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Exercise in Hypertension- Its Role and Recommendations

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Abstract

Hypertension is one of the most common medical disorders. It is associated with an increased incidence of all-cause and cardiovascular disease mortality. Physical exercise is found to have positive health benefits and improve well being of a person since time immemorial. Exercise is an integral component of lifestyle modifications. Lifestyle modifications such as regular exercise, weight loss (if overweight), dietary changes such as salt restriction, and cessation of smoking are advocated for the prevention, treatment, and control of hypertension. There are several mechanisms proposed for the beneficial effects of exercise in hypertension and include neurohumoral, vascular, and structural adaptations. Aerobic exercise training leads to reductions in resting BP of 5 to 7 mm Hg in individuals with hypertension. Regular exercise has proved to normalize the elevated blood pressure of mild to moderate intensity by many studies. Mild to moderate exercise has low risk and very few contraindications for most people. Based upon the current scientific evidence, the following prescription regarding exercise is recommended for patients with hypertension: *Frequency*- on most, preferably all, days of the week; *Intensity*- moderate intensity (40-<60% of VO2R; *Time*- =30 min of continuous or accumulated physical activity per day; *Type*- primarily aerobic endurance physical activity involving large muscle groups supplemented by resistance exercise.

Key words: Hypertension, Exercise, Physical Activity, Aerobic, Exercise Prescription, Guidelines

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Introduction:

Hypertension is a complex and a multifactorial disease that has become a major public health problem throughout the world because of its impact on morbidity and mortality. The prevalence of hypertension in India has been reported to range between 20–40% in urban adults and 12–17% among rural adults (1). There are 34 million hypertensive patients in urban India and 31.5 million in rural areas, according to the "Indian Hypertension Guidelines-II" (2).

Impressive changes have occurred in recent decades in the detection, treatment, management, and education of hypertension. As far as exercise is concerned, it was not until recent times that exercise has been included as an important component in the "hypertension story".

In 1986 the World Health Organization (WHO) and the International Society of Hypertension (ISH) stated that "increased physical activity is likely to reduce the risk of cardiovascular disease and is appropriate in mildly hypertensives" (3).

In 1991 a consensus document entitled 'Physical exercise in the management of hypertension' was published by the World Hypertension League. This document concluded that exercise programmes can contribute to the management of hypertension (4).

In 1992 the WHO/ISH recommendations included regular mild exercise in sedentary subjects in the primary prevention of hypertension (5). In 1993 this was followed by a memorandum of the WHO/ISH which stated that "it appears reasonable to advise that efforts to lower blood pressure by lifestyle modifications, including exercise, should normally precede any decision about the necessity of drug treatment of mild hypertension" (6).

In 1993 the US Joint National Committee on the Detection, Evaluation and Treatment of High Blood Pressure stated that physicians should vigorously encourage their hypertensive patients to adopt lifestyle modifications, including increased physical activity (7).

The American College of Sports Medicine recommended aerobic endurance exercise to reduce the incidence of hypertension in susceptible individuals and as the initial treatment strategy for individuals with mild to moderate hypertension (8).

After publication of the 1993 American College of Sports Medicine

(ACSM) Position Stand on physical activity, fitness, and HTN, the effect of endurance training on resting BP has been addressed in a number of meta-analyses of randomized controlled trials (9,10).

Regular exercise is now being widely advocated as an effective tool in the non-pharmacological treatment of hypertension and as an adjuct to its pharmacological treatment.

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) recommends engaging in regular aerobic physical activity such as brisk walking (at least 30 minutes per day, most days of the week. This can lead to reduction in systolic blood pressure (SBP) by 4–9 mm Hg (11).

