

Autonomic Function Test In 72 Hours Post-Myocardial Infarction Patient

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Abstract: Background: Survival after a Myocardial Infarction (MI) is determined by both left ventricular ejection fraction and ventricular arrhythmias which is tightly linked to autonomic dysfunction. Non-invasive autonomic function assessment in post infarction patients can be used for critical risk stratification among the same. Materials and Methods: This pilot case control study was conducted at department of Physiology and Cardiology of SRH University after approval from the institutional ethical committee. 30 post MI patients (72 hrs.) cases from department of cardiology & equal numbers of clinically healthy controls of similar age and gender were recruited following inclusion & exclusion criteria after written informed consent. Both the groups were interviewed for demographic, clinical, medical history, measured for anthropometry & investigatory parameters of Blood sugar & Serum creatinine. Later they were subjected to measurement of heart rate variability by polygraph using standard recording procedure. Data recorded was subjected descriptive and comparative analysis with $p < 0.05$ as significant. Results: Significant sympatho-vagal imbalance ($p = 0.009$) & decreased Parasympathetic system activity (HF) ($p = 0.02$) was observed in Post MI cases as compared to controls. Conclusion: Reduced anti fibrillatory effect (Decreased parasympathetic activity) persisted past 72hrs of stable MI in adults (age < 65 yrs) and may be a risk factor for sudden cardiac death in such patients. [Mittal M Natl J Integr Res Med, 2020; 11(2):03-07]

Key Words: autonomic function, Myocardial infarction

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Introduction: Cardiovascular disease (CVD) contributes to 30% of global mortality and 10% of global disease burden^{1,2}. Among all CVDs Myocardial ischemia (MI) has one of the highest rate of fatality especially due to ventricular fibrillation during post MI period and has an incidence of 64.37 per 1000 people in India³. Myocardial ischemia is defined by myocardial cell necrosis due to significant and sustained ischemia with the clinical presentation varying from a minor coronary event to life-threatening clinical situations & sudden death⁴.

Although standard risk factors such as smoking, abnormal lipids, hypertension, diabetes, high waist-hip ratio, sedentary lifestyle, psychosocial stress, and a lack of consumption of fruit and vegetables explained more than 90% of acute CHD events in South Asians⁵ the hemodynamic and autonomic function data also provide important synergistic information.

Long standing views maintain that survival after a MI was exclusively determined by left ventricular ejection fraction and by presence of ventricular arrhythmias⁶. The above provides clear evidence that autonomic markers may also carry a prognostic value.

A tight relationship between autonomic imbalance and life threatening arrhythmias has been shown by a wealth of experimental^{7,8} and clinical studies^{9,10} but have also underscored the

involvement of both arms of autonomic system post MI. Moreover precise time-course of sympathetic / vagal alterations and their contribution to arrhythmogenesis remains incompletely understood¹¹. ATRAMI (Autonomic Tone and Reflexes After Myocardial Infarction) studies^{9,12} has evidenced the use of heart rate variability as an important tool for discriminating moderate & high risk MI patients with depressed left ventricular ejection fraction in less than 65 years age group & underlined that scattered & varied autonomic balance in patients of post MI might be the effect of environment and genetic factors¹².

There is paucity of evidence of heart rate variability in post infarction patients in this region. It may be likely that autonomic dysfunction be used for risk stratification among high proportion of sudden arrhythmic deaths occurring in post MI patients. Hence this study was proposed with the aims to observe the autonomic function changes in post MI patients with documented evidence of acute myocardial infarction attending the tertiary care centre in the hilly state of Uttarakhand.

Material and Methods: Objectives: To compare the autonomic function parameters between post myocardial infarction patients with healthy comparative control. To study autonomic imbalance as a risk factor for post myocardial infarction patients.

Methodology: The study was conducted at department of Physiology and Cardiology of SRH University during a period of 3 months. After approval from the institutional ethical committee for conducting the study and after written informed consent the volunteers were recruited.

Study Design: This case control study was done to study the changes in autonomic function tests in post-MI patients.

Sample Size: Considering the short duration of study period and limitation of logistics this pilot study was done on 30 post myocardial infarction patients of less than 65 years admitted at ICU and equal number of clinically healthy controls of similar age (+/-1 year) and gender after a written informed consent.

Selection Of Subject: Cases were recruited from IPD of department of cardiology at Himalayan Hospital by convenient sampling till the sample size was reached.

Following inclusion and exclusion criteria was used for recruitment. Inclusion criteria for cases: Post-MI(after 72 hour) patients of less than 65 years. Inclusion criteria for Controls: Clinically healthy volunteers as evaluated by physician of less than 65 years.

