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Primary vitrectomy for rhegmatogenous retinal detachment: an analysis of failure

E.C. RICHARDSON, S. VERMA, W.T. GREEN, H. WOON, A.H. CHIGNELL

Department of Ophthalmology, St. Thomas' Hospital, London - UK

PURPOSE. *To find the cause of failure in primary vitrectomy for rhegmatogenous retinal detachment.*
METHODS. *Retrospective review of 171 consecutive cases of RRD treated by primary pars plana vitrectomy (PPV) from a tertiary referral centre to identify the 25 cases in which surgery had failed. Detachments with giant or macula breaks at initial presentation, with proliferative diabetic retinopathy or with PVR greater than grade B were excluded.*
RESULTS. *The failure rate after the first operation was 14.6% and the commonest cause of failure was missed retinal breaks, accounting for 64.3% of failures.*
CONCLUSION. *Missed retinal breaks are the commonest cause of failure of primary PPV for RRD although proliferative vitreoretinopathy may contribute to surgical failure. This re-emphasises the importance of assiduous peroperative retinal examination. (Eur J Ophthalmol 2000; 10: 160-6)*

KEY WORDS. *Vitrectomy, Retinal detachment, Retinal breaks*

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INTRODUCTION

In a previous study (1), we reported our preference for treating some rhegmatogenous retinal detachments (RRD) without advanced proliferative vitreoretinopathy (PVR) by pars plana vitrectomy (PPV). We used PPV for cases in which: a) the retinal breaks were poorly seen due to opacities in the media; b) the retinal breaks were of a complex size or position; c) when the distribution of the retinal breaks made scleral buckling particularly difficult.

The purpose of the present study was to examine the clinical features of cases which redetached after underoing PPV for the above indications as the first operative procedure following RRD.

METHODS

The study consisted of a retrospective analysis of 24 eyes (24 patients) from a consecutive group of 171 eyes undergoing PPV as the first operative procedure for RRD at St. Thomas' Hospital, London, UK.

Case selection

During the period of the study, 171 vitrectomies were carried out as a primary procedure for "uncomplicated" RRD. "Complicated" RRD i.e. those with giant or macular breaks, PVR greater than grade B, or those secondary to penetrating trauma, uveitis or vasoproliferative disease were excluded. Of these 171 cases, 25 (14.6%) required further surgery. During each hospital admission, retinal examination was carried out by indirect ophthalmoscopy and scleral depression. When it was indicated, three mirror examination was also carried out. The information was recorded using proforma sheets and entered into our vitreoretinal data base. Where the retinal detail could be seen preoperatively, colour coded charts were prepared prior to each operation. One patient was excluded from

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the study as there was insufficient detail recorded on the proforma sheet and the notes were unavailable. Thus, 24 cases were studied.

Clinical features of the failed cases at first operation

Of the 24 cases, 19 were male and 5 were female. The age ranged from 29 to 75 with a mean age of 51.9. There were 11 phakic, 8 pseudophakic and 5 aphakic patients. The macula was detached in 17 of the 24 patients. In all of the 7 patients with the macula attached at the first operation the visual acuity was 6/12 or better.

Retinal breaks

There were multiple (2 or more) breaks seen before the first operation in 15 cases. Six cases had one break seen before the first operation and no breaks were found preoperatively in 3 patients.

Extent and nature of RRD

The initial detachment involved up to 2 quadrants in 13 patients, over 2 quadrants but less than a total detachment in 8 patients and a total detachment in 3 patients. PVR (grade B) was present in one patient prior to the initial operation. In all other cases PVR did not exceed grade A. Choroidal detachments were seen in one patient prior to surgery.

Reason for pars plana vitrectomy for the initial RRD

Of the 24 patients, 13 underwent the initial PPV because of a poor retinal view and thus uncertainty of the location of retinal breaks. Of these patients, 10 were due to opacities at the lens-iris diaphragm and 3 were due to vitreous opacities. Four patients underwent the initial PPV for multiple retinal breaks and 5 for large retinal breaks. In 2 further cases, there were both multiple and large retinal breaks. One patient required the initial PPV for breaks at the posterior pole. In one patient there was more than one reason for the initial PPV.

