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# MIGS EXPERTS ON ABiC WITH iTRACK

Six surgeons share their experiences  
using a MIGS technology that targets  
multiple sources of outflow resistance.

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Optical fiber, light transmission

Catheter support wire

Section of optical fiber enlarged for visual purposes

Polymer shaft and distal atraumatic tip

Lumen

Ultra-thin, flexible  
0.5mm diameter optical fiber

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To see videos of this roundtable discussion, go to [eyetube.net/collections/ellex-abic/](http://eyetube.net/collections/ellex-abic/)

# MIGS EXPERTS ON ABiC WITH iTRACK

Six surgeons share their experiences using a MIGS technology that targets multiple sources of outflow resistance.

*Ike K. Ahmed, MD, led a panel discussion on microinvasive glaucoma surgery (MIGS) sponsored by Ellex iTrack during World Glaucoma Congress in Helsinki. Panel members shared their collective wisdom and experiences with MIGS and ab interno Canaloplasty (ABiC; Ellex). In addition to discussing how they envision the roles of these technologies in the glaucoma armamentarium going forward, the surgeons looked at how, as MIGS gains in popularity, an increasing number of physicians are exploring the adjunctive nature of these procedures with other MIGS options and with selective laser trabeculoplasty (SLT).*

## MULTIPLE PATHWAYS



**Ike K. Ahmed, MD:** *Let us start off by talking about how ABiC works in terms of improving the outflow pathway. What is the procedure's mechanism of action?*

**Inder Paul Singh, MD:** What I love so much about ABiC is that it works on multiple pathways. One of the issues we face with any MIGS device is the fact that preoperatively, we do not always understand where the resistance to outflow is occurring. Each one of the devices on the market works to enhance a different part of the natural outflow system. The advantage of ABiC is that instead of working on just one part of the pathway, it works on dilating Schlemm canal and improving function of the trabecular meshwork and distal collector channels. I think this kind of comprehensive approach to the natural outflow systems is the primary benefit of ABiC.



**Dr. Ahmed:** *Traditionally, the pathology of glaucoma was understood to reside in the trabecular meshwork. Based on the knowledge we have today, how can the ABiC procedure's mechanism of action specifically address glaucoma's pathologies?*

**Norbert Koerber, MBBS:** In our experiences performing standard canaloplasty over the years, each of us has used channelography in hundreds of cases. I would say that in many more than half those cases, we see partial or complete collapse of Schlemm canal. I think the only approach can be to dilate the canal, dilate the distal collectors, if possible, and dilate and stretch the trabecular meshwork to get all these pieces functioning together. With current preoperative diagnostics, we cannot know where the collapse has taken place in every case, and placing an implant without that knowledge is a blind shot. With ABiC, we address pathology directly. I think that makes a difference.

**Leon Au, MD:** I agree. With access to all the different MIGS and other devices on the market at the moment, ABiC's broad mechanism of action is part of the buy-in for me. If it just addressed the trabecular meshwork, then we have already had devices that do that for quite a long time. If glaucoma pathology were really that simple, then those devices would bring everybody's pressure down dramatically. We would have good outcomes, and there would not be a need for anything else. But we see that addressing only the trabecular meshwork does not achieve its purpose for a lot of the patients. It is not getting the pressure that we expect. This clearly goes beyond the meshwork.

With a lot of the devices we have, we try to improve the outcomes of bypassing the meshwork by being clever in our placement. We try to find out exactly where it should go, but we do not have a good live angiography to tell us. A procedure like ABiC that can hit 360° theoretically gives me an advantage that I think has to be more beneficial than targeting a particular segment.

**Dr. Ahmed:** I think you summed it up really well. The disease in its primary state is typically in the trabecular meshwork. But there are secondary considerations such as collapse of the canal, as Prof. Koerber mentioned, as well as pathology. As you said, Mr. Au, a procedure that has the ability to address all aspects of the outflow system is appealing.

## STUDY DATA



**Dr. Ahmed:** *We know that a procedure is only as good as the results we see in our patients. With ABiC, we benefit from having results from both the United States and international sites. Mark J. Gallardo, MD, has presented some 24-month data on standalone ABiC and a combination of the procedure with phaco.<sup>1</sup> Dr. Singh, what do the data look like to you? Does it reflect your personal experience?*



**Dr. Singh:** Dr. Gallardo is a good friend of mine who has done some great work. When you look at the data, there was a significant reduction in IOP of about 34% to 43% from baseline, with pressures going down to the low teens.<sup>1</sup> Medications were reduced about 60% to 78%.

What stands out to me is the fact that he showed positive outcomes for ABiC not just with cataract surgery, but also as a standalone procedure. When we look at data sets on other MIGS devices that we use, there is sometimes inconsistency with outcomes between a standalone procedure versus combination with cataract surgery. In Dr. Gallardo's study, standalone patients who were phakic or pseudophakic and patients who had ABiC with cataract surgery all had similar good results. I think that validates the approach where this procedure works on multiple mechanisms.

