Temporal Trends, Determinants, and Outcomes of Inpatient versus Outpatient Arteriovenous Fistula Operations

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Background: As high healthcare costs are increasing scrutinized, a movement toward reducing patient hospital admissions and lengths of stay has emerged, particularly for operations that may be performed safely in the outpatient setting. Our aim is to describe recent temporal trends in the proportion of dialysis access procedures performed on an inpatient versus outpatient basis and to determine the effects of these changes on perioperative morbidity and mortality.

Methods: The 2005–2008 American College of Surgeons National Surgical Quality Improvement Program database was queried for all primary arteriovenous fistula (AVF) procedures using current procedural terminology codes. Changes in the proportions of inpatient versus outpatient operations performed by year, as well as the associated 30-day postoperative morbidity and mortality, were analyzed using univariable statistics and multivariable logistic regression.

Results: Two thousand nine hundred fifty AVF procedures were performed over the study period. Overall, 71.7% ($n = 2{,}114$) were performed on an outpatient basis. Inpatient procedures were associated with higher 30-day morbidity (10.5% vs. 4.5%) and mortality (2.8% vs. 0.7%) than outpatient procedures (both, $P < 0.001$). There was a significant increase in the proportion of procedures performed on an outpatient basis over time (2005: 56% vs. 2008: 75%; $P < 0.001$). There were no changes in postoperative morbidity or mortality for inpatient or outpatient AVF over time ($P \geq 0.36$). Independent determinants of having an inpatient procedure included younger age (OR 0.99), increasing ASA class (ASA IV OR 1.56), congestive heart failure (OR 3.32), recent ascites (OR 3.25), poor functional status (OR 3.22), the presence of an open wound (OR 1.91), and recent sepsis (OR 6.06) (all, $P < 0.01$). Acute renal failure (OR 2.60) and current dialysis (OR 1.44) were also predictive ($P < 0.001$). After correcting for baseline differences between groups, the adjusted OR for both morbidity (aOR 1.93, 95% CI 1.38–2.69) and mortality (aOR 2.85, 95% CI 1.36–5.95) remained significantly higher for inpatient versus outpatient AVF.

Conclusions: Dialysis access operations are increasingly being performed on an outpatient basis, with stable perioperative outcomes. Inpatient procedures are associated with worse outcomes, likely because they are reserved for patients with acute illnesses, serious comorbidities, and poor functional status. Overall, for appropriately selected patients, the movement toward

Presented at the 2017 Annual Meeting of the VESS, Steamboat Springs, CO, February 2–5, 2017.

The authors declare no conflicts of interest to disclose.

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Ann Vasc Surg 2018; 46: 65–74
https://doi.org/10.1016/j.avsg.2017.07.032

Manuscript received: April 7, 2017; manuscript accepted: July 26, 2017; published online: 6 September 2017

performing more elective dialysis access operations on an outpatient basis is associated with acceptable outcomes.

INTRODUCTION

The Fistula First Breakthrough Initiative was launched by the National Kidney Foundation in 2003 in an effort to increase arteriovenous fistula (AVF) use in prevalent end-stage renal disease (ESRD) patients.[1] The guidelines state that at least 50% of patients initiating dialysis and 40% of prevalent dialysis patients should have a functioning AVF. In addition, there is a call to decrease the use of chronic catheters for long-term dialysis access (i.e., >90 days).[2] According to the Centers for Medicare and Medicaid Services (CMS) ESRD clinical performance measures, less than 10% of dialysis patients should be maintained on a catheter as their permanent chronic dialysis access in the absence of a maturing permanent access.[3]

Because of these initiatives, there is a push for physicians to try and attain permanent arteriovenous (AV) access as early as possible. Unfortunately, there are system-wide delays that make this goal challenging. The median time between an initial nephrologist visit to a vascular surgeon referral is 28 days, and the median time to see a surgeon after the referral is made is 52 days.[4] In addition, the mean time to AVF cannulation in the US is 3 months, making the timeline from initial nephrologist visit to AVF cannulation more than 6 months. Not surprisingly, patients who are first seen by nephrologist within 4 months of ESRD initiation are significantly less likely to initiate dialysis with an AVF.[5]

One potential solution to this problem is to attain vascular access while a patient with worsening chronic kidney disease is admitted to the hospital for other reasons. One of the largest perceived barriers to ESRD care is related to patient buy-in and compliance.[4] It therefore makes sense to take advantage of a situation when the patient is already in the healthcare system, where nephrology and surgical care are readily available, to secure permanent AV access. However, there are risks with exposing a patient who is acutely ill or suffering the physiologic imbalances that can be associated with dialysis initiation to surgery.[6,7] In addition, there is a recent movement toward reducing patient hospital admissions and lengths of stay to reduce healthcare costs, particularly for operations that may be performed safely in the outpatient setting.[8] It is therefore unclear as to whether performing an inpatient AV access procedure is efficacious to patient care.

In the present study, we describe the temporal trends in AV access creation, including differences in morbidity and mortality following inpatient versus outpatient AVF. We also identify independent predictors of inpatient AVF in an effort to better understand the driving factors behind these practice patterns.

METHODS

All patients aged ≥18 years undergoing primary AVF as identified by current procedural terminology (CPT) codes in the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database between January 1, 2005 and December 31, 2008 were included. Dates beyond 2008 were not included because NSQIP stopped collecting data on AVF after that date. Procedures included in the analysis included AVF by cephalic vein transposition (CPT 36818), AVF by upper arm basilic vein transposition (CPT 36819), AVF direct open (i.e., Cimino type; CPT 36821), and AVF by forearm vein transposition (CPT 36820). Patients who were less than 18 years of age ($n = 5$), those who underwent AVF by a specialty other than general or vascular surgery ($n = 1$), and those with missing variables of interest (ASA class = 5, transfer status = 17, and gender = 3) were excluded. The study was approved by the Colorado Multiple Institutional Review Board, who determined that it was not human subject research due to use of a completely deidentified database. Thus, patient informed consent was not obtained for this study.

Demographics, comorbidities, renal status (acute kidney injury [AKI], hemodialysis), and operative details (surgeon specialty, operation urgency, and AVF type performed) were collected for patients included in the analysis, along with whether the patient was admitted as an inpatient at the time of their procedure. NSQIP does not specify whether a patient's admission was related to the surgery or a related/unrelated medical issue; therefore, inpatient status was assigned as a binary variable (inpatient versus outpatient). Thirty-day postoperative outcomes including complications and mortality were also recorded. Complications were clustered as cardiovascular, pulmonary, or infectious complications as previously described.[9] Cardiovascular complications included postoperative transfusion, myocardial infarction, and