Supplement to

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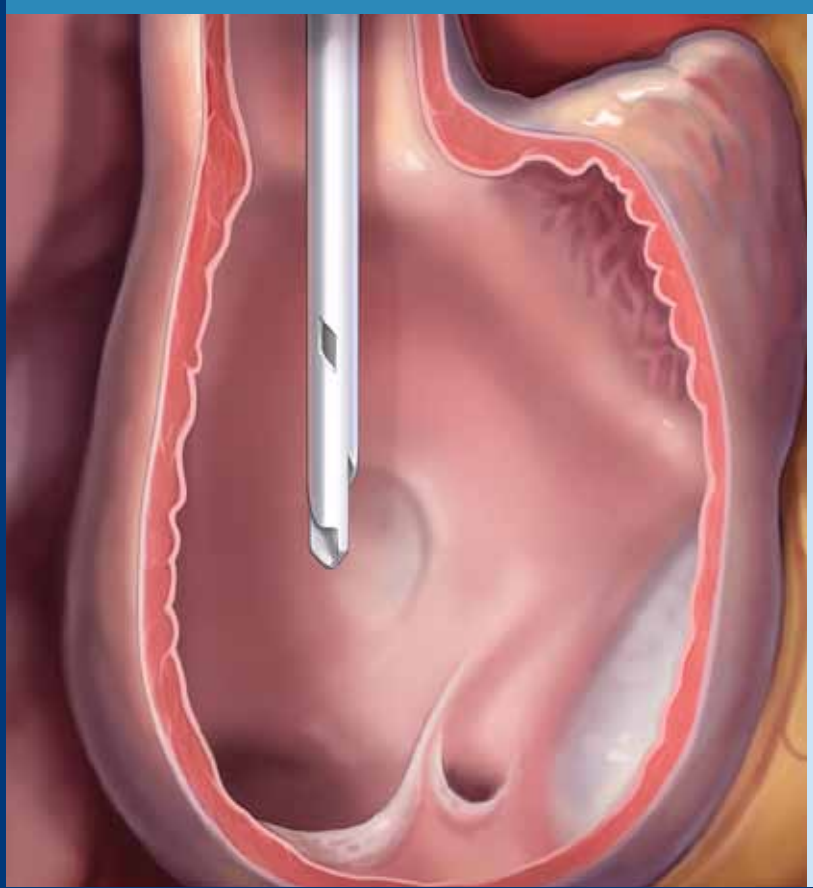
Endovascular TODAY

June 2012

OPTIMIZING HEMODIALYSIS CATHETER USE



An expert roundtable discussion sharing candid opinions on ideal catheter placement, maintenance, and removal.

Finding Consensus Despite Challenge

Our frequent use of hemodialysis catheters remains a paradoxical problem; few knowledgeable clinicians like them, but all of us use them. This dilemma and other pertinent topics related to hemodialysis catheters were recently discussed by a panel of expert clinicians, and their dialogue is presented in this supplemental issue of *Endovascular Today*. The participants in this discussion are highly regarded experts in vascular access for hemodialysis, including representatives from nephrology, vascular surgery, interventional radiology, and nursing.

Consensus was easy. The panelists agreed that the fundamental problem is our inability to create autogenous fistulas at the appropriate time in the predialysis patient. The current solution to this problem is, unfortunately, urgent or emergent placement of a hemodialysis catheter. The panelists debated causes and solutions, but all agreed that this is a multifactorial, systemic problem that will not soon be resolved.

The expert discussants also agreed that the current generation of hemodialysis catheters continues to be plagued by both early and late catheter failure. The etiologies of catheter failure were discussed, including poor insertion technique, suboptimal positioning of the catheter tip, and fibrin sheath formation. And, consequences of prolonged catheter use such as central venous stenosis stimulated a lively discussion among the panelists.

I hope that this roundtable discussion is interesting, educational, and provides new perspectives regarding the use of hemodialysis catheters in your patients.