**Dr. Ahmed:** *I think it is a very relevant finding because we see those significant reductions in IOP and medication use in standalone ABiC surgery, without the phaco as a confounder. The duration of the data stand out to me as well. With 12-month and 24-month data showing positive outcomes, I think we see some longevity.<sup>1</sup> We have wondered how long ABiC's mechanism of action would be effective, so these data give us something to consider.*

*Mahmoud A. Khaimi, MD, from Dean McGee Eye Institute has also shared data on his experience with both standalone and phaco combination surgeries. Results were similar.<sup>2</sup> Dr. Vold, have you seen those data? How do Dr. Khaimi's results compare to yours?*

**Steven D. Vold, MD:** According to Dr. Khaimi's 18-month data, he is lowering pressure by about 25%, and patients are generally getting off two medications.<sup>2</sup> It is interesting to me that when they combined ABiC with cataract surgery, almost 90% of patients were off all of their medications. That is a big deal.

Prof. Koerber and his colleagues have published full 3-year data on canaloplasty, showing they were getting pressures down into the low to mid teens.<sup>3</sup> This procedure has been proven over time. I have patients who had very similar procedures almost 10 years ago and still experience the benefits of surgery. The procedures have evolved a bit and shown us that by treating 360° of the angle and really opening up the pores in the trabecular meshwork, we can get long-standing results with this powerful tool.

**Dr. Ahmed:** *Prof. Koerber, you have a great deal of experience with canaloplasty, and you have also been a pioneer in novel glaucoma surgery. You have now put together some early 24-month data for ABiC. Can you tell us about your experience?*

**Prof. Koerber:** Of the results that we have mentioned, my experience is very close to those of Dr. Khaimi. I see a mean preoperative IOP of 20, but without washout, so the last measured IOP would not be the highest in the period before surgery.<sup>4</sup> The IOPs are reduced to approximately 16 mm Hg after 24 months, with a lower medication load than patients had before surgery.

Comparing these outcomes to the other studies on ABiC, we see that we can get rather consistent results from different physicians and locations. As we consider the effects of surgery, this is quite convincing. I think if we saw widespread differences, including high and low results, we would attribute success to an individual surgeon's technique. With similar results in different places, however, we know we can all do the same procedure and get the same outcomes, more or less. That is quite impressive.

**Dr. Singh:** I think you make a good point. The fact that multiple centers have had similar data probably indicates ABiC is truly a confirmatory procedure. We know where we are in the natural outflow pathway. When we feed the iTrack in Schlemm canal and visualize that blinking red light traveling all the way around the circumference of the eye, we are positive we are in the canal. Sometimes in other procedures I perform, I think I am in Schlemm canal, but I am not always certain. This even happens sometimes with iStent Trabecular Micro-Bypass Stent (Glaukos), which is a great procedure. However, with the device, I am confident I am where I need to be. That is a true benefit: confirmation that the surgeon is in the right place.

**Dr. Ahmed:** *Again, Prof. Koerber, you have a lot of experience with ab externo Canaloplasty, and you published long-term data on this.<sup>3</sup> How do you compare that experience, for which we have a great deal of evidence, to your experience now with ABiC?*

**Prof. Koerber:** I would say the ABiC cases end up after 1 to 2 years like the phakic ab externo approach. If I want to get lower, I would think that there is a difference of about 2 mm Hg, like comparing viscocanalostomy to canaloplasty. If I have cases that are very advanced, I still prefer the ab externo approach because I get to a bit above 12 mm Hg, and the number of medications goes up only 0.3 after 1 year.<sup>3</sup> After 8 years, the data show that the pressure goes up 1.0, from about 12 mm Hg to about 13 mm Hg.<sup>5</sup> That is not a large increase. Pressures remain low with a little more medication.

My primary goal with ABiC is to offer a surgical option to patients with intolerance to medication or, for example, good medical normal pressure regulation on multiple medications and advancing cataract. I want to offer them an opportunity to handle the cataract together with the glaucoma, with a low-risk profile.

**Dr. Ahmed:** You describe a lot of similarities between ab externo approaches and ABiC, which obviously has significantly different risks and effort. In your experience, ABiC might buy you an additional millimeter or 2 reduction in IOP for that extra work. Dr. Gallardo also published data showing these two approaches produce fairly similar outcomes in his core of patients.<sup>6</sup>

The fact that multiple centers have had similar data probably indicates ABiC is truly a confirmatory procedure.  
—Inder Paul Singh, MD

**?** **Dr. Perera,** you have a population in Singapore that may be a little different than in the United States. What is your experience there? How have you found ABiC results compare to the outcomes we discussed today?

**Shamira Perera, MD:** In Singapore, we have a lot more angle closure. In my experience, I would say that about 40% of our glaucoma patients have some sort of an angle closure, and some have mixed mechanisms. Of course, that means that cataract removal alone will have a significant effect on pressure. It is hard to tease apart what is really working when you do combined procedures. Is it the phaco or is it the MIGS?

