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Opinion Article

Electrocardiographic Changes in Arrhythmogenic Cardiomyopathy

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DESCRIPTION

Arrhythmogenic Cardiomyopathy (ACM), formerly known as Arrhythmogenic Right Ventricular Dysplasia (ARVD), is a rare but potentially life-threatening heart condition that primarily affects the structure and function of the heart's right ventricle. One of the key diagnostic tools in identifying ACM and monitoring its progression is Electrocardiography (ECG or EKG). This study explains the electrocardiographic changes observed in ACM, shedding light on how these ECG findings contribute to the diagnosis, management, and prognosis of this condition. ACM is a genetic disorder characterized by the replacement of myocardial tissue with fibrous and fatty deposits, primarily affecting the right ventricle of the heart. This structural remodeling can lead to arrhythmias, heart failure, and an increased risk of sudden cardiac death.

Electrocardiography is a fundamental diagnostic tool for evaluating the electrical activity of the heart. In ACM, ECG findings play a pivotal role in several aspects of the disease, including diagnosis, risk stratification, and ongoing monitoring.

Electrocardiographic changes in ACM

T-wave inversions: T-wave inversions in the right precordial leads (V1-V3) are a hallmark ECG finding in ACM. These inverted T-waves often appear during the early stages of the disease and may be present even when other diagnostic criteria are not met. T-wave inversions are considered significant when they are present in leads V1-V3 in individuals over the age of 14 and in V1-V4 in individuals under 14.

QRS complex prolongation: Prolongation of the QRS complex duration on the ECG is another common finding in ACM. This reflects the delayed activation of the ventricles due to the structural changes in the right ventricular myocardium. Prolonged QRS duration is associated with an increased risk of ventricular arrhythmias.

Epsilon waves: Epsilon waves are small, discrete, and often low-amplitude deflections at the end of the QRS complex in right precordial leads (V1-V3). These waves are highly specific to ACM and are indicative of delayed depolarization in the right ventricular myocardium. Epsilon waves are considered a pathognomonic feature of ACM.

Ventricular arrhythmias: Arrhythmias are a common manifestation of ACM, and they are often detectable on the ECG. Ventricular Premature Beats (VPBs) and Ventricular Tachycardia (VT) are frequently observed in affected individuals. These arrhythmias can be a major source of morbidity and are associated with an increased risk of sudden cardiac death.

Right Bundle Branch Block (RBBB): Right bundle branch block is a conduction abnormality that may be present on the ECG of individuals with ACM. RBBB is characterized by a delay or blockage in the electrical impulses traveling through the right bundle branch, leading to characteristic QRS changes on the ECG.

Torsades de pointes: Torsades de pointes is a specific type of polymorphic ventricular tachycardia that may occur in ACM. This arrhythmia is characterized by a twisting or "swirling" pattern on the ECG and can lead to syncope or sudden cardiac death if not promptly treated.

Fragmented QRS (FQRS): Fragmented QRS complexes, reflected as multiple small spikes within the QRS complex, are often seen in ACM. fQRS is associated with increased ventricular arrhythmias and may serve as a marker of disease severity.

Inferior and lateral T-wave changes: In some cases of ACM, ECG changes extend beyond the right precordial leads. T-wave inversions or abnormalities in the inferior and lateral leads (II, III, aVF, I, aVL) may be present, reflecting the involvement of the left ventricle or interventricular septum.

Exercise-induced ECG changes: Exercise stress testing can reveal dynamic ECG changes in ACM patients. These changes may include increased T-wave inversions, ventricular arrhythmias, and alterations in the QRS complex during exercise, further aiding in diagnosis.

Understanding the ECG findings in ACM is essential for various clinical purposes. ECG is a crucial tool for diagnosing ACM, especially in the presence of T-wave inversions, epsilon waves, or other specific ECG changes. Family members of

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affected individuals may also undergo ECG screening to identify asymptomatic carriers of ACM-associated genetic mutations. The presence of certain ECG abnormalities, such as epsilon waves, fQRS, and ventricular arrhythmias, can help stratify the risk of sudden cardiac death in ACM patients. Individuals with high-risk ECG features may require more aggressive management and closer monitoring. ECG findings guide the selection of appropriate treatments for ACM patients. Implantable Cardioverter-Defibrillators (ICDs) are often recommended for individuals with a history of sustained ventricular arrhythmias or high-risk ECG features. Antiarrhythmic medications and lifestyle modifications may also be customized based on ECG findings. Regular ECG monitoring is essential for tracking disease progression and assessing the effectiveness of treatments. Changes in ECG patterns can prompt adjustments in the management plan.

CONCLUSION

Electrocardiography plays a central role in the diagnosis, risk assessment, and management of Arrhythmogenic Cardiomyopathy. The distinctive ECG changes seen in ACM, including T-wave inversions, epsilon waves, and ventricular arrhythmias, provide critical information for clinicians. Early recognition and intervention based on ECG findings are key to improving outcomes and reducing the risk of sudden cardiac death in individuals with this rare but serious condition. As our understanding of ACM continues to evolve, ECG remains an invaluable tool in the ongoing fight against this challenging cardiac disease.