Original Article

The Diagnostic Significance of the Holter Monitoring in the Evaluation of Palpitation

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ABSTRACT

Purpose: To determine the diagnostic yield of the 24-hour Holter monitoring in the patients who were evaluated for palpitations.

Methods: A prospective, single-centre study was performed to evaluate the diagnostic yield of the Holter monitoring. The inclusion criteria was age greater then 18 years with the symptom of unexplained recurrent palpitations. The exclusion criteria was patients with known medical causes of palpitation, a history of documented arrhythmias, or a history of or the current use of anti-arrhythmic drugs. The outcomes included a diagnostic Holter monitor recording.

Results: The data analysis of the 335 patients who were studied, showed that there were 160 (47.8%) females and 175 (52.2%) males with a mean age of 55± 18.85 years (18 to 90 years). Ventricular ectopics as bigeminy in 36.7% patients and as couplets in 20% patients, were detected. Non-sustained VT was detected in 5.7% patients, VT was detected in 0.9% cases and SVT was detected in 12.5% cases. 3.58% cases had paraxosymal atrial flutter/fibrillation. The ST segment shift which is suggestive of silent ischaemia, was present in 17.6% of the study population. Second or higher degrees of AV blocks were noted in 2 cases, while one patient had the WPW syndrome. Ventricular bigeminy, couplets, VT,SVT and AF were statistically significant in the patients who were over the age of 50 years as compared to those who were less than 50 years.

Conclusion: In patients with non-specific symptoms, Holter monitoring has a significant role in the primary diagnosis of myocardial ischaemia or arrhythmia as a cause of such symptoms in the older age groups.

INTRODUCTION

Palpitation is one of the most common problems which are seen among the outpatients who present to internists and cardiologists. Although it is usually benign, it is occasionally a manifestation of potentially life-threatening conditions. Establishing the cause of palpitations may be difficult, because the historical clues are not always accurate [1]. Most of the patients with arrhythmias do not complain of palpitations. However, any arrhythmia, which includes sinus tachycardia, atrial fibrillation, premature ventricular contractions, or ventricular tachycardia, can cause palpitations. Palpitations should be considered as potentially more serious if they are associated with dizziness, near-syncope, or syncope. Non-arrhythmic cardiac problems such as mitral valve prolapse, pericarditis, and congestive heart failure, and non-cardiac problems such as anxiety, hyperthyroidism, vasovagal syncope, and hypoglycaemia, can cause palpitations. Palpitations also can result from the use of stimulant drugs, and over-the-counter and prescription medications. No cause of the palpitations can be found in up to 16 percent of the patients.

The American College of Cardiology (ACC) and the American Heart Association (AHA) recommend the Holter analysis for the patients with unexplained syncope, near syncope, palpitations and dizziness, as class I indications, for a symptomatic evaluation. Holter monitoring, usually, is indicated if the aetiology of the palpitations cannot be determined from the patient's history, physical examination, and resting ECG, but the yield of this instrument is low in the patients whose symptoms occur infrequently [2].

Holter monitoring has been increasingly used for detecting cardiac arrhythmias over the past 50 years. It was initially designed to observe the variations in the normal cardiac rhythm in everyday activities. In the recent years, its use has been further extended into the diagnosis of cardiac arrhythmias, quantification of arrhythmias, evaluation of the antiarrhythmic therapy, detecting the pacemaker malfunctions, in heart rate variability studies, and in the prognostic stratification of arrhythmias. It has also been used in detecting the silent episodes of myocardial ischaemia and in the evaluation of various nonspecific symptoms like palpitations, lightheadedness, blackouts, drop attacks and atypical chest pain. Holter monitoring is commonly employed for the diagnostic evaluation of these symptoms [1]. A prospective study was therefore undertaken to evaluate the benefit of Holter monitoring, for establishing the cause of palpitations in a group of patients who attended the Gandaki Medical College Teaching Hospital (GMCTH) during the past two and a half years.

PATIENTS AND METHODS

A prospective, single-centre study was performed to evaluate the diagnostic yield and the outcomes of the patients with palpitations, who were being evaluated with Holter monitoring. The Holter analyses of 335 consecutive patients of both sexes were selected from January 2010 to May 2012. Each patient provided an informed consent, and the GMCTH ethics committee approved the study. One investigator interviewed the eligible patients to confirm that their symptoms were palpitations.