Inevitably, we also have the problem of wondering if MIGS devices will cause more problems because they are not intended for full angle-closure eyes. We have seen problems. For example, some MIGS devices became plugged up with iris. ABiC is probably a good MIGS option in these cases, as there is nothing left inside the eye to incite inflammation. We have only used ABiC on open-angle cases, but it may be the way forward for some of these angle-closure patients. Of course, it is balanced by the fact that eyes with angle closure have peripheral anterior synechiae (PAS) as well. These PAS form quite rapidly and can cause downstream damage. We do not know if removing the PAS can relieve some of that downstream damage or if we can do anything to re-establish any flow before the pathways close off completely.

**Dr. Ahmed:** With angle closure, sometimes we think that the trabecular meshwork might have dysfunction as well, such as PAS or fibrous growth from the synechiae. Perhaps small microperforations created by the viscodilation of the canal with ABiC may help to address the mechanism of action as well—in all eyes, but particularly eyes with synechiae.

#### VISCODILATION

**?** **Dr. Ahmed:** Next, I would like to hear your experiences with the ABiC procedure essentially flushing the system temporarily with viscoelastic. I think a lot of surgeons would ask how long this lasts. If it is a temporary

*flush, why do we see some data show positive effects at 24 months?<sup>1,4</sup> Why do you think this seems to be sustainable, showing long-term effects when a flush would not have a continuous effect?*

**Dr. Singh:** There is likely a physical component, too. We are actually placing a catheter through Schlemm canal and likely breaking microadhesions, so there is a mechanical element to it, not only flushing the system. I think that the flushing and dilating help open up the trabecular meshwork and the distal collector channels as well. Dilating Schlemm canal by inducing some mechanical disruption with the addition of dilation with the viscoelastic has a significant impact on the longevity of the procedure.

**Dr. Vold:** In the seminal work of Doug Johnson, MD, at the Mayo Clinic on the histopathology of canaloplasty, he proposed that little perforations in the trabecular meshwork and Schlemm canal actually increase aqueous outflow thereby lowering IOP as part of the mechanism of action.<sup>7</sup>

**Mr. Au:** I certainly do not have data for a long duration as others in our panel do, but I have been surprised that this temporary flush and dilation seem to work well and last longer than I thought they would. In some patients, I felt that there was a lot of disease in the meshwork, such as pigment dispersion or pseudoexfoliation, so I am interested to learn why it seems to work as well as it does.

**Dr. Ahmed:** I also think glaucoma is, in some ways, a vicious cycle. Patients can have trabecular meshwork dysfunction, elevated IOP, collapse, herniation, and collector channel ostia malfunction. We break that cycle with the catheter's mechanical disruption, dilation of the trabecular meshwork and the affected filtration area, and flushing and opening of collector channel ostia. The pressure comes down because the cycle has been disrupted. The flush may be temporary, but the procedure breaks a vicious cycle, resulting in longer term effects. I think we need additional clinical data to support the potential theories behind the success of ABiC.

**Dr. Perera:** The idea of resetting the whole trabecular meshwork is reflected in the literature. No matter what medication the patient is using preoperatively—three drops, two drops, or one drop—the IOP seems to come down to about the same level.<sup>1-4</sup> That uniformity is a bit different than some of the other MIGS options that produce better



effects for higher pressures. It could be just a simple reset once we get the ABiC through that hole and get the viscodilation agent out.

#### SLT BEFORE OR AFTER ABiC

**?** **Dr. Ahmed:** *Along the same lines, it is interesting to think about adjunctive therapies, right? Again, we know the pathology in the trabecular meshwork is not necessarily going away, but we can address it with other modalities. Does anyone on the panel have experience using trabeculoplasty either before or after ABiC to address residual or even future trabecular meshwork dysfunction?*

**Dr. Singh:** I have done both, actually. I think SLT is a modality that we underutilize, at least in the United States. It has served me well both before and after MIGS. We looked at a retrospective analysis of our data for iStent patients with at least a year of follow-up, focusing on two subsets: patients who had previous SLT and initially had a good response and patients who did not respond well to SLT. We found that the group with a good response to SLT had a better response to iStent than those who did not respond as well.

These outcomes triggered me to think SLT may be a preoperative indicator of where the resistance lies. SLT is thought to work primarily at the level of the trabecular meshwork. For this reason, if SLT works well, then the trabecular meshwork might be the primary source of resistance. If SLT does not work well, I wonder if the resistance might be located in Schlemm canal or in the distal collector channels, and therefore, I might choose not to perform a trabecular meshwork-sparing procedure only.

So, as a preoperative measure, I think SLT has multiple benefits, including not only reducing medications, but also helping me diagnose the source of resistance. Postoperatively, SLT has helped to serve as an adjunct to help further reduce IOP in these MIGS patients.

