Extended Abstracts from

The Eleventh Annual Controversies in Dialysis Access

23-24 October 2014

The Grand America Hotel
Salt Lake City, Utah
USA

Course Directors

Ingemar Davidson, MD, PhD
Professor, Department of Surgery
The University of Texas Southwestern Medical Center, Dallas, TX - USA

Bart Dolmatch, MD, FSIR
Interventional Radiologist
Palo Alto Medical Foundation, Mountain View, CA - USA

Simulation of Dialysis Access - Salt Lake City, USA - October 22, 2014

Simulation of Dialysis Access (SoDA) – Eight Stations *Hands-On Dialysis Access Simulation*

Ingemar Davidson[1], Oliver Adriano[2], Jennifer Bartley[1], Gerald Beathard[3], Bart Dolmatch[4], Michael Gallichio[5], Maurizio Gallieni[6], Jaroslav Kudlicka[7], Billy Nolen[8], Sandy O'Rear[9], Eric Peden[10], John Ross[5], Anika Stiffend-Williams[9]

[1]Department of Surgery, Tulane University, New Orleans, LA - USA
[2]Lyndon B. Johnson Hospital, American Samoa
[3]University of Texas Medical Branch, Galveston, Texas - USA
[4]Palo Alto Medical Foundation, Mountain View, CA - USA
[5]The Regional Medical Center, Orangeburg, SC - USA
[6]San Carlo Borromeo Hospital, Milan - Italy
[7]Charles University, Prague, Check Republic
[8]Flight Safety, American Airlines, Fort Worth, TX - USA
[9]Parkland Memorial Hospital, Dallas, TX - USA
[10]The Methodist Hospital, Texas Medical Center, Houston, TX - USA

Training and learning in the field of access for dialysis, including peritoneal dialysis and hemodialysis is well suited for the use of simulators, simulated case learning, and team training. Simulators for dialysis access training is gaining popularity and allows for control the training environment by giving physicians a chance to practice new techniques without the steers and risk to patients (1). Simulators range from simple suture learning devices, inexpensive systems for venous puncture simulation, with pressurized tunneled conduits, to computer designed simulators to teach interventional procedures such as vascular access angiogram, balloon angioplasty and stent placing. Team training capitalizes on the principles used in aviation known as Human Factor (HF). The objectives of team training are to improve communication and leadership skills, and the use of checklists to prevent errors. In this context HF aims to promote a change in the attitudes towards vascular access from learning through mistakes in a non-punitive environment, to impact positively the employee performance and to increase staff retention by making the workplace safer, more efficient and user friendly. Simulation of Dialysis Access (SoDA) will introduce physicians to new techniques in dialysis access through hands-on experiences. Instructors at each station will share current simulation technology, and concept models and techniques geared to surgeons, interventional radiologists and allied health professionals. SoDA delivers examples of how simulation training can advance the field of dialysis access management.

Simulation training is an intense hands-on time consuming undertaking. The main purpose of the SoDA session is to increase awareness and share trends of simulation training for dialysis access. SoDA 2014 will have eight stations:

Station 1: Neck/Large Vein Ultra-Sound Anatomy – Placement of IJ Dialysis Catheters

A live volunteer will be used to show the neck vascular anatomy pertinent to dialysis access. Participants will practice hands-on needle cannulation of the internal jugular vein using ultrasound guidance on a realistic neck simulator.

Station 2: Vascular Mapping for Hemodialysis Access

At Station 2, participants will practice vascular mapping on a live subject. The faculty will educate using ultrasound machines, and attendees will have the opportunity to hold a probe to examine arteries and veins, and suggest the best access options.

Station 3: Dialysis Access Cannulation

Using an ultrasound guidance, proper placement of dialysis needle cannulation can be practiced into a conduit that is under pressure and filled with red colored fluid to show proper placement.

Station 4: The Peritoneal Cockpit

This station uses the aviation safety teaching principles to demonstrate the important tools and instruments needed for a peritoneal dialysis procedure, and why basic fact knowledge and the proper use of checklists can improve the quality and safety for patients and personnel.

Station 5: Computer Arm Simulation
The interventional radiology arm simulator will provide participants a chance to use interventional techniques to treat a dialysis access outflow stenosis.
Station 6: Vascular Anastomoses Suture Lab
Using various simulation devices from suture boxes to a newly developed arm simulator (2), participants will practice to suture an anastomosis with various suturing techniques discussed and demonstrated by instructors.
Station 7: Tools in Access Surgery
Why would you use that? In this "show and tell" station participants will be able to discuss most, instruments, tool and devices used in vascular access open and interventional procedures.
Station 8: Lessons from the flight deck
This SoDA station is an end of the day podium discussion with audience participation. The SoDA stations from training perspectives will be evaluated. The aviation Human Factor concept from a safety standpoint will be at the forefront. This includes how teamwork, communication skills, checklists and briefings create better processes, thereby improving the quality, effective and safe patient care.

References
1. Reznick RK, MacRae H. Teaching surgical skills--changes in the wind. N Engl J Med. 2006;355(25):2664-2669.
2. Eckstein H, Schmidli J, Schumacher H, et al. Rationale, scope, and 20-year experience of vascular surgical training with lifelike pulsatile flow models. J Vasc Surg. 2013;57:1422-1428.

11th Annual Controversies in Dialysis Access - Salt Lake City, USA - October 23-24, 2014

F is not for Fistula

Cynthia Bhola[1], Jay Hingwala[2], Charmaine Lok[2,3]
[1]Division of Nephrology, University Health Network, Toronto, Ontario - Canada
[2]Division of Nephrology, Department of Medicine, University Health Network, Toronto, Ontario - Canada
[3]Faculty of Medicine, University of Toronto, Toronto, Ontario - Canada

Hemodialysis central venous catheter (CVC) placement rates and duration of use have increased over the last 2 decades. Up to 80% of North American patients initiate hemodialysis with a CVC, and one third continue to use catheters 90 or more days after dialysis initiation. National guidelines recommend against the use of CVC because of higher complication rates.

Incident CVC use is associated with increased mortality and strategies are needed to decrease CVC use and to ensure ongoing processes are in place to attain high prevalent arteriovenous access (fistula and graft) permanent access.

A common and serious complication of CVC use is central venous stenosis which results in loss of patency of the central veins and the inability to create non-complicated, functional fistulas and grafts. University Health Network (UHN) is a university based hospital that has implemented a strategy to preserve thoracic venous sites and reduce internal jugular (IJ) vein catheter use. This strategy involves inserting tunneled femoral vein catheters in incident "urgent start" dialysis patients while facilitating a more appropriate definitive dialysis access.

"Urgent start" dialysis patients who require chronic dialysis, and do not have prior dialysis modality and access plans, have tunneled femoral vein catheters inserted. The vascular access coordinator and “nurse navigator” meticulously track the patient’s overall dialysis status (including decision making for modality/disposition), femoral vein catheter associated infections rates, thrombosis, and plans for subsequent dialysis access.

To date, over 25 tunneled femoral catheters have been inserted in this strategic process without complications. Subsequently, one catheter required intraluminal thrombolytic locking, while all other catheters maintained blood flow greater than 300 ml/min. There were no catheter-related infections (exit site infection or bacteremia). All patients have either transitioned to peritoneal dialysis or to an arteriovenous graft or fistula. One patient received a tunneled IJ vein catheter. Patients were asked to complete a vascular access survey, and all indicated satisfaction with their femoral catheter; they had minimal complaints of bruising, bleeding, or swelling at their access sites. Pain/discomfort at the exit site post insertion was the primary complaint, but they did not find it interfered with activities of daily living.

A femoral vein catheter insertion strategy for urgent start patients was found to be safe, effectively help avoid IJ CVC use, facilitate PD catheter insertion and appropriate HD vascular access placement.

Femoral catheter insertion makes the point that the catheters are TEMPORARY. Central venous catheters of all types have risks and should be avoided as much as possible. Avoiding upper body CVC central venous catheters prevents loss of central patency prohibiting permanent access placement in the future. Further prospective study is underway.

References

1. Di Iorio BR, Mondillo F, Bortone S, et al. Fourteen years of hemodialysis with a central venous catheter: mechanical long-term complications. J Vasc Access. 2006;7:60-5.
2. III. NKF-K/DOQI Clinical Practice Guidelines for Vascular Access: update 2000. Am J Kidney Dis. 2001;37(1 Suppl 1):S137-81.
3. Hingwala J, Bhola C, Lok CE. Using tunneled femoral vein catheters for "urgent start" dialysis patients: a preliminary report. J Vasc Access. 2014;15 Suppl 7:S101-8.
4. Hughes SA, Mendelssohn JG, Tobe SW, McFarlane PA, Mendelssohn DC. Factors associated with suboptimal initiation of dialysis despite early nephrologist referral. Nephrol Dial Transplant. 2013;28:392-7.
5. Mendelssohn DC, Ethier J, Elder SJ, et al. Haemodialysis vascular access problems in Canada: Results from the Dialysis Outcomes and Practice Patterns Study (DOPPS II). Nephrol Dial Transplant. 2005;21:721-8.
6. Moist LM, Trpeski L, Na Y, Lok CE. Increased hemodialysis catheter use in Canada and associated

mortality risk: data from the Canadian Organ Replacement Registry 2001-2004. Clin J Am Soc Nephrol. 2008;3(6):1726-32.
7. US Renal Data System. USRDS 2005 Annual Data Report: Atlas of Endstage Renal Disease in the United States, in Incidence and Prevalence; Patient Characteristics. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 2005.

PD in the ICU: Reality or Myth?

Micah R. Chan
Home Dialysis Director, Clinical Chief Associate Professor of Medicine, Division of Nephrology; University of Wisconsin School of Medicine and Public Health, Madison, WI - USA

Approximately 93% of the US ESRD population undergoes hemodialysis, while only 7% are dialyzed via peritoneal dialysis (PD). Peritoneal dialysis is underutilized in this country and yet survival is better in the first two years and equivalent long-term (1). Given the recent changes in the CMS ESRD bundled prospective payment system, PD is incentivized especially because of the value added care with cost savings. Peritoneal dialysis costs approximately $12,000 less per patient per year as compared to in-center hemodialysis. If PD prevalence rates increase to 15% of the dialysis population like in the 1980s, there is an estimated cost savings of >$1billion (2). Data has shown that AKI requiring dialysis is estimated at 27 per 100,000 patients and that mortality is exceedingly high with rates >50% in the critically ill (3). Often these patients have hemodynamic instability requiring pressor support, mechanical ventilation and often continuous renal replacement therapy. Given the recent data and trends in mortality comparing PD vs HD, infection-related causes seem to be associated with the high 90-day and annual mortality rates in the HD population. Several small studies have shown peritoneal dialysis to be an effective and safe dialysis modality for the ICU patient (4).
Technological advances in PD fluid, PD catheters and insertion techniques provide easy access without the need for vascular access. Previous contraindications to utilizing PD in the critically ill, such as peritonitis, poor ultrafiltration and early catheter leak have become less of an issue given these advances.
We will provide a compelling argument that PD should be considered as a viable modality for renal replacement therapy in the ICU.

References

1. Weinhandl ED, Foley RN, Gilbertson DT, Arneson TJ, Snyder JJ, Collins AJ. Propensity-matched mortality comparison of incident hemodialysis and peritoneal dialysis patients. J Am Soc Nephrol. 2010;21:499-506.
2. Golper TA, Guest S, Glickman JD, Turk J, Pulliam JP. Home dialysis in the new USA bundled payment plan: implications and impact. Perit Dial Int. 2011;31:12-6.
3. Tumlin JA, Chawla L, Tolwani AJ. The effect of the selective cytopheretic device on acute kidney injury outcomes in the intensive care unit: a multicenter pilot study. Semin Dial. 2013;26:616-23.
4. Ponce D, Berbel MN, Regina de Goes C, Almeida CT, Balbi AL. High-volume peritoneal dialysis in acute kidney injury: indications and limitations. Clin J Am Soc Nephrol. 2012;7:887-94.

PD Catheter Type Makes a Difference? Yes, It Does Make a Difference

Micah R. Chan
Home Dialysis Director, Clinical Chief, Associate Professor of Medicine, Division of Nephrology; University of Wisconsin School of Medicine and Public Health, Madison, WI - USA

The perception that PD is an inferior modality to hemodialysis given its complications of peritonitis, poor ultrafiltration, and catheter dysfunction, is likely the reason why nephrologists are hesitant to initiate patients on PD in the United States (1). Given the various technological advances in exit site prophylaxis, connector tubing and catheter type, these complications are decreasing in the last few years.

Critically ill patients admitted with ESRD on peritoneal dialysis have exceedingly high rates of mortality and technique failure. Therefore, in order to sustain growth of PD in dialysis patients, there needs to be an infrastructure of support starting with a dedicated team of physicians, mid-levels and nurses who care for these patients (2).
The initiation of PD requires this infrastructure and a training program but first and foremost needs the placement of a functional catheter. There are a variety of configurations and designs consisting of shape of intraperitoneal segment, subcutaneous portion, and number of cuffs (3).
We will provide a compelling argument that the type of PD catheter is important and should be considered in order to avoid higher complication rates and catheter dysfunction. It seems that recent data suggests that straight intraperitoneal catheters have a significant survival advantage as compared to coiled configuration.

References

1. Chaudhary K, Sangha H, Khanna R. Peritoneal dialysis first: rationale. Clin J Am Soc Nephrol. 2011;6:447-56.
2. Khan A, Rigatto C, Verrelli M. High rates of mortality and technique failure in peritoneal dialysis patients after critical illness. Perit Dial Int. 2012;32:29-36.
3. Hagen SM, Lafranca JA, IJzermans JN, Dor FJ. A systematic review and meta-analysis of the influence of peritoneal dialysis catheter type on complication rate and catheter survival. Kidney Int. 2014;85:920-32.

PD Catheter Type Makes a Difference? No, It Does Not Make a Difference

Maurizio Gallieni[1,2], Francesca Brunini[1,2]
[1] Nephrology and Dialysis Unit, Ospedale San Carlo Borromeo, Milan - Italy
[2] Specialty School in Nephrology, University of Milan, Milan - Italy

Peritoneal dialysis (PD) improves patient autonomy while reducing the cost of end stage renal disease treatment (1). Thus, improving technique survival should be a major goal of PD research and PD catheter technology can be one of the areas of improvement, because catheter function continues to be a problem in many PD programs. However, PD catheter performance as a form of dialysis access is excellent, compared to hemodialysis accesses, including AV fistulae. In fact, Singh et al (2) showed a 3-yr PD catheter survival of 91%: only PD catheter-related non-infectious problems were significantly associated with catheter failure. Other factors such as age, gender, race, BMI, diabetic status, co-morbidities, previous abdominal surgeries, peritoneal infections or exit site/tunnel infections did not affect the PD catheter survival.
The task of being skeptical about different PD catheter types in determining better outcomes is not in accordance with our practice, based on the use of a specific catheter, i.e. the self-locating PD catheter proposed by Dr. Nicola Di Paolo and collaborators (3). Twelve grams of tungsten inserted around the tip of the conventional Tenckhoff catheter keep the tip firmly in the Douglas cavity. Supporting the peculiar properties of the self-locating catheter are the results of a prospective non-randomized controlled trial, which showed that complications such as cuff extrusion, infection, peritonitis, early leakage, and obstruction, were statistically less frequent in 746 patients with self-locating catheters than in 216 patients with classic Tenckhoff catheters.
Remarkably, dislocation of the catheters was 0.8% versus 12.0% in the Tenckhoff group (2). This is associated with a remarkably lower use of laxatives and with a reduced number of hospital visits.
However, no randomized controlled trials were undertaken to confirm these findings, which therefore have not been considered by subsequent metanalyses. Thus, if we considered the available "good quality evidence" indeed PD catheter type makes no difference in PD outcomes. Strippoli et al (4, 5) evaluated the use of catheter-related interventions for the prevention of peritonitis in PD. Seventeen trials comparing different catheter insertion techniques, catheter types, use of immobilization techniques or different break in periods were identified. Among them, eight studies compared straight versus coiled catheters, one single cuff versus double cuff catheters. There was no significant difference in the risk of peritonitis, peritonitis rate, exit-site/tunnel infection, exit-site/tunnel infection rate or catheter removal/replacement between straight versus coiled intra-peritoneal portion catheters. The single trial comparing single versus double cuffed catheters showed no significant difference in the risk of peritonitis, exit-site/tunnel infection or catheter removal/replacement.
Accordingly, the UK Renal Association clinical guideline on peritoneal access (6) and the ISPD guidelines (7) suggest that no particular catheter type is proven better than another.

