

# JUVENILE T WAVES (A STUDY OF 100 NORMAL SUBJECTS)

B. B. DAS, M. RAY, S. K. MOHAPATRA AND S. P. DAS

*Department of Physiology,  
V.S.S. Medical College, Burla - 768 017 (Orissa)*

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**Summary :** "Juvenile pattern" of T wave inversion in the precordial leads of electrocardiogram was studied in 100 normal healthy Indians of 0 to 70 years of age in both sexes. Incidence of such pattern was observed in 25 subjects upto 19 yeavs of age. Persons of weight/height ratio less than 30% had higher incidence of juvenile T waves. Maximum incidence (48%) of juvenile T waves was observed in the annual income group of Rs. 15000/-. Exercise ECC showed slight flattening of the inverted T waves in  $V_1$  to  $V_3$  leads in eight subjects only.

**Key words :** precordial leads

T waves

juvenile pattern

## INTRODUCTION

Inversion of T waves in right precordial leads of he electrocardiogram (ECG) is a normal phenomenon in infants and it frequently persists in to the second decade of life ; in Negroes, this 'juvenile pattern' of T wave inversion in precordial leads  $V_{1-4}$  may persist into the third decade of life (3). Studies on American Negroes and similar studies in other countries including India show similar findings (1,7,8,11). Persistence of juvenile T wave pattern in right precordial leads, upto the adult age poses a difficult problem in the differential diagnosis of heart diseases and a hasty diagnosis may label a normal individual showing such juvenile pattern of T wave inversion as a heart patient (8).

The aim of the present study is to detect juvenile pattern of T wave inversion in  $V_1$  to  $V_4$  leads of ECG in 100 normal healthy Indian subjects of different age groups and differentiate it from other conditions giving rise to similar T wave changes.

## MATERIAL AND METHODS

100 healthy Indian subjects of age groups 0 to 70 years of both sexes were studied. They were the employees of V.S.S. Medical College, Burla, and their family members. Such a closed population conformed to more or less a homogenous population. They were of average body build and nutritional stattus.

Clinical examinations including signs and symptoms, recording of blood pressure, X-ray of chest and routine 12 lead ECG records were done on each subject in supine posture and then in standing posture. Hyperventilation for 50 to 90 seconds and ECG record in supine position and then exercise on Master's steps followed by ECG record in supine position were done after resting ECG record in all the subjects except four children of one year to three years of age as they did not co-operate, during hyperventilation and exercise. Cases in whom non-ejection click was heard, were excluded from the study. Some of the cases, in whom non-ejection clicks were not heard, were subjected for M-mode echocardiography to exclude sub-clinical mitral valve prolapse. The deflections in electrocardiograph were standardized, so that 1 millivolt gave 10 mm deflection at a paper speed of 25 mm. per second. All precautions were taken to avoid machine artifact.

Age, sex, body weight, height and economic status of each subject were recorded and an association of these factors with incidence of juvenile pattern of T wave inversion in the precordial leads was studied.

## RESULTS

Out of 57 males and 43 females juvenile pattern of T wave inversion was present in 10(17.54%) males and 15(34.88%) females (Table I and Fig. 1.)

There is no statistically significant relationship ( $P > 0.05$ ) of sex with incidence of juvenile T waves (Table I).

TABLE I : Association of sex with juvenile T waves.

Sex	Presence of juvenile T waves	Absence of juvenile T waves	Total
Male	10 (17.54%)	47 (82.46%)	57 (100%)
Female	15 (34.88%)	28 (65.12%)	43 (100%)
Total	25	75	100

$\chi^2 = 3.4$  at 1 d.f. ( $P > 0.05$ ) (Not significant).

When age factor is considered, it is observed that out of a total 28 subject upto 19 years of age, juvenile T waves are present in 25 subjects, i.e. 89.28% of cases. From 20 years onwards there is no incidence of juvenile T waves (Table II and III).