**Dr. Ahmed:** I look at ABiC as a procedure that is an intervention. It intervenes to address multiple aspects of outflow dysfunction, as we discussed earlier. There are some patients who need maintenance therapy to address continual challenges with the pathology of glaucoma, and that is where a procedure like SLT could be used as an adjunct. It could be a maintenance therapy, so to speak, to maintain an intact outflow system.

**Dr. Vold:** A corollary here, Dr. Ahmed, is if people have previous SLT, does that negatively impact ABiC? I think the answer is no. I looked at a lot of data for other angle procedures, including the Trabectome (NeoMedix), and SLT did not really have an impact.<sup>8</sup> Using SLT as a first-line therapy actually resulted in slightly better outcomes compared to people using medications long term.<sup>8</sup> It is good to know that SLT will not negatively impact MIGS procedures.

**Dr. Singh:** Has anyone here performed SLT after the ABiC procedure? My question is, will ABiC make the SLT work better postoperatively? Because if the issue is partly Schlemm canal, then when you perform SLT after opening up the canal with ABiC, you may get an even a better response than you had initially. We have actually seen this anecdotally in our practice.

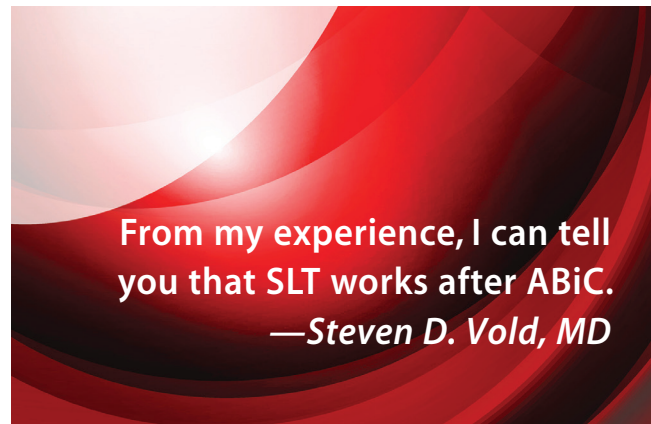
**Dr. Vold:** From my experience, I can tell you SLT works after ABiC. I do not know if outcomes are better because I have not compared the two, but I can tell you that it can be very effective. A supplemental SLT can lower the pressure an extra 2 or 3 mm Hg to get the pressure right where you want it—say, in the mid-teens. That can mean that your patient does not have to return to medications. It is definitely something to think about postoperatively.

## ABiC AND MIGS TREATMENT ARMAMENTARIUM

**?** **Dr. Ahmed:** *This is a great time to be in glaucoma surgery. We have, I think on last count, 12 different MIGS approaches. You can divide them up into canal-based procedures, suprachoroidal, and subconjunctival procedures, as well as endoscopic correlations. How do you think ABiC compares to the other MIGS options? With so many devices, this is a big question, of course. Dr. Perera, you alluded to it a little bit earlier. How do you see ABiC compared to the other MIGS options available to you?*

**Dr. Perera:** To start, let us look at the list of treatment options that just deal with the trabecular meshwork: the iStent, the Hydrus Microstent (Ivantis), the Kahook Dual Blade (New World Medical), and the Trabectome. There is likely a space for each one in different areas, depending on how they are reimbursed and how surgeons are learning to use the devices.

ABiC is quite unique because it leaves nothing in the eye. In terms of ease of use, I think the iStent injector is probably



a bit easier to use, particularly for cataract surgeons. I think glaucoma surgeons are more used to using the gonioscope for visualization of the angle, so they may be the ones moving toward the Hydrus, Kahook Dual Blade, or ABiC. There will be a differentiation depending on the surgeon's background as a cataract surgeon or a glaucoma surgeon.

**Mr. Au:** The competition for MIGS is tight. They all seem to be hitting the same mark for outcomes, reducing both IOP and medication use. There are small differences, but it is sometimes a bit hard to pick between the various MIGS options. I think it is always useful to have a MIGS procedure that combines glaucoma and cataract surgery as well as another procedure that improves outflow and involvement of the conjunctiva.

I do have a slight amount of concern when we implant things into Schlemm canal. I think we should put more study into understanding how Schlemm canal and the trabecular meshwork behave when they have a foreign body. Schlemm canal is a living membrane with endothelial cells, movement, and replication, rather than just a thin membrane that filters. I am concerned that having a foreign body may have a positive impact initially and a negative impact later.

**Dr. Perera:** Worldwide, very few devices have been removed. They come out very easily and there is not a lot of inflammation around them, but this has not been looked at in much detail. We do not know if inflammation and scarring could occur in Schlemm canal.

**Mr. Au:** Generally, we can expect that there may be scarring in any procedure, which is why glaucoma surgery ultimately fails over decades. Using small devices with less movement may be good. In my experience, larger devices offer more drainage and sometimes a better position, but you may see some scarring and some iris coming up with the foreign body. We have all seen devices attracting the iris, so I like the fact that with ABiC, I do not have to worry about the device getting blocked 2 or 3 years down the line. We need to do more about what we are doing to Schlemm canal now—whether we are shining a laser at it, sticking

a stent through it, or viscodilating it. ABiC may be a more natural procedure than the other MIGS options available.



