STUDY OF THE CLINICAL COURSE AND OPTICAL COHERENCE TOMOGRAPHY ANALYSIS OF MACULAR THICKNESS IN NEURORETINITIS

DISSERTATION SUBMITTED FOR PARTIAL FULFILLMENT OF

M.S. OPHTHALMOLOGY

BRANCH-III

REGIONAL INSTITUTE OF OPHTHALMOLOGY

GOVERNMENT OPHTHALMIC HOSPITAL

MADRAS MEDICAL COLLEGE

CHENNAI - 600 003.

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI – 600 032

MARCH 2012

CERTIFICATE

This is to certify that the dissertation entitled "**STUDY OF THE CLINICAL COURSE AND OPTICAL COHERENCE TOMOGRAPHY ANALYSIS OF MACULAR THICKNESS IN NEURORETINITIS"** is a bonafide work of **Dr. R. KANIMOZHI**, in partial fulfillment of the requirements for **M.S. Degree Branch – III (Ophthalmology)** examination of the Tamilnadu Dr. M.G.R. Medical University to be held in March 2012.

Prof.Dr. K. NAMITHA BHUWANESWARI M.S, DO
Head of Strabismology,
Paediatric & Neuro – Ophthalmology Dept,
Regional Institute of Ophthalmology
Government Ophthalmic Hospital,
Egmore, Chennai – 8.

Prof. Dr. K. VASANTHA, M.S, FRCS
Director and Superintendent
Regional Institute of Ophthalmology
Government Ophthalmic Hospital,
Egmore, Chennai – 8.

Dr. V. KANAGASABAI M.D, PhD.,
Dean
Madras Medical College and
Rajiv Gandhi Government General hospital
Chennai – 600 003

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled, entitled "**STUDY OF THE CLINICAL COURSE AND OPTICAL COHERENCE TOMOGRAPHY ANALYSIS OF MACULAR THICKNESS IN NEURORETINITIS"** is a bonafide and genuine research work conducted by me under the guidance of **Prof. Dr. K. NAMITHA BHUWANESWARI, M.S., D.O.,** Professor Department of Strabismology, Paediatric & Neuro – ophthalmology, Regional institute of Ophthalmology. Government Ophthalmic hospital. Chennai-600008.

Date **Dr. R.KANIMOZHI**

Place

ACKNOWLEDGMENT

I owe my thanks to **Dr. V. KANAGA SABAI. M.D, Ph.D., Dean,** Madras Medical College and Rajiv Gandhi Government General hospital, for granting me permission to conduct this study at the Regional Institute of Ophthalmology and Government Ophthalmic Hospital attached to Madras Medical College, Egmore, Chennai.

I thank **Prof. Dr. K.VASANTHA M.S, FRCS.**, Director and Superintendent of Regional Institute of Ophthalmology and Government Ophthalmic Hospital, Madras Medical College for her support and encouragement to conduct this study.

I extend my sincere and heartfelt thanks to my guide **Prof. Dr. K. NAMITHA BHUWANESWARI, M.S., D.O**., whose unfailing support and unfathomable patience with me has guided me to undertake this study to its successful completion.

I am grateful to **Dr. B. PRAMILA, M.S., Dr. K. S.T. LATHA, M.S, Dr. T. G. UMA MAHESWARI, M.S,** Assistant Professors, for their valuable guidance, support and encouragement rendered to me during the study.

I express my heartfelt thanks to **Dr. A. PALANI RAJ M.S.,** and **Dr. PADMA PRIYA, M.S.,** Assistant professors, Retina services who have done the imaging and interpretation of optical coherence tomography.

I am extremely grateful to all the Assistant Professors and post-graduates for their support during the study.

I thank all the patients who formed the back bone of the study and without whom this work would not have been possible.

Last but not the least, I thank “God, the Almighty” for being my guiding light all the way.

PART I

I ABBREVIATIONS

ATT	-	Anti Tuberculous Treatment
CMV	-	Cyto Megalo Virus
BD	-	Bi Daily
OD	-	Once Daily
AIDS	-	Acquired Immuno Deficiency Syndrome
IRVAN	-	Idiopathic Retinal Vasculitis, Aneurysms And Neuroretinitis
DUSN	-	Diffuse Unilateral Subacute Neuroretinitis
OCT	-	Optical Coherence Tomography
SD-OCT	-	Spectral Domain Optical Coherence Tomography
LED	-	Light Emitting Diode
RPE	-	Retinal Pigment Epitheum
NFL	-	Nerve Fibre Layer
OPD	-	Out Patient Department
TC	-	Total Count
DC	-	Differential Count
ESR	-	Erythrocyte Sedimentation Rate

TORCH	-	Toxoplasmosis, Rubella, Cyto Megalo Virus, Herpes
VDRL	-	Venereal Disease Research Laboratory
ELISA	-	Enzyme Linked Immuno Sorbent Assay
HIV	-	Human Immunodeficiency Virus
BP	-	Blood Pressure
RBS	-	Random Blood Sugar
BCVA	-	Best Corrected Visual Acuity
SRF	-	Sub Retinal Fluid
SRD	-	Serous Retinal Detachment
NCT	-	Non Contact Tonometer
CSF	-	Cerebro Spinal Fluid
ENT	-	Ear Nose Throat
AION	-	Anterior Ischemic Optic Neuropathy
BRVO	-	Branch retinal vein occlusion
CRVO	-	Central retinal vein occlusion
FTA-ABS	-	Flourescent Treponema Pallidum Antibody Absorption Test
VEP	-	Visually Evoked Potential

INTRODUCTION

Neuroretinitis is a form of optic neuropathy characterized by acute unilateral visual loss in the setting of optic disc swelling and hard exudates arranged in a star figure around the fovea.[1] It affects persons of all ages, although it occurs more often in the third and fourth decades of life, with no gender predilection. [2,3] It is mostly unilateral and may be precipitated by various known and unknown factors.

Neuroretinitis is a rare clinical entity often confused with the more common papillitis or papilledema. The fundus pictures have several common features and can be mistaken for one another by ill-experienced clinicians and sometimes even by ophthalmologists and neurologists.

However, there are certain diagnostic features distinctive for neuroretinitis. It is a distinct clinical entity with a different etiopathogenesis. Likewise its management and prognosis too differs from fundoscopically similar entities encountered more often in our clinical practice.

ANATOMY OF OPTIC NERVE HEAD

Optic disc is the water-shed zone between retina and optic nerve. It is the exit site of all ganglion cell axons of the retina, which converge at the optic disc to leave the eye and form the optic nerve.

The optic disc is located in the nasal retina 3-4 mm from fovea. It is 1.8mm in vertical diameter and 1.5 mm in horizontal diameter. Since there are no photo receptors over the disc, it is projected in visual space as an absolute scotoma, “The Blind spot of mariotte”. The blind spot is centered 15^0 from fixation and slightly below the horizontal meridian in the temporal visual field. It represents $7^0/5^0$ in the visual space.

The optic nerves are surrounded by meningeal sheaths, dura, arachonid and pia matter upto lamina cribrosa. There is extension of the intracranial subarachnoid space forward around the optic nerve to the back of the eye ball.

Blood supply

Surface area is supplied by retinal capillaries.

Pre laminar region is supplied by peripapillary chorioidal vessels.

Laminar portion of optic nerve head receives its blood supply from circle of Zinn, formed by short ciliary vessels.

Post laminar area is supplied by branches of pial plexus from central rential artery.

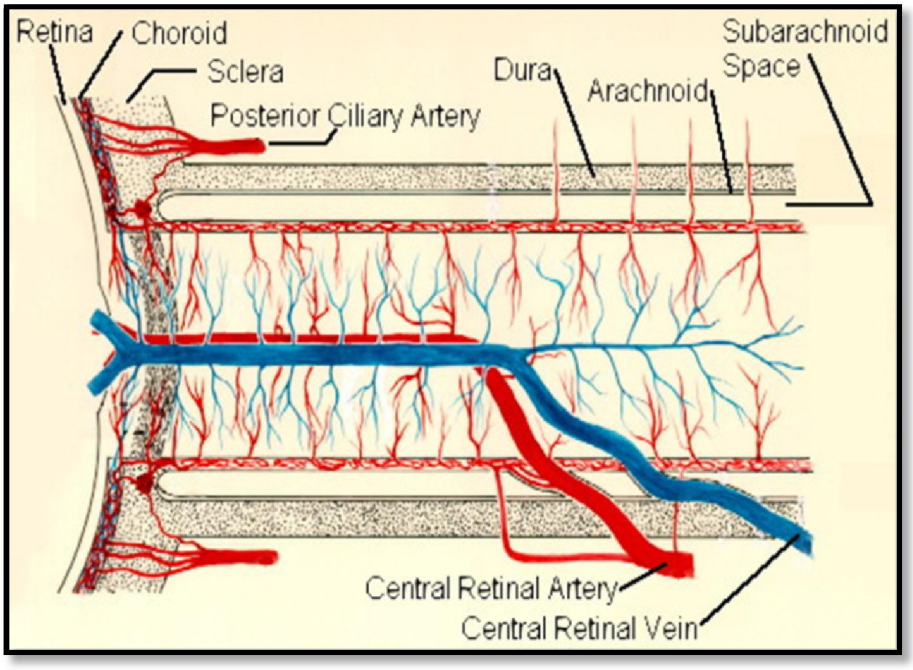


Fig.1 Blood Supply Of Optic Nerve Head

ANATOMY OF MACULA

The umbo, foveola, fovea, parafovea and perifovea together constitute the macula or the central area. The central area can be differentiated from the extra-areal periphery by the ganglion cell layer. In the macula, the ganglion cell layer is several cells thick, while in the extra-areal periphery it is only 1 cell thick. The macular border coincides with the course of the major temporal arcades and has an approximate diameter of 5.5mm

PARAMETERS OF MACULA

a) Diameter of fovea- 1.5 mm.
b) Diameter of parafovea- 1 mm.
c) Diameter of perifovea- 3mm.

1. UMBO

It is a tiny depression in the very center of the foveola which corresponds to the ophthalmoscopically visible foveal reflex.

2. FOVEOLA (350microns-0.35mm)

It is a small central region in which the thickness of retina is reduced so as to contain only photoreceptors, glial cells and muller cells.

3. FOVEAL AVASCULAR ZONE (FAZ-800microns-0.8mm)

It is located inside fovea but outside the foveola.

4. FOVEA (1500microns-1.5mm)

It is a small depression where the retina is reduced to half its normal thickness. Moving towards the centre of retina the inner nuclear layer is reduced to a double row of cells at edge of fovea.

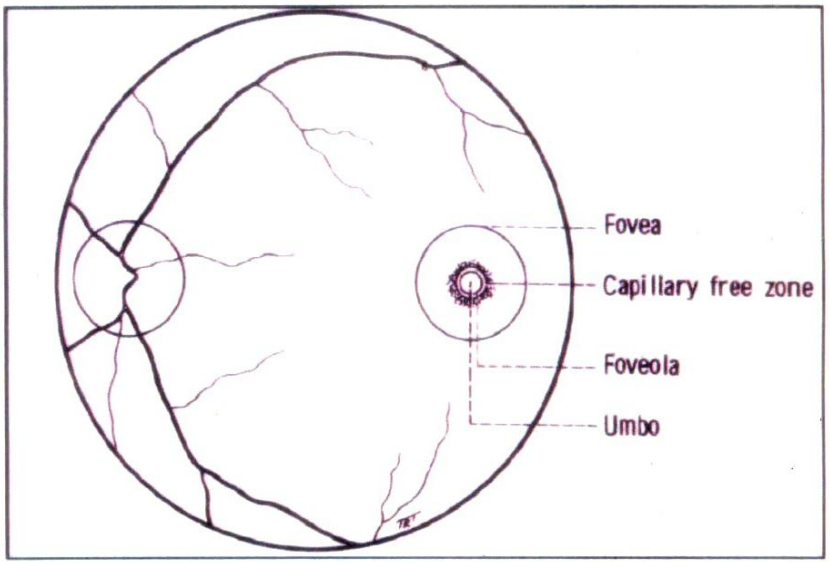


Fig 2 Anatomy of Macula

HISTOLOGY OF MACULA:

Retina at the macula consists of 3 types of cells and their synapses arranged from without inwards in the following layers,

