Surgical Pearls for the Beginning Vitreoretinal Fellow

BY ALOK S. BANSAL, MD; NIKOLAS LONDON, MD; AND ANDRE WITKIN, MD

Vitreoretinal surgery undoubtedly has a steep learning curve—one that requires awareness, technical skill, and humility. At the beginning of this academic year, retina fellows across the country are immersing themselves in a unique training environment. As we traverse this long and rewarding road, we asked advice from senior retina attendings who regularly teach fellows vitreoretinal surgery to offer their insights into the most common pitfalls encountered by retina surgeons in training.

What are the most common mistakes retina fellows make when learning scleral buckling? What advice do you have for safely draining subretinal fluid?

William Benson, MD, FACS: The first and most important mistake fellows make is inadequate localization of the retinal breaks, which thereby causes improper placement of the sutures to secure the band. The best way I know to hone this skill is by repetition and practice. I always check and recheck marking the break to ensure that I have it just right. The second mistake is that fellows tend to pull the encircling band too tight, causing too much buckle height. All that is needed is about 1 mm to 1.5 mm of buckle height. Commonly, fellows tend to pull the band very tight and raise the intraocular pressure (IOP) extremely high. All you need to do is to tighten the band just enough to raise the IOP a little, drain the fluid, then pull up the band about 10 mm through the suture. The third most common mistake young retina surgeons make is insufficient or unsafe drainage of subretinal fluid. To minimize complications during drainage, it is best to avoid the vortex veins and long ciliary arteries and not to drain too posteriorly. Next, when cutting down to the choroid, it is important to ensure all the scleral fibers are cut through to the choroid, allowing penetration of the subretinal space with a small needle. If there are remaining scleral fibers, the result is either an insufficient drain or the requirement of a larger needle, which raises the chance of subretinal hemorrhage.

Jason Hsu, MD: The toughest question in some cases is whether or not you really need to drain the subretinal fluid. Perhaps the one situation in which I feel most strongly about drainage is with inferior detachments, where the patient is not going to be able to appropriately position to keep the gas against the break(s). Chronic retinal detachments are another situation when I will consider drainage, as the subretinal fluid becomes like molasses and can persist for weeks to months when not drained. I also try to gauge the size of the anterior chamber (AC) to figure out how much of an AC tap I can get. If a patient has a fairly small AC, I know it's going to be nearly impossible to pull up the buckle and inject gas without skyrocketing the IOP to 100 mm Hg. In these cases, strongly consider drainage as well.

As with most vitreoretinal surgery, it is important to have a good plan and to always be prepared. I like to think ahead and try to identify a good location to drain subretinal fluid during my initial exam prior to performing cryotherapy. You want to avoid draining directly under the breaks, as this could lead to removal of liquefied vitreous without enough drainage of the subretinal fluid, as well as potential vitreous incarceration. Once I have identified a suitable drainage site, I prefer to cut down the sclera at the level of the buckle so that it will be covered and supported. I generally use a No. 57 blade until I just start to see the choroid. Diathermy is key in my opinion to avoiding subretinal hemorrhage especially in macula-off cases. Before entering the subretinal space, it's important to make sure you're set to go with either a syringe of saline solution or pure gas to repressurize the globe if necessary. After I punch through into the subretinal space with a small needle, I like to initially keep the

globe pressurized by using cotton tip applicators and applying pressure in areas posterior to the drainage site so as to avoid potential retinal incarceration. Often, you will see efflux of some pigment in the fluid when the drainage is nearly complete. At this point, I pull up the buckle and if necessary inject some balanced salt solution or gas to help normalize the IOP. It's important to avoid hypotony as much as possible during the drainage to lower the risk of choroidal hemorrhage.

What are the most common mistakes you see retina fellows make when learning vitrectomy? Given the plethora of instruments to master (foot pedals, microscope, bimanual instruments, vitrectomy machine), what advice do you have for optimizing efficiency in the operating room early in learning vitrectomy?

Dr. Hsu: Visualization is the critical step in learning to perform vitrectomy. Beginning retinal surgeons are often plagued by the difficulty of keeping the microscope centered and at the appropriate distance from the eye to keep the view optimal. Always make sure to zero out the settings before starting; most scopes will have a "center" button. This will minimize the situation where you're operating and reach the limit of the microscope excursion. When trying to stay centered during vitrectomy, there's a tendency early on to overdrive the scope. By minimizing how much you move the eye, you can also minimize how much you have to move the scope around. Especially with wide angle viewing systems such as the Binocular Indirect Ophthalmo Microscope (Oculus, Wetzlar, Germany), you can often manage a very good core vitrectomy without tilting the eye much. Along this line, it is also critical to learn proper adjustment of your viewing system. For the BIOM, it's important to "fill the lens" with the image of the fundus by adjusting the distance from the eye appropriately. I always encourage fellows to adjust the focus at the start of the case by zooming in on the optic disc. With good visualization, you'll be more efficient at identifying vitreous and other pathology, which will speed the case along. When the view is lost due to poor tracking with the microscope, it's important to immediately stop cutting, hold still with your hands, and adjust the scope. As fellows progress, one key indicator of proficiency is how smoothly they are able to move their hands and the scope simultaneously to always keep optimal visualization.