Thomas Vesely, MD
Moderator

Optimizing Hemodialysis Catheter Use

Roundtable Participants

Thomas Vesely, MD, (Moderator) is an interventional radiologist working at the Vascular Access Center in St. Louis, Missouri. He is President of the Vascular Access Society of the Americas and a member of the Board of Directors of the Association for Vascular Access. Dr. Vesely discloses that he is a paid consultant to Covidien.

Stephen R. Ash, MD, is a nephrologist with Indiana University Health Arnett in Lafayette, and Medical Director of the Wellbound dialysis program. He is Director of Research and Development for HemoCleanse, Ash Access Technology, and a number of other biotechnology firms he has helped to found. Dr. Ash was cofounder of the American Society of Diagnostic and Interventional Nephrology and is a past president of the American Society for Artificial Internal Organs. Dr. Ash discloses financial interest in HemoCleanse and Ash Access Technology and that he has been compensated by *Endovascular Today* for his participation in this roundtable.

Gail M. Egan is a nurse practitioner in interventional radiology for Community Care Physicians and an Instructor of Radiology at Albany Medical College, both in Albany, New York. Ms. Egan is a past president of the Association for Vascular Access and is active in the Society of Interventional Radiology. She is the 2008 recipient of the Suzanne LaVere Herbst Award for Excellence in Vascular Access Practice. Ms. Egan discloses that she is a paid consultant to Covidien, Interrad Medical, MedComp, Genentech, AngioDynamics, Elcam Medical, and Semprus Bioscience, and receives grant/research funding from Interrad Medical.

John R. Ross, MD, is the lead surgeon at the Dialysis Access Institute at the Regional Medical Center in Orangeburg, South Carolina. Dr. Ross' program is one of 18 in the United States that has been certified by the American Society of Diagnostic and Interventional Nephrologists. He completed his medical training at the University of South Carolina, School of Medicine and has been a board-certified surgeon for 30 years. Dr. Ross was a founding member and the first Vice President of the Vascular Access Society of the Americas. He serves on the editorial boards of *The Journal of Vascular Access* as well as *Endovascular Today*. Dr. Ross' professional interests include vascular access for hemodialysis patients and the implementation of a standard, comprehensive access care program encompassing patient, physician, and ancillary staff education. Dr. Ross discloses that he is a paid consultant to Covidien.

Jack Work, MD, is Professor of Medicine, Nephrology, at Emory University in Atlanta, Georgia. Dr. Work was a cofounder and past president of the American Society of Diagnostic and Interventional Nephrology, board member and treasurer of the Vascular Access Society of the Americas, and co-chairman of the National Kidney Foundation KDOQI Vascular Access Guidelines, published in 2006. Dr. Work discloses that he is a paid consultant to Hemosphere, Shire Pharmaceutical, and Vital Access and that he has been compensated by *Endovascular Today* for his participation in this roundtable.

What are the most challenging aspects of using hemodialysis catheters today?

Dr. Ash: Three immediately come to mind. The first is proper placement of the catheter so that it will work in the first place, which has its challenges. Then, we must be able to figure out what to do if flow begins to fail in the catheter. And finally, of course, there is the problem of infection. I think they are all challenging aspects.

Dr. Ross: I agree. Catheter use comes with challenges at every juncture, even before placement. The initial challenge is that we're often trying not to use them in the first place because of the associated complications. When we do use them, placement can be very difficult because many of these patients have already had multiple catheters and multiple stenoses, and we have to be quite creative just to get it in. As Dr. Ash said, the next challenge is to keep the catheters running. Function of the catheter usually becomes complicated because of a flow issue or an infection issue, and either can be very difficult to manage.

Dr. Vesely: One of the things I ask nephrologists is, "Which is more important: catheter-related dysfunction or catheter-related infection?" Almost universally, everyone says infection.