Common Exclusion criteria for both groups : LVEF <40 %, Frequent arrhythmias and extra systoles, Obstructive pulmonary disease, Unstable angina, Secondary hypertension, Chronic kidney disease, Current use of anti-diabetic medications or insulin, Current use of β blocker therapy, ACE inhibitors, statins.

Study Tools: Wall mounted tape, Weighing machine, Omron HBF-375 for BMI and for %body fat, Computerized polygraph i.e. Physiopac PP-8-Medicaid systems to measure Heart Rate Variability.

Study Protocol: After written informed consent the recruited volunteers were interviewed and later investigated at department of Physiology and Cardiology of SRHU University. Cases of post-MI (72 hours) patient were interviewed for demographic & clinical, medical history and measured for anthropometry at the ICU. The investigatory parameters of Blood sugar & Serum creatinine were recorded from the reports of the patients. Following interview they were

subjected to 5 minutes of ECG recording following standard protocol for calculating heart rate variability by polygraph using standard recording procedure.

HRV Analysis Procedure: Experimental procedure of HRV for assessment of will be done on Physiopac a 8 channels machine capable of recording signals of different physiological parameters simultaneously with a sampling rate of 1000 samples/sec; central frequency bands of spectral components (LF & HF); Low frequency: Minimum: 0.04 Hz, Maximum: 15 Hz; High frequency: Minimum: 0.15 Hz, Maximum: 0.40 Hz; points in frequency domain: 1024. Volunteers were asked to avoid caffeine and any kind of physical exercise in the last 24 hours.

Recording was done at an ambient temperature of 25°C, following a rest of 15 minutes. ECG recording was recorded for full 5 minutes for HRV analysis using the frequency domain of analysis. Fast Fourier transformation (FFT) was derived from the recordings of the above mentioned machine as under. Low frequency (LF) power (nu) for sympathetic activity, High frequency (HF) power for vagal activity (nu), LF/HF Ratio as sympatho-vagal imbalance. Control group of volunteers were also subjected to above procedure for collection of data and ECG recording at the dept of Physiology.

Statistical Analysis: The recorded data was analysed using SPSS Software version 20. Continuous variables like age, weight height, BMI LF, HF and LF/HF ratio are presented as mean and SD and categorical data like gender presented as proportions. Following tests for normality the two groups of cases and controls were compared for the observed variables using "t" test for significant difference in mean value. Odd risk for the autonomic dysfunction in MI cases was analysed and reported. Probability of less than 0.05 was set as significant.

Results: The study compares the demographic, anthropometric and heart rate variability parameters among 30 post MI cases with equal number of age and gender matched controls. The study observed that there was no significant difference of weight, height, BMI and % body fat between the two groups, hence the groups were identical with all other risk factors for MI except for the inclusion criteria. (Table 1)

Table 1. Demographic And Anthropometric Profile Of Post MI Case And Control

Variables	Cases (N=30)	Controls (N=30)	P Value
Age (Yrs)	55.6±6.7	54.17±6.9	0.42
Height(Cm)	166.7±11.2	164.7±7.1	0.42
Weight (Kg)	66.39±12.1	65.94±11.6	0.26
BMI (Kg/M2)	25.1±4.5	24.32±3.6	0.44
% Body Fat	28.52±7.4	27.03±5.9	0.39

Values in Mean±SD

Table 2. Comparison Of Heart Rate Variability Parameters & Investigatory Profile Of Post MI Case And Control

Variables	Cases (n=30)	Controls (n=30)	P value
Investigatory Profile			
RBS(mg/dl)	143.5±47.1	133.07±58.5	0.44
Creatinine(mg/dl)	1.04±0.4	0.94±0.32	0.29
Heart Rate Variability			
LF (nu)	74.75±27.7	69.29±13.2	0.33
HF (nu)	22.60±13.8	30.70±13.2	0.02*
LF/HF Ratio	4.49±2.7	2.89±1.78	0.009**

Values in Mean±SD; * p value less than 0.05; ** p value <0.01. Table 2 The investigatory profile and heart rate variability parameters when compared between the post MI cases and controls observed statistically significant decrease in the parasympathetic activity (HF) in post MI cases as compared to controls. Sympatho-vagal imbalance was significantly higher in post MI patients after 72 hrs as compared to the healthy controls. (Fig 1,2)

