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The Impact of Comorbidity Index on The Association between Vascular Access type and Clinical Outcomes among Elderly Patients Undergoing Hemodialysis

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Objectives: This study aimed to evaluate the impact of comorbidity burden on the association between vascular access type and mortality risk among elderly patients maintaining hemodialysis.

Methods: A total of 23,100 patients with ≥ 65 years undergoing hemodialysis were recruited from the Korean end-stage renal disease registry data (2001-2018). Study subjects were stratified into tertile according to Charlson comorbidity index (CCI; 4-5, 6, and ≥ 7) and compared the survival and hospitalization rate among the type of vascular access.

Results: The prevalence of arteriovenous fistula (AVF) use was lower, whereas that of arteriovenous graft (AVG) and central venous catheter (CVC) use was higher in the highest tertile of CCI compared to lowest tertile. During a median follow-up of 4.5 years, 4,405 (19.1%) of death, 1,061 (4.6%) of hospitalization due to access malfunction, and 180 (0.8%) of hospitalization due to access infection had occurred. Among all tertiles of CCI, the use of CVC showed highest risk for mortality compared to use of AVF. In the lowest tertile, the survival rate between the use of AVF and AVG showed no difference. However, in middle and highest tertiles, subjects with AVG showed significantly higher risk of mortality compared to those with AVF. When the subjects were classified according to combination of CCI tertile and the type of access (AVF vs. AVG), the highest tertile of CCI with use of AVG showed the highest risk for mortality compared to those with lowest tertile of CCI using AVF (hazard ratio, 1.75; 95% confidence interval, 1.28-2.39). The hospitalization risks due to access malfunction or infection were higher in patients with AVG or CVC than AVF in higher tertiles of CCI compared to the lowest tertile.

Conclusions: The use of AVF may be beneficial and switching to AVF should be considered in the elderly with high burden of comorbidity maintaining hemodialysis.

Table 1. The association between type of vascular access and all-cause mortality risk at different level of CCI index

Table 1. The association between type of vascular access and all-cause mortality risk at different level of CCI index (*P* for interaction between type of access and CCI)

	Model 1		Model 2		Model 3	
	HR (95% CI)	<i>P</i>	HR (95% CI)	<i>P</i>	HR (95% CI)	<i>P</i>
Lowest tertile of CCI (4-5)						
AVF (n = 6,748)	1.00 (reference)		1.00 (reference)		1.00 (reference)	
AVG (n = 1,515)	1.29 (1.12-1.48)	<0.001	1.26 (1.10-1.45)	0.001	1.28 (0.91-1.80)	0.15
CVC (n = 1,528)	4.05 (3.54-4.63)	<0.001	3.91 (3.41-4.49)	<0.001	2.93 (2.09-4.11)	<0.001
Middle tertile of CCI (6)						
AVF (n = 5,041)	1.00 (reference)		1.00 (reference)		1.00 (reference)	
AVG (n = 1,423)	1.29 (1.12-1.47)	<0.001	1.34 (1.17-1.53)	<0.001	1.39 (1.05-1.83)	0.02
CVC (n = 1,685)	3.38 (3.00-3.82)	<0.001	3.18 (2.81-3.60)	<0.001	3.22 (2.45-4.23)	<0.001
Highest tertile of CCI (≥7)						
AVF (n = 3,058)	1.00 (reference)		1.00 (reference)		1.00 (reference)	
AVG (n = 968)	1.39 (1.21-1.60)	<0.001	1.32 (1.15-1.53)	<0.001	1.35 (1.06-1.73)	0.01
CVC (n = 1,134)	3.22 (2.81-3.69)	<0.001	2.97 (2.59-3.41)	<0.001	2.25 (1.75-2.90)	<0.001

Model 1: Unadjusted

Model 2: Adjusted for age, sex, and CCI

Model 3: Model 2 + BMI, predialysis SBP, etiology of ESRD, functional status, history of hypertension, diabetes, or CVDs, hemoglobin, serum albumin, and total cholesterol

Abbreviation: HR, hazard ratio; CI, confidence interval; AVF, arteriovenous fistula; AVG, arteriovenous graft; CVC, central venous catheter; BMI, body mass index; SBP, systolic blood pressure; ESRD, end-stage renal disease; CVD, cardiovascular disease

Table 2. The association between type of vascular access and hospitalization at different level of CCI index

Table 2. The association between type of vascular access and hospitalization at different level of CCI index (*p* for interaction between type of access and CCI)

	Number of hospitalizations [†]	Access malfunction		Access infection	
	Mean ± SD	OR (95% CI) [*]	<i>P</i>	OR (95% CI) [*]	<i>P</i>
Lowest tertile of CCI (4-5)					
AVF (n = 6,748)	0.6 ± 2.4	1.00 (reference)		1.00 (reference)	
AVG (n = 1,515)	0.7 ± 1.2	1.96 (1.27-2.96)	0.002	2.65 (0.98-7.01)	0.06
CVC (n = 1,528)	1.0 ± 1.3	3.60 (2.41-5.25)	<0.001	1.72 (0.60-5.15)	0.32
Middle tertile of CCI (6)					
AVF (n = 5,041)	0.8 ± 1.7	1.00 (reference)		1.00 (reference)	
AVG (n = 1,423)	1.0 ± 2.8	1.20 (0.80-1.83)	0.37	3.52 (1.33-9.38)	0.01
CVC (n = 1,685)	1.2 ± 2.3	2.33 (1.59-3.37)	<0.001	3.33 (1.20-9.67)	0.02
Highest tertile of CCI (≥7)					
AVF (n = 3,058)	1.1 ± 1.4	1.00 (reference)		1.00 (reference)	
AVG (n = 968)	1.2 ± 1.3	2.00 (1.30-3.14)	0.002	3.44 (1.43-8.56)	0.01
CVC (n = 1,134)	1.5 ± 1.4	2.86 (1.83-4.40)	<0.001	3.59 (1.39-9.09)	0.01

[†]*P* for trend <0.001

* Models were adjusted for age, sex, CCI, BMI, predialysis SBP, etiology of ESRD, functional status, history of hypertension, diabetes, or CVDs, hemoglobin, serum albumin, and total cholesterol

Abbreviation: OR, odds ratio; CI, confidence interval; AVF, arteriovenous fistula; AVG, arteriovenous graft; CVC, central venous catheter; BMI, body mass index; SBP, systolic blood pressure; ESRD, end-stage renal disease; CVD, cardiovascular disease