Case Report
Pamukkale Medical Journal
doi:https://dx.doi.org/10.31362/patd.1218933

J wave as a rare ECG finding of malignant cardiac arrhythmia

Malign kardiyak aritmilerin nadir bir EKG bulgusu olarak J dalgası

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Posted date:14.12.2022 Acceptance date:03.03.2023

Abstract
In this case report, we present a 76-year-old female patient diagnosed with ventricular fibrillation in the emergency department who died after cardiopulmonary resuscitation. The importance of observing J waves in a patient's electrocardiogram after spontaneous return to circulation is addressed in terms of the risk of arrhythmia.

Key words: J wave, malignant arrhythmia, death.

Altintas E, Erat M, Guzes EB. J wave as a rare ECG finding of malignant cardiac arrhythmia. Pam Med J 2023;16:500-507.

Öz
Acil serviste ventriküler fibrilasyon saptanan ve kardiyopulmoner resüsitasyon uygulanıp, yaşamını kaybeden 76 yaşında bir kadın hastayı sunduk. Bu olgumuzda spontan dolaşıma geri dönüş sağlandıktan sonra hastanın elektrokardiyogramında gördüğümüz J dalgasını aritmi riski nedeni ile önemini vurguladık.

Anahtar kelimeler: J dalgası, malign aritmi, ölüm.

Altıntaş E, Erat M, Güzeş EB. Malign kardiyak aritmilerin nadir bir EKG bulgusu olarak J dalgası. Pam Tıp Derg 2023;16:500-504.

Introduction

The American Heart Association (AHA) reported that in 2022, 347.000 adult patients with cardiac arrest received interventions outside hospital settings, whereas 9.7/1.000 adults with cardiac arrest were attended to the hospital [1]. The AHA guidelines recommend that reversible causes be considered during cardiac arrest interventions [2].

Sudden cardiac death has been defined as a natural, unexpected, or accidental incident that does not result from committing suicide or poisoning and occurs within one hour of cardiac arrest [3]. The causes of sudden cardiac arrest are classified as cardiac and non-cardiac. Cardiac causes, which constitute 70% of sudden cardiac arrest cases, are categorized into two main groups: structural heart diseases and rhythm disorders. Rhythm disorders include conditions such as Brugada syndrome (BrS) and long and short QT [4].

The J wave has been noted in life-threatening conditions, such as hypothermia, hypercalcemia, BrS, vasospastic angina, and myocardial infarction (MI) [5], and is used in the definitions of BrS and early repolarization syndromes [5]. A common characteristic of both phenomena, J wave syndrome is observed at the transition point from the terminal part of the QRS complex to the ST segment, that is, at the J point in the electrocardiogram (ECG) [6]. The J wave is characterized by a high risk of arrhythmia depending on the patient's underlying conditions [5]. In view of the foregoing, the objective of this report is to discuss a rare case of J wave syndrome with the risk of malignant arrhythmia.

Case presentation

A 76-year-old female hypertensive patient presented to the emergency department with a complaint of chest pain that had been ongoing for a week. However, she developed sudden cardiac arrest during admission to the emergency department. Cardiopulmonary resuscitation (CPR) was performed on the patient for two minutes, which resulted in the recovery of spontaneous circulation (ROSC).

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An ECG of the patient was taken following the ROSC. The ECG revealed an accelerated junctional rhythm, narrow QRS, and a ventricular rate of approximately 70 beats/min (Figure 1). Additionally, right axis deviation, >2 mm ST segment elevation in the D1, aVL, and V2 leads, 1 mm ST segment depression in the D2 lead, 3 mm ST segment depression in the D3 and aVF leads (inferior derivations) were detected. Notch-shaped J waves were present in the inferior-lateral derivations (D2, D3, aVF, D1, aVL, and V6).

