

IVC Diameter in Patients With Chronic Heart Failure Relationships and Prognostic Significance

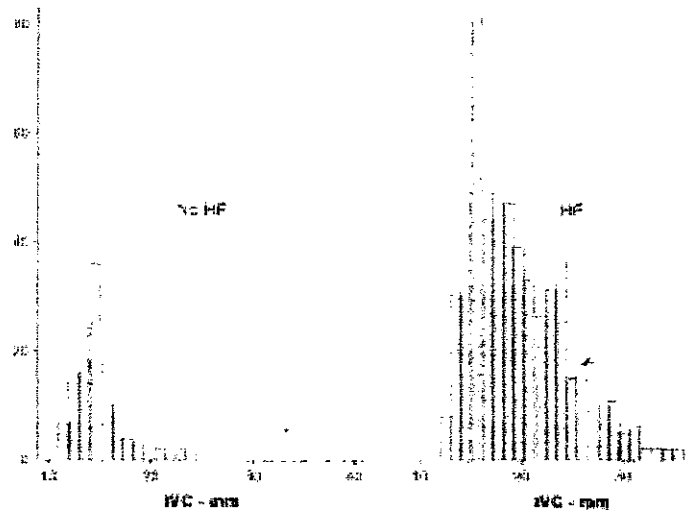
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Figure 1 Distribution of IVC Diameter

The distribution of inferior vena cava (IVC) diameter in patients without (left panel) or with (right panel) heart failure (HF).



Abstract

Abstract | Methods | Results | Discussion | Conclusions | References

Objectives The aim of this study was to assess the relation between inferior vena cava (IVC) diameter, clinical variables, and outcome in patients with chronic heart failure (HF).

Background The IVC distends as right atrial pressure rises. Therefore it might represent an index of HF severity independent of left ventricular ejection fraction (LVEF). The relation between IVC diameter and other clinical variables and its prognostic significance in patients with HF has not been explored.

Methods Outpatients attending a community HF service between 2008 and 2010 were enrolled. Heart failure was defined as the presence of relevant symptoms and signs and objective evidence of cardiac dysfunction: either LVEF <45% or the combination of both left atrial dilation (≥4 cm) and raised aminoterminal pro-brain natriuretic peptide (NT-proBNP) ≥400 pg/ml. Patients were followed for a median of 56 (interquartile range: 413 to 736) days. The primary composite endpoint was cardiovascular death and HF hospitalization.

Results Among the 893 patients enrolled, median age was 73 years, 33% were women, and 568 had HF. Patients with HF in the highest tertile of IVC diameter were older; had lower body mass index; were more likely to have atrial fibrillation and to be treated with diuretics; and had larger left atrial volumes, higher pulmonary pressures, and less negative values for global longitudinal strain. The LVEF and systolic blood pressure were similar across tertiles of IVC diameter. The IVC diameter and log [NT-proBNP] were correlated ($r = 0.55$, $p < 0.001$). During follow-up, 158 patients reached a primary endpoint. In a multivariable Cox regression model, including NT-proBNP, only increasing IVC diameter, urea, and the trans-tricuspid systolic gradient independently predicted a poor outcome. Neither global longitudinal strain nor LVEF were adverse predictors.

Conclusions In patients with chronic HF with or without a reduced LVEF, increasing IVC diameter identifies patients with an adverse outcome.

Figure 2 IVC Diameter and Outcome

Kaplan-Meier curves for the primary composite endpoint (heart failure [HF] hospitalization or cardiovascular death) in patients without HF (solid blue line) and by tertiles of inferior vena cava (IVC) diameter in patients with HF (red is lowest tertile, green is mid-tertile, and orange is highest tertile). Patients in the lowest tertile of IVC diameter had a rate of events similar to those considered not to have HF. For patients with HF, the hazard ratio for this outcome was 7.02 (95% confidence interval: 4.34 to 11.37; $p < 0.001$) in the highest versus lowest tertile with an approximate 50% probability of hospitalization for worsening HF or cardiovascular death within 18 months estimated from the Kaplan-Meier curve.

