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PRACTICE

PRACTICE POINTER

# Assessment of palpitations

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## What are palpitations?

Palpitations are a symptom characterised by awareness of the heartbeat, often described as a strong, skipping, fluttering, racing, pounding, thudding, or jumping sensation in the chest. Some patients describe a sensation of having to cough or their breath being taken away. However, patients occasionally mean something other than palpitations, such as chest discomfort, which may need a different line of investigation.

## What causes palpitations?

Most palpitations are benign (being atrial, nodal, or ventricular extrasystoles[1]), and probably less than half of cases are due to heart rhythm abnormalities or arrhythmias. Anxiety is a common cause of palpitations; up to a third have psychological causes.[2] Infrequently, however, they may be incapacitating and can lead to syncope or sudden cardiac death. Equally, a large proportion of patients with palpitations (67% in one study[3]) are diagnosed as having panic, stress, or anxiety when, instead, they have an underlying arrhythmia.[3 4]

Palpitations that are due to a heart rhythm abnormality are usually tachyarrhythmias or extrasystoles. They are rarely due to bradycardias. By far the most frequent form of palpitation comes from ventricular extrasystoles,[1] which the patient often describes as "missed or skipped beats." Other common causes include atrial fibrillation and/or flutter (paroxysmal, persistent, or permanent), paroxysmal supraventricular tachycardias or ventricular tachycardias (usually non-sustained and related to exercise) arising from the outflow tract of the right ventricle, and sinus tachycardia.

## Extrasystoles

Generally, ventricular or atrial extrasystoles are not associated with clinically significant structural heart disease. Relatively infrequent ventricular extrasystoles are common in the population and are not usually of concern in younger patients; an underlying cause is usually not identified. Frequent ventricular extrasystoles (at least 30 per hour) may be more of a concern in patients older than 55 years.[5]

Among 73 healthy patients (confirmed by non-invasive cardiac investigations) with about 10 000 ventricular extrasystoles per 24 hours, one sudden death and one death from cancer occurred over a 10 year follow-up, compared with an expected 7.4 deaths calculated from a standardised mortality ratio.[6]

However, in a study of 678 apparently healthy patients aged between 55 and 75 years, 56 had more than 30 ventricular extrasystoles per hour, of whom 12 died or had a myocardial infarction; in contrast, of 567 patients who had less than 10 ventricular extrasystoles per hour, 50 experienced such events (hazard ratio 2.65, 95% confidence interval 1.41 to 4.95; P=0.0025).[5] Although the extrasystole threshold seems much lower in this study, the patients were older and the risk of events was greater in those with higher Framingham risk scores.

Extrasystoles may sometimes be due to underlying myocardial ischaemia, scar, hypertension, heart failure, or, much less frequently, a cardiac myopathic process or inherited cardiac condition such as a channelopathy. Notably, very frequent ventricular extrasystoles (>20% of all heart beats) may cause, rather than result from, left ventricular systolic dysfunction.[7]

## Supraventricular arrhythmias

Paroxysmal supraventricular tachycardias are related to conduction abnormalities in the atrioventricular node or to the presence of bypass tracts. Atrial fibrillation and flutter, on the other hand, are associated with hypertension, heart failure, diabetes, coronary artery disease, obesity, sleep apnoea, thyrotoxicosis, acute or chronic alcohol misuse, and valvular heart disease, and they increase in incidence with age.[8] Atrial fibrillation and sustained atrial tachycardia at rates greater than 120 beats per minute can also induce left ventricular systolic dysfunction.

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**What you need to know**

Palpitations are common, and often frightening for the patient, but are usually benign; most are due to atrial or ventricular extrasystoles

For all patients with palpitations, undertake a careful history, examination, blood tests (full blood count, urea, creatinine, electrolytes, and thyroid function tests), and a 12 lead electrocardiogram for risk stratification. This will determine if and how quickly they need referral to a specialist

Refer patients to secondary care if the palpitations are provoked by exercise or associated with lightheadedness, syncope, persistent breathlessness, chest pain, or recurrent sustained tachyarrhythmias; if there is a history or signs of structural heart disease, heart failure, or hypertension or a family history of sudden cardiac death; or if the 12 lead electrocardiogram is abnormal

Ambulatory rhythm monitors are not always needed in primary care. If needed, tailor the monitoring to the frequency of symptoms (for example, use 24 hour to seven day Holter monitoring only if palpitations occur daily to weekly)

# How do we investigate them?

## Clinical history

The history is central to ascertaining the cause of palpitations and therefore whether the patient warrants referral to cardiology and how urgently. Boxes 1 and 2 outline what to ask.

