Extraocular Repeat Surgery of Retinal Detachment

A Minimal Approach

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Background: After a failed buckle surgery, the second procedure tends to be a gas injection and the third a vitrectomy.

Methods: The failures from two series, consisting of 752 and 500 buckle surgeries, were analyzed for cause, solution, and outcome after repeat surgery with a segmental or encircling buckle.

Results: The most frequent cause of failure was an undetected break. An analysis of the postoperative contour of the detachment suggested its presence and helped to locate it. Failure occurred nearly as frequently because the buckle was inadequate. It was poorly placed, too narrow, or too shallow. An undetected break or an inadequate buckle was the cause of 73% of the failures in the first series and 79% of failures in the second series. The failure from either cause responded, with few exceptions, to a segmental explant.

Conclusion: The arbitrary sequence of intraocular gas and then vitrectomy in response to failure to attach the retina with a scleral buckle often is misdirected.

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Between 1953 and 1971, scleral buckling was the most frequent surgery for retinal detachment. If the first buckle were segmental, repeat surgery after a failed procedure was often an encircling band and if that failed the third procedure was another band more posterior and more constricting. Two encirclements with 360° of coagulation was the limit in those years. The intent of the encirclement was to wall away undetected retinal breaks that might exist in the periphery and to relieve presumed vitreous traction. The phrase "creating a new ora serrata" became current.

With the advent of the fluorinated gases[1,2] and pars plana vitrectomy,[3] a new sequence of repeat surgery has evolved and is being used with increasing frequency. It is a gas injection, and if that fails, a vitrectomy with an encircling band if one is not already present. The thinking behind this sequence is that an intraocular gas bubble will tamponade the break that has failed to close on the buckle and therefore attach the retina. If it does not, the presumption is that there is either excessive preretinal traction or an undetected break in the periphery, and a vitrectomy, a band, extensive peripheral coagulation, and a second intraocular tamponade of gas or silicone oil should either capture the break or counter the traction. On the New York Hospital retinal service, most patients referred for repeat surgery already have had a gas injection and are being referred for a first or second vitrectomy.

When the causes of failures are examined, the routine injection of gas appears to be inappropriate for many patients and a vitrectomy excessive. In two series of uncomplicated detachments that underwent surgery a decade apart, 73% and 79% of failures to attach the retina occurred because either a break was undetected or the buckle was inadequate.[4,5] With the relative frequency of the causes for failure in mind, an interpretation of the changed contour of the detachment or the lack of change can usually indicate a more specific second surgery than a gas injection or a vitrectomy.

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Table 1. Failure after the 752 First Buckle Surgeries without Drainage

	No.
Initial cause (n = 80)	
Undetected break	30 + 1*
Inadequate buckle	21 + 6*
Proliferative vitreoretinopathy	17
Choroidal detachment	3
Macular hole	2
Cause of redetachment (n = 7)	
Buckle receded	6
Infected buckle	1

* Seven failures previously classified as of unknown origin,[4] in retrospect, were caused by an undetected break (n = 1) or an inadequate buckle (n = 6).

Patients and Methods

In 1971, we reported the results of 1000 consecutive retinal detachments that were treated surgically with segmental buckles, augmented occasionally by an encircling band.[4] The series covered the period 1963 to 1971, when we were converting from drainage to nondrainage surgeries. The incidence of nondrainage rose from 48% in the first 100 patients to 70% in the next 200 and to 88% in the last 200 patients. Early in the series, a bullous detachment, the presence of multiple breaks, old fluid, or aphakia were considered indications for drainage of subretinal fluid. Later in the series, only detachments with giant tears, proliferative vitreoretinopathy (PVR) greater than C2, eyes with severe scleral staphylomas, or eyes with glaucoma were drained. The extent of the detachment was never a factor.

