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Dialysis

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Relationship between changes of whole blood viscosity during hemodialysis and mortality in patients with end-stage renal disease

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Background: An increase in whole blood viscosity (WBV) may result in major atherosclerotic events.. A value of WBV is changed during hemodialysis, especially in patients with end-stage renal disease (ESRD). These changes of WBV may also be correlated with atherosclerotic mortality or overall mortality of patients with ESRD. However, there are few reports about the relationship between WBV and atherosclerotic mortality in dialytic patients with ESRD. We tried to investigate the correlations between WBV at variable shear rates before and after hemodialysis and atherosclerosis-related or overall mortality in patients with ESRD.

Methods: Forty-three patients with ESRD receiving hemodialysis were enrolled in this study. In this prospective observational study for approximately 5.8 years, a comparative analysis of the effects of values of WBV at shear rate of 300 S^{-1} (systolic WBV; SBV), 5 S^{-1} (diastolic WBV5; DBV5), and 1 S^{-1} (diastolic WBV1; DBV1) during dialysis on atherosclerosis-related and all-cause mortality was performed.

Results: Among a total of 43 patients, 27 (62.7%) died over the course of the study. 13 deaths were caused by atherosclerotic events. A high degree of WBV change at shear rate 5 S^{-1} during hemodialysis (ΔDBV5) was positive correlated with overall mortality of patients with ESRD (HR= 3.941; 95% confidence interval [CI], 1.057-14.701; $p=0.041$). A high change of diastolic blood pressure during hemodialysis was positive correlated with overall mortality (HR= 3.035; 95% confidence interval [CI], 1.039-8.867; $p=0.042$). However, a comparative analysis between values of WBV at each shear rate of 300 S^{-1} , 5 S^{-1} , and 1 S^{-1} and overall mortality did not show statistical significance.

Conclusion: Our data showed that high degree of changes in WBV at low shear rates might impact on overall survival, especially in patients with ESRD undergoing hemodialysis. However, large-scale studies to evaluate the relationship between WBV and mortality of atherosclerotic mortality will be needed.

Table: Table 1. Univariate Cox proportional hazard models of WBV for overall survival

Factor	Viscosity	HR	95% CI	<i>P</i> value
ΔDBP	High	3.03 5	1.039-8.867	0.042
	Moderate	0.82 7	0.287-2.832	0.725
	Low	1		
ΔDB V1	High	3.27 2	0.863-12.405	0.081
	Moderate	2.33 0	0.678-8.010	0.179
	Low	1		
ΔDB V5	High	3.94 1	1.057-14.701	0.041
	Moderate	2.14 6	0.620-7.421	0.228
	Low	1		

ΔDBV1,5: post-dialytic blood viscosity - pre-dialytic blood viscosity at shear rate of 1 S⁻¹, and 5 S⁻¹

Keywords: atherosclerosis, blood viscosity, dialysis, renal insufficiency