Retinal pigment epithelium

Layer of Rods and Cones

External limiting membrane

Outer nuclear layer

Outer plexiform layer

Inner nuclear layer

Inner plexiform layer

Ganglion cell layer

Nerve fibre layer

External limiting membrane

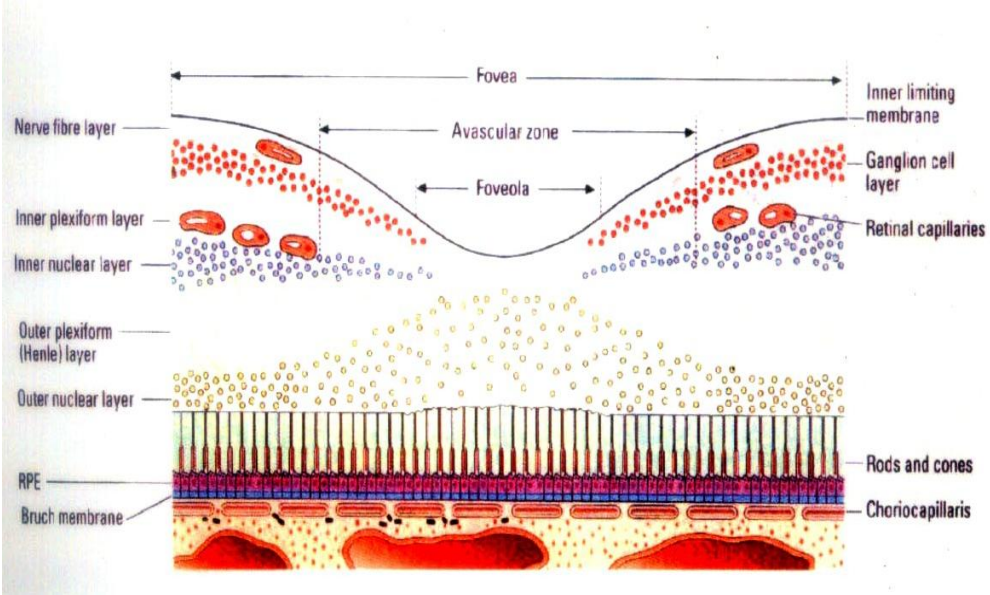


Fig 3.Histology of Macula

MACULAR FUNCTION TESTS

These are required for diagnosing as well as for following up of macular diseases and for evaluating the potential macular function in eyes with opaque media like in cataract, dense vitreous haemorrhage.

The retinal function testing can be divided into PSYCHOPHYSICAL and PHYSIOLOGICAL methods.

A Psychophysical test is subjective. A physical stimulus is presented to the patient and the patient indicates verbally or by other subjective means his detection of the stimulus.

Physiologic methods are objective. A stimulus is presented and a response parameter is measured by electro-physiological or other means.

PSYCHOPHYSICAL TESTS

1. Visual Acuity.
2. Pupillary Reaction.
3. Photostress test.
4. Amslers grid.
5. Two point discrimination test.
6. Entoptic phenomenon.
7. Tests dependent on macular pigment.
8. Maddox rod test.
9. Colour vision.
10. Foveal flicker sensitivity.
11. Grating psychophysics.
12. Dark adaptation.

13. Perimetry.
14. Laser interferometry.
15. Potential acuity meter.
16. Haidinger's brushes.
17. Maxwell's spot.
18. Koch's yellow filter test.

ELECTROPHYSIOLOGICAL TEST'S

1. Electroretinography (ERG).
2. Electrooculograhy (EOG).
3. Visually evoked response (VER).

AETIOLOGY OF NEURORETINITIS

Neuroretinitis is thought to be an infectious or immune mediated process that may be precipitated by a number of different agents. The common infections that cause neuroretinitis are cat-scratch disease, spirochetes especially syphilis[8], lyme disease, and leptospirosis[2]. Cat-scratch disease accounts for one third of infectious cases[9,10]. Additional causes include toxoplasmosis[11], mumps[12], salmonella[13], tuberculosis[14] and histoplasmosis. Despite thorough evaluation, approximately one half of cases remain idiopathic.

Neuroretinitis is commonly associated with an antecedent viral syndrome, suggesting a possible viral etiology in up to 50% of the cases; however viruses are rarely cultured from the CSF of such patients and serological evidence of a concomitant viral infection is usually lacking.

I. Infectious

1. Viruses-

i. Herpes simplex
ii. Hepatitis B
iii. Mumps
iv. Herpes Zoster
v. HIV
vi. HBV

2. Parasites-

i. Toxoplasma,
ii. Toxocara

3. Fungi-

i. Histoplasmosis

4. Bacteria-

i. Syphilis
ii. Leptospirosis
iii. Cat scratch disease
iv. Lyme disease
v. Tuberculosis
vi. Salmonella

II. Parainfectious (Immune mediated)

III. Idiopathic (Leber's stellate neuroretinitis)

Cat scratch disease

Cat-scratch disease, a systemic infection caused by the pleomorphic gram-negative bacillus Bartonella henselae, is the most common infectious process associated with neuroretinitis.

Patients present following cat exposure with fever, malaise, headache, eye pain and blurred vision. Examination typically reveals local lymphadenopathy. Some patients also have symptoms of arthritis, hepatitis, meningitis, or encephalitis.

Decreased visual acuity (ranging from 20/40 to counting fingers) is often associated with dyschromatopsia and afferent pupillary defect. Ophthalmoscopic findings include neuroretinitis, cottonwool spots, multiple discrete lesions in the deep retina, and stellate macular exudates.

B. henselae infection is confirmed with positive blood cultures or elevated immunofluorescent antibody titers or both. Therapy is aimed to promote resolution of neuroretinitis, restoration of visual acuity, and clearance of bacteremia[9]. Electrophysiologic studies show that when compared to the fellow eye, affected eyes have subnormal contrast sensitivity, abnormal color vision, and abnormal visually evoked potentials. However ERG may be normal. Recently polymerase chain reaction has been found to be a valuable method of diagnosing cat-scratch disease when serology is considered negative or borderline[17].

AIDS-associated CSD neuroretinitis may additionally have conjunctival and retinal bacillary angiomatosis. Although a self-limiting disorder, systemic corticosteroids with or without systemic antibiotics have been reported to be effective in this condition.[16] Azithromycin, ciprofloxacin, rifampicin, parenteral gentamicin, or trimethoprim-sulfamethoxazole has been found to be effective in immunocompromised patients.

Lyme disease

Neuroretinitis in Lyme disease may be unilateral or bilateral, but when bilateral is usually simultaneous and symmetric[18]. The patients usually live or work in an endemic area and may give a history of a tick bite within the last 6 months.

They often have cutaneous, cardiac and neurological manifestations. Cardiac manifestations include atrioventricular block, myocarditis, cardiomyopathy, and pericarditis. Neurological manifestations include meningitis, myelitis, encephalitis, cranial and peripheral neuropathies.

Although **ocular manifestations** of Lyme disease have long been noted, they remain a **rare feature** of the disease. The spirochete invades the eye early and remains dormant, accounting for both early and late ocular manifestations. A nonspecific follicular conjunctivitis occurs in approximately 10% of patients with early Lyme disease. Keratitis is characterized by nummular non-staining opacities. Inflammatory syndromes such as vitritis and uveitis, have been reported; in some cases, a vitreous tap is required for diagnosis. Neuro-ophthalmic manifestations include neuroretinitis, multiple cranial nerves involvement and optic atrophy.

Criteria for establishing that eye findings can be attributed to Lyme disease include the lack of evidence of other disease, other clinical findings consistent with Lyme disease, occurrence in patients living in an endemic area, positive

serology, and in most cases, response to treatment. Management of ocular manifestations often requires intravenous therapy[18].

Leber's stellate retinopathy

When there is no proven etiology to the disease, a diagnosis of Leber's idiopathic stellate retinopathy is made[19]. Thus it is a diagnosis of exclusion made after other known causes of neuroretinitis are ruled out.

It usually affects **children or young adults**. This diagnosis is mostly not assigned to patients aged more than 50 years until treatable causes of neuroretinitis or a macular star have been excluded. Most cases are unilateral. The incidence is equal in both sexes.

Patients present with acute loss of vision with or without ocular pain. A nonspecific viral illness precedes or accompanies the visual loss. Presenting visual acuity may be 20/20 to LP. But, most cases are in the 20/40 to 20/200 range.

In children, Leber's neuroretinitis must be distinguished from anterior optic neuritis and papillitis, since multiple sclerosis occasionally develops in children with these diseases[20]. A distinguishing feature is the development of macular star. In Leber's disease, the target tissue as suggested by Gass [21] is vascular whereas in anterior optic neuritis caused by demyelinating disease, the target tissue is primarily neural. Leber's neuroretinitis usually resolves without treatment within 6-12 weeks[19]. However the macular star may persist beyond this

period. Most patients recover good visual acuity with over 90% returning to 20/50 or better. Recurrences are very rare although in bilateral cases, involvement of the fellow eye may follow the first. Fluorescein study demonstrates intense hyperfluorescence due to leakage from capillaries within the disc. There is no leakage from the retinal vessels in the macula.

Idiopathic retinal vasculitis aneurysms and neuroretinitis (IRVAN)

IRVAN syndrome is the acronym for idiopathic retinal vasculitis, aneurysms and neuroretinitis. This syndrome typically affects young, healthy individuals; it has a female predominance, is usually bilateral and is not associated with any systemic abnormalities.

The most characteristic feature is the presence of macroaneurysms seen as dilatations of the retinal and optic nerve head arterioles. Exudative retinopathy and capillary nonperfusion is usually seen adjacent to retinal and optic nerve head aneurysms and is concentrated in the peripapillary location. This condition is not a true neuroretinitis as there is no clinically evident neuropathy but only late diffuse staining of the optic nerve head due to local vascular changes. There is little role of steroids and panretinal photocoagulation is advocated if retinal neovascularisation occurs[22].

Diffuse unilateral subacute neuroretinitis (DUSN)

DUSN is a progressive parasitic disease affecting the outer retina and retinal pigment epithelium (RPE). This syndrome is primarily unilateral, although

bilateral cases have occurred. The ocular findings include visual loss, vitreous cells, optic disc inflammation and leakage, transient recurrent crops of gray-white outer retinal lesions[23]. Stationary or migrating nematodes have been identified deep in the retina or in the subretinal space. DUSN is a condition in which prompt identification and destruction of the infecting nematode can result in the cessation of symptoms and the preservation of good visual acuity. If untreated, the disease progressively damages the retina and the optic nerve leading to severe visual loss. Laser photocoagulation of the nematode is the treatment of choice[24].Visual acuity may not improve significantly unless the worm is killed soon after onset of visual loss.

It has been found that thiabendazole is effective in the treatment of some patients when the worm cannot be found and when DUSN is accompanied by a moderate degree of vitritis that is associated with a breakdown in the blood-retinal barrier.[25] However antihelminthics have not been found to be that effective in confirmed cases of DUSN[26]. Regardless of the nature of the causative nematode, DUSN should always be suspected in healthy patients with unilateral ocular signs of persistent vitritis associated with papillitis, retinal vasculitis, and multifocal lesions involving the outer retinal layers.

Mutiple sclerosis

Multiple sclerosis is one condition that is not associated with neuroretinitis[2]. It is a well known fact that patients who develop typical optic

neuritis are prone to develop multiple sclerosis but there is no similar increased tendency for patients who experience an attack of neuroretinitis[27]. Thus, when a diagnosis of an attack of acute optic neuropathy as an episode of neuroretinitis rather than anterior optic neuritis is made, it substantially alters the neurologic prognosis in the patient being evaluated. Nevertheless, there have been anecdotal reports of patients with multiple sclerosis who developed neuroretinitis [28].

PATHOLOGY OF NEURORETINITIS

The pathogenesis of neuroretinitis is associated with the direct involvement of the optic nerve fibres by the infectious process or the inflammation leading to edema and fluid exudation from the inflamed cellular area of the peripapillary retina. Since macular exudates result more likely from the primary optic nerve disease, rather than from the inflammation of the retina, the idiopathic variety is also called as 'idiopathic optic disc edema with a macular star' rather than 'neuroretinitis'. [6] There is abnormal permeability of capillaries deep within the optic disc, with no abnormality of retinal vasculature. This results in leakage of lipid-rich exudates into the adjacent subretinal space and outer plexiform layer. With reabsorption of serum, lipid precipitates in a stellate pattern. When optic disc swelling and macular star are associated with focal or multifocal inflammatory lesions in the retina (retinitis), especially if an infectious cause is documented, the term neuroretinitis is doubtful. The macular exudates may not develop until two weeks after the onset; hence, the need to reexamine patients with acute papillitis with a normal macula within two weeks for development of macular star figure.

CLINICAL FEATURES

The clinical picture of neuroretinitis is characteristic and clinically distinct from other optic neuropathies.

The condition is usually painless but some patients complain of eye pain that may worsen with eye movements as seen in optic neuritis.If the neuroretinitis is due to an infectious process, there may be associated fever, malaise or headache.

Visual acuity at presentation can range from 20/20 to light perception. The degree of colour deficit is usually worse than the degree of visual loss would suggest.

