History and Necessity for Fistula First

Vascular Access Care before 1997

The arteriovenous fistula (AVF) was first described and used as a reliable form of hemodialysis (HD) vascular access (VA) by Brescia et al. (1) in 1966. Improvements in dialysis technology and the expansion of dialysis eligibility (e.g., inclusion of patients with diabetes) resulted in a rapid growth of the ESRD population. Many of these patients benefited from the development of prosthetic grafts when autogenous AVF were not feasible (2–5). In the mid-1980s, permanent catheters (central venous catheters [CVC]) in the internal jugular vein became a means of prolonging temporary access (6–8) and dramatically increased in use. The cumulative effect was a reduction in AVF use and an increase in graft and CVC use in the 1990s. This was associated with increased patient care costs; for example, up to 73% of patients were hospitalized to initiate dialysis and almost invariably had a temporary CVC inserted. VA was a major cause of morbidity and mortality (9), with HD access failure accounting for the most frequent cause of hospitalizations (10) and complications accounting for 14% of all ESRD expenses ($1 billion annually) (9).

1997 to 2003: Critical Events That Affected VA Care

In an effort to improve VA outcomes, the National Kidney Foundation published the Kidney Disease Outcomes Quality Initiative (K/DOQI) Clinical Practice Guidelines for Vascular Access in 1997. The goal was to optimize management of VA through a set of evidence- and opinion-based guidelines (10). In the following year, Centers for Medicare and Medicaid Services (CMS; the government-reimbursement agency for Medicare-insured patients) developed ESRD clinical performance measures (CPM) based on the K/DOQI VA guidelines, in response to the Balanced Budget Act of 1997 (11). VA-related CPM include (1) the proportion of HD patients with AVF, (2) the proportion of HD patients with a CVC, and (3) monitoring arteriovenous grafts for stenosis. The overriding goal of the CPM was to improve patient care and reduce costs.

In 2002, the total Medicare costs for the ESRD program were $17 billion, an increase of 11% over costs in 2001 (11); VA procedures increased by four times since 1991 and approached $200 million (12). Nephrologists in the United States had to care for 340,000 patients who were receiving dialysis in more than 4500 facilities.

Fistula First: A Landmark Initiative to Improve VA Care

In 2003, the CMS and the ESRD networks jointly formed and implemented a National Vascular Access Improvement Initiative called the Fistula First Initiative (FFI) (13). The primary goal of this continuous quality improvement (CQI) project was to increase the appropriate use of AVF for HD access and to reach or exceed the K/DOQI guidelines of 50% in incident and 40% in prevalent patients (14). The recently revised goal is to have 65% of prevalent patients using an AVF by 2009 (13).

The basis of the FFI, the CQI process, is important to review. The PDSA model of improvement is based on four basic elements: Plan–Do–Study–Act (Figure 1). The cycle begins with an improvement plan and ends with actions based on the learning gained from the Plan, Do, and Study phases. The FFI Workgroup determined the Plan, and the ESRD networks diligently implemented the plan in the Do phase. The Study, or analysis, phase not only evaluates whether the change was an improvement but also acknowledges, synthesizes, and considers new knowledge gained. The results of this evaluation will determine changes to be made in the Act phase, completing the cycle. The FFI Workgroup has already acted by increasing the target for prevalent AVF (from 40 to 65%), seemingly without complete consideration of the findings in the study phase, because the total impact of increasing AVF to the original 40% target is unclear. AVF have been promoted as the “best form of HD VA” on the basis of their superior patency, low complication and procedure rates, and subsequent low overall cost. Recall that the data on which the FFI and K/DOQI guidelines were based are now more than a decade old. Are these premises still valid in the 2007 Fistula First environment? The purpose of this article is to review the intended and unintended consequences of the FFI and to highlight the need for continual reevaluation by examining the impact of FFI on other ESRD care indicators and its effect on systemwide health care and specific patient costs, hospitalizations, and complications.

Impact of the FFI

The FFI should be applauded for its enthusiasm, resources provided, and positive impact on many programs. For example, the 2005 CPM Annual Report demonstrated that 39% of prevalent patients from a select sample were using an AVF.
during their last HD session (October through December 2004) (15). Individual programs have demonstrated even more impressive increases in AVF placement and use (Table 1). FFI provided motivation and support in the form of educational materials, tools to track outcomes, and a clearly outlined process through 11 “Change Concepts” to achieve the CPM targets. FFI brought VA to the forefront of HD care, has become internationally known, and is a “household” term in most US dialysis communities.