In this report, we have selected the 752 eyes that underwent surgery without drainage for our analysis of failure because they typify uncomplicated retinal detachments and represent nine of ten detachments that present to the average retinal surgeon. Eighty retinas failed to attach with the first surgery: 31 (39%) because of an undetected break and 27 (34%) because of an inadequate buckle. The retina in an additional seven eyes redetached between 3 weeks and 3 months because the buckle receded (n = 6) or because the buckle was infected and had to be removed (n = 1) (Table 1).

In the second series that we reported in 1989, we analyzed the causes for failure in 500 consecutive retinal detachments that underwent surgery with a balloon buckle without drainage of subretinal fluid.[5] All of the eyes were presumed to have only one break or a group of breaks within 1 clock hour and thus had an even more favorable prognosis than the earlier series. As in the prior series, the extent of the detachment was not a factor. Thirty-four retinas failed to attach with the first surgery: 11 because of an undetected break and 16 because the buckle was inadequate. After the balloon was deflated, an additional 12 redetached between 1 week and 3 months because of another break (n = 7) or because the cryopexy-induced adhesion without the support of the buckle was insufficient to maintain attachment (n = 5) (Table 2).

Preoperatively, the retinas in both series were drawn independently by a retinal fellow and one of us after the study with indirect ophthalmoscopy and a three-mirror contact lens with depression. Afterward, the retinal drawings were compared and any discrepancies were resolved by additional study.

Postoperatively, in both series, repeat surgery was preceded by a biomicroscopic search for an undetected break,[6] unless it was evident that the failure to attach was caused by a poorly placed sponge or balloon buckle. The search concentrated on the area of maximum probability derived from an interpretation of the new or unchanged borders of the detachment.

Results

Three patterns of detachment, after a failed buckle surgery emerged.

1. When the superior border of a temporal or nasal detachment fell below the buckle and the surface of the residual detachment was convex to the ora and persisted, it implied the presence of another break below the new superior border.
   Example: A superotemporal detachment with a horseshoe tear at 10:15 responded incompletely to the buckle (Fig 1). The superior border of the detachment fell from the 11:00 to 9:45 position; the inferior border remained unchanged. Unlike residual fluid that might be expected to become absorbed, the surface of the remaining detachment was convex to the ora and unchanged after 2 days. Biomicroscopy showed a small break at the 9:15 position below the new superior border that had been undetected in the preoperative examination. When the second break was buckled with a silicone sponge explant, the remainder of the detached retina became attached (Fig 2).

Table 2. Failure after 500 Balloon Insertions

	No.
Initial cause (n = 34)	
Inadequate buckle	16
Undetected break	11
Proliferative vitreoretinopathy	3*
Choroidal detachment	1
Balloon prolapsed	3
Cause after deflation (n = 12)	
Another break	7
Inadequate adhesion	5

* C2 was present preoperatively in two eyes.

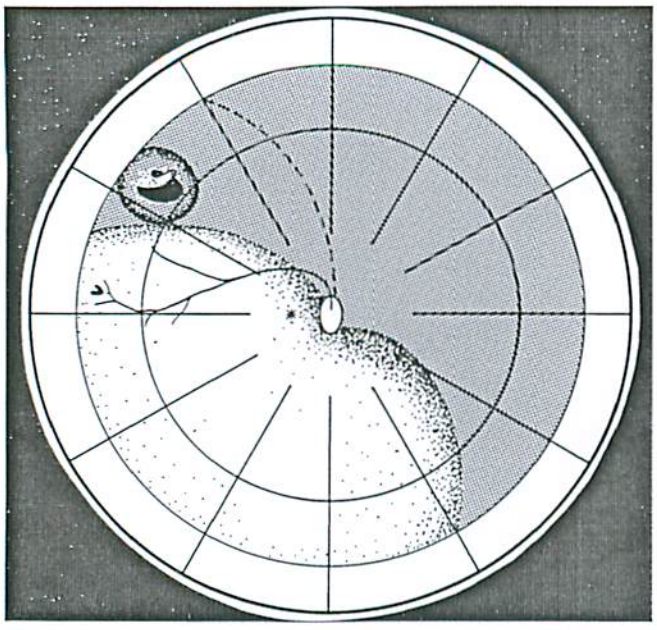

Figure 1. A temporal detachment 1 day after radial buckle surgery to close a horseshoe tear at the 10:15 position; the upper border of the detachment (broken line) dropped from the 11:00 to the 9:45 position. Biomicroscopy showed an undetected break at the 9:15 position.

