Radiocephalic and brachiocephalic arteriovenous fistula outcomes in the elderly

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Background: **A recent meta-analysis has suggested that patients aged >65 have worse outcomes with radiocephalic arteriovenous fistulas (RCAVFs) compared with brachiocephalic arteriovenous fistulas (BCAVFs). We hypothesized that outcomes in patients aged ≥80—a rapidly expanding cohort within this elderly group—might be skewing the results, and that age >65 may not be a contraindication to RCAVF formation. This study examined the effect of age group (<65, 65 to 79, ≥80) on functional outcomes (use; primary and secondary functional patency) in RCVAFs and BCAVFs.**

Methods: **We identified the outcomes of all patients undergoing a first surgical access procedure for a RCAVF or BCVAF between January 1, 2000, and December 31, 2005. We examined the effect of age and other factors including sex, diabetes mellitus, hypertension, late referral (<3 months before dialysis), dialysis before surgical access, preoperative duplex ultrasound imaging, and ethnicity on non-AVF use and primary and secondary functional AVF patency. Logistic regression and Cox proportional hazards regression models were used.**

Results: **From a total of 658 patients, 361 had a RCAVF, and 297 had a BCAVF. Their median age was 68.5 years (interquartile range [IQR], 54.4 to 76.5 years), and 288 (43.8%) were aged <65 years, 274 (41.6%) were 65 to 79, and 96 (14.6%) were ≥80. Age did not influence the site of the first surgical access ($P = .874$). Only 85.7% of patients actually progressed to hemodialysis, and the RCAVF or BCAVF in 45.7% of those was never used for dialysis. Female sex (hazard ratio [HR], 2.24; 95% confidence interval [CI] 1.387 to 3.643; $P = .001$) was the only factor associated with an increase risk of RCAVF nonuse, whereas diabetes (HR, 2.095; 95% CI, 1.261 to 3.482; $P = .004$) was the only factor associated with an increase risk of BCAVF nonuse. The respective primary patency rates at 1 and 2 years for RCAVFs were 46.0% and 27.1% for patients <65, 47.0% and 36.0% for those 65 to 79, and 45.7% and 38.1% for those ≥80. Only female sex (HR, 1.679; 95% CI, 1.261 to 2.236; $P = .001$) and prior hemodialysis (HR, 1.363; 95% CI, 1.0.29 to 1.804; $P = .031$) were associated with loss of patency of RCAVFs. The primary functional patency rates for BCAVFs at 1 and 2 years were 39.3% and 31.0% for those <65 years; 53.30% and 37.5% for those 65 to 79, and 46.3% and 42.6% for those ≥80. No factors analyzed were associated with loss of primary functional patency of BCAVFs.**

Conclusions: **Age did not affect usability, primary or secondary patency of either RCAVFs or BCAVFs. Although patient selection is important, even patients ≥80 years who are considered suitable for surgical placement of access should not be denied a RCAVF solely because of age. (J Vasc Surg 2008;47:144-50.)**

The increase in demand for hemodialysis in both North America and Europe is attributable to the large increases in end-stage renal failure (ESRF) in patients aged >65 years.[1-4] It has been suggested that the uptake of dialysis in the population aged ≥80 years has also contributed greatly to this phenomenon.[5,6] Between 1996 and 2003 in the United States, the number of patients starting dialysis per year in this age group has almost doubled, from 7054 to 13,577.[5] Furthermore in 1980, only 7.6% of new ESRF patients were >75 years; whereas in 2004, >25% of new patients were in this age group.[1]

Guidelines for vascular access recommend that the radiocephalic autogenous fistula (RCAVF) should be the first-choice access procedure for patients commencing dialysis.[7] Concern has been raised, however, that this is not appropriate for all age groups.[8] In general, outcomes for RCAVFs and brachiocephalic arteriovenous fistulas (BCAVFs) vary considerably in the literature and are difficult to interpret and compare owing to different patient characteristics and reporting of outcomes.[9] Meta-analysis data of 30 mainly retrospective studies suggests that >15% of all attempted RCAVFs fail in the early postoperative period.[10] The primary and secondary patency rates of AVFs in this analysis at 1 year were 62.5% (95% confidence interval [CI], 54% to 70.3%) and 66% (95% CI, 58.2% to 73.0%).[10] The reported patency of BCAVFs is comparable with that of RCAVFs.[11]