## Clinical examination

Although often normal, careful examination for signs of disease associated with palpitations is necessary. These include signs of heart failure (raised jugular venous pressure, ankle swelling, gallop rhythm, crackles), valvular heart disease (murmurs), thyrotoxicosis (tremor, thinness, goitre), and anaemia (pallor). Hypertension may be present.

## Clinical investigations

Essential investigations should include blood tests and a 12 lead electrocardiogram. Other investigations may include ambulatory rhythm monitoring. If underlying heart disease is suspected (or confirmed), the patient should be referred to cardiology for further investigations including an echocardiogram and sometimes an exercise tolerance test.

### *Blood tests*

These include:

- A full blood count (checking for anaemia and infection);
- Serum urea, creatinine, and electrolytes (checking for renal impairment or deranged sodium or potassium concentrations as possible causes of arrhythmias); and
- Thyroid function tests.

### *12 lead electrocardiogram*

Even though patients rarely experience palpitations during the consultation (and less so during the recording of the electrocardiogram), this test is crucial in offering more information than other cardiac investigations for the evaluation of palpitations. Box 3 lists key electrocardiographic features that should lower the threshold for seeking further advice. Palpitations in the context of a normal electrocardiogram are much less likely to be associated with a cardiac pathology or adverse clinical outcome. For patients with infrequent palpitations, asking them to attend your practice or the emergency department to have an electrocardiogram recorded during symptoms is not unreasonable.

### *Ambulatory rhythm monitors*

Ambulatory rhythm monitors include Holter monitors, patient activated event recorders (specific devices or modified smart phones), wearable patch monitors (for up to three or four weeks, and the implantable loop recorder. These are not always required in general practice, however, as the history, examination, blood tests, and 12 lead electrocardiogram may identify the underlying cause in up to 40% of patients.[5] Moreover, the correlation between palpitations and arrhythmias is poor,[9] and the diagnostic yield in the community setting is determined by symptom frequency.

If, from the history, clinical examination, and initial blood tests, you are happy that the patient is describing infrequent extrasystoles, an ambulatory rhythm monitor is not necessary. For palpitations that are not thought to be extrasystoles or for patients with a high burden of extrasytoles, an ambulatory rhythm monitor may help to clarify the diagnosis. However, restrict a 24 hour Holter monitor to patients who have at least daily symptoms, a 48 hour Holter monitor to those with symptoms on most days, and a seven day monitor to those with weekly symptoms, even if the 12 lead electrocardiogram is normal. Inappropriate use of short periods of ambulatory monitoring for infrequent symptoms is cumbersome for patients, delays the diagnosis, and is costly.[10] In a specialist electrophysiology clinic, the Holter monitor is necessary. This is to decipher the morphology and anatomical origin of the arrhythmia and detect short asymptomatic episodes that suggest the type of arrhythmia responsible for symptomatic episodes, rather than to identify its presence.

The table⇓ shows the diagnostic scenarios of ambulatory rhythm monitoring. The absence of an arrhythmia on an ambulatory rhythm monitor is often reassuring for the patient. The recording of an arrhythmia that corresponds to the patient's symptoms helps to clinch the diagnosis. Absence of an arrhythmia during an episode of palpitations is also diagnostic and is of great value to the patient and practitioner. Of note, when palpitations do not occur during an ambulatory recording and no arrhythmias are identified, the investigation is not diagnostic. The clinician should, therefore, not dismiss the patient's symptoms but consider an alternative ambulatory rhythm monitor over a great length of time.

*Patient activated event recorders*—These allow investigation of palpitations over a much longer period of time (typically a month) and are usually reserved for patients in secondary care with infrequent but sufficiently prolonged symptoms, who can activate the devices and have been risk stratified as an urgent referral (see next section). They diagnose clinical arrhythmia in a greater proportion of patients with paroxysmal palpitations and dizziness than do Holter monitors,[11 12] and they are more cost effective.[10] Some hospitals now provide smart phone monitors that can be used in concert with a smart phone application (figure⇓).

*Implantable loop recorder*—This is a small battery powered device inserted under the skin over the left chest wall that records the heart beat. For palpitations that are uncommon but associated with syncope, this may be needed because the patient is not able to activate recording devices.[13]

**Box 1: What to ask about palpitations**

What does the patient mean by "palpitations"? Ensure s/he is not describing a different symptom such as chest discomfort instead

Ask the patient to tap out on the table what s/he experiences during the palpitations. Are they fast (tachyarrhythmia), irregular (atrial fibrillation), or missed beats (extrasystoles)? Show how to tap out the normal rhythm if s/he does not understand

How long do the palpitations last, and how often do they occur?

Assess the severity. What does the patient do when the palpitations are present? Does s/he ignore them or sit or lie down? Or does s/he collapse or lose consciousness? Syncope during palpitations needs urgent specialist review

When do the palpitations occur? Palpitations during exertion or immediately afterwards need urgent specialist review as they may reflect cardiomyopathy, myocardial ischaemia, or channelopathy

Do they start suddenly? Can they be provoked?

