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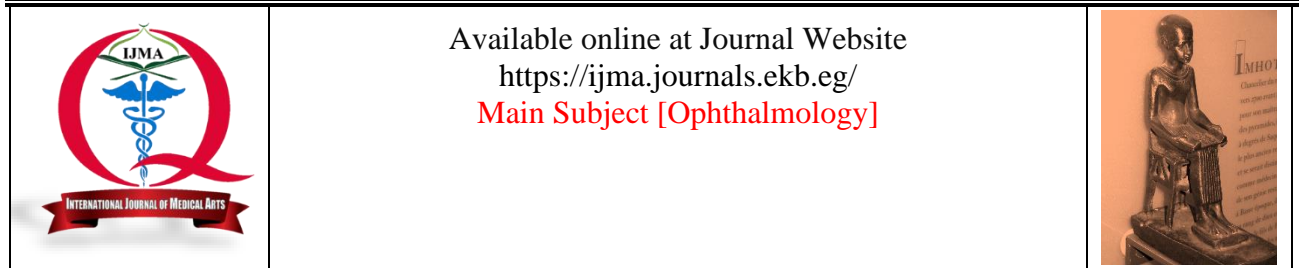
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Original Article

Outcome of Trabeculectomy in Phakic and Pseudophakic Eyes with Open Angle Glaucoma after Phacoemulsification: A retrospective Comparative Study

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ABSTRACT

Article information

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Background: Glaucoma is one of devastating eye disease with major complications up to blindness. Trabeculectomy is the standard surgical procedure for management of the disease. However, the success rate after previous phacoemulsification is not will addressed.

The aim of the work: The current work aimed to evaluate the effect of prior phacoemulsification surgery on the outcome of trabeculectomy for primary open angle glaucoma.

Patients and Methods: This is a retrospective study, that included all patients who underwent trabeculectomy for primary open angle glaucoma from January, 1st, 2017 till the end of December 2021. They were 36 phakic and 28 pseudophakic eyes. The operative success at the end of the sixth postoperative month was the primary outcome and different complications were the secondary outcome. Other collected data were patient demographics, pre- and post-operative intraocular pressure [IOP] and best corrected visual acuity [BCVA] at 2 weeks, and 1, 3, and 6 postoperative months.

Results: The glaucoma was of primary open type among majority of patients [79.7%]. At one, three and six postoperative months, the IOP was significantly reduced among phakic than pseudophakic groups. But the BCVA did not differ between phakic and pseudophakic groups either preoperative or at the follow up periods. The surgical failure was reported among 14 eyes [21.9%] and significantly increased in pseudophakic than phakic groups [35.7% vs 11.1%, respectively]. Choroidal detachment was reported among 7 eyes [10.9%], hyphema in one eye [1.6%] and bleb leak in 3 eyes [4.7%]; and there was insignificant difference between phakic and pseudophakic groups.

Conclusion: Previous phacoemulsification is associated with increased failure rate of trabeculectomy in patients with open angle glaucoma.

Keywords: Phacoemulsification; Open Angle; Glaucoma; Phakic; Retrospective.



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INTRODUCTION

Glaucoma is defined as an optic neuropathy, associated with progressive loss of ganglion cells, visual field defects and eventually to blindness if not adequately managed. The reported prevalence of glaucoma is 3.5% for the population aged 40–80 years. In addition, its burden is growing progressively ^[1].

Trabeculectomy is the gold standard filtering and curative surgery for the treatment of glaucoma ^[2].

Previous conjunctival incision or any intraocular surgery could lead to a worse prognosis of trabeculectomy. This is explained by fibrosis in conjunctival space-induced by inflammation, which could adversely affect the outcome of trabeculectomy ^[3].

Prior studies reported that, patients submitted to extracapsular cataract extraction [with inevitable conjunctival incision] had a lower rate of success of the trabeculectomy ^[4-6].

Phacoemulsification is the commonest surgical technique for cataract extraction. The main advantages include less ocular inflammation and absent corneal scarring. These advantages seem to provide benefits and associated with good outcome of trabeculectomy. However, studies comparing trabeculectomy results in pseudophakic and phakic eyes are limited and confined to specific populations ^[7-9].