However, a prospective study by the same authors of the RCAVF meta-analysis found that when "use for dialysis" is used as an outcome, patency rates are much worse[12]: 41% of RVACFs had failed by 6 weeks, and primary patency at 1 year was 33%. Similarly in an earlier North American study, only 34% of patients developed a RCAVF adequate for dialysis.[13] In this study, only 12% of RCAVFs constructed in the group aged >65 years were adequate to support dialysis compared with 54% of BCAVFs.[13]

A number of studies have observed mixed results in comparisons of outcomes in RCAVFs and BCAVFs in

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Competition of interest: none.

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0741-5214/$34.00

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doi:10.1016/j.jvs.2007.09.046

elderly populations. The definition of "elderly" varies but is usually >65 years.[8] Lok et al[14] observed that older patients generally had a greater risk of AVF maturation failure (hazard ratio, 1.7) than those <65, but that secondary patency was equivalent between age groups for all types of autogenous access. A recent meta-analysis of this literature, however, found an increase risk of failure of RCAVFs compared with BCAVFs (odds ratio, 1.525) in patients >65 years and has recommended that this finding should be considered when planning access surgery.[8] Given that the median age of patients with ESRF in the United States approaches 65 years,[1] the adoption of such recommendations has major implications for access programs.

To our knowledge, however, no studies have specifically considered outcomes in those ≥80 years. Given that the prevalence of comorbidity is high in those ≥80 years,[5] we hypothesized that poor outcomes in this subgroup within the "over 65" age group have skewed results and resulted in the worse outcomes for RCAVFs compared with BCAVFs observed in the "elderly" in most studies.[8] The aim of this study is therefore to examine the outcomes of RCAVFs and BCAVFs (use for dialysis, primary and secondary functional patency) after primary access (first attempted surgical procedure) in patient the age groups of <65, 65 to 79, and ≥80 years.

METHOD

Patients. All patients undergoing the first attempted first surgical access procedure between January 1, 2000, and December 31, 2005, were identified, and patients undergoing an autogenous RCAVF or BCAVF were included in the study. All cases were retrospectively identified using the theater logs, and patient records were interrogated. Recorded was information on age, ethnic group, diabetic status (oral hypoglycemics or insulin, or both), hypertension (use of antihypertensives), human immunodeficiency virus (HIV) status, intravenous drug use, timeliness of referral, and whether the patient had at any time received hemodialysis before the primary access procedure by way of a temporary central venous dialysis catheter. Accurate information on tobacco use was not available in the case notes and was not included.[9]

Preoperative assessment and operative procedures. The first fistula was placed preferentially in the nondominant arm and in the most distal position that appeared feasible when clinically assessed by a consultant surgeon. Clinical assessment involved a review of the patient's history of prior peripheral and venous cannulation, followed by a physical examination. Patients with a palpable radial pulse and a visible cephalic vein >2 mm from the wrist to antecubital fossa with a tourniquet in the nondominant forearm underwent RCAVF formation. Patients without these features, but with palpable brachial pulse and a cephalic vein >2 mm in the upper arm, underwent BCAVF formation.

No imaging was used to determine if there was any pre-existing central venous stenosis before surgery. Preoperative duplex ultrasonography (DUS) was only used when such clinical features were absent in the nondominant arm. This method of clinical rather than mandatory DUS preoperative assessment is supported by the literature.[15,16] When the preoperative DUS did not show anatomy favorable with the construction of a RCAVF or BCAVF,[17] but did demonstrate a suitable basilic vein, the patient was offered a transposed brachiobasilic arteriovenous fistula (BBAVF).[18] Patients without suitable autologous anatomy had upper arm brachioaxillary access grafts.

Both RCAVFs and RCAVFs were created using an end of the cephalic vein to the side of the artery anastomosis with continuous 6-0 synthetic monofilament. Operations were done under local anesthesia as a preference.

