ORIGINAL ARTICLE

ASSOCIATION OF AGE AND GENDER WITH VENTRICULAR LATE POTENTIALS IN PATIENTS WITH MITRAL VALVE PROLAPSE

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Background: Ventricular late potentials are extremely low amplitude and high frequency cardiac signals which are not detected by standard 12-lead ECG. These potentials have been established as non-invasive markers of ventricular arrhythmias. These parameters may be associated with the genesis of ventricular late potentials. This study was planned to investigate this relationship in patients with mitral valve prolapse. **Methods:** Thirty-seven patients with mitral valve prolapse were recruited through convenience purposive sampling. Patients of both the gender and any age were included in the study whereas those with acute or old myocardial infarction, diabetes mellitus and hypertension were excluded. Ventricular late potentials were determined using SAECG recording machine according to the standard criteria. **Results:** There were 23 men and 14 women aged 26.27±6.18 years. Nine (6 men and 3 women) patients had ventricular late potentials and the remaining (17 men and 11 women) were without these potentials. There was no association of age and gender with ventricular late potentials (p>0.05). **Conclusion:** Age and gender are not associated with ventricular late potentials in patients with mitral valve prolapse.

Keywords: Ventricular late potentials, signal averaged ECG, mitral valve prolapse, valvular disease,

Pak J Physiol 2014;10(3-4):3–5

INTRODUCTION

The 12 lead standard ECG cannot detect certain high frequency, low voltage signals hidden in the terminal part of QRS complex. Standard ECG can detect a signal which has a voltage of the order of few millivolts and frequency below about 100 Hz.[1] The voltage of ventricular late potentials ranges from 1 to 20 μV making them extremely small cardiac signals. Therefore detection of ventricular late potentials requires a high resolution ECG technique that should augment the signal of interest and diminish unwanted electrical noise. This technique which can detect ventricular late potentials is called signal averaged ECG.[2]

Ventricular Late Potentials had been the pivotal point of cardiac Electrophysiologic research for the last twenty five years and they have been investigated extensively. Pathophysiology of ventricular late potentials is diverse and can be attributed to anatomical as well as physiological factors. They appear in the areas where cardiac tissue architecture is modified due to necrosis, fibrosis or dystrophy causing delayed and fragmented depolarization.[3] Slowing of cardiac impulse is the basis that leads to appearance of ventricular late potentials degenerating into more serious ventricular arrhythmias. Ventricular late potentials act as non-invasive markers for the development of ventricular tachyarrhythmias.[4]

Mitral valve prolapse is a disorder that leads to some mechano-electrical alterations in the heart. A certain subset of patients with mitral valve prolapse remains at high risk of sudden arrhythmic death.[5] The disorder is more frequent in females as compared to males.[6] There is substantial evidence that males and females differ regarding their cardiac electro-physiology.[7] This is assumed to be due to the intrinsic differences of the cardiac cells like differential properties of ion channels or due to different sex hormones. Testosterone, in males alters QT interval by affecting electrolytes and ion channels. Similarly, Oestrogen can enhance refractory period by affecting potassium channels.[8] The different structural and functional properties between the two genders may affect the genesis of ventricular late potentials. With increasing age, heart rate rises due to imbalance of autonomic nervous system in favour of sympathetic dominance. At the same time there are other local and systemic effects of aging on heart. It is assumed that due to its effects on heart and autonomic nervous system, aging may affect ventricular late potentials.

Current study was planned to determine the association of age and gender with ventricular late potentials in patients with mitral valve prolapse.

SUBJECTS AND METHODS

It was a cross sectional study, conducted at Army Medical College, Rawalpindi in collaboration with National Institute of Heart Diseases Rawalpindi after getting institutional approval. Written informed consents were obtained from all the patients. Patients of both the gender and any age with mitral valve prolapse were included in the study. Mitral valve prolapse was diagnosed on 2 dimensional echocardiography as per the standard diagnostic criteria.[9] Patients with acute or

old myocardial infarction, diabetes mellitus and hypertension were excluded.

