

# Is GATT the Answer?

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*Journal of Current Glaucoma Practice* (2023): 10.5005/jp-journals-10078-1425

The *ab interno* approach for gonioscopy-assisted transluminal trabeculotomy (GATT) is one of the torchbearers of the minimally invasive glaucoma surgery (MIGS) revolution. The surgery does not ravage the conjunctiva-like bleb-dependent procedures and can achieve intraocular pressures (IOPs) in the low teens across the glaucoma spectrum,<sup>1</sup> saving it from being clubbed as a “minimally effective glaucoma surgery.”<sup>2</sup> Moreover, both its safety and efficacy profile are comparable to that of trabeculectomy, the reigning gold standard of glaucoma surgery. It may be performed with both the humble prolene suture and an illuminated micro-catheter. The former, especially, is an extremely cost-effective MIGS for both primary and secondary glaucomas in adults as well as children.<sup>3</sup>

## RATIONALE BEHIND GATT SURGERY: HOW DOES IT WORK, AND FOR HOW LONG?

### Outflow Resistance and Glaucoma

The complex, fenestrated network of trabecular meshwork (TM) cells within the extracellular matrix form the basis for aqueous humor outflow resistance and, consequently, the pathophysiology of various types of glaucoma. It is also the site of various therapeutic strategies that target trabecular dysfunction. There is a growing body of evidence demonstrating that the juxtacanalicular TM is the site for maximum outflow resistance. Thus, the rationale for GATT is to remove TM and the inner wall of Schlemm’s canal (SC), which is the major site of the resistance.<sup>4–8</sup> The *ab interno* approach of GATT allows direct visualization of the “trabecular shelf,” which indicates an open, cleaved collector system. However, it is critical to remember that it destroys the entire TM circumferentially, and that is the crux of its efficacy.

### Wound Modulation and Long-term Implications

At least for the foreseeable future, there are no means of modulating wound healing at the TM, which may have implications for its efficacy and success rates in the long term. There might be some preoperative risk factors that may modulate wound healing and surgical outcomes. Both might be influenced by several factors, such as the patient’s age, disease stage, duration of topical glaucoma medications, coexisting ocular problems and the characteristics of the angle. However, there is no marker like a bleb showing how SC heals postoperatively. GATT’s success rates seem to be promising in moderate to advanced open-angle glaucoma (OAG), with an overall success rate of 83.7%.<sup>9</sup> Patients with pseudoexfoliative glaucoma (PEXG) seem to have more favorable success rates (79%) compared to primary OAG (POAG) (73%); however, the difference was not statistically significant at the end of the 3rd year.<sup>10</sup> Future glaucoma research focuses on restoring the functionality of the TM and also the distal outflow system. Patients who have undergone GATT or have already dysfunctional distal outflow may just, therefore, become ineligible for these therapeutic

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**How to cite this article:** Bhartiya S, Aktas Z, Ichhpujani P. Is GATT the Answer? *J Curr Glaucoma Pract* 2023;17(4):167–168.

**Source of support:** Nil

**Conflict of interest:** None

options.<sup>6</sup> On the other hand, postoperative outcomes and their relationship with gonioscopic findings in the long term might shed light on how wound healing in the SC affects surgical outcomes.

### The Minimally Invasive Conundrum

Of course, GATT is minimally invasive when it comes to conjunctival handling and is also a bleb-free surgery. It is, therefore, free of bleb-related complications, with a better safety-to-efficacy profile.<sup>11</sup> But it is not minimally invasive when it comes to the vital TM.

## PATIENT SELECTION: WHO ARE THE BEST FITS? Type of Glaucoma

As is true for almost any other surgical technique, patient selection is the key to surgical success. The surgical outcomes of GATT are known to be good in pediatric/juvenile glaucoma and secondary glaucomas.<sup>12,13</sup> POAG, steroid-induced glaucoma, PEXG, and pigmentary glaucoma patients also do well with GATT surgery. In patients with PEXG, it is possible to achieve single-digit IOPs.<sup>14</sup> GATT surgery can also be done in patients with primary angle closure glaucoma combined with phaco and goniosynechiolysis with good outcomes and low complication rates.<sup>15,16</sup> This stands to reason since we bypass the main underlying pathology by decreasing the outflow resistance at the level of the juxtacanalicular TM. Even in glaucoma patients with a history of prior corneal surgery, GATT was found to be safe and successful.<sup>17</sup>

### Stage of Glaucoma

Gonioscopy-assisted transluminal trabeculotomy (GATT) surgery can be done in all stages of glaucoma since the entire circumference of the collector system is opened instead of a

segment. In advanced glaucoma, requiring IOPs in the low teens or single digits, GATT surgery can still be a reasonable option with the understanding that further medications or interventions might be needed over the disease course. However, in advanced cases with a mean deviation worse than  $-15$  dB, GATT is less likely to work as such patients have resistance to outflow at multiple layers.

It has also been seen that virgin eyes or eyes with less exposure to antiglaucoma drugs do better with GATT than those that have had years of drug exposure.<sup>18</sup>

GATT has also been successful in treating 60–70% of POAG patients with prior incisional glaucoma surgery.<sup>2</sup>

## IMPORTANT TO KNOW THE “MISFITS”

It is equally important to know in which patient GATT is contraindicated. Absolute contraindications include an inability to identify angle structures, a closed angle, a bleeding diathesis, an inability to stop anticoagulants, an unstable intraocular lens, or compromised corneal endothelium. Relative contraindications include inability to elevate the head 30° for the initial few postoperative weeks.<sup>19</sup>

## IS GATT, THEN, THE ANSWER?

The primary goal of all glaucoma surgeries is to prevent progression and permanent visual loss by lowering IOP for sure. We have so many alternatives in the glaucoma surgical armamentarium today. However, safety and cost-effectiveness are major concerns when picking the right choice for our patients. GATT in adults builds upon the success of traditional trabeculotomy done for pediatric glaucomas by eliminating conjunctival and scleral dissection. GATT surgery has several advantages over both filtration surgeries and MIGS devices, the main one being its blebless nature. Additionally, GATT opens the entire circumference of the collector system instead of relying on a quadrant, as in most of the other TM/SC-based MIGS techniques. Furthermore, in terms of cost per IOP lowering, it can provide significant benefits to patients at a very reasonable cost, as it can be done using inexpensive surgical instruments already present in almost every operating room.

Well, there is no perfect glaucoma surgery: given the varied and chimeric nature of the disease, there can be none. But is GATT a very strong contender for the race? Yes. Is it the most cost-effective MIGS giving conventional glaucoma surgery a run for their money? As of date, a resounding yes.

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