Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/k7y93d18

ROLE OF MRI IN EVALUATION OF ACUTE VISUAL SYMPTOMS-AN INSTITUTIONAL STUDY

Gandi Prem Kumar[1], Goolla Dhivya[2], Dr. S. Shruthi[3]*

[1]Assistant Professor, Govt Medical College Jagtial
[2]Assistant Professor, Govt Medical College Karimnagar
[3]*Associate Professor of Radiodiagnosis, Government Medical College, Sanga Reddy, Telangana.

***Corresponding Author:** Dr. P. Sunil Kumar
*Associate Professor of Radiodiagnosis, Government Medical College, Sangareddy, Telangana.

ABSTRACT

AIMS AND OBJECTIVES:

- To define and analyze MRI findings for characterization of various lesions causing acute visual syndromes(AVS).
- To diagnose lesions based on the MRI findings by correlating withprovided clinical data.
- To correlate the MRI diagnosis with final diagnosis.

MATERIALS & METHODS:

- This study was conducted in Department of Radiology and Imageology at Nizam's institute of medical sciences. The study was approved by the Institutional Ethics Committee. This is a prospective study, conducted over a period of 17 months(December 2022-April 2024)
- This study included 47 patients irrespective of their age who presented with symptoms and signs of acute visual syndromes underwent MRI. MR imaging features of various lesions were evaluated. The provided relevant clinical data was collected from the patients was reviewed. MRI diagnosis was given based on the imaging characteristics and provided clinical data.
- Possible explanation was drawn to explain the symptoms andtreatment response based on MRI features. The imaging features were correlated with final diagnosis.

RESULTS

- The overall mean age of the study population is 37.5 years with most commonly observed age group 40-50 years. We observed male preponderance in this study with maximum number of both males and females in inflammatory lesions. Inflammatory lesions were most prevalent in this study contributing to 47.8% (n=23) followed by space occupying and vascular lesions (19.5%, n=9), infections (17.3%, n=8) and miscellaneous lesions (Idiopathic intra cranial hyper tension(IIH) & posterior reversible encephalopathy syndrome)(15.1%, n=7).
- Overall most common pathology was optic neuritis(1) contributing to 32 %(n=15) of the study population followed by Tolosa hunt syndrome (12.7%. n=6), pituitary macro adenoma (8.5%, n=4), posterior reversible encephalopathy syndrome (PRES) (8.5%, n=4), tuberculosis (8.5%, n=4), fungal infections (6.3%, n=3), idiopathic intracranial hypertension (6.3%, n=3), sarcoidosis (4.2%, n=2), suprasellar pilocytic astrocytoma (2.1%. n=1) and left cavernous ICA aneurysm (2.1%, n=1).

- Out of 47 patients MRI detected abnormality in 41 patients (87%). MRI could not detect the pathology in 6 patients (12.7%), all these were patients of optic neuritis. The given single specific diagnosis based on MRI was correlated with final diagnosis in 37 patients (78%), two differential diagnoses were given in four (8.5%) patients. Out four patients first differential diagnosis was correlated with final diagnosis in three patients, second differential diagnosis was correlated with final diagnosis in one patient of pilocytic astrocytoma. In this study the overall sensitivity of MRI in detecting the lesions causing acute visual syndromes is 88.67% whereas specificity is 100%. Except for optic neuritis sensitivity and specificity of MRI in detecting the lesions is 100%.

Conclusion

- Conclusion of the present study is that while the symptomatology of acute visual syndrome is often nonspecific and confusing, MRI imaging adds sensitivity and specificity to the physical examination. Because of its better soft tissue resolution, characteristic signal intensity pattern of certain lesions and lack of ionizing radiation hazards, MRI should be the imaging modality of choice for patients.

INTRODUCTION

Acute visual syndromes (AVS) are group of syndromes which are comprising variety of entities. The ophthalmologist or neurologist are usually the first physicians to encounter a patient with visual loss and/or ophthalmoplegia. In the outpatient setting, patients who present with visual complaints are routinely evaluated only with a direct ophthalmologic examination and rarely require radiologic imaging investigation. The subset of patients seen in the emergency room with visual symptoms causes are usually stroke, trauma, or infection. For these patients, besides physical examination, preferential investigation with computed tomography (CT) is routinely performed given its ubiquitous accessibility, superior detail in osseous evaluation, and short scan time. However, there are highly morbid conditions wherein prompt recognition and management of an acute visual syndrome (AVS) requires physician to probe further. Suspicious symptomatology including abrupt visual loss or diminished vision, diplopia, ophthalmoplegia, and proptosis/exophthalmos requires further investigation with advanced imaging modalities such as magnetic resonance imaging (MRI). Conditions such as tumors, infections, inflammation, and vascular disorders may involve any segment of the visual pathway extending from the globe to the occipital lobes. This study will discuss a variety of AVSs including orbital apex syndrome, pathologies of cavernous sinus, acute hypertensive encephalopathy (posterior reversible encephalopathy syndrome), optic neuritis, pituitary apoplexy including hemorrhage into an existing adenoma, and idiopathic intracranial hypertension. A discussion of each entity will focus on the clinical presentation, management and prognosis when necessary and finally, neuroimaging with emphasis on magnetic resonance imaging.

An organized approach to imaging analysis in the setting of suspected AVS wherein MRI provides sensitivity and specificity was studied. Visual disturbances and/or ophthalmoplegia secondary to orbital apex syndrome (OAS), posterior reversible encephalopathy syndrome (PRES), pituitary adenoma/apoplexy, optic neuropathy (ON), and Idiopathic intra cranial hypertension9IIH) etc. were discussed. Pertinent pathophysiology, clinical presentation, radiologic diagnosis and treatment were also studies.

METHODOLOGY:

INCLUSION CRITERIA

- All patients referred to MRI with clinical symptoms and signs of acute visual syndromes (with duration of less than 10 days) were included.
- Cases of all age groups irrespective of sex were included in the study.

EXCLUSION CRITERIA

- Patients having general contraindications of MRI like history of claustrophobia and history of metallic implants insertion, cardiac pacemakers and metallic foreign body in situ.
- Unstable patients on life support mechanisms
- Patients with intra ocular lesions and patients of stroke were excluded in this study.
- Patients with abnormal renal function tests.

EQUIPMENT AND TECHNIQUE USED:

The study was performed on 3T MR scanner (MAGNETOM Skyra, Siem ens AG, Erlangen, Germany)

MRI TECHNIQUES

MRI was performed for patients who presented with acute visual symptoms after clinical examination.

The MRI protocol includes spin echo T1 axial plane, T2 FSE in axial, coronal, sagittal planes, spin echo T2 FLAIR in axial. T1 fat suppression with Gd enhancement in axial, coronal, and sagittal planes and DWI in axial. These sequences were performed in patients with acute visual symptoms.

Table 5. Parameters of various MRI sequences.

PARAMETERS	T1WI	T2WI	T1 fat suppression with Gd enhancement	FLAIR	DWI
TR	2000msec	5200 msec	465 ms	9000msec	5060.0msec
TE	9.0 msec	105.0msec	12 ms	81.0msec	64.0msec
FA	50	50	140	50	50
ST	3mm	3mm	3 mm 3 mm	3mm	5mm
TI	_		0.3 mm	2500msec	
MATRIX	320x320	512x520	230×384	512x512	112x110
			0.1 ml/kg of gadodiamide (OMNISCAN) at a strength of 0.5 mmol/ml		

MRI findings were analyzed, and imaging characterization of each condition were described. Those MRI findings were correlated with provided clinical data and final diagnosis.

Results and Observational analysis

Our study included 47 patients who presented with acute visual symptoms (blurring of vision, diplopia, orbital pain etc..).In this study we divided the lesions into four groups as inflammatory, infectious, space occupying & vascular lesions and other miscellaneous lesions(IIH,PRES).

Demographic profile of the patients:

Most commonly observed age group in this study is 40-50 years (n=17,36%) followed by 30 to 40 years (n=10,21%) whereas least commonly observed age group is 0-10 years (n=2.4.2%). The overall mean age of our study population is 37.5years with age ranging from 6 to 65 years. The mean age of inflammatory lesions is 49.5 years which was maximum among four groups followed by infectious lesions (mean age-38 years), space occupying & vascular lesions (25.4 years) other lesions i.e. IIH& PRES (26.8 years). Maximum age was observed in Tolosa hunt syndrome (75 years), minimum age was observed in craniopharyngioma. (6 years)

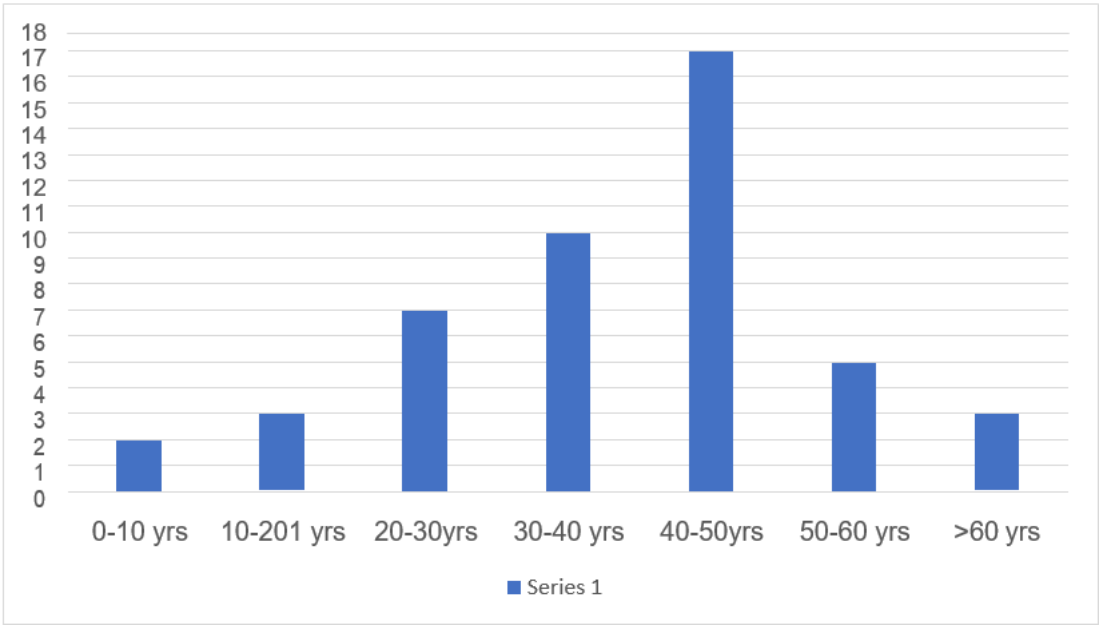


Figure 2: Bar diagram showing age distribution of the study. Most of the patients belongs to adult age groups (40-50 yrs,30-40 yrs)

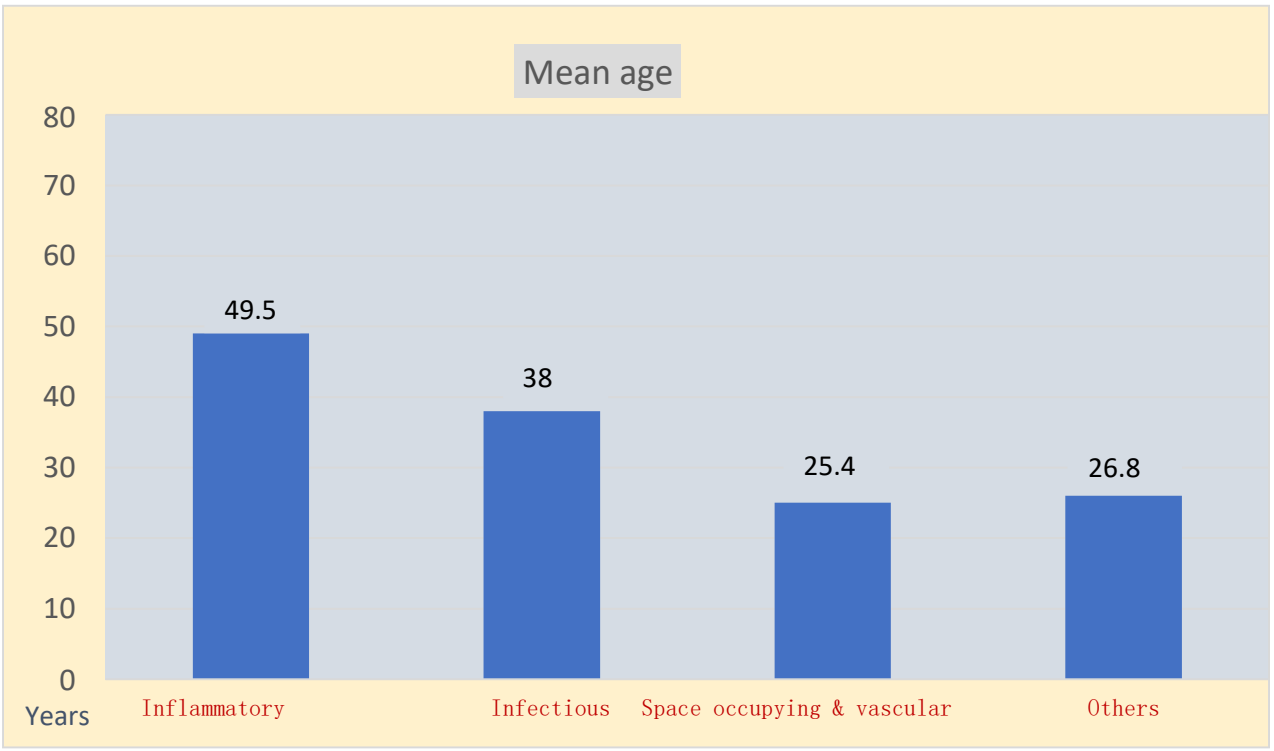


Figure 3: Bar diagram showing mean age of the various groups.