THE AIM OF THE WORK

The current aimed to evaluate the effect of prior phacoemulsification surgery on the outcome of trabeculectomy for primary open angle glaucoma.

PATIENTS AND METHODS

This is a retrospective study, that included all patients who completed trabeculectomy for open angle glaucoma at the Department of Ophthalmology, Al-Azhar University Hospital [Damietta] from January, 1st, 2017 till the end of December 2021 [including the whole duration of follow up]. We included patients with open angle glaucoma [primary or exfoliative], where diagnosis of glaucoma confirmed at their 35 years of age or later, with no history of previous ophthalmic surgery other than phacoemulsification in the last year prior to the trabeculectomy, and only one eye included in the study. On the extreme side, the exclusion criteria were trabeculectomy performed in the same setting with cataract surgery, aphakia, other ocular diseases than cataract, cataract with significant intraoperative complications, and any prior ocular surgery than clear cornea phacoemulsification.

Ethical aspects: The study was completed in line with ethical codes of Helsinki declaration for research conduct and reporting. The study protocol was approved by the Institutional Review Board of Damietta Faculty of

Medicine [Al-Azhar University] [IRB 00012367-22-01-006]. The patient consent was not required due to retrospective nature of the study and anonymization of data. However, an administrative consent was obtained to collect data.

The main indications of trabeculectomy were based on the clinical condition of the patient and surgeons' preferences. The indications included higher intraocular pressure [IOP] with maximal-tolerated medical therapy, with high probability of progression of glaucoma or detection of glaucoma damaging effects irrespective of the value of IOP.

Surgical procedure: The eye was prepped and draped after application of peribulbar anesthesia using 2% lignocaine and 0.5% bupivacaine. Then, a conjunctival incision was created along the limbus to create the conjunctival flap at the superior conjunctiva. A rectangular scleral flap was created. It was a 4-mm-wide and 3 mm-deep. A subconjunctival sponges soaked with mitomycin C [0.2mg/ml] or 5-fluorouracil [50mg/ml] had been applied for 2 minutes and 5 minutes for mitomycin and 5-fluorouracil respectively. This was followed by profuse irrigation by a balanced saline solution to wash away the residuals of mitomycin-C or 5-fluorouracil. The corneo-scleral block was excised after creation of a paracentesis tract in the peripheral temporal cornea. Then, peripheral iridectomy was completed. The closure of the scleral flap was performed by two 10-0 nylon sutures. If overfiltration was observed, more sutures were applied. The conjunctival flap was sutured by 10-0 nylon sutures. These were a combination of single interrupted and continuous sutures.

The postoperative treatment composed of topical dexamethasone [1mg/mL], levofloxacin [5mg/mL] and flurbiprofen [0.3mg/mL] were administered 5 times/day, followed by slow tapering over several weeks according to progress.

The operative success was recognized by post-operative intraocular pressure lower than 21 mmHg or > 20% reduction of IOP compared to preoperative values, no need for other glaucoma surgery, no phthisis or loss of light perception vision related to glaucoma.

Data collection: The data was collected: patient age, gender, type of glaucoma, preoperative values of intraocular pressure [IOP], postoperative intraocular pressure [at 2 weeks, 1, 3, and 6 months], preoperative best corrected visual acuity [BCVA] and postoperative values at 1, 3 and 6 months. The number of preoperative hypotensive medications and that after 2 weeks, 1, 3, and 6 months after surgery. Also, any complications were recorded and any needling procedures [if required] and other surgical interventions were also recorded. The primary outcome is the operative success [as defined previously]. The secondary outcomes included the values of intraocular pressure, number of postoperative hypotensive medications, visual acuity, postoperative complications or glaucoma surgeries.

