Editorial

Primary Rhegmatogenous Retinal Detachment Surgery in Modern Era

Amer Awan

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Rhegmatogenous retinal detachment (RRD) is a common clinical challenge that affects up to one of every 170 people[1]. RRD is one of the most common indications for vitreoretinal surgery. Jules Gonin treated the first case of idiopathic retinal detachment with a clear media on 16 October 1916 and the outcome was successful. Gonin subsequently reported on his first 300 cases (1929–1931) and quoted a success rate of 39%[2]. RRD surgery is somewhat different among ophthalmic surgeries because excellent outcomes may be achieved using three distinct approaches: scleral buckling (SB), first described in 1950s[3,4], pars plana vitrectomy (PPV) first reported in 1971[5] and pneumatic retinopexy (PR) first reported in 1986[6]. However, the main principles in RRD management include identification and treatment of all retinal breaks[7].

PPV is increasingly employed in the repair of primary RRD in most part of world due to advancement in vitrectomy machines and viewing systems. A 2012 US Medicare claims database analysis reported 74%, 11% and 15% of primary RRD being repaired with PPV, SB and PR, respectively[8], with substantial regional differences. Despite this evolving trend in more surgical exposure to PPV during training, reasonable number of surgeons still preferably use SB depending on the region. The 2015 Preferences and Trends survey revealed 67% of surgeons place an SB in 11% or more of RRD surgeries, with 24% placing an SB in 41% or more of RRD surgeries[9].

While high surgical success rates can be achieved with each technique, all approaches to primary RRD repair have less than perfect success rates: 10–40% of eyes require more than one surgical procedure, and as many as 5% of eyes may sustain permanent anatomic and functional failure despite favorable surgical timing and technical expertise[10]. Regardless of surgical approach, anatomic single operation success rate (SOSR) is influenced by pre-existing RRD characteristics. For example, high-risk RRD with giant retinal tear or in the presence of proliferative vitreoretinopathy (PVR), choroidal detachment (CD) or hypotony has a well-documented lower SOSR[11]. More common clinical findings such as inferior retinal breaks, increasing number of retinal breaks and extent of RRD appear to reduce SOSR[12].

In comparison to medical retinal diseases, surgical retinal diseases have less commonly been subjected to the scrutiny of large, prospective randomized clinical trials (RCTs). Furthermore, few prospective analyses have compared different approaches to RRD repair[13,14,15]. For a surgical trial, standardization of techniques among surgeons is a major challenge. The current analysis aims to synthesize published data and incorporate recent observational reports into a clinical guide for optimal decision-making when considering primary RRD surgical options.

Prospective Data

Retinal Detachment Study

The retinal detachment study[13] was a prospective multicentre RCT comparing SB with PR in 198 patients with uncomplicated RRD involving the superior two-thirds of the fundus with retinal breaks no greater than one clock hour in size. Anatomic SOSR (82% vs 73%) and final anatomic success rates (98% vs 99%) were not statistically different between the SB and PR groups, respectively. PR was associated with less ocular morbidity and significantly better postoperative visual acuity ($p = 0.01$). At 6 months postoperatively among macula-involving RRD patients, 56% of SB

cases compared with 80% of PR cases achieved 20/50 or better[13].

Scleral Buckling Versus Primary Vitrectomy in RRD (SPR)

The SPR study was a prospective multicenter RCT comparing SB with PPV[14,16]. Twenty-five European centers comprising 55 surgeons randomized 416 phakic and 265 pseudophakic eyes to SB or PPV. Exclusion criteria included RRD that could be treated with a single episcleral radial sponge and PVR stage B or C. Simultaneous SB placement to eyes randomized to PPV was allowed at surgeon discretion and was a significant limitation of the study.

