.3%
Vitreous	12	40.0%
Optic nerve complex	11	36.6%
Multiplecompartments	2	06.6%
Total	30	100%



Vitreous was the most common location affected by the pathologies seen in 12 out of 30 cases followed by optic nerve complex seen in 11 cases.

Table5:SpectrumofMalignantNeoplasticlesions

MalignantLesions	No of cases	Percentage
Retinoblastoma	1	50
ChoroidalMelanoma	1	50
Total	2	100

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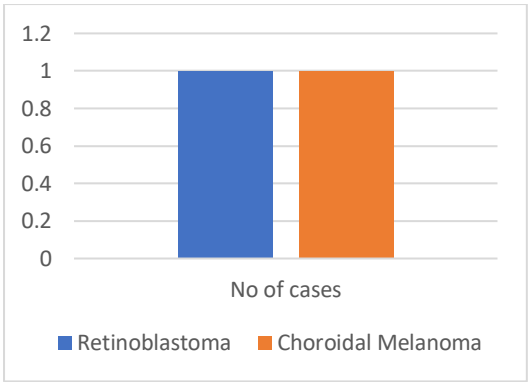


Table6: Spectrumofbenignneoplasticlesions

Benign neoplastic	No of cases	Percentage
ONGlioma	1	50
ON Meningioma	1	50
Total	2	100

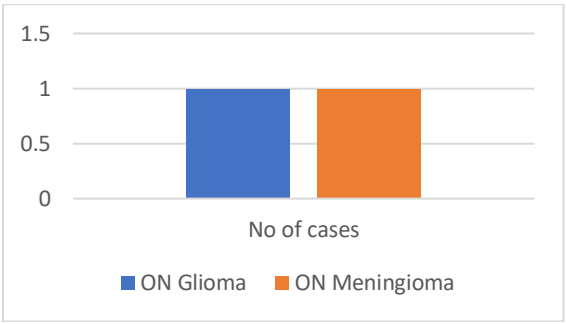
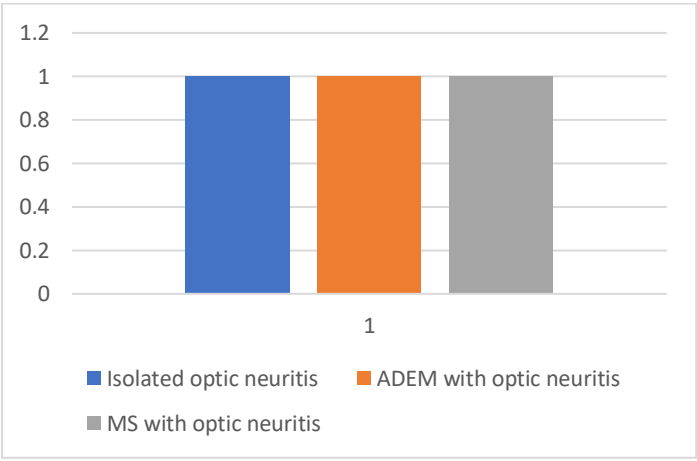


Table 7: Distribution based on optic neuritis causes

Benign neoplastic	No of cases	Percentage
Isolated optic neuritis	1	33.33
ADEM with optic neuritis	1	33.33
MS with optic neuritis	1	33.33
Total	3	100



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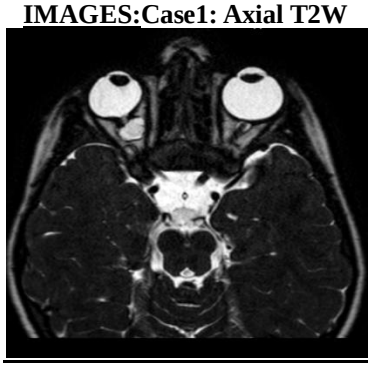
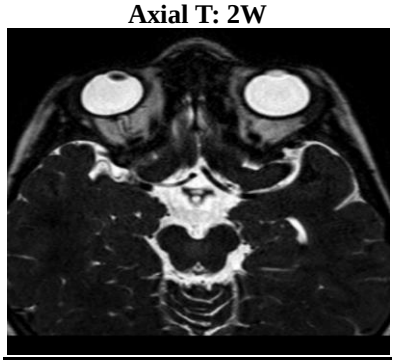
IMAGES:Case1: Axial T2W



Axial T: 2W

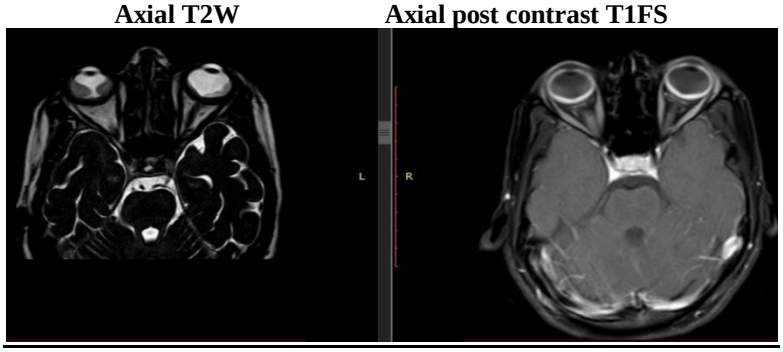


Case1: Right Sided Optic Nerve Colobomatous Cyst with Optic Nerve Atrophy

Small sized right optic globe with focal posterior defect at the level of optic disc and retro-bulbar intraconal fluid collection with internal septations indenting and displacing right optic nerve.

