Nephrol Dial Transplant (2013) 28: 2210–2211
doi: 10.1093/ndt/gft195
Advance Access publication 19 June 2013

Salt and the heart in chronic kidney disease: an atrial connection

Francesca Mallamaci and Giovanni Tripepi

CNR-IBIM and Nephrology, Dialysis and Transplantation Unit, Reggio Calabria, Italy

Correspondence and offprint requests to: Francesca Mallamaci; E-mail: francesca.mallamaci@libero.it

Keywords: left atrial volume, plasma sodium, chronic kidney disease

IN FOCUS

Renal function loss *per se* triggers myocardial alterations and cardiomyopathy and represents a strong prognostic factor for adverse clinical outcomes in patients with chronic kidney disease (CKD). Left atrial volume (LAV), together with left ventricular (LV) mass and function, is a fundamental echocardiographic parameter for assessing myocardiopathy in patients with advanced CKD [1]. Even though still not generally acknowledged, the left atrium is considered a first class indicator of diastolic dysfunction and/or volume excess, and it has been recently proposed that LAV may represent a valuable surrogate end-point in clinical studies in patients with CKD [2].

Pressure and volume overload are the main drivers of LV hypertrophy (LVH) and left atrial enlargement in CKD. For this reason, LAV is strongly associated with LV mass in many categories of high-risk patients [3–5] and enlarged LAV has been shown to predict mortality and cardiovascular events both in haemodialysis (HD) [1] and in peritoneal dialysis patients [6]. Importantly, not only baseline LAV but also LAV changes over time predict clinical outcomes in HD patients [7], indicating that this biomarker has potential for cardiovascular risk monitoring in this population. Of note, LAV in the HD population is a better predictor of outcomes than other echocardiographic parameters [1], and it was claimed that LAV monitoring may be applied to guide therapeutic decisions in CAPD patients [6].

In this issue of NDT, Wang *et al*. describe for the first time a direct association between plasma sodium and LAV in stage 3–5 CKD patients [8]. Observations by these authors are intriguing for two reasons. First, because they provide novel descriptive data on LAV and other echocardiographic parameters in asymptomatic CKD 3–5 patients, i.e. in a category of CKD patients where information on LAV is very scarce. Second, because the association between sodium and LAV is strong (plasma sodium explains ∼16% of the total variance in LAV) and is fully independent of LV mass, LV volume and other risk factors. Notwithstanding the low variability in plasma sodium (sodium ranging from 137 to 147 mmol/L), this parameter ranked as the fourth factor after LV mass, LV volume and age, explaining the variability in LAV. Remarkably, the strength of such a link was identical to that of LAV and anaemia, i.e. a well-recognized risk factor for alterations in heart geometry and function in CKD patients [9]. Calculations made on the basis of Table 5 of Wang's paper suggest that a 2 mmol/L increase in plasma sodium entails a 1.0 mL/m^2 increase in LAV ($P = 0.007$), an effect of the same order of a 8-year increase in age, a 3.0 g/m^2 increase in LVMI and a 1.8 g/dL decrease in haemoglobin. Clearly, the strength of this association needs to be confirmed in other surveys and in longitudinal studies before drawing strong conclusions about its potential pathophysiological and clinical implications. Pending confirmation studies, observations by Wang generate the hypothesis that stimuli originating in the atrium may modulate plasma sodium or vice versa. High salt intake, an intervention triggering extracellular volume expansion, raises plasma sodium in subjects with essential hypertension [10], suggesting that the LAV–plasma sodium link may be the expression of hypertonic volume expansion. Alterations in plasma sodium are much frequent in CKD patients and both hyponatraemia and hypernatraemia have been associated with adverse clinical outcomes in a large cohort of CKD patients [11]. A better understanding of mechanisms generating mild hypernatraemia in CKD and functional studies looking at the LAV–arginine vasopressin link are clearly needed to elucidate the intriguing LAV–plasma sodium link in this population. The hypothesis that mild hypernatraemia driven by sodium excess may trigger LAV enlargement is amenable to clinical testing in interventional studies of salt intake modification in CKD patients. In particular, future studies should focus not only on LAV but be extended to left atrial function and mechanics, the latter being an important physiological parameter and a very powerful predictor of clinical outcomes under high-risk conditions like myocardial infarction with ST elevation [12].

