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The Diagnostic Significance of the Holter Monitoring in the Evaluation of Palpitation at Tanta University Hospitals

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Palpitations are the second-most common cause of primary healthcare referrals to cardiologists and are linked to long-term morbidity. Despite the absence of a significant underlying cause, a considerable number of patients report fear and anxiety. The purpose of this study was to assess individuals who were evaluated for palpitation in order to ascertain the diagnostic yield of 24 or 48 hours of Holter monitoring.
Methods: 105 participants participated in this prospective observational cross-sectional research, children and adults, with palpitations, dizziness and syncope, with Holter monitoring 24 or 48 hours. Every patient had a thorough medical history, clinical evaluation, and physical assessment, Resting

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Electrocardiography (ECG), Transthoracic Echocardiography, and Holter monitoring. Patients were further subdivided into two groups: Positive Holter group and Negative Holter group.
Results: Symptoms among positive Holter response showed that 48.6% had palpitations, 34.2% had dizziness and 13.3% had syncope. Higher age, increased frequency of danger factors (Diabetes mellitus, Hypertension, Ischemic heart disease, cardiomyopathy), symptoms (Palpitations, Dizziness, Syncope), Premature ventricular contractions and lower Ejection fraction was observed in patients with positive Holter response compared to patients with negative Holter response. There was no significant association with sex, smoking, Atrial fibrillation, regular sinus rhythm, and premature atrial contractions ($P \leq 0.05$).
Conclusions: Holter Monitoring retains its value, despite the appearance of new investigations and considered the first line for assessment of palpitations as it is widespread and not expensive. It has a good outcome if the patient's symptoms are suggestive for arrhythmia, syncope and dizziness.

Keywords: Holter monitoring; palpitation; electrocardiography; echocardiography.

1. INTRODUCTION

One of the most typical presentations to general practitioners is palpitations, which are a prevalent symptom in the general population. They are the second most frequent cause of cardiologists' being referred from general care. While a considerable number of individuals feel worried and anxiety despite the elimination of a severe underlying cause, palpitations are linked to long-term morbidity. Differentiating palpitations with a benign origin from those connected to a serious underlying arrhythmia that needs immediate treatment, investigations, and referral is difficult at the basic healthcare level [1].

To determine the prognosis, direct therapy, and organise the patient's follow-up, a correct diagnosis is crucial. It is crucial to be able to accurately correlate the symptoms with an electrocardiographic record, allowing the identification or exclusion of a potential rhythm issue, in order to arrive at a diagnosis. Given that they frequently have transient symptoms and the patient is asymptomatic at the time of testing, making a diagnosis is not always straightforward [2].

Systems for electrocardiographic monitoring are the first line of defence in evaluating these individuals. The 24-hour Holter monitor was introduced within 60 seconds, which was a genuine revolution, and its use expanded quickly. It has also been a crucial tool in understanding the physiological behaviour of cardiac rhythm and in the follow-up of patients at risk of cardiovascular disease, in syncope work-up, in risk stratification of certain patients, or in the detection of silent arrhythmias, in addition to diagnosing palpitations [3].

With varying effectiveness values in accordance with the pretest likelihood of the population under study and the frequency of the symptoms, holter monitors have shown useful in diagnosing arrhythmias in individuals with palpitations or syncope [4].

It is now the method utilised in clinical practise the most frequently. Nowadays, the majority of Holter systems are made up of a portable recorder with a digital memory card and a number of cutaneous electrodes that record an ECG continuously. They typically permit 24-48 hours of monitoring time [5]

The purpose of this study was to assess individuals who were evaluated for palpitation in order to ascertain the diagnostic yield of 24 or 48 hours of Holter monitoring.

2. METHODS

105 participants participated in this prospective observational cross-sectional research, with palpitations, dizziness and syncope including children and adults, with Holter monitoring 24 or 48 hours at Cardiology Department, Tanta University Hospital, from August 2020 to August 2022.

After receiving clearance from Tanta University's Faculty of Medicine Ethics Committee, the study was carried out. All participants provided their written consent after being fully informed.

Exclusion criteria were Holter done for causes other than palpitations, dizziness and syncope.