In the United States, the proportion of patients who start HD with an AVF has remained unchanged at approximately 14% (15) since 1997; however, when “incidence” is redefined as any patient who initiated HD between January 1 to August 31 of a given year (data abstracted from October through December in respective year), a positive linear trend toward increasing AVF is seen (15) (Figure 2). From the perspective of the FFI, they have been successful in increasing the numbers of AVF created and achieving the 40% AVF prevalence rate (Table 1). The prevalent rate was reported as 41% as of January 2006 (13). Their success has prompted them to increase the AVF prevalence goal to >65%.

However, creating fistulas may not be the critical challenge. The true challenge is achieving 65% functioning fistulas in today’s dialysis patient. Several decades ago, AVF had acceptable primary failure rates of approximately 10% (16–19) and 1-yr primary patency rates between 70 and 80%. Now, primary failure rates range between 30 and 70% and have primary

![Figure 1. Plan–Do–Study–Act (PDSA) approach to continuous quality improvement.](image)

### Table 1. Examples of programs with a documented increase in AVF following K/DOQI guidelines or Fistula First

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Description</th>
<th>% AVF Before (Incidence/Prevalence)</th>
<th>% AVF After (Incidence/Prevalence)</th>
<th>Main Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascher et al. (91), 2000</td>
<td>Retrospective, 1996 to 1999, n = 247 patients with 99 AVF and 122 grafts</td>
<td>5% use in 110 patients</td>
<td>68% use in 137 patients</td>
<td>Application of K/DOQI recommendations</td>
</tr>
<tr>
<td>Schuman et al. (105), 2004</td>
<td>Retrospective, 1987 to 2002, review of 1540 grafts and 1090 fistulas created</td>
<td>17%/14% (1990) 30%/20% (1996)</td>
<td>84%/54% (2002)</td>
<td>Preoperative duplex vessel mapping; increase use of transposition fistulas</td>
</tr>
<tr>
<td>Ackad et al. (25), 2005</td>
<td>Prospective, 351 patients in 1999 and 383 patients in 2000</td>
<td>22%/26% (n = 259 March 1999)</td>
<td>60%/40% (n = 255 December 2001)</td>
<td>Full PDSA method via vascular access committee and multifaceted approach</td>
</tr>
<tr>
<td>Glazer et al. (109), 2006</td>
<td>Retrospective, 106 patients in 1997, 3785 patients in 2003</td>
<td>27%/30% (1997)</td>
<td>88%/62% (2003)</td>
<td>Multifaceted approach including workshops and local resources (e.g., algorithms, videos)</td>
</tr>
</tbody>
</table>

*aAdapted from reference (69). AVF, arteriovenous fistula; CVC, central venous catheter; K/DOQI, Kidney Disease Outcomes Quality Initiative; PDSA, Plan–Do–Study–Act.*

*bPercentage of AVF+graft at initiation over noncatheter accesses placed that year (CVC excluded).*
patency rates of 40 to 70% (20–24). Primary failure is due to early thrombosis and failure of the fistula to mature (FTM). The increase in AVF attempts and subsequent increase in FTM rates may have partly contributed to a higher use of CVC (25). A recent report demonstrated a greater dependence on CVC 90 d after HD initiation (60%) compared with a decade ago (46%) (26) and a lower conversion to grafts (25%) than previously noted (40%), implicating the use of CVC as a bridge until AVF maturation. Indeed, several clinical factors that are associated with increased risk for AVF failure are the identical factors that are associated with CVC use (23,27–29). These consistently include older age, coronary artery disease, and peripheral vascular disease (PVD). This makes “pathophysiologic sense” because adequate inflow and output are required for AVF maturation and would be hampered by the diseased vasculature, represented by atherosclerosis/arteriosclerosis. Other factors found in the literature, such as female gender and diabetes, are inconsistent predictors of fistula FTM and can be explained by their incorporation into coronary artery disease and PVD in multivariate analysis using data sets of appropriate size (23,30).

It is not surprising that the primary failure rate is high, given the aging dialysis population and their accompanying comorbidities.

