Viscocanalostomy versus Trabeculotomy in Primary Congenital Glaucoma

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Abstract: Objective: Is to compare the effect of viscocanalostomy to that of trabeculotomy in patients with primary congenital glaucoma. **Methods:** This study was done and included 20 patients, 12 males and 8 females. All patients were subdivided into 2 groups and underwent full ocular examination (under general anesthesia) as follows: Intraocular pressure (IOP) measurements using Perkins applanation tonometry; the first group (group A) include 10 patients with bilateral primary congenital glaucoma underwent trabeculotomy operation. The second group (group B) include 10 patients with bilateral primary congenital glaucoma underwent viscocanalostomy operation. Postoperative follow up after 1 and 6 months: (IOP) measurements corneal examination to determine the vertical and horizontal diameters. **Results**: There was highly significant reduction in IOP in group A and group B pre operative and post operative at 1 month and 6 months**.** There was significant reduction in the mean horizontal and vertical corneal diameters after 1 month and 6 months as compared to the mean pre operative values, however this difference was not statistically significant in both groups. As regarding post-operative complications, there were less complications in group B more than group A**. Conclusion:** Canalostomy proved to be as effective as trabeculotomy in lowering IOP. Moreover, it is likely to be a good surgical alternative with a higher long-term success rate in eyes with more aggressive disease.
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1. Introduction

Primary congenital glaucoma (PCG) is defined as primary when an isolated idiopathic developmental anomaly of the anterior chamber angle exists and secondary when aqueous outflow is impaired due to preexisting ocular or systemic disease [1]. In PCG developmental anomalies of the angle and trabecular meshwork lead to a decreased outflow of aqueous, resulting in markedly raised intraocular pressure and associated symptoms and signs [2]. Various surgical approaches have been proposed for surgical treatment of PCG including goniotomy, trabeculectomy with or without adjunctive antimetabolites, trabeculectomy and combined trabeculotomy- trabeculectomy [3]. The success rate of these techniques has been reported to range between 80% and 85%.However, viscocanalostomy on the other hand is a non penetrating glaucoma surgery (NPGS) which is associated with a good success rate with less complication than other surgeries [4]. Viscocanalostomy works by providing the aqueous with direct access to the canal of Schlemm across a thin sheet of scleral lamellae, and by further dilating the canal with viscoelastics [5].

2.Methods:

This study was done and included 20 patients, 12 males and 8 females. All patients were subdivided into 2 groups and underwent full ocular examination (under general anesthesia) as follows: Intraocular pressure (IOP) measurements using Perkins applanation tonometry; corneal examination to determine the vertical and horizontal diameters (with calipers) and the presence of edema, haze and Habb's stria, assessment of anterior chamber (depth, abnormal contents), gonioscopy with direct goniolens; funduscopy to assess the vitreous and the optic disc evaluation with emphasis on the status of neuroretinal rim and cup to disc ratio.

The first group (group A) included 10 patients with bilateral primary congenital glaucoma underwent trabeculotomy operation. The second group (group B) included 10 patients with bilateral primary congenital glaucoma underwent viscocanalostomy operation.

Postoperative follow up after 1 and 6 months: (IOP) measurements using Perkins applanation tonometry; corneal examination to determine the vertical and horizontal diameters (with calipers) and the presence of edema, haze and Habb's stria (under general anesthesia with intravenous Ketamine Hcl (Ketalar).

First group (group A) underwent trabeculotomy operation as follows: The bridle suture is inserted into superior rectus muscle and followed by limbal based conjunctival flap then cauterization is done. Limbal based, 3x3mm scleral flap is done and the flap is

dissected toward limbus till the gray limbal zone appears. Radial incision, 1-2mm is made bridging the transition zone, it should transect Schlemm's canal without entering anterior chamber. One arm of U-shaped trabeculotomy probe is inserted into canal lumen for its entire length (to right side) and then the handle is rotated, so that the distal end is moved toward the centre of anterior chamber resulting in disinsertion of trabecular fibers from their attachment to the scleral spur. A second probe is inserted (to left side) and a trabeculotomy is made in the opposite direction. Scleral flap is sutured with four 10-0 nylon sutures placed at corners and each side of flap near the limbus then conjunctival closure is done.

