

**Association of vascular access blood flow with short- and long-term mortality in  
chronic Hemodialysis Patients—a retrospective cohort study**

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**Supplementary material**

**Table S1.** Cox proportional hazard analysis for all-cause and vascular mortality using  
1020 mL/min as a cutoff point for higher or lower access flow groups

**Table S2.** Cox proportional hazard analysis for the relative risk of all-cause mortality  
considering patients with a  $Q_a < 500$  ml/min who were reclassified into  
another class after vascular intervention.

**Table S3.** Characteristics of patients according to access blood flow status stratified  
by 1000 ml/min.

**Figure S1.** Time-dependent receiver operating characteristic (ROC) curve of  $Q_a$  for  
all-cause mortality. Time-dependent ROC analysis identified the most  
discriminatory value of  $Q_a$  (1020 mL/min) for all-cause mortality in chronic  
hemodialysis patients.

**Figure S2.** Adjusted cumulative hazard function for all-cause mortality considering  
patients with a  $Q_a < 500$  ml/min who were reclassified into another class  
after vascular intervention

**Figure S3.** Time-dependent receiver operating characteristic (ROC) curve of Qa for all-cause mortality regarding the type of vascular access.

**Table S1.** Cox proportional hazards analysis for all-cause and vascular mortality using 1020 mL/min as a cutoff point for higher or lower access flow groups

Analysis	All-Cause Death		Cardiovascular or Cerebrovascular Death <sup>a</sup>	
	Hazard ratio (CI95)	P Value	Hazard ratio (CI95)	P Value
Univariate				
Access flow $\geq$ 1020 mL/min	1 (reference)	–	1 (reference)	–
Access flow < 1020 mL/min	1.79 (1.32–2.44)	<0.001	1.75 (1.13–2.71)	0.012
Multivariate <sup>b</sup>				
Access flow $\geq$ 1020 mL/min	1 (reference)	–	1 (reference)	–
Access flow < 1020 mL/min	1.61 (1.1–2.36)	0.014	1.68 (0.98–2.89)	0.061

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; CI95, 95% confidence interval; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; ESA, erythropoiesis-stimulating agents; ESRD, end-stage renal disease.

<sup>a</sup>Competing risks with cause-specific hazards

<sup>b</sup>Adjusted for age; sex; diabetes mellitus; CAD; CHF; CVA; COPD; liver cirrhosis; malignancy; systolic blood pressure; diastolic blood pressure; hemodialysis vintage; vascular access type; ESRD cause; cardiac index; hemoglobin, albumin, cholesterol, ferritin, sodium, potassium, ionized calcium, phosphate, and parathyroid hormone levels; Kt/V; and ESA dosage.

**Table S2.** Cox proportional hazard analysis for the relative risk of all-cause mortality considering patients with a Qa <500 ml/min who were reclassified into another class after vascular intervention

Analysis	All-Cause Death	
	Hazard ratio (CI95)	<i>P</i> Value
Univariate		
Access flow ≥ 1000 mL/min	1 (reference)	–
Access flow < 1000 mL/min	1.81 (1.34–2.44)	<.001
Multivariate <sup>a</sup>		
Access flow ≥ 1000 mL/min	1 (reference)	–
Access flow < 1000 mL/min	1.53 (1.06–2.20)	.022

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; CI95, 95% confidence interval; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; ESA, erythropoiesis-stimulating agent; ESRD, end-stage renal disease.

<sup>a</sup>Adjusted for age, sex, diabetes mellitus, CAD, CHF, CVA, COPD, liver cirrhosis, malignancy, systolic blood pressure, diastolic blood pressure, hemodialysis vintage, vascular access type, ESRD cause, cardiac index, hemoglobin, albumin, cholesterol,

ferritin, sodium, potassium, ionized calcium, phosphate, and parathyroid hormone levels, Kt/V, and ESA dosage.

