Holter ECG Monitoring in Assessing Arrhythmias in Patients with Palpitation

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Abstract

Background: Palpitation is one of the most common indications for Holter study. 24- hour Holter monitoring helps to detect abnormal cardiac rhythm which can be managed earlier if picked up sooner. Spot ECG has less sensitivity to pick episodic abnormal rhythm so longer monitoring time is essential. Various treatment modalities can thus be planned for non-benign and relatively benign arrhythmias like VT and PSVT respectively.

Methods: This was a single center prospective observational cross-sectional study conducted at BPKIHS, Dharan for three months between July 2023 to September 2023. The primary objective was to study abnormal cardiac electrical events in patients having palpation. There were 38 patients of palpitations that underwent 24-hour Holter study after fulfilling inclusion criteria. The data was recorded on an excel sheet and was analyzed using software SPSS 20.

Results: There were 47.4% (18) males and 52.6% (20) females. The mean age was 49.61± 17.63 years. There were 36.8% (14) patients in age group <45 years while 42.1% (16) were in age group 45 to 65 years and 21.1% (8) were in the age group >65 years. The maximum and minimum Heart rate were 180 and 35 beats per minute respectively. There was abnormal Holter ECG in 57.9% (22) and 42.1% (16) had normal ECG. Most common arrhythmia was VPC 17(77.2%) in our study. The association between the age group and Normal vs Abnormal Holter ECG was statistically significant (P Value=0.023) (Table 8). DM was the most common co-morbid illness in 5(13.2%), one participant had DM and HTN along with Dyslipidemia and other findings were smoking (5.3%), dyslipidemia (5.3%). There was no association between comorbid conditions and normal vs abnormal ECG Holter rhythm (P Value = 0.448).

Conclusion: Out of 38 participants VPC was the most common (77.2%) arrhythmia. The association between Age group and Normal vs Abnormal Holter was statistically significant (P Value=0.023). Most of the arrhythmias were benign. Diabetes was the most common risk factor present while 50% of subjects had no co-morbid illness.

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Introduction

Holter monitoring is a technique to determine ECG of a patient for longer duration. This helps to detect cardiac electrical activity in form of normal as well as abnormal rhythm. It helps to detect various fatal and non-fatal cardiac rhythm disturbances at times when patients develop symptoms like palpitation which is the motive of the current study. Dr Norman J. Holter and his team developed the device named "Holter". Electrocardiography began in 1893 with the work of Einthoven's string galvanometer.

The Holter monitor is a device that works on Galvanometer's principle to record electrocardiographic signals from an individual who is going about his daily activities, like continuous ambulatory electrocardiography. From 1961 several other modalities and advance gadgets have been manufactured for this purpose.[1]

Holter is indicated to establish link between palpitation and arrhythmia.[2] In a study by Kurt kroenke LTC et , it was found that palpitations accounted for 16% of symptoms that lead to visit general practitioner.[3]

Palpitations can be defined as the noticeable pounding, fluttering or irregular beating of the heart and diagnosis of the underlying rhythm is difficult as many patients are fully recovered by the time that they are seen. Physical examination and presenting electrocardiogram (ECG) are commonly normal.

Once captured, the symptomatic rhythm underlying about 9 in 10 episodes is benign.[4]

Palpitations are one of the distressing presenting complaints of subjects experiencing it which could have numerous dimensions as an explanation of its manifestation. This disorder not only affect patient's quality of life but is also associated with cardiac rhythm abnormality. Palpitations are one of the most common reasons for medical consultations.[5]

Arrhythmias can produce palpitations through multiple mechanisms. Arrhythmias can cause symptoms related to disorders of rhythm, disorders of rate, in cardiovascular hemodynamics. Intermittent disorders of rhythm such as paroxysmal supraventricular tachycardias, paroxysmal atrial fibrillation, atrial premature beats, and ventricular premature beats are frequent causes of palpitations. Disorders of rate also can be perceived as palpitations, and even sinus tachycardia or bradycardia can cause symptoms and surprisingly only normal sinus rhythm is found when or using ambulatory electrocardiographic (ECG) recording techniques.[6]

Rationale of the study

Arrhythmias are one of the causes for palpitations leading to decreased quality of life. In countries like ours there is not much study done showing palpitations having cardiac rhythm disorders.[7] Krunke et al have found 16% symptoms to be palpitations when visiting physicians per se. Patients presenting with palpitation need to be addressed for further evaluation in form of Holter study along with resting ECG as spot ECG does not necessarily give clue of cardiac rhythm disorders.[3] It is worth mentioning that palpitations can also be only manifestation of malignant cardiac rhythm disorder causing sudden cardiac death.

