Cyclocryotherapy: a review of cases over a 10-year period

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Abstract

There are conflicting reports on the value of cyclocryotherapy in the management of glaucoma. This retrospective study was carried out to assess the efficacy and complication rate of this procedure. The case notes of all patients undergoing cyclocryotherapy at a single centre over a 10-year period were reviewed. Case records were available for 68 eyes of 64 people. Thirty-eight eyes had neovascular glaucoma, nine had aphakic glaucoma, nine had angle closure glaucoma, three had primary open angle glaucoma, and nine had secondary open angle glaucoma. The mean follow-up periods for these groups varied from 2.0-6.3 years. The mean reduction in intraocular pressure following treatment varied from 7.9 mm Hg in the secondary open angle glaucoma group to 24.3 mm Hg in those with angle closure glaucoma. Pressure was controlled in 29.4% overall, ranging from 66.7% in the angle closure and primary open angle groups to 0% in the secondary open angle group. Of the painful eyes 71% were rendered comfortable, indicating that pain relief from cyclocryotherapy is not due solely to pressure control. 30% of the patients lost their vision following the procedure, phthisis occurred in 11.8% and four eyes (5.9%) went on to enucleation. Our results indicate that cyclocryotherapy affords good pain relief, without good pressure control, in various types of glaucoma. While there is an apparent high complication rate, visual loss and phthisis cannot be ascribed directly to the procedure, since these are eyes with a poor prognosis.

Since its description by Bietti in 1950¹ cyclocryotherapy has retained a place in the management of certain types of glaucoma. It is non-invasive and relatively easy to perform, but there are conflicting reports of its efficacy, and some series show a high incidence of visual loss and progression to phthisis in treated eyes. It was therefore decided to carry out a retrospective review of all cases undergoing cyclocryotherapy at our unit over the past 10 years to assess the efficacy and complication rate of this procedure.

Materials and methods

Included in this study are all available case notes of patients undergoing cyclocryotherapy over a 10-year period up to April 1989. Case records were available from 68 eyes of 64 people. The mean age for all patients was 67 years, range 13-88 years.

A carbon dioxide cryosurgical unit and a 2.5 mm probe were used for all procedures. A full

description of the operation was not available for all cases, but where indicated typical parameters were a 60-second single freeze, in 6-8 applications, covering 180° of the ciliary body.

The patients received topical atropine and corticosteroids postoperatively, and in addition glaucoma medication was continued as necessary.

Results

For the purposes of analysis the cases were categorised as shown in Table 1. Thirty-eight eyes had neovascular glaucoma, of which 26 were due to a central retinal vein occlusion and seven to diabetes. Nine eyes had aphakic glaucoma, nine had angle closure glaucoma, three had primary open angle glaucoma, and nine had secondary open angle glaucoma. The mean follow-up periods for these groups varied from 2.0 to 6.3 years (Table 2). The aim of treatment in all groups was reduction in intraocular pressure and/or control of pain. This latter consideration applied particularly to the neovascular group, 87% of whom had pain preoperatively.

The mean reduction in intraocular pressure following treatment varied from 7.9 mm Hg in the group with secondary open angle glaucoma to 24.3 mm Hg in those with angle closure (Table 3).

An intraocular pressure of more than 0 mm Hg but less than 22 mm Hg at one month was taken to indicate control of intraocular pressure. By this criterion the pressure was controlled in 29.4% of eyes overall, ranging from 66.7% in the angle closure and primary open angle groups to 0% in the secondary open angle group.

Of those eyes which were painful preoperatively 71.4% were comfortable following the procedure.

The figures for visual acuity changes must be interpreted with caution, since the case notes indicated that of the two patients in the primary open angle glaucoma group who lost vision one had age related macular changes and the other had anterior ischaemic optic neuropathy. If these two cases are ignored, then 30.3% of patients lost vision following the procedure.

Phthisis was defined as an intraocular pressure of 0 mm Hg or a shrunken eye, and this occurred in 11.8% of cases overall.

TABLE 1 Distribution of glaucoma categories in this series. SD = standard deviation

Category	Number	Mean age	SD
Neovascular glaucoma	38	67	16.9
Aphakic glaucoma	9	72	13.5
Angle closure glaucoma	9	75	10.8
Primary open angle glaucoma	3	75	9.2
Secondary open angle glaucoma	9	51	27.6

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TABLE 2 Preoperative data and follow-up periods

	Neovascular glaucoma	Aphakic glaucoma	Angle closure glaucoma	POA glaucoma	Secondary glaucoma
IOP					
Mean	54.8	39.5	46.4	27.3	39.6
SD	12.4	14.1	11.2	4.6	9.4
Acuity					
6/12+	0	1	0	3	0
6/18-6/60	0	0	1	0	1
CF	4	3	2	0	1
HM	9	3	2	0	4
PL	6	1	0	0	0
NPL	19	1	4	0	3
Pain	33	6	4	0	6
Follow up:					
Mean (years)	2.83	2.44	1.98	6.33	2.31
Range	0.08-9	1.5-5	0.02-10	5-8	0.02-8

CF=count fingers. HM=hand movements. PL=perception of light. NPL=no perception of light. POA glaucoma=primary open angle glaucoma. IOP=intraocular pressure.

