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Value and limitations of cyclocryotherapy

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Abstract. We studied a consecutive series of 114 eyes of 102 patients that were treated with cyclocryotherapy by one surgeon. Intraocular pressure reduction sufficient to avoid further surgical intervention was achieved in two-thirds of the cases. However, the postoperative visual acuity was worse than the preoperative level in 60% of the cases, and 12% of the eyes developed phthisis. Factors which influenced these results included the type of glaucoma and the age of the patient. Eyes with neovascular glaucoma had the worst results, while those having glaucoma in aphakia without neovascular glaucoma had the most favorable response to cyclocryotherapy. Findings further showed that younger patients required more cryotherapy to achieve pressure reduction. Phthisis developed significantly more often following initial treatments than in eyes undergoing one or more repeat cyclocryotherapy procedures.

Introduction

Cyclocryotherapy is the most commonly used cyclodestructive technique for the treatment of glaucoma at the present time. Reported results, however, vary considerably, leading to confusion regarding the value of this operation. We report a retrospective review of one surgeon's experience with cyclocryotherapy to help clarify the value and limitations of the procedure and the factors that may influence its results.

Materials and methods

We studied retrospectively a consecutive series of cases in which cyclocryotherapy was performed by one of the authors (MBS) over a 10-year period. The intraocular pressure was uncontrolled in each case despite maximum medical and laser therapy (when the latter was available), and intraocular procedures to control glaucoma had failed or were not felt to be indicated. All procedures in adults were performed under local anesthesia, while general anesthesia was used when treating children.

A nitrous oxide cryosurgical unit and a cryoprobe with a tip diameter of 2.5 mm were used for cyclocryotherapy. The cryoprobe was placed over the conjunctiva so that the edge of the probe was approximately 1 mm from the corneolimbal junction. The temperature of the cryoprobe was reduced to −80° C, and this was maintained for 60 s. One cryolesion was placed in clock-wise fashion at each clock hour for two or three quadrants. The more extensive treatments were selected for individuals with exceptionally high intraocular pressures (usually over 40 mm Hg) or who were of younger age (usually under 45 years).

Dexamethasone (0.5 cc) was injected subconjunctivally at the end of the procedure and the eye was dressed with atropine and an antibiotic-steroid ointment, which were continued daily for approximately 1 month. All preoperative medications for glaucoma except miotics were also continued until a reduction in intraocular pressure was observed.

Pre- and postoperative data from all patients were analyzed for statistical significance, using chi-square analysis.

Results

One hundred and fourteen eyes of 102 patients were included in the present study. The patients ranged in age from 5 months to 88 years, with a mean of 51.1 ± 22.8 years. The types of glaucoma treated are shown in Table 1. Fifty-eight eyes had neovascular glaucoma, of which 37 were phakic and 21 were aphakic. Another 33 eyes had glaucoma in aphakia without neovascular glaucoma. Ten of the latter cases had penetrating keratoplasty, and 3 additional post-keratoplasty eyes were phakic. One or more failed intraocular procedures to treat glaucoma had been performed in

Table 1. Distribution of the types of glaucoma in the Duke University Eye Center Series

Types of Glaucoma	No. of Patients	No. of Eyes
Neovascular glaucoma	53	58
Phakic	35	37
Aphakic	18	21
Glaucoma in aphakia[a]	31	33
Postkeratoplasty	10	10
Developmental glaucomas	5	8
Primary open-angle glaucoma	3	4
Iritis and glaucoma	3	4
Glaucoma after keratoplasty (phakic eyes)	3	3
Glaucoma after trauma	3	3
Angle closure glaucoma	1	1

[a] Exclusive of aphakic eyes with neovascular glaucoma

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Table 2. Preoperative data overall and by glaucoma types

	All cases	Neovascular glaucoma (phakic)	Neovascular glaucoma (aphakic)	Glaucoma in aphakia	Others
Age (years)					
Range	0.5–88	21–77	23–88	6–86	0.5–73
Average	(54)	(55.2)	(63)	(54.5)	(41.7)
Intraocular Pressure (mm Hg)					
Range	23–75	31–75	26–65	26–53	23–70
Average	(44.6)	(49.3)	(42)	(40.4)	(45.5)
Visual Acuity[a]					
≧20/60	8	0	0	7	7
≧20/400	16	2	3	8	3
CF	21	5	2	9	5
HM	33	10	10	9	4
LP	20	14	3	0	3
NLP	11	6	3	0	2
Follow-up (years)					
Range	0.5–9	0.5–8	0.5–6	0.5–9	1–8
Average	(2.6)	(3.2)	(1.9)	(3.4)	(2.95)

[a] Five visual acuities missing from "Other" category represent children too young to give response

CF = Count fingers; HM = hand motion; LP = light perception; NLP = no light perception

45 eyes prior to doing the first cyclocryotherapy. These included 12 eyes with neovascular glaucoma, 14 with glaucoma in aphakia, and 19 in the miscellaneous group. Table 2 shows additional preoperative data of the eyes grouped according to diagnoses. Follow-up time after cyclocryotherapy ranged from 6 months to 9 years with an average 2.6 years.

