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Prevalence of ECG abnormalities in healthy Zagazig University students

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Abstract

Background: Sudden cardiac death in the young adults is rare but it is tragic .It affects five per 100,000 yearly according to some studies. Nonstructural heart diseases that cause sudden cardiac death include long QT syndrome, short QT syndrome, Brugada syndrome , catecholaminergic polymorphic ventricular tachycardia ,idiopathic ventricular fibrillation (IVF) , AV node block , preexitation syndrome, and recently Early repolarization .Fortunately some these nonstructural heart diseases can detected by resting ECG.[1] [2]

Methods: In this study we collected a random sample of students from Zagazig University Student Hospital (during general examination during the application for the university) and university student accommodation in August and September 2017.Our sample collected was 2000 students ,800 met the inclusion criteria 474 were females and 326 were males ,the mean age was 18.42 ± 1.1.

Results: Males have significant more prevalence of early repolarization, LVH, RAD, LAD, wide QRS and sinus bradycardia than females. Female have significant more prevalence of short PR, low voltage and sinus tachycardia. Athletes have significant more prevalence of early repolarization, RAD, wide QRS, LVH, sinus bradycardia and long QT than non-athletes.

Conclusion: There is a variation in prevalence of ECG abnormalities between males and females, athletes and non-athletes like in early repolarization, LVH, RAD, LAD, wide QRS, sinus bradycardia, sinus tachycardia, long QT, short PR, WPW and low voltage.

Keywords: sudden cardiac death, early repolarization, LAD, wide QRS, short PR.

INTRODUCTION

Sudden cardiac death in the young adults is rare but it is tragic .It affect five per 100,000 yearl y according to some studies. Nonstructural heart diseases that cause sudden cardiac death include l ong QT syndrome, short QT syndrome, Brugada syndrome, catecholaminergic polymorphic ventric ular tachycardia, idiopathic ventricular fibrillation (IVF), AV node block, pre-excitation syndrome, a nd recently early repolarization. Fortunately some these nonstructural heart diseases can detected by resting ECG [1] [2].

There is a little data in Egypt about prevalence of SCD, the mean of ECG parameters and prev alence of ECG abnormalities in population. So in this paper we studied the prevalence of ECG abno rmalities in healthy Zagazig University students. This study provides data that can help in addition t

o old and coming studies to better management of sudden cardiac death especially in young age.

Aim of work:

To assess the prevalence of ECG abnormalities in healthy Zagazig University students.

Technical design: A cross sectional study carried out at Zagazig University Student Hospital and stude nt accommodation .Sample was collected in August and September 2017 at Zagazig University Student Hospital and student accommodation. 2000 healthy students of Zagazig University students, whom met the inclusion criteria were 800 .Our inclusion criteria is healthy student by general examination and me dical history between 17-25 years old. Exclusion criteria is student who have hypertension, diabet es mellitus, valvular heart disease, ischemic heart disease, renal impairment or o medications that caus e ST-T changes e.g. (Na channels blockers, beta blockers….etc.).

Methods: All patients were subjected to full history taking (especially syncope history and fami ly history of SCD), full general examination and resting ECG. Student was considered active (at hletic) if he participates in an amateur team, college team, local team or national team that requ ires regular competition against others, places a high premium on excellence and achievement, a nd requires regular physical training. Then a resting Electrocardiograph of the standard 12 leads in supine position after rest in a quiet room with a quiet respiration. ECG was done by electrocar diograph machine of Fukuda Denshi (Cardimax FX-7102) and was interpreted by three cardiol ogists from Zagazig University cardiology department. The criteria used for ECG abnormalitie s are shown in table (1).

Statistical analysis

Data collected throughout history, basic clinical examination, and standard ECG analysis was coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) **(**Statistical Package for the Social Sciences) software for analysis. Data were collected and submitted to statistical analysis. The following statistical tests and parameters were used. Mean was calculated by this equation **(**Mean = $\sum$**x** /n**)** where $\sum$x is the sum of the values and (n) is the number of subjects. Standard deviation (SD) was derived by this equation SD=$\sqrt{\Sigma(x - \bar{x})^2 / (n-1)}$, where $\Sigma(x-\bar{x})^2$ is the sum of the square of the differences of each observation. Chi square test was used to compare between two groups regarding the distribution of different variables by this equation $\chi = \sum[(O-E)^2$.