All patients had a thorough medical history with an emphasis on age and gender. Risk factors for cardiac arrhythmias, such as hypertension (HTN), were also present. Blood pressure less than 140

systolic and/or 90 diastolic on at least two separate occasions, diabetes mellitus (DM) of either type I (IDDM) or type II, or a history of HTN diagnosed and treated with medication (NIDDM) (Diagnosis criteria for diabetes was Blood sugar levels were 126 mg/dl (7.0 mmol/L) at fasting and 200 mg/dl (11,1 mmol/L) at 2-hour post-meal during the oral glucose tolerance test (OGTT). The test examines the plasma response to the ingestion of 75 g of concentrated glucose solution after two hours, when the HbA1C is less than 6.5% (48 mmol/L) and the random blood glucose level is less than 200 mg/dl (11.1% mmol/L) [6], Smoking, History of cardiomyopathy (history or recorded Echocardiography (ECHO)) and ischemic heart disease (IHD) (prior percutaneous coronary intervention and coronary artery bypass graft).

Clinical and physical examinations were done, including recording vital signs (blood pressure, heart rate, respiration rate, and temperature), checking neck veins, looking for symptoms of edoema in the lower limbs, checking the abdomen and chest, and doing a local cardiac assessment.

At the time of admission, a resting electrocardiogram (ECG) was performed using a paper speed of 25 mm/s and an amplification of 10 mm/mv.

The M-Mode ECHO was used during transthoracic echocardiography (TTE) to determine the ejection fraction (EF). An automated computer algorithm uses these measurements to determine left ventricular EF, Holter monitoring for 24 or 48 hours were also performed using CONTEC TM, Dynamic ECG Systems, 3 channels used (Model: TLC9803, Power: DC3V, Safety: Internally Powered Equipment, Type B, Contec Medical Systems Co.,Ltd).

2.1 Holter Monitoring Device

A lightweight recorder with a digital memory card and a number of cutaneous electrodes are used in holter devices to record the ECG continuously. Most often, they permit 24-48 hours of monitoring time, while other devices may record for up to 7 days [5].

Once the recording is complete, it is transferred into software running on a computer (or, in some cases, a cloud server) that typically enables an initial automatic analysis identifying the QRS complexes and the R-R interval to provide values like maximum/minimum rate, rate histograms, or ST segment analysis. The healthcare provider must next examine the information to rule out the presence of any potential artefacts and interpret the ECG results using the patient's symptom diary [2].

2.2 How to Use the Holter Device

Make sure the battery is charged, Place the wires on the chest using small, painless sticky electrodes, The wires plug into the monitor, Press the button to delete the previous recorded data, and make sure the device starts a new recording, The monitor clips onto pants or a belt, then the patient is asked to do normal routine, not avoid stress, work or exercise.

2.3 How to Use the Diary

We Asked the patient to make an entry for each different thing he does in the day, write in the time of day for each entry and write down any symptoms he feels during that activity.

Patients were further subdivided into two groups: Positive Holter group and Negative Holter group.

2.4 Statistical Analysis

The Statistical Package of Social Science (SPSS) application version 26 was used to analyse the data (IBM Inc., Chicago, IL, USA). The Kolmogorov-Smirnov test was initially used to determine if the data were normal. Frequency and percentage were used to characterise the qualitative data. The Chi Square Test was used to examine any associations between categorical variables. For data that was regularly distributed, continuous variables were shown as mean SD (standard deviation). The Independent T Test was used to compare the two groups. At $p \leq 0.05$, the results were deemed significant.

3. RESULTS

Table 1 lists the sociodemographic information and risk variables for the patients under investigation.

Table 2 shows the symptoms, ECG, and ECHO data among the studied patients.

Holter data collection showing that, minimum HR was 46.21 ± 8.61. Regarding rhythm of minimum HR, 87.6% showed sinus rhythm, 4.8% had Mobitz type 2 and 7.6% had AF. Mean maximum HR was 148.68 ± 25.76 with 69.5% of patients

Table 1. Sociodemographic information and risk variables for the patients under study (n = 105)

			n=105
Socio-demographic data	**Age (Years)**		43.15 ± 18.20
	Sex	**Male**	71 (67.6%)
		Female	34 (32.4%)
Risk factors	**Smoking**		23 (21.9%)
	DM		38 (36.2%)
	HTN		44 (41.9%)
	IHD		37 (35.2%)
	Cardiomyopathy		16 (15.2%)

