Prevalence of asymptomatic ECG abnormalities in Ground Duty Personnel in a forward Air Force Base

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Abstract

To find out the prevalence of various ECG abnormalities among asymptomatic ground duty personnel (GDP) at Forward Air Base, a comprehensive cardiovascular survey as a part of their annual medical examination (AME) was performed. A total of 2084 air warriors underwent ECG recording. Any symptomatic / low medical category (LMC) patient was excluded from this study. Out of 2084 GDP 467 were aged less than 25 yrs, 842 were between 25-35 yrs and 775 were more than 35 yrs of age. The prevalence rate of Right bundle branch block (RBBB) was 08, 08 and 05 in respective age groups. The other findings included sinus tachycardia, left bundle branch block, poor R wave in anterior leads (5/2084) and T inversion in Anterior leads 23 /2084. Further these individuals with abnormal ECG were not detected to have any metabolic and biochemical abnormality and there was no evidence of any structural / functional heart disease on 2D Echocardiography and TMT.

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Keywords- ECG: electrocardiogram, AME: annual medical examination, GDP: Ground duty personnel, RBBB: right bundle branch block, LBBB: left bundle branch block.

Introduction

Apart from their importance in assessing the role to find out various etiological factors, investigations of coronary artery disease (CAD) are important as they are the leading cause of mortality. Cardio vascular diseases (CV) are not rare in GDPs, but there are a few data on their prevalence. Physical conditioning during their training induces numerous CVS adaptations, including vagotonia and increased cardiac volume & mass. These adaptations are characteristics of the 'athletic heart' and account for most of the normal variants in athlete's ECG. Common alterations are vagotonia, sinus arrhythmia, junctional escape beats, first degree AV block.[1]. Common ECG variants associated with athlete heart are increased voltage, prominent U waves; inter ventricular conduction defect, early repolarisation and prolonged QT interval.

Aim of the study

This study was aimed to find out prevalence of ECG abnormalities in healthy GDPs at a forward Air Force Base and to investigate the significance of these changes in relation to the functional/ structural heart disease.

Methods

The study was conducted at Air Force Hospital collocated with the Air Force Base. Only GDPs who had presented for AME were studied to find out the prevalence of ECG abnormality in healthy young GDPs. They had all been active and found medically fit for their respective employment. Their health state was assessed by clinical examination, routine blood and urine tests. The subjects who were symptomatic of CVS or respiratory disease, or past h/o any hospitalization were excluded as this study was focused only on healthy asymptomatic GDPs. The 12 leads ECG were recorded in the recumbent position at a speed of 25mm/min. Care was taken to ensure consistency in positioning of precordial

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electrodes in conventional method. 2084 GDPs were included in this study. They were divided into 3 groups as per their age. Any significant abnormality on ECG was noted and those found with abnormal ECG were further tested with TMT following Bruce protocol II and 2D Echocardiography to detect any structural/ functional heart disease.

The following parameters were studied on ECG:

(a) Heart rate

(b) Mean QRS axis of 3 standard leads.

(c) Diagnostic criterion for RBBB:[2]

- QRS duration > 120 msec
- A secondary R wave in V1/V2
- Wide slurred S wave in lead I and V5/V6
- Associated feature: ST segment or T wave depression in V1-V2.

(d) Diagnostic criterion for LBBB [2]

- QRS > 120 msec
- Broad R in I, V5/V6
- Absence of Q in V5/V6

(e) Associated feature:

- Displacement of ST/T in opposite directions to the dominant deflection of the QRS complex.
- Poor R wave progression in chest leads.
- RS complex in V5/V6.
- Left axis deviation (LAD).

Results

A total number of 467 GDPs were aged less than 25 yrs, 842 of them were between 25-35 yrs of age and 775 were more than 35 yrs of age and arranged in Group I, II and III respectively.[table 1] All of them were having New York Heart Association status I, they were normotensive and their weights were within 3SD of acceptable limits as per standards of IAF.

Table 1: Age wise distribution of subjects in various groups

Age in years	Group I (< 25)	Group II (25-35)	Group III (>35)
No. of subjects	*467*	*842*	*775*

The prevalence of ECG abnormality detected in Group I was 7.28% and overall abnormality detected was 3.59% in this study. Further population detected to have ECG abnormality. The prevalence of QRS axis deviation in this study was 0.64% in group I.

ECG Findings (Table 2 refrers)

(a) Sinus Tachycardia: 5 were detected sinus tachycardia. Above 35 yrs of age no one had tachycardia.

(b) T inversion in Anterior leads: 11 in group I, 11 in group II and 01 in group III were detected to have T inversions in more than 2 consecutive anterior leads.

(c) Poor R-wave: 2 in group I and 3 in group II were detected poor R wave progression in chest leads signifying associated feature of LBBB.

(d) LAD: 03 in group I, 01 in group II and 03 in group III were detected to have LAD.

(e) LBBB: 2 in group II and 1 in group III were detected LBBB. In group I no one was found to have these changes.

(f) RBBB: 08 in group I, 08 in group II and 05 in group III were detected RBBB/incomplete RBBB.

(g) Sinus rhythm disturbances like sinus bradycardia and tachycardia were found in 08 subjects in group I and 04 subjects in group II.

