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Therapeutic role of yoga in hypertension

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Abstract

Systemic hypertension is an established risk factor for coronary artery disease and cerebrovascular accident and control of blood pressure reduces the risk of a major cardiovascular event. Both non-pharmacological and pharmacological treatment options are available to treat hypertension. Yoga, recently received more attention as a treatment modality for various lifestyle disorders, even though practiced in India since ancient times. In this review, we are analyzing the role of yoga in the treatment of systemic hypertension.

INTRODUCTION

Yoga is an effective, time-honored, and promising approach to the management of hypertension. It is a safe intervention if practiced according to prescribed safety guidelines. Yoga practices influence various somatic and psychological functions and help to bring a state of physiological and psychological balance. This helps in clinically relevant reduction in blood pressure in hypertension with a reduction in the dose of antihypertensive drugs required. Yoga is a complex intervention with multiple components. Yoga postures, breathing practices, and meditation are the three most important components in the effective management of hypertension. Yoga therapy is not just about performing yoga, but also about the cultivation of the right values and

attitudes toward day-to-day stressors. Yoga needs to be incorporated as a way of living a yogic lifestyle

LIMITATIONS:

There are studies showing no beneficial effect of yoga on blood pressure reduction. There are a lot of limitations in published studies including a small sample size; the absence of uniform yoga practice, the absence of adequate controls, and the absence of blinding and non-uniform research methodologies, making it difficult to compare various research protocols. Yoga practices, the duration of recommended practice, the techniques, and in some cases even the names of yoga practices differ with different schools of Yoga.

Standardized yoga therapy protocols for specific conditions are a debatable topic. A uniform set of practices cannot be recommended to every patient, as the yoga therapy prescription is based on the individual requirements of the patients. For this, a customized, tailor-made approach is required.

Yoga is sometimes termed as 'a laborious way to well-being' because of the time, effort, and motivation required for the practice. Yoga requires the person's willingness and cooperation for the practice. Patients' participation determines the treatment outcome in yoga therapy. Finally, it must be emphasized, that yoga is not a substitute for standard medical care and it is not for medical emergencies.

REAL-WORLD DATA

One meta-analysis showed that yoga had a modest effect on blood pressure control (systolic - 4.17 and diastolic -3.26 mm of Hg) and is significant ^[43]. They also found that yoga has a significant effect on blood pressure when compared to those not taking any treatment, but no effect in comparison with the exercise group. Subgroup analysis showed that maximum benefit was seen in those who were practicing posture, meditation, and breathing. Studies incorporating three elements of yoga practice posture, meditation, and breathing result in higher BP reduction (SBP -8.17 and DBP -

6.14 mm of Hg) [43]. However, according to some studies, the suggested key components of yoga intervention for hypertensive patients are breathing and meditation rather than physical activity [44]. In a meta-analysis, different yoga interventions were compared and it was observed that only the studies that included breathing and/or meditation techniques without postures had significant effects on hypertension [45]. Blood pressure reduction with yoga is compatible with other non-pharmacological interventions like exercise, and salt restriction [46]. Even this small reduction in blood pressure in people with hypertension reduces the risk of cardiovascular events [47].

Yoga reduces BP significantly (systolic BP 7.96 and diastolic BP 5.52 mm of Hg) compared to the no-treatment group and is comparable to exercise and other non-pharmacological treatment groups. Exercise and other non-pharmacological treatments to reduce BP in the range of 3-9 mm of HG compared to the no-treatment group [43].

The average blood pressure reduction with a single antihypertensive agent is about 10/5 mm of Hg and the addition of a second drug results in lower blood pressure reduction [48]. Considering these facts, the amount of blood pressure reduction achieved by yoga is significant and clinically relevant. Yoga practices combined with antihypertensive drugs have been shown to reduce blood pressure and pulse rate during resting conditions, during stimulus-induced conditions, and in mild-to-moderate hypertension. In most hypertensive patients, it reduces the dose of antihypertensive drugs required [28].

