

Research Article

Study of electrocardiographic patterns in clinically normal persons above sixty years of age

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ABSTRACT

Background: The study was done to analyse the electrocardiographic patterns in the asymptomatic and clinically normal subjects over the age of sixty years and also to compare and discuss the significant of electrocardiographic changes noted in these persons with earlier observations quoted in the literature.

Methods: The study was carried out during a period of one year and a total 283 persons were examined 33 persons who were not fulfilling the criteria mentioned were excluded. Thus 250 clinically normal persons above the age of 60 years comprised the study group.

Results: 30% of males had a vertical heart while in females the predominant position was Intermediate (36%). 15.87% males and 19.35% females showed an anticlockwise rotation and majority of the subjects showed a normal position of the heart. Only 3 males and 4 females showed abnormal left axis deviation and 3 males and 1 female exhibited right axis deviation. Small P wave were observed in 5 males (3.96%) and 4 females (3.22%) while tall P waves were noted in 6 males (4.67%) and 2 females (1.61%). None of the subjects exhibited P-R interval less than 0.12 sec. More than 0.20 sec. was noted in 3 males. In a total of 76 persons (30.40%) QTC was prolonged, 42 were males (33.33%) and 34 females (26.77%).

Conclusions: Parameters such as position of the heart (rotation, P wave duration and amplitude, P-R interval and QRS duration etc) were within defined normal limits, except the prolongation of QTC observed in 30.40% of persons. A negative history and clinical examination of an old person is a fair indication of his normal cardiovascular status and slight deviation of an electrocardiogram need not arouse any undue anxiety either in the physician or the patient.

Keywords: ECG, Old age, P-R interval, QTC duration

INTRODUCTION

Ageing is inevitable, but to be old without being a burden to one's family is the essential aspects of the medical care extended to them. Whatever be the duration of life it must be fully functioning and useful.

Ageing without senescence would therefore be the natural desire of every of every old person. With the improvement in the public health Services, the life span of the population has improved considerably in the last century. The

population of the old persons above sixty rocketed upto 96 million in 2011 as compared to 77 million in 2001 and is expected to be 133 million in 2021.¹

Having aimed at "Health for all" by 2000 A. D. a physician cannot ignore this significant group. Since the diseases of the cardiovascular system are a major contributory factor for the disability in this age group, efforts are necessary to assess the cardiovascular status for prevention, early diagnosis and prompt treatment of these diseases. Objective evaluation of the heart disease

in the old is complicated especially in our country on account of poor history, weaker communication and paucity of modern investigatory tools.

Electrocardiography is a simple, easily available tool for the physician to assess the cardiac status especially for ischaemic heart disease, hypertensive heart disease, valvular heart diseases and asymptomatic arrhythmias. However he is always in a dilemma whether electrocardiographic abnormalities minor be given any importance or otherwise because the norms of electrocardiogram in the old have not been clearly defined, particularly in our country. In view of this it is proposed to study the electrocardiographic patterns in the asymptomatic and otherwise healthy persons above the age of 60 years.

Aims and objectives

1. To analyse the electrocardiographic patterns in the asymptomatic and clinically normal subjects over the age of sixty years.
2. To compare and discuss the significant electrocardiographic changes noted in these persons with earlier observations quoted in the literature.

METHODS

The study was carried out at Ashwini Rural Medical College & Research Centre (ARMCH & RC), Kumbhari, Solapur (Maharashtra). Old persons over the age of 60 years were examined. Age was determined according to history. Persons who were smokers, taking any medicines, had symptoms or past history of cardio respiratory disease, hypertension, ischaemic heart disease, cerebrovascular accidents were excluded from the study.

Subjects fulfilling the following criteria on clinical examination were included. Resting, supine blood pressure less than 140 mm of Hg systolic, and 95 mm of Hg diastolic in males and less than 160 mm of Hg systolic and 95 mm of Hg diastolic in females.² No signs of cardiac disease on clinical examination. Auscultation of the heart failed to reveal any abnormality in the heart sounds ok any murmur. Respiratory system was normal.

