

Right Ventricular to Pulmonary Circulation Uncoupling is Associated with Impaired Left Ventricular and Left Atrial Strain in Patients with Degenerative Mitral Regurgitation

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BACKGROUND

The coupling between right ventricular (RV) function and the pulmonary circulation (Pc) emerged recently as a prognostic index in patients affected by degenerative mitral regurgitation (DMR) undergoing surgical or percutaneous repair. In this context, the deterioration of Left Ventricular (LV) and Atrial (LA) dynamics favors the development of pulmonary venous congestion and vascular remodeling, triggering pulmonary hypertension (PH) and right ventricular (RV) dysfunction. However, the prevalence of pulmonary circulatory right ventricular uncoupling in patients undergoing surgery for DMR and its relationship with LV and LA functioning has poorly been investigated.

Table 1.

Baseline characteristics	Admission
Age (ys)	54±14
Male sex (%)	65
Hospital stay (days)	11±8
LAVi (ml/m ²)	49±10
GPALS (%)	26±13
LVEF (%)	63±6
GLS (%)	-12.2±4
LV EDVi (ml/m ²)	70±20
TAPSE/PAPS (mm/mmHg)	0.84±0.2

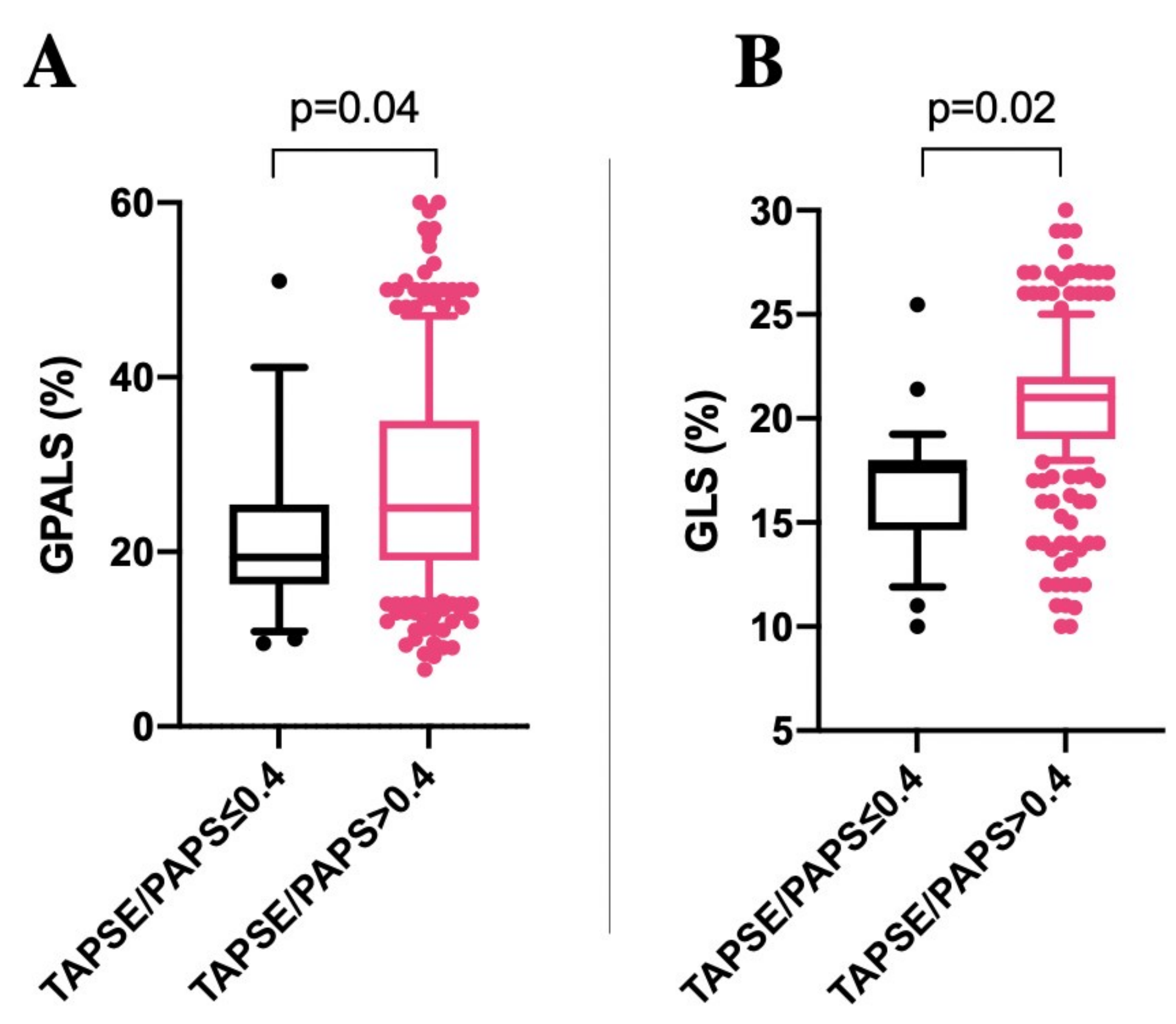


Figure 1. Panel A. Box and whiskers showing the difference in terms of LA strain according to TAPSE/PAPS ratio. Panel B. Box and whiskers showing the difference in terms of GLS according to TAPSE/PAPS ratio.

PURPOSE

The aim of the study was to investigate the prevalence of RV-to-Pc uncoupling, assessed by the ratio between tricuspid annular plane systolic excursion (TAPSE) to pulmonary artery systolic pressure (PASP) and its association with LV and LA strain in a cohort of patients with DMR undergoing cardiac surgery.

METHODS