Fig 1. Bar Chart showing Mean values of HF (nu) among Controls and Post MI Cases

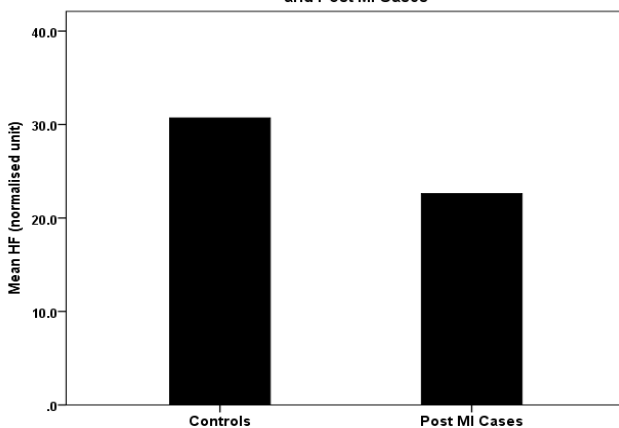
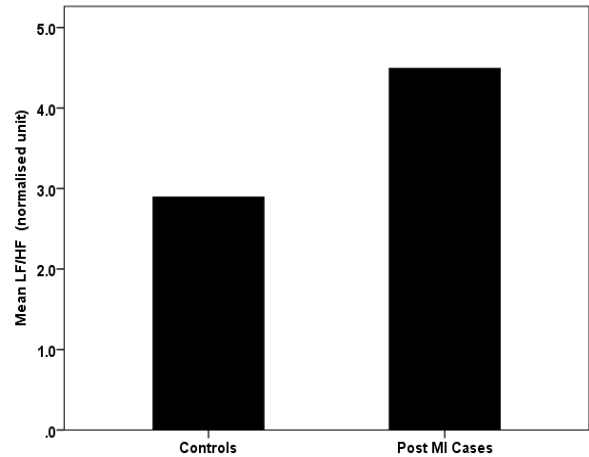


Fig 2. Bar Chart showing Mean values of LF/HF Ratio among Controls and Post MI Cases



Discussion: Our study observed the autonomic activity in post MI patients and its association with the change in heart rate variability. The high frequency component corresponds to cardiac parasympathetic activity, while the low frequency component reflects both parasympathetic and sympathetic component¹³.

We observed a significant decrease in parasympathetic activity and a significant increase in sympatho-vagal activity even after 72 hrs of the MI. Recent experimental studies have supported the hypothesis that sympathetic activation following ischemia of heart is delayed and that attenuated parasympathetic contribute to the early phase in the ventricular arrhythmia following acute MI^{14,15}. Since parasympathetic prolongs the action potential duration and effective refractory period¹⁶. Hence vagal activation has a anti-fibrillatory effect on ischemic myocardium¹⁴. With the studies in vivo experiments draws attention to the vagal withdrawal which occurs swiftly in response to ischemia the associated profibrillatory effects in ischemic myocardium may be involved in the pathophysiology of sudden cardiac death in these patients following recovery.

Similar feature of sympatho-vagal imbalance was observed by A.Gunther et al in their study on patients of MI¹⁷. Our results are also similar to study by P Lokaj et al which observed autonomic dysfunction as a result of decreased parasympathetic activity and/or increase in sympathetic activity¹⁸. Results of our study is also strengthened by the study in which normalised values of high frequency components are decreased and low frequency components are increased, indicating a sympathovagal imbalance

with a sympathetic predominance^{19,20}. Our results are also similar to study by Casolo GC et al which observed changes in HR variability during AMI because of decreased parasympathetic and/or increased sympathetic outflow to the heart²¹. However there was dissimilarity with the work of Webb et al who showed that there is an increase in parasympathetic or sympathetic activity²².

In MI, there occurs damage of chemoreceptor and mechanoreceptor in affected area due to local release of chemicals which causes the decrease in parasympathetic activity and increase in sympathetic activity²³. These observations of autonomic changes may be related to the development of ventricular fibrillation in later course and are relevant to sudden death in post myocardial infarction.

Conclusion: The study concluded that significant decrease in anti fibrillatory effect as observed by decreased parasympathetic system occurs in 72 hrs post MI patients in adults with age < 65 yrs with sympathovagal imbalance persisting even after 72hrs. Being a pilot study, small sample size was the limitation of the study and needs to be conducted on a larger sample of cases. But results of the study may open new dimensions in strategies for primary prevention of sudden cardiac death in post MI patients.

Acknowledgment: The authors acknowledge the SRH University for providing the logistics and financial aid for conducting of study. Authors also acknowledge the department of cardiology, HIMS, for helping to recruit the subjects for the study.

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Conflict of interest: None

Funding: None

Cite this Article as: Mittal M, Saxena Y. Autonomic Function Test In 72 Hours Post-Myocardial Infarction Patient. <i>Natl J Integr Res Med</i> 2020; Vol.11(2): 03-07
