

Fistula First Breakthrough Initiative: Targeting Catheter Last in Fistula First

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ABSTRACT

An arteriovenous fistula (AVF) is the optimal vascular access for hemodialysis (HD), because it is associated with prolonged survival, fewer infections, lower hospitalization rates, and reduced costs. The AVF First breakthrough initiative (FFBI) has made dramatic progress, effectively promoting the increase in the national AVF prevalence since the program's inception from 32% in May 2003 to nearly 60% in 2011. Central venous catheter (CVC) use has stabilized and recently decreased slightly for prevalent patients (treated more than 90 days), while CVC usage in the first 90 days remains unacceptably high at nearly 80%. This high prevalence of CVC utilization suggests important specific improve-

ment goals for FFBI. In addition to the current 66% AVF goal, the initiative should include specific CVC usage target(s), based on the KDOQI goal of less than 10% in patients undergoing HD for more than 90 days, and a substantially improved initial target from the current CVC proportion. These specific CVC targets would be disseminated through the ESRD networks to individual dialysis facilities, further emphasizing CVC avoidance in the transition from advanced CKD to chronic kidney failure, while continuing to decrease CVC by prompt conversion of CVC-based hemodialysis patients to permanent vascular access, utilizing an AVF whenever feasible.

An arteriovenous fistula (AVF) is the optimal vascular access for hemodialysis (HD), because it is associated with prolonged survival, fewer infections, lower hospitalization rates, and reduced costs (1–9). The First breakthrough initiative (FFBI) was conceived in 2003 by the Center for Medicaid and Medicare Services (CMS) and developed with the assistance of the Institute for Healthcare Improvement, at a time when 32% of patients were receiving HD via an AVF (Fig. 1) (1). This was followed by a national launch through sponsorship by CMS and coalition building with the dialysis community and in particular, the 18 ESRD networks. “Spread” theory was applied to the original 11 Change Concepts of FFBI (Table 1) and utilized the quality improvement expertise and infrastructure of the ESRD Networks to reach the target of 40% prevalent AVF in August of

2005, 10 months ahead of the projected schedule. This initial goal was based on the Kidney Disease Outcomes Quality Initiative (KDOQI) Clinical Practice Guidelines for Vascular Access (update 2000), which also included the CVC target of < 10% of patients undergoing HD for more than 90 days (10). The CVC goal was never a primary focus of the initiative, although CVC reduction was addressed continually. The current FFBI AVF target of 66% stands alone without an accompanying CVC goal, and is based on expectations to achieve an AVF prevalence similar to that in Europe and Asia as reported in the Dialysis Outcomes and Practice Patterns Study (DOPPS) (11).

In the past, there has been some controversy regarding whether or not an unintended consequence of FFBI would be an increase in CVC use. This has been dispelled (12,13) by prevalent access data for December 1995 through October 2010 (Fig. 1) demonstrating little change in total CVC prevalence, a marked increase in AVFs, and a dramatic fall in arteriovenous graft (AVG) prevalence from almost 65% to 20%. These data show that the US AVF rate was relatively stable at approximately 23% prior to 1998 and the incidence of

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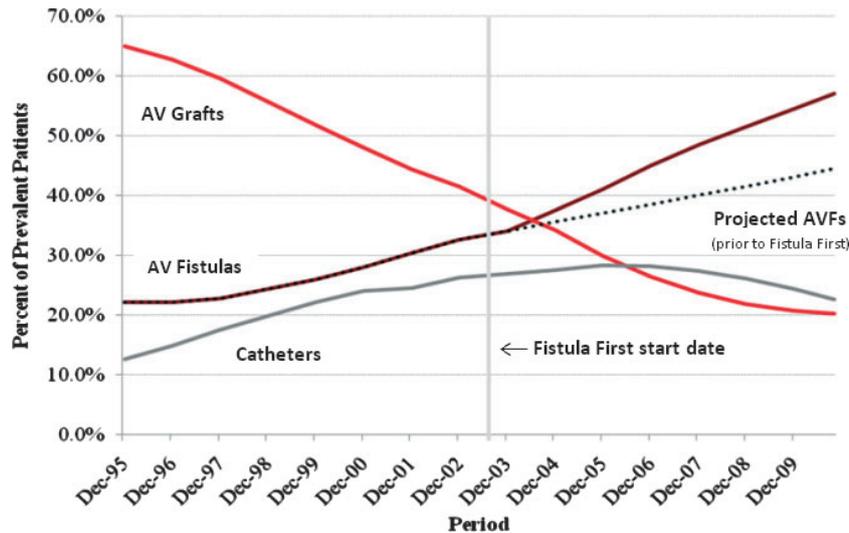


