

Review: Rapid assessment of patients with palpitations

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Summary Background. Palpitations are one of the most prevalent general practice presentations and a concerning aetiology for cardiac causes. Since many physiological and pathological causes induce palpitations, doctors tend to conduct long-term, expensive evaluations, laboratory tests and specialised examinations. In addition to increasing medical expenses, more evaluations can lead to distress for patients and their families. While palpitations tend to be benign, on the other hand, they may sometimes have life-threatening implications.

Objectives. To summarise the current study on rapid assessment of patients with palpitations; therefore, patients will receive adequate management and treatment effectively.

Material and methods. A comprehensive electronic search was conducted using PubMed, Google Scholar, SAGE and ScienceDirect. The following search keywords were used: palpitation, assessments, ECG, emergency and diagnostic testing. The search was limited to English-language publications from 1990 to 2021. Manual searching of relevant journals and reference lists was also performed.

Results. Palpitations are a common clinical sign caused by various factors. Palpitations are a frequent clinical symptom with a wide range of causes. A systematic rapid assessment can initially identify palpitations.

Conclusions. If the patient is examined during palpitations, the earliest echocardiogram (ECG) record is important in the diagnostic approach while waiting for further workup. A detailed history taking is then necessary to narrow the cause of palpitations. A comprehensive history helps determine which testing and monitoring will be needed.

Key words: medical history taking, echocardiography, physical examination.

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Background

Palpitations account for 16% of symptoms that drive patients to contact their general practitioner, according to studies in primary care settings, and are the second most frequent reason for referral to a cardiologist [1]. 14% of 190 patients in a prospective study in medical clinics of the University of Pittsburgh Medical Center (1996) presented with arrhythmias (16% with atrial fibrillation/flutter, 10% with supraventricular tachycardia and 2% with ventricular tachycardia), 3% with structural heart disease, 31% with psychosomatic illnesses, 4% with systemic causes and 6% with the use of medicine, illegal drugs or stimulants as the cause of their palpitations. Patients experiencing palpitations had a 15–31% chance of both experiencing anxiety or panic attacks according to case records [2]. Therefore, it is essential to conduct a thorough history and physical examination before proceeding with any additional evaluation or management recommendations. In an emergency, doctors also need to be alerted to patients whose palpitations might indicate a life-threatening condition [3].

Objectives

This review specifically provides a summary for general practitioners in primary care which underlines the necessity for a systematic, evidence-based, step-by-step work-up that can discriminate between patients with a benign prognosis and those with a worse prognosis, as well as additional treatment from the start.

Material and methods

A comprehensive electronic search was conducted by using four databases: PubMed, Google Scholar, SAGE and Sciencedirect. Relevant journal and reference lists were also searched manually. Only publications in English were considered for this search. A literature study, primary research papers and case studies were all reviewed. Articles written in languages other than English and those where the full text was not available were excluded. Palpitation, evaluations, electrocardiogram, emergency and diagnostics were some of the keywords used. Mendeley was utilised to collect and organise the retrieved articles. Multiple databases were retrieved, yielding a small number of duplicate citations that were removed utilising the Mendeley tool. Following a preliminary sorting by title and abstract, the full texts were examined, and the information was then organised into a review and a figure featuring an algorithm for rapid assessment of a patient with palpitations (Figure 1).

Result and discussion

Definition

Patients who have palpitations often describe them as feeling like their hearts are beating rapidly. This unpleasant sensation, which is described as a pulse or movement in the thorax and/or surrounding regions, often leads people to seek medical care [4]. When palpitations occur, it might be a symptom of