Sex distribution of the patients

This study included 29(63.1%) male patients and 18(36.9%) female patients with male preponderance (M: F-1.6:1). Highest number of males(n=12,41%)and females (37%) were observed in inflammatory lesions.

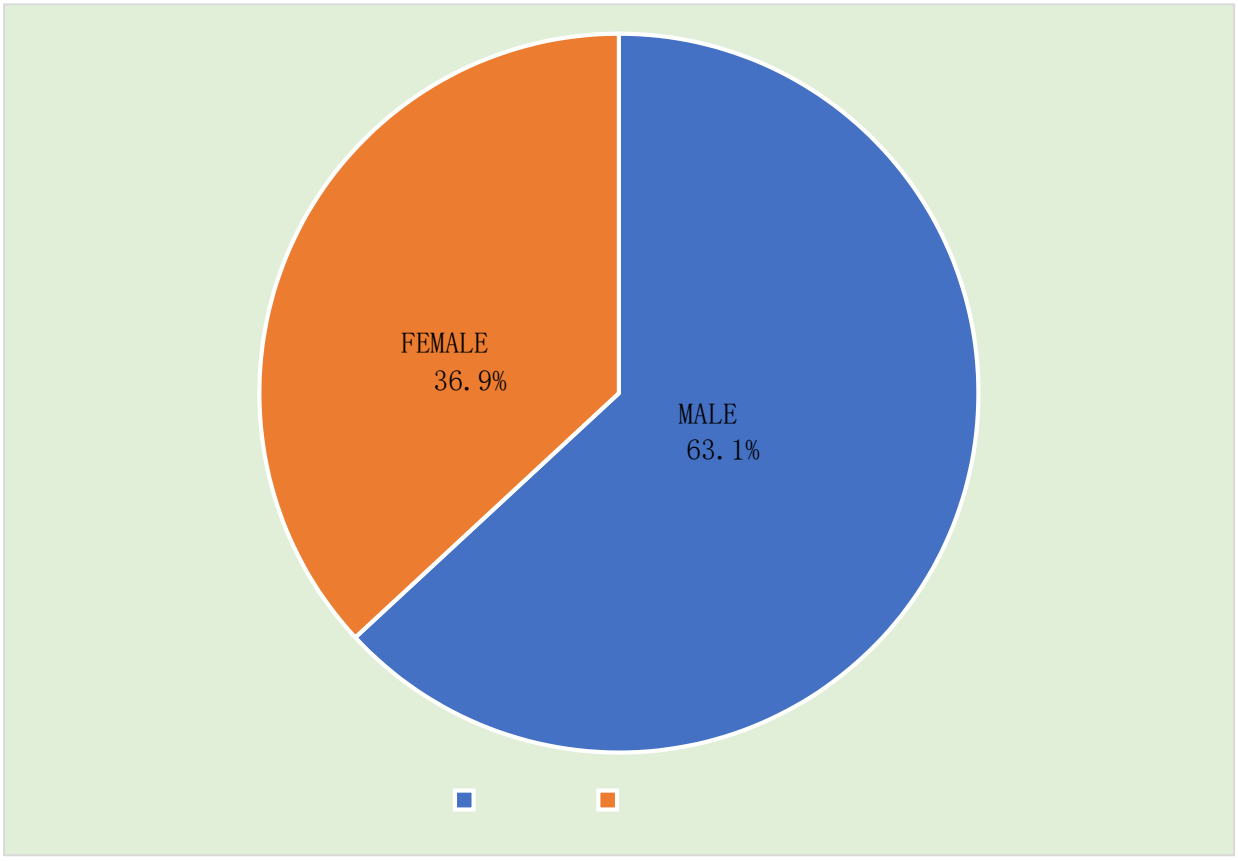


Figure 4: Pie chart showing overall sex distribution of study.

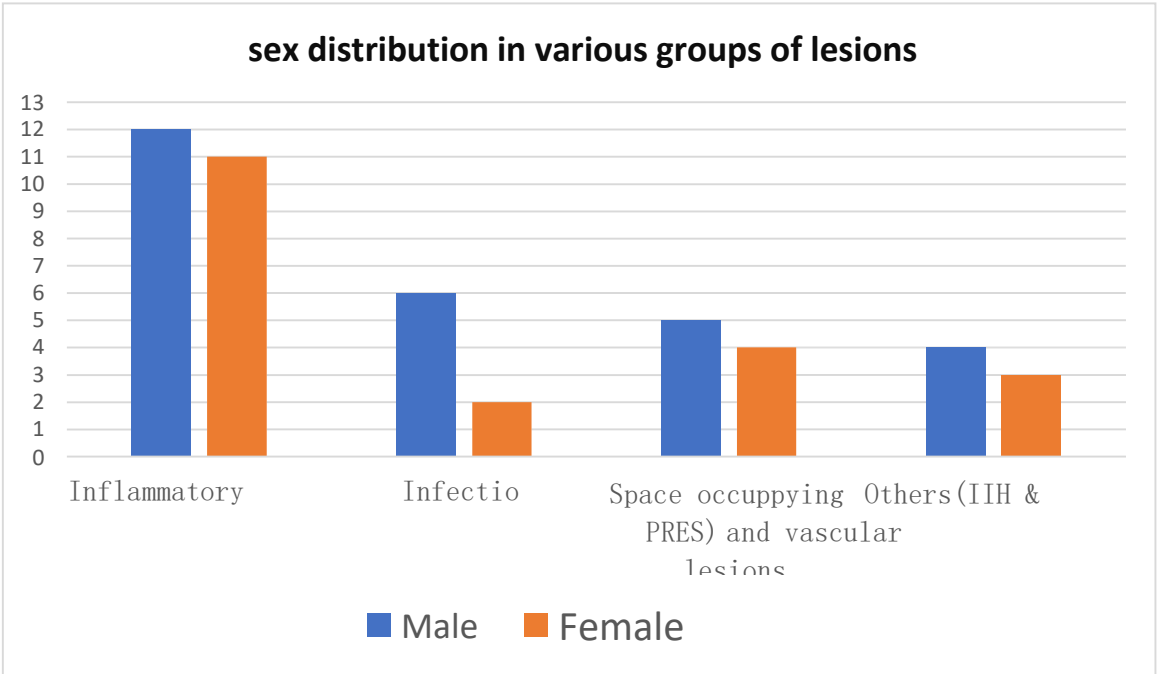


Figure 5: Bar diagram showing sex distribution in various groups of lesionsin the study. Maximum number of both males and females were observedin inflammatory group of lesions.

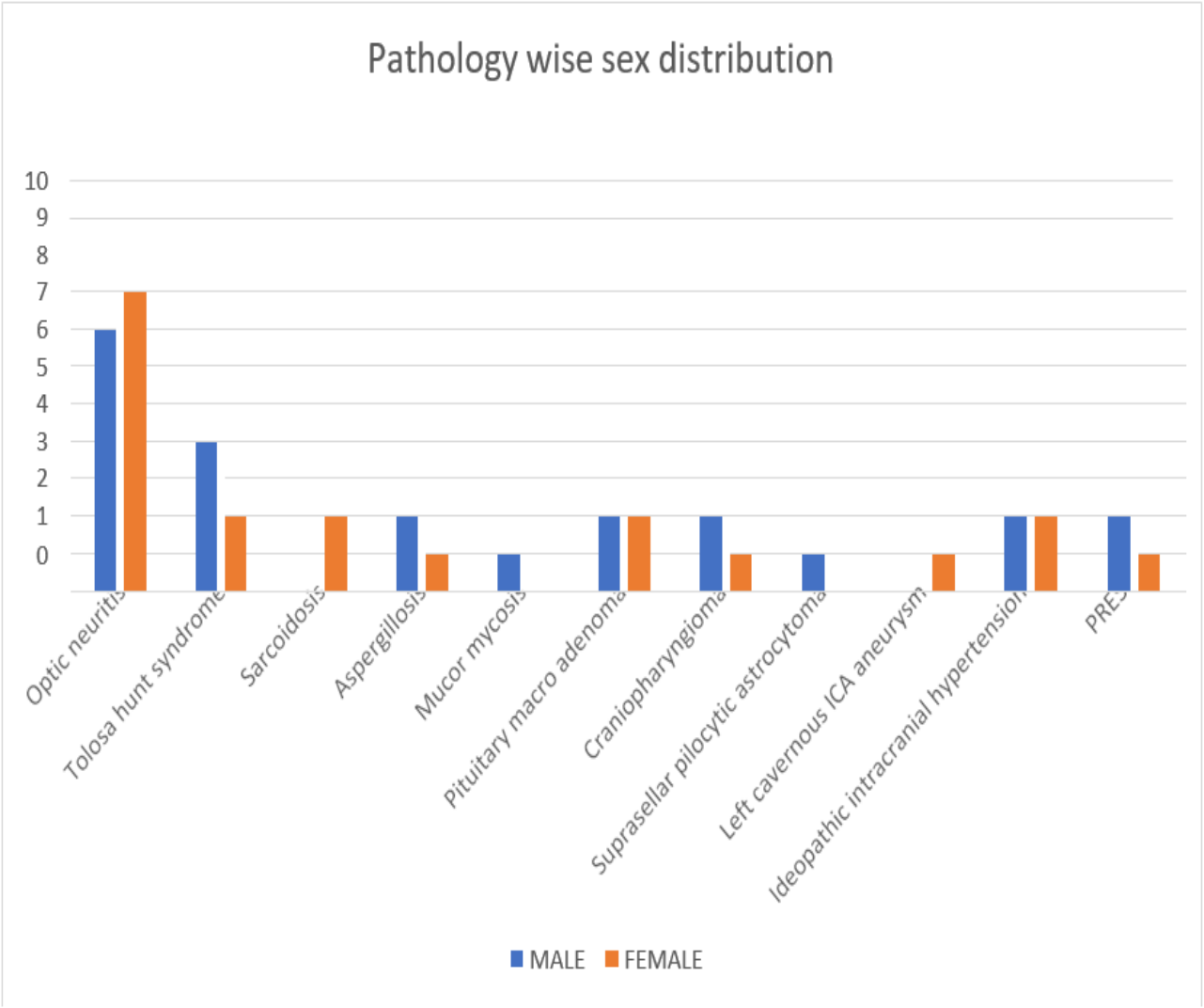


Figure 6: Bar diagram showing sex distribution of individual pathology.

