

Echocardiographic Features and Cardiac Motion in Electrical Alternans

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ABSTRACT. A 54-year-old female with adenocarcinoma of the lung developed cardiac tamponade. An electrocardiogram revealed electrical alternans of QRS complex. An echocardiogram demonstrated a large pericardial effusion and pendulous motion of the left atrium as well as of the left ventricle.

Echocardiographic features of cardiac tamponade and mechanism of electrical alternans were also discussed.

Key words : Pericardial effusion — Cardiac tamponade — Electrical alternans

Echocardiography is a sensitive, non-invasive technique for the evaluation of pericardial effusion.¹⁾

With a large amount of effusion the heart may swing within the pericardial sac, and this phenomenon has been shown to be related to the production of electrical alternans on the electrocardiogram (ECG).²⁻⁴⁾ The purpose of this report is to show an echocardiogram demonstrating a pendulous motion of the left atrium (LA) as well as of the left ventricle (LV) in electrical alternans.

CASE REPORT

A 54-year-old woman was admitted with the chief complaints of cough and progressive shortness of breath over a 6 months-period, and she was diagnosed as having an adenocarcinoma of the lung.

On physical examination she was well nourished and normally sized, with no cyanosis or clubbed fingers. Her pulse was regular and 114/minute. On auscultation heart sounds were muffled and distant, but no murmur or pericardial friction rubs were present. There were dullness to percussion and diminished breath sounds over the lower half of the right hemi-thorax. The liver was palpable 4 cm below the right costal margin.

A chest X-ray film showed generalized enlargement of the cardiac silhouette and pleural effusion (Fig. 1). The electrocardiogram revealed non-specific T-wave change, relative low voltage and electrical alternans of QRS complex (Fig. 2).

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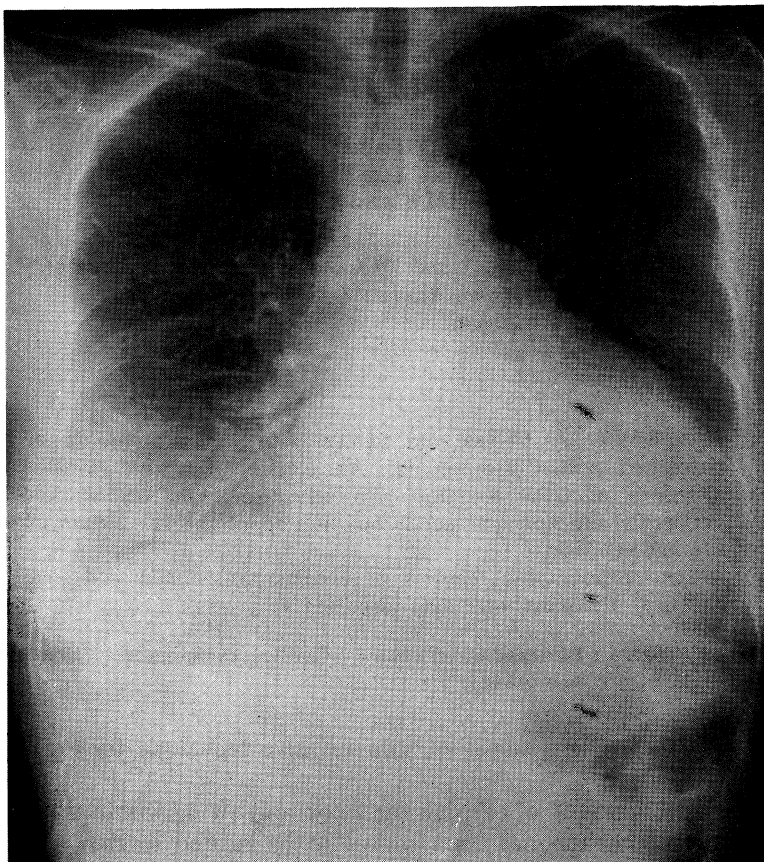


Fig. 1. Chest X-ray film on admission demonstrating an enlargement of the cardiac silhouette, suggesting pericardial effusion and pleural effusion.

An echocardiogram demonstrated the presence of a large pericardial effusion (Fig. 3A-C). Both the anterior and posterior heart walls showed a large anterior-posterior swinging. The two heart walls moved in the same direction rather than toward each other, the frequency of which was half that of the pulse (Fig. 3B, C). In addition the echo of the aortic root and the LA demonstrated swinging and pendulous motion of the LA as well as of the LV (Fig. 3C).

Because the patient's condition deteriorated clinically with cardiac tamponade, a pericardiocentesis was performed with removal of 800 cc of hemorrhagic pericardial fluid. The patient improved clinically, immediately upon its removal, with the disappearance of both electrical alternans and pericardial effusion.