**Dr. Ahmed:** *Dr. Vold, what about cutting and ablation techniques? Cutting the inner wall, or goniotomy, seems to be back in vogue, and many surgeons are using ablation techniques. How do you see them compare to ABiC?*

**Dr. Vold:** That is a great question. I was just counting, and I think there are about eight different procedures with trabecular bypass—maybe nine if you count suture trabeculotomy. We have the Trabectome, gonioscopy-assisted trans-luminal trabeculotomy (GATT), ABiC, iStent, Kahook Dual Blade, Hydrus, ab externo canaloplasty, and the Visco360 and Trab360 (Sight Sciences). If you are a new MIGS surgeon, your head is spinning.

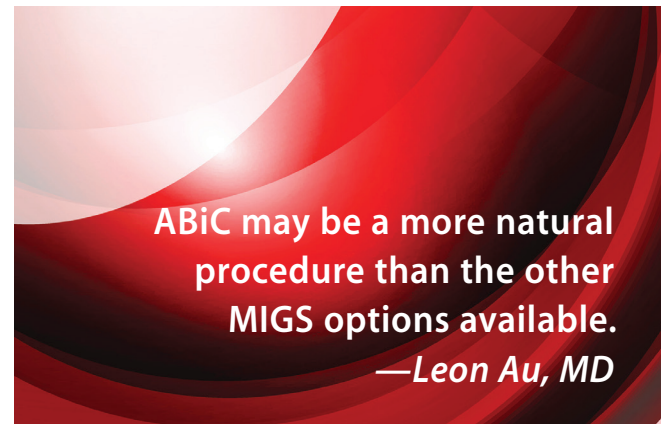
The way I think of it, we have the stents that are a good option for some patients. They are easy to implant, which is very appealing for a cataract surgeon. I think there is a role for them. In the United States, some of these stents are not covered by private insurance, and some are not covered by standard Medicare, so we can struggle with reimbursement. Furthermore, for example the iStent is only FDA approved in the United States when combined with cataract surgery. We do need to have a viable trabecular bypass surgical option for pseudophakic or phakic glaucoma patients. Surgeons need to have one or two stents options and some sort of alternative approach that does not involve stent placement.

Looking at the different options, I think ABiC may be a good alternative. It does not require a big piece of capital equipment. With just a little practice, I think surgeons can master the technical skills to do it well and get very efficacious results. Having one cutting procedure and maybe one viscodilation, depending on your pressure targets, could be advantageous.

**Dr. Singh:** Because ABiC is fairly atraumatic to the eye and can be performed during cataract surgery or as a standalone, it is a flexible procedure. We can always perform another procedure down the road if a patient needs one, which I think is important. If I need to place a stent or perform a goniotomy years later, previous ABiC does not in any way interfere with my ability to do so.

We are often asked how we navigate through all the different options for glaucoma. For my patients, if someone has mild to moderate glaucoma on one medication and a cataract, I often use the iStent. In my experience, it is a fairly straightforward procedure with a good safety profile, and patients understand that we will treat two problems (cataract and glaucoma) at once without significantly increased risk. However, if a patient is on two or three medications with a cataract, I can still try to get them off some of their medications by attempting a goniotomy, ABiC, or even a Cypass Micro-Stent (Alcon). I will say, without a cataract, I tend lean toward performing an ABiC procedure.

I think the choice of options depends on target pressure



and how many medications the patients are taking. If they are taking several medications for a long period of time, if we really want to get them off those medications, we need to consider where the resistance might be. Longer-term medications may have the potential to collapse the trabecular meshwork and canal. This factors into our decision. I also think that ABiC's flexibility as a cataract-accompanying or standalone procedure, as well as its minimal tissue disruption and postoperative recovery, make it a good choice for a variety of patients.

**Dr. Vold:** Another factor in that decision is the practicality of coding these procedures. ABiC has its own specific code, different from a goniotomy code or a stent code. Reimbursement always impacts utilization, and the fact that it has its own code can potentially be advantageous in the United States.

**Dr. Ahmed:** I think all of you have differentiated our options quite well. In some ways, I think it is great to have all these options, but in other ways I find it confusing. I would add to your comments that I have found the cutting techniques, particularly for large goniotomies, typically show blood reflex and bleeding in the anterior chamber. Although often it is self-limiting, it does delay recovery—sometimes longer than we want it to take. We do not seem to have that issue with regards to ABiC. The catheter is passed around a small goniotomy. To me, that is quite appealing in its effect on the recovery, compared to some of the cutting approaches.

### ABiC AS A STANDALONE THERAPY

**Dr. Ahmed:** *I hear all of you coming back to the ability to use ABiC as a standalone therapy as well as part of combined procedures. Prof. Koerber, how do you see the patient profiles for ABiC? When do you use it as a standalone treatment? Do you use it in phakic patients?*

**Prof. Koerber:** I did two phakic patients, but it makes me nervous because I fear contact with the natural lens. If the anterior chamber is deep enough, it is feasible, but it is still a considerable risk that you might touch the lens. For a





younger patient, that is not good.