Outcome. Patients were deemed to have proceeded to hemodialysis if they had received at least one hemodialysis session, regardless of how vascular access was provided for that session (dialysis catheter, autogenous fistula, or prosthetic graft). We identified the number of patients who had a surgical access procedure but did not proceed to hemodialysis, and the reason for nonproceeding in each case, such as a different form of renal replacement (ie, peritoneal dialysis or transplantation) or death before commencing renal replacement. Those patients who never had hemodialysis were excluded from functional patency calculations because the simple presence of a thrill within a fistula does not determine whether a fistula can be used for dialysis.[19]

A successful fistula was defined as one that had been used for hemodialysis. Primary functional patency was defined as the interval from the time of access placement until any intervention designed to maintain or re-establish patency, access thrombosis, or time of measurement of patency, and was expressed as a percentage of all the AVFs attempted in the hemodialysis population at 1 and 2 years.[9] Interventions included angioplasty, thrombectomy, and surgical revision of the fistula.

Secondary functional patency was defined as the interval from the time of access placement until access abandonment, thrombosis, or time of patency assessment, including interventions designed to re-establish functionality in thrombosed access, and expressed as a percentage of all the AVFs attempted in the hemodialysis population 1 and 2 years.

The dates of death or transplantation were recorded as relevant. Patients who underwent transplantation or died were considered as lost to follow-up and were censored for all survival analysis.

Statistical analysis. Logistic regression was used to assess the effect of age and fistula type on the progression of a patient onto dialysis after access surgery. Logistic regression was also used to examine the influence of preoperative DUS, age, diabetes, hypertension, sex, ethnic group, and prior hemodialysis on whether a fistula was ever used in the dialysis population. We performed a Cox proportional hazards regression analysis to examine the influence of preoperative DUS, age, diabetes, hypertension, sex, ethnic group, and prior hemodialysis on the primary and secondary patency of RCAVFs and BCAVFs (considered sepa-

Table I. Demographics

Demographics	*<65 y (n = 288), No. (%)*	*65 to 79 y (n = 274), No. (%)*	*≥80 y (n = 96), No. (%)*	*P (χ^2)*
Female sex	123 (42.7)	120 (43.8)	42 (43.8)	.963
Diabetes	95 (32.9)	93 (33.9)	23 (24.0)	.178
Hypertension	178 (61.8)	166 (60.6)	47 (48.9)	.075
Referral <3 months before first HD	58 (20.1)	60 (21.9)	25 (26.0)	.477
Line HD before surgical access	125 (43.4)	111 (40.5)	44 (45.8)	.614
Ethnic group				<.001*
White	246 (85.4)	236 (86.1)	93 (96.9)	
Asian	17 (5.90)	1 (0.37)	0	
Black	15 (5.20)	9 (3.28)	0	
Unclassified	10 (4.41)	26 (9.49)	2 (2.08)	
Fistula type				.453
RCAVF	161 (55.9)	153 (55.8)	47 (49.0)	
BCAVF	127 (44.1)	121 (44.2)	49 (51.0)	
Proceeded to dialysis (any modality)	247 (85.8)	238 (86.2)	79 (82.3)	.545

HD, Hemodialysis; *RCAVF,* radiocephalic arteriovenous fistula; *BCAVF,* brachiocephalic arteriovenous fistula.
*Statistically significant.

rately). Proportionality of hazards was checked using log-log plots.

To compare our findings with that of the recent meta-analysis, we also evaluated the patency of RCAVFs compared with BCAVFs for each age group using life tables and Kaplan-Meier survival analysis. The two groups were compared using a log-rank test. Statistical analysis was performed using Software Package for the Social Sciences (version 12.0 for Windows, SPSS Inc, Chicago, Ill). A $P < .05$ was considered statistically significant.

RESULTS

Patients. During the study period, 716 adults underwent the first access procedure for hemodialysis, and 658 had a RCAVF or BCAVF. A basilic vein transposition was done in 21 patients (2.9%), and 37 (5.1%) had an access graft as a primary procedure. There was no effect of age group on type of operation used for first access ($P = .874$, χ^2 test). Overall, 50.4% of first-placed fistulas were sited at the wrist (RCAVF).

