The Effect of Aerobic Training on Elderly Male Ambulant Hemiplegic Patients

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ABSTRACT

The purpose of this study was to investigate the influence of 8 weeks endurance training on ambulant hemiplegic patients. The measurement parameters were heart rate at rest, heart rate after walking, blood pressure at rest, blood pressure after walking, physiological cost index (PCI), and the speed of walking pre and post training program. Twenty elderly male ambulant hemiplegic patients due to cerebrovascular accident (CVA), either right or left, participated in this study. Their mean age was 58.9, SD 4.64 yr old, and duration of illness ranged from 12 to 24 months. The training program includes 5 minutes of worm up, 30 minutes work phase, followed by 5 minutes of cool down exercises. The results of this study showed a statistically significant difference after endurance training program in all parameters. These results indicating that endurance training play an important role in improving the cardiovascular functions, mobility, and walking efficiency in elderly patients with hemiplegia.

INTRODUCTION

Many patients experience a decline in mobility with aging due to multiple aging processes that affecting the body specially cardiopulmonary and musculoskeletal systems. Hemiplegia is consider one of the multiple diseases which is responsible for promote and enhance this decline, also may predispose to falling. Physical therapists usually focus training programs for patients with neurological problems on promoting voluntary, controlled, selective movements and on improving function. The goals for patients post CVA usually relate to regaining independence in basic activities of daily living (ADL) as soon as possible. Activities that are designed to improve cardiorespiratory fitness usually are not included in training programs. One reason is that many patients are not able to perform traditional aerobic exercise programs that involve continuous, rhythmical activities performed for 15 to 20 minute period. In addition, the approach often is to minimize physical stress if there is a concern that a cardiac or pulmonary complication may occur[12].

The progressive reduction in physical activity usually observed in aging is the major determinant of exercise deconditioning. The benefits of performing regular endurance exercise in older healthy persons have been well documented. Regular exercise may promote a high level of physiological functionning even into 7th and 8th decades[9]. 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 disease of musculoskeletal system[11].

Recommendation in order to potentiate improvements in general health and physical fitness, energy expenditure should be relatively high, this can be optimized by: a) extensive use of large muscle mass exercises in the training programs; b) spending most training time using higher repetitions[8-12] and multiple sets; c) using sets of exercise to exhaustion should be eliminated or greatly reduced to minimize adverse blood pressure responses (and reduce overtraining)[2].

The exercise can be prescribed by Heart Rate (HR) because a relative linear relationship exists between work intensity, oxygen consumption (VO2), and heart rate. Different methods utilizing HR are available. First, the prescription can be determined based on a fixed percentage of the patient s maximum heart rate. The highest heart rate (HR max), safely achieved during the graded exercise test (GXT). The HR max. is then multiplied by the conditioning intensity to determine target heart rate (70 - 85 % of HR max. closely corresponds to 60 - 80% of functional capacity or V02 max. A Second method is used for subjects who have not been tested using (GXT)[7]. The maximum HR is generally estimated to be 220 minus the subject's age[14].

In this study the prescribed training program was modified based on the unique characteristics of the hemiplegic patients. The patients exercised at an intensity of 65% to 80% of age predicted maximal heart rate when performing the activities of treadmill walking and lower extremity cycling. This formula was used to calculate the training heart rate.

Heart rate reserve (HRR) = HR max. - HR rest; Training HR = HR rest + 50% (HRR)[16].

MATERIALS AND METHODS

SUBJECTS

This study was carried out on 20 hemiplegic patients due to cerebrovascular accident (according to clinical evaluation and CAT report). Male only participated in this study with either right or left side affected. All functionally ambulant without assistance at least 50 meters. Their age ranged from 50 to 65 years, mean 58.95 years, (SD = 4.64), with duration of illness ranged from 12 to 24 months.

INSTRUMENTATION

Healthstyler, motorized treadmill, with length of 135 cm and width of 49 cm, with variable speed which was adjusted for all patients at 33 meter per minute as regular walking almost equal half the capacity of healthy persons.

