

# Manual small incision cataract surgery with ‘in the tunnel’ trabeculectomy in patients having primary open angle glaucoma and cataract

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## INTRODUCTION

Cataract surgery techniques have improved a lot over the years from couching to the latest micro-incision cataract surgery. Manual small-incision cataract surgery (MSICS) with trabeculectomy is now an acceptable option in the surgical management of combined cataract and glaucoma uncontrolled with maximum tolerated medical therapy. Early visual rehabilitation, better unaided visual acuity and surgical safety can be achieved in a great measure by reducing the incision size. The advantages associated with the smaller incision have made phacoemulsification the ideal technique for cataract surgery and the preferred one where the resources are available. However, this technique cannot be employed as the standard procedure in developing countries due to certain reasons. MSICS offers similar advantages with the merits of wider applicability, better safety, a shorter learning curve and lower cost. In SICS, however, the surgical skill and experience of the surgeon play a significant role in the results. Another advantage of manual SICS over other methods of cataract surgery is the shorter duration taken, making it particularly applicable to high volume cataract surgery. In the modified technique the Scleral flap was lifted and trabeculectomy was completed within the tunnel<sup>[1]</sup>.

In patients who have undergone glaucoma surgery, subsequent cataract surgery may induce inflammation that causes the glaucoma surgery to lose its effectiveness or even fail. One surgery may succeed in both clearing up central vision loss from cataract and in controlling peripheral vision loss from glaucoma by lowering the eye pressure. The problem of possibly worsening cataract following glaucoma surgery alone is eliminated. Intraocular pressure (IOP) control is usually better after a combined procedure than after cataract surgery

## Abstract

• **AIM:** Cataract surgery techniques have improved a lot over the years. The present study was designed to propose a novel and surgically easy technique of ‘in the tunnel’ trabeculectomy with lesser incidence of complications in the management of cataract with primary open angle glaucoma (POAG).

• **METHODS:** One hundred and three patients were included in a prospective, nonrandomized clinical study. 108 eyes of 103 patients with POAG and cataract were performed manual small incision cataract surgery (MSICS) combined with ‘in the tunnel’ trabeculectomy. The outcome of the surgery was evaluated in terms of the anatomical appearance of the bleb and its functional result over a period of 6 months.

• **RESULTS:** The mean intraocular pressure (IOP) on the first postoperative day was  $11.4 \pm 3.1$  mmHg in the tunnel incision group ( $P = 0.012$ ). On the second postoperative day the mean IOP was  $10.3 \pm 3.5$  mmHg ( $P = 0.065$ ). Shallow anterior chamber and iridocorneal touch occurred significantly less in the tunnel incision group.

• **CONCLUSION:** “Scleral tunnel incision” - trabeculectomy (STIT) appears to be steady lowering IOP during the first 6 months postoperatively. It is also relatively safe and has fewer early complications related to excessive aqueous outflow than conventional trabeculectomy (CT).

• **KEYWORDS:** ‘in the tunnel’ trabeculectomy; primary open angle glaucoma; conventional trabeculectomy; cataract

alone. In fact patients can often reduce or even eliminate the need for glaucoma medications after combined surgery just as after standard glaucoma surgery. A combined procedure can be especially beneficial for patients with glaucoma uncontrolled on medications who have a significant cataract. Also, for those with glaucoma well controlled on medications, it may offer the chance to reduce the need for medications or prevent anticipated pressure problems after the surgery. Trabeculectomy for glaucoma has recently been found to achieve target IOP and to prevent progression of visual loss in 80% to 90% of those undergoing surgery<sup>[2]</sup>.

Combined surgery provides early visual rehabilitation of the patient with cataract and glaucoma, reduces the risk of early severe postoperative pressure elevation, and may provide long-term reduction of IOP and decrease the need for glaucoma medication. Hence, the present work has been undertaken to investigate the advantages of the novel technique- MSICS with 'in the tunnel' trabeculectomy in patients having POAG and cataract.