Case 2:

Axial T2W **Axial post contrast T1FS**

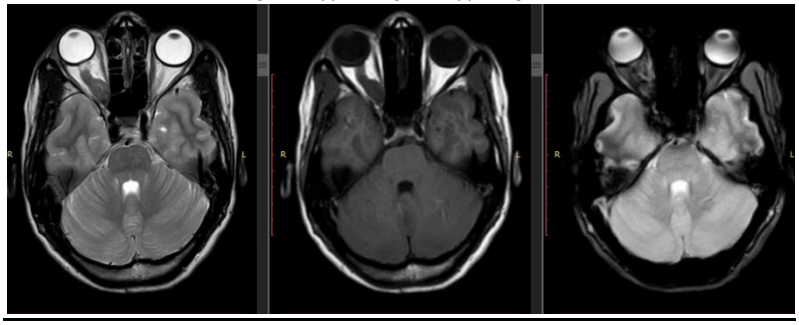


Case2: Bilateral Choroiditis with Retinal Detachment

Bilateral thickening of posterior choroid showing homogeneous enhancement on contrast.Bilateral retinal detachment with sub-retinal exudates

Case 3:

Axial T2W Axial T1WAxialFFE



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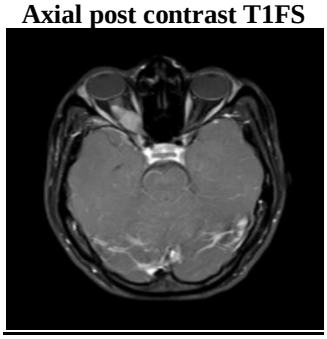
Axial post contrast T1FS

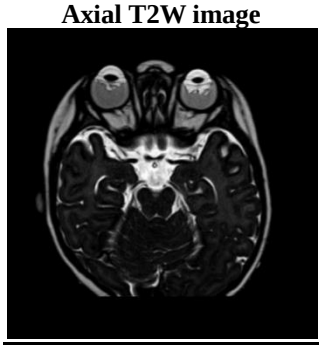


CASE3: Right sided optic nerve meningioma

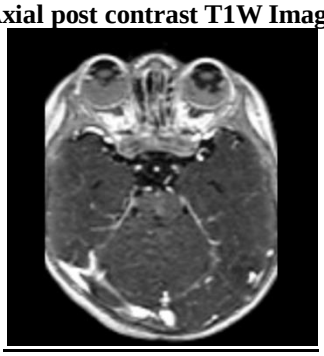
Well defined fusiform T1/T2 low signal intensity lesion centered on optic nerve in retro-bulbar intra-conal space with posterior extension through widened optic canal abutting right optic chiasma showing blooming on GRE and homogeneous enhancement on post-contrast study.

Case 4:

Axial T2W image



Axial post contrast T1W Image



CASE4: Bilateral retro-lental fibroplasias

Ill-defined retro-lental, polypoidal T1 hypointense, T2 hyperintense lesion in bilateral vitreous chamber showing subtle enhancement on post contrast study.

DISCUSSION:

In our study, the maximum percentage of patients were in the 31-40 years (26.6%). The age range was between 9 months and 66 years. The gender distribution of cases in our study with a male to female ratio of 1: 1.4. Out of 30 patients, 8 had bilateral involvement, 13 had right eye and 9 had left eye involvement.

According to study conducted byJarabhala Sandhya et al[4]majority of the ocular abnormalities occurred in vitreous followed by retina. In the present study Vitreous (40%)-12 cases was the most common layer involved followed by optic nerve complex (36.6%)-11 and retina (13.3%)-4.

The most frequent intraocular disease, according to a study by Skandesh B Met al[5]were vitreous haemorrhage, posterior vitreous detachment and retinal detachment.In our study, vitreous haemorrhage was the most common vitreal abnormality, occurring in 6 cases (20%), followed by posterior vitreous detachment, which was observed in 3 cases (10%). Among retinal pathologies, retinal detachment was the most frequent, identified in 6 cases. This included 4 cases of isolated retinal detachment, 1 case associated

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with VKH syndrome, and 1 case with retinoblastoma.

