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Original Article

MACULAR OCT FINDINGS AFTER SUCCESSFUL RHEGMATOGENOUS RETINAL DETACHMENT REPAIR; A COMPARISON BETWEEN CASES WITH AND WITHOUT VISUAL IMPROVEMENT

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Abstract

Purpose: *A comparative study using OCT to determine the possible causes associated with incomplete visual recovery after successful rhegmatogenous retinal detachment (RRD) repair in cases with and without visual improvement.* ***Patients& methods:*** *We studied 200 eyes of 200 patients with RRD that involved the fovea. The patients were examined and the findings recorded before and after surgery. The period from the onset of symptoms to presentation ranged from 3-60 days. OCT was performed at the 1st, 3rd, and 6th post-operative months. The patients were followed for a period from 6-18 months (mean 8.4 months).* ***Results:*** *On comparing the best corrected visual acuities (BCVAs) at 1st and 6th months, there was a mean gain of 3 Snellen lines (range; 1-6 lines) in 160 patients (80%) and no improvement in 40 patients (20%).The mean postoperative BCVA at 1,3 and 6 months of the improved patients was 6/60, 6/24,and 6/18 respectively (Log MAR equivalent of 1.00, 0.60 ,and 0.50). OCT of these 40 eyes without visual improvement showed subfoveal fluid in 10 eyes (25%), macular edema(ME) in 21 (52.5%) eyes, epiretinal membranes(ERM) in 15 eyes (37.5%), photoreceptor damage (distortion of the photoreceptors IS/OS junction in 31 eyes (77.5%), macular holes(MH) in 2 eyes (5%), and retinal pigment epithelium (RPE) degenerative changes in 11 eyes (27.5%). OCT of those with visual improvement also showed some abnormalities which contributed to incomplete visual recovery: ME in 21 eyes (13.2%), ERM in 9 (5.6%)eyes, subfoveal fluid in 40 eyes (25%), photoreceptor damage in 31 eyes (19.4%), and RPE degenerative changes in 12 eyes (7.5%).* ***Conclusion:*** *Incomplete and/or delayed visual recovery after successful retinal reattachment may occur even in cases with visual improvement due to many causes; photoreceptor damage, macular edema, epiretinal membranes, subfoveal fluid, macular holes, and RPE degenerative changes. OCT is a valuable and noninvasive tool for detecting, evaluating and follow-up of these cases.*

Keywords: *Macular OCT, Rhegmatogenous retinal detachment, Epiretinal membranes,*

1. Introduction

Rhegmatogenous retinal detachment (RRD) occurs due to separation of neurosensory retina from inner layer of retinal pigment epithelium (RPE) in presence of a retinal break [1]. The current treatment of RRD with multiple surgical techniques has anatomical success rate of more than 90%. Combined techniques of scleral buckle and pars plana vitrectomy are commonly performed by many vitreoretinal surgeons. This technique is used especially in complicated difficult cases such as RRD associated with proliferative vitreoretinopathy (PVR), giant retinal tears and inferior retinal breaks [2,3]. Factors that may influence functional recovery after macula-off RRD include preoperative VA, duration of macular detachment [4]. Despite the major improvement in the surgical anatomic results of rhegmatogenous retinal detachment (RRD) repair; postoperative visual complaints may occur after anatomically successful repair [5]. Incomplete visual recovery following surgery for RRD has been a matter of debate. Advances in retinal imaging have helped to demonstrate the possible causes of delayed or incomplete visual recovery [6]. Using OCT, we attempted to determine the causes of suboptimal visual recovery in reattached retinas after successful surgical repair [7].

