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Cardiovascular Changes in Elderly

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ABSTRACT

There have been many studies of arterial pressure in the apparently healthy population, but few have been primarily concerned with the elderly (Anderson and Cowan 1959).In healthy older persons systolic pressure rise is slight with age, while diastolic pressure is fairly constant but both remain within the average normal limit for any age. Therefore an old person whose blood pressure especially the diastolic is above these limits should be considered hypertensive.64 elderly, apparently healthy subjects were selected age ranging from 60 years and above. Out of these 60 cases, 33 cases were male subjects and 31 cases were female subjects. All the subjects belong to the "Home for the aged" situated in Ahmedabad City.60 young subjects were selected for control group, age ranging from 20 years to 30 years, 30 cases of male subjects and 30 cases of female subjects.Blood pressure and electrocardiographic changes are studied in all the subjects. Blood pressure is higher in geriatric subjects as compared to young adults

KEYWORDS: heart rate, blood pressure, ECG & geriatric subject

Introduction

The ageing process is a biological phenomenon common to all living organism. The causes and consequence of ageing of population is many complexes and intertwined so that their study is difficult and demand interdisciplinary approach.Gerontological research has developed exponentially in recent years with a literature explosion that already resist digestion. Most of the advances have however been made along the lines of scientific disciplines, such as in cellular ageing, sociology of ageing, demographic changes, physiological, psychological or economic sequence and so on. From the graph we can see the most outstanding ailments of the old are found under cardiovascular system. Vascular changes set imperceptibly in all organs. The various organs of the body then account of deficient oxygenation with consequence failure of their function. The cardiovascular disorders of aged are most noteworthy. Many studies have been done to know "What are the changes on cardiovascular system as aged advances?" It seemed wise to review the evidenced presented on this question during the last decade and to refer briefly to entire work whenever necessary .The purpose of these studies is to extend the results on the effect of ageing on cardiovascular system.

Among the cardiovascular disorders of the aged, hypertension forms a prominent group. This is common normal abnormality in each and every old person. Blood pressure recording is very important in clinical practice. Due to abnormal blood pressure i.e. hypertension, there are many chances of major disease which leads to death. So, we have taken interest in noting the normal range of blood pressure among aged person. We have also taken electrocardiogram readings to reveal the abnormalities of heart.

MATERIAL AND METHOD

64 elderly, apparently healthy subjects were selected age ranging from 60 years and above. Out of these 60 cases, 33 cases were male subjects and 31 cases were female subjects. All the subjects belong to the "Home for the aged" situated in Ahmadabad City.60 young subjects were selected for control group, age ranging from 20 years to 30 years, 30 cases of male subjects and 30 cases of female subjects. First their names, age and previous occupation was noted. Chief complains like chronic cough, breathlessness, palpitation, history of chest pain, history of hemiplegia and history of old heart attack is inquired and presence or absence of it is noted. Family history of such complaints past history for smoking, drinking and chewing tobacco is inquired and noted personal history is noted. After taking thorough history, general examination of the subject and cardiovascular examination is done.

Following parameters are noted.

Pulse and blood pressure were noted. For electrocardiogram, all the three cords are tied to RA, LA, l and earthling is tied to RL, other end of all these cords are tied to electrocardiogram portable machine and after taking STD., all the six limb leads L_1, L_2, L_3, aVR, aVL, aVF are taken and reading of ECG is done for rate, rhythm, P-wave, P-R interval, QRS complex, Q-T interval, ST segment and T wave. Any gross abnormalities are also noted.

OBSERVATION AND RESULTS

TABLE-I

HR, BP in Adult and Geriatrics (Male)

	Adult N=30	Geriatrics N=33	P Value
Heart Rate/min	74±11.2	80.7±13.5	More than 0.05
Systolic BP mmHg	120±3.3	141.6±21.0	Less than 0.01
Diastolic BP mmHg	80±2.3	82.9±9.3	More than 0.05

Table-I shows heart rate (HR) and blood pressure (B.P.) of adult and geriatric male subjects. In adult male; heart rate is 74 ± 11.2 / minute, systolic blood pressure is 120.7 ± 13.5 mmHg and diastolic blood pressure is 80.7 ± 2.3 mmHg while in geriatrics male subjects; heart rate is 80.7 ± 13.5/minute, systolic blood pressure is 141.6 ± 21.0 mmHg and diastolic blood pressure is 82.9 ± 9.3 mmHg.

P value of heart rate is greater than 0.05, so it is not significant while of systolic blood pressure is less than 0.01, which is highly significant and of diastolic blood pressure is greater than 0.05 which is not significant.

