Role of Transpupillary Thermotherapy in Central Serous Chorio-Retinopathy

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Abstract

Background: To assess the efficacy of transpupillary thermo therapy (TTT) in cases of chronic central serous chorio- retinopathy (CSCR).

Methods: A prospective evaluation was carried out on 25 cases of chronic CSCR who were subjected to TTT. Resolution of CSCR and improvement in visual acuity was noted after six weeks of therapy.

Result: Out of 25 patients, 13 (52%) had complete success (resolution of CSCR and improvement in visual acuity > 2 lines on Snellen's chart), 10 (42%) had qualified success (resolution of CSCR but no improvement in visual acuity) and two (8%) had failure to therapy (no resolution of CSCR or improvement in visual acuity).

Conclusion: TTT maybe a good modality in aiding resolution of subretinal fluid in cases of chronic CSCR. However, improvement in visual function is dependent upon integrity of photo receptor layer of retina which is not influenced by this modality. A controlled study could be undertaken to compare outcome of TTT with conservative management in cases of early CSCR such that deleterious effects of chronic CSCR on the retinal photoreceptor layer are avoided.

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Key Words : Transpupillary thermo therapy; Retinal atrophy; Macular volume; Chronic central serous chorio- retinopathy

Introduction

Central serous chorio- retinopathy (CSCR) is an idiopathic, self- limiting, non- inflammatory condition resulting in serous detachment of the retina in the macular region. It results from alterations in blood aqueous barrier at the level of retinal pigment epithelium (RPE). Commonly, there is detachment of neuro- sensory retina, while in some cases serous detachments of RPE may also occur [1,2].

Fluorescein angiography demonstrates abnormal focal defect in RPE causing leakage of fluid into the subretinal space. Recent studies done with indocyanine green (ICG) angiography reveal delayed lobular choroidal capillary filling in areas of hyperpermeability. These changes are suggestive of focal vascular compromise which lead to localized capillary venous congestion, ischemia and increased choroidal exudation with focal hyperpermeability of choroid. It can also diagnose polypoidal choroidal vasculopathy and areas of choroidal hyperpermeability.

Fundus fluorescein angiography is diagnostic and three characteristic patterns can be typically seen. Expansile dot pattern, smoke stack pattern and diffuse pattern with pooling of the dye in subretinal space are almost universally seen. Optical coherence tomography (OCT)

is a new, noninvasive technique that can demonstrate the presence of shallow retinal detachment and subretinal fluid. It is helpful in identifying subclinical detachments. It is particularly useful in following up cases of CSCR as useful comparisons of macular thickness and macular volume can be carried out.

Natural course of the disease is usually benign. Most cases of CSCR resolve spontaneously with little or no residual visual defects. Treatment is reserved for those showing no signs of resolving after 4- 6 weeks and those having frequent recurrences. These patients have significant residual visual disturbance resulting from RPE atrophy and choroidal neovascularisation.

In this study, patients suffering from long standing CSCR were assessed clinically and fundus pictures were taken. They were then subjected to fluorescein angiography. Following results of ICG angiography, transpupillary thermo therapy (TTT) was performed using large spot, low irradiance, long exposure protocol. The aims of this project was to study the effect of TTT on subretinal fluid and evaluation of visual recovery after TTT.

Material and Methods

Subjects for this study were selected from patients attending out patient department at Army Hospital (R&R)

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between March 2006 and Dec 2007. Twenty five patients of CSCR were included in this study. 15 cases were CSCR of more than three months duration, not showing signs of healing/ absorption of sub-retinal fluid with conservative management or conventional laser photocoagulation. Ten cases of recurrent CSCR, were also considered for inclusion in this study. Patients having pigment epithelium detachment or sensory neuro- retinal detachment or combined detachment were part of the study. Ethical clearance for this study was taken prior to sanction of the project. After written informed consent they were subjected to TTT.

Those having anterior segment pathology with CSCR which could hamper posterior segment evaluation were excluded. Also, patients with concomitant posterior segment disorders like optic disc pit, sub-retinal neo-vascular membrane (SRNVM) and choroidal mass were also excluded.