The Association of Physicians of India (API), Cardiological Society of India (CSI), the Indian College of Physicians (ICP), and the Hypertension Society of India (HSI) developed the "First Indian Guidelines For The Management Of Hypertension- 2001". Significant new data has emerged since then in areas of epidemiology, classification of hypertension and management strategies. Guidelines such as the JNC, BHS, ESH/ESC, NICE, and WHO-ISH have been revised based on emerging evidence from large, randomized controlled clinical trials. It was, therefore, felt necessary to update the Indian guidelines to align them with the current best evidence. Henceforth, the first Indian guidelines have been revised and updated and the second guidelines IHG II -2007 have been published under the stewardship of API. These Indian Hypertension Guidelines-II have been endorsed by various professional bodies, including Association of Physicians of India, Cardiological Society of India, Hypertension Society of India, Indian Society of Nephrologists, and Indian Medical Association.

The evidence that regular exercise has hypotensive efficacy comes from both epidemiological and intervention studies. Despite a few uncertainties with respect to the optimal exercise programme and the combined effects of drug treatment and exercise, there is sufficient evidence to encourage sedentary hypertensive patients to become more active.

Hypertension has been managed by pharmacologic and/or nonpharmacologic approaches. Nonpharmacologic approaches (now called therapeutic lifestyle changes) which include exercise

training, nutrition, weight management, stress management, and smoking cessation, have long been considered efficacious in the prevention and control of high blood pressure. An overwhelming number of studies have consistently shown that regularly performed aerobic exercise of mild-to-moderate intensity lowers blood pressure in patients with essential hypertension (12-19). The Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, the European Society of Hypertension, Heart Foundation of Australia, the American College of Sports Medicine and the Indian Hypertension Guidelines-II all recommend approaches such as regular physical activity for the prevention and treatment of HTN (20-23).

A Few Key Concepts:

To understand the role of exercise and ultimately prescribe it in the management of hypertension, it is essential to understand some of the key concepts and the terminology of exercise therapy.

Physical activity and exercise are often used interchangeably, but these terms are not synonymous. *Physical activity* is any bodily movement produced by the contraction of skeletal muscles that result in a substantial increase over resting energy expenditure. *Exercise* is a type of physical activity consisting of planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness. *Physical fitness* has typically been defined as a set of attributes or characteristics that people have or achieve that relates to the ability to perform physical activity.

There are two categories of exercise- acute and chronic. *Acute exercise* relates the physiological responses that occur with a single bout of exercise. *Chronic exercise* describes the responses that occur during a single bout of exercise by someone who has a history of repeated bouts, or physical training. To illustrate the difference, heart rate will increase with acute exercise, but the increase will be less in an individual with a history of chronic exercise (training). Blood pressure response to acute exercise has many dimensions. Acute exercise causes increases in blood pressure and cessation results in marked decreases (postexercise hypotension). Wide swings in blood pressure cause anatomical and physiological changes that influence baroreceptor functions in the regulation of blood pressure.

There are different types of exercises e.g. based upon the types of

muscle contractions necessary to execute movement. If contraction occurs with little detectable shortening of muscles, it is called *isometric*; whereas if shortening (concentric) or lengthening (eccentric) occurs in muscles, it is called *isotonic*, assuming the tension to be the same. These distinctions are relevant because isometric contractions elicit greater pressor responses than isometric ones. Exercise prescription for hypertensive populations must emphasize activities that require concentric and eccentric contractions and minimize those that are isometric in nature.

Exercises are also classified as aerobic and anaerobic exercises. *Aerobic exercise* consists of repetitive low-resistance movements that last over a long period of time, usually more than 10 minutes, such as walking or cycling. *Anaerobic exercise*, on the other hand, consists of high-resistance, low-repetitive movements that last only 1 to 3 minutes, interrupted by frequent periods of rest between exercise bouts, such as in weight lifting.

An important concept in exercise therapy comes from the concept of prescribing pharmacologic agents. Exercise can be arranged in a dosed fashion with predictable effects and side effects. The dose-relevant components of the exercise prescription are the frequency (F), the intensity (I), the time (T) (or duration), and the type (T) of exercise. In this regard, it is convenient to remember the anagram FITT. Of the four components of the FITT anagram, the intensity of exercise is by far the most important. Most of the skill in prescribing exercise is related to managing the intensity component.

