Geriatric Cardiac Axis Deviation in Response To Exercises

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ABSTRACT

The purpose of this study was to investigate the effect of exercises on cardiac axis deviation in elderly people. The study was conducted on thirty volunteers elderly subjects with an average age of 70 years old. An ECG record of the subjects before and after special training program for twelve weeks was taken. Analysis of the ECG was done to find the cardiac axis deviation. The results showed a significant difference between the axis deviation of before and after twelve weeks of exercise. These deviation were to the left side. The range of the deviation was within the normal values.

INTRODUCTION

There are a number of changes in cardiovascular system with aging. The most significant changes of the aged cardiovascular system fall into two categories: **a-** changes of the vascular system . **b-** changes of the heart[1].

Changes of the vascular system with age include the thickening of the supporting membranes of the vessels including capillaries, and elongation, tortuous and calcification due to deposition of starch like materials on the vessels wall[2]. There is a decrease of the sympathetic responsiveness of the smooth muscles of the vascular tissues in people of old age[3].

Aging has a direct effect on blood pressure. Both systolic and diastolic blood pressure tends to be increased. The changes of the mean arterial blood pressure is predominantly in systolic pressure[4]. The increase of blood pressure in elderly could be due to the loss of elasticity in the walls of the large arteries which increase the systolic and decrease the diastolic[5]. The stroke volume decreases 0.7 % a year after the age of 20 years old and this will reduce the cardiac output from approximately 5 liters \ minute at age of 20 years to 3.5 liters\minute at age of 75 years old[6].

Body mass also affect the cardiac axis deviation and it is a change of body fat and water content. Dehydration is a common consequence of aging especially during exercise[7].

The progressive reduction in physical activity usually observed in aging is the major determinant of exercise deconditioning. Regular exercise may promote a high level of physiological functioning even into 7^{th} and 8^{th} decades[8]. The importance of exercises and physical activity in old ages is to reduce the risk factors as cardiovascular and pulmonary

diseases, osteoporosis, depression, obesity impairment of cerebral functions and diseases of musculoskletal system[6]. The elderly people need cardiovascular training and instructions concerning appropriate activities under the supervision of the specialists in exercise physiology and physical therapy[9].

In advancing age, left axis deviation of the QRS. of the ECG can occur in the absence of clinical heart diseases[10].

In normal elderly during systolic time the pressure rises in the whole cardiovascular system. When the left ventricle becomes hypertrophied the cardiac axis may swing to the left side so that the QRS. of the ECG becomes predominantly negative in lead III. Left axis deviation is not significant until QRS deflection is also predominant negative in lead II[11].

The normal QRS axis deviation of the ECG lies between -30° and 110°. The mean electrical axis of the ventricles averages approximately 59° degrees.This axis can swing to the left or to the right in the normal heart. The abnormal left axis deviation lies between -30° and -90° and the right axis deviation between +110° and +180° are generally abnormal[12,13]. In advancing age left axis deviation of the QRS can occur in the absence of clinical heart diseases[10].

MATERIALS AND METHODS

Subjects:

Thirty subjects were involved for the study. Their age ranged between 65-75 years old. The subjects were examined by physician and they were medically free from any disease that might affect the exercise or the test.

Instrumentation:

A single channel Eta 150 ECG machine was used for recording of the QRS waves for lead I and lead III.

Sphygmomanometer was used to evaluate the blood pressure in mm/Hg.

Procedures:

The subject were in supine position with the limb electrodes fixed to the right arm, left arm, left leg and the earth was fixed to the right leg.

The record of ECG was done before exercise, after six weeks and after twelve weeks and the cardiac axis was measured.

Blood pressure was measured to evaluate the systolic and diastolic changes in response to exercise in elderly.

The total period of the exercise program was three sessions per/week for 12 weeks. Weight and height was taken before recording.

Stages of the test and exercise program:

Warm up phase for 5 minutes.: the subject from standing position started to move his arms and legs in slow motion, then the arms moved for upward motion of flexion and extension of the shoulder with elbow extension for ten times for each exercise.

Training phase: cycling for 10 minutes (as a free cycling).

