

Evaluation of Palpitations: Etiology and Diagnostic Methods

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Generally described as an uncomfortable awareness of one's own heartbeat, palpitations are a common clinical symptom. Even when the word "palpitations" is not specifically used, patients often report that their heart races, skips a beat, or seems at times to stop. The symptom of palpitations does not necessarily mean that an arrhythmia is present; conversely, an arrhythmia can occur without the sensation of palpitations. Most patients with palpitations go to their physician's office for evaluation, not only because the sensation is disagreeable, but also because they fear the symptom may represent serious cardiovascular disease. This article provides information on the etiology of palpitations and the diagnostic methods used in the evaluation of patients with palpitations, particularly those of cardiac origin.

DIFFERENTIAL DIAGNOSIS OF PALPITATIONS

Palpitations can occur from a myriad of causes that are both cardiac and noncardiac in origin. Weber and Kapoor¹ found that palpitations had a cardiac-related etiology in approximately 43% of patients reporting palpitations, whereas a psychiatric etiology accounted for approximately 30% of cases and miscellaneous or unknown causes accounted for the remaining 27%. The differential diagnosis of palpitations appears in **Table 1**.

When evaluating a patient with symptomatic palpitations, a clinician's primary goal should be to detect and identify the presence and nature of any underlying arrhythmia and to determine the presence or absence of organic heart disease or other precipitating causes. With these pieces of information, the clinician can better understand the pathophysiology and prognosis of the patient's condition and can better devise an appropriate treatment plan.

HISTORY

As in the evaluation of most medical disorders, taking a thorough history constitutes the most important part of the evaluation of persons with palpitations. In addition to obtaining patients' complete medical histo-

ry, specific features of episodes of palpitations should be sought.

Character of the Sensation

Because patients describe palpitations in different ways, determining the specific circumstances surrounding the episodes can help narrow the differential diagnosis, especially when palpitations indicate a cardiac pathology. For example, a feeling of "flip-flopping" in the chest is usually secondary to a premature atrial or ventricular contraction.⁴ Similarly, the sensation that the heart has stopped is secondary to the pause (compensatory or noncompensatory) that follows a premature beat, whereas pounding is often the manifestation of a forceful beat caused by postextrasystolic potentiation after a premature beat. A feeling of rapid fluttering in the chest is usually secondary to supraventricular or ventricular tachyarrhythmias, whereas patients with neck palpitations may have atrioventricular nodal tachycardia caused by simultaneous contraction of the atria and ventricles, which causes reflux of blood in the superior vena cava.⁵ Premature ventricular contractions also cause atrioventricular dissociation, resulting in pounding sensations in the neck and often a physical finding of cannon waves. Patients occasionally have difficulty explaining the exact nature of their palpitations, so sometimes it is helpful to ask them to tap the pattern of the beating they are feeling on a desk.

Mode of Onset and Termination

Palpitations that start and terminate abruptly usually indicate atrial or ventricular tachyarrhythmias.⁶ Palpitations that occur gradually usually indicate benign etiologies, such as sinus tachycardia during exercise or anxiety. On occasion, the high adrenergic

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Table 1. Differential Diagnosis of Palpitations