In a 20-year-old female, MRI revealed bilateral choroidal thickening with retinal detachment and post-contrast enhancement, indicative of Vogt-Koyanagi-Harada (VKH) syndrome. B.D. Lohman et al[6] highlights that VKH syndrome often presents with these MRI features, including choroidal thickening and serous retinal detachment, due to autoimmune inflammation. The enhancement on post-contrast imaging supports active inflammation, reinforcing the diagnosis of VKH syndrome and emphasizing the importance of MRI for accurate identification and management.

In a one year-old boy with leucokoria , MRI showed high signal intensity extending from the lens to the optic nerve head on T1- and T2-weighted images, without suppression on FLAIR. These findings, indicative of persistent fibrovascular tissue, align with those reported by Maqsood H et al[7], who documented similar MRI characteristics in PHPV, highlighting the utility of MRI in the diagnosis and assessment of this congenital condition.

In a 2-year-old boy, MRI revealed a heterogeneous hypointense mass in the chorio-retinal layer on T1-weighted images, with intermediate signal intensity on T2-weighted images and marked enhancement, along with extra-ocular extension. CT confirmed the presence of a heterogeneous mass with calcification. These findings align with those reported by Rauschecker et al[8], who emphasized MRI's crucial role in detecting intraocular calcifications a key feature of retinoblastoma. The correlation between MRI and CT findings reinforces the diagnosis and underscores the significance of imaging in evaluating retinoblastoma.

In this study 1 case of isolated optic neuritis on MRI revealed T2/STIR high signal intensity and post-contrast enhancement of the optic nerve. These imaging features are consistent with those reported in recent studies, such as Petzold et al[9] which highlight high T2/STIR signal as indicative of inflammation and demyelination, and post-contrast enhancement as a marker of active inflammation. These findings are crucial for diagnosing optic neuritis and differentiating it from other optic neuropathies.

This study evaluated optic neuritis associated with demyelinating lesions across various conditions. One case involved a 6-year-old girl with ADEM, presenting with bilateral optic neuritis and extensive bilateral white matter lesions, including the corpus callosum. Another case of an 18-year-old with multiple sclerosis exhibited optic neuritis along with periventricular, corpus callosum, and spinal cord lesions, consistent with classic MS imaging patterns. Both cases align with the findings reported by Tomonori Kanda et al[10].

The MRI findings in the two cases of idiopathic intracranial hypertension (IIH) revealed classic features such as optic nerve tortuosity, posterior globe flattening, and varying degrees of empty sella. In one case, a completely empty sella was observed, while the other displayed a partially empty sella. These observations are in line with advancements in MRI techniques discussed by Barkatullah AF et al[11], who noted that improved imaging methods have enhanced the ability to characterize intracranial changes associated with IIH. These include not only empty sella turcica and optic nerve tortuosity but also distension of the optic nerve sheath, posterior globe flattening, slit-like ventricles, and venous sinus stenosis

In this study, a case of right eye optic nerve coloboma with optic nerve atrophy showed a cystic lesion with low signal intensity on T1-weighted and FLAIR images, and high signal intensity on T2-weighted images, consistent with simple fluid. Internal septations within the cyst, though less common, are likely remnants of embryonic tissue. These MRI findings align with those reported by Ranga et al[12], who noted similar characteristics in optic nerve coloboma, reinforcing the diagnostic features of this condition.

In the study "Orbital Tumours and Tumour-like Lesions: Exploring the Armamentarium of Multiparametric Imaging,[13] optic nerve sheath meningiomas are characterized by well-defined, iso- or hypointense masses on T1 and T2-weighted MRI, with homogeneous enhancement post-contrast and blooming on GRE sequences. This aligns with the described case of a 29-year-old female, confirming the study's findings and highlighting the effectiveness of multiparametric imaging in diagnosing optic nerve sheath meningiomas.

In the present study, the MRI revealed fusiform enlargement of the left optic nerve with enhancement, a classic appearance for an optic nerve glioma. A study by de Blank PMK et al[14] highlights that in patients with NF1, optic nerve gliomas typically present with a fusiform or elongated mass that enhances with contrast, similar to the findings in the present case.

The MRI finding of enhancement around both optic nerve sheaths, producing a "tram track" appearance, is indicative of conditions such as optic perineuritis, where there is inflammation of the optic nerve sheath. This characteristic imaging pattern aligns with the findings discussed in the study by Ayaka Edo et al[15] on the usefulness of MRI for diagnosing optic perineuritis.

CONCLUSION:

MRI is a valuable tool for assessing posterior segment eye lesions, offering detailed visualization of intraocular structures, including the retina, choroid, and optic nerve. It provides crucial information on lesion size, extent, and tissue characteristics, aiding in the differentiation between benign and malignant conditions. MRI's ability to detect subtle changes in the posterior segment enhances diagnostic accuracy

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and supports more informed treatment planning, making it an essential component of ocular imaging

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