On the other hand, similar to what has been observed with the self-locating catheter, a curled tip catheter is considered by some clinicians as more likely to remain within the pelvis, offering a better drainage compared to a straight tip catheter (8). Once again, no evidence supports this common belief. In fact, a recent metanalysis reached the opposite conclusion (9). Hagen et al investigated whether there is a clinical advantage for one of the catheter types or configurations. They found that comparing straight vs. swan neck and single vs. double-cuffed catheters, no differences were found when results were pooled, confirming the results of the metanalysis by Strippoli et al (4, 5). However, comparison of straight vs. coiled-tip catheters demonstrated that survival was significantly different in favor of straight catheters (hazard ratio 2.05) and that, for surgically inserted catheters, the removal rate and catheter survival at 1 year after insertion were significantly in favor of catheters with a straight intraperitoneal segment (9).

Does the PD catheter type make a difference in patient outcomes? Based on the available evidence, the answer should be mainly NO. However, some studies and our personal experience suggest that this statement might change in the future. In this case, we should keep in mind the famous aphorism indicating that absence of evidence is not necessarily evidence of absence.

References

1. Davies SJ. Peritoneal dialysis—current status and future challenges. Nature Rev Nephrol 2013;9:399-408.
2. Singh N, Davidson I, Minhajuddin A, et al. Risk factors associated with peritoneal dialysis catheter survival: a 9-year single-center study in 315 patients. J Vasc Access. 2010;11:316-322.
3. Di Paolo N, Capotondo L, Sansoni E, et al. The self-locating catheter: Clinical experience and follow-up. Perit Dial Int 2004;24:359-364.
4. Strippoli GF, Tong A, Johnson D, Schena FP, Craig JC. Catheter type, placement and insertion techniques for preventing peritonitis in peritoneal dialysis patients. Cochrane Database Syst Rev. 2004 Oct 18;(4):CD004680.
5. Strippoli GF, Tong A, Johnson D, Schena FP, Craig JC. Catheter-related interventions to prevent peritonitis in peritoneal dialysis: a systematic review of randomized, controlled trials. J Am Soc Nephrol 2004;15:2735-2746.
6. Wilkie M, Jenking S, Shrestha B. The Renal Association Clinical Guideline - UK Peritoneal Access Guidelines, 5th edition, 2009. Available at: http://www.renal.org/Clinical/GuidelinesSection/PeritonealDialysis.
7. Figueiredo A, Goh BL, Jenkins S, et al. Clinical practice guidelines for peritoneal access. Perit Dial Int 2010;30:424-429.
8. Frost JH, Bagul A. A brief recap of tips and surgical manoeuvres to enhance optimal outcome of surgically placed peritoneal dialysis catheters. Int J Nephrol 2012, Article ID 251584.
9. Hagen SM, Lafranca JA, Ijzermans JN, Dor FJ. A systematic review and meta-analysis of the influence of peritoneal dialysis catheter type on complication rate and catheter survival. Kidney Int. 2014;85:920-932.

Cost Analysis of Hemodialysis Permanent Vascular Accesses: Arteriovenous Fistula versus Arteriovenous Graft

S. Daisy Kosa[1,2], Hannah Ferguson[1], Abdel Al-Sharif[1], Amiram Gafni[2], Cindy Ma[1], David Tang[1], Lehana Thabane[2], Andre Violante[1,2], Elgene Yranon[1], Charmaine E. Lok[1,2]

[1]Toronto General Hospital, Toronto - Canada

[2] McMaster University, Hamilton - Canada

Background: The optimal type of permanent vascular access (VA), arteriovenous fistula (AVF) or arteriovenous graft (AVG), may vary according to patient characteristics and circumstances. Thus, the resources required to establish and maintain patency for permanent VA in hemodialysis patients may also vary and is important to determine.

Objective: To compare the hemodialysis patient resources required to establish and maintain patency of AVFs versus AVGs over the VA lifetime (maximum 10 years post creation).

Methods: Patients with a first AVF or AVG created from January 1, 2002 to January 1, 2013 at Toronto General Hospital were studied. All VA creations, removals, and complications were prospectively collected and maintained in a VA clinical database. The costs of VA-related complications were derived from the provincial patient Ontario Case Costing Initiative database. Total costs include direct cost (directly related to the provision

of patient care, including: nursing, diagnostic imaging, pharmacy, labs) and indirect cost (overhead expense e.g. related to running the hospital).
Analysis: The median total cost per VA over its lifetime was compared for all AVFs and AVGs, as well as stratified within risk categories of fistula failure: low, mod, high, very high based on their failure to mature (FTM) score. The first day of costing is the day of VA creation.
Results: There were 729 VA created, there were 122 AVGs and 607 AVFs. When stratified by risk of fistula failure: 29%, 25%, 46% and 1% of AVFs were in the low, medium, high, and very high stratum respectively. The undifferentiated median VA lifetime cost associated with VA creation and complications was higher for AVGs ($5268.50) than AVFs ($4699.00). When evaluated by FTM risk score, the cost was higher for AVGs ($6901.00) than AVFs ($4370.00) in the low risk category. However, in the medium and high risk categories, cost was higher for AVFs ($3249.00, $5807.00) than AVGs ($2688.50, $5491.00). There were too few patients in the very high risk stratum to compare costs.
Conclusion: Resources used to maintain VA patency varied depending on the risk of VA failure. The cost was higher for AVGs than AVFs in the low risk category but similar or slightly less costly for AVGs than AVFs in the medium and high risk categories. Thus, in addition to clinical outcomes, consideration of the resources required to establish and maintain patency could optimize VA choice.

New Avenues for Dialysis Access Training and Certification

John Ross
Dialysis Access Institute, Orangeburg Regional Medical Center, Orangeburg SC - USA

Dialysis access has an extraordinary history spanning over 40 years. Around the world, key individuals in surgery, nephrology and radiology have been leading these efforts both at academic institutions and in the private community. There has also been the advent of a new specialty area, the interventional nephrology, mainly at office-based dialysis access clinics.
Over this period numerous clinical trials took place, with the device companies developing not only graft materials but also specialized endovascular tools such as high pressure angioplasty balloons and stent grafts to be utilized in the still evolving and challenging part of vascular surgery.
One year ago in South Carolina, a novel situation took place. Attached to a hospital a 16,000 square foot building was constructed with six operating rooms to allow a large number of cases to be performed on a daily basis, solely dedicated to dialysis access and training. The state of the art equipped center has live internet streaming capability to an audience anywhere in the world enabling people to watch and consider their own treatment modality. A decision was made to create a comprehensive tiered training for dialysis access, building on past experience legacy of key individuals, societies and initiatives. For example the Fistula First Breakthrough Initiative teaching principles are incorporated in the dialysis training program.
Several factors make this the right time and place to develop a training and certification program.
A trial (mock) training program and examination tested with five experienced dialysis access surgeons. After training, a basic core written multiple choice examinations consisting of 100 questions was given (Table I). The examination included 25 questions requiring judgment based clinical scenarios (Table II). An oral examination follows with 5 scripted questions addressing preoperative planning and specific access options along with management of common issues encountered in practice, like ischemic hand and access aneurysms. Also the oral examination included 100 power-point slides of x-ray, ultrasound, and dialysis access anatomy images testing the ability to make correct clinical decision in dialysis access patient care with a time constraint on information processing and decision-making (Table III).
The examination also includes the practical test. The logistics with state licensure have been worked out as well as privileging physicians for assisting/supervising on the clinical operating room cases. The initial access surgeons came through this training and examination performed both endovascular and open surgical procedures. It was designed such that each candidate was to do a basilic vein transposition, a simple fistula and/or graft and three percutaneous procedures consisting of thrombectomy, angioplasty and stent placement. At the conclusion of the training all five candidates were debriefed in a general discussion critiquing the training and the validity of examination and testing.
From this feedback, the training, testing and certification program will continue to be modified to create a fair, comprehensive and effective training curriculum. A 15 member dialysis access advisory board of key

opinion leaders from across the country has agreed to assist in the training and certification development and implementation. Also continued constructive criticisms are actively sought from other entities.
The process of securing Continuing Medical Education Accreditation hours for the training and examination process has begun. The dialysis access training and certification program is a beginning in an all-inclusive developing and refining process with widespread support from dialysis access surgical, nephrology and radiology leaders in the United States and abroad.
The review article in this issue of J Vasc Access by Ross et al, details the customized training model concepts by which this can be accomplished in a consistent, effective manner (1).

Reference

1. Ross J, Dolmatch B, Gallichio M, et al. Training and Certification in Dialysis Access. J Vasc Access 2014; 15 (Suppl 8): S3-S7.
www.TacidaGroup.com

Table I - Three Examples of 100 Basic Multiple-Choice-style written test questions

1. A patient presents with increased bleeding and pulsatile fistula in a left upper arm brachio-basilic AVF. The patient has no arm swelling. On angiography there is a >80% stenosis of the proximal venous swing segment and a 60% stenosis of the innominate vein without large collaterals present. You should angioplasty:
a. The innominate vein stenosis only
b. Both the innominate vein and basilic vein stenosis
c. Neither the innominate or basilic vein stenosis
d. The basilic vein stenosis only

2. The incidence of high bifurcation of the brachial artery is:
a. >50%
b. <5%
c. 10%-15%
d. 20%-33%

3. The nerve that traverses in the upper arm adjacent to the basilic vein is:
a. The median nerve
b. The ulnar nerve
c. The radial nerve
d. The median antebrachial cutaneous nerve

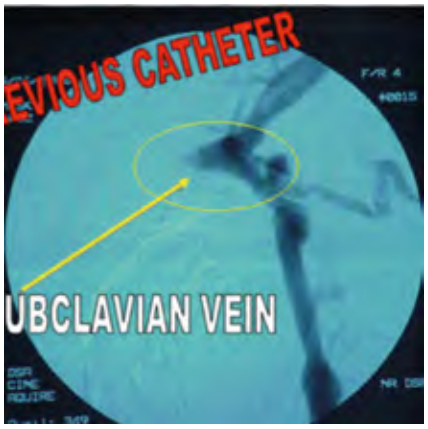
Table II - One example of 20 Multiple-Choice style written question requiring judgment

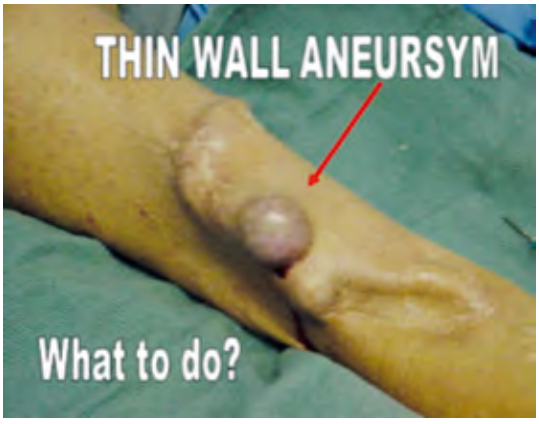
The patient is a 40-year-old working engineer with polycystic kidney disease (PCKD). The estimated GFR is 15 ml/min. He has no uremic symptoms. Vascular mapping with ultrasound reveals a radial artery diameter of 3.9 mm; Cephalic vein diameter at wrist is 4.3 mm. He has had no previous abdominal surgery. The right fore arm is depicted below.

What is the most appropriate and effective and safe strategy for this patient at this time?

A. Wrist radio cephalic, anastomosis fistula as soon as possible
B. Peritoneal Catheter (PD), only
C. Wrist AVF and a PD catheter in the OR setting
D. AVF as soon as possible and PD catheter or about 4 weeks before estimated dialysis start if patient desires and approved by the PD unit
E. Pre-emptive Living Donor Kidney Transplant

Table III - Two image samples (of 100) dialysis access training and examination of: "What to do next"





More Unchartered Territory: Navigating New National Standards for Access Procedures

Jack Work
Professor of Medicine, Emeritus, Emory University, Atlanta, GA - USA

The future landscape of dialysis access training is at the intersection between two seemingly unrelated issues that are undergoing tremendous upheaval: Graduate Medical Education funding and the ESRD Prospective Payment System. These two issues are linked by "outcome-based" funding and follow the "Golden Rule" - *The one with the gold makes the rules*!

Graduate Medical Education: In 1965 Congress approved the Medicare Bill. With the creation of public support through Medicare, graduate medical education (GME) was raised to the level of public policy. Recently, the Institute of Medicine (IOM) published a report commissioned in 2012 that reviewed GME governance and financing and found "a striking absence of transparency and accountability" (1). GME funding comes mostly from the Medicare program and is funneled to teaching hospitals and other GME sponsors for residency training through Medicare Part A adjustments; this funding was 15 billion dollars in 2012. The current GME funding system, although stable, is hospital-centric and as such discourages physician training outside of hospitals. The IOM recommended the development of a "physician workforce that can lead and improve an evolving healthcare system at lower costs" and increased "accountability and oversight of GME use of public funds." In addition, the IOM report recommended that Congress amend Medicare regulations to allow for performance-based financing of GME programs with the current payment system to be phased out completely within a ten-year transition (1). This translates into a future outcomes-based funding system for GME residency training that will no longer necessarily be hospital-centric. This likely will lead to a paradigm shift in how, when and where medical educational training occurs and perhaps who pays for the training (2).

ESRD Prospective Payment System: Prior to 2006, Medicare reimbursed separately billable ESRD drugs, which essentially subsidized the composite rate payment for the actual dialysis treatment that had remained flat for over 20 years. The bundled payment system was developed to encourage providers to operate efficiently and help

control cost. The bundled payment for dialysis services is also tied to a quality incentive program (QIP) which will rely on measures of dialysis facility performance which include addressing infections, anemia management, dialysis adequacy, mineral metabolism management, patient experience of care and vascular access. The QIP will reduce payments to ESRD facilities that do not meet certain performance standards (outcomes). The intention is that QIP will improve efficiency and promote quality of care (3). Large dialysis organizations (LDO or chain organizations), perhaps recognizing that a vascular access clinical measure would eventually become part of the bundle of services, have combined vascular access centers into their operations which are becoming more vertically integrated (for example Fresenius supplies dialysis products (dialyzers, dialysis machines and supplies), has dialysis facilities, distributes renal-related pharmaceuticals, operates an ESRD laboratory, and pharmacy). These vascular access centers have in general been additional profit centers for the LDO, however, if vascular access is totally integrated into the bundle of services, these centers will become cost centers. LDOs may become direct purchasers or employers of surgical services in order to become fully vertically integrated, and as such could potentially negotiate directly with CMS to provide ESRD services. ESRD Seamless Care Organizations (ESCOS) may be viewed as a step in this direction (4).

