Trabeculotomy Versus Combined Trabeculotomy And Deep Sclerectomy In The Management Of Primary Congenital Glaucoma (Comparative study)

A thesis

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List of Abbreviations

AC: Anterior chamber.

CAI: Carbonic anhydrase inhibitors.

CCT: Central corneal thickness.

DS/SST: Combined deep-sclerectomy/Subscleral trabeculectomy.

EUA: Examination under anaesthesia.

5-FU: 5-Fluorouracil.

IOP: Intraocular pressure.

MMC: Mitomycin-C.

NPGS: Non-penetrating glaucoma surgery.

PCG: Primary congenital glaucoma.

SC: Schlemm’s canal.

SD: Standard deviation.

SPSS: Statistical Package for the Social Science.

SST: Subscleral trabeculectomy.

TDM: Trabeculodescement membrane

UBM: Ultrasound bio-microscopy.

VA: Visual Acuity.
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Introduction

Congenital glaucoma is a disorder present at or near birth. It is due to a malformation of the aqueous drainage system. It is referred to as infantile when it is present within the first 3 years and juvenile if it occurs after 3 years of age. Primary congenital glaucoma (PCG) is a specific term referring to eyes that have an isolated maldevelopment in the angle without other developmental ocular anomalies or diseases that can raise the intraocular pressure (IOP). The disease affects males more often (56%) than females, and 6% of cases are bilateral (Biglan, 6002).

In congenital glaucoma, the maldevelopment of the anterior segment may involve the trabecular meshwork alone or in combination with the iris, cornea or both. The most common angle anomaly is trabeculodysgenesis with flat or concave iris insertion. Preoperative examination under anesthesia is necessary in congenital glaucoma. It is essential for measuring horizontal corneal diameter, measuring intraocular pressure using Perkin’s applanation device and assessing optic disc cupping (Mandal et al., 4002).
In the presence of corneal opacity, the gonioscopy is unfeasible and the value of ultrasound biomicroscopy (UBM) arises. UBM is an imaging technique that uses high-frequency sound waves to produce high resolution, 2-dimensional cross-sectional images of the anterior segment to a depth of penetration approximately 5 mm. It helps in assessment of the angle anomaly and anterior segment to exclude associated anomalies. It also can be done postoperatively to evaluate effectiveness of surgery (Pavlin et al., 1999).

Management of congenital glaucoma is mainly surgical. Medical therapy may be used as temporary measure, but surgical intervention is usually necessary. The objective of surgery is to normalize IOP together with prevention of progression of optic disc cupping and corneal enlargement. The classic surgery for congenital glaucoma is goniotomy provided that the cornea is clear and corneal diameter is $\leq 17$ mm. If the cornea is opaque preventing visualization of the angle details, alternatives are trabeculotomy, subsceral trabeculectomy, non-penetrating surgery or combined procedures (Al-Hazmi et al., 2002).

External Trabeculotomy or Trabeculotomy ab externo is a surgical procedure involves cannulation of Schlemm’s canal with subsequent centripetal rupture through the trabecular meshwork into the anterior chamber. It is indicated when the angle structures cannot be visualized through a cloudy cornea. Some surgeon’s prefer trabeculotomy as the initial surgical procedure in children (Beck, 2001).
Subscleral trabeculectomy is not the first procedure in congenital glaucoma due to the higher incidence of complications and the lower success rate due to the thick tenon capsule as well as the rapid wound healing. Therefore, it is usually combined with anti-fibroproliferative agents such as 5-flurouracil (5-FU) and mitomycin-C (MMC) which may improve the surgical prognosis (Azuara-Blanco et al., 1999).

Non-penetrating deep sclerectomy is a new surgical procedure in which an internal scleral block is removed under an outer scleral flap, Schlemm’s canal is unroofed and trabeculo-descement’s membrane is exposed under the outer flap. Trabeculotome – guided deep sclerectomy is a new technique that helps in identification and unroofing of Schlemm’s canal (Abdelrahman, 2002).

