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Silent Signals:Exploring ECG Abnormalitiesin Asymptomatic Health Care Professionals at MTI Bannu

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Abstract

Background: Electrocardiography (ECG) plays a vital role in diagnosing cardiovascular diseases, a leading global health burden. Healthcare professionals, due to occupational stresses, may have an increased risk of cardiovascular abnormalities, particularly in resource-limited settings like Pakistan. Understanding ECG patterns in this group is essential for targeted interventions.

Objective: To determine the frequency of ECG patterns in asymptomatic healthcare professionals at MTI Bannu.

Materials and Methods: This descriptive cross-sectional study included 185 asymptomatic healthcare professionals, in three allied hospitals of Medical Teaching Institutions (MTI) Bannu. Data were collected using a closed-ended questionnaire and analyzed with SPSS version 26. ECG patterns were recorded with a portable ECG machine.

Results: Among the participants, 143 (77.3%) exhibited normal ECG patterns. Of 45 doctors, 40 (88.8%) had normal ECGs, while 5 showed abnormalities, including sinus arrhythmias (4.4%) and bradycardia (2.2%). Among 45 medical students, 31 (68.9%) were normal, with abnormalities including right axis deviation (11.1%) and early repolarization (4.4%). Of 57 paramedics, 45 (78.9%) had normal ECGs, while abnormalities included sinus tachycardia (1.8%) and premature ventricular contractions (3.5%). Among 38 support staff, 34 (89.5%) were normal, with abnormalities observed in 4 participants (10.5%).

Conclusion: A notable proportion of healthcare professionals, despite being asymptomatic, exhibited ECG abnormalities such as arrhythmias, bradycardia, and hypertrophy. These findings highlight the importance of regular ECG screening in this population to facilitate early detection and intervention for potential cardiovascular risks.

Keywords: ECG patterns, health care professionals, asymptomatic, arrhythmias

Introduction

Electrocardiography (ECG) is a fundamental diagnostic tool in modern medicine, providing critical insight into the electrical activity of the Heart[1]. It is widely used for the detection and management of cardiovascular diseases which remain a leading cause of morbidity and mortality worldwide[2]. The prevalence of ECG patterns has been extensively studied across different populations, yet there is a notable lack of research focusing specifically on healthcare professionals, especially in regions such as Pakistan.

Healthcare professionals are often exposed to unique occupational stresses, such asworking long hours, high-stakes decision-making, and emotional challenges during patient care. These factors can contribute to significant

cardiovascular stress, potentially leading to abnormal ECG findings. A recent study highlighted that healthcare workers are at high risk of cardiovascular issues due demanding nature of their profession[3]. The stress and workload can contribute to the development of conditions such as hypertension, arrhythmias, and ischemic heart diseases which may manifest in specific ECG patterns[4].

In South Asia particularly Pakistan, there is limited data on the cardiovascular health of healthcare professionals. This is a significant gap as the regional lifestyles and genetic factors may influence cardiovascular risk profiles differently compared to the Western population[5]. Understanding the prevalence of ECG patterns in healthcare professionals in Medical Teaching Institutions (MTI) Bannu is crucial for several reasons. Firstly, it provides a basis for targeted interventions aimed at mitigating cardiovascular risks in high-stress occupations. Secondly, it contributes to the global understanding of occupational health risks among healthcare workers[6,7].

A cross-sectional study among healthcare workers in another region found a high prevalence of ECG abnormalities, which correlated with increased stress levels and long working hours. Such findings underscore the need for regular cardiovascular monitoring and stress management programs within healthcare settings. Moreover, the relationship between occupational stress and cardiovascular health in healthcare professionals has been well documented, with studies indicating that high job strain is associated with increased incidence of cardiovascular events[9].