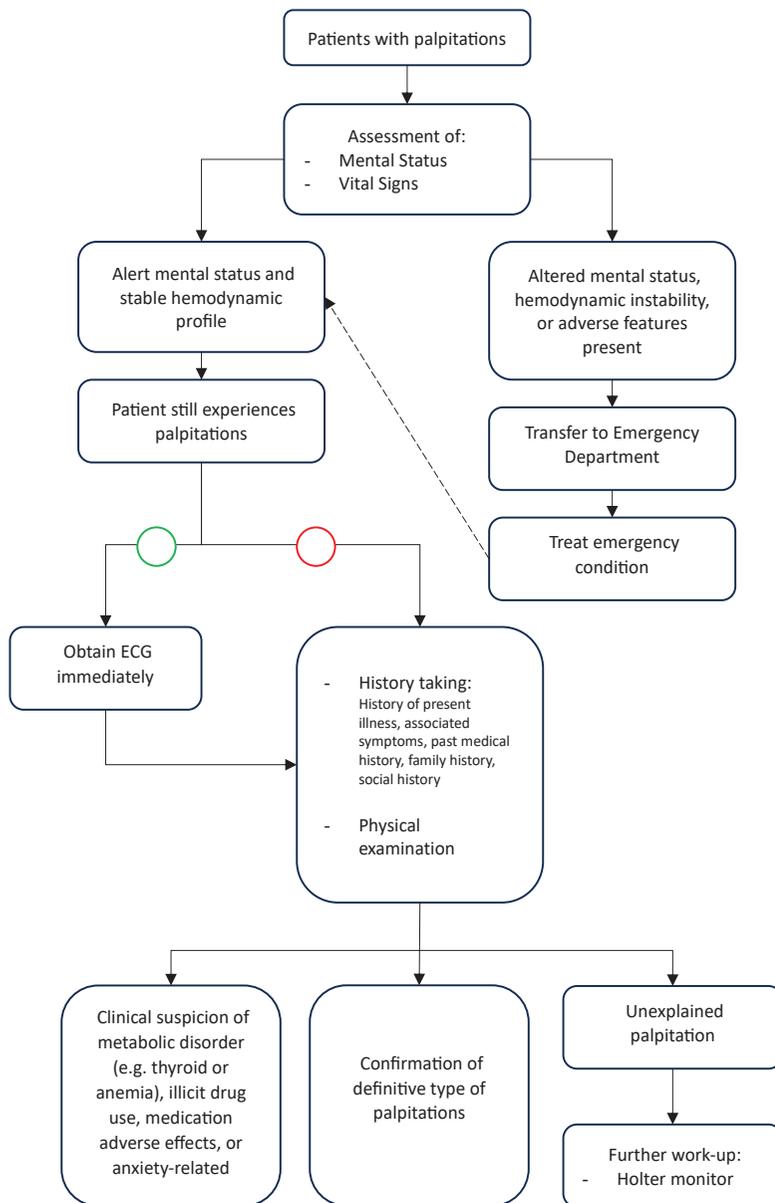


Figure 1. Rapid assessment of patient with palpitations algorithm

a cardiac arrhythmia. However, the same symptoms can be considered as physiological palpitations after an intense exercise or mental stress. Therefore, outside of these contexts, palpitations are considered abnormal [5]. Furthermore, it is important to recognise that physiological responses to increased body temperature, decreased intravascular volume and electrolyte imbalance are reversible causes of palpitations [3]. However, palpitations are also a general symptom that may be brought on by a wide variety of conditions.

Cause

A variety of factors can cause palpitations. The likelihood of a substantial underlying cause and the consequent risk of cardiac-related mortality is generally a source of initial concern. Although the most immediate issue during the assessment of a patient with palpitations is to identify any underlying cardiac cause, noncardiac factors may also contribute and may be treated (Table 1) [6]. In addition, a benign palpitation is often associated with palpitations (particularly if they are anxiety-related or extrasystolic) in patients who have no underlying heart disease [7]. On the other hand, out-of-hospital ventricular fibrillation (VF), recurrent sustained ventricular tachycardia (VT) and ventricular tachycardia with torsades de pointes (VT) in long QT

syndrome are the three most common types of malignant palpitations with a poor prognosis [8]. To distinguish malignant from benign palpitations, it is helpful to have a thorough history of syncope accompanied by malignant ECG features [9].

