Pakistan Journal of Neurological Sciences (PJNS)

Volume 17 | Issue 4 Article 5

12-2022

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https://doi.org/10.56310/pjns.v17i04.199

48 HOURS HOLTER MONITORING IN DETECTING OCCULT ATRIAL FIBRILLATION IN YOUNG PATIENTS WITH POSSIBLE CARDIOEMBOLIC STROKE

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Date of submission: *October 16, 2022* ***Date of revision:*** *December 24, 2022* ***Date of acceptance:****December 25, 2022*

ABSTRACT

Background and objective:

Atrial fibrillation (AF) is a common cause of ischemic stroke. AF is usually paroxysmal and could escape detection via single lead electrocardiogram ECG recorder. Holter monitoring is useful in this scenario. The objective of this study was to assess the role of 48 hours Holter monitoring in identifying clinically inapparent AF in young patients with ischemic stroke

Methods:

A retrospective cross-sectional study was conducted with patient data from November 2019 to February 2021. It was conducted in Neurology department of Pakistan Institute of Medical Sciences, Islamabad, Pakistan. Study contained medical records of 60 patients which were admitted in this time period. Forty-eight hours Holter monitoring was carried out for all the patients. Patient medical records were examined according to predetermined risk factors and criteria. Statistical analysis was done on SPSS version 25.0.

Results:

Ten out of 60 cases had positive results for AF during Holter monitoring. Fifty cases had negative results for AF during Holter monitoring. While the p value of the data obtained remained non-significant, results depict efficacy of Holter monitoring in detection of AF to some extent.

Conclusion:

Holter monitoring can identify AF, providing aid in prevention of secondary ischemic stroke. However, instead of 48 hours monitoring, a through 72 hours or extended monitoring will increase the effectiveness of this monitoring. In future, a study could be conducted where a large number of cases should be included so that statistical significance of data could be increased.

Key words: Holter monitoring, Ischemic stroke, Atrial Fibrillation

INTRODUCTION

Atrial fibrillation (AF) comprises of irregular heartbeats categorized via loss of P waves on ECG, along with one or more than one attacks lasting at least 30 seconds. While AF is more prevalent in the advanced ages or persons having other cardiovascular risk factors, it affects 3% of adult individuals, hence more prevalent in this age group. Symptoms related to AF could be identified in all three of its subtypes, known as permanent, persistent or paroxysmal AF. Though, some cases with AF related to stroke are also asymptomatic. This asymptomatic AF could occur during stroke or after stroke. It has been proven by research that AF enhances the chance of ischemic stroke fourfold to fivefold.[1] It is significant to investigate the stroke etiology and to decrease the chance of stroke recurrence through giving the patient suitable treatment options. Though, in nearly one-fourth of ischemic strokes, the primary factor/root cause can not be identified.[2] Stroke causes an increased economic problem for society. Per annum, European Union countries spend an average of 27€ billion on stroke associated expenses.[3] It means that

approximately 3% to 4% of health budgetis being spent on expenses created by this acute incident and after that because of therapy and care.[4] In cases presenting with transient ischemic attack (TIA) or ischemic stroke, approximately one-fourth of cases have AF as root cause.[5] Nevertheless, AF is usually paroxysmal and could escape detection via single lead electrocardiogram (ECG) recorder in nearly 48% of cases.[6] Subsequent to stroke, the occurrence of AF on single lead ECG ranges between 2% to 15%.[7] While 24-hour Holter monitoring is useful, it only identifies AF in 1% to 6% of total cases (mean 2.9%).[8-10] Even though clinical guidelines recommend a minimum of 24 hours cardiac monitoring after stroke occurance, observance to this Holter monitoring guideline is comparatively infrequent in the everyday life.[11,12]

Holter reported in 1961, the initial real-world use of a compact and handy magnetic tape "electro-cardio-recorder" whose weight was under 2 kg and the device could record nonstop for 10 hours.[13] Afterwards ECG monitoring is being utilized widely for numerous medical purposes, which include relationship of arrhythmias and its symptoms, assessment of prognosis, management of anti-arrhythmic treatment, and identification and treatment of myocardial ischemia.[14-16]

The present study was conducted to assess role of 48 hours Holter monitoring in identifying clinically inapparent AF in young patients with ischemic stroke.

METHODS

Study Design: A retrospective cross-sectional study

Place and duration of study: This study contains patient data from November 2019 to February 2021.

Sample size: This study contains medical records of 60 patients who were admitted with ischemic stroke during the study period.

Sampling technique: Non-probability consecutive sampling.

Data collection: Forty-eight hours Holter monitoring was carried out for all the patients included in this study. Patients were labeled positive if atrial fibrillation of 6 minutes or longer was detected during the monitoring. Patients' medical records were examined. Age of patient, gender of patients, their clinical diagnosis, stroke characteristics, demographics, electrocardiography and echocardiography results and duration and findings of Holter monitoring were listed.