Among phakic eyes, the SOSR and final anatomic success rate for SB and PPV groups were nearly identical: 63.6%, 96.7% and 63.8%, 96.6%, respectively. However, SB resulted in significantly better visual outcomes than PPV ($p = 0.0005$), reduced risk of reoperation ($p < 0.0001$) and reduced cataract development (45.9% vs. 77.3%; $p < 0.00005$), with anatomic success correlating positively with subretinal fluid drainage, and correlating negatively with multiple breaks, breaks larger than 1 clock hour and the use of cryopexy[14,17,18].

Among pseudophakic eyes, PPV resulted in a better SOSR ($p = 0.002$) and similar final success rate compared with SB (72.0%, 95.5% and 53.4%, 93.2%) and also reduced the risk of reoperation ($p = 0.0009$)[14,18]. Crucially, however, 66.7% of pseudophakic eyes randomized to PPV underwent simultaneous SB placement, a non-randomized event performed with surgeon preference; recurrent RRD occurred in 40.9% of eyes without an SB and 11.4% of eyes with an SB, a 3.5-fold greater rate of recurrent RRD without a SB. The authors concluded, "Anatomic results were significantly better in pseudophakic/aphakic patients operated on with an additional buckle"[14].

Possibly limiting current-day applicability of the SPR, this trial recruited patients between 1998 and 2003 and excluded PVR stage B and C. Since then, PPV techniques have experienced substantial refinement and miniaturization.

Scottish Retinal Detachment Study

It was a prospective, multicentre, population based epidemiology study[15], in which each patient with primary RRD presenting to one of the six vitreoretinal surgical centers in Scotland was approached for study inclusion. In total, 1202 cases were recruited to the study representing over 95% of all incident cases in Scotland during this period[15]. In total, 64.4% (628) of cases had a PPV, 29% (283) had a scleral buckle, 5.6% (55) had a combined PPV and scleral buckle and 0.9% (9) had pneumatic retinopexy as their primary surgical procedure. The choice of surgical procedure was based on clinical evaluation and the surgeon's preference. The overall SOSR was 80.8% (95% CI 78.1 to 83.3%) after one procedure[15]. No significant difference was noted in the success rate by types of surgery. The presence of preoperative proliferative vitreoretinopathy of any degree and each additional clock hour of detachment increased the risk of failure by an OR of 2.4 and 1.13 respectively ($p < 0.05$)[15].

In this study, the patients with macula off RD were further analyzed about the visual outcome. In total, there were 291 patients with macula-off RRD without pre-existing retinal disease who had successful repair after one operation. 65.9% achieved a final visual acuity (VA) of 0.48 log MAR (6/18). This model identified two time points (day 8 (95% CI 3 to 15 days) and (day 21 (95% CI 6 to 26 days) after which there was a statistically significant worsening in final VA19. Macula-affected RRD of ≤ 8 days demonstrated a significant continuing improvement in VA for each pairwise postoperative visit up to month 3, with an overall significant trend towards continuing visual gain up to 1 year. Individuals with the macula detached for over 8 days demonstrated a significant improvement in VA at the first postoperative visit (6 weeks) with no significant improvement thereafter[19].

Retrospective Data

European Vitreo-Retinal Society analysis

The European Vitreo-Retinal Society (EVRS) retrospectively evaluated 7678 RRD repaired by 176 surgeons across 48 countries[20]. This subjective, informational survey collected data from 2010 until July 2011 from EVRS members. Cases were considered uncomplicated or complex. Complex RRD were defined by the presence of PVR grade B or C, CD, hypotony, large or giant retinal tears and macular holes[21].

Among uncomplicated RRDs combining phakic, pseudophakic and aphakic eyes, PPV with or without SB was associated with a significantly greater final failure rate compared with SB alone (1.2% vs. 0.5% $p = 0.04$)[20]. The anatomic benefit of SB compared with PPV was driven by phakic patients, in whom final failure rates were 1.3% and 0.5% among PPV-treated and SB-

treated patients, respectively (p = 0.028). Among pseudophakic patients, no such difference in final failure rates was observed between PPV-treated and SB-treated eyes.