Where (O) is the observed value, and (E) is the expected value. Differences between quantitat ive independent groups by (t test) by the equation {t = ($\overline{X}$ 1 $*$ $\overline{X}$2)/(S_{x1x2} $*$ $\sqrt{2/n}$)}. (P value) was set at <0.05 for significant

Results

Our sample collected was 2000 students, 800 met the inclusion criteria 474 were females and 326 were males, the mean age was 18.42 ± **1.1**. Syncope history and physical activity is shown in (table 2), with syncope history more in female gender (4.3% in female, 1.2% in males) and more athletes in male gender (71% in males, 12.8% in females).

ECG abnormalities prevalence in total sample is shown in table 3. and comparison between males and female and comparison between athletes and not athletes are shown in (table 4) ,(table5) , (figure 1) and (figure 2).Males have significant more prevalence of early repolarization ,LVH ,RAD ,LAD ,wide QRS and sinus bradycardia than females. Female have significant more prevalence of short PR, low voltage and sinus tachycardia. Athletes have significant more prevalence of early repolarization, RAD, wide QRS, anterior fascicular block, posterior fascicular block, LVH, sinus bradycardia and long QT than non-athletes.

Discussion

ECG abnormalities prevalence in our sample was as following (1st degree HB 0.37%, early repolarization pattern 12.25%, sinus tachycardia 4%, sinus bradycardia 3.5%, atrial rhythm 0.6%, and WPW syndrome 0.5%).But in a study in Spain in 2018 showed (1st degree HB more than ours 0.73% ,lower Early repolarization pattern 2.46% ,lower sinus tachycardia 2.87% , more sinus bradycardia 5.39% ,lower atrial rhythm 0.21% ,lower WPW syndrome prevalence 0.5%)[3].

Early repolarization pattern was greater in our sample than a study done in Suez Canal University in Egypt 2018 on general population, (12.25 % vs. 6.7%). This difference may be due to our sample mean age was (18.42±1.1), but in this study the sample was random general population .Early repolarization pattern is known to be more prevalent in young age adults [4].

There is a difference in prevalence of ECG abnormalities between male and females .The current study included 474 females and 326 males, and showed that WPW syndrome more prevalent in males (0.9% vs. 0.21%) ,right axis deviation more in males (4.9% vs. 0.6%) more left axis deviation in males (4.6% vs. 1.7%) ,more left ventricular hypertrophy criteria of Sokolow-Lyon in males (9.8% vs. 0.42%),more short PR in females (10.11% vs. 7.7%),non-significant difference atrial rhythm prevalence (0.42% in females vs. 0.9% in males) and no difference in 1st degree HB(0.4% in females vs. 0.42% in males).

A study in Belgium in 2000 studied ECG abnormalities prevalence on 1620 males and 1497 females with age between 25 and 34,and found that , left ventricular hypertrophy criteria of Sokolow-Lyon more in males like ours (0.4% vs0.1%) , left axis deviation more in males like ours (1.4% vs. 0.9%) ,but WPW syndrome was lower in males than females in contrary to our study (0.06%in males 0.13% in females)[5].

A study in Poland in 2019 was done on 579 males and 502 females ,showed that left axis deviation more in males like ours(8.9%vs5%),no difference in right axis deviation in contrary to ours (0.6% in both),more left ventricular hypertrophy criteria of Sokolow-Lyon in males like ours (3.3% vs. 0.6%),short PR more in females like ours (4.8% vs. 1%) ,1st degree HB more males in contrary to ours(2.6% vs. 1.2%) and non-significant difference in atrial rhythm like ours (1.0% in males 1.2% in females) .The mean age in that study was 57.1 in males and 56.7 in females[6].

WPW syndrome prevalence in males in study in Singapore was 0.14%, in that research the ECG of 18476 young male adults in clinical examination before participation in military was studied. In ours it was more prevalent 0.9% [7].

In the current study we found that early repolarization pattern was significantly more in athletics (16.1% vs. 10.0%),wide QRS significantly more in athletics (6.2%vs 0.6%), left

ventricular hypertrophy criteria of Sokolow-Lyon was significantly more in athletics (8.2% vs. 2.0%),sinus bradycardia was significantly more in athletes(8.6% vs. 0.6%), significant more long QTc in athletes(1.7% vs. 0.6%), non-significant difference in 1st degree HB (0.25% In athletes vs. 0.39%),and non-significant difference in right atrial enlargement (1.4% in athletes vs. 1.2%).

A study in UK screened ECG abnormalities in 11,845 of population in U.K with age between 14 and 35 .This study was done between 2008 and 2012 and published in 2014. The sample of that study contained 4,081 athletes and 7,764 non-athletes. Athletes were defined as individuals competing in organized team or individual sports at regional, national, or international levels .Nonathletic were defined as individuals not involved in regular, organized competitive team or individual sports, including sedentary individuals and those exercising recreationally [8].