CONFLICT OF INTEREST STATEMENT

None declared.

(See related article by Yee-Moon Wang *et al.* Plasma sodium and subclinical left atrial enlargement in chronic kidney disease. *Nephrol Dial Transplant* 2013; 28: 2319–2328.)

REFERENCES

1. Tripepi G, Benedetto FA, Mallamaci F *et al.* Left atrial volume in end-stage renal disease: a prospective cohort study. J Hypertens 2006; 24: 1173–1180
2. Tamez H, Zoccali C, Packham D *et al.* Vitamin D reduces left atrial volume in patients with left ventricular hypertrophy and chronic kidney disease. Am Heart J 2012; 164: 902–909
3. Cioffi G, Mureddu GF, Stefenelli C *et al.* Relationship between left ventricular geometry and left atrial size and function in patients with systemic hypertension. J Hypertens 2004; 22: 1589–1596
4. Gerdts E, Oikarinen L, Palmieri V *et al.* Correlates of left atrial size in hypertensive patients with left ventricular hypertrophy: the Losartan intervention for endpoint reduction in hypertension (LIFE) study. Hypertension 2002; 39: 739–743
5. Piotrowski G, Banach M, Gerdts E *et al.* Left atrial size in hypertension and stroke. J Hypertens 2011; 29: 1988–1993
6. Kim SJ, Han SH, Park JT *et al.* Left atrial volume is an independent predictor of mortality in CAPD patients. Nephrol Dial Transplant 2011; 26: 3732–3739
7. Tripepi G, Benedetto FA, Mallamaci F *et al.* Left atrial volume monitoring and cardiovascular risk in patients with end-stage renal disease: a prospective cohort study. J Am Soc Nephrol 2007; 18: 1316–1322
8. Wang AY, Cheung S, Chan IH, Lam CW. Plasma sodium and subclinical left atrial enlargement in chronic kidney disease. Nephrol Dial Transplant 2013; Jan 12. [Epub ahead of print]
9. Levin A. Anemia and left ventricular hypertrophy in chronic kidney disease populations: a review of the current state of knowledge. Kidney Int Suppl 2002; 80: 35–38
10. Suckling RJ, He FJ, Markandu ND *et al.* Dietary salt influences postprandial plasma sodium concentration and systolic blood pressure. Kidney Int 2012; 81: 407–411
11. Kovesdy CP. Significance of hypo- and hypernatremia in chronic kidney disease. Nephrol Dial Transplant 2012; 27: 891–898
12. Lønborg JT, Engstrøm T, Møller JE *et al.* Left atrial volume and function in patients following ST elevation myocardial infarction and the association with clinical outcome: a cardiovascular magnetic resonance study. Eur Heart J Cardiovasc Imaging 2013; 14: 118–127

Received for publication: 25.3.2013; Accepted in revised form: 27.3.2013

Nephrol Dial Transplant (2013) 28: 2211–2214
doi: 10.1093/ndt/gft074
Advance Access publication 25 April 2013

Neonatal RIFLE

Zaccaria Ricci[1]
and Claudio Ronco[2,3]

[1]Pediatric Cardiac Anesthesia/Intensive Care Unit, Department of Pediatric Cardiology and Cardiac Surgery, Bambino Gesù Children's Hospital, IRCCS, Rome, Italy,
[2]Department of Nephrology, Dialysis and Transplantation, St. Bortolo Hospital, Vicenza, Italy and
[3]International Renal Research Institute, Vicenza, Italy

Correspondence and offprint requests to: Zaccaria Ricci; E-mail: z.ricci@libero.it

Keywords: acute kidney injury, classification, definition, RIFLE score

ABSTRACT

A standardized classification of acute kidney injury (AKI) has recently been proposed with the RIFLE (Risk, Injury, Failure, Loss of function, End-stage kidney disease) score. Such definition/classification has been applied both in adult and in paediatric patients. Neonatal definition of AKI likely results as a challenging task due to the peculiar renal pathophysiology of newborn critically ill patients. Their so-called 'immature kidneys' require careful management and neonatal AKI is