A 12 lead electrocardiogram was recorded in supine position after allowing the person to rest for 15 minutes and explaining the procedure. The tracings were analysed carefully with regard to heart rate, P amplitude and duration, P-R interval QRS duration and composition, QTC interval, ST segment and T wave abnormalities and any other abnormal electro-cardiographic pattern.

Following findings were regarded as normal –

1. P wave upright In lead II with a deflection of 0.5 mm to 2.5 mm and duration of 0.10 sec. or less.³
2. P-R interval from 0.12 sec. to 0.20 sec.⁴
3. QRS duration 0.10 sec in it's maximum.⁴
4. ST isoelectric or deviation on either side by less than 1 mm.³
5. T wave amplitude more than 50% of total QRS amplitude.

The frontal axis was determined according to Rowlands DJ.⁵ The heart rate was calculated from table 3.1 in principles of electrocardiography.⁴ QTC was determined according to normogram from Kissin and others⁶ reproduced by Goldman MJ⁴ and was called prolonged when it exceeded 0.43 sec. in women and 0.42 sec in men. The rotation of the heart was considered normal when transitional zone was observed in the neighbourhood of V4.⁴

Whenever an abnormal electrocardiogram was noted relevant investigations e.g. enzyme estimation, electrolyte estimation were done. The above observations were tabulated and conclusion was drawn.

RESULTS

The study was carried out during a period of one year from Feb. 2014 to Jan 2015. In total 283 persons were examined 33 persons who were not fulfilling the criteria mentioned were excluded. Thus 250 clinically normal persons above the age of 60 years comprised the study group.

Table 1: Showing age groups and sex distribution.

Age Groups in Years	Male (No. %)		Female (No. %)		Total (No. %)	
60-64	40	16.0	45	18.0	85	34.0
65-69	36	14.4	29	11.6	65	26.0
70-74	38	15.2	32	12.8	70	28.0
75-79	12	4.8	8	3.2	20	8.0
80 Onwards	--	--	10	4.0	10	4.0
Total	126	50.2	124	49.8	250	100

The group contained 126 males (50.2%) and 124 females (49.8). Number of males and females was nearly equal in all the age groups except those above 80 years which consisted of 10 females only.

Table 2: Showing averages and ranges of height, weight and skin fold thickness in various age groups.

Age Groups	Height in cms.		Weight in males		Weight in females		Skin fold thickness in mms	
	M	F	Kg. % of std. Wt.		Kg. % of Std. Wt.		M	F
60-40	157.32 (167-148)	147.31 (155-138)	46.53 (67.5-37)	75-79	41.33 (59.5-30)	80-84	5.82 (12-3)	5.15 (24-1)
65-69	162.11 (168-152)	147.93 (160-135)	47.2 (60-38)	75-79	38.36 (49-32)	75-79	4.97 (8-2)	4.20 (8-1)
70-74	161.05 (172-150)	147.56 (160-138)	47.03 (65-32)	75-79	39.98 (69-32)	80-84	4.97 (9-2)	4.59 (16-1)
75-79	158.50 (162-150)	148.13 (155-138)	46.75 (60.5-32)	75-79	34.69 (38-32)	70-74	4.58 (14-1)	2.25 (4-1)
80 onwards	----	141.9 (150-138)	----	----	35.15 (40-32.5)	75-79	----	2.7 (6.1)
Total	159.74 (172-148)	146.57 (160-135)	46.88 (67.5-32)	75-79	37.90 (75-79)		5.08 (14-1)	3.78 (24-1)

In all males weight for height was 75-79 percentage of standard weight and in female between the age of 60 to 64 years and 70 to 74 years it was 80-84 percentage of standard weight while in the females society of actuaries.⁷

Table 3: Showing position of the heart in different age groups.