It was learned that coronary angiography had been performed on the patient two days prior and that she had been discharged with 40% left anterior descending coronary artery stenosis. During the ROSC period after CPR, a notch-shaped J wave in the ECG in the inferolateral leads (Figure 2), a notched J-point elevation ≥0.1 mV, and a descending ST segment in the inferior derivations, especially in D2-aVF, were detected (Figure 3). The patient, who developed ventricular fibrillation (VF) and cardiac arrest shortly after CPR, was pronounced dead 30 minutes after CPR. During cardiac arrest, blood was drawn from the patient for laboratory tests, but the samples developed hemolysis in the laboratory, and the tests could not be performed. Because the patient was exitus, blood could not be drawn again. A signed consent form was obtained from the patient's daughter for the publication of this report.

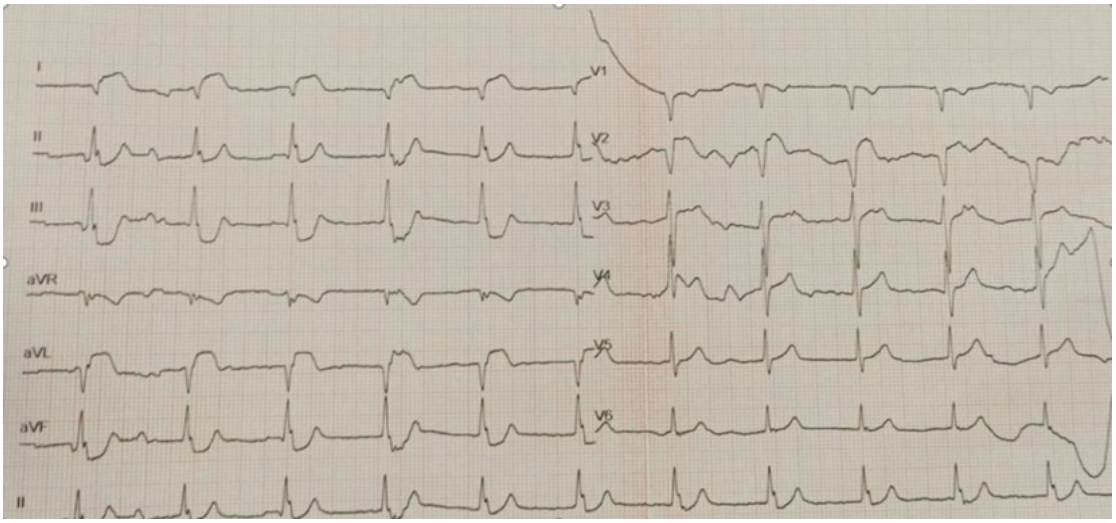

Figure 1. ECG of the patient after recovery of spontaneous circulation following cardiac arrest