Fig. 1. US Trends in Vascular Access, December 1995 through October 2010. Data Source: <http://www.fistulafirst.org/AboutFistula-First/FFBIData.aspx>. The vascular access percent prevalence is shown in red for AVF, brown for AVG, dark gray for total catheters and dotted line for projected AVF use based on trends prior to FFBI shown in 2003. The light gray line represents the FFBI launch. CMS changed the denominator definition for FFBI vascular access measures in March 2010. Prior to March 2010, the FFBI vascular access denominator was the sum of patients with AV fistula only, AV graft only, AV graft with AV fistula, CVC with AV fistula, CVC with AV graft, CVC <90 days no other access present, CVC ≥90 days no other access present, other access, and missing access type. Beginning in March 2010, the FFBI vascular access denominator was calculated as the sum of patients with AV fistula only, AV graft only, AV graft with AV fistula, CVC with AV fistula, CVC with AV graft, CVC <90 days no other access present, CVC ≥90 days no other access present, and other access.

Table 1. Fistula First Breakthrough Initiative: 13 Change Concepts with the first 11 representing the original concepts

1. Routine Continuous Quality Improvement review of vascular access
2. Timely referral to nephrologists
3. Early referral to surgeon for “AVF only” evaluation and timely placement
4. Surgeon selection based on best outcomes, willingness, and ability to provide access services
5. Full range of surgical approaches to AVF evaluation and placement
6. Secondary AVF placement in patients with failed or failing AVGs
7. AVF placement in patients with catheters where indicated
8. AVF cannulation training
9. Monitoring and maintenance to ensure adequate access function
10. Education for caregivers and patients
11. Outcomes feedback to guide practice
12. Modify hospital systems to detect CKD and promote AVF planning and placement
13. Support patient efforts to live the best possible quality of life through self-management

CVC-based dialysis was rising. The increasing CVC trend continued yearly for approximately 8 years prior to the start of the FFBI project in December 2003, thereafter stabilizing and then decreasing the percentage of CVC-based dialysis patients. However, the current catheter rate remains too high and additional focused effort in this area is warranted (1,12–15).

Many challenges remain ahead to optimize vascular access outcomes in the US, including the importance of care before the onset of ESRD, and an enhanced focus on CVC reduction in addition to ongoing activities to promote the AVF. Clearly there will always be a role for

the tunneled-cuffed CVC and uncuffed (short-term) CVC to treat patients who are in need of immediate dialysis and for those individuals with limited vascular access options and/or conditions that severely limit life expectancy. The uncuffed CVC also play a role as short-term “bridge access” during or following some cases of bacteremia. This article describes the causes and consequences of CVC-based HD, offers solutions or strategies to limit CVC use while promoting the AVF, and advocates for a nationwide priority for specific catheter targets. This information would disseminate through the ESRD networks to individual dialysis facilities, further emphasizing CVC avoidance in the transition from advanced CKD to chronic kidney failure and careful evaluation of every patient with CVC-dependent HD to transition efficiently to a permanent access (AVF if possible). This effort would foster national trends to increase AVF use, while decreasing CVCs.

Causes of the CVC problem are myriad and are summarized in Table 2. Strategies to reduce CVC use are summarized in Table 3 and can be found in the Forum of the ESRD Networks Medical Advisory Committee’s catheter reduction toolkit (16).

