

The High-Cost, Low-Quality Impact of Central Venous Catheters in Dialysis Access

Rethinking the approach to managing ESRD patients with emergent dialysis needs using early cannulation grafts.

BY KARL A. ILLIG, MD

Approximately 662,000 Americans have prevalent end-stage renal disease (ESRD), and there were 117,162 newly reported cases in 2013.¹ Approximately 80% of patients with ESRD began hemodialysis via central venous catheter (CVC) in 2015, with only 17% initiated with an arteriovenous fistula (AVF) and 3% with an arteriovenous graft (AVG).² At 90 days after initiation of dialysis, 68.3% of hemodialysis patients were still using a CVC. The high use of CVCs persists despite the Fistula First Breakthrough Initiative, which when launched in 2005, stressed the importance of placing AVFs as primary access in at least 50% of newly diagnosed ESRD patients and in 40% of prevalent patients undergoing hemodialysis, as recommended by national guidelines.³ In 2013, the Centers for Medicare & Medicaid Services increased the goal to 68% of prevalent patients.⁴

REASONS FOR THE HIGH PREVALENCE OF CVC USE

Despite the goals of the Fistula First Breakthrough Initiative, there are several reasons for the prevalence of CVCs, including delays in referrals for AVF creation and AVFs placed well in advance that were still unusable.

Although autologous AVFs remain the most effective means of providing dialysis access, they often require a period of 10 to 12 weeks to fully mature before they can be used for access, thereby necessitating alternative means of access in an emergent ESRD patient. CVCs are also used when an AVF is no longer usable and a replacement has not been created or fully matured.

Far too often, patients and their referring nephrologists do not seek vascular access in a timely manner. As recommended by the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative clinical practice guidelines, patients should be referred for an AVF "at least 6 months prior to the anticipated start of hemodialysis

treatments. This timing allows for access evaluation and additional time for revision to ensure a working fistula is available at initiation of dialysis therapy."⁵ The guidelines further note that, "a graft should, in most cases, be placed at least 3 to 6 weeks before the anticipated start of [hemodialysis] therapy. Some newer graft materials may be cannulated immediately after placement."⁵

In addition to the delay in referral for AVF creation, only 50% to 80% of fistulas mature. Thus, physicians resort to a CVC because of the relative ease of insertion and the quick access. However, the convenience of CVCs comes at a cost in terms of infection and mortality. In addition, patients with CVCs have a reduced quality of life, as the CVC limits their ability to shower or swim. It is time to consider a new paradigm for the treatment of ESRD patients.

INFECTION RATES

In general, infection remains the primary concern with dialysis access. In the chronic uremic patient on hemodialysis, infection is a leading cause of morbidity, second only to cardiovascular disease as a cause of death.² According to the United States Renal Data System, the total mortality rate due to infection is 76 per 1,000 person-years at risk, and sepsis is responsible for three-quarters of these deaths.² Compared with the general population, the incidence of sepsis in patients with ESRD can be up to 100 times as high. Infection is a major cause for hospitalization in this population, estimated to be responsible for as many as 20% of inpatient admissions.² These infections confer a higher risk of mortality in the ESRD patient than in the general population, with a diagnosis of septicemia carrying a cumulative mortality rate of 43% at 1 year versus 20% for the general population.⁶

As compared with other forms of dialysis access, AVFs have the lowest rate of thrombosis,⁷ require the fewest

interventions,^{7,8} and provide longer survival of the access.⁷⁻¹⁰ AVFs have lower rates of infection than AVGs, which in turn, are less prone to infection than CVCs. The infection rates of CVCs are stubbornly high. Patients receiving CVCs for dialysis access had relative risk of infection of 2.3 as compared with 1.47 for AVGs.⁵

USE OF EARLY CANNULATION GRAFTS

Early cannulation grafts, such as the GORE® ACUSEAL Vascular Graft, can provide emergent dialysis patients with a better alternative to CVCs. The GORE ACUSEAL Vascular Graft is a low-bleed, trilayer vascular graft that includes an elastomeric middle membrane between inner and outer layers of expanded polytetrafluoroethylene. The graft is designed to hinder suture line and cannulation needle bleeding. The dialysis unit nurses and technicians should hold pressure for 10 to 15 minutes to achieve hemostasis after needle removal. The GORE ACUSEAL Vascular Graft can be cannulated within 24 hours of implantation. Glickman et al conducted a study of 138 patients receiving the GORE ACUSEAL Vascular Graft and found that the graft can be cannulated within 72 hours of implantation with patency and complication rates similar to those observed with standard cannulation of expanded polytetrafluoroethylene grafts.¹¹ As a result, these new early cannulation grafts may allow early removal of CVCs or avoid their use entirely.