The results of this study showed that sinus bradycardia is more in athletes like our study (57.6% vs. 26.1%) early repolarization is significantly more in athletes (33.2% vs. 2.1%) left ventricular hypertrophy criteria of Sokolow-Lyon was more in athletics (33.2% vs. 2.1 %) ,significant lower prevalence of long QTc in athletes in contrary to our study (3.3% vs. 6.5),significant more 1st degree HB in athletes in contrary to ours (6.2% vs. 1.3) , significant more right atrial enlargement in athletes (1.9% vs. 1.1 %) [8].

In this study short QTc was more prevalent in athletes (13% vs. 6.9%) , but in our study we didn't detect short QTc in athletes or non-athletes ,but this may be due to difference in criteria of short QTc used in both studies. In our study short QTc was defined as QTc shorter than 340 ms in both males and females, but in this study short QTc was defined as QTc shorter than 380 ms [8].

A study was done in 2012 in Qatar on 800 athletes and 135 non-athletes. In that study, athletes competed at the national level and exercised ≥6h/week. Non-athletes in that study performed physical activity for less than 2 h/week. The sample involved many races, like black, Caucasian and people from the Arabic Gulf and North Africa. The study showed that early repolarization pattern more in athletics like our study (59.6 % vs. 45.2 %) , left ventricular hypertrophy criteria of Sokolow-Lyon was significantly more in athletics (23.5% vs. 9.6),1st degree HB more in athletes in contrary to ours (4.5% vs. 2.2%).)[9].

A study in 2007 in Italy was done on 32,657 competitive athletes. Of this sample 2430 were 20 years old or younger. In these age group WPW prevalence was 1.3% and in ours 0.8% , left ventricular hypertrophy criteria of Sokolow-Lyon was lower than ours (3.1% vs. 8.2), left anterior fascicular block approximately the same (2.0% in ours vs. 2.1%) [10].

Limitations of the study

Relatively small sample of our study in comparison to low prevalence of some undetected ECG abnormalities like atrial fibrillation, Brugada syndrome and short QT and few athletic female in our samples.

Conclusion

There is a variation in prevalence of ECG abnormalities between males and females, athletes and non-athletes like in early repolarization, LVH, RAD, LAD, wide QRS, sinus bradycardia, sinus tachycardia, long QT, short PR, WPW and low voltage.

There is a variation in the mean of PR interval, QRS duration, heart rate, and QT interval between males and females, athletes and non-athletes and between ethnicities.

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Tables

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Table 1: The criteria used for ECG abnormalities

Abnormality	Criteria
Early repolarization criteria	1. There is an end-QRS notch or slur on the downslope of a prominent R-wave. If there is a notch, it should lie entirely above the baseline. The onset of a slur must also be above the baseline. 2-Jp is ≥0.1 mV in 2 or more contiguous leads of the 12-lead ECG, excluding leads V1to V3 .3-QRS duration is <120 ms.
Long QT criteria	Heart-rate corrected QT interval (QT/√R-R interval = QTc) greater than 470ms in women and 450ms in men, in the absence of other known factors prolonging the QT interval.
Short QT criteria	Corrected QT less or equal 340 ms by Bazzet formula.
WPW syndrome criteria	o Short PR interval less than 120 ms. o slurred, slowly rising onset of the QRS in some leads (delta wave) and Wide QRS more than 120 ms.
A-V Nodal block criteria	*First degree : PR interval more than 200 ms. *Wenckebach: progressive increase in PR then failure of conduction. *Mobitz II: ratio between P waves to QRS is 3:1, 4:1 or more. *Third degree: p wave is present with complete A-V dissociation.
High voltage or LVH criteria	Sv1 plus Rv5 or Rv6 more than 3.5 mvolt (Sokolow-Lyon criteria)
Low voltage criteria	QRS voltage less than 10 mm in precordial leads and or less than 5 mm in limb leads.
Wide QRS criteria	QRS duration more than 120 ms in any lead
Respiratory sinus arrhythmia criteria	Sinus rhythm with P-P interval variation more than 120 ms
LAD criteria	Mean QRS axis -30 or less
RAD criteria	Mean QRS axis +100 or more
P pulmonale criteria	P wave more than 2.5 mm in voltage and P wave duration less than 120 ms

Table 2: syncope history and level of activity between male and female

		Gender		Total	X^2	P
		Female	Male			
History syncope	N	20	4	24	15.75	0.00**
	%	4.3%	1.2%	3.0%		
Physical activity (athlete)	N	61	231	292	706.6	0.00**
	%	12.8%	71.0%	36.5%		
Total	N	474	326	800		
	%	100.0%	100.0%	100.0%		

