Electrocardiographic Findings in 2,391 Cardiac and Non-Cardiac Patients in Japan

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Statistical analysis of electrocardiograms on 2,391 cardiac and non-cardiac patients in Japan aged from 12 years to over 50 years were performed. Of this group 1,288 individuals (54 per cent) revealed major abnormalities of electrocardiographic findings. The ratio of occurrence for Japanese males and females was shown.

Major abnormalities have been expressed in tables terms of rate per hundred for each 10-year age group. Each abnormality and its clinical significance is briefly discussed.

Mean ventricular potential for normal Japanese males and females has been calculated and represented.

STATISTICAL analysis of electrocardiograms among cardiac and non-cardiac patients in Japan, presented in this paper, has proven most interest. Much of the knowledge concerning electrocardiographic findings is based on information obtained from selected patient and clinical populations. In recent years, many investigators have reported about the relationship between electrocardiographic findings and specific cardiac diseases^{1, 2, 3, 4, 5, 6)}; and extensive statistical analysis was done on personnel of the U. S. Air Force⁷⁾, however, there is little or no information available on statistical analysis of electrocardiograms among cardiac and non-cardiac patients in Japan. The purpose of this study is to report the findings obtained from one such analysis.

MATERIALS AND METHODS

Two thousands and three hundreds and ninety-one tracings from a total of 3,468 electrocardiograms were selected for this study. Aged ranged from 12 years to over 50, and the study included both males and females. The population distribution, by 10-year age groups, is shown in Table I. All of the electrocardiograms were interpreted by one of the authors of this study, with use of BURCH's criteria⁸⁾.

TABLE I TOTAL NUMBER OF PATIENTS IN EACH AGE GROUP

Age Group	Number of Patients
12-19	143
20-29	469
30-39	356
40-49	298
50-and over	1025
Total	2391

The age distribution of the population was considered to be enough in breadth and depth, to enable us to make certain observations related to age. Any abnormalities noted in the electrocardiograms are based on the findings noted on the initial electrocardiogram only; no abnormalities were detected as a result of clinical findings, nor were any newly developed abnormalities noted, subsequently, in the presence of a previously normal tracing. Therefore the incidence studies are based strictly on the electrocardiographic findings that might be found in an asymptomatic; there was no instance of the clinical appearance of cardiac symptoms.

The male to female ratio showing the incidence of electrocardiographic findings among the 2391 individuals is shown in Figure 1. The mean electrical axis was also calculated and shown in Figure 1.

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TABLE II FREQUENT MAJOR ABNORMALITIES OF
Male 1,149

Diagnosis	12-19	20-29	30-39	40-49	50 & over	Total	Rate per 100
Myocardial Ischemia	7.7 (4)	13.3 (19)	3.1 (6)	11.1 (9)	3.1 (12)	50	4.4
Myocardial Damage	19.2 (10)	12.0 (18)	10.0 (15)	2.2 (2)	6.6 (25)	70	6.0
Left Vent. Hypertrophy	3.8 (2)	4.0 (6)	3.1 (6)	4.4 (4)	15.4 (60)	78	6.8
Right Vent. Hypertrophy	15.5 (8)	10.6 (15)	8.7 (14)	4.4 (4)	2.5 (10)	51	4.4
Right Bundle Branch Block	0 (0)	5.3 (8)	3.1 (6)	2.2 (2)	3.5 (14)	30	2.6
Myocardial Infarction	0 (0)	0 (0)	0 (0)	2.2 (2)	2.9 (38)	40	3.4
Atrial Disease	0 (0)	0 (0)	6.2 (10)	2.2 (2)	6.1 (24)	36	3.1
Atrial Fibrillation	0 (0)	0 (0)	1.3 (2)	4.4 (4)	3.5 (15)	21	1.8
Chronic Lung Disease	0 (0)	1.3 (2)	1.3 (2)	8.9 (8)	5.0 (21)	35	3.0
Low Voltage	0 (0)	0 (0)	10.7 (17)	4.4 (4)	9.2 (37)	58	5.0
Electrolyte Disturbance	3.8 (2)	4.0 (6)	1.3 (2)	0 (0)	1.0 (4)	14	1.0
Dextrocardia	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0	0
Arteriosclerotic Heart Disease	0 (0)	0 (0)	1.3 (2)	4.4 (4)	10.5 (41)	47	3.9

* number in parenthesis represent actual numbers of incidence

The major abnormalities have been expressed in the rates of hundred for some age groups when there were sufficient numbers of abnormalities present to permit these calculations to be made. These are shown in Table II.

RESULT AND DISCUSSION

A total of 1,288 major electrocardiographic abnormalities was found in the group, for an incidence rate of 54 per cent. The majority of abnormal electrocardiographic findings was found in the group of 50 years of age or older.

The division by sex showing the incidence of electrocardiographic abnormalities was male, 1,149, and female, 1,242, as shown in Figure 1.

Myocardial Damage
It is interesting to note that a definite correlation seems to exist for myocardial damage found in the female, based on age. Myocardial damage was observed with particular frequency in female patients. This appears with conspicuous frequency in female between the ages of 12 and 29.

Myocardial Ischemia

In comparison with myocardial damage, these findings were less common, however, a relatively high incidence was noted among males in the 20-29 and 40-49 year age groups. There was no evidence of coronary insufficiency noted in these patients however.

