

## SCIENTIFIC REPORT

## Long term effect on intraocular pressure of phacotrabeculectomy compared to trabeculectomy

J Lochhead, R J Casson, J F Salmon

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**Aim:** To compare the long term mean intraocular pressure (IOP) reduction after non-augmented single site phacotrabeculectomy with that after trabeculectomy and to determine the relation between preoperative IOP and IOP reduction.

**Methods:** A group of 44 consecutive patients with chronic open angle glaucoma who underwent phacotrabeculectomy were matched to a trabeculectomy control group and the results of surgery were compared. Linear regression analysis of preoperative IOP and IOP reduction was undertaken.

**Results:** The mean IOP reduction was significantly less in the phacotrabeculectomy group (6.7 (SD 2.1) mm Hg) than in the trabeculectomy group (11.0 (1.4) mm Hg) ( $p=0.0017$ ). There was a significant difference in surgical success between the groups. The preoperative IOP was significantly related to the postoperative reduction in IOP in both groups ( $p<0.001$ ).

**Conclusions:** In elderly white patients with chronic open angle glaucoma, phacotrabeculectomy is not as effective as trabeculectomy in reducing IOP. In both procedures the magnitude of IOP reduction is proportional to the preoperative IOP.

In recent years, there has been a widespread shift towards the use of combined phacotrabeculectomy as the surgical treatment of choice for coexisting cataract and glaucoma.<sup>1</sup> Despite its popularity, the efficacy of this operation compared to trabeculectomy remains unclear and published follow up periods are generally short, rarely exceeding a year.<sup>2–8</sup> In addition, the relation between the preoperative IOP and IOP reduction after phacotrabeculectomy has not been previously reported.

In this retrospective study, the long term efficacy of single site phacotrabeculectomy without intraoperative antimetabolites is compared to that of trabeculectomy in a matched group of patients and the relation between preoperative IOP and the magnitude of IOP reduction is examined.

## PATIENTS AND METHODS

From September 1996 to July 2000, 44 consecutive patients with chronic open angle glaucoma (COAG) at low risk of bleb failure, underwent combined phacotrabeculectomy without antimetabolites by a single surgeon (JFS). The results of surgery were retrospectively analysed. All patients with COAG who underwent trabeculectomy without antimetabolites during the same period by the same surgeon were identified, and 44 were matched to the phacotrabeculectomy group with respect to age, sex, race, and preoperative IOP. All patients were followed for at least 12 months, with an average follow up of 29 (SD 3.4) months in both groups.

Phacotrabeculectomy was performed using a fornix based, superior, one site approach. Phacoemulsification was undertaken through a 3.2 mm incision and a foldable three piece

silicone IOL was placed into the capsular bag. The scleral tunnel was incised at its lateral borders to create a scleral flap and a punch was used to create an internal sclerectomy. A peripheral iridectomy was then undertaken and the scleral flap and conjunctiva were sutured with 10-0 nylon. Postoperative drops consisted of topical chloramphenicol and dexamethasone 1% four times daily for 2 weeks, followed by topical prednisolone 1% four times daily for between 4 and 12 weeks depending on bleb appearance and function.

Trabeculectomy was performed superonasally using a fornix based conjunctival flap. A scleral flap was fashioned and a scleral punch was used to create an internal sclerectomy. A peripheral iridectomy was performed and the sclera and conjunctiva were sutured with 10-0 nylon. The postoperative drop regime was the same as that used in the phacotrabeculectomy group. Each patient was followed up postoperatively at intervals of approximately 1 day, 1 week, 1 month, 3 months, 6 months, 12 months, and then on a 6–12 monthly basis.

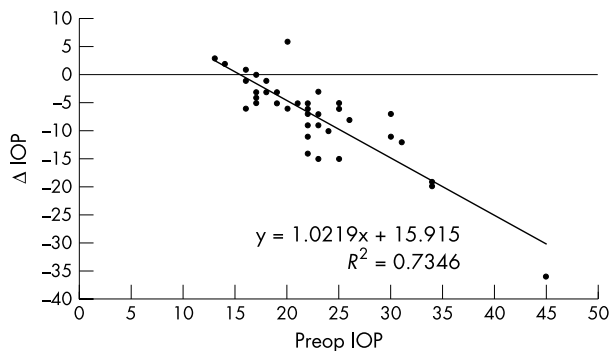
$\chi^2$  and Fisher's exact tests were used to compare the sex distribution and diagnoses between groups. Student's *t* tests were used to compare the age, preoperative mean IOP between groups, the duration of follow up, the mean IOP reduction, the mean reduction in the number of glaucoma medications and the change in visual acuity between groups. Surgical success was defined in terms of IOP control using two criteria: (1) IOP <22 mm Hg and >30% reduction in IOP without glaucoma medication, and (2) IOP <17 mm Hg without glaucoma medication. Kaplan-Meier survival analysis was used to determine the probability of surgical success in each group and the survival curves were compared using the log rank test. Linear regression analysis of preoperative IOP and IOP reduction was undertaken.

## RESULTS

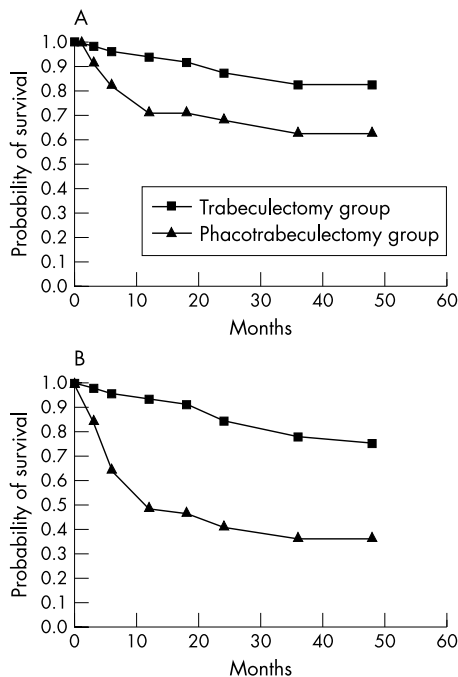
There were no significant differences between groups with respect to age ( $p=0.75$ ), sex ( $p=0.83$ ), diagnosis ( $p=0.22$ ), number of preoperative glaucoma medications ( $p=0.94$ ), or preoperative IOP ( $p=0.11$ ).