We retrospectively enrolled 390 patients with DMR who were evaluated for cardiac surgery at San Raffaele Hospital and underwent a complete transthoracic and transesophageal echocardiography. We then stratified patients by noninvasive TAPSE/PASP ratio at baseline as follows: Group 1: <0,40 mm/mmHg; Group 2: ≥0,40 mm/mmHg and correlated it with LV and LA strain. LA function was evaluated analyzing LA strain at peak relaxation (Global peak atrial longitudinal strain), while LV longitudinal systolic function was studied with Global Longitudinal Strain (GLS). Speckle tracking echocardiography was performed offline, and all patients were in sinus rhythm.

RESULTS

A total of 390 eligible patients (mean age 54±14 y, 65% male) who were admitted for mitral valve surgery at San Raffaele hospital (85% repair, 15% replacement) for hemodynamically significant DMR were retrospectively enrolled from January 2019 to June 2022. Mean hospital stay was 11±8 days. At baseline, only 30% of the cohort exhibited normal left ventricular (LV) and left atrial (LA) size and function, with the majority of the cohort exhibiting increased LA dimension (mean LAVi at admission 49±10 ml/m²) (**Table 1**).

When divided into two groups according TAPSE/PAPS ratio, similar clinical baseline characteristics were found. However, patients with lower TAPSE/PAPS (<0.4 mm/mmHg) exhibited significantly lower values of Global Longitudinal Strain (Group I: GLS -17±7% vs Group II: GLS -22±8%; p=0.02) and lower LA reservoir strain (group I: GPALS 22.7±11.3% vs group II GPALS 27.8±12.7%; p=0.04) (**Figure 1, Figure 2**). Additionally, a direct correlation between LA-Strain values and TAPSE/PAPS ratio was noticed (r=0.3, CI 95% 0.21-0.5; p<0.001).