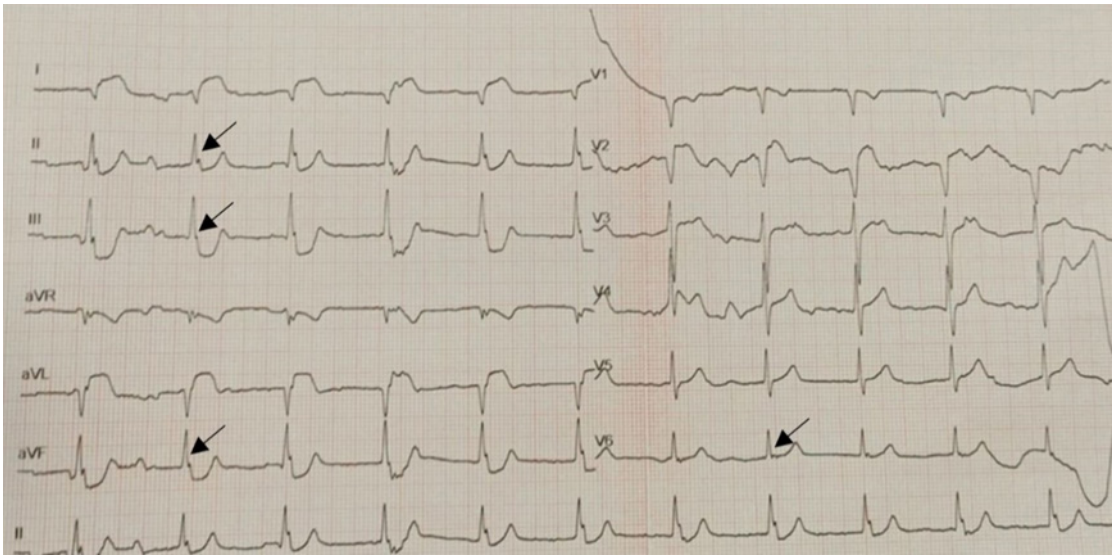

Figure 2. Notched-shaped J wave in the inferolateral derivations

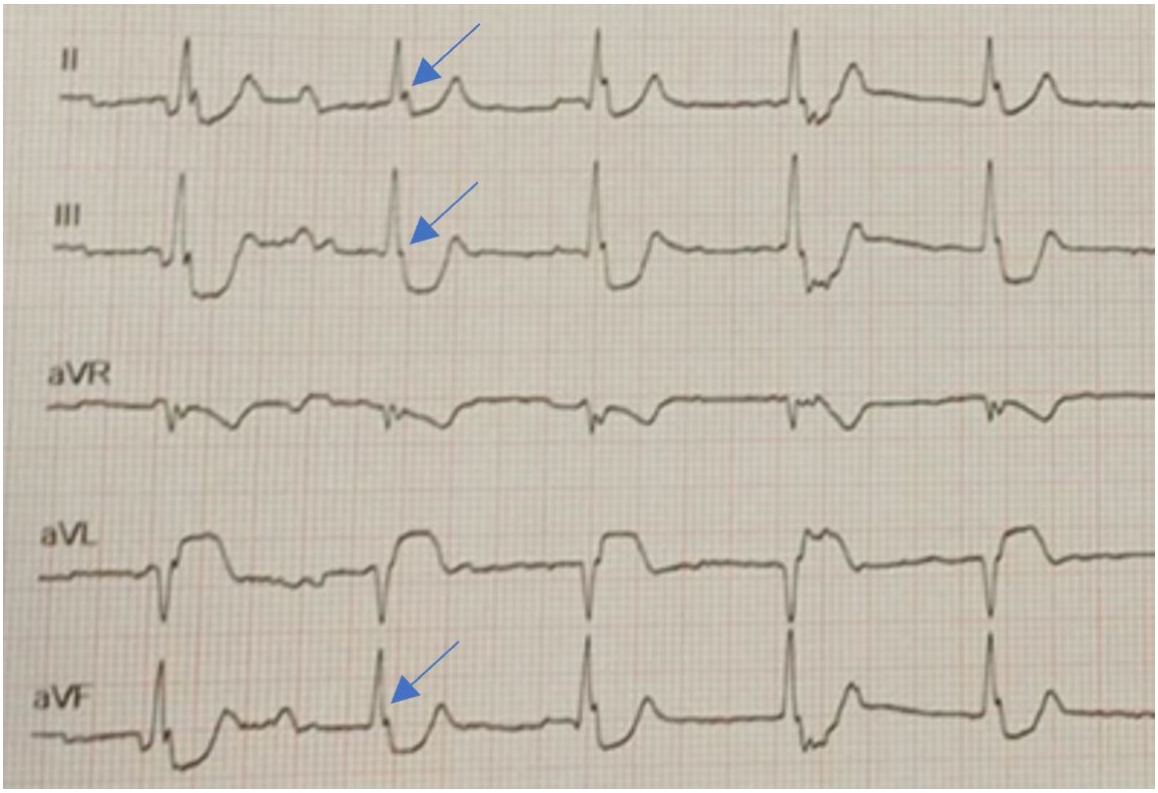

Figure 3. Notched J-point elevation ≥0.1 mV and descending ST segment in the inferior derivations

Discussion

The J wave, also known as the camel-hump sign or Osborn wave, is characterized in the literature by slurring or notching in the terminal part of the QRS in a standard 12-lead ECG. Additionally, it has been reported that J waves are associated with a high risk of arrhythmia depending on the underlying conditions. The most common causes include hypothermia, hypercalcemia, vasospastic angina, BrS, and MI [5-7]. In this report, we present a case with a malignant J wave characterized by inferolateral leads and a descending ST segment, in which the patient developed VF.