New Treatment Algorithm

The advent of early cannulation grafts has resulted in changing my personal algorithm for treating emergent dialysis patients (Figure 1). If the patient is healthy enough for surgery, instead of inserting a CVC, I begin by inserting a GORE ACUSEAL Vascular Graft. The patient is then able to begin dialysis in a matter of hours. If the patient is unable to undergo surgery, I first place a temporary jugular or femoral catheter and dialyze the patient once or twice. Once the patient has stabilized, I would insert a GORE ACUSEAL Vascular Graft and remove the catheter. Both of these strategies essentially eliminate the longer-term morbidity and mortality associated with catheter use and allow for quicker dialysis access.

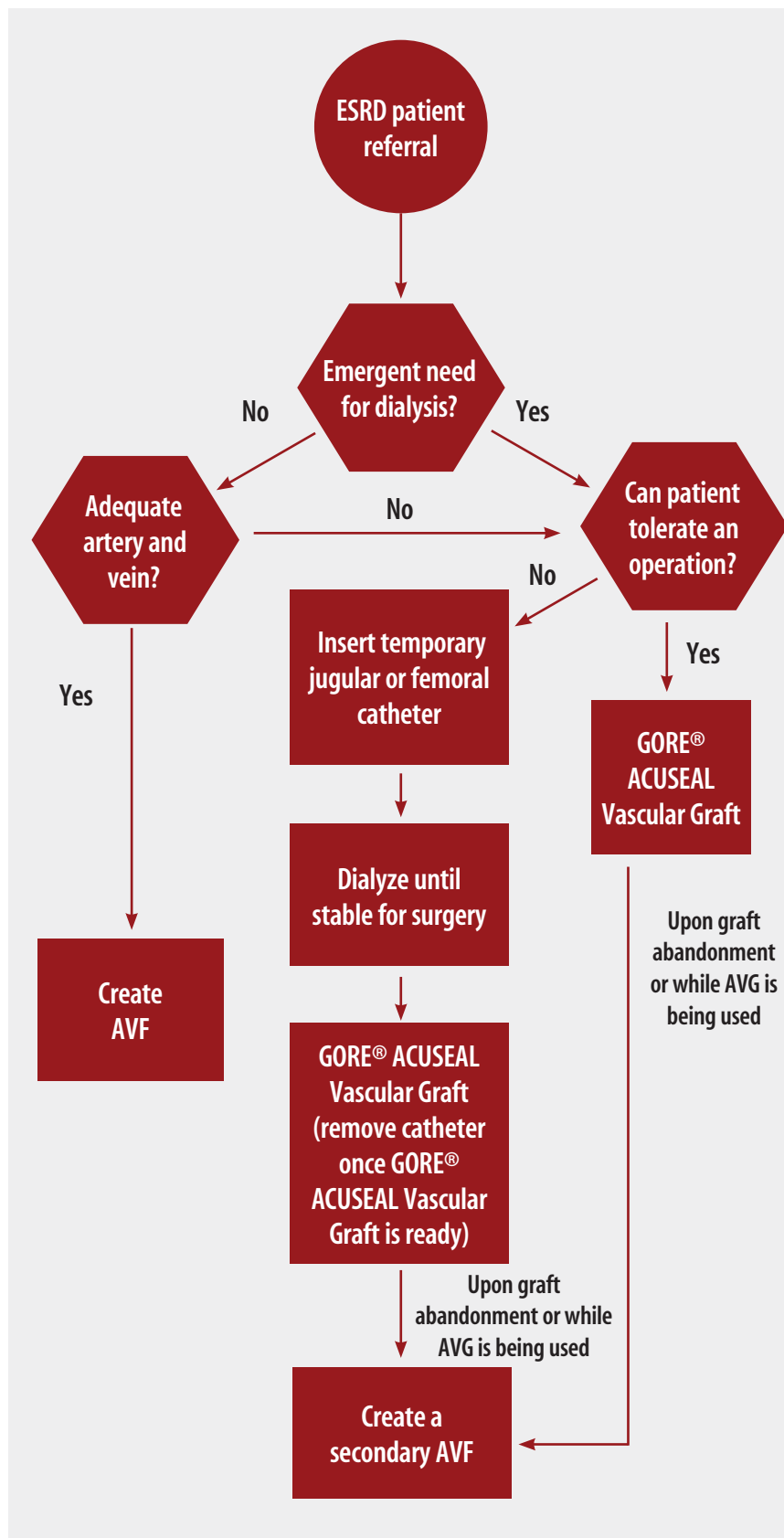


Figure 1. Algorithm for treating emergent dialysis patients.