Primary failures require significant interventions and costs to attain acceptable AVF cumulative survival; 24 to 42% of all AVF (31–33) will require intervention to facilitate maturation. Although approximately 70 to 80% will be successful (32,34,35), it will take an additional 3 mo, on average, until the AVF are sufficiently developed for cannulation (31). The greatest rate of CVC use after AVF creation has been reported at 6 mo (36). The timeline corresponds to the following sequence: AVF creation, discovery and confirmation of primary failure, intervention, and eventual maturation and use. Active research is required to determine factors that predispose to fistula primary failure and strategies to prevent and treat it to increase the numbers of functioning prevalent fistulas.

Impact on ESRD Indicators

An equally important ESRD indicator and CPM goal is to have <10% prevalent CVC. Since the introduction of the FFI, there has been a disturbing and progressive increase in CVC use, which may or may not be related to the high primary failure rate. In North America, the majority of patients continue to initiate HD with a CVC, even with AVF planning or creation (15,37,38). In 2006, 82% of patients in the United States initiated dialysis with a catheter (39). The percentage of patients who use a CVC as their first HD access has continued to grow since 1998 (15,40) while incident and prevalent graft use has correspondingly fallen (15,40) (Figures 3 and 4). This trend in increasing CVC use, reduction in graft use, and stable AVF use has been observed in other countries (29,41). However, centers and countries where AVF prevalence rates were already high have not demonstrated an impressive increase in AVF (Figure 4). In fact, there is a disconcerting increase in CVC and concurrent reduction in AVF in countries with previously high AVF rates, such as Italy (42), Spain (43), and Australia (28). This suggests that, above a given target, further functional fistulas may not be possible, although a target of >40% seems reasonable. The correct distribution of VA types is unknown and is likely a function of specific patient and health system characteristics, indicating that “one target does not fit all.” A concurrent approach to AVF promotion and CVC reduction is required; however, the available evidence suggests an urgent and immediate need to reevaluate and refocus our current activities to emphasize a reduction in catheters.

Catheter use is associated with increased morbidity and mortality. In a large survey of practice patterns involving all US dialysis centers (n = 3683 centers responding), cuffed CVC accounted for 68% of all access-related bacteremias (44). It has been estimated that, annually, approximately 30% of patients who use a CVC experience a septic or bacteremic episode (45). Sepsis-related hospitalizations have increased by 50% in less than a decade. Such admissions are associated with an increased risk for myocardial infarction, congestive heart failure, PVD, and stroke for the next 5 yr (46). The risk for a sepsis-

Figure 2. Percentage of adult in-center hemodialysis (HD) patients (all and incident) who underwent dialysis with an arteriovenous fistula (AVF) as their vascular access on their last HD session during October through December 2004 compared with previous study periods. 2005 ESRD CPM Project. Reprinted from reference (15), with permission.

Figure 3. Vascular access type for all adult in-center HD patients on their last HD session during the study period. 2005 ESRD CPM Project. Reprinted from reference (15), with permission.
attributable death in dialysis patients is 100 times that of the general population (47), with CVC associated with the greatest risk for infection-related and all-cause mortality (48). The consistent association of CVC use at any time and increased mortality (48–51) is the most compelling argument to reduce CVC use. Replacing grafts with CVC actually increases the overall risk for infection and mortality in the dialysis population. It has been demonstrated that switching from a CVC to either an AVF or graft reduces the risk for mortality (52).

Other significant consequences of using CVC include poor quality of life (53), lower flow rates compared with grafts and AVF (54–56) that may reduce dialysis adequacy (15,57), and the development of central venous stenosis. Central stenosis has been reported in 40% (58,59) of patients who undergo venography and, importantly, may preclude later AVF creation or hamper its maturation. Indeed, it has been well documented that patients who have had a CVC placed before AVF creation have reduced AVF survival compared with patients who did not receive a CVC (27,30,38).

The focused efforts given to FFI may have led to the decreased attention to the CPM indicator to reduce CVC. In the most recent CPM report, 2005, no patient group or center studied reached the CVC target of <10% (14); 74% of patients initiated HD with a CVC, and 52% continuing its use at 90 d, with a subsequent prevalent rate of 27% (15) (a 10% increase from 5 yr earlier). The primary reasons for CVC use were no AVF or grafts surgically planned or created (48%) followed by waiting for the AVF to mature (21%) (15). Even when an AVF was placed, approximately 60% (range 57 to 72%) of patients also required the use of a CVC (36). These reasons for CVC use have remained unchanged in the past 5 yr (60). However, there are few data on the patient’s perspective on VA type. A recent study of 165 patients who underwent dialysis with a CVC found that the patient perspectives on why they were using a CVC were different from that of the health care worker (58). For example, exhaustion of access sites was noted as a reason by 60% (range 57 to 72%) of patients who were using a CVC.

they and refuse to have surgery (15), a situation that may be worse in urban HD units. Asif et al. (61) found that 37% of CVC-dependent HD patients refused permanent access surgery despite aggressive educational efforts. The longer a CVC is in place, the less likely a patient will agree to AVF creation or use. One study that evaluated reasons for CVC use found that only duration of CVC dependence was associated with future access use (56).

