INFERIOR RETINAL BREAK: INTER-TERM RESULTS FOR THREE SURGICAL LINES.

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ABSTRACT

Purpose: to compare the anatomical and functional outcomes of the three types of surgery used in the treatment of primary retinal detachment (PRD) with inferior retinal break; scleral buckling (SB) alone, pars plana vitrectomy (PPV) alone and combined PPV with SB. Patients and methods: a non-randomized comparative prospective study included patients with PRD due to inferior break recruited from outpatient clinic from Ophthalmic Center Mansoura University. Preoperative demographic and baseline clinical data were collected and compared. Patients were assigned into three groups: scleral buckling group (SB), pars plana vitrectomy (PPV) and combined PPV\SB groups. Postoperative outcomes included anatomic success as primary measure and improvement in visual acuity as secondary measure. Results: A total of 66 eyes of 66 patients were included in the study. 13(19.7%) eyes in SB group, 36(54.5%) PPV, and 17 (25.8%) PPV\SB. There was statistically significant difference between the 3 groups regarding the age (p value=0.002), lens status (p value< 0.0005), axial length (p value=0.001), number of retinal breaks (p value< 0.005) and the mean follow up period (p value=0.002). There was statistically significant difference between the three groups regarding the anatomic success rate (p value=0.029), being highest in PPV group. There was highly statically significant difference between the three procedures in the best corrected visual acuity (BCVA) at 6 months postoperative (p value< 0.0005) with the combined PPV\SB achieving the least final vision. No vision threatening complications were recorded in any of the three groups. Conclusion: pars planavitrectomy with silicone oil injection was effective in management of PRD due to inferior breaks resulting in superior anatomic success as well as significant improvement in vision. These results were attained even without the need for special positioning of the patients postoperatively.

Abbreviations: PRD; primary retinal detachment, SB; scleral buckling, PPV; pars planavitrectomy, BCVA; best corrected visual acuity.

Key words: inferior breaks, pars planavitrectomy, primary retinal detachment, scleral buckling.

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INTRODUCTION

Rhegmatogenous retinal detachment (RRD) is frequently associated with superior breaks which are more feasible for treatment by either conventional scleral buckling (SB) alone or pars planavitrectomy (PPV) alone. Management of inferior breaks (IB) is more challenging to retinal surgeons. Earlier published studies had categorized the IB as one of the potential risk factors for anatomical failure.

Advances in instrumentation have posed superb interest in primary PPV. Yet, dealing with IB is still a matter of debate due to the issues of postoperative positioning. The majority of the internal tamponade agents have specific gravity that is less than that of the balanced salt solution. Thus they float on the surface, offering tamponading effect for superior quadrants of the retina. While their effect on the inferior parts remains inadequate to establish an effective tamponade. Moreover, PPV especially in phakic patients with IB may be confronted with difficulties in complete removal of the inferior vitreous. However, near complete drainage of sub retinal fluid (SRF) could be achieved during PPV which may anticipate for relatively short period of face-down position.

Over the past few years, escalating published studies have proposed the adjuvant use of SB concurrently with PPV for RRD with IB as a possibility to prevail over the aforementioned obstacles. This technique aimed to provide support for the inferior retina,
thereby avoiding the awkward posturing issues [8].

Nevertheless, this practice is not hazardous. The combined procedure is known to be technically challenging and time-consuming. It also bears the possibilities of all the complications related to SB, aseptic erosion, diplopia, refractive change, and infection and anterior segment ischemia [9].

Currently, different strategies are in employment for managing RD with IB without solid consensus on the most effective procedure. SB and PPV are most commonly used either alone or in combination. Comparative studies between PPV and SB are usually struggling to extrapolate owing to the lack of standardized inclusion criteria [10].

The aim of our study is to compare the anatomical and the functional outcomes of patients with RRD due to inferior breaks treated primarily with SB alone, PPV alone and combined SB\PPV.

**PATIENTS AND METHODS**

**Study design:** a prospective non-randomized comparative study. **Patient enrollment and grouping:** Patients with primary RRD (PRD) due to inferior breaks were recruited from the outpatient clinic in Mansoura ophthalmic center, Mansoura University from the period January 2013 to December 2014. Written informed consent was obtained from each patient after explaining the potential risks of the operation.

**Patients were excluded if they had:** proliferative vitreoretinopathy (PVR) grade B or worse, past history of RD surgery, detachment caused by retinal dialysis, subretinal fibrosis or demarcation lines and vitreous hemorrhage. Patients with more peripheral breaks or with one or two breaks on the same level were more likely to be assigned into the SB group.