Current ACGME Vascular Surgery Training: ACGME requirements for residency training programs are general guidelines that each training program must meet: number of vascular surgery procedures-greater than 500 in three years, but less than 1500 unless justified by the program director. No specific minimum number by type of procedure such as dialysis vascular access is prescribed. This becomes important given the DOPPS finding that during training "US surgeons created fewer fistulae (US mean=16 vs. 39-426 in other countries and noted less emphasis on vascular access placement compared with surgeons elsewhere" (5). The authors concluded that "surgical training is key to both fistula placement and survival" (5). Peritoneal dialysis access training has had similar results because of suboptimal surgical outcomes related to inadequate training and low procedure volume (6).

The future landscape of dialysis access training may be shaped by an intersection of GME and ESRD services, both funded by the public through CMS, and both tied to funding based on outcomes. Current ACGME program requirements lack specific requirements for dialysis access training. Clearly a restructuring of the current training programs is needed and the intersection of GME and ESRD services may provide the leverage for change.

References

1. Zimlich R. IOM recommends decade-long overhaul of Medicare GME funding program. Medical Economics July 30, 2014.
2. Wilensky G, Berwick D. Reforming the financing and governance of GME. N Engl J Med. 2014;371(9):792-3.
3. CMS finalizes Policy and Payment Rate Changes for End Stage Renal Disease Facilities in 2014. CMS.gov 11/22/2013.
4. Comprehensive ESRD Care Initiative CMS.gov 4/16/2014.
5. Saran R, Elder S, Goodkin D, Akiba T, Ethier J, Rayner H, Saito A, Young E, Gillespie B, Merion R, Pisoni R. Enhanced training in vascular access creation predicts arteriovenous fistula placement and patency in hemodialysis patients: results from the Dialysis Outcomes and Practice Patterns Study. Ann Surg. 2008;247(5):885-91.
6. Crabtree J. Who should place peritoneal dialysis catheters? Perit Dial Int 2010;30:142-150.

Trinity of Care: Components of Effective Dialysis Access Training

Ingemar Davidson[1], Bart Dolmatch[2], Michael Gallichio[3], John Ross[3]
[1]Department of Surgery, Tulane University, New Orleans, LA - USA
[2]The Palo Alto Medical Foundation in Palo Alto, California - USA
[3]Dialysis Access Institute, Orangeburg Regional Medical Center, Orangeburg SC - USA

Dialysis access procedures, open and endovascular, have become the most common surgeries performed in hospitals. Considering the invasive access cannulations for dialysis, more than 100 million needle punctures in renal failure patients in the USA per year. On average each dialysis patient undergoes more than two procedures per year to maintain a useable dialysis access.

There is a void in the appropriate and standardized training for dialysis access, including proper selection of the dialysis modality (i.e., hemodialysis vs peritoneal dialysis), type and surgical site selection, timing of access

placement, individuals authorized to perform dialysis access, and the institutional or facility setting in which to perform the access procedures. Until effective preventive measures for renal disease can be instituted, training those involved in ESRD treatment is one way to achieve improved outcomes and quality of life.

The dialysis access training concept: Three components constitute dialysis access training (Fig. 1). First, basic *knowledge* about dialysis access is delivered in the form of reading material. Second, workplace safety comes from *skills*, experience from practice on the job, and by incorporating simulation as part of skills training (1, 2). There is no substitute for knowledge and skills to achieve safety. The third component deals with the less defined concept of the *Human Factor* (HF) role contributing to work effectiveness and safety (3, 4). It entails many things related to human nature, such as the incentive to work, interpersonal skills, behavior, respect, and drive (5-7). The HF also known as crew resource management (CRM), trains the entire dialysis access team to optimize coordination of care and maximize communication between care providers. Also, the philosophy is to educate the trainee so that he or she will commit to train new team members coming into the dialysis access field. The review article in this issue of J Vasc Access by Ross et al, details training model concepts by which this can be accomplished in a consistent, effective, and customized fashion (8).

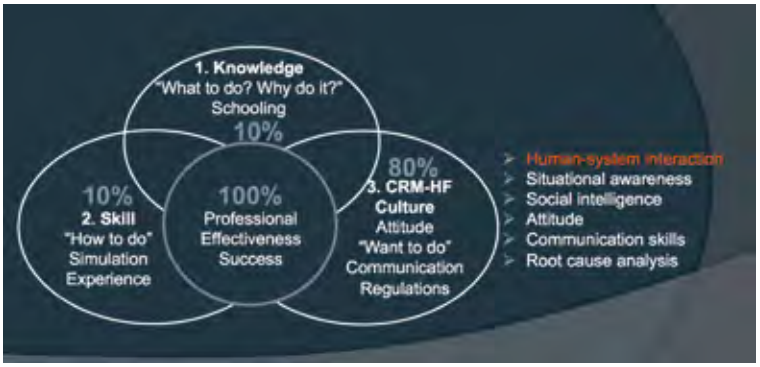


Fig. 1 - Three components of dialysis access training program. The human contribution to professional effectiveness may account for up to 80%.

References

1. Davidson I, Lok C, Dolmatch B, et al. Virtual reality: emerging role of simulation training in vascular access. Semin Nephrol. 2012;32:572-581.
2. Slakey DP, Simms ER, Rennie KW, et al. Using simulation to improve root cause analysis of adverse surgical outcomes. Int J Qual Health Care. 2014;26:144-150.
3. Reason J. The Human Contribution: Unsafe Acts, Accidents and Heroic Recoveries. Farnham Surrey, UK: Ashgate; 2008.
4. Dekker S. Just Culture: Balancing Safety and Accountability. Aldershot, UK: Ashgate Publishing Limited; 2007.
5. Goleman D, Boyatzis B. Social intelligence and the biology of leadership. Harvard Bus Rev. 2008;86:74-81.
6. Goleman D. Social Intelligence: the New Science of Human Relationships. New York, NY: Bantam Books; 2008.
7. Lucian L. Leape, Miles F. Shore, Jules L. Dienstag, Robert J. Mayer, Susan Edgman-Levitan, Gregg S. Meyer, Gerald B. Healy. Perspective: A Culture of Respect, Part 2: Creating a Culture of Respect. Academic Medicine, Vol. 87, No. 7 / July 2012.
8. Ross J, Dolmatch B, Gallichio M, et al. Training and Certification in Dialysis Access. J Vasc Access 2014; 15 (Suppl 8): S3-S7.
www.TacidaGroup.com

Where Would I Get My Outpatient Vascular Access Intervention?

Gerald A. Beathard
Clinical Professor of Medicine, University of Texas Medical Branch, Houston, TX - USA

There are several ways to address the question, "where would I get my outpatient vascular access intervention." First, it could be addressed from the viewpoint of making a selection from the type of specialties involved in providing this type of service - interventional nephrology, interventional radiology, and vascular surgery. Secondly, it could be addressed on a more individual basis geared to the qualifications of the individual physicians representing the possible alternatives. Prudence would dictate that the latter choice would be the correct one.

Having settled this issue, the next question relates to the attributes that make a physician qualified to provide dialysis vascular access intervention. This judgment should rest upon three issues. First, the individual should be knowledgeable about dialysis and dialysis patients. These patients are unique and have unique problems. It is not possible to provide optimal medical care without an understanding of this issue. Two cases can present with the same problem, but require completely different management due to issues related to their dialysis situation. Secondly, the individual should be knowledgeable and fully conversant in the area of dialysis vascular access. A lack of this attribute frequently results in inadequate and even inappropriate treatment. Thirdly, the individual must have the clinical skills and expertise necessary to accomplish the required procedures.

It is unfortunate that training programs in vascular surgery, interventional radiology and nephrology have and, by and large, continue to offer only minimal or no training in dialysis vascular access (1). While there are interventional radiologists and vascular surgeons that are leaders in this field and have made monumental contributions, they are the exception. In most communities, dialysis vascular access issues are relegated to a low priority and management is performed by excellent practitioners who provide superior care, but not necessarily as it relates to this category of problems.

This is not the case for interventional nephrologists. These practitioners are trained in dialysis and have expertise in the care of the dialysis patient. Their interventional activity is generally dedicated to dialysis vascular access exclusively. However, since they do not have general training in either radiology or surgery, their level of expertise has been questioned. Data published in the literature has answered this question in the affirmative.

A study was published (2) in which 14,067 procedures performed by interventional nephrologists were analyzed. The overall success rate of 98.9% with a complication rate of 3.54% is unsurpassed in literature. In another report (3) of 12,896 cases performed by interventional nephrologists, the overall complication rate was 3.1% and complications related to sedation/analgesia was 0.14%. In order to evaluate radiation dosage involved in procedures performed by interventional nephrologists, a study was performed (4) which included cases numbers ranging from 500 to 6000, depending upon the specific procedure involved. This study showed that reference point air kerma levels were threefold lower than what others have reported in the literature and kerma area product levels were 3 to 8 times lower (5, 6).

In a study (7) using Medicare claims data and the technique of multivariate propensity score matching, 27,613 patients treated by a nephrologist in a freestanding dialysis access facility were compared with an equal number of patients treated in a hospital outpatient department. Each individual patient was matched according to 42 different variables. The study found that patients treated in the freestanding center, cost per episode, hospitalization rate, access infection, instance of septicemia and overall mortality rate were significantly less.

References

1. Saran, R, Elder, SJ, Goodkin, DA, et al. Enhanced training in vascular access creation predicts arteriovenous fistula placement and patency in hemodialysis patients: results from the Dialysis Outcomes and Practice Patterns Study. Ann Surg 2008; 247:885.
2. Beathard GA, Litchfield T; Physician Operators Forum of RMS Lifeline, Inc. Effectiveness and safety of dialysis vascular access procedures performed by interventional nephrologists. Kidney Int. 2004;66(4):1622-32.
3. Beathard, GA, Urbanes, A, Litchfield, T, Weinstein, A. The risk of sedation/analgesia in hemodialysis patients undergoing interventional procedures. Semin Dial 2011;24:97.
4. Beathard, GA, Urbanes, A, Litchfield, T. Radiation dose associated with dialysis vascular access interventional procedures in the interventional nephrology facility. Semin Dial 2013;26:503.
5. Heye, S, Maleux, G, Oyen, RH, et al. Occupational radiation dose: percutaneous interventional procedures on hemodialysis arteriovenous fistulas and grafts. Radiology 2012; 264:278.
6. Vano, E, Sanchez, R, Fernandez, JM, et al. Patient dose reference levels for interventional radiology: a national approach. Cardiovasc Intervent Radiol 2009;32:19.

7. Dobson, A, El-Gamil, AM, Shimer, MT, et al. Clinical and economic value of performing dialysis vascular access procedures in a freestanding office-based center as compared with the hospital outpatient department among Medicare ESRD beneficiaries. Semin Dial 2013;26:624.

Fact or Fiction: Anastomotic Techniques Reduce Juxta-Anastomotic Stenosis

Michael H. Gallichio
Dialysis Access Institute, Orangeburg, SC - USA

The juxta-anastomotic region of vessels fused can be the crux to anastomotic success or failure. The surgeon can control the three-dimensional course of the access within the extremity and the location and configuration of the anastomosis. How these factors are addressed contributes to the longevity of the access similarly to how the configuration of the plumbing in one's house keeps sewage off the floors. However, no amount of good surgical technique can overcome bad surgical decision-making with respect to vessel choice and location, or thwart poor patient biology. The side-side anastomosis performed in the Brescia-Cimino fistula (1) portended the importance of anastomotic configuration and work by Barat (2), Silva (3), and others maintain that the technical considerations in performing the anastomosis are always considered vital. Nonetheless, forty-eight years after Brescia, we continue to have the same failure modes in dialysis accesses. I will review what has been written about decision-making in this regard and the attempt to improve access outcomes by optimizing the peri-anastomotic regions. But, much like any good story there is always both fact and fiction present in the narrative.

References

1. Brescia MJ, Cimino JE, Appel K, Hurwich BJ. Chronic hemodialysis using venipuncture and a surgically created arteriovenous fistula. N Engl J Med. 1966; 275: 1089-1092.
2. Bharat A, Jaenicke M, Shenoy S. A novel technique of vascular anastomosis to prevent juxta-anastomotic stenosis following arteriovenous fistula creation. J Vasc Surg. 2012; 55: 274-280.
3. Silva MB, Hobson RW, Pappas PJ, Padberg FT. Vein transposition in the forearm for autogenous hemodialysis access. J Vasc Surg. 1997; 26: 981-988.

Deep Basilic Vein: Teaching Algorithm for the Best Options

John Ross
Dialysis Access Institute, Orangeburg Regional Medical Center, Orangeburg, SC - USA

Basilic vein elevation and transposition (BVT) is an important procedure in the armamentarium of establishing a native vein dialysis access fistula conduit when other modalities of superficial vein fistulas in the forearm and upper arm are not viable alternatives. This presentation addresses questions about when and how to do and choose between basilic vein transposition (BVT) procedures.

Selecting the single- vs. two-stage selection becomes the first consideration. Deciding factors include selecting the size of the vein, which if larger than 4 mm in diameter, favors a single stage. The BVT procedure as a vein elevation directly under the incision is not a preferred procedure under most circumstances. The lateral flap variation of the elevation procedure is preferred as the cannulation segment is away from the incision and the scar. In either case the inflow is the distal brachial artery. If the median cubital branch of the basilic vein is present the proximal radial artery can be used as inflow minimizing the risk of distal steal. In cases of high brachial artery bifurcation (in about 20 %) the deeper artery (becoming the ulnar artery) should be used above the level of the elbow, again preventing hand ischemia or the steal syndrome.

Single-stage BVT. The single-stage procedure is preferred when a vein is of adequate diameter of at least 4 mm by ultrasound examination. In cases of previous forearm access, the basilic vein is often dilated and ideally suitable for a one stage procedure where the vein is completely mobilized and tunneled using a separate hollow tunneler device followed by an end vein-to-side artery anastomosis above the antecubital crease. The failure modes

associated with this type of BVT are the inflow and the outflow swing segment stenoses, somewhat obviated if there is no tension in these segments at the time of the anastomosis. The length of the vein is of paramount importance in deciding how to do this tunnel procedure. The tunneled one stage procedure may not be chosen in the massively obese and short arm as only 20-25 centimeters of total vein to be utilized as a significant portion of the vein is used to develop the swing segments, leaving only a short cannulation zone. Even with the buttonhole technique, at least 10-15 centimeters cannulation segment is needed.

Maturation time is quite variable. In case of no swelling after tunneling, the subcutaneous vein resembles an ideally placed graft and tunneled BVT fistulas can often be cannulated within four weeks. In contrast, with a lateral flap or the simple vein elevation procedure, the time to cannulation is longer or six to eight. With this type of vein elevated basilic vein, especially when pulsatile or lacking palpable thrill, an ultrasound or angiogram with anticipated angioplasty of the swing segment is indicated. Angioplasty of the swing segment must not be done too early after transposition or elevation because of uncontrolled rupture as the surrounding tissues have not adhered to the transposed or elevated vein appropriately.

