Can Your Center Improve Dialysis Access Delivery?

Algorithms for dialysis modality selection and tips for enhancing the way your facility treats dialysis patients.

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Much controversy surrounds the establishment of proper planning, placement, and management of dialysis access. This includes the selection of the dialysis modality (hemodialysis [HD] vs peritoneal dialysis [PD]), type of HD access, timing of access placement, and who places the access. The lack and difficulty of performing randomized studies in the heterogeneous and rapidly changing demographic of the end-stage renal disease (ESRD) population partly explains the dialysis access conundrum. Add to this the rapidly developing and competing technologies and the wide spectrum of professional experience, bias, and socioeconomic forces. All of these factors make the dialysis access multivariate and complex (see *Factors Influencing Dialysis Modality Selection*).[1]

MAKING THE RIGHT DECISION FOR THE INDIVIDUAL

Dialysis access outcomes depend on all of the stakeholders' individual efforts. Some people (including doctors) appear to be more effective and successful than others. Are these accomplished individuals just struck by good luck? Or, is there something else that makes some individual professionals more accomplished than others? In other words, what does it take to become a world-class expert?[2] In reference to ESRD, dialysis access surgery, and interventional procedures, certain highly technical skills and knowledge are required to perform the necessary procedures. Also, for maximal individual professional success, an interdependent mindset with a seamless, uninhibited flow of information between treating departments and the decision-making governing bodies will improve procedural effectiveness and outcomes.[3,4] Some personal attributes define team players, and leadership skills have been linked to brain cell physiology.[3,4] From this, we may hypothesize that when people work in concerted synergy as a team, safety and quality improve, and so several experts have created "Centers of Excellence." However, good leadership may suffer negative consequences because of organizations dominated with legal-rational authority, a style characterized by blame and shame.[5] True expertise develops when professionals openly report and share mistakes that everyone can learn from without the risk of punishment.[6]

THE CENTER EFFECT

Like individual experts, some hospitals and health care corporations advertise themselves as Centers of Excellence, implying that they are better than others. *Center Effect Factors That May Affect Outcomes* highlights issues that may come into play when promoting optimal outcomes and maximizing safety in the care of the ESRD patients in general, and specifically, for dialysis access procedures. ESRD patients represent a challenging population, with an overall annual mortality rate of approximately 20% in the United States. The timing and choice of dialysis modality and the type and site of HD access may mean death or survival for an individual patient; it

FACTORS INFLUENCING DIALYSIS MODALITY SELECTION

General factors

- Patient desire, including lifestyle and profession
- Socioeconomic factors
- Patient education on dialysis issues and options
- Nephrologist's education (equal education on HD and PD)
- Comfort level with dialysis modality
- Severities of comorbidities
- Surgical experience and technical support
- Stage of chronic kidney disease

Favoring HD

- Patient restrictions to learn the PD technique
- PD training facility availability
- Abdominal stoma (ie, colostomy)
- Previous, multiple abdominal surgeries
- Recurrent abdominal inflammatory events
- Obesity

Favoring PD

- Presence and status of veins and arteries, HD access problems
- Travel distance to dialysis facility
- Heparin intolerance
- Lower cost

will certainly have an impact on longevity. A center's administrative leadership style and culture will affect the center's overall success.[5,6] The quality of the protocols and policies in place, how well they are adhered to, and a rigorous and continuous quality improvement process affect the outcome as well. Preoperative duplex Doppler ultrasound evaluation with the surgeon present or performing the examination is one example of a policy driven by improving outcomes.[7,8]

The transplant community has long recognized the outcome variability within kidney transplant center outcomes that are reported annually by the United Network for Organ Sharing.[9] This phenomenon is known as the "Center Effect," a concept generally accepted in the transplant community, although it is difficult to define what specific factors make a center perform better or worse. Likewise, dialysis practices and outcomes vary greatly around the globe as well in the United States.[10] More specifically, access outcomes such as early arteriovenous fistula (AVF) clotting thrombosis at 6 weeks may vary between centers from 6% to 28%.[11] Similarly, the primary patency with expanded polytetrafluoroethylene (ePTFE) grafts is reported to be as high as 69% at 1 year,[12] while others report graft function of < 23% to 27% in recent years.[13]

Although it is difficult to pinpoint the exact causes of success, it is clear that it is multifactorial. In fact, it may represent the popular "tipping point" phenomenon as described by Gladwell.[14] In this context, doing the right thing for the right patient at the right time in the right amount for the right reasons is key. In other words, one has to do many small "rights" for each and every patient by every team member to become a Center of Excellence. The more "rights," the better the center. From daily experience, most health care workers and hospitals are far away from this imaginary goal. A failure rate of 60% of fistulas to mature to a usable state for dialysis[11] likely reflects a multitude of problematic factors in the system "error chain" that lead to failure.[6]