Data analysis: The data was analyzed using SPSS version 25.0

Ethical considerations: This study was approved by the Ethics Review Committee of Pakistan Institute of Medical Sciences.

RESULTS

All of the 60 patients admitted in the study underwent 48 hours Holter monitoring during admission time. When patients were listed according to their gender, 36 patients were male while 24 patients were female. Figure 1 is illustrating the gender wise distribution of patients included in the study.

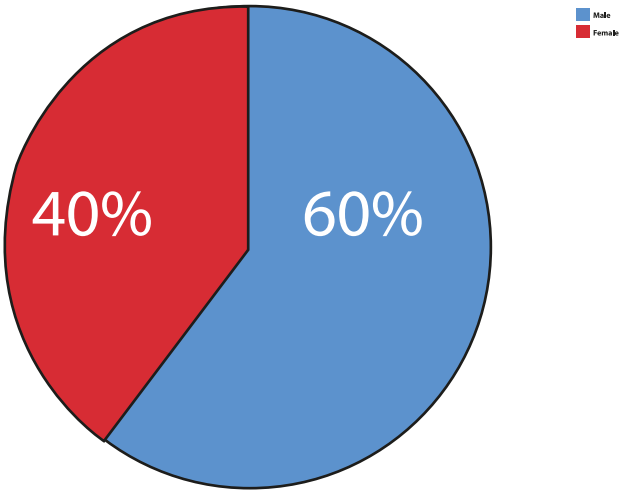

Figure 1: Illustration of the gender distribution in patients

When patient data was distributed according to their age, highest number of patients were present in age between 40 to 48 years. Figure 2 is illustrating the age wise frequency of patients included in the study.

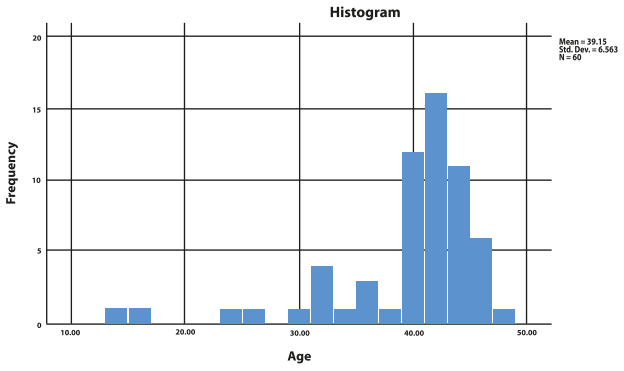

Figure 2: Illustration of age wise frequency of patients

The National Institute of Health Stroke Scale (NIHSS) depicts the neurological functioning in stroke patients. Score for individual ability ranges between 0 to 4, 0 for normal functioning brain and 4 for totally impairedbrain. NIHSS score for patient is computed by addition of number for every factor on the scale. Possible highest score is 42. Higher NIHSS depicts more impaired stroke patient. In present study majority NIHSS of patients ranges between 2 to 7 which indicates that patients were neurologically not affected to higher extents. Figure 3 is illustrating the NIHSS wise frequency of patients included in the study.

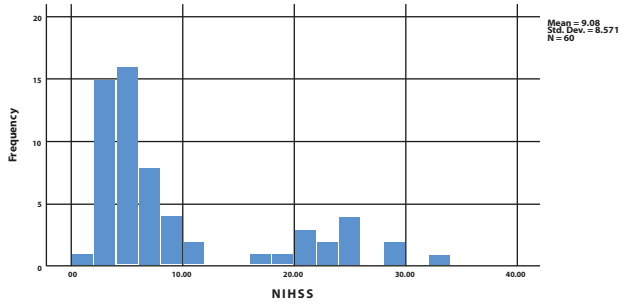

Figure 3: NIHSS wise frequency of patients

Glasgow Coma Scale (GCS) also represents the neurological functioning in patients. It includes scoring of responses like verbal, motor and eye opening which could be used for measurement of severity of the brain damage and patients' consciousness. Responses are rated between 1 and 6 with a cumulative score of 3 to 15, score 15 taken as normal. Initial GCS less than 5 is linked with 80% or greater probability of being near deathtime or death. Initial GCS greater than 11 is linked with 90% or greater probability of recovery. GCS prime usage is to eliminate any chance of severe brain injury and to aid in determining which patients need emergency medical treatment.[17]

In present study majority GCS of patients was between 12 to 13 which indicates that patients were neurologically not affected to higher extents. Figure 4 is illustrating the GCS wise frequency of patients included in the study.