Deep sclerectomy is as effective as trabeculectomy in the treatment of congenital glaucoma with fewer complications due to absence of anterior chamber penetration. Complications include macroperforation of the trabecular meshwork with the need to convert to trabeculectomy, scleral ectasia and iris incarceration but with a lower risk of hypotony and bleb related complications (Mendrinos et al., 2002).

The problems of goniotomy in children with hazy cornea and the progressive nature of the disease made some surgeons prefer to start with combined surgical procedures as a primary intervention for the management of primary congenital glaucoma such as combined trabeculotomy ab-externo and trabeculectomy (Khaw, 2001).
Aim of the work

Aim of this thesis is to compare the effectiveness of combined trabeculotomy and deep sclerectomy versus trabeculotomy alone in the management of primary congenital glaucoma.
Embryology of the cornea and anterior segment

The lens vesicle separates from the surface ectoderm by the sixth week of gestation. The optic cup, which arises from neural ectoderm, has reached the periphery of the lens at this time, and a triangular mass of undifferentiated neural crest cells overrides the rim of the cup and surrounds the anterior periphery of the lens. Three waves of tissue move forward between the surface ectoderm and the lens. The first of these layers differentiates into the primordial corneal endothelium by the eighth week and subsequently produces Descemet’s membrane. The second wave of tissue produces the stroma of the cornea and the third wave gives rise to the pupillary membrane and the iris stroma. The pigment epithelial layer of the iris develops in later months from neural ectoderm (Bron et al., 1997).

By the beginning of the fifth fetal month, a complete endothelial lining overlies the primitive anterior chamber creating a closed cavity. In addition, the iris insertion is now anterior to the neural crest tissue destined to become the trabecular meshwork. The endothelial lining undergoes fenestration in the final weeks of gestation and the first weeks after birth. The iris insertion also repositions posteriorly to gradually uncover the developing trabecular meshwork. At birth, the iris insertion has normally reached the level of the sclera spur. Posterior migration of the iris normally continues for about the first year of life (Bron et al., 1997).
**Anatomical structures of the anterior chamber angle**

The angle of the anterior chamber is the recess formed by the irido-corneal junction. Figure (1) shows structures of the normal angle which include:

A. Schwalb’s line.
B. Trabecular meshwork.
C. Scleral spur.
D. The iris processes.
E. Schlemm’s canal.
F. Collector channels. (Snell and Lemp, 1991):

A- Schwalb’s line:

Schwalb’s line (or ring) is an irregular elevation that runs circumferentially around the globe. It marks the termination of Descemet’s membrane and the transition from trabecular to corneal endothelium.

B- Trabecular meshwork:

The trabecular meshwork is a sponge-like connective tissue perforated sheets. In meridional section, the trabecular meshwork has a triangular shape with its apex at Schwalb’s line and its base at the scleral spur. It can be divided into two parts: anterior (non-filtering) and posterior (filtering). The anterior part lies just posterior to Schwalb’s line, it has no contact with Schlemm’s canal and therefore has no filtering function. The posterior filtering part covers the inner wall of Schlemm’s canal.
C-Scleral spur:

The scleral spur is a wedge shaped circular ridge that marks the deep aspect of the sclero-limbal junction. It receives the insertion of the anterior tendons of longitudinal ciliary muscle. Its anteromedial base forms the posterior attachment of the trabecular meshwork.

D-The iris processes:

These are broad-based flat triangular bands, which taper anteriorly and bridge the angle recess from the iris root to the trabecular meshwork with which they merge.

E-Schlemm’s canal (SC):

The canal of Schlemm is a narrow circular tube about 63 mms in circumference, which is lined by endothelium. It lies in the outer portion of the internal scleral sulcus. It conducts aqueous humor from trabecular region to the episcleral venous plexus via the collector channels.

F-Collector channels:

Schlemm’s canal is drained by a series of collector channels that in turn drain into a complex system of the episcleral venous plexuses and then towards the anterior ciliary veins.