

# Outcomes of Single-Plate Molteno Implants in Refractory Glaucoma

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**Purpose:** To evaluate the success rate and complications of single-plate Molteno tube implantation in patients with intractable glaucoma.

**Methods:** We reviewed the records of patients who had undergone single-plate Molteno tube implantation from 1995 to 2000 with at least 18 months of follow up.

**Results:** Thirty-six eyes of 35 (20 male and 15 female) patients with mean age of 29.7±25.3 (range 3-77) years were enrolled in the study. Preoperative intraocular pressure (IOP) was 34.5±10.4 mmHg with a mean of 2.3±0.8 medications which decreased to 18.0±7.6 mmHg with 1.9±1.2 medications after 32.8±16.1 months of follow up (P<0.0001). Complete success (IOP: 7-21 mmHg without medications), incomplete success (IOP: 7-21 mmHg with medication) and total success (sum of complete and incomplete success) rates were 19.5%, 55.6%, and 75%, respectively. At final follow up, visual acuity improved ≥1 line in 10 (27.8%), decreased ≥1 line in 8 (22.2%) and remained unchanged in 18 (50%) eyes. Postoperative complications occurred in 20 eyes (55.6%) including encapsulated bleb in 10 eyes (27.8%), tube-iris touch in 4 (11%), flat anterior chamber in 3 (8.4%), tube-cornea touch in 2 (5.6%), and retinal detachment, tube-lens touch, and tube blockage, each in 1 (2.8%). IOP dropped to zero in one eye resulting in visual loss.

**Conclusion:** In eyes at high risk for trabeculectomy failure, implantation of the Molteno tube can be considered as a procedure with acceptable success for control of IOP and preservation of vision. Long term follow-up is recommended to ensure timely management of the frequent complications of this procedure.

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## INTRODUCTION

Trabeculectomy is the most common surgical procedure used to increase aqueous drainage for glaucoma management. However it may not be technically feasible or have a low success rate in eyes with severe conjunctival scarring

secondary to previous ocular surgery and many other high risk conditions such as neovascular, aphakic or uveitic glaucoma. Aqueous drainage devices are recommended in such cases.<sup>1,2</sup> Shunt implantation is very effective in controlling IOP in cases with advanced or refractory glaucoma, but is associated with many

complications.<sup>3,4</sup> Furthermore, the majority of patients require antiglaucoma medications for better IOP control after surgery.<sup>5</sup> Herein we report our experience with single-plate Molteno implants at Farabi Eye Hospital, Tehran, Iran.

## METHODS

This interventional case series includes all cases of single-plate Molteno tube implantation procedures performed in a single-stage fashion from 1995 to 2000. Overall, the medical records of 36 eyes of 35 patients with more than 18 months of follow up were reviewed. Data included age at surgery, sex, diagnosis, number and type of previous surgical procedures, pre- and post-operative IOP and number of antiglaucoma medications, visual acuity, follow up duration, and complications.

Success and failure were defined as follows:

- Complete success: IOP 7-21 mmHg without antiglaucoma medications.
- Incomplete success: IOP 7-21 mmHg with antiglaucoma medications.
- Total success: sum of complete and incomplete success.
- Failure: IOP  $\geq 22$  mmHg despite use of medications, permanent hypotony (IOP  $\leq 6$  mmHg), phthisis bulbi, loss of light perception, or complications necessitating removal of the shunt.

## Surgical Technique

One glaucoma specialist (HA) performed or supervised all operations using the same technique. Traction sutures with 7-0 Vicryl were placed 1.5 mm posterior to the limbus at 6 and 12 clock hour positions followed by a fornix-based conjunctival peritomy in the superotemporal quadrant. Tenon's capsule was completely separated from the sclera at the site of the peritomy. After ensuring that the shunt device is intact, the tube was occluded in front of the plate by means of a 6-0 Vicryl suture. The plate of the device was sutured to the sclera 10 mm from the limbus with 7-0 silk or 8-0 nylon.

