Retinal detachment treated with intravitreal air: an evaluation of 241 cases

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SUMMARY 241 unselected cases of retinal detachment treated since 1971 with cryopexy and intravitreal air are discussed. The series is analysed according to the position of the retinal tear(s), and we describe briefly the surgical technique and evaluate the main complications.

The unchanging aim of retinal surgery is to reattach a living retina with as little damage to it and the rest of the eye as is consistent with success—at a first operation. There are many methods of achieving this end, and all retinal surgeons have been forced by the demands of different cases to use most of them at one time or another. It is only when the surgeon is left with a choice that any controversy occurs.

Methods

The use of intravitreal air has already been described in detail (Chawla and Birchall, 1973; Chawla, 1974). The basic operation may be briefly summarised here. Monitored freezing is applied to the retinal break(s); subretinal fluid is released through a scratch sclerotomy over a carefully selected site; sterile air is injected into the vitreous through the pars plana; a fine silicone band (No. 40) is placed around the equator of the eye; the patient is then positioned postoperatively to float the break(s) uppermost against the frozen area(s) for at least 48 hours. Two variations from the original technique should be mentioned.

SUBRETNAL FLUID
Before piercing the choroidal knuckle we now first coagulate it with a round ball diathermy electrode in the manner advocated by Freeman and Schepens (1974) though without any transillumination.

LOWER TEAR(S)
All except large equatorial breaks, lying between the 5 and 7 o'clock meridians, are treatable with intravitreal air. To raise the lower pole of the eye uppermost the patient is nursed head downwards in a tilted bed with a stitch around the inferior rectus muscle for 24 to 48 hours (see Fig. 1). Two main considerations determine whether patients are suitable for this method of treatment: (1) It must be possible to float the tear(s) uppermost; (2) the eye must be softened enough to make room for at least 1 ml of intravitreal air. This is usually done by subretinal fluid release, hence we prefer balloon to shallow detachments, but it may be necessary to alter the volume with intravenous mannitol solution or in rarer cases by release of fluid vitreous along a Graefe blade through the pars plana (Fig. 2).

AUGMENTED OPERATION
Where tears are present in opposite quadrants, not treatable with a single air bubble, we have sealed the lower tear with a radial sponge implant on the equator or with a circumferential segment of guttered silicone band (No. 20) for peripheral break(s). Local counter-traction is sometimes needed in the presence of a rigid retina, either as a primary or as a secondary procedure.

Although Rosengren (1938) had already established vitreal air injection as a reputable method, we were reluctant at first to use it freely. However, its effective simplicity, speed, and freedom from complications have now persuaded us to give it a rapidly increasing share (now 90%) of the retinal detachments treated in our service. Because of this earlier hesitation, the 241 cases discussed in this paper form less than 50% of our total numbers since 1971, but with 200 detachments per year to treat, it is now our procedure of choice. In this present group of patients the shortest follow-up is 6 months at the time of writing.

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We have broken the cases up according to the position and nature of the retinal tear(s), taking a flat retina as our main criterion of success but not dismissing the influence that the preoperative state of the macula and vitreous has had on central visual recovery (Chisholm et al., 1975).

EQUATORIAL BREAKS
Total: 155.
(a) Primary basic operation: first attempt, 95; second attempt after (i) first operation, 33; (ii) other procedures, 14.
(b) Augmented operation: first attempt, 11; second attempt after (i) first basic operation, 1; (ii) other procedures, 1.
Successes: 145 (94%); failures: 10.

FAILURES
Total: 10.
Nine of these started with little hope of success from the outset and all ended with a shrunken retina. The tenth, a balloon detachment with a solitary horseshoe tear, developed a violent vitreal inflammation 3 days after surgery. Although this subsided on treatment with high systemic doses of steroids and antibiotics, the vitreous cleared only enough to reveal a rigid, partially detached retina.

Of the others 4 might have reasonably been rejected for surgery anyway on the grounds of fibrosis. In another eye a giant horseshoe tear could be just seen through a vitreous haemorrhage. Another, also with a presenting vitreous haemorrhage, had already had argon laser photoocoagulation to curb hypertensive new-vessel formation. In 2 cases no healthy sclera could be found after sponges were removed from areas of widespread diathermy which had already induced similar destructive effects in the retinae. The last, grossly myopic and staphylomatous, eye required the easy removal of fluid vitreous because of a shallow detachment. This eye

Fig. 1 Inferior rectus stitch. Tilted bed

Fig. 2 Release of fluid from within the vitreous cavity
never recovered from the shock of surgery and collapsed quickly into phthisis.