Ms. Egan: My answer focuses on whether we deal with the most common problem or the most serious problem. I suppose you can look at it either way—the most serious problem potentially brings the highest risk for the patient. I think of infection, followed by limited access sites, and poor flow after that. Regarding the most common problem, hopefully it is simple, and you know how to deal with it. Even simple problems are not without cost, however, both in terms of lost dialysis treatments and the cost of intervention. For example, poor dialysis flow rates might be treated and improved with a simple alteplase lock, or they might require more aggressive intervention.

Dr. Vesely: I like that you brought up the topic of lost access sites. When working in the hospital, it seems that the infectious disease or critical care physicians want to remove every central venous catheter every time there is a hint of an infection. I don't know if they understand the challenges of lost access and catheter sites, but that's a really important issue.

Ms. Egan: That is true, as clinicians are often focused on managing the most immediate problems that present to them. I think changes in reimbursement for catheter-associated blood stream infections have had an impact on decision making in this area as well.

Even simple problems are not without cost, however, both in terms of lost dialysis treatments and the cost of intervention.
—Gail M. Egan

Dr. Work: The problems that have been mentioned so far are the ones that we associate with catheters in terms of creating high infection risk for the patient. But there is also an epidemic of central venous stenosis, which reduces the possibilities for long-term permanent access in the upper extremity. I would say that the most challenging problem is central vein stenosis caused by prolonged use of catheters.

Dr. Vesely: I agree that the incidence of central venous stenosis is increasing. The folks from the Fistula First Breakthrough Initiative contend that increasing fistula use has not led to a higher percentage of prevalent hemodialysis catheters. That may or may not be true, but in my opinion, the duration of catheter use seems to be much longer. When prosthetic grafts were prevalent, catheter duration was typically 4 to 6 weeks. Now it's commonly 3 to 4 months, or longer.

Do you think the duration of catheter use is causing the problem?

Dr. Work: Yes, I think the longer the catheter contact time, the more likely there will be a problem with central stenosis.

Do you think that the severity or incidence of central stenosis, especially superior vena cava stenosis, is higher in patients who have an upper arm fistula or graft and a catheter, compared to patients who have a catheter alone?

Dr. Ross: It's an excellent question. Once the high-flow state from an upper arm access is set in motion

on the same side that the catheter is in place, there seems to be a propagation of the central stenosis much more. There are not hard data to prove that, but it's what I believe.

Dr. Work: Agreed. After you put a high-flow access in either upper extremity, the central venous stenosis problem usually reveals itself. Could high flow actually increase the tendency for stenosis? I'm not aware of any data that directly address this question. There are data suggesting that angioplasty per se stimulates neointimal hyperplasia centrally, leading to progressive stenosis.

Dr. Vesely: The cause of central venous stenosis has been discussed for years. Is it due to an acute injury that occurs at the time of catheter placement, or is it a chronic injury caused by repetitive movement of the catheter tip against the vein wall? The increasing incidence of central venous stenosis seems to coincide with the Fistula First program, which suggests to me that the duration of catheter use—chronic repetitive injury—is really the culprit.

Dr. Work: Dr. Kohler demonstrated that a central venous catheter causes repetitive injury to the central vein endothelium during the cardiac and respiratory cycles leading to central stenosis using an animal model. In his model, he anchored the catheter midstream in the superior vena cava so that during the cardiac cycle and respiratory cycle, the catheter could not cause repetitive mechanical venous wall injury; these animals did not develop central venous stenosis compared to control animals exposed to repetitive catheter movement.[1]

The major dialysis companies have instituted policies of removal of catheters as soon as possible. But how do you know just when to take the catheter out?

Ms. Egan: We aim for patients coming in for catheter removal to have a fistula or graft that has been successfully used for at least 2 weeks. It's not a hard and fast rule, however, because we've had some instances where we've removed catheters in patients with relatively new permanent access, and they're back the next week because the access failed or couldn't sustain flow and we have to place another catheter. I also wanted to mention that there are patients who will always be catheter-based, for whatever reasons—related to their comorbidities or personal refusal to accept graft-fistula peritoneal

The key is identifying the patient very early and choosing the right access at the right time.