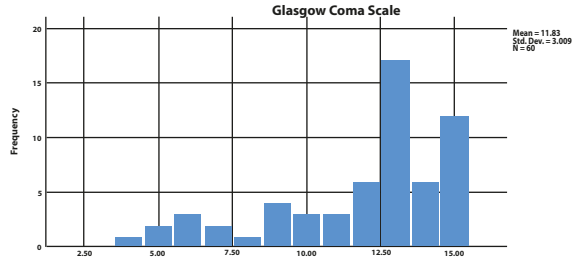

Figure 4: Illustration of GCS wise frequency of patients

Both NIHSS and GCS are used as measuring scale for patients neurological health. But these two are inversly propotional to each other a lower NIHSS score while a Higher GCS score indicate better neurological health. This inverse relation is showen in Figure 5 where a line graph is plotted between NIHSS and GCS using ANOVA software.

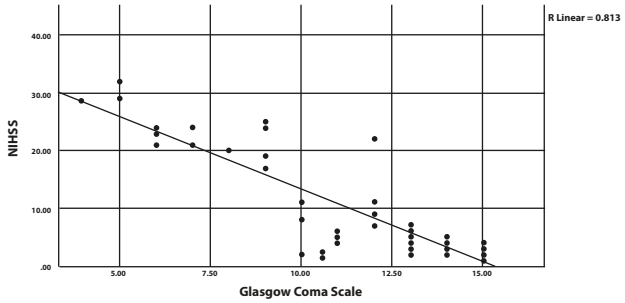

Figure 5: Inverse relation between NIHSS and GCS

50% of patients (30 patients) showed no previous family history of hypertension, diabetics, stroke and ischemic heart disease. Underlying factor and their percentages in rest of patients (30 patients) is presented in Figure 6. Most common factor was hypertension (28.3%) while least common factor associated was stroke (1.7%).

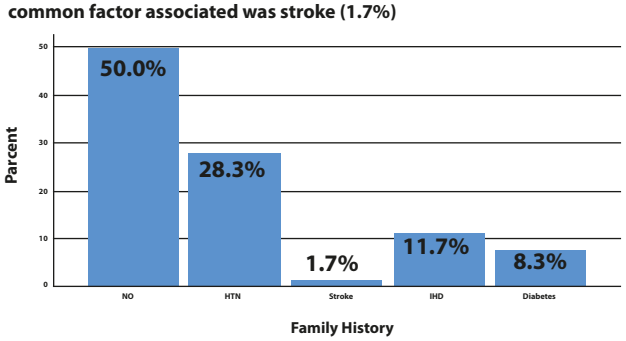

Figure 6: Illustration of factor wise family history and percentage in patients

When nature of neurological deficit was analyzed, majority (75%) cases of hemiparesis were seen. Second most prevalent deficit was ataxia (3.3%). Other deficits identified were comatose, aphasia, monoparesis, and vision loss and speech impairment. Nature of neurological deficit and their percentages are given in Figure 7.

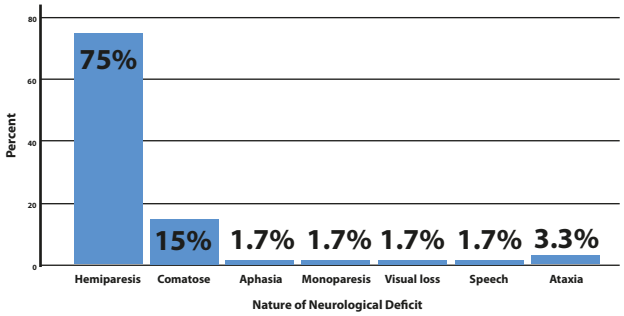

Figure 7: Nature of neurological deficit and their percentages

Neuroimaging was used to identify the location of infarction in the affected patients' brains. Most common location of infraction was in anterior brain, after which infraction was mostly recorded in posterior brain and brain stem. Location of infraction along with occurrence percentages are given in Figure 8.

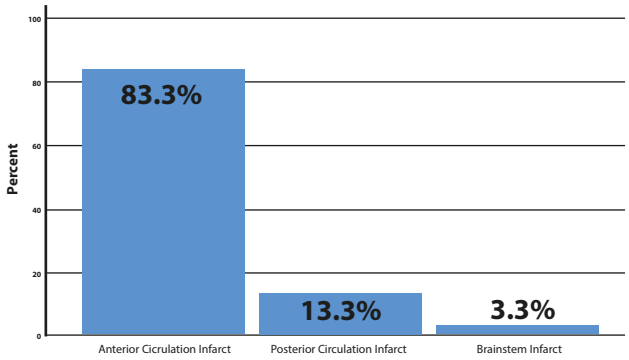

Figure 8: Location of infarction along with occurrence percentages

48 hours Holter monitoring showed that majority of patients remained normal after stroke occurance. Fifty out of 60 cases include in this study showed no signs of AF while only 10 patients showed sign for AF during Holter monitoring. Figure 9 is depicting normal and patients affected with AF percentages during Holter monitoring.