DISCUSSION

Electrical alternans is occasionally noted in patients with large pericardial effusion.⁴⁻⁶ The mechanism that the production of electrical alternans of QRS complex is synchronous with and due to pendulous motion of the heart within the fluid-filled pericardial sac has been confirmed by echocardiographic,²⁻⁴

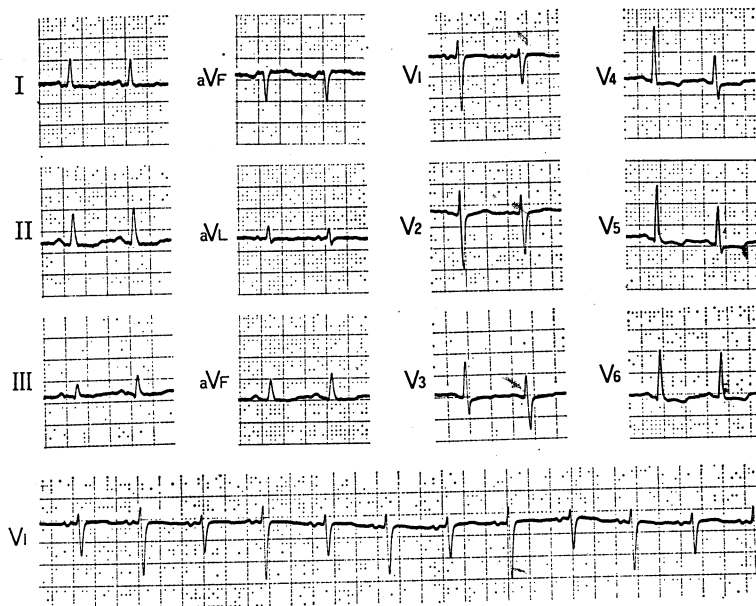


Fig. 2. Electrocardiogram showing electrical alternans of QRS complex.

cineangiographic⁷⁾ and operative observations.⁸⁾

Although pendulous motion of the LV, which is the echocardiographic correlate of QRS alternating, has been well described,²⁻⁴⁾ few previous reports of pendulous motion of the LA in electrical alternans have been described.⁹⁾ Sotolongo and associates reported that previously undescribed LA motion (pendulous motion) accounted for alternation of the P-wave along with the QRS complex in a patient with cardiac tamponade.⁹⁾ They noted that the standard precordial ECG leads showed QRS alternations, and only with the aid of a bipolar chest lead (Lewis lead), total electrical alternans was clearly evident.

Though in our patient, electrical alternans of only QRS complex was recorded in standard 12-lead ECG, pericardial effusion behind the LA and pendulous motion of the LA could be demonstrated on echocardiogram, as described by Sotolongo and associates.⁹⁾

It has been considered that fluid behind the LA theoretically cannot be pericardial effusion because at that level, the pericardium is tightly bounded to the LA wall.¹⁰⁾ For this reason, fluid behind the LA on echocardiogram has been regarded as pleural effusion. But a recent report demonstrated that an echo-free space behind the LA may be noted in large pericardial effusion.¹¹⁾

Therefore, when cardiac tamponade is suspected, it would be worthwhile to observe pendulous motion of the LA carefully and to obtain a Lewis lead in attempt to demonstrate total electrical alternans.