Palpitation is one of the most common cardiac symptoms encountered in medical practice, but it poorly corresponds to demonstrable abnormalities. Many palpitations are not serious. However, palpitation may indicate the possible presence of serious cardiac arrhythmias. It may occur more frequently during pregnancy, which is a high- cardiac output state. Postpartum cardiomyopathy is a structural disease that is unique to this population. Pregnant women also have an increased risk of new arrhythmias, including atrial fibrillation hence persistent palpitations should be evaluated thoroughly. Holter monitoring can be a safe and useful tool for this.[8]

Various studies in Nepal that shows actual incidence, etiologies and easily available means for diagnosis of palpitation are limited. Hence, this study was conducted to assess the findings on 24-hour ECG Holter monitoring.

Aims and Objectives:

Primary:

To document cardiac arrhythmia using 24-hour Holter study.

Secondary:

1. To study various fatal and non-fatal cardiac arrhythmia in patients having palpitations.

2. To study clinic-demographic profile of arrhythmia in such patients.

3. To assess the association between arrhythmia and clinic-demographic profile of the study participants.

Review of literature

The American College of Cardiology (ACC) and the American Heart Association (AHA) recommend the Holter analysis for the patients with palpitations as class I indications, for symptomatic evaluation. Holter monitoring, usually, is indicated if the etiology 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.[9]

Weber BE et al have found the etiology of palpitations as cardiac in 43%, psychiatric in 31%, miscellaneous in 10%, and unknown in 16%. Forty percent of the etiologies could be determined with the history and physical examination, an electrocardiogram, and/or laboratory data. Thus it seems essential to have Holter done to elicit underlying arrhythmia.[10]

In a study by Paaladinesh T et al it was found that prolonged electrocardiographic monitoring with demonstration of symptom correlation is required to make the diagnosis of a cardiac arrhythmia for most patients with recurrent palpitations emphasizing need for prolong ECG monitoring.[11]

Chan et al in their study truly mentioned that the history and physical examination only may reveal features suggesting cardiac arrhythmias to be more or less likely in patients with palpitations and the diagnosis will typically be confirmed however, with cardiac monitoring during symptoms.[12]

Faruque et al found that 24-hour Holter monitoring is an important investigation for evaluation of patients with palpitation, dizziness and syncope. Arrhythmias were detected frequently in both symptomatic and asymptomatic patients and it is well known that any arrhythmia would cause palpitations now and then so one must be careful to avoid attributing a symptom to an arrhythmia until a close temporal relationship is demonstrated and Holter study was useful tool in this study.[13]

In a case report, where a woman complained of palpitation was diagnosed as case of pseudo-AV block a rare rhythm disorder that respond to betablockers. Hereby it seems essential to study palpitation by Holter to reveal rare cardiac rhythm disorder as its etiology.[14]

A study by Jeff hong et al found that patients evaluated for chest pain, palpitations and syncope were having postural tachycardia syndrome in 24- hour holter study. Thus need for holter monitoring for evaluation of palpitation is advantageous in revealing various cardiac arrhythmia.[15]

Karki B et al in their study have found palpitations to be the most common indication for Holter study and hence a need to study Holter in subjects having palpitation is essential tool for patient management.[16]

R Adebayo et al studied 310 patients, out of which 134 were males (43.2%) and 176 were females (56.8%). The commonest indication for Holter ECG was palpitation followed by syncope in 71 (23%) and 49 (15.8%) of subjects, respectively. Thus Holter study is an efficient means of detecting arrhythmia as one of the s reason for palpitations.[17]

A study by Weinstock et al showed palpitations as common chief complaints in a variety of settings including primary care, urgent care, the emergency department, and cardiology offices. The complaint of palpitations can refer to tachycardia, skipped beats, premature beats, or fluttering in the chest. The prevalence of palpitations in the community was 6% to 11%. Palpitations were also the second most common reason for referral to cardiology.[18]

Methods and methodology

Type of study: Descriptive Observational Cross-sectional study

Duration of study: Three months.