Second, remember that the cutter is not a magic wand. Waving it around in the eye does not efficiently remove vitreous. When fellows are first learning to do core vitrectomy, there is a tendency to stay still in the center of the eye without effectively attacking the edge of the hyaloid. However, somewhere soon after that stage, many start to think the core vitrectomy will go faster if they move the cutter around more quickly. This is often not the case. It is more important to learn good illumination so that you can visualize the gel. Once you've developed this skill, then the next step is to keep the cutter engaged in gel at all times.

Finally, don't tense up and don't rush. Death-gripping instruments severely decreases your fine motor abilities. It's important to get comfortable—adjust your chair height and microscope level to keep a good posture. Get in focus before you start cutting. I think there's the impression that if you don't move quickly enough, the attending is going to take over. But without these preparations, you are more likely to get into trouble and have the attending switch with you sooner.

Joseph Maguire, MD: I think the first most common mistake made by fellows is not knowing or reviewing the mechanics of the vitrectomy machine or microscope prior to beginning the surgery. When first learning vitrectomy, it's sensory overload—you have to control foot pedals on both feet, hold instruments in both hands, and look through an operating microscope with an inverting system; not to mention mastering a complex vitrectomy machine with many subroutines. On top of all that, you are foremost concerned about taking care of a patients eye and trying not to cause any harm. Prior to even operating, I recommend all of my fellows spend time in the wet lab, go to an empty operating room and familiarize themselves with the pedals and microscope, and also chat with the nurses on how to troubleshoot the machine. Another important point is to always zero the microscope and adjust your pupillary distance as soon as you sit down in the surgeon's chair.

The second most common thing I see fellows struggle with is poor illumination within the eye. In other words, the light pipe is going one way, and the instrument is directed the other way. The light pipe should always lead your active instrument as much as possible, and the active instrument should be within the center of circle of the light illumination.

Lastly, young retina surgeons in training are appropriately over-cautious. This tends to cause inefficiency and wasted movements within the eye. Due to poor illumination, fellows have a tendency to move fluid, rather than cutting vitreous gel. When performing an efficient core vitrectomy, I always tell my fellows, "movement equals error." It is critical to stay in one place and remove all the gel in one area before systematically proceeding to the next area. It is critical to avoid dragging your instruments

through vitreous gel, so I recommend working superiorly around your sclerotomies first, then proceeding inferiorly in a systematic fashion.

Diabetic vitrectomy and traction retinal detachment are among the most challenging surgeries to master in fellowship. What tips do you have for the young retina surgeon regarding your approach to these cases?

Dr. Hsu: First, I'm a fan of preoperative intravitreal bevacizumab (Avastin, Genentech) 3 to 5 days prior to a scheduled pars plana vitrectomy. This technique often dramatically decreases the amount of intraoperative hemorrhage and allows relatively easier delamination of the membranes. One concern is that these patients are among the sickest we treat, and so the cases are often cancelled or rescheduled at the last minute. The concern with preoperative bevacizumab is that it can worsen the tractional detachment, particularly when surgery is delayed. Therefore, I now make sure my schedulers have received all the patients' preoperative clearance paperwork from their cardiologists or primary care physicians before scheduling surgery and the visit prior to the surgery for the bevacizumab injection.

Controlling hemorrhage during these cases is very important, as uncontrolled hemorrhage can complicate the case dramatically by limiting visualization. It's important to be ready to increase IOP when necessary and have diathermy (with a good tip) ready at all times.

More than with most surgeries, it's important to watch the duration of the case and perfusion status because these patients will often not be able to tolerate high IOP or tamponade levels for long due to their underlying vascular compromise. It's therefore important to work efficiently to achieve the surgical goals. Ideally, this is relief of all traction (whether anterior-posterior or tangential). I tend to visualize what membranes are going to most affect the macula and get to these first. Nasal membranes are my last priority as they often have little bearing on the macular outcome (although I do like to relieve as much traction as I can safely in order to minimize recurrent vitreous hemorrhage in the future). Beside aiming for a good anatomical outcome, you constantly have to ask yourself what are the risks and benefits of each step. If the risks outweigh the benefits, just don't do it. Remember that the functional outcome for the patient far outweighs a good anatomic outcome.

Dr. Maguire: When faced with a complicated diabetic traction retinal detachment with vitreous hemorrhage, I always tell my fellows to never attack the blood directly because you never know what's below it. You only want to cut and remove what you can see first and always try to work from the edges inward. Like uncomplicated core vitrectomy, I like to start superiorly with dense vitreous hemorrhage because, in case you cause an inadvertent retinal break, superior breaks are generally easier to repair than inferior. Also, often, just by removing the superior and core vitreous, inferior vitreous hemorrhage will come to you rather than you having to go after it.

Another key intraoperative sign to use is to see how the vitreous gel is reacting to your cutter—if it is undulating freely, you know it's not tethered to retina and you're likely safe to keep cutting. However, if the gel appears tight and static, you know it must be attached to either a neovascularization, a fibrotic peg, or the retina. When this is encountered, move to a different area where the gel is not as adherent. The optic nerve is an important landmark that can allow you to gain access to the macula to remove preretinal membranes. Often, by inducing a posterior vitreous separation, either with the cutter or by removing condensed vitreous with forceps, you can then proceed to more adherent areas of traction.

Lastly, diabetic traction retinal detachments are complex and, if not undertaken in a systematic fashion, can lead to many iatrogenic complications. I cannot stress enough how critical it is to be patient in identifying bridging membranes and fibrous pegs. One of the most challenging aspects in these cases is to know when to say "when." Often, perfection is indeed the enemy of good. ■

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