Factors influencing absorption of subretinal fluid

P. K. LEAVER, G. H. CHESTER, AND S. H. SAUNDERS*

From Moorfields Eye Hospital, City Road, London

It is well known that spontaneous absorption of subretinal fluid (SRF) occurs after scleral-buckling procedures without drainage of SRF for retinal detachment, provided that the retinal break or breaks are closed at or after surgery (Custodis, 1953; Lincoff, Baras, and McLean, 1965; Scott, 1970; Lincoff and Kreissig, 1972; Chignell, 1974). Several theories have been put forward to explain this phenomenon (Weidenthal, 1967; Scott, 1970; Foulds, 1975) and the conditions under which spontaneous absorption will occur have been established (Lincoff and Kreissig, 1972; Chignell, 1974; Leaver, Chignell, Fison, Pyne, and Saunders, 1975). However, the rate of absorption and the factors influencing it have not been adequately documented.

We studied patients in whom successful reattachment of the retina was achieved after surgery without drainage of SRF in order to establish whether any factors might be reliably used to predict the rate of SRF absorption after a non-drainage procedure. Factors which it was considered might influence the rate of absorption were: the patient’s age and refractive error, characteristics and duration of the retinal detachment, and the nature of the surgery performed.

Patients and methods

Two hundred cases of retinal detachment successfully managed at Moorfields Hospital between 1969 and 1973 by a scleral-buckling procedure without drainage of SRF were studied. In all cases the non-drainage procedure was undertaken according to well-established criteria (Lincoff and Kreissig, 1972; Chignell, 1974; Leaver and others, 1975) and was judged to be technically satisfactory both at and after surgery. At no time was there any positive indication for reintervention. Cases of accidental perforation of the sclera during a planned non-drainage operation were excluded and only cases in which the SRF could be easily identified and quantified before and after surgery were included in the study. Patients who had had retinal detachment surgery previously and aphakics were included, but eyes in which the underlying disease was thought to be complex—such as giant tears, macular holes, and retinoschises—were excluded.

In all cases silastic sponge explants or silicone-rubber bands were used to create scleral buckles and cryotherapy to produce chorio-retinal adhesion. The use of acetazolamide, osmotic agents, or massage of the globe was variable. The amount of SRF remaining after surgery was assessed daily for one week and thereafter at 14 days, one month, and two months. Examination was carried out using the binocular indirect ophthalmoscope in all cases. The Goldmann three-mirror contact lens was used in some cases to confirm the ophthalmoscopic findings.

Results

The results (Table I, Fig. 1) show the number of cases in which all SRF had been absorbed. In order to predict the probable rate of SRF absorption

<table>
<thead>
<tr>
<th>Absorption time (days)</th>
<th>&lt;2</th>
<th>3-7</th>
<th>8-28</th>
<th>&gt;28</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. (per cent) of eyes</td>
<td>98 (49)</td>
<td>55 (27)</td>
<td>27 (14)</td>
<td>20 (10)</td>
</tr>
</tbody>
</table>

![FIG. 1 SRF absorption time in 200 eyes](http://bjo.bmj.com/)

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in a clinical situation we simplified the figures further by comparing the cases in which SRF absorption was complete in less than one week with those in which absorption took longer. In 98 cases (49 per cent) all SRF had been absorbed by the end of two days, in 55 cases (27 per cent) absorption took between two and seven days, in 27 cases (14 per cent) it took between eight and 28 days, and in 20 cases (10 per cent) it was not complete until more than one month after surgery. The rate of SRF absorption related to sex, age, and refractive error is shown in Table II.

The 200 patients comprised 100 men and 100 women, and absorption was complete in less than one week in 82 per cent of the men and 71 per cent of the women. Fifty-nine patients were aged under 40, 75 were between 40 and 60, and 66 were over 60 years. SRF absorption was complete in less than one week in 47 (80 per cent) patients under 40 years of age, in 50 (76 per cent) patients over 60 years, and in 57 (75 per cent) of those between 40 and 60 years. In 190 cases where the refractive error was accurately known there were 55 emmetropes, 19 hypermetropes, 57 low myopes, and 59 high myopes (spherical component > -6.0 D). Of the 59 high myopes 43 (73 per cent) took less than one week to absorb compared with 103 (79 per cent) of the remaining 131 cases.

CHARACTERISTICS OF RETINAL DETACHMENT

The rate of absorption related to the nature of the detachment is shown in Table III.

