Surgical Outcomes of Trabeculotomy Combined with Sinusotomy for Juvenile Glaucoma

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Purpose: To evaluate the outcome of trabeculotomy combined with sinusotomy for juvenile glaucoma.

Methods: We studied 16 patients (25 eyes) (age range, 11–50 years) with juvenile glaucoma for a minimum follow-up period of 1 year. We performed combined trabeculotomy and sinusotomy surgery in 13 juvenile glaucoma patients (18 eyes), and trabeculotomy alone in 6 patients (7 eyes).

Results: The intraocular pressure (IOP) of the combined surgery group was 29.8 ± 7.8 mm Hg before surgery and 15.6 ± 3.0 mm Hg 1 year after surgery. The IOP of the trabeculotomy-alone group was 29.1 ± 6.4 mm Hg before surgery and 15.4 ± 2.4 mm Hg 1 year after surgery. A postoperative IOP spike that was higher than the preoperative IOP was recorded in 2 eyes of the combined surgery group and in 2 eyes of the trabeculotomy group. The combined surgery group consisted of 7 eyes with a previously failed glaucoma surgery, and 11 eyes having a first glaucoma surgery. The postoperative IOP in these 11 eyes was 15.5 ± 2.8 mm Hg.

Conclusion: Trabeculotomy is very effective in lowering the IOP in patients with juvenile glaucoma. Sinusotomy does not play an important role in tension control.

Key Words: Glaucoma, goniodysgenesis, sinusotomy, trabeculotomy.

Introduction

Trabeculotomy is considered to be the procedure of choice for the treatment of congenital and developmental (late-onset goniodysgenesis) glaucoma, as trabeculectomy has more complications and a lower success rate in younger patients. Sinusotomy, with several technical modifications, is a surgical procedure to externalize Schlemm’s canal. Lately, sinusotomy alone is not used as a standard technique for glaucoma surgery. Combined trabeculotomy and sinusotomy surgery has been reported to be effective in Japanese patients with primary open-angle glaucoma and exfoliation glaucoma as the first-choice procedure. However, some technical modifications of sinusotomy for the externalization of Schlemm’s canal have been reported. In these reports, combined trabeculotomy and sinusotomy prevented the intraocular pressure (IOP) elevation within 2 weeks after surgery, which is sometimes observed after trabeculotomy alone. In addition, the IOP level is maintained at about 16 mm Hg for a long follow-up period with this procedure, while the IOP is usually in the high teens with successful trabeculotomy alone.

The surgical results of combined trabeculotomy and sinusotomy have not been reported for juvenile glaucoma; therefore, we performed trabeculotomy combined with sinusotomy in patients with juvenile glaucoma and compared the outcome with trabeculotomy alone for control of the IOP during the early postoperative period.

Materials and Methods

The surgical results of trabeculotomy with or without sinusotomy were prospectively studied in 16 juvenile glaucoma patients (25 eyes). We performed trabeculotomy and sinusotomy (combined surgery)
on 13 patients (18 eyes), and trabeculotomy alone on 6 patients (7 eyes). The patients in the combined surgery group were 27.1 ± 12.5 years of age (range, 12–50 years), and those in the trabeculotomy alone group were 17.5 ± 6.8 years of age (range, 11–29 years).

The diagnosis of glaucoma was based on an elevated IOP, glaucomatous optic nerve changes, glaucomatous visual field loss, and gonioscopic findings. Gonioscopic examination revealed typical goniodysgenesis in all patients. The minimum follow-up period was 1 year, and the mean follow-up period was 20.8 ± 7.1 months for the combined surgery group and 29.1 ± 11.7 months for the trabeculotomy group.

Seven eyes from the combined surgery group had previous glaucoma surgery, while none of the eyes from the trabeculotomy group had previous glaucoma surgery. To evaluate the need for medical antiglaucoma treatment, we assigned one point for each antiglaucoma medication, and two points for oral acetazolamide. A prostaglandin analogue (isopropyl unoprostone or latanoprost) was selected to be the first choice of antiglaucoma medications, and a β-blocker was selected to be the second choice, in most cases.