PRECAUTIONS AND CONTRAINDICATIONS:

The following is a brief description of precautions and contraindications of yoga practices in hypertension. [Table 3]

Yoga postures:

Hypertensive practitioners have even higher blood pressure during an exercise and in holding a static yoga posture, proportionate to the effort required to practice. Overstraining and excess muscular efforts stimulate the sympathetic nervous system, resulting in increased blood pressure. Therefore, it is advised to refrain from the

stronger forms of practice and hold static postures for long periods ^[38]. Relaxation in shavasana at the end of asana practice is beneficial.

Aggressive and sudden changes in yoga postures such as standing up quickly from a lying down position should be avoided as they may be stressful. Care should be taken while practicing backbends, especially in a standing position. Breath should not be held during a yoga posture. Strenuous practice should also be avoided in the elderly or people with high ocular pressure disorders. During yoga practice, if the breath is rapid, and the person feels agitated, flushed, dizzy, or uncomfortable, it is advised to come out of the pose and rest in Shavasana. Supported and modified stretching using blankets, bolster, or a chair for support is also recommended.

Although inversions and head-below-heart postures improve health and reduce anxiety and stress, they are not recommended for people suffering from high blood pressure ^[9,38]. They can cause a significant rise in both systolic and diastolic arterial pressures. In inverted yoga poses, the intra-thoracic pressure is increased. Pumping against gravity increases the cardiovascular strain resulting in increased blood pressure. Modifications in some of these yoga poses are recommended. For example, in child's pose, or adho mukha shvanasana (downward facing dog pose), the head can be supported with folded blankets or pillows, so that it is at the level of heart. In viparita karni, the yoga inversion poses supported legs up the wall can give inversion benefits of lymphatic drainage and improved venous return from the lower extremities without adding the risk of increased blood pressure. Other asanas such as mayurasana (peacock pose), and dhanurasana (bow pose) compress the front of the diaphragm, which can raise blood pressure.

Pranayama:

Pranayama is a safe practice suitable for all age groups. However, If practiced in the wrong way, it may cause harm and even complications. Judicious practice under expert guidance is a must. Caution is required especially for vulnerable patients and those having health issues. Gentle, soothing, and relaxing pranayama practices are effective in the management of hypertension. No violent or fast breathing should be practiced.

Overstraining is not recommended. The ratio of the inhalation exhalation should not be forced.

Hyperventilation practices such as fast-paced bhastrika pranayama may be unsafe in patients with hypertension and cardiovascular disease, as they cause vasoconstriction and increase blood pressure [39]. Suryabhedan pranayama (right nostril breathing) has a sympathetic stimulating effect and should be avoided [39]. The breath retention practices (kumbhaka) during pranayama can result in a significant increase in systolic, diastolic, and mean arterial pressure [40]. It may be due to the combined effect of an increased level of heart rate and total peripheral resistance during kumbhaka. It is contraindicated in hypertension, heart disease, and individuals recovering from an illness, surgery, or injury.

Bandha:

Bandha, which means to lock, close off, or stop, are yoga practice that redirects the flow of blood and lymph to other parts of the body. They consist of neuro-muscular locks and involve changes in internal pressure to a very high degree. The practice of bandha with long retention of breath strains the heart and is not recommended for hypertension [9]. Bandha practices during pranayama should also be avoided.

Cleansing Practices:

Kapalbhati, a popular breathing technique that consists of forceful exhalations followed by passive inhalations increases diastolic BP suggesting sympathetic stimulation [41]. Shankha prakshalana (alimentary tract cleansing) involves repeating rounds of drinking salt water, performing a set of asanas, and evacuating the bowels. This kriya can be risky for individuals with hypertension because water intake may lead to a rise in blood volume and thus cardiac output. The physical exertion involved in the procedure may cause further heart rate rises. A short and simplified version of this kriya, known as Laghu shankha prakshālana requires lesser physical strain. Preliminary evidence suggests its safety in patients with mild to moderate essential hypertension [42].

An additional file provides a brief description of contraindicated yoga practices in hypertension with images [see Additional file 3].

SAFETY OF YOGA FOR HYPERTENSION:

Population-based surveys and clinical trials suggest yoga is a relatively safe intervention as compared to other forms of physical activity. However, the most commonly reported adverse effects of yoga are pain and soreness, muscle injuries, and fatigue [37]. To avoid the adverse effects, **yoga should be learned under the guidance of a qualified yoga professional**. Since the benefits of yoga are influenced by frequency, duration, and method of practice, the recommended yoga therapy protocol should be followed to gain optimum benefits [37].

