Estimation of the right atrial pressure by ultrasound-assessed internal jugular vein in patients with advanced chronic heart failure

E. Ammirati, D. Marchetti, G. Colombo, A. Garascia, F. Macera, M. Cipriani, E. Perna, L. D'Angelo, M. Frigerio, F. Oliva

Niguarda Ca Granda Hospital, Milan, Italy
Funding Acknowledgement: Type of funding source: None

Background: In patients with systolic chronic heart failure (CHF) clinical signs of congestion cannot always be evident at clinical examination. Right atrial pressure (RAP) measured by right heart catheterization (RHC) is an accurate and reproducible marker of blood volume. A non-invasive accurate tool to identify CHF patients with normal RAP would be desirable to tailor therapy.

Purpose: To validate an ultrasound (US)-assessed internal jugular vein distensibility (JVD) ratio to identify patients with normal mean RAP (defined as 7 mmHg or less) measured by RHC.

Methods: We first identify the JVD ratio that allows the most accurate identification of patients with normal RAP in a prospective calibration cohort of 100 patients with systolic CHF. Then, we tested the JVD ratio threshold to identify patients with normal RAP in a validation cohort of 101 consecutive patients with systolic CHF. All patients had a left ventricular ejection fraction (LVEF)<50% and underwent RHC in the setting of heart transplant work-up. At the time of jugular vein puncture, we recorded the internal jugular vein diameter by conventional linear probes. JVD ratio was calculated as the ratio between maximum diameter (during Valsalva maneuver) and rest diameter of the vein (FIGURE). Finally, we assessed the prognostic value of the JVD ratio in the follow up of the first 100 patients.

Results: In the calibration cohort (mean age 53 years, 13% female; median LVEF 25%, 81% in NYHA class III/IV) we define the best threshold of the JVD ratio to identify patients with normal RAP that has 1.6 with an area under the curve (AUC of 0.74; p<0.0001). Based on this JVD ratio threshold we defined patients with low JVD ratio (≤1.6; n=58; median RAP 8 mmHg) and patients with high JVD ratio (>1.6, n=42; median RAP 4 mmHg). High JVD ratio and low JVD ratio groups had similar clinical and laboratory characteristics. In the validation cohort (mean age 55 years, 13% female; median LVEF 25%; 56% in NYHA class III/IV) using the previously defined 1.6 JVD ratio threshold, we identified 51 patients with low JVD ratio (median RAP 8 mmHg) and 50 patients with high JVD ratio (median RAP 3 mmHg; p<0.0001) The JVD ratio threshold has an accuracy to identify patients with a normal RAP with an AUC of 0.82 (p<0.0001); a predictive positive value of 0.94, negative predictive value of 0.51, specificity of 0.90, and sensitivity of 0.65. Finally, in the calibration cohort, the CHF patients with low JVD ratio (≤1.6) had a higher cumulative incidence of overall death, heart transplant, or left ventricular assist device (42.7% vs. 16.1% in the high JVD ratio group, p log-rank 0.006) at a median of 13-month follow-up.

Conclusions: We found that US-assessed JVD ratio is a convenient and accurate diagnostic tool to identify patients with advanced systolic CHF with normal vs. increased RAP. This tool could be tested in the ambulatory setting to modulate therapies, particularly diuretics and vasodilators.
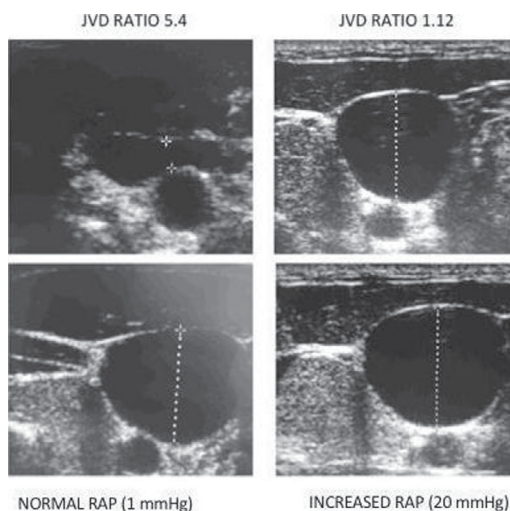

Figure 1