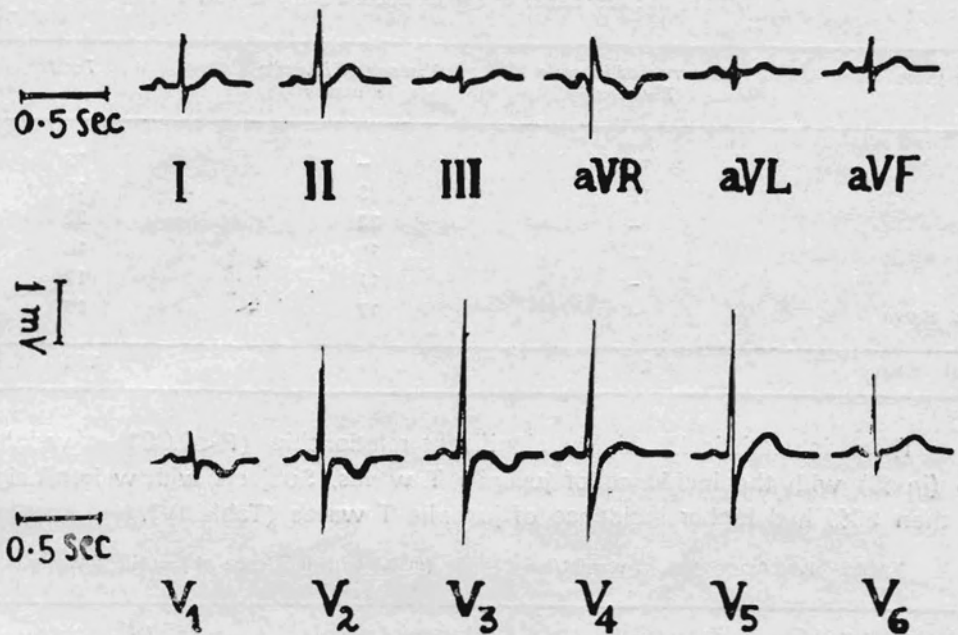


Fig. 1 : Normal E.C.G. in a 4-year old boy in supine posture. The T waves are inverted in V<sub>1-3</sub>.

TABLE II : Distribution of age, sex and juvenile T waves.

Age in years	Male		Female		Total
	Presence of juvenile T waves	Absence of juvenile T waves	Presence of juvenile T waves	Absence of juvenile T waves	
0-9	6	-	7	-	13
10-19	4	3	8	-	15
20-29	-	13	-	9	22
30-39	-	11	-	5	16
40-49	-	10	-	7	17
50 and above	-	10	-	7	17
Total	10	47	15	28	100

TABLE III : Association of age distribution and juvenile T waves.

<i>Age in years</i>	<i>Presence of juvenile T waves</i>	<i>Absence of juvenile T waves</i>	<i>Total</i>
0-9	13	-	13
10-19	12	3	15
20-29	-	22	22
30-39	-	16	16
40-49	-	17	17
50 and above	-	17	17
Total	25	75	100

There is statistically highly significant relationship ( $P < 0.001$ ) of weight/height ratio (in %) with the incidence of juvenile T waves. Subjects with weight/height ratio less than 30% had higher incidence of juvenile T waves (Table IV).

TABLE IV : Association of weight/height ratio (in %) with incidence of juvenile T waves.

<i>(Weight/Height) x 100</i>	<i>Presence of juvenile T waves</i>	<i>Absence of juvenile T waves</i>	<i>Total</i>
< 30%	23 (92%)	18 (24%)	41 (41%)
> 30%	2 (8%)	57 (76%)	59 (59%)
Total	25 (100%)	75 (100%)	100 (100%)

$\chi^2 = 37.53$  at 1 d.f. ( $P < 0.001$ ) (Highly significant).

Family income and incidence of juvenile T waves have statistically significant ( $P < 0.02$ ) relationship. Maximum incidence (48%) of juvenile T waves was observed in the families of annual income of Rs 15000/- (Table V).

TABLE V : Association of income distribution of family with incidence of juvenile T waves.

<i>Annual income range (Rs)</i>	<i>Presence of juvenile T waves</i>	<i>Absence of juvenile T waves</i>	<i>Total</i>
5,000	5	24	29
5,000-10,000	4	27	31
10,000-15,000	4	9	13
15,000 and above	12	15	27
Total	25	75	100

$\chi^2 = 10.62$  at 3 d.f. ( $P < 0.02$ ) (Significant).

