



Absorption of Sub-Retinal Fluid Under Macula after Scleral Buckling Surgery for Rhegmatogenous Retinal Detachment on Optical Coherence Tomography

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Objective: To determine the incidence of sub-macular fluid by Optical Coherence Tomography (OCT) and its clinical consequences on visual acuity after apparently successful scleral buckling surgery in uncomplicated macula-off, rhegmatogenous retinal detachment.

Material and Methods: This case series was conducted at Institute of Ophthalmology, Mayo Hospital Lahore from February 2011 to July 2012. Total 54 patients of age above 20 years with uncomplicated, macula-off, rhegmatogenous RD of less than 1 month duration were selected after fulfilling inclusion and exclusion criteria. After informed consent, all patients underwent scleral buckling surgery with or without intra-operative external drainage, and followed for complete clinical examination especially for visual acuity and OCT scan of the macula at 1st, 2nd, 3rd, and 6th month postoperatively to detect the presence of sub-macular fluid and to establish its association with visual acuity.

Results: Out of total 54 patients 3 left follow-up after surgery due to unknown reasons. Follow-up data of 51 patients was recorded, out of which only 7(13.7%) clinically had sub-macular fluid 1 month after surgery but OCT showed 22(43%) cases having sub-macular fluid. At 1st follow-up visit (after 1 month) 10(19.6%) patients and at last follow-up visit (after 6 months) 20(39.2%) patients attained the best corrected visual acuity of 6/12 or better. Total 10(50%) out of 20 patients, who got final VA of 6/12 or better, had macular detachment for duration of less than 7 days.

Conclusions: Sub-macular fluid on OCT was found to be directly associated with delayed visual recovery. Postoperative evaluation of persistent sub-macular fluid can be done more efficiently by OCT. Sub-macular fluid after SB surgery may persist for many months, and can cause delayed visual recovery.

Key Words: Ocular Coherence Tomography(OCT), Rhegmatogenous Retinal Detachment, Sub-retinal Fluid.



Introduction:

It is estimated that 45 million people are blind worldwide mainly due to cataract, glaucoma and trachoma¹. As prevalence of these causes of blindness is high in developing countries so retinal problems are ignored, under-treated or mal-treated due to lack of services². In developed countries retinal pathologies are major cause of blindness³. Retinal detachment is a major blinding cause which is affecting 18 eyes per hundred thousand populations per year⁴. Scleral buckling (SB) surgery is one of the methods to manage retinal detachment (RD)⁵. Other methods include pars plana vitrectomy and a combination of scleral buckling surgery and vitrectomy. The modern scleral buckling procedure is considered a good choice for most cases unless PVR is present.⁶ Previously, it was considered that anatomical restoration of retina is achieved much earlier than its function but later on it was supposed that anatomy is not restored completely. Probably Machemer was the first who reported the collection of residual sub-retinal fluid (SRF) after resolution of experimental RD in monkeys⁷. The introduction of OCT has resulted in identification of SRF, integrity of optic nerve head and other macular pathologies that are difficult to assess on clinical examination.⁸ Persistent SRF has been described on OCT in patients who have undergone successful SB surgery for RD.⁹ This fluid is associated with poor visual acuity and often can neither be seen on slit-lamp examination, B-Scan ultrasonography nor detected by fundus fluorescein angiography (FFA). This persistent SRF is associated with poor vision in such patients and leads to visual improvement upon its resolution. Studies to date have reported incidence of persistent SRF 1 month after scleral buckling surgery ranging from 27% to 78% and it has been reported that fluid can take up to 12 months to resolve.¹⁰

Materials and Methods:

Total 54 consecutive patients of age above 20 (range 20-60 yrs) years presenting to Institute of Ophthalmology, Mayo Hospital Lahore, with uncomplicated (Without any other ocular pathology or PVR) macula-off, primary rhegmatogenous RD were recruited. Patients with pre-existing macular pathology (e.g., age-related macular degeneration, macular hole, macular scars, vitreo-macular traction) diabetic retinopathy, hypertensive retinopathy and breaks not manageable by SB surgery alone (e.g. giant retinal tears and posterior breaks) were excluded.

