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Prediction of hemodialysis vascular access failure using data from segmental bioimpedance analysis

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Objectives : Hemodialysis (HD) vascular access dysfunction is a major cause of morbidity and hospitalization in patients with end-stage renal disease (ESRD) on HD. Although most patients on HD undergo surveillance monitoring for vascular access such as measurement of access flow, the results have been variable and inconsistent. Bioimpedance analysis (BIA) has been widely used for the assessment of body water volume and nutritional status in patients with ESRD. The purpose of this study was to investigate whether segmental BIA can properly identifies regional fluid changes of limbs of ESRD patients on HD and it can be used to predict HD vascular access failure.

Methods : One hundred five patients with ESRD on HD (62 males and 43 females; mean age 64.0 ± 13.9 years; mean HD duration 53.2 ± 48.1 months; prevalence of diabetes 48%) were examined. Body composition measurements of post-dialysis patients were carried out by segmental BIA, using eight tractile electrodes according to the manufacturer's instructions (InBody 2.0, Biospace Co. Ltd, Seoul, Korea). The difference of water volume between upper limbs was calculated from water volume of upper limb with vascular access for HD minus that of the opposite upper limb. Demographical, clinical and laboratory data at the time of the measurement of body composition were recorded. The primary outcome was primary unassisted vascular access patency within 3 months.

Results : The median difference of water volume between upper limb with vascular access for HD and the opposite upper limb was 202 ml (13.0%) [interquartile range, 95-240 ml and 6.1-15.3%]. Within 3 months of body composition measurement, 33 of 105 patients (31.0%) experienced vascular access failure. When the patients were divided into three groups based on the tertiles of difference of water volume between upper limbs (lower tertile <7.8%; middle tertile 7.8-13.1%; upper tertile >13.1%), higher levels of difference of water volume between upper limbs were associated with greater vascular access failure (14% vs. 29% vs. 51%, p for trend across tertiles = 0.001). Older age, higher serum ferritin concentration, and use of arteriovenous graft for HD were associated with vascular access failure in the univariate Cox proportional hazards regression analysis. After adjustment with other variables, older age

and higher levels of difference of water volume between upper limbs were associated with greater vascular access failure within 3 months.

Conclusions : We conclude that segmental BIA may be used as a tool that predict vascular access failure in the patients with ESRD on HD through calculating the difference of water volume between upper limbs.

Keywords : bioimpedance analysis, hemodialysis, vascular access