## MATERIALS AND METHODS

**Materials** In the present retrospective, nonrandomized clinical study, 103 patients underwent "scleral tunnel incision" - trabeculectomy (STIT). Among 103 eyes, in which 5 bilateral and 98 new as well as old POAG & NTG cases with cataract attending K. S. Hegde Medical Academy Ophthalmology outpatient department from 2005 to 2010 were included. Patients with secondary glaucomas, angle closure glaucoma and previous ocular operations in the same eye, failed follow-up, dislocated and intumescent cataract and cases of uveitis were excluded from the study. The protocol was approved by the institutional ethical committee and a detailed informed and written consent was obtained from all the participants. Diagnosis of glaucoma confirmed using routine methods of slit-lamp examination, fundus evaluation, applanation tonometry, gonioscopy, visual field evaluation using 30-2 programme in automated perimeters whenever possible and provocative tests were done, when in doubt. All cases were examined and operated by a single surgeon.

## Methods

**Surgical procedure** (1) Scleral tunnel was performed by giving peribulbar block with suitable anaesthetic agent. Fornix based conjunctival flap was done. Haemostasis was achieved with bipolar cautery. A 7 mm horizontal straight scleral tunnel incision, 3mm away from 12 o'clock limbus was done; (2) Deep sclerectomy within the tunnel was done by making a small horizontal deep scleral incision within the tunnel after lifting the superficial flap. This incision was 4 mm in length and situated about 1mm inside the outer scleral incision; (3) In the tunnel trabeculectomy, the patient was done with extracapsular cataract surgery with IOL implantation. Trabeculectomy (4mm×2mm) was done with Vanna's bent

scissors after lifting the scleral flap. This was followed by iridectomy; (4) Closure of in the tunnel trabeculectomy was done by reforming the anterior chamber with balanced salt solution. Conjunctiva was closed at limbus with 10% Ethilon. Inferior sub-conjunctival injection of gentamicin and dexamethasone was given; (5) Slit-lamp biomicroscopic examination was done at 1 day, 1 week, 1 month and 6 months. The state of the bleb was studied for size, position, contour, vascularisation, leak and height of bleb.

**Postoperative management** Postoperative treatment included a combination of steroid and antibiotic topically for 6 months. Anti-glaucoma medication was also given only if IOP was >25mmHg.

**Statistical Analysis** The data obtained were analyzed for statistical significance using one way ANOVA. *P* value less than 0.05 was considered the level of significance.

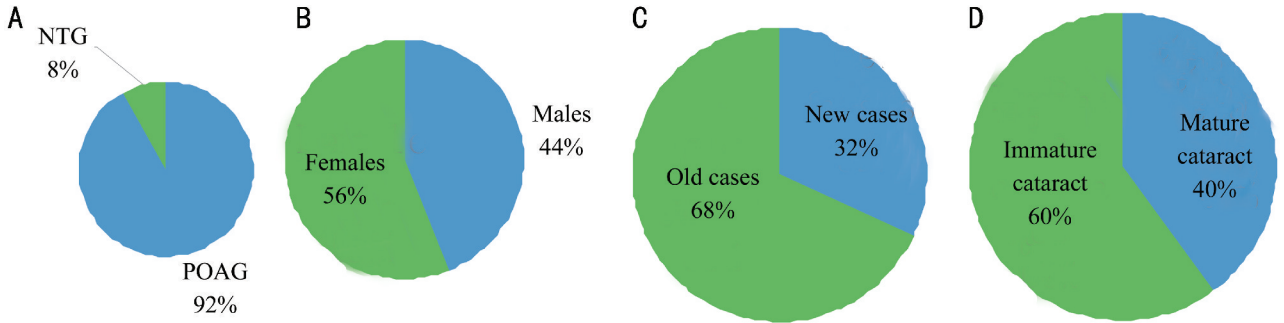
## RESULTS

In the present study included 8 cases of normal tension glaucoma (NTG), 95 cases of POAG, 45 males, 58 females in which 33 new cases glaucoma, 70 old cases of immature cataract patients (Figure 1).

