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Echocardiography right atrial area and inferior vena cava diameter interest to predict right atrial pressure in pulmonary arterial hypertension

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Background: Risk stratification in Pulmonary Arterial Hypertension (PAH) is based on multiparametric approach including invasive measurement of invasive right atrial pressure (RAP) by right heart catheterization (RHC). Therefore, following 2015 ESC/ERS pulmonary hypertension (PH) guidelines, RHC are frequently repeated every 4 to 6 months until RAP <8 mmHg.

Purpose: To explore the interest of right atrial area (RAA) and inferior vena cava (IVC) diameter measured by transthoracic echocardiography, as a surrogate for right atrial preload to detect RAP <8 mm Hg and avoid repeated RHC in PAH patients.

Methods: From a prospective single PAH referral center, we have included all patients with a diagnosis of PAH (confirmed by PH team). During the follow up, transthoracic echocardiography and a RHC was performed on the same day. RAA (cm2) was measured in the apical four-chamber view, at end-systole, just prior to tricuspid valve opening, excluding the area under tricuspid valve annulus. In the subcostal view, at 1.0 to 2.0 cm from the junction with the right atrium, IVC diameter (mm) was reported. Both RAA and IVC were compared to RAP.

Results: 97 PAH patients were included (35 males, mean age 65 ± 16y, mean arterial pressure was 45 ± 16 mmHg, cardiac index 3.0 ± 1.0 l/min/m² and right atrial pressure was 7.6 ± 4.7 mm Hg). Both IVC diameter and RAA averaged 18.1 ± 6.3mm and 22.5 ± 8.2 mm by echocardiography, respectively. IVC diameter and RAA had a significant but weak correlation with right atrial pressure <8 mmHg measured by RHC ($r = 0.42$, $p < 0.01$ and $r = 0.41$, $p < 0.01$, respectively). Targeting a good specificity (Sp = 0.75), ROC curves analysis identified 10 mm for the IVC diameter and 20 cm² for RAA if IVC diameter was > 10 but < 20 mm to predict RAP <8 mmHg (area under the curve = 0.72). Thus, in our cohort, 40% could have been followed-up non-invasively by echocardiography with IVC diameter ≤10 mm or >10 but <20 mm with RAA ≤20 cm² with only 2% of misclassification. For the remaining 58% unclassified PAH patients out of these echocardiographic ranges, RHC would have been requested.

Conclusion: In a cohort of PAH patients, targeting a low risk clinical worsening or death (identified by RAP <8 mmHg in RHC), echocardiography, with the use of IVC diameter ≤10 mm or >10 but <20 mm with RAA ≤20 cm², right heart catheterisation may be avoided in 40% of cases with extremely low misclassification.