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The Prediction of Intraocular Pressure Rise Following Argon Laser Trabeculoplasty

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Summary
Forty-five patients with poorly controlled chronic open angle glaucoma underwent pneumotonography immediately prior to argon laser trabeculoplasty. The coefficient of facility of outflow (c-value) was calculated from the pneumotonography and correlated with the intraocular pressure rise one hour after the argon laser trabeculoplasty. It appeared that there was a strong relationship between a low c-value indicating a poor outflow facility and a large intraocular pressure rise following argon laser trabeculoplasty. The implications of being able to predict the intraocular pressure rise after argon laser trabeculoplasty are discussed.

The introduction of argon laser trabeculoplasty (ALT) by Wise and Witter in 1979[1] has undoubtedly helped the lot of patients suffering from chronic open angle glaucoma (COAG) who are inadequately controlled on medical therapy. Many workers have demonstrated the efficacy of the technique to a greater or lesser extent.[2,3,4,5] However, the procedure is not without its problems. In most patients, a rise in intraocular pressure (IOP) occurs within approximately 12 hours of the procedure, but reports have indicated that some patients may experience a rise up to 36 hours following ALT.[6,7] In one such case the pressure rise was so great that the central vision was lost.[6] Several writers suggest monitoring the IOP in the post-laser patient for 4 hours or more.[8,9] However, the majority advocate only 1 to 2 hours of monitoring.[6,10,11] A busy outpatient department does allow the latter follow up time, but any longer would have great administrative drawbacks. In view of these problems, any method of predicting the degree of IOP rise in a patient who is to undergo ALT must be welcomed.

The measurement of the outflow facility can be regarded as giving a useful indication of trabecular meshwork efficiency.[12] Unfortunately, the outflow facility has not proved to be a good predictor of 'glaucoma.' However, we felt it may be a better predictor of a 'stressed' trabecular meshwork, as is the case after laser trabeculoplasty. Pneumotonography has been recognised as a quick and repeatable method for determining the coefficient of facility of outflow (c-value).[13]

Material and Methods

Forty-five patients (45 eyes) with COAG were admitted to the study. All had visual field loss characteristic of COAG, glaucomatous disc cupping, an untreated intraocular pressure of more than 23mm Hg and gonioscopically open angles. All were selected to undergo ALT because of increasing visual field loss and poor IOP control

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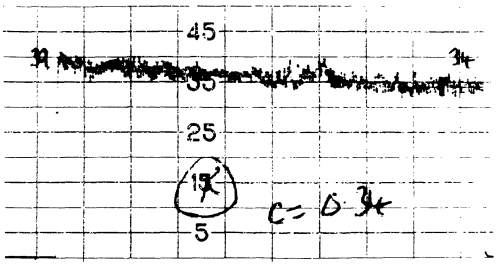

Fig. 1. *A two minute recording of the intraocular pressure using the pneumo-tonograph with a 10g weight attached to the sensor head. A marked fall of pressure is noted during the period, thus indicating a good coefficient of facility of outflow (c=0.34 μl/min/mm Hg).*

despite maximum tolerated medical therapy. The intraocular pressure was measured using the standard Goldmann applanation technique on arrival at the hospital, the patient having taken his usual medications. Pneumotonography was then performed using an Alcon pneumotonograph which had been recently calibrated and a 10g weight on the sensor head for a 2 minute duration tracing (Figs. 1 and 2). The coefficient of facility of outflow was then easily calculated using the tables supplied with the instrument. The patient then underwent ALT after a short break.

The laser used was a Coherent Argon laser using the blue-green wavelength (498 nm). The conventional technique of 50 burns of 50μ diameter placed on the anterior trabecular meshwork involving 180 degrees of the inferior angle was used. The exposure time was set at 0.1 secs and the power adjusted to give a transient blanching or gas bubble—usually within the range of 0.8 to 1.2W. The laser was delivered through a conventional Goldmann one-mirror gonioscope contact lens.

One hour after the ALT the IOP was again measured using Goldmann applanation. If the IOP had been elevated by more than 6mm Hg, a tablet of acetazolamide 250mg was administered, and the patient instructed to wait a further hour. The IOP was measured again. Once the IOP had settled to an acceptable level, the patient was allowed home on his original medications. No post-operative steroid drop was used. Three patients selected at random were called again 24 hours later and their IOP measured again. One patient was recalled 36 hours later for similar measurements. All patients were seen again four weeks after the ALT, and their IOP remeasured. Upper half ALT was then performed if deemed necessary with pneumotonography being performed as before. Thirteen other patients were randomly selected for further pneumotonography. Follow up was continued for a maximum time of 15 months following the ALT.