A second group (group B) underwent viscocanalostomy operation as follows: The bridle suture is inserted into superior rectus muscle then a fornix based conjunctival flap is dissected (note; no cauterization). A superficial partial thickness scleral flap is dissected to approximately one third sclera thickness. A second deeper partial thickness scleral flap is dissected to provide access to Schlemm's canal then high viscosity viscoelastic substance (Healon 5%) is injected into Schlemm's canal with a special cannula (viscocanalostomy cannula). A Descemet's window is created by gentle pressure at the site of Schlemm's canal by cellulose sponge followed by removal of deep scleral flap. The superficial scleral flap is tightly sutured to minimize subconjunctival fluid flow and bleb formation (by five 10-0 nylon sutures with the fifth suture placed at 12 o'clock).Viscoelastic substance is injected into the area of the sclerotomy then conjunctival closure is done.

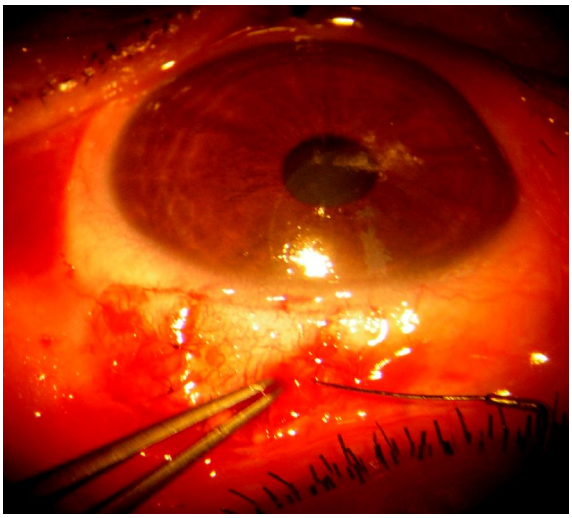

Figure 1: injection of the viscoelastic by viscocanalostomy cannula under the scleral flap

Statistical presentation and analysis of the present study was conducted, using the mean, standard deviation (SD) and Standard student "t test", test of significance of the difference between two means.

3. Results:

This study was enrolled on 20 patients, 12 males and 8 females and all patients subdivided into 2 groups. The first group (group A) include 10 patients with bilateral primary congenital glaucoma (20 eyes) underwent trabeculotomy operation. The second group (group B) include 10 patients with bilateral primary congenital glaucoma (20 eyes) underwent canalostomy operation. There was highly significant reduction in IOP in group (A) and group (B) pre operative and post operative at 1 month and 6 months *P* value (=0.001) and (=0.001) respectively (Table. 1). There was no significant difference in post operative IOP after 1 month and 6 months between group (A) and group (B) *P* value (=0.733) and (=0.635) respectively. (However, the mean post operative IOP after 1 month and 6 months was lower in group B) (Table 1).

There was significant reduction in the mean horizontal corneal diameter after 1 month and 6 months as compared to the mean pre operative horizontal corneal diameter, however this difference was not statistically significant in both groups (Table 2).There was no significant difference in post-operative horizontal corneal diameter after 1 month and 6 months between group (A) and group (B) *P* value (=0.671) and (=0.511) respectively. (However, the mean post operative horizontal corneal diameter after 1 month was lower in group B and after 6 months was lower in group A) (Table. 2). There was significant reduction in the mean vertical corneal diameter after 1 month and 6 months as compared to the mean pre operative vertical corneal diameter), however this difference was not statistically significant in both groups (Table. 3). There was no significant difference in post operative vertical corneal diameter after 1 month and 6 months between group (A) and group (B) *P* value (=0.089) and (=0.098) respectively. (However, the mean post operative vertical corneal diameter after 1 month and 3 months was lower in group B) (Table 3).

As regarding post-operative complications, there were less complications in group b more than group A in group (A): 4 eyes (2 eyes were complicated by hyphema, 1 by hypotony and 1 by iritis) while in group (B): 3 (1 eye was complicated by hyphema, 1 by hypotony and 1 by descemet's membrane detachment). *P* value was 0.633 and there was no significant difference between group (A) and group (B) (Table. 4).

Table (1): Reduction difference in mean and SD of IOP (mmHg) pre operative and post operative 1 and 6 months in group (A) and group (B):

Group		Pre op.IOP per mmHg	Post.op. IOP After 1 month	Post.Op. IOP After 6 months	t.test	p.value
A	Mean±SD	30.40±5.36	16.20 ±2.83	14.70 ± 2.10	4.326	0.001
B	Mean±SD	29.90 ± 4.72	15.85 ±3.55	14.35 ± 2.49	2.336	0.001
			p. value = 0.733	*p*. value = 0.635		

Pre op. IOP per mmHg= Pre operative intraocular pressure, Post.op. IOP after 1 m = postoperative IOP after 1month, Post. Op. IOP After 3 m = postoperative IOP after 3 months