**Impact on the Health Care System**

The cumulative societal costs have not been formally studied, but considerations must include the increasing burden of non-maturing fistulas and their requirements, including the dramatic increase in CVC use. The majority (70%) of the cost of maintaining an AVF is in the initial surgery and diagnostic radiology procedures required to support AVF function (62). In Canada, this cost to facilitate AVF maturation is not different from that of a successful graft (AVF CAN$7740 in the first year versus graft CAN$8130 in the first year) (62). In the United States, the cost of AVF creation and managing its complications is $11,609/yr (40). The CVC cost per procedure is $13,000 (40); thus creation of an AVF that then requires intervention to facilitate its maturation and use of a CVC until the AVF is usable will cost a minimum of $24,000. When AVF primary failure occurs, the costs are more than doubled (40,62) (costs of CVC complications not included). However, AVF intervention is effective (approximately 80%) (34,63) and necessary in approximately one third of patients to achieve FFI objectives. An AVF that can be created and then functions without intervention is the most cost-effective (US$4862/yr) (40); but such a scenario occurs in only 40% (32) of AVF. Once an AVF is functioning, it has the lowest inpatient and outpatient maintenance cost of all accesses (40).

The use of “bridging catheters” before fistula functioning increases the risk for complications. Catheter-related complications contribute a tremendous financial burden to the health care system. For example, the cost of treating one HD CVC-related bacteremia in the United States has been estimated to be as high as $45,000 per episode (64) with an average of $22,000 (65) per bacteremic episode. Annually, approximately 30% of patients who use a CVC have a septic or bacteremic episode (45). Studies that compare the financial costs of creating and maintaining access types (62,66) underestimate the cost of CVC, because CVC-attributable costs are excluded once patients have died (62) (mortality rate was 51% in the first year in patients who exclusively used CVC). It is further underestimated as a result of the inability to capture data on access procedures, infection-related hospitalizations, or deaths in non-Medicare-insured patients.

**Impact on the Patient: The Patient Is First**

In the most recent K/DOQI VA update, 2006, the workgroup recognized that “the fistula first at all costs” may not be the most cost-effective or optimal approach for each individual” (67). They emphasized that a functional AVF is the goal, not the insertion of an AVF with a poor chance at maturing. As quoted from a member of the FFI Workgroup and the K/DOQI work-
For addressing the important problem of primary failure, the “up front” investment in AVF is great, with the need for greater postoperative monitoring and intervention to facilitate maturation and manage early failures. However, once AVF are functioning, the “upkeep” is minimal because of their low complication rate. Only approximately 45% of AVF are functional without intervention after creation (32); the procedure rate is 1.45 (33) to 3.3 procedures per AVF required for maturation or 1.75 procedures per access year (32). Once an AVF is matured, the revision rate ranges from 0.17 to 0.57 (20,21,73-75) and is required in approximately 50% of AVF (32,76). This contrasts to fewer interventions for graft maturation, whereas the revisions required for grafts per access year ranges between 0.44 and 1.80 (20,21,73,75,77) (typically three to six rimes greater than for AVF). In balance, whereas fistulas require up to three times more interventions for maturation, grafts can require up to six times more interventions for maintenance to achieve similar cumulative survival (Figure 6). Better prospective studies are required to evaluate the cumulative intervention and survival rates in accesses in current practice.

Access survival is unimportant without patient survival. Studies have previously demonstrated an association between AVF use and a patient survival benefit (48,51). However, attaining targets for AVF was not associated with reduced mortality in a large prospective study of incident dialysis patients (78). The impact of previous or concurrent CVC use was not accounted for and may have diluted a possible survival benefit attributable to AVF use.

