

Retina Surgery Fundamentals

Tips from Wills Eye attendings.

WITH SUNIR J. GARG, MD; OMESH GUPTA, MD, MBA; AND JASON HSU, MD

Toward the beginning of the academic year, residents are either starting their journey in ophthalmology in earnest or taking on new responsibilities. Likewise, newly minted retina fellows are sharpening their focus and developing skill sets different from those that had served them well in residency. Senior retina fellows are honing their office-based and surgical skills and starting to think about going out on their own in a short time. In our highly technical field, many elements of what we do require substantial proficiency and finesse, but everything we learn is based on the bedrock of certain OR fundamentals. Some of these we learned as medical students on our basic surgery clerkships, while others are particular to ocular microsurgery and have been honed during residency. Finally, many maneuvers are unique to retinal surgery and must be developed during fellowship training and beyond. We interviewed some of our attendings to get their perspective on OR fundamentals for vitreoretinal surgery. We hope these pointers might be either an introduction, if you are new to vitreoretinal surgery, or perhaps an opportunity to reflect on what is second nature if you are an experienced surgeon.



— Christopher Brady, MD

DO YOU HAVE ANY PARTICULAR WAY YOU LIKE TO PREPARE FOR THE OR?

Sunir J. Garg, MD: There are 2 things that help me prepare for my day in the OR. The first is mental preparation. Something as simple as scrubbing often gives me a few minutes before surgery to collect my thoughts and allows me to focus on the surgery at hand and deemphasize the other things that may be going on around me. The second thing I do is try to keep myself physically healthy. Spending long days in the OR is physically exhausting. Our equipment and posture in the OR can also be very taxing on our bodies. A regular exercise regimen to me is critical. When I don't exercise regularly (specifically when I do not do yoga for more than a few days), my lower back starts to bother me. This is a constant reminder of how important it is to stay in good physical shape to be able to do our jobs.

Omesh Gupta, MD, MBA: I require mental and physical preparation prior to long days in the OR. The physical preparation is more often overlooked than the mental. This is particularly true for those of us recently out of fellowship. Whether relocating, moving into a new house, or having young children, your exercise regimen usually suffers.

I also make it a habit to review all the cases before the day I operate. I try to write special notes and reminders to

myself on the chart the day I sign the patient up for surgery. Then, when I review the patient chart the day before surgery, I remind myself of these nuances before each case. I also make sure my difficult cases are scheduled earlier in the day. From a physical standpoint, I am more alert, and I find myself thinking about a difficult case throughout the day if it is scheduled near the end of the day.

Jason Hsu, MD: When possible, a good night's sleep is essential for me. Surgery can be grueling some days and it's critical to be able to keep a sharp focus and steady concentration. Also, don't forget the importance of a good, healthy breakfast. On busy OR days, this is especially true. Hypoglycemia, dehydration, and a growling stomach are not generally beneficial to mental fortitude.

DO YOU HAVE TIPS ON HOW TO BEST POSITION PATIENTS FOR VITREORETINAL SURGERY?

Dr. Garg: The most important thing for me is to bring the patient as close to the head of the bed as possible. I basically want the crown of the head up against my abdomen. This allows me to sit straighter at the microscope and dramatically reduces fatigue. I also like to sit low to the ground. When I'm sitting in the chair with my feet on the foot pedals, I like my knees to be bent at a 90° angle, as this reduces stress on my back and ankles.

In order to position the patient most effectively, I imagine myself sitting in my chair with my feet on the pedals, with my knees appropriately bent. I then bring the microscope in so that I am sitting upright with my head neutral. I then imagine myself wheeling the patient into position. This is the most effective way I have of keeping my body neutral during surgery.

Dr. Gupta: Maintaining ideal positioning can be a challenge when special situations arise. Patients with severe kyphosis or other neck issues can be made comfortable, and the rest of the body can be placed in reverse Trendelenberg. This may appear very awkward, but often patients can be very comfortable even for a lengthy surgery. Obese patients are also uncomfortable laying flat. Again, position the head appropriately, but in this case place the rest of the body in Trendelenberg. This alleviates thoracic and abdominal pressure that otherwise could cause uncomfortable back stress or breathing difficulty.