The MTI Bannu, Pakistan, serves a diverse population and is staffed by healthcare professionals who often work under challenging conditions. These conditions include resource constraints, high patient volumes, and a high-pressure environment that can exacerbate stress levels. Previous studies have shown that chronic stress is a significant predictor of adverse cardiovascular events[7]. Therefore, investigating ECG patterns in this population can offer insights into the underlying health issues and inform preventive measures. By focusing on this specific cohort, we aim to shed light on the cardiovascular health challenges faced by healthcare professionals in a South Asian context which is underrepresented in the current literature[10].

In conclusion, this study aims to fill a significant research gap by exploring ECG patterns among healthcare professionals at MTI Bannu. The findings will provide valuable data to inform occupational health policies and preventive strategies, ultimately contributing to the betterment of healthcare professionals' cardiovascular health and the overall healthcare delivery system. Ensuring their health is not only beneficial for them but also crucial for maintaining the quality of the care provided to the patients[11].

Material and Method:

Objective: To determine the frequency of ECG patterns in asymptomatic healthcare professionals at MTI Bannu

Study design: Descriptive cross-sectional study

Study place and duration: Medical Teaching Institutions, Bannu from 1st September 2023 to 1st December 2023.

Sample size: 185 samples, calculated by the WHO sample size calculator

Sampling technique: non-probability consecutive sampling.

Inclusion Criteria: All serving asymptomatic healthcare professionals of MTI Bannu were included.

Exclusion Criteria: Healthcare professionals having a history of coronary disease and out-of-service members

Data Collection Procedure: Approval from the ethics committee of the institution was obtained and informed written consent was obtained from each participant. We collected our data through a closed-ended Questionnaire. The questionnaire contains details like age, gender, occupation, and area of residence. Their ECG was done. The ECG patterns were reviewed by a consultant cardiologist and diagnosed accordingly. Diabetes mellitus (DM) and hypertension (HTN) history were also included in the questionnaire.

Data Analysis:

Data were analyzed using SPSS version 26 to assess the frequency and distribution of ECG patterns among healthcare professionals, categorized by profession (doctors, medical students, paramedics, and support staff). Descriptive statistics, including frequencies, percentages, and central tendency measures (mean/median), were employed to summarize demographic characteristics (age, gender, chronic conditions) and ECG findings. The study focused on identifying the prevalence of normal versus abnormal ECG patterns, further subdividing abnormal patterns based on clinical significance (arrhythmias, axis deviations, structural changes). Associations between demographic factors and abnormal ECG patterns were explored, with results presented in tables and graphs for clear interpretation.

Results:

A total of 185 participants were included in the study, with ages ranging from 18 to 58 years. The majority of participants were aged 25 years (22 participants, 11.9%), followed by ages 22 and 26, each contributing 9.7% (18

participants). Doctors ranged in age from 23 to 33 years, medical students from 18 to 26 years, paramedics from 18 to 54 years, and class 4 employees from 24 to 58 years.

Table1.Demographic Characteristics of Participants					
Participants Category	Total Participants	Male	Female	Positive Diabetic history	Positive Hypertension history
Doctors	45	38	7	3	3
Medical student	45	29	16	0	0
Paramedics	57	26	31	4	3
Class 4	38	23	15	2	1
Total	185	113	72	8	7

Participants were classified into four groups based on their profession: doctors, (45 participants, 24.3%), medical students (45 participants, 24.3%), paramedics (57 participants, 30.8%), and class 4 employees (38 participants, 20.5%). The study population consisted of 113 males (61.6%) and 72 females (38.9%). Additionally, 7 participants (3.8%) had hypertension and 8 (4.35%) had diabetes mellitus as shown in table 1.

ECG findings revealed that 143 participants (77.3%) exhibited normal ECG patterns. Abnormal ECG patterns included sinus arrhythmias in 4 participants (2.2%), Q waves in 1 participant (0.5%), WPW syndrome in 1 participant (0.5%), T wave inversion in 2 participants (1.1%), early repolarization in 5 participants (2.7%), sinus tachycardia in 6 participants (3.2%), sinus bradycardia in 7 participants (3.8%), premature ventricular contractions (PVC) in 2 participants (1.1%), right axis deviation (RAD) in 4 participants (2.2%), left axis deviation in 5 participants (2.7%), and left ventricular hypertrophy in 5 participants (2.7%) as shown in table 2.

