



**A STUDY TO EXPLORE CORRELATION BETWEEN TRANSPULMONARY GRADIENT AND PULMONARY ARTERY SYSTOLIC PRESSURE FOR IDENTIFICATION OF RIGHT HEART DYSFUNCTION. A PROSPECTIVE OBSERVATIONAL STUDY**

**Anaesthesiology**

<b>Dr Kangkan Sharma</b>	DM Student, Department of Cardiac Anaesthesiology, NRS Medical College, Kolkata
<b>Dr Haripada Das*</b>	Professor and HOD, Department of Cardiac Anaesthesiology, NRS Medical College, Kolkata *Corresponding Author
<b>Dr Sampa Dutta Gupta</b>	Professor and HOD, Department of Cardiac Anaesthesiology, NRS Medical College, Kolkata
<b>Dr Aditi Das</b>	Senior Resident, Department of Cardiac Anaesthesiology, NRS Medical College, Kolkata
<b>Dr Soumyadip Pal</b>	Senior Resident, Department of Cardiac Anaesthesiology, NRS Medical College, Kolkata
<b>Dr Tulip Jana</b>	DM Student, Department of Cardiac Anaesthesiology, NRS Medical College, Kolkata
<b>Dr Lini Srivastava</b>	DM Student, Department of Cardiac Anaesthesiology, NRS Medical College, Kolkata
<b>Dr Shabahat Ali Siddiqui</b>	DM Student, Department of Cardiac Anaesthesiology, NRS Medical College, Kolkata
<b>Dr Animesh Makal</b>	Tutor, Department of Cardiac Anaesthesiology, NRS Medical College, Kolkata

**ABSTRACT**

A total of 86 moderate to severe mitral stenosis (MS) patients with tricuspid annular plane systolic excursion (TAPSE) less than 18mm were evaluated for transpulmonary gradient (TPG) and pulmonary artery systolic pressure (PASP) with an aim to explore the best option among them for assessment of right ventricular dysfunction. TAPSE is an well established marker of RV dysfunction. A TAPSE of less than 18mm would lead to a diagnosis of RV dysfunction. It was revealed that TPG does not have a good correlation with PASP (r value 0.28). Therefore to conclude that the TPG and PASP have mild correlation in predicting right ventricular function.

**KEYWORDS**

TPG, TAPSE, PASP

**1. Introduction:**

Reactive pulmonary hypertension (PH) accompanying left-sided heart valve disease has long been recognized as a risk factor for early and late mortality after surgery [1,2]. Although this PH is simply considered secondary to right ventricular (RV) dilatation in response to left-sided events and is usually referred to as "functional," its cause remains uncertain. [3,4] We hypothesized that left-sided events resulting in PH also lead to RV dysfunction. If true, recognizing this has important implications for choice of procedure, and to predict and manage postoperatively. Therefore, the objectives of this study was to correlate the degree of PH with clinical indicators of right-sided heart failure and both qualitative and quantitative measures of right-sided heart function in patients with mitral valve disease.

TAPSE is an well established marker of RV dysfunction. A TAPSE of less than 18mm would lead to a diagnosis of RV dysfunction. [6,7] We tried to explore the correlation of TPG and PASP to better explore the options of a simple, effective and non-invasive diagnostic tool for identification of right heart dysfunction.

**Aims and objectives:**

To explore the correlation between TPG and PASP for identification of right heart dysfunction.

**2. MATERIAL AND METHODS:**

This Prospective observational study was carried out in Cardiothoracic and Vascular surgery (CTVS) OT of a tertiary care superspecialty OT from March 2018 to August 2019.

Mitral valve stenosis patients posted for mitral valve replacement (MVR) were the study population for this research work. Sample size was calculated from a pilot study with 10 patients to find out the correlation of PASP and TPG. It was found to be 90% in each group. With the above information it was calculated that 86 subjects will be required to define this proportion with 5% margin of error and 95% confidence level.

Patients aged between 20 to 65 years, both sex; moderate to severe MS; patients undergoing MVR with mechanical prosthetic valve were included.

