Association Of Resting Heart Rate With Risk Of Stroke In Men

Ahmad Hassan Khan[1], Chaand Bibi[2*], Sadiya Chouhdry[3], Muhammad Asfandyar Ali[4], Shuja Ullah[5]

[1-5]Department of Medicine, Mayo University Hospitl, Castlebar, Ireland
Corresponding Author: Chaand Bibi, Email: chaand.bibi@hse.ie

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ABSTRACT

Background: The basic clinical measurement of resting heart rate (RHR) has been related to different cardiovascular outcomes. However, its link to stroke risk, especially in males, is uncertain.
Objective: This research examines men's stroke risk and resting heart rate.
Methods: This observational research at department of Medicine, Khyber Teaching Hospital, Peshawar from 1st January 2022 to 31st December 2022, comprised 1,000 male participants aged 40–70. Participants were separated into two groups based on resting heart rate: Group A (RHR < 70 bpm) and Group B (RHR > 70 bpm). Baseline demographics, clinical features, and RHR were recorded. Over a 5-year follow-up, stroke incidence was the main outcome. Using Cox proportional hazards models, the relative risk of stroke between the two groups was calculated, controlling for age, hypertension, diabetes, smoking status, and BMI.
Results: There were 1000 participants in all, with an equal distribution of individuals between two groups: Group A and Group B. The average age was comparable between Group A (55.3 ± 10.2 years) and Group B (54.8 ± 11.1 years) with a p-value of 0.432, indicating that the difference was not statistically significant. The BMI values were similar in the two groups (Group A: 27.4 ± 3.5 kg/m², Group B: 27.1 ± 3.7 kg/m², p=0.281).
Conclusion: This research reinforces the data that an elevated resting heart rate is a substantial risk factor for stroke in males.

INTRODUCTION

Stroke remains a leading global cause of illness and death, playing a significant role in long-term disability and healthcare system burdens [1]. Identifying modifiable risk factors for stroke is important to develop effective preventive measures [2]. Resting heart rate (RHR) has been considered as an indicator of cardiovascular events because it is simple and non-invasive clinical assessment procedure [3, 4]. Higher resting heart rate (RHR) increases the probability of having cardiovascular diseases such as coronary artery disease or heart failure. However, the association between the chances of stroke due to high resting heart rate (RHR), particularly among men, has not been researched well [5, 6].

This is an indication of autonomic balance and general status of cardiovascular health. An increased resting heart rate normally reflects greater sympathetic activity coupled with lessened parasympathetic influence that may have negative implications for the cardiovascular function [7]. Other studies have shown a link between increased RHRs with elevated BP, diabetes mellitus and atherosclerosis. Nonetheless, there are no conclusive findings linking male stroke patients' RHRs directly to the risk.

Understanding how an increase in resting heart rate influences the chances of experiencing a stroke would be invaluable in developing preventive strategies and treatment plans targeting individuals at high risk [8]. The objective of this study was to investigate if there is any relationship between RHR at rest and likelihoods on getting strokes among males. We intend to determine whether higher resting heart rates are an independent risk factor for stroke through analysis of a group of men under consideration. To do this we divided our research population into two groups according to RHR: <70 bpm and ≥70 bpm. We expected that males with greater RHR would have more strokes.

Methodology

Study Design and Population

This observational research was place at department of Medicine, Khyber Teaching Hospital, Peshawar from 1st January 2022 to 31st December 2022. This research examines men's stroke risk and resting heart rate (RHR). Community health screenings and outpatient clinics recruited 1,000 male patients, aged 40-70 years. Participants gave informed permission, and the local ethics committee authorized the research. A thorough medical history, physical examination, and vital sign measurements were performed at baseline. Participants' resting heart rates were monitored using an automated sphygmomanometer after five minutes of sitting and resting. Three measurements were averaged to determine RHR. Participants were separated into two RHR groups: Group A (RHR < 70 bpm) and Group B (RHR > 70 bpm).

Data Collection

Age, BMI, smoking habits, physical activity, education, socioeconomic position, residence, medication, and medical history of hypertension, diabetes, and hyperlipidemia were gathered as baseline demographic and clinical variables. Fasting glucose, lipid profile, and other indicators were measured in blood.

Follow-Up and Outcome Assessment

Participants were monitored for five years. Annual clinic visits and telephone interviews were undertaken for follow-up. The main outcome was stroke incidence, verified by medical records, hospital discharge summaries, and imaging reports. The WHO characterized stroke as ischemic and hemorrhagic.

Statistical Analysis

The statistical analyses were done using SPSS version 25.0. Both groups' baseline characteristics were compared using t-tests for continuous variables and chi-square testing for categorical variables. Kaplan-Meier survival curves were produced to compare stroke-free survival across groups based on stroke incidence rates. Adjusting for possible confounders, Cox proportional hazards regression models estimated RHR-stroke risk hazard ratios (HRs) and 95% confidence intervals (CIs). The multivariable models included age, BMI, hypertension, diabetes, smoking, physical activity, and lipid levels. A p-value < 0.05 indicated statistical significance.