The most common field defect is a cecocentral scotoma, but central scotomas, arcuate defects, and even altitudinal defects may be present. A relative afferent pupillary defect is present in most patients, unless the condition is bilateral. This is indicative of optic disc involvement. Absence of afferent pupillary defect indicates a primary macular involvement[4]. The degree of optic disc swelling ranges from mild to severe, depending in part on the timing of the first examination. In severe cases, splinter hemorrhages may be present. Segmental disc swelling has been reported.

A macular star figure composed of lipid (hard exudates) may not be present when the patient is examined soon after visual symptoms begin, but tends to become more prominent as the optic disc swelling resolves[5]. Small, discrete,

usually white, chorioretinal lesions may occur in both the symptomatic and asymptomatic eyes[6].

Posterior inflammatory signs consisting of vitreous cells and venous sheathing as well as occasional cells and flare may occur.

INVESTIGATIONS TO DETERMINE THE ETIOLOGY OF NEURORETINITIS

Ocular

1. Color vision,
2. Contrast sensitivity
3. Amslers grid
4. Fluorescein angiography
5. VEP

Systemic

1. Blood culture-cat scratch disease
2. VDRL and FTA-ABS- Syphilis
3. Viral serology
4. Mantoux , chest X ray
5. ESR
6. Lumbar Puncture- opening pressure, cells, proteins, glucose,
7. CSF culture for bacteria especially leptospirosis and fungi
8. Immunofluorescent antibody test- cat scratch disease
9. ELISA- Toxoplasmosis, Toxocariasis
10. Polymerase chain reaction- cat scratch disease
11. Neuroimaging

DIFFERENTIAL DIAGNOSIS

1. AION
2. Hypertensive retinopathy
3. BRVO/CRVO, rarely papillophlebitis
4. Papilledema
5. Compressive optic neuropathy
6. Infiltrative optic neuropathy
7. Nonspecific uveitis

TREATMENT

Treatment of neuroretinitis depends on whether there is an underlying infectious or inflammatory condition that requires therapy. No treatment is required in the idiopathic group as the disease is self-limiting.

Cat-scratch disease is usually described as a benign, self-limited illness[30]. Patients with neuroretinitis associated with cat scratch disease have been treated with prednisolone, dexamethasone, clindamycin, ciprofloxacin, trimethoprim-sulfa, or tetracycline and all had improved vision.[31,32] Doxycycline and rifampicin appear to shorten the course of disease and hasten visual recovery. Long-term prognosis is good, but some individuals may acquire a mild postinfectious optic neuropathy.

Patients with neuroretinitis and secondary or late syphilis should be treated with intravenous penicillin, and patients with Lyme disease should also be treated with an appropriate antibiotic such as ceftriaxone, amoxycillin, or tetracycline. Though systemic steroids have been tried, there is no definite evidence that such treatment alters either the speed of recovery or the ultimate outcome.[19] The prognosis in most cases of idiopathic neuroretinitis is excellent as it is self limiting.

CLINICAL COURSE:

Neuroretinitis is usually a self-limited disorder with a good visual prognosis.

Typically over 6 to 8 weeks, the optic disc swelling resolves and the appearance of the disc becomes normal or mildly pale.

The macular exudates appear late and progress over about 7 to 10 days, then remain stable for several weeks before gradual resolution occurs over 6 to 12 months.

Most patients ultimately recover good visual acuity, although some complain of persistent metamorphosia or nonspecific blurred vision from mild disruption of the macular architecture.

Most patients do not experience a subsequent attack in the same eye, and only a few patients develop a similar attack in the fellow eye.

Recurrent Idiopathic Neuroretinitis is an uncommon condition in which repeated acute episodes lead to progressive and permanent visual loss[4]. This disorder usually affects young adults and has no predilection with regard to sex. The interval between attacks is quite variable ranging from 1 month to 9.8 years. Treatment of the acute attack with either oral or intravenous corticosteroids has not appeared to alter the visual prognosis of this condition. Although the cause of recurrent idiopathic neuro retinitis has not been elucidated, an autoimmune disorder has been proposed that involves occlusive vasculitis affecting the optic disc. Long-term immunosuppression has been tried in some of these patients.

OPTICAL COHERENCE TOMOGRAPHY

Optical Coherence Tomography is a new diagnostic tool that can perform tomography or cross – sectional imaging of biological tissues with ≤10 microns axial resolution using light waves.

Principle:

It uses infrared light. The speed of light is almost a million times faster than sound and this difference allows the measurement of structures with resolution of ≤ 10 microns compared to 100 micron scale of ultrasound.

Ultrasound needs contact with the tissue under study, whereas OCT does not require any contact.

It is a non contact, non – invasive device where a broad band width of near infra –red light beam (820nm) is projected on to the retina. The light gets reflected from the boundaries between the microstructure and also gets scattered differently from tissues with different optical properties. It then compares the echo time delay of the same wavelength that is reflected from a reference mirror at a known distance.

Optical coherence tomography uses, low coherence or white light interferometry to perform high resolution measurements and imaging.

An optical beam from a laser or light source which emits short optical pulses or short coherence length light is directed onto a partially reflecting mirror (optical beam splitter). The partially reflecting mirror splits the light into two beams, one beam is reflected and the other is transmitted. One light beam is directed on to the patient's eye and is reflected from intraocular structures at different distances. The reflected light beam from the patient's eye consists of multiple echoes which give information about the range or distance and thickness of different intra-ocular structures. The second beam is reflected from a reference mirror at a known spatial position. This retro-reflected reference optical beam travels, back to the partial mirror (beam splitter) where it combines into the optical beam reflected from the patient's eye.

When the two light pulses co-incide they produce a phenomenon known as interference which is measured by a light sensitive detector (photodetector). Thus the interferometer can precisely measure the echo structure of reflected light and perform high resolution measurements of the distance and thickness of different tissue structures. The key feature of interferometer is that it can measure the time delay of optical echoes by comparing the reflected light beam with a reference beam. While the explanation presented here assumes that the light is composed of short optical pulses, the measurement may also be performed using non-pulsed or continuous light with a short coherence length. For this reason, the measurement technique has been termed ‘low coherence interferometer’.

The light source for the interferometer is a compact super luminescent diode, which is coupled directly into an optical fiber. This light source is similar to laser diode used in optical compact disc players, except in OCT, the diode source is designed to emit short coherence length light. The interferometer is constructed using a fiber optic coupler which functions, analogous to a beam splitter. The arm of the interferometer which consists of reference mirror is located within the instrument, while the optical fiber in the second arm of the interferometer is connected to the OCT ophthalmic instrument resembling a slit lamp biomicroscope or fundus camera.

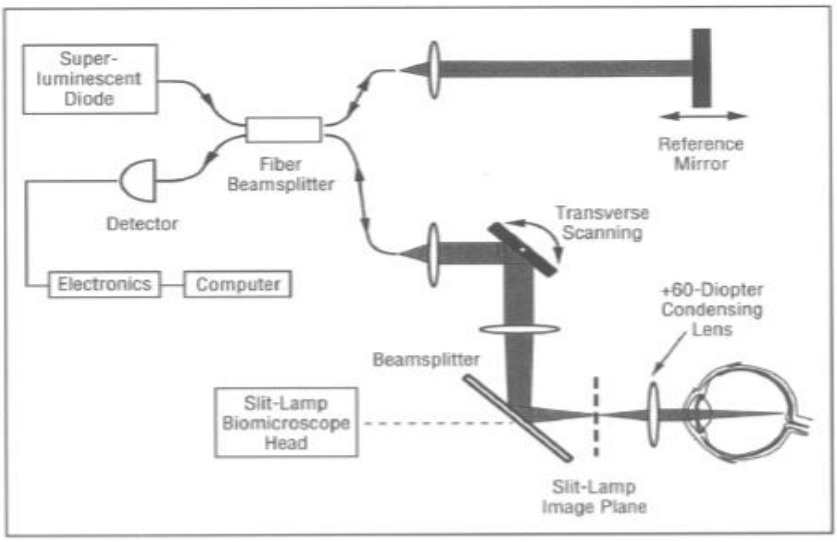


Fig 4. Schematic diagram of the fiber-optic interferometer and imaging optics comprising the optical coherence tomographic scanner.

Image resolution

The image resolution of OCT in the axial (or longitudinal) verses transverse directions is determined by different mechanisms. The resolution of the image in the axial (longitudinal) direction is determined by the resolution of the optical ranging measurement. This is determined by the physical properties of light source which is used for the measurement. If a short pulse laser source is used, the axial resolution is determined by the pulse duration. Conversely, if a continuous, low-coherence light source is used, the axial resolution is determined by the 'coherence length' of the light source. It is important to note that the measurement of distance or tissue thickness can, in practice, be performed with significantly higher resolution than this limit.

The transverse resolution of the image is determined by the size of the focused optical beam. This is a function of the optics used to project the beam onto the eye and this is determined by factors such as whether imaging is performed over a large depth, such as in the anterior eye, or whether the focusing angle is restricted, as in imaging the retina. The image resolution is also a function of the size of the tomogram that is desired.

OCT Scan Protocols in Macula

The protocols that are helpful in macular diseases are the following ;

(i) Line Scan

The line scan gives an option of acquiring multiple line scan without returning to main window. The length of the line scan and the angle can be altered, though one has to keep in mind that as the scan length increases the resolution decreases.

(ii) Radial Lines

The scan protocol consists of 6 -24 equally spaced line scans that can be varied in size and parameters. All the lines pass through a central common axis. The radial lines are useful for acquiring macular scan and retinal thickness / volume analysis.

(iii) Macular thickness map

This is the same as radial lines except that the aiming circle has a fixed, diameter of 6mm. This helps in measuring the retinal thickness.

(iv) Fast macular thickness map

It is designed for use with retinal thickness analysis. When done in both the eyes, it can be used for comparative retinal thickness / volume analysis. It is a quick protocol that takes only 1.95 sec to acquire six scans of 6mm length each.

(v) Raster Line

This provides an option of acquiring series of line scans that are parallel, equally spaced and are 6 – 24 in number. These multiple lines scans are placed over rectangular regions, the area of which can be adjusted so as to cover the entire area of pathology. This is especially useful in conditions like choroidal neo-vascular membrane one wishes to obtain scans at multiple levels.

(vi) Repeat:

Repeat protocol enables one to repeat any of the previously saved protocols using same set of parameters, which includes scan size, angle, placement of fixation, light emitting diode (LED) and landmark.

Normal macular scan

On a 10mm horizontal line scan passing through the foveal centre, one can clearly demarcate two major landmarks namely optic disc and fovea.

1. The optic disc is seen towards the right of the tomogram and is easily identifiable by its contour.

2. The central depression represents the optic head cup and the stalk continuing behind is the anterior part of the optic nerve.

3. The fovea is seen to the left and is easily identifiable by the characteristic thinning of retinal layers.

4. The vitreous anterior to the retina is non-reflective and is seen as a dark space.

5. The interface between the non – reflective vitreous and back scattering retinal layers is the vitreo-retinal interface.

6. The retinal nerve fiber layer is highly reflective and increases in thickness towards the optic nerve.

7. The posterior boundary of the retina is marked by a hyper – reflective layer that represents retinal pigment epithelium(RPE) and chorio capillaries.

8. Just anterior to RPE – chorio-capillaries complex is a minimally reflective layer that represents photoreceptors.

9. Above this layer of photoreceptors are alternating layers of moderate and low reflectivity that represents different layers of neuro-sensory retina.

10. The retinal blood vessels within the neuro-sensory retina shows back scatter and also cast a shadow behind.

Image Interpretation:

OCT displays the tomograms in real time using a false colour code scale that represents the degree of light back scattering from tissues at different depths in the retina.

COLOUR CODES:

Blue, Black (dark colours) - regions of minimum relative optical reflectivity.

Red, White (bright colours)- regions of high optical reflectivity.

Deeper choroid and sclera represented as weak reflections due to signal attenuation.

Retinal pigment epithelium (RPE) and chorio-capillaries are seen as high reflective red layer.

Dark layer immediately anterior to retinal pigment epithelium is the photo receptor layer.

Middle retinal layer exhibits moderate back scattering.

Nerve fiber layer (NFL) is highly reflective and inner most.

Vitreo retinal interface is well defined due to contrast between NFL and non reflective vitreous.

Hyper – reflective lesions are:

Hard exudates: Seen as hyper – reflective shadows in the neuro-sensory retina that completely blocks the reflections from the underlying retina.

Blood: Blood causes increasing scattering. Small to thin hemorrhages are seen as hyper reflective lesions .Thick hemorrhages blocks the reflections from the underlying structure.

Scars: All fibrotic lesions including disciform scars, choroidal rupture scars, healed choroiditis etc are hyper – reflective.