Distribution of the lesions

Inflammatory lesions were most common in this study contributing to 47.8% (23 cases) of the total cases followed by space occupying & vascular lesions (19.5%,9 cases), Infectious lesions (17.3%,8 cases), Idiopathic intracranial hypertension (8.6%,4 cases) and posterior reversible encephalopathy (6.5%,3 cases)

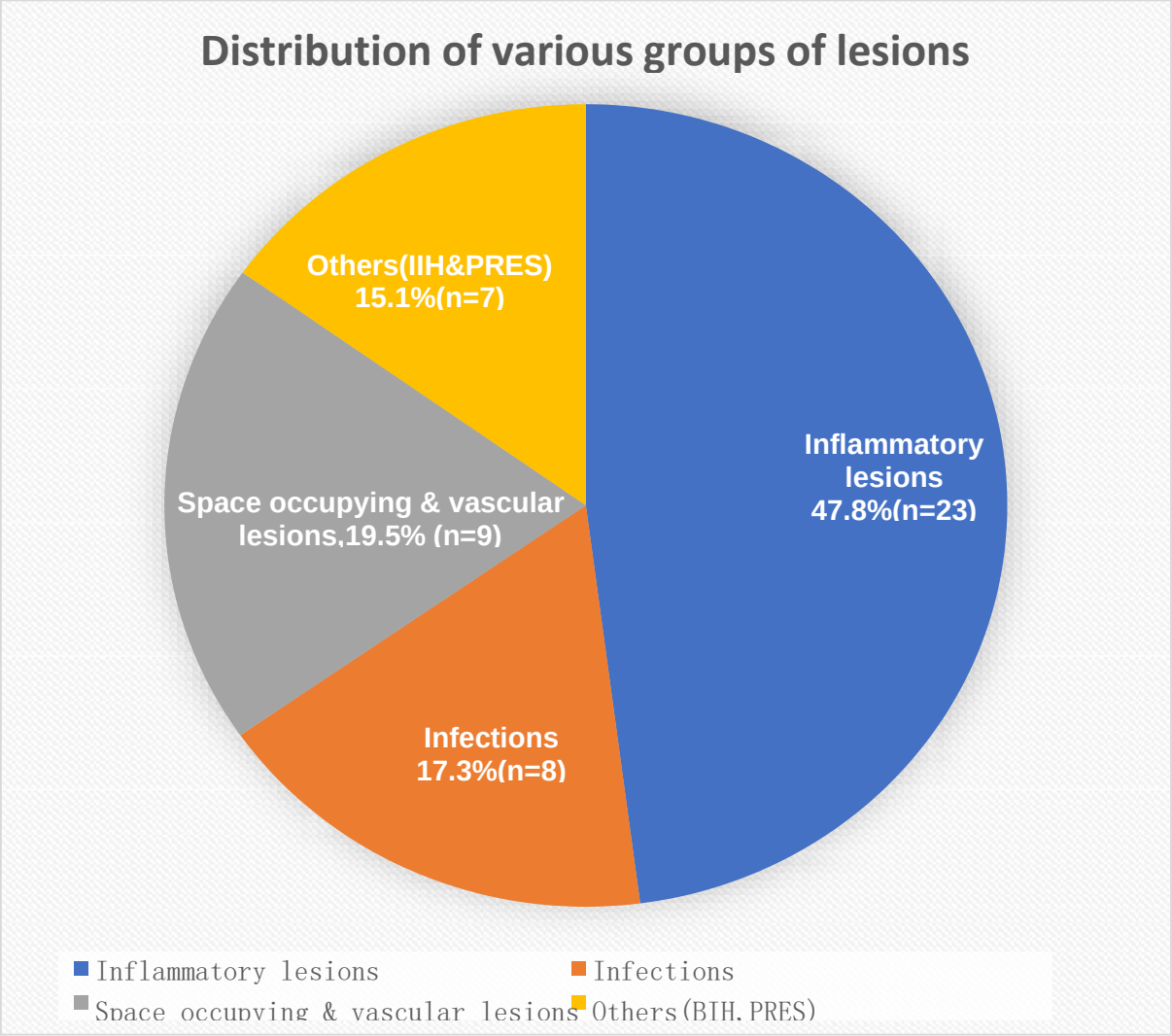


Figure 7. Pie chart showing distribution of various groups of lesions.

Table 6. Showing number of cases contributed by individual pathology

GROUP	DIAGNOSIS	NUMBER OF CASES
1. Inflammatory lesions	a. Optic neuritis	15
	b. Tolosa hunt syndrome	6
	c. Sarcoidosis	2
2. Infections	d. Fungal	4
	e. Tuberculosis	4
3. Space occupying & vascular lesions	f. Pituitary macroadenoma	4
	g. Craniopharyngioma	3
	h. Supra sellar Pilocyticastrocytoma	1
	i. Left cavernous ICA aneurysm	1
4. Others	j. Benign intracranial hypertension(BIH)	4
	k. Posterior reversible encephalopathy	3

Optic neuritis was more commonly observed in this study accounting for 31.9% of study population followed by Tolosa hunt syndrome (12. 7%).Supra sellar pilocytic astrocytoma and left cavernous ICA were leastcommon each contributing to one patient (2.1%).

Etiologies

In this study most common etiology was found to be MS (n=6, 12.7%) followed by NMO (8.5%) which were responsible for optic neuritis. In cases of infections we found diabetes as etiology in 2

patients of aspergillosis (4.2%). SLE was etiology in two cases (4.2%)of posterior reversible encephalopathy. Immunosuppression was least commonly observed etiology (in one case (2.1%) of mucormycosis). Rest of the cases were idiopathic and etiology was undetermined.

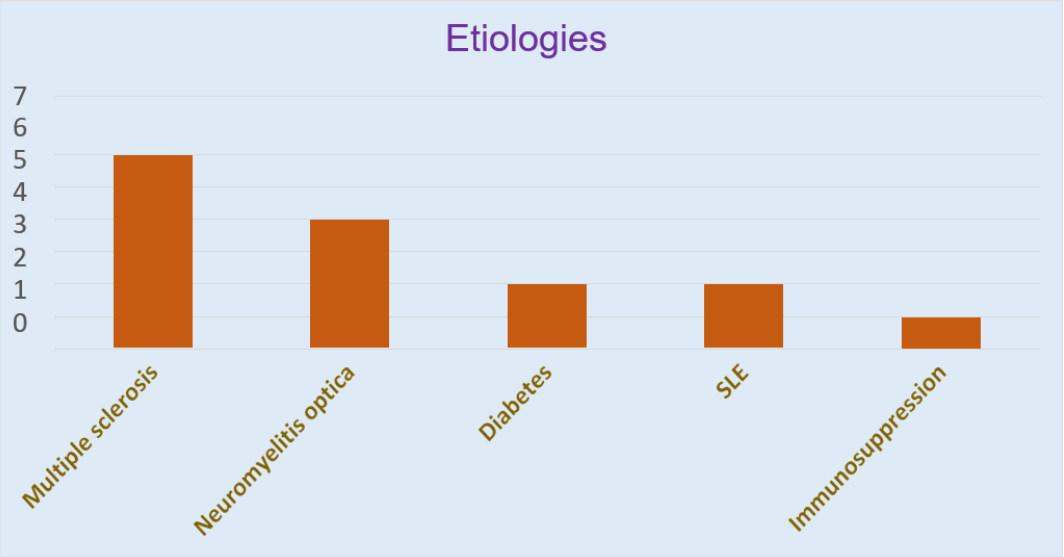


Figure 8: Bar diagram showing prevalence of etiology of this study.

Inflammatory lesions

In present study inflammatory lesions were more prevalent contributing to 47.8% (n=23). Among inflammatory lesions optic neuritis was more common contributing to 15 patients (65%) which is the largest proportion (32.6%) of study population. Tolosa hunt syndrome was next more common contributing to 6 patients accounting for 12.7% of study population followed by sarcoidosis (n=2,4.2%).

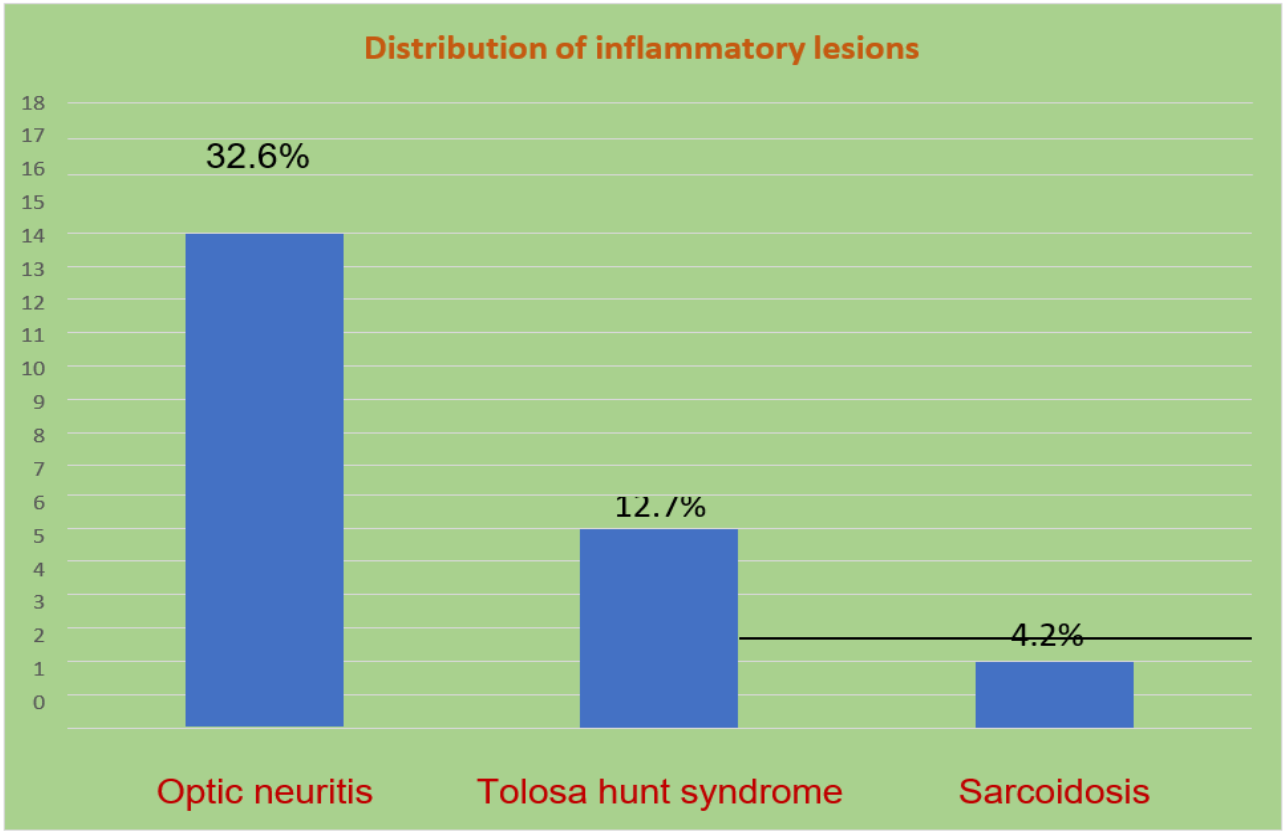


Figure 9: Bar diagram showing distribution of inflammatory lesions.

Optic neuritis

Out of 15 patients of optic neuritis seven patients were (46%) males and eight (53%) patients were females (M: F-0.8:1).

In 15 cases of optic neuritis multiple sclerosis (MS) and NMO were observed as etiologies in 6 patients (40%), 4 patients (26%) respectively. In 5 patients (33%) no etiology could be identified. MRI detected abnormality in 9 patients (60%) of optic neuritis, in 6 cases (40%) no abnormality was detected.