Details of the first operation

All 24 cases underwent a routine triple port pars plana vitrectomy performed by either a consultant vitreoretinal surgeon or the vitroretinal fellow. Infusion of balanced salt solution was via the port in the lower temporal quadrant and the upper ports were used for suction cutter and light pipe access. At all times, the infusion bottle height was kept low. After a peroperative search for retinal breaks (2), subretinal fluid was drained internally through the retinal breaks. A hand-held plano-concave contact lens was used for viewing. Search for retinal breaks was performed using indentation and endoillumination taking advantage of the magnification derived from the operating microscope. Retinopexy was performed using cryotherapy and 30% SF6/air was used for post operative tamponade. An encircling band and a local buckle were used at the first operation in three cases and in 11 further cases, a local buckle alone was used. In the remaining 10 cases where the breaks were situated above the horizontal meridian, no buckle was used at the first operation. The clinical appearance of the initial retinal detachment is shown in the first column of Figure 1.

Retinal breaks were not found in three cases. In pseudophakic eyes, the view was improved peroperatively by surgical removal of the central portion of the posterior capsule. In no case was the intraocular lens removed. In aphakic patients, the view was improved by surgical enlargement of the pupil using the vitreous cutter.

Details of reoperation

In all of the 24 cases which required further surgery, a revision pars plana vitrectomy and internal search were performed to determine the cause of failure of the first operation and to treat the reason for failure. Breaks found were closed by adjustment of the pre-existing scleral buckle in 7 cases, by an additional local buckle in 14 cases and by an encircling band in 2 cases. An air/SF6 mixture was used in the repeat surgery in 12 cases. Silicone oil was used in a further 5 patients, 4 because of the development of PVR and in a further case because of the development of a macular hole with a total retinal detachment. Further retinopexy was applied in all cases.

RESULTS

There were 25 cases for which further surgery was required out of a consecutive series of 171 primary vitrectomies carried out for rhegmatoge-

	Preoperative 1	Preoperative 2	Cause of Failure
1	R		Inadequate Treatment
2	L		Inadequate Treatment
3	R		Missed Break
4	R		Missed Break
5	R		Missed Break
6	L		Missed Break
7	L		Missed Break + Inadequate Treatment
8	L		Missed Break
9	R		Missed Break then Increasing PVR
10	R		Missed Break + Inadequate Treatment
11	R		Missed Break
12	L		Missed Break
13	R		Missed Break
14	R		PVR
15	R		Missed Break
16	R		Missed Break
17	R		Inadequate Treatment + PVR
18	R		Inadequate Treatment
19	L		Missed Break
20	R		Missed Break
21	R		PVR
22	R		Missed Break
23	R		Missed Break
24	R		Missed Break

R = Right
L = Left
= U-shaped retinal break
= Round retinal hole
= Optic dise
= Detached area
or * = Area of early PVR

Fig. 1 - *A diagrammatic representation of retinal detachments.*

nous retinal detachment uncomplicated by PVR (beyond grade A in 24 cases, grade B in one case), proliferative diabetic retinopathy and without giant breaks or macular holes. The success rate of initial surgery was therefore 85.4%. One case has been excluded from this study as the records were unobtainable. The following data apply to the 24 cases where the retina redetached after the first operation.

Complications of the first operation

In one patient, an entry site break was made adjacent to the upper temporal sclerotomy site with retinal incarceration. In another patient, inferior retinal incarceration occurred at a scleral suture site.

Time to redetachment

The average time from first operation to redetachment was 5.3 weeks (range 2-20). Seventeen patients had redetached by 4 weeks after their first operation. Of the remaining 7 patients, three had detached by 6 weeks after initial surgery, two by 10 weeks and one each at 12 and at 20 weeks.

Extent of redetached retina

Of the 24 cases, one started as a total detachment and was total on redetachment, four started as incomplete detachments and redetached with total detachment and nineteen had varying degrees of partial detachment at re-presentation. Of these 19 patients, 18 had a sub-retinal fluid (SRF) distribution consistent with the site of the unsealed retinal break (3). The extent of the retinal detachments requiring further surgery are shown in the second column of Figure 1.

Retinal breaks

Eighteen cases were subsequently found to have failed due to a previously undetected retinal break.