**Aphakic Detachments**

Total: 49.

   Retina flat after
   (a) Primary basic operation: first attempt, 15; second attempt after (i) basic operation, 1; (ii) other procedures, 1.
   (b) Augmented operation: first attempt, 1; second attempt after (i) basic operation; (ii) other procedures, 1.

2. Other tears with incidental aphakia.
   Retina flat after
   (a) Primary basic operation: first attempt, 11; second attempt after (i) basic operation; (ii) other procedures, 4.
   (b) Augmented operation: first attempt, 1; second attempt after (i) basic operation; (ii) other procedures.
   Successes: 36 (73%); failures: 13.

**Failures**

Total: 13.

Aphakic detachments, even the straightforward ones, have a rather sinister reputation that we have not been able to confirm. All but 1 of our failed cases started out with a poor prognosis but in only 4 of these could gross vitreous loss at cataract extraction be held to blame. Of the remaining 9 there was 1 in which vitreous blood partially obscured the retina. The next very myopic eye became phthisical; 2 more presented with advanced fibrosis.

Three had suffered previous surgery. The first, a young man, lost the lens after a penetrating injury which tore the retina along the equator with a fair degree of vitreal haemorrhage. The primary augmented operation held this retina flat for about 6 months before shrinkage took it beyond the scope of a second surgical attempt. The second, also in the same age group, had had multiple needlings for congenital cataract. A basic operation flattened the retina for a year, after which he relapsed with a fresh tear and suffered a vitreous haemorrhage at the second operation. This was thought to be due to the cryopexy. The third was virtually inoperable following excessive diathermy.

The next eye, on top of its other problems, had a successful corneal graft for interstitial keratitis. Two basic operations failed because a posterior polar tear was not seen at first. This retina flattened partially after a third basic operation during which the cryopexy caused a choroidal haemorrhage; that the graft has survived all these surgical insults may reflect well on the gentleness of the technique.

**Dialysis**

Total: 24.

Spontaneous including one giant tear.
Retina flat after
(a) Primary basic operation: first attempt, 18.
(b) Augmented operation: first attempt, 1.
Traumatic.
Retina flat after
(a) Primary basic operation: first attempt, 2; second attempt, 1.
Successes: 22 (91.6%); failures: 2.

**Failures**

Total: 2.

The first, a moderate myope, with 3 small temporal dialyses, became a surgical catastrophe. A posterior sclerotomy was performed to reduce the intraocular pressure, which had risen out of control for no detectable reason during the operation, and he suffered a vitreous haemorrhage. The second with traumatic retinal detachment and lens subluxation and vitreous haemorrhage, flattened for 6 months before relapsing with preretinal retraction.

**Macular and Posterior Polar Holes**

Total: 13.

Retina flat after
(a) Primary basic operation: first attempt, 6. One of these suffered three days postoperatively an acute inflammatory episode in the vitreous which cleared on high doses of steroid and antibiotics. Second attempt after (i) basic operation, 1; (ii) other procedures, 3.
Successes: 10; failures: 3.

Because the retinal elevation in post-polar detachments does not usually advance beyond the equator, subretinal fluid has to be let out beside the more posterior and hence larger choroidal vessels. Should this prove impossible, then, to make way for the air bubble, fluid vitreous can be released in much the same manner as that described for posterior sclerotomy in malignant glaucoma (Scott and Smith, 1961).

**Failures**

Total: 3.

All of these cases were highly myopic. In 2 no explanation could be offered for the failure except poor uptake of cryopexy at the posterior pole. The third eye collapsed into intractable hypotony.

**Complications**

In our other cases, as well as in those of this series, the most common cause of choroidal or choroido-vitreal haemorrhage is cryopexy, despite careful monitoring of the iceball. However, disabling
vitreous haemorrhage occurred in just 2 cases, and
flat choroidal haemorrhage gravitated to the
macular area in only 3 instances.

Subretinal fluid release produced no signif-
ificant bleeding but did produce incarceration of the
retina on 6 occasions (2 in one patient with bilateral
shallow detachments and multiple holes). Because
the release site was chosen with this complication in
mind, all of these were contained with ease and
safety with a little extra cryopexy and the same air
bubble or a small scleral infolding buckle.