The inclusion criteria was age greater then 18 years with a symptom of unexplained recurrent palpitations, either as a chronic problem or a single episode which required a hospital admission. Occasional ectopic beats i.e. APCs (Atrial Premature Contractions), nodal escape beats or VPCs (Ventricular Premature Contractions) which were less than 10 per minute were regarded as abnormal findings but not as a definite evidence of arrhythmia and they were also included in the study.

The exclusion criteria was patients with any definitive evidence of myocardial ischaemia, which was detected on a resting electrocardiogram and with any definite evidence of arrhythmia, which was detected on a resting electrocardiogram. The patients with other known medical causes of the symptoms, a history of documented arrhythmias, or a history of or the current use of anti-arrhythmics, were also excluded.

For the Holter monitoring, Cardio Blue 24 was used, which is a full disclosure ECG recorder with a bluetooth communication and it offers the possibility of recording 3 or 5 channels. The Cardio Visions - ECG data analysis software was used for analyzing the data. The disc was attached to a strap which the patient wore on his/her shoulder, and it was 50 gram in weight (exclusive of the AAA single alkaline battery).

On Holter monitoring, the evidences for dysrhythmia were ventricular ectopics (isolated, bigeminy, couplets, runs) and supraventricular episodes which included APCs (atrial premature contractions) and nodal escape beats (isolated, pairs, runs). The sinus pauses and the heart rate (minimum, maximum and average) were also recorded. The isolated ventricular ectopics which were less than 10% and the isolated supraventricular episodes which were less than 10% were regarded as insignificant arrhythmias. Clinically, the significant cardiac arrhythmias are defined as a symptomatic, sustained, Supraventricular Tachycardia (SVT, supraventricular rate, >150 beats/min), an Atrial Fibrillation (AF) or a flutter, a sustained Ventricular Tachycardia (VT, ventricular rate,>120 beats/min), a sinus pause which is longer than 3 seconds, a non-Wenckebach, second-degree heart block, or a third-degree heart block [Table/Fig-1]. For ischaemia, the ST- segment shift which is defined as a 1 mm ST segment shift (either an elevation or a depression), was studied in one or both of the channels.

The Holter data collection included the baseline rhythm, documentation of the symptoms during recording, the average Heart Rate

Atrial
Atrial ectopic beats > 30/h   Atrial bigeminy   Paroxysmal atrial tachycardia   Atrial flutter or fibrillation
Ventricular
Ventricular ectopic beats > 30/h   Ventricular bigeminy/couplets   Ventricular tachycardia
Nodal
Nodal ectopic beats >30/h   Nodal bigeminy   Nodal tachycardia
Others
WPW associated with tachycardia   Sinus Pause of > 3 sec   Second or higher degree of AV Blocks

[Table/Fig-1]: Criteria for a positive Holter Response.

(HR), the minimum HR, the maximum HR, ventricular ectopy, supraventricular ectopy, and the Holter diagnosis. The Holter diagnoses were defined by the ACC/AHA guidelines as: the documented symptoms with a recorded arrhythmia, which were capable of causing the symptoms, the documented symptoms without the presence of arrhythmia, no documented symptoms with a recorded arrhythmia and no documented symptoms or arrhythmia.

All the data were analyzed by using SPSS, version 16 (SPSS Inc., Chicago IL). The results of the above mentioned variables were compared by using the Chi square analysis.

RESULTS

The data analysis of the 335 patients who were studied, showed that there were 160 (47.8%) females and 175 (52.2%) males with a mean age of 55± 18.85 years (18 to 90 years). 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. 83 (24.8%) cases showed a normal Holter study. The arrhythmias which were detected during the Holter monitoring period have been listed in [Table/Fig-2].On Holter monitoring, it was found that the ventricular ectopics which were less than 10% were present as an isolated event in 191 (57%) patients. The ventricular ectopics occurred as bigeminy in 36.7% patients and as couplets in 20% patients. It was observed that the supraventricular episodes which were less than 10% were present as isolated events in 36.7% patients and that they occurred as runs in 1% patients. A non-sustained VT was detected in 19 (5.7%) cases, VT was detected in 3(0.9%) cases and SVT was detected in 42 (12.5%) cases. 12 (3.58%) cases had a paraxosymal atrial flutter/fibrillation. Sinus pauses were not present [Table/Fig-2].