The Two-stage BVT. The first stage can be done in three different ways depending on the location of the available adequate basilic vein. First, if the median cubital vein is in close relationship to the radial artery or the brachial artery, it could be used for the anastomosis. Second, the posterior branch of the basilic vein on the medial aspect of the forearm can be rotated up to the brachial artery above the elbow crease. This gives a longer vein in the upper arm when the second-stage procedure is done. The second-stage procedure must be planned at the time of the first-stage procedure. The third first stage method is to use the common basilic branch at the confluence of the median cubital vein and the posterior basilic branch. This is rotated up as an end-to side anastomosis to the brachial artery. With this particular procedure some vein length is lost, which is of little consequence in cases of a long upper arm basilic vein. As in the single stage BVT, a short obese arm may preclude this method for not yielding enough cannulation length.

Maturation time. Before stage two surgery six to eight weeks are needed for the basilic vein to dilate to approximately 8 mm in diameter. A decision must be made whether to do a new vein-artery or an end vein to end vein anastomosis. The transposition procedure on the second-stage can be done in one of three ways. First, a full basilic vein tunneled transposition (as discussed above with the one stage BVT) can be in this second stage. If no stricturing around the vein is found during dissection close to the first arterial anastomosis and the vein measures about 8 mm, a vein end-to-end anastomosis can be done using interrupted suture technique or with interrupted suture-less clips. This basilic vein end to end anastomosis technique using the suturing clips has not been associated with stricture developing at the anastomosis.

Sometimes in doing a second-stage basilic vein transposition, mobilization and using the posterior basilic vein branch or the confluence of the basilic vein lends itself to anastomosis stenosis and is not appropriate for vein-vein anastomosis. In such a case the defined vein of adequate caliber is measured and after tunneling an end vein to side brachial artery anastomosis is performed. The first stage vein fistula anastomosis is suture ligated close to the arterial anastomosis making sure there are no missed competing tributaries.

The second method involves creation of a lateral flap basilic vein elevation without tunneling of the basilic vein. The entire basilic vein is mobilized with great attention given to the axillary area during mobilization. As a key component of this procedure, the two or three large perforating branches usually present in the axilla, should not be divided as they stabilize the basilic vein and prevent rotation, kinking and stenosis. The median antebrachial cutaneous nerve must be dissected free and kept intact. It can be placed in a separate plane such as that a new anastomosis is not needed. The lateral flap is created, like a thick mastectomy flap and developed for up to four centimeters and extended from three to four centimeters above the level of the elbow all the way to three to four centimeters below the axilla. Under-suturing is done with an absorbable suture which creates a tunnel with the vein in place under the flap. Simple skin closure is then instituted. Cannulation can usually be started after 8 weeks.

The third method of performing the 2-stage procedure is to raise the vein under the skin at the incision. Complete mobilization of the basilic vein is done as mentioned above for the one -stage procedure and then suturing of the subcutaneous tissues and fatty tissues with the vein placed directly underneath the skin closure. The scarring that takes place often makes it very difficult to cannulate and also may present discomfort for the patient, making this procedure less preferred.

Dressing application. Because of the large subcutaneous space, regardless of incision type, seroma formation is likely to occur. Placing rolls of gauze along the incision line wrapping with some compression left for 4-5 days may help minimize fluid buildup.

Summary. The basilic vein elevation or transposition procedures are important options in the dialysis access arsenal, but require much technical attention and judgment for outcome success. This includes decision opting for a single or two-stage procedure and whether a complete tunneled transposition or only vein elevation is to be done. The local anatomy and the patient factor play a major role in this decision making algorithm.

Surgery and AVF immaturity: What matters most? Patient factors are most important

Michael Allon
Professor of Medicine, University of Alabama at Birmingham, Birmingham, AL - USA

For the past 10 years there have been tremendous efforts to promote increased AVF use in hemodialysis patients, spearheaded by the KDOQI Vascular Access guidelines (1) and by the Fistula First Initiative. These national efforts have been extremely successful in increasing AVF placement and use among U.S. hemodialysis patients (2). At the same time, analysis of the AVF outcomes in numerous publications has highlighted large differences in AVF maturation in different patient populations. In particular, older age, female sex, forearm fistula location, peripheral vascular disease, cardiovascular disease, and obesity have all been associated with higher rates of AVF non-maturation (3, 4). Theoretically, the use of routine preoperative vascular mapping should be the "great equalizer", by ensuring selection of the optimal vessels in patients who are at higher risk of AVF non-maturation. However, large prospective studies have demonstrated that discrepancies in AVF maturation persist even when preoperative vascular mapping is applied, with lower maturation rates observed in older patients, women, and those receiving a forearm AVF (3). The likely explanation is that there are functional properties of vessels that impair their ability to dilate following AVF maturation, thereby limiting AVF maturation. These functional properties are not measured by standard preoperative vascular mapping, which focuses only on structural properties (vessel diameters). Non-maturing AVF may be salvaged in many cases by subsequent percutaneous or surgical interventions (5, 6). However, as compared to AVF that mature without subsequent interventions, those that require interventions to promote maturation have shorter secondary survival and require many more procedures to maintain their long-term patency for dialysis (7). It is critical for nephrologists and surgeons to understand patient factors that limit AVF success, and to plan access accordingly. The optimal strategy may be to place AVF in patients with relatively high likelihood of AVF maturation, and place AVG preferentially in those patients who have a high likelihood of AVF non-maturation (8).

References

1. KDOQI clinical practice guidelines and clinical practice recommendations for vascular access 2006. Am J Kidney Dis 2006;48 (suppl 1):S176-S322.
2. Lynch JR, Wasse H, Armistead NC, McClellan WM. Achieving the goal of the Fistula First Breakthrough Initiative for prevalent maintenance hemodialysis patients. Am J Kidney Dis 2011;57:78-89.
3. Peterson WJ, Barker J, Allon M. Disparities in fistula maturation persist despite preoperative vascular mapping. Clin J Am Soc Nephrol 2008;3:437-41.
4. Lok CE, Allon M, Moist LM, Oliver MJ, Shah H, Zimmerman D. REDUCE FTM I (Risk equation determining unsuccessful cannulation events and failure to maturation in arteriovenous fistulas). J Am Soc Nephrol 2006;17:3204-12.
5. Singh P, Robbin ML, Lockhart ME, Allon M. Clinically immature arteriovenous hemodialysis fistulas: effect of US on salvage. Radiology 2008;246:299-305.
6. Asif A, Roy-Chaudhury P, Beathard GA. Early arteriovenous fistula failure: A logical proposal for when and how to intervene. Clin J Am Soc Nephrol 2006;1:332-339.
7. Lee T, Ullah A, Allon M, Succop P, El-Khatib M, Munda R, et al. Decreased cumulative access survival in arteriovenous fistulas requiring interventions to promote maturation. Clin J Am Soc Nephrol 2011;6:575-81.
8. Allon M, Lok CE. Dialysis fistula or graft: The role for randomized clinical trials. Clin J Am Soc Nephrol 2010;5:2348-54.

Surgery and AVF Immaturity: What Matters Most? Surgical Judgment and Technique Are Most Important

Lawrence M. Spergel
Clinical Consultant, Fistula First / Catheter Last National Breakthrough Initiative, Sonoma, CA - USA

Successful arteriovenous fistula (AVF) construction and patency are a product of adequate vessels and other patient factors on the one hand, and the skill and judgment of the surgeon on the other. Clearly, without adequate vessels, the surgeon is challenged with identifying other options to provide hemodialysis access, which may preclude the possibility of constructing an AVF. However, even with optimal vasculature and other conditions, the surgeon who does not possess the skill and judgment to provide a well-functioning, appropriately chosen AVF, will have marginal or poor AVF outcomes. With AVF access, although most surgeons have, or can quickly develop, the skills necessary to construct an AVF, many surgeons do not have the judgment needed to maintain AVF access for the long term—or even in the short term. In many cases, this is due the paucity or lack of cases in surgical training, which in turn is caused by the absence of nearby dialysis centers. The hemodialysis population is very small considering the size of the population and these patients are spread out throughout the United States. Other causes of inadequately prepared access surgeons, with resulting poor outcomes, include the lack of surgical training programs and fellowships, and the multitude of surgeons who are not dedicated to really learning how to practice this extremely demanding sub-specialty. Regardless of the cause of the lack of optimal surgery for these patients, it has clearly been shown that when the surgical skill and/or judgment and/or dedication are lacking, AVF outcomes, both in incident and prevalent patients, suffer. The outcomes among surgeons vary widely, representing a major example of the "center effect." For example, a review of as yet unpublished data collected as part of the Fistula First Breakthrough Initiative (FFBI), shows a consistent pattern of this "center effect", more specifically a "surgeon effect", throughout the U.S. So when the AVF outcomes are reviewed in a given center, where the demographics and other variables are essentially the same, the AVF outcomes often vary widely among the surgeons. Further, centers within the same demographic were repeatedly seen to have widely disparate AVF outcomes based on the surgeon outcomes at one center vs. the other(s). This "surgeon effect" has also been described in the international literature. In conclusion, there is a clear "surgeon effect" seen when evaluating AVF outcomes. Further, although patient anatomy and other factors play a major role in successful AVF outcomes, the role of the surgeon is even more significant, in that the data show that those surgeons who have the skill, judgment and dedication needed to provide optimal autogenous vascular access, consistently do so. This is evidenced by very high incident and prevalent AVF rates, and low failure rates related to the non-maturing AVF, in spite of managing their fair share or more, of patients with poor vessels, multiple co-morbidities, and multiple prior accesses. In order to achieve optimal access outcomes, a call-to-action is needed to demand that adequate training be available and credentialing be required, of surgeons who choose to provide vascular access, and more specifically AVFs, for our hemodialysis patients.

Embolization of accessory veins redux: What did I get wrong? What did I get right?

Scott Trerotola
University of Pennsylvania Medical Center, Philadelphia, PA - USA

Whether accessory veins are anything but a very rare contributor to non-maturation remains controversial. This is curious in light of overwhelming circumstantial and direct evidence that they are not, and it is even more curious that this poorly supported intervention has not been subjected to a prospective randomized trial by those wishing to promote it. Indeed, as mentioned repeatedly in the past (CIDA 2007, 2010, 2013), this is an ideal topic for a randomized trial – there are large numbers of non-maturing fistulae in the US and both treatment patterns (embolization and PTA-only) are in widespread use. There is a clearly definable endpoint, ie maturation and this study would not be terribly expensive to carry out. In light of this it seems logical to conclude that the reason such a trial has not been carried out is that those promoting accessory vein treatment simply do not want to see the results of such a trial, because it may represent the death knell for a lucrative practice.

Just how lucrative is side branch embolization? Until 2014, when the embolization CPT codes were revamped and revalued, the embolization code 37204 paid 18 RVU or slightly over $800 to the physician. The code had no practice expense valuation. In addition, practitioners were apparently coding for every selective venous catheterization and based on the data I presented at CIDA 2013 (1) it is highly likely that at least some physicians were using the embolization code more than once in clear violation of CPT guidance language since the "offending" vessels treated were in the same surgical field. The result was a staggeringly high proportion of 37204 coding coming from nephrologists (25% of all use in 2012) in spite of this specialty having no other use for this code (which was widely used by interventional radiologists, vascular surgeons and cardiologists for multiple other purposes including trauma, vascular malformations, tumors, etc) than side branch embolization. Not that nephrologists were the only offending party in this practice; there is little doubt that surgeons and interventional radiologists embolized side branches, however since the same code was used for that and the other treatments above (including in ESRD patients), one cannot tease out the percentage applied to side branch treatment. One can reasonably conclude that perhaps half of all 37204 use was paid for a procedure that is not only unproven but also has substantial evidence against its efficacy (1-11). All of this I got right; and as I reported the PHYSICIAN payment for side branch embolization plummeted by half to 9 RVU, and in addition the previously associated supervision and interpretation codes 75894 and 75898 (the latter used for each vessel embolized, 1.65 RVU and not subjected at that time to the multiple procedure reduction, MPR) that had added several more RVU to the 18 RVU for 37204 were bundled into the single code 37241. Further, the CPT guidance language accompanying this code indicates very clearly that it is to be used only once regardless of the number of vessels treated in a session (although the catheterization codes can still be used). In my 2013 analysis I concluded that this massive devaluation of venous embolization (the arterial codes were devalued far less) was most likely due to the practice of side branch embolization. I am certain I got this right, and I stand by my conclusions. What I did not foresee, and only became evident when the CMS Final Rule was released early in 2014, was that the reimbursement for side branch embolization would perversely and paradoxically INCREASE as a result of Practice Expense valuation (PERVU) in the new code 37241 which had not been present in 37204. As a result, there was actually a sharp rise in reimbursement for this practice in the non-facility (ie outpatient centers) setting: the code 37241 alone now pays some $5000 to the center depending on region! Yes, I definitely got this wrong, and I can only hope that this will not serve as an inducement to continue this unproven, expensive practice. Perhaps the public release of CMS payments to individuals, which occurred for the first time earlier this year, will shine a strong light on those most egregiously performing side branch embolization. Indeed, when one compares equal volume practices with a heavy or exclusively dialysis intervention book of work and sees such marked disparities (2012 one year payments to individuals ranging to $5 million and more) it is difficult to ascribe these to anything other than side branch embolization. Only time will tell, and perhaps an outraged public. In the meantime, the need for a RCT to support this practice should be ever more urgent to those who believe in it.
What I also got right last year was that the evidence speaks strongly against side branches as a cause for non-maturation in all but a tiny percentage of patients. I will not revisit the data existing at that time again here; the argument is summarized in prior CIDA abstracts (1-3) and the references below (4-11). In the past year, to my knowledge there has been only a single meaningful contribution to this evidence basis, and what a contribution it is. Liang et al (4) from Taiwan added masterfully to the already burgeoning literature against side branch embolization in their report earlier this year. In 58 non-maturing AVF (which interestingly included thrombosed and "obliterated" fistulae), they reported 97% technical success and maturation rates nearly identical to prior reports (45% primary, 84% secondary patency at 1 year, 37% primary, 80% secondary patency at 3 years). Of relevance to this discussion, they described "competing or collateral" vessels in 37% initially and 27% post-PTA, and embolized in only one of these patients. When they analyzed those with residual visible side branches and those without, there was no difference whatsoever in the outcomes. I believe this is the first paper to perform such an analysis and as such it allows us, albeit in a non-randomized way, to perform an "apples to apples" comparison within a single study instead of comparing different studies with different practices (which incidentally also showed no difference). Bravo to this group for their restraint in not treating those residual vessels, and this paper provides the clear path forward: we should ignore side branches unless they can very clearly be shown to directly affect access function such as with flow measurement during occlusion (and this will result in very rare treatment, in my experience approximately 1%).
The burden of proof, which will inevitably be requested by CMS in order to continue reimbursing for this practice, now lies squarely on those wishing to promote it. I can only hope we will see the beginning of a randomized trial by CIDA 2015, but I won't hold my breath.