TABLE-II

HR, BP in Adult and Geriatrics (Female)

	Adult N=30	Geriatrics N=31	P Value
Heart Rate/min	88±12.2	90.2±11.3	More than 0.05
Systolic BP mmHg	120±3.3	144.6±22.6	Less than 0.01
Diastolic BP mmHg	81.3±1.8	79.3±9.7	More than 0.05

Table-II shows heart rate (HR) and blood pressure (B.P.) of adult and geriatric female subjects. In adult female subjects; heart rate is 88 ± 12.2/ minute, systolic blood pressure is 120 ± 3.3 mmHg and diastolic blood pressure is 81.3 ± 1.8 while in geriatric female subjects; heart rate is 90.2 ± 11.3/minute, systolic blood pressure is 144.6 ± 22.6 mmHg and diastolic blood pressure is 79.3 ± 9.7 mmHg.

P value of heart rate more than 0.05, so it is not significant while of systolic blood pressure is less than 0.01, which is highly significant and of diastolic blood pressure it is more than 0.05, which is not significant.

TABLE-III
HR, BP in Geriatrics Male and Female

	Adult N=33	Geriatrics N=31	P Value
Heart Rate/min	80.7±13.5	90.2±11.3	Less than 0.01
Systolic BP mmHg	141.6±21.0	144.6±22.6	More than 0.05
Diastolic BP mmHg	82.9±9.3	79.3±9.7	More than 0.05

Table-III shows heart rate (HR) and blood pressure (B.P.) of geriatrics male and female subjects. In adult male subjects heart rate is 80.7 ± 13.5 / minute, systolic blood pressure is 141.6 ± 21.0 mmHg and diastolic blood pressure is 82.9 ± 9.3 mmHg, while in female subjects; heart rate is 90.2 ± 11.3 / minute, systolic blood pressure is 144.6 ± 22.6 mmHg and diastolic blood pressure 79.3 ± 9.7 mmHg.

P value of heart rate is less than 0.01, so it is highly significant while of systolic blood pressure is more than 0.05, which is not significant and of diastolic blood pressure it is also more than 0.05, which is not significant.

TABLE-IV
HR, BP in Age Group in years in Male

	60-70 years N=18	71-80 years N=15	P Value
Heart Rate/min	77±11.6	83.9±14.5	More than 0.05
Systolic BP mmHg	142.4±21	140.8±21.06	More than 0.05
Diastolic BP mmHg	83.1±10.5	82.8±7.7	More than 0.05

Table-IV shows heart rate (HR) and blood pressure (B.P.) according to age group in male subjects. In the age group 60-70 years heart rate is 77 ± 11.6 / minute, systolic blood pressure is 142.4 ± 21 mmHg and diastolic blood pressure is 83.1 ± 10.5 mmHg, while in 71-80 years group; heart rate is 83.9 ± 14.5/minute, systolic blood pressure is 140.8 ± 21.06 mmHg and diastolic blood pressure is 82.8 ± 7.7 mmHg.

P value of heart rate, systolic blood pressure and diastolic blood pressure is more than 0.05, which is not significant.

TABLE-V
HR, BP Age group in years in Female

	60-70 years N=20	71-80 years N=11	P Value
Heart Rate/min	87.9±11.0	94.2±10.6	More than 0.05
Systolic BP mmHg	147±19.1	140.3±27.8	More than 0.05
Diastolic BP mmHg	78±8.9	80.5±11.0	More than 0.05

Table-V shows heart rate (HR) and blood pressure (B.P.) according to age group in female subjects. In the age group 60-70 years; heart rate is 87.9 ± 11.0 / minute, systolic blood pressure is 147 ± 19.1 and diastolic blood pressure 78 ± 8.9 mmHg, while in 71-80 years group; heart rate is 94.2 ± 10.6, systolic blood pressure is 140.3 ± 27.8 mmHg and diastolic blood pressure is 80.5 ± 11.0 mmHg.

P value of heart rate, systolic blood pressure and diastolic blood pressure is more than 0.05, which is not significant.

TABLE-VI
ECG readings in Adult and Geriatric Male

	Adult, N=30		Geriatric, N=33	
	Duration in second	Voltage mV	Duration in second	Voltage mV
P wave	.08±0	.1±.05	.07±.02	.1±.06
QRS Wave	.05±.02	.7±.5	.06±.02	.5±.3
T Wave	.09±.03	.2±.1	.10±.02	.2±.2
PR Interval	.14±.02		.14±.02	
QT Interval	.15±.02		.15±.02	

Table-VI shows Electrocardiographic (ECG) readings of adult and geriatric male subjects. In adult subjects; duration of P wave is .08 seconds, QRS wave is .05 ± .02 seconds, T wave is .09 ± .03 seconds and voltages of P wave is .1 ± .05 mv, QRS wave is .7 ± .5 mv, T wave is .2 ± .1 mv. And PR interval is .14 ± .02 seconds, QT interval is .15 ± .02 seconds, while in geriatric subjects; duration of P wave is .07 ± .02 seconds, QRS wave is .06 ± .02 seconds, T wave is .10 ± .02 seconds and voltages of P wave is .1 ± .06 mv, QRS wave is .5 ± .3 mv, T wave is .2 ± .2 mv and PR interval is .14 ± .02 seconds and QT interval is .15 ± .02 seconds.