—John R. Ross, MD

catheters. And, I've had patients who are catheter-dependent for more than 10 years.

I've heard of people automatically changing catheters at certain intervals. We don't do that. We had one catheter about a year ago that was stuck; we ended up cutting right down onto it. This situation concerned all of us, but it's typically not a problem that we see. The longest I think I've seen any tunneled catheter stay in place is about 3 years.

Most patients (80% or more) start dialysis with a tunneled hemodialysis catheter. How do we reduce the use of catheters at the initiation of dialysis?

Dr. Work: The nephrology community has received a mixed message from the Centers for Medicare & Medicaid Services. CMS is promoting a fistula-first approach and also criticizing nephrologists for using too many catheters. At the same time, CMS reimbursement policies create barriers for prompt vascular access care. Take for instance the patient who is uninsured when starting dialysis but will become eligible for full Medicare coverage. The policy of having to wait 91 days before the patient becomes eligible for coverage is a barrier for reducing catheters and increasing fistulas. A patient who doesn't choose or isn't a candidate for home dialysis is relegated to 91 days' worth of catheter exposure before anything can happen in terms of a permanent access. Changing this policy would go a long way toward reducing catheter duration as well as improving the fistula rate. Currently, the patient, who will ultimately

have Medicare coverage, has had one or two catheter exchanges for either infection or dysfunction during the initial 91 days on dialysis, and the costs of those are tremendous.

Dr. Ash: I never really thought about it this way, but the 20% of people who do come to dialysis with a fistula are principally patients who either were on Medicare already or who had private insurance. It is the uninsured or patients not yet on Medicare who have the greater tendency to start with a catheter.

Dr. Work: That's exactly right, although I think we nephrologists can do a better job of making sure patients who have private insurance or are already on Medicare arrive at dialysis with a working permanent access. But you are correct—it's largely patients who are uninsured at the time of starting dialysis and are eligible for Medicare but not until that 91-day waiting period is over.

Dr. Ross: For me, the key is identifying the patient very early and choosing the right access at the right time. If it happens to be a fistula, use the fistula. If we are getting into the fistula syndrome of not being able to develop appropriately, then we use a graft if it is absolutely necessary. It is all about choosing the right running blood access at the right time for that particular patient to obviate or decrease catheter utilization.

Dr. Vesely: The nephrologists are often not providing early patient education. Patients are allowed to delay their decisions. Initiation of hemodialysis too often becomes an urgent or emergency situation, and the patient receives a tunneled hemodialysis catheter. With proper education and encouragement, we should be able to increase the number of patients who elect to have early placement of a fistula.

Ms. Egan: It's an invisible disease, isn't it? Most of the patients are still making urine, and it's not like there is a tumor or skin lesion or something that is obvious. It is easier for them to deny what's going on.

Dr. Vesely: The National Kidney Foundation has created patient education programs for the predialysis patient, but I have not seen widespread adoption of them. I believe nephrologists can be paid for this patient education, which makes me wonder why it's not more popular.

We need to provide better education and help get the patient beyond the stages of denial. I don't think we do a very good job of that as a community.
—Jack Work, MD

Dr. Work: I think Gail makes an excellent point about it being an invisible disease. Unfortunately, nephrologists and the other team members who approach these patients often do not recognize that when we tell patients they have end-stage renal disease, it is often the equivalent of telling the patient that they have cancer. We need to provide better education and help get the patient beyond the stages of denial. I don't think we do a very good job of that as a community.

Dr. Ash: I am sometimes embarrassed by the fact that I can have many visits with chronic kidney disease patients without getting them scheduled for a permanent access. Yet, if they have a visit with my nurse practitioner once, I find that they are already scheduled for their vein mapping and access procedure. The nurse practitioner is a whole lot better at following algorithms than I am.