Patients with other respiratory or cardiac problems (like COPD, bronchial asthma, pulmonary tuberculosis (TB), lung malignancy, lung fibrosis or collapse, bronchiectasis, pleural effusion, pleural tumours, primary PH, other valvular heart disease, congenital heart disease, pericardial disease, coronary artery disease, acute or recent exacerbation of pulmonary hypertension, were excluded from this study.

PASP, TAPSE, TPG, Body surface area (BSA), Heart rate (HR), Central venous pressure (CVP), Cardiac output (CO), Oxygen saturation (SpO<sub>2</sub>%) in room air, Partial pressure of oxygen (PaO<sub>2</sub>) in room air, Haematocrit before bypass (HCT) were the study variables.

ECG, IBP, SPO<sub>2</sub> probe, ETCO<sub>2</sub>, CVP, CO monitoring by continuous CO monitor EV 1000, TTE (Vivid™ E 95) were continuously monitored and recorded

After obtaining institutional ethics committee clearance and informed consent from a total of 86 moderate to severe MS patients undergoing MVR with TAPSE <18 mm were allocated in this study population. [6,7]

After receiving the patients in OT, attaching all the standard monitors following institution of arterial and central line. EV1000 for cardiac output monitoring attached. Thereafter anesthesia was performed according to institutional practice. A multilumen internal jugular catheter was inserted for measurement of CVP and for fluid/medication administration after intubation, anaesthesia and monitoring maintained as per institutional protocol thereafter.

Before incision final preoperative evaluation of TPG and PASP were done by transthoracic probe of VividTME 95/ Version 202/ model no. GE 000500. This was the end point of this study

Thereafter MVR was performed on cardiopulmonary bypass according to standard protocol. After completion of procedure patients were shifted to ITU with proper monitoring.

**STATISTICS:** All data were entered into an excel spread sheet and were analyzed using standard statistical software like SPSS and Statistica 17.0 software. Pearson r correlation was used to measure the degree of the relationship among the variables. r value .2-.4 mild, .4-.7 moderate and >.7 strong is considered.

**3.RESULTS -** A total of 86 consecutive patients with TAPSE <18 posted for mitral valve replacement surgery were included in this prospective study.

**Table : 1 Demographic parameters in the study population**

Serial no	parameter	value
1	Age(years)	37.67±11.28
2	Sex(male:female)	29:57
3	BSA(mean±SD)	1.47±0.12
4	ASA IV	86
5	HCT	38±2.84
6	SPO2	95.29±1.19
7	PaO2	81.5±6.5
8	CO	3.85±0.32
9	HR	78.66±6.08
10	SBP	106.97±14.27
11	CVP	12.39±2.37

**Table : 1 shows, mean ±SD of all the demographic parameters  
Table : 2 Correlation between TAPSE TPG and PASP (r VALUE)**

Parameters	R value
TPG&PASP	0.28

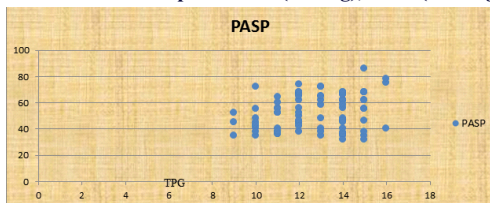
**Table : 2 shows the values tested by Pearson correlation coefficient. mild positive correlation between TPG & PASP (0.28).**

**Table : 3 Shows TPG>12 in both the genders**

gender	male	female
number	8/29	38/57
percentage	28	67

**Table : Show that the percentage of mixed pulmonary hypertension (TPG>12 ) is more in females than males.**

**Figure : 1 Shows scatterplot of TPG(mmHg), PASP ( mm Hg)**



Shows mild positive correlation exists between TPG and PASP

**4.Discussion:** Most patients of valvular heart disease show significant decrease in pulmonary artery pressure after relief of valve stenosis. Though, persistent or residual PH is observed in many patients even after successful relief of mitral valve obstruction by surgical MVR. Therefore preoperative prediction for postoperative pulmonary hemodynamic following valve replacement is important in isolated mitral stenosis patients as well as in patients with isolated cause of right ventricular dysfunction or pulmonary vascular disease, which may complicate the clinical scenario. Besides the presence of fixed component of PH, other factors like patient-prosthesis mismatch are responsible for the persistence of PH even after therapeutic intervention.<sup>[9]</sup>