Table 2: Abnormality wise distribution of ECGs recorded between 01 Jan 10 – 31 Mar 11

Abnormality	Group I (18-25 Years)	Group II (25-35 Years)	Group III (35-55 Years)
RBBB	8	8	5
LBBB / LAHB	0	2	1
LAD	3	1	3
POOR R V1-V3	2	3	0
T INVERSION CHEST LEADS	11	11	1
SINUS TACHYCARDIA	4	1	0
SINUS BRADYCARDIA	4	3	0
VPC	2	2	0
TOTAL	**34/ 467**	**31/ 842**	**10/ 775**

All those GDPs who were detected to have ECG abnormalities underwent TMT and 2D Echo. They were found to have no functional/structural heart disease. The LBBB cases were transferred to cardiology centre for further investigations.

Discussion

Globally there is a rise in diseases like HTN in young, stroke in young and early CAD [11]. The present practice of doing ECG in early part of service is advantageous as it gives us an opportunity to detect early life style changes and also enable us to take suitable corrective actions both in terms of diagnosis and / or intervention.

The various GDPs reported to this hospital were divided into 3 groups so as to detect early changes in them and to document non progressive ECG changes if any in subsequent years. Defining attribution of a disease to service is also a part played during AME. In the absence of baseline ECG during enrollment, it is difficult to attribute ECG changes in young GDPs due to physical training imparted in 1st year of training. However, there are studies which had concluded that changes in athletic heart including echo-cardiographic changes can be reverted back with in 2-4 months of stopping exercise[6]. Similar findings from reported by Balady et al during his analysis of 289 professional football players [8]. Also, in Belgium Ganse et al found no difference in ECG changes in 30 cyclists involved in competitive sports when compared them with untrained healthy controls [7].So ideally these GDPs should undergo baseline ECG prior to and at the end of their physical training schedule to assess the significance of these findings.

The ECG abnormality in Group I was 7.28 % and in Group II was 3.68 %, this difference was probably related to selection bias, as in this study only subjects with medical standards A4G1 were considered. Further to this as age advanced chances of getting medical disabilities also increases. Therefore some subjects in Group II and III may have low medical classification for other cardiovascular disease like Hypertension, CAD, type 2 diabetes etc, and were not considered in this study. The total number of newly diagnosed cases of ECG abnormality in GDPs at this base of age group between 25-35 years during the study period were 02 and age group between 35-55 years were 10, and they were also not included in this study. However even overall incidence of 7.28% abnormality in group I was no different from that of abnormalities prevalent in rural population [3]. It is also recommended to conduct a demographic survey of these subjects as there are considerable geographic variations in rural population across the country. In similar study from China, Rao X et al found prevalence of abnormal ECG from 7.74% to 20.9% and this was higher for men than women in

Guangzhou. However, even with high abnormality rate in these populations, the overall incidence of coronary heart disease remained low in them [9].

The following ECG findings commonly seen in healthy young adults are: sinus bradycardia, tachycardia, incomplete RBBB, Right Axis deviation, Left axis deviation, prolong QRS duration, tall R wave and deep S wave in chest leads, and tall T wave in chest leads.[7]. Evidently these changes may also be seen in certain pathological conditions. Considering limitations of clinical examination these subjects may be considered fit for service employability only after undertaking further investigations on case to case basis to exclude possible pathological disease. [7]. Thereby it can be deduced that changes in heart occurred during physical training are either reverted or remained insignificant after some time.

Some abnormal ECGs are also encountered in a note-worthy percentage of general population. The prevalence of RBBB in this study was 1.01%. In other study group, Gupta et al had found prevalence of 18.6/1000 RBBB in Indian population [3]. Stein et al from Brazil detected 9.24% cases of exercise induced RBBB out of 8047 subjects.[4]. These changes may show late or conceal the important ECG signs of Myocardial infarction or ischemia, and may mask or simulate changes that of ventricular hypertrophy. In most cases RBBB has a pathological cause though it is also seen in healthy individuals. The common pathological causes of RBBB are RHD, Cor-pulmonale, Cardiomyopathy, IHD, Pulmonary embolism and atrial septal defects. [5].

The overall prevalence of QRS axis deviation to left in this study was 0.33% and in Group I was. In a similar study Gupta et al [3] had found the prevalence of left or right axis deviation in 10.6/ 1000 population in rural India. In other study from Belgium, Van Ganse et al had found absence of significant differences in QRS axis in trained athletes when compared with untrained subjects. The possible significance of these findings should be assessed by prolonged prospective studies in athletes and untrained control subjects [7].

The prevalence of ECG abnormality in asymptomatic air warriors at this station was 3.6%. The RBBB and T-wave changes were most common out of them. The other ECG abnormalities like VPC/LBBB should be further evaluated with testing like stress Thallium, Holter studies or coronary angiography [10]. However, due to limitations these were not performed as a part of this study and these personnel were referred to higher centre for further investigations.

Conclusion

The prevalence of asymptomatic ECG abnormalities in GDPs is no more than that prevalent in rural Indian population. The present practice of recording ECG in Indian Air force at 2nd year of service, 25 yrs and 30 yrs is good. However, in the absence of ECG recording at entry level, it is difficult to ascertain whether these changes has occurred during physical training to GDPs or they were enrolled with these abnormalities. Therefore it is suggested that an ECG may be recorded at entry level before enrollment and any deviation from normal should be made a ground for rejection of their candidature in service. Hence it is recommended that ECG be recorded at entry level. It is also recommended that assimilation of similar data from other IAF units be consolidated to get broader picture of exact prevalence of ECG abnormality in young and healthy GDPs in IAF.

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Answers to Aviation Medicine Quiz

1. d	6. c	11. b	16. a	21. d
2. d	7. a	12. c	17. d	22. d
3. b	8. d	13. a	18. c	23. b
4. b	9. a	14. b	19. d	24. a
5. a	10. a	15. a	20. d	25. c