Dr. Work: That's why care needs to be provided using a team approach, and we really don't take advantage of a multidisciplinary approach enough.

What are the roles for short-term catheters?

Ms. Egan: There is a limited role for short-term catheters, such as in the patient who needs emergent dialysis or for someone needing apheresis who may have 10,000 platelets and you can't correct them fast enough. But we've been more aggressive with tunneled catheters. We're not very good at predicting who in acute renal failure is going to recover and who is not.

Dr. Ross: I agree. Short-term catheters are utilized particularly when there is an emergency situation in which the patient obviously has a need for urgent dialysis. This might be as a bedside catheter placement, or when there is a catheter complication, such as an infection where the permanent catheter or tunnel catheter must be removed and a temporary catheter is used to treat the patient through the infection until we can go back through another access.

Can home dialysis patients use catheter access with reasonable risk?

Dr. Ash: Home dialysis patients are a group that we don't focus on very much. They have a lower incidence of infection than almost any patient in the secondary unit.[2] Although I still push fistulas for these patients, if the patient ends up with a catheter, I think there's reasonable benefit and reasonable risk to our home dialysis patient to use a central venous catheter.

Dr. Work: It is certainly the observation that home patients using tunneled central venous catheters have an extremely low infection rate.[3]

Is placement of the hemodialysis catheter tip into the right atrium still a controversial issue?

Dr. Work: I don't think it's much of a controversial issue since the demand in the dialysis unit has been for high flow to gain good clearance. It seems as if the right atrial placement of the catheter has been the standard of care to get consistent high flow. In attempts using superior vena cava catheters in the past, we could not get adequate flows. When the split catheters came along, they would often not split in the superior vena cava but would in the right atrium. As catheter tips evolved, it became even more important to get the high flows by having the tips of the catheter in the right atrium.

Ms. Egan: It's not a controversial issue in my community, but with other central catheters, some people will really get concerned if a small-caliber catheter is in the right atrium and we know we're putting 14-F dialysis catheters there.

Dr. Ash: I think that the venous tip should be in the right atrium. I believe KDOQI recommends that both tips be there, but it is not always so easy to accomplish. If you look at the anatomy, the arterial tip is 3 cm cranial to the venous tip, and the whole catheter can ride up 3 cm, on average, when the patient stands up. That means to really accomplish the recommended placement you would have to put the venous tip 6 cm past the junction of the superior vena cava to the right atrium. That risks placing the venous tip of the catheter against the lower right atrial wall.

The operating physician or nurse must be knowledgeable of central venous anatomy, fluoroscopic landmarks, and expected movement of the catheter tip.

—Thomas Vesely, MD

Dr. Vesely: I am surprised that catheter tip positioning continues to be a controversial issue. During the past decade, changes in hemodialysis catheter design and materials have improved their safety and performance. In most patients, it is appropriate to position the catheter tip in the upper right atrium. But, of course, the operating physician or nurse must be knowledgeable of central venous anatomy, fluoroscopic landmarks, and expected movement of the catheter tip. The position of the tip of a central venous catheter should be specifically tailored to each patient.

The old dogma prohibiting placement of a catheter tip in the right atrium is based on fear of complications. It's my understanding that more than 250,000 tunneled hemodialysis catheters are inserted each year in the United States, but there are few recent reports describing complications attributed to tip positioning in the right atrium.

Many states now allow appropriately trained registered nurses, nurse practitioners, and physicians' assistants to insert central venous access devices. These procedures can be performed at the patient's bedside using ultrasound guidance and catheter tip locator devices. The new generation of catheter tip locator devices has been rapidly adopted by PICC nursing teams.

Ms. Egan: I agree, and I think this then begs the question about competition because it is frankly going to make it easier for devices to be placed in all sorts of settings.

Does placing the tip of a tunneled hemodialysis catheter into the middle of the right atrium lead to complications?

