

Association of Vascular Calcification and Residual Renal Function in Hemodialysis Patients

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Introduction

- Vascular calcification (VC) is common and may contribute to cardiovascular mortality in patients with end-stage renal disease.
- Little is known about the effect of residual renal function (RRF) on VC in patients on hemodialysis (HD).
- We hypothesized that RRF was associated with VC and affected cardiac function and cardiovascular events.
- Therefore, we investigated the correlation between RRF expressed as GFR and VC in patients on HD and conducted echocardiography. Furthermore, new cardiovascular events were evaluated after study enrollment.

Methods

- One hundred six patients with RRF on maintenance HD for 3 months were recruited between January 2014 and February 2015 from 3 different HD centers.
- We used residual renal urea clearance (KRU) to measure RRF.

$$\text{Urea clearance} = \frac{2 \times (\text{urine urea concentration} \times \text{urine volume})}{\text{urine collection duration} \times (\text{BUN1} + \text{BUN2})}$$
 - * BUN1: sampled at the end of the first dialysis session of the week
 - * BUN2: sampled immediately before the next session
- To assess VC severity, we conducted abdominal aortic calcification score (AACS) analysis, ambulatory blood pressure monitoring, and brachial-ankle pulse wave velocity. We also performed echocardiography to evaluate cardiac function.

Results

Table 1. Baseline characteristics according to KRU.

Variables	KRU <0.9 ml/min/1.73m ² (n=53)	KRU ≥0.9 ml/min/1.73m ² (n=53)	P- value
Age (years)	58.2±9.1	60.0 ± 12.7	0.394
Male, n (%)	26 (49.1)	29 (54.7)	0.697
HD duration (months)	37.4 (19.5–56.6)	13.6 (7.0–42.9)	<0.001
Diabetes, n (%)	31 (58.5)	29 (54.7)	0.695
Coronary artery disease, n (%)	23 (43.4)	20 (37.0)	0.994
Interdialytic weight gain (kg)	1.9±1.3	1.1±1.0	<0.001
Residual renal urine (cc)	250 (120–400)	1000 (800–1575)	<0.001
Diuretics, n (%)	32 (60.4)	42 (79.2)	0.03
Resistance to ESAs, n (%)	8 (15.1)	2 (3.8)	0.046
Hemoglobin (g/dL)	10.1±1.1	10.2±1.3	0.854
Albumin (g/dL)	3.8±0.4	3.7±0.5	0.862
Calcium (mg/dL)	8.7 (8.1–9.1)	8.6 (8.2–8.9)	0.915
Phosphate (mg/dL)	4.6±1.4	4.4±1.1	0.513
Ca X P (mg ² /dL ²)	40.5 (34.2–45.1)	38.3 (30.8–43.8)	0.281
Total cholesterol (mg/dL)	138 (107.0–160.0)	140.0 (110.5–164.5)	0.382
LDL cholesterol (mg/dL)	72.0 (53.0–89.0)	86.0 (62.0–103.0)	0.024
CRP (mg/L)	0.9 (0.4–3.0)	0.5 (0.3–1.1)	0.029
Parathyroid hormone (pg/dL)	243.8 (102.4–415.2)	196.6 (118.8–346.0)	0.649
β2-microglobulin (mg/L)	22.4±6.7	17.3±5.8	0.008
KRU (mL/min/1.73m ²)	0.3 (0.2–0.6)	2.5 (1.5–3.0)	<0.001
Single-pool Kt/V	1.6±0.4	1.5±0.3	0.591

Table 2. ABPM, PWV, and abdominal aorta calcification score in HD patients according to KRU.