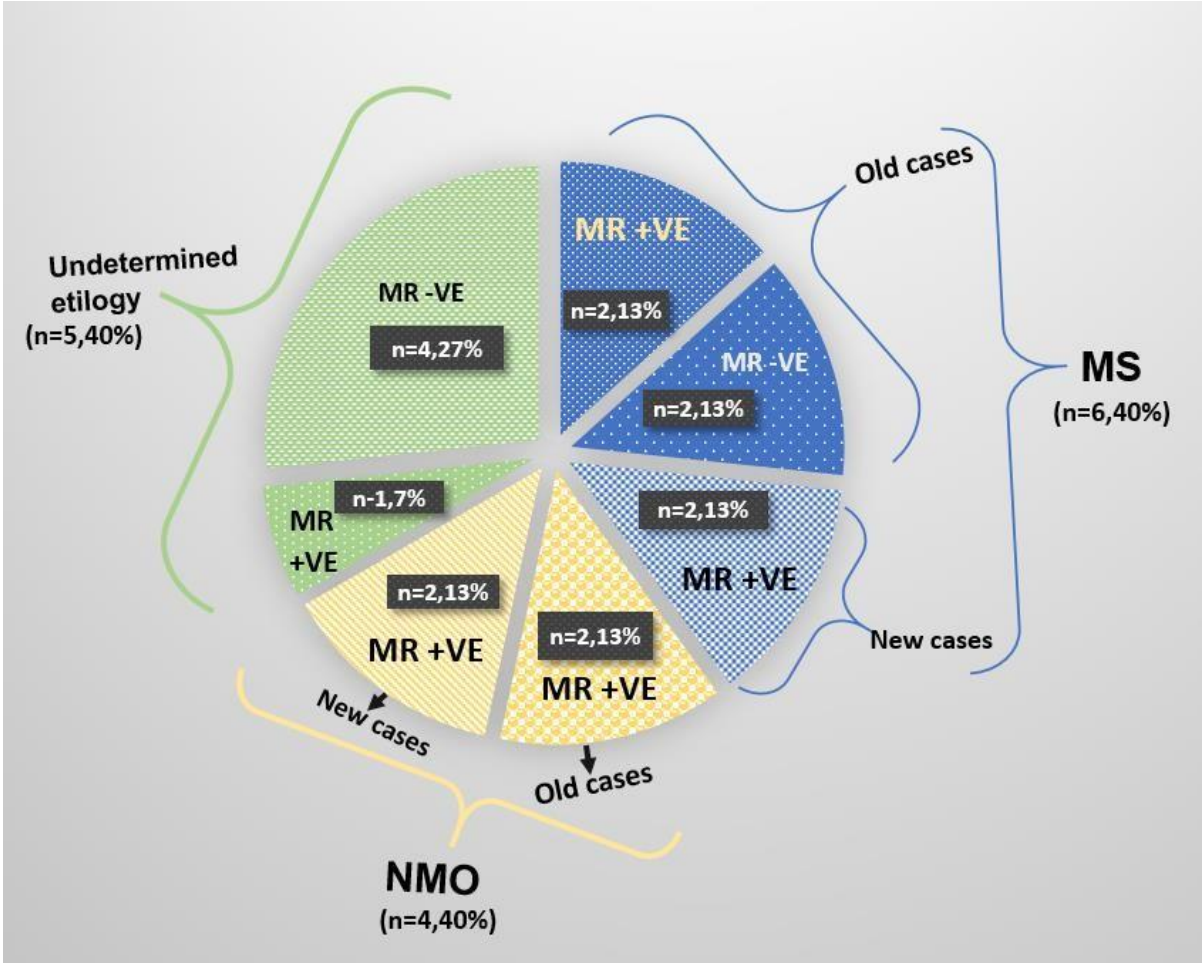


Figure 10: Pie diagram showing positivity and negativity of MRI in detecting of optic neuritis.

Multiple sclerosis (MS)

Out of 6 cases of MS four (26%) were known cases whereas two (13%) were newly detected cases.

Known cases of MS were presented with diminished visual acuity and orbital pain on both sides(2). Out of 4 known patients of MS, in two cases both optic nerves showed T2/FLAIR hyper intensities with patchy enhancement. There were also small T2/FLAIR hyper intense areas seen involving periventricular white matter which were perpendicular to the lateral ventricles few of them showing patchy enhancement and similar lesions were also noted in splenium of corpus callosum.

In remaining two known cases of MS chronic demyelinating plaques were seen in periventricular white matter and corpus callosum but no altered signal intensities were seen in optic nerve or chiasma.

The newly detected cases of MS were presented with decreased visual acuity on right side and weakness of both lower limbs. Visual evoke potentials(VEP) of these patients showed latency. In these patients right optic nerve was mildly bulky (5.9 mm) and showed T2/FLAIR hyper intensities

with patchy enhancement. There were T2/FLAIR hyper intensities involving periventricular white matter (perpendicular to the lateral ventricles) and body of corpus callosum in both patients. Similar lesions were seen in mid brain in one patient and cerebellum in other one.MRI spine of these cases showed multiple T2/FLAIR hyper intensities withpatchy enhancement were noted in cervical cord involving C3, C4 levels in one patient and C2, C4, C5 levels in other patient. We gave right optic neuritis with possible demyelinating etiology in these cases. CSF analysis showed oligoclonal IgG bands which confirmed the diagnosis of MS.
Out of six patients, four patients showed significant improvement in visualacuity and the other two patients showed poor improvement.

Neuromyelitis optica(NMO)
In four cases of NMO two were known cases, two were newly detected cases.
Known patients of NMO were presented with diminished visual acuity andretro orbital pain on both sides. MRI of these patients showed T2/FLAIR hyper intensities involving optic nerves and optic chiasm on both sides with patchy enhancement. However, no white matter lesions were seen.

Both newly detected cases of NMO were presented with diminished visual acuity on left side and weakness of both lower limbs. Visual evoked potentials(VEP) of these patients showed latency. In these patients left optic nerve showed T2/FLAIR hyper intensities with enhancement. One patient showed T2/FLAIR hyper intensities with enhancement in pons. MRI spine was also done in these patients. Both cases showed T2/FLAIR hyper intensities with patchy ring like enhancement in cervical cord. Thoracic spine was also involved in one patient. In view of presence of lesions in spinal cord as associated findings we gave optic neuritis with possible demyelinating etiology of NMO.CSF analysis showed NMOantibody positivity in one case and anti-MOG antibody positivity in anothercase(3).

Out of four cases of NMO, two cases (50%) showed poor improvement with treatment and the other two patient showed good response.

Cases with undetermined etiology
We observed five cases (33%) of optic neuritis with undetermined etiology. All these were presented with diminished visual acuity on both sides and retro orbital pain. Fundoscopic examinations of 2 patients (50%)showed papillitis.

Out of four patients in only one case both optic nerves showed T2/FLAIR hyper intensities with patchy enhancement. CBP, ESR, CSF analysis were normal in these patients. Anti-nuclear anti-bodies (ANA), anti- neutrophil cytoplasmic antibodies (ANCA) and viral markers were negative in all these cases.

MR negative cases
MRI could not detect lesions in six patients, out of four, two were known cases of MS, four were undetermined etiology. Visual evoke potentials(VEP) of these patients showed latency of P100 component. Five of these cases (including one known case of MS) showed good response to steroids. In view of high sensitivity of VEP and good steroid response, clinically these cases were diagnosed with optic neuritis.

Various locations of the lesions on MRI of the patients were summarisedin table

Table 7. MRI findings in patients of optic neuritis

Etiology	Case	History	Age /sex	Effected side	Involved segment of optic nerve	Involvement of chiasm	Enhancing white matter lesions	Enhancing Spinal cord lesions	Improvement of visual acuity with treatment
MS	1	Known case	25/F	B/L	Intra orbital+ intracanalicular	-	-	-	Significant
	2	New case	28/F	R	Introrbital	-	Corpus callosum+periventricular WM+midbrain	C2, C4, C5 levels	Significant
	3	New case	24/ M	R	Introrbital	-	Corpus callosum+periventricular WM+cerebellum	C3, C4 levels	Poor
	4	Known case	33/ M	B/L	Introrbital		-	-	Significant
NMO	5	Known case	49 /F	B/L	Intra orbital+ Intracanalicular + cisternal	present	-	-	Significant
	6	New case	28/F	L	Intra orbital+ Intracanalicular	-	-	Cervicomedullary junction,C3t0C6,D5 to D9	Poor
	7	Known case	32/ M	B/L	Intra orbital+ Intracanalicular + cisternal	present	Pons	-	Poor
	8	New case	22/F	L	Introrbital	-	-	C2 to C6	Significant
Undetermined	9	-	F	B/L	Intra orbital+		-	-	Significant

Tolosa hunt syndrome

Out of 23 patients of inflammatory lesions we observed 6 cases (40%) of Tolosa hunt syndrome in this study. Out of six, four (66.6%) were males and two (33.3) were females (M: F-2:1).

Out of 6, four patients (66.6%) were presented with left sided retro orbital pain and diplopia, two (33.3) were presented with right sided retro orbitalpain.

Five patients had no past history, one patient had past history of anti- tubercular treatment(ATT) for pulmonary tuberculosis.

Fundoscopy examination was normal in all cases. Routine investigationslike CBP, ESR were within normal limits in all cases.

In four patients MRI showed similar features which were enlargement of the left cavernous sinus with soft tissue causing lateral bulge along the dural surface. It was showing extension into superior orbital fissure(SOF) through orbital apex. On T1 it was showing iso intensity, T2/FLAIR heterogeneous hyper intensity. On post contrast T1 FATSAT images it showed enhancement. Similar findings were noted in remaining twopatients (one patient with history of ATT usage) on right side. No additional findings were noted.

All the patients met the primary and secondary criteria of Tolosa and the International Headache Society (HIS) 2004 except for ICA involvement.

Based on the characteristic MRI findings we gave Tolosa hunt syndromein five cases.

For one case in view of history of ATT usage we gave two differential diagnoses. We gave Tolosa hunt syndrome as first possibility and tuberculosis as second possibility.

CSF analysis, serum. ACE levels, were normal in all cases. Anti-nuclear anti bodies (ANA), antineutrophil cytoplasmic antibody (ANCA) and viral markers were negative. Montoux test was negative in five cases.

All the cases showed good response to steroids with significant improvement of visual symptoms. Based on the investigations and steroid response all the cases were clinically diagnosed as Tolosa hunt syndrome.

Sarcoidosis

In present study we observed two patients (8%) of sarcoidosis and both were young females. They presented with bilateral retro orbital pain, diplopia on right side and headache with duration of less than 8 days.

In one patient MRI showed enlargement of right cavernous sinus with T1
/T2 isointensity, FLAIR heterogenous hyperintensity. On post contrast T1FAT SAT images showed intensely enhancing asymmetrical soft tissue noted in both cavernous sinuses (more on right side) extending in to orbital apices and encasing optic nerves. Both optic nerves were showing patchy enhancement on post contrast T1 FAT-SAT images. There was thickening of the left tentorium with nodular enhancement. Enhancementof the anterior falx was also noted.

Another case showed similar findings without involvement of tentorium and falx. There was additional findings of thickening and enhancement in pachymeningeal in left temporal and frontal regions.

Based on the above findings we gave two differentials in the study sarcoidosis was given as first possibility and lymphoma was given as second possibility.

CBP, ESR were normal in both cases. CSF analysis showed elevated serum ACE (>5.4 mumol/l/min) levels in both patients which confirmed thediagnosis of sarcoidosis.

Significant visual improvement was seen in one patient with steroids. Other case showed partial

improvement of the symptoms with steroids.

Infectious lesions

In present study infectious lesions were contributing to 17.3% (n=8) of study population. In these lesions we observed infections of fungal and tubercular, each contributing to 50% (n=4) of the infections.

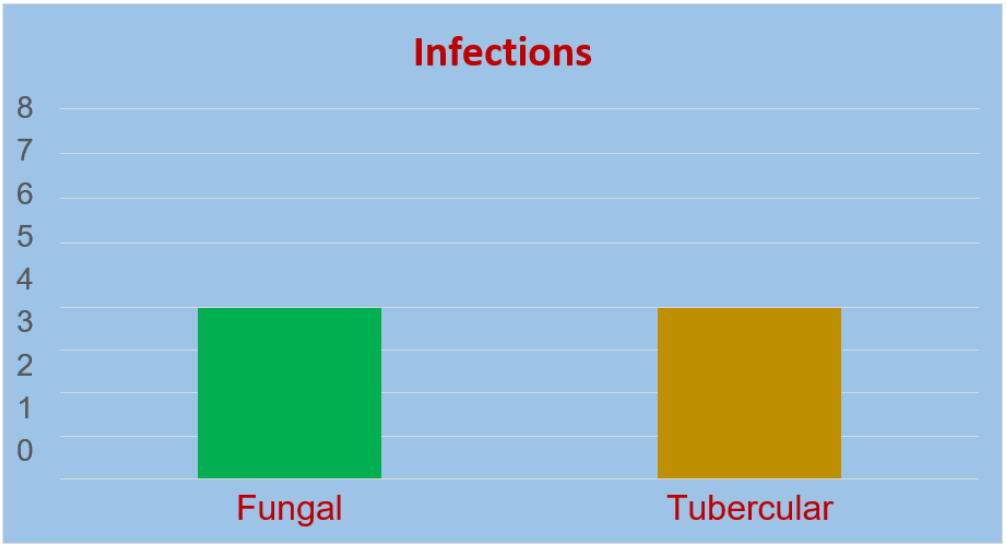


Figure 11: Bar diagram showing distribution of type of organismsin infections.

