GLAUCOMA TREATED WITH DIAMOX*† PRELIMINARY REPORT OF 20 CASES

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THE use of Diamox in glaucoma logically follows Friedenwald's concept that the bicarbonate ion is secreted in the production of aqueous. Diamox is a powerful inhibitor of carbonic anhydrase and has been shown to be safe for human beings. By preventing, in part, the secretion of bicarbonate it diminishes aqueous production and consequently lowers intra-ocular pressure.

The use of Diamox in glaucoma was first reported by Becker (1954) and further annotated by Grant and Trotter (1954).

The present paper is intended as a preliminary report of the first twenty cases of glaucoma treated with Diamox in the Ophthalmic Department of the Edinburgh Royal Infirmary.

Material

The patients treated comprised twelve cases of secondary glaucoma, six of congestive glaucoma, and two of chronic primary glaucoma. The particulars of age, sex, and previous history are given in Table I (overleaf).

The cases of secondary glaucoma included nine of uveitis with increased intra-ocular pressure (Cases 5, 7, 8, 10, 12, 13, 16, 18, 19), of which three were also aphakic (Cases 12, 13, 18); one was secondary to an intumescent lens (Case 20), one was secondary to an intra-ocular foreign body with traumatic cataract (Case 11), and one followed perforating keratoplasty (Case 2).

The patients with congestive glaucoma included five cases of acute congestive glaucoma (Cases 3, 4, 9, 14, 15) and one of repeated subacute congestive episodes with peripheral anterior synechiae (Case 6).

In both patients with chronic simple glaucoma (Cases 1 and 17) operation was thought to be undesirable; Case 17 had had two previous drainage operations without adequate control, and Case 1 had already lost one eye through infection following a trephine operation.

In the earlier cases Diamox was only used if the patient had failed to respond to other means of therapy, but later, as the potentialities and indications became clearer, patients were treated with Diamox as the drug of choice, especially in secondary and congestive glaucoma.

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TABLE 1

Case No.	Age	Sex	Eye	Diagnosis	Previous History
1	75	M	Bilateral	Chronic primary glaucoma	Right trephine, 1954, followed by panophthalmitis and enucleation
2	65	F	Right	Corneal degeneration; keratoplasty; secondary glaucoma	Temporary reduction of tension with eserine, pilocarpine, and cortisone
3	78	M	Left	Acute congestive glaucoma	Tension 57-67 mm. Hg. Paracentesis without relief
4	61	M	Left	Acute congestive glaucoma	Bilateral exfoliation of capsules
5	39	M	Left	Disciform keratitis; secondary glaucoma	Cortisone and homatropine
6	56	M	Bilateral	Subacute congestive attacks of glaucoma	Cupped discs, arcuate scotomata, narrow angle with peripheral anterior synechiae. No response to miotics
7	62	M	Left	Iridocyclitis; secondary glaucoma	Iridocyclitis. Atropine given
8	55	F	Bilateral	Uveitis; secondary glaucoma	Delay of 2 months after diagnosis
9	43	F	Right	Acute congestive glaucoma	No response to miotics
10	64	F	Left	Subacute uveitis; secondary glaucoma	On atropine
11	41	M	Left	Traumatic cataract after intra-ocular foreign body; secondary glaucoma	No response to eserine and pilocarpine
12	57	F	Left	Cyclitis after extracapsular extraction; secondary glaucoma	First rise in tension controlled by withdrawal of hyoscine
13	46	M	Left	Bilateral cyclitis with complicating cataract extraction of left lens; secondary glaucoma	Anterior synechiae and obliteration of angle. Partial response to miotics
14	54	M	Bilateral	—	Syphilis treated 27 years ago, recurrent subacute glaucoma, cupped atrophic discs, field changes; raised tension 14.1.55 not controlled by eserine and pilocarpine but controlled by D.F.P.
			Left	Acute congestive glaucoma	Acute rise not reduced by miotics
15	83	F	Bilateral	Absolute glaucoma (right). Acute congestive glaucoma (left)	Right eye blind for 6 years. Left, no response to miotics
16	42	M	Bilateral	Iridocyclitis; secondary glaucoma	Right eye blind. Left no response to atropine or iridectomy
17	67	M	Bilateral	Chronic glaucoma with repeated operations	Bilateral trephine, right iridencleisis, left cyclodialysis
18	72	F	Left	Intracapsular extraction followed by cyclitis; secondary glaucoma	No response to miotics
19	70	M	Right	Bullous keratitis, uveitis; secondary glaucoma	—
20	67	F	Right	Intumescent lens; secondary glaucoma	Mature cataract