Area. In 76 eyes the retinal detachment was confined to one quadrant and in 57 (75 per cent) of

Table II  Absorption time of SRF in 200 patients related to sex, age, and refractive error

<table>
<thead>
<tr>
<th>Patients (no.)</th>
<th>Absorption time</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (per cent)</td>
<td>No. (per cent)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men (100)</td>
<td>82 (82)</td>
<td>18 (18)</td>
<td></td>
</tr>
<tr>
<td>Women (100)</td>
<td>71 (71)</td>
<td>29 (29)</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 40 (59)</td>
<td>47 (80)</td>
<td>12 (20)</td>
<td></td>
</tr>
<tr>
<td>40-60 (75)</td>
<td>56 (75)</td>
<td>19 (25)</td>
<td></td>
</tr>
<tr>
<td>&gt; 60 (66)</td>
<td>50 (76)</td>
<td>16 (24)</td>
<td></td>
</tr>
<tr>
<td>Refractive error*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High myopes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; -6.0 D (59)</td>
<td>43 (73)</td>
<td>16 (27)</td>
<td></td>
</tr>
</tbody>
</table>
| Others (131) | 103 (79) | 28 (21) | |<p>Table III  Absorption time of SRF in 200 eyes related to the character of retinal detachment</p>

<table>
<thead>
<tr>
<th>Character of detachment (no.)</th>
<th>Absorption time</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (per cent)</td>
<td>No. (per cent)</td>
<td></td>
</tr>
<tr>
<td>Area (quadrants)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 1 (76)</td>
<td>57 (75)</td>
<td>19 (25)</td>
<td></td>
</tr>
<tr>
<td>&gt; 1 (124)</td>
<td>96 (77)</td>
<td>28 (23)</td>
<td></td>
</tr>
<tr>
<td>Depth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shallow (38)</td>
<td>29 (76)</td>
<td>9 (24)</td>
<td></td>
</tr>
<tr>
<td>Ballooned (162)</td>
<td>134 (83)</td>
<td>28 (17)</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncomplicated (153)</td>
<td>122 (80)</td>
<td>31 (20)</td>
<td></td>
</tr>
<tr>
<td>Dialyses (25)</td>
<td>16 (64)</td>
<td>9 (36)</td>
<td></td>
</tr>
<tr>
<td>Aphakic (22)</td>
<td>15 (68)</td>
<td>7 (32)</td>
<td></td>
</tr>
</tbody>
</table>

these the SRF had absorbed by the end of one week. Of the 124 cases in which the area of detachment was greater than one quadrant 96 (77 per cent) took less than one week to absorb.

Depth. In 162 cases the detachment was bullous while in 38 it was shallow: 134 (83 per cent) of the bullous and 29 (76 per cent) of the shallow detachments had reattached by the end of one week.

Type. The 200 cases studied comprised 178 phakic and 22 aphakic eyes and in 25 of the phakic eyes the retinal detachment was caused by a retinal dialysis. In the phakic group 16 (64 per cent) of the detachments associated with a dialysis had absorbed in less than one week as against 122 (80 per cent) of the remainder. Of the aphakic cases 15 (68 per cent) absorbed within one week of surgery.

DURATION OF RETINAL DETACHMENT

Retinal detachments of less than two weeks' duration were compared with those in which the detachment had been present for longer than two weeks (Table IV). Absorption of SRF took less

Table IV  Absorption time of SRF related to duration of retinal detachment in 200 eyes

<table>
<thead>
<tr>
<th>Duration of detachment (no.)*</th>
<th>Absorption time</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (per cent)</td>
<td>No. (per cent)</td>
<td></td>
</tr>
<tr>
<td>&lt; 2 weeks (72)</td>
<td>62 (86)</td>
<td>10 (14)</td>
<td></td>
</tr>
</tbody>
</table>
| > 2 weeks (121) | 85 (70) | 36 (30) | |<p>*Precise duration unknown in 7 cases</p>
than one week in 62 (86 per cent) of the detachments of recent onset compared with 85 (70 per cent) of those of longer standing (Fig. 2). In seven cases the precise duration of the retinal detachment was unknown.

SURGICAL PROCEDURE

Type. In 181 cases a local buckling procedure was used and 141 (78 per cent) of these had reattached in one week (Table V). The remaining 19 cases were managed by encirclement or a combined procedure and in 12 (63 per cent) the SRF had absorbed within one week.