Dr. Ross: For me, it depends on how the right atrium is identified. Often, catheters are put in and we look at the silhouette of the right atrium, but if we perform right arteriography with contrast, we find that the big pool of blood is actually higher up in the right atrium, higher up in the silhouette, or maybe even lower in the silhouette.

Dr. Work: I wonder how much of this worry is due to the fact that the vast majority of dialysis catheters that come to the market are piggybacked to the 510(k) process, where the original catheter's indication and positioning was always above the SVC or at the SVC.

Dr. Vesely: I don't know if that's necessarily true. I recently reviewed the Instructions for Use (IFU) documents for several popular hemodialysis catheters, and the insertion instructions state that the tip of the catheter can be positioned in the right atrium. I've also seen journal advertisements and other marketing materials for hemodialysis catheters with drawings that depict the catheter tip in the upper right atrium.

Dr. Ash: I agree that if you put the arterial lumen in the lower part of the SVC, the catheter won't work well. But there is a situation in which it can be difficult or almost impossible to put the catheter in the middle of the right atrium, and that's with a left-sided catheter. By tension of the catheter, both tips will be against the right atrial wall. Right-sided catheters have a propensity to sit on the left side of the vena cava. But if a catheter placed from the left side rests on the right side of the vena cava and right atrium wall, the tips are not really in the middle of the atrium. I think that is why there is a higher early failure rate for left-sided catheters, at approximately 25%.[4,5]

Ms. Egan: It's tricky, and you do have to fiddle with them a lot on the table. Then you wonder why you're fiddling with it to get it to work, knowing the catheter tip position will change when the patient is upright. Especially from the left, I will overshoot the mark a little to account for retraction I know will occur over the next couple of days.

If a catheter placed from the left side rests on the right side of the vena cava and right atrium wall, the tips are not really in the middle of the atrium.

—Stephen R. Ash, MD

Dr. Vesely: I agree; I typically add a little more length when inserting left-sided catheters. If I'm in doubt, I'll choose a longer catheter. I agree with Dr. Ash's comments that hemodialysis catheters inserted from the left side tend to have more problems. However, I'm also aware of studies that report similar numbers of problems with left and right catheters. In my own experience I've learned that catheters inserted from the left side require more skill for proper positioning.

Must all hemodialysis catheters achieve a blood flow rate greater than 400 mL/min?

Dr. Vesely: Dr. Louise Moist and her colleagues published a landmark article in 2006 and reported that not all patients require a blood flow rate of 400 mL/min or higher.[6] Some patients had adequate dialysis kinetics with catheter blood flow rates of 300 mL/min. In these patients, we might be using a Ferrari when a Ford Taurus would do.

Dr. Ash: I think that is exactly right. Dr. Gerry Beathard always brings up the point that with cardiopulmonary recirculation of grafts and fistulas, the actual efficiency of dialysis is cut down by the ratio of the access flow to the cardiac output. Therefore, a catheter running at 400 mL/min can have the same efficiency as fistula needles with blood flow running at 450 mL/min.[7] I think this fact needs to go into calculations of dialysis efficiency that are based on blood

flow rate. Of course, if you run the catheter backward, you will have recirculation of blood from the arterial to venous lumen and lose any benefit versus a fistula or graft.

Dr. Work: There is a great deal of discussion as to whether catheter flow should be greater than 300, or should we push that up to 400 with the larger-diameter catheters that have become available since the last KDOQI rewrite. I think we just don't really have good data to suggest that we need these high-efficiency catheters. There are also tradeoffs. The larger-diameter catheter has more wall contact with the vein endothelium, and perhaps that leads to more central vein stenosis. Frankly, I look at the hemodialysis catheter as something you really have to have a plan to get rid of, with the exception of the highly selective patients we discussed earlier.

Dr. Vesely: But the expectation is that the patient will need a tunneled hemodialysis catheter for 3 to 6 months, right?

Dr. Work: Here we get back to that original problem of the system barriers, of getting permanent access into these patients sooner rather than after the 90-day delay on most patients, and then waiting a long time to get a permanent access after that 3 months is over. When we get over that initial system barrier, we can move that timeline back closer to when the patient actually starts dialysis.

