From the Western Vascular Society

An age-based comparison of fistula location, patency, and maturation for elderly renal failure patients

Jonathan Misskey, MD,[a] Jason Faulds, MD, MSc,[a,b] Ravi Sidhu, MD, MEd,[a,c] Keith Baxter, MD, MSc,[a,b] Joel Gagnon, MD,[a,b] *and* York Hsiang, MB ChB, MHSc,[a,b,*] *Vancouver, British Columbia, Canada*

ABSTRACT

Objective: Current Kidney Disease Outcomes Quality Initiative guidelines do not incorporate age in determining autogenous arteriovenous hemodialysis access placement, and the optimal initial configuration in elderly patients remains controversial. We compared patency, maturation, survival, and complications between several age cohorts (<65 years, 65-79 years, >80 years) to determine whether protocols should be modified to account for advanced age.

Methods: All patients at two teaching hospitals undergoing a first autogenous arteriovenous access creation in either arm between 2007 and 2013 were retrospectively analyzed from a prospectively maintained database. Kaplan-Meier survival and Cox hazards models were used to compare access patency and risk factors for failure.

Results: There were 941 autogenous arteriovenous accesses (median follow-up, 23 months; range, 0-89 months) eligible for inclusion; 152 (15.3%) accesses were created in those >80 years, 397 (42.2%) in those 65 to 79 years, and 392 (41.8%) in those <65 years. Primary patencies in patients >80 years, 65 to 79 years, and <65 years were 40% ± 4%, 38% ± 3%, and 51% ± 3% at 12 months and 12% ± 5%, 13% ± 3%, and 27% ± 3% at 36 months ($P < .001$). Primary assisted patencies were 72% ± 4%, 70% ± 2%, and 78% ± 2% at 12 months and 52% ± 5%, 52% ± 3%, and 67% ± 3% at 36 months ($P < .001$). Secondary patencies were 72% ± 4%, 71% ± 2%, and 79% ± 2% at 12 months and 54% ± 5%, 55% ± 3%, and 72% ± 3% at 36 months ($P < .001$). Radiocephalic patencies were lowest among older cohorts; in those >80 years, 65 to 79 years, and <65 years, they were 65% ± 7%, 67% ± 4%, and 77% ± 3% at 12 months and 41% ± 8%, 51% ± 5%, and 68% ± 4% at 36 months ($P = .019$). Secondary brachiocephalic access patencies in these cohorts were 78% ± 5%, 80% ± 3%, and 82% ± 3% at 12 months and 68% ± 7%, 66% ± 5%, and 77% ± 4% at 36 months ($P = .206$). Both the age groups 65 to 79 years and >80 years demonstrated superior brachiocephalic vs radiocephalic secondary patencies ($P = .048$ and $P = .015$, respectively); however, no differences between configuration and secondary patency were observed within the cohort <65 years. Radiocephalic access maturation failure at 12 and 24 months was 25% ± 3% and 29% ± 4% in those <65 years, 32% ± 3% and 39% ± 4% in those 65 to 79 years, and 40% ± 7% and 48% ± 8% in those >80 years ($P = .006$). Brachiocephalic access maturation failures were 17% ± 3% and 20% ± 3% at 12 and 24 months in those <65 years, 21% ± 3% and 25% ± 4% in those 65 to 79 years, and 18% ± 5% and 21% ± 5% in those >80 years ($P = .740$). On multivariate analysis, coronary disease, female sex, previous ipsilateral or bilateral catheters, radiocephalic configuration, and age >65 years were associated with secondary patency loss.

Conclusions: Patients aged 65 to 79 years and >80 years had inferior primary, primary assisted, and secondary patency and maturation compared with those <65 years. When stratified by configuration, radiocephalic accesses demonstrated lower patency and maturation compared with brachiocephalic accesses for patients aged 65 to 79 years and >80 years and were an independent predictor of secondary patency loss. (J Vasc Surg 2018;67:1491-500.)

For the past decade, elderly patients have represented the fastest growing segment of the end-stage renal disease (ESRD) population. During this time in the United States, incident patients older than 75 years starting hemodialysis increased 12%,[1] and in Canada, there has been an overall increase from 5% in 1980 to 28.2% in 2010 in this same group.[2] These patients present multiple challenges to caregivers, including a limited life expectancy, multiple age-related comorbidities, increased supportive care requirements, and frequent failure to qualify for transplantation. Given the poor long-term survival of elderly patients on hemodialysis,[3] the primary objective in establishing renal access for this population is to achieve reliable vascular access with a low primary failure rate while minimizing costly or futile intervention.

From the Division of Vascular Surgery, University of British Columbia,[a] the Division of Vascular Surgery, Vancouver General Hospital[b], and the Division of Vascular Surgery, Saint Paul's Hospital.[c]

*Principal investigator

Author conflict of interest: none.

