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Dialysis Adequacy and Incident Atrial Fibrillation in Hemodialysis Patients

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Objectives: Atrial fibrillation (AF) can lead to stroke, heart failure, and mortality, and has a greater prevalence in dialysis patients than in the general population. Several studies have proposed that uremic toxins might promote AF development. However, the association between dialysis adequacy and incident AF has not been well established.

Methods: In this retrospective study, we analyzed 27,475 patients receiving maintenance hemodialysis, included in the Periodic Hemodialysis Quality Assessment by Health Insurance Review & Assessment Service (HIRA). The main exposure was single pooled Kt/V and the primary outcome was the development of AF.

Results: During a median follow-up of 4.8 years, incident AF occurred in a total of 4,229 (15.4%) patients. Participants with higher single pooled Kt/V tended to have lower AF incidence. In survival analysis, there was a graded association between the risk of incident AF and single-pool Kt/V quartiles: subdistribution hazard ratios and 95% confidence intervals (CI) for the second, third, and the highest quartile compared with the lowest quartile were 0.90 (95% CI, 0.83-0.98), 0.85 (95% CI, 0.78-0.93), and 0.80 (95% CI, 0.73-0.89), respectively. When treating single-pool Kt/V as a continuous variable, a similar association was found. In addition, the risk of incident AF in the highest quartile of urea reduction ratio was 0.83-fold (95% CI, 0.76-0.91) lower than in the lowest quartile. Sensitivity analyses showed consistent results. This association was more pronounced in men.

Conclusions: As the part of the Joint Project on Quality Assessment Research by HIRA, this nationwide cohort study showed that lowering uremic toxin burden through increased dialysis clearance could be associated with a lower AF development risk in patients receiving maintenance hemodialysis.

Table 1. Incidence rates of atrial fibrillation according to quartile of spKt/V

Outcomes	Total	Quartile of spKt/V			
		Q1 (<1.33)	Q2 (1.33 to 1.49)	Q3 (1.50 to 1.70)	Q4 (≥1.70)
No. of participants, n (%)	27475	6869	6869	6869	6868
Person-year	131808	32782	32516	33179	33331
Incident Atrial fibrillation					
Incidence of outcome, n (%)	4229 (15.4)	1122 (16.3)	1064 (15.5)	1050 (15.3)	993 (14.5)
Incidence rate per 1000 person-years	32.1	34.2	32.7	31.7	29.8
All-cause mortality					
Incidence of outcome, n (%)	9286 (33.8)	2328 (33.9)	2404 (35.0)	2312 (33.7)	2242 (32.6)
Incidence rate per 1000 person-years	70.5	71.0	73.9	69.7	67.3

Abbreviations: spKt/V, single-pool Kt/V.

Table 2. Associations of dialysis adequacy with incident atrial fibrillation

Dialysis adequacy	Model 1		Model 2		Model 3	
	sHR (95% CI)	P value	sHR (95% CI)	P value	sHR (95% CI)	P value
spKt/V						
Quartile						
Q1 (<1.33)	1.00 (Reference)	-	1.00 (Reference)	-	1.00 (Reference)	-
Q2 (1.33 to 1.49)	0.92 (0.84-0.99)	0.039	0.90 (0.82-0.98)	0.013	0.90 (0.83-0.98)	0.015
Q3 (1.50 to 1.69)	0.89 (0.81-0.97)	0.007	0.85 (0.78-0.93)	<0.001	0.85 (0.78-0.93)	0.001
Q4 (≥1.70)	0.83 (0.76-0.92)	<0.001	0.80 (0.73-0.89)	<0.001	0.80 (0.73-0.89)	<0.001
Continuous						
per 0.1 increase	0.98 (0.97-0.99)	<0.001	0.98 (0.96-0.99)	<0.001	0.98 (0.96-0.99)	<0.001
URR						
Quartile						
Q1 (<67.3)	1.00 (Reference)	-	1.00 (Reference)	-	1.00 (Reference)	-
Q2 (67.3 to 71.5)	0.93 (0.86-1.00)	0.058	0.93 (0.86-1.01)	0.065	0.93 (0.86-1.01)	0.076
Q3 (71.6 to 75.8)	0.88 (0.81-0.96)	0.002	0.88 (0.81-0.95)	0.002	0.88 (0.81-0.96)	0.003
Q4 (≥75.9)	0.83 (0.75-0.90)	<0.001	0.83 (0.76-0.91)	<0.001	0.83 (0.76-0.91)	<0.001
Continuous						
per 10 increases	0.87 (0.83-0.92)	<0.001	0.87 (0.83-0.92)	<0.001	0.87 (0.83-0.92)	<0.001

Note: Model 1: minimally adjusted for age and sex. Model 2: Model 1 + medical aid, dialysis vintage, body mass index, predialysis systolic blood pressure, ultrafiltration, and a history of diabetes mellitus, congestive heart failure, myocardial infarction, cerebrovascular disease, and chronic obstructive pulmonary disease. Model 3: Model 2 + the use of medications (antihypertensive drugs and statins), and laboratory measurements (hemoglobin, serum albumin, and serum calcium).

Abbreviations: sHR, subdistribution hazard ratio; CI, confidence interval; spKt/V, single pooled Kt/V; URR, urea reduction ratio.