Dr. Ross: I think > 400 mL/min is an ideal target. It's not a must, but it is a target because many nephrologists believe that, depending on the size of the patient, if flows like this can be obtained without significant recirculation, they can reach adequate dialysis if blood flow is > 400 mL/min.

What are the important causes of early catheter failure?

Dr. Vesely: How do you approach a dysfunctional catheter? For example, the catheter was working well with a blood flow rate of 450 mL/min 2 weeks ago, but last week the blood flow decreased to 350 mL/min, and now it is less than 300 mL/min. How would you approach that problem?

Ms. Egan: By the time the patient comes to me, the dialysis center has typically already tried thrombolytics and reversing lumens. The first thing we do is shoot some contrast through both lumens, and I usually shoot the proximal lumen first because if I see a big fibrin sheath, I usually don't bother to shoot the distal lumen. We make a decision about what we're going to do depending on the patient's situation. If there is acute hyperkalemia, I'm not going to take the time to do a tPA infusion. We do a lot of them, and they can work well. If that fails, or we don't have a few hours to treat, then we'll pass guidewires through the catheter, back it up a bit and inject contrast to opacify more of the brachiocephalic vein and proximal SVC. If there's a stenosis, we can treat it with venoplasty and slide a new catheter into place over the existing wires.

I think alteplase works, and it buys you some additional good treatments, but it is time limited.
—Jack Work, MD

Dr. Work: I agree with Gail in terms of always looking for a sheath. We've seen a change with the institution of the bundle where the dialysis unit's no longer willing to pay that $90 for alteplase. That becomes expensive quite quickly. If alteplase is even used in the hospital for a dialysis patient, some third-party payers are charging it back to the dialysis unit. Unfortunately, in some areas in the US now, alteplase just cannot be used because of the cost concerns.

Dr. Vesely: Is instillation of a thrombolytic agent a good first step for treatment of a dysfunctional hemodialysis catheter?

Dr. Work: I think alteplase works, and it buys you some additional good treatments, but it is time

limited. If I have a patient who has just had a graft placed yesterday or is having it placed tomorrow and his catheter is not working, alteplase will buy enough time until I can start using his graft, and at virtually no cost to the patient other than the alteplase. In that circumstance, I would use alteplase to buy a few good dialysis treatments until the permanent access is ready to use. But, in the majority of cases, I have to exchange the catheter looking for a sheath.

Dr. Ash: I also think tPA works to relieve obstruction of catheters, and it's always surprised me that it often works, even in cases in which we've subsequently documented fibrous sheaths at the end of the catheter.[8,9] The pathologic steps are that the sheath slowly moves down the catheter, then covers the arterial port, and then the sheath forms a nidus for a clot. Infusion of tPA or a dwell of tPA can remove the clot to open up the port, but it does not remove the fibrous sheath. Catheters with outflow failure relieved by tPA have about a 50% failure rate in another month, so it's not a permanent solution at all.[8,9] Regarding a sheath, I know it's quite possible to balloon a sheath before you put in the next catheter, but I always try to find a separate entry site even into the same vein and stay out of the sheath altogether. Basically, I have a catheter in, and I go just above it into the internal jugular vein, put in the wire, place a new catheter, and then take the old one out. Sometimes I can't do that, such as when a vein is too narrow, and I certainly have exchanged catheters using exactly the same tract. But if I have my preference and there is a space available just above the catheter for another guidewire, I'd prefer to put the catheter in a new tract and avoid the possibility of putting it back in the same sheath.

Dr. Vesely: I am not apprehensive about using a large-diameter balloon for disrupting a fibrin sheath. I typically use a 12- or 14-mm-diameter angioplasty balloon. After inflating the balloon several times, it is important to inject contrast and verify that the fibrin sheath has been sufficiently disrupted. A fibrin sheath can be surprisingly resilient, and it may take more than one effort to break it up.