Data including ocular and systemic history of all patients who were to undergo SB surgery by single experienced surgeon was documented and preoperative

ocular examination along with characteristics of RD was recorded. Special care was taken on history to explore the exact duration of retinal and macular detachment. Assessment of best-corrected visual acuity by Snellen's Acuity Chart, pupil reaction, anterior segment examination by slit lamp and retinal examination by indirect ophthalmoscope and slit lamp bio-microscopy using Volk 90 and 78 diopters lens after dilatation of pupils, intraocular pressure by Goldman applanation tonometer and OCT scan (optovue A5, 1, 0, 90) was done wherever possible. In some patients OCT was not possible due to undetectable height of SRF or poor fixation. In some patients where fixation was poor, external fixator light was used. Scleral buckling surgery with or without intra-operative SRF drainage and cryopexy was done by single surgeon after taking informed consent. All patients were examined by same surgeon on 1st postoperative day; minimal postoperative complications were managed accordingly. Complete ocular examination along with OCT scan was done at first post-op day and each follow-up visit.

Follow-up visits were scheduled on 1st, 2nd, 3rd and 6 months postoperatively. If at any visit no SRF was seen on OCT, follow-up was terminated and no further investigation was undertaken. In some patients where small amount of SRF was persistent and unaltered on consecutive visits FFA was carried out to rule out any leakage or ischemia.

Results:

Out of total 54 registered patients 3 left follow-up due to unknown reasons before 1st follow-up visit. Pre-operative demographic data of patients is shown in table 1. Follow-up data was calculated of 51 patients.

Age (Years)	Range Median	20 -60 40.0
Gender	Male	30(55.5%)
	Female	24(44.5%)
Laterality	Right	29(53.7%)
	Left	25(46.3%)
Best Corrected VA	Range	6/36 - PL/PR
	Median	6/60
Type of Break	Hole	24 (44.4%)
	UST	25(46.2%)
	Dialysis	5(9.2%)

Table 1: Pre-Operative Data

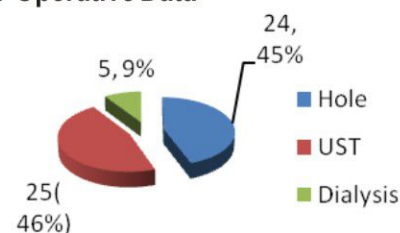


Fig 1: Type of Breaks



No major complications occurred in any patient peri-operatively. Per-operative external drainage of SRF was done in 20 patients; intra-vitreous air was injected in 03 patients.

On first follow-up visit at one month post-operatively, out of 51 only in 7(13.7%) patients SRF under macula was detectable clinically and 22(43%) patients showed sub-macular fluid on OCT. At the end of six months, clinically detectable macular detachment was present in 02(3.9%) but on OCT scan 9(17.6%) patients still had sub-macular fluid (Fig.2) and those were the patients with poor visual outcome. OCT scan proved better in early identification of epi-retinal membrane in 7 (13.7%) patients during the assessment of subretinal fluid. We did not observe any significant relationship between duration of absorption of sub-macular fluid with gender, refractive status of patient, type of break and location of break