If comfortable positioning cannot be maintained with sedation, I would not hesitate to suggest general anesthesia. The majority of the cases that we perform can be accomplished with minimal sedation. In some cases, general anesthesia can actually allow a shorter operating time compared with local anesthesia with sedation, especially if the patient is uncomfortable.

Dr. Hsu: Positioning is critical for vitreoretinal surgery, even for shorter cases. The first task is to have the patient in an optimal position that will allow performance of safe and comfortable surgery. I prefer the patient's head to be fairly flat, if not slightly chin-up. The cases where the patient ends up chin-down are the ones where I'm cursing in my mind. A flat or chin-up position typically allows the best comfort and visualization during the procedure and is especially critical for patients with deep-set eyes or high brows.

Before I start operating, I like to make sure I'm in good position also. The height of the bed should be adjusted so that the wrists and hands feel natural on the wrist rest and patient's forehead. Next, it's important to adjust the chair height and microscope in order to make sure your back and legs are comfortable. No slouching!

DO YOU HAVE ANY PARTICULAR WAY YOU LIKE THE PATIENT TO BE PREPPED?

Dr. Garg: I often prep my own patients. No one is going to be as meticulous about the application of povidone-iodine as I will. As the patient starts to drift off to sleep before I do the block, I put tetracaine in each eye. I then administer the block. After that, I douse the eye with povidone-iodine, and I deliberately pull the eyelids

in various directions in order to get the drops into all the nooks and crannies. I apply povidone-iodine to the eyelashes at this point, prior to the standard prep. This gives a few additional minutes of contact time prior to the official prep of the eye. This helps to ensure that the most important parts of the eye are adequately sterilized.

Dr. Gupta: The duration of povidone-iodine contact is critical. I try to place povidone-iodine or ensure that somebody places it in the eye as soon as the patient arrives to the operating room. By the time the patient is appropriately positioned, the table and equipment are set up, and the rest of the eye is prepped and draped, the initial drops have fully taken effect. I also make sure that there is adequate retraction of the lids when draping. Tincture of benzoin offers additional adherence of the drape to the surrounding skin to adequately retract the lids away from the surgical field. It is important to allow enough time for the benzoin to dry and the draping of the patient will be consistently good. If there are lashes still near the field despite these efforts, I will often pluck lashes with forceps that are placed off the sterile field or place a Tegaderm (3M) dressing over the area.

Dr. Hsu: There's no question that povidone-iodine is the most important factor in preventing endophthalmitis. I am liberal about applying it topically in and around the eye. I think at least 5% povidone-iodine is essential, but 10% may be even better at eradicating bacteria more quickly. Once the eye is prepped, draping is also important to maintain a sterile field. I hate having eyelashes sticking out near the cannulas where the instruments go in and out. If you have a "squeezer" or someone with deep-set eyes, have an assistant use the backs of 2 cotton tip applicators to hold the upper and lower lid while the drape is placed. If the drape is on but the eyelashes are exposed, I will often use a Tegaderm dressing and place this directly over the eye while an assistant retract the lids using another set of cotton tip applicators. This will invariably solve the eyelash issue.

HOW DO YOU LIKE TO POSITION AND PLACE YOUR VITRECTOMY CANNULAS?

Dr. Garg: I place my inferotemporal port closer to the 6-o'clock position rather than closer to the horizontal position. When the infusion line is placed closer to the horizontal, it forces the other 2 ports to go more toward the 12-o'clock position than I would like. I like the other 2 sclerotomies to be near the horizontal median.

Dr. Gupta: My positioning sometimes depends on the type of case. For patients with superior pathology, I often place the sclerotomies at the 3-o'clock and 9-o'clock

positions. It allows for easier torqueing of instruments to address the superior pathology. I also pay attention to the position of the infusion cannula. Even with the most modern vitrectomy machines, the jet of the infusion can easily be aimed at the optic nerve and/or macula. This is particularly noticeable when performing an air-fluid exchange. Some machines allow changing the settings to minimize the force of the infusion stream.