TABLE-VII
ECG readings in Adult and Geriatric Female

	Adult, N=30		Geriatric, N=31	
	Duration in second	Voltage mV	Duration in second	Voltage mV
P wave	.06±.02	.1±0	.07±.01	.01±.05
QRS Wave	.05±.01	.8±.3	.04±.01	.06±.3
T Wave	.12±.02	.2±.08	.10±.03	.3±.4
PR Interval	.11±.01		.14±.02	
QT Interval	.15±.03		.23±.05	

Table-VII shows electrocardiographic (ECG) readings of adult and geriatric female subjects. In adult subjects; duration of P wave is .06 ± .02 seconds, QRS wave is .05 ± .01 seconds, T wave .12 ± .02 seconds and voltages of P wave is .1 ± 0 mv., QRS wave is .8 ± .3 mv, T wave is .02 ± .08 mv and PR interval is .11 ± .01 seconds and QT interval is .15 ± .03 seconds while in geriatric subjects; duration of P wave is .07 ± .01 seconds, QRS wave is .04 ± .01 seconds, T wave is .10 ± .03 seconds and voltage of P wave is .01 ± .05 mv, QRS wave is .06 ± .3 mv., T wave is .3 ± .4 mv. And PR interval is .14 ± .02 seconds and QT interval is .23 ± .05 seconds.

TABLE-VIII
ECG readings in Geriatric Male and Female

	Male, N=33		Female, N=31	
	Duration in second	Voltage mV	Duration in second	Voltage mV
P wave	.07±.02	.1±.06	.07±.01	.01±.05
QRS Wave	.06±.02	.5±.3	.04±.01	.06±.3
T Wave	.10±.02	.2±.2	.10±.03	.3±.04
PR Interval	.13±.02		.14±.02	
QT Interval	.23±.04		.23±.05	

Table-VIII shows electrocardiographic (ECG) readings of geriatric male and female subjects. In male subjects; duration of P wave is .07 ± .2 seconds, QRS wave is .06 ± .02 seconds, T wave is .10 ± .02 seconds and voltages of P wave is .1 ± .06 mv, QRS wave is .5 ± .3 mv, T wave is .2 ± .2 mv and PR interval is .13 ± .02 seconds, QT interval is .23 ± .04 seconds while in female subjects; duration of P wave is .07 ± .01 seconds, QRS wave is .04 ± .01 seconds, T wave is .10 ± .03 seconds and voltage of P wave is .01 ± .05 mv, QRS wave is .06 ± .3, T wave is .3 ± .04 mv and PR interval is .14 ± .02 seconds and QT interval is .23 ± .05 seconds.

TABLE-IX
Percentage of ECG abnormalities in geriatrics Male and Female

	Male N=33	Female N=31
Normal	42.4%	70.9%
Abnormal	57.6%	29.1%

Table-IX shows percentage of electrocardiographic abnormalities in geriatric male and female subjects. In male subjects; 42.4% are normal and 57.6% are abnormal while in female subjects; 70.9% are normal and 29.1% are abnormal.

DISCUSSION

Present study consists of 60 normal young subjects and 64 apparently healthy elderly subjects. The present study shows that in normal young subjects systolic blood pressure is 120 ± 3.3 mmHg while diastolic blood pressure is 80.6 ± 2.3 mmHg. In geriatrics subjects, systolic blood pressure is 143.1 ± 22.6 mmHg and diastolic blood pressure is 81.1 ± 9.7 mmHg.

Best and Taylor in physiological basis of Medical Practice states that age exerts a definite influence upon the blood pressure. A slow steady but gradual rise takes place from adolescence to old age even in healthy persons. The average value for normal young subjects for systolic blood

pressure is 120 mmHg; while diastolic blood pressure is 80 mmHg and in geriatric subjects systolic blood pressure is 140 mmHg and diastolic blood pressure is 87 mmHg.

Our values coincide very well with the values of Best and Taylor for both normal and geriatric subjects. In our study diastolic blood pressure is little lower than the value given by Best and Taylor, but it falls within the range.

According to Richard et al in healthy adult subjects, the systolic blood pressure is 120 ± 13.7 mmHg and diastolic blood pressure is 76 ± 9.9 mmHg. These values are similar to our values. In elderly people in his study systolic blood pressure is 142 ± 21.2 mmHg and diastolic blood pressure is 85 ± 12.4 mmHg. These values coincide with our results.