Table 1. Cardiac and noncardiac causes of palpitations [6]

| Cardiac | Noncardiac |
|------------------------------------|-------------------------|
| Atrial fibrillation/flutter | Alcohol |
| Atrial myxoma | Anaemia |
| Atrial premature contractions | Anxiety/stress |
| Atrioventricular reentry | Beta-blocker withdrawal |
| Atrioventricular tachycardia | Caffeine |
| Autonomic dysfunction | Cocaine |
| Cardiomyopathy | Exercise |
| Long QT syndrome | Fever |
| Multifocal atrial tachycardia | Medications |
| Sick sinus syndrome | Nicotine |
| Supraventricular tachycardia | Paget disease of bone |
| Valvular heart disease | Pheochromocytoma |
| Ventricular premature contractions | Pregnancy |
| Ventricular tachycardia | Thyroid dysfunction |

Diagnosis strategy

History taking

Rapid initial evaluation

The majority of people with palpitations have no symptoms at the time of assessment. Haemodynamic status plays a crucial role in ensuring patient safety. Heart rates outside of the normal range, whether bradycardia (less than 60 beats per minute) or tachycardia (more than 100 beats per minute), should be regarded as deterioration symptoms since a patient with normal rates is unlikely to have a serious haemodynamic compromise. Patients suffering adverse effects should be sent to the emergency department (ED) as soon as possible for further examination and immediate care. Adverse effects of palpitations include low systolic blood pressure (less than 90 mm Hg), increased heart rate (more than 150 beats per minute), decreased heart rate (less than 40 beats per minute), cardiac failure, chest discomfort and impaired consciousness [10].

A transfer to the ED is also required when cardiac arrhythmias are suspected in a person with a history of coronary artery disease and who are accompanied by an altered mental status or chest pain [3]. ECG recording is the key to a rapid assessment if the patient presents while experiencing palpitations. According to the results of the research, rapid assessment by 12-lead ECG less than 5 minutes after arrival is mostly accountable for adequate management [11]. Prehospital administration with an even earlier ECG showed more benefits, especially for people with paroxysmal atrial fibrillation or junctional tachycardia, which tend to terminate quickly without antiarrhythmic medications [12].

History of present illness and palpitation

At first, the patient's symptoms of palpitations should not be confused with chest pain or its manifestations [13]. Once it has been determined that a patient is experiencing palpitations, it is necessary to identify their characteristics, specifically the frequency and rhythm. Basic questions such as "rapid, slow or normal" or "regular or irregular" might be useful. Then clarify to the patient the sense of skipping, missing or extra beats, since these may imply ventricular ectopics [14]. A description of the palpitation's characteristics may aid in determining the underlying cause (Table 2) [15].

Due to ectopic beats, extrasystolic palpitations lead to the 'missing/skipping a beat' or 'sink of the heart'. Patients report that they seem to stop and start again, creating an uncomfortable feeling, even a sense of a hit to the chest. This type of palpitation is regularly observed even in young people, typically without cardiac disease, and usually has a good prognosis linked with the existence of atrial or ventricular extrasystolic beats [16].

The rapid swinging, or 'beating wings' in the chest, is described by patients with tachycardia palpitations. The perceived extremely rapid heart rate (greater than the maximum esti-

mated cardiovascular rate based on the patient's age) can be regular, as in re-entrant atrioventricular tachycardia, atrial or ventricular tachycardia, or irregular or arrhythmic, as in atrial fibrillation or post-atrial fibrillation atypical atrial flutter. Intense, yet rhythmic, pulsations are experienced. Conditions like aortic regurgitation and other structural heart disorders, as well as systemic causes of severe strokes, including fever and anaemia, are often linked with such symptoms [17].