Mercury manometer, was used to measure the blood pressure at the beginning, during, and at the initial 30 seconds after completing the training period.

HR Monitor, was used to estimate exercise intensity during training sessions. The monitor consists of an elastic strap containing two rubber electrodes with small transmitter attached, and a receiver that is contained in a wrist watch type device.

Stop watch, to calculate the velocity of the patient.

PROCEDURE

TREATMENT PROCRAM

Heart rate and blood pressure were measured at the beginning of sessions, during, and at the end of each session for all the patients. Also during the training sessions, the patients were asked frequently about any symptoms such as chest pain that could indicate excessive cardiac stress.

The program was conducted using treadmill walking every other day, three days per week, for eight weeks. Each session was 40 minutes, consisted of warm up exercises for 5 minutes, work phase includes, treadmill walking for 30 minutes training, (5 minutes treadmill walking, alternating with mat activities for 5 minutes), then followed by 5 minutes cooling down. The warm up exercises included 20 - 30 repetitions of shoulder flexion, shoulder abduction, and external rotation. The mat activities included hip flexion, abduction, and internal rotation. Also the knee flexion and extension from supine and sidelying was encouraged. The sessions ended with a cool down period in which the warm up exercises were repeated.

SUBJECT EVALUATION

- The heart rate and the blood pressure were measured at the beginning, and at the initial 30 seconds after completing the walk pre and post treatment program.
- The patient was asked to walk in self-selected walking speed for 30 meters in a smooth surface and the velocity was calculated by using the stop watch pre and post treatment program.
- P.C.I. (the physiological cost index), which is the difference between resting and walking heart rate divided by walking velocity. The PCI was used to estimate the cardiovascular stress associated with functional walking pre and post treatment program.

Statistical Analysis: Student t test was used to determine the significance between pre-treatment and post-treatment values at the level of P 0.01.

RESULTS

Twenty male ambulant hemiplegic patients with a mean age of 58.95 years (SD = 4.64), participated in this study. The results showed that a significant decrease heart rate at rest, heart rate after walking, blood pressure at rest, blood pressure after walking, and physiological cost index while the walking veocity is significantly increased. Table (I) presents their mean duration of illness, the mean heart rate at rest, the maximum heart rate, the heart rate reserve, and the training heart rate. Table (2) illustrated the pre-treatment, post-treatment means and standard deviations of heart rate at rest, heart rate after walking, blood pressure at rest, blood pressure after walking, velocity, and the physiological cost index. The graphic representation was shown in (fig 1 and 2). The mean value of the pre-training heart rate at rest was 84.4 beats ± 9.46, while post-training mean was 80.75 beats ± 7.79 with the mean difference of 3.65 beats ± 3.18

training was statistically highly significant with low probability of error P= <0.0001. The mean value of the pre-training heart rate after walking was 101.7 beats ± 7.01, while post-training mean was 97.6 beats ± 6.24 with the mean difference of 4.1 beats ± 3.02. This change difference due to training was statistically highly significant with low probability of error P= <0.0001. The mean value of the pre-training blood pressure at rest was 153/95 mmHg ± 9.5-9.6, while post-training mean was 144.5/89.5mmHg ± 6.3-6.5 with the mean difference of 8.5/5.5 mmHg ± 7.5-5.6

training was statistically highly significant with low probability of error P= <0.0001.

The mean value of the pre-training blood pressure after walking was 165/100 mmHg ± 6.2-6.6, while post-training mean was 161/97 mmHg ± 6.1-4.7 with the mean difference of 4/3.25 mmHg ± 4.8-3.7. This change "difference" due to training was statistically highly significant with low probability of error P= <O.OOOS. The mean value of the pre-training velocity was 9.7 m/minutes + 3.1, while post-training mean was 13.48 m/min + 3.39 with the mean difference of 3.78 m/min + 2.1. This change "difference" due to training was statistically highly significant with low probability of error P= <0.0001. The mean value of the pre-training PCI was 1.87 + 0.45, while post-training mean was 1.3 + 0.43 with the mean difference of 0.57 + 0.49. This change difference due to training was statistically highly significant with low probability of error P= <0.0001.