2. When the pattern of the detachment (lateral, superior, or inferior) converted to another pattern, it indicated the presence of an undetected break consistent with the new pattern.[6]

Example: A superior detachment (it distributed to both sides of the 12:00 radian) was apparently caused by a small hole at the 12:00 radian and by a large break temporal to it (Fig 3). The two breaks were buckled with a broad radial sponge. Two days later, only the anterior edge of the larger break was in contact with the buckle and a fishmouth had developed at the posterior edge of the buckle. A gas injection to tamponade the fishmouth was contemplated on the third day, until it was noted that both borders of the detachment had changed; the temporal border had ascended and the nasal border had descended (Fig 4). The detachment, originally superior, was assuming the pattern of a lateral detachment. It implied another break in the superior nasal quadrant. Biomicroscopy showed an undetected break at the 1:30 position. The break was beyond the resolution of the indirect ophthalmoscope. The configuration of the vessels around the break was drawn in detail at the microscope, and the break was localized by the vessels at the operating table. The location was buckled with a balloon. The retina became attached by the next day. The hole that could be seen through the laser's biomicroscope was photocoagulated (Fig 5). When the balloon was withdrawn 7 days later, the retina remained attached.

3. When the borders of the detachment remained unchanged after buckling surgery and the buckle appeared to be in good position, the most probable cause was an undetected break above the buckle.
Example: A horseshoe tear at the 9:00 position in

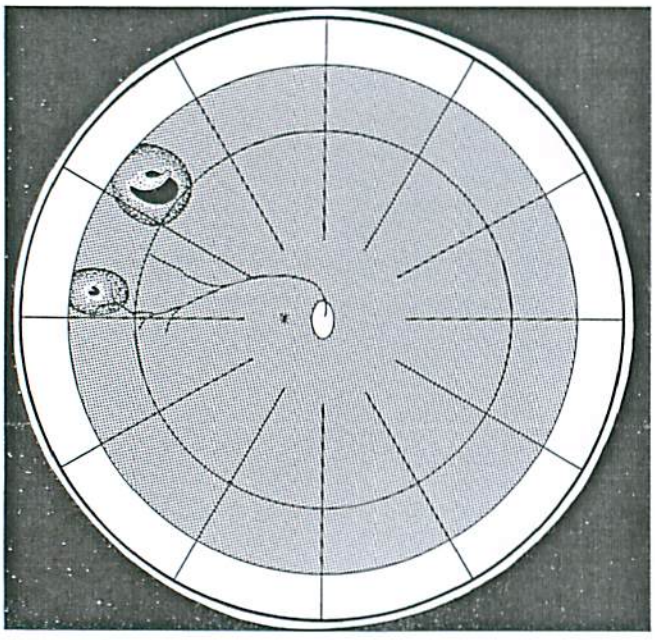

Figure 2. One day after inserting a silicone sponge beneath the break at the 9:15 position in the detachment depicted in Figure 1, the retina attached.