Cardiac causes	Drug-induced causes	High cardiac output states
Atrial	Alcohol (use or withdrawal)	Anemia
Paroxysmal atrial flutter/fibrillation	Amphetamines	Arteriovenous fistula
Paroxysmal atrial tachycardia	Anticholinergic agents	Beriberi
Premature atrial contractions	β-Blockers (withdrawal)	Fever
Reentry (ie, Wolff-Parkinson-White syndrome)	Caffeine, nicotine	Paget's disease
Sick sinus syndrome (eg, bradycardia-tachycardia syndrome)	Cardiac glycosides	Pregnancy
Sinus tachycardia	Cocaine	Thyrotoxicosis
Atrioventricular node	Epinephrine	Psychiatric causes*
White syndrome)	Ganglionic blockers	Agoraphobia without panic disorder
Ventricular	Nitrates	Dysthymia
Premature ventricular contractions	Structural abnormalities	Generalized anxiety
Ventricular tachycardia/fibrillation	Acute left ventricular failure	Hypochondriasis
Metabolic causes	Aortic aneurysm	Major depression
Hyperthyroidism	Atrial myxoma	Panic disorder
Hypoglycemia	Cardiomegaly	Simple phobia
Hypo/hypercalcemia	Congenital heart disease	Social phobia
Hypo/hyperkalemia	Atrial septal defect	Somatization disorder
Hypo/hypermagnesemia	Patent ductus arteriosus	Other causes
Pheochromocytoma	Ventricular septal defect	Emotional stress
	Mitral valve prolapse	Hyperventilation
	Pacemaker (function or failure)	Idiopathic flushing
	Pericarditis	Mastocytosis
	Prosthetic heart valves	Migraine
	Pulmonary embolism	Postmenopausal period
	Regurgitant valvular lesions	Premenstrual syndrome
		Scombroid fish poisoning
		Strenuous physical activity

*See Barski et al.^{2,3}

tone caused by a paroxysmal arrhythmia results in sinus tachycardia after the arrhythmia terminates, so that the end of the paroxysmal tachycardia is not always perceived as abrupt by the patient. Thus, although cardiac arrhythmias are typically marked by abrupt onset and termination, they are not always.⁷

Precipitating Factors

A history of palpitations during strenuous activity is often normal, but palpitations during minimal stress suggest an underlying pathology, such as myocardial ischemia, congestive heart failure, atrial fibrillation,

anemia, thyrotoxicosis, or deconditioning. Prolonged QT syndrome, an inherited abnormality of myocardial repolarization, has received more attention recently because of the increased risk for sudden cardiac death associated with it. This disorder may present with palpitations during times of catecholamine excess and manifest itself as polymorphic ventricular tachycardia (VT) during these times.⁸

Use of drugs is another major precipitating cause of palpitations. Although patients may not be taking any prescribed medications, it is crucial to ask them if they have taken any over-the-counter remedies (eg,

sympathomimetic agents for allergies or colds), diet pills, illicit drugs (eg, cocaine), alcohol, tobacco, or even caffeinated beverages or chocolate.⁹

Associated Symptoms

Syncope, anxiety, dizziness, and chest pain are all symptoms associated with palpitations. Some of these symptoms are often secondary to a rapid heart rate and may have no further significance.

Syncope. Syncope is a serious symptom in patients with palpitations and may represent VT or a very rapid supraventricular tachycardia (SVT). Syncope caused by VT is a condition often requiring referral to an electrophysiologist for further evaluation. In patients with structurally normal hearts who have syncope caused by VT, the syncope may be secondary to a very rapid heart rate and thus may respond to antiarrhythmic therapy.¹⁰ However, syncope in patients with VT and underlying heart disease is often refractory to antiarrhythmic therapy and may herald sudden death. Syncope caused by SVT is rare, occurring as a manifestation of a very rapid heart rate and often responding to antiarrhythmic therapy.

Anxiety and dizziness. Palpitations associated with anxiety, a lump in the throat, dizziness, and tingling in the hands and face suggest sinus tachycardia accompanying an anxiety state marked by hyperventilation.

Angina. Palpitations associated with angina may suggest myocardial ischemia precipitated by increased oxygen demand, secondary to a rapid heart rate.

Relief with Vagal Maneuvers

Termination of palpitations with carotid massage or other vagal maneuvers (eg, Valsalva maneuver) may be effective in patients with SVTs, particularly in cases involving atrioventricular nodal tachycardia or a bypass tract.¹¹ Some patients may have learned such techniques on their own and only come for evaluation when the techniques are no longer effective in aborting the palpitations.

PHYSICAL EXAMINATION

The opportunity to perform a physical examination during an arrhythmia is rare. In most cases, physical examination is performed when the rhythm is normal in an attempt to delineate evidence of underlying organic heart disease. There are certain findings of a routine examination that, if detected, may be helpful. Examples of pertinent findings include general signs of anxiety (eg, tremors, nervous mannerisms), abnormal vital signs, pale skin, exophthalmos, goiter, jugular venous distension, carotid bruits, diminished carotid

upstroke, heart murmurs, gallops and clicks, wheezes, rales, lower extremity edema, and calf tenderness.