Hypo – reflective lesions are:

a) Serous fluid:

Retinal edema is the commonest cause of reduced back scattering and one can actually point out the site of fluid accumulation. The serous fluid that is devoid of any particular matter produces an optically empty space with no back scattering.

b) Hypo – pigmented lesions of RPE.

Advantages of OCT over FFA

- Non contract, non invasive
- Time saving technique

- Totally avoids mild complications like nausea to life threatening hyper-sensitivity reactions seen in FFA.
- Measurement of retinal thickness by OCT correlates more strongly with visual acuity than the presence of leakage on angiography.
- OCT is effective and superior to FFA in demonstrating axial distribution of fluid.
- Can be repeated as many times needed.
- Can quantitatively assess retinal thickness and demonstrate any associated RPE structural anomalies.

PART II

AIMS AND OBJECTIVES

1. To correlate the visual outcome with macular (OCT) thickness and reduction of hard exudates (fundoscopy).

2. To find the cause of neuroretinitis.

3. To assess the improvement of visual acuity with treatment.

4. To describe the morphological features of neuroretinitis based on Optical Coherence Tomography.

5. To assess the cause in case of poor vision.

MATERIALS AND METHODS

Subject Selection: All new cases attending Ophthal OPD diagnosed with neuroretinitis in the period of 2 years (June 2009 and June 2011).

Inclusion Criteria:

1. All patients with defective vision due to neuroretinitis of infectious or inflammatory origin.
2. Patients of all age groups

Exclusion Criteria:

1. Associated retinal pathologies
2. Recurrent neuroretinitis
3. Hypertensive and diabetic retinopathy

All patients presenting with defective vision and fundus examination showing papillitis with macular star were investigated to rule out infectious etiology. Diabetic, hypertensive retinopathy and other fundus pathologies were ruled out.

Visual acuity, colour vision, pupillary assessment, visual field examination including amslers test, detailed fundus examination and investigations like TC, DC, ESR, TORCH screening,VDRL, ELISA for HIV, Mantoux test,chest Xray , BP,RBS were done.

Patients with idiopathic etiology were given intravenous bolus steroids (Methyl Prednisolone 500 mg twice daily for 3 days) and either

Tab. Ciprofloxacin 500mg BD or Cap. Doxycycline 100 mg OD for 14 days.

In case of tuberculosis patient was started on ATT followed by tab. prednisolone 1mg/kg/day was given.

Toxoplasmos was treated with oral steroids undercover of antibiotics.

CMV neuroretinitis was treated with intravenous acyclovir 500mg, 8th hourly for a period of 2 weeks.

Screening procedures at presentation and on each visit:

Visual acuity (BCVA)
Pupillary assessment
Colour vision
Visual fields
Fundus examination
Fundus photograph
Optical Coherence Tomography

Optical Coherence Tomography analysis of macular thickness was done using SD-OCT. Line scan and macular thickness map was done. The correlation of visual acuity with resolution of hard exudates on fundus examination and the corresponding reduction of macular thickness by OCT were analysed.

RESULTS

In this prospective observational study 22 eyes of 20 patients with neuroretinitis was included based on the inclusion and exclusion criteria.

AGE DISTRIBUTION OF CASES

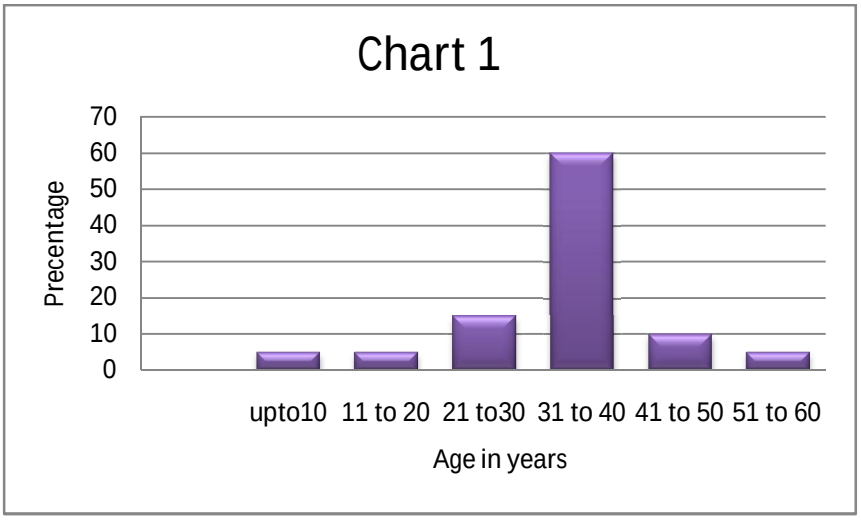
In our study the minimum age of presentation was 7 years and maximum age of 57 years with mean value of 33.55years (Table-1).

Table-1

AGE	MINIMUM	MAXIMUM	MEAN
0-60	7	57	33.55

Table-2

Age (years)	Frequency	Percent
Upto 10	1	5
11-20	1	5
21-30	3	15
31-40	12	60
41-50	2	10
51-60	1	5
Total	20	100

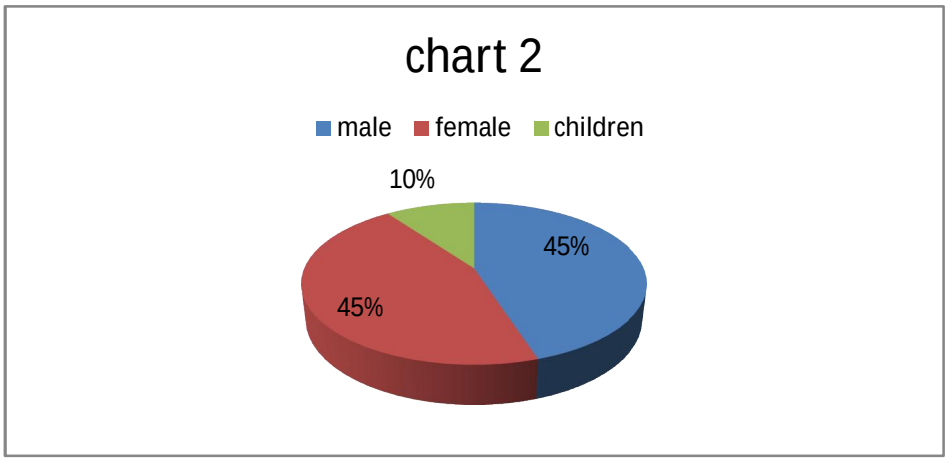


Regarding age distribution of cases 60% of patients belonged to 31-40 years, 15% in 21-30 years and 10% in 41-50 years and 5% each in rest of the groups (table -2).

Sex Distribution

Table -3

Sex	**FREQUENCY**	**PERCENT**
Male	9	45
Female	9	45
Children	2	10
Total	20	100

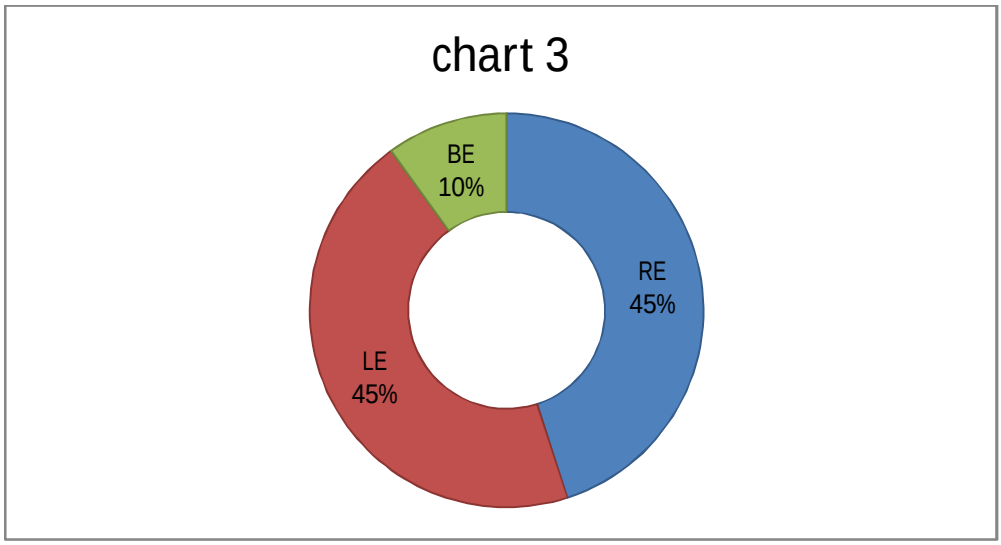


In our study males and females were affected equally (45% of cases), children in 2 cases (10%). (Table-3).

Laterality

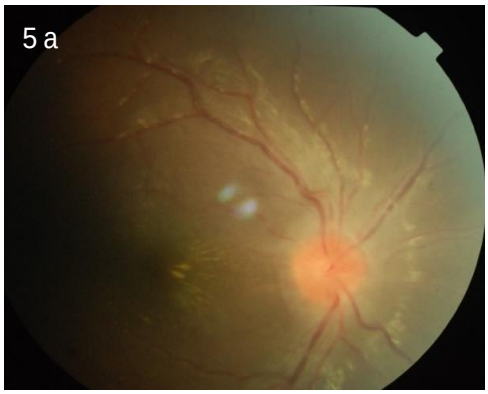
Table -4

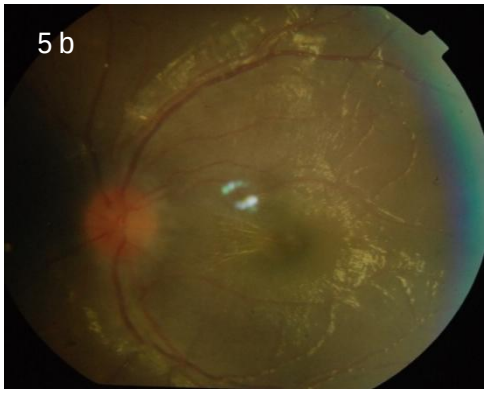
Eye	Frequency	Percent
RE	9	45
LE	9	45
Bilateral	2	10
Total	20	100

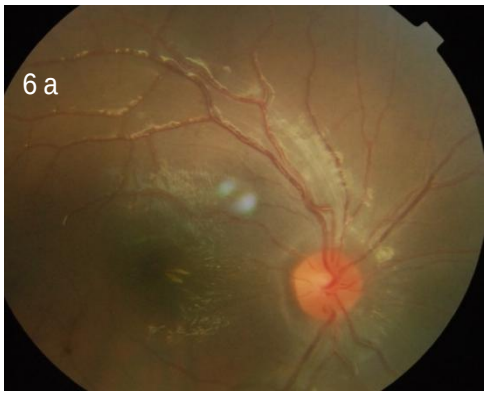


In our study the numbers of eyes affected were 45% each for right and left eye. Bilateral involvement is seen in 10% of cases (Table-4).

Case 9







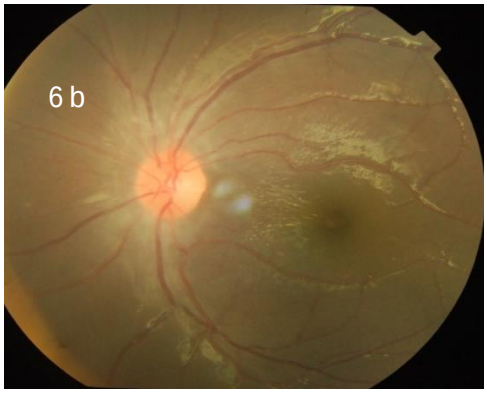


Fig 5 a,b Fundus photograph of case 9 showing bilateral neuroretinitis

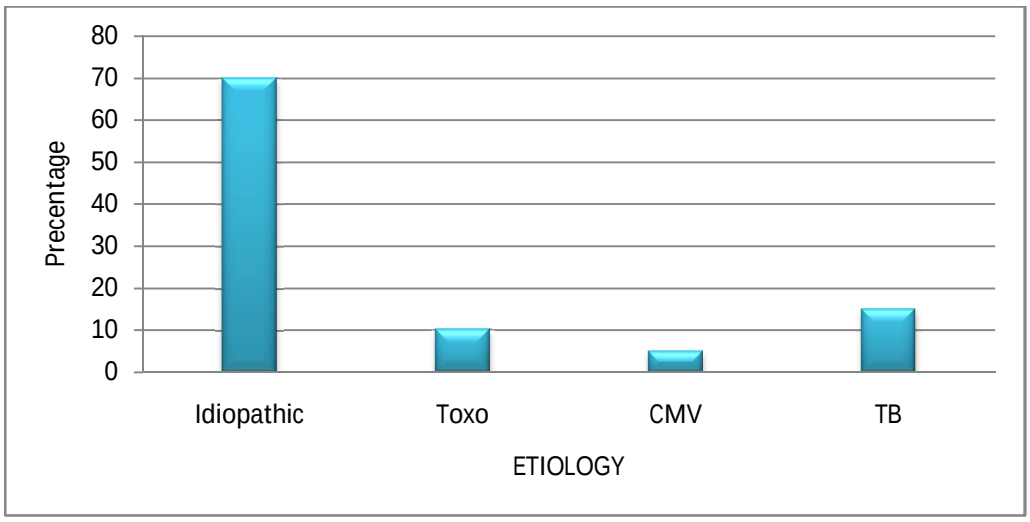
Fig 6 a,b Fundus pictures taken at 4 weeks follow up showing resolution of disc edema and hard exudates at macula.

