Adopting Canaloplasty in Your Practice: A Multi-Surgeon Panel

Treatments for ocular disease have changed dramatically in the last 25 years due to rapidly progressing technology that meets the needs of patients today. While glaucoma remains one of the leading causes of vision loss, traditional treatments like trabeculectomy, though successful in the majority of cases, carry a significant incidence of complications and corresponding morbidity.

The introduction of Canaloplasty has revolutionized the treatment of primary open-angle glaucoma in much the same manner as phacoemulsification altered the landscape of cataract treatment. In this monograph, some of the leading experts in Canaloplasty share their wisdom, experience, and expertise for surgeons who desire to incorporate Canaloplasty into their practice.

Members of the multi-surgeon panel include:

Ike Ahmed, MD
Mississauga, Ontario

Howard Barnebey, MD
Bellevue, Washington

Louis Cantor, MD
Indianapolis, Indiana

Richard Lewis, MD
Sacramento, California

Rob Noecker, MD
Pittsburgh, Pennsylvania

Q: Let's begin by discussing how long you have been performing Canaloplasty and how may procedures you did before you were comfortable with it.

Noecker: I've been doing Canaloplasty a little over a year and a half. It was about 10 or 12 procedures before I felt confident that I could predict what the outcome was going to be. After that, the cases would go consistently and the results were consistent.

Cantor: I feel that I'm always learning in surgery, even procedures I've been doing for decades. I learn something about Canaloplasty every time I do it as well. I've done 30 or more cases to date, but I felt I've actually operated in this space before, with other nonpenetrating procedures and deep sclerectomy. I felt fairly comfortable from the first case doing the dissection and understanding the anatomy. I would say in my first five to 10 cases, I felt very comfortable with the procedure, the dissection, and passing the microcatheter, and getting the appropriate amount of distension of the canal, as well as the appropriate amount of tension on the suture.

Ahmed: I've been doing this type of surgery for the last 8 years, so, it's not like I just started doing this type of approach. I think it was about 10 cases or so before I was comfortable with the procedure. From what I've seen in terms of our experience when teaching fellows and residents and other surgeons, I think it's around 10 cases before a surgeon feels confident.

Lewis: I've been involved with Canaloplasty for over 4 years. I would say I performed somewhere between 10 and 20 procedures before I was comfortable.

Barnebey: I've been performing Canaloplasty a little bit more than a year and a half. I previously worked with the viscocanalostomy procedure, and that goes back about 10 years. I also did some procedures with the Aqua-Flow porcine implant. I felt I was proficient perhaps after 15, 20 cases.

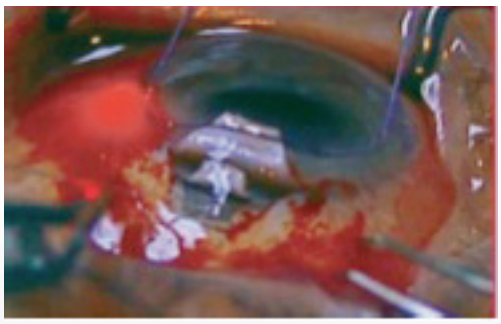
Q: What training did you participate in to prepare for doing Canaloplasty?

Cantor: We did a wet lab here; iScience set up a microsurgical practice lab so we did some procedures in that regard first. The staff from iScience was then in the operating room when we did the first few cases. That was very helpful of them to share what they had seen and what other doctors had related to them as important things to help facilitate the procedure, such as having the appropriate depth on the dissection, and so on.

Noecker: I did a couple of wet labs and that was very helpful, especially in getting the relative depth of the anatomy. The wet labs are great because you are able to work with human tissue and are in a very controlled environment. It's important to get comfortable with the depth of the two incisions and know exactly how thick the flap is going to be. Then it really came down to doing it and repetition. It doesn't sound all that insightful, but it's really just doing it time after time and realizing what the range of variability in individuals is.

Barnebey: I took the didactic course and practiced on cadaver eyes multiple times before I did my first procedure. I remember doing my first procedure—I had practiced on a cadaver eye the night before to go over the steps and the different subtleties to the procedure, as well as reviewing some of the videotapes that iScience had made available. Then, I had a representative from iScience with me for the first five to 10 procedures.

Lewis: I was really on the ground level of this procedure and was actually one of the ones teaching the wet labs. So, I've been involved since the beginning. We developed the courses and presented the data at different meetings, so it's been a fun and rewarding project.



The iTrack™ 250A Canaloplasty Microcatheter with the lighted tip is inserted into Schlemm's canal and provides access to 360 degrees around the canal.

Q: What was your biggest difficulty in learning the procedure, and how did you overcome it?