MEASURES TO IMPROVE YOUR CENTER

Optimal Treatment of Hand Ischemia

Hand ischemia, or "steal," after dialysis access placement occurs in up to 10% of cases when the distal brachial artery is used for inflow[15-17] and carries severe morbidity rates and tissue or limb loss, if not recognized and treated. Three distinct etiologies include: (1) blood flow restriction to the hand from arterial occlusive disease either proximal or distal to the AV access anastomosis; (2) true steal may occur from excess blood flow through a large AV access conduit; and (3) the lack of vascular (arterial) adaptation or collateral flow reserve (ie, atherosclerosis) to the increased flow demand from the AV conduit may bring on hand ischemia symptoms from inadequate tissue perfusion. These three causes of steal may present alone or in concert. The diagnosis of steal is based on an accurate history and physical examination and is confirmed with tests including an arteriogram and duplex ultrasound evaluation including finger pressures as mandated by the history and physical examination findings.

Tailoring the management and treatment of steal from diagnostic findings and patient characteristics is likely to prevent many cases and also improve outcomes. The aging ESRD population has made the management of hand ischemia more challenging. Overall, there are five treatment options outlined in a recent review article.[18] First, there is the observation of developing symptoms in mild cases. Second, balloon angioplasty, and possibly

stenting, is the appropriate treatment for an arterial stenosis, performed as part of the diagnostic arteriogram because inflow stenosis is seen in one-third of steal cases. Along with this, there are at least three distinct surgical corrective procedures that exist to counteract the physiology of steal. These are distal revascularization and interval ligation (known as *DRIL*),[16] and the proximalization of arterial inflow, as popularized by Zanow.[17]

Finally, controlled banding of the access to restrict access blood flow guided by intraoperative finger-pressure measurements, with blood volume flow to relieve the ischemic pain, is often the only option short of ligating the access in this very fragile patient population that often has devastating cardiovascular comorbidities.[19] In recent years, the authors have increasingly used arterial inflow higher up toward the axilla, which could be considered a preemptive proximalization of the arterial inflow procedure. The ultimate treatment strategy depends on the severity of symptoms, the extent of the patient's comorbidities, and the local dialysis access technical team's support and available skills. Making the correct diagnoses and the right treatment selection will relieve suffering, prevent ischemia-induced impaired function and tissue loss, and perhaps prolong life in up to 5% to 10% of the access population.[18]

Heparin Bonding

Heparin bonding to artificial surfaces, such as ePTFE, with prolonged bioactivity retention (Carmeda BioActive Surface coating technology, Upplands Väsby, Sweden [a subsidiary of W. L. Gore & Associates, Flagstaff, AZ]) has evolved into a clinically useful technique. A preliminary, nonrandomized report in survival estimates showed a 15% to 20% improved primary graft patency in 83 heparin-bonded grafts when compared to 67 control ePTFE grafts. At 6 and 12 months, patency for the heparin-bonded graft group was 88% and 78%, respectively, which is also significantly higher than the rates of 69% and 58% for the control group, respectively ($P = .007$). The overall combined clot-free survival rate for all 150 ePTFE grafts was 69% at 12 months,12 which compares favorably to the 23% to 28% that occurred in a recent United States multicenter study.[13]

Early Referral and Vein Preservation

There are two measures that would markedly improve the outcome of dialysis access. First, early referral to the nephrology specialist and access surgeon for evaluation increases the likelihood for PD or having a usable hemoaccess (ie, a native AVF or graft) and the avoidance of morbidity due to prolonged central vein catheter placement. Therefore, when the kidney glomerular filtration rate approaches 30 mL/min (chronic kidney disease Stage 4), patient education about renal replacement therapy and dialysis access must begin, and referral for a preemptive transplant and dialysis access consideration must be made. Second, preserving veins by preventing venopunctures and intravenous lines for potential future dialysis access veins for AVF placement also increases the chances for a useable native vein AVF. There is a lot of abuse of potential AVF veins from intravenous lines and blood draws. Only the dorsal aspect of the hands should be allowed for venous blood access. Patients undergoing HD can have blood draws done during dialysis treatment to preserve veins.

These are simple policy decisions made by individuals with the vision and mission to do and implement the right choice. Peripherally inserted central catheter lines must never be used in patients with an expected need for dialysis. The use of subclavian veins for dialysis catheters has universally been abandoned. In this context, cardiology colleges must also change the practice pattern from using the subclavian to the internal jugular vein. Vein preservation also entails patient education, compliance, and understanding. Also, intense, concerted education of hospital workers must take place for these measures to become universally applied and effective.