Consequences of CVC Use

Morbidity

Infection Catheter-related infections include both local, exit site or tunnel infections without bacteremia, and catheter-related or systemic bacteremia. Patients

Table 2. Root Causes for Prolonged CVC use and Barriers to Reducing CVC

1. Failure to educate the patient about vascular access
2. Failure to plan vascular access in advance
3. Poor surgical judgment and lack of skill in AVF creation
4. Reimbursement challenges for care leading up to HD initiation and in the first 90 days before Medicare eligibility
5. Lack of urgency of nephrologist and dialysis unit staff to remove CVC
6. Patient CVC preference after initial use
7. Poor cannulation skills resulting in access failure
8. Failure of nephrologist and dialysis unit staff to recognize a dysfunctional or failed access
9. Failure of surgeon and/or interventionalist to treat a dysfunctional or failed access
10. Absence of CQI process

Table 3. Strategies to reduce CVC. See ESRD Network MAC Catheter Reduction Toolkit for details

1. Incident HD patients
 - Detection of CKD by primary care physicians
 - Vessel preservation
 - Referral to nephrology for eGFR < 30 ml/minute/1.73 m²
 - Referral to vascular access surgeon for eGFR < 20 ml/minute/1.73 m² for permanent access evaluation (AVF when feasible)
 - Patient education for dialysis modalities including peritoneal dialysis, hemodialysis (home and in center), and kidney transplantation
 - Patient education regarding HD vascular access
2. Prevalent HD patients
 - Vessel preservation
 - Vessel mapping and surgical referral for new access if CVC is present
 - Patient education regarding HD vascular access
 - Patients with AVGs have a plan in place for conversion of a failed or failing AVG to a secondary AVF
 - Protocol for CVC removal
 - Early recognition and intervention for AVF dysfunction or failure

with CVC-based HD have higher rates of antibiotic utilization, bacteremia, and sepsis than patients with AVGs or AVFs (2,6,17). The Center for Disease Control and Prevention applied a pooled mean estimated rate of 1.05 per 1000 CVC days to estimate that 37,000 (sensitivity analysis range: 23,000–57,000) episodes of catheter-related bacteremia occurred in US HD patients during 2008 (17).

Lacson and colleagues reviewed the annual relative risk of bacteremia in four studies using AVF as the reference (1.0), and found no significant increase in the AVG risk (1.05–1.63), while the CVC risk was significantly higher (1.95–8.49) with no overlap with the AVF reference in the 95% confidence interval in three of four studies (6). Thus, CVC reduction using AVF or in selected cases AVG, is an obvious infection control measure.

Hospitalization The average all-cause hospitalization rate for American HD patients in 2008 was approximately two per patient per year and 12.5% of these admissions were due to vascular access problems as the primary diagnosis (2). Approximately one-half of the hospitalizations in a patient's first year of HD are access-related (18). CVC use confers higher all-cause hospitalization rates and also specifically for bacteremia and

sepsis (2). Rates of US vascular access admissions have decreased 45.1% from 1993 to 2008, primarily as a result of a shift in procedures to the outpatient setting (2).

In an observational study from a US large dialysis organization, conversion from a CVC to an AVF or AVG was associated with a significantly lower hazard ratio (0.69) for annual hospitalization compared to those patients that maintained CVC access as a reference (1.0) (7). This lower hazard ratio was similar to patients treated continually with an AVF (0.70). Patients who converted from an arteriovenous access to a CVC had the highest hazard ratio (1.22). Expanding CVC-reduction strategies should be associated with reduced hospitalization.

CVC Dysfunction CVC dysfunction is defined in the literature as reduced blood flow rates, by abnormal arterial (inflow) or venous pressures, or by inadequate dialysis delivery as measured by Kt/V (19). The KDOQI guideline definition of CVC dysfunction is a blood flow less than 300 ml/minute or excess inflow negative pressure (≥ -250 mmHg) with the caveat that small lumen CVC in adults or those used in children are not designed to achieve this blood flow (15). Common causes of CVC dysfunction are thrombus accumulation and fibrin sheath formation (19). About 35% of CVC fail by 1 year and roughly two thirds of those failures are due to thrombosis (19).

Definitive therapy of established CVC dysfunction often requires CVC exchange. A promising randomized controlled trial of prophylactic post-HD instillation of 1 mg tissue plasminogen activator (tPA) weekly with heparin 5000 units per ml on other days versus the same heparin dose thrice weekly in newly inserted CVC showed a significant decrease in dysfunction from 38.4% to 20% as well as significantly reduced incidence of catheter-related bacteremia from 13% to 4.5% (20). Use of tPA to maintain flow and prevent infection should be studied further. Although nearly all patients achieve adequate dialysis dose using currently recommended parameters, the lower blood flow rates and increased recirculation associated with CVC, results in less efficient dialysis dose delivery (19).