A detailed pre-operative examination was carried for all the patients, including Snellen's visual acuity (converted to Log MAR for statistical analysis), intraocular pressure, slit lamp of anterior segment and examination of the posterior segment for PVR grading determination of the extent of detachment with detailed number, site, size and type of the breaks using slit lamp bio microscopy with +90 Volk non contact lens examination and indirect ophthalmoscope.

All the surgeries were performed by one retinal surgeon (MME) under general anesthesia.

**For the PPV group:** conventional transconjunctival 23- gauge three-port PPV using Oertli vitrectomy (Hafnerwisensasse 4, Switzerland) was performed. After removal of the central and peripheral vitreous; trimming of the vitreous base with removal of any traction bands on the retinal tears was carried via scleral depression. Then fluid-air exchange was done for draining of the subretinal fluid throughout the break. Diode laser retinopexy was applied as a barrage around the breaks. Drainage retinotomy was not performed in any of the cases. Silicone oil (5000 centistokes) was injected as an internal tamponade in all the cases. No special positioning was needed postoperative.

**For the PPV\SB group:** additional 360° scleral encirclement was performed using a silicone band (240), sutured at about 12-14 mm from the limbus.

**For the SB group:** first a 360° peritomy was performed followed by the four recti with 2-0 silk sutures. Localization of the retinal break was carried out by cryotherapy application then 360° scleral encircle band. This was augmented with a circumferential buckle (silicone tyre-277) to support adjacent multiple breaks. In cases with single break: sponge 505 was used. Drainage of SRF was mandatory in all the cases followed by tightening of the preplaced buckle.

**Postoperative follow up:** Silicon was removed from PPV and the combined group after 3 months from the primary operation. For all the groups; postoperative follow up was scheduled at 1 month, 3 months, and 6 months. In each visit; BCVA was assessed (functional outcome) and the anatomic retinal status was examined (anatomic success was defined as the number of attached retinas after the first surgery). Any complications were recorded and managed probably.

**Statistical analysis:**

SPSS version 16 (SPSS Inc., Chicago, USA) was utilized to analyze the provided data. Shapiro-Wilk test was used to test the normality distribution for quantitative variables. Parametric data were presented as mean ± SD (standard deviation). Comparison between the three groups was carried out by one way Anova test followed by post Hoc Tukey for pair wise comparison. Comparison of data within the same group was carried by paired t-test. Comparing qualitative data was carried by Chi square test. P value ≤0.05 was considered statistically significant.
RESULTS

A total of 66 eyes of 66 patients were included in the study. SB group included 13 (19.7%) eyes, 36 eyes (54.5%) in PPV group and 17 eyes (25.8%) in combined SB/PPV. There was statistically significant difference between the 3 groups regarding the age (p value=0.002), lens status (p value<0.0005), axial length (p value=0.001), number of retinal breaks (p value<0.005) and the mean follow up period (p value=0.002). The preoperative baseline and demographic data of the three groups are given in details in Table 1.

Table 1: demographic and baseline clinical data of the included patients

<table>
<thead>
<tr>
<th>Preoperative parameters</th>
<th>SB group (N=13)</th>
<th>PPV group (N=36)</th>
<th>PPVSB group (N=17)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) Mean ±SD</td>
<td>34.3±6.19AB</td>
<td>42.5±7.64A</td>
<td>43.12±7.37B</td>
<td>0.002*</td>
</tr>
<tr>
<td>Gender (n%) Male</td>
<td>8(61.5)</td>
<td>25(69.4)</td>
<td>6(35.3)</td>
<td>0.061</td>
</tr>
<tr>
<td>Female</td>
<td>5(38.5)</td>
<td>11(30.6)</td>
<td>11(64.7)</td>
<td></td>
</tr>
<tr>
<td>Lens status (n%) Phakic</td>
<td>10(76.92)</td>
<td>5(13.9)</td>
<td>2(11.8)</td>
<td>&lt;0.0005*</td>
</tr>
<tr>
<td>Pseudophakic</td>
<td>3(23.07)</td>
<td>23(63.9)</td>
<td>12(70.6)</td>
<td></td>
</tr>
<tr>
<td>Aphakic</td>
<td>0(0)</td>
<td>8(22.2)</td>
<td>3(17.6)</td>
<td></td>
</tr>
<tr>
<td>BCVA (LogMAR)</td>
<td>1.01±0.17</td>
<td>1.13±0.24</td>
<td>1.035±0.21</td>
<td>0.128</td>
</tr>
<tr>
<td>Macula off (n%)</td>
<td>4(30.76)</td>
<td>15 (41.67)</td>
<td>8 (47.05)</td>
<td>0.672</td>
</tr>
<tr>
<td>Axial length (mm) Mean ±SD</td>
<td>23.83±1.12AB</td>
<td>25.69±2.21A</td>
<td>26.82±2.45B</td>
<td>0.001*</td>
</tr>
<tr>
<td>Retinal breaks mean±SD</td>
<td>1.31±0.4AB</td>
<td>2.94±0.826A</td>
<td>2.76±0.831B</td>
<td>&lt;0.005*</td>
</tr>
<tr>
<td>Follow up period (months)</td>
<td>7.38±1.45A</td>
<td>8.81±1.91AB</td>
<td>7.24±0.97B</td>
<td>0.002*</td>
</tr>
</tbody>
</table>