References

1. Trerotola SO. Accessory Veins: The Crisis Upon Us. J Vasc Access 2013;14:S38.
2. Debate: Con: Transcatheter Embolotherapy of Collaterals in Immature AVFs. J Vasc Access 2007;8:138-139.
3. Trerotola SO. Fiction: There's no proof that accessory veins cause immaturity. J Vasc Access 2010;11:218-219.
4. Liang H, Fu J, Wang P, et al. Endovascular salvage of immature autogenous hemodialysis fistulas. Cardiovasc Intervent Radiol 2014;37:671-678.
5. Beathard GA, Settle SM, Shields MW. Salvage of the nonfunctioning arteriovenous fistula. Am J Kidney Dis 1999; 33:910-916.
6. Faiyaz R, Abreo K, Zaman F, Pervez A, Zibari G, Work J. Salvage of poorly developed arteriovenous fistulae with percutaneous ligation of accessory veins. Am J Kidney Dis 2002;39:824-827.
7. Beathard GA, Arnold P, Jackson J, Litchfield T. Aggressive treatment of early fistula failure. Kidney Int 2003;64:1487-1494.
8. Turmel-Rodrigues L, Mouton A, Birmele B, et al. Salvage of immature forearm fistulas for haemodialysis by interventional radiology. Nephrol Dial Transplant 2001;16:2365-2371.
9. Shin SW, Do YS, Choo SW, Lieu WC, Choo IW. Salvage of immature arteriovenous fistulas with percutaneous transluminal angioplasty. Cardiovasc Intervent Radiol 2005; 28:434-438.
10. Clark TW, Cohen RA, Kwak A, et al. Salvage of nonmaturing native fistulas by using angioplasty. Radiology 2007;242:286-292.
11. Nasser G, Nguyen B, Rhee E, Achkar K. Endovascular treatment of the "failing to mature" arteriovenous fistula. Clin J Am Soc Nephrol 2006;1:275-280.

When Declotting an AVF, What Really Matters?

Jeffrey Hoggard
Capital Nephrology Associates, Raleigh, NC - USA

The clotted arteriovenous fistula is a good example of the tremendous clinical variability of hemodialysis vascular access. While the literature has documented the safety, efficiency, and cost effectiveness of performing dialysis access interventions in outpatient access centers, performing fistula thrombectomy in the outpatient setting requires increased materials, time, and skill compared with clotted grafts (1, 2). Experience and good clinical judgment are the foundation of a good outcome; and what really matters.

Dialysis Fistulas exist in more configurations and sizes than grafts; and, when fistulas present thrombosed, there are more factors to consider in proceeding with a thrombectomy than with grafts. The first and critical issue is patient safety. Because of the larger volume of clot, the risks for pulmonary embolism, distal arterial emboli and death are greater. The patient and interventionist should carefully consider these increased risks in the informed consent process, and the best decision may be to not do the thrombectomy (3).

Timing is important. In general, the earlier one can perform the thrombectomy after the clotting event, the easier and more successful the procedure will be. A fistula that has been clotted more than 7 days is exponentially more difficult. Duration of the procedure is another time factor to consider. Percutaneous interventions in the clotted fistula lasting more than 60 minutes tend to have less immediate and long term success. In this situation, terminating the declot procedure, placing a temporary catheter, and re-thinking a different approach is prudent. For the larger, aneurysmal, and "mega" fistulas, the ability to remove all the clot is important. Even if flow is restored to the fistula, the presence of residual wall thrombus can act as a nidus for new clot formation, propagation, and re-thrombosis (4). There are a variety of percutaneous thrombectomy devices and use of these expensive tools is reasonable if they reduce the time of the procedure and make complete clot removal easier (5). A minimally invasive surgical venotomy is a very cost-effective way to evacuate a large clot burden quickly and efficiently (6, 7). This contrasts with the small immature fistulas where the small vein wall may be collapsed and the only clot is the platelet plug at the arterial anastomosis. In this situation the clot burden is not a critical issue; rather, the access approach to the immature clotted fistula is probably more important. The small fragile fistula vein may infiltrate and hematoma at the sheath entry site once flow is restored. A distal radial artery access approach is useful for clotted immature forearm radiocephalic fistulas and upper arm fistulas to avoid cannulation injury to the fragile immature fistula vein (4, 8). Correcting the typical inflow problem is important to allow maturation of this fistula and prevent re-thrombosis.

Heparin anticoagulation is very important. For heparin allergic patients who are not on coumadin or other alternative agents, thrombectomy can be particularly frustrating due to recurrence and propagation of clot during clot removal. Thrombolytic drugs are useful adjunctive therapy particularly when the clot burden is larger. Thrombolytics can be delivered via a pulse-spray delivery catheter or simply injected and massaged into the clot prior to the procedure, or can be injected during the procedure. There is no role for routine antibiotic prophylaxis in percutaneous thrombectomy procedures.

Finally, after successfully re-establishing flow and removing all thrombus, the cause of the clotting event must be determined with careful imaging of the inflow and outflow (9, 10). In the immature fistula it is almost always an inflow lesion. In the mature fistula, one more likely will find a significant outflow or central stenosis. In the absence of a significant flow limiting lesion, one needs to look for and treat low cardiac output, hypotension and coagulation problems. The interventionist's diagnosis of the cause of the clotting event should be discussed in the procedure report. Specific surveillance and monitoring issues that might help prevent future fistula thrombosis should be emphasized.

References

1. Beathard GA, Litchfield T, et al. Effectiveness and safety of dialysis vascular access procedures performed by interventional nephrologists. Kidney Int. 2004;66(4):1622-32.
2. Schon et al. Comparison of Procedure Cost for Thrombectomy of Arteriovenous Fistulas and Grafts. Seminars in Dialysis 2013;26:344-348.
3. Clark et al. Outcome and Prognostic Factors of Restenosis after Percutaneous Treatment of Native Hemodialysis Fistulas. J Vasc Interv Radiol 2002; 13: 51-59.
4. Chih-Cheng Wu et al. Radial artery approach for endovascular salvage of occluded autogenous radial-cephalic fistulae. Nephrol Dial Transplant 2009;24:2497-2502.
5. Littler et al. AngioJet Thrombectomy for Occluded Dialysis Fistulae: Outcome Data. Cardiovasc Intervent Radiol 2009;32:265-270.
6. Seung-Moon Joo et al. Recanalization of Thrombosed Arteriovenous Fistulas for Hemodialysis by Minimal Venotomy. J Vasc Interv Radiol 2013;24:401-405.
7. Won et al. A Venotomy and Manual Propulsion Technique to Treat Native Arteriovenous Fistulas Occluded by Thrombi. AJR 2012:198:460-465.
8. Li-Chuan Hsieh et al. Radial Arterial Approach with Adjunctive Urokinase for Treating Occluded Autogenous Radial-Cephalic Fistulas. Cardiovasc Intervent Radiol 2009;32:1202-1208.
9. Han M, Kim JD, Bae JI, Lee JH, Oh C-K, Han C, Won JH. Endovascular treatment for immature autogenous arteriovenous fistula. Clinical Radiology 2013; 68: e309-315.
10. Nassar G. Endovascular Management of the 'Failing to Mature' Arteriovenous Fistula. Tech Vasc Interventional Rad 2008;11:175-180.

This AVF Clotted Yesterday: Try to Salvage It? Yes: It Should Be Tried Percutaneously

Timothy W.I. Clark
University of Pennsylvania School of Medicine, Philadelphia, PA - USA

Native fistulae have eclipsed grafts to become the most common vascular access through the combined efforts of Fistula First™ and other organized initiatives. Despite lower all-cause mortality and infection compared to grafts and catheters, a subset of fistulae will fail over time and thrombose. Over the last 15 years, percutaneous thrombectomy has evolved to become first-line management of the majority of clotted dialysis fistulae; there are relatively few instances where a clotted fistula is best managed with surgical thrombectomy. Percutaneous thrombectomy for a typical patient with a clotted fistula is equally as likely as surgical revision to achieve clinical success, more likely to preserve native venous conduit, and using current techniques requires fewer resources.

1. Equivalent clinical success

Both percutaneous and surgical thrombectomy are associated with >90% clinical success entailing restoration of access patency for at least one dialysis session. Although primary patency is higher in some surgical series, secondary patency rates are not significantly different.

2. Greater preservation of native venous conduit

This is a universally acknowledged limitation of surgical management of access thrombosis. This is evident within the consensus guidelines of K/DOQI of 2006, wherein the target thresholds of primary patency for surgical thrombectomy are substantially higher than that of percutaneous thrombectomy. As stated in K/DOQI 8.4.3, *"Surgical correction is set to a higher standard because of the use of venous capital".* This is bourne out in the subsequent metaanalysis performed by Tordoir et al comparing surgical and endovascular thrombectomy, wherein 6/7 (86%) of the cited surgical series involved abandonment of the initial AV fistula anastomosis and creation of a new anastomosis, placement of an interposition graft, or a patch angioplasty using synthetic conduit.

3. Requires fewer resources

Limited data exists as to the relative costs of utilization of percutaneous thrombectomy compared to surgical thrombectomy for AVFs. In the 1990s Dougherty et al calculated costs of percutaneous thrombectomy of AVGs to be higher than surgical revision, however their analysis did not include professional fees (surgeon and anesthesiologist) as all procedures were performed within an endovascular operating room within a hospital. That study was also performed in the era using a substantially more expensive lytic agent (urokinase), and therefore does not reflect contemporary practices. Significant evolution has occurred in endovascular techniques since the 1990s, including the availability of less expensive lytic agents, improved thrombectomy devices, and ultra-high pressure angioplasty balloons. Most importantly, as found in a large observational study by Lok et al of 1140 dialysis patients, grafts were more than 16 times more likely to require treatment for thrombosis compared to fistulas (0.98 vs. 0.06/1000 catheter days, $P<0.001$).

More recently, Miller et al calculated an average cost of $12,904 when percutaneous salvage of thrombosed immature AVFs was performed, compared to access abandonment and creation of a new access ($15,359).

Summary

Percutaneous thrombectomy of dialysis fistulae is the default first-line strategy for fistula thrombosis. Percutaneous thrombectomy preserves venous conduit, requires fewer resources, and enables earlier return of patients to their scheduled dialysis. Surgical thrombectomy retains an important role for a minor subset of patients who cannot undergo percutaneous thrombectomy.

References

1. National Kidney Foundation: KDOQI Clinical Practice Guidelines and Clinic Practice Recommendations for 2006 updates: hemodialysis adequacy, peritoneal dialysis adequacy and vascular access. Am J Kidney Dis 2006; 48: S1–S322.
2. Clark TWI, Hirsch DA, Jindal KJ, Veugelers PJ, LeBlanc J. Outcome and prognostic factors of restenosis following percutaneous treatment of native hemodialysis fistulae. *J Vasc Interv Radiol* 2002; 13: 51-59.
3. Rajan DK, Clark TW, Simons ME, Kachura JR, Sniderman K. Procedural success and patency after percutaneous treatment of thrombosed autogenous arteriovenous dialysis fistulas. J Vasc Interv Radiol 2002; 13:1211-1218.
4. Hingorani A, Ascher E, Kallakuri S, Greenberg S, Khanimov Y. Impact of reintervention for failing upper extremity arteriovenous autogenous access for hemodialysis. J Vasc Surg 2001; 34:1004-1009.
5. Shatsky JB, Berns JS, Clark TWI, Kwak A, et al. Single-center Experience with the Arrow-Trerotola percutaneous thrombectomy device in the management of thrombosed native dialysis fistulas. J Vasc Interv Radiol. 2005;16(12):1605-1611.
6. Tordoir JHM, Bode AS, Peppelenbosch N, van der Sande FM, de Haan MW. Surgical or endovascular repair of thrombosed dialysis vascular access: Is there any evidence? J Vasc Surg 2009; 50: 953-956.
7. Dougherty MJ, Calligaro KD, Schindler N, Raviola CA, Ntoso A. Endovascular versus surgical treatment for thrombosed hemodialysis grafts: A prospective, randomized study. J Vasc Surg 1999;30:1016-1023.
8. Lok CE, Sontrop JM, Tomlinson T, et al. Cumulative Patency of Contemporary Fistulas versus Grafts (2000–2010). Clin J Am Soc Nephrol 2013:8:810-818.
9. Miller GA, Hwang W, Preddie D, Khariton A, Savransky Y. Percutaneous Salvage of Thrombosed Immature Arteriovenous Fistulas. Seminars in Dialysis 2011;24:107-114.

Surgical Salvage of Thrombosed Arteriovenous fistula

Surendra Shenoy
Washington University School of Medicine, Saint Louis, MO - USA

Despite thrombotic complications being less frequent in arteriovenous fistulae (AVF), increasing prevalence of AVF has resulted in increased incidence in fistula thrombosis. Attempting thrombectomy in an AVF is an accepted practice; however there exists a significant lack of evidence to make a rational decision regarding its timing and approach. A thrombectomy can be performed with image guided percutaneous intervention (IGI) or using surgical means with direct visualization in the operating room. Both techniques have inherent merits and demerits (Tab. I) in the present clinical setup. Goal of thrombectomy should be to use a technique that is likely to provide the longest patency in given situation (1).

Thrombosis could happen in AVF in use that needed several assists to mature or those that matured without any assist. Some may have aneurysmal dilations from outflow stenosis with acute and chronic thrombi and others due to inflow problems with acute thrombi alone. Current surgical and interventional literature does not differentiate these factors to provide an outline for planning thrombectomy. The descriptive data and procedural outcome (2-4) show variable success with both techniques.

We reviewed 63 (52 patients, M33:F19) consecutive surgical AVF thrombectomies performed in functional AVF between 2008 and 2013. Time to thrombosis from creation of AVF was 56 (range 7-213) months. Mean clot duration was 30 days (range 1-200). 90% presented with bridging catheters (33% failed IGI, 57% IGI felt not possible, 10% surgical thrombectomy without tunnel catheter). The procedural success was 95% and salvage rate 98%. Post thrombectomy median followup was 14 (I-Q range 3-20) months. 17 (27%) patients needed no further interventions. Remaining 46 patients needed 92 procedures (10 surgical, 26 IGI thrombectomies and 56 other IGI) (mean 2.0, range 1-7 procedures) to maintain cumulative patency (Fig. 1). 24 AVF were given up (mean 8 months, range 0.6-35mo) during the follow up period.

Surgical thrombectomy is an effective technique to reestablish patency in thrombosed fistulae that were in use. It is efficient in removing chronic thrombi with minimal risk of embolic complications. It provides an opportunity to reconstruct the inflow or the outflow problems, aneurysms repair and provide healthy skin coverage often while the conduit is still in use avoiding a bridging catheter and prolong access patency. It also avoids the need for peripheral stents and stent related complications thus preserving the venous real estate for future use. It is useful even in situations where interventional thrombectomy fails or cannot be offered. Surgical thrombectomy should be considered in all fistulae that have been functional for a period of time.