It is evident that there is no “perfect” VA, although the fistula is the closest to ideal. Given some of the uncertainties raised, room should be made to consider possible roles of grafts in helping to reduce CVC and increase AVF. The FFI statement that “any new graft must be considered a system failure and appropriate action taken” may be both unjust and unwise. As mentioned, the K/DOQI VA guidelines stated that AVF have “excellent patency once established” and “lower complication rates” (14), whereas one study referenced stated “the patency rate of PTFE grafts was significantly (P < 0.01) better than that for endogenous fistulae” (69). Figure 5 demonstrates superior graft cumulative patency compared with AVF. The data from this figure emphasize the significant impact of early AVF failures. When early failures are not considered, AVF and grafts have equivalent survival. Indeed, altering the presentation of data comparing cumulative survival (time from access creation to irreversible failure) can have a significant impact on the conclusion that survival of AVF is superior to grafts. One-year primary (intervention-free or unassisted) survival (Figure 6) and secondary (cumulative or assisted) survival are higher in AVF than in grafts when early failures or failures of AVF maturation are excluded, but this is not true for cumulative patency when early events are included in the analysis (20,70). Allon et al. (20) found a superior 6-mo assisted patency rate with grafts and an identical 2-yr cumulative patency when compared with AVF. Multiple studies have demonstrated this discrepancy (71,72), which is due to differences in primary failure rates of AVF compared with grafts and whether these failures are included in calculations of survival analysis.

Figure 5. Example of a Kidney Disease Outcomes Quality Initiative reference indicating AVF as the best permanent access with fewest complications. Reprinted from reference (69), with permission.
lights the need for properly designed prospective studies to answer this question.

Cautions surrounding graft use remain. They have been found to have higher rates of complications such as aneurysms (81,84,85) and have a significantly greater risk for infection compared with AVF (71). Historically, they have required more interventions to manage stenosis and thrombosis (71); however, with the introduction of the CPM indicator of structured routine monitoring and intervention, thrombosis rates are now low (86,87).

Suggestions for Access Improvement

Although the FFI has had many successes, there have been some unexpected outcomes as well, particularly the rise in CVC use. As indicated in the FFI CQI process, the goal is to study and act to improve continually VA and patient care. Some suggestions follow.

Continue Fistula First with Review and Reevaluation of the 11 Steps

The FFI provides 11 key “Change Concepts” that are conceptually excellent. However, each should also undergo a PDSA process to make appropriate modifications when indicated. For example, the FFI recommends the use of their Fistula Establishment Algorithm, whereby the first step is to determine vein mapping: “No surgical referral till vein mapping done,” and, “No operating room schedule without them.” This may not apply to all centers and patients and may instead delay the creation of AVF. The eagerness to find strategies to promote AVF may have attenuated a critical evaluation of these strategies. It is important to remember that studies that demonstrated the benefits of preoperative duplex scanning to map vessels were not randomized (88–91) and were published concurrently with the active promotion of AVF creation. The criteria on which a vessel is suitable for AVF creation by duplex ultrasound are not established. Many variables should be considered (89,92,93), and using minimal vessel diameter as a sole criterion should be avoided. Doing so may preclude the use of veins that would have been acceptable by clinical examination (24,94).

Furthermore, several recent studies demonstrated no significant association between vessel diameter and AVF primary failure (95). Of note, even when preoperative mapping occurs, it does not improve the maturation rate of AVF (20,22). Primary failure occurs with similar frequency in centers that routinely perform preoperative vascular mapping as in those that do not (20,55). Physical examination preoperatively and/or postoperatively has been shown to have a 70 to 80% success rate in predicting adequate AVF (55,96,97). The selective, rather than routine, use of duplex ultrasound on patients whose forearm anatomy cannot be defined by physical examination has resulted in the creation of AVF in 80% of cases with comparable patency rates (94). A patient-focused approach that limits this resource to patients whose anatomy cannot be defined clinically and those with previous CVC, pacemakers, trauma, or suspicion of central vein stenosis may not only reduce patient inconvenience and cost but also avoid delays to surgery. Prolonged waiting time from surgical referral to access creation contributes to HD initiation with a CVC with its adverse impact on subsequent AVF patency (37,38).

Develop and Evaluate a Skilled Fistula Cannulation Policy

FFI has importantly highlighted a critical aspect to AVF functioning: Its cannulation. FFI recommends a policy to allow new AVF to develop for at least 8 to 12 wk before cannulation. Although there has been debate regarding the use of maturation time policies and its impact on AVF survival (30,98), there is a unanimously agreed-on need to determine “cannulation readiness” by clinical examination (99,100) and not solely on time from AVF creation. Clinical examination (101) by experienced nurses has been able to predict AVF maturity 80% of the time (96) and is reinforced by the FFI. The FFI advises certification of three levels of cannulation competence, with only the highest level staff authorized to cannulate new AVF. This may have a positive impact on the incidence of significant tissue infiltration with its attendant complications of prolonged CVC.

