ORIGINAL RESEARCH PAPER
Volume-9 | Issue-5 | May-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

USEFULNESS OF PULMONARY ARTERY ACCELERATION TIME IN DAY TO DAY PRACTICE- AN OBSERVATIONAL STUDY

Cardiology

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ABSTRACT

BACKGROUND: TRPG is the most commonly used echocardiographic parameter for assessment of PHTN. TRPG is underestimated in up to 40% of patientswhere other parameters like PAT can be useful.
METHODS: In patients with PHTN of various etiologies, various clinical and echocardiographic variables werenoted includingTRPG and PATand analyzed.
RESULTS: 43 patients with mean age of 36.5yearswere enrolled. Mean LVEF was 59.3%(±11.3). Mean TRPG was 40.5mmHg(±25.1) and PAT was 63msec(±13.1). TRPG was underestimated in 48.8% of patients of which two thirds were due to trivial and mild TR jet. Most common etiology was Rheumatic heart disease. Among moderate to severe TR jet(n=14), there was significantcorrelation between TRPG and PAT(Rho -0.60, P=0.022) and correction of PAT with RV Ejection time(PAT/RVET) increased strength of correlation to -0.78(P=0.001). In moderate to severe TR, equation correlating TRPG and PAT was log10(TRPG)= 2.47-(0.01*PAT).
CONCLUSION: Pulmonary artery acceleration time is a useful parameter for echocardiographic assessment of PHTN particularly in those with incomplete TR jet.

KEYWORDS

pulmonary artery acceleration time;pulmonary hypertension

INTRODUCTION:

Pulmonary Hypertension(PHTN) is defined as mean pulmonary artery pressure(mPAP) greater than 25mm Hg at rest as measured by Right heart catheterization (RHC). Tricuspid regurgitation peak gradient (TRPG) is the most commonly used echocardiographic parameter to assess pulmonary hypertension. TR jet is underestimated in up to 40% of the population whereas pulmonary artery acceleration time (PAT) can be assessed with ease in almost all patients.

Both TRPG and PAT assessed by echocardiography are known to correlate well with invasive measures of pulmonary artery pressure by right heart catheterization.The present study is proposed to evaluate the usefulness of PAT in echocardiographic assessment of pulmonary hypertension when TRPG is underestimated due to incomplete TR jet.

MATERIALS AND METHODS:

This is a prospective and observational study done in a tertiary care hospital over a period of 3 months from October 2019 to December 2019. Patients with features of Pulmonary hypertension of various etiologies who were12 years of age or aboveand consented for the study were enrolled in this study.Pulmonary hypertension was suspected by echocardiography when TRPG was more than or equal to36mmHg and/or PAT was less than 105msec.

Aim of the study was to evaluate the usefulness of PAT in assessment of pulmonary hypertension when TRPG was underestimated due to incomplete TR jet. Basic epidemiologic data including age, sex and clinical history were noted. Echocardiographic parameters of LV systolic function, RV function, TR jet, TR peak gradient, Heart rate, RV ejection time and Pulmonary artery acceleration time were noted. Descriptive statistics were expressed in mean and standard deviation. Statistical correlation between variables were done using Pearson correlation. Statistical analysis was done using SPSS v23 software.

RESULTS:

Total of 43 patients with pulmonary hypertension of various etiologies were enrolled in the study of which there were 16 males and 27 females. Mean age of the patients was 36.5years(±17.3). Mean left ventricle ejection fraction was 59.3%(±11.3) and 7 had Right ventricular dysfunction. Mean heart rate was 92 beats/min (±17.1) and all the patients were in sinus rhythm. TRPG was underestimated (<36mm Hg) in 48.8% of patients with pulmonary hypertension in whom PAT was <105 msec. Mean TRPG was 40.5 mm Hg (±25.1) and PAT was 63 msec (±13.1).

Most common etiology was Rheumatic heart disease(n=12), followed by Atrial septal defect (n=10), Ventricular septal defect (n=6), Eisenmenger syndrome(n=4), acute pulmonary embolism(n=2), Chronic Thromboembolism related Pulmonary hypertension (n=2), post Mitral valve replacement(n=2), Cardiomyopathy(n=2), Mitral valve prolapse MR (n=1) andIdiopathic Pulmonary hypertension (n=2).

Among those with trivial TR jet(n=8), TRPG was underestimated in 75% of patients, mean PAT was 61.6msec (±14.1) and TRPG was 26.2 mm Hg (±13.1) with Pearson correlation (Rho) of 0.11(P=0.796). Among mild TR jet(n=21), TRPG was underestimated in 61.9% of patients, mean PAT was 65.5msec (±13.2) and TRPG was 32.5 mm Hg mm Hg (±11.2) with Rho of -0.17(P=0.473).