Table I summarizes the patient demographics for the 658 patients undergoing RCAVF and BCAVF formation (the study population) for each age group. The median age was 68.5 years (IQR, 54.4 to 76.5 years). No patients were positive for HIV, and only one patient (<65 years, BCAVF) had a history of intravenous drug use. Median follow-up was 24.0 months (IQR, 11.7 to 47.2 months). The three age groups were well matched apart from ethnicity.

Overall, 161 patients (24.5%) had a preoperative DUS, and age did not influence this ($P = .903$ χ^2). Preoperative DUS was done in 21.6% patients (78) undergoing RCAVF creation, and there was no difference among the age groups (<65, 23.6%; 65 to 79, 21.6%; ≥80, 14.9%; $P = .443$ χ^2). Of patients undergoing a BCAVF, 27.9% (83) had a preoperative DUS, and once again, this did not differ among the age groups (<65, 23.6%; 65 to 79, 29.8%; ≥80, 34.7%; $P = .260$ χ^2). Of interest was that the 24 patients (25%) in the ≥80 group who had DUS were more likely to have a BCAVF (n = 17) than a RCAVF (n = 7, $P = .025$ χ^2). This was not true of the <65 group ($P = .997$ χ^2) or the 65 to 79 age group ($P = .121$ χ^2).

When patients who had a RCAVF were compared with the BCAVF group, there was no difference in age ($P = .063$), hypertension ($P = .578$), ethnicity ($P = .06$), prior hemodialysis ($P = .195$), late referral ($P = .073$), or preoperative DUS ($P = .06$). Within the RCAVF group, however, the proportion of men was significantly ($P = .0001$) higher (65.9%) than in the BCAVF population (45.5%). Furthermore, the proportion of diabetic patients was lower ($P = .005$) in the RCAVF group (27.4%) compared with the BCAVF group (37.7%).

Hemodialysis population. Of the 658 adults undergoing RCAVF or BCAVF formation, 564 (85.7%) went on to receive hemodialysis, and 94 did not. The median age of the hemodialysis population was 68.7 years (IQR, 54.5 to 76.5 years). Not proceeding to dialysis was not associated with any age group ($P = .398$) or fistula types ($P = .101$). The reasons the 94 patients did not proceed to dialysis included renal replacement was not yet required in 53 (56.4%), 19 (20.2%) had died, and 22 (23.4%) had alternative renal replacement (peritoneal dialysis in 17, transplantation in 5).

Successful use of fistulas in the hemodialysis population. Table II summarizes the successful use rates of RCAVFs and BCAVFs for each age group. Of RCAVFs in the hemodialysis population, 160 (54%) were successfully used for dialysis. This rate was 10% higher in the groups aged 65 to 79 and ≥80 years than in the <65 group, but the difference was not significant ($P = .391$). We found that the only factor associated with failure of a RCAVF to be used was female sex (OR, 2.24; 95% CI, 1.387 to 3.638; $P = .001$). Dialysis was successful through 141 of the BCAVFs (54.2%). The only factor associated with failure of a BCAVF to be used for dialysis was diabetes (OR, 2.095; 95% CI, 1.261 to 3.482; $P = .004$). Of

Table II. Successful use of an arteriovenous fistula for dialysis in each age group

Fistula type	*<65 y (%)*	*65 to 79 y (%)*	*≥80 y (%)*	*P* (χ^2)
RCAVF	68/137 (49.6)	75/131 (57.3)	21/36 (58.3)	.391
BCAVF	55/110 (50)	64/107 (59.8)	22/43 (51.2)	.317

RCAVF, radiocephalic arteriovenous fistula; *BCAVF,* brachiocephalic arteriovenous fistula.