Dr. Hsu: In this age of small-gauge vitrectomy, the key to a self-sealing incision is technique. I prefer a very flat approach to insertion of the trocars. Once the blade reaches the cannula, I try to lift up only 30° to 45° to push the cannula into the eye. However, I tend to make a shorter scleral tunnel with the inferotemporal infusion port by not necessarily pushing the trocar all the way to the cannula and lifting up 90° to insert the cannula into the eye. I have seen several cases with long scleral tunnels leading to the infusion cannula popping into the choroidal space and causing a choroidal detachment. I would rather suture a sclerotomy than deal with a choroidal. In terms of placement, I'm most particular about the locations of the superonasal and superotemporal cannulas. For most macular cases, such as holes and puckers, I like these cannulas to be more toward 10 and 2 o'clock. Placing these cannulas too horizontal can be uncomfortable when trying to peel, particularly if your dominant hand is encountering a large nasal bridge. For retinal detachments, however, I think it is more important to place the cannulas just above 3 and 9 o'clock so that you're not handicapping yourself when trying to treat superior pathology.

WHAT IS THE BEST WAY TO HOLD VITRECTOMY INSTRUMENTS?

Dr. Garg: Holding instruments is easy, once the rest of your body is in appropriate position. After I have seated myself comfortably at the microscope, I allow my arms to hang down at my side. I then try to have my upper arm weight supported passively at my shoulder girdle as well as at my wrists/palms as they rest on the patient's forehead. There is then very little weight transferred to my fingers. When I am teaching fellows, I encourage them to imagine their hands like 2 pieces of clay that passively rest on a surface (the patient's head) and slowly mold themselves to that surface. That enables the fine muscles in my hand to focus on dexterous movements and not on weight support. I also do not hold my instruments like a pencil. Instead, I imagine myself holding my thumb and index finger together and make a circle with my hand similar to the way I would hold a bottle I was drinking from. I then hold the instrument between my fingers with enough tension on it to actuate it and stop it from slipping but not

firmly enough to crush it. The plastic is already inanimate, so there is no need to choke it to death.

Dr. Gupta: I encourage all beginning surgeons to carry around a vitrector probe and pair of forceps in their hands and try to spin them around. At the end of any case, the vitrector tip can be cut off from the tubing. Spinning it around in your right and left hand creates muscle memory and a level of comfort that you will need in the OR.

Dr. Hsu: The best advice I received when I first started performing vitrectomies was to relax. It's also probably the most difficult advice to carry out as a beginning surgeon. When your hands are clamped down like vises, your fine muscle control is gone. For microsurgery, you absolutely need fine muscle control. I find that keeping your shoulders down, wrists well-supported, and hands relaxed makes surgery much easier and much more precise. Also, any tremor seems to be accentuated by gripping too strongly.

HOW DO YOU USE YOUR INSTRUMENTS TO ACHIEVE IDEAL ILLUMINATION?

Dr. Garg: When starting out with surgery, your illumination should move in tandem with your vitrectomy port. You also want to have the light focused on where you are and where you are going, and not where you have been. Again, holding the light pipe as I would a bottle rather than as a pencil also gives me more degrees of freedom in the eye. Tangential illumination is often overlooked and can be very helpful particularly when trimming the vitreous skirt. My former fellows may wake up in sweats when they hear me say the words "Drive the BIOM" (which I heard numerous times from my attending, Carl Park, MD). I encourage my fellows to make many fine movements with the scope to keep things in focus.

Dr. Gupta: I often find that it is much easier to identify and cut vitreous on the same side of the eye that the light source is introduced. This cannot be accomplished in patients who are phakic because you cannot cross the eye with the vitrector, but it should be performed in all patients who are pseudophakic. The position of the scope is often overlooked when the beginning surgeon is trying to visualize while operating. I tell our fellows that the scope pedal is the most important element to pay attention to when learning how to operate. It is natural to focus on the vitrector or forceps, but, if your scope is positioned properly and illumination is adequate, everything else falls into place.

Dr. Hsu: With wide-angle illumination and xenon light sources, there is actually more room for error, leading to occasional sloppiness. Typically, I can tell when a trainee

has mastered vitrectomy by whether he or she is able to keep the vitreous near the cutter well-illuminated most of the time while still being able to keep the retina just behind the cutter evenly lit. Most beginning surgeons have the most difficulty with illuminating the side of the retina on which the endoilluminator is focused. For instance, if the endoilluminator is in the temporal port, many initially have trouble keeping the temporal retina well lit. The most important tip in this circumstance is holding the instrument very vertically. In pseudophakic eyes, I tend to bring the endoilluminator closer to the cutter at most times to provide better tangential lighting of the vitreous. Phakic eyes can be tough, particularly when trying to shave gel on the same side on which the cutter is inserted. Often, it is challenging to achieve the same tangential lighting on this side because the endoilluminator cannot cross too far without risking damage to the crystalline lens. In these circumstances, I sometimes need to pull the light pipe back near the port and rely on more diffuse illumination.