Age Groups	60-64		65-69		70-74		75-79		Above 80		Total	
	M	F	M	F	M	F	M	F	M	F	M	F
Position	%	%	%	%	%	%	%	%	%	%	%	%
Vertical	11 (27.5)	6 (13.33)	13 (36.11)	6 (20.69)	12 (31.57)	8 (25)	2 (16.66)	7 (87.5)	-	-	38 (30.15)	27 (21.77)
Semivertical	2 5	5 11.11	7 19.44	5 17.24	3 7.84	5 15.62	-	-	-	-	12 9.52	15 12.09
Intermediate	9 22.5	18 40	7 19.44	15 51.72	15 39.47	9 28.12	5 41.66	-	-	3 30	36 28.51	45 36.29
Semihorizontal	7 17.5	7 17.5	6 16.66	1 3.44	-	6 18.75	3 25	-	-	5 50	16 12.69	19 15.32
Horizontal	11 27.5	9 20	3 8.33	2 6.89	8 21.05	4 12.5	2 16.66	1 12.5	-	2 20	24 16.66	18 14.52

Maximum number of males had a vertical heart while in females the predominant position was Intermediate.

Table 4: Showing rotation of the heart along longitudinal axis in different age groups.

Rotation Age Groups	Anticlockwise				Normal				Clockwise				Total Male	Total Female
	Male		Female		Male		Female		Male		Female			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
60-64	4	10.00	9	20.00	35	87.5	36	80.00	1	2.5	-	-	40	45
65-69	9	25	4	13.79	26	72.22	25	86.21	1	2.78	-	-	36	29
70-74	7	18.42	4	12.5	31	81.58	27	84.37	-	-	1	3.12	38	32
75-79	-	-	3	37.5	10	83.33	5	62.5	2	16.67	-	-	12	8
80 onwards	-	-	4	40.00	-	-	6	60.00	-	-	-	-	-	10
Total	20	15.8	24	19.35	102	80.95	99	79.85	4	3.17	1	0.80	126	124

Twenty males (15.87%) and 24 females (19.35%) showed an anticlockwise rotation and majority of the subjects showed a normal position of the heart.

Table 5: Showing axis distribution in different age groups.

Age Groups Axis	60-64		65-69		70-74		75-79		80 onwards		Total	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
	%	%	%	%	%	%	%	%	%	%	%	%
Less than -30°	3	3	-	-	-	1	-	-	-	-	3	4
	7.5	6.66				3.12					2.38	3.22
-30° to -15°	8	-	3	1	6	1	2	-	-	1	19	3
	20	-	8.33	3.44	15.78	3.12	16.66	-	-	10	15.07	2.41
0° to 90°	29	42	32	28	32	29	8	8	-	9	101	116
	72.5	93.33	88.88	96.55	84.21	90.62	66.66	100	-	90	80.15	93.54
More than 90°	-	-	1	-	-	1	2	-	-	-	3	1
	-	-	2.77	-	-	3.12	16.66	-	-	-	2.38	0.8
Total	40	45	36	29	38	32	12	8	0	10	126	124

Only 3 males and 4 females showed abnormal left axis deviation and 3 males and 1 female exhibited right axis deviation.

Table 6: Showing amplitude of P wave in various age groups.

P wave amplitude Age groups	Less than 0.5 mm				0.5mm up to 2.5mm				More than 2.5 mm				Total	
	M.	%	F.	%	M.	%	F.	%	M.	%	F.	%	M.	F.
	No.		No.		No.		No.		No.		No.		No.	No.
60-64	2	5	1	2.22	38	95	44	97.77	-	-	-	-	40	45
65-69	2	5.55	3	10.34	30	83.33	26	89.65	4	11.11	-	-	36	29
70-74	1	2.6	-	-	37	97.36	31	96.87	-	-	1	3.12	38	32
75-79	-	-	-	-	10	83.33	7	87.5	2	16.6	1	12.5	12	8
80 onwards	-	-	-	-	-	-	10	100	-	-	-	-	-	10
Total	5	3.9	4	3.22	115	91.26	118	95.16	6	4.76	2	1.6	126	124

Small P wave were observed in 5 males (3.96%) and 4 females (3.22%) while tall P waves were noted in 6 males (4.67%) and 2 females (1.61%).

Table 7: Showing P-R interval in different age groups.