Cooling down phase: alternating flexion and extension of hip and knee to the right angle for both lower limbs., alternating abduction and adduction of the hip joint with

the knee extension for 5 minutes (ten times each exercise).

Measurement of cardiac axis deviation: **(Fig.1)**

a) The R wave of the QRS was measured from the ECG in lead I and lead III.
b) The S wave of the QRS was measured from the ECG in lead I and lead III.
c) The values of the R wave was subtracted from the S wave in lead I and lead III.

The Einthoven diagram was used to find the value of QRS axis deviation by measuring the value of lead I which resulted from the subtraction of S from R and the same in lead III. A perpendicular was droped from the point of lead I and also another perpendicular was droped from lead III, a line is drawn through the point of intersection of the two vectors of the leads to the center of the diagram. The angle between this line and the base line is the cardiac axis deviation of the QRS .

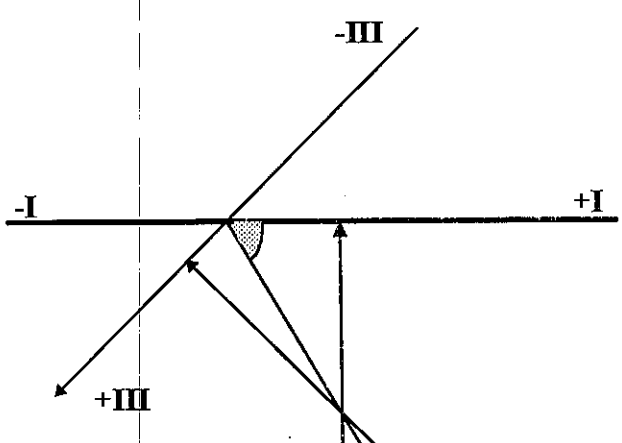

Figure (1): Measurement of cardiac axis deviation.

Statistical analysis:

Student t-test was used to determin the significance of difference between pre test and post test axis deviation, and blood pressure values at the level of p 0.05.

RESULTS

The cardiac axis deviation during resting before starting the exercise program was 34.0° ± 25.7°. After six weeks the cardiac axis deviation changed to 27.27° ± 24.9 which mean a left axis deviation . This results was found to be not significant. The test was continued for another six weeks which mean a total period of 12 weeks.

The results has been changed to a significant value and the mean cardiac axis has changed to 23.2° ± 23.27° to the left side. The blood pressure was found to be significantly changed after exercise for both the 6 weeks and 12 weeks.The mean and standard deviation of the systolic blood pressure before exercises was 133.17 ± 12.76 mmHg and decreased to 129.83 ± 12.06 mmHg after 6weeks then changed to 127.5 ± 11.35 mmHg after 12 weeks of ergometric exercise.

The diastolic blood pressure was 82.33 ± 5.04 mmHg before exercise and decreased to 81.33 ± 4.72 mmHg after 6 weeks and to 80.17 ± 3.34 mmHg after12 weeks of ergometric exercise .The results showed a significant difference at the level of $p < 0.05$. (Table 1 and Figure 2).

Table (1): The Mean and standard deviation of the cardiac axis and blood pressure in elderly before and after 6 & 12 weeks of exercises.

Variable	Mean+SD Before	Mean+SD After 6 W	Mean+SD After 12 W
Cardiac Axis	34.00±25.7	27.27±24.9	23.2±23.2*
Systolic B.P	133.17±12.8	129.8±12.6*	127.5±11.4*
Diastolic B.P	82.33±5.0	81.33±4.72*	80.17±3.34*

Cardiac axis recorded in degrees.
Blood pressure records in mmHg..
* Significant at $p < 0.05$