Central Venous Stenosis and Occlusion Prolonged CVC use is the most common etiology for a spectrum of stenosis and occlusion resulting in reduced blood flow in the central veins in HD patients including the: superior vena cava, internal jugular, innominate, and subclavian veins (21). Other central venous access, implantable pacemakers, and peripherally inserted central catheters (PICC), also increase the risk. Patients with central venous stenosis or occlusion may have significant symptoms, and poor long-term vein patency, limiting vascular access options. Symptoms, including edema of the arm, neck and face; corresponding discomfort; and chest wall varicosities, may occur spontaneously or emerge following the increased venous return from establishing an AV access in the ipsilateral arm. Percutaneous interventions to expand or re-canalize the central veins should be offered only for those patients with symptoms (21). Surgical bypass of the central veins is

performed only rarely in desperate cases, since this operation is a major undertaking in this patient group.

Mortality

Catheter-related sepsis is one of the most common causes of death in the HD population (2). Several observational studies with adjustment for comorbidity have demonstrated mortality associations substantially highest for CVC, lower for AVG and least for AVF (3–5,8,9). Moreover, the mortality rate associated with AVGs trended higher than AVF in all five studies assessed by Lacson, but was statistically significantly higher only in the diabetic subpopulation of one of the five studies evaluated (6). They reported the annual relative risk of mortality with CVC access as a range 1.40–2.74, a statistically significant increase in all five studies compared to the reference AVF (1.0). The DOPPS observational data (8) and a post hoc analysis of the hemodialysis study (9) found all-cause mortality was significantly improved for those patients treated initially with a CVC after conversion to an AVF.

CVC plays an obvious role in the risk of death secondary to infection, but may also contribute to cardiovascular mortality through the effects of micro-inflammation, fostering unstable atherosclerotic plaque, as described in an epidemiologic study of bacteremia, subsequent death, and subsequent cardiovascular events (22). CVC avoidance is clearly associated with prolonged life.

Costs

Similar to mortality and hospitalization outcomes data, costs for dialysis are greatest for patients with CVC access, intermittent for AVGs, and lowest for AVFs, with total annual costs for 2008 of \$ 90,110, 79,337, and 64,701, respectively (2). Over 30% of the annual Medicare budget in 2008 was related to CKD and the trends for this expenditure continue to rise. ESRD care accounts for 20% of the CKD dollars (2).

CVC insertion is the most common access event for an HD patient (2). Schon and colleagues modeled the impact of achieving the 66% target AVF prevalence in 2003 versus the observed approximately 32% AVF prevalence, estimating \$840 million Medicare savings in access-attributed expenditures (23). The FFBI targeted increase in AVF use was also projected to extend survival by 35,000 additional life-years, and increase overall lifetime expenditures by a net of \$1.4 billion. The authors calculated that an increase to 66% AVF would be achieved at a net incremental cost of \$40,000 per year of life gained.

Approaches and Strategies to Reduce CVC Use While Promoting AVF Use

CKD Stage 4 and Transition

Perhaps the greatest challenge that faces the quality improvement activities in HD is expanding the effort to impact patient care in the transition from stage 4 CKD to chronic kidney failure. A disappointing 43% of patients with a new diagnosis of ESRD in 2008 had no nephrology care in advance of kidney failure, while just 25% received care for more than 1 year (2). Lack of nephrology care contributes to CVC prevalence at dialysis initiation of nearly 80% (Fig. 2). The variation in CVC prevalence at dialysis initiation according to the duration of nephrology care was 89.0% for none, 69.1% for 0–12 months and 55.0% for more than 12 months of care (2). Nephrology care requires the detection of CKD by the primary care physician and referral to a nephrologist.

