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Phenotyping acute decompensated heart failure by intrarenal venous flow and right ventricle-pulmonary circulation uncoupling

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Topic(s):
Acute Heart Failure – Pathophysiology and Mechanisms

Citation:

Background
Intrarenal venous blood flow (IRVF) has recently been used to assess renal haemodynamics in heart failure (HF). Different IRVF patterns have been described, with discontinuous IRVF related to a worse outcome compared to the continuous one.

Purpose
We aimed at studying the interaction between IRVF and the right heart dynamics thorough the study of right ventricular (RV) to pulmonary circulation (PC) coupling in acute decompensated (AD) HF patients.

Methods
92 ADHF patients underwent a transthoracic echocardiography followed by renal ultrasonography and laboratory tests. The IRVF was evaluated by Venous Impedance Index (VII)

Results
Dividing the population according to the different IRVF patterns allowed to phenotype the HF population. Patients with the worst IRVF pattern (monophasic) showed significantly higher prevalence of pulmonary hypertension and RV dysfunction with a lower TAPSE/PASP ratio. Patients with continuous IRVF pattern showed normal pulmonary pressures and RV function with a higher TAPSE/PASP ratio. A strong logarithmic correlation between VII and TAPSE/PASP ratio was observed (R² = 0.5406).

At multivariate linear regression analysis, RV to PC uncoupling was identified as independent determinant of VII. TAPSE/PASP was inversely associated with VII (-0.55±0.16, p=0.0011). LVEF was not associated with VII (p=0.08).

No difference in renal function laboratory test was found while NT-proBNP was significantly higher in the IRVF monophasic group.

Conclusions
The identified correlation between RV to PC uncoupling and the IRVF pattern provides new evidence regarding the pathophysiological mechanisms of cardio-renal syndrome paving the way to interventions with proven effectiveness on the RV to reverse the unfavorable kidney hemodynamics and failure.

<table>
<thead>
<tr>
<th></th>
<th>Total (92)</th>
<th>Continuous (32)</th>
<th>Pulsatile (19)</th>
<th>Biphasic (15)</th>
<th>Monophasic (26)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VII</td>
<td>0.49±0.36</td>
<td>0.11±0.06</td>
<td>0.38±0.12</td>
<td>0.74±0.05</td>
<td>0.95±0.02</td>
<td>&lt;0.0001</td>
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<tr>
<td>LVEF (%)</td>
<td>43.9±16.1</td>
<td>51.4±13.4</td>
<td>41.6±15</td>
<td>43±15.3</td>
<td>34±16.3</td>
<td>0.002</td>
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<tr>
<td>TAPSE (mm)</td>
<td>16.7±5.5</td>
<td>20.1±5.1</td>
<td>13.9±2.7</td>
<td>17±6.5</td>
<td>13.7±4.3</td>
<td>&lt;0.0001</td>
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<tr>
<td>PASP (mmHg)</td>
<td>41.6±14.5</td>
<td>30.9±6.9</td>
<td>42.9±9.3</td>
<td>52.6±12.6</td>
<td>50.3±16.3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>TAPSE/PASP</td>
<td>0.46±0.26</td>
<td>0.69±0.24</td>
<td>0.33±0.08</td>
<td>0.34±0.14</td>
<td>0.29±0.11</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Creatinine (mg/dL)</th>
<th>1.25±0.52</th>
<th>1.25±0.59</th>
<th>1.17±0.49</th>
<th>1.26±0.52</th>
<th>1.31±0.48</th>
<th>0.6</th>
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<tbody>
<tr>
<td>GFR (ml/min/1.73sqm)</td>
<td>58.9±2.2</td>
<td>59.6±22.9</td>
<td>60.2±17.8</td>
<td>61.6±23.5</td>
<td>55.4±16.9</td>
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<tr>
<td>NT-proBNP (ng/L)</td>
<td>5511±7764</td>
<td>2231±2463</td>
<td>6365±10318</td>
<td>7257±8173</td>
<td>7509±8380</td>
<td>0.004</td>
</tr>
</tbody>
</table>

VII = Venous impedance index; LVEF = left ventricle ejection fraction; TAPSE = Tricuspid annular plane systolic excursion; PASP = Pulmonary artery systolic pressure; IVC = Inferior vena cava; GFR = Glomerular filtration rate