The presentation of data is as the mean ±SD or frequency (%). DM: Type 2 diabetes, HTN: high blood pressure, IHD: ischemic heart disease

Table 2. Symptoms, ECG, and ECHO data among the studied patients

		n=105
Symptoms	**Palpitations**	76 (72.4%)
	Dizziness	36 (34.3%)
	Syncope	14 (13.3%)
Resting ECG	**Normal Sinus Rhythm**	97 (92.4%)
	AF	8 (7.6%)
	PVCs	31 (29.5%)
	PACs	9 (8.6%)
ECHO data	**EF**	57.87 ± 10.54
	Mitral valve disease	56 (53.3%)
	Aortic valve disease	14 (13.3%)
	Structural heart disease	67 (63.8%)
	Congenital heart disease	10 (9.5%)
	IHD	37 (35.2%)

The presentation of data is as the mean± SD or frequency (%). AF: Atrial fibrillation, ECG: Electrocardiography, ECHO: Echocardiography PVCs, PACs, EF, and IHD all stand for premature ventricular contractions and premature atrial contractions, respectively.

Table 3. Holter data and cardiac arrhythmias detected among the studied patients

			n=105
Holter data	**Holter monitoring duration/ hours**		38.40 ± 11.81
	Minimum HR		46.21 ± 8.61
	Rhythm of Minimum HR	**Sinus**	92 (87.6%)
		Mobitz type 2	5 (4.8%)
		AF	8 (7.6%)
	Maximum HR		148.68 ± 25.76
	Rhythm of Maximum HR	**Sinus**	73 (69.5%)
		SVT	12 (11.4%)
		AF	16 (15.2%)
		V. Tachycardia	4 (3.8%)
	Holter Result	**Positive**	80 (76.2%)
		Negative	25 (23.8%)
Cardiac arrhythmias	**PVCs**		60 (57.1%)
	PVCs % Median (Min-max)		4.0 (0.5 - 20)
	PACs		31 (29.5%)
	PACs % Median (Min-max)		5.0 (1-24)
	SVT		23 (21.9%)
	AF		29 (27.7%)
	Atrial Flutter		13 (12.4%)
	Ventricular Tachycardia		11 (10.5%)
	Heart Block		11 (10.5%)

The median (Min-max) or frequency (%) of the data are displayed. Atrial fibrillation, often known as heart rate, Supraventricular tachycardia (SVT), Premature atrial contractions (PACs) and premature ventricular contractions (PVCs)

had sinus rhythm, 11.4% had supraventricular tachycardia (SVT), 15.2% had AF, 3.8% showed ventricular tachycardia and 76.2% showed positive Holter response. Table 3.

57.1% of patients had premature ventricular contractions (PVCs), 29.5% had premature atrial contractions (PACs), 21.9% had SVT, 27.7% had atrial fibrillation (AF), 12.4% had atrial flutter, 10.5% had ventricular tachycardia, and 10.5% had heart block. Table 3

Symptoms among positive Holter response showed that 48.6% had palpitations, 34.2% had dizziness and 13.3% had syncope. Table 4

Table 4. Symptoms among positive Holter response related to total patients

Symptoms	(n=105)
Palpitations	51/105 (48.6%)
Dizziness	36/105 (34.2%)
Syncope	14/105 (13.3%)

Data are presented as frequency (%).

There was a significant association between Holter results and age, risk factors, symptoms, resting ECG, and ECHO. Higher age, Higher incidence of risk factors (DM, HTN, IHD, cardiomyopathy), symptoms (Palpitations, Dizziness, Syncope), PVCs and lower EF was observed in patients with positive Holter response compared to patients with negative Holter response (P ≤ 0.05). There was no significant association with sex, smoking, Normal Sinus Rhythm, AF, and PACs. Table 5

4. DISCUSSION

The documentation of brady- and tachy-arrhythmias is aided by holter monitoring (24H). The 24H continues to be a first-line indication during the diagnostic work-out of various cardiac diseases, despite its unsatisfactory yield and the adoption of other and more efficient monitoring approaches. This is most likely caused by the technique's widespread availability and affordable price [7]. Regarding demographic information, the researched group's average age in our study was 43.15 (18.20) ranged from 10 to 71 years. Two thirds of them (67.6%) were males while 32.4% were females.