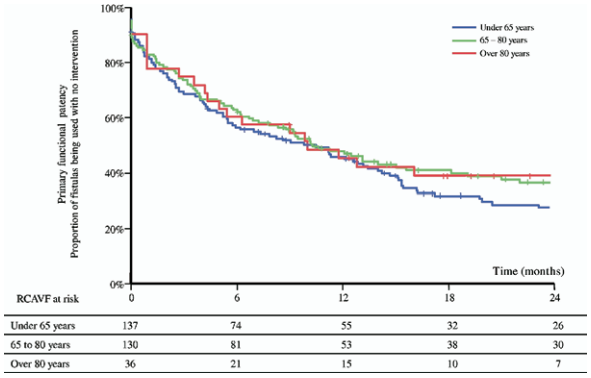


Fig 1. The impact of age on primary functional patency of radiocephalic arteriovenous fistulas in the hemodialysis population. Age had no significant effect on patency (log-rank $P = .3508$). Survival curves in the figure were terminated at 2 years and remained reliable at that time.

interest, the group aged 65 to 79 generally had the best outcome, although once again, this difference did not reach statistical significance.

Patency of fistulas in the hemodialysis population. The overall primary functional patency rates at 1 and 2 years were 46.4% and 32.1% for RCAVFs and 47.7% and 37.3% for BCAVFs.

The patency rates at 1 and 2 years for RCAVF were 46.0% and 27.1% for the <65 group; 47.0% and 36.0% for the 65 to 79 group, and 45.7% and 38.1% for the ≥80 group (Fig 1). The secondary patency rates at 1 and 2 years were 46.1% and 27.8% for the <65 group; 47.8% and 37.5% for 65 to 79 group, and 47.8% and 39.9% for the ≥80 group (Fig 2). The age groups did not differ significantly in primary (log-rank $P = .3508$) or secondary (log-rank $P = .2761$) patency. Using Cox regression analysis, we identified that female sex (HR, 1.657; 95% CI, 1.246 to 2.205; $P = .001$) and hemodialysis before surgically created access (HR, 1.331; 95% CI, 1.007 to 1.759; $P = .031$) were associated with loss of primary functional patency of RCAVFs. Both female sex (HR, 1.625; 95% CI, 1.220 to 2.164; $P = .001$) and prior hemodialysis (HR, 1.359; 95% CI, 1.026 to 1.801; $P = .033$) were also associated with loss of secondary patency of RCAVFs. Age group (<65, 65 to 79, ≥80) did not influence loss of primary functional or secondary functional patency.

The primary functional patency rates for BCAVF at 1 and 2 years were 39.3% and 31.0% for the <65 group,

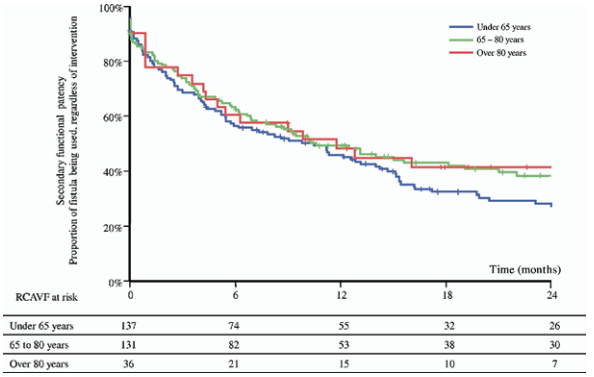


Fig 2. The impact of age on secondary functional patency of radiocephalic arteriovenous fistulas *(RCAVFs)* in the hemodialysis population. Age had no significant effect on patency (log-rank $P = .2761$). Survival curves in the figure were terminated at 2 years and remained reliable at that time.

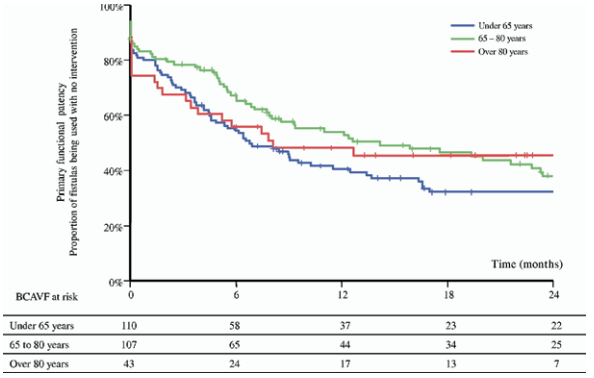
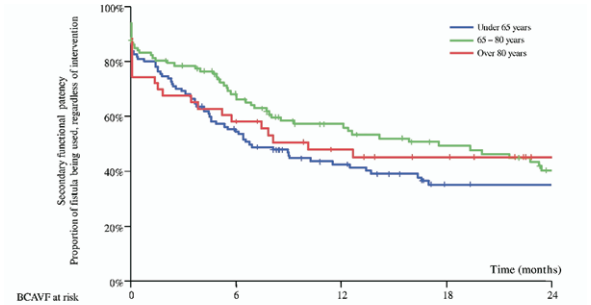