Fungal infections

Out of 4 patients of fungal infections 3 cases (6.3%) were found to be *Aspegillosis fumigatus* and one case ((2.1%) was *Mucormycosis.*

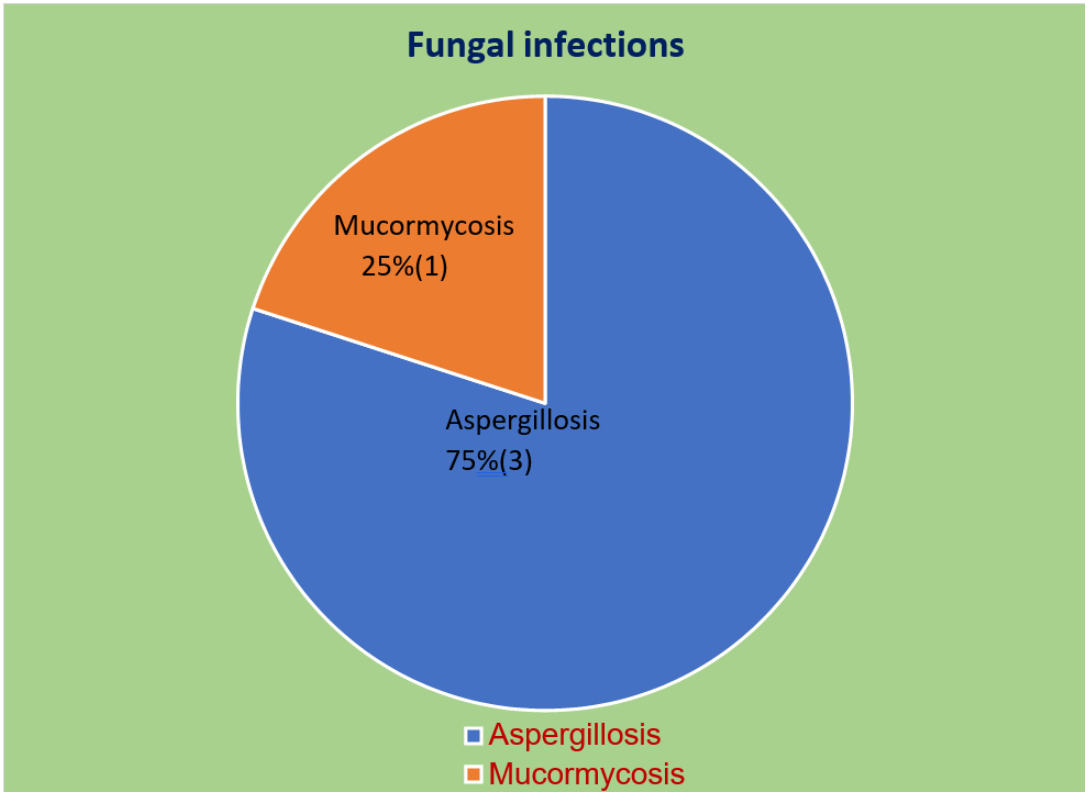


Figure 12: Pie chart showing distribution of organisms in fungal infectionsAll the patients were presented with headache, diplopia, blurring of vision and retro orbital pain with duration of less than one week.

Aspergillosis

Out of three cases of Aspergillosis two patients (50%) were known diabetics. Other case had no past history.

In two known diabetic patients MRI of one patient revealed T2/FLAIRhyperintense soft tissue in bilateral maxillary, bilateral ethmoid sinuses, with heterogeneous enhancement and showing extension into left orbital apex. There was erosion /discontinuity in the wall of ethmoid sinuses. Another patient showed mucosal thickening in bilateral ethmoid, sphenoid, maxillary sinuses with enhancement. There was also enlargement of the left cavernous sinus with enhancing soft tissue extending into the orbital apex.

We gave possibility of fungal infection. Mucosal biopsy confirmed the diagnosis with culture showing Aspergillus fumigatus in these two patients. Second patient showed improvement with systemic anti fungals.Whereas surgical debridement was needed in the first patient.

MRI of the patient with no past history showed heterogeneously enhancing soft tissue measuring 2x1.7cm extending from lateral wall of left sphenoid sinus into orbital apex. We gave possibility of fungal infection. Mucosal biopsy confirmed the diagnosis of Aspergillosis. This patient was treated with surgical debridement.

Mucor mycosis

One of the patient of mucormycosis was a known patient of renal transplantation on immunosuppression.

MRI showed mucosal thickening in bilateral frontal, ethmoidal, maxillary sinuses(L>R) and left sphenoid sinus showing heterogeneous enhancement.

There was Ill defined heterogeneously enhancing soft tissue with T2/FLAIR hyper intensity involving left maxillary, ethmoid, sphenoid sinuses showing extension into left cavernous sinus and the orbital apex,encasing the left optic nerve. Multiple hypointense foci noted in the mass.Left optic nerve was bulky and heterogeneously enhancing. There was also extension of soft tissue into the pterygopalatine fissure with erosion of the posterior wall of the left maxillary antrum. Based on these findings we gave possibility of invasive fungal infections. Mucosal biopsy confirmed the diagnosis of mucormycosis. This patient was treated with surgical debridement.

Table 8. MR findings and clinical features of patients of fungal infections.

	Case	Age/sex	Past history	Age/sex	Involved sinuses	Bone erosions	Treatment
Aspergillosis	1	45/F	DM	45/F	bilateral maxillary, bilateralethmoidal	+	Surgical debridement
	2	40/M	-	40/M	Left sphenoid	+	Surgical debridement
	3	53/M	DM	53/M	bilateral ethmoid, sphenoid, maxillary	-	Medical(IV anti fungals)
Mucormycosis	4	35/M	Postrenal transplantaion	35/M	Left maxillary, ethmoidal, sphenoidal	+	Surgical debridement

Tuberculosis

We observed four cases (8.5%) of tuberculosis three were males and one was female. Out of four patients, in two (50%) there was concomitant pulmonary involvement. In one case (25%)cervical lymphadenopathy was seen along with CNS involvement. One case was isolated CNS tuberculosis involving cavernous sinus.

In two patients with pulmonary involvement MRI of one patient showed heterogeneously enhancing soft tissue involving left cavernous sinus showing extension into orbital apex encasing the optic nerve. T2/FLAIR heterogeneous hyper intensities noted with patchy enhancement in basalcisterns which represent exudates. Similar findings were noted in other case

with additional findings of nodular thickening of anterior falx and leptomeningeal enhancement in left frontal region. Chest radiograph of these patients showed consolidations in both lung fields. In view of above findings, we gave tuberculosis as first possibility. Positive Montoux test in these patients confirmed the diagnosis.

In patient with cervical lymphadenopathy we found enhancing a soft tissue involving left cavernous sinus showing extension in to orbital apex. T2/FLAIR hyper intense areas were also noted in bilateral optic nerves and optic chiasm with patchy enhancement. In view of cervical lymph nodal enlargement and Montoux positivity we gave tuberculosis as first possibility. FNAC of lymphnode showed granulomatous inflammationwhich confirmed the diagnosis.

The patient with isolated CNS involvement showed multiple confluent ring enhancing lesions in suprasellar region cistern obliterating the cavernoussinus showing extension into both orbital apices and encasing both optic nerves. Basal exudates and meningeal enhancement in both temporal lobes were additional findings. Based on characteristic imaging features of confluent ring enhancing lesions, tuberculosis was given as first possibility. Surgical biopsy was done in this case confirmed the diagnosisof tuberculosis.

MRI findings were summarized in Table 9.

Table 9. MRI findings and associated conditions in TB patients.

Case	Age/sex	Associated clinical condition	Lesions	Basal exudates	leptomeningeal enhancement	Dural enhancement
1	44/F	Consolidation in both upper and midzones	soft tissue in left cavernous sinus showing extension in toorbital apex	+	-	-
2	26/M	Consolidation in both upper zones	soft tissue in left cavernous sinus showing extension in to orbital apex	+	+	+
3	43/M	Cervical lymphadenopathy	soft tissue in left cavernous sinus showing extension in toorbital apex	-		
4	24/M	-	Confluent ring enhancing lesions	+	+	-

Space occupying & vascular lesions

We observed 8 cases of space occupying, sella and supra sellar lesions and one case of left cavernous ICA aneurysm presented with acute visual symptoms contributing to 19.5% of study population. Among space occupying & vascular lesions pituitary macroadenomas were more common contributing to 8.5% (n=4), followed by craniopharyngiomas contributing to 6.3%(n=3). Suprasellar pilocytic astrocytoma and left cavernous ICA aneurysm were less common each contributing to2.1%(one case).

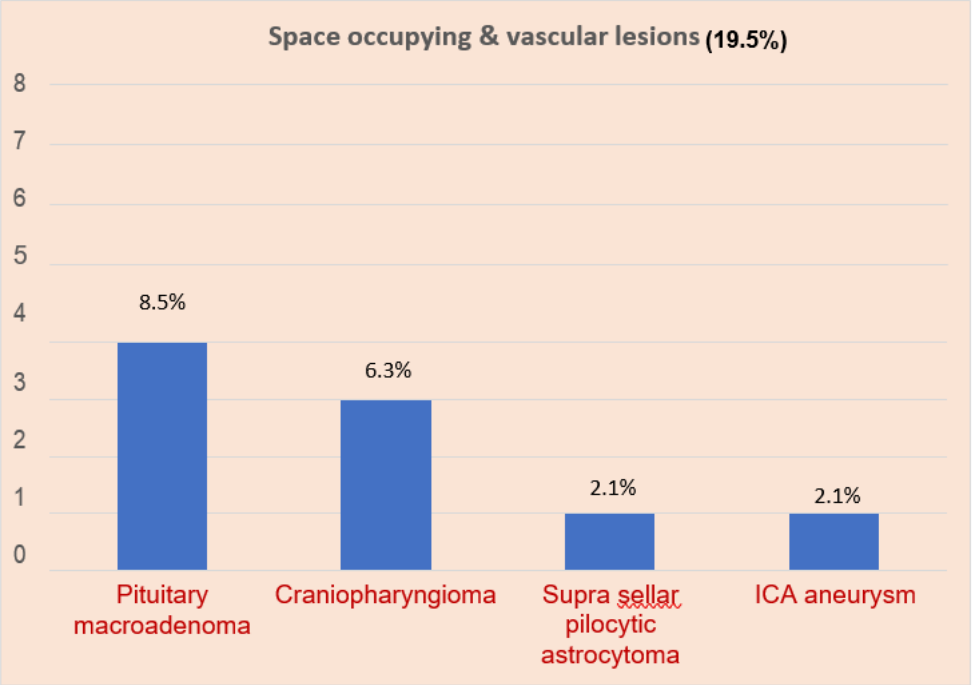


Figure 13: Bar diagram showing distribution of various space occupying &vascular lesions

Pituitary macroadenoma

In this study out of 9 patients of space occupying & vascular lesions we observed four patients (33.3%) of pituitary macro adenoma with haemorrhage. In these, two were males and two were females (M: F-1:1).Three cases presented with blurring of vision on both sides and headache,one case presented with left sided vision loss with duration of less than aweek.

MRI findings

MRI of all these cases showed mass lesions occupying and causing expansion of sella with supra sellar extension bulging into cavernous sinus. Sizes of the all lesions was found to be >3.2 cm, with largest lesion measuring 4.2 cm smallest lesion measuring 3.3 cm. The lesions were T1 iso intense with large dependent T1 hyper intensecomponent within, showing fluid-fluid levels which is hypo intense on T2/FLAIR. The lesions were showing predominantly peripheral intense homogeneous enhancement with non-enhancing central portion with characteristic 'figure of 8' appearance. Intra tumoral bleed was identified as non-enhancing dependent T1 hyper intensity with fluid-fluid levels which was hypo on T2 and FLAIR. The lesions were compressing the optic chiasm with moderate displacement (i.e>3 mm relative to the expected normal location of the visual pathway) in all patients. Based on the characteristic imaging findings pituitary macro adenoma with bleed was given as possibility. Diagnosis was confirmed in three cases by surgical biopsy. In one case diagnosis was confirmed by biochemical evaluation with increased levels of prolactin.

Management and treatment response

Three cases showed partial improvement of visual symptoms with surgicalresection of tumour. One case showed significant improvement of the visual symptoms with steroid therapy(4).

Craniopharyngioma

Out of 9 patients of space occupying & vascular lesions we found three patients (33%) of craniopharyngioma. All these were found to be adamantinomatous type. Out of three two were children (One patient was 6-year-old male child one is 7-year-old female child) and one adult (43 year). These patients presented with blurring of vision and headache.

All three cases showed Large well defined suprasellar mass lesions with cystic areas within, larger one measuring 3.3 cm smaller one measuring 2.8 cm. The lesions were showing T1 iso intensity with

multiplehyperintense areas within. On T2/FLAIR the lesions were hyperintense with multiple hypo intense areas within (corresponding T1 hyper intense areas) with few cystic components. The lesions were causing compression of the optic chiasm with thinning and displacement. On CT the lesions showed multiple calcifications within. Based on these findings we gave possibility of craniopharyngioma. All three patients underwent surgical resection. Histopathological examination of the surgical specimens confirmed the diagnosis.

Pilocytic Astrocytoma

In present study we found a case (11%) of supra sellar pilocytic astrocytoma, which was a 7-year-old male presented with chronic headache with sub-acute visual disturbance of visual acuity with sudden vision loss, fundoscopy showed papilledema.