If a patient is unable to verbally express their palpitations, it may be beneficial to ask them to tap their fingers on a table or to orally mimic the rhythm that is being felt in their heart. Furthermore, the conditions accompanying palpitations are usually helpful for understanding their cause. Some of these cases are shown in Table 3. Additionally, it is essential to analyse the aggravating and relieving variables associated with palpitations [18].

The onset of symptoms when a patient is speaking in front of many people may indicate a more benign cause, such as anxiety or supraventricular tachycardia. According to one study, the longer the palpitation lasts, the more probable it is caused by an arrhythmia rather than a noncardiac cause [19]. However, palpitations that last for just a few seconds are more likely to be premature ventricular contractions (PVCs) or premature atrial contractions (PACs). Sustained palpitations that last minutes (or more) are more likely to be caused by supraventricular arrhythmias, ventricular arrhythmias or anxiety [12].

When investigating the chronology of palpitation, it is important to determine where the patient was and what they were doing when the palpitations began. When occurring while sitting, it may have a vagal nerve-mediated aetiology (such as ventricular premature contraction), but when active or exercising, it may be the result of dehydration, implying progressive mitral valve prolapse cardiomyopathy or exertional syncope. Research found that the odds that palpitations have a cardiac cause are much higher when they occur at work or upon awakening from sleep. Posture and postural alterations need close attention as well. For example, standing up after a leaning position has been linked to atrioventricular nodal re-entrant tachycardia. Premature ventricular contractions and supraventricular tachycardia are usually detected while the patient is lying in bed [20]. However, it is essential to note that if the patient is experiencing palpitations during a history taking, it is naturally unnecessary to carry out this extensive history taking. In these conditions, the rapid initial assessment is to record an ECG immediately.

Associated symptoms

Patients experiencing palpitations should be checked for signs of loss of consciousness. Syncope can be caused by arrhythmias, like ventricular tachycardia, or structural heart diseases, such as hypertrophic cardiomyopathy with outflow tract obstruction reducing cardiac output to the point that cerebral

Table 2. Types of palpitations and their clinical presentations [15]

| Type of palpitation | Subjective description | Heartbeat | Onset and termination | Trigger situations | Possible associated symptoms |
|---------------------|---|--|-----------------------|-------------------------------|---|
| Extrasystolic | 'Skipping/missing a beat', 'sinking of the heart' | Irregular, interspersed with periods of normal heartbeat | Sudden | Rest | – |
| Tachycardiac | 'Beating wings' in the chest | Regular or irregular, markedly accelerated | Sudden | Physical effort, cooling down | Syncope, dyspnoea, fatigue, chest pain |
| Anxiety-Related | Anxiety, agitation | Regular, slightly accelerated | Gradual | Stress, anxiety attacks | Tingling in the hands and face, lump in the throat, atypical chest pain, sighing dyspnoea |
| Pulsation | Heart pounding | Regular, normal frequency | Gradual | Physical effort | Asthenia |

blood supply is impaired. Although vasovagal syncope can occur with the syncope or presyncope, it mainly involves an elevated risk of malignant ventricular arrhythmia during exercises in an athlete, leading to sudden cardiac death. It is estimated that one to three sudden cardiac deaths occur every 100,000 persons/year among young athletes [21].

Cardiac palpitations induced by heat intolerance may suggest hyperthyroidism, while fever may suggest an infection. On the other hand, shortness of breath or a shaking feeling, nausea, dizziness, chest discomfort and paraesthesia might lead to an anxiety or panic attack diagnosis [22]. Natriuretic hormone hypersecretion causes polyuria, a symptom of atrial tachyarrhythmias, especially atrial fibrillation. On the contrary, the suspicion of supraventricular tachycardia, particularly atrioventricular, is caused by the sensation of a rapid and regular pulse of the neck (‘frog sign’) [23]. This is the result of the contraction of the atrium against the closed mitral and tricuspid valves [24].