P-R interval Age groups	Less than 0.12 sec.				0.12 to 0.20 sec				More than 0.20 sec.				Total	
	M.	%	F.	%	M.	%	F.	%	M.	%	F.	%	M.	F.
	No.		No.		No.		No.		No.		No.		No.	No.
60-64	-	-	-	-	39	97.5	45	100	1	2.5	-	-	40	45
65-69	-	-	-	-	34	94.44	29	100	2	5.5	-	-	36	26
70-74	-	-	-	-	38	100	32	100	-	-	-	-	38	32
75-79	-	-	-	-	12	100	8	100	-	-	-	-	12	8
80 onwards	-	-	-	-	-	-	10	100	-	-	-	-	-	10
Total	-	-	-	-	123	97.61	124	100	3	2.38	-	-	126	124

None of the subjects exhibited P-R interval less than 0.12 sec. More than 0.20 sec. was noted in 3 males.

Table 8: Showing number of persons with prolonged QTC.

Age groups	Male		Female	
	No.	%	No.	%
60-64	12	30	7	15.55
65-69	14	38.88	*10	35.70
70-74	15	39.42	10	31.25
75-79	1	8.33	3	33.75
80 onwards	-	-	4	40.00
Total	42	33.33	34	26.77

*Not measured in because of multiple ectopics.

In a total of 76 persons (30.40%) QTC was prolonged, 42 were males (33.33%) and 34 females (26.77%). A rise in percentage is apparent as age advances.

DISCUSSION

Electrocardiography has lately become one of the basic tools in investigating a case with cardiovascular Disease. Electrocardiograms may be interpreted by seeking a match between the observed pattern and one of large number of patterns previously found to be associated with various diseases. Therefore analysis of an abnormal

electrocardiogram would need standardization of electrocardiographic pattern in a particular situation.

The studies on electrocardiographic pattern in old person done in the past present a conflicting data. An attempt is therefore made to define a normal electrocardiographic pattern observed in clinically healthy old persons in this study, and compared with the observations of the other scientists. Significance of abnormal electrocardiographic patterns is discussed.

The study consisted of 250 persons (126 males and 124 females). A glance at Table 2 reveals that the subjects included in our study are below the average weight as defined by Jelliffe BB.⁷ Similarly they were of a lower weight than that of Pathak's Series¹ selected for similar purpose. The subjects from Pathak's series¹ belonged to higher socioeconomic group whereas our patients were mainly the villagers coming from poor socioeconomic group and hence the difference. There was no significant difference in the height in these two series.

The following electrocardiographic Observations are documented in our study and compared.

Position of the heart

Although in practice the electrical position of the heart does not signify pathological states in general and is known to vary from person to person due to body built, age, and body deformities, we observed Intermediate heart in 36 males (28.57%) and 45 females (36.29%), next in frequency was vertical heart in 38 Males (30.15%) and 27 females (21.11%) while horizontal heart was noted in 24 males (16.66) and 18 females (14.52%). Similar findings are reported by Simonson R. and keys A⁸ where 30% of the subjects had vertical heart and 16.8% had horizontal hearts.

The age groups of these persons was between 45 - 55 years and all were men.

	V + S V	I	H + S H
OUR SERIES	92	81	77
N=250	(30.8%)	(32.4%)	(30.8%)
Simonson series	91	59	52
N= 202	(45.1%)	(29.2%)	(25.7%)

V - Vertical, SV - Semivertical, I - Intermediate, H - Horizontal, SH - SEMihorizontal.

Rotation of the heart and axis deviation

Twenty males (15.87%) and 24 females (19.35%) exhibited anticlockwise rotation while clockwise rotation was demonstrated in 4 males (3.17%) and 1 female (0.80%).

This is in accordance with Blackburn H. et al⁹ who have noticed a marked trend of loss of R wave amplitude with

increasing age in all leads and a continuous decrease of S wave amplitude with age in right precordial leads thus shifting the junctional zone more towards the right i.e. anticlockwise. Simonson B¹⁰ has also reported that the QRS vector is rotated more anteriorly in older men. Left axis deviation i.e. axis less than -30° was observed in 3 males (2.38%) and 4 females (3.22%).