Economic Benefits

A recent study analyzed the cost of the comparative treatments for patients with ESRD on dialysis and concluded that the GORE ACUSEAL Vascular Graft has the lowest cost. The United States study compared patients treated with the GORE ACUSEAL Vascular Graft, CVCs, AVGs, and AVFs. Patients were followed over 6 months. Infection, reintervention, and comparison with national cohorts were determined with actual costs projected to 1 year using a propensity score-matched cohort.¹²

The rate of sepsis requiring hospitalization per 1,000 dialysis days was 1.4 for CVC, 0.3 for AVF, and 0.5 for AVG and the GORE ACUSEAL Vascular Graft ($P < .001$). The total cost of care at 1 year was \$10,056 for CVCs, \$6,442 for AVFs, \$8,325 for AVGs, and \$5,422 for GORE ACUSEAL Vascular Graft ($P < .05$).¹² Primary-assisted patency was 100% for all dialysis access at 6 months with no deaths. The study demonstrated that the GORE ACUSEAL Vascular Graft had the lowest cost of care and a significantly lower rate of infection compared with CVCs.¹²

SUMMARY

The ability to implant a graft that allows almost immediate cannulation is changing the way we approach ESRD patients with emergent dialysis needs. The comparative lower infection and morbidity rates associated with the GORE ACUSEAL Vascular Graft over CVCs point the way to a better solution to managing patients who are in emergent need of dialysis. ■

1. Saran R, Li Y, Robinson B, et al. US Renal Data System 2015 annual data report: epidemiology of kidney disease in the United States. *Am J Kidney Dis*. 2016;67(3 suppl 1):A7-8.
2. United States Renal Data System (USRDS). USRDS 2015 annual data report: atlas of chronic kidney disease and

end-stage renal disease in the United States. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2015. Available at <http://www.usrds.org/2015/view/Default.aspx>. Accessed May 2, 2016.

3. Centers for Medicare & Medicaid Services. What is Fistula First: questions and answers. November 2004. Available at <https://www.cms.gov/medicare/end-stage-renal-disease/esrdqualityimprovement/downloads/fffaqs.pdf>. Accessed May 2, 2016.

4. ESRD National Coordinating Center. Fistula First Catheter Last Workgroup Coalition. Available at <http://esrdncc.org/ffcl/for-ffcl-professionals/>. Accessed May 2, 2016.

5. National Kidney Foundation KDOQI guidelines. Clinical practice guidelines and clinical practice recommendations: 2006 updates. New York: National Kidney Foundation; 2006. Available at: http://www2.kidney.org/professionals/KDOQI/guideline_upHD_PD_VA/. Accessed May 2, 2016.

6. US Department of Health and Human Services; Office of Disease Prevention and Health Promotion. National action plan to prevent health care-associated infections: road map to elimination: chapter 6: end-stage renal disease facilities. April 2013. Available at <http://health.gov/hcq/pdfs/hai-action-plan-esrd.pdf>. Accessed May 2, 2016.

7. Perera GB, Mueller MP, Kubaska SM, et al. Superiority of autogenous arteriovenous hemodialysis access: maintenance of function with fewer secondary interventions. *Ann Vasc Surg*. 2004;18:66-73.

8. Huber TS, Carter JW, Carter RL, Seeger JM. Patency of autogenous and polytetrafluoroethylene upper extremity arteriovenous hemodialysis accesses: a systematic review. *J Vasc Surg*. 2003;38:1005-1011.

9. Pisoni R, Young EW, Dykstra DM, et al. Vascular access use in Europe and the United States: results from the DOPPS. *Kidney Int*. 2002;61:305-316.

10. Mehta S. Statistical summary of clinical results of vascular access procedures for haemodialysis. In: Sommer BG, Henry ML, editors. *Vascular Access for Hemodialysis*. 2nd ed. Chicago: Gore; 1991:145-157.

11. Glickman MH, Burgess J, Cull D, et al. Prospective multicenter study with a 1-year analysis of a new vascular graft used for early cannulation in patients undergoing hemodialysis. *J Vasc Surg*. 2015;62:434-441.

12. Desai SS, Dua A, Callahan CD. Short-term quality of care outcomes of tunneled dialysis catheters, arteriovenous fistula, arteriovenous graft, and early cannulation dialysis access. *J Am Coll Surg*. 2015;221:S183-S184.

Karl A. Illig, MD

Professor and Director
Division of Vascular Surgery
University of South Florida
Tampa, Florida
killig@health.usf.edu

Disclosures: None.