

Trabeculectomy: long-term follow-up

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SUMMARY The postoperative course of 309 eyes subjected to trabeculectomy has been studied over a 7-year period. The results have been compiled with regard to effectiveness to maintain a normal range of intraocular pressure with and without postoperative medication. The figures have been assessed *in toto* and for 3 groups of glaucoma, namely, open angle, chronic angle-closure, and acute angle-closure. Results support those of other reports to show that trabeculectomy gives satisfactory control over the years in a reasonably high proportion of eyes and with relatively few postoperative complications. There is also a small group of combined trabeculectomy with cataract extraction.

As a result of histological investigations there has been general acceptance that so-called 'primary glaucoma' has been the result of decreased outflow facility associated with changes in the trabecular meshwork. Consequently several microsurgical operations on the trabeculum have been devised to increase the facility of outflow. Trabeculectomy (Smith, 1960, 1962, 1969; Strachan, 1967; Harms and Dannheim, 1969), sinusotomy (Krasnow, 1968), trabeculectomy (Cairns, 1968, 1969; Watson, 1970), and trepano-trabeculectomy (Dellaporta, 1975; Neubauer, 1977) have been described. Several workers have assessed the results (Thyer and Wilson, 1972; Ridgeway, 1974; Swartz and Anderson, 1974; Spaeth *et al.*, 1975; Schwartz *et al.*, 1976).

Combined trabeculectomy with cataract extraction has been recorded (Thyer and Wilson, 1972; Rich, 1974; Eustace and Harun, 1974; Mackensen *et al.*, 1974; Neetens, 1976).

The results of trabeculectomy, documented from many sources, have led to its becoming an accepted procedure for treatment of chronic open-angle and chronic angle-closure glaucoma. For acute angle-closure glaucoma simple peripheral iridectomy is the procedure of choice for many clinicians, though with this group there is the problem of incomplete control and the necessity for further operations.

The purpose of this report is to add to the data relating to long-term results of trabeculectomy performed for 3 classes of primary glaucoma, namely, open-angle, chronic angle-closure, and

acute angle-closure. The results are assessed entirely with regard to the pressure. Vision and possible secondary lens changes have not been taken into account. There is another small group treated by combined trabeculectomy and cataract extraction.

Method and material

The procedure adopted is basically that described by Cairns (1969) and modified by Watson (1970) and is outlined in a preliminary study by Thyer and Wilson (1972). Since 1972 the technique has remained unchanged. Certain minutiae have been observed:

(a) The conjunctival section is situated 9 or 10 mm behind the limbus to keep it as remote as possible from the scleral section.

(b) The conjunctival flap is handled with forceps as little as possible.

(c) The conjunctiva and Tenon's flap is dissected forwards to include as much Tenon's as possible in the flap.

(d) Cautery is used to the minimum extent.

(e) The scleral flap tends to become thicker and the dissection deeper as it is continued forward, so caution is required to avoid perforating the globe prematurely.

(f) The deep trabecular lamella of about 3 × 1 mm is outlined by a knife or razor-blade fragment and deepened until penetration occurs; at this point it is advisable to remove the lid retractor to avoid pressure on the globe.

(g) The assistant retracts the scleral flap while the operator grasps the full thickness of the trabecular rectangle and dissects it with the point of the blade from within out. If the deepest layer of the

trabeculum is not engaged in the forceps, a fine Cellophane-like membrane is left which has to be dissected out separately.

(h) Iridectomy may be performed when the iris presents, but a neater procedure is effected if this can be left until the rectangle has been excised. After iridectomy the scleral lamella may be folded back promptly with minimum loss of aqueous.

(i) The conjunctivo-Tenon's flap is carefully stitched back with a running stitch, then examined for possible points of leakage.

Over a 7-year period 309 eyes have been observed. So far as the records allow, the results have been recorded with regard to the control of tension in these eyes classified into the categories of open-angle, chronic angle-closure, and acute angle-closure glaucoma. Tensions have been recorded preoperatively, early postoperatively, and then at varying intervals during the next postoperative period. The preoperative tensions have some relevance with regard to open-angle glaucoma, but with angle-closure glaucoma the tension is restored to normal by osmotic therapy.

Early postoperative tension refers to the first 3 postoperative weeks, and the later postoperative tensions are those taken at 12 months, then at the last recorded tension, which may be up to the 7th year. When several recordings have been entered over a short period of 3 or 4 weeks, the average of these tensions is selected for this review. When possible the tension as recorded by applanation is used in preference to Shiotz tonometry.

Results

Table I gives an indication of the postoperative pressure of 309 eyes as recorded at 3 postoperative intervals. The number of cases with pressures below 21 mmHg increases with successive follow-ups, largely at the expense of the number of cases with pressures over 24 mmHg. The number of cases with pressures of 21 to 24 remain much the same over the period of observation. This might suggest that there is an initial period in which the tension is raised

Table 1 Frequency of distribution of postoperative pressure recorded in mmHg

	Under 21	21-24	25 and over	Not recorded	Total
Immediate postop. pressure	205	33	34	37	309
1 year postop. pressure	233	28	12	36	309
Last recording	264	28	16	1	309

Table 2 Eyes with elevated tensions recorded in mmHg in immediate postoperative period: follow-up at end of 1 year

	Number recorded	Under 21	21-25	Over 25	Not recorded	Total
Tension over 25 at immediate post-operative recording	31	25	4	2	3	34

Table 3 Final results of tonometry in mmHg

	Under 21	21-24	25 and over	Not recorded	Total
Open angle	109 (87%)	10	6	1	126
Chronic angle-closure	90 (80%)	13	9	0	112
Closed angle	65 (93%)	5	1	0	71
Total	264 (85%)	28	16	1	309

$\chi^2 = 5.70$, DF = 4, P not significant.