Table (1): Means and SD of age, heart rate at rest, maximum heart rate, heart rate reserve, and the training heart rate.

Parameters	Mean	S.D	Minimum	Maximum
Age	58.95	4.64	50	65
Duration of illness	17.15	4.07	12	24
HR at rest	84.4	9.5	72	100
HR max	161.05	4.64	155	170
HR reserve	76.65	13.34	56	98
Training HR	122.5	3.40	118	128

Table (2): The pre-treatment post-training means and standard deviations of heart rate, blood pressure, velocity, and P.C.I and the significance of the results.

Parameters	PRE-TTT		POST-TTT		DIFFRENCE		SIGNIFICANCE	
	X	SD	X	SD	X	SD	T	P
HR at rest	84.4	9.46	80.75	7.79	3.65	3.18	5.1	<0.0001
HR after walking	101.7	7.01	97.6	6.24	4.1	3.02	6.1	<0.0001
BP at rest	153/95	9.5-9.6	144.5/89.5	6.3-6.5	8.5/5.5	7.5-5.6	5.1-5.1	<0001
BP after walking	165/100	6.2-6.6	161/97	6.1-4.7	4/3.25	4.8-3.7	3.8-3.9	<0005
Velocity	9.7	3.1	13.48	3.39	3.78	2.1	8	<0.0001
P.C.I	1.87	0.45	1.3	0.43	0.57	0.49	5.2	<0.0001

P<0.01

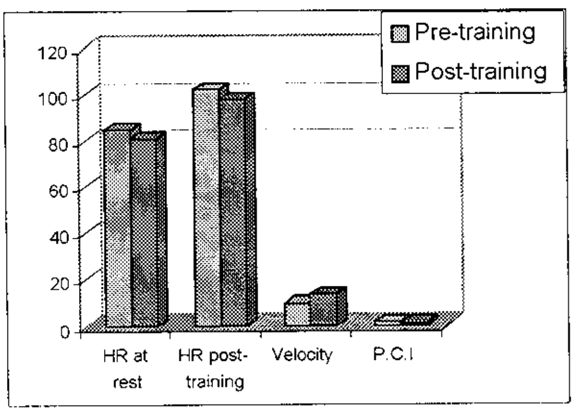

Fig. (1): The pre-training, post-training means and SD of HR, velocity, and P.C.I.

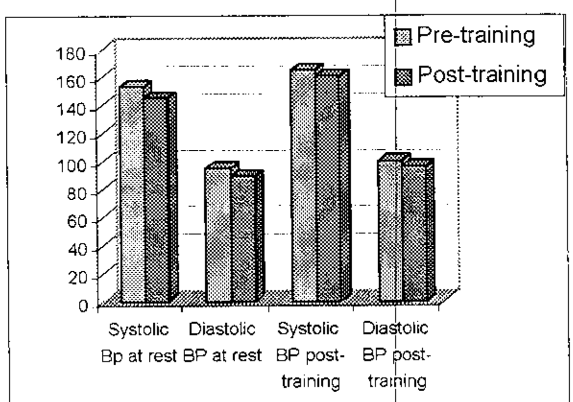

Fig. (2): The pre-training, post-training means and SD of BP, at rest and after walking.

DISCUSSION

In this study the efficacy of using aerobic training as rehabilitation for elderly male ambulant hemiplegic patients was investigated through the response of heart rate, systolic and diastolic blood pressure, physiological cost index, and the speed of walking pre and post training program.

These results were in accordane with the finding of koyama[8] which stated that exercise can provide substantial benefits to older subjects raising the elders physical performance and also counteract negative changes associatws with aging.

The result of the present study supported by many previous studies confirm the efficiency of using aerobic training for healthy elders as well as elderly patients which is supported by skinner[15] and consistent with Andersen[1] as he observed a decrease of blood pressure after aerobic training program.