In the phacotrabeculectomy group, one patient required an anterior vitrectomy and placement of a sulcus fixated IOL while in the trabeculectomy group there were no intraoperative complications recorded. Two patients in the phacotrabeculectomy group and four in the trabeculectomy group developed a choroidal effusion in the early postoperative period which settled spontaneously. Four patients in the trabeculectomy group had a postoperative hyphaema. Two patients in each group were given subconjunctival injections of 5-fluorouracil in the early postoperative period.

The mean (95% CI) postoperative IOP was significantly higher in the phacotrabeculectomy group (15.5 (1.1) mm Hg) than in the trabeculectomy group (13.0 (1.0) mm Hg) at the end of the follow up period ( $p=0.0017$ ). The mean IOP reduction at the end of the follow up period was significantly less in the phacotrabeculectomy group (6.7 (2.1) mm Hg) than in the



**Figure 1** Linear regression analysis of preoperative intraocular pressure (IOP) and change in intraocular pressure ( $\Delta$ IOP mm Hg) for phacotrabeculectomy.



**Figure 2** (A) Probability of survival for both the phacotrabeculectomy and trabeculectomy groups using criterion 1, when success was defined as an IOP less than 22 mm Hg and IOP drop >30% at any time after the first postoperative month, or the introduction of any glaucoma medication ( $p=0.032$ ). (B) Probability of survival for both the phacotrabeculectomy and trabeculectomy groups using criterion 2, when success was defined as an IOP less than 17 mm Hg at any time after the first postoperative month, or the introduction of any glaucoma medication ( $p<0.001$ ).

trabeculectomy group (11.0 (1.4) mm Hg) ( $p=0.0017$ ). The reduction in the mean number of glaucoma medications at the end of the follow up period was not significantly different between the groups ( $p=0.4$ ). Linear regression analysis revealed that the level of preoperative IOP was significantly related to the postoperative reduction in IOP in both the phacotrabeculectomy group (Fig 1) ( $R^2=0.735$ ;  $p<0.001$ ) and in the trabeculectomy group ( $R^2=0.502$ ;  $p<0.001$ ). There was a significant difference in surgical success between groups using criterion 1 ( $p=0.0046$ ) (Fig 2A) and a greater difference using the more stringent criterion 2 ( $p<0.001$ ) (Fig 2B).

At the final follow up visit, there was a mean gain in the number of lines of Snellen visual acuity from baseline in the phacotrabeculectomy group (1.9 (0.6)) compared to a mean loss in the trabeculectomy group (0.8 (0.4)) ( $p<0.001$ ).

## DISCUSSION

All of the patients included in this study were elderly (mean age 77 years) and white. It is important therefore to appreciate that these results are not necessarily applicable to younger individuals or to other ethnic groups.

A recent review of the literature reveals that the mean IOP reduction achieved by phacotrabeculectomy augmented with mitomycin C (MMC) is similar to that achieved by trabeculectomy, albeit with a higher complication rate, and that augmentation with 5-fluorouracil (5-FU) produces variable results.<sup>1</sup> However, without the use of MMC, the evidence suggests that phacotrabeculectomy does not achieve the same IOP reduction as that of trabeculectomy alone, regardless of the operative technique.<sup>1</sup>

We found that the mean IOP reduction at the end of our follow up period was significantly greater in the trabeculectomy group. Other investigators have reported similar results.<sup>9</sup> However, in a prospective study, Guggenbach *et al* reported that after 1 year the mean IOP reduction was not significantly different between the two groups.<sup>10</sup> These patients were not randomised and the patients in the group undergoing phacotrabeculectomy were significantly older ( $p<0.001$ ) than those in the group undergoing trabeculectomy.

Our results for trabeculectomy are similar to those reported by Watson and Grierson who found a linear relation between preoperative IOP and the reduction in IOP achieved by trabeculectomy.<sup>11</sup> Using regression analysis we also found a linear relation between preoperative IOP and postoperative IOP reduction after phacotrabeculectomy. At moderately elevated preoperative IOP levels the reduction achieved by phacotrabeculectomy was less than that achieved by trabeculectomy.

In terms of surgical success, using the criteria that we set, trabeculectomy alone had a better outcome. The reason for this is not clear but it may involve the breakdown of the blood-aqueous barrier that accompanies phacoemulsification and the release of inflammatory mediators leading to reduced bleb function.<sup>12</sup> Differences in bleb position may also have had a role.<sup>13</sup>

Phacotrabeculectomy has been shown to be an effective procedure in terms of visual improvement and our results are similar to those previously reported. In comparison, trabeculectomy tended to result in a long term reduction in visual acuity, principally because of the development of cataract. The complication rates for these two procedures were found to be otherwise similar.

In preoperative decision making, two important implications arise from these data: firstly, phacotrabeculectomy without antimetabolites is unlikely to achieve a low target pressure without additional glaucoma medication and, secondly, in elderly white patients with chronic open angle glaucoma, a high preoperative IOP is not a contraindication to phacotrabeculectomy if only a moderate target pressure (in the mid to high teens) has been set.

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