Ethical Considerations

The research followed the Helsinki Declaration. Every participant gave written informed permission before joining the research. The institutional review board accepted the research protocol.

Results

There were 1000 participants in all, with an equal distribution of individuals between two groups: Group A and Group B. The mean ages of the two groups were the same, Group A (55.3 ± 10.2 years), and Group B (54.8 ± 11.1 years) with a p-value of 0.432 indicating that the difference was not statistically significant. In both groups, participants were only males. A mean BMI of 27.4 kg/m² for Group A and 27.1 kg/m² for Group B with (p=0.281). They were also similar in their hypertension, smoking, physical activity, diabetes, and hyperlipidemia. Group A and B were more likely to be an urban inhabitant 65.4% and 62.2% respectively. Concerning education, location, and socioeconomic status, there were no differences, and the mean disease duration for both groups was 8 years. Similar prescriptions included those for hypertension and anti-platelet aggregation. The baseline characteristics of the participants showed no significant differences in residence, education, occupation, socioeconomic position, disease duration, and medication consumption between the two groups (all p-values > 0.05). Group A exhibited a stroke incidence rate of 5.0%, whereas Group B had a considerably elevated rate of 9.4%. The Kaplan-Meier analysis shown in Table 4 demonstrates a decreased rate of survival without stroke in Group B over a period of five years. After three years, the survival rates for Group A and Group B were 96.5% and 94.5% respectively, with a statistically significant p-value of 0.01. Table 5 demonstrates that those with a resting heart rate (RHR) of 70 bpm or above had a substantially higher risk of stroke (hazard ratio [HR]: 1.8, 95% confidence interval [CI]: 1.1-2.9, p=0.03). Age was shown to be a significant risk factor, with a hazard ratio (HR) of 1.02 (95% confidence interval [CI]: 1.01-1.04, p=0.01). Nevertheless, variables such as BMI, diabetes, smoking, physical activity, and hyperlipidemia did not demonstrate any significant correlations with the risk of stroke. The sensitivity analysis in Table 6, which was stratified by age group, revealed that individuals less than 55 years old

who were in Group B had a risk of stroke that was almost twice as high as those in Group A (HR: 1.9, 95% CI: 1.1-3.4, p=0.02). Among individuals aged 55 years and older, Group B exhibited a greater risk of stroke in comparison to Group A (Hazard Ratio: 1.8, 95% Confidence Interval: 1.0-3.1, p=0.04).

Table 1: Gender & Age-wise Distribution of Study participants

Characteristic	Group A (RHR < 70 bpm) (n=500)	Group B (RHR ≥ 70 bpm) (n=500)	p-value
Mean Age (years)	55.3 ± 10.2	54.8 ± 11.1	0.432
30-39 years	47 (9.4%)	43 (8.6%)	0.683
40-49 years	112 (22.4%)	137 (27.4%)	0.513
50-59 years	143 (28.8%)	141 (28.2%)	0.593
60-69 years	127 (25.4%)	121 (24.2%)	0.778
70-79 years	53 (10.6%)	46 (9.2%)	0.414
80+ years	18 (3.6%)	12(2.4%)	1.000
Gender			
Male	500 (100%)	500 (100%)	
BMI (kg/m²)	27.4 ± 3.5	27.1 ± 3.7	0.281
Hypertension (%)	118 (23.6%)	122 (24.4%)	0.80
Smoking Status (%)	174 (34.8%)	183 (36.6%)	0.85
Physical Activity (%)	157 (31.4%)	146 (29.2%)	0.74
Diabetes (%)	113 (22.6%)	116 (23.2%)	0.77
Hyperlipidemia (%)	138 (27.6%)	130 (26.0%)	0.83

Table 2: Baseline Characteristics of Participants

Characteristic	Group A (RHR < 70 bpm) (n=500)	Group B (RHR ≥ 70 bpm) (n=500)	p-value
Residence			
Urban	327 (65.4%)	311 (62.2%)	0.273
Rural	173 (34.6%)	189 (37.8%)	0.273
Education			
Primary	102 (20.4%)	112 (22.4%)	0.578
Secondary	196 (39.2%)	191 (38.2%)	0.638
Higher	202 (40.4%)	197 (39.4%)	1.000
Profession			
Manual Labor	212 (42.4%)	219 (43.8%)	0.576
Office Work	288 (57.6%)	281 (56.2%)	0.576
Socioeconomic Status			
Low	134 (26.8%)	158 (31.6%)	0.548
Middle	252 (50.4%)	243 (48.6%)	0.648
High	114 (22.8%)	99 (19.8%)	1.000
Disease Duration (years)	8.2 ± 4.5	8.0 ± 4.8	0.610
Medications			
Anti-hypertensives	289 (57.8%)	303 (60.6%)	0.593
Anti-platelets	211 (42.2%)	197 (39.4%)	0.638

Table 3: Incidence of Stroke by Resting Heart Rate Group

Group	Number of Participants (n)	Stroke Events (n)	Incidence Rate (%)
Group A (RHR < 70 bpm)	500	25	5.0%
Group B (RHR ≥ 70 bpm)	500	47	9.4%
Total	1000	72	7.2%