A paracentesis was then performed with a 23-gauge needle at the limbus in the space between the cornea and iris, parallel to the iris. The appropriately trimmed tube was inserted through the needle tract bevel side up. The extraocular portion of the tube was sutured to the sclera by one 10-0 nylon mattress suture. The tube was fenestrated in the extraocular portion with the needle of the 7-0 Vicryl suture to ensure aqueous drainage during the time for degradation of the Vicryl suture. A scleral patch graft 4×6 mm in size was used to cover the exposed portion of the tube. The conjunctiva was then sutured using 10-0 nylon. Subconjunctival antibiotic and steroid was administered at the end of the operation and the eye was patched. A topical antibiotic was prescribed for 1 month and a topical steroid was prescribed for 2 months postoperatively.

## RESULTS

This study includes 36 eyes of 35 patients including 20 male (57%) and 15 female (43%) subjects with mean age of  $29.7 \pm 25.3$  (range 3-77) years and mean follow up of  $32 \pm 16.1$  (range 18-72) months. Mean preoperative IOP was  $34.5 \pm 10.4$  mmHg with  $2.3 \pm 0.8$  antiglaucoma medications which was reduced to  $18 \pm 7.6$  mmHg with  $1.9 \pm 1.2$  antiglaucoma medications by the end of the follow up period ( $P < 0.0001$ ).

The glaucoma diagnoses included congenital (14 eyes), aphakic/pseudophakic (11 eyes), traumatic (7 eyes), and primary open angle glaucoma (POAG, 4 eyes). Previous glaucoma surgical procedures were as follows: inferotemporal trabeculotomy and superonasal trabeculotomy-trabeculectomy at least once in the congenital glaucoma group, trabeculectomy at least once in the aphakic/pseudophakic and traumatic groups, and trabeculectomy at least twice in the POAG group.

Overall and subgroup success rates are presented in tables 1 and 2. Complete, incomplete, and total success was achieved in 19.4%, 55.6%, and 75% of eyes by the end of the follow up period, respectively.

**Table 1** Success rates during follow up

Follow up	No. (%)		
	Complete success	Incomplete success	Total success
1 day	6 (16.7)	23 (63.9)	29 (80.6)
6 months	5 (13.9)	21 (58.3)	26 (72.2)
12 months	7 (19.4)	21 (58.3)	28 (77.8)
18 months	7 (19.4)	21 (58.3)	28 (77.8)
Final visit	7 (19.4)	20 (55.6)	27 (75.0)

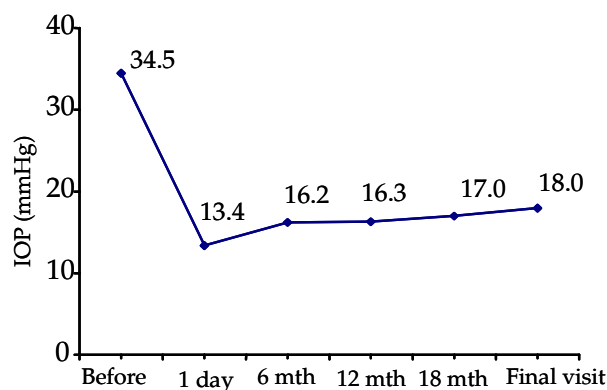
**Table 2** Total success rate by glaucoma diagnosis at different follow up intervals

Follow up	Glaucoma diagnosis: No. (%)			
	Congenital (n=14)	Aphakic/pseudophakic (n=11)	Traumatic (n=7)	POAG (n=4)
1 day	12 (85.7)	9 (81.8)	4 (57.1)	4 (100)
6 months	13 (92.9)	7 (63.6)	4 (57.1)	2 (50)
12 months	10 (71.4)	10 (90.9)	5 (71.4)	3 (75)
18 months	10 (71.4)	10 (90.9)	5 (71.4)	3 (75)

POAG: primary open angle glaucoma

Postoperative IOP gradually increased during time such that mean IOP was 13.4 mmHg without any medication on day 1 which increased to 18 mmHg with use of antiglaucoma medications at final follow up (Fig.1). Postoperative complications were noted in 20 eyes (55.6%) (table 3). Encapsulated bleb, fibrotic tissue surrounding the shunt plate, was the most frequent complication.

Visual acuity improved ( $\geq 1$  Snellen line) in 10 eyes (27.8%) and deteriorated in 8 eyes (22.3%) by the end of the follow up period.