Among complex RRDs, outcomes were superior with PPV compared with SB alone[21]. Among patients with grade B PVR, PPV with or without SB resulted in significantly improved outcomes, with a final failure rate of 0.8% compared with 4.0% with SB alone (p = 0.0017). In eyes with choroidal detachment or hypotony, PPV performed better than SB alone, with 4.9% vs 14.7% final failure rates, respectively (p = 0.0015). Finally, in eyes with large or giant retinal tears, PPV performed better than SB alone, with 2.2% vs 10.2% final failure rates, respectively (p = 0.00000007).

Wills PVR Study Group

In this retrospective, single centre, based study 678 patients were identified as having RRD. Patients were considered at high risk for PVR if they presented with retinal detachment in two or more quadrants, retinal tears > 1 clock hour, preoperative PVR, or vitreous hemorrhage.

Of the 678 patients with RRD, 65 were identified as high risk for PVR. 36 patients were treated with simultaneous PPV-scleral buckle and 29 patients were treated with PPV alone, with an overall success rate of 63.1%. The use of PPV-scleral buckle was associated with significantly higher SOSR compared with patients treated with PPV alone (odds ratio, 3.24; 95% confidence interval, 1.12-9.17; P = 0.029). Visual acuity at 3 months post-procedure or final follow-up was no different between the treatment groups. Overall, 23.1% of patients developed postoperative PVR with no difference between surgical approaches.

Recommendations Based on Evidence and Individualized Approach

It is very important to consider duration of RRD and status of macula as deciding factors in timing of surgery. RRD reattachment surgery should be considered as an emergency surgery. Even in macula off RRD early surgery achieves better visual outcome. Status of posterior vitreous detachment (PVD), clarity of media such as cataract and vitreous opacities, location of breaks (anterior versus posterior) are vital elements in selecting the choice of procedure.

SB and PPV offer a number of well-accepted benefits and shortcomings to be considered for the individual patient. Encircling SB can create a significant refractive shift and SB elements can interfere with extraocular muscle function and contribute to ocular misalignment and resultant diplopia. It can also lead to buckle extrusion with passage of time that can cause recurrent infection, eventually producing thinning of sclera. PPV allows simultaneous removal of vitreous opacities. However, PPV typically involves the use of gas tamponade, temporarily precluding air travel and often requiring short-term head positioning. In addition, PPV can lead to cataract progression eventually, often necessitating additional ocular surgery after RRD repair. In selected patients, PR is a good option, obviating the need for an operating room and carrying limited ocular risks.

In phakic patients, PPV may make it difficult to remove the anterior peripheral vitreous, thus allowing the potential for residual traction that may have been relieved by SB and may lead to additional retinal breaks[22]. However, with introduction of smaller gauge valved vitrectomy systems (23 gauge, 25 gauge & 27 gauge) and modification of PPV techniques, anterior peripheral vitreous can be tackled in a better way. In summary, PR, SB and PPV all afford a high rate of surgical success and substantial visual benefit can be achieved in most RRD cases.

However, specific approaches may be optimal in certain clinical scenarios, supporting a personalized approach to RRD reattachment surgery. Many young, phakic patients with uncomplicated non PVD RRD may be ideally suited for SB rather than PPV. Uncomplicated pseudophakic RRD or phakic RRD with PVD may be successfully repaired with PPV, SB, PR or combination technique, but current trends indicate a greater use of PPV with similar success rate. More complex RRD may be best approached with PPV with or without supplemental SB placement. In PPV cases gas tamponade works very well with better visual outcome in simple RRD and slight complex RRD with type A and B PVR. However posturing is a key to remove sub retinal fluid and keep the break closed while laser or cryotherapy produces adequate adhesion.

RRD has an excellent reattachment rate and better visual outcome if timely intervention is done. Referring ophthalmologists should stress the patients to immediately see the vitreo-retinal surgeon and have early surgery.

Authors Affiliations

Amer Awan
Consultant Ophthalmologist and Retinal Surgeon
Shifa International Hospital, Islamabad.

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