Another important issue observed over the last decade is a rising trend toward initiating dialysis at a higher level of eGFR from less than 8 to 11.1 ml/minute/1.73 m² with 52% starting dialysis at an eGFR > 10 ml/minute/1.73 m² in 2008 versus 20% in 1996 (2). Although dialysis initiation should be individualized, both a recent randomized trial (24) and a US

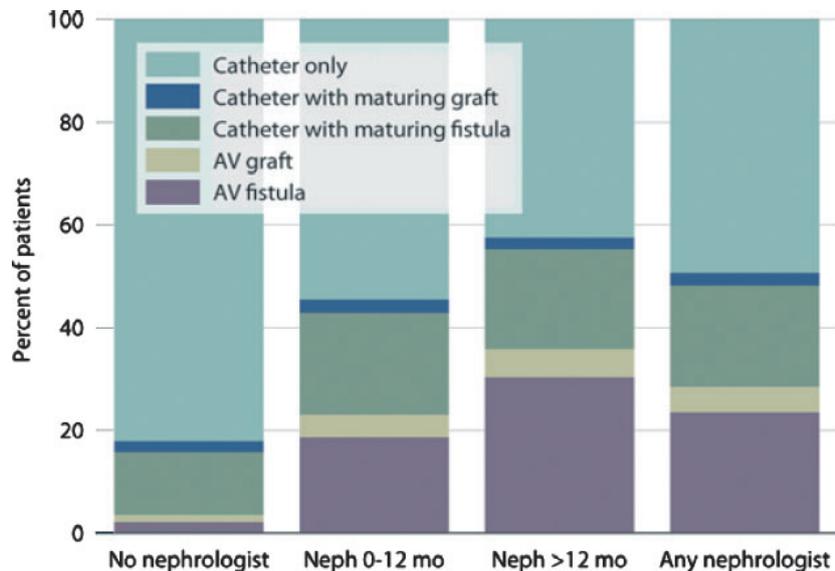


Fig. 2. Vascular access by timing of nephrology care in 2008. Data Source: USRDS Annual Data Report 2010.

observational analysis (25) support the safety of starting dialysis at lower levels of eGFR, with close ongoing nephrology care. The relevance of the initiation of dialysis at higher levels of kidney function implies less vascular access planning time for those 57% of patients that had nephrology care prior to initiating dialysis in 2008.

Some leaders in CKD care have proposed the 30-20-10 eGFR-based criteria as general recommendations to promote AVF for incident patients, suggesting these eGFR thresholds: (1) referral to nephrology for kidney replacement therapy education and preparation at 30 ml/minute/1.73 m², (2) referral to the surgeon for vascular access at 20 ml/minute/1.73 m² and (3) dialysis initiation at 10 ml/minute/1.73 m² (26). The 30-20-10 criteria have not been embraced by nephrologists, if more than half of the patients start with kidney function higher than 10 ml/minute/1.73 m².

The presence or absence of a functioning AVF should be a factor in the timing of the dialysis initiation clinical decision process for those patients who do not have urgent indications for HD such as severe uremic symptoms or intractable CKD complications. Accordingly, the CVC risks should be balanced with potential benefits of avoiding uremic complications. A patient with only mild fatigue may be best cared for by postponing dialysis with close nephrology observation to allow for AVF creation and access maturation if possible.

Establishing an AVF in a large proportion of patients requires a thorough knowledge of surgical options including complex procedures such as vein transpositions. Planning a successful AVF primarily involves patient history, physical exam and Doppler ultrasound vessel mapping along with other imaging in selected cases (15,27). The proportion of AVF failure secondary to thrombosis or non maturation reported in the literature varies widely from 10% to 60% (28–30). A randomized controlled trial designed to evaluate the role of clopidogrel after AVF creation found an approximate 60% early AVF failure rate (28). However, the intervention rate to improve patency with surgery or interventional percutaneous procedures was quite low in this trial and some have speculated that the patency would have been enhanced with more rigorous surveillance (31,32).

A plethora of studies have shown the value of vessel mapping in improving vessel selection and options, thereby increasing the chances of obtaining a successful AVF and reducing prolonged CVC use (30). A protocol for vessel mapping is available at the FFBI website (1).

A recent paper from the Fistula First Clinical Practice Workgroup explored the role of an AVG when objective venous mapping fails to document suitable vessels for an AVF (33). This paper acknowledges that for some patients a failed AVF often results in CVC use. Moreover, these authors suggest that an AVG initially not only allows for CVC avoidance, but, when placed in the forearm, may also enlarge the proximal outflow vessels for a future secondary AVF with vein maturation as a result of the increased flow attendant to the AVG.

