SMALL FLAP SCLEROTOMY (RECTANGULAR FLAP SCLEROTOMY)*

BY

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THIS operation described in the *Trans. Ophthal. Soc. U.K.*, Vol. XXX (1910), p. 199, has suffered from a reputation for uncertainty. But we now know fairly well in which types of glaucoma the failures have occurred; the uncertainty does not apply to all glaucoma. In its restricted field the method seems assured of permanent survival; it requires renewed consideration as one of the means of reducing or abolishing late infections.

It has been in regular use in Nottingham since 1909. Mr. Laws has used the method almost exclusively throughout for all primary glaucomas, acute and chronic. He has repeated the operation when necessary.

To count as a perfect result, not only must there be a lasting reduction of tension to normal, but the filtration must be through uniformly grey scar-lines, without any trace of fistulous openings. The overlying conjunctiva retains much or all of its normal transparency; and the thickening from oedema is commonly moderate.

Our experience has shown perfect filtration to be assured from even moderately well performed operations in all mild untreated glaucomas, i.e., in those with quite moderate tension; also in eyes which had been under treatment by miotics, but in which the treatment was becoming ineffectual.

The failures have occurred in the more advanced glaucomas with considerable tension, though in such eyes there have been also many excellent results. We hope shortly to make an attempt to follow up some of the older cases again. But it may be stated generally that the harder the eye, and the longer the hardness has lasted, the greater is the tendency to firm healing, or to leakage only through undesirable fistulous openings.

These are precisely the eyes which furnish the more troublesome temporary recurrences of tension after wide iris-prolapse operation (see *Trans. Ophthal. Soc. U.K.*, 1919, and *Brit. Jl. of Ophthal.*, May, 1920). In primary glaucoma there seem to be practically no permanent failures after this prolapse operation; and even no troublesome transient recurrences in the milder and earlier glaucomas. The temporary failures by this method correspond with the permanent failures of other operations. The two must have the same cause. Since the cause of the transient return of tension must obviously be some temporary condition, this same

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temporary condition must account also for the permanent failure of such operations as flap sclerotomy, performed on these high-grade advanced glaucomas. The only transient condition which seems capable of explaining the recurrence peculiar to this group of glaucomas, is a relatively highly albuminous aqueous from the sudden great fall from high-grade plus tension to a definitely sub-normal tension for a time.

However, the explanation is of quite secondary importance. Whatever the condition may be, it evidently tends towards firm permanent healing of an iris-free wound, though it does not prevent filtration developing later through a fold of prolapsed iris.

The important observation was made that some of the very advanced untreated Indian glaucomas, which gave protracted recurrences of tension, had been readily reducible by eserine before operation. It is a fair deduction that in these eyes recurrence could have been prevented by keeping the tension normal for a sufficient period beforehand. The special liability to return of tension would have been removed, and the eyes would have been rendered suitable for flap sclerotomy. Thus the group of eyes in which, as shown by experience, we may expect certain and complete success from flap sclerotomy, is evidently susceptible of some enlargement by preparatory miotic treatment.

Thus the broad division of glaucoma into two main groups, according to completeness or incompleteness of response to miotics acquires practical significance.

It may be a sound practical rule to utilize rectangular flap sclerotomy *only where eserine acts well, and only after preparatory miotic treatment* lasting two to six weeks, according to the degree and probable duration of the previous (continuous) plus tension. At least we can thus restrict the application of the method to cases in which we may confidently expect always complete success.

There is still some doubt regarding the permanency of reduction by iris-free filtering cicatrices generally. I have lately had to operate again on the two eyes of a medical man which had been satisfactorily relieved by wedge-isolation operations performed in 1909. And Mr. Laws has lately had to operate a second time on a buphthalmic eye for return of tension after a flap sclerotomy performed, like the above, in 1909.

This doubt may be appreciably lessened by the above preparatory miotic treatment. The freer filtration obtainable by thus reducing to a minimum the condition which makes for firm healing, must tend towards permanency.