Detailed history of duration of attack, recurrence of attacks, steroid therapy and treatment was taken. Best corrected visual acuity (BCVA) was checked on standard Snellen's chart. Detailed anterior segment evaluation under slit lamp was carried out in all cases. Intra ocular pressure was checked with Applanation tonometer in all cases. Posterior segment evaluation was carried out stereoscopically with dilated pupils under slit lamp biomicroscope using +90 D Volk lens and then by indirect ophthalmoscope using +20 D lens. Retinal periphery was thoroughly evaluated in detail in all cases. In cases with CSCR, Amsler's grid examination was performed.

OCT and fast macular test protocol were performed in all cases. We studied macular thickness, macular volume and morphology of detachment. OCT formed a reliable tool to follow-up cases of CSCR following treatment.

Fundus fluorescein angiography (FFA) forms the gold standard for diagnosing and treating a case of CSCR. Patients were subjected to FFA after taking written informed consent. Ocular USG was performed whenever macular thickness was found to be more than 500 microns on OCT to rule out any choroidal mass lesion.

TTT was performed using Nidek diode laser 810 nm. Mainster standard lens with 2% methylcellulose as coupling agent was used. Large spot, low irradiance, long exposure protocol using 1.2 mm spot size, 120 to 200 mW power with 2- 3 second exposure was used. Three to five confluent burns were placed along the edge of retinal elevation. Number of burns placed was related to the size of retinal elevation. Laser burns were applied to the most dependant part of the detachment. Three to seven confluent overlapping burns were applied along the inferior edge of the detached retina (Fig. 1). The energy level was initially kept at 120 mW and gradually increased till a faint white reaction was seen on the retina.

Patients were followed up after one week and then once a month for next six months. BCVA, stereoscopic fundus examination and Amsler's charting were performed on every visit. Repeat fluorescein angiography and OCT were done after three months of performing TTT.

Results

Patients enrolled in our study were between 30 and 55

Table 1

BCVA pre and post treatment with TTT

BCVA	Pre TTT	Post TTT	Change
6/ 60 or worse	4 (16%)	3 (12%)	- 1
6/36	16 (64%)	6 (24%)	- 10
6/ 24	3 (12%)	11 (44%)	+ 8
6/ 18	2 (8%)	3 (12%)	+ 1
6/ 12 or better	Nil	2 (8%)	+ 2

Table 2

Complications/problems encountered with TTT

Problems encountered with TTT	Number of patients (%)
Inadequate reaction	7 (28%)
Foveal damage	1 (4%)
Bleeding/Hemorrhage	Nil

years in age with a mean age of 45.5 years of which 17 (68%) patients were males. 13 (52%) patients had clerical work and sedentary lifestyle, while 2(8%) were school teachers, 6 (24%) housewives and 4 (16%) were general duty soldiers.

BCVA before therapy and following therapy with TTT is depicted in Table 1. Stereoscopic fundus examination using +90D Volk lens and indirect ophthalmoscopy before and after therapy with TTT is shown in Chart 1.

On OCT measurement macular thickness ranged from a minimum of 223 to 562 microns (average 390 and mean 345.5 microns). Macular volume ranged from 8.86 to 14.41 cubic microns (average 10.76 and mean 9.87 cubic microns).

Classical smoke stack pattern was seen on FFA in only 7 (28%) cases whereas blot pattern was seen in other 17 (68%) patients. In one case, due to presence of extensive exudates in macular region blocked fluorescence was seen. Complications encountered with TTT are shown in Table 2. We had only one case where the burn spread to involve parafoveal region resulting in a paracentral scotoma, none of the other complications were serious enough to cause any visual deterioration. No significant changes were noted in pre and post TTT ICG as depicted in Fig. 2.

Significant changes were observed in post TTT OCT scanning (Table 3), which revealed decrease in thickness and volume of macula (Figs. 3,4). Post TTT macular thickness ranged from 156 to 234 microns (average 175 microns) and macular volume from 6.86 to 8.07 mm³ (average 7.05 mm³).

