

ORIGINAL ARTICLE

EFFECT OF AGE AND GENDER ON ARRHYTHMIAS IN PATIENTS WITH CHRONIC HEART FAILURE

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Background: Heart failure is a complex clinical syndrome. Modern therapeutics have led to an increase in prevalence and incidence of heart failure among the aging population. The prognosis of heart failure in women has generally been better than in men. The main cause of death in heart failure is supposed to be the sudden arrhythmic death. Arrhythmia frequency varies in both sexes. Different hormonal and electrophysiological differences exist between genders that contribute to arrhythmogenesis. **Objective:** To determine the effect of age and gender on arrhythmias in patients with chronic heart failure. **Methods:** This descriptive cross sectional study was conducted at Armed Forces Institute of Cardiology/National Institute of Heart Diseases, from April to August 2013. It involved 48-hour holter monitoring of 53 heart failure patients using holter electrocardiography recorder. Digital ECG data were analysed for type and frequency of arrhythmias. Effect of age and gender on arrhythmias was finally analysed using statistical software. **Results:** There was no significant association of advancing age with the rise in arrhythmia frequency. Effect of gender on arrhythmias analysis revealed that frequency of arrhythmias was significantly higher in females as compared to males (p -value < 0.05). **Conclusion:** Arrhythmia frequency was significantly low in men as compared to women, but the effect of age on arrhythmogenesis was not significant.

Keywords: Arrhythmias, heart rate variability, ambulatory ECG recording, holter monitor

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INTRODUCTION

Heart failure is considered a complex clinical syndrome characterized by impaired myocardial performance and progressive activation of neuro-endocrine system leading to circulatory insufficiency and congestion.¹ With advancement in therapeutics, the prevalence and incidence of heart failure is increasing among the aging population. There are an estimated 23 million people with heart failure worldwide.^{2,3} According to European society of cardiology guidelines 2012, approximately 1–2% of the adult population in developed countries have heart failure⁴, with the prevalence rate of $\geq 10\%$ among persons 70 years of age or older.⁵ One of the reasons for this is the improvement in treatment of hypertension and coronary heart diseases, allowing patients to survive an early death and to develop heart failure. Among the patients older than 65 years, at least 20 percent of hospital admissions are due to heart failure.⁶

Framingham study demonstrates that the incidence of heart failure approximately doubled with each decade of life. The mean age at the diagnosis of heart failure in 1960s was 63 years which increased to 80 years in the 1990s.⁷ Although the prevalence of heart failure is increasing due to aging of the population but the trend with regard to age-related incidence of heart failure is not very clear.

The prognosis of heart failure in women is better than in men. In different therapeutic trails it has been observed that women had lower risks of most fatal

and nonfatal outcomes.⁸⁻¹⁰ In a multivariable analysis, it was observed that female gender was associated with significantly longer survival.¹¹ The main causes of death in heart failure are either electrical instability or pump failure.¹²⁻¹⁴ Electrical instability leads to ventricular arrhythmias terminating into sudden cardiac death. Studies have shown that the potential for sudden cardiac death in heart failure was very high in both males and females. Almost 30 to 50 percent of all cardiac deaths in patients with heart failure are categorized as sudden deaths, with or without preceding symptoms.^{12,13,15} Different clinical studies (AIRE trial, MADIT II trial) suggested that in heart failure patients unwitnessed deaths within one hour of symptoms are mostly due to terminal arrhythmias.¹⁶⁻¹⁸ Ventricular tachycardia degenerating into ventricular fibrillation is the most common cause of sudden death.¹⁴

In various studies it has been established that electrophysiological differences exist between genders that contribute to arrhythmogenesis. They may be due to different sex hormones or due to the intrinsic differences in cardiac cells between males and females. In females, estrogen affects potassium channel protein synthesis, which can prolong repolarization and can increase atrial refractory periods.¹⁹ In men it was seen that testosterone can also alter potassium currents leading to effect on QT interval.²⁰ Apart from hormonal differences, electrophysiologic substrates also differ between two genders. In animal studies, it was observed that

myocytes isolated from female rabbits showed reduced outward potassium current density and longer action potential duration.^{21,22}

This study is aimed to find out the effect of age and gender on the frequency of arrhythmias in heart failure patients in our population. Knowledge of such difference is important not only to study the manifestation and progression of heart failure but also for the optimal management in such cases.

MATERIAL AND METHODS

This descriptive, cross sectional study was conducted at Armed Forces Institute of Cardiology/National Institute of Heart Diseases, Rawalpindi (AFIC/NIHD) and Army Medical College, Rawalpindi from April to August 2013. Before commencement of the study, formal approval was obtained from Medical Ethics Committee of Army Medical College and Institutional Review Board of AFIC/NIHD. Written informed consent was also acquired from the patients under study.

Fifty-three patients with the diagnosis of chronic heart failure were recruited by convenience sampling. Patients from either sex, having age more than 15 years and with left ventricular ejection fraction equal to or less than 40% were included in the study. Patients who had acute myocardial infarction during the last six weeks were excluded from the study.

