The swinging heart: Cardiac alternans and right ventricular collapse in classic tamponade

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A 63-year-old man with tonsillar squamous cell cancer presented with a six-day history of progressive dyspnea. His physical examination revealed tachycardia (heart rate of 118 beats/min), tachypnea (respiratory rate of 30 breaths/min), hypotension (blood pressure of 94/68 mmHg) and pulsus paradoxus (22 mmHg). The jugular veins were distended and his heart sounds were distant. His electrocardiogram demonstrated electrical alternans and diffuse ST segment elevation and PR depression, while his chest x-ray revealed a markedly enlarged cardiac silhouette. A very large pericardial effusion was noted on transthoracic echocardiography, with diastolic compression of the right ventricle and resultant under-filling of the left ventricle (Figure 1A). Concomitant electrocardiographic tracings also revealed electrical alternans resulting from the pendular motion of the heart to and away from the chest wall (Figure 1B).

The term electrical alternans remains a misnomer in the setting of pericardial effusions. True electrical alternans is associated with abnormal conduction by Purkinje fibres or ventricular myocardium. In large pericardial effusions, so-called electrical alternans results from the pendular motion of the heart within the enlarged pericardial sac; this motion changes the anatomical relation of the heart to the recording electrodes. A mechanical component has also been suggested as a potential cause in this setting. Ventricular compression by pericardial fluid impairs diastolic filling, which results in decreased stroke volume and reduced ventricular emptying via the Frank-Starling mechanism. As a result, there is an increase in end-diastolic volume during the next cardiac cycle, leading to an augmentation of stroke volume and ventricular emptying. This alternation enables the perpetuation of mechanical alternans, which reinforces the classical finding of alternans due to cardiac motion in the setting of tamponade (1).

REFERENCE

1. Surawicz B, Fisch C. Cardiac alternans: Diverse mechanisms and clinical manifestations. *J Am Coll Cardiol* 1992;20:483-99.

Figure 1) Transthoracic echocardiography revealing a very large pericardial effusion. **A** Diastolic compression of the right ventricle (open arrow) and resultant under-filling of the left ventricle (solid arrow). **B** Concomitant electrocardiographic tracings revealing electrical alternans resulting from the pendular motion of the heart to and away from the chest wall (double-tipped arrow)

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