Table I - Inherent differences between surgical and interventional thrombectomy

	Surgical	**Interventional**
Procedure scheduling	Can be cumbersome	Relatively easy
Patient convenience	Can be inconvenient	Relatively easy
Anesthesia (sedation/general)	Easy to schedule	Difficult to schedule
Hybrid procedures	Easy to use image guidance	Percutaneous intervention only
Thrombus management	Relatively easy	Can be difficult
Risk of embolic problems	Relatively low	Always at risk
Choices for salvage	Many options for reconstruction	Tunnelled dialysis catheter
Complication management	Readily available	Difficult to obtain

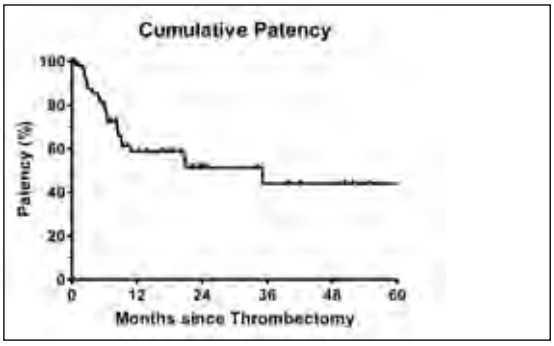


Fig. 1 - *Cumulative patency after surgical thrombectomy.*

References
1. Okada S, Shenoy S. Arteriovenous access for hemodialysis: preoperative assessment and planning. J Vasc Access. 2014;15 Suppl 7:S1-5.
2. Jain G, Maya ID, Allon M. Outcomes of percutaneous mechanical thrombectomy of arteriovenous fistula in hemodialysis patients. Semin Dial. 2008;21:581-583.
3. Oakes D, Sherck JP, Cobb LF. Surgical salvage of failed radiocephalic arteriovenous fistulae: techniques and results in 29 patients. Kidney Int 1998;53:480-487.
4. Ponikvar R. Surgical Salvage of thrombosed native arteriovenous fistulas for hemodialysis by Interventional Nephrologists. Ther Apher Dial 2009;13:340-344.

Is There Any Role for Bare Metal Stents in Dialysis Access?

Timothy W.I. Clark
University of Pennsylvania School of Medicine, Philadelphia, PA - USA

Covered stents are becoming more widely utilized in the treatment of dysfunctional dialysis accesses. Randomized trials have indicated that endografts have a higher primary unassisted patency over angioplasty alone; it should be recognized that the inclusion and exclusion criteria of such trials are quite selective and may not reflect many real-world situations. While evidence continues to accumulate for stent graft placement over angioplasty, there is a paucity to support the incremental benefit of a stent-graft over a bare metal stent. There are still multiple scenarios where bare metal stents provide certain advantages over their covered stent counterparts.

1. Venous junctions
Covered stents can impede venous drainage from the arm or lower extremity when these devices are placed with the covered segment spanning the confluence of dialysis access outflow and the venous drainage of the extremity. Examples of this include the cephalic arch, the junction of an upper arm graft with a basilic or axillary vein, and thigh grafts when the superficial and/or common femoral veins may be compromised.

2. Preservation of collaterals when treating arterial inflow disease
Patients with symptomatic peripheral arterial disease contributing to vascular steal symptoms will often benefit from endovascular treatment of hemodynamically significant inflow stenosis. These arterial lesions may be subject to in-stent stenosis, and stent graft placement may cover critical collateral vessels.

3. Cannulation zone of access
Although every attempt should be made to avoid placing any stent within a cannulation zone of an access, there are scenarios when failure of angioplasty/thrombectomy may require stent placement within a cannulation segment to prevent certain access failure. Repetitive needle cannulation through the interstices of a bare metal stent can produce stent fracture, however bare metal stents appear less susceptible to cannulation-induced damage and infection compared to covered stent counterparts.

4. Preservation of the interval jugular vein during treatment of central venous lesions
It is usually possible to place a tunneled catheter through the interstices of a bare stent using a directional catheter and guidewire to cross the interstices and then serial dilation to enable placement of a peelaway sheath. This may be difficult or impossible when the internal jugular vein is jailed by a covered stent.

5. Cost constraints
Recently published randomized trials have suggested that covered stents confer superior primary unassisted patency over angioplasty. It remains unclear as to whether covered stents are cost effective over bare metal stents, and secondary patency between bare and covered stents are not significantly different. The incremental cost of covered stents has yet to be justified in terms of cost effectiveness as measured through dollars per quality-adjusted life-years ($/QALY).

References
1. Chan MR, Young HN, Yevzlin AS. The effect of in-stent restenosis on hemodialysis access patency. Hemodial Int. 2009;13:250-256.

2. Maya ID, Saddekni S, Allon M. Treatment of refractory central vein stenosis in hemodialysis patients with stents. Semin Dial. 2007;20:78-82.
3. Haskal ZJ, Trerotola S, Dolmatch B, et al. Stent graft versus balloon angioplasty for failing dialysis-access grafts. N Engl J Med. 2010;362:494-503.
4. Haskal J. Twelve month results of the RENOVA trial: a prospective multicenter randomized, concurrently-controlled comparison of the Flair endovascular stent graft vs. balloon angioplasty in dialysis access grafts. J Vasc Interv Radiol. 2013;24:S5.
5. http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfTopic/pma/pma.cfm?num=P130006
6. Shemesh D, Goldin I, Zaghal I, et al. Angioplasty with stent graft versus bare stent for recurrent cephalic arch stenosis in autogenous arteriovenous access for hemodialysis: a prospective randomized clinical trial. J Vasc Surg. 2008;48:1524-1531.

Central Venous Obstruction (CVO) – Worse than Lymphoma!

Bart Dolmatch
The Palo Alto Medical Foundation, Palo Alto, CA - USA

Given the title of this abstract, one might think I'm trying to make the case that hemodialysis patients with CVO have higher morbidity or mortality rates than comparable patients with lymphoma. That may or may not be true, and that's exactly the point! Our ability to understand and classify lymphomas (1) has led to different treatment pathways with significant improvement in survival for many patients. But we don't have any true understanding of different types of CVO's. With no clinical, anatomic, or etiologic classification, we treat all CVO's similarly and report mediocre results after angioplasty with or without stent placement.

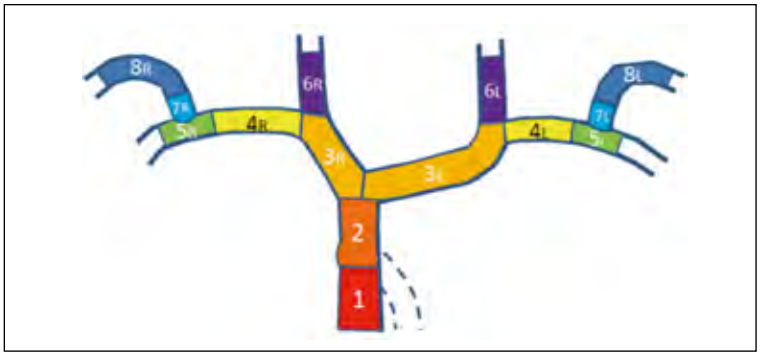
Perhaps, just like lymphoma, there are different types of CVO's? If so, it's likely that different CVO's should be treated differently to achieve optimal patency. But with no widely adopted classification schema we will never know.

There is a predicate for developing a vascular-based classification system. Many years ago the entire spectrum of peripheral arterial disease (PAD) was poorly classified. In 1954, René Fontaine proposed a clinical severity scoring system for PAD (2) that now has been largely replaced by the Rutherford classification system (3). Anatomically, PAD occlusive disease has also been studied. The Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC and TASC II) separates PAD into different groups of stenosis and occlusion (4). Recommendations for treatment are based upon the TASC lesion category for aortoiliac, femoropopliteal, and infrapopliteal occlusive arterial lesions.

Classification of CVO is long overdue. Severity of symptoms should be described, for example:

0. Asymptomatic
1. Swelling without impact on daily life
2a. Swelling affecting activities of daily life
2b. CVS affecting hemodialysis (with or without swelling)
3. Swelling with secondary medical complications
4. Swelling that is a threat to life or limb

Anatomic location of CVO(s) should be noted using a system such as:



Finally, a schema that encompasses all of the causes of CVO should be developed, such as:

1. Intraluminal or mural CVO
    a. Thrombus (acute or subacute)
    b. Neointima (or organized mural thrombus)
    c. Hyperplastic valve
    d. Device (catheter, leads)
    e. Stent or stent graft device (mechanical +/or hyperplasia associated)
    f. Radiation
    g. Surgery
    h. Malignancy
2. Extraluminal CVO (Extrinsic compression)
    a. Benign
        i. Vascular
        ii. Bone and/or ligament
    b. Malignant
3. Flow leading up to the CVO
    HQ. High flow (patent ipsilateral AV access)
    LQ. Low flow (no AV access flow on ipsilateral side)
4. Etiology unknown for CVO

For example, CVO may be due to subclavian vein thoracic outlet extrinsic compression or brachiocephalic vein in-stent restenosis. Angioplasty is probably the first percutaneous intervention used by an interventionalist in both situations. Is that the best approach? Should some lesions require stent or stent graft placement while others never even undergo angioplasty? We don't know because we don't study different CVO's independently. Nearly all of the CVO literature combines different types of lesions and reports the aggregate outcome.
Until we recognize that differing clinical severity may require different strategies, and that there are many different anatomic types and etiologies for CVO, we will continue to practice a "one size fits all" approach with no useful data to guide the selection of treatment of our patients. The time has come to establish a framework for understanding CVO, and while the examples I provide may require modification, they are offered as a starting point for discussion.

References

1. http://www.lls.org/content/nationalcontent/resourcecenter/freeeducationmaterials/lymphoma/pdf/nhl.pdf
2. Fontaine R, Kim M, Kieny R. Surgical treatment of peripheral circulation disorders. [Die chirugische Behandlung der peripheren Durchblutungsstörungen]. [Article in German]. Helvetica Chirurgica Acta 1954;21(5/6):499-533.
3. Rutherford RB, Baker JD, Ernst C, et al. Recommended standards for reports dealing with lower extremity ischemia: revised version. J Vasc Surg 1997;26:517.
4. Norgren L, Hiatt WR, Dormandy JA, TASC II Working Group et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). J Vasc Surg. 2007;45(Suppl S):S5-67.

Rethinking central venous stenosis

Scott Trerotola
University of Pennsylvania Medical Center, Philadelphia, PA - USA

In spite of the repudiation of subclavian vein use for hemodialysis catheters and the associated internal jugular revolution of the 1990s, promoted heavily by the 1997 and subsequent K/DOQI guidelines, and in spite of the best efforts of the Fistula First Breakthrough Initiative (FFBI), now dubbed Fistula First Catheter Last (FFCL), catheter use and associated central venous stenosis (CVS) remain as much of a problem today as they were in the last century. With 80% of patients initiating hemodialysis using catheters in the United States, it is not a wonder that a recent study from our practice showed a 50% prevalence of CVS in nearly 500 patients studied with fistulography over a 4 year period from 2009-2013 (1). Further, in spite of a strict practice of never using the subclavian vein for access, over half of these stenoses were in the subclavian vein (SCV). These numbers

are strikingly similar to those found by Surratt et al in a 1991 paper describing preoperative screening: a 41% prevalence of CVS was found (2). There was a difference: in the latter study, all patients with CVS had had prior catheters and all had been in the subclavian vein. Not surprisingly, all stenoses detected were in the subclavian vein, not the brachiocephalic (especially in light of the US-based nature of the study). Thus, one might reasonably wonder whether in promoting IJ over SCV, have we simply traded on CVS location for another? Fortunately, the answer appears to be no, although the question bears consideration far beyond the scope of this brief report as we begin to rethink CVS.

It is important to note that not all patients with CVS in our study were symptomatic, and that was the major focus of the research (1). In fact, we were able to show that while the prevalence of CVS was identical among those with fistulae and those with grafts, only 14% of patients with fistulae were symptomatic while 25% of those with grafts had symptoms (arm, face or breast swelling), and this was highly statistically significant (P=0.002). Looked at another way, if one considered only those with CVS (ie, half the cohort), 29% with fistulae were symptomatic compared with 52% with grafts (P=0.005). This important distinction builds on prior work showing that the results of CVS PTA are better in patients with fistulae compared with grafts (3) and adds further support to the FFBI/FFCL effort at promoting fistulae. We also found that regardless of access type, CVS was less likely to be symptomatic if the patient had forearm compared with upper arm access (P=0.005) (1). We believe our study may help inform access planning: if a patient has mild to moderate CVS on preoperative mapping ipsilateral to an excellent forearm cephalic vein, and no CVS but no good veins for a fistula on the contralateral side, the patient is likely better served with the fistula ipsilateral to the CVS than a graft on the non-CVS side. This concept runs counter to present access planning algorithms yet once again should make us rethink CVS.

Sometimes rethinking means revisiting and reinforcing what we already know. A relatively recent study from France reinforces the findings of Levit et al (4) concerning asymptomatic CVS. Renaud et al reported 4 year results of observing rather than treating minimally symptomatic or asymptomatic CVS and showed that only 40% of 53 patients progressed to having symptoms over that time. Importantly, there was no difference in access outcomes or in the results of eventually treating CVS compared with a control group of 50 patients with symptomatic CVS. Curiously, 63% of the patients in the study (all of whom had CVS) had never had a catheter! This observation should at least give us pause and cause us to rethink what we take as gospel regarding the relationship between catheters and CVS. Regarding asymptomatic CVS, the message remains clear: do not treat until symptoms occur. In spite of this, even in my own practice I sometimes see patients treated for asymptomatic CVS. Further, several generations of fellows coming from other institutions have been very surprised to learn this important concept as CVS had been treated across the board during their residencies. It seems the oculotherapeutic reflex is a difficult one to avoid.

New tools have allowed us to apply some more science to the treatment of symptomatic CVS. In a study we reported at SIR 2014, we used direct flow measurement to determine the effects of CV PTA on access circuit flow (6). The results were at once surprising and predictable. There is little if any evidence that CVS affects access function (7), a key fact that reinforces the above tenets regarding asymptomatic CVS. Our prospective study showed that flow increased only minimally after CV PTA (95% CI 0-29%), yet symptoms were eliminated in all but one patient (96%). This apparent paradox is difficult to grasp unless we fully disconnect the concepts of flow and access function from clinical symptoms. We are just beginning to understand this relationship, and for those who want to justify CV PTA based on access dysfunction alone, think again.

Regarding decision making in CVS PTA, most interventionalists long ago abandoned pressure measurement for guiding such interventions, yet a new study may cause us to rethink this as well. Lin et al used pullback pressure measurements during CVS PTA (it is not clear how many were symptomatic), applying a 5 mm Hg cutoff and comparing this to percent residual stenosis post PTA, using <30% and 30-50% as "success" and "acceptable" respectively (8). Using 12 month postintervention primary patency, these authors found that while percent residual stenosis did not predict patency, pullback pressures did, but only if the residual stenosis was >30%. My interpretation of these results is that if there is residual stenosis >30%, rather than immediately placing a stent, interventionalists should perform pullback pressure measurements, and if the gradient is <5 mm, which it will often be, no further intervention should be performed. This has most definitely caused me to rethink pressure measurements in CVS PTA. Further, applying this simple and inexpensive problem solving tool will help to curb the continued explosion of stent and stent-graft use.

In summary, as the evidentiary landscape inevitably shifts in hemodialysis access interventions, we are sometimes forced to rethink these interventions. After a period of remarkable stability, the CVS landscape has changed rapidly in the past few years, opening multiple new avenues for research while reinforcing some tried and true concepts.