Etiology

Table-5

Etiology	Frequency	Percent
Idiopathic	14	70
Toxo	2	10
CMV	1	5
TB	3	15
Total	20	100

CHART - 4



Regarding the etiology 14 cases (70%) were idiopathic, 2 patients (10%) were positive for toxoplasmosis, 3 patients (15%) positive for tuberculosis, 1 patient (5%) for cytomegalo virus (Table -5).

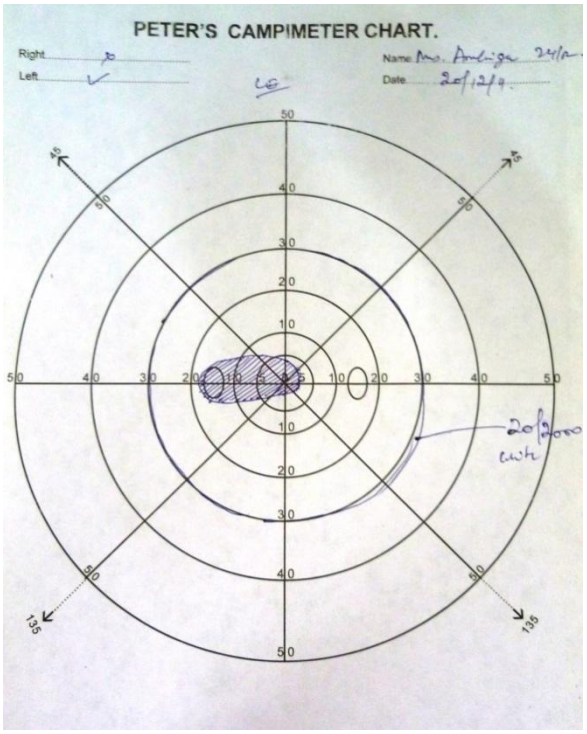


Fig 7. photograph of campimeter chart showing centrocaecal scotoma in left eye of case 19.

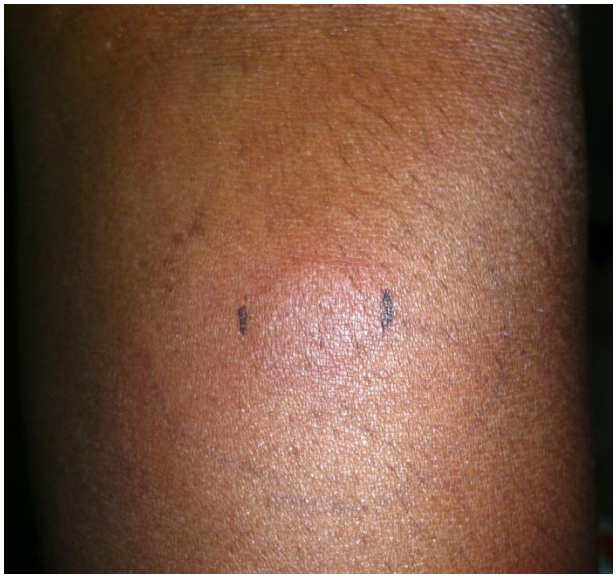


Fig 8. photograph showing positive mantoux test (18mm) in case 19.

Systemic features

Table-6

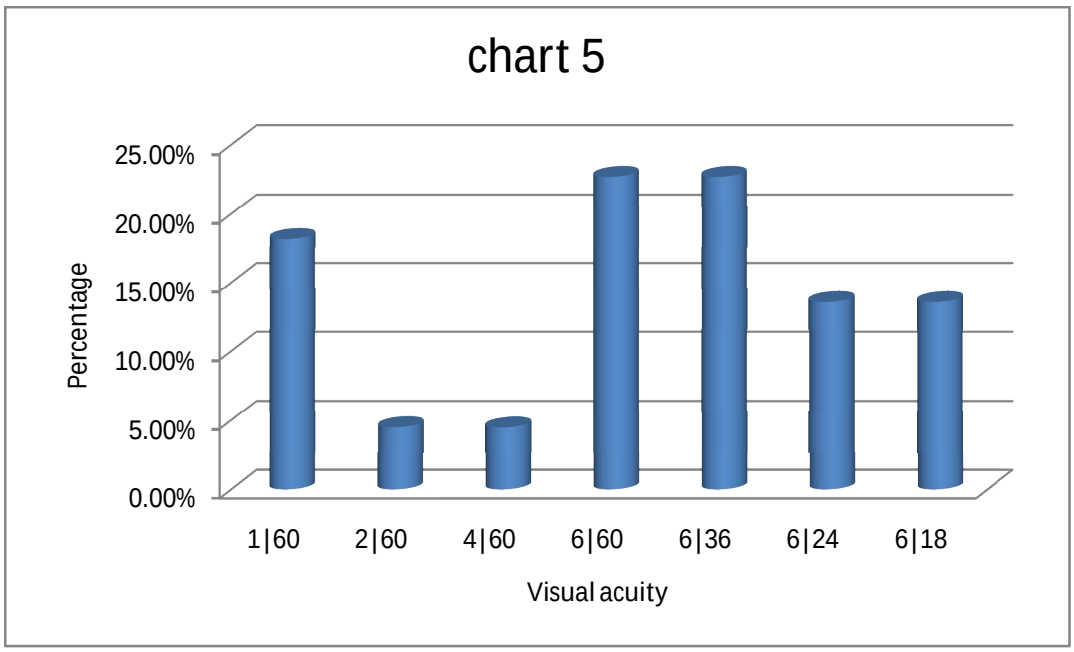
Systemic features	Frequency	Percent
Absent	13	65
Present	7	35
Total	20	100.0

Systemic features were present in 7 cases (35%) and absent in 13 patients (65%). One patient had fever and cerebellar ataxia, 6 patients had fever within 2 weeks before the onset of visual symptoms (Table-6).

Visual acuity at the time of presentation

Table-7

Visual acuity	**Frequency**	**Percent**
1/60	4	18.2
2/60	1	4.5
4/60	1	4.5
6/60	5	22.7
6/36	5	22.7
6/24	3	13.6
6/18	3	13.6
Total	22	100.0



Visual acuity at the time of presentation was 1/60 in 4 eyes (18.2%), 2/60 in 1 eye (4.5%), 4/60 in 1 eye (4.5%), 6/60 in 5 eyes(22.7%), 6/36 in 5 eyes(22.7%) 6/24 in 3 eyes(13.6%), 6/18 in 3 eyes (13.6%). The visual acuity was better (6/18-6/24) in patients who presented late, a month after the onset of visual symptoms (chart 5).

Time lag

Table-8

Time (days)	Frequency	Percent
0-14	4	20
15-21	13	65
More than 21	3	15

The time interval between the onset of symptoms and initial presentation at the hospital was between 2 to 3 weeks in 65% of cases, less than 2 weeks in 20% of cases, more than 3 weeks in 15% of cases. Range was between 10- 30 days with a mean value of 14.4 days (Table-8).

Visual fields

Table -9

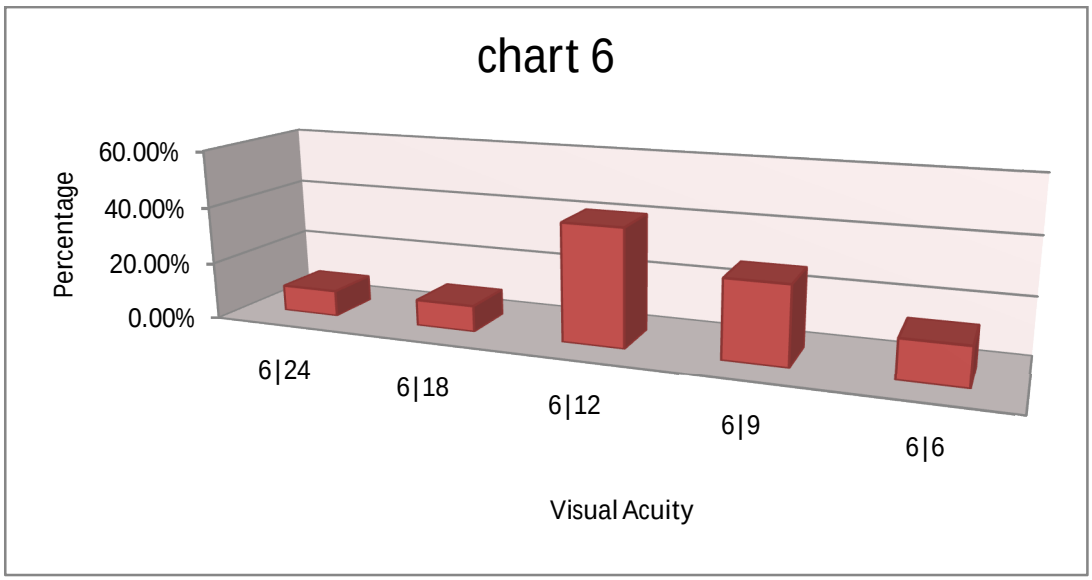
Visual fields	Frequency	Percent
Normal	2	9.10
Central scotoma	13	59.1
Centrocaecal scotoma	7	31.8
Total	22	100.0

Central fields were normal in 2 eyes of the same patient who presented 1 month after the onset of symptoms with features of resolution. Defective in 20 eyes (90.91%). All the patients had distortion of lines in amsler's test, 13 eyes (59.1%) had central scotoma, 7eyes (31.8) had centrocaecal scotoma (Table-9).

Visual acuity at 2 weeks

Table-10

V/A	Frequency	Percent
6/24	2	9.1
6/18	2	9.1
6/12	9	40.9
6/9	6	27.3
6/6	3	13.6
Total	22	100.0



Visual acuity improved 2 6/10 in 40.9% of eyes.6/9 in 27.30 % eyes 6/6 in 13.60% of eyes (table 10).

Visual fields at 2 weeks

Table -11

Visual fields	Frequency	Percent
Normal	4	18.2
Abnormal	18	81.8
Total	22	100.0

Visual fields examinations were normal in 4 eyes (18.2%), metamorphosia was present in 18 eyes (81.8%) and central scotoma in 2 eyes in addition (Table -11).

Visual acuity at 4 weeks

Table 12

Visual acuity	Frequency	Percent
6/9	3	13.6
6/6	19	86.4
Total	22	100.0

Visual acuity improved to 6/9 in 3 eyes (13.6%), 6/6 in 19 eyes (86.4%) at 4 weeks follow-up (Table 12).

Visual fields at 4 weeks

Table 13

Visual fields	Frequency	Percent
Normal	19	86.4
abnormal	3	13.6
Total	22	100.0

Visual field was abnormal in3 eyes (13.6%) all 3 eyes had persistence of metamorphosia (Table 13).

Fundus at 4 weeks

Table 14

Fundus examination	Frequency	Percent
Normal	6	22.27
Hard exudates+	16	72.73
Total	22	100.0

Fundus examination showed resolution of disc edema in all cases with normal macula (without hard exudates) in 6 eyes (22.27%). Hard exudates were present in 16 eyes (72.73%) at 4 weeks follow-up period (Table-14).