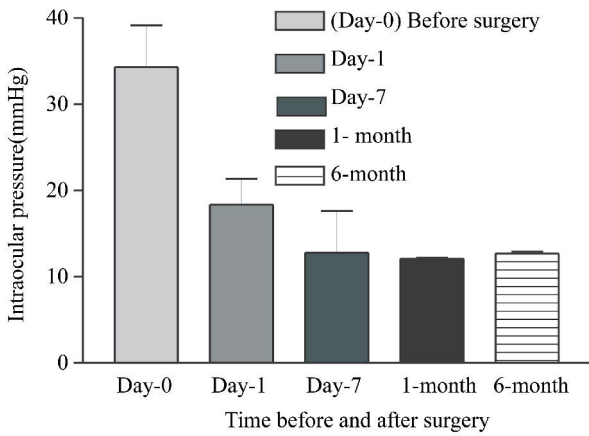
The surgical outcome was assessed in terms of IOP, visual acuity, and the incidence of complications. IOP was measured on day 1, at the end of 1 week, 1 month and 6 months postoperatively and as clinically indicated, using Goldmann applanation tonometry (Figure 2). The postoperative evaluation showed all blebs were flat, diffuse and located posteriorly. There was no incidence of bleb leak. The highest reduction in IOP was 22mmHg (Figure 3). The postoperative IOP was significantly less ( $P=0.001$ ) as compared to that of preoperative IOP in both the groups. The mean IOP on the first postoperative day was significantly higher ( $P=0.001$ ) in the STIT group than in the CT group and the difference almost reached the level of significance on the second day too (Figure 1, 2). This finding indicated that the flap in the scleral tunnel incision was tighter than that in the conventional technique, scleral tunnel incision trabeculectomy with one releasable suture<sup>[3]</sup>. A diagrammatic picture showed aqueous drainage through the trabeculectomy wound, scleral opening into the subconjunctival space has shown in Figure 4. Figure 5-10 demonstrated the main surgery procedure and the effectiveness of the MSICS with 'in the tunnel' trabeculectomy in patients having POAG and cataract along with a functional diffuse bleb seen after 6 months of postoperative period.

## DISCUSSION

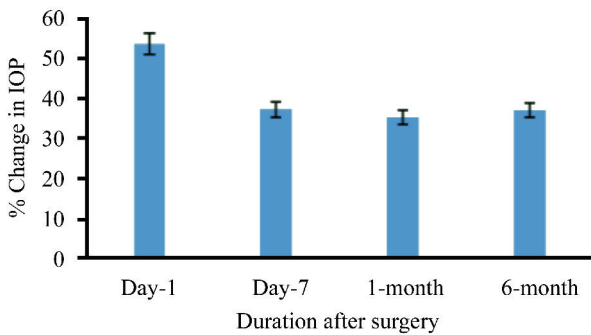
The previously published studies have reported that pressures rises up to 36% of patients with combined procedures<sup>[4,5]</sup> compared with the reported incidence of up to 72% in patients with glaucoma undergoing cataract surgery alone. In the present study 6% of the eyes had early postoperative IOPs higher than 24mmHg.



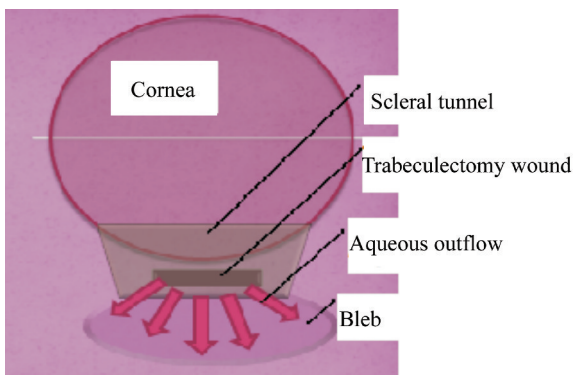
**Figure 1** The figures showing the types of glaucoma, its sex-wise distribution, duration of glaucoma and on its maturity A: Type of glaucoma; B: Sex distribution; C: Glaucoma cases; D: Cataract cases.



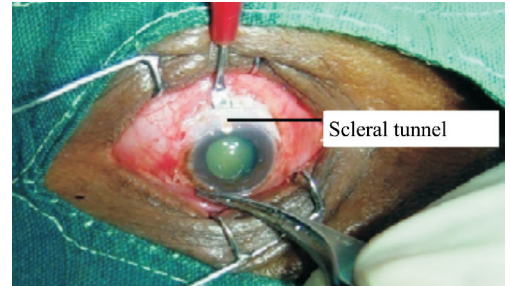
**Figure 2** Mean intraocular pressure after the surgery maintained almost same throughout the follow-up.