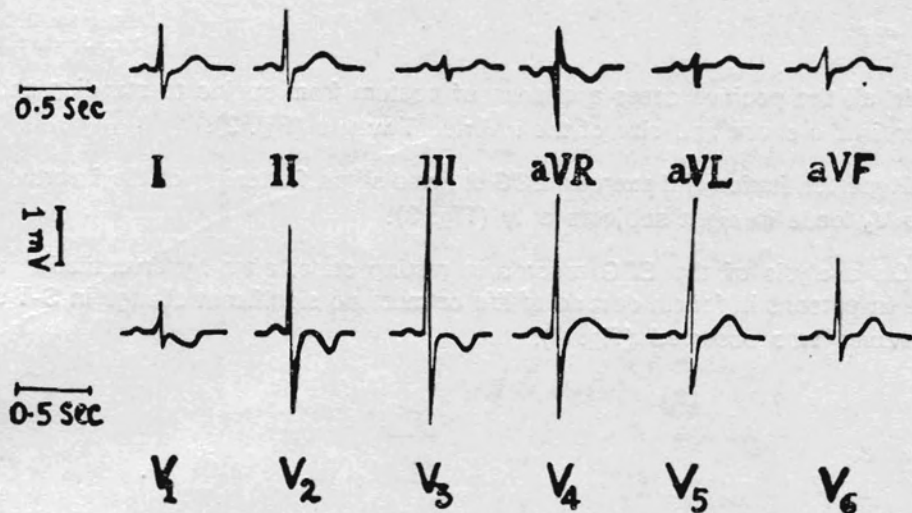


Fig. 2 : E.C.G. of the same boy in standing posture. No alteration in the shape and size of the inverted T waves in V<sub>1-3</sub>.

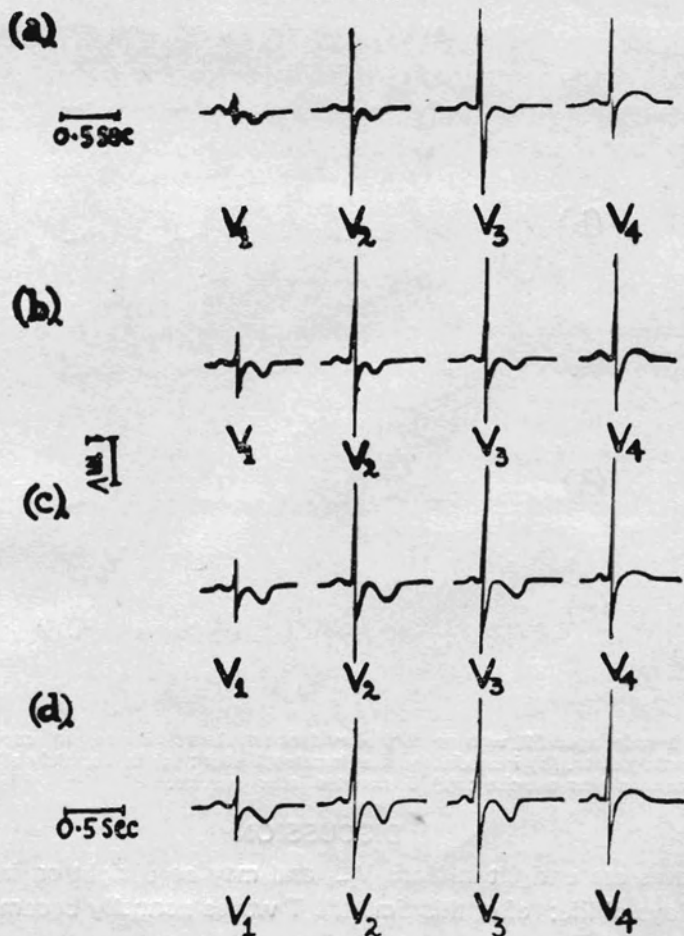


Fig. 3 : ECG of the same boy in supine posture : (a) immediately after hyperventilation; (b) immediately after exercise; (c) 2 minutes after exercise; (d) 5 minutes after exercise.

In all the positive cases a change of posture from supine to standing showed no alteration in the shape and size of the inverted T waves (Fig. 2).