Test used: one way Anova test followed by post Hoc Tukey HSD for pair wise comparison. Similar letters indicate significant difference.

SB; scleral buckling, PPV; pars planavirectomy, PPVSB; combined Scleral buckling\pars planavirectomy, n; number, BCVA; best corrected visual acuity, LogMAR; logarithm of minimum resolution. SD; standard deviation. P value; significance at <0.05.

There was statistically significant difference between the three groups regarding the anatomic success rate (p value=0.029). Four cases (30.8%) in SB showed retinal re-detachment due to missed break in two cases (phakic eyes at 1 month postoperative) and due to development of PVR in the other 2 cases (pseudophakic eyes). PPV was carried out in the four eyes where the retina remained attached till the end of the follow up period. In the PPV group; 2 eyes (5.6%) showed re-detachment after silicone removal: one case due to PVR and one case due to missed break. At 5 months four cases (23.5%) in PPVSB developed recurrent RD due to PVR. Re-PPV was done in the recurrent cases once discovered in the PPV and combined group. Table 2 gives details about the anatomic outcome according to lens status in each group.

Table 2: anatomic success after primary surgery among the studied groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>SB n=13</th>
<th>PPV n=36</th>
<th>PPVSB n=17</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total attached (%)</td>
<td>9(69.2)A</td>
<td>34 (94.4)A</td>
<td>13 (76.5)</td>
<td>0.029*</td>
</tr>
<tr>
<td>N of attached retina in subgroups (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phakic</td>
<td>8(80)</td>
<td>3(13.3)A</td>
<td>29(93.6)A</td>
<td></td>
</tr>
<tr>
<td>Pseudophakic</td>
<td>1(100)</td>
<td>5(100)</td>
<td>2(66.7)</td>
<td></td>
</tr>
</tbody>
</table>

Test used: Chi square test followed by post Hoc test for pairwise comparison. Similar letters indicate significant difference. P value; significance at <0.05. P1=comparison of success rate in phakic subgroup; P2=comparison of success rate in pseudophakic\aphakic subgroup.

SB; scleral buckling, PPV; pars planavirectomy, PPVSB; combined Scleral buckling\pars planavirectomy.

As regard the functional outcomes, there was highly statically significant difference between the three procedures in the BCVA at 6 months postoperative (p value<0.0005) with the combined PPVSB group achieving the least final vision. There was statistically significant improvement in the final BCVA in PPV (p value<0.0005) while the improvement was insignificant in the other 2 groups (Table 3).
Table (3): Pre- and postoperative best corrected visual acuity among the three groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th>SB</th>
<th>PPV</th>
<th>PPV\ SB</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative BCVA</td>
<td>1.01±0.17</td>
<td>1.13±0.24</td>
<td>1.03±0.21</td>
<td>0.128</td>
</tr>
<tr>
<td>BCVA at 6 months (logMAR) mean ±SD)</td>
<td>0.45±0.077A</td>
<td>0.50±0.12B</td>
<td>0.80±0.08AB</td>
<td>&lt;0.0005*</td>
</tr>
<tr>
<td>PI</td>
<td>0.465</td>
<td>&lt;0.0005*</td>
<td>0.139</td>
<td></td>
</tr>
</tbody>
</table>

**Test used:** One way Anova test followed by post Hoc Tukey HSD for pairwise comparison. Similar letters indicate significant difference. **PI:** test used paired t test compare pre- and postoperative BCVA within the same group.

**SB:** scleral buckling, **PPV:** pars planavitrectomy, **PPV\ SB:** combined Scleral buckling\pars planavitrectomy. **BCVA:** best corrected visual acuity, **LogMAR:** logarithm of minimum resolution, **SD:** standard deviation. **P value:** significance at <0.05.