References

1. Kothari S, Trerotola SO. Central venous stenosis is more often symptomatic in hemodialysis patients with grafts compared to fistulae (abstract). J Vasc Interv Radiol. 2014;25:S181-182.
2. Surratt RS, Picus D, Hicks ME, Kleinhoffer M, Jendrisiak M. The importance of preoperative evaluation of the subclavian vein in dialysis access planning. AJR Am J Roentgenol. 1991;156(3):623-625.
3. Rajan DK, Chennepragada SM, Lok CE, et al. Patency of endovascular treatment for central venous stenosis: Is there a difference between dialysis fistulas and grafts? J Vasc Interv Radiol. 2007;18:353-359.
4. Levit RD, Cohen RM, Kwak A. Asymptomatic central venous stenosis in hemodialysis patients. Radiology. 2007;238:1051-1056.
5. Renaud CJ, Francois M, Nony A, Fodil-Cherif M, Turmel-Rodrigues L. Comparative outcomes of treated symptomatic versus non-treated asymptomatic high-grade central vein stenoses in the outflow of predominantly dialysis fistulas. Nephrol Dial Transplant. 2012;27:1631-1638.
6. Yan Y, Sudheendra D, Dagli M, et al. Effect of central venous angioplasty on hemodialysis access circuit flow (abstract). J Vasc Interv Radiol. 2014;25:S19-20.
7. Trerotola SO. Central Venous Stenosis: Best avoided; if found, best ignored; if treated, best ballooned; if stented, best covered? J Vasc Access. 2011;12:S41-43
8. Lin Y, Yang C, Chu C, et al. The role of postintervention pullback pressure gradient in percutaneous transluminal angioplasty for central vein stenosis in hemodialysis patients. Cardiovasc Intervent Radiol. 2013;36:1296-1305.

Novel Payment Models to Encourage Quality and Efficiency

Gordon McLennan
Cleveland Clinic Foundation, Society of Interventional Radiology Renal Disease Service Line, Chagrin Falls, Ohio - USA

Despite high quality medical institutions and advanced medical care in the US, average life expectancy, infant mortality, and other measures of health system quality are worse in the US than in other countries (1). With the increased cost of delivering care in the US, a growing proportion of our nations' Gross Domestic Product will be consumed by health care such that by 2020 we are projected to spend $4.6 trillion or 20% of GDP (2). By 2030, 20% of the US population will be over the age of 65 with the fastest growing age group being over 85 years old (3, 4). To meet the growing costs of an aging population, the Center for Medicare and Medicade Services (CMS) has developed a strategic plan that focusses on 4 goals which seek better care at lower costs through coordination of care, increasing prevention and better population health, expanding health care coverage leading to what they term "Enterprise Excellence" which is meant to imply a system that integrates services towards best outcomes at the lowest possible costs (5). The Center for Medicare and Medicaid innovation was established to develop new payment and service delivery models in accordance with the Social Security Act (Section 1115A) and the Affordable Care act. This part of CMS is focused on developing new demonstration projects to determine what new payment models would be helpful to deliver high quality care at a lower cost.

In the area of renal disease, a demonstration project is available for participants who want to try to deliver care to ESRD patients as an accountable care organization. This project seeks to create ESRD Seamless Care Organizations (ESCOs) who will take on responsibility for the medical care of beneficiaries with ESRD.

In addition to this, CMS requested information from specialty organizations related to alternative models of specialty care. The Society of Interventional Radiology and the Coalition for Vascular Care (which represented nephrologists and interventional nephrologists) prepared responses to the CMS inquiry in April 2014. The approach to this type of service consolidation needs to be considered in the context of the overall care of the patients. Both groups made recommendations that broke the episodes of care for the ESRD patient into separate periods of time related to their dialysis access. In general, one can think of this as from the time of diagnosis to the time of access placement/first use; then the period of access maintenance; then the period of transition from one access to another. The SIR also proposed a period from acute access catheter placement to first use so it can be distinguished from the planned access.

If care can be integrated between specialties in these periods of care, we should be able to promote AVF use and limit catheter use among dialysis patients, which will lead to better survival, lower hospitalization rates, and lower cost.

References
1. Muennig PA, Glied SA. What changes in survival rates tell us about US health care. Health Affairs. 2010;29(11):2105-2113.
2. CMS Office of the Actuary. National Health Expenditure Projections 2010-2020.
3. Vincent GK, Velkoff VA. The Next Four Decades: The Older Population in the United States: 2010 to 2050. Census Bureau, May, 2010.
4. http://www.aoa.gov/agingstatsdotnet/Main_Site/Data/2010_Documents/Population.aspx.
5. CMS Strategy: The Road Forward 2013-2017. Center for Medicare and Medicaid Services; March 2013. http://www.cms.gov/About-CMS/Agency-Information/CMS-Strategy/Downloads/CMS-Strategy.pdf

Re-thinking quality metrics for vascular access care

Michael Allon
Professor of Medicine, University of Alabama at Birmingham, Birmingham, AL - USA

At present, the following vascular access metrics are the focus of the dialysis networks:

1. What proportion of vascular access placed by a surgeon are AVF vs AVG?
2. What proportion of HD patients use an AVF for dialysis?
3. What proportion of HD patients use CVC for dialysis?

These metrics are over-simplistic and do not take into account the extraordinary complexity of optimizing vascular access outcomes. Should we really judge a surgeon as "better" because he or she places a higher proportion of AVF? How do we factor AVF non-maturation, need for access revisions, the duration of CVC dependence and frequency of CVC infections? Is it possible that a surgeon who is more selective in which patients receive an AVF is actually doing a better job of preventing CVC complications? Is it sufficient to know that a given dialysis unit has X% of AVF without knowing the longevity of the accesses, the frequency of access interventions, the number of CVC in use, or the frequency of catheter-related bacteremia? Are these quality metrics appropriate if they don't take into account patient characteristics?

I would propose that we need a modified set of vascular access metrics that address factors that directly impact patient welfare:

1. What proportion of incident HD patients experience CVC related bacteremia before they have a functional vascular access?
2. What is the overall burden of vascular access procedures of any kind (new access, percutaneous or surgical revisions, CVC placement or exchange)?
3. What is the frequency of catheter-related bacteremia?

These proposed metrics are more difficult to collect, but are much more relevant to the welfare of hemodialysis patients.

Comprehensive Interventional Care at the Out-Patient Dialysis Center – Diversify?
Yes: Alignment and Integration for Comprehensive Patient Care

Jeffrey Hoggard
Capital Nephrology Associates, Raleigh, NC - USA

Dialysis access is an expensive part of the ESRD program and the majority of dialysis access care is now provided in outpatient vascular access centers (VAC). The efficiency, safety, and cost-effectiveness of the VAC model is well-documented (1- 3). Typical VAC procedures include the placement and removal of hemodialysis and peritoneal catheters, vessel mapping, diagnostic angiography with therapeutic interventions including angioplasty, stenting and thrombectomy. The clinical and business successes of the VAC model have experienced ongoing growth and expansion in more recent years. Service lines and procedure types have expanded to include dialysis access

surgical creation, endovascular interventions for peripheral arterial and venous disease, lipectomy for deep fistulas, and aneurysm surgical revisions.

Nationally there has been consolidation of the independent VACs; the majority of this business activity has been by the large dialysis organizations (LDO) (DaVita Lifeline, Inc. and Fresenius Vascular Care). This consolidation is not surprising in the current health care environment for several reasons. This alignment of care coincides with the formation of Accountable Care Organizations (ACO's) which promise to deliver a more concerted, less fragmented type of health care (4). Furthermore, reimbursement for the typical dialysis access procedures has been trending down and consolidation allows larger economies of scale that help maintain financial viability. The ACO model of healthcare will require coordination across multiple specialties and disciplines to achieve excellent outcomes at lower cost. The ability to provide for planning, creation, and maintenance of dialysis access under one roof and outside the hospital setting will be more timely and efficient. Should the reimbursement for dialysis access creation and maintenance ultimately become bundled with reimbursement for dialysis care, these consolidated entities will likely have an advantage in controlling this expensive health care cost.

This new alignment of dialysis access care raises the standard of care because accreditation (AAAHC or The Joint Commission) of the VACs is a requirement for both DaVita Lifeline and Fresenius Vascular Care. While accreditation is not required at independent VACs, this author feels that safety is improved, liability costs decrease, and staff recruitment is enhanced when there is compliance with national accreditation standards. A consolidated entity can also provide a common electronic health record (EHR) among numerous VACs which is another advantage of this alignment of care. The ability to track the details of a large number of procedures allows for development of powerful databases and registries, which is important for future clinical trial work in this field. Similarly, such an EHR can help establish important and truly representative benchmarks for procedural outcomes and complications. In this new alignment of care networking of interventionists is facilitated; this will allow best practices in this field to be identified and applied.

In summary, the benefits of the alignment of care of LDO's and VACs outweigh the potential conflicts of interest.

References

1. Dobson A, El-Gamil AM, Shimer MT, DaVanzo JE, Urbanes AQ, Beathard GA, Litchfield TF. Clinical and economic value of performing dialysis vascular access procedures in a freestanding office-based center as compared with the hospital outpatient department among Medicare ESRD beneficiaries. Semin Dial. 2013;26:624-632.
2. Beathard GA, Litchfield T; Physician Operators Forum of RMS Lifeline, Inc.Effectiveness safety of dialysis vascular access procedures performed by interventional nephrologists. Kidney Int. 2004;66:1622-1632.
3. Mishler R, Sands JJ, Ofsthun NJ, Teng M, Schon D, Lazarus JM. Dedicated outpatient vascular access center decreases hospitalization and missed outpatient dialysis treatments. Kidney Int. 2006;69(2):393-398.
4. Kutscher B. Out of their comfort zone. Dialysis provider DaVita needs to integrate big physician practice to move toward integrated care. Mod Healthc. 2013;43(37):6, 12-4, 1.

Comprehensive Interventional Care at the Out-Patient Dialysis Center – Diversify?
No: Too Close for Comfort, Favors Self-Referral

Gordon McLennan
Cleveland Clinic Foundation, Society of Interventional Radiology Renal Disease Service Line, Chagrin Falls, Ohio - USA

The first question we need to define is "what is meant by Comprehensive Interventional Care"? To the interventional radiologist, Comprehensive Interventional Care represents all aspects of interventional radiology. This includes management of peripheral vascular disease, gynecologic intervention, urologic intervention, biliary intervention, pain management and spine augmentation, as well as the care needed for maintenance of dialysis access. For the purposes of this debate, however, we need to focus on the term "Out-patient Dialysis Center" as well. In the context of the "Out-patient Dialysis Center", the Interventional center has a significant financial relationship with the dialysis provider. This is often a dialysis center, a nephrology group, or a large dialysis organization. When these organization have an ownership stake in the interventional center then there is a significant risk of self-referral and collusion that raises ethical questions of conflict from the point of view of the patient, the

interventionalists, and the referring physicians who work for the owner organization. While diversification of interventional procedures for interventionalists working independently should not be constrained as long as their training, credentialing, and abilities allow them to provide the best care to their patients, these decisions should not be colored by financial arrangements that require oversight of larger organizations that are motivated by limiting material costs and directing practitioners to perform procedures with questionable evidence to support them when remuneration is the driving factor.

PD – What Should Nephrologists Be Doing to Increase Adoption and Expand Training?

Maurizio Gallieni[1,2], Francesca Brunini[1,2], Barbara Fusi[1], Alessandra Beltrame[1], Cristina Pinerolo[1]
[1] Nephrology and Dialysis Unit, Ospedale San Carlo Borromeo, Milan - Italy
[2] Specialty School in Nephrology, University of Milan, Milan - Italy

Peritoneal dialysis (PD) is a valid home based dialysis modality, which can be considered the ideal treatment to start renal replacement therapy, when residual renal function allows an optimal fluid management and depuration (1). Compared to hemodialysis, PD better preserves residual renal function and it is associated with excellent outcomes in quality of life and even after renal transplantation. In addition, costs are lower. However, PD is underutilized in most Countries, with rates often inferior to 10% of the total dialysis population (2).
Many different reasons are determinants of this situation. We propose here the possible approaches that could increase adoption of PD, focusing in particular on expanding training in different aspects of PD.
Bias against PD. One of the main reasons for a low PD adoption is that many nephrologists are not confident with this dialysis modality and therefore they believe that it is inferior to hemodialysis. Even worse, there are significant misperceptions or prejudices against PD among practicing nephrologists and other medical professionals (2). These can be overcome only through continuing education directed to all nephrologists treating CKD patients and by giving support to PD programs within hospital based nephrology units.
Continuing education. A practical approach to continuing education for nephrologists who already are in practice is to create a local/regional network of nephrologists with active PD programs and start an educational initiative with a series of 4 to 6 monthly meetings per year with a specific topic and/or with case discussions. These meetings should also be open to all the nephrology fellows in the area (in order to integrate with practice-based information the academic training, if any, they are already receiving). The organizing committee should prepare the scientific program and should guarantee their own active participation to the initiative. The PD industry may be an active part in this educational project through an unrestricted grant with a very low budget. This project has been active in the Milan area for the past three years, named "the Peritoneal Dialysis Thursdays" after the day of the week when the meeting takes place. The initiative has been successful from the participation standpoint and we believe it has raised the interest towards PD.
Choice of dialysis modality. Pre-dialysis patient education plays a very important role in the correct choice of the best treatment modality for each individual patient (3). A specific approach aimed at illustrating the characteristics of the available modalities (pre-emptive transplant, PD, hemodialysis). The quality of this educational process is also important: going through this process should take at least three dedicated visits, involving physicians, nurses, dieticians, social workers and possibly other patients already undergoing dialysis who can report their experience to the new dialysis patient.
Training fellows. Many nephrology and surgical fellowship programs do not offer adequate PD training. This is mainly due to the often limited number of PD patients and of dedicated nephrologists to this clinical area, even in academic centers. For nephrologists, 6 months of training during their fellowship should be considered, with the possibility of extended training for those willing to be actively involved in a PD program in their future practice. In the training program, PD access should have a dedicated module and both surgical and nephrology fellows should know how to place a PD catheter.
Peritoneal access. In another communication in this meeting (4), it has also been suggested that the dialysis access surgeon, usually with a vascular background, may not consider performing PD catheter placement or be trained to place PD catheters. Thus, vascular access surgeons should know about PD and routinely ask patients if PD as an option has already been appropriately discussed by the referring nephrologist. PD access is simpler and lasts longer than AV access: starting PD may also give more time for creating an adequate AV access when PD will be no longer feasible.

As already defined for hemodialysis access, nephrologists should aim at creating a PD access team, taking into account the available specific resources and organization in the center where they operate. When nephrologists have seen an adequate number of PD catheter placements during their training, they can be instrumental in teaching this maneuver to a general surgeon, even if she/he has never done it, in case the nephrologist needs to take over or start a PD program in a center where no dedicated access surgeons are available. Nephrologists can take an active part in PD catheter placing. In some centers, interventional nephrologists place PD catheters with a percutaneous technique. In others, they may participate to surgical placement, in collaboration with a PD access surgeon.

References

1. Ghaffari A, Kalantar-Zadeh K, Lee J, Maddux F, Moran J, Nissenson A. PD First: Peritoneal dialysis as the default transition to dialysis therapy. Semin Dial 2013;26:706-713.
2. Saxena R. Peritoneal dialysis: misperceptions and reality. Am J Med Sci. 2014;348:250-261.
3. Lok CE, Davidson I. Optimal choice of dialysis access for chronic kidney disease patients: developing a life plan for dialysis access. Semin Nephrol. 2012;32:530-537.
4. Davidson I, Gallichio M, Ross J. Who decides between peritoneal and hemo-dialysis? Surgeons should make most of these decisions. J Vasc Access 2014; 15 (Suppl 8): S38.