Some vascular access surgeons do not agree with this concept and physicians who favor this approach must

be careful not to place stents or “jump” bypass revision grafts after an AVG failure, as this destroys the opportunity for a secondary AVF (34). A common opposing view is that if an outflow vein is available in the mid-arm to support an AVG, that vein should be adequate to construct an AVF or a primary or staged autogenous vein transposition. This emphasizes the debate concerning the surgeon’s selection of the best access for each individual patient.

The Fistula First website has many useful features, including a monthly dashboard summarizing incidence and prevalence of vascular access types from facilities at the Network level, including AVF, AVG, CVC >90 days, CVC <90 days, and CVC with maturing AVF. This allows for a comprehensive snapshot of vascular access use. One of the limitations of including an AVF target alone in the FFBI is illustrated by April 2011 prevalence data from ESRD Network 6 that includes 53.1% AVF and 18.6% CVC. This would be assessed as one of the poorer performing regions in the nation using only the AVF goal of 66%, yet Network 6 has one of the lowest CVC rates (1). This lower CVC proportion would arguably be associated with improved outcomes (lower rates of bacteremia, hospitalization, mortality, and annual costs) compared to other Networks that have higher AVF and higher CVC prevalence.

Multidisciplinary Approach

The multidisciplinary approach to HD vascular access is a critical component in promoting optimal access outcomes and is required by the CMS Conditions of Coverage for Dialysis Facilities (35). An example of an opportunity to apply a simple and clear intervention across disciplines is vessel preservation as promoted by arm vein preservation (1). A brief overview of each of the disciplines involved follows.

Primary Care Including the primary care physician in the access approach is the only way to impact care in the transition to chronic kidney failure. This begins with targeted screening of patients with at minimum diabetes, hypertension or age 60 years and older using eGFR and urinary albumin-creatinine ratio to detect CKD and implementing a clinical action plan that includes patient safety with preservation of arm veins. Referral to the nephrologist for eGFR less than 30 ml/minute/1.73 m² among other indications (36) and coordination of care are the key elements to begin the process of education and preparation for kidney replacement therapy.

Nephrologist The nephrologist must be the leader of the vascular access team, assuming responsibility and accountability for leading the effort to educate patients about kidney replacement therapy options for advanced CKD in addition to vascular access planning and maintenance as supported by the Renal Physicians Association (37), FFBI (1), the ESRD Networks (16), and others. The nephrologist’s role in vascular access includes: (1) oversight of the multi-disciplinary continuous quality improvement (CQI) team; (2) ultimate

responsibility for patient care and education in the dialysis facility, including participation in routine vascular access CQI rounds; (3) selection of surgeon and interventionalist; and (4) coordination of care with the vascular access coordinator and nurse. Physical exam of the vascular access should be part of nephrology training programs.

Data for 2008 show the lowest prevalent dialysis CVC usage to be among those patients under the care of a nephrologist for 12 months or greater. When that group of patients started dialysis, 30% used an AVF and an additional 20% had a maturing AVF with a CVC. Dialysis with CVC alone was 45%, and AVG were used in approximately 5% of this population (2). These numbers reflect improved outcomes, however, they are far from the stated goals (38). CKD patients with reliable nephrology care may also prolong the time to ESRD, allowing additional opportunities for kidney replacement therapy preparation. In addition to vascular access planning for HD, extending nephrology care for more patients approaching chronic kidney failure is important for evaluation for pre-emptive kidney transplantation and selection for peritoneal dialysis.

Surgeon Selection of surgeons who can perform the full range of AVF procedures is crucial. Vascular access surgical care has been provided through several surgical specialties in the US, including general, vascular, transplant, thoracic, urologic surgeons, and a small number of other non-surgical specialties, including nephrology. These groups have a wide range of educational forums, journals, and professional societies, in their respective specialties, making it difficult to remain current in new concepts, procedures, and technologies in HD vascular access. The FFBI has played an important role in bridging this information gap.

Vascular access is the last area of vascular surgery remaining in the general surgical field and will likely remain within the domain of both fellowship trained vascular surgeons and general surgeons in the future. DOPPS data for the US found that 61% of vascular surgeons and 31% of general surgeons performed AVF operations (5). Surgical training in vascular access, and particularly in AVF creation, varies widely in both general and vascular programs and has been modest or even lacking within many institutions, as program directors grapple with ever-increasing education requirements and time constraints. This was also highlighted by the DOPPS data showing a 34% lower risk of AVF failure when created by surgeons who had performed at least 25 AVF procedures during training ($p = 0.002$) (5).