No vision threatening complications were recorded in any of the three groups. Conjunctival erosion was recorded in one case (7.7%) in SB group, two cases (11.8%) developed cataract and two cases (5.6%) in PPV group developed increased in the intraocular pressure that returned to normal values after silicon removal.

**DISCUSSION**

For decades, SB has been the standard surgery in the paradigm for treatment of RRD especially in phakic patients. This practice had been an attempt to avoid the potential risk for cataract that is frequently encountered after PPV. More recently; considerable number of surgeons started to move away from SB toward PPV\[11\]. Augmenting vitrectomy surgery with SB was another proposed choice adopted by many surgeons especially for inferior breaks that are enduring to represent a challenging surgery\[12\]. However, the selection of the technique often depends on the surgeon’s experience, which is usually guided by the preoperative findings beside the accessibility of particular surgical instruments\[10\]. The current study was planned to compare between the three presented lines for management of the PRD caused by inferior breaks.

In our study, the anatomic success was achieved in 69.2%, 94.4% and 76.5% in SB, PPV and PPV\SB group respectively. There was statistically significant difference between the 3 groups, where PPV attained the highest rate of success. Again the difference was significant on adding the lens status to the comparison. PPV was superior to the conventional SB in the pseudophakic cases with RRD. These results are consistent to those published in a meta-analysis involving studies over long period (1966 to 2004). In the later study; PPV was proved to have better anatomical outcomes in patients with pseudophakicRD than SB. While, no difference could be proven between PPV alone and PPV combined with SB\[13\].

Conversely, two comparative trials reported insignificant difference between SB and PPV in patients with pseudophakicRRD regarding the anatomical outcome after the primary surgery\[14,15\].

Postoperative PVR is the considered the most serious complication after RD surgery and has been estimated to take place in about 18% of the cases after PPV\[16\]. Scrutinizing our results demonstrated that PVR was the cause of failure in 7 out of 10 of the recurrent cases occurring more in the PPV\SB group (4 cases). This result was similar to that reported by Wickham et al\[4\]. In their study they concluded that PVR is more likely to occur in PPV supplemented with SB than PPV alone in patients with inferior breaks. PVR was experienced in two of our cases in SB group this may be attributed to the cryotherapy used which is known to result in higher incidence of PVR exceeding that of the endolaser (25.8% vs 2.2%)\[17\].

During the follow up period; 10 of the included patients in our study required secondary surgery (PPV with silicone oil). The reattachment outcome after the second operation was 100% for all the patients in the 3 groups regardless the lens status. Mehta et al reported the same rate in their study comparing between PPV alone and PPV\SB only\[16\].

Attainingspecial head posture after PPV has been considered mandatory especially when using gas as an internal tamponade. Even so, some patients are incapable of maintaining such positions owing to diverse medical and physical circumstances. This negative aspect might have guided the retinal surgeons to advocate the use of SB with PPV for dealing with these breaks\[17\]. In our study, silicon oil was used as an internal tamponade without the need for special postoperative positioning.
Regarding the visual outcome; our series record significant VA improvement in PPV group only (P value<0.0005). We believe that the increased percentage of macular detachment (47.05%)in PPVSB together with the cataract progression might be the causes for poor improvement of VA in this group. Moreover, scleral buckling is well known for inducing errors of refraction, which together with the early failure; might be the cause of insignificant improvement of vision in SB group. Similarly, Sharma et al reported significant improvement of VA after PPV for inferior break group (from 0.8 to 0.54)[2]. On the other hand, Rush and associates noticed no significant difference in the BCVA in their study comparing the same three lines of repair in cases with medium complexity RRD[10].

As regard complications, we did not encounter any sight threatening complications along the follow up period which is comparable to the results of many studies comparing same techniques[2,10,17].

LIMITATIONS AND RECOMMENDATIONS

One of the limits of this study was the relative small sample size. Also the significant different in the baseline criteria of the patients in the groups may have affected the results. On the other hand, having a single surgeon for all the cases adds the privilege of excluding this factor from the results. In addition; the prospective nature of the study design had facilitated the precise data recording. We believe that performing total shaving of the vitreous together with adequate laser barrage around each single break can achieve comparable results-even superior to those achieved on combining vitrectomy with buckling.

CONCLUSION

Pars planavitrectomy with silicone oil injection proved to achieve superior anatomical and functional results when compared to either buckling alone or combined PPVSB in cases of RRD due to inferior break. These results were attained even without the need for special positioning of the patients postoperatively.

FINANCIAL DISCLOSURE

The authors declare no financial interest.

REFERENCES