Hard exudates at 4 weeks on OCT

Table- 15

Exudates on OCT	Frequency	Percent
Absent	2	9.1
Present	20	90.9
Total	22	100.0

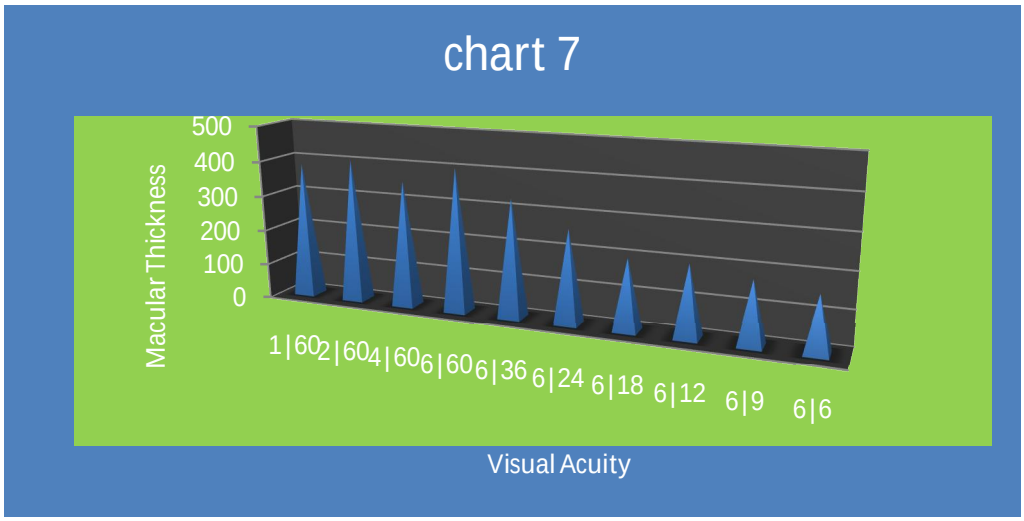
Hard exudates were present in 20 eyes (90.9%), absent in 2 eyes (9.1%) at 4 weeks follow-up (Table-15).

Optical Coherence Tomography

Central macular thickness at presentation

Table 16

V/A	No.	Mean	Minimum	Maximum
1/60	4	384.25	343	441
2/60	1	406.00	406	406
4/60	1	357.00	357	357
6/60	5	406.80	335	453
6/36	5	333.00	306	356
6/24	3	264.33	255	274
6/18	3	200.67	197	205
Total	22	336.09	197	453



OCT demonstrated flattening of the foveal contour, thickening of the neuro-sensory retina, and accumulation of sub retinal fluid (SRF) in all studied eyes. Retinal exudates appeared as multiple hyper-reflective foci in the outer plexiform layer. The average central macular thickness was 336µm (range 197–453µm) at presentation (chart 7).

Foveal thickness - 4 weeks

Table 17

V/A	N	Minimum	Maximum	Mean
6/9	3	135	182	163.00
6/6	19	145	167	154.68
Total	22	135	182	155.82

At the end of 4 weeks OCT demonstrated average central macular thickness of 155.82 µm with a range of 135 to 182µm and restoration of foveal contour to normal in all cases (Table 17).

Analysis of Central macular thickness

Table-18

Foveal thickness	N	Minimum	Maximum	Mean
At the time of presentation	22	197	453	336.09
At 2 weeks	22	147	267	193.36
At 4 weeks	22	135	182	155.82

Central macular thickness was in the range of 197-453 µm at the time of presentation with a mean value of 336.09. At 2 weeks follow up minimum thickness was 147µm and maximum was 267µm with mean of 193.36. Macular thickness was in the range of 135-182 µm with a mean value of 155.82 (Table-18).

In CHI-Sq. Chart correlation between visual acuity and macular thickness p value was 0.001 indicating in the difference in macular thickness is significant(>0.01).

INVESTIGATIONS

Table-19

Investigation	Frequency	Percent
Tuberculosis	3	15
IgM Toxoplasmosis	2	10
IgM CMV + TOXO	1	5
Normal	14	70
Total	20	100

In our study tuberculosis was positive in 3 cases (15%), IgM for toxoplasmosis in 2 cases (10%), IgM CMV+TOXO positive in 1 case (5%). No causative agent was identified in 14 cases (70%) (Table19).

TREATMENT

Table -20

TREATMENT	NO OF CASES	V/A AT 4 WKS			
		6/9	percent	6/6	Percent
STR+T.CIPRO	8	1	5	7	35
STR+C.DOX	8	1	5	7	35
STR+SYS.AB + SYS.AV	1	0		1	5
STR+ T.CIP+ATT	1	1	5	0	0
STR+C.DOX+ATT	2	0	0	2	10
total		3	15%	17	85%

In the treatment group patients treated with Tab.Cipro visual acuity was 6/6 in 7 cases (35%), 6/9 in 1 case (5%). In patients treated with Cap.Doxy visual acuity was 6/6 in 7 cases (35%), 6/9in 1 case (5%) (Table 20). Tuberculosis was treated with antituberculous treatment in addition to steroids and oral antibiotics. Patient with toxoplasmosis was treated with steroids undercover of Tab. Azithromycin. Intravenous acyclovir was given in a patient with serological evidence of CMV infection along with systemic antibiotics.

DISCUSSION

1. AGE

In this study 22 eyes of 20 patients were examined. Majority of the patients belonged to 30 to 40 years of age group. The minimum age of onset was 7 years and maximum age was 57 years with a mean of 33.55 years.

Glaser JS: Neuro-ophthalmology. Hagers-town, Md, Harper & Row Publishers Inc, 1978, vol 10, p 85 showed that neuroretinitis is more common in 3^{rd} to 4^{th} decade.

Chi SL, stinnett S, Duke eye center and Duke university medical centre, American Academy of Ophthalmology Sep 2011, have shown that in their study of 53 patients with neuroretinitis, the mean age of onset was 28.5 years with a range of 8-65 years.

2. SEX

In our study 9 females (45%), 9 males (45%) and 2 children (10%) were affected. The female to male ratio was 1:1.

Glaser JS: Neuro-ophthalmology. Hagers- town, Md, Harper & Row Publishers Inc, 1978, vol 10, p 85 have also shown similar findings in their study with no gender predilection.

3. LATERALITY

Right eye was affected in 9 cases (45%), left eye in 9 cases (45%) and both eyes in 2 cases (10%).

Carroll DM, Franklin RM. Leber's idiopathic stellate retinopathy,. Am J Ophthalmol 1982; 93: 96-101 shown that most of the cases were unilateral.

Chi SL, stinnett S, Duke eye center and Duke university medical centre, American Academy of Ophthalmology Sep 2011, in their study of 53 patients observed that 83% of cases were unilateral and 17% of cases were bilateral.

4. ETIOLOGY OF NEURORETINITIS

The etiology of neuroretinitis in our study was infection in 30% of cases. Tuberculosis (15%), toxoplasmosis (10%) constituted the majority of cases.70% of cases were idiopathic in etiology.

Walsh FB, Hoyt WF. Neuroretinitis. In: Clinical neuro-ophthalmology. 3 rd ed. Baltimore, Md: Williams and Wilkins Co; 1982. p. 234-5.

The etiopathology of neuroretinitis is obscure. Neuroretinitis is thought to be an infectious or immune-mediated process that may be precipitated by a number of different agents. Commonly associated with an antecedent viral syndrome, in up to 50% of the cases, viruses are seldom cultured from vitreous and aqueous humor and CSF of such patients, and the serological evidence of a concomitant viral infection is usually lacking. Proposed causative viral agents

include herpes simplex, hepatitis B, mumps and the herpes viruses associated with the acute retinal necrosis syndrome. Other common infections that cause neuroretinitis are CSD, spirochetosis especially syphilis, Lyme disease and leptospirosis. Presumed etiologies for neuroretinitis also include toxoplasmosis, toxocariasis and histoplasmosis.

5. TREATMENT OF NEURORETINITIS

In our study all the patients received high dose intravenous bolus methyl prednisolone along with oral antibiotics. Systemic antibiotics, antiviral drugs were given depending upon the etiology.

Ghuari, Lee A, Optic disc edema with a macular star, Survey of Ophthalmology 43(3); 270-274, 1998.

Purvin V, Sundarm S, Kawasaki A, Neuroretinitis: review of the literature and new observations J. Neuro-ophthalmology 31: 58-68; 2011

Treatment of neuroretinitis is directed underlying etiology. Tuberculosis requires consultation with an infectious disease specialist. If an infectious etiology is suspected appropriate workup with broad-spectrum antibiotic is started. Treatment includes observation, bolus intravenous steroids, steroid with antibiotic, steroids only.

6. VISUAL ACUITY AT PRESENTATION

In our study visual acuity at presentation was between 1/60 t0 6/18. Visual acuity at the time of presentation was 1/60 in 4 eyes (18.2%), 2/60 in 1 eye (4.5%), 4/60 in 1 eye(4.5%), 6/60 in 5 eyes(22.7%), 6/36 in 5 eyes(22.7%) 6/24 in 3 eyes(13.6%), 6/18 in 3 eyes (13.6%). The visual acuity was better (6/18-6/24) in patients who presented late, a month after the onset of symptoms.

Dreyer RF, Hopen G, Gass JDM, Smith JL: Leber's idiopathic stellate neuroretinitis. Arch Ophthalmol 1984; 102: 1140-45 showed that the Visual acuity at presentation can range from 6/6 to light perception.

Chi SL, stinnett S, Duke eye center and Duke university medical centre, American Academy Ophthalmology Sep 2011, study on clinical characteristics of cat scratch neuroretinitis showed that visual acuity at presentation ranged from 6/6 to counting fingers.

7. VISUAL ACUITY AT 4 WEEKS

Visual acuity improved to 6/6 in 19 eyes (86.4%), 6/9 in 3 eyes (13.6%) at 4 weeks follow-up period. Patients with final visual acuity of 6/9 at presentation had vision of 1/60, 2/60, 4/60 and presented at 20, 14, 20 days respectively.

Dreyer RF, Hopen G, Gass JDM, Smith JL: Leber's idiopathic stellate neuroretinitis. Arch Ophthalmol 1984; 102: 1140-45 observed that 26 of 27 patients recovered vision of 6/12 or better within 2 months follow-up.

8. FUNDUS EXAMINATION AT 4 WEEKS

Fundus examination showed resolution of disc edema in all cases with normal macula (without hard exudates) in 6 eyes (27.3%). Hard exudates were present in 16 eyes (72.7%) at 4 weeks follow-up period.

Dreyer RF, Hopen G, Gass JDM, Smith JL: Leber's idiopathic stellate neuroretinitis. Arch Ophthalmol 1984; 102: 1140-45 showed that over 6 to 8 weeks,the optic disc swelling resolves, and the appearance of the disc becomes normal or mildly pale. The macular exudates appear late and progress over about 7 to 10 days, then remain stable for several weeks before gradual resolution occurs over 6 to 12 months.

9. OPTICL COHERENCE TOMOGRAPHY EXAMINATION

OCT demonstrated flattening of the foveal contour, thickening of the neuro-sensory retina, and accumulation of sub retinal fluid (SRF) in all studied eyes. Retinal exudates appeared as multiple hyper-reflective foci in the outer plexiform layer. The average central macular thickness was 336μm (range 197–453μm) at presentation. The macula appeared normal in contour on repeated exams during follow-up and presence of hard exudates in 17 eyes (77.27%).

Macular findings on optical coherence tomography in cat-scratch disease neuroretinitis; Z Habot-Wilner, D Zur, M Goldstein, D Goldenberg, S Shulman, A Kesler, M Giladi and M Neudorfer

Eight eyes of seven patients with confirmed CSD neuroretinitis, mean age 33±9.9 years, range (6–48 years) were included in the study. All patients presented clinically with optic nerve swelling and macular edema or macular exudates. OCT demonstrated flattening of the foveal contour, thickening of the neurosensory retina, and accumulation of subretinal fluid (SRF) in all studied eyes. Retinal exudates appeared as multiple hyper-reflective foci in the outer plexiformlayer. The average central macular thickness was 460μm (range 170–906μm) and the average maximal retinal thickness was 613μm (range 387–1103μm), at presentation. The macula appeared normal on repeated scans during follow-up.

Case 1

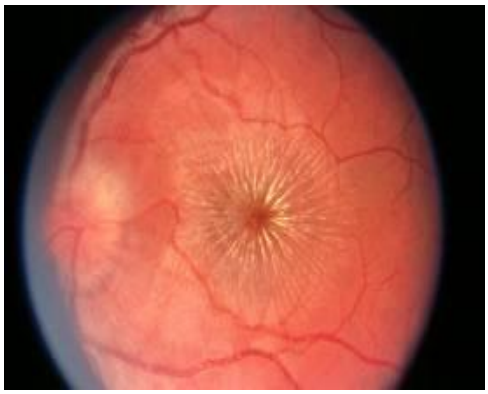


Fig 9.Fundus photograph showing macular star and disc edema.