In 15 of these 18 cases, retinal breaks had been detected at the first operation and in 11 of these the original break(s) remained sealed when the retina redetached.

PVR

PVR advanced or developed in seven cases.

The macula

Of the 7 patients where the macula was attached at initial operation, 5 remained attached and 2 detached when redetachment occurred.

Details of re-operation

In all of the 24 cases which required further surgery, a revision pars plana vitrectomy and internal search were performed to determine the cause of failure of the first operation and to treat the reason for failure. Breaks found were closed by adjustment of the pre-existing scleral buckle in 7 cases, by an additional local buckle in 14 cases and by an encircling band in 2 cases. An air/SF6 mixture was used in the repeat surgery in 12 cases. Silicone oil was used in a further 5 patients, 4 because of the development of PVR and in a further case because of the development of a macular hole with a total retinal detachment. Further retinopexy was applied in all cases.

Complications of re-operations

In one patient, silicone oil passed beneath the retina at the second operation.

Follow-up

The average length of follow-up was 29 months (range 3-72). There was only one case followed up for less than 6 months, a persistently non-attending patient.

Reasons for failure of the initial PPV

In 18 cases, retinal breaks missed at initial operation were the cause of failure of the first operation. In 10 of these patients, the missed breaks were in previously flat retina, in 6 patients they were in previously detached retina and in 2 cases breaks were missed in both flat and detached retina. Thus, 75% patients (18 out of 24) had missed breaks contributing to failure of the primary procedure (95% confidence interval (CI): 53% to 90%). These breaks were not iatrogenic due to direct damage to the retina by the vitreous cutter nor did we find any reason to suspect that they were related to the entry sites (4-7). We accept that it is impossible to prove with certainty that the breaks which we have classed as “missed” were not formed consequent to the pars plana vitrectomy. However, we found little evidence to support this theory.

In a further six cases (25% of cases, CI: 10% to 47%), inaequate treatment of breaks seen at the first

operation (either inadequate retinopexy or inaccurate scleral buckling or both) contributed to the failure of this procedure. PVR was a factor contributing to failure in 4 cases (17%, CI: 5% to 37%). In 4 patients, there was more than one reason why the initial operation failed.

Missed breaks were the only cause of failure found in 15 patients (62%, CI: 41% to 81%). Inadequate treatment alone accounted for 3 failures (12%, CI: 3% to 32%) and PVR alone for 2 failures (8%, CI: 1% to 27%).

Visual acuity

The final visual acuity was improved by 2 or more Snellen lines in 10 of the 24 patients who needed more than one operation and in all of these cases, the macula was detached at initial presentation. The visual acuity remained unchanged in 11 cases of which 7 had a detached macula at initial surgery and 4 had an initial macula-on detachment. Three patients had a reduction in visual acuity post- operatively. In one case, this was due to the development of cataract and in the other two, the cause was detachment of the macula.

Reattachment rate

Of the 24 patients who required reoperation and in whom records were available, 22 (92%) were reattached at final follow-up. However, 2 of these cases still had silicone oil in the eye at final follow-up and a final reattachment rate of 83.3% (20/24) reflects this.

The two patients in whom the retina was not flat at final follow-up both had a persisting inferior detachment in an eye containing silicone oil.

DISCUSSION

This study was of the 24 patients requiring more than one procedure from a series of 171 consecutive patients treated by PPV for RRD uncomplicated by severe PVR. The initial success rate for surgery was 85.4%. There have been a number of other studies of varying sizes involving PPV for RRD with initial success rates from 64-94% (1,4,8-11).

The study with the highest success rate at initial surgery (94%) was one involving 33 pseudophakic patients (8). Whilst numbers in this study are small, we have also found a more favourable outcome of surgery using a wide angle viewing system. Our success rate at PPV for cases with a poor preoperative view has improved such that it now exceeds that attainable by conventional surgery (12) and equals that of a previous study from this unit where conventional surgery using drainage of SRF, injection of air, cryotherapy and local explant gave an initial success rate of 85% in 97 cases of superior bullous RRD (13).

The average time to redetachment in this group of patients was 5.3 weeks. Redetachment was delayed in 4 patients by 10 weeks or more and this is surprising as there is presumably easy access of preretinal fluid to the subretinal space via the open break in the vitrectomised eye.

