Echocardiographic determinants of tricuspid regurgitation in patients with severe pulmonary arterial hypertension


Functional tricuspid regurgitation (TR) is a common finding in patients with severe pulmonary arterial hypertension (PAH). It is not well known which factors are involved in the development of such TR.

Objective: To analyze the anatomic, functional, and hemodynamic determinants of tricuspid regurgitation severity in patients with severe PAH.

Methods: Transthoracic echocardiogram was performed in 39 patients with severe PAH (26 women, mean age 44.8±13.5 years). NYHA functional class I-29%, II-33% and III-38%. Severity of TR was assessed quantifying the effective regurgitant orifice (ERO) by PISA method. Different measurements involving right ventricular (RV) function and geometry (RV myocardial performance index, RV sphericity index, and diastolic RV area), tricuspid valve anatomy (tricuspid valve annulus size, valve tenting height), and hemodynamics were obtained by measuring cardiac output and systolic RV RA gradient. Correlations between ERO and the different parameters were analyzed.

Results: Correlations are shown in Table.

<table>
<thead>
<tr>
<th>TV</th>
<th>TV</th>
<th>RV</th>
<th>RV</th>
<th>RV</th>
<th>RV</th>
<th>RA</th>
<th>Cardiac output</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td>0.61</td>
<td>0.63</td>
<td>0.66</td>
<td>0.6</td>
<td>0.25</td>
<td>0.16</td>
<td>0.26</td>
</tr>
<tr>
<td>p</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>0.1</td>
<td>0.3</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Conclusion: In patients with severe pulmonary arterial hypertension, the severity of the TR is related to an altered RV geometry. The hemodynamic severity and the RV systolic dysfunction were not associated with the severity of the TR.

Right ventricular systolic function is abnormal in patients with cirrhosis

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Background: Systolic dysfunction in patients with cirrhosis is hyperdynamic. The size of the left ventricle is normal to increased but no definite conclusion has been offered for the right ventricular (RV) size and function. In this study we aimed to show the hyperdynamic response of RV in patients with cirrhosis by using conventional and tissue Doppler echocardiographic parameters.

Methods: Forty-one patients with chronic liver failure (33 male, mean age 46±12 years) and 19 age- and sex-matched healthy controls were studied prospectively. Standard echocardiography and pulsed wave Doppler tissue imaging of the tricuspid annulus at the RV free wall were performed. RV volumes and areas and ejection fraction (EF) were obtained. Systolic RV pressure was estimated by maximal tricuspid regurgitation (TR) velocity. Tricuspid valve systolic excursion and Tei index for right ventricle were also calculated. Peak iPOD was measured from the continuous wave Doppler-derived TR profile.

Results: Groups were similar with respects to body surface area and mean blood pressures. There were no differences between left and RV EF's among the groups. RV diastolic and systolic volumes and areas of the cirrhotic patients were significantly higher than control group (all p<0.05). Compared with the control group RV pressure and RV wall thickness were increased in patients with cirrhosis (30.0±6.7 vs 21.9±5.3 mmHg, p<0.001) and 0.54±0.09 vs 0.43±0.08 cm, p<0.001 respectively). No differences were demonstrated with regards to tricuspid valve systolic excursion, peak iPOD between the groups. There was a tendency for lower Tei index values in patients with cirrhosis compared to control group (0.21±0.16 vs 0.28±0.13, p=0.06, respectively). RV CO, cardiac index and peak systolic velocity (S) of the tricuspid annulus were higher in cirrhotic patients than control group (4.6±1.5 vs 2.7±0.8 l/min, p<0.01; 1.92±0.7 vs 1.4±0.3 l/min/m², p=0.01 and 20.4±8.6 vs 18.6±5.6 cm/s, p<0.01, respectively).

Conclusion: We conclude that in cirrhotic patients RV is enlarged and hypertrophied with higher RV systolic pressure compared to control group and demonstrates abnormal systolic function.