Table 4 Mean postoperative pressures in mmHg for the 3 groups

	Immediate	1 year	Final follow-up
Open angle	17.20	16.32	16.29
Chronic angle-closure	16.87	15.89	16.56
Acute angle-closure	15.21	16.51	15.62
F ratio	1.38 NS	0.23 NS	0.71 NS

and which is corrected later. The 12 cases quoted at 1 year are not necessarily compiled from the 34 quoted in the immediate postoperative period, so further study of the 34 cases is shown in Table 2.

Of the 34 cases the follow-up of 3 was inadequate, so they were excluded. Of the 31 remaining there were only 2 in which the tension remained over 25, so there had been a reduction in tension in 29 and a satisfactory level was obtained in 25 out of 31.

Results of the different types of glaucoma which have been designated as open-angle, chronic angle-closure, and acute angle-closure are recorded in Table 3. They show that there is no significant difference between the 3 groups and that the results in the acute angle-closure glaucoma are as satisfactory as for the other 2 groups. This is further evident from Table 4, which shows the mean postoperative pressures for the 3 groups.

Medication in the form of miotics was administered to 66 out of 230 eyes (28.7%) after the 1 year period and to 68 out of 239 eyes (28.4%) at the

end of the follow-up period. These data are shown in Table 5.

A certain proportion underwent further surgery as a result of inadequate control of tension even with medication. These are shown in Table 6.

Complications were recorded in 71 cases and consisted entirely of shallow or absent anterior chamber, hyphaema, and late infection and a central vein occlusion. These complications have been compiled for the 3 groups and are shown in Table 7. One of these cases requires attention, namely the case of venous thrombosis.

Central vein thrombosis in the operated eye

Table 5 Numbers of cases with continued administration of medication

	Medication at final follow-up			Total	
	Not in use	In use	Not recorded		
Medication at end of 1 year	Not in use	215	15	0	230
	In use	17	49	0	66
	Not recorded	7	4	2	13
	Total	239	68	2	309

Table 6 Eyes which underwent further surgery

	No operation	Operation	Total
Open angle	123	3	126
Chronic angle-closure	107	5	112
Acute angle-closure	71	0	71
Total	301	8	309

Table 7 Complications (figures refer to number of eyes)

	Shallow anterior chamber	Hyphaema	Late infection	Central vein occlusion	Total
Open angle	22	9	0	1	32
Chronic angle-closure	24	4	0	0	28
Acute angle-closure	8	3	1	0	12
Total	54	16	1	1	72

Table 8 Combined trabeculectomy with cataract extraction tensions recorded in mmHg

Number recorded	Immediate postoperation			Tension after 1 year			Complications			
	Not recorded	Under 21	21-25	Over 25	Under 21	21-25	Over 25	Not recorded	Hyphaema	Flat alc
15	4	5	3	3	10	2	0	3	4	2

occurred in a man aged 71. The operation was carried out under general anaesthesia and appeared straightforward. At the first postoperative refraction the maximum vision obtainable was 6/60, when the typical appearance of central vein obstruction was noted. The exact mechanism whereby the operation contributed to the vascular condition has not been established, but there is the possibility that some coughing occurred during the recovery from the anaesthetic which may have affected an eye in which the pressure was reduced to almost nil.

Since these results were compiled for 309 eyes 1 further serious case of infection has occurred in a frail female patient of 70. The operation appeared straightforward, but on the third postoperative day the media began to appear slightly cloudy and by the fifth day there was purulent panophthalmitis. The eye was removed and culture revealed a profuse growth of *Staphylococcus aureus*. Subsequent research into a possible cause has proved negative.

Trabeculectomy combined with cataract extraction has been recorded in 15 patients (Table 8). It will be noted that the recordings at 1 year show 2 patients with tensions of 21 to 25 mmHg; of these, 1 died and the other had tension restored to 19 mmHg during the next year. The numbers of eyes treated by this procedure is too small for critical analysis, but the results so far are encouraging.

Conclusions

Trabeculectomy appears to compare favourably with any other procedure for the 3 groups of cases which have been studied. The development of cataract has not been a subject of the study, but this complication has not been apparent in the normal clinical appraisal of the patients.

The results with acute angle-closure are interesting as trabeculectomy is not generally considered routine procedure for this group. Clinical observation, however, had led to the conclusion that simple peripheral iridectomy was frequently inadequate and needed to be followed by further surgery at a later date. The treatment for this group, therefore, has been to restore normal tension by medical agents, then to perform a trabeculectomy on the acute eye and a prophylactic peripheral iridectomy on the other eye. Of the 71 eyes treated in this way it will be seen that none required further surgery.

In comparison with other forms of glaucoma surgery the most noticeable feature of trabeculectomy has been the lower proportion with choroidal effusion and shallow anterior chamber. It would seem that this benefit has been achieved by the fixation of the scleral flap, which has prevented a sudden leakage of aqueous. On the other hand the immediate postoperative tension has tended to remain raised for several days until a channel has been established. For these cases reduction of tension may be helped by stopping atropine and by some massage over the closed lid.

This study may be considered to support the results of other workers who have helped to establish the recognition of trabeculectomy as a valuable asset in the routine treatment of glaucoma.

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