Fig 3. The impact of age on primary functional patency of brachiocephalic arteriovenous fistulas *(BCAVFs)* in the hemodialysis population. Age had no significant effect on patency (log-rank $P = .1453$). Survival curves in the figure were terminated at 2 years and remained reliable at that time.

53.30% and 37.5% for the 65 to 79 group, and 46.3% and 42.6% for the ≥80 group (Fig 3). The secondary patency rates at 1 and 2 years were 41.0% and 33.6% for the <65 group; 55.7% and 39.2% for the 65 to 79 group, and 46.3% and 42.6% for the ≥80 group (Fig 4). No significant difference for primary (log-rank $P = .1453$) or secondary (log-rank $P = .2470$) patency was found among the age groups, and no factors could be identified that were associated with loss of primary or secondary patency of BCAVFs. Once again, age group (<65, 65 to 79, ≥80) did not influence loss of primary functional or secondary functional patency.

Comparing the performance of each fistula type in each age group. When we compared functional patency between RCAVFs and BCVAFs for each age group, we found no significant differences. In the <65 group, there was no difference in primary ($P = .6749$) or secondary functional patency ($P = .9399$) between RCAVFs and



BCAVF at risk	0	6	12	18	24
Under 65 years	110	58	38	24	23
65 to 80 years	107	65	44	34	25
Over 80 years	43	25	17	13	7

Fig 4. The impact of age on secondary functional patency of brachiocephalic arteriovenous fistulas *(BCAVFs)* in the hemodialysis population. Age had no significant effect patency ($P = .2470$ log-rank). Survival curves in the figure were terminated at 2 years and remained reliable at that time.

BCAVFs, nor were their differences in the group aged 65 to 79 years (primary $P = .9766$ and secondary $P = .8288$). The primary and secondary functional patency of the RCAVF and BCAVF in the ≥80 group is shown in Fig 5.

DISCUSSION

To our knowledge, this is the first peer-reviewed and Medline indexed study to specifically consider and compare functional outcomes of autogenous fistulas in the rapidly expanding ≥80 age group. More than half the patients in our study were aged >65 years, and almost 15% of the total study population was ≥80 years. These demographics are in keeping with the predicted increase in demand for renal replacement therapy in elderly patients.[20] Although patient survival is lower in the ≥80 population,[21] the cost of dialysis is similar to other life-extending interventions that preserve the quality of life in elderly patients.[21] Demand is set to further increase, so it is important to establish if the current clinical access guidelines are appropriate in this age group, particularly in light of the meta-analysis data suggesting outcomes of RCAVFs are worse than BCAVFs in the elderly.[8]

It is noteworthy that only 85.7% of patients undergoing their first attempted RCVAF or BCAVF actually ever received hemodialysis either with that access, a dialysis catheter, or a subsequent surgically created access. Most of the patients in this nonhemodialysis group had not yet required renal replacement therapy at a median of 24 months after access surgery. Planning and delivering optimal predialysis care, with timely surgical access for hemodialysis is important and is associated with reductions in mortality and morbidity.[22] This requires not only early nephrology referral but also the appropriate number of surgical sessions to create and maintain dialysis access. Planning must allow for such a nonproceed rate.