Table 3: ECG abnormalities prevalence among studied group

		N	%
1st degree HB		3	0.37
Early repolarization		98	12.25
Short PR	total	73	9.12
	With WPW	4	0.5
Respiratory sinus arrhythmia		147	18.4
RAD		19	2.4
LAD		23	2.9
Wide QRS		21	2.6
Ant fascicular block		7	0.9
Post fascicular block		6	0.8
Sokolow-Lyon criteria of LVH		34	4.3
Low voltage		22	2.8
Sinus bradycardia		28	3.5
Sinus tachycardia		32	4
Atrial rhythm		5	0.6
Long QT		8	1.0
P pulmonale		10	1.3
Abnormalities	-VE	285	35.6
	+VE	515	64.4
	Total	800	100.0

Table 4: ECG abnormalities comparison between Male and female

		Gender		Total	X^2	P
		Female	Male			
1st degree HB	N	2	1	3	0.21	0.64
	%	0.42%	0.4%	0.37%		

Early repolarization		N	45	53	98	22.04	0.00**
		%	9.5%	16.4%	12.25 %		
Short PR	Total	N	48	25	73	15.41	0.00**
		%	10.11%	7.7%	9.12%		
	WPW	N	1	3	4	3.1	0.072
		%	0.21%	0.9%	0.5%		
Respiratory sinus arrhythmia		N	94	53	147	4.06	0.044*
		%	19.8%	16.3%	18.4%		
RAD		N	3	16	19	33.51	0.00**
		%	0.6%	4.9%	2.4%		
LAD		N	8	15	23	14.25	0.00**
		%	1.7%	4.6%	2.9%		
WIDE QRS		N	3	18	21	42.66	0.00**
		%	0.63%	5.5%	2.6%		
Ant fascicular block		N	2	5	7	13.17	0.00**
		%	0.42%	1.5%	0.9%		
Post fascicular block		N	2	4	6	10.37	0.001**
		%	0.42%	1.2%	0.8%		
Sokolow-Lyon criteria of LVH		N	2	32	34	101.93	0.00**
		%	0.42%	9.8%	4.3%		
Low voltage		N	22	0	22	38.09	0.00**
		%	4.6%	0.0%	2.8%		
Sinus bradycardia		N	4	24	28	58.53	0.00**
		%	0.84%	7.4%	3.5%		
Sinus tachycardia		N	27	5	32	19.17	0.00**
		%	5.7%	1.5%	4.0%		
Atrial rhythm		N	2	3	5	3.37	0.066
		%	0.42%	0.9%	0.6%		
Long QT		N	3	5	8	1.71	0.19

	%	0.6%	1.5%	1.0%		
P pulmonale	N	4	6	10	3.91	0.048 *
	%	0.8%	1.8%	1.3%		
Total	N	474	326	800		
	%	100.0%	100.0%	100.0 %		

Table 5: ECG abnormalities according to Athlete and non-athlete

			Physical activity		Total	X^2	P
			No	Athlete			
Degree 1ST HB		N	2	1	3	0.37	0.67
		%	0.39%	0.25%	0.37%		
Early repolarization		N	51	47	98	17.06	0.00**
		%	10.0%	16.1%	12.25%		
Short PR	Total	N	48	25	73	12.83	0.002*
		%	9.4%	8.6%	9.1%		
	WPW	N	2	2	4	0.8	0.08
		%	0.39%	0.68%	0.5%		
Respiratory sinus arrhythmia		N	95	52	147	0.19	0.65
		%	18.7%	17.8%	18.4%		
RAD		N	8	11	19	10.11	0.001**
		%	1.6%	3.8%	2.4%		
LAD		N	13	10	23	1.37	0.24
		%	2.5%	3.4%	2.8%		
WIDE QRS		N	3	18	21	57.67	0.00**
		%	0.6%	6.2%	2.6%		
Ant fascicular block		N	1	6	7	15.72	0.00**
		%	0.2%	2.1%	0.9%		
Post fascicular block		N	1	5	6	8.68	0.003*
		%	0.2%	1.7%	0.8%		
Sokolow-Lyon criteria of LVH		N	10	24	34	42.91	0.00**
		%	2.0%	8.2%	4.3%		
Low voltage		N	19	3	22	25	0.005*
		%	3.7%	1.0%	2.8%		
Sinus bradycardia		N	3	25	28	91.38	0.00**
		%	0.6%	8.6%	3.5%		
Sinus tachycardia		N	29	3	32	28.26	0.00**
		%	5.7%	1.0%	4.0%		
Atrial rhythm		N	2	3	5	4.74	0.029*