2. Patients and methods

Prospectively, we studied 200 eyes of 200 patients with RRD that involved the fovea. The patients underwent surgical repair (scleral buckling "SB", pars plana vitrectomy "PPV", or combined) in the Ophthalmology Department, Sohag Univ. Hospital in the period between January 2014 and March 2016. The approval of the faculty ethics committee was obtained and written informed consent for the surgery and examinations was obtained from each patient after a full explanation of the procedures. The period from the onset of symptoms to presentation ranged from 3-60 days. The patients were followed for a period from 6-18 months (mean 8.4 months). The patients were examined and the findings recorded before and after surgery by the slit lamp biomicroscopy and indirect ophthalmoscopy. Pre-operative best corrected visual acuities (BCVA) were recorded and ranged from HM -3/60 (mean 1/60). Visual acuities were converted to log MAR visual acuities for statistical analysis. All eyes had no previous intervention as regards retinal repair. Seventy-three patients 36.5%) had scleral buckling (SB), 85 (42.5%) had 23 gauge pars plana vitrectomy (PPV), and 42 (21%) had combined SB+PPV. Thirty-five patients needed gas tamponade (17.5%) and 92 (46%) needed silicon oil. Vitrectomy was done in cases with relatively posterior breaks, pseudophakic eyes, and those without detectable breaks preoperatively. Ten eyes (20%) needed cataract extraction in the process of surgery, while 71 eyes (35.5%) were already pseudophakic and 6 eyes (3%) were aphakic. There were no recorded intraoperative complications. OCT was performed at the 1st, 3rd, and 6th postoperative months using the Topcon 3D 2000 machine. All clinical examinations and OCT studies were carried out after pupillary dilatation and OCT done in the horizontal and vertical sections of the posterior pole.

3. Results

There were 130 male and 70 female. The age in years ranged from 21-70 (mean 48 years). The mean pre-operative log MAR VA was 1.7 (Snellen equivalent of 1/60). Demographic and fundus details of the patients are summarized in table (1).

Table (1) Demographic and fundus details of the patients

Age, mean (range)	48 (21-70)
Gender	130 M, 70 F (65%, 35%)
Preoperative VA, mean (range)	1/60 (HM-3/60), 1.7 (2.1- 1.5)
Quadrants of RD:(1, 2, 3, total)	(20, 42, 83, 55)

Surgery: SB PPV SB+PPV	-73 (36.5%) -85 (42.5%) (60, SO and 25 gas tamponade) -42 (21%) (32, SO and 10 gas tamponade)
Number of tears:(1, 2, ≥3)	82, 70, 48
PVR grade: (no, A, B, C)	(62,71, 35, 42)
Lens status (phakic, pseudophakic, aphakic)	(123, 71, 6) (60.5%, 35.5%, 3%)

Primary success was defined as retinal reattachment at the 6-month follow-up. Fifteen patients needed 2 procedures to reattach the retina, and 5 patients needed 3 procedures. On comparing BCVAs at 1st and 6th months, there were a mean gain of 3 Snellen lines (range; 1-6 lines) in 160 patients (80%) and no improvement in 40 patients (20%). The mean postoperative VA at 1, 3, and 6 months of the improved patients was 6/60, 6/24, and 6/18 (Log MAR equivalent of 1.00, 0.60, and 0.50). OCT of these 40 eyes without visual improvement showed subfoveal fluid in 10 eyes (25%), macular edema (ME) in 21 (52.5%) eyes, epiretinal membranes (ERM) in 15 eyes (37.5%), photoreceptor damage (distortion of the photoreceptors IS/OS junction in 31 eyes (77.5%), macular holes (MH) in 2 eyes (5%), and retinal pigment epithelium (RPE) degenerative changes in 11 eyes (27.5%), figs. (1,3,2 & 4). OCT of those with visual improvement also showed some abnor-malities which contributed to incomplete visual recovery: ME in 21 eyes (13.2%), ERM in 9 (5.6%) eyes, subfoveal fluid in 40 eyes (25%), photoreceptor damage in 31 eyes (19.4%), and RPE degenerative changes in 12 eyes (7.5%).