PARTICULARS OF TWENTY CASES

Ocular Tension (mm. Hg) before Diamox		Date of starting Diamox	Ocular Tension (mm. Hg) on Diamox		Duration of Therapy (weeks)	Results
Right	Left		Right	Left		
—	31-36	14.11.54	—	17-20	1	Only temporarily controlled. Left trephine
31-36	—	2.2.55 and 14.3.55	23	—	3	Controlled by Diamox
31-36	—		17	—	continuous	
—	49	14.12.54	—	26	4 days	Only temporarily controlled. Iridectomy
—	49	2.2.55	—	25	10 days	Control maintained with pilocarpine
—	31-39	29.1.55	—	17-20	10	Controlled by Diamox
41	41	19.1.55	26	23	11	Controlled by Diamox
—	41	31.12.54	—	17-20	4 days	Controlled by Diamox
77 (P.L.)	77 (6/18)	13.12.54	77 unchanged	77	6 hours	Not controlled. Iridectomies
90	—	16.11.54	68	—	3 hours	Not controlled. Iridectomy
—	49	17.11.54	—	26	16	Controlled by Diamox
—	67	28.1.55	—	23-26	11	Controlled by Diamox
—	57	6.12.54	—	23-26	16	Controlled by Diamox
—	31-36	23.2.55	—	26		
—	31	22.11.54 and 26.1.55	—	17	2	Controlled by Diamox
—	36		—	25	10	
—	—	—	—	—	—	
—	67	25.1.55	—	67	6 hours	
67 (no P.L.)	57-67 (6/24)	—	—	—	—	Controlled by Diamox
—	40	11.2.55	26	23	1	
—	—	15.2.55	—	19	8	Controlled by Diamox
36	—	10.12.54	23	—	8	Only temporarily controlled. Right cyclodialysis
—	31-36	21.2.55	—	17	7	Controlled by Diamox
49	—	7.3.55	31	—	3 days	Not controlled. Paracentesis
49-57	—	7.3.55	15-17	—	4	Controlled by Diamox

Results

Cases were considered to be "controlled" where the ocular tension was lowered and remained at 26 mm. Hg or below.

Diamox was considered to control a case if it reduced the tension by itself or if it was used in combination with other remedies which had failed to control the tension when used alone.

Cases were considered to be "not controlled" if the tension was lowered insufficiently and surgical intervention became necessary.

Secondary Glaucoma.—In this group of twelve cases, ten (Cases 2, 5, 7, 10, 11, 12, 13, 16, 18, 20) were considered controlled and two (Cases 8 and 19) not controlled.

In the two non-controlled cases the glaucoma was secondary to uveitis. One (Case 8) had been known to have bilateral secondary glaucoma 2 months before she came to the hospital and at that time the visual acuity in one eye was 6/24, and the other eye was almost blind. The second patient (Case 19) was an old man aged 70 with bullous keratitis, uveitis, and secondary glaucoma; the ocular tension was lowered to 31-36 mm. Hg and operative intervention was undertaken.

Congestive Glaucoma.—Of the six patients treated, three were considered controlled; one of these was controlled solely by Diamox (Case 4), whereas the other two (Cases 6 and 15) received Diamox and miotics but had not been controlled by the use of miotics alone. Two of the non-controlled cases showed so little improvement that operation was considered advisable (Cases 9 and 14); the sixth was only temporarily controlled (Case 3) and was subsequently operated upon.

Chronic Glaucoma.—Both patients treated with Diamox showed an adequate but only temporary reduction in pressure. In the first case (Case 1) the tension rose after 7 days of therapy and a trephine operation was carried out. The other case (Case 17) was controlled by Diamox for 8 weeks, but then the tension rose again and cyclodialysis was performed.

The detailed results are shown in Table I, and the cases are summarized in Table II.

TABLE II
SUMMARY OF RESULTS

Type of Case	Number Treated	Number Controlled	Number not Controlled	Remarks
Secondary Glaucoma ...	12	10	2	—
Congestive Glaucoma ...	6	3	3	—
Chronic Glaucoma ...	2	2*	—	*Control only temporary
Total	20	13(+2*)	5	*Control only temporary

Dosage

In congestive cases 500 mg. Diamox was given orally and repeated after 6 hours if necessary. As all our congestive cases happened to occur at the beginning of the series we have not used Diamox intravenously as recommended by American authors. The congestive cases controlled by Diamox have been taken off Diamox and are now controlled by miotics alone.

In all other cases 250 mg. Diamox was used orally every 6 hours with 30 gr. sodium bicarbonate. When the tension was controlled on this dosage, the dose of the drug was reduced to 250 mg. twice daily and later in the series to 125 mg. 6-hourly which was found to be more effective. After that the dosage may be further reduced to 125 mg. thrice or twice daily, and in some cases, especially of secondary glaucoma, the drug can be discontinued when the inflammatory process subsides.

The maintenance dose has to be worked out on a principle of trial and error. In one case 250 mg. 6-hourly was the only controlling dose; another required 250 mg. thrice daily, but most cases require less than that.

In the cases on a high maintenance dosage the serum potassium and sodium levels have remained within normal limits and the patients are well.

Side-Effects

All the patients complained of tingling in the fingers and toes even when on small doses of Diamox. Some experienced polyuria and thirst but were not apparently inconvenienced. Two complained of dyspepsia. One, who had had a peptic ulcer previously (Case 4), discontinued the drug and was very fortunately controlled on miotics after that; the other is taking the Diamox with a glass of milk (Case 13).

Conclusions

- (1) Diamox can exert a powerful effect in lowering intra-ocular pressure.
- (2) It reduces ocular tension in various forms of glaucoma, either alone or in conjunction with other drugs.
- (3) Diamox seems to be particularly valuable as a method of therapy in cases of secondary and congestive glaucoma.
- (4) In chronic simple glaucoma the tension is reduced by Diamox, but only temporarily; further studies in this form of glaucoma are desirable.
- (5) Fairly heavy doses of Diamox can be given for long periods without troublesome side-effects.

Summary

Twenty cases of glaucoma treated with Diamox are reported. The results, dosage, and side-effects are discussed.

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REFERENCES

- BECKER, B. (1954). *Amer. J. Ophthalm.*, **37**, 13.
GRANT, W. M., and TROTTER, R. R. (1954). *Arch. Ophthalm. (Chicago)*, **51**, 735.