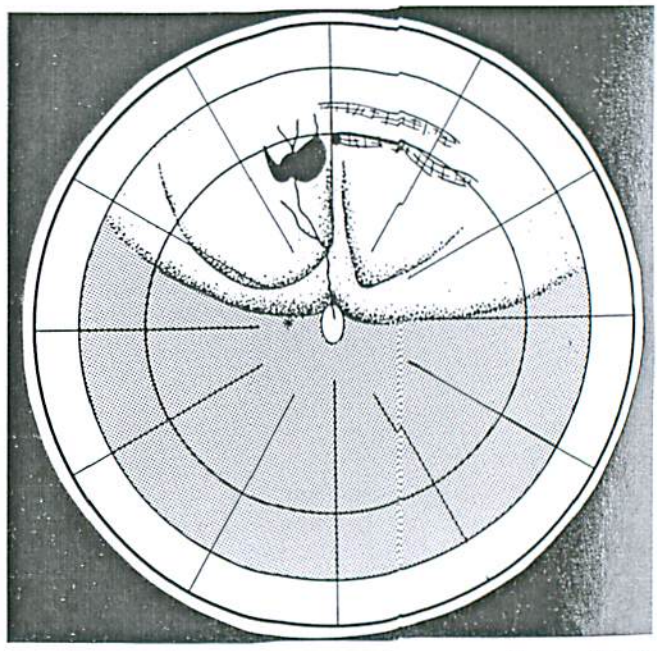

Figure 3. A superior detachment apparently was caused by a small hole at the 12:00 position and a large break at the 11:00 position. There is a double line of lattice nasally.

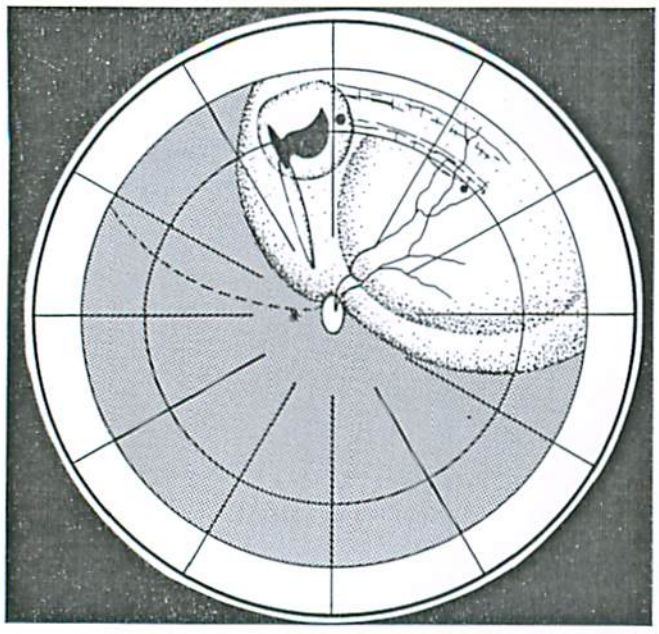

Figure 4. Three days after the breaks in the detachment depicted in Figure 3 were buckled with a scleral sponge, the contour was assuming the pattern of a nasal detachment. There was an undetected break at the 1:30 position inferior to the nasal edge of the lattice.

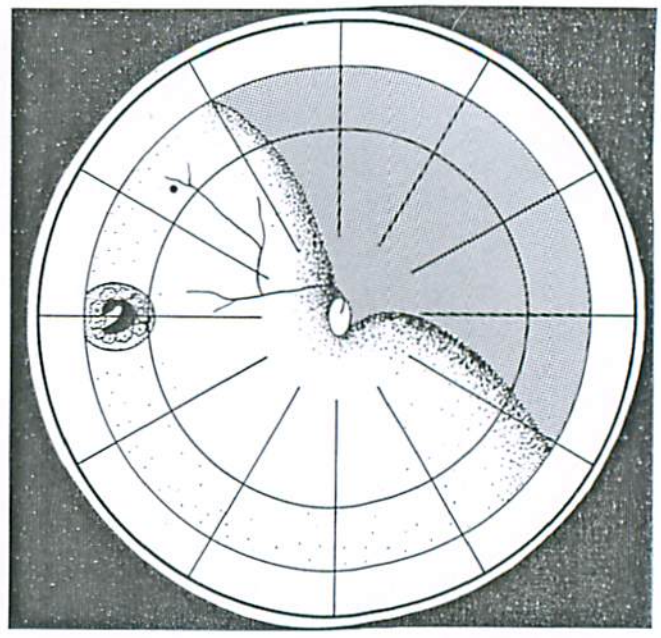

Figure 6. The borders of a nasal detachment extending from the 4:00 to 11:00 positions were unchanged 2 days after a break at the 9:00 position was buckled. Biomicroscopy showed an undetected break at the 10:15 position.

a superonasal detachment appeared accurately buckled, but the retina failed to attach and the borders of the detachment remained unchanged (Fig 6). Biomicroscopy showed an undetected break at the 10:15 position. The break was beyond the resolution of indirect ophthalmoscopy and was localized by the configuration of the adjacent vessels at the repeat surgery. It was buckled with a silicone sponge. The retina became attached and the break was treated the next day with laser photocoagulation (Fig 7).