Based on resolution on OCT and improvement in BCVA, results were tabulated into following categories :-

- Complete success: Reduction in macular thickness >100 microns with improvement in visual acuity >2 lines on Snellen's chart.
- Qualified success: Reduction in macular thickness > 100 microns but no improvement in BCVA.
- Failure: No /minimal reduction in macular thickness with no improvement in BCVA.

Complete Success	13 (52%)
Qualified Success	10 (40%)
Failure	02 (8%)

Fig. 1 : CSCR <4DD size depicting location of three confluent overlapping TTT burns of 1.2 mm size along its dependant inferior margin of elevated retina.

Pre TTT ICG

Post TTT ICG

Fig. 2 : Pre & post TTT ICG of the same patient showing no change in ICG pattern as compared to changes on OCT noted in Fig. 3 & 4 below.

Fig. 3 : Pre TTT OCT of patient with CSCR showing macular thickness and volume.

Fig. 4 : Post TTT OCT of same patient showing reduction in macular thickness and volume.

Discussion

Central serous chorio- retinopathy is a self limiting condition occurring predominantly in young individuals between 20-50 years of age. Recovery starts spontaneously within three months of onset. 95% of patients recover within 4-8 weeks with full visual recovery in six months [3]. However, recurrences are common and observed in almost one third to one half patients. 10% have three or more recurrences. Only 5% of patients have severe visual loss. Since the disease is self limiting, no treatment is advocated in the initial phase. After a three months wait for spontaneous resolution, laser photocoagulation of the leak can be performed if the site of leak is at least one fourth disc diameter away from the fovea. However, if no resolution

Fig. 5 : OCT pictures showing complete absorption of subretinal fluid following TTT but atrophy of retinal photoreceptor layer with poor visual recovery.

is seen within the first three months, alternative therapeutic modalities can be thought of. However, laser photocoagulation has its limitations and carries a 2- 5% risk of development of choroidal neovascularisation after several months of treatment [4]. ICG angiography is a useful tool in demarcating the choroidal vasculature and

Table 3**Pre and post TTT changes in macular thickness and volume**

	Minimum	Pre TTT Maximum	Average	Minimum	Post TTT Maximum	Average
Macular thickness	223 microns	562 microns	390 microns	156 microns	234 microns	175 microns
Macular Volume	8.86 mm ³	14.41 mm ³	10.76 mm ³	6.86 mm ³	8.07 mm ³	7.05 mm ³

Chart 1 :

precise delineation of the defects of choroidal circulation and evaluating choroidal neo-vascular membranes [5].

Polypoidal choroidal vasculopathy (PCV) is a chronic condition with history of repeated recurrences of spontaneous leakage or haemorrhage at the macula which may closely mimic recurrent CSR [6]. Following ICG angiography, the abnormal choroidal vasculature can be precisely demarcated and treated with photodynamic therapy (PDT) or TTT.

Many workers have reported favourable outcomes with transpupillary thermo therapy (TTT) in cases of CSCR [6]. Shukla et al [7], applied TTT to cases of chronic CSCR with subfoveal leaks and noted resolution of subretinal fluid in 96% cases following single round of treatment with improvement of visual acuity in 92% cases. Hussian et al [8], had mixed outcome with resolution of subretinal fluid occurring only in 64% cases. Moderate improvement in visual acuity of 2-3 lines was noted in 52.7% cases. In a case report by Wei et al [9], improvement was seen following TTT in a case of long standing CSCR of 20 months duration. Resolution of subretinal fluid with marginal improvement in visual acuity was also noted.