Place of study: BPKIHS, Dharan

Study population: Patients presenting with palpitations in cardiology department, BPKIHS, Dharan
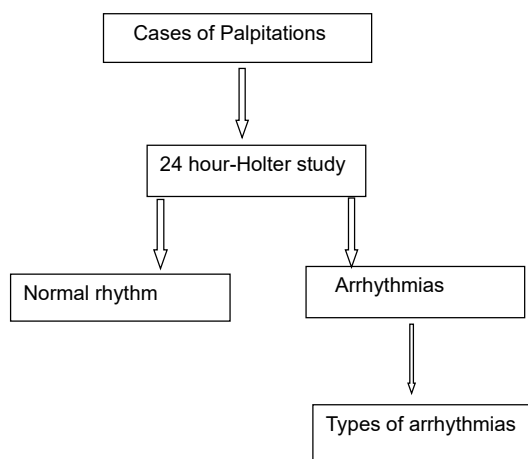
Inclusion Criteria:

1. Age ≥18 years

2. Subjects with palpitation as presenting complaint.

3. Subjects who have not undergone previous Holter study for palpitation.

Exclusion Criteria:

1. Age≤18years.

2. Patients already having diagnosed for arrhythmia as cause of palpitation

3. Patients having documented arrhythmias.

4. Patients who don't give consent.

5. Patients who are having valvular heart disease.

6. Uncontrolled hyperthyroidism.

7. Patients taking antiarrhythmic drugs

Conceptual Frame work of the study:

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        │  Cases of Palpitations  │
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                    │
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        ┌─────────────────────────┐
        │   24 hour-Holter study  │
        └─────────────────────────┘
              │           │
              ▼           ▼
   ┌────────────────┐  ┌──────────────┐
   │ Normal rhythm  │  │  Arrhythmias │
   └────────────────┘  └──────────────┘
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                   ┌──────────────────────┐
                   │ Types of arrhythmias │
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Sample size: 38

Sample size calculation:

Using prevalence (P) of palpitation as 69 % in a study by Badri et al[7], sample size is estimated using following formula: n=Z2Pq/d2, where, n= sample size, Z=95%, CI value of 1.96, P= prevalence, q=1-P, d= precision (5%) The average number of patients visiting cardiology department requiring 24-hour Holter monitoring is around 25 per month. The duration of the study will be three months. Hence, there will be about 75 subjects to evaluate for Holter monitoring. Hence, corrected sample size is estimated using following formula: N=n/(1+n/estimated sample size) =38

Data collection methods:

All participants had undergone thorough detailed medical history, clinical evaluation and relevant investigations. Patient data included: age, gender, height and weight. Clinical variables will include hypertension, diabetes, present smoker, alcohol consumption, dyslipidemia, and IHD and symptomatology. Patients presenting to the department of cardiology for Holter monitoring and fulfilling inclusion and exclusion criteria were included in study. Each patient with relevant symptoms fulfilling inclusion and exclusion criteria was advised for 24-h Holter monitoring. A SEER 12 Digital Holter ECG Recorder unit was strapped to each patient after necessary ECG lead placement based on Mason-Likar 10 electrode 12 lead monitoring system.[19] The patients were admitted and advised to continue normal routine daily activities. They were advised to keep a record of the time they experienced significant symptoms such as palpitations, dizzy spells, presyncope or syncope. The 24-h Holter recording was subsequently transferred to a MARS computer-based ECG analysis and editing system for the analysis of the reports using CARDIODAY Holter ECG software. The reports were reviewed by the cardiologists (authors).

