The ultimate pulsus paradoxus: failure of aortic valve opening with inspiration

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A 45-year-old female with a history of breast cancer presented with dyspnoea and fatigue. On physical examination, the radial pulse disappeared with inspiration. Transthoracic echocardiography demonstrated a large pericardial effusion (PE) (see Supplementary data online, Videos S1) with features of cardiac tamponade. Right atrial compression (see Supplementary data online, Videos S2) and right ventricular (RV) diastolic collapse (see Supplementary data online, Videos S3) were present with masses noted on the visceral pericardium suggestive of metastasis (see Supplementary data online, Videos S4). M-mode echocardiography showed an increase in the RV size, decrease in the left ventricular (LV) size and marked decrease in mitral valve opening with inspiration (Panel A). The aortic valve (AV) failed to open with inspiration (Panel B) and this was associated with the absence of flow in the descending thoracic aorta (Panel C). Transmitral Doppler demonstrated marked inspiratory decrease of flow velocity and duration (Panel D) with opposite findings across the tricuspid valve (Panel E).

Cardiac tamponade is characterized by significant inspiratory decrease in LV filling with subsequent drop in stroke volume resulting in pulsus paradoxus. The amplitude and duration of AV opening correlate with the blood flow across the valve. Failure of the AV to open in systole reflects a marked decrease in diastolic LV filling across the MV. This leads to precipitous reduction in LV ejection and stroke volume resulting in the lack of flow across the AV. In addition to cardiac tamponade, inspiratory failure of AV opening could be encountered in other conditions including pulmonary embolism. In the absence of a premature beat or irregular rhythm, this sign is a strong evidence of severe pulsus paradoxus.

Supplementary data are available at European Heart Journal – Cardiovascular Imaging online.

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