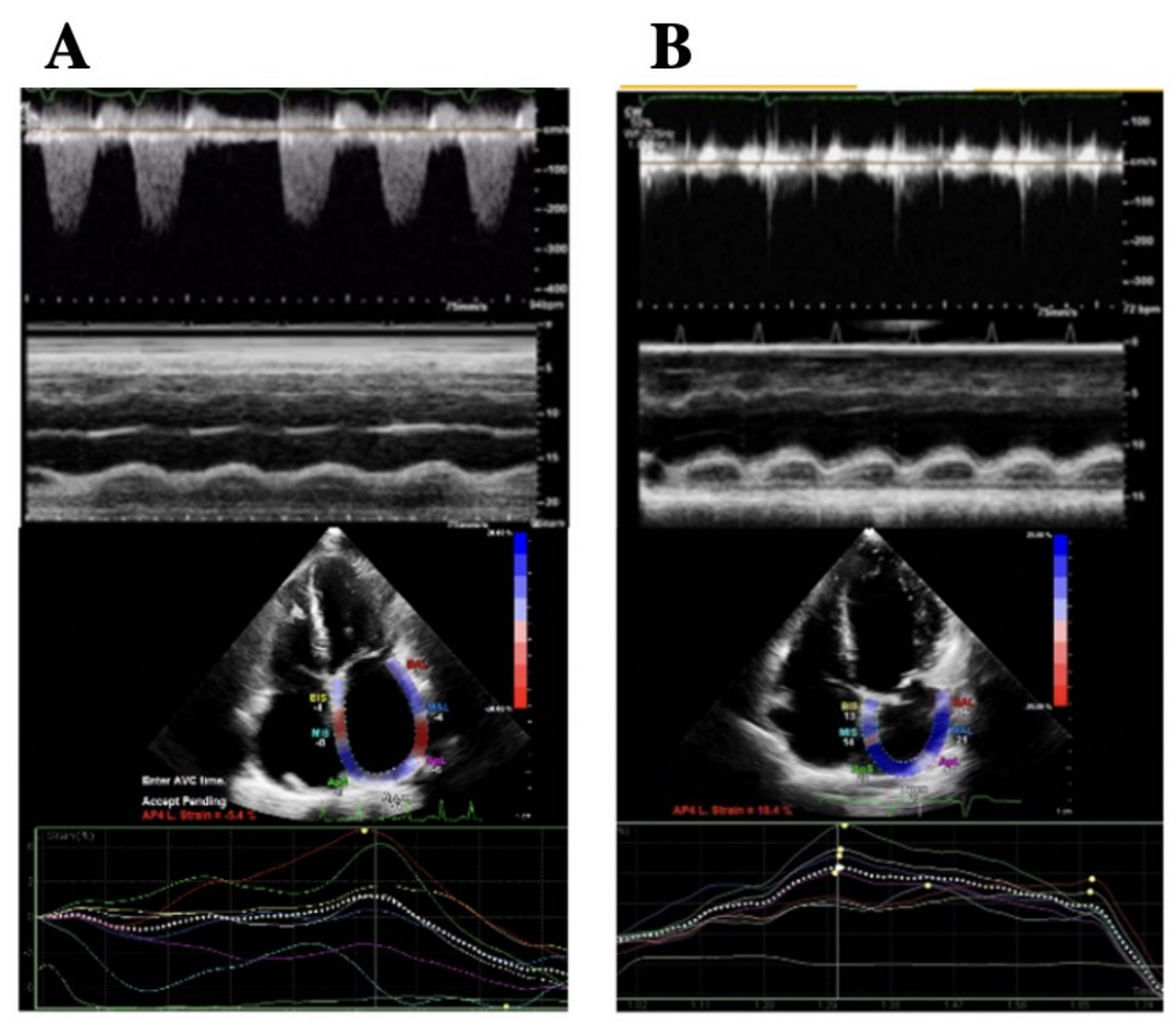


Figure 2. Panel A Representative case of a patient in Group I (TAPSE/PAPS ≤ 0.4 mm/mmHg, reduced LA strain, reduced GLS) Panel B Representative case of patient in Group II (TAPSE/PAPS > 0.4 mm/mmHg, increased LA strain, increased GLS);

CONCLUSIONS

In DMR, there is a strong association between echo-derived measures of LA and LV mechanics and RV to Pc uncoupling, with higher values of LA strain and GLS correlating with a better RV functioning and coupling. These results, although preliminary, suggest the importance of a multiparametric approach in the risk-stratification of these patients, potentially improving the long-term outcome.