Figure 6. Unassisted (a) and assisted (b) survival of fistulas versus grafts when primary failure is excluded. Reprinted from reference (110).
use, greater interventions, and complications (102). The estimated annual cost attributable to infiltration-related complications is approximately 8 million (102).

**Selectively Use Grafts: They Do Have a Place**

Although the FFI philosophy encourages an AVF to replace every failed access, a high-risk patient (e.g., risk factors for CVC use and AVF failure) might have a forearm loop graft immediately placed, rather than proceed to an upper arm AVF, obviating the need for a CVC (33,72,103-105). This would permit greater flow to veins, maturing the upper arm such that an AVF can be created when the graft fails rather than attempting to salvage it. With this approach to Fistula First, one center concurrently increased its prevalent AVF rate to 54% and reduced its CVC rate to 9% (105). This is also a reasonable approach in late-referral patients to avoid the risk for initiating HD with a CVC. The chances of having an AVF placed once a CVC has been in place for >6 mo is low (56), and the risk for death in the first year with exclusive CVC use is >50% (62).

**Optimize Predialysis Care**

Clearly, the optimal path is to avoid CVC and graft placement and to initiate dialysis with a functioning fistula. The K/DOQI guidelines (2000 update) recommended surgical referral within 6 to 12 mo and fistula placement within 1 to 4 mo of anticipated dialysis (14); it has recently been updated (2006) to recommend fistula placement 6 mo before dialysis start (67). The FFI advocates earlier fistula construction, 6 to 12 mo of anticipated HD start (Change Concept 3). This is a very carefully considered and important guiding practice point by the FFI because surgical referral and actual fistula construction are very different tasks. The time from surgical referral to actual creation varies among surgeons, institutions, and countries, ranging from 2 wk (United States), to 1 mo (Europe), to 2 mo (Canada) (37). Another 4 to 8 wk are required to determine whether a fistula is going to mature (96,101), and then time is required to book the appropriate intervention, have it done (this may take another 2 wk), and then monitor again for 2 to 6 wk to determine whether the fistula will mature. Approximately 4 mo have now passed, and if another fistula is required, then there is not enough time for a new fistula to be created and adequately matured before the patient’s first dialysis (31).

The problem is further compounded when patients are referred late to nephrologists, because they need to be assessed by the nephrologist first before surgical referral. This does not even consider the patient and his or her need to synthesize that he or she will need renal replacement therapy, consider modality choices, and understand the implications of VA. Indeed, even when patients are referred >4 mo before initiating dialysis, only 45% commence dialysis with a permanent access (106). Another study specifically evaluated the impact of predialysis care on VA placement and use at dialysis initiation. Lee and Allon (107) found that only one third of patients who were followed before dialysis initiated dialysis with a functioning fistula, and >50% initiated with a CVC. Clearly, a better understanding of the reasons for initiating dialysis with a CVC when followed adequately in predialysis clinic is required. Concurrently, the nephrology community should encourage and support greater education of primary care practitioners for the need for timely nephrology referral of patients regarding their (1) chronic kidney disease, (2) need for modality choice and appropriate access, and (3) pros and cons of various access types, and of surgeons and radiologists regarding the urgency for timely interventions. This will allow the creation and facilitation of fistulas so that they can mature and function for the patient’s first dialysis.

**Individualize Patient Care**

Although an AVF should be considered for all patients, patients’ access history and risk factors for AVF failure should be incorporated into decision making (23). For example, in a 66-yr-old black woman who requires an urgent dialysis start, who has poor vessels on preoperative mapping, and for whom the most likely success for an AVF is in the upper arm, the evidence suggests that a forearm loop graft may be preferable to an upper arm AVF (33,72). If the graft can be made to achieve a 3-yr cumulative patency, then it may improve the flow rates to the upper arm and improve the chances of a successful upper arm AVF. This AVF may then survive for many years. At minimum, it has potentially extended the patient’s life by 3 yr (by virtue of preserving future access sites) and avoids the unnecessary risk of a CVC. If an upper arm AVF were created instead, did not mature, and was converted to a graft, then it may only have a cumulative survival of 3 yr and the patient would have suffered the loss of a potential access site. The ideal scenario would be a matured, functional upper arm AVF; this highlights the need for optimal predialysis care and early surgical referral sufficient to allow a functional fistula at dialysis start.