J point elevation, the height of the J wave, the ST segment slope (upward, horizontal, or downward slope), and the number of leads in the ECG are important features [8]. Early repolarization is defined as >1 mm elevation of the J point and ST segment in two or more consecutive derivations. The J wave is described as either benign or malignant based on its characteristics. Accordingly, a J point with a descending or horizontal ST segment is considered malignant, and a J point with a rapidly rising ST segment is considered benign [9]. Inferolateral leads in particular place a patient at risk of developing VF [10]. A slurred or notched J point or J-point elevation ≥0.2 mV is also associated with an increased risk [6].

J waves have been associated with cardiac arrhythmias in the acute and chronic phases of MI. Konishi et al. [11] reported that slow conduction and reentry related to scarring are prerequisites and may cause late activation of the myocardium, thus contributing to the J wave pattern. In a study in which the ECG findings of patients who developed MI and ventricular tachyarrhythmias (VT) were examined postoperatively, it was reported that the presence of the J wave was statistically significant in the ECGs of the patients who developed VTs. Based on this finding, it has been suggested that such patients should be further evaluated for additional treatment (e.g., radiofrequency catheter ablation) [12]. In another study, it was noted that this situation may resemble arrhythmias caused by the coexistence of living and fibrotic tissues in postoperatively infarcted myocardial tissue [13].

Three main pathogeneses have been described for cardiac arrhythmogenic diseases in patients with sudden cardiac arrest. These are a conduction abnormality, repolarization abnormality, and excitation abnormality. In a conduction abnormality, the cause of VF is a structural abnormality and the heterogeneity of depolarization caused by BrS, an inferolateral J wave, and an idiopathic structural abnormality. Ablation is the recommended treatment [14]. In a case report by Boukens et al. [15], electrophysiological mapping was performed in a patient with an early repolarization pattern. The clinicians reported that there are localized structural abnormalities and recurrent arrhythmias can be reduced by ablation treatment.

In comparison, in the case presented herein, we initially thought that the J wave was associated with lateral wall MI, given the ST elevation in the lateral leads and reciprocal ST depression in the inferior leads. On the other hand, the fact that the ECG was taken after CPR and that the patient's coronary angiography, which had been taken two days prior, revealed non-critical lesions suggested that the J wave may have been associated with vasospastic angina or idiopathic VF. Emergency room physicians therefore need to determine the presence of J waves in ECGs and should be mindful of possible VT and sudden death, especially in the presence of malignant J waves.

In conclusion, it is of critical importance to determine the presence of J waves in the ECGs of patients in the emergency department. If determined, the patient should be evaluated further for the underlying causes of the J wave. The physician should subsequently distinguish between the benign and malignant forms of the J wave and be mindful of life-threatening arrhythmia in the case of patients with malignant forms of the J wave.

Conflicts of interest: The authors declare no conflicts of interest.

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Consent to participate: The authors certify that they obtained all the appropriate patient consent forms. The patient's daughter provided her consent for the patient's images and other clinical information to be reported in this journal. The patient's daughter understands that the patient's name and initials will not be published, and that although due effort has been made to conceal the patient's identity, anonymity cannot be guaranteed.

Authors' contributions to the article

E.A.: Conceptualization, writing and editing of the review, supervision.

M.E.: Writing and editing of the review, supervision.

E.B.G.: Conceptualization, writing of the original draft.