**Surgical Procedures**

A limbal-based conjunctival incision was made and a 4 × 4 mm scleral flap of four-fifths thickness was created at the limbus. After identifying Schlemm’s canal, the external wall of Schlemm’s canal was opened along the full width of the scleral flap. U-shaped probes were inserted into both sides of the flap and were rotated 90° into the anterior chamber, cutting through the trabecular meshwork. After the rotation of the probe was completed, the scleral flap was punched out with a microtrephine (diameter: 0.5 mm or 1.0 mm) over the site of Schlemm’s canal to externalize Schlemm’s canal (sinusotomy).

The scleral flap was closed with five 10-0 nylon sutures. The conjunctival flap was then closed, and topical antibiotics were applied.

**Results**

The mean (±SD) IOP of the combined surgery group was 29.8 ± 7.8 mm Hg before surgery and 15.6 ± 3.0 mm Hg 1 year after surgery; that of the trabeculotomy alone group was 29.1 ± 6.4 mm Hg before surgery and 15.4 ± 2.4 mm Hg 1 year after surgery. The mean (±SD) medication score of the combined surgery group was 3.4 ± 1.4 before surgery and 1.4 ± 0.9 after surgery. The mean medication score of the trabeculotomy group was 3.6 ± 1.5 before surgery, and 0.4 ± 0.5 after surgery. A postoperative IOP spike that was higher than the preoperative IOP was recorded in 2 eyes of the combined surgery group and in 2 eyes of the trabeculotomy group. The IOP was higher than 30 mm Hg for a short period postoperatively in 3 eyes of the combined surgery group and in 2 eyes of the trabeculotomy group (see Table 1).

The IOP of the first operation group (11 eyes) who had combined surgery was 15.5 ± 2.8 mm Hg after surgery. The IOP of the trabeculotomy group (7 eyes) was 15.4 ± 2.4 mm Hg after surgery. The mean medication score for the first surgery group was 0.9 ± 0.8 (see Table 2).

**Discussion**

Juvenile glaucoma is a disease with goniodysgenesis that is due to a fetal maldevelopment of the iridocorneal angle. Thick subcanalicular connective tissue including basement membrane-like material was reported to be the etiology of the glaucoma in juvenile glaucoma. Trabeculotomy reduces the outflow resistance in the trabecular meshwork following the rotation of the probe into the anterior chamber. This procedure is regarded as a suitable choice of treatment for juvenile glaucoma.

We performed trabeculotomy with a scleral flap trephination for the externalization of Schlemm’s canal in juvenile glaucomatous eyes, and compared its results with trabeculotomy alone. The mean IOP of 18 eyes with a mean follow-up period of 20.8 months after the combined surgery was 15.6 ± 3.0 mm Hg, and medications of all eyes were one or two types of eyedrops. On the other hand, the mean IOP of 7 eyes after trabeculotomy alone with a mean follow-up of 29.1 months was 15.4 ± 2.4 mm Hg with administration of one or two types of eyedrops. There

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**Table 1. Surgical Outcomes of Combined Surgery for Juvenile Glaucoma**

<table>
<thead>
<tr>
<th>Group*</th>
<th>Eyes</th>
<th>Age</th>
<th>Preop (mm Hg)</th>
<th>Postop (mm Hg)</th>
<th>Preop Medication Score</th>
<th>Postop Medication Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>18</td>
<td>27.1 ± 12.5</td>
<td>29.8 ± 7.8</td>
<td>15.6 ± 3.0</td>
<td>3.4 ± 1.4</td>
<td>1.4 ± 0.9</td>
</tr>
<tr>
<td>B</td>
<td>11</td>
<td>28.3 ± 13.2</td>
<td>27.9 ± 8.8</td>
<td>15.5 ± 2.8</td>
<td>2.8 ± 1.4</td>
<td>0.9 ± 0.8</td>
</tr>
<tr>
<td>C</td>
<td>7</td>
<td>17.5 ± 6.8</td>
<td>29.1 ± 6.4</td>
<td>15.4 ± 2.4</td>
<td>3.6 ± 1.5</td>
<td>0.4 ± 0.5</td>
</tr>
</tbody>
</table>

*Group A: trabeculotomy + sinusotomy, Group B: trabeculotomy + sinusotomy as first operative procedure, Group C: trabeculotomy only.
was no significant difference in the postoperative IOP between the two groups.