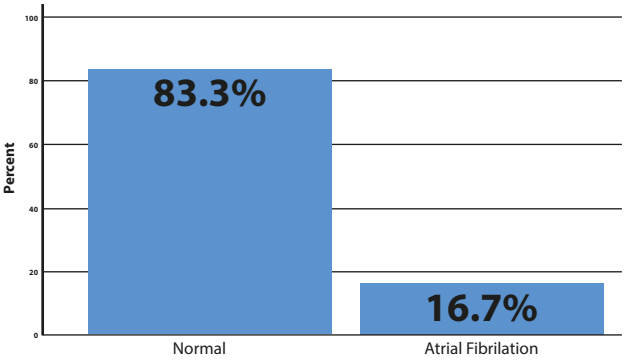

Figure 9: Normal and affected AF patients percentages during Holter monitoring

Table 1 shows age, NIHSS and GCS details of the patient.

Table 1: Mean Age, NIHSS and GCS in our study subjects

	N	Minimum	Maximum	Mean	Std. Deviation
Age	60	14.00	48.00	39.1500	6.56345
NIHSS	60	1.00	32.00	9.0833	8.57132
Glasgow Coma Scale	60	4.00	15.00	11.8333	3.00940
Valid N (list wise)	60				

Tables 2 is showing frequencies of smoking , diabetes and blood vessel involved in our study subjects .

Table 2: Frequncy of smoking, diabetes and involved blood vessel in the study population

Smoking

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	17	28.3	28.3	28.3
	No	43	71.7	71.7	100.0
	Total	60	100.0	100.0	

Diabetes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	7	11.7	11.7	11.7
	No	53	88.3	88.3	100.0
	Total	60	100.0	100.0	

Neuroimaging Findings

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MCA	44	73.3	73.3	73.3
	PCA	8	13.3	13.3	86.7
	Brainstem Infarct	2	3.3	3.3	90.0
	ACA	6	10.0	10.0	100.0
	Total	60	100.0	100.0	

When chi-square test was applied on data obtained after Holter monitoring of patients, p value came as non- significant for all the three domains i.e. pearson Chi-Square, likelihood ratio and linear-by-linear association. Details of statistics applied on obtained data is given in table 3.

Table 3: Details of statistics applied on obtained data

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.256[a]	2	.324
Likelihood Ratio	1.801	2	.406
Linear-by-Linear Association	2.082	1	.149
N of Valid Cases	60		

DISCUSSION

Persistent AF is usually easy to detect via routine ECG valuation during stroke, so to demonstrate a relationship between the two is quite easy. But as paroxysmal AF have short term spontaneous episodes during a course of seven days, it is not easy to detect via routine ECG valuation. In some cases where patients were not evaluated through proper examination it was mistakenly taken as cryptogenic stroke.[18]

Circumstances which are identified as mutual risk factors for paroxysmal AF and stroke, such as hypertension, age, diabetes mellitus, tobacco use, valvular heart disease, male gender, coronary heart disease, sleep apnea, inflammatory disorders, heart failure and chronic kidney disease have depicted their role in the association between stroke and paroxysmal AF.[19] In present study, 60% cases were reported in male gender while cases were more prevalent in advance age group in comparison with younger age groups.

Studies from different countries have presented that PAF can be identified in nearly 10% of cases by increasing the follow-up days up to 30 days, in the cases that were examined for the identification of Embolic stroke of undetermined source (ESUS). Additionally, paroxysmal AF could be identified in one quarter of cases via constant monitoring, for example, via implanted loop recording gadgets/ devices.Though, there is a need to devise an algorithm for case selection and to detect progressive cardiac rhythm, since not all stroke cases could receive this type of intense monitoring.[20]

In present study, 10 (16.7%) out of 60 cases reported had paroxysmal AF during 48 hours. The p value came as non-significant, but this monitoring had shown that it may have some effectiveness for detecting paroxysmal AF in larger cohorts. In a recent study from Turkey, where results were non-significant for Holter monitoring, researchers suggested that statistical significance could be increased by a thorough evaluation in larger population. [21]

CONCLUSION

Holter monitoring could identify PAF providing aid in prevention of secondary ischemic stroke. However, instead of 48 hours monitoring, a through 72 hours or extended monitoring will increase the effectiveness of this monitoring.Also, a large number of cases should be included in the study so that statistical significance of data could be increased.

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Conflict of interest: Author declares no conflict of interest.
Funding disclosure: Nil

Authors' contribution:
Bushra Khalid; Design, data collection, data analysis, manuscript writing
Soban Khan; Design, data collection, manuscript writing
Muhammad Tariq; Concept, data collection, manuscript revision
Sajid Ali; Concept, design, manuscript revision
Ijaz Ali; Design, data collection, manuscript writing
Zaid Waqar; Concept, data collection, manuscript writing