In our study, 23 eyes had beneficial effects of laser and underwent gradual resolution of subretinal fluid as

suggested by pre and post TTT studies by OCT. The average thickness of retina at the macula decreased from 390 microns to 175 microns and the average macular volume reduced from 10.76 mm³ to 7.05 mm³ following therapy with TTT. The granular appearance of the outer photoreceptor layer decreased with gradual approximation of the neurosensory retina and RPE. Of course the thickening of RPE remained largely unaltered and PED's took longer time to resolve. The detachment resolved and improvement in BCVA of two lines or more on Snellen's chart was noted in 13 cases. In ten cases, significant reduction in macular thickness occurred but improvement in BCVA was less than 2 lines on Snellen's chart. All these cases had persistent retinal findings like retinal atrophy and persistence of subretinal precipitates. Similar beneficial effects of photocoagulation has been reported in several studies including the largest study by Spitznas et al [10], involving 139 consecutive cases without treatment and 109 consecutive cases who received photocoagulation treatment.

In two cases of long standing CSCR of more than six months duration, no significant change occurred after TTT. These cases of chronic long standing CSCR had atrophic changes in neurosensory layer of retina. There was gross loss of photoreceptor layer and atrophy of fovea. Hee et al [11], reported the presence of intra-retinal oedema and cystic changes on OCT when the disease becomes chronic. Wang et al [12], reported that foveal attenuation in CSCR is associated with more than four months' duration of symptoms and persistent BCVA reduction occurs despite resolution of the serous detachment.

This may be explained in terms of chronic, recurrent nature of the disease. In all these eyes, high resolution OCT demonstrated changes in the foveal photoreceptor layer that were correlated with the actual visual acuity. OCT provided detailed view of different layers non-invasively comparable to anatomic- histological study of retina [13]. The photoreceptor layer was clearly discernable with high resolution OCT. The photoreceptor layer that was preserved was seen to have either even or granulated appearance. As the disease process gets prolonged, the photoreceptor layer undergoes degeneration and it gives an appearance of granulation on the outer neuroretinal layer. When there was loss of photoreceptor layer, the fovea looked atrophic and on

OCT visualized as thinning (Fig. 5).

Though there is uncertainty in quantifying the duration of the retinal detachment, a temporal sequence of the different tomographic patterns can be deduced from the history of these patients and follow up. It is presumed that layer of rods and cones suffers due to lack of nutrition and apoptosis occurs if the disease does not resolve within few a months, leading to foveal attenuation [14]. In CSCR which healed, no changes were noted in the retinal pigment layer as compared to normal individuals [15]. OCT detects both neurosensory detachment and pigment epithelial detachments because of high resolution. It serves as a reliable tool in following up cases of CSCR by accurately measuring the macular thickness and volume.

TTT using Nidek 810 nm Diode laser is a cheap, safe and effective method of treatment. The laser energy is absorbed by the RPE cells. The mechanism of action can be postulated to be stimulation of the diseased RPE cells, over an area much larger than that by conventional argon laser photo-fomentation, to absorb the overlying fluid. Inadequate reaction was observed in post treatment period in 7 (28%) cases. In one patient the burn extended into the macular region with resultant poor BCVA. We did not encounter choroidal neovascularisation due to TTT in any case. Re-treatment was not carried out in any case. Treatment delay in recurrent cases or those not showing signs of resolution beyond three months may result in secondary retinal atrophic changes. Hence, in our opinion, ideal time frame for considering this management option should be 3-4 months from the onset of CSCR.

Thus, CSCR is a self limiting benign disorder which recovers completely with full visual recovery in about three months time. Most cases do not require any further treatment, however in cases which do not recover spontaneously a variety of therapeutic options can be offered. TTT is a modality which has shown to have encouraging results in reducing subretinal fluid and settling of retina in 92% cases in our study. However, used TTT in cases of long standing CSCR beyond three months. The probable action of TTT could be due to stimulation of the diseased RPE cells resulting in absorption of overlying sub retinal fluid. However, visual recovery improved in 52% of cases only due to secondary atrophic changes in the retina.

A case controlled prospective interventional trial of TTT versus spontaneous resolution of fluid in CSCR needs to be done to evaluate if TTT can be recommended as a primary early therapeutic option in CSCR before the onset of secondary atrophic retinal changes.

Conflicts of Interest

This study has been financed by research grants from the O/o DGAFMS, New Delhi.

Intellectual Contribution of Authors

Study Concept : Lt Col V Mathur, Col JKS Parihar, SM, VSM, Lt Col R Maggon

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