Are the palpitations associated with breathlessness or chest pain? A brief sensation of having to cough or "breath taken away" suggests extrasystoles, whereas persistent breathlessness may be a sign of heart failure or myocardial ischaemia. Chest pain during palpitations may reflect coronary artery disease or a tachyarrhythmia

How do the palpitations end? Sudden termination suggests a paroxysmal supraventricular tachycardia. Can the patient end the attacks by coughing, straining (Valsalva manoeuvre), or breath holding, especially with the face in water (diving reflex), suggesting paroxysmal supraventricular tachycardia?

**Box 2: What to ask about medical and family history**

What drugs is the patient taking? The following classes of drugs (with examples) are associated with tachyarrhythmias: β agonists (salbutamol), antimuscarinics (amitriptyline), theophylline (phylocontin), dihydropyridine calcium channel blockers (nifedipine), class 1 anti-arrhythmics (flecainide, disopyramide), drugs that may prolong the QT interval (erythromycin, moxifloxacin), and illicit drugs (cocaine, amphetamines)

Are there any contributing lifestyle factors? Alcohol excess, caffeine, and illicit drugs provoke extrasystoles and atrial fibrillation

Are there other social or medical factors that may lower the threshold for some arrhythmias? For example, business or other worries, lack of sleep, and fever are associated with ventricular extrasystoles and atrial fibrillation

Are there medical conditions that may be associated with atrial fibrillation and flutter? For example, hypertension, heart failure, coronary artery disease, valvular heart disease, diabetes, obesity, sleep apnoea, thyrotoxicosis, and acute or chronic alcohol misuse

Are there medical conditions that may be associated with tachyarrhythmias? For example, anaemia, thyrotoxicosis

Is there a family history of sudden cardiac death? Sudden cardiac death (which may have caused drowning, epilepsy, or a road traffic accident) under the age of 40 years is suggestive of an arrhythmia and raises the possibility of an inherited cardiac condition

**Box 3: 12 lead electrocardiogram practice pointers for palpitations—when to consider specialist referral**

Atrial fibrillation or atrial flutter

Second degree atrioventricular block

Third degree atrioventricular block

Myocardial infarction

Left ventricular hypertrophy (with or without strain pattern)

Left bundle branch block

Abnormal T waves and ST segments

Pre-excitation (Wolff-Parkinson-White pattern of a slow rise in the initial portion of the QRS (delta wave))

Abnormal QT/QTc interval

## When should we seek specialist input?

The cornerstone of the assessment of palpitations is risk stratification, to determine the need for referral and its urgency.[14]

## Low risk features for which referral is not mandatory

- Isolated palpitations (described as skipped beats, pounding, or short fluttering) that are not provoked by exercise and not associated with symptoms such as lightheadedness, syncope, persistent breathlessness, or chest pain;
- No history or signs of structural heart disease, heart failure, or hypertension and no family history of sudden cardiac death; and
- A normal 12 lead electrocardiogram.

In these cases, palpitations are generally due to extrasystoles or sinus tachycardia.

## Routine cardiology referral (preferably to cardiologists who are also cardiac electrophysiologists)

- Palpitations associated with symptoms such as chest pain or lightheadedness;
- A history of recurrent sustained tachyarrhythmia, atrial fibrillation, or flutter;
- A history or physical signs of structural heart disease, hypertension, or heart failure;
- A clear history of palpitations, consistent with a paroxysmal supraventricular tachycardia (sudden onset and offset of a fast regular heartbeat), with multiple non-diagnostic ambulatory rhythm monitor recordings (these patients could be referred directly to an electrophysiologist for electrophysiological studies and any necessary treatment); or
- An abnormal 12 lead electrocardiogram (apart from second degree or third degree atrioventricular block, which requires urgent referral).

## Urgent cardiology referral

- Palpitations during exercise;
- Palpitations associated with syncope or pre-syncope;
- Family history of sudden cardiac death or inheritable cardiac conditions; or
- Second degree or third degree atrioventricular block on the 12 lead electrocardiogram.

## Can the patient drive?

In the United Kingdom, the Driver and Vehicle Licensing Agency (DVLA) regulations state that if an arrhythmia has caused incapacity or is likely to cause incapacity, the patient must not drive.[15] It is the clinician's responsibility to notify the patient of this, document it in the case records, and advise the patient to contact the DVLA, who will make the final recommendation.[16] Similarly, US and European guidelines for fitness to drive for class 1 licence holders recommend that driving should stop while patients have symptoms (with tachyarrhythmias or bradyarrhythmias). Driving may resume once symptoms are controlled for one month, although in the United States a longer restriction is recommended pending evaluation of any broad complex tachycardia.[17] For class 2 (large lorries and buses) licence holders, the restrictions are more stringent.