TAPSE is a surrogate marker for RV function using M-mode on TTE.As the RV dilates and function declines, the movement of tricuspid annulus decreases per cardiac cycle. [12,13,14]

TPG is defined as mPAP minus PCWP and the PVR is calculated as TPG divided by the cardiac output. When TPG and PVR are elevated in PH due to left heart disease, patients necessarily have an elevated

mPAP as a consequence of elevated PCWP in addition to structural abnormalities of the pulmonary vasculature.

The aim of this study was to find out the best option among TPG and PASP for assessment of RV dysfunction which is not only for preoperative assessment but also will be helpful in serial assessment of right ventricular function postoperatively i.e after valve replacement.

In the present study we evaluated 86 patients with moderate to severe MS with TAPSE value less than 18 mm. All the patients were posted after optimization with preoperative SPO2, PaO2, CO, HR,SBP, CVP within normal range as shown in Table : 1 as demographic parameters.

Final evaluation immediately before skin incision revealed that, all three echocardiographic findings with values deviated from normal range when the value of TAPSE was 15.5±1.58 ; TPG was 12.7±1.85 and PASP was 53.3±13.23 .

It was also revealed that TPG does not have a good correlation with PASP(r value 0.28).

As shown in Table 3 incidence of out of proportion (TPG>12) is more in female ie,67% than male28%.This is similar to the study done by Hondoko and co-workers and the study done by Hart SA and co-workers. [15,18] Hondoko and coworkers found the incidence of PH due to left heart disease in female to be 72%. [15] Hart SA and coworkers found that female were five folds more prone to develop high TPG than males(p value = 0.003). [18]

This is to mention that postcapillary (elevated PCWP>15 mmHg) PH is a defining feature of PH for left heart disease. A potentially more useful classification might include passive, reactive and mixed PH, which takes into account the presence or absence of pulmonary vascular disease. Though severity of pathology of left heart disease may be enhanced by systemic inflammation reaction from CPB. WHO classification of pulmonary hypertension relies on the TPG and the PVR. [9,12] In our study we have found mean TPG value 12.7 ±1.85. It indicates that there may be presence of mixed variety of pulmonary hypertension. even before cardiopulmonary bypass in mitral valve replacement surgery.

Both TPG and DPG (pulmonary artery diastolic pressure minus PCWP) depend equally on PAWP, and that both depend on CO, and in terms of percentage even similarly in PAWP between 1 and 31 mmHg. Depending on this reference study ,we chose TPG instead of DPG. [15]

The severity of PH is classified by Doppler echocardiography based on estimated PASP . A TPG < 12 mm Hg defines passive PH and TPG ≥ 12 mm Hg defines reactive PH.[10,11] the present study also revealed the same result.

RV function has significant role in increasing postoperative morbidity and mortality. If the underlying pathology is predominantly in the pulmonary arterioles and small pulmonary arteries, PH is termed as pre-capillary.[8] If the underlying cause of raised pulmonary artery pressure(PAP) is left heart disease(LHD),PH is termed as post-capillary PH (Ipc-PH).[9] By definition, in Ipc-PH the raised PAP is passive meaning there is no intrinsic pathology in pulmonary circulation so as to maintain forward flow in response to elevated left sided filling pressures. However in some of these patients chronic passive elevation of pulmonary artery pressure leads to pathologic changes in the small pulmonary arteries and arterioles such that the process is no longer passive. The raised PAP in these cases becomes combined: elevated left sided filling pressures and intrinsic pulmonary vascular disease termed combined post-capillary and pre-capillary PH (Cpc-PH).[9]

**5.CONCLUSION :** Therefore to conclude that, the TPG and PASP have mild correlation in predicting right ventricular function.

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