Pulmonary arterial systolic pressure during exercise in myeloproliferative diseases: Preliminary study

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Introduction: Pulmonary arterial hypertension (PAH) has been reported to be a common finding in chronic myeloproliferative diseases (CMD) and the most recent clinical classification of PAH (Venice, 2003) proposes CMD as an associated condition for PAH. Noninvasive Doppler echocardiographic assessment of pulmonary arterial systolic pressure is the procedure of choice to diagnose CMD.

Purpose: To use Doppler echocardiography at rest and during treadmill exercise to determine pulmonary arterial systolic pressure (PASP) in pts with CMD.

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Methods: We studied 55 patients (mean age 52±15 yrs, mean RVAP 2.1±2.120 mmHg, 38 with primary pulmonary hypertension (PPH), 14 with idiopathic dilated cardiomyopathy (DCM) and 3 normal patients. From apical 4c view, we recorded longitudinal myocardial motion within the RV basal septal (septal) and free (free) walls with pulsed DTI and measured maximal velocity (S max), mean velocity (S mm), time-interval velocity integral (S TVI) and duration (S dur) of systolic S wave. All our patients also underwent right heart catheterization with determination of RVAP within a delay less than 40 hrs.

Results: For the whole group, RVAP correlated with S max (r=0.51, p=0.000), free S TVI (r=0.60, p=0.000), free S dur (r=0.29, p<0.04) and with S max (r=0.59, p=0.000), S TVI (r=0.68, p<0.000), S dur (r=0.38, p=0.005). From the results of our final 17 pts (PPH pts), we derived the following equation: echo-derived RVAP = 2.070* S TVI - 0.644. This formula was then validated in the other 38 pts. For the whole group, echo-derived RVAP correlated well with RVAP (r=0.71, p<0.000). This was also true in subgroups of pts with PPH (21 pts, r=0.89, p<0.000) and with DCM (12 pts, r=0.83, p=0.002).

Conclusion: Sop S TVI seems to be the more accurate parameter in the evaluation of RVAP, witnessing the importance of septal shortening regarding RV systolic ejection. This study validates a new easy formula (RVAP = 2.070* S TVI - 0.644) to calculate RVAP from DTI study of systolic RV longitudinal motion which proves to be accurate in patients with primary pulmonary hypertension and patients with idiopathic dilated cardiomyopathy.

Echocardiographic estimation of right ventricular diastolic function in patients after acute myocardial infarction treated with primary angioplasty

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Right ventricular (RV) dysfunction is clinically relevant in a variety of disease states affecting both the coronary and progessing and being also an important issue in post-infarct pts.

Aim: To investigate RV systolic and diastolic function in patients with acute myocardial infarction (AMI) treated with primary PTCA during 6-month follow-up.

Material and methods: Studied group consisted of 47 pts aged 58.3±10.8 yrs,27 with anterior and 20 with inferior AMI subjected to primary PTCA. In no patient RV infarction was diagnosed. Pts with confirmed reinfarction were excluded. All healthy age-matched persons served as controls. In each subject echo study comprising tissue Doppler imaging was performed 3 days, 1 and 6 months after AMI. Analysis of tissue velocity curves included peak systolic velocity (Sm) peak early (Em) and late (Am) diastolic velocity and isovolumic relaxation time (ITRM) obtained from the basal segment of RV free wall as well as from the basal segments of left ventricle (LV).

Results: Initially impaired RV diastolic function improved gradually during the observation which was expressed by Em/Am 1 month and by Em/Am and ITRM 6 months after AMI. The extent of RV diastolic function improvement was associated with concomitant amelioration of global and regional LV diastolic abnormalities, particularly in interventricular septum (IVS) which was evidenced by significant correlations of the decrease in ITRM between examinations after 3 days and 6 months and similar decrease in LV global ITRM and ITRM achieved from IVS as well as the increase in regional Em/Am ratio from (IVS (p=0.60, p<0.01; r=0.69, p<0.05); 0.55, p<0.04 respectively).

No significant changes in RV systolic function parameter - Sm was noted throughout the observation.

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