CASE REPORT

Electrocardiographic features of Wolff-Parkinson-White syndrome

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Wolff-Parkinson-White syndrome (WPW) is the commonest form of ventricular pre-excitation. It is characterised by the presence of an accessory pathway between the atria and the ventricles which provides an alternative route for ventricular activation. This bypass tract avoids the atrioventricular node (AVN) permitting premature ventricular activation hence the term pre-excitation. Historically Wolff, Parkinson, and White first described the condition in 1930 in a series of 11 healthy young adults with a functional bundle branch block, an abnormally short PR interval and paroxysms of tachycardia or atrial fibrillation.

The ECG features are characteristic and important to recognise. Although some patients may remain asymptomatic throughout their lives, others are prone to tachyarrhythmias that may be life threatening. It is seen in around 2.4% of patients presenting with a regular narrow complex tachycardia to the emergency department where it can be successfully treated with the restoration of sinus rhythm. Atrial fibrillation associated with WPW is less common. In this situation rapid and irregular ventricular responses are seen, which may degenerate into ventricular fibrillation.

This article consists of two case histories followed by a review of the literature covering diagnostic and urgent initial therapeutic issues.

CASE HISTORIES

Case one
A 14 year old boy presented to the emergency department complaining of palpitations and dizziness. He had no medical history of note. A 12 lead ECG was performed that demonstrated a narrow-complex tachycardia with retrograde P waves (fig 1). He was haemodynamically stable and treated with adenosine. He reverted to sinus rhythm and the 12 lead showed evidence of pre-excitation (fig 2). He was referred for risk stratification by electrophysiological studies. He was found to have an accessory pathway with both antegrade and retrograde properties and underwent successful radiofrequency ablation.

Case two
A 52 year old woman presented to the emergency department with a three hour history of chest pain and shortness of breath. She had a medical history of palpitations.

Figure 1  Narrow-complex tachycardia with retrograde P waves visible deforming early part of ST segment.

Figure 2  Pre-excitation with shortened PR interval and “delta wave”—that is, slurred upstroke of QRS complex, most visible in rhythm strip.

Figure 3  AF in WPW. Note irregularly irregular rhythm with delta wave visible in QRS. Note fast ventricular response.
anywhere along the atrioventricular groove and the left lateral ventricles. It consists of a thin filamentous structure situated from a failure of complete separation of the atria and 2).

In patients with WPW is a combination of pre-excitation and normal conduction giving rise to a short PR interval and a delta wave followed by a relatively normal QRS complex (fig 1). In pre-excitation syndromes the accessory pathway permits the impulse to bypass the AVN and the wave of depolarisation travels up the accessory pathway producing a narrow complex tachycardia (fig 4B). The QRS morphology is normal (fig 4C). In atrial fibrillation with pre-excitation activation of the ventricles is predominantly via the accessory pathway (fig 4D). This causes the expected irregular rhythm but the ventricular depolarisation occurs later than in patients with WPW. The mechanism of ventricular depolarisation in sinus rhythm (fig 4A). This is reflected on the ECG as a shortened PR interval. Non-physiological slowing occurs at this point before conduction to the His-Purkinje system and the ventricular muscle. The PR interval represents the time taken for the atria to depolarise. The accessory pathway is congenital in origin and results in the formation of the accessory pathway (fig 2). Simultaneous activation of the ventricle occurs as the remainder of the AVN and His-Purkinje system and the ventricular muscle. The PR interval is shortened following a relatively normal QRS complex. Delta waves follow the QRS complexes in the presence of pre-excitation (fig 4B). If the accessory pathway is situated more anteriorly along the atrioventricular groove and the left lateral ventricles the QRS complex is widened with a bizarre morphology. Occasional activation of the accessory pathway may occur (fig 4D). This is known as a concealed pathway.

The accessory pathway is a conduction system that exists in the heart and is responsible for the generation of ventricular depolarisation. It is also known as the Wolf-Parkinson-White syndrome. The accessory pathway allows for antegrade conduction (from atrium to ventricle) and retrograde conduction (from ventricle to atrium). In normal hearts, the AV node is responsible for the conduction of electrical impulses from the atria to the ventricles. However, in patients with WPW, the accessory pathway bypasses the AV node and can conduct electrical impulses directly to the ventricles, allowing for abnormal intraventricular conduction.

The presence of an accessory pathway increases the risk of arrhythmias, particularly atrioventricular re-entrant tachycardia (AVRT). AVRT occurs when an impulse is conducted through the accessory pathway and then travels back to the atria through the AV node, creating a re-entry circuit. This can result in a rapid, sustained tachycardia that may be hemodynamically unstable. Treatment options for AVRT include pharmacological therapy, radiofrequency ablation, and surgical intervention.
hence break the circuit. Adenosine is used to prolong AVN refractoriness but it should be used with full resuscitation facilities. This is because atrial fibrillation with a rapid ventricular response maybe induced in as many as 12% of patients.8

A haemodynamically compromised patient with an AVRT or AF must undergo electrical cardioversion. Flecainide is a useful alternative in the stable patient with AF or an antidromic broad complex tachycardia. Calcium channel blockers, digoxin, and amiodarone6–9 must be avoided in the management of the patient with AF. This is because of the potential to increase accessory pathway conduction by increasing AVN block with the inherent danger of precipitating ventricular fibrillation.

Significant advances have been made in the field of electrophysiological studies. Radiofrequency ablation has radically changed the management of these patients. This is particularly important given that the long term safety of many antiarrhythmics has not been fully elucidated. The long term success rates of such procedures are now thought to be approaching 95%.1 The risk of serious side effects is low and occurs at a rate of less than 1%.2 Radiofrequency ablation was previously limited to patients with episodes of atrial fibrillation or frequent or disabling symptoms. WPW syndrome is a condition that primarily affects younger people in whom long term anti-arrhythmic prophylaxis is undesirable. There is now evidence to suggest that as its safety improves there may be a place for the risk stratification of all patients.

CONCLUSION

WPW syndrome is the commonest form of ventricular pre-excitation. It is not infrequently encountered in the patient presenting to the emergency department with tachyarrhythmias. After restoration of sinus rhythm prompt referral to cardiology is essential for risk stratification through electrophysiological studies. Recent advances in diagnostic and therapeutic procedures in this field mean that the long term prognosis for these patients is good.

Contributors

FPM initiated the idea with WJB. LK reviewed the literature and wrote the manuscript. FPM edited the manuscript and will act as guarantor of the paper.

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REFERENCES