TABLE 3 Postoperative data

	Neovascular glaucoma	Aphakic glaucoma	Angle closure glaucoma	POA glaucoma	Secondary glaucoma
Mean IOP reduction* (mm Hg)	20.4 (17.8)	11.8 (12.8)	24.3 (22.0)	8.0 (3.6)	7.9 (8.3)
IOP† ≤21 mm Hg	10 26.3%	2 22.2%	6 66.7%	2 66.7%	0
Comfortable	24/33 72.7%	5/6 83.3%	3/4 75%	—	3/6 50%
Vision:					
Worse	13	2	3	2	2
Same	25	6	6	1	6
Improved	0	1	0	0	1
Repeat treatment	4	1	3	0	2
Phthisis	6	1	1	0	0
Enucleation	2	0	1	0	1

†At 1 month.
*SD in parentheses.

TABLE 4 Area of ciliary body treated in eyes which subsequently became phthisical

	Area of ciliary body treated			
	180°	270°	360°	Unknown
Neovascular glaucoma	1	2	2	1
Angle closure glaucoma	0	0	1	0
Aphakic glaucoma	0	0	1	0

Four eyes (5.9%) went on to have enucleation. The only recorded early complication recorded was a hypopyon on the first postoperative day in one patient with aphakic glaucoma. This settled satisfactorily with topical corticosteroids.

Discussion

In our series neovascular glaucoma forms the largest group, comprising 56% of cases. This group accounted for 51% of cases reported by Brindley and Shields² and only 21% of the series reported by Caprioli *et al.*³ The difference may reflect the fact that these reports are from specialist glaucoma centres.

The intraocular pressure at one month after operation, or as soon as possible after that, was chosen because the full effect of the procedure

should be evident by this time.⁴ Although there was a significant reduction in intraocular pressure in all groups, particularly in neovascular and angle/closure glaucoma, pressure control at one month was disappointing, with only 29.4% of eyes controlled overall and only 26.3% controlled in the neovascular group. This is lower than other published series, which report control in 55-66% of neovascular glaucoma^{2,3,5,6} and 59-67% overall.^{2,3,7} Our results may reflect inadequate technique, since the procedure is performed infrequently, as shown by the record of only 68 such operations over a 10-year period, and experience in the technique is therefore limited. The variation in technique recorded in the case notes supports this notion.

Cyclocryotherapy decreases aqueous production by damaging the ciliary epithelium and the vascular supply to the ciliary body. The destructive effect depends on the freezing rate and the tissue temperature achieved. At -15°C extracellular water crystallises, leading to increased extracellular concentration of electrolytes, with resulting cellular dehydration and disruption. Below -15°C intracellular ice crystals form, causing far greater damage.⁴

To ensure placement over the pars plicata a 2.5 mm probe should be used, and this should be placed 1 mm from the limbus nasally, temporally, and inferiorly, and 1.5 mm superiorly.^{4,8} A freeze temperature of -80°C is desirable to produce a toxic concentration of electrolytes.⁴ The freeze time should be longer than 30 seconds so that the changes occurring in cells can cause permanent damage. At -80°C a 60-second application appears to be most appropriate.³ There is a direct relationship between the extent of treatment and intraocular pressure reduction, and this parallels the histological changes resulting from treatment.⁹ Most of the serious complications (hypotony, phthisis bulbi) are found after 360° treatment.³ The initial treatment should therefore be limited to one hemisphere.

Despite poor pressure control in our series, the procedure rendered 71.4% of painful eyes comfortable. This indicates that pain relief from cyclocryotherapy is not due solely to pressure control.

The visual loss from other causes in two of the patients with open angle glaucoma indicates that caution must be exercised when attributing decrease in visual acuity to the cyclocryotherapy. It must be borne in mind that the majority of these patients are elderly (mean 67 years) and that these are unhealthy eyes, many of which have a poor prognosis regardless of treatment. Our rate of visual loss of 30% overall and 34% in neovascular glaucoma is relatively low. Brindley and Shields² report a 60% visual loss overall and 68% in the neovascular group. Other published figures for visual loss in the latter group are 70%³ and loss of light perception in 37-59%.^{5,6} If the two patients with primary open angle glaucoma who lost vision are excluded, then of our patients who lost vision only two out of 20 achieved control of intraocular pressure. It may be therefore, that it is failure to lower the intraocular pressure which is responsible for visual loss rather than the procedure itself.

Our figure of 11.8% progression to phthisis

(15.8% in the neovascular group) accords with other series. Caprioli *et al*³ reported phthisis in 12% with 360° treatment and in 6% with 180° treatment. Brindley and Shields² found 12% overall and 22% in the neovascular group. Krupin and Mitchell⁶ noted phthisis in 14% of neovascular cases at 12 months, and in 34% ultimately, with mean follow-up of 24.9 months and phthisis developing at a mean of 14.4 months. Although our figures were too small for statistical analysis, it was noted that of the seven patients with phthisis for whom operative details were recorded the extent of treatment was 360° in four, 270° degrees in two, and 180° in only one (Table 4). Overall, the extent of treatment was 180° in 35, 270° in 11, 360° in 13, and unknown in nine. This lends support to the notion that no more than 180° should be treated at a single session.

Our results indicate that cyclocryotherapy affords good pain relief, without good pressure control, in various types of glaucoma. While there is an apparent high complication rate, visual loss and phthisis cannot be ascribed directly to the procedure, since these are eyes with a poor prognosis. It should be borne in

mind that prevention of rubeotic glaucoma is paramount, and that there are very favourable reports for the use of photocoagulation combined with modified filtration surgery for neovascular glaucoma.^{10 11}

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