In our study, we attempted RCAVFs or BCAVFs in 92% of patients undergoing the first access procedure for dialysis. Rates of RCAVFs and BCAVFs do not fall with age. In the planning of RCAVF and BCAVF surgery, only 161 patients (24.5%) had a preoperative DUS. Although it has been suggested that all patients should have imaging before access surgery,[23] evidence suggests that clinical examination alone gives equivalent results. In a United Kingdom study, 145 patients underwent clinical examination by a surgeon, followed by ultrasonographic mapping.[15] The surgeon felt able to site access clinically in 106 patients, but considered DUS would be helpful in 39 (26.9%), a proportion similar to what we have observed. Subsequent DUS by a blinded clinician changed the proposed site of access of only one of the 106 patients in whom DUS was considered unnecessary. Furthermore, a recent randomized trial has demonstrated no difference in technical success or cumulative fistula survival between patients assessed clinically and those assessed with DUS.[16] In our study, logistic regression and Cox regression analysis did not demonstrate any effect of preoperative DUS on nonuse or functional patency, respectively.

We found that overall, only 301 hemodialysis patients (53.4%) had a fistula that was successfully used for dialysis. Although the differences do not reach statistical significance, slightly more fistulas are needled in the older age groups, with the fistulas in the 65 to 79 age group performing best. This failure rate of 46.6% appears high compared with the meta-analysis of RCAVF outcomes, which reports a 15.3% early or technical failre rate,[10] but is equivalent or better than other studies that have defined fistula success in terms of fistula usability.[13,24,25]

A number of factors have been associated with early fistula failure, including demographic factors of age,[14,26,27] female sex,[14,25-28] already commenced dialysis,[29] comorbidity (diabetes[11,27,28]), and more recently, the anatomic factors of radial artery diameter,[30,31] intima-media thickness,[32] and cephalic vein size.[33,34] In this study, we found that female sex alone was associated with nonuse of a RCVAF. This is likely to relate to the smaller vessel diameter found in women, although female sex has itself been recognized as an independent risk factor for failure.[25] Furthermore, we found only diabetes was associated with nonuse of BCAVF, which is consistent with other studies that have examined BCAVFs independently.[11]

We hypothesized that functional outcomes for RCAVFs would be worse than BCAVFs in patients ≥80 years, yet this study did not demonstrate any effect of age on outcomes for either procedure. Indeed, factors associated with the loss of primary and secondary patency of RCAVF were female sex and prior hemodialysis using a central venous catheter, factors well-recognized in the literature.[35]

A number of studies have specifically examined the effect of age on outcome, with conflicting results,[8] but none have considered the ≥80 age group. Lok et al[14] demonstrated excellent and equivalent cumulative access survival rates at 1 year of 75.1% in the >65 patients and 79.7% the <65 age group for all autogenous fistulas. In the RCAVF group, however, the authors reported 1-year cumulative survival rates of 83.5% in the <65 patients com-

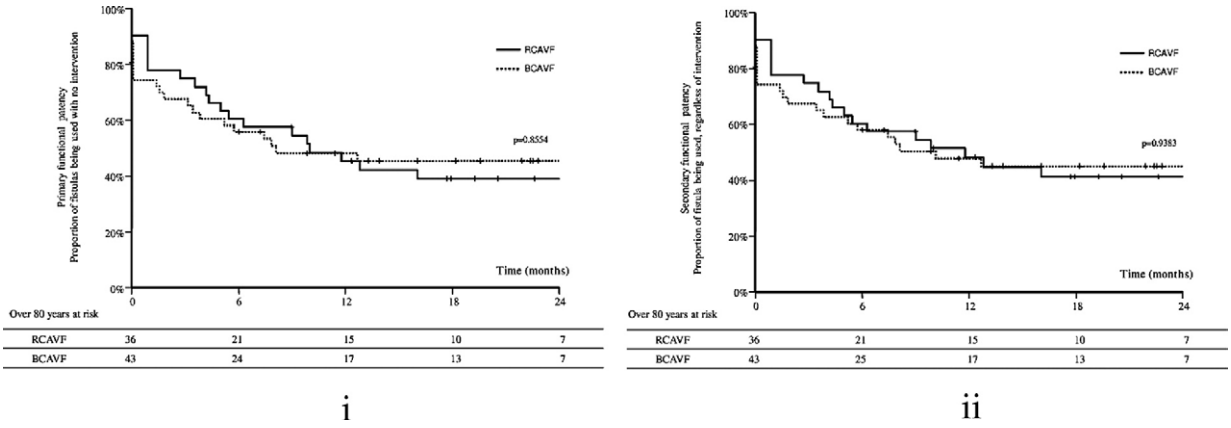


Fig 5. The impact of radiocephalic arteriovenous fistula *(RCAVF)* site vs brachiocephalic *(BCAVF)* on **(A)** primary and **(B)** secondary functional patency in the hemodialysis population aged ≥80 years. Survival curves in the figures were terminated at 2 years and remained reliable at that time.