Nassir [8] revealed that 100 patients were enrolled throughout the trial period, with a gender split of 38% men and 62% women, with a mean age of 38.

Paudel et al. [9] stated that the 335 patients that were investigated had a mean age of 55 years ± 18.85 years, with 160 (47.8%) females and 175 (52.2%) men (18 to 90 years).

Irfan et al. [10] According to a research, patients were 53.71± 15.52 years old on average. There were 46% men and 54% women.

Table 5. Association between Holter result and different parameters (Sociodemographic data, Risk factors, Symptoms, Resting ECG, and ECHO)

			Holter Result		P value
			Positive (n=80)	Negative (n=25)	
Sociodemographic data	**Age (Years)**		48.46 ± 16.67	26.16 ± 11.23	≤0.001*
	Sex	**Male**	54 (67.5%)	17 (68.0%)	0.963
		Female	26 (32.5%)	8 (32.0%)	
Risk factors	**Smoking**		19 (23.8%)	4 (16.0%)	0.413
	DM		38 (47.5%)	0 (0%)	≤0.001*
	HTN		44 (55.0%)	0 (0%)	≤0.001*
	IHD		37 (46.2%)	0 (0%)	≤0.001*
	Cardiomyopathy		16 (20.0%)	0 (0%)	0.015*
Symptoms	**Palpitations**		51 (63.8%)	25 (100%)	≤0.001*
	Dizziness		36 (45.0%)	0 (0.0%)	≤0.001*
	Syncope		14 (17.5%)	0 (0.0%)	0.025*
Resting ECG	**Normal Sinus Rhythm**		72 (90.0%)	25 (100%)	0.100
	AF		8 (10.0%)	0 (0.0%)	0.100
	PVCs		31 (38.8%)	0 (0.0%)	≤0.001*
	PACs		9 (11.2%)	0 (0.0%)	0.079
ECHO	**EF**		55.41 ± 10.88	65.72 ± 2.82	≤0.001*

*Data are shown as mean, ±standard deviation, or frequency (%), with *significance denoted by a P value ≤ 0.05. DM: Type 2 diabetes, IHD stands for ischemic heart disease. Premature ventricular contractions (PVCs), premature atrial contractions (PACs), and ejection fraction are all terms used to describe atrial fibrillation.*

Aman et al. [11] 107 people in total participated; 69 (64.5%) of them were men, and 38 (34.5%) were women. With 89 (83%) children older than 7 years old, the median age was 10 years (range: 5-18 years).

In our study, 72.4 % of patients had Palpitations, 34.4 % had dizziness and 13.3 % had syncope.

In accordance to our study, Irfan et al. [10] study showed that 61 % of patients were complaining from palpitations, 24 % from dizziness and 15 % from syncope.

In contrast, research by Paudel et al. [9] revealed that all of the patients complained of palpitations.

According to Aman et al. [11], syncope/presyncope (32.7%), chest discomfort (20.5%), shortness of breath (19.6%), and colour change/pallor (10.3%) were the most frequent accompanying symptoms with palpitation.

In our study the positive Holter results represents about 76.2 % and the negative results represents about 23.8 %. Dizziness and Syncope are significant in Holter results than palpitations in which 45 % of Positive Holter results is due to Dizziness and 17.5 % is due to Syncope compared to 0 % of Negative Holter results for each of them.

On the other hand, 100 % of Negative Holter results is due to Palpitations compared to 63.8 % of Positive Holter results.

Similar to our results, The Positive Holter results in Paudel et al. [9] study represents about 75.2% and the negative results represents about 24.8%. On the other hand, the Irfan et al. [10] investigation revealed that 82% of patients had recorded arrhythmia on the Holter monitoring reports and 18% did not.

Arrhythmia was present in 20% of patients who had dizziness, 50% of patients who experienced palpitations, and 12% of patients who experienced syncope.

On the other hand, according to Aman et al. [11], 37% of patients had favourable Holter readings.

Age and Holter findings were significantly correlated in our research., p value ≤0.05. Higher age was observed in patients with positive Holter response (48.46 ± 16.67) as compared to 26.16± 11.23 in patients with negative Holter response.