Data collection tool: Pretested proforma

Data management and analysis:

Data was collected using a pre-designed semi-structured data collection tool by the investigator. Data entry was done in MS-Excel Program 2010 and subsequently uploaded in SPSS version 20.0. Descriptive data analysis such as frequency and percentage for categorical variables and mean and standard deviation for quantitative variables were estimated. Chi square test was applied to measure the association between independent categorical variables and outcome variables "Arrhythmias". A p-value ≤ 0.05 was considered statistically significant for all analysis. Using SPSS software, tabulations and cross tabulations were done and values expressed as mean plus minus standard deviation

Result

A total of 38 patients having palpitation were enrolled in the study with 47.4%[18] males and 52.6%[20] females. The age group of patients was between 19 to 79 years with mean age of 49.61± 17.63 years. The Median age was 48.5 years with a range of 60 years. There were 36.8%[14] patients in age group <45 years while 42.1%[16] were in age group 45 to 65 years and 21.1%[8] were in the age group >65 years. The maximum and minimum Heart rate were 180 and 35 beats per minute respectively. The average BMI was 25.2± 2.97 kg/m²(Table 1). There was abnormal Holter ECG in 57.9%[22] and 42.1% [16] had normal ECG (Table 2).

Table 1. Demographic profile of the study population (N=38).

Variables	Frequency
Age (years) (mean ± SD)	49.61 ± 17.63
Age (median, IQR)	48.5 (36 – 64)
Minimum age	19 years
Maximum age	79 years
Male	18 (47.4%)
Female	20 (52.6%)
Age<45 years	14(36.8%)
Age 45 to 65 years	16(42.1%)
Age>65 years	8(21.1%)
BMI (kg/m2) (Mean ± SD)	25.20 ± 2.97

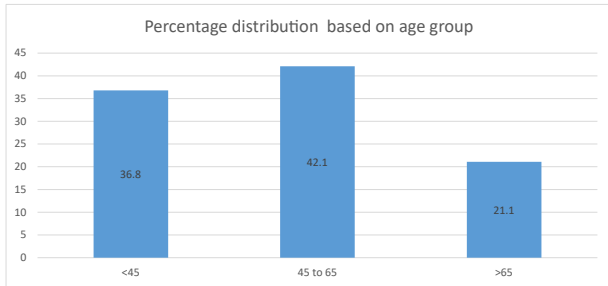|		
Maximum BMI	31.5	
Minimum BMI	19.0	
BMI (Median, IQR)	24.9 (23.37- 27.00)	
Maximum Heart rate	180 beats per minute	
Minimum Heart rate	35 beats per minute	

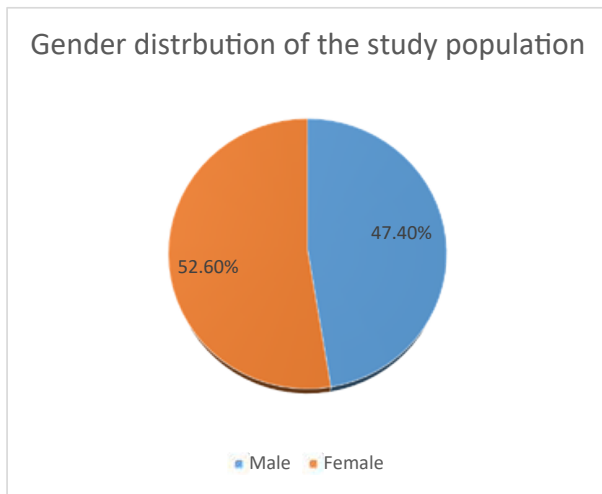Figure 1: Bar diagram showing distribution of the study population based on Age group (N=38).

Figure 2: Pie Chart showing Gender distribution of the population having 20 (52.6%) Females and18 (47.4%) males i.e. females outnumbered males.

Table 2: ECG manifestations in the 24 -Hour Holter report of the participants (N=38).