DIAGNOSTIC EVALUATION

Laboratory Studies

The purpose of performing laboratory studies is to identify or rule out possible precipitating factors, in particular those suggested by the history and physical examination. The value of laboratory testing in the evaluation of palpitations is rather limited and straightforward. In general, measurement of hemoglobin, serum glucose, and electrolyte levels and thyroid function tests should be performed in every patient with palpitations.

12-Lead Electrocardiogram

Every patient with palpitations of unknown origin also should have a resting 12-lead electrocardiogram (ECG). A 12-lead ECG obtained during an episode of palpitations can help in the diagnosis of a precise arrhythmia. In most cases, however, it is not possible to obtain a 12-lead ECG during the arrhythmia. Nevertheless, a 12-lead ECG is still useful, because it might detect evidence of conduction system disease, bundle branch block, ischemia, chamber enlargement, prior myocardial infarction, or other forms of organic heart disease. A list of ECG findings and their possible causes are provided in [Table 2](#).¹²

Ambulatory Monitoring

If results of history, physical examination, laboratory tests, and ECG do not yield a specific diagnosis, further diagnostic evaluation using ambulatory monitoring is suggested.

Holter monitoring. If palpitations occur on a daily basis, 24-hour Holter monitoring may help determine the etiology of the palpitations. With this technique, a patient is asked to continue with his/her regular activities and record any symptoms and the time of their occurrence in a diary. The 24-hour rhythm strip is then analyzed. If palpitations occurred during the monitoring period, correlation of the symptoms with an underlying arrhythmia based on the rhythm strip and the diary may be possible. If symptoms occur but there is no arrhythmia, a cardiac cause is less likely, and it is appropriate to look for nonarrhythmic causes of palpitations. The American Heart Association and American College of Cardiology (AHA/ACC) have specific guidelines for the use of Holter monitoring in the evaluation of palpitations.¹³

Transtelephonic electrocardiographic monitoring. Another instrument used to study palpitations is a

Table 2. Electrocardiographic Clues in the Evaluation of Palpitations

Electrocardiographic Findings	Possible Cause
Long QT interval	Polymorphic ventricular tachycardia*
Marked left ventricular hypertrophy	Hypertrophic obstructive cardiomyopathy, aortic stenosis, or severe hypertension
Q waves	Prior myocardial infarction (warrants search for nonsustained or sustained ventricular tachycardia*)
Short PR interval, delta waves	Wolff-Parkinson-White syndrome
Ventricular premature depolarizations, left bundle branch block with a positive axis	Idiopathic ventricular tachycardia, right ventricular outflow tract type*
Ventricular premature depolarizations, right bundle branch block with a negative axis	Idiopathic ventricular tachycardia, left ventricular type*

*Data from Zimetbaum and Josephson.¹²

transtelephonic postevent recorder. These handheld devices are given to patients and are applied to the precordium when symptoms occur. The patient presses a button to record about 30 seconds of cardiac rhythm, which is stored in the memory of the device and later transmitted over the telephone for printing and interpretation. Newer transtelephonic devices are now available that have memory loops, which allow retrieval of cardiac rhythm data 2 minutes before the device is activated. These devices are given to the patient for approximately 30 days; they are particularly helpful in patients who do not have palpitations on a regular basis. In randomized clinical trials, event recorders were found to be more diagnostic and cost effective than were Holter monitors in patients with less frequent and intermittent palpitations.^{14–16}

Treadmill Exercise Testing

Treadmill exercise testing may be helpful in establishing the etiology of palpitations in patients whose palpitations are precipitated by exercise and who have risk factors for ischemic heart disease. Exercise stress testing may be particularly useful for certain patients deemed to be at high risk for ischemic heart disease by global risk assessment.¹⁷