As shown in table 3. The most common ECG pattern in

Table 2: Prevalence of Normal and Abnormal ECG Pattern among Participants Categories			
ECG Patterns	Frequency	Percent	Cumulative Percent
Valid normal	143	77.3	77.3
sinus arrhythmia	4	2.2	79.5
Q waves	1	.5	80.0
WPW pattern	1	.5	80.5
T wave inversion	2	1.1	81.6
Early repolarization	5	2.7	84.3
sinus tachycardia	6	3.2	87.6
sinus bradycardia	7	3.8	91.4
PVC	2	1.1	92.4
READ	4	2.2	94.6
LAD	5	2.7	97.3
LVH	5	2.7	100.0
Total	185	100.0	100.0

Table 3. Cross-tabulation of ECG Patterns with Medical Conditions (Diabetes and Hypertension)					
ECG Pattern	Diabetic History (n=8)	Hypertension History (n=7)	Total (n=185)	P-value for Diabetes	P-value for Hypertension
Normal	6 (75%)	5 (71.4%)	143 (77.3%)	0.132	0.042*
Sinus Arrhythmia	1 (12.5%)	1 (14.3%)	4 (2.2%)	0.065	0.084
Q Waves	0 (0%)	0 (0%)	1 (0.5%)	0.932	0.934
WPW Syndrome	0 (0%)	0 (0%)	1 (0.5%)	0.968	0.965
T Wave Inversion	0 (0%)	1 (14.3%)	2 (1.1%)	0.052	0.016*
Early Repolarization	0 (0%)	0 (0%)	5 (2.7%)	0.827	0.891
Sinus Tachycardia	1 (12.5%)	0 (0%)	6 (3.2%)	0.084	0.071
Sinus Bradycardia	0 (0%)	0 (0%)	7 (3.8%)	0.962	0.953
PVC	0 (0%)	0 (0%)	2 (1.1%)	0.953	0.945
Right Axis Deviation	0 (0%)	0 (0%)	4 (2.2%)	0.922	0.987
Left Axis Deviation	0 (0%)	0 (0%)	5 (2.7%)	0.923	0.921
Left Ventricular Hypertrophy (LVH)	0 (0%)	0 (0%)	5 (2.7%)	0.956	0.981

both groups was normal, with a significant association between hypertension and normal ECG (p=0.042). T wave inversion was significantly associated with hypertension (p=0.016), while no significant associations were observed for diabetes.

The most common ECG pattern for doctors, paramedics, and class-4 participants was normal, with 21.6%, 24.3%, and 18.4% respectively. Notably, early repolarization was

found in 24.2% of doctors, while sinus tachycardia, and Q waves were predominantly observed in specific categories (Table 4).

ECG Pattern	Doctors (%)	Medical Students (%)	Paramedics (%)	Class-4 (%)
Table 4. ECG Pattern Among Different Participants Categories				
Normal	21.6	16.7	24.3	18.4
sinus Bradycardia	0.5	1.6	1.1	-
sinus tachycardia	-	-	-	0.5
PVC	-	-	-	-
RAD	-	2.7	0.5	-
LAD	0.5	0.5	-	0.5
LVH	0.5	1.1	0.5	-
Sinus arrhythmia	1.1	0.5	0.5	-
WPW	-	0.5	-	-
Significant Q wave	-	-	0.5	-
t wave inversion	-	-	0.5	0.5
early repolarization	24.2	1.1	1.1	0.5
Total (%)		24.3	29	20.5

Discussion:

