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HEART RATE VARIABILITY (HRV) IN ANTERIOR AND INFERIOR WALL ST ELEVATION MYOCARDIAL INFARCTION

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Contribution

RU conceived, designed and did statistical analysis. SHC did data collection and manuscript writing. KA did review. All authors contributed equally.

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ABSTRACT

Objective: To measure and compare HRV between acute anterior wall ST elevation MI and inferior wall ST elevation MI.

Methodology: This cross sectional study was conducted at Department of Cardiology, Bahawal Victoria Hospital Bahawalpur, from 14th October 2016 to 13th April 2017. Patients were divided into 2 groups consisting of anterior wall myocardial infarction and inferior wall myocardial infarction having age 30-60 years after thrombolytic therapy. Heart rate variability was measured by pre-discharge 24 Holter monitoring using time domain method and Holter data was analyzed by MT 200 ECG V204 software. Quantitative variables like age, heart rate variability indices were presented as mean$\pm$1SD. T-test was used to compare means and Chi Square test is applied to compare the frequencies. P $\leq$ 0.05 was considered as significant.

Results: A total of 100 patients were included in the study with 50 in anterior wall MI group and 50 in inferior wall MI group. The mean age in this study was 48.21 $\pm$ 8.93 years. Males were predominant than females with 87% and 13% respectively. The mean SDNN, SDANN and SDNN index were 79.38$\pm$24.57ms, 53.67$\pm$16.03 ms and 50.19$\pm$22.18 ms respectively. No significant difference found regarding risk factor, and HRV indices (SDNN, SDANN and SDNN index) except in smoking in gender. When comparison was made within anterior wall myocardial infarction and inferior wall myocardial infarction and two ages groups then again neither in risk factors nor in HRV indices showed significant difference.

Conclusion: No significant difference was found in heart variability indices among the patients of anterior wall MI versus inferior wall MI.

Key Words: Anterior wall myocardial infarction, Inferior wall myocardial infarction, Heart rate variability.

INTRODUCTION

ST-segment elevation myocardial infarction (STEMI) is common presentation of acute coronary syndrome and it is one of the leading cause of mortality and morbidity globally. Hospital mortality of ST-segment elevation myocardial infarction is still 5-6%.[1,2] Mortality of STEMI is due to heart failure and malignant arrhythmias which is 19% and 36% respectively.[3] After acute myocardial infarction (AMI), cardiac autonomic dysfunction is the possible explanation for malignant arrhythmias and sudden cardiac death. Because after AMI, sympathetic activity increased and parasympathetic decreased which increased the risk of ventricular tachycardia and fibrillation.[4,5] The autonomic disturbance is varying according to localization of AMI. Altered cardiac autonomic dysfunction is widely measured by Heart rate variability (HRV) analysis. Low HRV indicates increased sympathetic tone and decreased parasympathetic tone.[4] Heart rate variability (HRV) is the physiological phenomenon of variation in the beat to beat interval. Although heart rate variability in early phase of MI is one of the risk-stratifying parameter.[3,6,7] Most commonly used indices are SDNN (standard deviation of all NN intervals-normal mean 141± 39 msec.), SDANN (standard deviation of the averages of NN intervals in all 5 min segments of the entire recording-normal mean 127 ± 35msec) and SDNN index (mean of the standard deviations of all NN interval for all 5 min segments of the entire recording-normal mean 74.40 ± 29.04 msec).[8] These indices are used to measure the autonomic modulation after AMI. It has been observed that vagal tone increased in acute inferior wall MI and sympathetic tone increased in acute anterior wall MI. But there is scanty data for quantitative measurement and comparison of cardiac autonomic changes occurred between acute inferior wall MI and acute anterior wall MI.[9] So, this study was planed to measure and compare HRV between acute anterior wall MI and inferior wall MI with 24 hour Holter monitoring. This study was undertaken to measure and compare HRV between acute anterior wall ST elevation MI and inferior wall ST elevation MI..