One male and one female amongst these had left anterior Hemiblock. Michie¹¹ has noted left axis deviation as a sole abnormality in 19 of his subjects, who had no history of heart disease. Mihalic¹² has reported it to be 11% in his series and McNamara³ as 42%. The findings of anticlockwise rotation and lesser percentage of left axis deviation are not in accordance to the commonly observed age trends. The previously reported series do not restrict only to clinically normal subjects and are from western countries. Simonson E^{8,13} has opined that overweight tends to accelerate the age trends and the effects is more as the age advances. Thus our subjects being in the underweight group, the commonly observed age trends of clockwise rotation and shift of the axis towards left are not observed.

Ostrander¹⁴ has observed a significant increase in morbidity and mortality due to heart disease in those who had abnormal left axis deviation even as the only abnormality. Right axis deviation was noted in 3 males and 1 female. The female had associated RBBB and all the males had right ventricular hypertrophy.

P wave amplitude

P wave amplitude less than 0.5 mm in lead II was noted in 5 males (3.96%) and 4 females (3.22%). This is comparable to that reported by McNamara³ who had not found a single case in his series of 100 subjects. Jensen¹⁵ noted normal P waves in 49 persons and almost isoelectric in only one case. However Taran¹⁶ had noted low P waves in lead II in as many as 20 persons in a total of 102, and he has attributed the change as an evidence of myocardial damage. Six males (4.76%) and 2 females (1.61%) showed P waves more than 2.5 mm. In 4 males and 1 female it was the sole abnormality and in remaining 2 males had associated right ventricular hypertrophy and remaining female had right bundle branch block. Isolated single abnormality of tall P wave may be passed as normal in the old age group.

P-R Interval

Prolongation of P-R interval was noted in 3 males and in none of the females. One male had an associated left ventricular hypertrophy, the other had right ventricular hypertrophy and in the remaining it was the sole abnormality. This is low frequency is in accordance with Jensen¹⁵ who had noted P-R interval between 0.12 sec. to 0.14 sec in 4, 0.15 sec to 0.19 sec in 43 and 0.20 sec in 3 persons, and Gelman I, Brown S¹⁷ who had observed in 2 cases amongst the group of 60. Michie¹¹ reported it in 3%

of the subjects and Pathak¹ has not reported a single case. However Simonson R¹³ has observed a significant increase in P-R interval of about 0.01 sec. occurring from 3rd to 6th decade and his findings are substantiated by Pipeberger H. V. et al¹⁸, Keys A. et al.¹⁹ Significant shorter duration of P-R interval in female as reported by Simonson E²⁰, was not noted in this series. Life Expectancy following the diagnosis of first degree heart block varies widely depending upon the underlying cause rather than the abnormality itself^{21,12} and under these circumstances either as short or prolonged P-R interval should be regarded as of clinical significance.

Prolongation of QTC Interval

A significant observation in this study was Prolongation of QTC noted in 42 males (33.33%) and 34 females (26.77%). A progressive rise in percentage was noted in females as the age advances. In males similar trend was noted upto 74 years of age and the last group which was small¹² showed a decline. This is in consistence with Simonson E¹³ who reported a significant increase of 0.01 sec. from 3rd to 6th decade.

Schlomka et al.²² have also reported a Prolonged QT interval in 196 older patients who were obese as well hypertensive. No reports were noted showing any other significant finding regarding QTC interval are cerebrovascular disease, drug administration, alcoholism, Hypothermia, click systolic murmur syndrome, myocarditis and hypothermia²³ and can be detected with reasonable accuracy on clinical examination and cannot be attributed to the abnormality observed here. Hence prolongation of QTC is considered as an age trend.

CONCLUSIONS

1. The parameters such as position of the heart, rotation of the heart, axis, P wave duration and amplitude, P-R interval and QRS duration and amplitude are within defined normal limits, except the prolongation of QTC observed in 30.40% of persons.
2. A negative history and clinical examination of an old person is a fair indication of his normal cardiovascular status and slight deviation of an electrocardiogram need not arouse any undue anxiety either in the physician or the patient.

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