Our study shows that systolic blood pressure in elderly male subjects is 141.6 ± 21 mmHg and diastolic blood pressure is 82.9 ± 9.3 mmHg while in elderly female subjects systolic blood pressure is 144.6 ± 22.6 mmHg and diastolic blood pressure is 79.3 ± 9.3 mmHg.

The study of Richard P.Lasser and Arthur M.Master shows that at the age of 60-64 years systolic blood pressure is 142 ± 21.1 mmHg and diastolic blood pressure is 85 ± 12.4 and in female subjects, systolic blood pressure is 144 ± 22.3 mmHg and diastolic blood pressure is 85 ± 13.0 mmHg. The value for systolic blood pressure in male and female subjects and diastolic blood pressure of male subjects are comparable to the results of Richard et al. However, the diastolic blood pressure in female subjects shows difference of 6 mmHg, when compared to the work of Richard et al.

W.F.Anderson and N.R.Cowan show that in male subjects at the age of 60-64, systolic blood pressure is 153 ± 17.8 mmHg and diastolic blood pressure is 85.8 ± 8 mmHg while in female subjects systolic blood pressure is 157.3 ± 19.6 mmHg and diastolic blood pressure is 85.5 ± 8.2 mmHg respectively. Here systolic blood pressure value is slightly higher, but the range is equal to our study. Diastolic blood pressure is very nearer to our study. The difference being only of 1 to 2 mmHg.

Present study regarding electrocardiogram show that in geriatric male subjects, percentage of abnormal record of electrocardiogram in male subjects is 57.6% and in female subjects the percentage record of abnormal electrocardiogram is 29.1%. In our study percentage of abnormalities in electrocardiogram is 43.3%; prolonged PR interval – suggestive of delayed A-V conduction in 3.1%, ST segment depression – suggestive of ischaemic heart disease in 18.7%, prolonged QRS complex in 3% and low voltage ECG in 7.8%.

Theodore T.Fox[42] et al show that 66.7% of electrocardiogram is abnormal. Out of these 33.6% show ST segment depression. Our study show only 43.3%. Main abnormality is ST depression.

The difference in percentage of abnormality of electrocardiogram in our study and Theodore T.Fox et al study is perhaps due to the fact that we have taken apparently healthy subjects aged 60 years, while he has done the random selection of the subjects.

R.J.McNamara stated that "as indicated in table abnormal electrocardiogram have been found in widely varying proportion of apparently normal elderly persons." These results probably can be accounted for on the basis of different purpose of the study and criteria in selection of case materials, as well as subjective variations in reporting of electrocardiogram in aged persons.

Series	No. of cases	Age Group	% Abnormal ECG
Willius	700	75-96	54.5
Jenson, Smith & Cartwright	50	50-65	0
Gelman & Brown	60	61-100	30
Duthoit, Warenburg & Pinchart	116	60-88	98
Lohr & Tillmanns	162	51-90	41
Warnecke	70	65-88	54
Levitt	100	70 & over	26
Elaiser and Kondo	100	70 & over	85
Fox, Klements & Mandel	300	60-100	66
Taran & Kaye	102	60-90	64
Fox, Weaver & Francis	300	60-90	49
Our study	64	60-80	43.3

All the above studies confirm that when there is a hypertension and cardiac enlargement, there is a definitely abnormal electrocardiogram.

R.J.McNamara stated that physiological tissue change of normal ageing is as follows :

1. Gradual tissue desiccation.
2. Gradual retardation of cell division, capacity of cell growth and tissue repair.
3. Gradual retardation in the rate of tissue oxidation (lowering of the basal metabolic rate).
4. Cellular atrophy, degeneration, increased cell pigmentation and fatty infiltration.
5. Gradual decrease in tissue elasticity and degenerative changes in the elastic connective tissue.
6. Decreased speed, strength and endurance of skeleto-neuromuscular reactions.
7. Decreased strength of skeletal muscle.
8. Progressive degeneration and atrophy of the nervous system, impaired vision, hearing, attention, memory and mental endurance.

In the elderly people, therefore abnormal electrocardiogram might be due to the functional changes in the myocardiogram. So even before changes in structure of heart or even before symptoms develop there may be abnormal electrocardiogram.

SUMMARY AND CONCLUSION

The present study includes the examination of 60 young subjects of 20 to 30 years of age (Male-30 and female-30) and 64 apparently healthy geriatric subjects of 60 to 80 years of age (Male-33 and female-31).

In geriatric female systolic blood pressure is slightly higher than geriatric Blood pressure and electrocardiographic changes are studied in all the subjects. Blood pressure is higher in geriatric subjects as compared to young adults male. Diastolic blood pressure in geriatric subjects is not much affected as compared to systolic blood pressure.43.3% of the apparently healthy geriatric subjects show abnormal electrocardiographic record.3.1% shows prolonged PR interval and 18.7% shows ST segment depression.

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