Results

The scattergram (Fig. 3) shows the difference between the pre and post laser intraocular pressures correlated with the pre-laser coefficient of facility of outflow (c-value). This includes the 45 eyes in the trial and also six eyes which underwent a second stage ALT. The regression line was calculated and indicates a correlation between these two parameters of -0.599 ($p=<0.0001$). Thirteen of the 45 patients had an IOP rise of greater than 6mm Hg. One patient had a rise of 16mm Hg (18-34 mm Hg) one hour after the procedure. However, one hour after the administration of acetazolamide, all IOPs had fallen to the pre-operative pressure or below. None of the patients examined 24 or 36 hours after the procedure was found to have an elevated IOP at that time. Of the 19 patients who underwent further pneumotonography (6 second half ALT and 13 randomly selected patients), 13 showed a c-value higher (i.e. better outflow facility) than pre-laser, the c-values of 2 patients were the same and those of 4 patients were worse.

The long term follow up of the 45 patients revealed three had proceeded to trabeculectomy. The remaining 42 had IOPs which were satisfactorily controlled, albeit on maximum tolerated medical therapy.

Discussion

The rise in intraocular pressure following ALT is a distinct disadvantage of an otherwise well tolerated and effective procedure. The basis for this rise is ill-understood, but it is

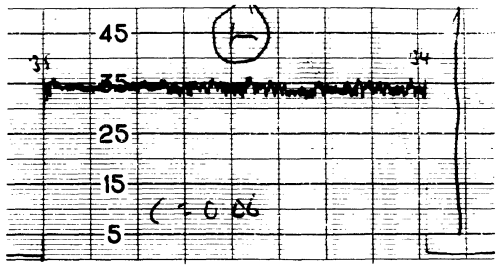

Fig. 2. *A similar two minute recording of intraocular pressure in a patient with a poor coefficient of facility of outflow. (c=0.06 μl/min/mm Hg).*

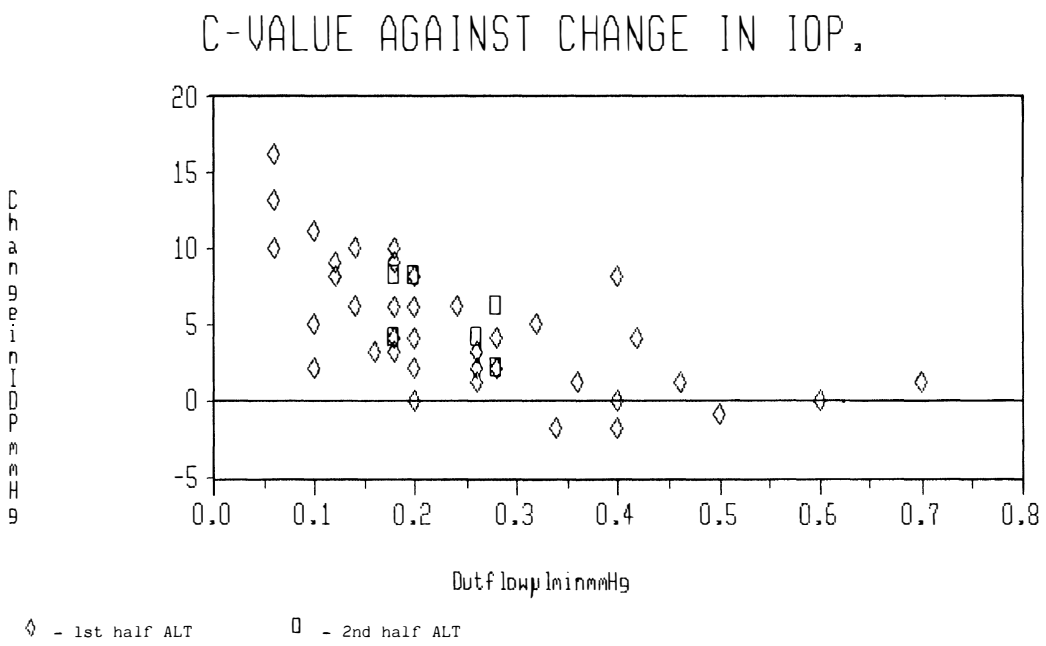

Fig. 3.

likely that inflammation and tissue oedema of the trabecular meshwork contribute to a large extent.[14] Post-laser iritis, albeit to a very minor degree was seen in all our patients, yet the degree of iritis seemed to bear no relationship to the IOP rise. It does seem logical, however, that patients who have a poor outflow facility in the first place may well succumb to higher IOP rises after the ALT produces a certain amount of inflammatory reaction. We feel that this indeed has been demonstrated by our results. Pneumotonography is a quick and easy technique to master and is well tolerated by the patient. It produces an accurate result within 2 minutes and this result can aid the ophthalmologist in his post-laser monitoring. We believe it is still prudent to keep all patients in the outpatient department for one hour after ALT, but only those with a c-value of less than 0.2µl/min/mm Hg should be kept for longer in case the IOP rises still further. This would reduce patient waiting time, reduce administrative problems and allow the more efficient management of the laser 'list'.

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