MRI of the patient showed a large lobulated supra sellar solid cystic lesion showing extension into sella and left parasellar cistern measuring 6.7x6.5x6.3cm(APxTRxCC). It was heterogeneously hypo intense on T1, hyper on T2/FLAIR with heterogeneous enhancement on post contrast. The lesion was causing compression and displacement of 3rd ventricle. The lesion was extending to prepontine cistern and interpeduncular cistern inferiorly. It was extending into the body of left lateral ventricle obstructing the foramen of monro causing supratentorial hydrocephalus. The optic nerve and chiasma were not seen separately from the lesion.

Conventional MRI findings were correlated with Diffuse tensor imaging (DTI) of brain in which optic tracts and chiasm were not visualised with possibility of disruption.

We had given craniopharyngioma as first possibility, pilocyticastrocytoma as second possibility for the lesion.

The case was treated surgically with resection and biopsy confirmed the diagnosis of pilocytic astrocytoma.

There was no significant visual out come on post-operative follow up.

Left Cavernous ICA aneurysm

In this study we found a case (11%) of 65-year-old hypertensive female who presented with left sided blurring of vision, ptosis and diplopia with duration of 6 days. Clinically stroke was suspected in this case in view ofhypertension.

MRI revealed a rounded flow void occupying the entire left cavernous sinus measuring 2.3 cm which is causing compression and thinning the left optic chiasm. It showed intense enhancement on post contrast T1 FATSAT images. Follow up DSA confirmed partially thrombosed giant aneurysm arising from the cavernous segment of the left ICA.

The patient underwent endovascular treatment with flow diverter device placement and showed significant improvement of the visual symptoms.

Other lesions

Apart from above mentioned pathologies we observed 4 cases (8.5%) of Idiopathic intracranial hypertension(IIH) and 3 cases (6.3%) of posterior reversible encephalopathy.

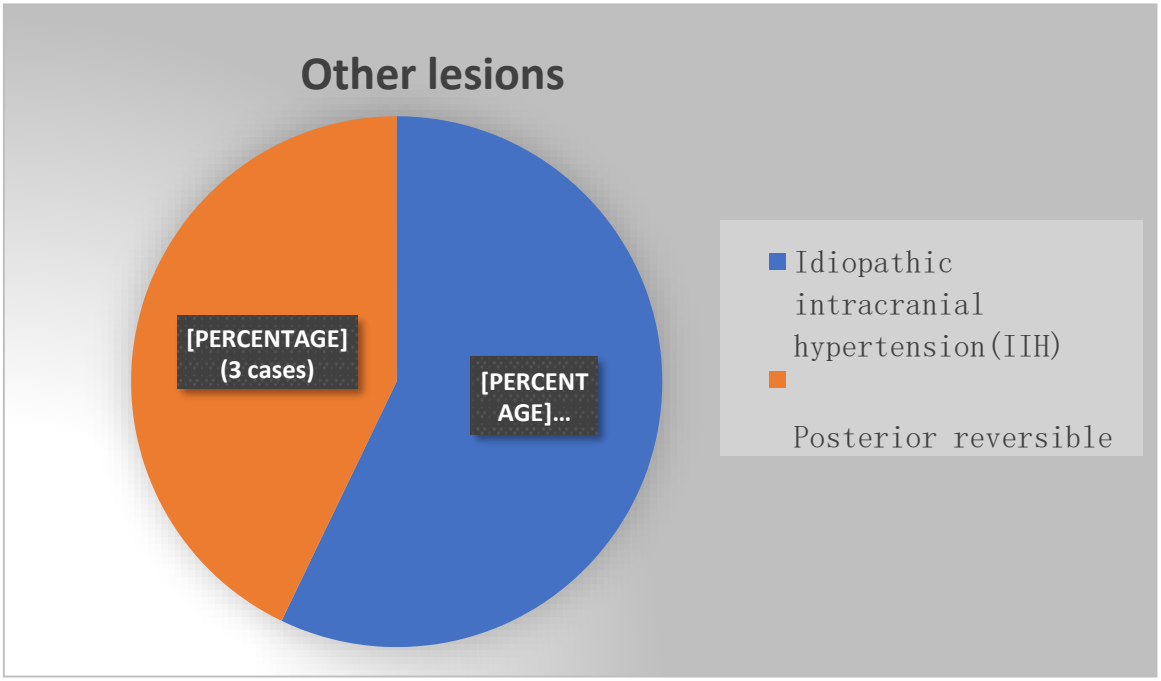


Figure 14: Pie chart showing distribution of IIH and PRES

Idiopathic intracranial hypertension(IIH)

We found four cases (8.5%) of IIH, out these, two cases were females andtwo were males (M: F-1:1). Out of four, three cases were referred to MRIfor MR venography(MRV)with suspicion of cerebral venous thrombosis. One case referred for MRV and MRI orbits with suspicion of IIH clinically.

All patients were presented with headache and vision field defects. Diplopia was also present in other two patients.

In all these cases we found posterior flattening of globe, protrusion of the optic nerve head, and expanded CSF space around the optic nerves. Empty sella was seen in two patients No other lesions were detected in the brain. Based on these findings we gave possibility of IIH.

All these cases improved with use of Acetazolamide and corticosteroids.

Table 10. MRI findings of patients of IIH.

case	Age/sex	Posterior flattening of globe	Expansion of CSF space around optic nerve	Empty sella
1	23/F	+	+	-
2	29/F	+	+	+
3	32/M	+	+	-
4	35/M	+	+	-

Posterior reversible encephalopathy syndrome(PRES)

In present study three cases (6.3%) of PRES were observed. Out of threetwo were male and one was female (M: F-2:1). Two female patients wereknown patients of SLE. These patients presented with visual disturbancesand seizures with duration of 2 days. Clinical examination revealedaccelerated hypertension in all three patients. Laboratory investigations ofall patients showed elevated creatinine. MRI revealed symmetrical T2 and FLAIR hyper intense areas involving grey and subcortical white matters of bilateral occipital lobes, parietal lobes involving superior frontal sulcus in two patients. Anterior frontal lobes were also involved in one patient. DWI showed no evidence of restriction.

Patients were managed with correction of the elevated BP and correctionof azotemia. All patients showed symptomatic improvement. Follow up MRI images showed resolution of findings in all patients.

Diagnostic value of MRI

In this study of 47 cases presenting with acute visual symptoms we detected lesions in 41(87%) cases. Out of 41 cases in 37 cases (78.7%) we gave a single specific diagnosis which was correlating with final diagnosis.

We gave two differential diagnoses in 4 cases (8. 5%).Out of 4 cases firstdifferential diagnosis was correlated with final diagnosis in 3 cases (6. 3%).Second differential diagnosis was correlated in one case (2.1%). In 6cases (12.7%) we were not able to detect the abnormality.

In this study over all sensitivity of detecting the lesions of acute visual syndromes(AVS) by MRI is 88.67%, whereas specificity is 100%

Table 11. Diagnostic value of MRI in diagnosing the various lesions of thestudy.

Pathology	Total number of cases	Specific diagnosis or firstpossible diagnosis	Two differential diagnoses	Un diagnosed
1.Optic neuritis	15	9	-	6
2.Tolosa hunt syndrome	6	5	1	-
3.sarcoidosis	2	-	2	-
4.Pituitary macro adenoma	4	4	-	-
5.Craniopharyngioma	3	3		
6.Pilocytic astrocytoma	1	-	1	-
7.ICA aneurysm	1	1	-	-
8.Fungal infection	4	4		-
9.Tuberculosis	4	4	-	-
10.Benign intracranial hypertension	4	4	-	-
11.Posterior reversible encephalopathy	3	3	-	-
	47(100%)	37(78.7%)	4(8.5%)	6(12.7%)

Inflammatory lesions

Out of 23 cases of inflammatory lesions we gave single specific diagnosisin 18 cases (38%).In all these cases our diagnosis was correlated with final diagnosis.

We gave two differential diagnoses in 3 cases (13%). Out of those 3 casestwo cases were found to be sarcoidosis and one case was found to be Tolosa hunt syndrome. In cases of sarcoidosis we gave lymphoma as the second differential diagnosis. For one case of Tolosa hunt syndrome we gave tuberculosis as second differential diagnosis.

We were not able to detect pathology in 6 cases (26%) of inflammatory lesions. All these 6 cases were found to be optic neuritis.

So in this study sensitivity of MRI in diagnosing the inflammatory lesions is 80% whereas specificity is 100%.

Out of 15 cases of optic neuritis we gave single specific diagnosis in 9 cases (60%). We were not able to detect 6 case (40%) of optic neuritis.

So in present study sensitivity of MRI in diagnosing the optic neuritis is 71.2%, specificity is 100%.

Out of 6 cases of Tolosa hunt syndrome we gave Tolosa hunt syndrome as single possible diagnosis in 5 cases (83%). For one case (17%) we gave Tolosa hunt syndrome as first differential diagnosis and tuberculosisas second differential.

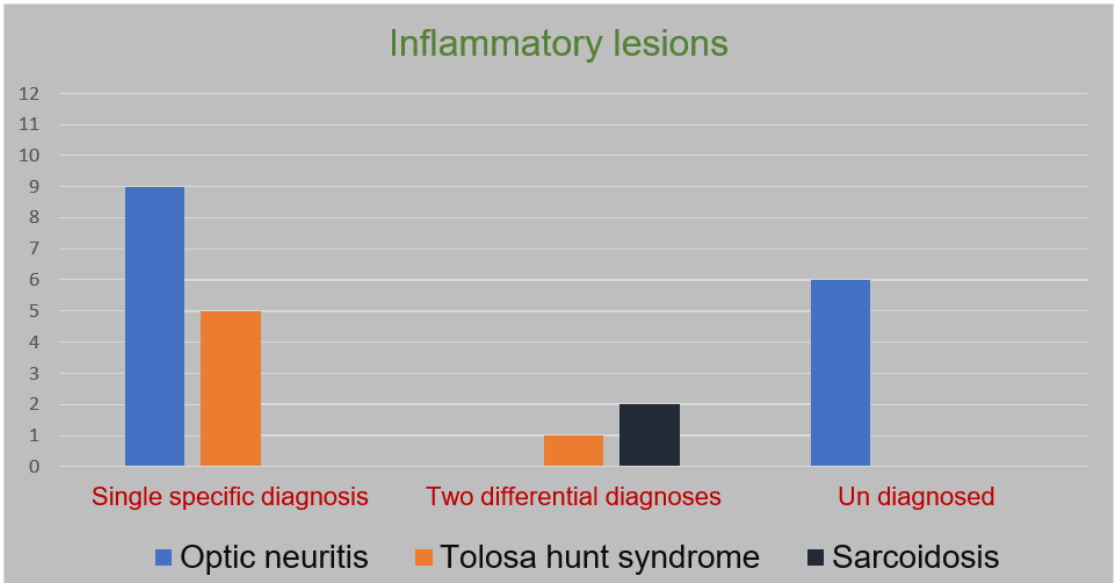


Figure 15: Bar diagram showing diagnostic value of MRI in diagnosing the inflammatory lesions

Infections

We gave single specific diagnosis in all 8 cases of infections. Our diagnosis was correlated with final diagnosis in all cases. Four cases were found to be tuberculosis, remaining four cases were found to be fugal infections. So in our study sensitivity and specificity of MRI in diagnosing the infections are 100%.

Space occupying and lesions

Out of 9 cases of space occupying and vascular lesions we gave singlespecific diagnosis in 8 cases (88%).In cases of pituitary macro adenoma (4 cases,44%), craniopharyngioma (3cases,33%), left cavernous ICAaneurysm (1 case,11%)our diagnosis was correlating with final diagnosis.

For one case (11%) of supra sellar pilocytic astrocytoma we gave PNET as first possibility and pilocytic astrocytoma as second possibility. The second differential diagnosis was correlated with final diagnosis.

In this study sensitivity of MRI in diagnosing the space occupying lesionsis 100 % with specificity of 100%.