Within the total study population, intraocular pressure control was defined as more than 0 mm Hg but less than 24 mm Hg and was achieved in 66% of the eyes. Twelve percent of the cases developed phthisis, which we defined as no recordable pressure. Phthisis usually occurred within 1 month after cyclocryotherapy, suggesting that most cases were a direct consequence of the therapy and were not a consequence of end-stage disease. Absence of pain was noted postoperatively in 95% of the eyes. Relief of pain was the primary indication for cyclocryotherapy in 11 cases, although the actual number of patients with pain prior to surgery could not be determined since this was not recorded for all patients. The final visual acuity was better than the preoperative level in 10% of the cases, while 60% had worse postoperative vision. This was measured as a reduction of two or more lines on the Snellen chart or a drop to at least one lower vision category (i.e., count fingers, hand motions, presence or absence of light perception). Eleven eyes had no light perception before surgery, as compared with 44 eyes postoperatively. Thirty-seven of the latter eyes were in the neovascular glaucoma groups, although the correlation between the extent of retinal pathology and the loss of light perception after cyclocryotherapy was not statistically significant.

Table 3 shows the postoperative results in eyes grouped according to the type of glaucoma present. Among the major categories, phakic eyes with neovascular glaucoma had the worst outcome: pressure control occurred in 59%, phthisis in 22%, and a worse postoperative vision in 68%. Eyes with glaucoma in aphakia (but without neovascular glaucoma) had the most favorable results, with pressure control in 82%, phthisis in 3%, and visual reduction in 52%. The subset of aphakic eyes that had undergone penetrating keratoplasty had the best results, with pressure control in all cases and a 40% incidence of reduced visual acuity. However, none of these differences between groups are statistically significant, with the exception of phthisis in the eyes with neovascular glaucoma (phakic and aphakic) as compared to the eyes with glaucoma in aphakia. This latter difference was significant at $P=0.04$. The development of phthisis did not correlate with the level or duration of preoperative intraocular pressure elevation, the extent of cyclocryotherapy given, or the degree of preoperative angle closure present.

Thirty eyes in the overall study population required more than one cyclocryotherapy. The mean age of the patients in this group was 39.9 years, compared to a mean of 55.5 years among those patients who received only one treatment. This age difference is statistically significant with $P<0.01$. The need for more than one treatment did not correlate significantly with the preoperative intraocular pressure or the extent of cyclocryotherapy given. Of the 14 eyes that became phthisic, 13 occurred after one treatment and only one occurred among those eyes requiring more than one cyclocryotherapy. This finding is not statistically significant ($P<0.08$).

Discussion

Our data are consistent with most previously reported evaluations of cyclocryotherapy. The operation was effective in lowering intraocular pressure, with approximately two-thirds of the treated eyes having sufficient pressure reduc-

Table 3. Post-operative data in all eyes and by types of glaucoma (numbers represent eyes)

	All eyes	Neovascular glaucoma (phakic)	Neovascular glaucoma (aphakic)	Glaucoma in aphakia	Others
Intraocular pressure					
Controlled	75 (66%)	22 (59%)	15 (71%)	27 (82%)	11 (47%)
Comfortable	[a]	33 (89%)	20 (95%)	33 (100%)	[a]
Phthisis	14 (12%)	8 (22%)	2 (10%)	1 (3%)	3 (13%)
Visual acuity					
≧20/60	[a]	0	0	6	[a]
≧20/400		1	0	9	
CF		1	1	6	
HM		2	3	7	
LP		8	5	2	
NLP		25	12	3	
Vision worse than preop		25 (68%)	15 (71%)	17 (52%)	
Repeat treatments					
1	27	5	1	9	12
2	4	1	0	3	0
3	4	1	1	2	0

[a] Incomplete data due to inclusion of young children

tion to avoid any further surgical interventions. Approximately one-fourth of the cases, however, required one or more additional cryoprocedures to achieve a satisfactory pressure reduction. Unfortunately, the cost of achieving pressure reduction was high, with nearly two-thirds of the cases having a worse final visual acuity than preoperatively and 12% of the eyes developing phthisis.