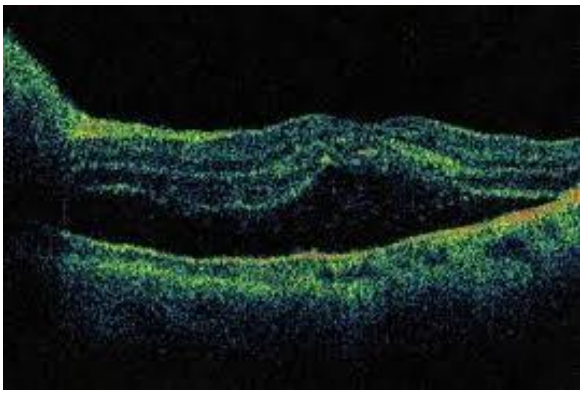


Fig 10. OCT picture showing serous retinal detachment

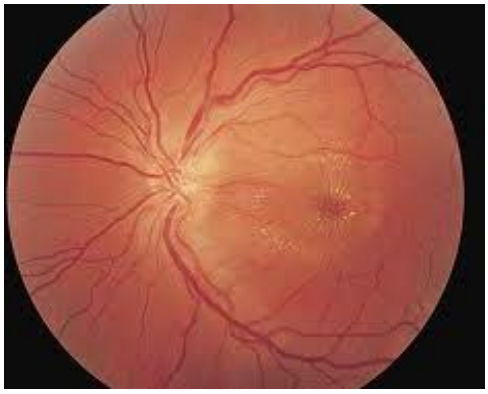


Fig 11 Fundus photograph showing resolution of disc edema and macular star.

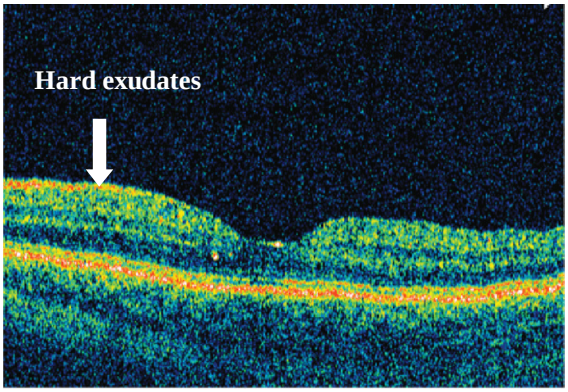


Fig 12. OCT picture showing resolution of serous detachment and presence of hard exudates.

CASE 6

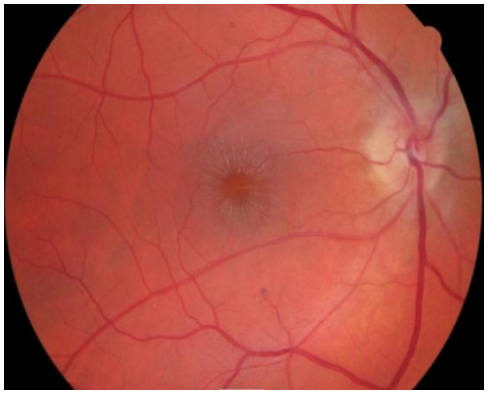


Fig.13 Fundus photograph of patient 1 showing disc edema, macular star

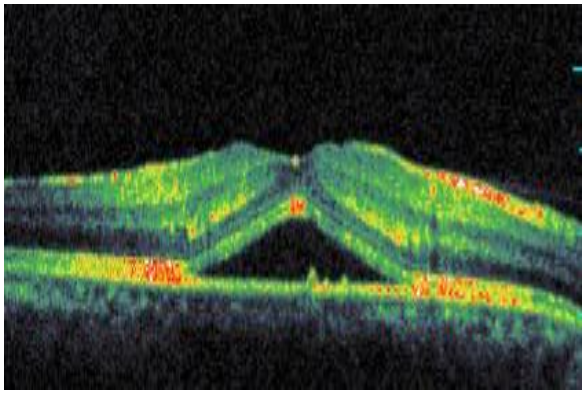


Fig.14 OCT Picture showing small serous retinal detachement

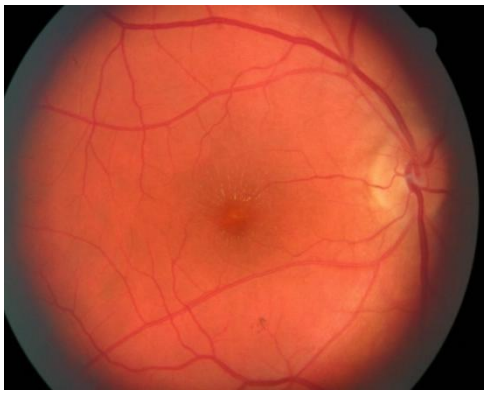


Fig.15 Fundus photograph showing resolution of disc edema and persistence of macular star.

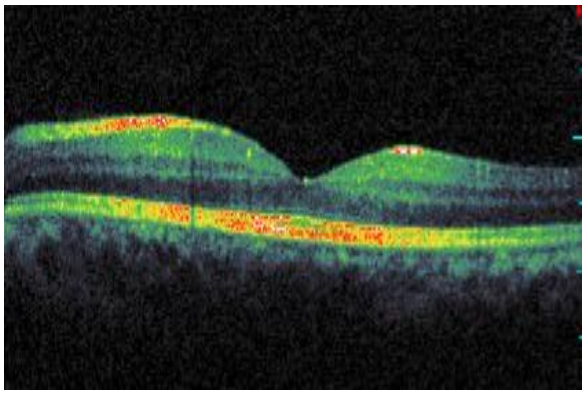


Fig.16 OCT picture showing resolution of serous detachment and presence of hard exudates

CASE 19

Fig.17 Fundus photograph showing disc edema with macular star

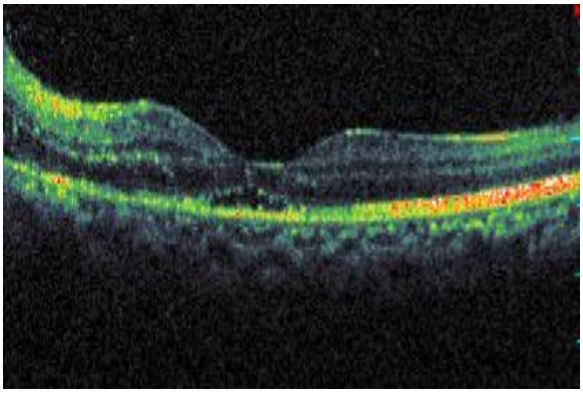


Fig .18 OCT picture showing small sub foveal serous detachment of macula

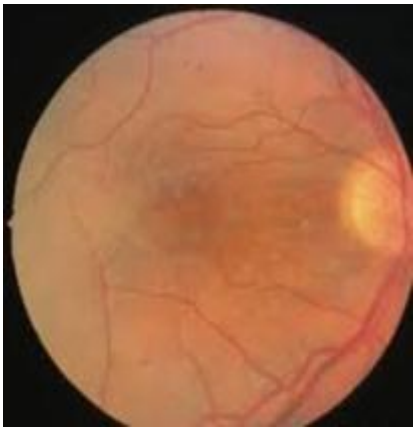


Fig 19 Fundus photograph showing resolution of hard exudates and disc edema at 4 weeks.

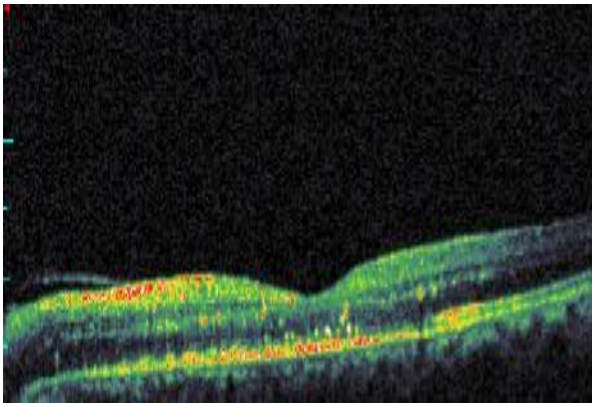


Fig 20 OCT picture showing resolution of serous detachment and prominence of hard exudates.

CONCLUSION

To conclude in our study the following observations were made

1. Neuroretinitis was more common between 3rd to 4th decades of life.
2. Males and females were equally affected.
3. Presentation was unilateral in most of the cases.
4. Bilateral presentation was common in children.
5. Bilateral presentation was most likely to be associated with an infectious etiology.
6. In adults with systemic manifestations, infectious etiology should be ruled out.
7. Presenting visual acuity was between 6/60 and 6/36 in 45.4% of patients.
8. Visual acuity was 6/24 or better in patients who presented late during the course of illness suggesting spontaneous recovery.
9. All the patients had final visual acuity of 6/9 or better.
10. Metamorphosia was present in 90.91% of patients at the time of presentation.
11. Central and centrocaecal scotoma was the commonest visual field defect encountered.
12. Metamorphosia resolved in 95% of patients.
13. Central and centrocaecal field defects resolved in all patients.

14. Pupil showed relative afferent pupillary defect in 91% of eyes at the time of presentation.

15. RAPD improved with visual improvement.

16. Colour vision was defective in 91% of eyes

17. Colour vision returned to normal in all cases.

18. Macular edema was observed as early as 5 days.

19. Hard exudates were present in the macula as early as 7 days after the onset of visual symptoms.

20. Disc edema started resolving with appearance of hard exudates in macula and was complete at 4 weeks.

21. Visual acuity and field defects improved with the resolution of macular edema suggesting that macular edema was the cause of defective vision and field defects.

22. Neuroretinitis was idiopathic in etiology in 70% of patients.

23. Tuberculosis and Toxoplasmosis was the common infectious agent in 25% of patients.

24. Visual improvement was faster when treated with steroids and antibiotics

25. No significant difference in final visual acuity on treatment with either Tab. Cipro or Cap .Doxy.

26. Optical coherence tomography of macula showed serous macular detachment in all cases

27. OCT demonstrated flattening of the foveal contour, thickening of the neuro-sensory retina, and accumulation of sub retinal fluid (SRF) in all studied eyes. Retinal exudates appeared as multiple hyper-reflective foci in the outer plexiform layer.

28. Improvement in visual acuity was associated with resolution of macular edema on fundoscopy and reduction of macular thickness on OCT.

29. Hard exudates became more prominent with resolution of macular edema and resolution of disc edema.

30. Hard exudates were present on fundus examination in 72% of cases at 4 weeks follow up. OCT demonstrated hard exudates in 91% of cases.

31. Reduction of macular edema correlated well with improvement in visual acuity rather than resolution of hard exudates.

32. Persistence of metamorphosia in some cases may be due to persistence of hard exudates at macula demonstrated well on OCT.

33. Macular thickness on OCT correlated well with visual acuity. Greater the central macular thickness poorer the visual acuity. OCT is an adjuvant tool in management of neuroretinitis.

LIMITATION OF THE STUDY

Due to Economic constraints ELISA for Toxocara and Bartonella were not done in our study.

BIBLIOGRAPHY

1. Maitland CG, Miller NR. Neuroretinitis. Arch Ophthalmol.1984; 102: 1146-50.

2. Walsh FB, Hoyt WF: Neuroretinitis. In Clinical Neurophthalmology. Ed 3. Baltimore, Md, Williams & Wilkins Co, 1982, p 234-235.

3. Glaser JS: Neuro-ophthalmology. Hagers-town, Md, Harper & Row Publishers Inc, 1978, vol 10, p 85.

4. Purvin V, Chioran G. Recurrent neuroretinitis. Arch Ophthalmol. 199; 112: 365-371.

5. Gass JDM: Stereoscopic Atlas of Macular Disease, Diagnosis and Treatment, 2nd ed. St.Louis, CV Mosby, 1977, pp. 376-379.

6. Carroll DM, Franklin RM. Leber.s idiopathic stellate retinopathy. Am J Ophthalmol 1982; 93: 96- 101.

7. Purvin V, Ranson N, Kawasaki A. Idiopathic recurrent neuroretinitis-Effects of long-term immunosuppression. Arch Opthalmol 2003; 121:65-67.

8. Folk JC, Weingeist TA, Corbett JJ, Lobes LA, Watzke RC. Syphilitic neuroretinitis. Am J Ophthalmol. 1983; 95: 480-486.

9. Reed JB, Scales DK, Wong MT, Lattuada CP. Bartonella henselae neuroretinitis in cat scratch disease. Diagnosis, management and sequelae. Ophthalmology 1998; 105: 459-466.

10. Suhler EB, Lauer AK, Rosenbaum JT. Prevalence of serologic evidence of cat scratch disease in patients with neuroretinitis. Ophthalmology. 2000; 107: 871- 876.

11. Fish RH, Hoskins JC, Kline LB. Toxoplasmosis neuroretinitis. Ophthalmology. 1993;100: 1177-1182.

12. Foster RE, Lowder CY, Meisler DM, Kosmorsky GS, Baetz-Greenwalt B. Mumps neuroretinitis in an adolescent. Am J Ophthalmol. 1990; 110:91-93.

13. Fusco R, Magli A, Guacci P. Stellate maculopathy due to salmonella typhi: a case report. Ophthalmologica. 1986; 192:154-158.