DO YOU HAVE ANY POINTERS ON FINISHING VITREORETINAL SURGERY IN TERMS OF CLOSING THE VITRECTOMY PORTS?

Dr. Garg: When in doubt, use a stitch. I had the pleasure to be present during the transition to small-gauge vitrectomy. All the cases I performed in the first year of my fellowship were 20-gauge sutured cases before we transitioned to 25-gauge. Nobody thought twice about throwing stitches during 20-gauge vitrectomy, but somehow it seems to be anathema in 25-gauge vitrectomy. I have never regretted placing a stitch; rather, I have regretted not placing a stitch.

Dr. Gupta: Cut down the conjunctiva overlying the sclerotomy if you cannot clearly see the sclerotomy with the conjunctiva intact. I often perform an air-fluid exchange prior to the end of the case. I do this for a variety of reasons, but 1 benefit is the easy detection of an incompetent wound due to air bubbling under the conjunctiva. If you are planning to place sutures before you remove the cannulas, then you can throw the suture and feel the cannula with the needle. As you pull out the cannula, you can finish the throw. This works nicely, and I often use this technique in eyes that I fill with oil.

Dr. Hsu: The key to a good closure is usually a good opening. I cannot stress enough the importance of wound construction at the beginning in order to optimize the chances of a sutureless closure. I like to massage over the site of the scleral tunnel immediately as the cannula is being removed. I'm also a big fan of 25-gauge over 23-gauge surgery because my experience has been that 25-gauge

incisions self-seal better. If the patient is left with fluid in the eye, any evidence of bleb formation is a strong indication for a suture. Gas or air-filled eyes can be checked by sprinkling balanced salt solution over the sclerotomy site and looking for bubbling. I have a low threshold for suturing.

Another major rookie mistake I see with closures is letting gas or air-filled eyes become hypotonous for too long. This can lead to choroidals and even hyphema due to hemorrhage from Schlemm canal. My usual technique is to remove 1 of the superior ports first while still under air infusion. If this is leaking, I can place my suture and be done with that site. Next, I inject the gas while venting the remaining superior port. This cannula is then removed, and I try to normalize the intraocular pressure (IOP). If this site is leaking, I have my suture on hand to close it quickly and pump up the eye. Finally, the infusion cannula is removed and the site sutured if leaking. I always put a 30-gauge needle on the gas syringe as soon as the cannula is removed so I'm ready to inject additional gas if needed.

If I am leaving the eye air-filled, the process is much simpler; I remove 1 superior port first and suture if leaking, then remove the second superior port and again suture if leaking. After removing the infusion cannula, I quickly assess for a leak and suture when necessary. A neat trick to normalize the IOP at this point is to place a 25- to 30-gauge needle on the end of the air infusion tubing and insert it through the pars plana. This should ensure that the eye pressure remains stable. ■

Sunir J. Garg, MD, is an Assistant Professor of Ophthalmology at Thomas Jefferson University Retina Service and Wills Eye Hospital in Philadelphia. He is in practice at Mid Atlantic Retina Consultants with locations in Pennsylvania and New Jersey. He may be reached at sunirgarg@yahoo.com.



Omesh P. Gupta, MD, MBA, is an Associate with Mid Atlantic Retina. He may be reached at ogupta1@gmail.com.



Jason Hsu, MD, is with Mid Atlantic Retina. He is a Clinical Instructor of Ophthalmology at Thomas Jefferson University in Philadelphia and is an Attending Vitreoretinal Surgeon at the Wills Eye Institute.



Christopher Brady, MD; Mike Dollin, MD; and John D. Pitcher III, MD, are second-year vitreoretinal fellows at Wills Eye Institute in Philadelphia, PA, and members of the Retina Today Editorial Board. Dr. Brady may be reached at christopherjbrady@gmail.com; Dr. Dollin may be reached at mike.dollin@gmail.com; and Dr. Pitcher may be reached at johndpitcher@gmail.com.