	%	0.4%	1.0%	0.6%		
Long QT	N	3	5	8	9.78	0.002*
	%	0.6%	1.7%	1.0%		
P pulmonale	N	6	4	10	0.61	0.43
	%	1.2%	1.4%	1.2%		
Total	N	508	292	800		
	%	100.0%	100.0%	100.0%		

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Figures

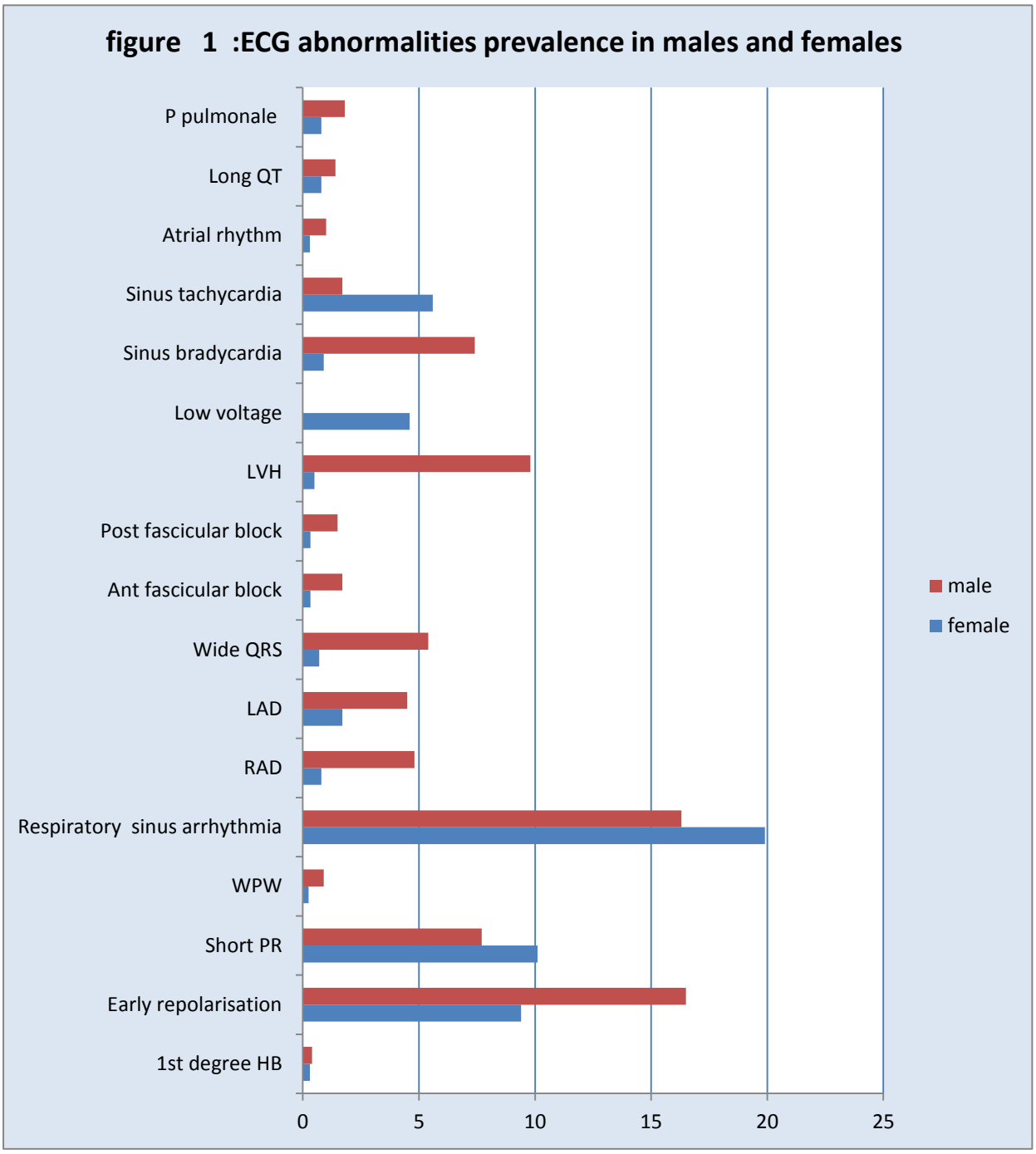

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Figure 2 :ECG abnormalities prevalence according to Athlete and not