I do not know of any other operation which provides with certainty an equally good filtering cicatrix with so little trouble or risk, or disturbance of the eye. And even if one were mistaken as regards the infallibility of the method in these selected cases, the

need for a rare repetition of this small operation would not be a very serious matter. See the case reported below.

Possibly equally as important as the *eserin* beforehand is the free use of atropin after operation, continued as long as any congestion of the eye remains. An attempt may be made by repeated instillations to dilate the pupil on the first evening or even earlier if, as not infrequently happens, an irido-dialysis has been produced. The practice is based on the old observation that the average results of iridectomy were better in the glaucomas with high-grade tension. Any tendency to immediate recurrence of tension, whether brought about by atropin or not, should have a greater effect in opening up the wound if it be a rectangular flap incision, than if it be an ordinary iridectomy wound.

In a few very advanced glaucomas, readily controlled by *eserin*, I have preferred iris prolapse operation to flap sclerotomy. These have been eyes with considerably impaired central vision, and with the fellow eye blind or nearly so. In such cases the drawbacks of the (moderate) astigmatism and of the somewhat enlarged pupil of the prolapse operation, are negligible. In these cases it is of supreme importance that the permanence of the relief of tension should be as nearly absolute as possible; the slightest further deterioration of vision might have a crippling effect.

A case was shown at Oxford—one of the very few eyes upon which I have repeated a flap sclerotomy. The tension two months before the first operation only measured 47 Schiötz, but the eye did not respond well to *eserin*. One daily instillation of $\frac{1}{4}$ per cent. solution reduced the tension partly, but under three instillations daily the tension rose again. The case, therefore, did not fall into the group most suitable for flap sclerotomy, as above defined, though the tension was never very great. The first operation in August, 1911, only lowered the tension to an average of 37, the same effect as was got from one daily instillation of *eserin*. The second flap sclerotomy, however, performed in May, 1912, produced a lasting fall in tension; two recent measurements gave 19 and 25. The eye shows typical scars; those of the first operation are faintly coloured with uveal pigment, revealing some adhesion of the iris to the scar, which, however, is not visible. I think this adhesion of iris may have been largely responsible for the insufficiency of the first result, though such a trace of iris pigment is frequently seen in the scars of successful cases.

The fellow eye, with Schiötz tension 37 when first seen, has been treated satisfactorily by one daily instillation of *eserin* till lately, when this became ineffectual. As with the first eye, an increase in frequency of the drops to three times daily raised the tension from 40 to 60. So a prolapse operation was performed on June 9th, this year.

The operation is still performed as described in 1910, with the 3.5 mm. bent broad needle for the end cut, and the trowel-handled narrow knife for the side cuts. Both need to be sharp, particularly the latter. A number of modifications have been tried, but none of them have given improved results.

I personally like to extend the lateral incisions rather far into the deeper layers of the cornea, with the idea of thereby increasing the shrinkage of the flap. Probably this shrinkage accounts for the fact that in our hands the knife operation has given better results than those got by cutting a somewhat similar flap with Bishop Harman's twin-scissors.

The flap need not be strictly rectangular. And to lessen the possibility of pressure of the narrow knife on the lens in the sawing movements, the cutting edge may be conveniently directed forwards and inwards for the inner incision, and forwards and outwards for the outer incision. Also a quite short flap has often served fully as well as the longer flaps. (I can remember injuring the lens only in one of these operations. Posterior stellate cataract formed early and ripened rapidly. The flap was a long one. The fellow eye was operated upon at the same time with a shorter flap, without trouble of any kind.)

Some surgeons are still inclined to question the existence of the strictly filtrating cicatrix, thinking that the leakage may be always through fistulous openings, possibly microscopic. The illustration on next page is from a section of an eye excised for recurrent

tension two weeks after the performance of rectangular flap sclerotomy; the section was kindly given to me years ago by Mr. Greeves.