METHODOLOGY

It is a cross sectional study which was carried out in Department of Cardiology, Bahawal Victoria Hospital, Bahawalpur, Pakistan during October 2016 to April 2017.Non-probability consecutive sampling technique were used. After taking permission from ethical review committee. Patients (anterior wall MI and inferior wall MI) were selected from CCU BVH Bahawalpur fulfilling the inclusion and exclusion criteria, after informed written consent. All patients of anterior and inferior wall ST elevation myocardial infarction only who got thrombolytic therapy with age range 30-60 of both gender were included. Those patients who were not willing, autonomic neuropathy, thyrotoxicosis, hypothyroidism, diabetes mellitus, renal failure, previous history of MI, late presentation (after 24 hrs), cardiogenic shock, or known case of valvular heart disease, ventricular arrhythmia or atrial fibrillation, second or third degree AV nodal block, frequent PVCs (10/min), bigeminy or trigeminy and cerebrovascular accident were excluded. Those who required cardiopulmonary resuscitation during Holter monitoring or problem in computer processing (difficult analysis due to signal artifact, sinus beat <80, frequent premature beats >15%, recording <20 hrs, long or frequent episodes of atrial tachyarrhythmia or unsuccessful signal collection) were also excluded from the study. Heart rate variability was measured at pre-discharge with 24 Holter monitoring system (Schiller MT 200, 3 channel recording device, utilizing 5 chest electrodes). Holter data was analyzed by MT 200 ECG V204 software and time domain method of HRV used. Heart rate variability was compared between anterior wall and inferior wall MI.

SPSS version 20.0 were used for data analysis. The qualitative variable like gender, type of MI (acute anterior or inferior wall MI), hypertension and smoking were presented as frequency and percentage. Quantitative variables like age, heart rate variability as measured by SDNN, SDANN, SDANN index were presented as mean ± 1SD. Two tailed T-test was used to compare means and Chi Square test is applied to compare the frequencies. P≤0.05 was considered as significant.

RESULTS

In this study age range was from 30 to 60 years with mean age of 48.21 ± 8.93 years. Male were predominant then female with 87% and 13% respectively. The mean SDNN, SDANN and SDNN index were 79.38±24.57ms, 53.67±16.03ms and 50.19±22.18ms respectively. The demographic data of the patients and gender difference is shown in table-1. No significant difference found regarding risk factor, and HRV variables (SDNN, SDANN and SDNN index) except in smoking in gender. When actual study comparison was made within anterior wall myocardial infarction and inferior wall myocardial infarction groups than again neither in risk factors nor in HRV variables showed significantdifference between two groups (Table-2). Similarly then comparison were made among the age groups(age ≤45 years and age >45years), strangely no significant difference found either in risk factors or in HRV variables between two groups (Table 3).

Table 1: Demographic Variables with Gender Difference (n=100)

	Male (n=87)	Female (n=13)	Total (n=100)	P value
Age (mean±SD)	47.83±9.15	50.77±7.03	48.21±8.93	0.3
HTN n (%)	31(79.5)	8(20.5)	39(39)	0.13
Smoker n (%)	64(94.4)	4(5.9)	68(68)	0.004
Anterior MI n (%)	44 (88)	6(12)	50(50)	1.0
Inferior MI n (%)	43 (86)	7 (14)	50 (50)	1.0
Age =45 years	38(90.5)	4(9.5)	42(42)	0.6
Age >45 years	49(84.5)	9(15.5)	58(58)	0.6
SDNN ms mean±1SD	78.72±23.67	83.77±30.72	79.38±24.57	0.5
SDANN ms mean±1SD	53.84±15.68	52.54±18.87	53.67±16.03	0.8
SDNN Index ms mean±1SD	49.43±21	55.3129.48	50.19±22.18	0.4

Table 2: Demographic Variables with Difference of Myocardial Infarction (n=100)

	Anterior MI (n=50)	Inferior MI (n=50)	Total (n=100)	P value
Age years mean±1SD	48.48(8.7)	47.94(9.19)	48.21±8.93	0.76
Male n (%)	44 (50.6)	43(49.4)	87(87)	1.0
Female n (%)	6(46.2)	7 (53.8)	13 (13)	1.0
HTN n (%)	16(32)	23(46)	39(39)	0.22
Smoker n (%)	30(60)	28(56)	68(68)	0.8
Age =45 years	20(40)	22(44)	42(42)	0.84
Age >45 years	30(60)	28(56)	58(58)	0.84
SDNN ms mean±1SD	76.42±24.24	82.34±24.8	79.38±24.57	0.23
SDANN ms mean±1SD	53.18±17.44	54.16±14.6	53.67±16.03	0.76
SDNN Index ms mean±1SD	45.88±19.5	54.50±24.01	50.19±22.18	0.06

Table 3: Demographic Variables with Difference of Age Group (n=100)