pared with 72.5% in the >65 patients. Similar to Lin et al,[36] Lok et al also found that age was also associated with early failure of RCAVFs.[14] Conversely, Golledge et al[37] found that younger patients had a higher risk of RCAVF failure in the first month. Several other studies, however, have found that age does have a negative impact on RCAVF outcome.[38,39] Increased age has been associated with increase intima-media thickness[32] and lower fistula flow rates,[36] both associated with fistula failure.

Given the lack of concordance in the literature, a recent meta-analysis set out to establish whether RCAVFs have the same risk of failure in elderly and nonelderly patients, and whether RCAVFs have the same risk of failure as more proximal access.[8] That analysis found that an increased risk of failure of RCAVFs in older patients. The authors included 13 studies published during a period of 10 years with various definitions of fistula failure and patency; however, only 10 of the 13 studies specifically compared patency of RCAVFs of younger adults with "elderly" adults. Elderly was defined most commonly as >65 years, but in one article included in the analysis, "elderly" was defined as "older than 50 years" and in three articles as "older than 70 years." Given the heterogeneity of reporting and small number of trials included, we would not implement the authors' recommendation that elderly patients should have BCAVF formed in preference to a RCAVF, especially in light of our own findings. Indeed the suggestion that elderly patients have significant benefit from BCAVF compared with RCAVF has not been upheld by our data for either the group aged 65 to 79 years or the ≥80 group (Fig 5).

Bias within patient selection affects all nonrandomized studies, and we acknowledge that this may explain why we have observed equivalence between the age groups and fistula sites. More men and fewer diabetic patients had RCAVFs. It is difficult outside of a randomized study to separate whether these factors simply confound the clinical or anatomic selection of site or have independently influenced the surgeon's decision to choose a type of fistula.

Another weakness of this study is that we do not know what proportion of all hemodialysis patients are not offered any surgical access procedure, although we believe it to be low. It is conceivable that, compared with the other age groups, a larger proportion of patients aged ≥80 receive hemodialysis using a dialysis catheter and a fistula is never attempted. The policy of our unit, however, is to minimize the number of patients who undergo dialysis through a central venous catheter, and there are no explicit criteria for excluding patients from surgically created dialysis access. Nevertheless, it could be argued that we may have selected out only the patients most likely to do well in the older age groups, whereas not attempting a surgical access procedure in a younger patient would be unlikely.

Prospective randomized trials in access surgery are scarce.[40] A randomized, controlled trial comparing RCAVFs with BCAVFs in the elderly population in whom either is anatomically suitable is required to definitively answer the question of which is the more appropriate procedure. However, it is incontrovertible that in our hands, patients >65 suitable for any form of surgical access should not automatically be offered a BCAVF as a first-access procedure. We will continue to advocate the use of RCAVFs in those patients in whom it appears clinically appropriate.

CONCLUSION

Older patients in this series have equivalent RCAVF and BCAVF outcomes. Female sex is an important risk factor for both RCAVF nonuse and loss of patency. Although patient selection is important, elderly patients considered suitable for surgical placement of access should not be denied a RCAVF solely because of their age.

AUTHOR CONTRIBUTIONS

Conception and design: AW
Analysis and interpretation: AW, JM, PL, DM
Data collection: AW, WN, PB, SB

Writing the article: AW
Critical revision of the article: AW, WD,JM, PL, DM
Final approval of the article: AW, WN, PB, SB, JM, PL, DM
Statistical analysis: AW
Obtained funding: Not applicable
Overall responsibility: AW

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Submitted Jul 23, 2007; accepted Sep 19, 2007.