Peritoneal Dialysis First, Hemodialysis Second

The concept of "PD first" implies that whenever feasible, PD should be offered as the first dialysis modality. PD provides a survival benefit for the first several years after dialysis initiation in the majority of patients.[20-27] Moreover, individuals who receive a transplant while on PD have better long- and short-term transplant outcomes compared to those who are on HD immediately before kidney transplant.[28,29] While on PD, plans can be made to place a native vein AVF. The PD option allows extra time for the AVF to mature and for creative access options such as two-stage surgical procedures that optimize hemoaccess outcome effectiveness. As all dialysis access modalities have a certain failure rate over time, proactively placing a native vein AVF in a PD patient serves as a "life insurance" should the PD modality later fail. The concept of PD first and HD second must not be seen as a competition between therapies,[30,31] but rather that they are complementary, because over time, dialysis access options are considered integral parts of thoughtful long-term planning.

Training the Dialysis Team by Simulation

The concept of dialysis access simulation training is relatively new. The authors propose developing a comprehensive, multidisciplinary training curriculum, using

CENTER EFFECT FACTORS THAT MAY AFFECT OUTCOMES

- Leadership, including hospital administrative support
- Crisis versus planned dialysis access management style
- Access team members' skill, knowledge, and attitude
- Policies and protocol sophistication and level of adherence
- Continuous quality improvement process
- Pre-ESRD education program
- Patient selection algorithm for mode of dialysis and type of hemoaccess
- Degree of interdependent thinking among team members and leadership
- Attitude and culture of the institution
- Communication skills between team members (personalities, character, trust level, etc.)

didactic, interactive, e-based learning, telemedicine, and virtual reality simulation technologies to improve the quality and efficiency of all dialysis access procedures, including dialysis needle cannulation skills for HD nurses and technologists. The primary goal of the simulation training is to reduce errors and maximize patient comfort and safety. The simulation-based training program allows for multidisciplinary research that is designed to improve, validate, and enhance each aspect of dialysis access procedures and techniques.

Dialysis access simulation training embraces the development of new educational paradigms, with team training techniques and new methods of simulating surgical and nonsurgical delivery methods and will set national standards for education. This training will teach, train, and certify local, regional, and international health care professionals treating ESRD patients. Its emphasis on telemedicine and distance learning will increase its reach and availability as a way to test new medical devices and techniques.

In this real-life environment, participants will receive intensive instruction and hands-on training in the latest medical procedures, devices, and standards, enabling them to reduce medical errors and provide the most effective patient care. Because it is comprehensive and multidisciplinary in its scope and approach, simulation training is a resource for medical professionals treating dialysis access patients. Several competencies comprise this new learning paradigm. It includes some older teaching modalities such as knowledge-based and clinical technical skills, as well as new teaching that encompasses the concept of social intelligence (formerly emotional intelligence), which is best described by words such as *attitude*, *professionalism*, *trust*, and *leadership* to mention a few. Finally, but perhaps most importantly, is the understanding of safety and error prevention from an individual's perspective, as well as system-based design error prevention. In this regard, the health care industry is slowly picking up half of a century of ever-progressing experience from the aviation safety programs that are at least partially responsible for the unprecedented safety record of North American commercial airlines.

In the broadest terms, practice patterns correlate to outcomes including patient survival and access longevity, as well as the cost to society at large. Individuals, institutions, governments, and specialty societies may directly or subliminally influence the selection of dialysis modalities. The most visible and widespread effort in this regard is the Centers for Medicare & Medicaid Services' Fistula First National Vascular Access Improvement Initiative.[30] Similarly, the International Society for Peritoneal Dialysis is stressing the underutilization of the PD modality, especially in Western societies.[31]

Selecting a mode of dialysis access is of critical importance in planning a successful transition to dialysis treatment of patients approaching ESRD. A sound, long-term dialysis access algorithm is designed to maximize patient quality of life, improve survival, and be cost-effective. Rather than emphasizing the doctrine of one modality fitting all, doing the right thing for each patient, each time, is ethically and morally the better model. The issue is not who places the access but who does it right, every time, for everyone, and everywhere. It should be outcome and patient driven. The decision-making algorithm for two similar patients may vary based on individual circumstances summarized in *Factors Influencing Dialysis Modality Selection*. Therefore, different dialysis modalities and access types must not be seen as being in competition with one another but rather as complementary, because over a lifetime, the dialysis patient may use both PD and several types of HD access sites, and most importantly, receive a working transplant. However, only 2.7% of the dialysis population receives a kidney annually because of the shortage of organs. In addition, many patients on dialysis do not qualify for transplant because of severe comorbid conditions.

CONCLUSION

A detailed patient history and examination are the mainstay of dialysis access modality selection, including the site and type of access. The same principles apply to the main-

tenance of access for longevity. As a lifelong access utilization strategy, PD should be considered as the first dialysis modality in all suitable cases, followed by appropriately planned HD. Duplex Doppler ultrasonography examination is the next logical step after history and physical examination for preoperative vascular mapping in determining the optimal HD access type and site. Also, Duplex ultrasound testing will diagnose the majority of vascular access complications and demonstrate the proper surgical or interventional radiology mode of management. ■

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