	Age =45years (n=42)	Age >45years (n=58)	Total n=100	P value
Male n (%)	38(43.7)	49(56.3)	87(87)	0.55
Female n (%)	4(30.8)	9(69.2)	13 (13)	0.55
HTN n (%)	15(38.5)	24(61.5)	39(39)	0.67
Smoker n (%)	31(45.6)	37(54.4)	68(68)	0.4
Anterior MI n (%)	20(40)	30(60)	50(50)	0.84
Inferior MI n (%)	22(44)	28(56)	50 (50)	0.84
SDNN ms mean±1SD	77.02±21.91	81.09±26.4	79.38±24.57	0.4
SDANN ms mean±1SD	52.45±17.1	54.55±15.3	53.67±16.03	0.5
SDNN Index ms mean±1SD	39.55±5.23	54.48±4.84	50.19±22.18	0.4

DISCUSSION

Heart rate variability is used to assess the balance between vagal and sympathetic activity or autonomic disturbances in the heart rate which leads to to cardiac arrhythmia and sudden death.[10-12] In 1965 Hon and Lee first time noticed that fetal distress is associated with change in heart beat intervals.[13] HRV is accepted as clinical test when it was confirmed that it is one of the strong and independent risk factor for cardiac arrhythmias and sudden death especially after acute myocardial infarction.[14] Sympathetic surge after acute myocardial infarction is strong predictor of malignant arrhythmias and sudden death while parasympathetic activity has protective effect. Low heart rate variability shows sympathetic over activity which is one the powerful and independent risk for malignant arrhythmias and sudden death after acute myocardial infarction. When low HRV combine with depressed LV function (ejection fraction), then prognosis even more worse.

Different studies have been performed to measure heart rate variability for risk stratification after acute myocardial infarction, some within 48 hours of acute myocardial infarction and some at the time of discharge i.e. day 5-8 but no significant difference was found even when compared in early phase of HRV and at the time of discharge. So HRV measured in different types of myocardial infarction like acute anterior wall ST elevation MI, acute inferior wall ST elevation MI, acute lateral wall ST elevation MI and non-ST ST elevation MI etc but there is no comparison available between different MI. After acute MI early death and complication is depends on age, Diabetes mellitus and infarct size and these deaths mainly due to ventricular fibrillation and ventricular tachycardia. Although in acute

coronary syndrome parasympathetic activity decreased while sympathetic activity increased. This autonomic change after acute coronary syndrome leads to myocardial electrical instability and lead to ventricular fibrillation and ventricular tachycardia. But exact mechanism of autonomic change is unknown.

As a rule HRV should reduce after acute myocardial infarction and greater the infarct size, greater myocardial vulnerability and electrical instability and more reduced HRV. More sympathetic excitation weakens or inhibits vagus influence on the sinus node, which reduces heart rate oscillations and HRV. As in inferior wall MI the infarct size is very small and HRV should not be reduced as much as in anterior wall MI. But this study failed to show any significant difference of HRV between anterior wall and inferior wall MI. Although HRV slightly raised in inferior wall MI but statistically non-significant between two MI. Mean heart rate variability of SDNN in anterior wall vs inferior wall MI are 76.42±24.24ms vs 82.34 ±24.8ms (p>0.23), SDANN 53.18±17.44ms vs 54.16± 14.64ms (p>0.76), SDNN index 45.88±19.47ms vs 54.50±24.016ms (p>0.06) milliseconds respectively. S Vaishna et al. conducted a study on different type of MI and mortality after MI in relation to HRV. He concluded that there was no significantly difference in HRV indices between two MI but in inferior wall MI HRV indices were slightly better than anterior wall MI but again statistically non-significant which exactly mimic our study. HRV indices were significantly reduced in non survivors patients.[21]

The women as compared to men have different symptomatology, pathology and outcomes in IHD. Because atypical presentation is more common in women than men Women has the worse prognosis than men after acute myocardial. The cardiovascular risk factors are also different in women than men. Morbidity and mortality is high in women with metabolic syndrome as compared to women without metabolic syndrome. HRV indices also affected by gender but controversial data is available. A large meta-analysis showed that HRV index is lower in female than male in healthy population. This study also compared the HRV index between genders, but no difference is found between the gender. Different studied showed decreased HRV indices with increasing age but this study is failed to show such difference when compared between two groups of age i.e. <45 and >45 years. This study overall did not find any difference in HRV indices when compared between inferior wall and anterior wall MI, two age groups and gender. There was also no effect modifier in this study.

More studies with lager sample size and long follow-up may able to find the risk of death among the different type of MI.

CONCLUSION

This study concluded that there is no difference among the heart rate variability indices in different type of MI, age group and gender.

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