Central Venous Stenosis Is More Often Symptomatic in Hemodialysis Patients with Grafts Compared with Fistulas

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ABSTRACT

Purpose: To determine whether hemodialysis patients with central venous stenosis (CVS) are more frequently symptomatic if they have grafts versus fistulas.

Materials and Methods: A retrospective review was performed of 500 consecutive discrete patients, half with fistulas and half with grafts, who had fistulograms performed over a 4-year period. All fistulograms were evaluated for CVS, which was graded into quartiles. The presence of collaterals was noted and graded. Patient records were analyzed for symptoms of CVS, including face, neck, breast, or limb swelling. Statistical analysis was performed to determine the association between access type, degree of stenosis, location of stenosis, and symptoms.

Results: Of 500 fistulograms, 31 were excluded because of inadequate or absent central imaging. Of the remaining 469 patients, 235 had fistulas and 234 had grafts. CVS was present in 51% of patients with fistulas (119 of 237) and 51% of patients with grafts (118 of 237). When CVS was present, 29% (35 of 119) of patients with fistulas were symptomatic versus 52% (62 of 118) of patients with grafts ($P = .0005$). Overall, only 15% of patients with fistulas in the entire cohort were symptomatic compared with 27% of patients with grafts ($P = .002$). Sex, access side, and transposition did not influence symptoms; however, patients with upper arm access were more likely than patients with forearm access to be symptomatic ($P < .0001$), independent of access type.

Conclusions: CVS is more likely to be symptomatic in patients with grafts versus fistulas, and patients with upper arm access are more likely than patients with forearm access to be symptomatic.

ABBREVIATIONS

BCV = brachiocephalic vein, CIV = common iliac vein, CVS = central venous stenosis, EIV = external iliac vein, FFBI = Fistula First Breakthrough Initiative, FFCL = Fistula First Catheter Last, K/DOQI = Kidney Diseases/Outcomes Quality Initiative, SCV = subclavian vein, SVC = superior vena cava

Central venous stenosis (CVS) is a common problem for patients receiving hemodialysis in the United States. It is estimated that 25%–40% of patients with end-stage renal disease receiving hemodialysis have CVS (1), and this estimated prevalence has changed little since before the widespread transition from subclavian to jugular access for hemodialysis catheters (2). As a result of this high incidence, the focus in the literature has been on what can be done to treat CVS effectively and whether or not it is beneficial to treat CVS in asymptomatic patients (3–9).

In addition, a major focus in the Kidney Diseases/Outcomes Quality Initiative (K/DOQI) concerning CVS was prevention (10). The focus of the Centers for Medicare and Medicaid Services Fistula First Breakthrough Initiative (FFBI) has also been prevention, such as through avoidance of transvenous cardiac rhythm devices, in addition to reinforcing existing K/DOQI recommendations regarding avoiding subclavian catheterization and ideally avoiding catheters altogether (Fistula First Catheter Last [FFCL]). Among the main reasons that the emphasis in K/DOQI and FFBI has been on

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From the SIR 2014 Annual Meeting.

S.O.T. is a paid consultant for Cook, Inc, B Braun, W. L. Gore & Associates, Bard Peripheral Vascular, OrbiMed, and Teleflex; receives royalties from Cook, Inc, and Teleflex; and has received grants from Vascular Pathways. None of the other authors have identified a conflict of interest.

J Vasc Interv Radiol 2015; 26:240–246

http://dx.doi.org/10.1016/j.jvir.2014.10.048

prevention are the relatively poor results associated with treatment of CVS, whether using percutaneous transluminal angioplasty (PTA), stents and stent grafts, or surgery (3–9).