## What should we tell the patient?

A patient adviser suggests: "Be honest and reassuring. Explain what they are, how they arise, and at what threshold you would refer them to a specialist, or if and why additional tests may not be needed." If specialist referral is not necessary, and the palpitations are considered to be, for example, infrequent extrasystoles, spend some time explaining that these are due to extra heart beats that usually arise from the main pumping chamber of the heart; that, although palpitations may be frightening, they are unlikely to cause harm; that further tests are not needed but that you would refer to a specialist if the palpitations occur with exertion or with other symptoms such as chest pain, lightheadedness, or loss of consciousness or are sustained.

## How patients were involved in creating this article

We invited a patient to comment on the paper and the patient's own experience and expectations of an "ideal" consultation with a primary care physician, inserting their comments in the relevant section.

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1 Hiss RG, Lamb LE. Electrocardiographic findings in 122,043 individuals. *Circulation* 1962;25:947-61.
2 Weber BE, Kapoor WN. Evaluation and outcomes of patients with palpitations. *Am J Med* 1996;100:138-48.
3 Lessmeier TJ, Gamperling D, Johnson-Liddon V, et al. Unrecognized paroxysmal supraventricular tachycardia: potential for misdiagnosis as panic disorder. *Arch Intern Med* 1997;157:537-43.
4 Barsky AJ, Cleary PD, Coeytaux RR, Ruskin JN. Psychiatric disorders in medical outpatients complaining of palpitations. *J Gen Intern Med* 1994;9:306-13.
5 Sajadieh A, Nielsen OW, Rasmussen V, et al. Ventricular arrhythmias and risk of death and acute myocardial infarction in apparently healthy subjects of age >or=55 years. *Am J Cardiol* 2006;97:1351-7.
6 Kennedy HL, Whitlock JA, Sprague MK, Kennedy LJ, Buckingham TA, Goldberg RJ. Long-term follow-up of asymptomatic healthy subjects with frequent and complex ventricular ectopy. *N Engl J Med* . 1985;312:193-7.
7 Baman TS, Lange DC, Ilg KJ, et al. Relationship between burden of premature ventricular complexes and left ventricular function. *Heart Rhythm* 2010;7:865-9.
8 Go AS, Hylek EM, Phillips KA, et al. Prevalence of diagnosed atrial fibrillation in adults: national implications for rhythm management and stroke prevention: the AnTicoagulation and Risk Factors in Atrial Fibrillation (ATRIA) Study. *JAMA* 2001;285:2370-5.
9 Barsky AJ. Palpitations, arrhythmias, and awareness of cardiac activity. *Ann Intern Med* 2001;134:832-7.
10 Kinlay S, Leitch JW, Neil A, Chapman BL, Hardy DB, Fletcher PJ. Cardiac event recorders yield more diagnoses and are more cost-effective than 48-hour Holter monitoring in patients with palpitations: a controlled clinical trial. *Ann Intern Med* 1996;124:16-20.
11 Thavendiranathan P, Bagai A, Khoo C, Dorian P, Choudhry NK. Does this patient with palpitations have a cardiac arrhythmia? *JAMA* 2009;302:2135-43.
12 De Asmundis C, Conte G, Sieira J, et al. Comparison of the patient-activated event recording system vs. traditional 24 h Holter electrocardiography in individuals with paroxysmal palpitations or dizziness. *Europace* 2014;16:1231-5.
13 National Institute for Health and Care Excellence. Transient loss of consciousness ('blackouts') management in adults and young children. NICE, 2010 (NICE clinical guideline 109).
14 Wolff A, Campbell C. 10 steps before your refer for palpitations. *Br J Cardiol* 2009;16:182-6.
15 Driver and Vehicle Licensing Agency. For medical practitioners: at a glance guide to the current medical standards of fitness to drive. DVLA, 2014.
16 Binns H, Camm J. Driving and arrhythmias. *BMJ* 2002;324:927-8.
17 Banning AS, Ng GA. Driving and arrhythmia: a review of scientific basis for international guidelines. *Eur Heart J* 2013;34:236-44.

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# Table

**Table 1| Possible outcomes of ambulatory rhythm monitoring**

| Ambulatory rhythm monitor results | Palpitations during ambulatory rhythm monitoring? | |
|---|---|---|
| | Yes | No |
| Arrhythmia | Arrhythmia diagnosed | Coincidental arrhythmia or asymptomatic form (possibly diagnostic) |
| No arrhythmia | Palpitations are not due to arrhythmia | No diagnosis possible |

## Figure


Smartphone monitor and app, with two metal finger pads on reverse and heart rhythm on screen. Reproduced with permission from AliveCor