As a population advances from early old age to advanced old age, its composition changes[16]. The elderly have special biological characteristics that affect their need and capacity for exercise; however the plasticity of the motor system to a training load appears to be maintained into the tenth decade of life in humans[4]. Aging is accompanied by a gradual loss of lean tissue and an increase in fat, even in the absence of obesity. The decline in muscle mass and bone mineral impart reflects lower physical activity and endocrine changes. Total body mass, limb muscle volume, and cross sectional area of limb muscles and fiber number are all reduced with age[5]. Walking distance declines with age and tends to be lower in women than men, although there are regional and cultural differences. Walking at least one mile (1.6 Km) three times a week is associated with a lower risk of bone fracture in free living elderly[13].

Endurance can be defined as the time that a person can maintain either a static force or a power level involving a combination of concentric and / or eccentric muscular contraction. The stress submaximal exercise imposes on a patient, and, therefore, the endurance or tolerance for that exercise intensity, depends on how much energy is needed to successfully perform the task in relation to the patient s maximal capacity[6]. Programs to increase moderately vigorous rehabilitation regimens may improve health and capacity for independent living in the elderly by increasing strength and endurance, maintaining healthier body composition and metabolism, and improving nutrition[10]. The elderly had more adipose tissue and less muscle mass than the young. Glycogen stores and muscle 02 consumption increased significantly in response to training only in the elderly. The muscle oxidative capacity was 128% greater in the elderly. Multiple studies have shown that endurance type training leads to enhanced capacity for aerobic metabolism in the elderly[3].

In this study the changes in resting and walking heart rate and blood pressure values would be expected with endurance exercise training. The fact that heart rate during steady state walking either stayed the same or decreased suggests that a cardiovascular training adaptation occurred. Also decreased in PCI, which is the ratio of the change in heart rate from rest to walking to the work rate or walking velocity, indicate that the patients were more efficient in their walking. This mean that patients were able to walk fast with a similar heart rate response.

From the results of the present work we noticed a significant reduction in heart rat at rest (3.655±3.18) and heart after walking (4.1±3.02). The blood pressure at rest

(8.5/5.5±7.5-5.6) and after walking (4/3.25±4.8-3.7) was significantly decreased.

The results of table (2) showed a significant increase in walking velocity (3.78±2.1) and significant decrease in physiological cost index (0.57±0.49).

CONCLUSION

The nature of the training response in the elderly hemiplegic patients depends on intensity and type of training. The benefits of maintaining or improving strength in the elderly may include correction of gait disturbances and safer ambulation, prevention of falls, reduction in bone fractures, improved mobility and stamina, improved performance of activities of daily living. As the number of elderly hemiplegic persons increases in our society, it becomes more important to develop strategies for preventing these people from becoming frail elderly.

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الملخص العربي

تأثير التدريبات الهوائية على الرجال كبار السن من مرضى الشلل النصفي

يهدف البحث إلى دراسة تأثير برنامج التدريبات الهوائية على كبار السن من الرجال مرضى الشلل النصفي سواء كانت اليمنى أو اليسرى.
تم إختيار (٢٠) مريضا تتراوح أعمارهم بين (٥٠-٦٥ عاما) بمتوسط (٥٨,٩ عاما) وتتراوح مدة مرضهم من (١٢-٢٤ أسبوعا) ويستطيعون المشي بدون مساعدة لمسافة ٥٠ مترا على الأقل.
أستمر البرنامج التدريبي لقوة التحمل لمدة ٨ أسابيع بمعدل ثلاث مرات أسبوعيا.
تم تقييم جميع المرضى مرتين، مرة قبل بداية التدريبات والمرة الثانية بعد البرنامج التدريبي.
وقد أظهرت النتائج تأثيرات ايجابية ذات دلالة إحصائية لكل القياسات وهذا يدل على أن البرنامج له دور مهم وفعال في تحسين الأداء الوظيفي للقلب والدورة الدموية بالإضافة إلى تحسن كفاءة المشي.