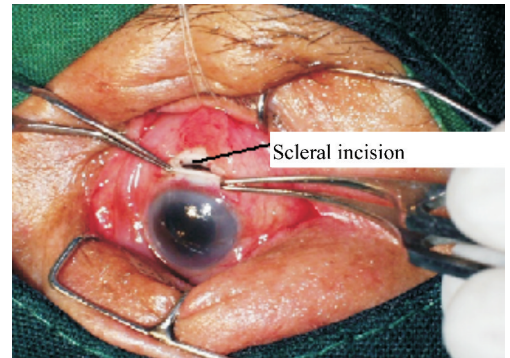
**Figure 3** Percentage reductions in the mean intraocular pressure after the surgery showing a good, steady and stable lowering of IOP with minimal fluctuation.



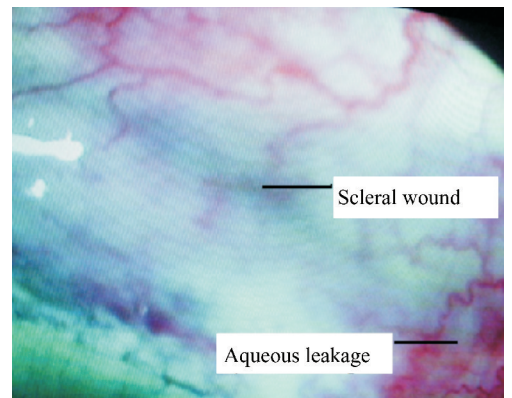
**Figure 4** Diagrammatic picture showing aqueous drainage through the trabeculectomy wound, scleral opening into the sub-conjunctival space.



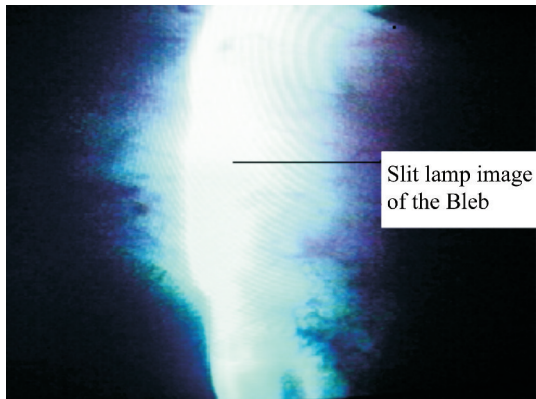
**Figure 5** Scleral tunnelling for cataract extraction and trabeculectomy was showing a 7mm horizontal straight scleral tunnel incision, 3mm away from 12 o'clock position in limbus.



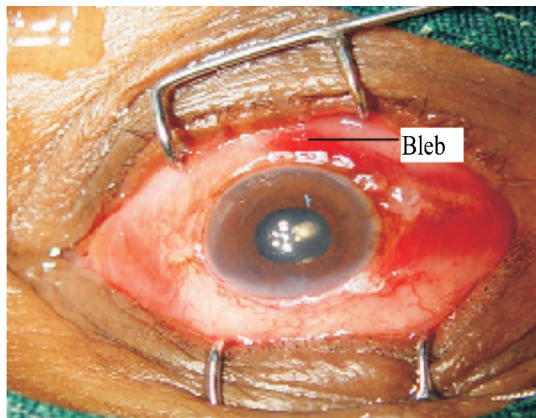
**Figure 6** Trabeculectomy procedure to enhance aqueous outflow. Scleral flap was lifted with the help of forceps to show the trabeculectomy wound. A small horizontal deep scleral incision with 4mm in length and situated about 1mm inside, the outer scleral incision was made within the tunnel after lifting the superficial flap using Vanna's bent scissors.



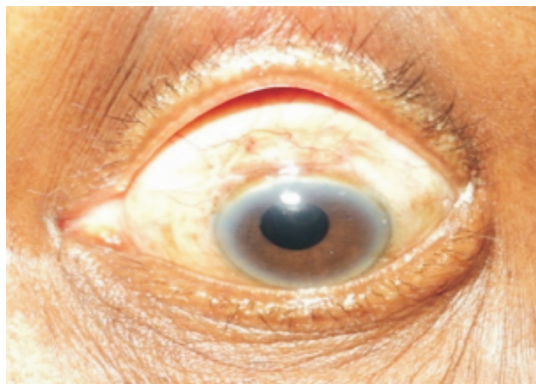
**Figure 7** Figure showing the aq. Diffusion through the entire scleral wound creating diffused bleb which are all flat, diffuse and located posteriorly.