Although yoga is an effective and promising approach to the management of hypertension, it should be used as a complementary therapy and not as a substitute for professional medical advice, diagnosis, and treatment of hypertension. Yoga is not for medical emergencies.

Those who are having any health issues must take a medical opinion before proceeding with various yoga practices. Even if the blood pressure is maintained at acceptable normal levels with medication, safety precautions should be followed.

The room where yoga is practiced should not be too hot as in “hot yoga,” since it increases cardiovascular strain, raising blood pressure.

MECHANISM OF YOGA IN HYPERTENSION:

Various mechanisms by which yoga reduces blood pressure include **[Figure 2]**

Effect on stress:

Yoga by controlling mental stress and autonomic imbalance helps to prevent and control hypertension [24,25]. Mental stress and sympathetic overactivity contribute to the development of systemic hypertension and cardiovascular morbidity [26]. Yoga modulates the physiological response to stress *via* neurohumoral activation [27]. It optimally balances the sympatho-vagal stress response [27]. Yoga cultivates

psychosomatic harmony, induces relaxation, and reduces stress. As a result, emotional stability occurs, the somatization symptoms are relieved, and the systolic and diastolic blood pressure is reduced [23]. ¹ Chronic stress-induced sustained muscular contraction reduces the lumen /diameter of blood vessels in the muscles. This can lead to increased blood pressure. Yoga induces relaxation and decreases arterial tone and peripheral resistance. Yoga is also helpful in various stress-induced psychological disorders like anxiety, depression, and insomnia [24].

Autonomic regulation and Parasympathetic dominance:

Yoga practices specifically affect cardiovascular autonomic regulation and tend to normalize it [28]. They control ³ the autonomic nervous system and influence the brain's electrical rhythms, heart rate, and systolic and diastolic blood pressures [29]. Yoga relaxation and slow-paced pranayama techniques decrease sympathetic activity and enhance parasympathetic activity [12,17,20,21]. These practices optimally balance sympatho-vagal stress response and enhance healthy cardiovascular functioning [16,27,30].

Improved baroreceptor sensitivity:

Various yogic practices also reduce chemoreceptor response and improve baroreceptor sensitivity which restores blood pressure to normal in patients with essential hypertension [25]. Baroreceptor sensitivity can be enhanced significantly by slow breathing practices of yoga [18]. Ujjayi pranayama exerts gentle pressure on the carotid sinuses. Many baroreceptors in the carotid sinus serve as "sampling areas" for homeostatic mechanisms that maintain blood pressure. Improvement in baroreflex sensitivity results in the normalizing of autonomic cardiovascular rhythms [24].

Effect on hormone secretions:

Some yoga postures exert ¹ controlled pressure on the kidneys and the adrenals, regulating blood supply to them which mainly regulate blood pressure through secretions of hormones like renin, angiotensin, adrenalin, etc [31].

Beneficial effect on comorbid conditions:

Yoga-based lifestyle intervention is an important treatment modality in the reduction of blood pressure, as is found to be beneficial in various other cardiovascular risk factors like obesity, dyslipidemia, and diabetes mellitus [32,33].

Improvement in sleep quality:

Studies have shown an association between insomnia and elevated blood pressure of stage 1 and 2 hypertension [34]. Yoga practices such as Om chanting and yoga nidra are beneficial in improving the sleep quality of chronic insomnia patients [24]. Yoga has been suggested as an adjuvant nonpharmacological option for making effective and sustainable changes in patients suffering from sleep disorders.

Beneficial effect on sarcopenia:

⁸ Sarcopenia, the age-related loss of muscle mass and muscle function is associated with hypertension in older adults [35]. Yoga practice is beneficial to prevent and attenuate the age-related deterioration of physical health, muscular strength, and flexibility [36]. Holding yoga postures for a few seconds builds strength by using body weight for resistance, which in turn slows the onset of sarcopenia. They also strengthen the skeletal muscles and improve bone density.

The effects of various yogic practices in managing hypertension and their mechanisms are mentioned in **Table 2**.