Types of ECG Rhythm in Holter study	Frequency	Percentage
Normal	16	42.1
Abnormal	22	57.9
Insignificant RVOT VPCs (Lowen class 1)	7	18.4
Insignificant LVOT VPCs (Lowen class 1)	2	5.3
PACs (Lowen class 1)	1	2.6
Non-Sustained Ventricular Tachycardia	1	2.6
Atrial fibrillation	1	2.6
WPW	1	2.6
CHB	1	2.6

RVOT VPC (Lowen class ≥2) and Bigeminy	2	5.3
RV Apex VPC (Lowen class 1)	2	5.3
RVOT VPC and LVOT VPCs both (Lowen class ≥2)	1	2.6
VPCs (Lowen class ≥2) and PSVT	2	5.3
Significant RVOT VPCs (Lowen Class≥ 2)	1	2.6
Total	38	100

Table 2 shows 16 (42.1%) participants with normal Holter while 22(57.9%) had Abnormal study with different types of arrhythmias. The maximum Heart rate documented was 180 beats per minute and minimum Heart rate was 35 beats per minute.

Table 3 Distribution of different types of Abnormal rhythms in the Holter report (n=22).

Types of Arrhythmias	Frequency	Percentage
1. VPCs	17	77.2
Lowen class 1	11	64.7
Lowen class ≥2	6	35.9
2. PACs (Lowen class 1)	1	5.8
3. AF	1	5.8
4. NSVT	1	5.8
5. PSVT	2	11.7
6. WPW	1	5.8
7. CHB	1	5.8
8. VPC Bigeminy	2	11.7

This table shows 77.2% subjects had VPCs with 64.4% having Lowen class 1 and 35.9% had Lowen class ≥2. VPCs were most common ECG Holter finding with PSVT as second most common arrhythmia, one had CHB and WPW was found in one patient, similarly one subject had NSVT and one had AF with pause of < 3 seconds.
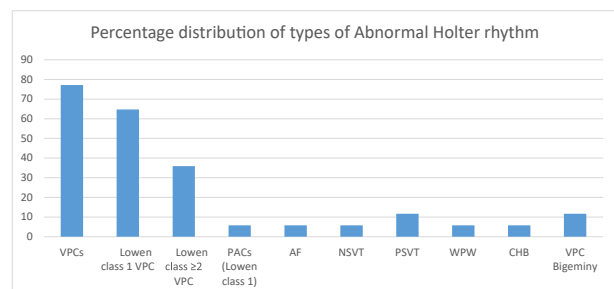

Figure 3: Bar diagram showing distribution of Abnormal 24- hour Holter rhythm of the study participants.

Table 4 Distribution of ECG Holter rhythm based on age group (N=38).

24 Hour Holter ECG	Age Group of the Patients in Years			Total
	<45	45 to 65	>65	
Normal	8	8	0	16
Insignificant RVOT VPCs (Lowen class 1)	2	1	4	7
Insignificant LVOT VPCs (Lowen class 1)	1	1	0	2
PACs (Lowen class 1)	0	0	1	1
NSVT	0	1	0	1
Atrial fibrillation	0	0	1	1
WPW	0	1	0	1
CHB	0	1	0	1
RVOT VPC (Lowen class ≥2) and Bigeminy	0	2	0	2
RV apex VPC (Lowen class 1)	2	0	0	2
RVOT VPC and LVOT VPCs (Lowen class ≥2)	0	1	0	1
VPCs (Lowen class ≥2) and SVT	0	0	2	2
Significant RVOT VPCs (Lowen class ≥2)	1	0	0	1
Total	14	16	8	38

P Value=0.027

In the age group less than 45 years 6 had VPCs, 8 had normal rhythm, in the age group 45 to 65 years 5 had VPCs, 8 had normal rhythm, one had NSVT, one each had CHB and WPW, In the age group >65 years 6 had VPCs, one had Atrial fibrillation and one had PAC. The association between age group and Holter rhythm was statistically significant with P value=0.027.

Table 5: Holter study of the participants based on Normal vs Abnormal distribution (N=38).