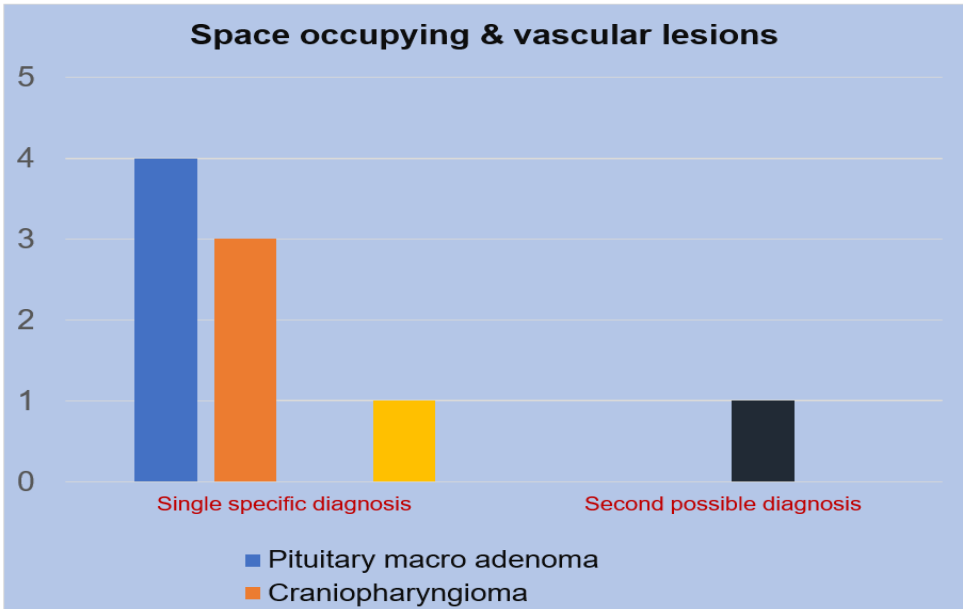


Figure 16: Bar diagram showing diagnostic value of MRI in diagnosing thespace occupying & vascular lesions.

Discussion

In present study we evaluated various lesions involving cavernous sinus,orbital apex(OA) and optic nerves causing acute visual symptoms. In our study we divided the lesions into four groups as inflammatory lesions, infectious lesions, space occupying, vascular lesions and miscellaneous.

Inflammatory lesions

Inflammatory lesions associated with acute visual loss includes direct involvement of the optic nerve with demyelinating inflammation of the optic nerve as optic neuritis or lesions of the orbital apex with involvement of the optic nerve(5). Inflammatory disease within the orbital apex may presentas painful ophthalmoplegia with or without associated optic neuropathy. Typically, the onset of symptoms is abrupt with progression over days to weeks.[22]

Optic neuritis, Tolosa hunt syndrome and sarcoidosis were observed as inflammatory causes in this study. We observed optic neuritis was the most common among inflammatory lesions accounting for 15 cases. Nextcommon was Tolosa hunt syndrome accounting for 6 cases. Sarcoidosiswas the least common inflammatory lesion in present study accounting for2 cases.

Limitations of the study

- This study includes a small sample size with only 47 patients and hence larger studies are required for further analysis**.**
- Our study could not explain the reason for false negativity of MRI in some patients with optic neuritis.
- In this study we did not measure the length of the enhanced portion of the optic nerve, we considered only number of involving segments to correlate with treatment.
- This study could not explain the acute presentation of visual symptoms in patients of craniopharyngioma, suprasellar atrocytoma andcavernous sinus aneurysm.
- To diagnose the lesions this study relied only on classical MRI featuresof the lesions which were previously mentioned, we did not define anynew MRI features.

- **Summary**
- This is an observational prospective study approved by the Institutional Ethics Committee involving of the patients presented with acute visual syndromes who were referred to our department evaluated by MRI over a period of 17 months from December 2022-April 2024.
- Forty-seven (47) patients, presented with acute visual symptoms, wereincluded in this study. In this study we observed male preponderance (63%).Majority of the patients belongs to 40-50 years (36%) and 21-30years (21%) age groups.
- Inflammatory lesions (n=23,48%)were most common in this studyfollowed by space occupying lesions (n=9, 23%).Among inflammatorylesions optic neuritis (n=15,31%) was more commonly observed.
- This study showed sensitivity (88.67%) and specificity (100%) of MRI are high in diagnosing the acute visual syndromes. Among the 47 patients MRI detected the lesions in 41(87.2%) patients.
- Out of 15 patients of optic neuritis MRI showed abnormality in 9 patients. The sensitivity of MRI is fairly good (71.2%) in diagnosing theoptic neuritis However it is less comparing to other pathologies in our study. However, MRI helped to rule out other pathologies in these patients. MRI helped in identifying etiology of the optic neuritis in 8 (58%) patients. Classical findings of multiple sclerosis (MS) like white matter lesions in brain, perpendicular to lateral ventricles and involvement of corpus callosum were seen in two patients helped us toidentify the etiology. We differentiated MS from neuromyelitis optica (NMO) in 4 patients (26%) of optic neuritis by observing the classical findings of NMO and MS in these patients(6).
- In this study it was observed that MRI could not show abnormality in 6 patients (12. 7%).All

those six patients were of optic neuritis. Reviewedand follow up investigations showed alterations of visual evoke potential (VEP) parameters in all patients of optic neuritis. Clinicians relied on VEP findings and steroid response in these patients todiagnosis the optic neuritis. So in patients in whom MR could not explain the symptoms, VEP and steroid response were needed.

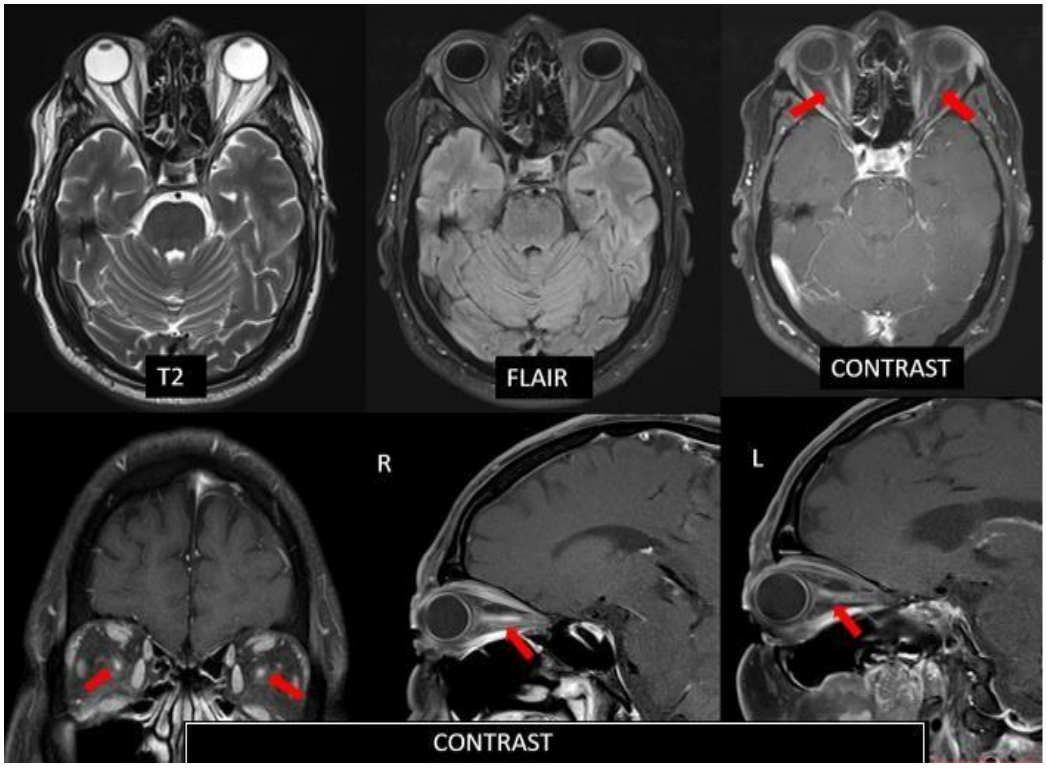
- To diagnose Tolosa hunt syndrome this study had adapted criteria defined by Tolosa, Hunt and the International Headache Society (IHS) 2004(7)**.** We found 6 patients (12.7%) of Tolosa hunt syndrome. To followthis criteria Gadolinium enhanced scans were needed to diagnose theTolosa hunt syndrome. In almost all these patients (n=5,83%) we diagnosed the pathology correctly. In one case (1,17%) we gave Tolosa hunt syndrome as second possibility in view of history of past history of ATT usage. Steroid response confirmed the diagnosis in these patients.
- Although neurosarcoidosis involvement of cavernous sinus rarely described in the past case reports we observed two cases (4.2%) of sarcoidosis presenting as orbital apex syndrome in this study. The cranial nerve involvement, nodular enhancement of the dura were favourable features to support the diagnosis of sarcoidosis in these patients(8). On-contiguous dural enhancement was observed differentiating feature between lymphoma and sarcoidosis in this study.
- We observed four cases (8.4%) of CNS TB presented as orbital apex in this study. The classical MRI features of tuberculosis like basal exudates, meningeal enhancement, confluent ring enhancing lesions had a major role in diagnosing these cases. Clinical history like concomitant pulmonary involvement and lymph nodal enlargement were more valuable in reaching the diagnosis in two of these patients.
- Invasive fungal sinusitis was contributing to 4 (8.4%) patients of the study population. Heterogeneously enhancing soft tissue extending from sinuses to cavernous sinus and orbital apex with involvement of the optic nerve with history of immunosuppression and diabetic observed in two cases. Surgical debridement was main stay of treatment in these patients.
- Sellar and supra sellar mass lesions causing diminished visual acuity and opthalmoplegia were contributed to 8 patients (17%) of the study. Out of eight mass lesions four patient were of pituitary macroadenomawith internal hemmorhage. Characteristic MRI signal intensity of acute hemmorhage i.e. Dependent T1 hyper intensity, T2/FLAIR hypo intensity with fluid fluid levels were observed in these patients helped us to narrow down the diagnosis. On visualisation of the optic chiasma explained the symptoms in this patients.Three patients of adamantinomatous craniopharyngiomas were observed in this study. Classical features of cystic component, calcification, suprasellar location, enhancement pattern were supported the histologicaldiagnosis. One case (2.1%) of suprasellar pilocytic astrocytoma presented with chronic headache and acute vision loss was observed in the study. Suprasellar location Solid cystic nature, lobulated appearance, heterogeneous enhancement were made us to give craniopharyngioma as first possibility. Histopathological diagnosis waspilocytic astrocytoma.
- We observed one case (2.1%) of left cavernous ICA aneurysm causing diplopia and ptosis. Intensely enhancing large flow void in the left cavernous sinus was seen. The aneurysm occupied the entire left cavernous sinus which explained the symptoms of the patients as thisaneurysm is compressing the cranial nerves III and VI.
- Four cases (8.4%)of IIH were observed in the study. MRI showed classical features (posterior flattening of globe, enlarged CSF space around the optic nerves & empty sella) in these patients. We observed three cases (6.3%) of PRES in the study, two were females with history of SLE. Vasogenic edema (T2/FLAIR hyper intensities with facilitated diffusion) in cortex and subcortical white matter of occipital, parietal and frontal lobes were observed in these patients. Symptoms were improved with correction of accelerated hyper tension with resolution of MRI findings in follow up scans in these patients.

Conclusion

Conclusion of the present study is that while the symptomatology of acutevisual syndrome is often nonspecific and confusing, MRI imaging adds sensitivity and specificity to the physical examination. Because of its bettersoft tissue resolution, characteristic signal intensity pattern of certain lesions

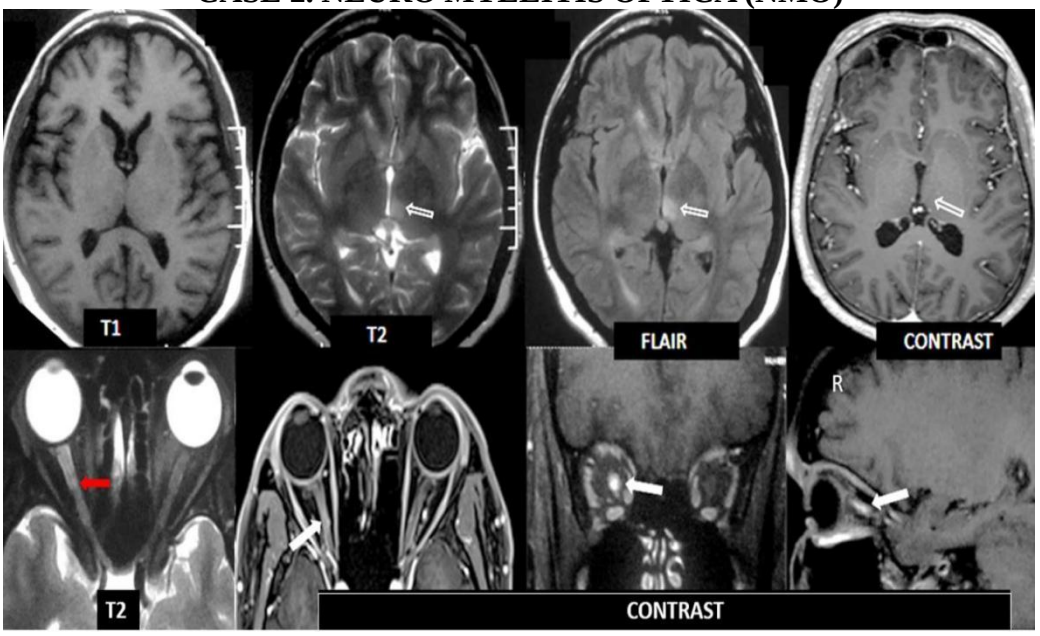
and lack of ionizing radiation hazards, MRI should be the imaging modality of choice for patients with suspected acute visual syndromes. However, clinical data and treatment response necessary to confirm the diagnose of certain inflammatory lesions of orbital apex syndrome.