YOGA PRACTICES FOR HYPERTENSION:

PRACTICAL CONSIDERATIONS:

Sherman (2012) proposed consideration of the domains such as style of yoga, the dose and delivery of yoga, components of the yoga intervention, specific class sequences, dealing with modifications, selection of instructors, facilitation of home practice and measurement of intervention fidelity over time while developing an appropriate yoga protocol [7].

It must be noted that the duration of recommended yoga practice, the techniques, and in some cases even the names of some practices differ with different schools of Yoga.

The yoga therapy prescription is based on the individual requirements of the patients. For this, a customized, tailor-made approach is required.

The following are some yoga practices recommended for hypertension. [Table 1 and Figure 1]

An additional file provides details of recommended yoga practices in hypertension with images [see Additional file 1].

Shatkriya (Cleansing practices):

These are six yogic cleansing techniques described in the Hatha Yoga texts. It is believed that regular internal cleansing enhances the functional capacity of the organs. There is limited scientific evidence on the efficacy of these kriyas available. However, a few studies recommend trataka (concentrated gazing) for hypertension, Jala neti can be practiced once a week, however, other cleansing techniques are contraindicated [8,9].

Sharir sanchalana (Warm-up practices):

These are loosening exercises that relieve stiffness and prepare the body for the practice of asana. They ease tension accumulated in different body areas and improve blood circulation. For optimal pose performance and injury prevention, it is vital to warm up before yoga practice.

Surya Namaskara (Sun salutation):

It involves a series of dynamic yoga postures performed in a specific sequence. Slow-paced practice according to the individual capacity is advised for pre and stage I hypertension [10]. Performing Suryanamaskar at a fast pace is more like aerobic exercise, resulting in increased strength and endurance. In contrast, slow-paced practice results in a decline in cardiovascular parameters to normal levels, similar to yoga training.

Asana (Yoga postures):

Asana practiced with awareness is capable of bringing about the stability of body and mind. Asana practice improves the vital flow of energy through the body, resulting in a positive sense of well-being. It is a preparatory practice for meditation that fosters a quieting of the mind. The yoga postures should be modified to suit individual needs considering other associated comorbidities.

Pandey *et al* suggested the potential of gentle restorative yoga as a therapeutic option for hypertensive patients ^[11]. In this, yoga poses are practiced using props to facilitate stretching, provide support, and induce relaxation. Shavasana (corpse pose) is the most important posture described widely in the management of hypertension ^[12]. While relaxation poses and gentle restorative yoga are mostly effective in hypertension, other asanas may be performed as additional practices.

An additional file provides details of additional yoga practices in hypertension with images [see Additional file 2].

Pranayama (Regulated breathing):

Pranayama is a vital component of yoga associated with the regulation of breathing. Pranayama can be added as a supportive therapy with drugs in mild or moderate cases of hypertension ^[13]. Slow breathing practices are effective in reducing blood pressure and are recommended as the ⁵ first treatment for low-risk hypertensive and prehypertensive patients who are reluctant to start medication ^[14]. Ujjayi pranayama (ocean breath) without breath retention significantly decreases stress-induced changes in cardiorespiratory parameters and decreases blood pressure ^[15]. Studies have shown immediate benefits of sukha pranayama (easy, comfortable breathing), ^[16] nadi shodhana (alternate nostril breathing), ^[17] slow-paced bhasrika (bellows breath),^[18] chandra nadi (left unilateral forced nostril breathing), ^[19] bhramari (humming breath), ^[20] sheetali (cooling breath), ^[21] and pranava (Aum chanting) ^[13] pranayama practices in reduction of blood pressure.

Pranayama and meditation can be practiced while sitting in a chair, sukhsana (comfort pose), ardha padmasana (half lotus pose), padmasana (lotus pose) or vajrasana (thunderbolt pose). In meditative postures, the heart rate and the breath slow down, which lowers the blood pressure.

Mudra (Subtle gestures):

Mudra is a term meaning a 'bodily position' or 'gesture'. Mudra can be practiced independently or incorporated into yoga postures, pranayama, and meditation. The

effects of yoga practice are enhanced with mudra, as they deepen awareness and concentration.

