Dissociation between Alterations in Myocardial Perfusion and R-Wave Amplitude after Hemodialysis

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Dear Sir,

We read with interest the paper by Ono et al. [1] on the effect of dialysate sodium on the appearance of ischemic patterns in ECG. Elevation of dialysate sodium from 133 to 141 mEq/l in unselected patients did reduce the incidence of hypotensive episodes and related symptoms as well as the frequency of R-wave increase in ECG postdialysis. In contrast to Diskin et al. [2], they described a positive correlation between weight loss and changes in R-wave amplitude and suggested that the use of 141 mEq/l sodium dialysate reduces the high incidence of myocardial ischemia.

In a group of 7 selected patients with proved coronary artery disease (CAD) and stable angina pectoris, we assessed the effect of hemodialysis (4 h, sodium 140 mEq/l) on myocardial perfusion and left ventricular function in CAD. Combined radionuclide ventriculography and thallium-201 perfusion imaging was performed at rest and during supine bicycle exercise pre- and postdialysis. The investigation included Holter recording with continuous S-T level monitoring as well as standard electrocardiograms to analyze the sum of R-wave variations (ΣR). Left ventricular ejection fraction (54.7 vs. 66.1%, $p < 0.05$) and segmental motion abnormalities (4.51 vs. 2.50, $p < 0.01$) improved after dialysis. In accordance, exercise capacity increased, reflected by an improvement of exercise duration (178 vs. 415 s, $p < 0.01$), maximal S-T segment depression (2.78 vs. 1.88 mm, $p < 0.05$) as well as angina score (2.57 vs. 1.42, $p < 0.01$). Significant S-T segment depression ($p < 0.01$) and increase of R ($p < 0.01$) was a constant finding at pre-dialysis peak exercise and correlated well ($r = 0.79$) with exercise-induced ischemia in thallium perfusion imaging. However, despite augmentation of myocardial perfusion and LV function after volume removal, a significant increase in resting ΣR ($p < 0.01$) was observed, while S-T segment remained unchanged ($p < 0.05$). This discordance between changes in LV performance and R-wave response excludes myocardial ischemia as the sole determinant of R-wave increase after dialysis. Since the role of left ventricular volume in determining R-wave change (Brody effect) has been challenged [3–6], other factors could have an important influence on R-wave amplitude variations, including abnormal myocardial conduction patterns, altered depolarization and repolarization patterns [3].

Our observation of improved LV function and R-wave increase are in good agreement with the study of Ishikawa et al. [7] who found that in heart failure of various etiologies a reduction in

heart size due to therapy resulted in a net increase in R-wave amplitude. In a canine model, Manoach et al. [8] observed an increase of R-wave amplitude after improvement of LV function with digitalis. Therefore, reduction in myocardial stretching might be an additional factor in determining R-wave amplitude variations. Further investigations are required to determine the influence of an increase in ionized calcium, magnesium and/or loss of potassium during dialysis. In summary, our data demonstrate the difficulty of using R-wave changes to identify either ischemia or left ventricular dysfunctions in the clinical setting. It should be emphasized that an increase in R-wave amplitude after hemodialysis might not lead to an erroneous conclusion of myocardial ischemia. Based on our data that fluid overload impairs myocardial perfusion, we came to an opposite practical consequence than Ono et al. [1]. We reduced sodium dialysate concentrations to 125–135 mEq/l in order to prevent the iatrogenic compound in inducing fluid overload and thereby myocardial ischemia.

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