Choroidal detachment masquerading to the un-
wary as an actual retinal detachment becomes a
complication only when large enough to affect
vision. A deliberately eccentric encircling band which
blocked half the vortex veins was the culprit in 2
cases which settled when the band was cut. Two
further patients complained of a deep ocular dis-
comfort refractory to routine analgesics. The bands
were sectioned and the pain settled, but neither these
nor any of the others in our series showed any signs
of anterior segment ischaemia.

Vitreous inflammation occurred only twice. Of
these cases 1 cleared to a great extent, though
leaving large trailing vitreous floaters. The second
cleared only enough to reveal a traction detachment.

In 1 case a blunt needle allowed air to strip the
pars plana. Although in this particular eye the retina
was already in the grip of fibrosis, this complication
is not irreversible and the air can be removed, just as
one would remove subretinal fluid, quite easily, pro-
vided its presence in the wrong place is recognised.
This mishap can be eliminated by watching for the
needle tip before depressing the plunger.

Discussion

It is the current orthodoxy to disfavour the use
of intravitreal air for 5 main reasons. It is alleged
that the air bubble cannot remain long enough to be
useful; that air can bring about permanent changes in
the vitreous; that the release of subretinal fluid is
too dangerous a practice; that the air bubble can
introduce infection; that one cannot visualise the
retina through the bubble. This is not our ex-
perience.

From the first attempt's success rate alone there
can be no reasonable doubt that the air bubble does
in fact remain long enough to carry out its task. In
none of our cases (even those 8 with diabetes) did
the vitreous develop any adverse features that might
fairly be ascribed to the harmful effect of air.

Subretinal fluid release need not be dangerous if
one does not take liberties with the basic rules. The
release site must be scrupulously chosen and marked
where the retinal detachment is deep, where the
major choroidal vessels can be easily avoided, and
where an accidental retinal perforation or incar-
ceration can be contained either by the air bubble or
by a small scleral infold. In practice the ideal point
lies over the centre of a major equatorial tear should
one such be available. If fluid vitreous appears, as
it may rarely do, in place of subretinal fluid, the eye
is still softened and thus satisfactorily prepared for
the intravitreal air injection.

We have found only 1 choroidal-vitreous ha-
morrhage that could have resulted from this
manoeuvre, and, contrary to present belief, we would
blame cryopexy as the commonest cause of such
haemorrhages, which, if present, occurred prior to the
release of subretinal fluid. As for intravitreal
infection, only 2 eyes developed a posterior vitreal
inflammation, and only 1 of these was left with
permanent disability as a result.

If the air is introduced from a dry syringe with a
single movement of the plunger, then the bubble will
also be single and the retinal view as informative as
it was before the injection, provided one views the
fundus with the binocular indirect ophthalmoscope,
which is unaffected by the gross change in refraction
of the eye.

The release of fluid vitreous along a Graefe blade
is always a last choice in detachments with multiple
holes where just too much subretinal fluid exists to
allow tear sealing with a buckle but not enough to
allow its safe release. Preoperative slit-lamp exami-
nation of the vitreous is essential in all cases, for
although deep detachments always present with a
very fluid vitreous, so frequently may shallow
detachments, which progress slowly as a result of
either tiny tears or of a partially solid vitreous
cortex. A shallow retinal detachment with a relatively
'healthy' vitreous is most likely to settle with local
buckling or encirclement to catch the posterior tear
edge, because the retina in these cases is detach-
ing reluctantly.

The inferior rectus stitch has extended the use of
air to all inferior tears except those on the 6 o'clock
equator, which lie usually too far posterior to be
brought uppermost by positioning. Any discomfort
due to the stitch is lost in the general discomfort of
the operation. The head-down position, although
less than pleasant, is maintained rigorously for only
24 hours, and no stitch is ever allowed to remain
beyond 48 hours. There has been no evidence of
postoperative impairment of extraocular muscle
action.

The apparent emphasis on the discussion of
failures aims to demonstrate that many of these
cases were given the chance of an operation without
any confident prospect of success, although in many
instances this pessimism proved unfounded. Some
19% of all our patients came to surgery with evidence of preretinal retraction, whether as fixed folds, rolled tear edges, taut opercula, or a rigid vitreous.

We believe that our primary success rate with the need for only one relatively short general anaesthetic must commend this method to more surgeons than those harassed by long operating lists. We contend that this series of 241 cases, accepted with no thought to prognosis, indicates a greater place for the routine use of intravitreal air in retinal detachment surgery.

References


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