Past medical history

One study revealed that palpitations of a patient are most likely psychiatric in young people; a hypochondria or somatisation disorders have been previously identified. A study showed that 15% to 31% of patients with palpitations present with an underlying panic disorder [6]. If anxiety is believed to contribute, the clinician might utilise the Generalized Anxiety Disorder (GAD-7) scale. Other related symptoms, such as diaphoresis and peripheral numbness, may also contribute to an anxiety diagnosis or panic attack [25]. However, doctors should not presume that a known behavioural disorder is the cause of palpitations in psychiatric patients, because up to 13% of these individuals have a non-psychiatric aetiology [26]. Arrhythmias may be exacerbated by thyroid dyscrasia; thus, a thyroid disorder should be evaluated promptly for its symptoms [27].

Medication history

Medication history is particularly important since it might be the cause of the presented symptoms. There is evidence linking the use of over-the-counter medications, such as pseudoephedrine nasal decongestants, omega-3 polyunsaturated fatty acids, coenzyme Q10 and carnitine, to the development of palpitations [28]. Patients should also be asked about their use of illicit drugs, like cocaine and methamphetamine. The signs and symptoms that should be observed are pupil dilation, perspiration, thirst and a dry mouth. Additionally, marijuana consumption may also cause palpitations [29].

Family history

A family history of diseases as can also help in direct palpitation assessment. Prolonged QT syndrome, cardiomyopathy, anxiety and thyroid disease can also occur in the family. The patient should also be asked about any family history of heart disease, namely deaths before the age of 55 for males and before the age of 65 for females [30].

Social history

Social history should be obtained, and an assessment of lifestyle variables relating to the increasing perception of palpitations, including high intake of caffeine and smoking, should be carried out. A typical cause of palpitation is caffeine, as it is very common in the habits of many patients. Cigarettes and other nicotine products may also contribute to heart palpitations [31]. There is also the possibility that drugs like anabolic steroids, which athletes and weightlifters use to enhance performance, might cause palpitations [29].

Physical examination

While a physical examination is beneficial, this may be insufficient for patients with palpitations. This is mostly owing to intermittent palpitations and the absence of symptoms upon admission to a healthcare facility. A physical examination, however, allows for the recognition of many potential causes and the establishment of a differential diagnosis. After initial rapid assessments are made, patients who are stable need a focused cardiovascular examination to ensure pulse, blood pressure, cardiac sounds and signs of cardiac failure [22].

The assessment of vital signs may be a crucial hint for palpitations, even if they are within normal range, especially in a shift from the baseline. For example, an elevated heart rate and loss of weight may suggest an excess of thyroid hormones. Although palpitations are less often associated with pulmonary causes, an increased heart rate or respiratory rate with a low pulse oximetry may indicate pulmonary causes, such as multifocal atrial tachycardia or a pulmonary embolism. Lower blood pressure or orthostatic blood pressure may indicate a loss of volume. Orthostatic vital signs can help identify postural orthostatic tachycardia syndrome (POTS), which generally involves periodic palpitations and light-headedness or syncope symptoms. POTS is characterised as orthostatic tachycardia, in which the heart rate rises by more than 30 beats per minute (or 120 beats per minute) without orthostatic hypotension. A series of orthostatic blood pressure measurements with pulse can help in a diagnosis when there is a clinical suspicion of POTS [32].

While the patient is still symptomatic, a physical examination is not the most common method, since it may emerge intermittently. When this occurs, it is vital to assess the regularity and frequency of the heartbeat by listening to the chest or palpating the arterial pulse. Atrial fibrillation is indicated by an irregular pulse with no repetitive pattern. There are many different types of cardiac arrhythmia, but atrial fibrillation (AF) is the most common sustained arrhythmia in adults worldwide. High-risk sub-groups, such as post-stroke patients, might benefit from targeted preventative interventions and screening programmes for early AF identification. Pulse palpation and/or short-term ECG in patients above 65 years of age revealed an AF prevalence of 4.4%, with previously undetected AF in 1.4% [33].