Table (2): Reduction difference in horizontal corneal diameter (in mm) pre operative and post operative 1 and 6 months in group (A) and group (B):

Group		Pre op. h. corneal d. per mm.	Post.op. h.corneal d After1 m. per mm.	Post. Op. h. corneal d After 6 m. per mm.	t. test	*p*. value
A	Mean±SD	13.12±1.47	12 ±0.53	11.27 ± 0.37	0.526	0.324
B	Mean±SD	12.97 ±0.61	11.92 ±0.56	11.36 ± 0.49	0.635	0.229
			p. value = 0.671	*p*. value = 0.511		

Pre op. h. corneal d.= Pre operative horizontal corneal diameter, Post. op. h. corneal d after 1 m Postoperative horizontal corneal diameter after 1 month, Post. op. h corneal d After 3 m. = Postoperative horizontal corneal diameter after 3 months.

Table (3): Reduction difference in vertical corneal diameter (in mm) pre operative and post operative 1 and 6 months in group (A) and group (B):

Group		Pre op. v. corneal d. per mm.	Post. op. v. corneal d. After1 m per mm.	Post. Op. v.corneal d. After 3 m. per mm.	t. test	*p*.value
A	Mean±SD	12.05±1.02	11.80 ±0.41	11.40 ± 0.66	0.526	0.336
B	Mean±SD	12.32 ±0.49	11.44 ±0.52	11.07 ± 0.50	1.224	0.419
			p.value = 0.089	*p*.value = 0.098		

Table (4): Post operative complications in group (A) and group (B):

	Group(A)	Group (B)
Hyphema	2(10%)	1(5%)
Hypotony	1(5%)	1(5%)
Iritis	1(5%)	-
Descemet's membrane detachment	-	1(5%)
Total	4(20%)	3(15%)
X^2	1.268	
P. value	0.663	

4. Discussion:

In this study, there were no significant difference in IOP, vertical and horizontal corneal diameters between group (A) and group (B) after 1 and 3 months and this indicates that both operations are seem to be equally effective in treatment of primary congenital glaucoma.

Noureddin *et al.* (2006) suggested that eight patients with bilateral primary congenital glaucoma were enrolled in the study. After establishing the diagnosis, the more severely affected eye was randomly selected to undergo either trabeculotomy or viscocanalostomy, whereas the second eye underwent the other surgery 2 weeks after the first. The patients were examined on day 1, week 1, week 4 and thereafter every 4 weeks. Intraocular pressure (IOP) and corneal diameter measurements were obtained at week 1, month 6 and at the last reported follow-up. The paired-sample's Student's t test was applied for statistical analysis. The mean (standard deviation (SD) follow-up period was 12.5 (1.86) months. Preoperative OT of eyes undergoing trabeculotomy (34.0 (2.6) mm Hg) and that of eyes undergoing viscocanalostomy (32.3 (4.1) mm Hg) showed no

significant difference (P=0.1). A drop in IOP was noted in both groups at week 1, month 6 and at the last follow-up visit (P=0.001). Similarly, a decrease in the post operative vertical and horizontal corneal diameters was noted in the two study groups. In addition, viscocanalostomy proved to be as effective as trabeculotomy in lowering IOP. Moreover, it is likely to be a good surgical alternative with a higher long-term success rate in eyes with more aggressive disease 4.

Also Yong *et al.,* 2012 reported that viscocanalostomy provides high success rate, lower post operative mean IOP and fewer complications in the study enrolled on 51 eyes of 42 patients [5]. In addition, Tamcelik and Ozkiris (2008) suggested that viscocanalostomy is safer and more effective than classical trabeculotomy[6]. Chai *et al.*, 2010 Trabeculotomy was found to have a greater pressure-lowering effect compared with viscocanalostomy. However, viscocanalostomy had a significantly better risk profile[7]. Also results obtained by Mendicino *et al.* (2000) compared the long-term surgical results of trabeculotomy and viscocanalostomy and reported significantly better intraocular pressure control with the former technique as they believed that it is more standardized than the latter technique. [8] Other researchers as Shaffer and Hoskins, (2001) reported that the two procedures were equally effective [9].

Viscocanalostomy works in congenital glaucoma because it bypasses the positional changes of the anterior iris insertion and the scleral spur that were documented by ultrasound biomicroscopy. With this surgery, the aqueous egresses through the scleral window into the canal of Schlemm that is always reported to be normal in these eyes, except when they are untreated for a long time 10. A second mechanism of action of viscocanalostomy is the increase in the uveoscleral flow due to the tight scleral flap sutures, forcing the percolating aqueous through the remaining sclera [11].

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