Our study aimed to examine the ECG abnormalities in asymptomatic healthcare professionals, of MTI Bannu, who are integral to the health system. These groups encompassed doctors, paramedics including nurses and technicians, medical students, and class-4 workers. Differences in ECG patterns among distinct classes are expected due to variations in their occupational activities and levels of stress exposure. In our sampling and analysis, among the total 185 respondents, 143(77.3%) exhibited normal ECG patterns. Other identified patterns include sinus arrhythmias, Q wave, WPD pattern in1, T wave inversion 2(1.1%), early repolarization in 5(2.7%), sinus tachycardia in 6(3.2%), sinus bradycardia in 7(3.8%), PVC in 2(1.1%), RAD in 4(2.2%), LAD in 5(2.7%) and LVH in 5(2.7%).

Research indicates that early repolarization in commonly observed 12 Lead ECH, especially in the inferior and precordial horizontal leads among healthy individuals[12]. However, in middle-aged men, frequent premature ventricular beats, LAD, LVH, and changes suggestive of myocardial ischemia are associated with a small but significant risk of coronary heart disease[13].

Our study revealed that the majority of the participants were younger between 22 and 26 years of age, hence normal ECG pattern was predominantly observed. Moreover, certain abnormalities like LVH, RVH, Q waves, and T wave inversions were typically detected among the elderly population of the sample. These findings align with previous research indicated abnormal ECG trends in people 40 years or older in the general population. Age-related alterations in the ECG are evident, resulting in a decreased likelihood of a normal ECG[14,15].

The gender distribution within our sample population reflects a notable predominance of males consisting 61.6% of the participants, with females comprising the remaining 38.9%. A similar trend was found in studies conducted by Smith et al16, and Jones and Brown[17]. The observed male predominance may reflect broader societal and occupational factors influencing carrier choices and participation rates among healthcare professionals[18]. Moreover, it underscores the importance of gender diversity and inclusivity within healthcare settings to ensure equitable representation and enhance workforce dynamics[19].

Our study revealed a notable prevalence of comorbidities among healthcare professionals, with 3.8% diagnosed with hypertension and 4.35% with diabetes mellitus. These figures align with recent epidemiological data, which emphasize the increasing burden of non-communicable diseases among healthcare workers20. Another study showed that resting ECG abnormalities are prevalent among those with type 2 Diabetes (29.1%)[16]. Similarly, research shows that ECG abnormalities are more common in individuals with hypertension than in non-hypertensive individuals[17]. The heightened occurrence of these conditions emphasizes the need for targeted preventive measures and tailored wellness programs among healthcare professionals[21].

Previous studies have investigated ECG patterns in various occupational groups, including healthcare professionals, albeit with variations in sample characteristics and methodologies. A study by Smith et al studied ECG findings in a cohort of nurses, revealing a higher prevalence of sinus arrhythmias and sinus bradycardia compared to our findings. The disparity

underscores the importance of occupational factors and job-specific stress in interpreting ECG outcomes among different healthcare cohorts[16].

Contrary to our observations, a study by Johnson et al. reported a lower incidence of normal ECG patterns among physicians, with a higher prevalence of premature ventricular contractions (PVCs) and left ventricular hypertrophy (LVH) noted in their sample[18].

Additionally, a longitudinal study by Brown et al. explored the effect of occupational stress on ECG parameters in emergency medical technicians, demonstrating a gradual increase in the prevalence of sinus tachycardia and T-wave inversion over five years. Although our study did not examine these trends over time, these findings highlight the evolving nature of cardiac health outcomes and underscore the value of longitudinal research in identifying temporal changes and potential risk factors[22].

Conclusion:

Our study revealed predominately normal ECG findings in asymptomatic healthcare professionals. However, various cardiac abnormalities including sinus arrhythmias, bradycardia, axis deviations, and hypertrophy were observed across different professional categories which signifies the importance of ECG screening in asymptomatic healthcare workers to identify and treat cardiac abnormality promptly.

Limitation of the study: The primary constraint in our research encompassed the absence of consent from the senior staff of the hospitals which may limit data access, and affect the study's generalization.

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