**Figure 1** Mean intraocular pressure (IOP) before and at different follow up periods

**Table 3** Postoperative complications\*

Complication	N (%)
Encapsulated bleb	10 (27.8)
Tube-Iris touch	4 (11.2)
Flat anterior chamber	3 (8.4)
Tube-corneal touch	2 (5.6)
Hypotony (IOP = 0 mmHg)	1 (2.8)
Retinal detachment	1 (2.8)
Tube-lens touch	1 (2.8)
Tub obstruction by iris	1 (2.8)

\*Some eyes developed more than one complication.

## DISCUSSION

Glaucoma drainage devices consist of two portions: tube and plate. The tube is inserted into the anterior chamber and the plate is fixated on the sclera. Some shunt devices are valved such as the Ahmed and Krupin implants and some are not such as the Molteno and Baerveldt implants. In valved devices, the valve mechanism opens at IOP of 10-12 mmHg and closes at IOP of 8 mmHg. This function decreases the probability of early postoperative hypotony.<sup>2,6,7</sup> In non-valved devices, 2 methods are employed to prevent early postoperative hypotony. One

method is the staged procedure in which the tube is inserted 6 weeks after fixation of the plate. The other method is to occlude the tube at the time of implantation with a 7-0 or 6-0 Vicryl suture to prevent the outflow of aqueous fluid for 4-5 weeks during which the suture will be degraded and a fibrotic capsule will be formed surrounding the tube preventing excessive aqueous outflow.

Although success rates of 90-100% have been reported following glaucoma shunt procedures,<sup>8-10</sup> the results of our study were similar to those of most previous studies.<sup>11-15</sup> Variations in implant types, surgical technique, length of follow up, success criteria and underlying disorders in different studies limit comparison. However, 60-80% of eyes with Molteno tube implants had IOP of 22-24 mmHg for at least one year postoperatively.<sup>2</sup>

In the current study, IOP was within the range of 7-21 mmHg with or without medication in 75% of eyes with an average follow up of 32.8 months. Millis et al<sup>14</sup> reported the results of Molteno tube implantation in 77 eyes and reported a total success rate of 57% with mean follow up of 44 months. Broadway et al<sup>15</sup> stated total success rate of 60.5% for Molteno tube implants in 119 eyes after 43 months. Total success rates in various diagnostic subgroups were 83% for aphakic/pseudophakic, 80% for uveitic, 73% for POAG, and 50% for developmental glaucoma. Although success rate was higher in eyes with aphakic/pseudophakic glaucoma, the authors mentioned this condition as a risk factor for failure. Freedman and Rubin<sup>11</sup> reported incomplete success rate of 72% after mean follow up of 30 months in a group of 82 black patients with refractory glaucoma.

Eid et al<sup>16</sup> reported the results of tube-shunt procedures on 18 eyes of 15 patients after a mean follow up of 43.3 months and found that 5 cases (27.8%) lost light perception and 7 cases (38.8%) maintained visual acuity within 1 Snellen line compared to preoperative values. In our series, postoperative visual acuity improved in 27.8%, decreased in 22.3% and remained unchanged in 50%.

Overall, complications encountered in our

study were similar to other reports,<sup>5,15</sup> however certain complications such as choroidal hemorrhage, corneal edema, chronic intraocular inflammation, hyphema, and cataract which have been reported in other studies,<sup>4,7,15</sup> were not observed in our series.

Complications of tube shunt surgery are relatively common<sup>11-15</sup> and there is evidence that adjunctive use of mitomycin C may increase the rate of certain complications such as early postoperative hypotony,<sup>17</sup> tube erosion through the conjunctiva,<sup>18</sup> and tube blockage.<sup>19</sup> Therefore, antiproliferative agents should be considered in eyes thought to be at high risk of tube failure such as traumatic glaucoma, neovascular glaucoma, younger age, and multiple previous surgeries with extensive conjunctival scar.<sup>15,17</sup> Ocular hypotony is one of the reported complications in shunt surgery.<sup>16</sup> We did not use any antimetabolite agent in our series. In one of our cases, IOP reached zero and further intervention was not performed because of poor vision.

In conclusion, the results of our study show that single stage implantation of a single-plate Molteno device is effective and relatively safe for management of intractable glaucoma in eyes at high risk for trabeculectomy failure. Considering the high rate of post-operative complications, regular and long term follow up seems to be essential for timely detection and management.

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