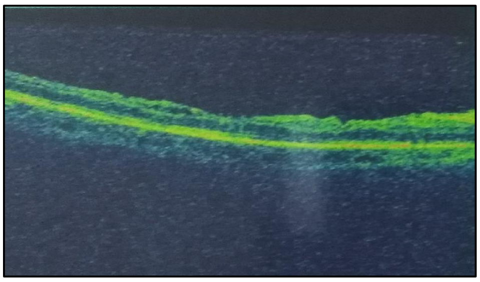

Figure (1) Minimal spongiform macular edema with corrugated inner retinal surface, loss of retinal details and amalgamated IS-OS with RPE layers

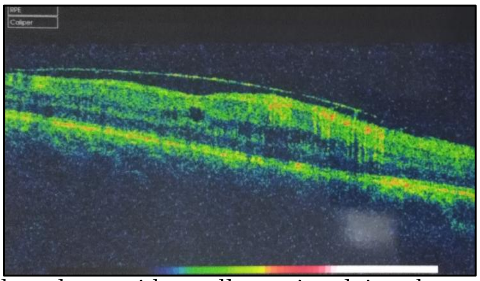

Figure (2) Spongiform macular edema with small cyst involving the center and thickened ILM with epiretinal membrane

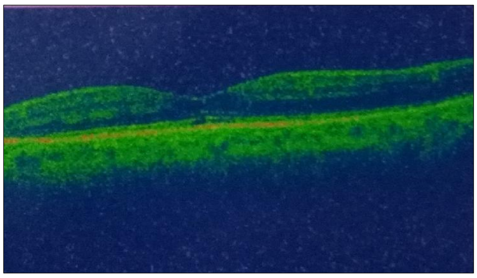

Figure (3) Minimal spongiform macular edema with disruption in the IS-OS complex

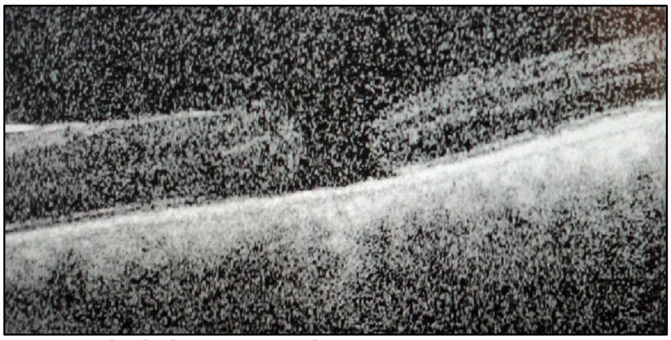

Figure (4) Full thickness macular hole post pars plana-vitrectomy

4. Discussion

Incomplete functional recovery may occur after successful anatomic reattachment of RRD. Reduced post-operative VA may result from ERMs, CME, pigment migration, MHs, retinal folds, myopic shift, or cataract [8]. Other postulated causes are photoreceptor misalignment, loss of photoreceptor outer segments, RPE degenerative or hypertrophic changes [9]. Shedbale et al [10] prospectively studied 20 eyes of 20 patients with RRD that involved the fovea. The mean logMAR VAs were 1.30, 1.42, and 1.00 (Snellen equivalent of 3/60, 2/60, and 6/60) preoperatively, at one month, and at 6 months postoperatively respectively. On analyzing VAs at the 1st and 6th postoperative months, there was a mean gain of 3 Snellen lines (range; 1-7 lines) in 12 eyes and no improvement in 8 eyes. OCT of these 8 eyes showed ERM with ME in 2 eyes, photoreceptor damage in 2 eyes, CME in one eye, MH in one eye, subfoveal fluid in one eye, and subretinal precipitates in one eye. In those with visual improvement, the ones with least improvement (one line) had ERM with ME (2 eyes), subfoveal fluid (1 eye), RPE degenerative changes (1 eye). Wolfensberger and Gonvers [11] used pre- and postoperative OCT to study 16 eyes of 16 patients with macula-off RRD. Preoperative OCT demonstrated widespread retinal edema, the extent of which, they concluded, doesn't appear to influence final postoperative vision. In 11 of the 16 cases, OCT images at one month after surgery showed foveal detachment with residual subfoveal fluid that was not visible clinically or on angiography. Long-term persistence of this fluid could be observed in 8 cases at 6 months and in one case at 12 months and was associated with incomplete recovery of VA. Schocket et al [8] used UHR OCT to assess micro-structural changes in the retina that may explain incomplete visual recovery after successful RD repair. They obtained UHR OCT foveal images in 17 patients with visual complaints after RD surgery. The mean pre and postoperative log MAR VA was 1.37 and 0.48 respectively (Snellen equivalent of 20/390 and 20/60). Anatomical abnormalities included distortion of the photoreceptor IS/OS junction in 14 of 17 patients (82%), ERMs in 10 of 17 patients (59%), residual SRF in 3 of 17 patients (18%), and CME in 2 of 17 patients (12%). In 5 patients with macular spring RD, 4 had distortion of the outer retina after RD repair. In the present study, many abnormalities have been detected in those patients with anatomically reattached retinas but without visual improvement and even in those with vision improvement but with postoperative visual complaints. These abnormalities