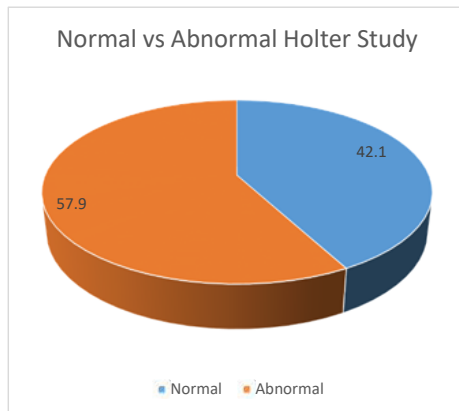| ECG	Frequency	Percentage
Normal	16	42.1
Abnormal	22	57.9
Total	38	100

Figure 4 shows 57.9% had abnormal Holter study while 42.1% had normal findings.

Table 6: Distribution of cardiac Arrhythmias based on Fatality.

Arrhythmia	Frequency	Percentage
Fatal	2	9.0%
Non-fatal	20	91%
Total Arrhythmias	22	100%

Table 6 Shows out of total abnormal rhythm 2 patients were having fatal cardiac rhythm: One was Ventricular Tachycardia and the other was having Complete Heart Block, 20 patients had arrhythmia that was not fatal.
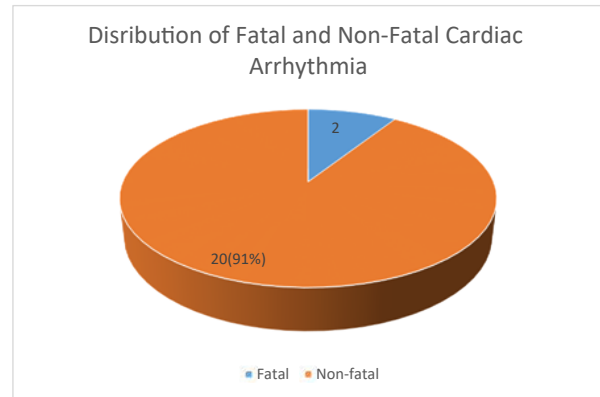

Figure 5: Pie Chart showing fatal and non-fatal arrhythmia in the study participants.

Table 7: Association between Gender and Normal vs Abnormal Holter ECG (N=38).

Gender	Normal	Abnormal	Total
Male	7	11	18
Female	9	11	20
Total	16	22	38

(P-Value=0.73)

This Table shows 11 Males (61.1%) and 11 Females (55%) had Abnormal Holter while 7 (38.8%) Males and 9 (45%) females had Normal Holter report. However, the association between Gender and type of Normal vs Abnormal Holter did not reach statistical significance (P-value=0.73).

Table 8: Association between Age -group and Normal Vs Abnormal Holter ECG.

Age-group	Normal	Abnormal	Total
<45	8	6	14
45 to 65	8	8	16
>65	0	8	8
Total	16	22	38

P-Value =0.023

The Table 8 shows that patients within the age group >65 years, 8 (100%) had abnormal Holter. In the age group 45 to 65 years, Normal and Abnormal Holter were present in 8 (50%) participants respectively while patients in Age group less than 45 years 8 (57.1%) had normal study and 6 (42.8%) had abnormal. The association between age group and Normal vs Abnormal ECG showed statistical significance (P Value=0.023).

Table 9: Distribution of comorbidities among the study participants (N=381).

SN	Co-morbid conditions	Frequency	Percentage
1.	None	19	50
2.	HTN	3	7.9
3.	DM	5	13.2
4.	Smoking	2	5.3
5.	Dyslipidemia	2	5.3
6.	HTN+ Dyslipidemia	1	2.6
7.	DM+ Dyslipidemia	2	5.3
8.	DM+ Smoking	1	2.6
9.	DM+ HTN	2	5.3
10.	DM+ HTN+ Dyslipidemia	1	2.6
11.	Total	38	100

The Table 9 shows 19 (50%) subjects had no comorbid conditions and out of remaining 50%, DM was the most common comorbidity, HTN was second most common condition. HTN, DM and Dyslipidemia was found in one subject.

Table 10: Association between Comorbidities and Normal vs Abnormal arrhythmia(N=38).