Variables	KRU <0.9 ml/min/1.73m ² (n = 53)	KRU ≥0.9 ml/min/1.73m ² (n =53)	P- value
ABPM (mmHg)			
Daytime mean blood pressure	108.9±14.4	104.5±12.4	0.095
Nighttime blood pressure	102.6±15.4	100.4±14.3	0.474
Non-dipper, n (%)	41 (80.4)	38 (79.2)	0.999
baPWV (cm/s)	1836.1±250.4	1676.8±311.0	0.005
AACS	4.0 (1.0–10.0)	3.0 (0.0–8.0)	0.050

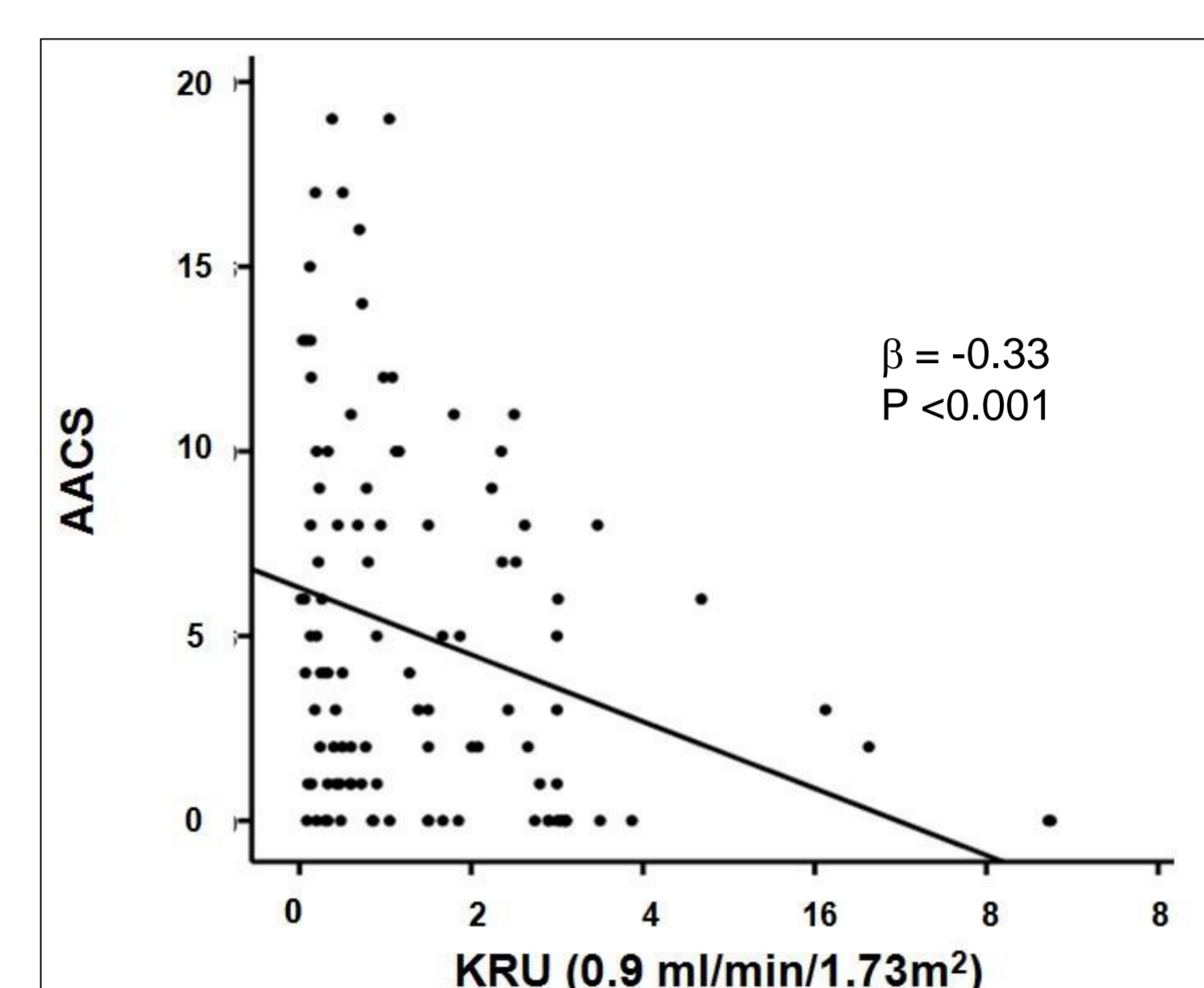


Figure 1. The association of abdominal aorta calcification score and KRU.