I prefer the combined approach or the pseudophakic patient for standalone ABiC. The mean age of my patients is in the 60s, so a cataract is usually developing. I tell my patients, “We have a problem with your optic nerve. Your optic nerve is unique, and that is my primary concern. I can fix a problem with the lens by implanting an IOL, but I cannot fix the nerve, only preserve it. The lens is expendable, but the nerve is not.” Even if the lens has only traces of cataract, I recommend we do a combined procedure and get rid of the lens. These patients need reading glasses anyway, so why not? I think I probably do more combined procedures than some other surgeons, but it makes sense in my older patient population.

**Mr. Au:** Whenever we see good standalone results, it pleases us that we have a technology that works. In my opinion, however, we can get better results when we combine MIGS with cataract surgery. Even though the cataract may not be very symptomatic, I would probably opt to treat it and get a little extra in terms of pressure lowering. Any amount of anterior chamber manipulation, including spending time in the anterior chamber under viscoelastic during ABiC or a stent procedure, increases the chances for the patient to develop a cataract. In that case, although it is nice to have a standalone procedure that actually does work with a good degree of confidence, I think combined surgery tends to be a more common approach.

**Dr. Ahmed:** There are so many pseudophakic patients in our practices who had cataract surgery maybe 20 or 30 years ago, and now they are on multiple glaucoma medications. I think that captive group can benefit from this kind of procedure. We get better control, medication reduction, compliance, and few side effects. I use ABiC for these pseudophakic patients and other common procedures for phakic patients.

I have been impressed with the lack of cataract formation

after the standalone ABiC procedure. This was a surprise. I thought maybe we would see more of it—not necessarily from lens touch, which I think is rare, but just from opening the eye, using viscoelastics, and changing the aqueous flow long term. Because I have not seen very much cataract formation, I am still encouraged that standalone ABiC surgery may be an option. Nevertheless, I think the most obvious use is the combination procedure, as we just discussed, for pseudophakic patients. I feel comfortable using it for the right phakic patient as well.

**Dr. Singh:** My sweet spot is the pseudophakic patient. In fact, the other day I did a couple of pseudophakic monocular patients. In these cases, we did not want to perform trabeculectomy or tube shunt or any other procedure with similar higher risk profiles. To me, for these patients, the question is not, “Why use ABiC?” but rather, “Why not?”

Pseudophakic patients on two or three medications—that they cannot remember to take, find their cost to be high, experience side effects, and complain all the time about them—are great MIGS candidates. What ABiC and all the other MIGS devices have done for me is change my definition of glaucoma and therefore my threshold to offer a MIGS device. Before, I used to say, “Your glaucoma is controlled. Your pressure is stable. Your visual field is not getting worse, so your optic nerve is fine. I know how badly the drops bother you, but that is just how it is. I will see you back in 4 months.” Now quality of life has become a big part of that equation. If I have a pseudophakic patient admitting to forgetting a medication even a couple times a week or having to pay a lot for prescriptions, I think that patient deserves to be given the option to have a MIGS procedure. In my experience, ABiC is a procedure that has worked especially well on pseudophakic patients.

**Dr. Vold:** Along those lines, I am pleased to report that I see extremely quiet eyes after ABiC. Most patients only require taking topical anti-inflammatory ocular medication for 1 or 2 weeks postoperatively. This allows us to avoid potential postoperative steroid-induced IOP spikes and to get patients off their topical glaucoma medications more rapidly in the postoperative period.

### COMBINED MIGS



**Dr. Ahmed:** *What about combined MIGS? We have seen combined MIGS using different modalities or even the same mechanism. Do you have any experiences or*

*thoughts about combining other MIGS with ABiC?*

**Dr. Singh:** I mentioned that I have done a few ABiC cases with the Kahook Dual Blade. They have turned out very well. I have performed only six of these combination procedures, but I think complementary mechanisms of action are something to look for to improve outcomes. We could combine ABiC with CyPass, Kahook, iStent, or other procedures.

The benefit, in my opinion, is that we can avoid as much trauma as possible by maximizing outflow to the best of our ability, and combination procedures may achieve that by addressing multiple mechanisms. I have used supraciliary devices such as the CyPass, all of which worked very well. However, I do like to still maximize natural outflow if possible. If I have an angle that I can see very well in a patient with mild to moderate disease taking one to two medications, I do not mind trying ABiC first. I can always go back and implant a supraciliary stent, if needed. It all depends on patient selection. If the angle is not very easy to see or there is some scarring or other pathology, I go straight for a supraciliary stent or a subconjunctival MIGS device like the Xen45 (Allergan).

