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Letter to the Editor
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The Electromechanical Association Artifact with Limb Leads Electrodes Placed upon the Torso

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INTRODUCTION

"Electromechanical association artifact" is a special type of artifact that can mimic myocardial infarction, electrolyte abnormalities, arrhythmias, and abnormal T-waves.[1,2] This type of artifact is surprisingly common in clinical practice and even in scientific literature, but not easy to recognize.[1-3] It can occur with both self-adhesive and clip-cuff electrodes,[1-3] but the reported cause of the pulsation was always distal extremity arteries to date (e.g., radial or posterior tibial artery). I would like to report a case in whom a limb electrode applied to the chest according to Mason-Likar system was the source of artifact.[4]

CASE

A 56-year-old male with known coronary artery disease was admitted to our outpatient clinic for routine follow-up. He was asymptomatic, but his first electrocardiogram (ECG) was as shown in Figure 1A. Although the attending physician concerned about ischemia at first glance, he also suspected an artifactual cause and ordered a repeat ECG. The second ECG was as shown in Figure 1B. To reproduce the first ECG, we placed electrodes to their original position and noticed that the pulsation of the axillary artery can be visible underneath the left shoulder electrode, which was made more discernable with the help of a tongue depressor. After reproducing abnormal ECG, connection to another electrode, just below to the first one, eliminated the arterial pulsation artifact (Figure 2).

DISCUSSION

The electromechanical association artifact is a dangerous artifact with an unusual source, i.e., the cardiovascular system itself. Since it is "heart-made," it is synchronous with underlying rhythm and does not separate with the native electrocardiographic waveforms, which is generally expected from artifacts as the cycle length of the artifact and the underlying rhythm is usually different. This association causes a consistent distortion of the underlying wave morphology and can mimic myocardial infarction, electrolyte abnormalities, arrhythmias, and abnormal T-waves of many cardiac and extra-cardiac pathologies.[1-3]

The reported cause of the artifact was always distal extremity arteries until now, i.e., radial or posterior tibial artery. This is the first time that a limb electrode placed on the chest caused an electromechanical association artifact. In the current case, ECG showed abnormal T-waves in limb leads and ST-segment elevation in the chest leads. The attending physician concerned of acute ischemia at first glance and computer interpretation was also ST-segment elevation myocardial infarction. On careful inspection, it is evident that the source of artifact on the first ECG was right arm electrode because only lead I and II, but not lead III, showed these abnormal T waves. The chest electrodes also showed some ST-segment distortion because "electromechanical association artifact" also affects precordial leads via the Wilson central terminal, which constitutes the negative pole of the unipolar leads by connecting three limb electrodes through a resistive network to give an average potential across the body. Repositioning the right arm

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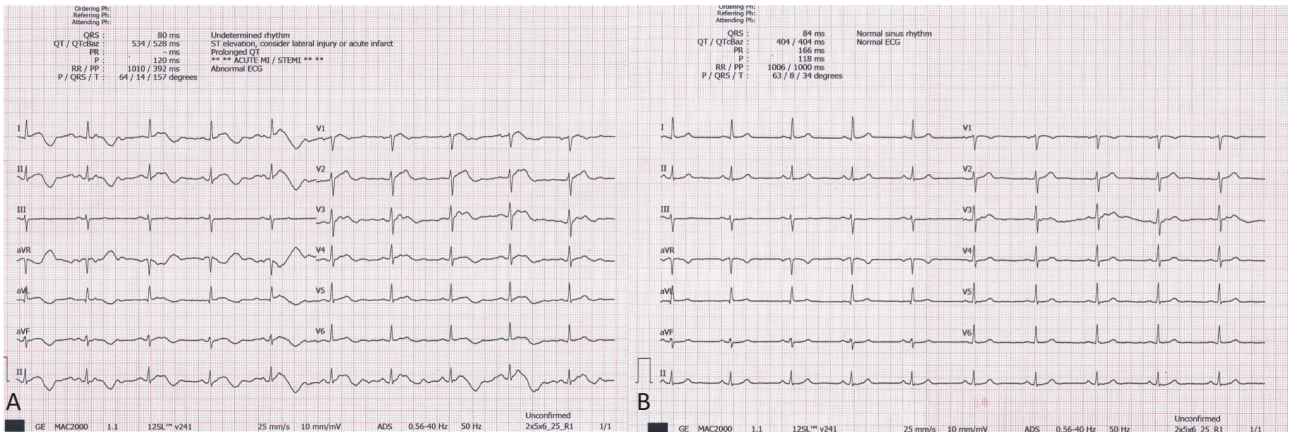