The ST segment shift was present in 59 (17.6%) of the popula-

Arrhythmias	Patients (N=335)	
	No.	%
Supraventricular ectopics	123	36.7%
AEB/NEB >30/h	3	1.0%
Atrial Bigeminy	1	0.3%
Atrial flutter and fibrillation	26	7.8%
Supraventricular tachycardia	42	12.5%
Ventricular ectopy	191	57.0%
Ventricula ectopic beats >30/h	135	40.3%
Bigeminy	123	36.7%
Couplets/triplets	67	20.0%
Ventricular tachycardia	22	6.6%
WPW with tachycardia	1	0.3%
AV Block (second or higher degree)	2	0.6%

[Table/Fig-2]: Cardiac arrhythmias detected.

tion, in which 3% were ST-segment elevations and 14.6% were ST-segment depressions. Second or higher degrees of the AV blocks were noted in 2 (0.6 %) cases, while one patient (0.3%) had the WPW syndrome.

The prevalences of arrhythmia were compared in the patients with ages of less than 50 years and above 50 years, which suggested

that ventricular bigeminy, couplets, VT and AF were statistically significant in the patients with ages above 50 years. A silent ischaemia was also significant in elderly patients [Table/Fig-3].

Catogories	Age <50 years old N= 117	Age ≥50 years old N=218	P value
PVC	45 (38.7%)	146 (72%)	<0.0001
Bigeminy	27 (23.1%)	96 (44.0%)	<0.0001
Couplets	14 (12.0%)	53 (24.3%)	<0.0001
Supraventricular ectopics	43 (36.8%)	80 (36.7%)	NS
Non sustained VT	1 (0.9%)	18 (8.3%)	<0.0001
SVT	4 (3.4%)	38 (17.4%)	<0.0001
AF	2 (1.7%)	24 (11.0%)	<0.0001
ST T changes	8 (6.8%)	51 (23.4%)	<0.0001

[Table/Fig-3]: Cardiac arrhythmias and silent ischemia in age less than 50 years Vs above 50 years.

DISCUSSION

The technology for and the clinical use of the Holter recordings have expanded rapidly during the past 20 years. This has led to the development of small (50 g) portable tape recorders which are capable of storing >24 hours of electrocardiographic data, i.e. more than 100000 beats. This can be contrasted with the routine ECGs, which would consume almost a mile of ECG paper over a similar period. The popularity of the Holter ECG, therefore stems from its value in evaluating the symptoms, i.e. cardiac and neurological symptoms, and asymptomatic conditions, by the detection of the arrhythmias and the ST-segment changes in the evaluation of cardiac disease [3]. In addition, it may also be used for assessing the therapeutic efficiency of the anti-arrhythmic agents and for evaluating the safety and the efficiency of a cardiac rehabilitation programme. Finally, it may be the only means of evaluating the pacemaker malfunctions.

Numerous studies have therefore been undertaken, on Holter monitoring, in the evaluation of symptoms. Lipski et al., [4] evaluated 55 patients with symptoms of syncope, dizziness and palpitations and they found a 55% incidence of cardiac arrhythmias. Tabatznik [5] showed a 60% incidence of cardiac arrhythmias in his group of patients with a history of syncopal attacks. Similarly, this study showed a 68,5% incidence of cardiac arrhythmias in a group of 54 patients who experienced palpitations. The results which were obtained in most of the studies were similar, even thought there were significant variables. The period of the Holter monitoring influences the detection of the cardiac arrhythmias. Lown and Wolff [6] have stated that a period of more than 10 hours is necessary for the detection of the serious arrhythmias. This study was standardized by performing a 24-hour Holter monitoring, as was suggested by Lown and Wolff.

The most challenging cases of palpitations are those which are caused by a benign atrial or ventricular ectopy or those which are associated with a normal sinus rhythm. Most of the patients with palpitations, who undergo an ambulatory monitoring, have been found to have one of these conditions [Table/Fig-4] [7-9]. A normal sinus rhythm is found in up to one third of the patients with palpitations, who undergo evaluations. No cause of the palpitations was found in 24.8% of our study population, which was similar to the findings of most of the studies. Ventricular pre-

mature contractions and a nonsustained ventricular tachycardia were also found in a substantial proportion of the patients with palpitations, and in the patients with structurally normal hearts, they were not associated with an increased mortality [10]. We attempted to reassure the patients with these benign diagnoses, that these rhythms were not life-threatening.