**Table S3.** Characteristics of patients according to access blood flow status stratified by 1000 ml/min

Variables	Access blood flow (mL/min)		<i>P</i> Value
	<1000 ml/min	1000 to 1999.9 ml/min	
Number of patients	225	153	
Age (years)	63.00 (52.53–71.00)	55.61 (44.18–65.00)	<0.001 <sup>a</sup>
Sex			0.11 <sup>b</sup>
Female	129 (57.3)	75 (49)	
Diabetes mellitus	93 (41.2)	26 (17)	<0.001 <sup>b</sup>
Hypertension	160 (71.1)	97 (63.4)	0.12 <sup>b</sup>
Blood pressure (mmHg)			
Systolic	120 (110–140)	120 (110–140)	0.93 <sup>a</sup>

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Diastolic	70 (70–80)	76 (70–80)	0.23 <sup>a</sup>
Dyslipidemia	52 (23.1)	36 (23.5)	0.93 <sup>b</sup>
CAD	77 (34.2)	41 (26.8)	0.13 <sup>b</sup>
CVA	30 (13.3)	5 (3.3)	0.001 <sup>b</sup>
CHF	23 (10.2)	11 (7.2)	0.31 <sup>b</sup>
COPD	15 (6.7)	7 (4.6)	0.39 <sup>b</sup>
Liver cirrhosis	6 (2.7)	6 (3.9)	0.50 <sup>c</sup>
Malignancy	16 (7.1)	13 (8.5)	0.62 <sup>b</sup>
Cardiac index (L/min/m <sup>2</sup> )	3.10 (2.60–3.60)	3.70 (3.20–4.45)	<0.001 <sup>a</sup>
Cause of ESRD			<0.001 <sup>c</sup>
Diabetic nephropathy	70 (31.1)	19 (12.4)	

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GN	107 (47.6)	90 (58.8)	
Hypertensive/ischemic nephropathy	7 (3.1)	3 (2.0)	
TIN	12 (5.3)	8 (5.2)	
Other	12 (5.3)	20 (13.1)	
Unknown	17 (7.6)	13 (8.5)	
Access type			0.008 <sup>b</sup>
Fistula	182 (80.9)	139 (90.8)	
Graft	43 (19.1)	14 (9.2)	
Hemodialysis vintage (weeks)	270.86 (133.71–375.29)	286.86 (175.07–369.00)	0.39 <sup>a</sup>
Dosage of ESA (U/month)	14500 (7000–23500)	16000 (6750–26000)	0.44 <sup>a</sup>

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Laboratory parameters			
Hemoglobin (g/dl)	9.80 (9.20–10.50)	9.70 (8.90–10.60)	0.20 <sup>a</sup>
Albumin (g/dl)	4.30 (4.00–4.50)	4.30 (4.10–4.50)	0.34 <sup>a</sup>
Cholesterol (mg/dl)	188.00 (162.00–217.00)	190.00 (165.00–213.75)	0.83 <sup>a</sup>
Triglyceride (mg/dl)	134.00 (91.00–219.00)	136.00 (89.25–207.25)	0.70 <sup>a</sup>
Ferritin (ng/ml)	619.00 (441.00–871.00)	673.50 (462.25–924.00)	0.21 <sup>a</sup>
TSAT (%)	32.14 (24.77–39.59)	33.54 (27.02–41.18)	0.12 <sup>a</sup>
Na (mmol/l)	139.00 (138.00–141.00)	140.00 (138.00–141.00)	0.86 <sup>a</sup>
K (mmol/l)	4.70 (4.20–5.00)	4.90 (4.50–5.40)	0.003 <sup>a</sup>
Ionized calcium (mg/dl)	4.76 (4.42–5.07)	4.69 (4.38–5.09)	0.49 <sup>a</sup>
Phosphate (mg/dl)	5.09 (4.30–6.30)	5.95 (4.62–7.10)	0.002 <sup>a</sup>