Left Ventricular Hypertrophy

A relatively high incidence of left ventricular hypertrophy was noted in the group over 50. These are generally related to arteriosclerotic changes in the heart, closely related to the patients age.

Right Ventricular Hypertrophy

In contrast to left ventricular hypertrophy, the rate of incidence of right ventricular hypertrophy were found to be more clinically significant, particularly in the higher incidence noted in males. The highest rate of incidence was found among males in the 12-19 age group. The incidence was found to decrease progressively with age in the male group.

ELECTROCARDIOGRAPHIC FINDINGS-RATES/100*

Female 1,242

12-19	20-29	30-39	40-49	50 & over	Total	Rate per 100
3.3 (2)	2.8 (6)	5.1 (10)	2.7 (4)	7.3 (30)	42	3.3
23.3 (14)	22.0 (47)	14.1 (27)	19.4 (28)	13.8 (59)	175	14.1
0 (0)	0.9 (2)	2.0 (4)	4.1 (6)	9.6 (41)	53	4.2
6.6 (4)	0 (0)	1.0 (2)	0 (0)	2.4 (10)	16	1.3
3.3 (2)	0.9 (2)	1.0 (2)	1.4 (2)	1.4 (4)	12	1.0
0 (0)	0 (0)	0 (0)	0.7 (1)	1.6 (8)	9	0.7
3.3 (2)	1.8 (4)	3.0 (12)	1.4 (2)	4.9 (19)	39	3.1
0 (0)	0.9 (2)	0 (0)	0 (0)	1.4 (6)	8	0.6
0 (0)	0.9 (2)	3.0 (6)	2.8 (4)	0.4 (2)	14	1.1
6.6 (4)	12.8 (29)	15.1 (31)	22.2 (32)	11.6 (48)	144	11.6
6.6 (4)	7.3 (16)	4.0 (8)	6.9 (10)	10.1 (43)	71	5.7
3.3 (2)	1.8 (2)	0 (0)	1.4 (1)	0 (0)	5	0.4
0 (0)	0 (0)	1.0 (2)	5.5 (8)	14.1 (60)	70	5.6

The incidence of congenital heart disease in Japan is found to be less common when compared with the white and Negro population⁸⁾. We think this significant as an observation on the life expectancy of patients who have congenital heart disease; such as ventricular septal defects, atrial septal defects, pulmonary stenosis and others. Life expectancy for the latter is short and, of course, such patients must limit considerably their physical activities.

Right Bundle Branch Block

There were no noteworthy findings, specifically related to age, for this group, although a high incidence was noted among males than female. None of these patients had any myocardial infarction or rheumatic histories previously.

Myocardial Infarction

It is interesting to note that the incidence of myocardial infarction among Japanese is very low, when compared with whites and Negroes⁹⁻¹³⁾. Males were found to have a higher inci-

dence than females. On the basis of this study, the rate of incidence in Japan was found to be only 2.0 per cent.

Atrial Disease

Seventy-five cases (Male 36 and Female 39) of atrial disease were noted. The rate of incidence was about equal. Most of these findings are based on the diphasic or abnormal pattern of P waves in leads II, III, and AVF. No exact correlation was found between age and incidence of occurrence in the present study.

Atrial Fibrillation

Twenty-nine subjects (Male 21 and Female 8) were found to have atrial fibrillation. The progressively increasing incidence noted in the older male groups would seem to indicate a relationship with the progressive arteriosclerotic changes of heart found in the over 50 age group.

Chronic Lung Disease

Forty-nine subjects (Male 35 and Female 14) were found to have chronic lung disease. An

increasing tendency of the high P and prominent changes in P waves are closely related to age distribution, in the case of males.

Low Voltage

A striking feature of these findings is that the number in the male group was 58, whereas the female group numbered 144. The occurrence was noted in all the female age groups, from the age of 12 to over 50. The high incidences among females would seem to be related to constitutional differences between males and females. Underlying diseases, which may exist in this group, and now being investigated.

Electrolyte Disturbances

A total of 85 subjects (Male 14 and Female 71) of electrolyte disturbances were found. An interesting feature of these findings is that they seem to occur at all ages with no single age group being prominent. Less incidence was

noted among males than females. Females are more highly susceptible to electrolyte disturbance. These disturbances are probably of metabolic origin or due to changes in underlying diseases.

Dextrocardia

Only five cases of dextrocardia were found among females, none in males. This is perhaps clinically significant and we can postulate that the higher incidence among women may be due to their gene complexity¹⁴⁾, so far as dextrocardia is concerned.

Arteriosclerotic Heart Disease

These findings are very closely related to age distribution. No incidence of arteriosclerotic heart disease was detected under the age of 30. Of course, further clinical diagnosis might yield different findings. It is worthy of note to point out that these were no really significant dif-

Estimated Male to Female Ratio of Incidence of Electrocardiographic Findings in 2391 Individuals

Fig. 1.

ferences in the rate of incidence between the male and female age groups in this study.

SUMMARY

Electrocardiograms on 2,391 Japanese individuals aged from 12 years to over 50 years were studied. Of this group 1,288 major abnormalities (54 per cent) revealed significant electrocardiographic changes. The ratio of occurrence for Japanese males and females was charted.

The electrocardiographic findings are presented in this paper and major abnormalities noted were selected and has been expressed in our tables terms of rate per hundred for each 10-year age group. Each abnormality and its possible clinical significance is briefly discussed. The study also shows the mean electrical axis of normal males and females in Japan in the group observed.

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