In this study, ventricular and supraventricular ectopic beats were the commonest arrhythmias which were noted, but these occurred in inadequate numbers and were therefore regarded as being coincidental. The most significant arrhythmias (which could have been responsible for the palpitations) which were detected were ventricular bigeminy, couplets, paroxysmal supraventricular tachycardia, ventricular tachycardia and atrial fibrillation. It must be noted, however, that more than one type of arrhythmia occurred on a few of the analyzed recordings.

Condition	Kinlay et al., [7] (N=100)%	Zimetbaum et al., [8] (N=105)%	Zimetbaum et al., [9] (N= 408)%	Paudel B et al., (N=335)%
Sinus rhythm	35	18	39	24.8
Ventricular ectopic	12	20	36	57.0
Atrial ectopics	0	8	13	36.7
Atrial fibrillation	6	17	2	7.8
Ventricular achycardia	0	2	1	5.7
Sinus tachycardia	29	7	5	40
Supraventricular tachycarda	18	10	4	12.5

[Table/Fig-4]: Percentage of patients with palpitaiotn in whom various conditions were diagnosed by event recorder

Holter monitoring can detect episodes of silent myocardial ischaemia in patients with coronary artery disease. However, for the nonspecific symptoms with no coronary artery disease, the chances of finding out an underlying, silent ischaemia are low. According to the ACC/AHA guidelines, there is little evidence that Holter monitoring provides reliable information concerning myocardial ischaemia in asymptomatic subjects without any known coronary artery disease [11]. The present study showed that the probability of detecting silent ischaemia with Holter monitoring was 17.6% and that it was found to be significantly common in the patients who were above the age of 50 years. These findings were consistent with those of various studies of Holter monitoring which were done on patients with ischaemic heart disease, which indicated that silent myocardial ischaemia was the most frequent manifestation of coronary artery disease and that it occurred in almost 70-80% of the ischaemic episodes [1], [12], [13].

The ventricular ectopics are more readily experienced by the patients as palpitations. Perhaps this is because of the compensatory pause that follows such ectopics. The patients with palpitations remained symptomatic and functionally impaired and they had increased rates of panic disorder and a frequent number of physician visits following the Holter monitoring [14]. The detection of arrhythmias may improve if the duration of the Holter monitoring is increased [15].

Holter monitoring may have a role in identifying the asymptomatic older adults who are at risk of a sudden cardiac death due to arrhythmias. In our study, ventricular bigeminy, couplets, VT, SVT,

AF, a higher degree of AV blocks and silent ischaemia were noted in the same age group of the patients, who were the vulnerable group for developing sudden cardiac death, which was similar to the findings of many recent studies [16,17].

However, the recent studies which were done on the palpitation aetiology provided an improved evidence that can guide a family physician through the diagnosis. In a prospective cohort study which was done on 190 patients at a university medical centre, who complained of palpitations and were followed up for one year, an aetiology was determined in 84% of the patients. Among these patients, 43% had palpitations which were caused by cardiac causes causes (40% had an arrhythmia and 3% had other cardiac cause), 31% had palpitations which was caused by anxiety or panic diorder, 6% had palpitations which were caused by street drugs or prescription and over-the counter medication, 4 % had palpitations which were caused by other noncardiac causes. No specific cause of the palpitations could be identified in 16% of the patients. Psychiatric and emotional illnesses such as anxiety, panic, and somatization disorders may be the underlying problems in many patients [18,19]. These findings were almost similar to those of our study. Although arrhythmias frequently cause palpitations, most of the patients with arrhythmias do not actually notice their arrhythmias and they are unlikely to report having palpitations [20].

CONCLUSION

Among the patients with non-specific symptoms, Holter monitoring has got a significant role, in the primary diagnosis of myocardial ischaemia or arrhythmia as a cause of such symptoms in elderly patients. However, the routine use of Holter monitoring as a first line investigation for evaluating non-specific symptoms, needs a critical appraisal.

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