Statistical analysis: The quantitative data had been expressed by their arithmetic mean and standard deviation. However, relative frequency and percentages were used to express qualitative variables. Groups were compared by independent samples “t” test or Chi square tests, or their equivalent for quantitative and qualitative data respectively. P value < 0.05 was considered statistically significant. All procedures were completed by statistical package for social sciences [SPSS], version 16 [SPSS Inc., Chicago, USA].

RESULTS

The present work included 64 eyes scheduled for trabeculectomy. 36 of them were phakic and 28 were pseudophakic. Patient age ranged from 39 to 66 years, and males represented 60.9%; and there was insignificant difference between phakic and pseudophakic groups. The glaucoma was of primary open type among majority of patients [79.7%] and exfoliative among 20.3%. The number of preoperative hypotensive drugs ranged between one and four drugs and there was insignificant difference between both groups. In addition, preoperative

best corrected visual acuity [BCVA] and preoperative intraocular pressure [IOP] were also non-significant between both groups. 5-fluorouracil was the major used antimetabolite [73.4%], while mitomycin C [MMC] was used among 26.6% [Table 1]. The IOP was non-significant between phakic and pseudophakic groups at preoperative values and at two weeks postoperatively. However, at one, three and six months the IOP was significantly reduced among phakic than pseudophakic groups. However, BCVA did not differ between phakic and pseudophakic groups either preoperative or at the follow up periods [Table 2].

Regarding primary outcome at six postoperative months, the surgical failure was reported among 14 eyes [21.9%] and significantly increased in pseudophakic than phakic groups [35.7% vs 11.1%, respectively] [Table 3].

Regarding postoperative complications, choroidal detachment was reported among 7 eyes [10.9%], hyphema in one eye [1.6%] and bleb leak in 3 eyes [4.7%]; and there was insignificant difference between phakic and pseudophakic groups [Table 4].

Table [1]: Patient demographics and preoperative data of study groups

| Variable | | Phakic[n=36] | Pseudophakic [n=28] | Total[n=64] | Test | P value |
|--------------------------------------|-------------|--------------|---------------------|-------------|------|---------|
| Age [years] | Mean±SD | 54.83±7.09 | 57.03±7.03 | 55.79±7.09 | 1.23 | 0.22 |
| | Min. – Max. | 39-66 | 40-65 | 39-66 | | |
| Sex [n, %] | Male | 20[55.6%] | 19[67.9%] | 39[60.9%] | 1.01 | 0.31 |
| | Female | 16[44.4%] | 9[32.1%] | 25[39.1%] | | |
| Type of glaucoma | POAG | 29[80.6%] | 22[78.6%] | 51[79.7%] | 0.04 | 0.84 |
| | Exfoliative | 7[19.4%] | 6[21.4%] | 13[20.3%] | | |
| N. of preoperative hypotensive drugs | Mean±SD | 2.03±0.77 | 2.07±0.54 | 2.05±0.68 | 0.25 | 0.80 |
| | Range | 1-4 | 1-3 | 1-4 | | |
| Preoperative BCVA [LogMar] | Mean±SD | 0.48±0.25 | 0.49±0.22 | 0.48±0.24 | 0.18 | 0.86 |
| | Range | 0.2-1.1 | 0.3 -1.2 | 0.2-1.2 | | |
| Preoperative IOP [mmHg] | Mean±SD | 28.89±1.39 | 27.32±1.52 | 27.07±1.45 | 1.18 | 0.24 |
| | Range | 25-30 | 24-30 | 24-30 | | |
| Intraoperative Metabolites | 5-FU | 29 [80.6%] | 18[64.3%] | 47[73.4%] | 2.13 | 0.12 |
| | MMC | 7[19.4%] | 10[37.5%] | 17[26.6%] | | |