Filtration was shown by "quite a good area of oedematous conjunctiva." But the filtration was insufficient; and one knows now that the moderate flow which takes place through the typical filtering cicatrix could not possibly have been sufficient to relieve the tension in this eye. It was a case of very advanced secondary glaucoma, with filtration angle obliterated by firm union.

Mr. Greeves made serial sections showing that the gap at the end of the flap was everywhere fully occupied by new fibro-cellular tissue. I have little doubt that in this case the tissue would ultimately have become further organised into a dense impermeable scar. But in its present filtering stage it serves fairly well to illustrate the final condition of the scars which are found clinically to filter permanently and satisfactorily.

It is no more strange that, bathed in aqueous, the healing process should remain permanently incomplete after these operations, than that it should fail altogether in the centre of a trephine hole. It would be strange indeed if, in not grossly dissimilar cases, there were only the two extremes—complete failure on one hand, and firm union on the other—with no connecting links.

It is perfectly obvious clinically that the tissue composing the filtering grey lines is quite different from that which causes the disappearance of a fully healed scleral wound. (Ordinarily it is impossible to locate soundly healed scleral wounds).

Further, I do not believe there is ever a leaking hole in a scleral scar, which does not give clinical evidence of its existence. Where the leakage is least there is always a dark point to be seen. The clear conjunctiva over it is, perhaps, slightly elevated; and, particularly in the pigmented Indian eye, there is some washing away of pigment from this covering conjunctiva, and a tendency to accumulation of pigment in the form of an imperfect ring at a little distance around the opening.

There are other larger fistulous openings which cannot be seen, because the flow of aqueous is so free as to alter the minute anatomy of the (swollen, oedematous) overlying conjunctiva sufficiently to make the conjunctiva opaque, whitish. Whenever this opacity is marked, one must admit at least the probability of a fistulous track beneath.

The serious practical question arises: with our present knowledge, particularly as considered above, is it any longer fair to the patient deliberately to aim at the formation of a sclero-corneal fistula, in treating a glaucoma which can be relieved with certainty by the truly filtering cicatrix of a flap sclerotomy? Is not one incurring an entirely unnecessary risk of late infection, for a very doubtful advantage in the matter of assured permanency of filtration? The question is a large one; but there is much pertinent material now available for collation. And there seems to be a growing feeling against acceptance of late infections as inevitable. I personally believe the liability to the severer grades of late infection will be almost entirely eliminated from glaucoma operations.

In the milder glaucomas the problem of prevention appears to be adequately met by such procedures as flap sclerotomy. Not only must the conjunctival changes be reduced to a minimum, but, knowing that virulent organisms can penetrate beyond the normal conjunctival epithelium, we cannot afford to dispense with the available thick living filter in the sclero-corneal wound, shown in the illustration.

The infective danger.—I have never known of a late infection after flap sclerotomy, though such may possibly have occurred in advanced glaucomas where relief has been obtained by a partly fistulous scar. The case of possible ectogenous infection through an apparently unexceptionable scar, reported in the *Ophthalmoscope*, 1914, p. 5, warns one to be cautious in one's expectations; but in this case the inflammation was not severe, the operation was wedge sclerotomy, and one has no definite knowledge of the anatomy of the cicatrices produced by this operation. With the suggested restriction of the use of flap sclerotomy, one may fairly assume that the method gives practical immunity from risk of massive infection.

One must beware of connecting particular operations necessarily and exclusively with certain types of scar. Take, for instance, trephining as practised by Col. Elliot. In the milder glaucomas now particularly considered, only a section of the disc is removed, particularly of the deeper layers, and much of the trephine hole is covered by a lid of impermeable corneal tissue. (It does not seem clear that this superficial covering of corneal tissue ever becomes permeable to aqueous. The gradual extension of a conjunctival thickening over the cornea, like the growth of a pterygium, is seen with any fistulous track close to the limbus. In the conditions of this sort which I have seen from other operations, the dark leaking point under the conjunctiva has remained always unaltered in size). The result is that there is an oblique track made between a slit-like opening below and a similar one above. The narrower the slit the more likely is it to become bridged by new tissue, such as shown in the above illustration; and doubtless the moderate leakage through such a truly filtering scar is ample for some glaucomas, for a time at least, though the slit is so short.