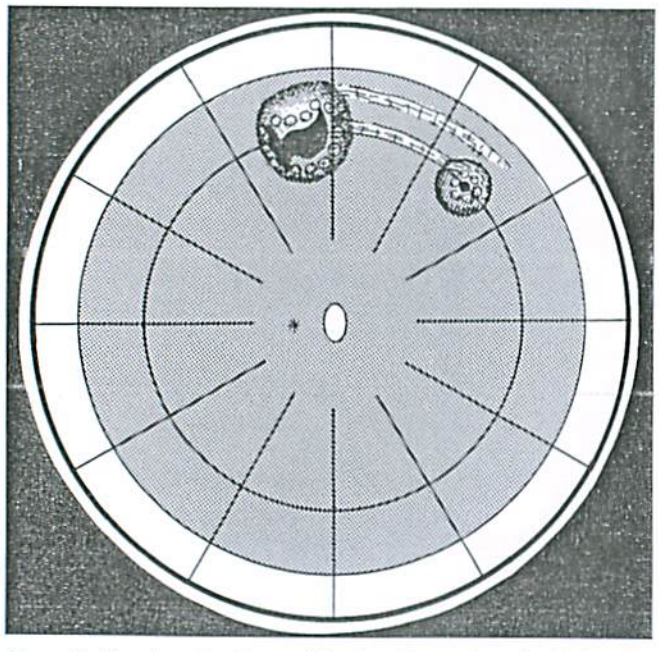

Figure 5. One day after the nasal break in Figure 4 was buckled with a balloon, the retina attached.

In the first series of initial failure to attach the retina (n = 80), the pattern of detachment in 31 eyes suggested the presence of an undetected break. The break was found in 25 eyes and the retina attached with a segmental sponge buckle. Retinas of the remaining six eyes did not attach with extensive prospective wide circumferential buckles and encircling bands. In 27 eyes, the buckle at the postoperative examination was deemed inadequate. These were attached by altering the position or replacing the sponge (n = 21) and by draining subretinal fluid (n = 6). In the less-frequent categories of failure (Table 1), two of the three choroidal detachments attached spontaneously and PVR developed in one. The two detachments with macular holes were attached with a buckle at the macula and drainage of subretinal fluid. Five of the 17 eyes designated as having PVR because of one or more star folds were attached with larger segmental buckles, some with the addition of an encircling band. The remaining 12 eyes with PVR did not respond to a second or third buckle surgery. They might have responded to a vitrectomy, had it been available then.

The retina redetached in seven eyes between 3 weeks and 3 months after the first surgery because the buckle diminished in height (n = 6) or because the buckle be-