Table [2]: IOP and BCVA among studied groups

| | | Phakic [n=36] | Pseudophakic [n=28] | t | P value |
|-----------------------------|-------------|---------------|---------------------|-------------|---------------|
| Preoperative IOP [mean±SD] | | 26.89±1.39 | 27.32±1.52 | 1.18 | 0.24 |
| Postoperative IOP | At 2 weeks | 12.22±1.24 | 12.86±1.51 | 1.84 | 0.07 |
| | At 1 month | 13.42±1.18 | 14.18±1.19 | 2.55 | 0.013* |
| | At 3 months | 15.03±1.98 | 16.36±1.89 | 2.71 | 0.008* |
| | At 6 months | 16.56±2.42 | 18.75±3.54 | 2.93 | 0.005* |
| Preoperative BCVA [mean±SD] | | 0.48±0.25 | 0.49±0.22 | 0.18 | 0.86 |
| Postoperative BCVA | At 2 weeks | 0.52±0.20 | 0.46±0.20 | 1.10 | 0.27 |
| | At 1 month | 0.53±0.16 | 0.47±0.21 | 1.41 | 0.16 |
| | At 3 months | 0.51±0.10 | 0.45±0.14 | 1.84 | 0.07 |
| | At 6 months | 0.52±0.10 | 0.47±0.13 | 1.66 | 0.10 |

Table [3]: Primary outcome among studied groups

| | | Phakic [n=36] | | Pseudophakic [n=28] | | Total [n=64] | |
|---------------------|-----|--------------------------|-------|---------------------|-------|--------------|-------|
| | | n. | % | n. | % | n. | % |
| Failure at 6 months | Yes | 4 | 11.1% | 10 | 35.7% | 14 | 21.9% |
| | No | 32 | 88.9% | 18 | 64.3% | 50 | 78.1% |
| Statistics | | $X^2 = 5.57, p = 0.03^*$ | | | | | |

Table [4]: Postoperative complications among studied groups

| | Phakic [n=36] | | Pseudophakic [n=28] | | Total [n=64] | | Statistics | |
|----------------------|---------------|------|---------------------|-------|--------------|-------|-------------|-------------|
| | n. | % | n. | % | n. | % | Test | p |
| Choroidal detachment | 3 | 8.3% | 4 | 14.3% | 7 | 10.9% | 0.75 | 0.35 |
| Hyphema | 0 | 0.0% | 1 | 3.6% | 1 | 1.6% | 1.30 | 0.25 |
| Bleb leak | 1 | 2.8% | 2 | 7.1% | 3 | 4.7% | 0.67 | 0.41 |

DISCUSSION

Glaucoma remains the second leading cause of blindness worldwide. It is estimated that, globally by the year 2040, glaucoma will affect 111.8 million^[10]. The only available intervention to slow the progression of glaucoma is the reduction of IOP to guard against damage of retinal nerve fibers and subsequent loss of the visual field^[1]. Trabeculectomy is the corner-stone and standard filtration surgery resulting in reduction of IOP after the first or repeated procedure^[11-12].

It is not well known if previous phacoemulsification had an impact on the outcome of trabeculectomy. Thus, the current study retrospectively evaluated the potential effect of previous cataract surgery on the final results of glaucoma surgery. Results revealed that, the failure rate was significantly higher among pseudophakic than phakic eyes [35.7% vs 11.1% respectively].

In addition, the rate of postoperative complications was higher among eyes with previous phacoemulsification. However, the difference did not reach statistical significance. The reported complications included choroidal detachment, hyphema, and bleb leak, reported in 14.3%, 3.6% and 7.1% in pseudophakic group and 8.3%, 0.0% and 2.8% in phakic group, respectively. These results are in line with Takihara *et al.*^[8] who performed a prospective clinical study, for 39 phakic eyes and 25 pseudophakic eyes with open angle glaucoma. They defined surgical failure on three IOP values, 21 or higher [A], 18 mmHg or higher [B] and 15 mmHg or higher [C]. The one-year surgical failure rate was significantly increased in pseudophakic than phakic eyes at criteria A and B, but the level at criteria C was statistically insignificant. For criteria A, it was 27% vs 5%, and for B-criteria, it was 41% vs 16% for pseudophakic and phakic eyes, respectively. Pseudophakia was significantly associated with higher rate of surgical failure, and IOP was significantly higher in the pseudophakic than phakic groups at 6 and 9 months but not at 12 months.