Figures 1. *(A) First electrocardiogram which showed abnormal T waves in lead I, II, aVF, and ST-segment elevation in V1 through V6. The attending physician concerned of ischemia, but also suspected an artifactual cause. Note that the computer algorithm diagnosed acute ST-segment elevation myocardial infarction. (B) A second electrocardiogram is now grossly normal, but there is the persistence of a tiny wave in ST-segment in lead V3. The cause of this distortion is most probably cardiac pulsation this time.*

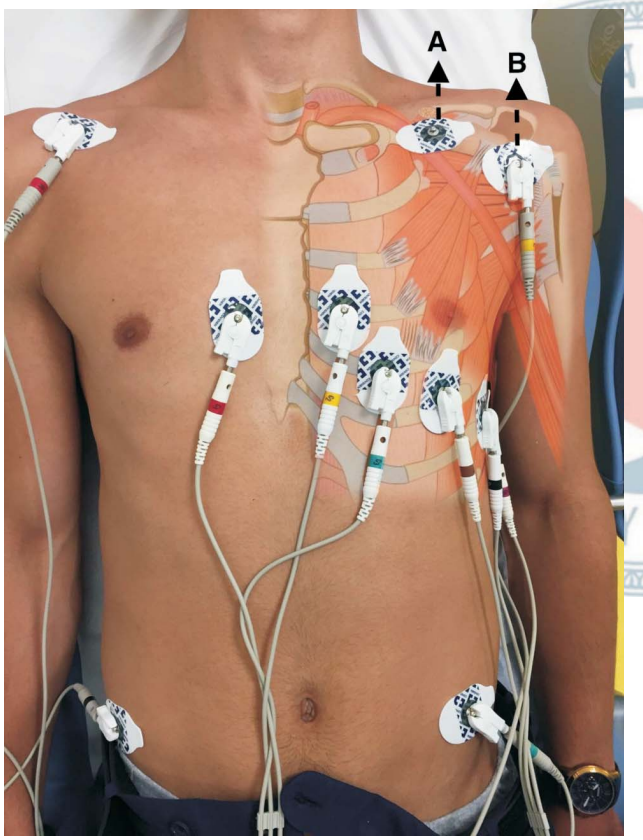

Figure 2. *The positions of the ECG lead electrodes and possible artery relation. Position A. The elctrode is on the artery; position B. The electrode is perfectly placed.*

electrode slightly off the axillary artery pulsation eliminated the artifact.

Another interesting finding, in this case, is that there is still a tiny wavelet which slightly distorts ST-segment in the second ECG. This distortion is only seen in one lead, so it is not a real electrical phenomenon, but another artifact. Its constant temporal relationship with the QRS complex, which coincides with ventricular systole, indicates that its source is again the cardiovascular system itself. Since we noticed this finding retrogradely, we failed to have a repeat ECG after relocating lead V3; but cardiac pulsation is the most probable cause of this milder artifact. The involvement of lead V3 is also understandable because it is one of the most possible leads that can be influenced by precordial cardiac pulsations.

It is now shown that self-adhesive electrodes applied to the chest can produce electromechanical association artifacts. This may also be important for an exercise stress test in which the Mason-Likar system is frequently used and stronger arterial pulsations during exercise can push electrodes more forcefully.

I here report, for the first time, “electromechanical association artifact” can occur with chest electrodes, especially in leaner individuals. When an abnormal ECG that exhibits suspicious wave contours and possibly only one completely normal limb lead is encountered, irrespective of extremity or chest location is used for limb electrodes or clip-cuff or self-adhesive electrode is used, “electromechanical association artifact” should be considered. Cardiac pulsation can also produce a milder form of this artifact by only affecting a single chest lead.

LEARNING POINTS

Electromechanical association artifact is an electrocardiogram artifact, in which an arterial pulsation distorts underlying electrocardiogram waveforms. However, the reported cause of the pulsation was always distal extremity arteries. Cardiac pulsation can also produce a milder form of this artifact by only affecting a single chest lead. This case shows, for the first time, "electromechanical association artifact" can occur with chest electrodes, especially in leaner individuals.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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