A 29-year-old man presents with a recent episode of light-headedness of sudden onset. Although he denies associated loss of consciousness, witnesses report that he was briefly unresponsive to verbal stimuli. He also denies chest pain, dyspnea, palpitations, and diaphoresis; he is currently asymptomatic.

The patient had a similar episode 2 years earlier for which he did not seek medical attention. Otherwise, his medical history is unremarkable. He denies alcohol and illicit drug use, and he has no family history of cardiac disease or sudden death.

His vital signs are normal. Heart rate is regular and rhythm is normal; no murmurs are audible. Results of the rest of the examination are normal.

Results of a complete blood cell count and comprehensive metabolic profile are all normal, as is a chest radiograph. ECG reveals a Wolff-Parkinson-White (WPW) pattern, with characteristic short PR interval and preexcitation delta wave.

WPW syndrome is the most common type of ventricular preexcitation syndrome. In 1930, Wolff, Parkinson, and White were the first to describe an ECG pattern with the following 2 major features:

- A short PR interval (less than 120 milliseconds), which reflects rapid atrioventricular (AV) conduction through an accessory pathway (the bundle of Kent) that bypasses the AV node, resulting in faster activation ("preexcitation") of the ventricles.
- A slurred QRS upstroke (delta wave), which is the result of fusion between the early ventricular activation and later activation resulting from normal AV nodal conduction.

WPW pattern versus WPW syndrome. WPW pattern refers solely to the ECG findings, whose prevalence in the population is only 0.15% to 0.25%. The pattern is more common in males than in females. The anomaly is congenital but not necessarily inherited. It may be associated with other congenital abnormalities, including Epstein anomaly, mitral valve prolapse, and hypertrophic cardiomyopathy.

ECGs may show daily--even hourly--variation within the same patient and reflect a sensitivity to influences such as stress and caffeine. Although most patients with WPW pattern remain asymptomatic, some--such as this patient--experience palpitations, light-headedness, and syncope resulting from tachyarrhythmias. These latter patients have WPW syndrome, which is associated with a small (0.1% to 0.6%) but significant risk of sudden death.

Pathophysiology of WPW-associated tachyarrhythmias. There are 3 main mechanisms by which tachycardia develops in patients with WPW syndrome. The first mechanism involves a reentrant circuit in which the accessory pathway conducts the impulse to the ventricles. This causes the classic wide-complex tachycardia associated with a slurred QRS upstroke, or delta wave. The second mechanism involves a reentrant circuit in which the accessory pathway conducts the impulse back to the atria. This causes a narrow-complex tachycardia--usually paroxysmal supraventricular tachycardia (PSVT). In the third mechanism, the accessory pathway is merely a "bystander" that provides an alternate route of conduction to the ventricles. This third mechanism is characteristic of a broad range of tachycardias, including atrial fibrillation. Because it causes rapid ventricular rates (faster than 200 beats per minute) that can degenerate into fibrillation and lead to sudden death, it is potentially the most life-threatening of the 3 mechanisms.

The most common type of tachycardia seen in WPW syndrome is PSVT, which occurs in 80% of affected patients. Atrial fibrillation occurs in 15% to 30% of patients with WPW syndrome, and atrial flutter occurs in 5%. AV nodal reentrant tachycardias and ventricular tachycardias (choice B) are less common in patients with WPW syndrome.
**Evaluation.** Patients with the WPW pattern can be further assessed with an electrophysiology (EP) study. Electrophysiologists can localize and define the role and number of accessory pathways. They can also assess the risk of life-threatening arrhythmias and sudden death. The risk factors most commonly identified include a short (less than 250 milliseconds) RR interval during atrial fibrillation, a short (less than 270 milliseconds) antegrade refractory period of the accessory pathway, and multiple accessory pathways. Finally, an electrophysiologist can evaluate a patient for potential treatment options.

There is some controversy about the referral of asymptomatic patients with WPW pattern for an invasive EP study. Some groups advocate referral for all patients with WPW pattern who are younger than 35 years. Others recommend the study only for patients with WPW pattern who have a family history of sudden death or a "high-risk" occupation (such as a pilot or bus driver). However, most authorities advocate referral for an invasive EP study for all patients with WPW syndrome. Thus, choice D is correct, and C is incorrect.

**Management.** Treatment is not necessary for patients with asymptomatic preexcitation or infrequent, asymptomatic tachycardias. Acute management of symptomatic or persistent tachycardias depends on the underlying mechanism. Patients with PSVT are treated the same as those without WPW syndrome. Patients in whom WPW syndrome is associated with wide-complex tachycardias--and especially with atrial fibrillation and atrial flutter--require special precautions. In these patients, medications such as b-blockers, calcium channel blockers, adenosine, and digoxin should be avoided because they may decrease the refractory period in the bypass tract, thereby increasing the ventricular rate. Thus, choice A is incorrect. Patients with WPW syndrome associated with atrial fibrillation or flutter should be treated only with procainamide or cardioversion. Ibutilide, a newer agent, has also shown promise in these patients. Avoid chronic pacing in patients with WPW syndrome; it may lead to atrial fibrillation.

Drugs, surgery, and radiofrequency ablation have been used to prevent the recurrence of tachycardia in patients with WPW syndrome. Medical therapy (with the same agents used for acute management) may be appropriate for patients who have infrequent symptoms. However, because the long-term efficacy and side effects of these medications in patients with WPW syndrome are unknown, ablation has become more widely used. Surgical ablation offers an almost 100% cure rate. However, radiofrequency ablation is less invasive, more cost-effective, and almost as successful, with cure rates ranging from 90% to 95%. The complication rate of radiofrequency ablation is 2.1% and the mortality rate is 0.1% to 0.3%.

**Outcome of this case.** The patient was referred for an EP study, which revealed inducible atrial fibrillation and rapid antegrade conduction down an accessory pathway. The accessory pathway was subsequently ablated using radiofrequency waves. The patient had no symptoms during a stress test following the procedure and did not require further intervention. One month later, he continued to be normally active and remained asymptomatic. *