### ABiC PEARLS

**Dr. Ahmed:** *The safety of MIGS is something that we almost take for granted. We do not talk about it very much, but we are all consistent in our awareness and appreciation of it. What challenges can you share that you have had performing ABiC? How did you resolve those challenges? Perhaps you can share some pearls for those surgeons who are starting to do ABiC?*

**Mr. Au:** I am probably the least experienced ABiC surgeon around this table. I have done a fair amount of angle-based surgery, however, and I think we may be somewhat biased because we are very comfortable in the angles. If someone who is not comfortable operating in the angle does ABiC as a first angle surgery, then it is going to take a long time to get used to gonioscopy.

For me, ABiC was quite easy to learn. The only difficulty I had was understanding that the iTrack can ping out of the eye from time to time. I have since learned to thread it in so that it remains in the right place. This simple tip can be very helpful.

It is surprisingly easy to open the meshwork to see Schlemm canal. I do not even have to rip any measure; I just a cut and a peel down, just like looking through blinds. I have yet to fail to put the iTrack all the way around. I



have failed to implant devices into the canal before, but it seems to be surprisingly easy to thread the iTrack through Schlemm canal.

**Dr. Vold:** Experience has taught me a few things about the ABiC procedure that have really helped me. For example, when you open up the angle with the needle, utilize viscoelastic liberally in the eye to minimize blood reflux into the anterior chamber while performing the procedure. If the eye is a little underinflated, more blood reflux commonly occurs making it more difficult to visualize where the catheter enters Schlemm canal. I think all of us here are currently using Healon GV (Johnson & Johnson Vision) for ABiC. If blood reflux occurs, I/A or additional viscoelastic can assist with visualization. The importance of good visualization cannot be underestimated when performing any MIGS procedure, for that matter.

The other thing is to make sure that you come from a proper angle when you insert the iTrack catheter into the eye. If you come from too steep an approach, it makes the procedure much more difficult. If your paracentesis size is just a little bit more tangential to your entry point on the eye, it works very nicely because you can have the paracentesis help guide the iTrack catheter into the canal.

My last two pieces of advice are, first, to avoid enlarging the goniotomy by using a second instrument, such as a Kuglen hook, when you are retracting the catheter from Schlemm canal and, ultimately, the anterior chamber. Position the iTrack catheter close to the angle structures to prevent tearing the trabecular meshwork and Schlemm canal and the formation of a rather large trabeculotomy. Finally, a pearl I use in all my angle procedures: pressurize the eye at the end of the case to prevent hyphema. Anytime you are in the angle, you do not want to have blood in there. I like to set the pressure at 20 to 25 so that the eye is firm enough to avoid any hyphema the next day. For me, that has been really helpful.

**Dr. Singh:** Those are great points. In my first few cases, I found that I kinked the iTrack. I was nervous the first few times, and I thought, “I am going to turn the head and attempt to create a good view of the angle. I have the catheter ready, and I create my tangential paracentesis,” and then I grabbed the iTrack, pressing hard, and all of a sudden—kink! Once it kinks, it can be a little harder to get in there. So be careful not to press too hard. There are now special forceps available that decrease the chance of kinking the catheter. I do also think creating the paracentesis as close to theotomy as possible allows the catheter to follow the curvature a little easier and keeps it from kinking as easily.



**Dr. Ahmed:** *How about instrumentation for the otomy? What is your favorite instrument for making the otomy to start? How many clicks does it take?*

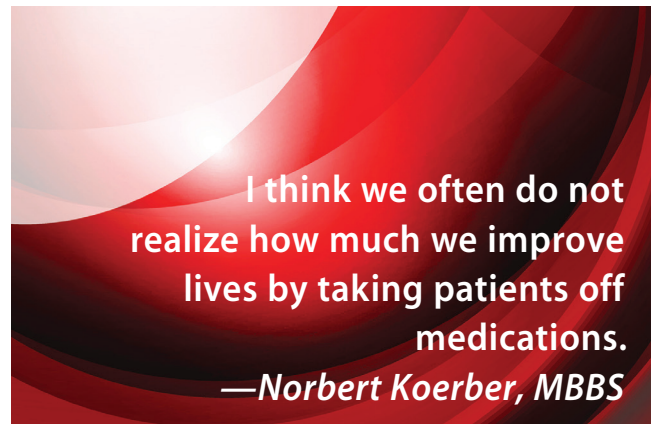
**Dr. Singh:** I tell the technician to click every clock hour. For the otomy, I use a cystotome needle. A cystotome needle is what we use for cataract surgery, so it is readily available in our operating suite. It works well to create the otomy and allows me to pull down on the meshwork to confirm the exposed wall of Schlemm canal.

**Prof. Koerber:** I use a 24-gauge needle and bend it 30° at the tip so I have a nice angle to cut and a good tool to grab the meshwork. I also go behind the tubular line to permit parallel access by the paracentesis, and I use a 25-gauge membrane forceps to advance the iTrack. I do about 8 clicks in while threading the catheter and 8 clicks out.