Another trial by Takihara *et al.*^[13] retrospectively evaluated the effect of pseudophakia on the success rate of trabeculectomy for open angle glaucoma and reported higher significant failure rate if failure defined as second glaucoma surgery, IOP 21 mmHg or higher and if IOP 18 mmHg or higher. At the end of first postoperative year, the success rate in phakic vs pseudophakic eyes was 97.8% vs 78.6% [$p < 0.001$] for repeated surgery, 92.9% vs 72.8% for criterion B [IOP 21 or higher] [$p = 0.004$], and 73.1% vs 53.1% for criterion C [IOP 18 mmHg or higher] [$p = 0.009$].

The reported trabeculectomy high failure after phacoemulsification could be explained by different mechanisms. First, intraocular surgery is associated with stimulation of inflammatory reaction and breakdown in the blood-aqueous barrier, as reported by Engel *et al.*^[14]. Second, promotion of subconjunctival and bleb fibrosis due to induction of leucocyte migrations by monocyte

chemoattract protein-1 [MCP-1] as evidenced by higher levels of MCP-1 in the aqueous humor with phacoemulsification^[15-16]. In another study, Inoue *et al.*^[17] demonstrated significant increase of interleukin-8 [IL-8] and MCP-1 in pseudophakic eyes with open angle glaucoma [OAG] when compared to phakic group.

In the current study, choroidal detachment reported in excess in pseudophakic eyes, but with insignificant difference than phakic group. These results are in line to that reported by Torres-Costa *et al.*^[18] who reported comparable results, where choroidal detachment was reported among 20.8% and 10.3% of pseudophakic and phakic eyes, respectively. Takihara *et al.*^[8] also observed more frequency choroidal detachment in pseudophakic eyes than phakic eyes [36% 15%, respectively, $p = 0.06$].

The current study results differ than that reported by Torres-Costa *et al.*^[18] who could not find significant difference between phakic and pseudophakic eyes, regarding failure rate after trabeculectomy for OAG. Another study by Supawavej *et al.*^[7] retrospectively evaluated the success rate of trabeculectomy in 39 phakic and 39 pseudophakic eyes. They also reported insignificant difference between both groups regarding failure rate. However, their patients are of different ethnicities, which could explain the controversy between the current study and those two studies.

In an interesting study, Mathew *et al.*^[9] retrospectively compared success rates at 5 years after three glaucoma surgeries. The 5 years success rate was very close between group [58% for trabeculectomy alone, 57% for trabeculectomy followed by cataract surgery with postoperative two years and 59% for trabeculectomy after cataract surgery]. In addition, males were at higher risk of surgical failure. Unfortunately, we assessed the short-term success rate [at 6 months] and could not extend the evaluation beyond this duration due to higher drop rate of patient's follow up

One possible explanation for such controversy is the different age groups between phakic and pseudophakic eyes. For example, Torres-Costa *et al.*^[18] believe that, younger patients are prone to more risk of trabeculectomy failure. The age of pseudophakic group, in their study, were significantly older than phakic group, and as the younger age is associated with more trabeculectomy failure, this could be responsible for the insignificant difference between both groups reported in their study. We propose that, if the ages were matched as the current study, the failure rate could reach statistical significance.

Law *et al.*^[19] also hypothesized that, older age is associated with lower fibroblast activation and low inflammatory cells than in younger subjects. It represented another explanation for the effect of age on success rate of trabeculectomy and could explain the controversy between the current study and others with insignificant differences.

Another explanation is related to the criteria of studied populations and related to ethnic variations. For example,

Jampel *et al.* [20] evaluated the success and complications of trabeculectomy and observed that the European-derived race is associated with an increased success rate. Thus, the future researches must address the effect of different variables such as patient's age and ethnicity on the success rate of trabeculectomy.

Two major limitations of the current work were the small sample size and short follow up duration. Another limitation is the retrospective design of the study. Thus, prospective future studies with longer duration of follow up and large sample size are recommended. However, these limitations did not affect the value of the current work as it added to available literature [which is already scarce] about the effect of prior phacoemulsification on the trabeculectomy success rate.

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None to be disclosed

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