**Figure 8** Picture showing the shallow bleb while observing through the slit-lamp.



**Figure 9** Diffuse bleb was seen during the immediate postoperation.



**Figure 10** Functional diffuse bleb was seen after 6 months of postoperation.

In ECCE combined with trabeculectomy a relatively large conjunctival incision is needed and the sclera wound has to be enlarged for nucleus delivery. The potential disadvantages of this procedure are increased manipulation of conjunctival and sclera flaps with possible increase in postoperative inflammation and subsequent fibrosis of the filtering bleb area and filtering bleb failure. The prevalence of a shallow or flat anterior chamber occurring after combined surgery has been reported to be between 5% and 26%<sup>[6,7]</sup>.

In the present study, there are significantly less complications due to excessive aqueous outflow, such as reduced anterior chamber depth or iridocorneal touch, in the STIT group than in the CT group. STIT appears to be equivalent to

conventional trabeculectomy (CT) in lowering IOP during the first 6–12 months postoperatively. It is also relatively safe and has fewer early complications related to excessive aqueous outflow than CT. These results are in accordance with the previous controlled studies on releasable sutures<sup>[8,9]</sup>.

The advantage of the STIT procedure lies in its low cost and high efficacy without the use of sophisticated instruments or pharmacologic wound modulators. Other potential advantages over conventional trabeculectomy includes the use of a small incision, there is less risk of shallow/flat anterior chambers, persistent hypotony, bleb leaks, corneal endothelial toxicity, hypotony maculopathy and endophthalmitis<sup>[10,11]</sup>.

In the tunnel trabeculectomy, it provides an encouraging with optimal pressure control with negligible complications, increasing comfort, decreasing cost of living and improved visual outcome along with decrease in the incision size, absence of suture, decreased inflammation, more controlled ostium and relatively more posterior diffuse bleb<sup>[12]</sup>.

The mean postoperative IOP was low with minimal fluctuation over the period of 6 months without anti-glaucoma medication indicating a very steady and smooth control of IOP. Bleb function was satisfactory. There was no complications and discomfort. Bleb was diffuse and more posterior Bleb was flat. The bleb was away from the limbus and was formed due to the leak of aqueous from a long (7mm) incision. There was no hypotony and the level of IOP was maintained at a steady level because it was a double walled incision; hence there was a controlled leak of aqueous. There was no wound leak because the bleb was far away from the limbal sutures. Added to this, there was the advantage of no suturing, thereby saving surgeon's time and cost and preventing patients' discomfort. Therefore, procedure in the present study offers the theoretical advantages of good visual rehabilitation with improved IOP control in the long term and avoids the high risk of failure associated with conventional filtering surgery. The combined procedure also exposes the patient to a single surgical experience, reducing the risks of repeated surgery and saving on costly operating room time. Hence it can be considered as a safe alternative to conventional combined surgery. Further follow-up is needed to assess bleb behavior over a long period of time.

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## 手法小切口白内障术联合小梁切除治疗 POAG 合并白内障

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### 摘要

**目的:** 白内障手术技术在近年已经得到了很大提高。本文提出了一项创新且操作简便的隧道内小梁切除术, 并并发症少, 用于治疗白内障合并原发性开角型青光眼 (primary open angle glaucoma, POAG)。

**方法:** 对于纳入该前瞻性、非随机性临床研究的 103 例 108 眼白内障合并 POAG 患者行手法小切口白内障手术 (manual small incision cataract surgery, MSICS) 联合隧道内小梁切除术。随访 6mo, 依据气泡的解剖学外形及其功能对手术疗效进行评估。

**结果:** 术后第 1d, 隧道内切口组的平均眼压 (intraocular pressure, IOP) 为  $11.4 \pm 3.1 \text{ mmHg}$  ( $P=0.012$ ), 术后第 2d 的平均 IOP 为  $10.3 \pm 3.5 \text{ mmHg}$  ( $P=0.065$ )。隧道内切口组的浅前房和虹膜角膜接触明显减少。

**结论:** 巩膜隧道切口小梁切除术 ("scleral tunnel incision"-trabeculectomy, STIT) 的眼压在术后 6mo 平稳降低。STIT 相对安全, 类似过多房水外流的早期并发症比传统小梁切除术 (conventional trabeculectomy, CT) 少。

**关键词:** 隧道内小梁切除术; 原发性开角型青光眼; 传统小梁切除术; 白内障