**Back to PDSA and Future Directions**

The FFI should be congratulated for its significant efforts and achieving the goal of increasing AVF in many centers, particularly where the AVF rate was previously low. FFI provided a structure and benchmarking standard for clinical nephrologists to implement change. However, is change necessarily an improvement? The impact of FFI must also be measured by the disappointing effects on AVF, with higher rates of AVF primary failure and increased costs of promoting and maintaining AVF creation and function, the perhaps inappropriate decline in grafts, and the devastating increase in CVC with their attendant effects on patient morbidity, quality of life, and mortality. What should the act be now? Analysis and reevaluation should stimulate appropriate action and a new plan (Figure 1). It is incumbent on the FFI Workgroup to complete the PDSA cycle and study the impact of FFI before further raising its targets.

Although it is crucial to engage in such CQI study, it is equally essential to encourage new scientific inquiry in the form of basic or clinical research to address the issues raised. Specifically, research studies are needed in the following areas: To determine how to predict, prevent, or treat failure of AVF maturation; to perform an economic evaluation of preoperative vessel mapping using a randomized, controlled trial; to determine methods to reduce cannulation mishaps; formal cost anal-
ysis of AVF versus grafts from creation to unsalvageable failure (that include the costs and complications of CVC use); patient preferences for access types; and outcomes when grafts are used as a bridging access. The nephrology community and our patients would benefit from the same leadership that FFI has demonstrated to increase AVF in the plan and do phases. Now, this leadership should be applied to reducing CVC.

Conclusions

FFI is an exemplary systemwide CQI project that has resulted in a higher number of incident AVF created. It has provided resource materials, education, and useful policies, such as cannulation policies, to improve access care. On the negative side, it has also increased the need for preoperative diagnostic and therapeutic procedures, produced a high number of AVF failures and subsequent procedures to salvage AVF, and increased CVC use and its attendant consequences. These all lead to increased costs both to the patient’s health and to the health care system. High-risk patients who have recurrent AVF failures will ultimately succumb to surgical fatigue and refuse future efforts for a permanent AVF. Grafts may play a role in high-risk patients (especially those with previous AVF failures) or those who are referred late, with the dual benefit of maturing vessels for future AVF and obviating the need for CVC and their associated adverse consequences. Recognition of these factors has led the K/DOQI VA 2006 update to suggest that grafts can be used as a “planned bridge” to an AVF and failing forearm grafts can be converted to upper arm AVF (67). This highlights the need to individualize patient care; it requires careful planning with appropriate and timely referral to specialists (nephrologist, surgeon, and radiologist) and should occur along the continuum from predialysis care to the time when the access subsequently fails and needs intervention or a new fistula. Policy changes and quality initiatives require continual critical evaluation to determine whether the resulting behavior change is necessarily an improvement. If overall benefit cannot be demonstrated, then an appropriate reevaluation of the change should ensue. The current evidence strongly suggests a need to shift from a seemingly single emphasis on “Fistula First” to a concurrent approach of “Fistula First” and “Lines Last,” with grafts used as necessary.

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Disclosures

None.

References


39. Collins A: Presidential Address: Late Breaking News (USRDS 2006 data), Presented at the clinical spring meeting of the National Kidney Foundation; April 10 to 14, 2007; Orlando, FL


52. Allon M, Daugirdas J, Depner TA, Greene T, Ornt D,


Yuan J, Dheeraj R, Bhola C, Lee J, Lok CE: Reasons for Haemodialysis Catheter Use and Its Complications: Patient and Vascular Access Coordinator Perspectives. Presented at the spring meeting of the National Kidney Foundation; April 10 to 14, 2007; Orlando, FL.


Engemann JJ, Friedman JY, Reed SD, Griffiths RI, Szczezec LA, Kaye KS, Stryjewski ME, Roller LB, Schulman KA, Corey GR, Fowler VG Jr: Clinical outcomes and costs due to *Staphylococcus aureus* bacteremia among patients receiving long-term hemodialysis. *Infect Control Hosp Epidemiol* 26: 534–539, 2005


Astor BC, Eustace JA, Powe NR, Klag MJ, Fink NE, Coresh J; for the CHOICE Study: Type of vascular access and