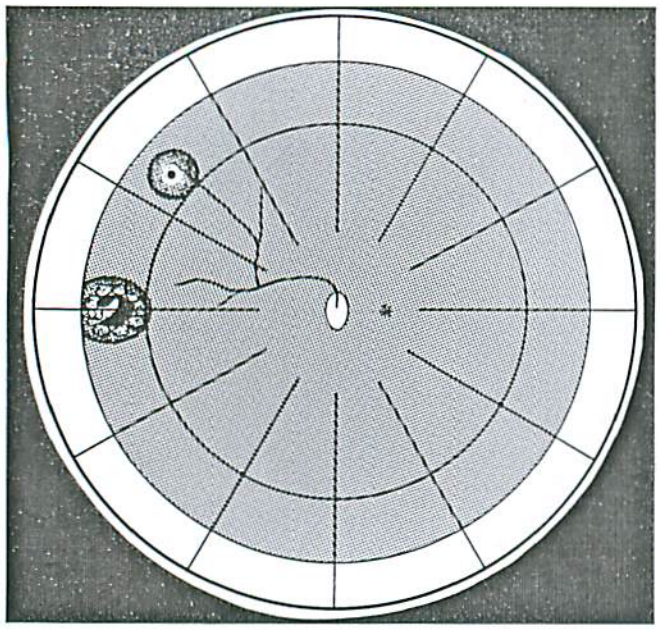

Figure 7. The retina in Figure 6 reattached the day after a balloon was inserted at the 10:15 position.

came infected and had to be removed (n = 1). All retinas were reattached in a second surgery with another segmental buckle or an encircling band to augment and sustain the height of the existing buckle.

In the second series of retinas that failed to attach (n = 34), the pattern of the detachment in 11 eyes predicted an undetected break. Breaks were found in seven eyes, were buckled with silicone sponges, and the retinas attached. Additional prospective circumferential buckling failed to attach the remaining four retinas. In 16 eyes, it was apparent that the balloon buckles were inadequate: in 11 eyes, the breaks were too large for the balloon and in five the balloon was imperfectly placed. All retinas were attached by expanding the balloon or altering its position (n = 6), by injecting a gas bubble to tamponade the balloon buckle (n = 6), or by replacing the balloon with a segmental sponge (n = 4). In the less-frequent categories of failure (Table 2), one choroidal detachment became complicated by PVR that was thought to be inoperable. In the three eyes in which the balloon leaked and prolapsed, the retinas were attached with radial sponges. In two of the three eyes designated as having moderate PVR (C2), the retinas were attached with segmental sponge buckles. One retina was attached with a vitrectomy.

The retina redetached in 12 eyes between 1 week and 3 months after the balloon was deflated and removed. In a second surgery, three retinas reattached with another balloon, seven with a segmental sponge buckle, and one with a buckle and vitrectomy.

Discussion

It is our experience that at least 88% of rhegmatogenous retinal detachments are relatively uncomplicated when they first present and will respond to one or more segmental buckles augmented occasionally by an encircling band, with or without drainage of subretinal fluid.[4–6] Failure in the drained eye is manifested by partial or complete redetachment, and in the undrained eye by incomplete or no attachment. The pattern of the detached retina will become the same upon mobilization after either procedure.

The most frequent cause of failure is an undetected break. The break will be small or it would not have been overlooked. Some breaks may be beyond the resolving power of indirect ophthalmoscopy and require biomicroscopic techniques. An interpretation of the borders of the detachment will indicate the area on which to concentrate. With few exceptions, the additional break can be closed with another segmental buckle. A second break does not portend a bad prognosis, and we think it is not an indication for extensive prophylactic buckling.

An inadequate buckle is nearly as frequent a cause of failure. It is relatively easy to diagnose, because in most cases part of the break will have come in contact with the buckle and the residual detachment coincides with the leaking edge. Most often, moving the buckle to close the leaking edge will attach the retina, less often it requires a broader buckle, rarely a higher one. We emphasize that a scleral buckle that appears correct in size and position in relation to the break rarely fails to attach the retina. When it does fail, the most likely cause is an undetected break above the buckle. In the first series of 752 retinal detachments treated without drainage, only 6 (<1%) failed to attach when the buckle appeared adequate and there was no undetected break above. All retinas attached with drainage. In the second series of 500 eyes, 6 (1.2%) failed to attach on a balloon that was in good position. The six retinas were attached by a gas tamponade. In the second series, a gas injection was used instead of drainage, because the choroid is likely to be congested for a few days after a balloon or sponge buckle surgery and a perforation for drainage carries an increased risk of choroidal bleeding.

Gas injection has become a popular second procedure after a failed buckle, because it is mechanically logical, can be done without reopening the wound, and frequently succeeds. A gas injection would probably have attached the retina in the six inadequate buckles in the first series that were drained. With additional coagulation, gas also might have attached some of the retinas for which the sponge buckles were moved or replaced. Gas, however, would have only temporarily attached the retinas in the 42 eyes with undetected breaks (examples 1–3), unless the breaks also were found and coagulated.

