

Nurses' Impact on the Choice and Longevity of Vascular Access

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The overwhelming movement toward use of arteriovenous (AV) grafts among patients undergoing in-center hemodialysis in the United States that started over 30 years ago has been attributed to a variety of factors. These factors include: (a) the aging of the dialysis population, (b) an increase in the prevalence of diabetes, atherosclerotic vascular disease, and other comorbidities, (c) an increased emphasis on higher blood flow rates, (d) late initiation of predialytic care, (e) a reimbursement structure that favors graft construction, and (f) health economic pressures. The latter has led to a decrease in the number of trained nurses in dialysis centers and an increase in the number of patient care dialysis technicians with inconsistent training and certification. By the mid-1990s, only 20% of patients on dialysis in the United States were dialyzing with an AV fistula (Allon & Robbin, 2002).

Over three decades of clinical data have now irrefutably confirmed that, compared with AV fistulae, patients dialyzing with synthetic grafts experience an alarming increase in the frequency of stenosis, thrombosis, and infection—requiring a 2.4- to 7.1-fold higher frequency of salvage procedures (i.e., angioplasty, thrombectomy, and surgical revision) (Allon & Robbin, 2002). Patients with synthetic grafts experienced significantly higher rates of hospitalization and death compared with fistulae (Centers for

A preponderance of data highlights significant improvements in outcomes when patients dialyze with arteriovenous fistulae compared with either catheters or grafts. "Fistula First" is a nationwide, evidence-based, quality improvement effort that is striving to improve vascular access outcomes by increasing the percentage of patients who dialyze with arteriovenous fistulae. Nephrology nurses will have a profound effect on achieving the goals outlined by Fistula First, including both the choice and longevity of vascular accesses.

Medicare & Medicaid Services, 2004). Even more dismal statistics are associated with the use of catheters. For example, dialysis facilities with more than 28% of patients using catheters have a 30% increase in the risk of mortality ($P = 0.003$); a 28% increase in the risk of all-cause hospitalization ($P = 0.01$); and a 63% increase in the risk of hospitalization for access repair, septicemia, or infection ($P = 0.001$) (Pisoni et al., 2001).

The association between patient outcomes and choice of vascular access was recently reconfirmed by the United States-based Choices for Health Outcomes in Caring for ESRD (CHOICE) Study. This analysis reported survival data from 616 patients for up to 3 years after the initiation of hemodialysis. Overall, 1,084 accesses were used over this timeframe (185 AV fistulae, 296 AV grafts, and 603 central venous catheters) for a total of 1,381 person-years of vascular access exposure. Results showed that patients who dialyzed with a central catheter or AV graft had an adjusted relative hazard of death that was 47% and 21% higher, respectively, compared with those who dialyzed using an AV fistula (Astor, Eustace, Powe, Klag, Fink, & Coresh, 2005).

Similar reports summarizing evidence-based outcomes data were the original impetus for the development of the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (NKF-K/DOQI™) Clinical Practice Guidelines for Vascular Access in the United States. First released in 1997 and subsequently updated in 2000, these guidelines outlined quality of care recommen-

dations to guide the choice and preservation of vascular access, including the recommendation that a primary AV fistula be constructed in at least 50% of all incident patients who initiate hemodialysis. In addition, patients who were already on hemodialysis should be reevaluated for construction of a primary AV fistula whenever their current vascular access fails. Ultimately, the guidelines recommend that 40% of prevalent hemodialysis patients should have a native AV fistula, and less than 10% of chronic prevalent hemodialysis patients should be maintained on catheters as their permanent dialysis access (National Kidney Foundation, 2001).

Improving Vascular Access Outcomes: How Far Do We Have to Go?

The most comprehensive analyses of worldwide vascular access-related outcomes have been conducted by the Dialysis Outcomes and Practice Patterns Study (DOPPS) – an international, prospective, longitudinal, observational study of hemodialysis practices and associated outcomes. These baseline DOPPS data highlighted significant international differences in vascular access practice patterns among both incident and prevalent patients (see Table 1), with the United States having the lowest percent of AV fistula use, and the highest percent of AV grafts and central catheters (Pisoni et al., 2002; Rayner et al., 2003).

