

SPECIAL ARTICLE

Hemodialysis Vascular Access Training and Practices Are Key to Improved Access Outcomes

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Recognizing that autologous arteriovenous fistula use was associated with improved outcomes in hemodialysis patients, the 1997 Dialysis Outcomes Quality Initiative (DOQI) vascular access practice guidelines from the National Kidney Foundation stressed fistulas as the optimal means of dialysis vascular access. In the United States, this emphasis has continued with the Fistula First Breakthrough Initiative. Much of the data supporting fistulas for dialysis access are derived from longitudinal cohorts, including the Dialysis Outcomes and Practice Patterns Study (DOPPS), dialysis provider databases, and other sources. This article reviews major findings from these data sources, focusing on specific practices and characteristics associated with greater arteriovenous fistula use in dialysis facilities worldwide. Important and often overlooked characteristics that are discussed in detail include specific preferences of dialysis staff regarding access type and the emphasis placed on fistula primacy and the number of fistulas created during surgical training. For example, in the DOPPS, the risk of initial fistula failure was 34% lower when fistulas were placed by surgeons who had created at least 25 fistulas during training ($P = 0.002$). It is imperative that dialysis clinicians advocate actively for specific dialysis access types on behalf of individual patients. Vascular surgery teaching programs must supervise adequate numbers of fistula procedures for every trainee.

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In 1997, the National Kidney Foundation's original Dialysis Outcomes Quality Initiative (DOQI) vascular access practice guidelines sought to increase the placement of autologous arteriovenous fistulas in US hemodialysis (HD) patients.¹ The DOQI set goals of at least 50% fistula rates for new (incident) patients and 40% for prevalent patients. In the United States in 2003, the Centers for Medicare & Medicaid Services, the End-Stage Renal Disease (ESRD) Networks, and key provider representatives jointly recommended adoption of a National Vascular Access Improvement Initiative to achieve the DOQI goals. In 2005, this effort

transitioned into the Fistula First Breakthrough Initiative (FFBI), with delineated goals that included increasing the fistula rate in prevalent patients to 66% and decreasing both catheter use and vascular access complications in HD patients.² There has been some measure of success to date, with the FFBI reporting an increase in US fistula prevalence to 55% in March 2010.³ To reach this goal, members of the dialysis community are striving to understand the barriers to more widespread use of fistulas, which could reflect any combination of patient, provider, and system factors.

Given widely differing fistula rates worldwide, it can be helpful to examine practices across health care cultures and systems when attempting to discern optimal vascular access strategies. In addition to discussing local data sources and guideline statements, the present review uses data generated from the Dialysis Outcomes and Practice Patterns Study (DOPPS), a large prospective observational study of HD patients in 12 nations that collects detailed aspects of demographics, comorbid conditions, laboratory values, prescriptions, and dialysis practices at both patient and facility levels.^{4,5} This article reviews vascular access practice differences across nations; considers factors associ-

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ated with varying use of the 3 major access types, namely arteriovenous fistula, arteriovenous graft (AVG), and catheter; briefly compares the outcomes (including thrombosis, hospitalization, and mortality) associated with each access type; and suggests clinical approaches that could enhance fistula creation, highlighting strategies that have been successful in health care systems worldwide. Overall, current data strongly suggest that intensified demand for fistulas by dialysis clinicians and meticulous vascular surgery performed by thoroughly trained operators can result in superior patient outcomes, and these findings are emphasized.

MORTALITY AND MORBIDITY: THE INFLUENCE OF VASCULAR ACCESS

In multiple observational studies, the risk of mortality associated with the use of catheters and AVGs for vascular access universally exceeds that seen with fistulas.⁶⁻⁹ For example, in the DOPPS, the relative risk of death was 15% higher for HD patients with an AVG than for those with a fistula ($P = 0.001$) in more than 28,000 patients from more than 300 dialysis units worldwide.⁶ Individuals receiving maintenance dialysis with a percutaneous catheter fared even worse, with a 32% higher relative risk of death compared with the fistula group ($P < 0.0001$) after adjustment for case mix,

comorbid conditions, and laboratory values. Despite extensive adjustment, it is possible that unmeasured confounding factors influenced these mortality differences, with sicker patients a priori both unable to undergo creation of a fistula and more likely to die. Although patients in this study dialyzing with a catheter or an AVG were older and had higher prevalences of numerous comorbid conditions compared with patients dialyzing with a fistula, examining case-mix-adjusted facility vascular access percentages using instrumental variable analysis showed similar results. These findings are corroborated by studies from the US Renal Data System (USRDS),⁷ Australian and New Zealand Dialysis and Transplant Association Registry,⁸ and ESRD Network 6 in the United States.⁹

Differences in mortality have long been recognized in HD patients in Japan, Europe, and the United States,¹⁰ and differences in patient demographics and burdens of comorbid disease have explained only a portion of the varying risks of death,¹¹ suggesting that differing practice patterns also may account for variability in mortality. In Fig 1, mortality risk is compared between Europe and the United States, first unadjusted, then adjusted for case mix and select laboratory values, and last, also adjusted for access type.⁶ As indicated in Fig 1, there would be no significant difference in mortality risk between Euro-

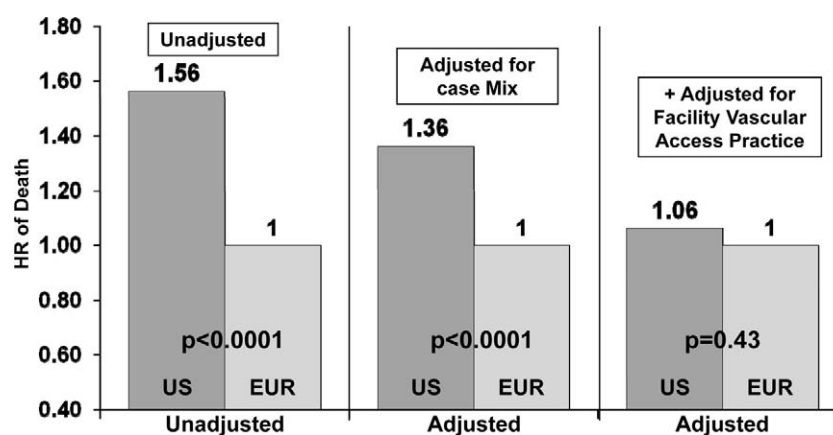


Figure 1. Case-mix-adjusted mortality hazard ratio (HR) for hemodialysis (HD) patients in the United States versus Europe (EUR), with and without adjustment for differences in facility vascular access use. The HR of mortality for HD patients in the United States versus EUR ($n = 24,398$) stratified by study phase is shown after different levels of adjustment: unadjusted; adjusted for patient age, sex, black race, number of years with end-stage renal disease, body weight, 14 summary comorbid conditions, whether treated in a hospital-based unit, facility median treatment time, facility percentage of patients with serum phosphorus level >5.5 mg/dL, and facility percentage of patients with serum calcium level >10 mg/dL; and further adjusted for percentage of facility vascular access use plus the previous 23 adjustments. All models accounted for facility clustering effects. EUR refers to France, Germany, Italy, Spain, and the United Kingdom. Data source: Pisoni et al.⁶

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