Meditation:

There are two major types of meditation, concentration and open awareness. Concentration meditation involves a focus on a word, sound, prayer, or phrase. Expansive, open awareness or mindfulness meditations emphasize developing a passive attitude towards intruding thoughts, emotions, or body sensations, and a return to focus. Both types have a significant effect in reducing blood pressure [22,23]. Mindfulness meditations can be practiced as formal, dedicated practice or informal, integrated practice during the activities of daily life. While the formal practice deepens the meditation experience, the informal practice emphasizes meditation as a way of living.

Yoga Nidra (Yogic sleep):

Yoga nidra ² is a comprehensive, profound relaxation technique for removing physical, mental, and emotional tensions. This practice includes awareness of different body parts, relaxation, breath awareness, auto-suggestions, and imagery. It reduces anxiety, and stress and improves autonomic functions in hypertensive patients [24].

YOGIC WAY OF LIFE:

The yoga practice affects different levels, and various somatic and psychological functions may be influenced by it. Therefore, yoga interventions should be planned and performed accordingly. Apart from 'doing' yoga postures or breathing practices, the cultivation of the right values and attitudes towards day-to-day stressors and adopting a yogic lifestyle is vital in reducing stress and managing hypertension [6].

The classical yoga texts describe the concept of chitta prasadanam (happiness of mind) and ways to achieve it. The mental qualities of maitri, karuna, mudita, and upeksha are suggested to achieve a blissful state of mind. They provide a yogic way of approaching a wide variety of people and situations in everyday life.

Maitri is an attitude of friendliness toward the happiness of others. It is the ability to share another person's happiness instead of being jealous. Having such a perspective makes it possible for us to celebrate the beauty of human experiences. We can learn, understand, and grow through the friendship of happy and positive people. Karuna means compassion for the sorrows of those suffering. This is essential for spiritual and personal growth. It means helping if someone is upset, and comforting them. Compassion teaches us to be less judgmental and accept others as they are. It also develops an emotional understanding and bond. Mudita is a joyfulness towards the good deeds of others. It is about appreciating the virtuous qualities of others and finding inspiration to cultivate them. Upeksha refers to indifference towards the negative behavior of others. It is the quality of developing equanimity or neutrality towards those who were unkind, or those who have hurt us. Taking the opposite view towards negative thoughts and actions (pratipaksha bhavanam) also gives important insights into the management of emotions.

Mindfulness qualities such as living in the present moment, acceptance, letting go, gratitude, and loving-kindness are also effective antidotes for stress and anxiety.

WHAT IS YOGA?

Yoga is an art, a science, and a philosophy of living a healthy lifestyle. Originating in India over 5000 years ago, yoga was primarily about spiritual progress. "Yoga" means union, and signifies the merging of Atman, the individual consciousness, with Paramatman, the universal consciousness. On a practical level, yoga practice aims to enhance our lives with holistic health, happiness, and harmony while overcoming the sufferings of human life.

Yoga is a complex intervention that includes cleansing processes (shatkarma), postures (asana), breathing exercises (pranayama), bandhas (locks) and mudras (gestures), dhyana (meditation), relaxation, chanting mantras, dietary guidelines, a code of conduct, philosophy and spirituality.

CONCLUSION

Systemic hypertension is a major public health issue and of the total hypertensives, only about 1 in 4 adults (24%) have well-controlled hypertension [1]. It is an established risk factor for coronary artery disease, cerebrovascular accident, cardiac failure, atrial fibrillation, chronic kidney disease, heart valve diseases, aortic syndromes, and dementia [2].

Hypertension accounts for 14% of deaths and control of hypertension is associated with a 35 to 40% reduction in the risk of cerebrovascular accident 50% reduction in the risk of heart failure and a 20-25% reduction in the risk of myocardial infarction [3,4]. Uncontrolled hypertension contributes to 49% of coronary artery disease and 62% of cerebrovascular disease [2]. On average 5 mm of Hg reduction in systolic blood pressure reduces the risk of a major cardiovascular event by about 10% [5].

Lifestyle modifications like reduced dietary sodium intake increased intake of fruits and vegetables and regular physical exercise help in the prevention and treatment of hypertension in addition to pharmacological agents. Yoga is becoming increasingly popular not only among the public but also among healthcare professionals as a modality to tackle various lifestyle diseases like hypertension, diabetes, and dyslipidemia.

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