The American College of Sports Medicine characterizes aerobic exercise intensity as low, moderate or high based on elicited rise in heart rate. Predicted maximum heart rate is calculated by the following formula, PMHR= 220-age in years. An exercise is categorized as low-intensity if it elicits 35% to 59% of predicted maximum heart rate. Moderate-intensity exercise is that which elicits 60% to 79% of PMHR. Exercise eliciting a response greater than this is considered high-intensity.

METs (Metabolic equivalents) are a useful and convenient way to describe the intensity of a variety of physical activities. Aerobic exercise intensity can also be categorized based on METs. One MET is the energy spent at rest to maintain basal bodily functions. (1 MET= 3.5 mL O_2/kg/min). In a recent update to a joint American College of

Sports Medicine and Centers for Disease Control and Prevention publication, light physical activity or exercise was defined as requiring less than 3 METs, moderate activities or exercises requiring 3-6 METs, and those exercises or exercises which demand more than 6 METs are called vigorous or high-intensity.

How exercise lowers blood pressure?

Aerobic exercise lowers BP through multiple mechanisms (17) including the following:

- Lower sympathetic nerve traffic accompanied by potentiation of the baroreceptor reflex
- Reduced arterial stiffness and increased total systemic arterial compliance
- Increased release of endothelium-derived nitric oxide that may be related to lower plasma cholesterol
- Increased insulin sensitivity

Amount of fall in blood pressure with regular exercise:

The reduction in blood pressure with regular aerobic exercise is approximately 8 to 10 mm Hg for systolic and 7 to 8 mm Hg for diastolic blood pressure in hypertensive patients. These decreases in BP may not seem to be large at the first look, but as the ACSM point out, a 2 mm Hg reduction in systolic and diastolic BP reduces the risk of stroke by 14% and 17%, and the risk of coronary artery disease by 9% and 6% respectively (12).

Clinical significance of exercise training-induced fall in blood pressure:

Increased physical activity is associated with reduced incidence of hypertension. Thus an appropriate recommendation for a public policy on primary prevention of hypertension should include the implementation of low to moderate intensity exercise program 3 to 5 days per week. In patients with borderline BPs, increased physical activity may prevent the progression to hypertension.

As the population ages, hypertension becomes more prevalent and increasingly more difficult to treat. With increases in the use of pharmacologic agents, the incidence of side effects increases, and compliance becomes a very important issue. The implementation of regular exercise alone or as an adjunct to medication in hypertensive patients can improve BP control at relatively lower doses of drugs and reduce adverse events. This is also likely to reduce the financial burden, reduce the risk of other disorders such as obesity and stroke, and improve quality of life for these patients.

Relaxation Exercises:

Although it is known that relaxing can counteract the short-term increases in blood pressure that are caused by stress, it is not known if a sustained programme of relaxation can produce long-term reductions in blood pressure or decrease the risk of death, heart attack and stroke.

In some of the studies conducted in India, relaxation techniques such as Yoga, meditation and biofeedback have been shown to reduce blood pressure (24-27).

However, in a recently published Cochrane review (28), pooled findings from 1,198 people with blood pressure over 140/85 mm Hg who were enrolled in 25 randomised controlled trials were evaluated. These trials compared the effect of relaxation either with no treatment or with a dummy treatment which wasn't expected to reduce blood pressure. Overall, relaxation reduced blood pressure by a small amount: the average reduction was 5/3 mm Hg, but might be anywhere between 8/5 mm Hg and 3/2 mm Hg. Different trials gave different, sometimes inconsistent, results. Many of the trials were not well designed or conducted. In the good quality trials, relaxation resulted in smaller average reductions in blood pressure and the results could even be consistent with an average increase in blood pressure. Even when all the trials were put together, the combined group of all the people in all the trials wasn't large enough and the trials didn't run for long enough to tell us whether relaxation could reduce the risk of death, heart attack or stroke. Few people reported side-effects of relaxation and, on average, people were just as likely to report side-effects of the comparison treatment. Different types of relaxation were taught in different trials. It was difficult to disentangle their effects, especially as many trials used a combination of methods. Overall, reviewers found no evidence that autogenic training was effective. Progressive muscle relaxation, cognitive/behavioural therapies and biofeedback seemed to be more likely to reduce blood pressure. However, some of the reduction in blood pressure was almost certainly due to aspects of treatment that were not related to relaxation, such as frequent contact with professionals who were trying to help.