Cantor: Finding that deep plane and being deep enough to unroof Schlemm's canal during the dissection of the deep sclerectomy, and not dissecting completely through and into the anterior chamber or anteriorly or more posteriorly and exposing large areas of uvea and choroid is really the challenge. It's not the conjunctival dissection, the superficial scleral flap dissection, passing the catheter, or the closure. It's the deep flap dissection. I think a lot of those challenges early on came from perhaps not using appropriate instruments and blades to assist with that dissection.

Noecker: I think most people are familiar with trabeculectomy—you're going to go farther interior into the cornea with your primary flap, your superficial flap. Then the second part, and probably the more stressful part for beginning surgeons, is getting used to how deep you need to be for your deep flap or the secondary flap. For me it was initially deeper than I thought or was really comfortable doing, but once you realize when you get that depth and can kind of see some hint of the choroid right beneath that, that's when you know you're at the right depth. If you get that step down, that's really what makes everything else fall into place.

Ahmed: The biggest difficulty is really appreciating the need to be fairly deep in the dissection. That sort of hurdle is important because the fear is going too deep and penetrating the eye. That fear then leads to being superficial of the dissection and therefore missing the canal. I teach residents and fellows, and we go through this same issue every year.

Q: What other common procedures in ophthalmology do you see as having a similar learning curve to Canaloplasty?

Cantor: Besides corneal surgery, probably the other one that's now been around for a while is phaco. Phacoemulsification was viewed early on as highly technically complex with a steep learning curve and very easy to cause complications. You can rupture the capsule, damage the cornea, and so on, but we see where that has led us today, it's now the dominant procedure. I learned cataract surgery through extracapsular surgery and while in practice, had to make the transition to phacoemulsification. And it was obviously well worth the learning curve, which wasn't what most of us figured it would be.

Lewis: I think cataract surgery is very similar. If you were trained in one procedure and then learned phaco, that learning curve was very, very similar.

Noecker: If you look at how ophthalmologists learn cataract surgery, no one's great at it after 10 procedures. I would say the same in terms of predictable efficacy for trabeculectomy. I think when phaco first came out, it took some people 10 years to make the jump, and if they were close to retirement they never did. I'm in an environment where I teach residents and fellows all the time. I can tell you that there's a lot of anxiety at the beginning of the academic year that the new surgeons may never learn this technique. But by the end, they're all fairly proficient at it.

Barnebey: The learning curve is in many ways similar to learning phaco. When that procedure was first introduced, there was a lot of thought in the community that it was going to be too difficult to learn, similar to the perception of Canaloplasty now.

Q: What are the benefits of Canaloplasty over other procedures?

Lewis: The advantages are that you don't have to depend on the conjunctiva for wound healing. You don't have any problems in terms of dealing with a bleb in the short or long term. You have a much easier postoperative course. You don't have to see the patient as often, and you don't have to worry about a lot of the problems associated with hypotony.

Barnebey: We are finally doing a procedure that specifically addresses where the obstruction is for outflow. So, the theoretical construct we have is that with the combination of the stent and the viscodilation of the entire Schlemm's canal, we're able to get aqueous to flow through trabecular meshwork into Schlemm's canal again. That's most likely a return back to normal physiology, which is a strong appeal, as opposed to bypassing the trabecular meshwork completely with either a trabeculectomy or a tube. Next, we have a procedure that works in the absence of creating a filtering bleb. Filtering blebs have gotten better over the years, but they still are not as predictable as we would like. They run the spectrum with both short-term and long-term complications with ocular discomfort, scarring over, and not scarring enough. Then, we end up with hypotony, developing leaks, and also occasionally becoming infected.

Cantor: The primary advantage of Canaloplasty is that we avoid creating a filtering bleb, which is the Achilles' heel of our standard glaucoma procedures, especially trabeculectomy. The source of most of our long-term complications and problems, some of which are quite serious and can lead to loss of vision, are related to bleb-associated complications. The emphasis in the new approaches to glaucoma surgery is on how we can control pressure surgically without creating a bleb. The benefits to the patients are number one: good pressure control. The results of Canaloplasty in my patients have been very, very favorable. Number two: we don't often get hypotony and some of the recovery issues that are associated with hypotony following glaucoma surgery. Also, visual recovery from surgery can be quicker.

Ahmed: The reduction of postoperative complications and the amount of time spent dealing with potential issues. I'm talking specifically about hypotony and shallow chamber complications and also wound-healing issues. With Canaloplasty, these have become quite insignificant. It's also provided an earlier alternative to surgical intervention in glaucoma treatment. We had meds, laser, a huge gap, and then surgery.