A ‘cannon A wave’, seen when examining a jugular venous pulse, is common in ventricular tachycardia. Vagal manoeuvres,

Table 3. Clinical characteristics of tachycardiac palpitations [15]

| Type of arrhythmia | Heartbeat | Trigger situations | Associated symptoms | Vagal manoeuvres |
|---------------------------------------|--|--|---|------------------------------------|
| AVRT, AVNRT | Sudden onset, regular with periods of elevated heart rate | Physical effort, changes in posture | Polyuria, frog sign | Sudden interruption |
| Atrial fibrillation | Irregular with variable heart rate | Physical effort, cooling down, post-meal, alcohol intake | Polyuria | Transitory reduction in heart rate |
| Atrial tachycardia and atrial flutter | Regular (irregular if A-V conduction is variable) with elevated heart rate | | | Transitory reduction in heart rate |
| Ventricular tachycardias | Regular with elevated heart rate | Physical effort | Signs/symptoms of haemodynamic impairment | No effect |

AVRT – Atrioventricular Re-entrant Tachycardia; AVNRT – Atrioventricular Nodal Re-entry Tachycardia; A-V – Atrioventricular.

such as carotid sinus massage, may help differentiate between various types of tachycardia [34]. An abrupt cessation of tachycardia is highly indicative of tachycardia involving the atrioventricular node, while a temporary reduction in frequency is more indicative of atrial flutter or atrial tachycardia (Table 3). The arrhythmia pattern of auscultation might also help in the aetiology of diagnosis. If the murmur is extremely loud, cardiomyopathy should be suspected as the underlying reason [35]. Aortic regurgitation and diastolic tumour plop are two additional murmurs that are frequently related to the sensation of palpitations. In younger individuals with palpitations, other heart valve diseases, particularly congenital lesions, should be explored [36].

Diagnostic testing

If the patient is assessed while experiencing palpitations, a 12-lead ECG is the gold standard for diagnosis. The diagnostic variability of an ECG performed at the time of a patient's complaint is 30% to 60%. A thorough understanding of the ECG, in addition to pertinent clinical presentation and laboratory data, is essential for correct diagnosis and subsequent therapy. It enables the physician to analyse the P and QRS morphologies, as well as the relationship between these two waves, the frequency and regularity of the heart rhythm, and eventually provides an accurate diagnosis on the correlation between palpitations and the presence or absence of arrhythmia. This difference between arrhythmic and non-arrhythmic palpitation is critical for future assessment [5,12, 37].

In addition, detailed ECG analysis can reveal either the mechanism or critical evidence leading to this diagnosis in the course of arrhythmia. However, it should be emphasised that P waves are not always visible during rapid tachycardia, making diagnosis challenging. Vagal manoeuvres and pharmacological tests, such as intravenous adenosine or ajma-line, conducted during ECG recording, are of particular interest because they can reveal atrial activity or abruptly interrupt tachycardia, enabling the kind of arrhythmia to be determined [38]. Alternatively, obtaining a transoesophageal ECG during tachycardia should be considered.

If the patient does not experience palpitation during the examination, an ECG remains highly important, as it provides critical data on any underlying origin or structural disorder, which is usually a strong indicator for prognostics when ventricular arrhythmia is considerably less likely to develop when an ECG is entirely normal [39]. Table 4 shows the key features of an ECG, which should be more specific to underlying cardiac aetiology.

| Conduction abnormalities | Structural heart disease-related |
|---|---|
| <ul style="list-style-type: none"> • Bundle branch block (particularly left bundle branch block) • Ventricular pre-excitation (short PR interval and delta wave) • Prolonged QTc interval • Extreme first-degree atrioventricular block • Second- or third-degree atrioventricular block (these should be referred urgently to a cardiologist) • Presence of other arrhythmias (e.g. atrial fibrillation) | <ul style="list-style-type: none"> • Left ventricular hypertrophy • T Wave and ST-segment changes • Features of past myocardial infarction |

In addition, if physicians suspect a cardiac disease such as myocardial infarction or congested heart failure, it may be essential to assess serum-cardiac biomarkers and a Digoxin level (if accessible). A chest X-ray is highly specific but has low sensitivity in cardiopulmonary screening. Patients suspected of tak-

ing illicit substances may benefit from urinalysis screening. In such instances, the differential diagnosis is true arrhythmia and, specifically, ventricular tachycardia [3].