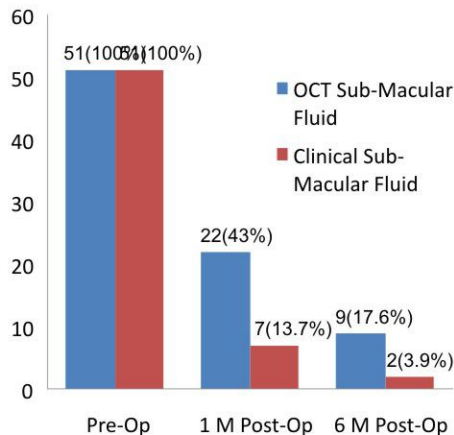


Figure 2: Sub-Macular Fluid On OCT and Clinically Detected Fluid

Best corrected visual acuity found to have direct relationship with submacular fluid. At 1st follow-up visit visual acuity was improved in all patients and 19(37.2%) patients reached VA of 6/24 or better out of which 10(19.6%) attained the VA of 6/12 or better. At the end of follow-up 20(39.2%) patients reached VA of 6/12 or better (Fig.3). There was significant improvement of VA in patients who got early reattachment of retina. Out of 20 patients who got final VA of 6/12 or better, 11(55%) patients were having preoperative VA equal to or better than 6/60. Duration of macular detachment was also found to be significant in relation to early attainment of good final VA. Total 10(50%) out of 20 patients, who got final VA of 6/12 or better, had macular detachment for duration of less than 7 days. Improvement in VA has direct relationship with amount of sub-macular fluid and it continues to improve with absorption of sub-macular fluid. Status of VA, pre-op and at different follow-up visits is shown in table 2 and 3.

VA	PRE-OP	MONTH			
		1	2	3	6
6/6	0	0	0	0	0
6/9	0	1	2	3	6
6/12	0	9	11	13	14
6/18	0	3	5	7	11
6/24	0	7	7	8	9
6/36	0	7	7	7	6
6/60	11	12	13	10	3
3/60 or less	40	12	6	3	2

Table 2: Visual Acuity at Different follow up visits.

VA	PRE-OP	MONTH			
		1	2	3	6
6/18 or better	0%	21.5%	35.29%	45.0%	60.7%
6/60-6/24	21.5%	54.90%	54.90%	49.01%	35.29%
3/60 or less	78.5%	25.29%	11.76%	5.88%	3.92%

Table 3: Visual Acuity at Different follow up visits in percentage.

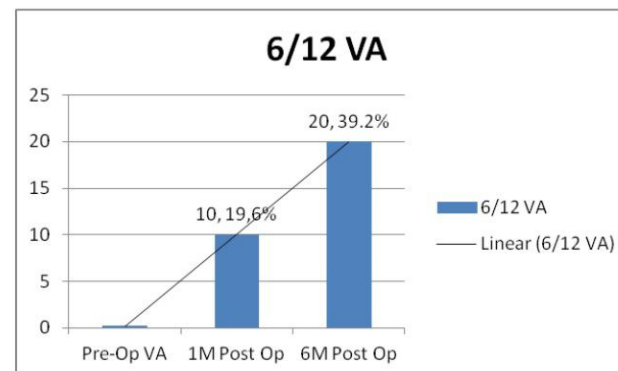


Figure 3: Post-Operative Visual Acuity

Discussion:

Before the advent of the 20th century, eyes with RD were considered incurable but in 1929 Jules Gonin changed the concept of RD surgery when he introduced igni-puncture by applying hot spot at area of RD. 11 Later on Gonin observed that once all retinal breaks are adequately sealed, SRF would reabsorb spontaneously. 12 In some patients, however, there



is a delay in SRF reabsorption. Scleral buckling surgery is an excellent surgical procedure for the repair of uncomplicated RD with the success rate of 85%-95%.¹³ Results of scleral buckling surgery depends upon multiple factors such as surgeon expertise, instruments, duration of detachment, location of break, macular involvement and associated ocular pathologies. Introduction of OCT not only helped us efficiently in assessment of SRF, which definitely affects the surgical outcome; but also helped us in analysis of other macular pathologies which were not detectable clinically. It also helps in evaluation of retinal nerve fiber layer and morphology of optic nerve head