Noecker: There are a number of benefits. Number one is Canaloplasty is fairly predictable—what went on in the operating room will predict the outcome. If I did a nice clean procedure where I'm happy with the size of the window and the suture tension, then that's a case that will almost always do well postoperatively. The variability in healing is also reduced, so I don't have to consider that factor in choosing what procedure to do on a patient. I don't have to worry about the bad effects of a bleb. I have never had a patient who's had problematic hypotony or any vision threatening condition postoperatively with Canaloplasty. I think a little more time in the operating room is worth the effort—I can go out of town after doing a Canaloplasty a couple days before, where you're often sometimes leery of doing that after other glaucoma procedures.

Q: What is the effectiveness of Canaloplasty?

Barnebey: The outcomes have been excellent, and for many people, the postoperative course is much smoother. Our results, which we're intending on putting together for publication, show that the numbers are comparable to a trabeculectomy. We're getting pressures in the low teen range without the use of adjunctive medication. That's very, very positive.

Lewis: I have to say the vast majority is successful. I've had a couple that have failed, and I'm not quite sure why. But for the most part, I've been very happy with it. I presented data from a multicenter study (See Table 1) at AAO 2008 that showed sustained IOP and medication reduction and a good safety profile (See Table 2).

Table 1. Multicenter Study: 24-Month Updated Results[1]

	N	IOP	P-value	Meds
Baseline	165	23.9	----	1.9
6 Months	104	15.7	<.0001	0.4
12 Months	119	15.7	<.0001	0.5
24 Months	101	15.5	<.0001	0.5

Table 2. Canaloplasty–Safety[1]

Postoperative Complications of Note	
Choroidal Effusion	0.5%
Hypotony	0.5%
Hyphema	2.3%

Ahmed: Our data includes over 150 patients, both with straight Canaloplasty and those with combined procedures. We're finding that on average, we're getting very close to similar pressure reductions to trabeculectomy. Our average pressures are hovering in the low teen level—numbers very similar to trabeculectomy.

Noecker: It's realistic to get patients off medications and their pressures down to the mid to low teens more often than not. When they start at higher pressures they may not get as low, but we can be successful in reducing their pressures significantly.

Q: Do you have any tips for surgeons beginning to do Canaloplasty?

Barnebey: It's no different than learning how to do a phaco. I think if somebody has some experience doing standard glaucoma procedures and understand how to handle the tissues and postoperative issues that come up after trabeculectomy, they can, with a little bit of work, transition into Canaloplasty. It does take a little work and having a good mentor who can teach them how to work through some of these issues.

I think the whole procedure, becoming facile with it, is a whole string of pearls. It's not any one particular "ah-ha," but rather building on things. For example, do Canaloplasty under a local block. Some people do them as a topical. I like having the eye immobile. I also do a traction suture, which has a gap in the *continued*

center, and the traction suture, which I place in clear cornea, allows me to hold back the superficial flap. It serves two functions, one as an extra hand to hold the superficial flap back, but also to rotate the eye down.

Cantor: A very small bevel-up blade for creating that deep sclerectomy helps achieve a proper depth, and then maintain that depth throughout the dissection. Early on, I was trying to use the same instruments and blades I would use for trabeculectomy. It's not as easy to maintain consistency in the flap development with those blades as it is with something like a 1-mm bevel-up Grieshaber or a small spatula blade. I think learning to use the right instruments, finding the plane, and staying in that plane are really critical. Passing the microcatheter into Schlemm's canal is actually one of the easiest parts of the procedure if you do a proper dissection and expose the canal.

Noecker: It's like learning any new eye procedure and really thinking about what each step does in terms of the next set-up. After getting nice sharp edges on that deep dissection, you'll easily find the plane of Schlemm's canal, and that makes the window easy to find. You want to make it as big as you feel comfortable with and take the time to do. Also, I like to keep the pressure high before I hit Schlemm's canal.

Q: What is your patient selection process for Canaloplasty?

Barnebey: Well, initially we were pretty selective with patients, and as the experience grew and my confidence in the procedure grew, it basically did a 180—now I consider every single patient a candidate for a Canaloplasty unless there's a particular reason not to do it. And the only reasons that I've seen not to do it would be people who have had a prior trabeculectomy that has failed or people with neovascular glaucoma or a lot of scarring so the angle is narrow.

Ahmed: For the vast majority of patients with open-angle glaucoma, Canaloplasty has become my procedure of choice. We do need an open angle—patients with a very narrow angle are not good candidates. For patients who need a very low pressure, in the single digits, I will typically do a trabeculectomy.