Thirty-seven patients were recruited in the study through non-probability purposive sampling. Signal Averaged Electrocardiogram was recorded using SAECG recording machine '1200 EPX High Resolution Electrocardiograph'. Three bipolar leads X, Y and Z were used to record Signal Averaged ECG according to the standard protocol. The recording continued till the noise was reduced below 0.3 μV which normally took from 15 to 20 minutes. Ventricular late potentials were considered to be present when at least two out of the following three criteria were fulfilled.[10]

1. Duration of total filtered QRS complex >114 ms
2. Low amplitude signal under 40 μv (LAS 40) >38 ms
3. Root mean square voltage of last 40 ms of fQRS (RMS 40) <20 μV.

Statistical analysis was done using SPSS-22. Descriptive statistics were used to describe the results. Fisher's Exact Test was used to find association between gender and ventricular late potentials whereas Pearson correlation coefficient was used to determine correlation between age and the SAECG parameters. Alpha value was set at <0.05 for significance.

RESULTS

There were 23 men and 14 women aged 26.27±6.18 years. Nine patients had ventricular late potentials and the remaining 28 were without these potentials. Out of 9 with ventricular late potentials, 6 were male and 3 were female whereas 17 males and 11 females had no ventricular late potentials. There was no association between gender and ventricular late potentials as shown on Fisher's Exact Test (p=0.54) (Table-1).

Correlation of age with the three parameters of SAECG was determined using Pearson correlation coefficient. None of the correlation was significant (p>0.05) (Table-2).

Table-1: Association of gender with ventricular late potentials

	Ventricular late potentials		*p*
Gender	**Present**	**Absent**	
Male	6	17	0.54
Female	3	11	

Table-2: Correlation of age with SAECG parameters

SAECG parameters	*r*	*p*
Duration of Filtered QRS complex (ms)	-0.13	0.43
Duration of Low amplitude signal under 40 μv (ms)	-0.09	0.56
Root Mean Square Voltage of signal in last 40ms of fQRS (μv)	-0.11	0.51

DISCUSSION

Results of our study show that ventricular late potentials are not associated with age and gender. Although studies show that both the factors affect cardiac electrophysiology directly or indirectly, however, they seem not to affect the mechanisms underlying the genesis of ventricular late potentials. Gender mainly affects functional parameters of cardiac electrophysiology whereas ventricular late potentials are primarily based upon structural alteration of the heart. Although functional parameters do play some role in generation of ventricular late potentials, these may not be much significant in patients with mitral valve prolapse as for as their effect on ventricular late potentials is concerned. The major factor that is altered by advancing age is autonomic nervous system which controls rate and rhythm of heart. Considering the results of our study, it seems logical to assume that autonomic nervous system is not the fundamental factor underlying the genesis of ventricular late potentials which is also supported by many studies.

No studies are available online whereby association of age and gender with ventricular late potentials have been investigated. However the effects of age and gender on cardiac electrophysiology have been extensively studied and the implied findings can be extrapolated onto the ventricular late potentials.[11–13] Interestingly, the implications are not straightforward but quite complicated. Tanaka[14] carried out a study on effects of age and gender on ventricular arrhythmias. They studied 315 male and 310 female patients of ventricular arrhythmias (n=625) with mean age of 54±17 years. They divided the patients into 5 groups based upon the origin of ventricular arrhythmias. They found that right ventricular out flow tract ventricular arrhythmias were 1.5 times more frequent in women compared to men. The prevalence of left ventricular out flow tract ventricular arrhythmias increased with age as compared to the right ventricular out flow tract arrhythmias. They reported that although gender and age affected ventricular arrhythmias but the effect was dependent upon the site of origin of the arrhythmias. Our study showed no effect of age and gender on ventricular late potentials which are the markers of ventricular arrhythmias. The paradox may be due to the multifaceted and complicated genesis of ventricular arrhythmias which makes association of age and gender with ventricular late potentials unpredictable.

Despite the fact that age and gender affect cardiac electrophysiology, our study did not find association of these parameters with ventricular late potentials. This provides an implicit clue about the pathophysiology of ventricular late potentials which seems to be complex and multifactorial. However, a study with larger sample size is recommended to verify the effects of age and gender on ventricular late potentials.

CONCLUSION

Age and gender are not associated with ventricular late potentials in patients with mitral valve prolapse.

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