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Editorial Comment

EDITORIAL COMMENT

Is relative overhydration measurement by bioimpedance spectroscopy useful in reducing morbidity and mortality in chronic kidney disease?

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ABSTRACT

It is well known that one of the main determinants of mortality and morbidity in chronic kidney disease (CKD) and end-stage renal disease (ESRD) patients is fluid overload acting on the cardiovascular system causing hypertension, increased arterial stiffness, left ventricular hypertrophy and eventually heart failure. Therefore, assessment and management of volume status is crucial. Bioimpedance spectroscopy is one of the most popular and practical methods for volume evaluation. Volume evaluation should be a routine part of following CKD and ESRD patients, in order to decrease associated mortality and morbidity.

Keywords: bioimpedance spectroscopy, cardiovascular disease, kidney disease, volume evaluation

One of the main determinants of mortality and morbidity in chronic kidney disease (CKD) end-stage renal disease (ESRD) patients is fluid overload. Fluid overload acts on the cardiovascular system causing hypertension, increased arterial stiffness, left ventricular hypertrophy and eventually heart failure [1–4]. Thus to decrease cardiovascular risk among ESRD patients, finding a sensitive specific and practical method to detect fluid overload is highly crucial. Many modalities assessing fluid overload are available, such as visualizing B lines on lung ultrasonography, bioimpedance spectroscopy, echocardiography and clinical judgment. More sophisticated methods such as computed tomography and magnetic resonance imaging are also available, but they are costly and impractical for daily practice. Bioimpedance spectroscopy, however, is becoming popular since it is practical and economical [4].

Vega *et al.* discuss whether relative overhydration (overhydration (OH)/extracellular water) causes more mortality and morbidity in Stages 4 and 5 CKD (ESRD) patients who do not receive haemodialysis in their recent prospective study [5]. Their research consists of 356 patients with a median follow-up of 50 (24–66) months. They collected demographic and clinical data of the patients including cardiovascular comorbidities and diuretics usage rate, which was 43% among the patients. Only non-haemodialysis patients were included at the beginning of the study yet the authors reported that 125 patients (35%) required haemodialysis during their study. They stated that mean relative OH was 2.3 ± 0.8%. The authors divided the study population into two, those whose relative OH exceed 0% and those whose do not. The result was the increased mortality in the patients with > 0%. The authors concluded that bioimpedance is a valuable method to follow up not only haemodialysis patients but also non-haemodialysis ESRD patients to decrease cardiovascular morbidity and mortality.

Fluid OH monitoring by bioimpedance spectroscopy has gained attention in recent years, and Vega *et al.* investigate if

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this method predicts mortality and morbidity in non-dialytic ERSD patients. The effectness of the bioimpedance method has been assessed in haemodialysis patients before [6–8], yet this article is the first in the field as it discusses the same method in non-haemodialysis patients. Furthermore, the strength of this study comes from the large number of participants. In addition, the duration of the follow-up, which is a median of 50 months, increases the credibility.

The manuscript opens new questions and stimulates further research. There are also interesting findings that are not directly predictable. First, as also discussed by the authors, bioimpedance recordings were only noted at the beginning of the study. Assessing whether measuring relative OH in regular check-ups (e.g. monthly) increases morbidity in ESRD patients and thus helps to arrange renal replacement therapy might be studied as well. Studying such a hypothesis may yield more solid evidence about the usefulness of this method in daily practice. Moreover, recording sodium and water intake and urine output, and how these variables affect relative OH measured by bioimpedance spectroscopy, would be valuable in terms of accuracy of OH risk estimation. This might be achieved by regular clinical check-ups, recording mean values and taking them into account. Secondly, it is interesting to note that mortality predictors and cardiovascular event predictors are different. Proteinuria, C-reactive protein, impaired kidney function and previous cardiovascular events are predictors of cardiovascular events [2], whereas, an independent association with mortality and age, Charlson index, higher C-reactive protein levels, low lean tissue index and relative OH was observed. It would be better to comment on this finding and discuss why OH was associated with total mortality but not with cardiovascular events. It is also worth mentioning whether N-terminal prohormone of brain natriuretic peptide was associated with fluid overload. Thirdly, the authors reported that 125 patients (35%) required haemodialysis during their study [5]. However, they did not mention the independent predictors related to dialysis beginning. Fourthly, the authors mentioned the diuretics usage rate of the study population. However, information regarding the dosage, the regimen changes and how bioimpedance results are affected by those changes are not discussed. Moreover, the beneficial effects of angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARB) on the cardiovascular system are a widely known fact. ACE inhibitor and ARB usage rates, dosages, changes in the regimens, the correlation between bioimpedance recordings caused by those drugs and whether those recordings predict morbidity and mortality in the study population would be important information.

Preservation of residual renal function is critical in management of both haemodialysis and non-haemodialysis ESRD patients in terms of reducing anaemia rates, decreasing the inflammatory burden and better control in management of electrolyte balances [9]. Discussing whether assessing fluid OH of the patients regularly by bioimpedance spectroscopy would be of benefit in terms of preserving the residual renal function might be investigated in a similar study population in the future.

Overall, Vega *et al*. present new evidence about the success of bioimpedance spectroscopy in predicting the mortality and morbidity of non-haemodialysis ESRD patients by assessing the relative fluid OH [5]. The article offers a sufficient amount of patients followed for a reasonable period. Periodical measuring of the relative OH is lacking, and the question of whether this method is useful in clinical practice is left unanswered. The hypotheses of whether periodical follow-up with bioimpedance spectroscopy would predict residual renal function and how differences in diuretic types and dosages affect the results of relative OH in non-haemodialysis ESRD patients would be worth investigating in future studies.

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