Assessment of patients before commencing exercise program:

All hypertensive patients must be carefully screened for the presence of secondary causes of hypertension, the presence of risk factors, target-organ

damage, and the presence of cardiovascular disease.

Exercise testing and monitoring is not necessary for prehypertensive or stage one or two hypertensive who are less than 50 years and have no cardiovascular disease risk. Patients who are more than 50 years and have cardiovascular disease or suspicion of cardiovascular disease should be started with low-impact activities such as walking, cycling, and swimming but it is better to have an exercise tolerance test and interval ECG monitoring in case of chest pain.

Exercise prescription for control of Hypertension:

For most hypertensive patients, exercise is quite safe. The American College of Sports Medicine in its most recent document recommends the following exercise prescription guidelines for the hypertensive patients (29).

Frequency: Aerobic exercise on most, preferably all, days of the week; resistance exercise 2-3 days/week.

Intensity: Moderate-intensity aerobic exercise (i.e. 40% to <60% VO2R) supplemented by resistance exercise training at 60% to 80% 1-RM.

Time: 30-60 min/day of continuous or intermittent aerobic exercise. If intermittent, use a minimum of 10-minute bouts accumulated to total 30-60 min/day of exercise. Resistance training should consist of at least one set of 8 to 12 repetitions.

Type: Emphasis should be placed on aerobic activities such as walking, jogging, cycling, and swimming. Resistance training using either machine weights or free weights may supplement aerobic training. Such training programs should consist of 8 to 10 different exercises targeting the major muscle groups.

Ten-Commandments:

Given below are the 'Ten-commandments' relating to exercise in hypertension, adapted from the *ACMS's Guidelines for Exercise Testing and Prescription*, Eighth Edition.

1. If resting SBP >200 mm Hg and/or DBP >110 mm Hg, **DO NOT EXERCISE**.
2. When exercising, it appears prudent to maintain SBP =220 mm Hg and/or DBP =105 mm Hg.
3. Patients with severe or uncontrolled BP should add exercise training to their treatment plan only after first being evaluated by their physician and being prescribed antihypertensive medication.

4. For patients with documented CVD, such as ischemic heart disease, heart failure, or stroke, vigorous-intensity exercise training is best initiated in rehabilitation centers under medical supervision.
5. β-blockers and diuretics may adversely affect thermoregulatory function and cause hypoglycemia in some individuals.
6. β-blockers, particularly the nonselective types, may reduce submaximal and maximal exercise capacity primarily in patients without myocardial ischemia. Consider using perceived exertion to monitor exercise intensity in these individuals.
7. Antihypertensive medications such as α–blockers, calcium channel blockers, and vasodilators may lead to sudden reductions in postexercise BP. Cool-down period should be extended and carefully monitored in these situations.
8. A majority of older persons will have hypertension. Older people experience similar exercise-induced BP reductions as younger people.
9. For individuals with documented episodes of ischemia during exercise, the exercise intensity should be set (=10 beats/min) below the ischemic threshold.
10. Avoid the Valsalva maneuver during resistance exercise training.

Conclusion:

Despite the well-established benefits of regular aerobic exercise, its utilization in the non-pharmacologic treatment of hypertension is still limited. While medical students spend years learning about how to prescribe drugs, they are rarely instructed on the value of the exercise prescription for various medical conditions, or how to prescribe it. Although it can be difficult to motivate patients to exercise regularly, the benefits of exercise equate to the effects of drug treatment and should be vigorously encouraged. More attention must be directed at increasing physical activity and encouraging regular physical exercise both in hypertensives and in the population at large. Most of the physicians' recommendations to patients with hypertension are in the nature of negative advice e.g. don't eat high-fat foods, don't smoke, don't hurry, don't worry etc. But people are infamous for ignoring negative advice. Exercise represents positive health advice. The value of using a positive recommendation that may indirectly lead the patients to discontinue bad behaviours can hardly be overestimated.

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