In 1976, we endorsed O'Connor's[7] recommendation for injecting gas to tamponade a failing scleral buckle. However, after some years, we and others[8,9] recognized that intravitreal gas added a small but significant degree of morbidity to uncomplicated retinal detachments. Intravitreal gas, in addition to tamponading the break, also tamponades the cortical vitreous (which is usually separated from the retina posterior to the break) against the retina where it tends to adhere,

proliferate, and in some eyes provoke preretinal traction and new retinal tears. The influx of cells and protein, which intravitreal gas stimulates, augments the proliferative process.[10]

Hilton et al[11,12] did not find that gas stimulated "vitreous inflammation" in a series of uncomplicated retinal detachments treated by pneumatic retinopexy. Postoperatively, they found new breaks in 7% (7/100) and PVR in 3% (3/100). Chen et al,[13] however, encountered new tears in 21% (11/51) and PVR in 10% (5/51) after pneumatic retinopexy. Kreissig et al[5] assembled 500 patients treated with pneumatic retinopexy from ten reports in the literature for comparison with a similar series of detachments treated with balloon buckles. In the eyes treated by pneumatic retinopexy, new breaks occurred in 15% (74/500) and PVR in 4% (18/500). In the eyes treated with buckles, new breaks occurred in less than 2% (7/500) and PVR in less than 1% (1/500). Although the rate of complications from pneumatic retinopexy may not be prohibitive, the comparison with external buckling supports the contention that intravitreal gas adds a small, but significant degree of morbidity to the management of retinal detachment.

Vitrectomy is proposed for the management of uncomplicated recurrent retinal detachment by Friedman and D'Amico.[14] They suggest that vitrectomy interrupts the progression of an underlying disease. The suggestion contradicts reports that vitrectomy actually may provoke PVR. In none of the nine patients in their series did PVR develop. However, Gartry et al[15] reported that PVR developed in 8% (10/114) of eyes initially uncomplicated by PVR that were treated with vitrectomy as a first procedure. Hakin et al[16] reported that PVR developed in 20% (25/124) of eyes without prior PVR that were initially treated with vitrectomy. Cowley and associates[17] have stated that the strongest predictor for the development of PVR, after retinal detachment surgery, is the use of vitrectomy.

Vitrectomy has been advocated as a means of finding an undetected break. In the absence of opaque media, a poorly dilating pupil, or a pupil obstructed by lens capsule, however, a vitrectomy procedure rarely detects a break that was not found by preoperative study. Recently, we and others have compressed the detached posterior retina with perfluorocarbon liquid to express subretinal fluid (the schlieren phenomenon) from an undetected anterior break to demonstrate and localize the break. The principle is correct, but the origin of the stream from small breaks is not identifiable.

The value of vitrectomy for the repeat surgery of detachments that have developed a degree of PVR which precludes attachment by buckling is undeniable. However, the appropriateness of its use for lesser degrees of PVR is open to question. Zivonjovic[18] makes the point when he states that ". . . an attempt at a conventional operation is worth trying for old detachments with a star fold, curled tear edges, and other symptoms of moderate PVR." Chang et al[19] and Kreissig et al[20] have demonstrated that posterior PVR with star folds will respond to radial buckles beneath the breaks if the breaks are more than 1½ hours from the star folds. Of the patients in this report, PVR of a degree that would not respond to one or more buckles developed in only 13 eyes (<2%) in the first series (n = 752) and in only two eyes (<0.5%) in the second series (n = 500); 0.5% to 2% may represent the natural incidence of that degree of PVR in the course of uncomplicated retinal detachment.

In conclusion, most failures to attach the retina will respond to a minimal second procedure consisting of a segmental buckle to close a previously undetected break or to correct an inadequate buckle. A gas injection or vitrectomy should not be the automatic response to failure.

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