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iPTH (pg/ml)	66.85 (22.95–164.36)	84.85 (34.48–197.70)	0.12 <sup>a</sup>
Kt/V urea	1.40 (1.28–1.56)	1.36 (1.24–1.49)	0.01 <sup>a</sup>
Outcomes during follow-up period			
All-cause death	131 (58.2)	59 (38.6)	<0.001 <sup>b</sup>
Vascular mortality <sup>d</sup>	63 (28)	21 (19.6)	0.06 <sup>b</sup>

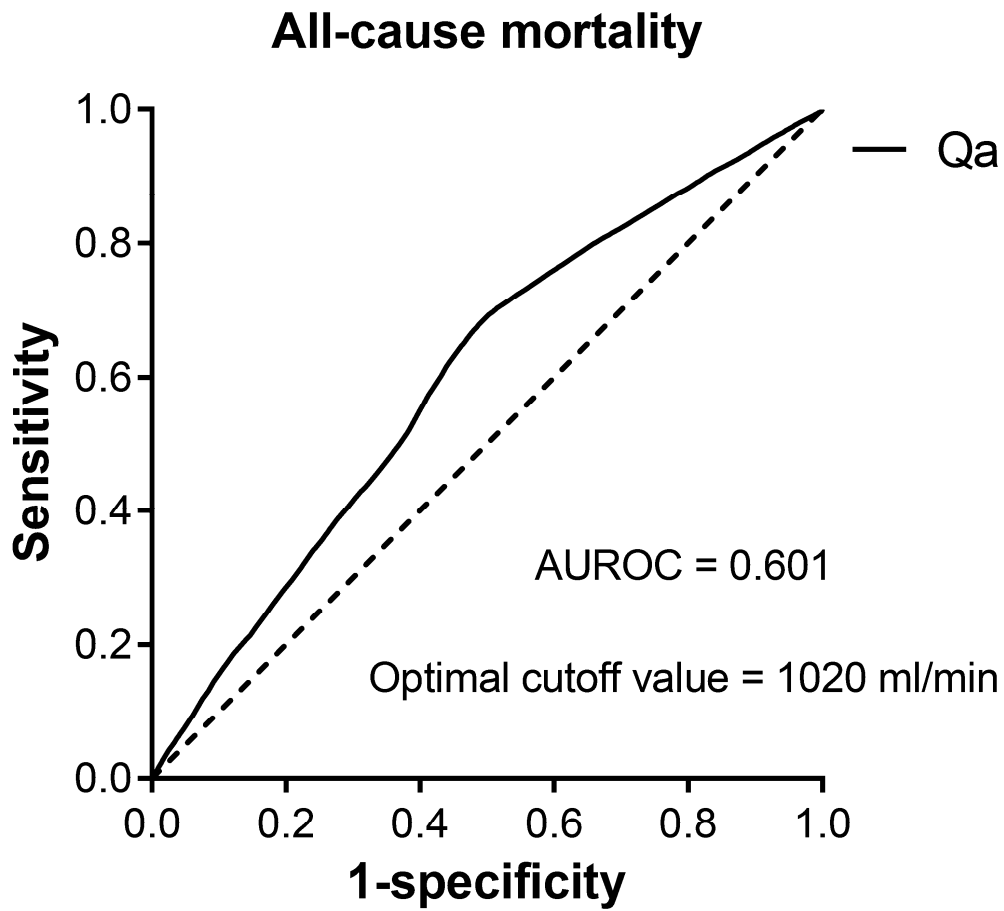
Data are expressed as n (%) for categorical data and as medians (interquartile ranges) for continuous data.

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; ESA, erythropoiesis-stimulating agent; ESRD, end-stage renal disease; GN, glomerulonephritis; iPTH, intact parathyroid hormone; TSAT, transferrin saturation; TIN, tubulointerstitial nephritis.