CASE 1. OPTIC NEURITIS



A 23/F patient presented with diminished visual acuity since 4 days. Axial T2 and FLAIR images showing mild hyper intensities in intra orbital segment of both optic nerves. Axial, coronal and sagittal images of Post contrast T1 Fat suppressed sequence showing enhancement of optic nerves (red arrows). Significant improvement of visual acuity seen with steroids.

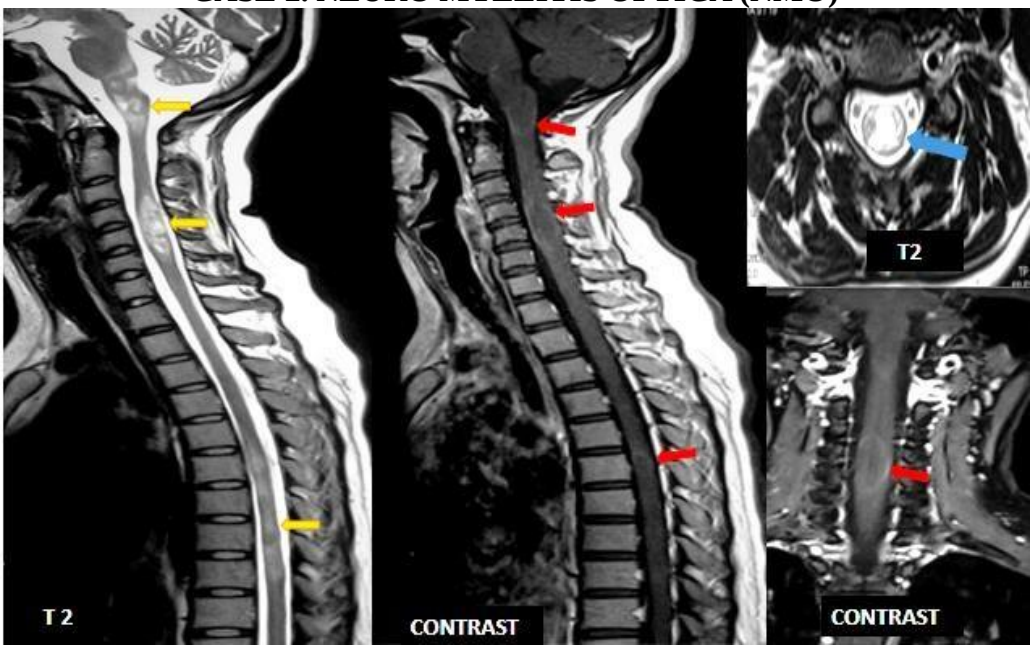
CASE 2. NEURO MYELITIS OPTICA (NMO)



Case 2. A 28/F presented with blurring of vision and weakness of both lower limbs since 6 days.

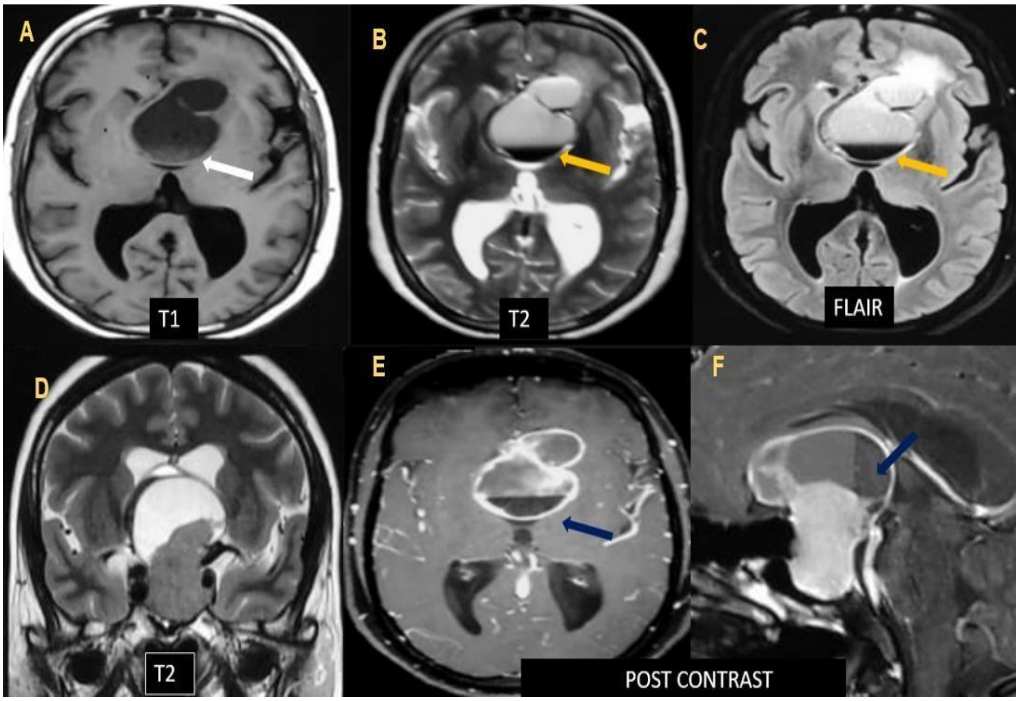
Axial T2, FLAIR images showing hyper intensearea in left thalamus with no contrast enhancement (open arrows). axial T2 magnified images of orbits showing hyper intensities in right optic nerve (red filled arrow). Axial, coronal and sagittal images of the post contrast T1 fat suppressed images showing enhancement of the right optic nerve.
….to be continued

CASE 2. NEURO MYELITIS OPTICA (NMO)



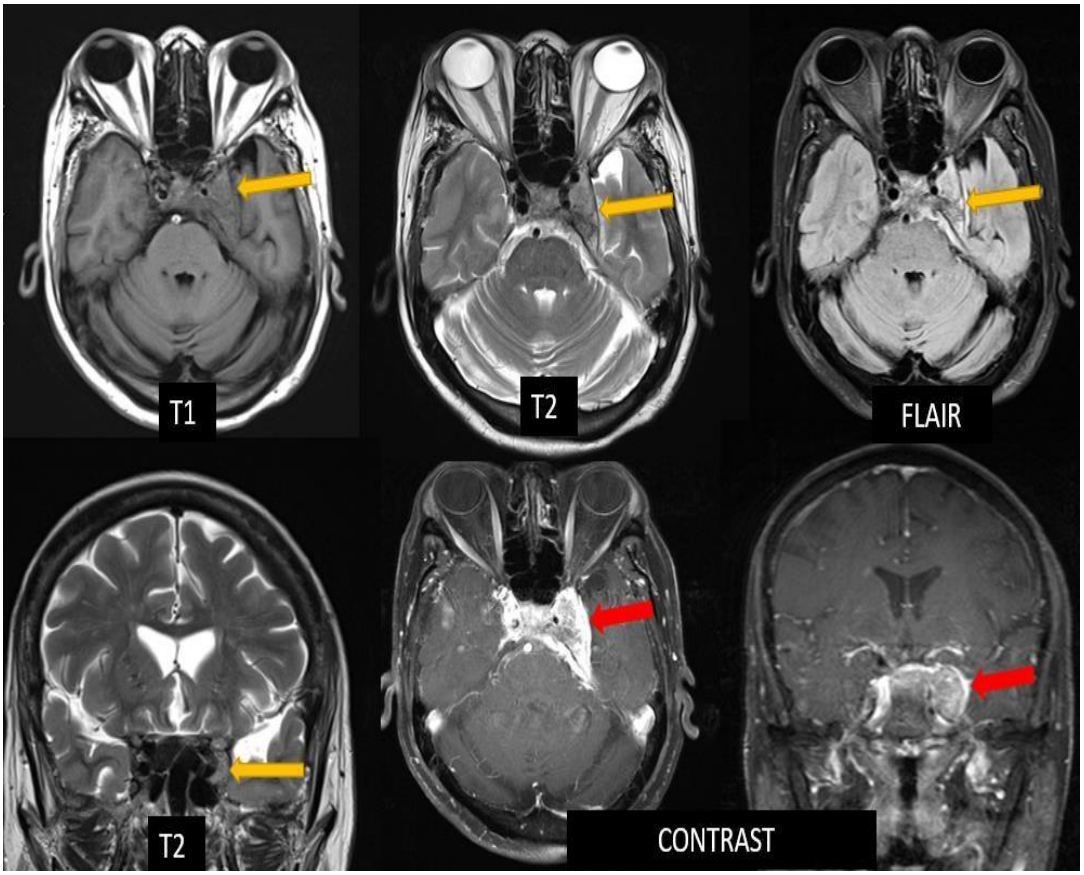
In the same patient sagittal T2 weighted images of the MRI spine showing multiple hyperintense areas in medulla, cervicomedullary junction, C3 to C6 levels, D5 to D9 levels (yellow arrows), Axial T2 weighted image showing hyper intensity involving both anterior and posterior portions of the cord (blue arrows). Corresponding areas are showing peripheral rim like enhancement in post contrast images (red arrows). Serum aquaporin-4 (AQP4-Ab or NMO-IgG) antibodies were positive in this patient.

CASE 3. PITUITARY MACRO ADENOMA WITH HEMORRHAGE.



Case 3. A 40/M presented with sudden vision loss and diplopia since oneday. Coronal T2 weighted image (D)of the MRI brain reveals a large iso to mildly hyper intense mass lesion occupying and expanding sella with supra sellar extension it is showing large cystic component within. Axial T1 weighted image showing fluid-fluid levels with dependent hyper intensity (white arrow) which is hypo on T2 and FLAIR images suggestingacute bleed (yellow arrows). Post contrast images (E, F) showing peripheral rim like enhancement with non-enhancing cystic component (blue arrows). The patient underwent surgery. Histopathological examination of post excision biopsy showed pituitary adenoma.

CASE 4. TOLOSA HUNT SYNDROME.



Case 4.A 32/M presented with left retro orbital pain and diplopia since 7 days. MRI brain showing expansion of the left cavernous sinus with T1 isointense, T2, FLAIR iso to mildly hyper intense soft tissue extending into orbital apex (yellow arrows). On post contrast it is showing heterogeneous enhancement (red arrows). Blood investigations, serum ACE levels were normal, viral markers, Monteux test were negative. Significant improvement was seen with steroids.

REFERENCES

1. Petzold A, Wattjes MP, Costello F, Flores-Rivera J, Fraser CL, Fujihara K et al. The investigation of acute optic neuritis: a review and proposed protocol. NatureReviews Neurology. 2014 Aug;10(8):447.
2. Balcer LJ, Miller DH, Reingold SC, Cohen JA. Vision and vision-related outcomemeasures in multiple sclerosis. Brain. 2014 Nov 27;138(1):11-27.
3. Petzold A, Plant GT. Diagnosis and classification of autoimmune optic neuropathy. Autoimmunity reviews. 2014 Apr 1;13(4-5):539-45.
4. Mukhi SV, Lincoln CM. MRI in the evaluation of acute visual syndromes. Topics in magnetic resonance imaging. 2015 Dec 1;24(6):309-24.
5. Wingerchuk DM, Banwell B, Bennett JL, Cabre P, Carroll W, Chitnis T Et al. International

consensus diagnostic criteria for neuromyelitis optica spectrum disorders. Neurology. 2015 Jul 14;85(2):177-89.
6. Bodanapally UK, Shanmuganathan K, Shin RK, Dreizin D, Katzman L, Reddy RP, Mascarenhas D. Hyperintense optic nerve due to diffusion restriction: diffusion- weighted imaging in traumatic optic neuropathy. American Journal of Neuroradiology. 2015 Aug 1;36(8):1536-41.
7. Sánchez RV, Lopez-Rueda A, Olarte AM, San LR. MRI findings in Tolosa-Hunt syndrome (THS). BMJ case reports. 2014 Nov;2014.
8. Smith JK, Matheus MG, Castillo M. Imaging manifestations of neurosarcoidosis. American Journal of Roentgenology. 2004 Feb;182(2):289-95.