Comorbidities	Normal vs Abnormal Holter study		Total
	Normal	Abnormal	
None	8	11	19
HTN	2	1	3
DM	1	4	5
Smoking	1	1	2
Dyslipidemia	1	1	2
HTN+ Dyslipidemia	1	0	1
DM+ Dyslipidemia	0	2	2
DM+ Smoking	0	1	1
DM+HTN	2	0	2
DM+HTN+ Dyslipidemia	0	1	1
Total	16	22	38

(P Value=0.448)

Table 10 shows 11 patients having no comorbidities had abnormal cardiac rhythm and 0ne patient with HTN, DM and Dyslipidemia had abnormal rhythm. There was no statistical significance between comorbid conditions and cardiac arrhythmia (P Value =0.448) in terms of Normal vs abnormal rhythm.

Discussion

The study of Holter in patients of palpitation is regarded as key modality of detecting abnormal cardiac rhythm. Our study included all the subjects having palpitation in isolation and underwent 24 -hour Holter recording. Palpitation has been very common presenting complaints in various studies and thus we intended to study Holter in such patients to detect any abnormality regarding cardiac rhythm.

A twelve-lead Holter monitor is very accurate and can instantly diagnose various supraventricular and ventricular ectopics, tachyarrhythmias and bradyarrhythmia in symptomatic patients with unexplained palpitation, dizziness, presyncope and syncope.[20]

The period of the Holter monitoring influences the detection of cardiac arrhythmias. Lown and Wolff have stated that a period of more than 10 hours is necessary for the detection of serious arrhythmias. This study was standardized by performing a 24-hour Holter monitoring, as was suggested by Lown and Wolff.[21]

In our current study 57.9% of subjects showed abnormal Holter study, where VPCs were most common arrhythmia, one had WPW and one had CHB wile two patients had PSVT.

A study by SF Nassir which had 62% patients with palpitations showed that 87% of patients had less than 10% premature ventricular ectopic as an isolated event while 90% of the patients have Supraventricular arrythmias less than 10% as isolated events. The mean minimum heart rate was 45, mean maximum heart rate was 117 and mean average heart rate was 65 beats per minute.[22]

S Sulfi et al conducted a study where the mean age of the study group was 66 ± 19 years. The most common indications were altered consciousness (41.7%) and palpitations (36.2%). Among patients with palpitations recordings were normal in 2247 (83.6%). Most abnormalities were paroxysmal atrial fibrillation (PAF, 6.6%), narrow com- plex tachycardia (NCT, 2.8%) non-sustained or sustained ventricular tachycardia (NSVT/VT, 2.6%). Our study also showed abnormal rhythm in 57.9% subjects with VPC as most common arrhythmia and NSVT in one subject two patients had PSVT whereas on had WPW and other one had AF.[23]

In the study conducted by Karki B et al, palpitation (65.4%) was the most common indication for Holter monitoring followed by dizziness (23.1%), presyncope (7.7%) and syncope (3.8%). The mean minimum heart rate was 55 bpm, the mean maximum heart rate was 117bpm and the mean average heart was 74 bpm. Twenty-nine (37.2%) cases revealed normal Holter study and arrhythmias were detected in 49 (62.8%) cases.[16]

Similarly, to this our study had 57.9% abnormal cardiac rhythm, two fatal arrhythmia (9.1%) and 20 (91%) non-fatal arrhythmias. There were 47.4% males and 52.6% females.

Out of the 310 patients reviewed, 134 were males (43.2%) and 176 were females (56.8%). The commonest indication for Holter ECG was palpitation followed by syncope in 71 (23%) and 49 (15.8%) of subjects, respectively. Premature ventricular complex and pre- mature atrial complex were the commonest types of arrhythmias in 51.5% and 15% subjects, respectively.[17]

Thus, most studies that have been conducted had shown palpitations to be most common indication for Holter study and results obtained in our study found cardiac arrhythmia in almost more than 50% of subjects as in previous articles.