How to Troubleshoot PD Catheter Malfunction

Peter B. Hathaway
Medical Director, Utah Vascular Clinic, Salt Lake City, Utah - USA

Non-infectious peritoneal dialysis (PD) catheter malfunction can be a vexing problem for patients and caregivers. Catheter malfunction can manifest as flow disturbance, pain, weight gain or leakage, and often results in ineffective or interrupted PD. Because there are many potential causes of malfunction, a systematic approach is useful when confronted with a problematic peritoneal dialysis catheter.

The first step when troubleshooting PD catheter malfunction is to communicate directly with the appropriate caregiver, typically the patient's PD nurse. The PD nurse can provide critical information about the nature of the problem including catheter flow disturbance, large dialysate residuals or recent changes in the PD prescription. Second, the operator should agree to see the patient as soon as possible in order to avoid a prolonged dialysis interruption. The patient encounter should include inquiries about bowel habits, the presence of fibrin in the dialysate, and the location of any pain. The catheter site should be inspected and the appearance of new hernias or scrotal swelling noted. Third, a fluoroscopic examination of the abdomen should be performed. Unless contra-indicated, contrast injection through the catheter during live fluoroscopy is preferable to plain abdominal radiography, and is often definitive in establishing the etiology of catheter malfunction (1). Finally, a directed ultrasound exam or computed tomography with intraperitoneal contrast injection (CT peritoneography) can be useful problem-solving tools when needed.

Most catheter malfunction can be categorized as occurring either with- or without flow disturbance (1). Flow disturbances include resistance to dialysate inflow, abnormally slow outflow, and incomplete drainage resulting in large fluid residuals. Causes of catheter flow disturbance paired with abnormal catheter position on fluoroscopy include catheter trapping due to adhesions or hernias, omental wrapping and simple upper-abdominal malposition. Causes of flow disturbance with a normal catheter position on fluoroscopy include constipation, fibrin plug or sheath, large taenia coli, catheter fracture, catheter kinking and peritoneal loculations. CT can be a helpful adjunct in selected cases when catheter trapping or peritoneal loculations are suspected and the fluoroscopic exam is indeterminate (1).

Causes of problematic PD in the absence of flow disturbance include peritoneal leaks, abdominal hernias, and pain during dialysate inflow or outflow (2). The presence of a pericatheter leak can often be identified with ultrasound (1). CT peritoneography can be useful to identify a leak when the source is indeterminate, characterize a hernia, identify adhesions, or differentiate unilateral from bilateral processus vaginalis when scrotal swelling is present (3). Inflow pain can be produced by air infusion, jet effect or dialysate that is too warm, cold, acidic or hypertonic. Outflow pain can be caused by excessively negative drain pressures, catheter malposition, or the catheter abutting the bladder or rectum (2).

Once the reason for catheter malfunction has been established, a treatment plan can be made and implemented.

Guidewire (4), Fogarty catheter (5) or trochar manipulation (6) under fluoroscopy can sometimes correct a malpositioned catheter. Intra-catheter thrombolytics (7), guidewire manipulation and intraperitoneal anticoagulants can ameliorate fibrin plugging (1). Replacement of a catheter is required to correct kinks, fractures, and malpositioned catheters that fail guidewire manipulation (1). Surgery is necessary to address omental wraps, long taenia coli, hernias, and some types of leaks (1). Finally, correction of constipation or dialysate- and cycler-specific issues is needed when the problem is determined to be unrelated to the dialysis catheter itself (2).

References

1. Gokal R, Alexander S, Ash S, et al. Peritoneal catheters and exit-site practices toward optimum peritoneal access: 1988 update. Perit Dial Int. 1998;18:11-33.
2. Maaz DE. Troubleshooting non-infectious peritoneal dialysis issues. Neph Nurs J. 2004;31:521-533.
3. Cochran ST, Do HM, Ronaghi A, et al. Complications of peritoneal dialysis: evaluation with CT peritoneography. Radiographics. 1997;17:869-878.
4. Kwon YH, Kwon SH, Oh JH, et al. Fluoroscopic guide wire manipulation of malfunctioning peritoneal dialysis catheters initially placed by interventional radiologists. J Vasc Interv Radiol. 2014;25:904-910.
5. Gadallah MF, Arora N, Arumugam R, et al. Role of Fogarty catheter manipulation in management of migrated, nonfunctional peritoneal dialysis catheters. Am J Kidney Dis. 2000;35:301-305.
6. Simons ME, Pron G, Voros M, et al. Fluoroscopically-guided manipulation of malfunctioning peritoneal dialysis catheters. Perit Dial Int. 1999;19:544-549.
7. Zorzanello M, Fleming W, Prowant B. Use of tissue plasminogen activator in peritoneal dialysis catheters: a literature review and one center's experience. Nephrol Nurs J. 2004;31:534-537.

Who decides between Peritoneal and Hemo-Dialysis? Surgeons Should Make Most of these Decisions

Ingemar Davidson[1], Michael Gallichio[2], John Ross[2]
[1]Department of Surgery, Tulane University, New Orleans, LA - USA
[2]Dialysis Access Institute, Orangeburg Regional Medical Center, Orangeburg SC - USA

There is a void in the appropriate and standardized training for dialysis access, including proper selection of the dialysis modality which is hemodialysis (HD) vs peritoneal dialysis (PD), type and surgical site selection, timing of access placement, individuals authorized to perform dialysis access, and the institutional setting in which to perform the procedures.

Ideally, a patient needing access for dialysis comes to the dialysis access surgeon informed with a knowledge base and firm desire of mode of dialysis which is PD or HD. Sadly, this is far from reality as there is much training and experience bias. A vascular surgeon may not consider performing PD catheter placement or be trained to place PD catheters, thereby excluding a major patient cohort from the most desirable first time dialysis mode of renal replacement therapy (RRT). Many nephrology fellowship programs do not offer adequate PD training and the referring physicians may not inform or even discourage patients of the PD option. Patients often present with a biased view from misinformation about the risks and benefits between HD vs. PD.

The goal of initiating dialysis with the optimal modality and a functioning access is more likely when patients and their families receive high-quality, individualized education supported by the entire ESRD team (1). Hence it is not a single physician's decision, but rather a result from a concerted team effort. Dialysis access training programs must teach team members about short and long-term dialysis access planning and effective execution. Therefore, an informed patient will make the ultimate selection decision based on objective unbiased information. During the life of the patient many are subjected to PD and HD as well as transplantation. A continuously updated short and long-term dialysis plan is part of an effective dialysis access algorithm.

HD and PD modalities must not be seen as competitive but rather complementary, as over a patient's lifetime both modalities are likely to be used, optimizing effective long-term planning as the overall outcome goal. Generally PD as first dialysis modality serves the patient best (2). A review article in this issue of J Vasc Access by Ross et al, details a dialysis access training program method which induces effective selection of dialysis modalities (3).

References

1. Lok CE, Davidson I. Optimal Choice of Dialysis Access for Chronic Kidney Disease Patients: Developing a Life Plan for Dialysis Access. Semin Nephrol. 2012;32:530-537.
2. Singh N, Davidson I, Minhajuddin A, et al. Risk factors associated with peritoneal dialysis catheter survival: a 9-year single-center study in 315 patients. J Vasc Access. 2010;11(4):316-322.
3. Ross J, Dolmatch B, Gallichio M, et al. Training and Certification in Dialysis Access. J Vasc Access 2014; 15 (Suppl 8): S3-S7.
www.TacidaGroup.com

Increasing Peritoneal Dialysis Utilization

Gerald A. Beathard
University of Texas Medical Branch, Houston, Texas - USA

Although peritoneal dialysis (PD) has been shown to have a definite advantage, it has been reported that the proportion of dialysis patients treated with PD is declining. To address the situation it has been suggested that a "PD first" approach be taken for the renal failure patient starting dialysis (1). In reviewing this problem, Blake et al (2) have listed several steps that provide a useful framework for developing a comprehensive plan for increasing PD utilization.

The first step is the identification of all potential PD candidates. This should include all new ESRD patients as well as those with a failing arteriovenous access or a failing transplant. The majority of new dialysis patients began hemodialysis with a central venous catheter (CVC). Offering urgent start peritoneal dialysis to these patients avoids the complications of a CVC.

Secondly, part of this process must be the assessment of barriers and contraindications to PD. While a contraindication is an absolute disqualification a barrier is not. Barriers such as impaired vision and patient frailty can be a challenge, but can be overcome.

The next step involves offering the option of PD. This must be preceded by a structured, multidisciplinary education program involving both the patient and their family. Studies have shown that only such a program is successful in increasing the utilization of home modalities (3).

The fourth step is allowing the patient to make their informed choice. It has been suggested (2) that the actual number of patients in a dialysis program selecting PD can be used as a gauge of the quality of the decision process. If less than one third of patients considered to be eligible for PD eventually choose the modality it suggests an inadequacy in the program.

The next step is PD catheter placement. Unfortunately, there are hurdles involved in accomplishing this goal. In one study (4), of 124 patients who chose PD at the time of education only 59 started dialysis therapy with PD. Other than the fact that a few patients either died or were transplanted, the reasons for this discrepancy varied - age over 75 years, being unemployed and, to a degree, non-glomerular disease and, to a degree, non-white race. In addition, 13 patients choosing PD but starting HD already had a permanent arteriovenous access in place.

The final step is represented by the successful initiation of PD. Problems may be encountered when PD catheters are placed but do not function and when caregivers are not trained or willing to assume the responsibility of PD care. It has been suggested that at least 85% of patients having attempted PD catheter placement should accomplish the goal of successful home PD therapy. This percentage should be used as a gauge to judge the effectiveness of the program.

Nephrology involvement and commitment to the PD program is critical for success. One study (5) found that almost 90% of patients felt their physician influenced their modality selection. Additionally, studies have shown that nephrologist placed PD catheters results in a marked increase in PD utilization in a dialysis program (6).

References

1. Ghaffari A, Kalantar-Zadeh K, Lee J, et al. PD First: peritoneal dialysis as the default transition to dialysis therapy. Semin Dial. 2013;26(6):706-13.
2. Blake PG, Quinn RR, Oliver MJ. Peritoneal dialysis and the process of modality selection. Perit Dial Int. 2013;33(3):233-41.
3. Wu IW, Wang SY, Hsu KH, et al. Multidisciplinary predialysis education decreases the incidence of dialysis and reduces mortality--a controlled cohort study based on the NKF/DOQI guidelines. Nephrol Dial Transplant 2009;24(11):3426-33.

4. Liebman SE, Bushinsky DA, Dolan JG, Veazie P. Differences between dialysis modality selection and initiation. Am J Kidney Dis 2012;59(4):550-7.
5. Wuerth DB, Finkelstein SH, Schwetz O, et al. Patients' descriptions of specific factors leading to modality selection of chronic peritoneal dialysis or hemodialysis. Perit Dial Int 2002;22(2):184-90.
6. Asif A, Pflederer TA, Vieira CF, et al. Does catheter insertion by nephrologists improve peritoneal dialysis utilization? A multicenter analysis. Semin Dial 2005;18(2):157-60.

Who Decides Between PD and HD?
The Joint Committee: "The Access Team" per (National) Policies and Procedures

Jack Work
Professor of Medicine, Emeritus, Emory University, Atlanta, GA - USA

Patients with chronic kidney disease frequently are unaware of their kidney disease or have a poor understanding of their condition. Often they do not see a nephrologist until late in the course of their disease. In a study by Mehrotro, over a third of patients do not see a nephrologist until less than 4 months before initiating dialysis (1). In this same study, the majority of ESRD patients were not aware of their ESRD options, including peritoneal dialysis, home hemodialysis and transplantation. Based on similar studies and patient advocacy, CMS, the primary payer of ESRD services, mandated that ever patient must be informed about all treatment modalities in the 2008 Conditions of Coverage update. The "Conditions of Coverage" are the de facto National policy and procedures covering ESRD services (2).

Patients who are referred late in the course of their disease reach end stage more rapidly, have an increased incidence of complications such as anemia and cardiovascular events, are more likely to start dialysis using a catheter, have an increased hospitalization rate and poorer survival (3). Early referral should decrease the likelihood of these adverse events. Indeed this is the conceptual framework that forms the basis of an interdisciplinary team (IDT) for patient education. Given the complexities of ESRD, the IDT most often includes a nephrologist, advanced practice nurse, renal dietitian, social worker, pharmacist, and occasionally a surgeon with the focus on the patient. The IDT notion is not new: The Missouri Kidney Program started a patient education program composed of a renal social worker, renal dietician and a nurse in 1984 (4). However, the IDT approach has failed to become a standard of practice in ESRD patient care. The American Association of Kidney Patients have found in spite of the fact that nearly 70% of surveyed ESRD patients received education about in-center hemodialysis, only 58% reported being told about peritoneal dialysis and 31% about home hemodialysis (5). The IDT approach also is consistent with the Conditions of Coverage mandate: "The Patient has the right to be involved in their Plan of Care, and informed about all treatment modalities." Hence the IDT focus is on shared decision-making and patient choice.

The 2008 Conditions of Coverage authorize eligible providers to bill for kidney disease education services for patients with advanced renal disease (CPT code G0420 and G0421). These kidney disease education classes became widely available in 2010 and are usually conducted in nephrologists office or out patient hospital facilities mostly lead by advanced practice nurse for group classes and by nephrologists for individual classes (6). Because this is a relatively new program, there are few studies to date that clearly demonstrate an effect of these interventions on patient outcomes. Recently there has been a decline in kidney disease education classes because of CMS Medicare contractor denials of payment. Kidney disease education class bills are 5 times more likely to be denied than a typical Medicare bill. Indeed, the most denied claims come from Palmetto, a CMS contractor, which covers North and South Carolina, West Virginia and Virginia, states with a high prevalence of dialysis patients (6).

Kidney disease education and the team (IDT) approach are relatively new to the ESRD arena. There is now a clear CMS mandate for patient care providers to embrace this process to provide better patient out comes that most importantly include the full participation of the patient in the process.

References

1. Mehrotro R, Marsh D, Vonesh E, Peters V, Nissenson A. Patient education and access of ESRD patients to renal replacement therapies beyond in-center hemodialysis. Kidney Int. 2005;68:378-390.
2. Federal Register Vol. 73, No. 73, Tuesday April 15, 2008: Rules and Regulations S494.70, S494.100.
3. Mendelssohn D. Coping with the CKD epidemic: the promise of multidisciplinary team-based care. Nephrol Dial Transplant. 2005;20:10-12.
4. King K, Witten B, Brown J, Whitlock R, Waterman A. The Missouri Kidney Program's patient education program: a 12 year retrospective analysis. Nephol News Issues 2008;22:44-45.
5. Fadem S, Walker D, Abbott G, et al. Satisfaction with renal replacement therapy and education: the American Association of Kidney Patients Survey. Clin J Am Soc Nephrol 2011;6:605-612.
6. Davis JS, Zuber K. The nephrology interdisciplinary team: an education synergism. Adv Chronic Kidney Dis. 2014;21(4):338-343.

Authors Index