The American Journal of Surgery (2014) 208, 800-805

The American Journal of Surgery®

Clinical Science

Arteriovenous grafts have higher secondary patency in the short term compared with autologous fistulae

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KEYWORDS:
Dialysis access;
Prosthetic graft;
PTFE;
Patency

Abstract

BACKGROUND: To estimate patency of arteriovenous fistulas (AVFs) and grafts (AVGs) for dialysis access.

METHODS: Records of all adult patients who had a dialysis access placed from January 2008 to June 2011 were retrospectively reviewed.

RESULTS: A total of 494 patients with 655 accesses (390 AVFs, 265 AVGs) were examined. We found that AVG fared worse in assisted primary patency. But AVG had superior secondary patency up to 1.2 years (hazard ratio [HR] .6, confidence interval [CI]: [.4 to .8]) and was no different than AVF after 1.2 years. (HR 1.6, CI: [.9 to 3.1]). On univariate analysis, dialysis catheters negatively impacted assisted primary patency (HR 1.4, CI: [1.09 to 1.77]).

CONCLUSIONS: AVG can be maintained with higher rates of secondary patency in the short term and are no different in the long term. This result suggests that in patients with limited life expectancy an AVG may be an effective alternative to an AVF to reduce both catheter time and associated complications.

In the 2012 United States Renal Data System Annual Data Report, end-stage renal disease (ESRD) patients between the ages of 65 and 74 had a mortality rate of 42% at 2 years. This rate was even higher for patients 75 years or older (58%). The number of older patients initiating dialysis is continuing to increase.[1,2] The current guidelines emphasize placement of autologous arteriovenous fistula (AVF) instead of arteriovenous graft (AVG), despite longer maturation periods for AVF (2 to 4 months) and primary failure rates of 20% to 50%.[3,4]

These facts often make tunneled catheters the 1st method of dialysis access for patients, particularly for those without medical care coverage and access to proper primary preventative care. The rate of ESRD patients starting dialysis with a

Supported in part by the Clinical and Translational Science Award (UL1TR 000439).

The authors declare no conflicts of interest.

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Manuscript received August 9, 2013; revised manuscript December 23, 2013

0002-9610/$ - see front matter © 2014 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.amjsurg.2014.01.010

catheter ranges from 42% to 81%, depending on prior nephrology care.[1] Dialysis catheters have a high risk of infection and mortality and thus these patients have a prolonged period of time at increased risk of dialysis-related complications, while waiting for AVF maturation. These catheter risks have led many to advocate "catheter last" over "fistula first."[5–7] Our predominantly urban patient population presents at later stages of chronic kidney disease and often do not have time for AVF maturation before initiation of dialysis. Therefore, we conducted a retrospective study of dialysis accesses to compare patency outcomes of AVF with AVG in an urban institution with multiple specialties and surgeons.

Methods

An institutional review board-approved retrospective study was undertaken of all dialysis access fistulas and grafts placed in adults at University Hospitals Case Medical Center in Cleveland, Ohio, from January 2008 to June 2011. Data were obtained from the electronic medical records from the hospital as well as the region's major dialysis center to enhance completeness in postoperative follow-up. Patient demographics were gathered from the 1st outpatient encounter or hospital admission note. These variables included patient age, race, body mass index, diabetes, hypertension, coronary artery disease, peripheral artery disease, and tobacco use ever. Perioperative data were collected, including vein mapping, dialysis catheter at the time of access placement, and number of previous accesses. Finally, variables specific to fistula or graft were also recorded, including presence of a looped configuration, use of tapered diameter polytetrafluoroethylene (PTFE), use of heparin-bonded PTFE, or need for fistula transposition. All information was input into a secured Research Electronic Data Capture database.[8] The primary outcome was access survival, determined by assisted primary patency and secondary patency, as defined by the recommended standards for reporting arteriovenous access.[9] Assisted primary patency was defined as the thrombosis-free period and included any *maintenance* procedures. Secondary patency was defined as the time period until thrombosis and abandonment, transplant, or death and included any intervention to *re-establish* patency. Primary patency is dependent on the surveillance regime. Since surveillance varied considerably among the 9 surgeons who placed dialysis access at our institution, primary patency could not be formally analyzed. All accesses placed were included in the analysis, regardless of whether they matured sufficiently for use or not.[9] All patient access choices were left to the individual surgeon. This included vein mapping and size thresholds as well as artery size parameters. When available, autologous vein of greater than 2.5 mm in diameter is preferred by all our surgeons. All AVGs placed were PTFE and were either straight 6-mm tubes or 4- to 7-mm tapered diameters. Primary failure was defined as any access that was abandoned without having been used for dialysis.

Baseline characteristics were summarized for patient variables and access-level variables with means/standard deviation for continuous variables and frequencies/percentages for categorical variables. For patient variables, balance between study groups (only AVF, only AVG, and both AVF and AVG) was tested using analysis of variance for continuous variables and a chi-square test for categorical variables. For access-level variables, balance between study groups (AVF and AVG) was tested using generalized estimating equation models to account for the likelihood of correlation of perioperative characteristics for multiple accesses within a subject.

Marginal Cox proportional hazards regression models were used to assess if covariates were associated with access patency. The marginal model was used to account for multiple accesses within the same subject, which would be expected to be correlated. "Proportional hazards" implies that the hazard ratio (HR) is constant over time. If the HR is not constant over time, then a key assumption of the Cox model is violated and it needs to be modified. The proportional hazards assumption was investigated using 2 methods: graphically by plotting the log-integrated hazard versus time and numerically by the Grambsch and Therneau test.[10] If a violation of the assumption was found, then a new model was made bisecting time. The time chosen was based on the above 2 methods. The result is a single model that allows for the estimation of different HRs before and after the time bisection and meets the proportional hazards assumption for the whole model. In short, this analysis gives a more accurate HR of patency loss relative to any particular point in time after the access was placed.

The multivariable models were based on a prespecified list of covariates based on what has previously been found important in the literature.[3,11] The Kaplan–Meier method was used to show graphically the probability of continued patency over time. In cases where the time course in the Cox model required bisection, a novel Kaplan–Meier curve was produced with the usual interpretation up to the time of bisection, and showing the probability of continued access survival, beyond this initial period, thereafter. Although there is no direct equivalence between a Cox model and a Kaplan–Meier curve (one is a semiparametric model and the other is a nonparametric graphical technique), the novel Kaplan–Meier curve is intended to show the change in HR in a parallel way to what is found from including a cut point in a Cox model. Also, unlike in the Cox model, no adjustment has been made to account for multiple accesses within a subject in the Kaplan–Meier plots. A HR greater than 1 indicated increased risk of patency loss, while an HR less than 1 indicated protection from patency loss.

Results

There were a total of 494 patients with 271 having only fistulas placed, 153 with only grafts, and 70 patients with both, for a total of 655 accesses (390 AVFs, 265 AVGs). Of