Paudel B et al in their 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). Arrhythmias found were ventricular ectopics as bigeminy in 36.7% patients and as couplets in 20% patients. 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% of cases had paroxysmal atrial flutter/fibrillation. 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.[7]

Lipsi et al found that Holter electrocardiographic monitoring in 55 symptomatic patients with syncope, palpitations or dizziness uncovered significant arrhythmias in 30 patients (55 percent).They

had observation period of at least 24 hours including a period of sleep, the procedure was also used in both symptomatic and asymptomatic patients of transient arrhythmias or conduction abnormalities not documented by routine electrocardiograms. However, very long periods of monitoring may be needed to make a diagnosis in those with only sporadic symptoms.[24]

A study showe4d that the ventricular ectopics were more readily experienced by patients as palpitations 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. Long-term ambulatory ECG monitoring is widely used to evaluate patients presenting with palpitations, dizziness, and syncope.[1]

Burkhardt D et al mentioned that most of the reports in the literature show a high prevalence of arrhythmias in patients studied for palpitation and concluded that the Holter ECG monitoring was very useful. However, associations between symptoms and arrhythmias has only been shown in a small proportion of cases and the value of the ECG monitoring methods like Holter must be weighed against its costs.[25]

In a study by Abott Allan V et al 43% had palpitations caused by cardiac causes having some form of arrhythmias, 3% had other cardiac causes, 31% had palpitations caused by anxiety or panic disorder, 6% had palpitations caused by street drugs or prescription and over-the-counter medications, and 4% had palpitations caused by other noncardiac causes. Although arrhythmias frequently cause palpitations, most patients with arrhythmias do not actually notice their arrhythmia and are unlikely to report having palpitations. Hence our research was prioritized to study patients having palpitation.[26]

Diamond T H et al in their investigation of 85 patients with 68 (80%) male and 17 (20%) female Holter examination detected that 58 (68.2%) patients had normal cardiovascular findings, 13 (15.3%) had ischemic heart disease, 7 (8.2%) showed a Wolff-Parkinson White (WPW) pattern, 6 (7%) had mitral valve prolapse and 1 (1,2%) had a coronary artery bypass graft. Definitive diagnosis of the cause of the palpitations was not obtainable from either the resting or stress ECGs. 10 patients (11.8%) were on specific anti-arrhythmic therapy, comprising betablockers, calcium antagonists and disopyramide. These 10 patients were not analyzed separately since all experienced palpitations during the monitoring period.[27]

Conclusion

Our current study enrolled 38 subjects with mean age 49.61± 17.63 years, maximum age was 79 while minimum age was 19 years. The study included 18 (47.4%) male and 20 (52.6%) female population. Participants with age group <45 years were 14 (36.8%), age group between 45 to 65 were 16 (42.1%) while subjects in age group > 65 years were 8(21.1%). The mean BMI was 25.2±2.97 kg/m2. The maximum HR was 180 bpm and minimum was 35 bpm (Table 1). There were 16 (42.1%) normal Holter and 22 (57.8%) abnormal ECG rhythm (Table 2). Most common arrhythmia was VPC 17 (77.2 %), followed by PSVT (2) and bigeminy, one had CHB, and one had WPW syndrome, atrial fibrillation was present in single patient (Table 3). Two subjects (9%) had fatal cardiac arrhythmia i.e. VT and CHB whereas the rest (91%) arrhythmias were non- malignant or non- fatal (Table 6). Gender distribution showed 11 (61.1%) males and 11 (55%) females had abnormal ECG Holter and there was no statistical significance (P Value=0.73) between gender and Normal vs abnormal Holter study (Table 7). Abnormal rhythms in age group >65years was 100%, age group 45 to 65 years was 50% while age group < 45 years was 42.8%. The association between the age group and Normal vs Abnormal Holter ECG was statistically significant

(P Value=0.023) (Table 8). Out of total study subjects 50% had one or more co-morbid illness with DM being found in 5(13.2%), one participant had DM and HTN along with Dyslipidemia and second most common findings were smoking (5.3%), dyslipidemia (5.3%) (Table 9). There was no association between comorbid conditions and normal vs abnormal ECG Holter rhythm (P Value = 0.448) (Table 10).

Limitations

The study was of short duration and only a limited number of patients (38) could be included for analysis. The patients were admitted in the ward for 24-hour ECG Holter monitoring which might have affected their daily routine activities and might have missed the arrhythmias related to exertion. This was a single center study with small sample size so it cannot be generalized to the general population.

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