Hyperventilation and exercise ECG showed slight flattening of the inverted T waves in  $V_1$  to  $V_3$  leads in eight subjects only (Fig. 3).

On analysis of the ECG records in resting state, after hyperventilation and after exercise in persons in fourth decade of life or more no significant change in S-T segments and T waves was observed (Fig. 4).

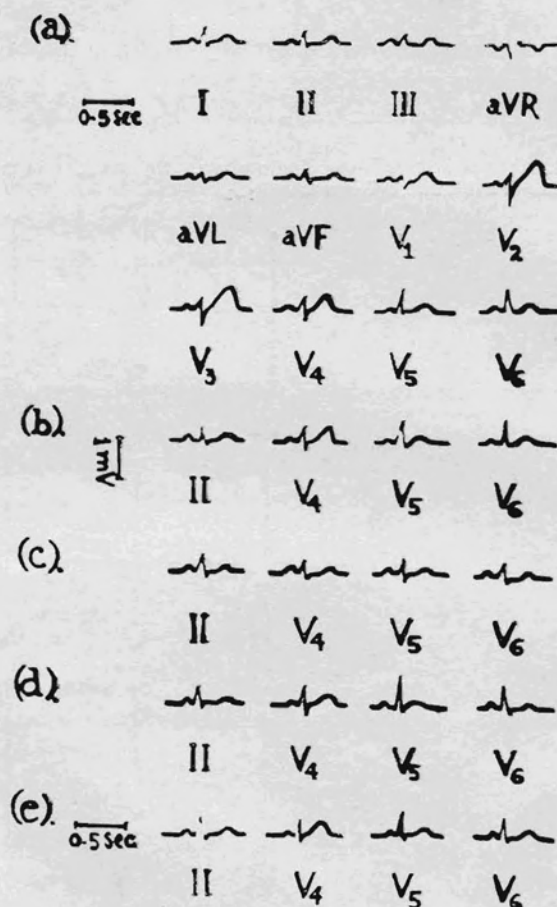


Fig. 4 : ECG of a male, aged 52, with no clinical evidence of heart disease, in supine posture : (a) in resting state, (b) immediately after hyperventilation; (c) immediately after exercise; (d) 2 minutes after exercise ; (e) 5 minutes after exercise.

#### DISCUSSION

The T waves are upright in leads  $V_2-6$  and may be upright or inverted in  $V_1$  lead within first 2-4 days of life; after this time the T waves normally become inverted in leads

$V_{1-4}$  (3, 4, 5, 13). Ziegler (14) observed that such T waves remained inverted upto 12 years of age. Patel *et al.* (8) studied 100 patients (excluding heart diseases) and found that juvenile pattern of T wave inversion was present in 61% of cases of 0 to 31 years of age. Shah *et al.* (10) found that in normal individuals incidence of juvenile T waves diminished as age advanced, but some subjects showed juvenile T waves even at 50 to 70 years of age.

In the present series, juvenile T waves in  $V_{1-4}$  leads were found in 25 subjects (89.28%) out of 28 subjects of 0 to 19 years age group. There was no incidence of juvenile T waves in subjects from 20 years onwards. Such inverted T waves in  $V_{1-4}$  leads were present in cent per cent subjects upto 9 years of age. Subjects of weight/height ratio less than 30% showed higher incidence of juvenile T waves. Rare association of silent and severe coronary atheroma with normal resting ECG in persons in fourth decade of life or more was excluded by recording ECG in such persons in resting state, after hyper-ventilation and after exercise.

Sehmi (12) emphasizes the relatively greater proportionate size of the right ventricle to the left in the children. This together with the shape of the chest and position of the heart may explain the genesis of negative T waves in the precordial leads in this age group (2).

The juvenile T wave is an inverted T wave descending slowly and rising abruptly to the base line (8). Thus the peak of the T wave is near the end of it and not at its beginning, producing an asymmetrical T wave.

T wave inversion is also common in ischaemic heart disease, right ventricular strain and digitalis therapy (6,8,9). In digitalized patient, ST segment is sagging with T wave inversion; in right ventricular strain and ischaemic heart disease T wave is symmetrically inverted with ST segment depression.

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