are subfoveal fluid, ME, ERM, photoreceptor damage, RPE degenerative changes, and MH. In the 40 eyes without improvement, photoreceptor damage, ME, and ERM were the commonest abnormalities seen in our patients (77.5%, 52.5%, 37.5% respectively). Ten patients (25 %) had subfoveal fluid, 11 patients (27.5 %) had RPE degenerative changes, and 2 (5 %) had macular holes. Barr [12] and Wilson and Green [13] studied the histopathologic effects of RD surgery and found that the most common abnormalities complicating RD surgery were the formation of ERMs and photoreceptor atrophy. In an eye with RD, the outer retina is deprived of its nutrient supply from the underlying choroid, and thus photoreceptor atrophy ensues. Experimental RDs in cats have shown that changes in the outer nuclear layer can occur after only one hour of RD and continued progressive loss of photoreceptors occurs in retinas detached 13-30 days [14]. After reattachment of the cat retina, atrophy of the photoreceptors was present in 42-day detachments but there was only limited atrophy in retinas detached only 3-7 days. Photoreceptor atrophy may be responsible for the reduced VA seen in patients after anatomically successful RD repair [8]. The presence of residual subfoveal and/ or subretinal fluid has been reported in various studies [10,11,15-17] to vary from 27-78% and even in patients with macular–sparing RDs [10]. OCT showed a gradual diminution and a final disappearance of this fluid during the follow-up periods. The cause of macular detachment in patients with uninvolved macula preoperatively is not clear; this could be the result of fluid movement from the original location of the RD towards the posterior pole during or immediately after the operation especially if the RD was not far away from the macular area. Another cause could be localized loss of adherence of the RPE to Bruch's membrane due to surgical trauma with subsequent leak of fluid from the choroid to the sub-RPE space and then to the subretinal space [10]. In the present and other studies, ERM formation was a common cause. This may raise the issue of the contribution of ILM peeling in cases of macular involvement with RD. although this subject is still a matter of debate and it is not possible with the present knowledge to confidently choose whether peeling the ILM in ERM surgery is associated with an improvement in vision [20]. There are many variables which could affect the final visual recovery of RRD patients such as the age of the patient, the cause of RD (myopia, trauma, post-surgery…), the duration of RD and the presence and severity of PVR, the presence and duration of macular detachment, and others. Further studies are needed to show the impact of these individual variables on the final visual outcome.

5. Conclusion

Incomplete and/or delayed visual recovery after successful retinal reattachment may occur even in cases with visual improvement due to many causes; photoreceptor damage, macular edema, epiretinal membranes, subfoveal fluid, macular holes, and RPE degenerative changes. OCT is a valuable and noninvasive tool for detecting, evaluating and follow-up of these cases.

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