BRAIN NATRIURETIC PEPTIDE AS A BIOMARKER OF PULMONARY CONGESTION IN STAGE 5 CKD ON DIALYSIS

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OBJECTIVES

High Brain Natriuretic Peptide (BNP) is a marker of left ventricular hypertrophy (LVH) and LV dysfunction and volume overload and entails a high mortality risk in dialysis patients. Pulmonary congestion as assessed by the number of ultrasound B lines (US-BL) is another emerging biomarker of death and cardiac events in the same population (1). We investigated the association between BNP and lung congestion (US-B lines) and the interplay between these two risk factors in the high risk of death and cardiovascular (CV) events in dialysis patients.

METHODS

In a cohort of 136 dialysis patients (age: 63±14 yrs; M: 60%; diabetics: 23%), we investigated the mutual associations among plasma BNP, US-BL, LV mass (LVMI) and US-B lines and analysed the relationship between BNP, LVMI and US-BL with a composite end-point of death and/or fatal and non-fatal cardiovascular (CV) events. US-B lines were recorded over the whole lung area by using standard US probes by a novel technique well validated in dialysis patients (2).

Fig.1 – Box and wisher Plot of BNP and US-B Lines

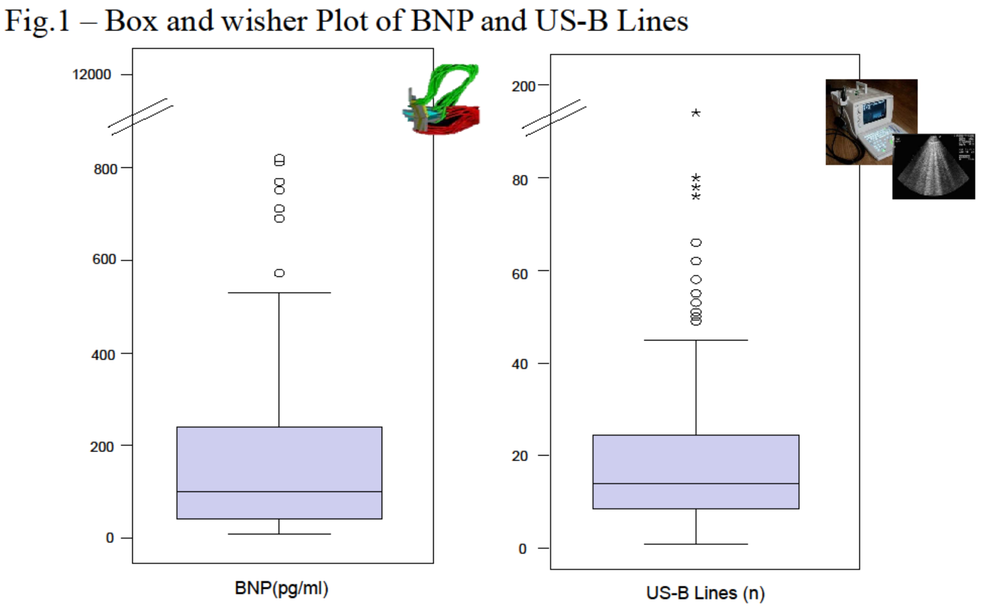
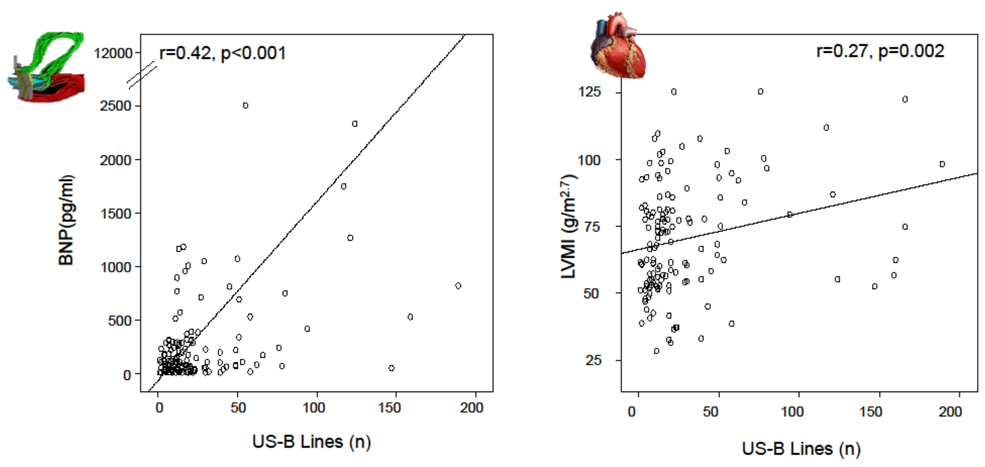


Fig.2 - Correlation analysis of US-B Lines with BNP and LVMI



RESULTS

Plasma BNP [median 112 pg/ml; inter-quartile range (IQR): 46–307 pg/ml] and US-BL (median 15, IQR: 9-31) (Fig.1) were directly and significantly interrelated (r=0.42, P<0.001) and this association was stronger than that between US-BL and LVMI (r=0.27, P=0.002) (Fig.2). In a multiple linear regression model, including age, gender, smoking, diastolic BP and CV comorbidities as well as BNP and LV mass, only BNP (β=0.30, P=0.002) maintained an independent relationship with US-BL. In this model, LVMI failed to independently correlate with US-BL (β=0.08, P=0.41) to become a significant correlate of US-BL (β=0.20, P=0.03) only after the exclusion of BNP from the model. The results of such statistical modelling suggest that high BNP captures the explanatory power of LVMI for pulmonary congestion. During the follow-up period (median: 29 months; IQR: 14-36 months) 65 patients presented the composite end-point of death and/or fatal and non-fatal CV events. In two separate multivariate Cox's regression models both BNP (HR: 1.02, 95% CI 1.01-1.04, P=0.001) and US-B lines (HR: 1.05, 95% CI: 1.02-1.08, P=0.003) were independently associated with the combined outcome while in a model including both risk factors only BNP maintained an independent relationship with the same outcome.

CONCLUSIONS

The strong, independent association between BNP and lung congestion in dialysis patients indicates that this biomarker provides information on a pathway conducive to pulmonary oedema generated and/or potentiated by LV disorders and volume overload. This steady-state relationship accords with prospective analysis showing that the predictive power for death and CV events of lung congestion largely overlaps with that of high BNP. Overall, these findings underscore the importance of targeting LV disorders and volume overload to curb the excessively high risk of death and CV complications in stage 5-D CKD patients.

REFERENCES:

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2) Mallamaci F, Benedetto FA, Tripepi R, Rastelli S, Castellino P, Tripepi G, Picano E, Zoccali C. Detection of pulmonary congestion by chest ultrasound in dialysis patients. JACC Cardiovasc Imaging. 2010 Jun; 3(6): 586-94.