

Presence and significance of mid-systolic notch on right ventricular outflow tract velocity envelopes in pulmonary hypertension due to heart failure

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Background: A mid-systolic notch (MSN) of the right ventricular outflow tract (RVOT) pulsed-wave Doppler envelope, which is recognized as a characteristic finding in pre-capillary pulmonary hypertension (PH), is often observed in heart failure (HF) patients. However, clinical significance of MSN formation in HF has not been elucidated.

Methods: Consecutive 233 HF patients who underwent right heart catheterization and echocardiography within 24 hours were enrolled. Isolated post-capillary PH (IpcPH) was defined as mean pulmonary arterial pressure (mPAP) >20 mmHg, mean pulmonary artery wedge pressure (mPAWP) >15 mmHg, and pulmonary vascular resistance (PVR) <3 Wood units and combined pre- and post-capillary PH (CpcPH) was as mPAP >20 mmHg, mPAWP >15 mmHg, and PVR ≥3 Wood units. Pulmonary arterial capacitance (PAC) was calculated as stroke volume / pulmonary arterial pulse pressure [mL/mmHg]. MSN was defined as formation of notch within first half of the RVOT pulsed-wave Doppler envelope.

Results: Prevalence of IpcPH, CpcPH, and without PH were 87 (37%), 45 (19%), and 101 (43%), respectively and MSN was observed in 8 (9%) of IpcPH, 17 (38%) of CpcPH, and 1 (1%) of patients without PH. Among the hemodynamic and echocardiographic parameters, mPAP and PAC independently determined occurrence of MSN in all the multivariable models (Table). Interestingly, when the PH patients were dimidiated according to median PAC (3.2 mL/mmHg), 25 out of 102 PH patients (25%) with low PAC showed MSN whereas any of PH patients with high PAC did not (Figure).

Conclusion: MSN was frequently observed in HF patients showing CpcPH. Combination of elevated pressure and reduced compliance of the pulmonary circulation could determine occurrence of MSN in HF.

Determinants of MSN occurrence

	Univariable analysis		Multivariable analysis							
	Model 1		Model 2		Model 3		Model 4			
variables	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
LV ejection fraction	0.97 (0.94-0.99)	0.007	1.00 (0.96-1.03)	0.795						
LV mass index	1.00 (1.00-1.02)	0.143								
PAW pressure	1.13 (1.08-1.18)	<0.001			0.92 (0.82-1.03)	0.135				
Mean PA pressure	1.14 (1.09-1.19)	<0.001	1.08 (1.02-1.14)	0.006	1.15 (1.04-1.27)	0.004	1.08 (1.00-1.17)	0.030	1.07 (1.01-1.14)	0.025
Mean RA pressure	1.14 (1.06-1.22)	<0.001					1.00 (0.90-1.11)	0.978		
Pulmonary vascular resistance	1.97 (1.45-2.67)	<0.001							1.20 (0.88-1.63)	0.225
Pulmonary arterial capacitance	0.27 (0.15-0.48)	<0.001	0.49 (0.26-0.92)	0.010	0.44 (0.23-0.85)	0.004	0.47 (0.24-0.93)	0.011	0.49 (0.26-0.93)	0.011

Abstract Figure.