According to our study, Paudel et al [9].'s comparison of the prevalence of arrhythmia in patients aged 50 and older and younger reported that PVCs, VT, and AF were statistically meaningful in patients over the age of 50.According to Holter findings our study show that PVCs presented among 57.1% of patients, PACs was present in 29.5% of patients, SVT in 21.9%, AF in 27.7%, atrial flutter in 12.4%, ventricular tachycardia in 10.5% and 10.5% showed heart block.

These results agreed with Paudel et al. [9] who reported that ventricular ectopic 57% of patients, atrial ectopic 36.7% of patients, atrial fibrillation in 7.8% of patients, ventricular tachycardia in 6.6% of patients and SVT in 12.5% of patients.

38% of the patients displayed ventricular ectopic, 11% had sick sinus syndrome, 5% had ventricular tachycardia, and 3% had total heart block, according to Faruque et al. [12] Just 1% of individuals developed supraventricular ectopic, atrial flutter, atrial fibrillation, or Wolf Parkinson White syndrome.

Irfan et al. [10] discovered that the most common arrhythmias observed on 24-hour Holter monitoring reports were atrial ectopy in 60% of cases, ventricular ectopy in 54%, ventricular tachycardia in 7% of cases, and SVT in 38% of cases, of which 2% had sustained SVT lasting 2-3 minutes. 10% had sinus exit block, 6% had sinus arrest, 2% had paroxysmal atrial fibrillation, 15% had sinus bradycardia, and 5% had different degrees of AV block.

Aman et al. [11], in contrast to our results, claimed that premature ventricular contractions presented in 11.2 % of patients, atrial ectopic beats presented in 8.4 % of patients, SVT in 2.8 % of patients and ventricular tachycardia presented in 0.9 % of patients.

In our study the most common arrhythmia detected was PVCs (57 %) followed by PACs (29 %). In line with our results Aman et al. [11] has stated that PACs and premature ventricular complexes were the two most prevalent aberrant findings during the investigation.

In accordance to our study Paudel et al. [9] has said that premature ventricular and atrial heartbeats were the most often seen arrhythmias.

Sarasin et al. [13] was discovered that bradyarrhythmias are the most prevalent diagnostic arrhythmias, but ventricular ectopy and atrial fibrillation are the most frequent non-diagnostic arrhythmias, occurring in 23 patients (16%) and 14 patients (10%), respectively.

According to Holter data these studies show that minimum HR was 46.21 ± 8.61. Regarding rhythm of minimum HR, 87.6% showed sinus rhythm, 4.8% Mobitz type 2 and 7.6% AF. Mean maximum HR was 148.68 ± 25.76 with 69.5% of patients had sinus rhythm, 11.4% SVT, 15.2% AF, 3.8% showed ventricular tachycardia.

Nassir [8] the mean maximum heart rate was 117, the mean average heart rate was 65, and the mean lowest heart rate was 47.

According to Aman et al. [11], the median maximum heart rate was 142 bpm (range: 80-212 bpm), the median lowest heart rate was 59 bpm, and the median average heart rate was 91 bpm (range: 62-147 bpm).

The mean minimum heart rate was 54 bpm, the mean maximum heart rate was 114 bpm, and the mean average heart rate was 85 bpm, according to Paudel et al. [9].

Our study demonstrates that there was a statistically significant correlation between co-morbidities and Holter outcomes, p value ≤ 0.05, in accordance with risk factors. Positive Holter responses were related with DM, HTN, IHD, and cardiomyopathy, representing 47.5%, 55.0%, 46.2%, and 20% of cases, respectively.

33% of the patients had a history of coronary artery disease, according to Nassir [8]. 27% of people had a history of DM, whereas 23% had HTN. In 24% of people, smoking was discovered, and in 14%, an increased lipid profile was detected.

5. LIMITATIONS

Our study had a small sample size, and Holter readings were recorded at 24 and 48 Hours only.

6. CONCLUSIONS

Holter Monitoring still retains its value, despite the appearance of many other new investigations and considered the first line for assessment of palpitations as it is widespread and not expensive. It has a good outcome if the patient's symptoms are suggestive for arrhythmia, syncope and dizziness.

7. ETHICAL APPROVAL AND CONSENT

The study was carried out, after receiving clearance from Tanta University's Faculty of Medicine Ethics Committee and all participants provided their written consent after being fully informed.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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