Reoperation. Retinal detachment surgery had previously been performed on 54 eyes, and the SRF had absorbed completely within one week in 34 (64 per cent) of these. Of the remaining 146 eyes, 119 (80 per cent) took one week or less to absorb.

Statistical analysis

The significance of the results was subjected to \( \chi^2 \) testing. The duration of retinal detachment (\( P < 0.025 \)) and the number of operations performed (\( P < 0.01 \)) had a significant influence on the SRF absorption time at the 2.5 per cent level.

Age, sex, refractive error, and the area and depth of SRF had no significant effect on the rate of retinal reattachment.

The small numbers of retinal dialyses and aphakics in the types of retinal detachment and of encircling operations in the types of surgical procedure make valid statistical comparison within these groups impossible.

Discussion

Although the introduction of non-drainage methods has eliminated some of the most serious complications from retinal detachment surgery (Cibis, 1965; Chignell, Fison, Davies, Hartley, and Gundry, 1973) it can also create a dilemma for the surgeon. Persistence of SRF after non-drainage procedures is common and, as this study shows, may continue for more than one week in as many as 25 per cent of cases. Knowing what factors influence the rate of SRF absorption would enable the surgeon to predict more accurately the outcome of the operation and to decide if reoperation is necessary. In the few previous studies of the rate of SRF absorption the results and conclusions have been conflicting (Lincoff and Kreissig, 1972; O'Connor, 1973). While most authors agree that SRF absorption after non-drainage procedures is rapid in most cases, the proportion and types of cases in which absorption is delayed is still a matter of controversy.

SRF is generally thought to be absorbed into the choroidal circulation and it has been proposed that the integrity of the choriocapillaris and the osmolality of the SRF largely control the rate of retinal reattachment (Heath, Beck, and Foulds, 1962; Weidenthal, 1967; Scott, 1970; Lincoff and Kreissig, 1972; O'Connor, 1973).

Age, high myopia, and the volume of SRF might be expected to influence SRF absorption if functional ability of the choriocapillaris is relevant. Our figures do not support this hypothesis. Possibly the correlation of delayed absorption of SRF with age described by some authors (Nadel, Gieser, and Lincoff, 1971; O'Connor, 1973) may be attributed to inadequate mobilization of elderly patients. The practice of early and intensive mobilization at Moorfields Hospital may explain the contradictory findings in our study.
The protein content and hence osmolality of the SRF increases with the duration and extent of the retinal detachment (Heath, Beck, and Foulds, 1962; Chignell, Carruthers, and Rahi, 1971; Weber and Wilson, 1963). Our findings suggest that long-standing detachments take a significantly longer time to reattach (P < 0.025) as do those requiring reoperation (P < 0.01), but the volume of SRF does not influence the rate of reabsorption. These results might suggest that SRF should be drained in long-standing detachments. However, it is doubtful whether the degree of visual recovery is greatly influenced by early reattachment in cases where the retina has been detached for longer than two weeks (Gundry and Davies, 1974; Grupposo, 1975).

In both retinal dialyses and aphakic cases sub-retinal fluid absorption was prolonged, but there are insufficient numbers to make a valid statistical comparison with the less complicated group. The prolonged absorption time in dialysis may be due to slow progression of retinal detachment and late presentation, although Lincoff and Kreissig (1972) postulated that reattachment is slow when the retinal break is inferiorly situated, as is common in these cases. In aphakia the anatomy and hydrodynamics of the globe are so disturbed that it is impossible to suggest a simple cause for the prolonged absorption time.

Probably the type of surgical procedure does not in itself affect the rate of SRF absorption. The small numbers in one group compared with the other as well as the selection of cases for each type of operation makes it impossible to draw a valid comparison between local and encircling procedures.

Conclusion

Our study shows that of the factors we investigated the only one that definitely influences the rate of SRF absorption is the duration of the retinal detachment. In the absence of specific reasons for the failure of retinal reattachment the persistence of SRF should not in itself be regarded as an indication for early reoperation.

Summary

In 200 cases of retinal detachment successfully treated without drainage of subretinal fluid complete reattachment of the retina was achieved in the first postoperative week in 76 per cent of cases. Delay in subretinal fluid absorption in the remaining 24 per cent of cases was directly related to the duration of the retinal detachment but was not influenced by the patient’s age, refractive error, or the characteristics of the detachment.

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