Presented as a plenary presentation at the Thirty-first Annual Meeting of the Western Vascular Society, Colorado Springs, Colo, September 24-27, 2016.

Correspondence: Jonathan Misskey, MD, 3rd Fl, Department of Surgery, Vancouver General Hospital, 3100-950 W 10th Ave, Vancouver, BC V5Z 4E3, Canada (e-mail: jon.misskey@gmail.com).

The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

0741-5214

https://doi.org/10.1016/j.jvs.2017.08.080

Arteriovenous fistulas have well-documented superior patency compared with other access types,[4] fewer complications,[5] and improved overall survival of patients.[6] However, National Kidney Foundation Kidney Disease Outcomes Quality Initiative (KDOQI) hemodialysis access guidelines do not take age into account in recommendations for access placement.[7] Reported age-related differences in patency rates between fistula configurations and the limited life expectancy of elderly patients on dialysis have caused many to question using the most distal access available in all cohorts.[8] Results from multiple studies suggested that elderly patients have lower patency and usage rates of forearm autogenous arteriovenous accesses compared with those in the upper arm[9,10]; however, this conclusion remains controversial, and several large series including very elderly cohorts refute this finding.[11-13] In addition, the lack of younger comparison cohorts, a universal definition of the term *elderly*,[10] and survival data for patients limits the generalizability of findings. Higher access failure and nonmaturation rates can result in unnecessary operative morbidity and increased use of central venous catheters, which have demonstrated inferior survival outcomes compared with surgically created access in all age cohorts.[11,12]

The goal of our study was to compare patency, maturation, complication rates, and survival of patients in several selected age groups (<65 years, 65-79 years, and >80 years) undergoing autogenous arteriovenous access to determine whether the standard approach to renal access should be modified to account for advanced age.

ARTICLE HIGHLIGHTS

- **Type of Research:** Single-center retrospective review of prospectively collected single-institution data
- **Take Home Message:** Of 941 patients with autogenous arteriovenous access, those 65 years of age or older had inferior patency rates and fistula maturation compared with younger patients. In the elderly patients, radiocephalic access had worse patency and maturation than brachiocephalic access, and this effect occurred particularly in women and in those who had prior procedures, such as central access lines.
- **Recommendation:** The authors suggest performing brachiocephalic vs radiocephalic fistulas in the elderly, particularly in those >80 years of age.

METHODS

Study design. Data were collected for all patients undergoing creation of a first-time autogenous arteriovenous access in either arm for hemodialysis at two academic teaching hospitals in Vancouver, British Columbia, Canada, from September 2007 to August 2013 with follow-up through to August 2014. Only the first arteriovenous access attempt in either extremity was considered for data collection; subsequent fistula creation attempts on the ipsilateral arm, tunneled catheters, and arteriovenous grafts were excluded. Data were extracted from the Patient Records and Outcome Management Information System (PROMIS), a prospectively maintained, province-wide database for all patients with ESRD in British Columbia. Ethics approval was obtained by the University of British Columbia Clinical Research Ethics Board (study No. H13-00766). In addition, all patients with ESRD entering the PROMIS database sign a consent form authorizing the use of their demographic, clinical, laboratory, and dialysis data for research purposes.

Selection of patients and clinical practice. Both centers follow an autogenous access-first policy for arteriovenous access creation in all patients of all age groups, with preference for the most distal configuration on the nondominant hand in keeping with the Fistula First Initiative and national and international guidelines.[7,14] Before access creation, patients are seen by a multidisciplinary team consisting of a nephrologist, a vascular access nurse, and a vascular surgeon to determine the timing and configuration of hemoaccess. All referred patients undergo a dedicated history, physical examination, and preoperative duplex ultrasound examination to map arterial and venous access sites in the upper extremities. Preoperative arterial duplex ultrasound mapping of the brachial, radial, and ulnar arteries includes waveform assessment for the presence of distal or proximal occlusive disease and B-mode imaging for arterial size measurements and the presence of calcification. Venous assessment includes measurements of the depth and diameter of the cephalic and basilic veins with and without a tourniquet at 10 to 12 points from wrist to the axilla and Doppler analysis of venous flow to assess for obstruction. Patients with evidence of significant arterial disease based on a pulse discrepancy, resting differential arm pressures of 20 mm Hg or more, and duplex ultrasound findings of proximal or severe distal occlusive disease are referred for computed tomography angiography or catheter-based angiography for further evaluation and potential primary treatment. Patients with a history of multiple previous central venous accesses, the presence of prominent chest wall collaterals or upper extremity or chest edema, or blunted waveforms on duplex ultrasound are referred for preoperative formal venography for assessment and potential treatment of central venous stenosis and assessment of outflow veins in the extremity.

At both centers, surgeons follow a predominantly anatomy-based algorithm for autogenous arteriovenous access. Patients with a tourniquet cephalic vein diameter at the wrist >2.5 mm in diameter free of significant