TABLE 275-4 INDICATIONS FOR PACEMAKER IMPLANTATION IN CHRONIC BIFASCICULAR AND TRIFASCICULAR BLOCK

Class I
1. Intermittent third-degree AV block
2. Type II second-degree AV block
3. Alternating bundle branch block
Class IIa
1. Syncope not demonstrated to be due to AV block when other likely causes (e.g., ventricular tachycardia) have been excluded
2. Incidental finding at electrophysiologic study of a markedly prolonged HV interval (>100 ms) in asymptomatic patients
3. Incidental finding at electrophysiologic study of pacing-induced infra-His block that is not physiologic
Class IIb
1. Neuromuscular diseases such as myotonic dystrophy, Kearns-Sayre syndrome, Erb dystrophy, and peroneal muscular atrophy with any degree of fascicular block regardless of the presence of symptoms, because there may be unpredictable progression of AV conduction disease
Class III
1. Fascicular block without AV block or symptoms
2. Fascicular block with first-degree AV block without symptoms

Source: Modified from AE Epstein et al: J Am Coll Cardiol 51:e1, 2008.

or first-degree AV block that develops in the setting of preexisting bundle branch block. Fascicular blocks that develop in acute MI in the absence of other forms of AV block also do not require pacing (Table 275-3 and **Table 275-4**).

PACEMAKER THERAPY IN BIFASCICULAR AND TRIFASCICULAR BLOCK

Distal forms of AV conduction block may require pacemaker implantation in certain clinical settings. Patients with bifascicular or trifascicular block and symptoms, particularly syncope that is not attributable to other causes, should undergo pacemaker implantation. Pacemaking is indicated in asymptomatic patients with bifascicular or trifascicular block who experience intermittent third-degree, type II second-degree AV block or alternating bundle branch block. In patients with fascicular block who are undergoing electrophysiologic study, a markedly prolonged HV interval or block below the His at long cycle lengths also may constitute an indication for permanent pacing. Patients with fascicular block and the neuromuscular diseases previously described should also undergo pacemaker implantation (Table 275-4).

SELECTION OF PACING MODE

In general, a pacing mode that maintains AV synchrony reduces complications of pacing such as pacemaker syndrome and pacemaker-mediated tachycardia. This is particularly true in younger patients; the importance of dual-chamber pacing in the elderly, however, is not well established. Several studies have failed to demonstrate a difference in mortality rate in older patients with AV block treated with a single-(VVI) compared with a dual-(DDD) chamber pacing mode. In some of the studies that randomized pacing mode, the risk of chronic atrial fibrillation and stroke risk decreased with physiologic pacing. In patients with sinus rhythm and AV block, the very modest increase in risk with dual-chamber pacemaker implantation appears to be justified to avoid the possible complications of single-chamber pacing.

276 Supraventricular Tachyarrhythmias

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Supraventricular tachyarrhythmias originate from or are dependent on conduction through the atrium or atrioventricular (AV) node to the ventricles. Most produce narrow QRS-complex tachycardia (QRS duration <120 ms) characteristic of ventricular activation over the Purkinje system. Conduction block in the left or right bundle branch or activation of the ventricles from an accessory pathway produces a wide QRS complex during supraventricular tachycardia that must be distinguished from ventricular tachycardia **(Chap. 277)**. Supraventricular tachyarrhythmia may be divided into physiologic sinus tachycardia and pathologic tachycardia **(Table 276-1)**. The prognosis and treatment vary considerably depending on the mechanism and underlying heart disease.

Supraventricular tachycardia can be of brief duration, termed *nonsustained*, or can be sustained such that an intervention, such as cardioversion or drug administration, is required for termination. Episodes that occur with sudden onset and termination are referred to as paroxysmal. *Paroxysmal supraventricular tachycardia* (PSVT) refers to a family of tachycardias including AV node reentry, AV reentry using an accessory pathway, and atrial tachycardia.

CLINICAL PRESENTATION

Symptoms of supraventricular arrhythmia vary depending on the rate, duration, associated heart disease, and comorbidities and include palpitations, chest pain, dyspnea, diminished exertional capacity, and occasionally syncope. Rarely, a supraventricular arrhythmia precipitates cardiac arrest in patients with the Wolff-Parkinson-White syndrome or severe heart disease, such as hypertrophic cardiomyopathy.

Diagnosis requires obtaining an electrocardiogram (ECG) at the time of symptoms. For transient arrhythmia, ambulatory ECG recording is warranted **(see Table 277-1)**. Exercise testing is useful for assessing exercise-related symptoms. Occasionally an invasive electrophysiology study is warranted to provoke the arrhythmia with pacing, confirm the mechanism, and often, perform catheter ablation.

Physiologic Sinus Tachycardia The sinus node is comprised of a group of cells dispersed within the superior aspect of the thick ridge of muscle known as the crista terminalis where the posterior smooth atrial wall derived from the sinus venosus meets the trabeculated anterior portion of the right atrium **(Fig. 276-1)**. Sinus p waves are characterized by a frontal plane axis directed inferiorly and leftward, with positive p waves in leads II, III, and aVF; a negative p wave in aVR; and an initially positive biphasic p wave in V1. Normal sinus rhythm has a rate of 60–100 beats/min. Sinus tachycardia (>100 beats/min) typically occurs in response to sympathetic stimulation and vagal withdrawal, whereby the rate of spontaneous depolarization of the sinus node increases and the focus of earliest activation within the node typically shifts more leftward and closer to the superior septal aspect of the crista terminalis, thus producing taller p waves in the inferior limb leads when compared to normal sinus rhythm.

Sinus tachycardia is considered physiologic when it is an appropriate response to exercise, stress, or illness. Sinus tachycardia can be difficult to distinguish from focal atrial tachycardia (see below) that originates from a focus near the sinus node. A causative factor (such as exertion) and a gradual increase and decrease in rate favors sinus tachycardia, whereas an abrupt onset and offset favor atrial tachycardia. The distinction can be difficult and occasionally requires extended ECG monitoring or even invasive electrophysiology study. Treatment for physiologic sinus tachycardia is aimed at the underlying condition **(Table 276-2)**.

Nonphysiologic Sinus Tachycardia *Inappropriate sinus tachycardia* is an uncommon condition in which the sinus rate increases spontaneously at rest or out of proportion to physiologic stress or exertion.