Cantor: The spectrum of glaucoma is so broad that one size could never fit all. I think we need different procedures for different circumstances, patients, and stages of disease, and Canaloplasty offers an option. I have been doing Canaloplasty in more patients with early to moderate stages of damage from glaucoma, and I've also been using it a lot in combined glaucoma and cataract procedures—especially those with mild to moderate amounts of damage. Patients who have far advanced disease and are on four medications, I think we still need to put a hole in the eye. But in others, I feel very comfortable utilizing Canaloplasty. And as I've utilized it more, my patient selection is becoming a little broader as well, as we've had good success with the procedure.

Noecker: I think a patient with mild to moderate glaucoma on medical therapy, who has not had surgery other than say cataract surgery, and has a nice open angle is an ideal candidate. Patients where any risk of hypotony is unacceptable are also those for whom I seriously consider Canaloplasty. Also, Canaloplasty is very well tolerated with cataract surgery.

Lewis: I try to do Canaloplasty most of the time. However, if there's a previous angle surgery, I won't attempt it. If someone had a previous glaucoma operation, I may or may not offer Canaloplasty. I may try it, but if I can't get there I'll convert to a different procedure. I prefer not having a bleb and a procedure that isn't dependent on the healing of the conjunctiva.

Q: What final advice do you have for surgeons considering adopting Canaloplasty?

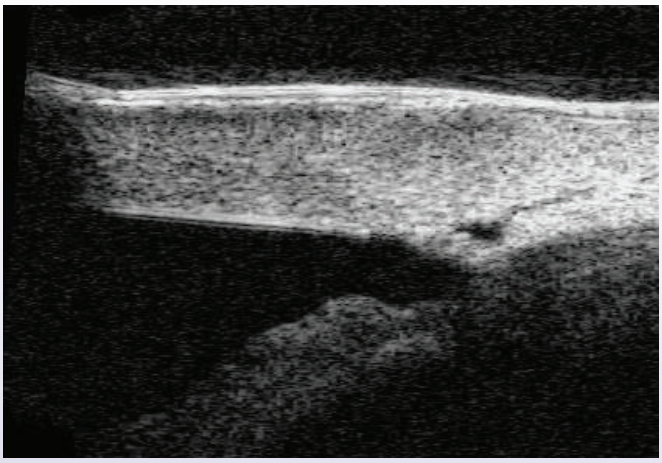
Barnebey: I think the biggest piece of advice I would share is the importance of making a commitment. For somebody who is completely happy with trabeculectomy and everything is working well, it may be a challenge for them to make a commitment to a newer procedure, which, in some ways, is a little bit more demanding. On the other hand, if people want to do something differently, and in my opinion, better, then it's important that to make a commitment and stay the course. It's important to understand that there'll be some challenges along the way, similar to a phaco, until they acquire the skill set. So a commitment needs to be made for at least 15 or 20 cases.

Lewis: I think that they need to take the course. They need to be well trained and anticipate the learning curve and know that it is worth learning the procedure. It's like any procedure, the more you do, the better you are at it.

Noecker: I think there are some key steps and you have to have some surgical skill, but I think most surgeons who do whatever type of surgery are more than capable of doing Canaloplasty. The other thing I've seen is my operating times have dropped, probably by 50% because I've learned from other surgeons various techniques, like suturing the canal.

Ahmed: I really look at Canaloplasty as an intervention for patients that I would potentially go to earlier than I would traditional surgery. There are a lot of patients in that gray area that you would like to do surgery, but their surgical risks are too high. Potentially they may be at higher risk for progression. Or if they have progression, we may be uncertain about the pros and cons of surgery.

Cantor: The first thing they should do is find an opportunity to practice the procedure in a wet lab. From working with practice eyes on a wet lab, you can refresh your memory of the anatomy and see what it looks like in a simulated practice environment. They'll learn that it's not as difficult as they might have envisioned. Not that this is an easy procedure, but they will learn it's not as difficult as they think, and that they do already possess the technical skills as a surgeon to perform this procedure. There are no new skills you need to learn—they are all skills that we use pieces of in other surgical procedures.



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The next thing is to select patients for your first few cases who you don't believe will pose any significant challenges. You want primary surgical eyes that aren't going to have a lot of conjunctival scarring, but not an eye that might have unusual anatomy such as like a high hyperope or high myope. You want someone whose glaucoma is not far advanced, but more in the mild to moderate range.

Third would be to have an experienced colleague with you for your first cases. But if not, the staff at iScience is very knowledgeable and will come and provide support, ultrasound, and anything that's necessary. They will even supply the appropriate instruments for your first few cases so that you optimize the environment that you're operating in and are using instruments that are perhaps more suited for this type of surgery than other instruments that you would use.

1. Lewis RA. Canaloplasty: a safe and effective alternative to trabeculectomy. Presented at American Academy of Ophthalmology Conference; 2008 Nov 8-11; Atlanta, Ga.

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