When these data were first released, the international variations in both the type of vascular access

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Note: This article is supported by a financial grant from Amgen. The manuscript has undergone peer review. The information does not necessarily reflect the opinions of ANNA or the sponsor.

Table 1
International Comparison of Vascular Access Placement

Country	A-V Fistula		A-V Graft		Catheter	
	Incident	Prevalent	Incident	Prevalent	Incident	Prevalent
United States	15%	24%	23%	58%	61%	17%
United Kingdom	48%	67%	2%	9%	50%	22%
Spain	69%	82%	5%	12%	26%	7%
Italy	60%	90%	0%	4%	39%	5%
Germany	83%	84%	1%	12%	15%	4%
France	62%	77%	2%	15%	35%	6%

Note: From Pisoni et al., 2002; Rayner et al., 2003.

used and the survival of the access were often attributed to differences in case mix and the presence of sicker patients (i.e., those with an increased number of and/or more serious comorbidities) in the U.S. dialysis population. However, the DOPPS has challenged this hypothesis. The DOPPS incorporates extensive adjustment for case mix—including both classic epidemiological demographics and extensive comorbidity clusters—that allow comparisons to determine the impact of clinical and practice-pattern factors on “equal” patients. Using this technique, the DOPPS found that the large difference between the U.S. and Europe in the use of AV fistulae was not accounted for by differences in case mix. The authors found that practice patterns and the emphasis on placing more fistulae in Europe were the primary reasons for the difference in access placement. They estimated that about 79% of the U.S. hemodialysis population would be expected to use an AV fistula if the European model of vascular access placement were applied (Pisoni et al., 2002). Similarly, an analysis of data from 133 U.S. dialysis facilities found significant geographic differences in graft use that were not explained by patient case mix. For example, a significantly greater percentage of

patients were using grafts in the south-central states (87% of prevalent patients; AOR = 1.97), and fewer patients were using them in New England states (51% of prevalent patients; AOR = 0.38) (Young et al., 2002).

The Fistula First Program

The significant differences in access-related outcomes seen in the United States gave rise to the evidence-based Fistula First program. This nationwide initiative was launched by the Centers for Medicare & Medicaid Services (CMS) in April 2004 to encourage breakthrough improvements in vascular access outcomes that achieve and surpass the recommendations made by NKF-K/DOQI™. In a review of critical areas of opportunity for rapid health care improvement, the CMS projected that failure to adopt the NKF-K/DOQI™ recommendations for eligible patients in the United States has resulted in over 5,000 unnecessary deaths each year. There were also significant increases in the cost of care (e.g., about 25% to 50% of all hospital admissions and hospital days for patients on hemodialysis are attributable to vascular access placement and related complications). As a result, the program has set an overall goal to

increase the percentage of patients with fistulae to 66% over the next 5 years (CMS, 2005a).

Key elements of the Fistula First initiative include: (a) publishing data on access use from all Medicare-approved dialysis facilities in the United States, (b) modifying the ESRD Conditions of Coverage to mandate use of fistulae (the first comprehensive revision in 28 years), (c) highlighting vascular access-related outcomes in the ESRD Clinical Performance Measures project, (d) coordinating quality improvement efforts through CMS's 18 ESRD networks and 53 independent quality improvement organizations, and (e) outlining 11 specific interventions that dialysis facilities can implement to increase the prevalence of fistulae (see Table 2) (CMS, 2005a; CMS 2005b). With the launch of the Fistula First program, CMS has reconfirmed the vision outlined in the K/DOQI™ guidelines. Those guidelines declare AV fistulae to be the “gold standard” for establishing access to a patient's circulatory system and mandate the ESRD Networks to spearhead the implementation of achieving and surpassing the goals outlined by NKF-K/DOQI™ (CMS, 2004).