In patients with palpitations, there is no strong evidence for direct laboratory testing. While some articles recommend that all thyroid stimulating hormones, complete blood counts and basic panel metabolic controls should be carried out in patients with palpitations, the 2011 European Heart Rhythm Association states that targeted lab tests should only be performed if histories and physical tests suggest causes such as hyperthyroidism, anaemia, drug use or pheochromocytoma. A disturbance in renal function or an imbalance of potassium and sodium may potentially trigger cardiac arrhythmias [40].

Palpitations without a clear diagnosis are categorised as „unexplained palpitations“ when history taking, a physical exam and ECG have been carried out. Ambulatory ECG monitoring is suggested for patients with unexplained palpitations who fulfil one of the following criteria, according to the expert consensus in 2017 by the International Society for Holter and Noninvasive Electrocardiology and the Heart Rhythm Society (ISHNE-HRS) [41]:

- When history, physical examination and 12-lead ECG suggest a possibility of arrhythmia.
- In the setting of diagnosed structural heart disease, family history of sudden cardiac death or inherited channelopathy with known risk of arrhythmia.
- When patients need reassurance and a specific explanation of their symptoms.
- When symptoms warrant therapy and specifics of treatment depend on a formal arrhythmic diagnosis (e.g. ablation, antiarrhythmic therapy).

If unexplained palpitations occur randomly throughout the day, evaluation using the Holter is recommended as it records heart rhythms continuously for 24-48 hours. In order to link the time of their symptoms with a certain section of ECG recording, patients need to keep a journal of their symptoms during the recording period. One study found that although 53% of patients had no symptoms at all throughout the 24-hour Holter monitoring period, 13% of patients had an arrhythmia associated to their symptoms, and 34% of patients experienced typical symptoms despite the recording of normal sinus rhythms. The 24-hour Holter diagnostic output for palpitation evaluation varies between 5% and 39%. It is also important to note that the 48-hour Holter monitor had no higher diagnostic yield than the 24-hour Holter monitor for detecting maximum ventricular ectopy in individuals with coronary artery disease [42].

The ability to identify palpitations, especially AF, with mobile health devices is rapidly increasing. Nevertheless, many of them require clinical validation, thus their usage in the clinic should be approached with caution. When AF is found by a device screening tool, like a mobile or wearable device, a single-lead ECG tracing of more than 30 seconds or a 12-lead ECG analysed by a doctor with ECG interpretation expertise is needed to make a final diagnosis of AF. However, a confirmatory additional ECG diagnosis (a 12-lead ECG or Holter monitoring) must be acquired when AF detection is not based on an ECG recording (for example, with devices employing photoplethysmography) [33].

Conclusions

Palpitations are a frequent clinical symptom with a wide range of causes. The arrhythmia will initially be identified through a systematic rapid assessment. If the patient is only examined when experiencing palpitations while waiting for additional work-up, the earliest ECG recording remains an essential aspect in the diagnostic strategy. In order to narrow down the cause of the palpitations, a comprehensive history is then required. All aspects of the patient's past, including their personal, social and medical histories, as well as their family history, should be addressed. A thorough history will aid in determining who will require additional tests and monitoring. Despite the

fact that the physical examination may give limited additional information, it should be utilised to guide future work-up. Currently, the patients may choose a variety of consumer-grade wearable heart monitor devices, such as smartwatches. Their use and efficacy are still being studied.

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