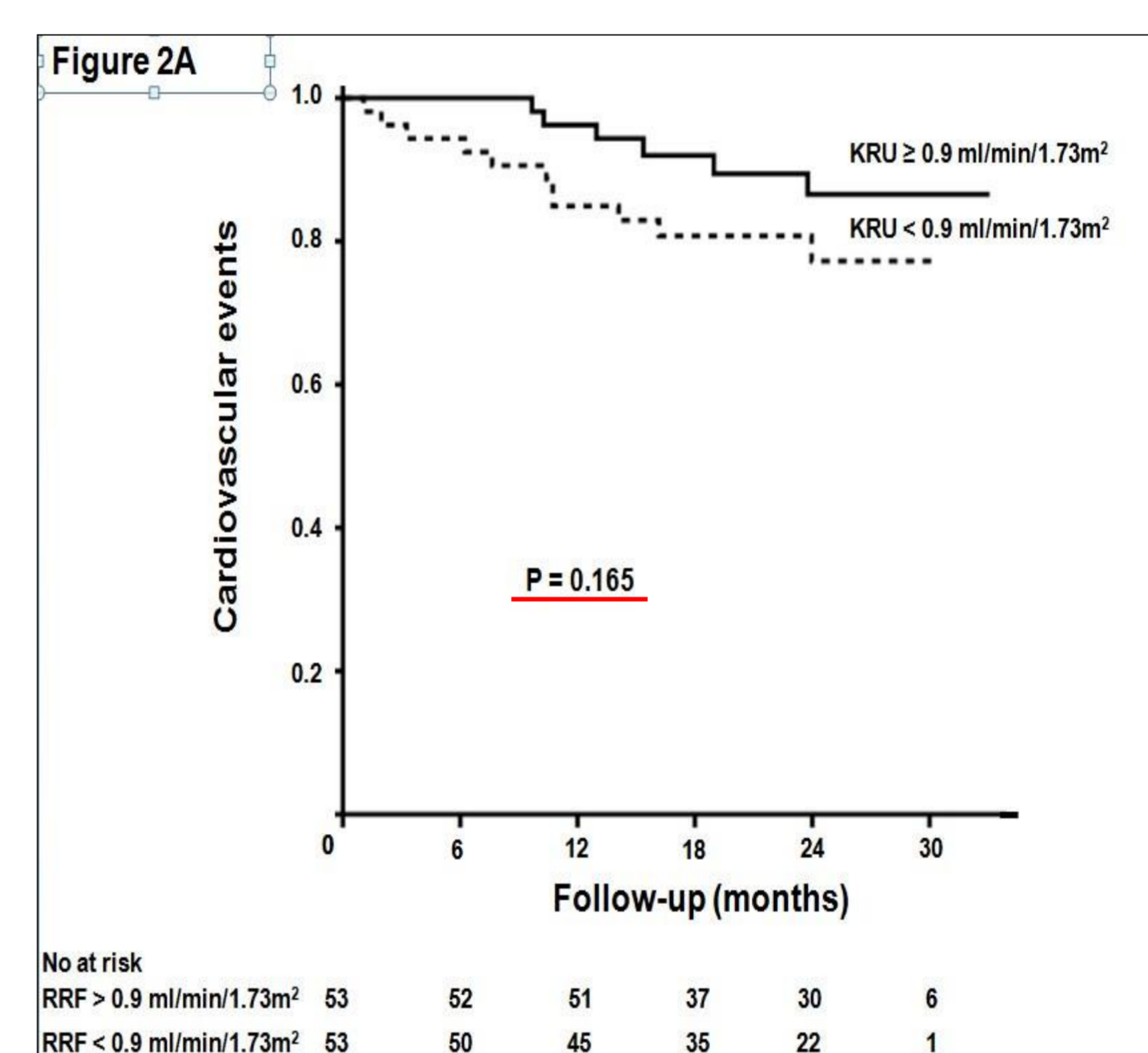


Figure 2A. Kaplan-Meier analysis of CV events in HD patients according to KRU. CV events were comparable between patients with KRU <0.9 and KRU ≥0.9 ml/min/1.73m².