The FFBI (now FFCL) has strongly promoted use of fistulas over grafts and catheters for multiple reasons, including lower infection rates, better access survival, and better overall survival with fistulas. A potential additional advantage of fistulas over grafts was explored in this study. Based on a prior report showing that central venous PTA had better results in patients with fistulas compared with patients with grafts (4), it was hypothesized that there might be differences with respect to symptomatic CVS among access types or location or both. These differences, if confirmed, not only could lend further support to the FFBI/FFCL thrust for fistulas but also might inform access planning in patients with preexisting CVS. The purpose of this study was to compare CVS characteristics, in particular symptoms, between patients with fistulas and patients with grafts.

MATERIALS AND METHODS

Institutional review board approval and informed consent waiver were received for this study, which was compliant with the Health Insurance Portability and Accountability Act guidelines. Using a prospectively acquired quality assurance database of hemodialysis access interventions, obtained daily from a primary quality improvement database (Hi-IQ; Conexsys, Lincoln, Rhode Island), 250 consecutive unique patients with arteriovenous fistulas and 250 consecutive unique patients with arteriovenous grafts were identified over a 4-year period ending on April 30, 2013. Patients were excluded (n = 31) if they had inadequate or absent central imaging.

Demographics are shown in Table 1. After exclusions (n = 31), 50% of patients in the study population had fistulas (235 of 469) and 50% had grafts (234 of 469). Of subjects, 52% (240 of 469) were men; mean age was 62 years (range, 21–96 y). In the fistula group, 62% (146 of 235) were men, and mean age was 62 years. In the graft group, 40% (94 of 234) were men, and mean age was 63 years.

Fistulograms were performed by 1 of 19 board-certified and certificate of added qualification certified or eligible attending interventional radiologists or trainees under direct attending supervision. The access was punctured with either a 4-F coaxial access set (Micropuncture; Cook, Inc, Bloomington, Indiana) or an 18-gauge Angiocath (Becton-Dickinson, Franklin Lakes, New Jersey). Fistulography was performed by hand injection of iodinated contrast medium or carbon dioxide (n = 1) in the event of residual renal function or contrast allergy during serial digital subtraction imaging at 2 frames per second using a fixed C-arm imaging system (Axiom Artis dTA, Multistar TOP; Angiostar, Siemens Medical Solutions, Erlangen, Germany). Mobile C-arms were never used. Post-processing was performed by the attending physician, and one or more subtracted images was stored for each imaged portion of the access, including the central veins, in the department's picture archiving and communication system (Centricity; GE Healthcare, Milwaukee, Wisconsin). Central venous imaging was omitted only if contraindicated by contrast dose considerations or other rare considerations (eg, access embolization) where central venous imaging would not be relevant. Specifically, central venous imaging is considered an integral part of the access imaging protocol, and the fistulogram is considered incomplete without it. There was no selection of patients for central venous imaging based on symptoms. After the diagnostic study, treatment of lesions in symptomatic patients was performed using PTA primarily, supplemented with stents or stent grafts rarely; during the time period of this study, the overall annual stent implantation rate including CVS ranged from 4%–5.7%. Regarding CVS, divisional protocol dictated that only symptomatic patients (ie, patients with arm, face, or breast swelling; with clot caught in the stenosis during thrombectomy; or with very central anastomoses such as from axillary loop grafts in which the stenosis acted as a venous outflow stenosis) were treated; however, the operating attending physician could elect to treat the stenosis if he or she believed it was necessary to do so.

For the analysis, the central venous portions of the study were displayed from a work list created by another member of the study team (S.K.) and were displayed in chronologic order—more or less randomly as to access type—and the grader was blinded as to access type. The patient's central veins were analyzed by a single observer (S.O.T.) with >20 years of experience in hemodialysis access interventions for degree of stenosis and graded by

Table 1. Demographics

					Access Location			
Access Type	**Cohort Size**	**% Male**	**Mean Age**	**CVS**	**Upper Arm**	**Forearm**	**Femoral**	**Chest**
Fistula	235	62%	62	51%	171	64	0	0
Graft	234	40%	63	51%	197	19	12	6
All	469	52%	62	51%	368	83	12	6

CVS = central venous stenosis.