Does CVP Correlate with Transesophageal Echocardiographic Evaluation of Right Heart Function?

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Introduction

Important goals in the management of cardiac patients under general anesthesia include accurate evaluation of right heart function, preload status, and assessment of fluid responsiveness. Central venous pressure (CVP) recorded from the right atrium or superior vena cava is said to reflect intravascular volume. The ability of the CVP to predict fluid responsiveness, i.e., an increase in stroke index/cardiac index following a fluid challenge, has indirectly advanced the idea that CVP is a measure of right heart function and that patients with right ventricular failure may exhibit elevated CVP. Several echocardiographic parameters including right ventricular ejection fraction, amplitude of the tricuspid annular plane systolic excursion (TAPSE) assessed by M-mode, and tricuspid annular systolic velocity (TASV) recorded by Doppler tissue imaging (DTI) have been used to evaluate right ventricular function (RVF).

Methods

With institutional review board approval, 33 patients ([58 ± 14.6 years old] (M/F 22/11)) who presented for elective cardiac surgery were studied retrospectively. As part of the standard surgical protocol, each patient received a pulmonary artery catheter (PAC) to allow for continuous monitoring of the central venous pressure and a comprehensive transesophageal echocardiography (TEE) exam. The amplitudes of the TAPSE and TASV were used to assess RVF. Average peaks of TAPSE and TAPSE were recorded. Thresholds of 12 cm/s and 9 cm/s using TASV were used to differentiate between normal, moderately, and severely reduced RVF, while TAPSE ≥20 mm was used to differentiate between normal and reduced RVF.

Table 1

<table>
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<tr>
<th>Patient Characteristics</th>
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<tr>
<td>Age, mean ± SD (range), yrs</td>
<td>58 ± 14.6 (20–77)</td>
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<td>Gender, %</td>
<td>33% Female/67% Male</td>
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<td>CVP, mean ± SD (range), cm</td>
<td>16.24 ± 4.45 (6.00–26.00)</td>
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<td>TASV, mean ± SD (range), m/s</td>
<td>0.08 ± 0.03 (0.04–0.20)</td>
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<tr>
<td>TAPSE, mean ± SD (range), mm</td>
<td>17.42 ± 5.74 (5.51–39.58)</td>
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Results

The CVP recorded for each patient was then compared to the TAPSE and TASV to see if elevated CVP was reflected as a reduced TAPSE or TASV [Figure 1 and Table 1]. There was no correlation between the CVP and TASV (r=0.131, p=0.467) or the CVP and TAPSE (r=0.146, p=0.417). TASV and TAPSE, which have been shown to be good echocardiographic parameters to evaluate right heart function, correlated well (r=0.829, p<0.0001) [Figure 2].

Discussion

While a low CVP may indicate hypovolemia, a high CVP may not always indicate hypervolemia and can also result from

- Increased chamber wall stiffness (from myocardial ischemia or abnormal relaxation)
- Increased pressure surrounding the heart (pericardial or intrathoracic pressure)

Conclusion

The lack of correlation between the CVP and both the TASV and TAPSE suggests that CVP is not a useful predictor of right ventricular function in our patient population. Whether a better correlation will be found in patients with acute right ventricular failure requires further study.

References