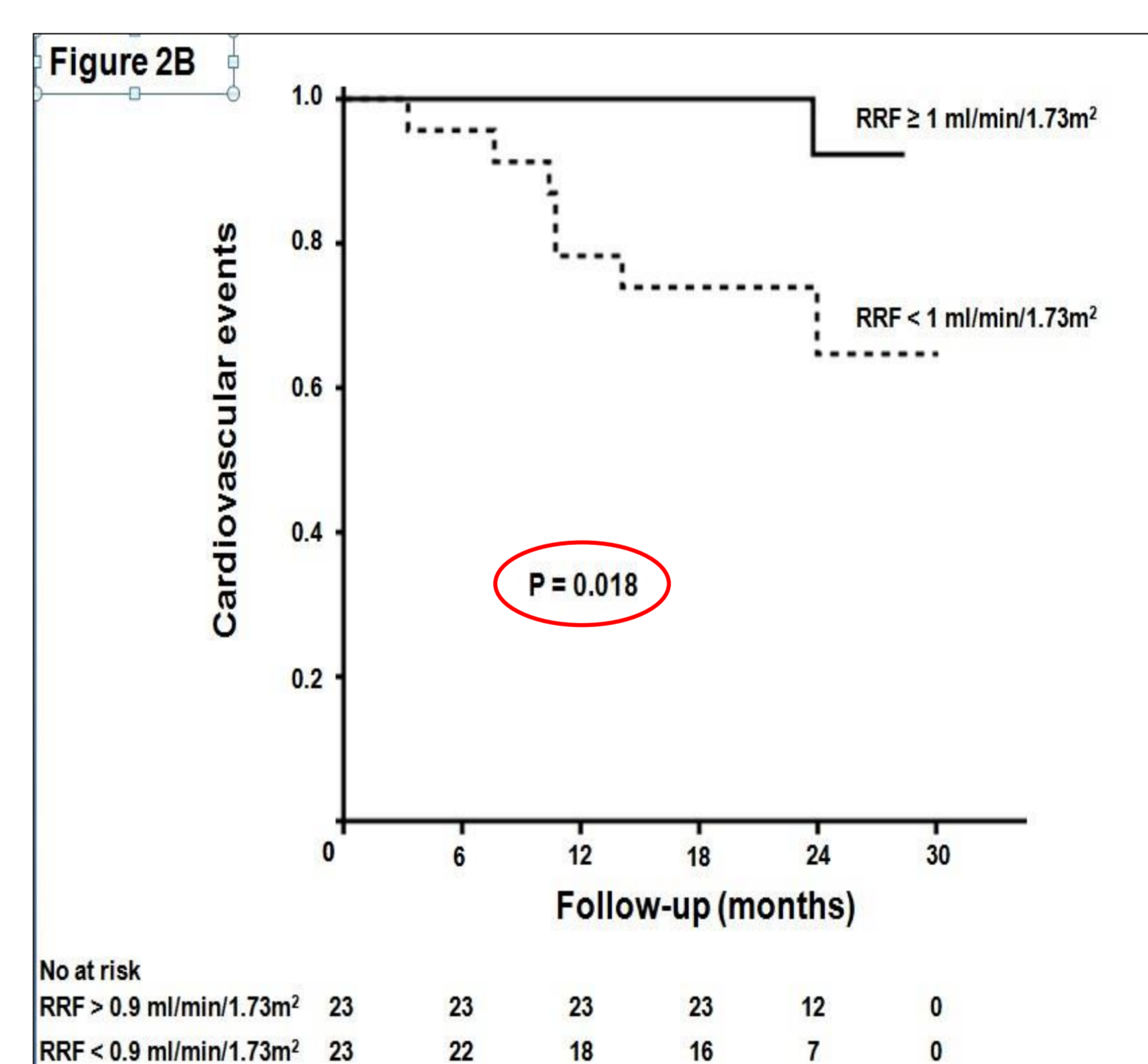


Figure 2B. Kaplan-Meier analysis of CV events in non-diabetic HD patients according to KRU. CV were significantly lower in patients with KRU ≥1.0 ml/min/1.73m².

Conclusion

- Increased AACS was independently associated with RRF deterioration. In particular, in non-diabetic patients on HD, CV events were higher in patients with a low RRF.
- This result suggests that preservation of RRF may prevent VC. In addition, the effort to protect RRF may be more important in non-diabetic than in diabetic patients on HD.