Echocardiography

The value of echocardiography for patients with palpitations lies in the assessment of ventricular function and the determination of the presence or absence of valvular diseases. The information gathered helps clinicians assess the presence and type of organic heart disease, determine the prognosis, and decide on therapy. Echocardiography is particularly useful in the evalua-

tion of patients whose palpitations may be secondary to structural heart disease, as in patients with hypertrophic obstructive cardiomyopathy. Echocardiography also can help establish the diagnosis and severity of mitral valve prolapse in patients with an unremarkable physical examination. Hence, in young patients with unexplained palpitations, an echocardiogram might support a diagnosis of mitral valve prolapse, which has been related to cardiac arrhythmias.¹⁸ The AHA/ACC have special recommendations for the use of echocardiography in evaluation of patients with palpitations.¹⁹

Electrophysiologic Studies

Some patients with palpitations may benefit from more invasive electrophysiologic studies (EPS).^{20,21} This testing may be particularly helpful in the evaluation of patients who have a documented inappropriately rapid pulse rate but normal electrocardiographic findings and patients who have palpitations preceding syncope or the sporadic occurrence of palpitations. Moreover, patients with SVTs that are frequent and not easily controlled with medical treatment often benefit greatly from EPS and, if appropriate, radiofrequency ablation. Patients with VT who have syncope or evidence of organic heart disease also are potential candidates for EPS because of their increased risk for sudden cardiac death. If EPS reveal an evidence of inducible arrhythmia in these patients, treatment with radiofrequency ablation or placement of an implantable defibrillator often significantly improves prognosis. The AHA/ACC also have specific guidelines for the use of EPS in evaluation of patients with palpitations.²² General indications for referral to an electrophysiologist appear in **Table 3.**

Table 3. General Indications for Referral to an Electrophysiologist in Patients with Palpitations

Hypertrophic cardiomyopathy with ventricular tachycardia
Long QT syndrome
Potentially life-threatening arrhythmia requiring intervention
Rhythm problems in patients with pacemakers and defibrillators
Right ventricular dysplasia with ventricular tachycardia
Second- and third-degree atrioventricular blocks
Sustained ventricular tachycardia
Symptomatic sinus bradycardia
Uncontrolled or recurrent atrial fibrillation refractory to standard therapies
Unexplained symptomatic ventricular ectopy

MANAGEMENT CONSIDERATIONS

After obtaining a thorough history, performing a complete physical examination, and choosing appropriate laboratory studies and other noninvasive evaluations for patients with palpitations, the physician should have a firmer understanding of the etiology of the problem and its appropriate treatment. Specifically, the physician should be able to identify the nature of any arrhythmia present; detect underlying precipitating causes or structural or ischemic cardiac disease; explain to the patient the nature of the problem, as well as its significance and prognosis; suggest any pertinent additional evaluations (eg, EPS); and recommend a treatment approach. In general, treating the cause of the palpitations can reduce or eliminate their occurrence. A detailed discussion of appropriate pharmacologic and nonpharmacologic treatment of various causes of palpitations is beyond the scope of this paper.

SUMMARY

Palpitations are a nonspecific symptom that do not necessarily imply underlying serious heart disease but do raise concerns on the part of the patient and physician. If an arrhythmia is present, it should be taken very seriously, because it may be a sign of another organic cardiac/metabolic problem or an indicator of a serious degree of incapacitating symptoms. Evaluation of palpitations thus involves detecting any underlying arrhythmia, assessing the severity of symptoms, and excluding the presence of underlying structural heart disease or other precipitating causes. Patients with palpitations can generally be evaluated on an outpatient basis. However, patients whose palpitations are accom-

Table 4. Indications for Admitting Patients with Palpitations to the Hospital

Arrhythmias associated with hemodynamic compromise
Life-threatening arrhythmias requiring rapid control (eg, rapid tachyarrhythmias, polymorphic ventricular tachycardia)
Significant underlying heart disease (eg, cardiomyopathy with congestive heart failure, atherosclerotic heart disease with active ischemia)
Symptomatic arrhythmias associated with angina or syncope

panied by syncope, hemodynamic compromise, or an uncontrolled arrhythmia may require hospitalization for aggressive cardiac evaluation (**Table 4**) and, possibly, EPS to guide treatment.

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