14. Duke-Elder S, Dobree JH:Diseases of the retina. In Duke-Elder (ed); System of Ophthalmology, vol.10 London, Henry Kimpton, 1967, pp. 126-127.

15. Bird AC, Smith JL, Curtin VT. Nematode optic neuritis Am J Ophthalmol 1983; 95: 480- 486.

16. Forooghian F, Lam WC, Hopkins J, Dhanda D. Bilateral Neuroretinitis with Peripapillary Serous Retinal Detachments in a patient with HIV and HBV. Arch Ophthalmol 2005; 123: 1447-1449.

17. Labalette P, Bermond D, Dedes V, Savage C. Cat-scratch disease neuroretinitis diagnosed by a polymerase chain reaction approach. Am J Ophthalmol 2001; 132: 575- 576.

18. Lesser RL, Kornmehl EW, Pachner NR, et al. Neuro-ophthalmologic manifestations of Lyme disease, Ophthalmology.1990; 97: 699- 706.

19. Dreyer RF, Hopen G, Gass JDM, Smith JL: Leber's idiopathic stellate neuroretinitis. Arch Ophthalmol 1984; 102: 1140- 45.

20. Kennedy C, Carter S. Relation of optic neuritis to multiple sclerosis in children. Paediatrics 1961; 28: 377- 387.

21. Gass JDM. Diseases of the optic nerve that may simulate macular disease. Trans Am Acad Ophthalmol Otolaryngol 1977; 83: 766-769.

22. Chang TS, Aylward W, Davis JL, Mieler WF et al. Idiopathic retinal vasculitis, Aneurysms, and Neuroretinitis. Ophthalmology 1995; 102: 1089- 1097.

23. Slakter JS, Ciardella AP. Diffuse unilateral stellate neuroretinitis. Retina Vitreous macula 1998: 806-12.

24. Gass JDM, Braunstein RA. Further observations concerning the diffuse unilateral subacute neuroretinitis syndrome. Arch Ophthalmol 1983; 101: 1689-97.

25. Gass JDM, Callanan DG, Bowman CB. Oral therapy in diffuse unilateral subacute neuroretinitis. Arch Ophthalmol 1992; 110: 675-80.

26. Casella AMB, Farah ME, Belfort R. Antihelminthic drugs in diffuse unilateral subacute neuroretinitis. Am J Ophthalmology1998; 125

27. Parmley VC, Schiffman JS, Maitland CG, Miller NR, Dreyer RF, Hoyt WF. Does neuroretinitis rule out multiple sclerosis? Arch Neurol. 1987; 44: 1045- 1048.

28. Williams KE, Johnson LN: Neuroretinitis in patients with multiple sclerosis. Ophthalmology 2004; 111(2): 335-40.

29. Leavitt JA, Pruthi S, Morgenstern BZ. Hypertensive retinopathy mimicking neuroretinitis in a twelve-year old girl. Survey of Ophthalmology 1997; 41: 477- 480

30. Carithers HA. Cat-scratch disease. An overview based on a study of 1,200 patients. Am J Dis Child. 1985; 139: 1124.

31. Golnik KC, Marotto ME, Fanous MM, Heitter D. Ophthalmic manifestations of Rochalimaea species. Am J Ophthalmol 1994;118: 145-151.

32. Chrousos GA, Drack AV, Young M, Kattah J, Sirdofsky M. Neuroretinitis in cat-scratch disease. J Clin Neuro ophthalmol. 1990; 10; 92-94.

33. W. Sawaki, S. Ishiko, R. Kinouchi, Y. Kato, Retinal Changes in Leber's Idiopathic Stellate Neuroretinitis Using 3–Dimentional Optical Coherence Tomography ophthalmology, Asahikawa Medical College, Asahikawa, Japan.

34. Z Habot-Wilner, D Zur, M Goldstein, D Goldenberg, S Shulman, A Kesler, M Giladi and M Neudorfer ; Macular findings on optical coherence tomography in cat-scratch disease neuroretinitis , The Association for Research in Vision and Ophthalmolog. 2005.

35. Optical coherence tomography in a case of bilateral neuroretinitis. Stewart MW, Brazis PW, Barrett KM, Eidelman BH, Mendez JC , The Association for Research in Vision and Ophthalmology. 2005

PROFORMA

STUDY OF THE CLINICAL COURSE AND OPTICAL COHERENCE TOMOGRAPHY ANALYSIS OF MACULAR THICKNESS IN NEURORETINITIS

NAME: CASE NO:

AGE : IP/OP NO:

SEX : DATE:

OCCUPATION: CONTACT NO:

ADDRESS:

COMPLAINTS

Defective vision / visual field loss / distortion of objects / fever / orbital or ocular pain / pain on eye movement / fever / headache / nausea / vomiting.

Visual disturbances - unilateral/ bilateral, onset, duration, progressive/static/ recovering

HISTORY

Fever / malaise/ cough/ cold/ joint pain/ exanthematous illness/ skin rashes/ ENT sepsis/ dental sepsis/ loss of weight/ loss of apetite / chest pain/ seizures/ neck stiffness/ tick bite/ recent travel

Contact with tuberculosis

Contact with pet animals

Consumption of undercooked food

PAST HISTORY

Similar Episodes/ Hypertension / Diabetes Mellitus / Tuberculosis / Syphilis/ HIV / Exanthematous Fever / Connective Tissue Disorder / Endocrine Disorders / Malignancy.

FAMILY HISTORY

Similar disease in the family members

GENERAL EXAMINATION

Pulse: B.P: Respiratory rate:

Temperature

Anemia

Lymphadenopathy

Focal sepsis

Mastoid Tenderness

Skin rashes

OPHTHALMIC EXAMINATION

Head Posture

Facial Symmetry

Laterality	RE	LE
Eye Position		
Eye lids		
Ocular movements		
Conjunctiva		
Cornea		
Anterior chamber		

Iris

Pupil

1. Size
2. Shape
3. Light reflex
    a) Direct
    b) Consensul
    c) Near reflex

Lens

Anterior vitreous phase

FUNDUS BOTH DIRECT & INDIRECT

Media

Disc

Macula

Vessels

Periphery

Best Corrected Visual Acuity

Distant

Near

Colour vision

Retinoscopy

Intraocular tension (NCT)

Visual fields

Central

Peripheral

Fundus photograph

Optical Coherence Tomography of macula

Line Scan

Macula Thickness Map

SYSTEMIC EXAMINATION

Cardiovascular System

Respiratory System

Gastrointestinal System

Genitourinary system

E.N.T Examination

Central nervous system

PROVISIONAL DIAGNOSIS

INVESTIGATIONS

Hematology:

Hb% TC DC ESR

Mantoux test Chest X Ray

Blood VDRL ELISA

TORCHES SCREENING

Blood sugar- Fasting, Post prandial

C.S.F analysis (if any)

Urine – Albumin Sugar Motion – Ova Cyst

MRI brain if needed

FINAL DIAGNOSIS:

TREATMENT GIVEN:

FOLLOW UP:

AT 2 WEEKS	RE	LE
Visual acuity (BCVA)		
Pupillary assessment		
Colour vision		
Visual fields		
Fundus examination		
Fundus photograph		
Optical Coherence Tomography		

AT 4 WEEKS:	RE	LE
Visual acuity (BCVA)		
Pupillary assessment		
Colour vision		
Visual fields		
Fundus examination		
Fundus photograph		
Optical Coherence Tomography		

KEY TO MASTER CHART

M - Male

F - Female

R - Right eye

L - Left eye

SF - Systemic Features

1 - absent

2 - Present

V/A - Visual Acuity

Pupil

1 - Normal

2 - RAPD

RAPD - Relative afferent Pupillary Defect

CV - Colour Vision

1 - Normal

2 - Defective

V/F - Visual Field

1 - Normal

2 - Abnormal

FUN - Fundoscopy

1 - Normal

2 - Abnormal

OCT - Optical Coherence Tomography

HE - Hard Exudates

1 - absent

2 - Present

INV - Investigation

1 - NEGATIVE

2 - TB

3 - IgM CMV+

4 - IgM toxo+

TREAT - Treatment

1 - STR

2 - T.CIP

3 - C.DOX

4 - SYSTEMIC ANTIBIOTIC

5 - SYSTEMIC ANTIVIRAL

6 - ATT

S. NO	Name	MRD NO	SEX	AGE	EYE	S.F	ON PRESENTATION								AT 2 WEEKS							AT 4 WEEKS							INV	TREAT
							V/A	TIME	PUPIL	CV	V/F	FUN	OCT	HE	V/A	PUPIL	CV	V/F	FUN	OCT	HE	V/A	PUPIL	CV	V/F	FUN	OCT	HE		
1	Eganathan	234894	m	30	L	1	6|24	30days	2	2	2	2	255	2	6|9	1	1	1	2	176	2	6|6	1	1	1	1	157	2	1	1+2
2	Vinayagam	464105	m	35	R	1	6|36	15 days	2	2	2	2	306	2	6|12	2	2	2	2	189	2	6|6	1	1	1	2	148	2	1	1+3
3	Naseema	340862	f	31	R	1	6|18	20 days	2	2	2	2	200	2	6|9	1	1	2	2	147	2	6|9	1	1	1	2	145	1	1	1+2
4	Nagammmal	457277	f	31	L	1	6|60	10 days	2	2	2	2	335	2	6|12	2	2	2	2	198	2	6|6	1	1	2	2	153	2	1	1+3
5	Kumari	652331	f	45	L	1	6|36	20 days	2	2	2	2	321	2	6|12	2	2	1	2	191	2	6|6	1	1	1	2	162	2	1	1+2
6	Velmuugan	761160	m	38	L	2	2|60	14 days	2	2	2	2	406	2	6|24	2	2	2	2	267	2	6|9	1	1	1	2	172	2	2	1+3+6
7	Baskaran	962568	m	35	R	1	1|60	10 days	2	2	2	2	396	2	6|9	1	1	2	2	177	2	6|6	1	1	1	2	152	2	1	1+2
8	Jessigrace	161906	f	57	L	1	1|60	20 days	2	2	2	2	343	2	6|18	2	2	2	2	180	2	6|6	1	1	2	2	135	2	1	1+3
9	Pasupathy	272521	m	7	R	2	6|18	30days	2	3	1	2	197	2	6|6	1	1	1	2	148	2	6|6	1	1	1	1	148	1	3+4	1+4+5
9	Pasupathy	272521	m	7	L	2	6|18	30days	2	3	1	2	205	2	6|6	1	1	1	2	159	2	6|6	1	1	1	1	159	1	3+4	1+4+5
10	Sambath	311016	m	29	L	2	1|60	10days	2	2	2	2	453	2	6|18	2	2	2	2	227	2	6|6	1	1	1	2	167	2	4	1+4
11	Kalyani	337814	f	42	R	2	6|60	14 days	2	2	2	2	389	2	6|12	2	2	2	2	197	2	6|6	1	1	1	2	154	2	1	1+3
12	Radha bai	452194	f	35	R	1	6|36	18 days	2	2	2	2	356	2	6|9	2	1	2	2	188	2	6|6	1	1	1	2	164	2	1	1+2
13	Shenbagam	571069	f	38	R	1	4|60	12days	2	2	2	2	357	2	6|24	2	2	2	2	231	2	6|6	1	1	2	2	182	2	1	1+3
14	Surya	790682	m	40	L	1	6|24	20days	2	2	2	2	264	2	6|6	1	1	2	2	164	2	6|6	1	1	1	1	149	2	1	1+2
15	Vasantha	821195	f	32	R	1	6|36	15 days	2	2	2	2	354	2	6|12	2	2	2	2	195	2	6|6	1	1	1	2	155	2	1	1+3
16	Mohan	146146	m	37	L	2	6|60	10days	2	2	2	2	412	2	6|12	2	2	2	2	207	2	6|9	1	1	1	2	159	2	2	1+2+6
17	Kesavan	364934	m	33	R	1	6|36	15days	2	2	2	2	328	2	6|9	1	1	2	2	192	2	6|6	1	1	1	2	152	2	1	1+3
18	Alagammal	478563	f	37	R	1	6|60	30days	2	2	2	2	274	2	6|12	1	1	2	2	187	2	6|6	1	1	1	2	148	2	1	1+2
19	Ambika	542548	f	27	L	2	1|60	15 days	2	2	2	2	432	2	6|12	2	2	2	2	199	2	6|6	1	1	1	2	156	2	2	1+3+6
20.A	Karthik	668456	m	12	R	2	6|24	20days	2	3	2	2	351	2	6|9	2	2	2	2	165	2	6|6	1	1	1	1	152	2	4	1+5
20.B	Karthik	668456	m	12	L	2	6|24	20days	2	3	2	2	367	2	6|9	2	2	2	2	174	2	6|6	1	1	1	1	159	2	4	1+5