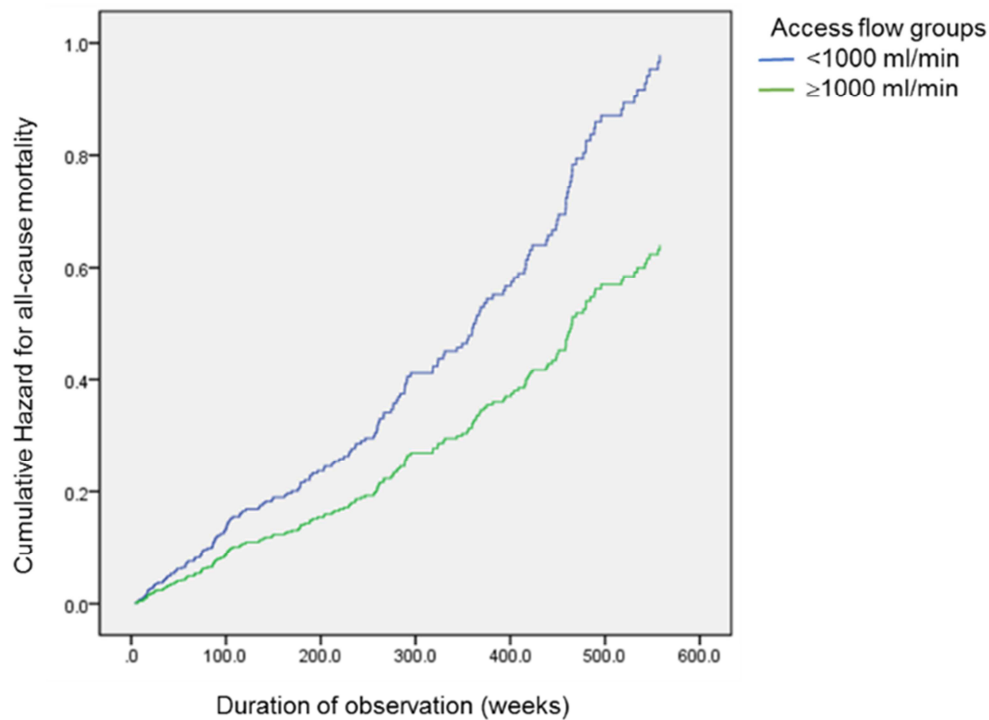
<sup>a</sup>Mann-Whitney U test <sup>b</sup>Pearson chi-squared test <sup>c</sup>Fisher's exact test <sup>d</sup>Vascular mortality was defined by a composite of cardiovascular or cerebrovascular death.

**Figure S1.** Time-dependent receiver operating characteristic (ROC) curve of Qa for all-cause mortality.

Time-dependent ROC analysis identified the most discriminatory value of Qa (1020 mL/min) for all-cause mortality in chronic hemodialysis patients.



**Figure S2.** Adjusted cumulative hazard function<sup>a</sup> for all-cause mortality considering patients with a Qa <500 ml/min who were reclassified into another class after vascular intervention.



<sup>a</sup>Adjusted for age, sex, diabetes mellitus, CAD, CHF, CVA, COPD, liver cirrhosis, malignancy, systolic blood pressure, diastolic blood pressure, hemodialysis vintage, vascular access type, ESRD cause, cardiac index, hemoglobin, albumin, cholesterol, ferritin, sodium, potassium, ionized calcium, phosphate, and parathyroid hormone levels, Kt/V, and ESA dosage. CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; ESA, erythropoiesis-stimulating agent; ESRD, end-stage renal disease.

**Figure S3.** Time-dependent receiver operating characteristic (ROC) curve of Qa for all-cause mortality regarding the type of vascular access.

Time-dependent ROC analysis identified the most discriminatory values of Qa (1020 mL/min for patients with an AVF and 970 mL/min for patients with an AVG) for all-cause mortality in chronic hemodialysis patients.