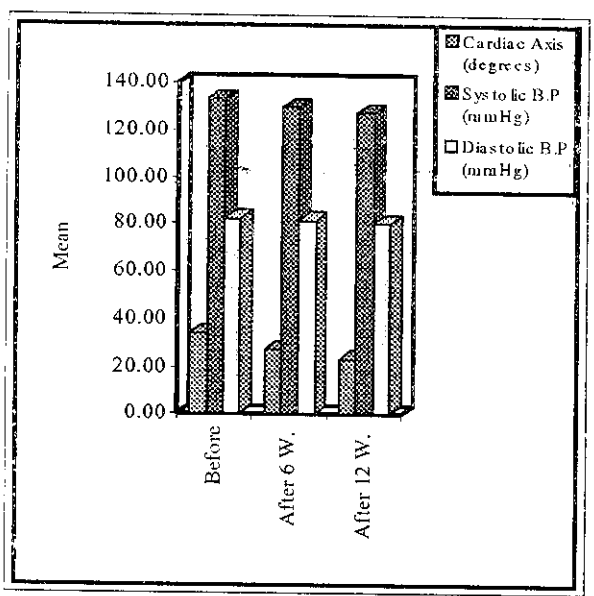

Fig. (2): The mean values of various parameters before and after ergometric exercise.

DISCUSSION

As it was mentioned by Otto and James[6] the stroke volume decreases to 0.7% a year after the age of 20 years old .These will reduce cardiac out put approximately 3.5 liters / minute at the age of 75 years old.These changes will affect cardiac axis deviation. With exercise the electrical cardiac axis deviation moves to the right or left. With age the mean cardiac axis during rest was 34.0° ± 25.7 that means a deviation to the left side. After exercise the cardiac axis deviation was found to be 23.2 ° ± 25.27 to the left side. The effect of exercises on cardiac axis deviation showed a significant value relatively to the pre-test records as it was 34.0° ± 25.71 after 6 weeks of ergometric exercises which changed to 23.2° ± 23.27 after 12 weeks of exercise. The standard deviation was large in axis deviation because the electrical cardiac axis deviation varies between positive values and negative values (-30 and + 110.)

For the blood pressure there was a significant change after 12 weeks of exercise it has been changed from 133.17 ± 12.8 mmHg to 127.5 ± 11.4 after 12 weeks of exercise in systolic blood pressure and the diastolic has changed from 82.33 ± 5.0 mmHg to be 80.17 ± 3.34.

The changes of the cardiac axis deviation might be due to the increase of the strength and endurance of the cardiac muscles which in turn affect the power of contraction leads to changes of the cardiac axis deviation .The direction of axis to the right or to the left will be suggested by the exercises needed to rehabilitate patient or improves the ordinary people.

Changes of cardiac axis deviation in response to exercise proves the idea of the effect of activities on elderly people which was mentioned by Joi and Linda[8].

Reduction of the risk factors of inactivity by exercise as stated by Lunardi et al[9] proved by the improvment of blood pressure in elderly people in this work.

It was concluded from this work that the calculation of cardiac axis deviation from ECG records will determine if the elderly people can be improved or not by using a noninvasive evaluation method. As it was shown in this work that blood pressure and cardiac axis deviation is a save evaluation of progressive active exercise.

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الملخص العربى

زاوية انحراف القلب استجابة للتمرينات فى المسنين

الهدف من البحث :

اجريت هذه الدراسة لمعرفة تاثير التمرينات على زاوية انحراف القلب فى المسنين وذلك من خلال استخدام جهاز رسام القلب الكهربائى وكذلك قياس ضغط الدم.

مواد واساليب البحث :

اشترك فى هذه الدراسة ثلاثون مسنا متطوعين تتراوح اعمارهم بين ٦٥و٧٥عاما تم عمل رسام القلب لهم لتحديد زاوية القلب باستخدام شكل اينتهوفن وكذلك قياس ضغط الدم.

قامت العينة بعمل تمرينات مكونة من :

- ٥ دقائق تسخين بتمرينات للذراعين والساقين
- ١٠ دقائق تمرينات على الدراجة الثابتة
- ٥ دقائق تهدئة بتمرينات للذراعين والساقين

وقد اظهرت الدراسة النتائج التالية :

هناك تاثير واضح للتمرينات على زاوية انحراف القلب فى المسنين فقد اتجهت الزاوية تجاه اليسار كما انخفض ضغط الدم.

وعليه يمكن استنباط الاتى :

يحتاج المسن لعمل التمرينات بصفة مستمرة ولكن يجب تقييمه باستمرار لمتابعة تحسن حالة القلب بطريقة آمنه وهى غير مكلفه وهو قياس زاوية انحراف القلب وضغط الدمز