Patients fulfilling the inclusion criteria underwent ambulatory ECG recording for 48 hours using holter monitors. In this study, we used three different holter recorders, Life Card CF, DMS 300-4A and DMS 300-7A, available at AFIC/NIHD. After 48 hours of recording, the digital ECG data were transferred from holter recorder to the computer having compatible software. Out of three channels, the one which displayed best ECG recording and with least artefacts was selected. The digital ECG recording was manually edited with extreme care and all the erroneous beats were identified and removed from the data. After editing, the Holter ECG data were analyzed for cardiac arrhythmias using 'Life card CF Holter software (Pathfinder 700), and 'DMS serial Holter software premier 12' compatible with Life Card CF and DMS 300-4A/DMS 300-7A respectively. Different types of supraventricular and ventricular arrhythmias were analysed. Statistical analysis was done by using SPSS-21. Type and frequency of various arrhythmias and their association with age and gender was determined. Frequencies were analyzed using descriptive analysis and correlation was found using chi square test. The alpha value was set at <0.05 for significance.

RESULTS

Mean age of the patients was 57.68±16.41 years and male to female ratio was 3.4 to 1 (n=53). Frequency analysis of ventricular arrhythmias in males and females

shows that out of 42 male patients 30 (73%) had arrhythmias whereas 11 female patients out of 12 (91%) had arrhythmias. Table-1 depicts the significant statistical difference ($p<0.05$) in the frequency of arrhythmias between male and female patients using Chi-square test. The results showed that female patients in our study population of chronic heart failure were statistically more prone to have ventricular arrhythmias compared to males.

Twenty-six percent heart failure patients with arrhythmias (14 out of 53) were above 60 years of age. The frequency of patients having arrhythmias dropped again in age group 70 years and above. Although the results indicated the frequency of arrhythmias increased with advancing age, the relationship was somewhat nonlinear ($p>0.05$) (Table-2). This depicted that there was no effect of age on development of ventricular arrhythmias in patients with chronic heart failure.

Table-1: Comparison of male and female patients having ventricular arrhythmias

Gender	Total patients	Patients with arrhythmia	<i>p</i>
Male	41	30	0.003
Female	12	11	

Table-2: Frequency of ventricular arrhythmias in different age groups

Arrhythmia	Age groups (years)							<i>p</i>
	19-29	30-39	40-49	50-59	60-69	70-79	80-89	
Present	1	6	5	6	14	7	2	0.447
Absent	2	1	3	1	3	1	1	

DISCUSSION

Our study results show that 73% males and 91% females with heart failure had cardiac arrhythmias. This illustrates significantly high prevalence of ventricular arrhythmias in females in our population ($p=0.03$). Similar results were reported in a study conducted by Bongiorno *et al* in which prevalence of various ventricular arrhythmias were noticed to be higher in females as compared to males.²³ In another study conducted by Lampert *et al*, significant differences were observed between males and females in baseline clinical and laboratory characteristics in advance heart failure but no data on the difference in arrhythmia frequency was identified.²⁴ Clinical and experimental studies suggest that gender differences may be due to intrinsic sex differences in cardiac tissue in males and females or on the basis of facts that different sex hormones have different effect on the electrophysiology of myocardiocytes.^{25,26} These effects have been identified in epidemiological prevalence of some of the most common supra ventricular and ventricular arrhythmias.²⁷ We used convenience sampling in our study due to which female sample size was considerably small as compared to the males. However, 91% of females in our study had episodes of ventricular arrhythmias during 48

hours of holter monitoring. The results from our study are supported by previous studies suggesting that female sex is more prone to fatal arrhythmias in chronic heart failure.

Research shows that survival of patients with heart failure is significantly influenced by age, gender, race and the aetiology of the heart failure.²⁸⁻³⁰ Mortality rate in heart failure increases with age.²⁸ Elderly patients with heart failure are prone to develop arrhythmias both atrial and ventricular. Many of these arrhythmias are asymptomatic, but some can precipitate pump failure and can lead to sudden cardiac death (SCD).³¹ In different studies age adjusted incidence of heart failure was studied and mean age at diagnosis of heart failure in females was reported to be 80 years and in males 74 years from year 1950–2000.^{9,12} Results of a retrospective study on Medicare beneficiaries showed decline in the beneficiaries of age 80–84 and increase in the age group 65–69 years indicating decrease in incidence of heart failure above 69 years age.³² In comparison with above studies, most of the patients in our study group having advanced heart failure were elderly with age group above 60 years and were also having fatal ventricular arrhythmias. Although the frequency of arrhythmia increased with advancing age in our heart failure patients but the effect of age on arrhythmia was not statistically significant. Results of our study (i.e., 56% patients with arrhythmias and heart failure were >60 years old) also indicated increasing incidence of fatal complications with the advancement of age.

In different studies the relationship between heart failure mortality, age and gender were studied separately showing men have higher rate of hospital admissions across all age groups.^{28,33} In contrast, we aimed to study the effect of age on both, arrhythmia and heart failure. Our results suggested that with advancing age the frequency of heart failure and arrhythmia increases irrespective of gender. Although, the results showed significantly high frequency of arrhythmias in the female patients, however, it is suggested to conduct further studies with larger sample size. Such studies will help in early detection of heart failure and treatment of factors predisposing to arrhythmia. These measures could assist in reduction of mortality rate due to heart failure and its complications.

CONCLUSION

The frequency of heart failure increased with age but there was no significant association of advancing age with the rise in frequency of arrhythmias. Arrhythmia frequency was higher in females as compared to males and the difference was statistically significant.

LIMITATIONS OF STUDY

The study was conducted in a short duration of time using convenience sampling. Therefore, small sample size was relatively small and male to female ratio was not equal.

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