



## Original article

# Echocardiographic findings in haemodialysis patients according to their state of hydration

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### ABSTRACT

**Background:** Chronic fluid overload is frequent in hemodialysis patients (P) and it associates with hypertension, left ventricular hypertrophy (LVH) and higher mortality. Moreover, echocardiographic data assessing fluid overload is limited. Our aim was to evaluate the relationship between fluid overload measured by bioimpedance spectroscopy (BIS) and different echocardiographic parameters.

**Methods:** Cross-sectional observational study including 76 stable patients. Dry weight was clinically assessed. BIS and echocardiography were performed. Weekly time-averaged fluid overload (TAFO) and relative fluid overload (FO/ECW) were calculated using BIS measurements.

**Results:** Based on TAFO three groups were defined: A- dehydrated, TAFO <-0.25 L 32 P (42%); B- normohydrated, TAFO between -0.25 and 1.5 l: 26 (34%); C- overhydrated, TAFO>1.5 l: 18 (24%). We found significant correlation between TAFO and left atrial volume index (LAVI) (r: 0.29; p=0.013) but not with FO/ECW (r 0.06; p=0.61). TAFO, but not FO/ECW kept a significant relationship with LAVI (p=0.03) using One-Way ANOVA test and linear regression methods. LVH was present in 73.7% (concentric 63.2%, eccentric in 10.5%). No differences between groups in the presence of LVH or left ventricular mass index were found.

**Conclusions:** We found that left atrial volume index determined by echocardiographic Area-length method, but not left ventricle hypertrophy or dimensions of cavities, are related on hydration status based on bioimpedance measured time-averaged fluid overload (TAFO), and not with FO/ECW.

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## Hallazgos ecocardiográficos en pacientes en hemodiálisis según su estado de hidratación

### R E S U M E N

#### Palabras clave:

Volumen de aurícula izquierda  
Sobrehidratación  
Bioimpedancia espectroscópica  
Sobrehidratación promedio  
semanal  
Hemodiálisis

**Introducción:** La sobrehidratación es frecuente en pacientes en hemodiálisis (P) y se asocia con hipertensión, hipertrofia ventricular izquierda (LVH) y mayor mortalidad. Los datos ecocardiográficos evaluando sobrecarga hídrica son escasos. Nuestro objetivo fue evaluar la relación entre sobrehidratación medida por Bioimpedancia multifrecuencia (BIS) y parámetros ecocardiográficos.

**Métodos:** Estudio transversal observacional, con 76 P estables; El peso seco fue determinado clínicamente; se realizaron ecocardiograma, BIS y analítica sanguínea. Se calcularon la sobrehidratación promedio semanal (TAFO) y sobrehidratación relativa (FO/ECW).

**Resultados:** 3 grupos: A- deshidratados, TAFO <-0.25 L: 32 P (42,1%); B- normohidratado, TAFO -0.25 - 1.5 L: 26 P (34,2%); C- sobrehidratados TAFO > 1.5 L: 18 P (23,7%). Encontramos correlación significativa entre TAFO e índice de volumen auricular izquierdo (LVAI) ( $r: 0.29$ ;  $p=0.013$ ) y no con FO/ECW ( $\rho 0,06$ ;  $p = 0,61$ ). TAFO, pero no FO/ECW, mantuvo una relación significativa con LVAI ( $p = 0,03$ ) utilizando test de ANOVA y regresión lineal. LVH estuvo presente en 73,7% de P (concéntrica 63,2%, excéntrica 10,5%). No encontramos diferencias entre grupos en cuanto a la presencia de LVH, ni del índice de masa ventricular izquierda.

**Conclusiones:** Nosotros observamos que el índice de volumen auricular izquierdo determinado por longitud de área medida por ecocardiograma y no la hipertrofia ventricular izquierda o dimensión de cavidades se relaciona con el estado de hidratación medido por sobrehidratación semanal y no con FO/ECW.

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## Introduction

Chronic fluid overload is a frequent problem in patients treated by hemodialysis; and it is known to be associated with different clinical conditions like hypertension, increased arterial stiffness, left ventricular hypertrophy, heart failure and consequently higher morbidity and mortality.<sup>1</sup> In this regard, maintaining a normal extracellular volume status<sup>2</sup> is one of the major targets of the therapy; yet establishing the hydration state of dialysis patients is one of the most challenging that nephrologists face in their daily practice.

Hydration state can be measured by different methods. In clinical routine, fluid management is largely based on subjective clinical assessment and the probing for dry weight procedure.<sup>3</sup> New noninvasive bedside tools, such as bioimpedance spectroscopy (BIS), facilitate objective assessment of fluid status.

Multifrequency bioimpedance spectroscopy is a validated technique that objectively defines the individual overhydration status, taking into account the individual's body composition.<sup>4</sup> The hydration status, evaluated by bioimpedance spectroscopy, is an important and independent predictor of mortality in chronic hemodialysis patients.<sup>5,6</sup> Bioimpedance can be useful in guiding fluid management with a favorable impact in cardiovascular parameters.<sup>7</sup> Fluid status can be expressed as pre- or postdialytic fluid overload, but to assess the cardiovascular condition of a patient, the time averaged fluid overload (TAFO) seems to better reflect the long-term cardiovascular load.<sup>8</sup>

Cardiovascular disease is the major cause of death in patients with advanced chronic disease<sup>9</sup> and echocardiography is an established technique to estimate the risk for cardiovascular complications in patients with end-stage renal; been a radiation free technique that provides noninvasive assessment of cardiac structures and function. It is widely available and recommended in patients with end-stage renal disease for diagnosis, guidance of treatment, and pretransplantation evaluation.<sup>10</sup> However, there is limited data on echocardiographic parameters evaluating hydration status in patients undergoing dialysis.

Our aim was to assess the relationship between hydration status and echocardiographic parameters in hemodialysis patients.

## Methods

### Patients

We conducted a cross-sectional study including 76 patients (68.4% male) from the dialysis unit of a secondary hospital with 103 hemodialysis patients. Patients that were more than two months in the technique in stable condition and without hospital admissions during the previous two months were included. Patients with contraindication for BIS (implanted electronic device, metallic prostheses of any type, amputated patients, pregnant or lactating women) were excluded. Six patients (7.3%) with a previously known severe valvulopathy or bad acoustic window also were excluded. Patients were 18 years old or above and had signed an informed consent

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