Immediate Impact of Successful Percutaneous Mitral Valve Commissurotomy on Echocardiographic Measures of Right Ventricular Contractility

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ABSTRACT

- **Purpose:** Functional analysis of the right ventricle (RV) cannot be reliably evaluated by conventional echocardiography due to its complex geometry and load dependence of ejection phase indices. dp/dt, the Tei index, and myocardial acceleration during isovolumic contraction (IVA), all indicators of RV contractility, are affected by RV contractility.

- **Methods:** Fifty-nine patients presented to Ibn Roch University Hospital with MS suitable for PTMC between April and March 2009. Of these, there were seven males, with a mean age of 51 ± 8.3 years. Eight had atrial fibrillation, and four had a history of prior PTMC. None had systemic hypertension, diabetes mellitus, more than mild aortic or mitral regurgitation and/or aortic stenosis, greater than New York Heart Association functional class III, or previous aortic or mitral valve surgery. Indications for PTMC were New York Heart class II or III, planimetered MVA < 1.5 cm², moderate RV systolic pressure, and absence of concomitant cardiovascular disease requiring surgical correction.

- **Echocardiographic measurements:** Two-dimensional (2D) echocardiography and Doppler studies were performed before and 24–48 h after PTMC. All studies were obtained using a Vivid 7 ultrasound machine equipped with a 3.5 MHz transducer. The Tei index of RV myocardial performance was calculated as the ratio between systolic valve closure to tricuspid valve opening, divided by the RV ejection time, determined by pulsed Doppler. The Doppler derived dp/dt was calculated as follows: the two points were on the RV acceleration spectrum, corresponding to 1 m/s and 2 m/s were identified. Pulsed wave DT was obtained by activating the machine’s Doppler tissue imaging feature. A 3.5 mm sample volume was placed on the lateral side of the tricuspid annulus. Peak myocardial velocities during systole, early, and late diastole together with the isovolumic contraction time were measured at a sweep speed of 100 mm/s. The final values of all parameters were obtained after averaging over three cardiac cycles.

- **Statistical analysis:** Data were expressed as mean ± SD. Analysis employed the Student’s t-test for paired data to determine the significance of differences before and after PTMC. To show the relationship between the variables in the patient groups, Pearson correlation analysis was performed. A p-value < 0.05 was considered statistically significant. The statistical package SPSS 16.0 (version 16.0, SPSS Inc., Chicago, IL, USA) was employed.

- **RESULTS:**

- **Table 1:** Echocardiographic data before and immediately after percutaneous mitral commissurotomy (PTMC)

- **Table 2:** Two-dimensional echocardiographic parameters of right ventricular contractility before and immediately after percutaneous mitral commissurotomy (PTMC)

- **DISCUSSION:**

- **IVA** did not change following PTMC, in spite of the fact that systolic pulmonary pressure decreased significantly suggesting that it is afterload independent. IVA has been validated as a load independent measure of RV systolic function and is suggested to be a strong index of contractility because it reflects the rate change of contractile force during isovolumic contraction. Also, Sade et al showed that IVA was the most independent of the hemodynamic severity of MS and that patients with preserved RV contractile reserve and high SPAP may still benefit from surgery and have favorable outcome. They concluded that these patients may be better served by being identified before RV contractile dysfunction occurs.

- **SV** also did not change after PTMC. Wang et al. compared several echocardiographic variables with RV ejection fraction using cardiac magnetic resonance imaging and concluded that tricuspid flow was the best independent predictor of RV ejection fraction. The absence of change of SV before and after PTMC may be related to load independence suggesting that it might serve as another measure of RV contractility especially in the presence of pulmonary hypertension.

- **RV dp/dt and RV Tei index improved significantly after PTMC. This may mean an improvement of RV contractile function but may also reflect the sensitivity of these parameters to afterload changes. This is suggested by the lack of correlation among dp/dt, Tei index and SPAP before PTMC. We think this may be related to the contribution of other factors to RV function especially related to the decrease in pulmonary arterial pressure. Blanchard et al. found, in 93 patients with CTEPH, that Tei index improved significantly after thromboendarterectomy (from 0.52 to 0.33, p < 0.0001). PVR was correlated with RV Tei index before and after surgery (r = 0.78 and r = 0.67, respectively; p < 0.0001), and the change in PVR correlated with the change in RV Tei index (r = 0.75; p < 0.0001).

CONCLUSION

Our study suggests that RV dp/dt and the RV Tei index are afterload dependent while RV IVA and SV are unaffected by an acute decrease in RV peak systolic pressure following PTMC. Further, the RV IVA and SV independence of ventricular geometry and straightforward measurement make these indices particularly attractive in evaluating patients with mitral stenosis.

BIBLIOGRAPHY