**Dr. Vold:** I typically use a 27-gauge needle. I was instructed to do about 2 clicks per clock hour, so about 24 clicks for Healon GV. If you are using Healon (Johnson & Johnson Vision), they advise you to do about 3 clicks per clock hour or 36 clicks, which is a little bit more than what we are doing.

**Dr. Ahmed:** I think in Canada, our system is a little different than it is in the United States. I find that 25 or 27 MVR blades are all useful. I generally use about 2 clicks per clock hour. First, I think the key thing is to keep the eye pressurized very well. Second, I want to keep the iTrack moving to reduce the chance that I will be in one spot and potentially cause an issue. Third, I only click upon withdrawal of the iTrack—as opposed to when I enter.

We have done some postoperative optical coherence tomography, which shows us not only the dilation of the canal, but also dilation of the aqueous veins in the collector system downstream. I feel like ABiC gives me a better chance to achieve that. I have not yet seen a significant Descemet’s detachment. I agree that theoretically, it could be an issue, and usually it is self-limiting.



## PATIENT SELECTION



**Dr. Ahmed:** *Getting back to the patient profile, how would you look at ABiC compared to some of the suprachoroidal procedures like the Xen45 or CyPass Micro-Stent? Do you have any experiences or thoughts about how to differentiate between candidates for these procedures?*

**Mr. Au:** For ABiC, my patient selection criteria will be very similar to my canal-based surgeries. It is a bit early for me to figure out exactly where suprachoroidal procedures fit in. Suprachoroidal is a big space. You put a device in, and the pressure comes down quite impressively. At the moment, I would be very reluctant to put a suprachoroidal stent in a young phakic patient, because I am not entirely sure what that would do. You have more experience in terms of how it would affect the refraction, what it would do to the lens position, and what would happen if you do a phacoemulsification on someone with a suprachoroidal stent.



**Dr. Ahmed:** *How do you compare a subconjunctival procedure such as Xen45 to ABiC?*

**Mr. Au:** We all have had experience with subconjunctival drainage. Subconjunctival drainage remains a more potent pressure-lowering procedure, compared to the other MIGS procedures out there. I think it is a different game, but it is best suited to a different patient cohort than ABiC.

The two also have completely different postoperative journeys. I think that subconjunctival surgery is not a fit-and-forget procedure. When you try to make it fit-and-forget, then you do not quite get the results you want. These patients need more tender loving care.

There are many occasions when I want a fit-and-forget procedure in Schlemm canal space, just like ABiC. I think the two approaches are not competitive in these cases, and I would plan conjunctival surgery. Restoring natural drainage tends to be my first approach, which is why (right or wrong), I am reluctant to perform ciliary body procedures as a first-line treatment. Enhancing natural outflow is what I like to do first, rather than an inflow procedure.

**Dr. Singh:** There is no right or wrong in these situations. Our choice is often a balance between target IOP and need to reduce medications on one side, and safety and adverse events on the other. Recently, I have been very happy with the Xen45 gel stent for my more moderate to severe patients, but candidates need to have a healthy conjunctiva. I am careful to pay more attention and am more aware of any risk of fibrosis. No matter how low and diffuse the Xen45 bleb is, fibrosis can still occur. For anybody who has thicker tenons, localized or diffuse scarring, or an overall unhealthy conjunctiva, I do not feel as comfortable performing a conjunctival surgery that causes a bleb. In these patients, I will often look to ABiC as way to help reduce IOP without the concern about bleb fibrosis. Therefore, for patients who are phakic or pseudophakic and taking multiple medications, there is very little downside to trying an ABiC procedure.



**Dr. Ahmed:** *Prof. Koerber, can you tell us about your ideal patient for ABiC? Which patients do you typically select?*

**Prof. Koerber:** The ideal patient, I would say, shows progression in the optical coherence tomography but does not yet show a visual field defect. The second indication is intolerance to drugs, whatever IOP the patient has. I would even perform ABiC in a patient who has a pressure of 14 mm Hg but is taking 3 medications and has bad tolerance. The patients are so happy later. I get many letters from patients telling me how happy they are because their quality of life has improved. They just feel better. The burden and the side effects of the medications are gone, and they can finally relax. I think we often do not realize how much we improve lives by taking patients off medications.

**Dr. Ahmed:** I think inherent to the concept of MIGS is the effort to be proactive rather than reactive. The ability to get patients off medications and lower IOP at the time of cataract surgery, regardless of the patient history, is becoming incumbent upon us. Standalone MIGS is growing as well because we understand that most patients are not compliant with medications,<sup>9,10</sup> even if we do not always see the effects of noncompliance. The ability to reduce medication use is one of the advantages of a procedure like ABiC.



## CONCLUSION

I want to thank everybody for contributing to this excellent roundtable. Hopefully, this is going to help us understand the role of ABiC. We have all read the 24-month data for ABiC, and we are familiar with its unique, multimodal mechanism of action. It has the welcome flexibility to work in combination with cataract or other MIGS surgery and as a standalone procedure. I look forward to seeing more contributions from our panelists in the field and hopefully hearing from others who are learning the procedure. ■

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