Among moderate to severe TR jet(n=14), TRPG was underestimated in only 14.3% of the patients, mean PAT was 60.1 msec (±12.5) and TRPG was 60.5 mm Hg (±33.1) with Rho of -0.60(P=0.022) which was statistically significant and correction of PAT with RV Ejection time (PAT/RVET) increased strength of correlation to 0.78 (P=0.001).In moderate to severe TR jet, the logarithmic regression equation correlating TRPG and PAT in this subgroup was log10(TRPG)= 2.47-(0.01*PAT).

Table 1: Baseline Characteristics of patients:

Characteristics (n= 43)	MEAN	SD
Age (years)	36.5	17.3
LV Ejection Fraction %	59.3	11.3
TAPSE (mm)	18.9	5.0
RV S' (cm/s)	11.6	2.9
TR peak gradient (mm Hg)	40.5	25.1
Heart rate (beats per minute)	92	17.1
Pulmonary artery Acceleration time (PAT) msec	63	13.1
RV Ejection time (RVET) msec	283.6	37.2
PAT/RVET	0.22	0.03

Table 2: Comparison of PAT and TRPG between Trivial, mild and moderate to severe Tricuspid regurgitation jet.

TR JET	No	PAT (msec) Mean+SD	TRPG (mm Hg) Mean+SD	PAT vs TRPG Pearson correlation Rho (P value)	(PAT/RVET) vs TRPG Pearson correlation Rho (P value)
TRIVIAL TR	8	61.6 + 14.1	26.2 + 13.1	0.11 (0.796)	-0.18 (0.679)
MILD TR	21	65.5 + 13.2	32.5 + 11.2	-0.17 (0.473)	-0.25 (0.271)
MODERATE TO SEVERE TR	14	60.1 + 12.5	60.5 + 33.1	-0.60 (0.022)	-0.78 (0.001)

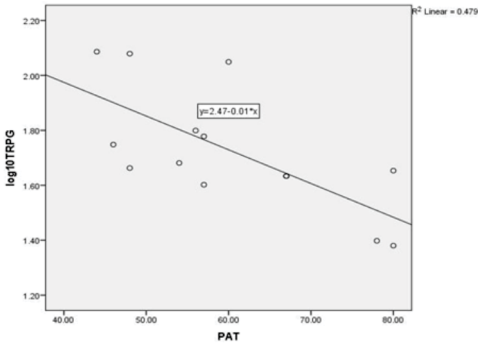

Figure 1: Scatterplot showing relationship between log10(TRPG) and PAT in patients with moderate to severe TR jet. Log_{10}TRPG= 2.47- (0.01*PAT)

DISCUSSION:

PAT is a useful echocardiographic tool for detection of pulmonary hypertension and is known to correlate well with mean pulmonary artery pressure measured from right heart catheterization.[1,2,3] Concept of increased flow acceleration in RVOT in pulmonary hypertension was first demonstrated by kitabatake et al in 1983.[4] PAT has a sensitivity of 84% and specificity of 84%. The sensitivity and specificity remained the same when measured in RVOT, main pulmonary artery or right pulmonary artery.[5] TR jet was found to be incomplete in up to 40% of population in many studies and hence TRPG may underestimate pulmonary hypertension.[5,6] In our study it was underestimated in 48.8% of patients.

Present study evaluated the usefulness of PAT when TRPG was underestimated due to incomplete TR jet. In patients with trivial and mild TR jet, TRPG was underestimated in 75% and 61.9% respectively and there was no significant correlation between PAT and TRPG. Whereas in patients with moderate to severe TR jet, TRPG was underestimated in only 14.3% of the patients and significant correlation of TRPG with PAT was found in patients with moderate to severe TR jet(Pearson correlation of -0.60, P- 0.022). Correction of PAT with RVET (PAT/RVET) in moderate to severe TR jet significantly increased the strength of correlation to -0.78 (P- 0.001). In moderate to severe TR jet, logarithmic regression equation describing TRPG and PAT was log10(TRPG)= 2.47-(0.01*PAT). Similar relationship was established between TRPG and PAT in various studies.[7,8,9]

Limitations of our study wasother echocardiographic variables were not included in this study andabsence ofinvasive hemodynamic measurements of pulmonary artery pressuresfor comparison of echocardiographic variables in the assessment of pulmonary hypertension.

CONCLUSION:

PAT is a relatively simple tool for assessment of pulmonary hypertension with special significance in patients where TR jet is incomplete. Incorporation into routine practice is less time consuming and more precise for assessment of pulmonary hypertension.

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