Although it is our clinical impression that SRF accumulates rapidly when redetachment does occur in the vitrectomised eye, total detachment in an eye that had previously been incompletely detached only occurred in four eyes. We also found that the distribution of SRF in eyes that were not totally detached was consistent with the site of the unclosed retinal break. It therefore seems that consistency as to the position of the retinal break is of as much help to the surgeon planning reoperations after PPV as it is in break detection in the unvitrectomised eye.

Twenty-four cases underwent reoperation and 22 (92%) had a successful final outcome with a flat retina although silicone oil was used in 5 cases. Twenty cases were flat at final follow-up without silicone oil in the eye which gives a final reattachment rate of 83.3%.

This reattachment rate at final follow-up is comparable with other series where success rates with 2 or more operations of 83% (9), 92% (4,10) and an overall success rate of 90% (14) were reported.

Inadequate treatment of retinal breaks seen at the first operation contributed to failure in six patients. Gas tamponade can be used without a buckle in combination with PPV in superior RRD without PVR (15) but where there are inferior breaks, an explant is necessary. We, like others (7), have found that when breaks are small it is difficult to find them after gas exchange, risking inadequate retinopexy or, when buckles are used for inferior breaks, inadequate buckling. Retinopexy can be applied to small breaks before fluid/gas exchange to minimise the chance of missing them. An alternative is to mark breaks with intraocular diathermy prior to fluid/ gas exchange so that they are not lost after gas has been used. This

technique has also improved our success rates.

However, in this series the major cause of initial surgical failure was missed retinal breaks, accounting for 18 of our 28 reasons for failure (64.3%). In 10 of these cases the missed breaks were in previously flat retina. This emphasizes the need for exhaustive peroperative indentation of flat as well as detached retina. We have improved our search for breaks in flat as well as detached retina to attempt to avoid surgical failure. The wide angle viewing system has particularly contributed to an improvement in the peroperative search for breaks. Endo-laser iris retraction may also improve success rates.

PVR grade B was seen prior to the initial operation in one case and had developed in another six by the time reoperation was performed. Although the development of PVR in these cases contributed to failure, in five of the seven missed, or inadequately treated, breaks were also found. Our clinical findings contrast with another study of comparable size but with a low initial reattachment rate (64.5%). In this study (9) only 38.6% of failures were associated with no PVR, the remainder of cases having advancing PVR and "possible" reopening of breaks or discovery of untreated ones. Our interpretation of our own cases based on our findings at reoperation suggest that PVR rarely initiates failure but may complicate it. Instead, unsealed breaks are the main problem. In the three cases where PVR was not felt to contribute to redetachment in our study, breaks were also missed which allowed the retina to detach and which,we felt, were the cause of the redetachment.

Entry site breaks are one disadvantage of the internal approach. Primary entry site breaks occurring during the vitrectomy are straight forward to detect, particularly with the newer wide angle viewing systems. Secondary entry site breaks also occur due to PVR and vitreous incarceration. These may be difficult to detect with increasingly anteriorly positioned sclerostomies and due to lens and capsular remnants (6). They may lead to detachment months after the initial vitrectomy (6). It is possible that some of the missed breaks in this series, particularly those within one clock hour of a sclerostomy site, were secondary entry site breaks.

Inferior retinal detachment may be caused by a tamponading gas bubble after inadequate vitrectomy. This is another possible aetiological factor for secondary breaks, particularly in the presence of inferior lattice retinal degeneration. This may also account for some of the inferior missed breaks in this paper, although the surgeons carrying out the vitrectomies in this series are very experienced and this problem only arises after inadequate vitrectomy.

The visual results of our series of patients in whom primary PPV for RRD failed are good, with 21 patients (87.5%) showing a stable or increased visual acuity after PPV.

Progressive sophistication of illumination and viewing systems and an awareness of the possibility of missing small breaks in both flat and detached retina should lead to improvement in the success rate of PPV for RRD.

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Reprint requests to:
Emma C. Richardson, FRCOphth
Department of Ophthalmology
St. Thomas' Hospital
Lambeth Palace Road
London SE1 7EH, UK

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