Table 4: Stroke-Free Survival Rate (Kaplan-Meier Analysis)

Time (Years)	Group A (RHR < 70 bpm) (n=500)	Group B (RHR ≥ 70 bpm) (n=500)	p-value (Log-rank test)
1 Years	99.0%	98.5%	0.01
2 Years	98.0%	97.0%	
3 Years	96.5%	94.5%	
4 Years	95.0%	92.0%	
5 Years	93.0%	90.0%	

Table 5: Cox Proportional Hazards Regression Analysis for Stroke Risk

Variable	Hazard Ratio (HR)	95% Confidence Interval (CI)	p-value
RHR ≥ 70 bpm vs. < 70 bpm	1.8	1.1-2.9	0.03
Age	1.02	1.01-1.04	0.01
BMI	1.01	0.98-1.05	0.32
Hypertension	1.5	1.0-2.3	0.05
Diabetes	1.4	0.9-2.1	0.12
Smoking	1.3	0.8-2.0	0.18
Physical Activity	0.9	0.6-1.4	0.60
Hyperlipidemia	1.2	0.8-1.8	0.30

Table 5: Sensitivity Analysis - Stratified by Age Group

Age Group (Years)	Group A (RHR < 70 bpm)	Group B (RHR ≥ 70 bpm)	Hazard Ratio (HR)	95% Confidence Interval (CI)	p-value
< 55 Years	10/250 (4.0%)	18/250 (7.2%)	1.9	1.1-3.4	0.02
≥ 55 Years	15/250 (6.0%)	29/250 (11.6%)	1.8	1.0-3.1	0.04

Discussion

The research aimed to determine the relationship between resting heart rate (RHR) and stroke risk among 1000 adult males who were classified into two groups: Group A (RHR < 70 bpm) and Group B (RHR ≥ 70 bpm). Our investigation suggests that a high resting heart rate in men is linked with increased risk of stroke, which corresponds with other studies. Jensen et al.'s comprehensive study conducted in 2012 demonstrated that each upsurge of ten beats per minute in RHR had an associated 16% increased likelihood of getting a stroke, regardless of whether male or female [9]. In another study by Zhang et al., those with above 80 beats per minute had approximately one and half times higher chances of having a stroke compared to those below sixty [10]. Only men were studied while various RHR cut-off points were

used. However, the hazard ratio observed for men patients with RHR >70bpm at 1.8 was much similar to what has been reported by many researchers as being indicative of higher risks involved.

The prevalence of hypertension that has been identified in our study is also consistent with other previous studies. Hypertension rates of 24% to 26% were noted in the Atherosclerosis Risk in Communities (ARIC) study in comparable groups, which is close to 23.6% and 24.4% found in our groups [11]. Our smoking prevalence (34.8% and 36.6%) is slightly higher than the national average of 27.7% obtained from the NHIS, which could be due to regional differences or population characteristics [12].

Furthermore, among men, the five-year incidence rate for stroke was seen to be at 5.0% for subjects whose rest heart rate is less than seventy while it stood at 9.4% for individuals whose rest HR exceeded or equaled seventy during this time frame. These figures are almost similar to findings from Kannel et al.'s research [13]. Over a comparable period, this survey disclosed that persons with greater RHR experienced nine percent occurrence of cerebrovascular accident. Such internal consistency across different populations and study designs enhances the trustworthiness of the link between increasing resting heart rate (RHR) and stroke burden.

Accordingly, Cox regression analysis showed that individuals with a resting heart rate (RHR) above or equal to seventy have higher chances of suffering from strokes. The hazard ratio was found to be equal to 1.8 with a 95% confidence interval (CI) of 1.1-2.9 and a p-value of 0.03. Moreover, it supports the previous studies that found an increased RHR to be independent stroke and cardiovascular events predictor [14]. Age was one risk factor that was significant in this study as well, hazard ratio=1.02 (95% CI: 1.01-1.04), p=0.01. It is well documented that the older people get, the higher their chances of having a stroke become known as age is an established risk factor for stroke which increases its probability due to heart disease or other causes in general). Other factors such as BMI, diabetes mellitus type II, cigarette smoking habits, level of exercise and hyperlipidemia were not significantly associated implying that resting heart rate (RHR) is more accurate determinant for stroke danger within this particular segment of population.

Sensitivity analysis which was broken into two age groups (<55 years and ≥55 years) showed that those who had a high resting heart rate (RHR) were about twice as likely to have a stroke compared to those with low RHR. The increased risks were statistically significant both in the younger (hazard ratio [HR]: 1.9, 95% confidence interval [CI]: 1.1-3.4, p=0.02) and older patients (HR: 1.8, 95% CI: 1.0-3.1, p=0.04). These results fit well with studies that indicate that a higher resting heart rate is a major risk factor for different age groups; [15].

Conclusion

This study confirms previous findings that elevated resting heart rate is an important stroke risk factor in men. These results highlight the importance of monitoring and managing resting heart rate (RHR) as part of comprehensive stroke prevention strategies. Future studies should focus on the underlying causes and possible interventions to mitigate this risk factor.

Conflict of Interest: NILL

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