The most recent data from the Clinical Performance Measures (CPM)

Table 2
Change Concepts to Increase the Prevalence of Fistulae in Patients on Dialysis

Change Concept	Example Nursing Role(s)
Routine CQI Review of Vascular Access	Vascular access CQI coordinator.
Timely Referral to Nephrologist	Provide education for patients and families on the benefits of A-V fistulae to protect vessels.
Early Referral to Surgeon for AVF only Evaluation and Timely Placement	Work with nephrologists to perform appropriate evaluations and physical exams prior to surgery referral.
Surgeon Selection Based on Best Outcomes, Willingness, and Ability to Provide Access Services	Work with nephrologists to communicate expectations to surgeon regarding AVF placement.
Full Range of Appropriate Surgical Approaches to AVF Evaluation and Placement	
Secondary AVF Placement in Patients with AV Grafts	Examine outflow vein of all forearm graft patients ("sleeves up") at least monthly to identify patients with suitable upper outflow vein for elective secondary AVF conversion in upper arm. Inform nephrologist/surgeon of findings.
AVF Placement in Patients with Catheters Where Indicated	Coordinate protocol to track all patients on catheters for early removal of catheter.
Cannulation Training for AV Fistulae	Ensure that the best cannulators teach A-V fistula cannulation to all appropriate dialysis staff.
Monitoring and Maintenance to Ensure Adequate Access Function	Implement standard procedures for monitoring, surveillance, and timely referral for failing A-V fistulae.
Education For Caregivers and Patients	Provide routine facility staff in-servicing and educational programs on vascular access. Provide education for patients and their families to improve quality of care and outcomes.
Outcomes Feedback to Guide Practice	Review data routinely in facility staff meetings and track changes in outcomes over time.

Note: From Centers for Medicare & Medicaid Services, 2005b.

project indicate significant improvement in fistulae placement since the introduction of the Fistula First program (CMS, 2004). In this report, the percentage of incident and prevalent patients dialyzing with an AV fistula had increased to 35% (CMS, 2004). Although the U.S. fistulae placement rate still lags behind

other countries—and is well below the goal outlined by Fistula First—these data show a promising trend that is resulting from the concentrated efforts of the Renal Networks and dialysis facilities. However, data also show an alarming and ongoing increase in the number of U.S. patients dialyzing with “permanent”

catheters (USRDS, 2005), despite the fact that analyses show that 87% of these patients are candidates for AV fistulae (CMS, 2004). Thus, although the trend of increased fistulae placement is promising, we are only about halfway to the goal set forth by Fistula First.

Nurses' Impact on Access Choice and Survival

CMS acknowledges that recommendations and tools are not enough to yield large-scale changes in clinical practice. Rather, a paradigm shift is required to alter expectations and makes all members of the nephrology community advocates for appropriate fistula placement (CMS, 2005a). Although this goal will encompass the entire nephrology team—including the patient—it is not surprising that nurses are expected to play a key role in both encouraging fistulae placement and maximizing access survival.

Data from the DOPPS reveal the potential impact that a nurse advocate can have on encouraging placement of AV fistulae. In an analysis of 133 U.S. dialysis facilities, for example, patients were more than twice as likely to use a graft instead of a fistula if their nephrologist or nurse preferred grafts over fistulae (AOR = 2.3; $P < 0.01$, reference group = facilities that did not prefer grafts). These data suggest that the preferences of medical professionals in general—and of nephrology nurses in particular—influence the choice of vascular access (Young et al., 2002).

Nephrology nurse expertise is also key to ensuring access survival. A DOPPS investigation into the potential impact of professional staff experience on outcomes, for example, found that each 20% increase in the percentage of experienced staff (those who worked in dialysis for more than 3 years) is associated with an 11% reduction in AV fistula failure (RR = 0.89; $P < 0.05$), and an 8% reduction in graft failure (RR = 0.92; $P < 0.01$). These data highlight the need for comprehensive policies and procedures, as well as ongoing edu-

cation to ensure that new nephrology nurses are mentored by their more experienced colleagues to help ensure good vascular access outcomes (Pile, 2004).