Certain factors were found to influence our results of cyclocryotherapy. The type of glaucoma appears to be clinically significant, although most of our findings did not reach statistical significance. Eyes with glaucoma in aphakia (exclusive of those with concomitant neovascular glaucoma) had the most favorable outcome, with intraocular pressure controlled in 82% of our cases. This observation is consistent with the report of Bellows and Grant (1978), who found favorable results with cyclocyrotherapy in eyes with chronic open angle glaucoma in aphakia. The subset of aphakic eyes with a history of penetrating keratoplasty had the best results, with pressure control in all cases. This finding is similar to the studies of West et al. (1973) and Binder et al. (1975) who reported good results with cyclocryotherapy for glaucoma after penetrating keratoplasty.

Eyes with neovascular glaucoma had the worst outcome among the major categories by glaucoma type, with intraocular pressure controlled in 64% and a worse postoperative visual acuity in 69%. However, only the difference in the incidence of phthisis between the eyes with glaucoma in aphakia and those with neovascular glaucoma reached statistical significance. Previous reports with cyclocryotherapy for neovascular glaucoma have been conflicting. Feibel and Bigger (1972) and Klein and Kuechle (1981) found a favorable response among their patients with neovascular glaucoma following cyclocryotherapy. In contrast, Faulborn and Birnbaum (1979), Krupin et al. (1978) and Shihab et al. (1982) found that the main benefit of cyclocryotherapy in this disease was relief of pain, since visual results were generally poor despite reasonable pressure control. The results of our present study are more consistent with the latter observations, in that the neovascular glaucoma group had a poor outcome from the standpoint of phthisis and visual loss but did have relief of pain in a high percentage of patients.

The influence of age on the outcome of cyclocryotherapy is an observation that has not received emphasis in previous reports. Our present results with regard to age are biased in that a greater number of cryoapplications per treatment session were empirically selected for younger patients, based on our clinical impressions that younger individuals require more cryotherapy to achieve pressure reduction. This impression was confirmed in that the mean age of patients requiring one or more additional procedures was statistically less than those who achieved pressure control after one treatment. It remains our practice, therefore, to apply cyclocryotherapy to approximately 270° in the eyes of those patients under 45 years of age, while usually using 180° or less for older individuals.

Our results show that 13 of the 84 eyes receiving only one treatment developed phthisis, as compared to one of 30 eyes undergoing one or more repeat procedures. Although this finding was not statistically significant, it does suggest that eyes which withstand the first treatment may by less apt to develop phthisis after subsequent cyclocryotherapy procedures.

The results of our present study provide some understanding as to what might be anticipated following cyclocryotherapy. In this regard, realistic goals of therapy differ according to the type of glaucoma present. The main value of cyclocryotherapy for neovascular glaucoma is comfort and avoidance of enucleation, while other patients (especially those with glaucoma in aphakia) may obtain useful reduction of intraocular pressure as well as maintenance of visual function. The high complication rate associated with cyclocryotherapy in patients with all types of glaucoma argues against its routine use as primary surgical

intervention in most cases. Although knowledge of the factors influencing the outcome of such therapy may help the surgeon to know what to anticipate, it does not provide much hope for significantly improving the results of this operation. As we have found, there is still a great need to continue the search for better procedures for treating the various difficult forms of glaucoma.

References

Bellows AR, Grant WM (1978) Cyclocryotherapy of chronic open-angle glaucoma in aphakic eyes. Am J Ophthalmol 85:615–621

Binder PS, Abel R Jr, Kaufman HE (1975) Cyclocryotherapy for glaucoma after penetrating keratoplasty. Am J Ophthalmol 79:489–492

Faulborn J, Birnbaum F (1979) Cyclocryotherapy of haemorrhagic glaucoma: clinical long time and histopathologic results. Klin Monatsbl Augenheilkd 170:651–664

Feibel RM, Bigger JF (1972) Rubeosis iridis and neovascular glaucoma. Evaluation of cyclocryotherapy. Am J Ophthalmol 47:862–867

Klein J, Kuechle HJ (1981) Cryotherapy of the ciliary body in cases of secondary glaucoma with poor prognosis. Klin Monatsbl Augenheilkd 179:470–472

Krupin T, Mitchell KB, Becker B (1978) Cyclocryotherapy in neovascular glaucoma. Am J Ophthalmol 86:24–26

Shihab ZM, Fu YA, Lee P-F (1982) Cyclocryotherapy in advanced glaucoma. Glaucoma 4:146–148

West CE, Wood TO, Kaufman HE (1973) Cyclocryotherapy for glaucoma: pre- or postpenetrating keratoplasty. Am J Ophthalmol 76:485–489

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