But the points to consider are: (1) That attempts to graduate the flow of aqueous in accordance with one's estimate of the needs of individual cases, by altering the size and shape of sclero-corneal openings, seem to have been rewarded with but indifferent success. Hence the hypotonies, the bleb-like cicatrices and the septic disasters, which have occurred even in the best eyes—those eyes least prone to such troubles, and most easily relieved by true filtration.

And (2) though punch operations and trephinings have produced many "flat cicatrices," yet these are the operations least designed to afford the full available protection. They are the procedures most calculated to form definitely open sclero-corneal tracks, imperfectly protected. The more the flow of aqueous is narrowed to a point, the freer must be the sclero-corneal canal for any given quantity of fluid to pass; and the nearer the point is to the adherent limbus, the greater is the tendency to direct forward passage through the conjunctiva. What is needed, on the contrary, is an extended line of filtering scar tissue under the loose conjunctiva away from the limbus.

Permanency of relief of tension. In attempting to check a progressive disease or tendency by an outlet of limited capacity, one must feel apprehensive lest the limit of the relief provided be reached sooner or later, unless immediate needs are considerably over-supplied. Unless there were some elasticity in the means provided for relief, more or less immediate hypotony must be a necessary accompaniment of any but quite temporary operative relief of glaucoma. Evidently these filters are not ordinarily called upon to work at once at their full capacity; some elasticity in action must be admitted (see *Trans. Ophth. Soc. U.K.*, Vol. XXXIX [1919], pp. 227-8).

Also it seems clear that the fundamental changes responsible for the tendency to plus tension—the predisposing causes of glaucoma—commonly progress very slowly indeed. Otherwise the results of the more moderate filtration operations would be much less durable than they have proved to be. Evidently these operations must act largely by breaking the vicious circle. The most important element in the advance of untreated glaucoma seems to be the high tension itself, as seen in its effect on the filtration angle, and possibly otherwise.

But the practical question of permanence is one to be settled by experience only. One must distinguish between quite early returns of tension (really primary failures to relieve tension satisfactorily) and late recurrence after years. The only examples of the latter known to me, following small flap sclerotomy, or wedge sclerotomy are those mentioned above; but doubtless there must have been others, more particularly in cases which one is inclined now to class as unsuited for sclerotomy.

Here again, as in considering late infection, it is a question of the type of scar produced, rather than of particular operations.

And it may yet prove to be of no small advantage altogether to escape hypotony in providing relief by means of the strictly filtering cicatrix.

The three late failures above mentioned have as yet meant little more than the necessity for supplementary operations. In two of the eyes ample warning was given by the appearance of haloes around lights; and the third eye is still a useful organ.

THE GOVERNMENT OPHTHALMIC HOSPITAL, MADRAS

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DURING the autumn of 1919, I had the pleasure and privilege of attending the great eye clinic at the Government Ophthalmic Hospital, Madras. Several others, who have had similar good fortune, have recorded their experience with details of the hospital, its buildings, methods and administration, and a repetition of this from me would, I think, be superfluous; nevertheless, many things have changed and many further improvements been accomplished recently under the able guidance of Colonel Kirkpatrick, who succeeded Colonel Elliot as superintendent, and a few notes of my impressions may be of interest.

The new infectious block is now in full running order; it is a two-storey building equipped on similar lines to the rest of the hospital and possesses a large theatre provided with two operating tables which are placed each alongside a large window. The pathological department is much more fully equipped and possesses a wealth of interesting material; Wassermann test and cultures are still made at the King Institute, a very large and up-to-date