What measures do you take to prevent catheter-related infection?

Dr. Vesely: A recent publication reported the rate of catheter-related infections in oncology units, critical care units, and hemodialysis units during the 5-year period from 2004 to 2009.[10] During that 5-year period there was nearly a 50% decrease in catheter-related infections in oncology units and critical care units but, unfortunately, there was little change in the catheter infection rate in hemodialysis units. The success of oncology and critical care units can be attributed to nursing education regarding the importance of sterility during catheter insertion and catheter care procedures. It is unfortunate that these educational programs have not been adopted by many hemodialysis units.

A fibrin sheath can be surprisingly resilient, and it may take more than one effort to break it up.
—Thomas Vesely, MD

Dr. Ash: When properly used, the needle-less connectors of certain types can be helpful. Proper general care and technique and education can go a long way toward diminishing catheter infection rates. In my experience, if you implement the KDOQI steps for catheter access, as you would in a clinical trial, the infection rate will go down. Dr. Beathard showed that those units with a high infection rate diminished it significantly by rigorously enforcing the proper steps including masks, gloves, draping, antiseptic use, and so on.[11] The number of accesses to a hemodialysis catheter is much higher than with other catheters. If a central vein catheter is used for a daily or weekly injection, as in a port for infusion, then you have only a few Luer lock connections to the access point during use. When doing standard hemodialysis, there are about 12 per week.

Dr. Ross: Early catheter failures are often related to placement technique and positioning, but catheter

infection is usually something that develops weeks if not months later. With catheter exchanges, however, we will sometimes see an infection rate that is a little bit higher, particularly if we use the same exit site. Other than that, I don't believe there is much we can do in terms of positioning or repositioning other than to use exquisite sterile technique. In the dialysis clinics, the connections of the catheter and how much sterility is being used can vary considerably.

Dr. Work: We have had fairly good success using the TEGO device, which decreases the number of times that the actual lumen of the catheter is opened up to the air to just once weekly. We have a very acceptable infection rate, although zero would be the ideal. There are certain states where only nurses can handle catheters at all in dialysis units, and then there are other states where a tech or a nurse can handle them. I'm not aware of any studies that compared the infection rates in these different states.

You would anticipate or hypothesize that the professional RN might have a better result. I think that Steve pointed out at the very beginning that home dialysis patients have the lowest rates of infection; that really speaks to the fact that if you have a well-trained person who has a vested interest in taking care of the catheter, the infection rate is quite low.

Does catheter design affect catheter-related infection?

Dr. Ash: Dr. Tal and colleagues had a study that compared catheters with sideholes to catheters without sideholes.[12] Both were the standard DD Mahurkar–type catheter configuration. He found that there was somewhat better flow within the catheters with sideholes, at least over 1 to 2 months of follow-up. The one significant result was that catheters with sideholes had a higher incidence of catheter-related bloodstream infections. He postulated that it was probably because there were clots hanging on the sideholes at the tip of the catheter, and a clot is harder to cure from an infection than a clean catheter.

Dr. Vesely: Dr. Work, a number of papers in the last several years have taught nephrologists how to make their own lock using gentamicin, and a number of different mixtures have been tried and used. Should nephrologists be concocting solutions for use in difficult patients, or every patient? Should they be using tPA? The routine use of alteplase has also been advocated by some.

Early catheter failures are often related to placement technique and positioning, but catheter infection is usually something that develops weeks if not months later.

— John R. Ross, MD

Dr. Work: That's a complex question given the change in the rules of bundling and cost shifting. A study using tPA just once a week did show a decreased infection rate, but again, that's an additional cost of close to $100 per week that is not reimbursed separately. The different solutions and antibiotic locks also fall into the category of being an additional cost to the dialysis unit. If you look at it as an additional cost with reimbursement being ratcheted down, all the incentives are misaligned for investigating such an approach. Unfortunately, I don't think it's going to happen. ■

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