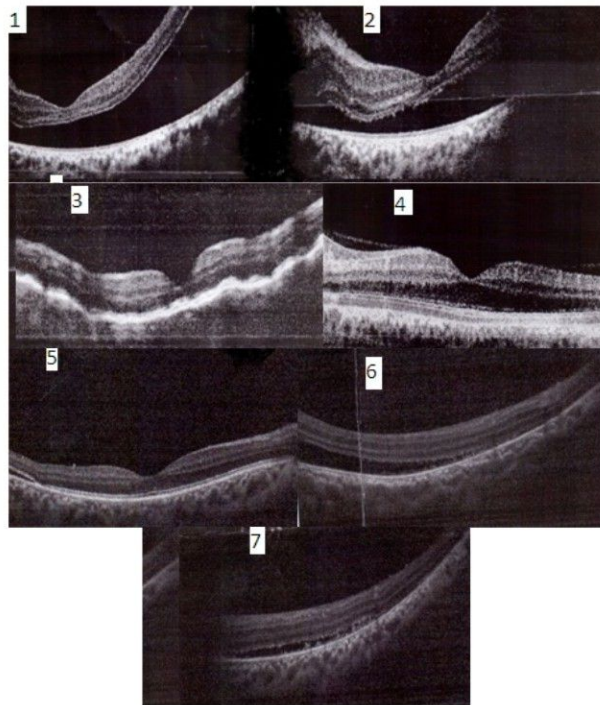


Figure: Serial Optical Coherence Tomography, Macular and Peripheral, 1- Pre-operative Submacular Fluid. 2- 1st Post-operative Day after SB. 3- One Month After SB. 4- Three Month After SB. 5- Six Month After SB. 6-Pre-Operative Peripheral SRF. 7- Three Month After SB Peripheral SRF

In our study 43% patients at first month follow-up showed the persistence of sub-macular fluid on OCT which is consistent with the results of Kovacevic I et al¹⁴ and Bensen SE et al¹² who showed some difference due to duration of detachment because most of our patients came late with almost total RD. Although we did not observe significant effect of duration of RD on persistence of SRF but it has been demonstrated that older the SRF, delayed will be the absorption of SRF¹⁵. Similarly in our study, we performed the scleral encirclement in relatively more percentage of patients

which may reduce the choroidal blood flow^{16,17}, while the segmental SB do not seem to reduce choroidal perfusion^{16,17}. However, this is very small group to study the effect of scleral encirclement on choroidal perfusion, so results cannot be concluded. It has also been proposed that scleral encirclement and segmental buckling cause anterior segment ischemia and refractory inflammation which lead to delayed SRF absorption^{12,18} but in our study only 3 patients showed minimal inflammation which was associated with cryotherapy and on FFA not a single patient showed signs of ischemia and change in perfusion. It was proposed by O Connor et al¹⁹ that age of patient plays significant role in the absorption of SRF because it is directly related to functional capacity of retinal pigment epithelium but in our study we could not conclude this fact which is consistent with the study of Robertson DM et al²⁰. We did not observe any significant relationship between duration of absorption of sub-macular fluid with gender, refractive status of patient, type of break, and location of break.

Seo JH et al described that persistent SRF may slow visual recovery along with all components of vision²¹; similarly in our study it was strongly proposed that sub-macular fluid is associated with poor VA, more the sub-macular fluid, worse was the visual outcome. At 1st follow-up visit SRF was decreased in all patients and it was associated with increased VA in all patients. Median VA of our all patients shifted from 6/60 to 6/36 and 37.2% patients attained the VA of 6/24 while the final VA reached 6/12 or better in 39.2% of patients, these results are consistent with Yang CH et al²². In our study, as the sub-macular fluid absorbed, VA improved, similar fact was concluded by Hagimura et al²³ but such association was not proposed by Baba et al²⁴. Duration of macular detachment play significant role in attainment of good VA^{25,26} as we concluded in our study that 50% of patients who attained final VA of 6/12 or better were of less than 7 days duration. Similarly preoperative VA is also important, good preoperative VA; better will be the prognosis. Out of 20 patients who got 6/12 or better final VA, 55% patients were having preoperative VA of 6/60. Presence of sub-macular fluid led to decreased VA, poor central vision, refractive error, metamorphopsia and loss of streopsis^{9, 21, 24}, but there was little difference in final visual outcome except those in which the duration of macular detachment was prolonged.

Conclusion:

Sub-macular fluid on OCT was found to be directly associated with delayed visual recovery. Postoperative evaluation of persistent sub-macular fluid can be done more efficiently by OCT. Persistent sub-macular fluid after SB surgery may persist for many months, and can cause delayed visual recovery.


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