The FFBI has featured surgeon education and training workshops on national, regional and local levels and collaborated with the Society for Vascular Surgery and the Society for Vascular Ultrasound to develop vascular access quality measures (27). Reversing the low priority status of vascular access in many medical communities has been a challenging process. Despite significant improvement with leadership from the National Kidney Foundation, Society for Vascular Surgery, FFBI, and other organizations, much more work lies ahead.

Interventionalist This critical member of the multidisciplinary access team is perhaps the most heterogeneous, including radiologists, surgeons, and nephrologists. The role for the interventionalist varies widely depending on local availability and expertise. Most AVFs and AVGs will require intervention(s) at some point to maintain function and Fistula First has offered instruction in this discipline within its many vascular access programs. Currently, there are vascular access centers that are dedicated to the interventional management of established access as well as providing catheter access and vascular mapping for the planning of new access. Such centers are increasing in number, but their locations are restricted to densely populated areas, where it is economically feasible to operate such centers. A future challenge is to more clearly define the role of the interventionalist in vascular access care, as well as to find ways to make this management modality available to everyone.

Dialysis Nurse The role of the nurse as the professional most skilled in AVF and AVG care and cannulation is difficult in the US where dialysis facilities often utilize one RN for every 10–12 patients (39). Some states require that nurses attend to catheter-treated patients as an infection control measure, which has the unintended consequence of re-directing nurses from AVF and AVG patients (39). Cannulation complications, such as infiltration, are associated with AVF created within the previous 6 months and contribute to the risk of AVF thrombosis with resultant CVC dependence (40).

The nurse may be among the most skilled dialysis professionals in the examination of the vascular access. This was confirmed by a prospective study where the experienced nurse was shown to be highly reliable in predicting AVF success (30). In addition, nurses play important roles in patient education, as members of the access team who often interact more frequently with the patient than other members. They may be able to better address individual access concerns, such as alterations in body image. The critical role of nurses in vascular access care is probably underestimated and undervalued with few studies in the medical literature.

Vascular Access Coordinator As part of Change Concept 1 in the FFBI Change Package of strategic concepts and guidelines for improvement (Table 1), the FFBI has recommended designation of a dialysis facility staff member, preferably an RN, to serve as Vascular Access Coordinator (VAC). The VAC is responsible for overseeing vascular access care and management, as well as continuous quality improvement. One tertiary referral center reported significant improvements in incident vascular access with an AVF increase from 56% to 75% and a CVC reduction from 40% to 25%, using a patient flow plan designed to allow the VAC nurse to play a pivotal role in each step, from CKD education through assessment and management of access problems (41).

Patient Patient-centered care is a key recommendation of the Institute of Medicine (42) and the last FFBI Change Concept. In advanced CKD, creation and

maturation of an AVF prior to the initiation of dialysis requires patient education and ample time. However, patients who are asymptomatic or have minimal symptoms universally prefer to forestall HD initiation; they perceive the evaluation and creation of the AVF as inexcusable steps toward that undesirable end. Assessment of the impact of Medicare reimbursement for patient education for stage 4 CKD should address vascular access, and the role education plays in improving access outcomes (43). In addition, patient education clearly plays an important role in selection for peritoneal dialysis and kidney transplantation. These alternative kidney replacement modalities are components of a comprehensive CVC-reduction strategy. Lastly, patient education in access care should promote self-cannulation and self-assessment for early detection of access problems and prevention of infection through enhanced skin care.

Conclusion

The FFBI has made great strides toward improving vascular access in the US, demonstrated by the overall improvement in AVF use since the program's inception from 32% in May 2003 to nearly 60% in 2011, with an associated marked reduction in AVG utilization. CVC use has declined slightly during this period for patients >90 days vintage, but CVC utilization in the first 90 days of nearly 80% remains unacceptably high. The yet-to-be achieved AVF target of 66% should continue to be promoted. However, the next major phase of the FFBI will focus on CVC-reduction strategies and guidelines to decrease CVC use to the NKF-KDOQI target of less than 10% in prevalent patients, while also reducing CVC use in incident patients.

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