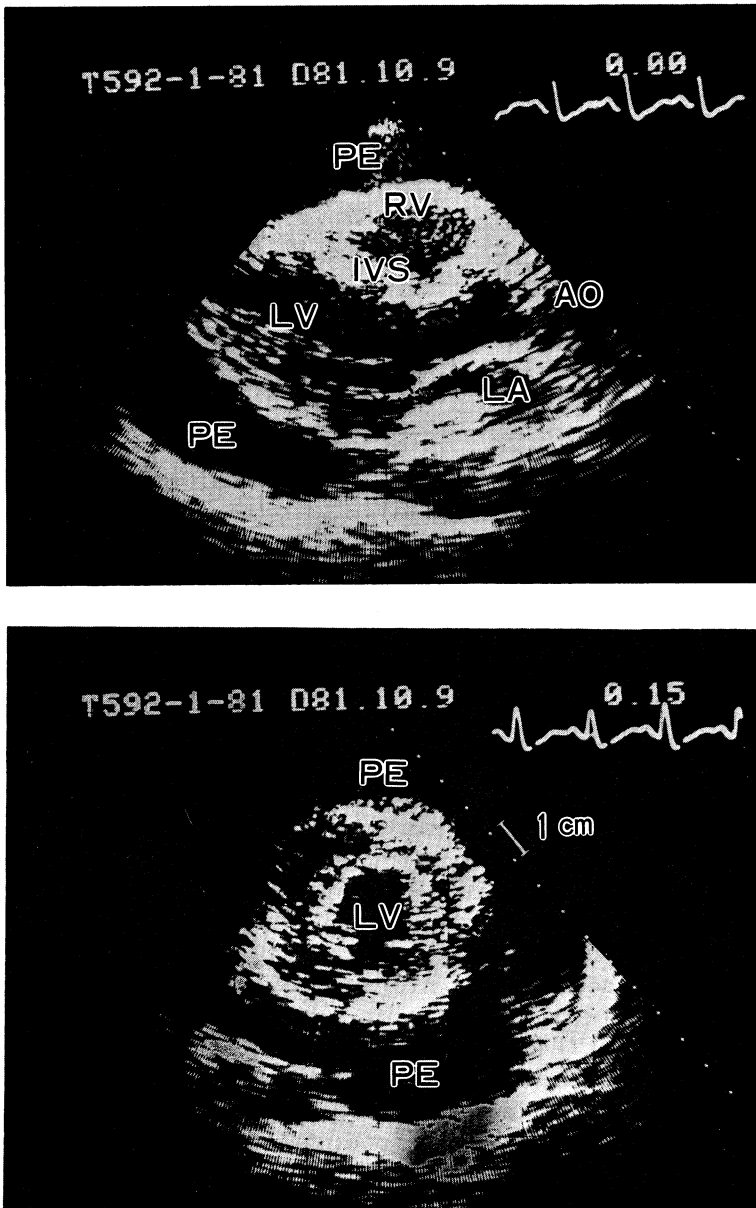
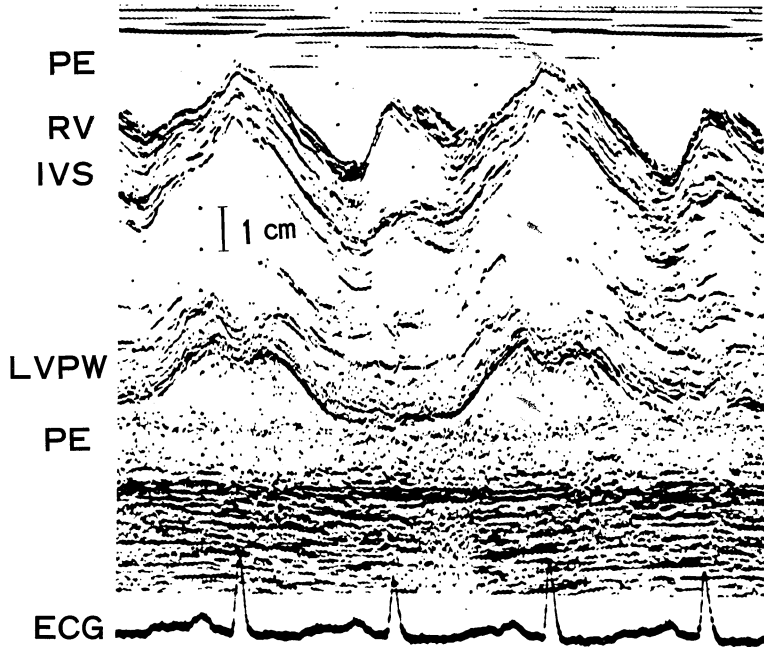
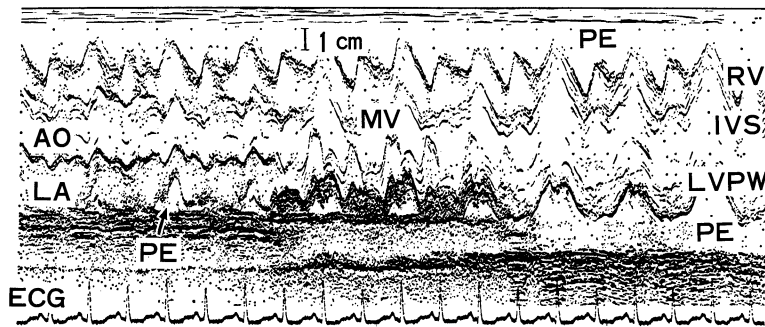


Fig. 3. A : Two-dimensional echocardiogram demonstrating a large pericardial effusion. Upper : long axis view, Lower : short axis view



B : M-mode echocardiogram showing large anterior and posterior echo-free spaces (pericardial effusion). The anterior and posterior walls of the heart are moving synchronously with each heart beat. Electrical alternans corresponding to abnormal anterior-posterior heart motion can be clearly identified. Paper speed=50 mm/s.



C : M-mode sector scanning from the aortic root and the left atrium to the left ventricle, showing pericardial effusion behind the left atrium, and pendulous motion of the left atrium as well as the left ventricle. Paper speed=25 mm/s. The echocardiograms were performed with a Toshiba SSH-11A instrument using standard techniques and a 2.25 MHZ focused transducer was used. AO ; aortic root, MV ; mitral valve, LA ; left atrium, RV ; right ventricle, IVS ; interventricular septum, LVPW ; left ventricular posterior wall, PE ; pericardial effusion, ECG ; electrocardiogram.

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