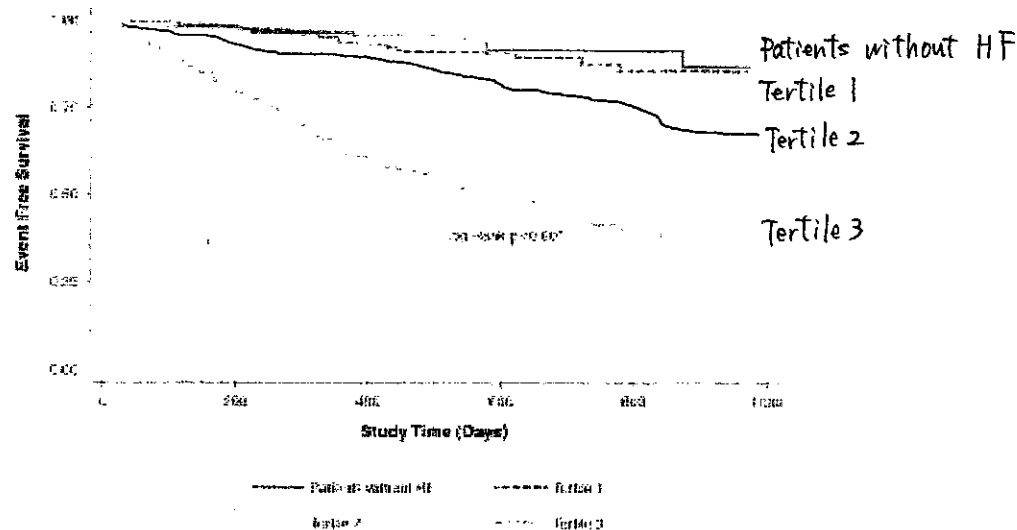


Figure 3 IVC Diameter and Log [NT-proBNP] as Predictors of Outcome Receiver-operating characteristic curves are used to compare log N-terminal B-type natriuretic peptide (NT-proBNP) and inferior vena cava (IVC) diameter as predictors of prognosis at 1 year for the combined endpoint of heart failure hospitalization and cardiovascular death. The IVC diameter (blue line) had a slightly greater area under the curve (AUC) (0.76 with a 95% confidence interval: 0.71 to 0.81) than log [NT-proBNP] (AUC: 0.73, 95% confidence interval: 0.68 to 0.78), but the difference was not statistically significant ($p = 0.20$).

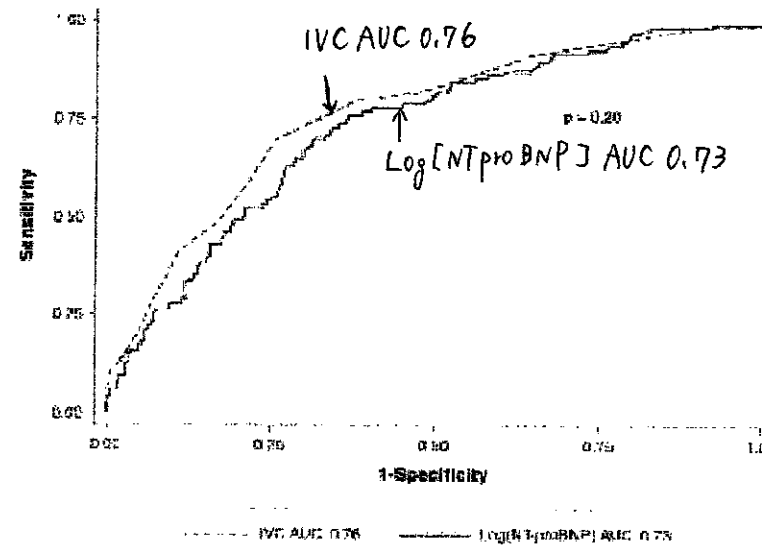


Figure 4 Echocardiographic Measures as Predictors of Outcome Receiver-operating characteristic curves are used to compare inferior vena cava (IVC) diameter and echocardiographic measures (left atrial volume indexed to body surface area [LAVI], tricuspid annular plane systolic excursion [TAPSE], trans-tricuspid systolic (TR) gradient, and global longitudinal strain [GLS]) as predictors of prognosis at 1 year for the combined endpoint of heart failure hospitalization and cardiovascular death. The IVC diameter had a greater AUC (0.76 with a 95% confidence interval [CI]: 0.71 to 0.81) than TR gradient (AUC: 0.73, 95% CI: 0.67 to 0.78), LAVI (AUC: 0.64, 95% CI: 0.59 to 0.71), GLS (AUC: 0.51, 95% CI: 0.44 to 0.58), or TAPSE (AUC: 0.37, 95% CI: 0.31 to 0.43). The difference was statistically significant (chi-square = 78.44; $p < 0.001$).