Sinusotomy may not have an additive effect in lowering the postoperative IOP of juvenile glaucoma for a long period, considering that low postoperative IOP can be achieved with trabeculotomy alone in juvenile glaucoma. However, this statement should be restricted to juvenile glaucoma, as some authors have shown that sinusotomy induced lower IOP in more eyes with primary open-angle glaucoma than did trabeculotomy alone.6–12

Some technical modifications of sinusotomy for the externalization of Schlemm’s canal have been reported. In the previous reports, no significant differences were detected in the IOP control of primary open-angle glaucoma between the microtrephination technique and the other methods.7,8

There are some limitations to this study, even though this is a prospective case series. The two groups were not truly comparable for a number of reasons: (1) the mean ages of the two groups were different (27.1 vs 17.5 years); and (2) 7/18 patients in the combined surgery group had had prior ocular surgery, whereas none of 7 in the trabeculotomy alone group had prior surgery. However, a comparison of the first-operation eyes in the combined surgery group had prior surgery. However, a comparison of the first-operation eyes in the combined surgery group. In the previous reports, no significant differences were detected in the IOP control of primary open-angle glaucoma between the microtrephination technique and the other methods.7,8

In the present study, 3/18 eyes showed IOP higher than 30 mm Hg for a short period after combined surgery. To some extent, the combined surgery suppressed the elevated IOP within 2 weeks, but not in all cases.

We have reported the surgical results in the 7 eyes with failed previous glaucoma surgery. Six of these 7 eyes were operated on through the inferior limbus. When prior intraocular surgery has been performed at the superior limbus, subsequent trabeculectomy may not be possible because of extensive fibrosis and adhesions or increased vascularity. The filtration options in these situations include trabeculectomy below the horizontal meridian in a region of unoperated conjunctiva. Trabeculectomy at the inferior limbus has been reported to offer an opportunity for surgical success but can have a high risk of failure as well because of the increased risk of complications, including early wound leak, choroidal effusion, late bleb leak, and bleb-related endophthalmitis.17 In the 6 eyes of the present series, we observed only hyphema in the early postoperative days, but have not yet observed early wound leak, choroidal effusion, flat anterior chamber or late bleb leak. The blebs were flat and vascularized. Therefore, there was little opportunity for such blebs to develop late bleb leak and related complications. However, longer follow-up periods are needed to prove the advantages of this combined surgery. Late onset bleb leaks and related infection are current concerns as postoperative complications after filtering surgery with antimetabolites.18,19 We believe that trabeculectomy with intraoperative Mitomycin C should be avoided as much as possible in younger patients, such as those with juvenile glaucoma.

We conclude that trabeculotomy is very effective in treating juvenile glaucoma. Sinusotomy does not play an important role in tension control; however, it does suppress postoperative tension spike.

### Table 2. Intraocular Pressure Measurement After Surgery

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Group A (mm Hg)</th>
<th>Group B (mm Hg)</th>
<th>Group C (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Range</td>
<td>n</td>
</tr>
<tr>
<td>1 day</td>
<td>16.0 ± 6.4</td>
<td>7–30</td>
<td>18</td>
</tr>
<tr>
<td>3 days</td>
<td>14.9 ± 7.1</td>
<td>6–32</td>
<td>18</td>
</tr>
<tr>
<td>7 days</td>
<td>19.1 ± 8.0</td>
<td>8–34</td>
<td>18</td>
</tr>
<tr>
<td>2 weeks</td>
<td>17.7 ± 4.5</td>
<td>10–28</td>
<td>17</td>
</tr>
<tr>
<td>1 month</td>
<td>16.4 ± 4.4</td>
<td>9–23</td>
<td>16</td>
</tr>
<tr>
<td>3 months</td>
<td>15.3 ± 3.6</td>
<td>10–23</td>
<td>16</td>
</tr>
<tr>
<td>6 months</td>
<td>16.2 ± 4.5</td>
<td>11–28</td>
<td>13</td>
</tr>
<tr>
<td>1 year</td>
<td>15.6 ± 3.0</td>
<td>11–21</td>
<td>18</td>
</tr>
</tbody>
</table>

*Group A: trabeculotomy + sinusotomy, Group B: trabeculotomy + sinusotomy as first postoperative procedure, Group C: trabeculotomy only, n: number of operated eyes.*
References