Nephrology nurses can play a leading role in initiating policies and procedures that will improve vascular access outcomes. Examples of leadership roles can include: (a) proactive presurgical consultations and education of surgeons, (b) ongoing education of the multidisciplinary team, (c) proactive education of patients and family members, and (d) continual mentoring of staff members who manipulate or care for the vascular access (Nguyen, Griffith, & Treat, 2003; Pile, 2004). The nurse's role in encouraging fistulae placement and care is illustrated in the following case study.

Case Study

R.B. is a 64-year-old male patient who has been undergoing hemodialysis using a forearm-placed AV graft for 14 months. The nephrology team has established a goal of increasing the prevalence of AV fistulae in patients with AV grafts, including proactive patient assessment prior to primary AV graft failure. During a monthly assessment, the nurse asks the patient to remove his shirt for a "sleeves up" assessment, and the outflow vein of the forearm graft is evaluated to determine if it is suitable for immediate use as an AV fistula. The nurse discusses the findings with the nephrologist, recommending that the patient be evaluated for conversion to a direct upper arm AV fistula.

The vein is evaluated by fistulogram, revealing that the outflow vein and draining system back to the heart are normal. The vein is then tested by cannulating the outflow vein with the venous needle during 2 consecutive dialysis sessions. Both sessions are uneventful, and the nephrology team discusses the plan for conversion from graft to upper arm fistula with the patient, staff, and surgeon. The plan is documented in the patient's chart, and reinforced by

the nurse vascular access manager, who is a proponent of AV fistulae. The nurse provides education to the patient on the advantages of converting to an AV fistulae, including ongoing chair-side updates on the current status of the graft. Although initially uncomfortable about changing from a graft to a fistula, ongoing education by the nurse and other members of the nephrology team convince the patient that a fistula provides him with the best opportunity for improving access outcomes.

Three months later, ongoing monitoring detects a trend of a decrease in the flow rate, and physical assessments detect mild swelling around the access site and prolonged bleeding after needle withdrawal. The nurse also notes a pulse at the arterial and mid sections of the graft (suggestive of low flow rates).

On the basis of signs of impending graft failure, the patient is scheduled for direct conversion of the arterialized upper arm outflow vein of the forearm graft to a direct upper arm AV fistula. An experienced nurse oversees fistula care and mentors newer nursing staff on the buttonhole cannulation technique used with this patient. The nursing staff also initiates a vascular access surveillance and monitoring program, including examination of the access site before each treatment and trending of dynamic venous pressures to screen for stenosis.

Discussion

The simplest opportunity to convert from a graft to a fistula is the conversion of a mature upper arm outflow vein of a forearm graft to a direct upper arm AV fistula. Such conversions should be considered for all forearm graft patients, and scheduled no later than the first signs of graft failure (and no later than following the first intervention for stenosis or thrombosis), since graft interventions may damage or utilize the outflow vein. If the evaluation does not reveal a vein that is suitable for conversion to an AV fistula, a fistulogram should

be ordered at the first sign of graft failure for diagnostic purposes as well as to check suitability of the outflow vein. If a suitable basilic or cephalic outflow vein is identified but is too deep for safe cannulation, the plan for a transposition AVF should be discussed and documented. The timing of the procedure should be based on evidence of graft failure and the patient's condition (CMS, 2005b).

It is important to note that while nurses are typically not the primary decision-makers for the choice of vascular access, they see their patients more frequently than other members of the nephrology team. Their opinions are consequently known and often of considerable importance in a patient's decision.

Conclusion

Fistula First is a national program that encourages systematic evaluation of vascular access choices, with the goal of increasing the percentage of patients dialyzing with an AV fistula. This evidence-based initiative has set a goal of having 66% of patients in the U.S. dialyzing with an AV fistula within the next 5 years. Nephrology nurses will have a profound effect on achieving the goals outlined by Fistula First, including both the choice and longevity of vascular accesses.

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