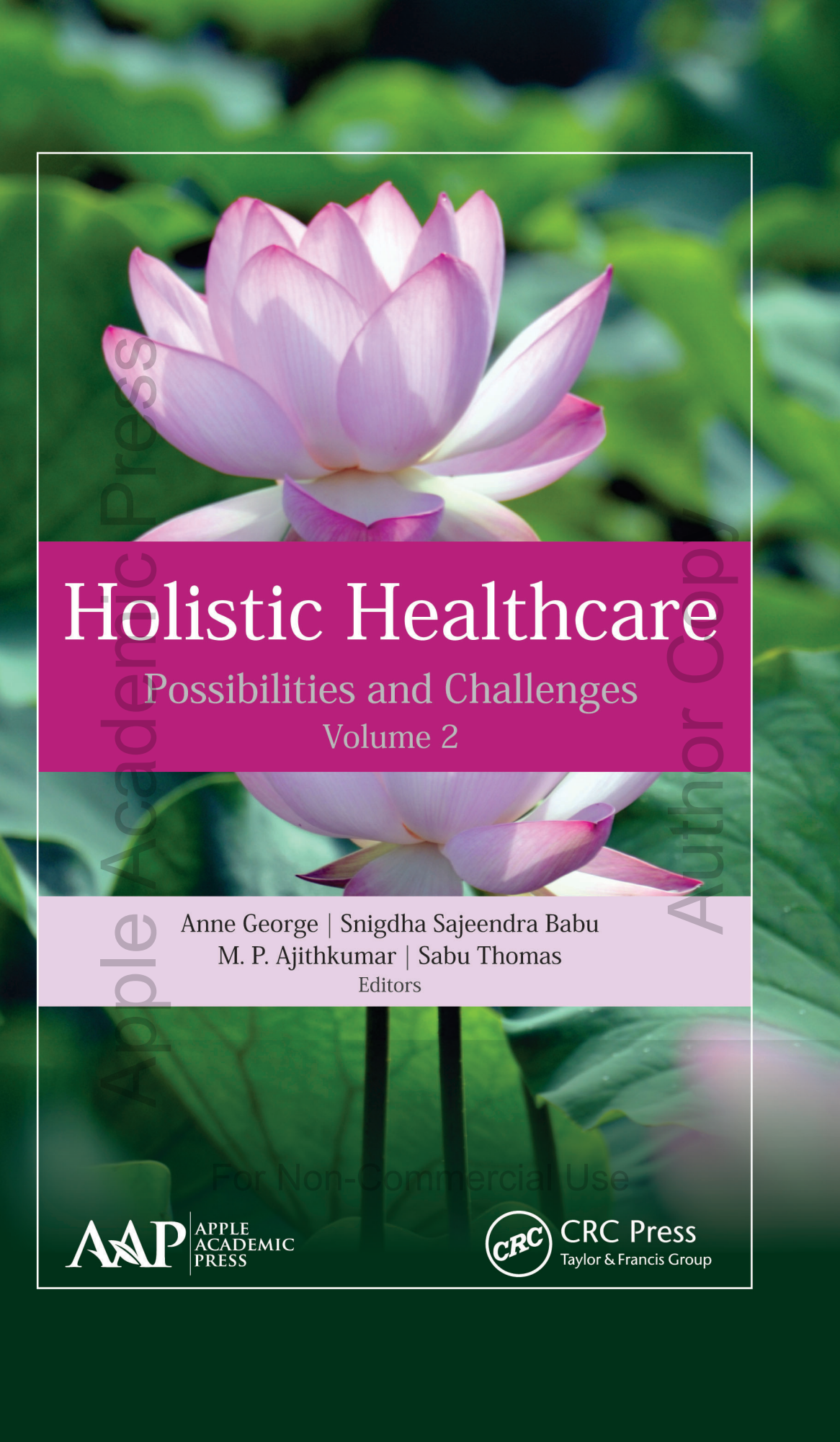

Holistic Healthcare

Possibilities and Challenges

Volume 2

Anne George | Snigdha Sajeendra Babu
M. P. Ajithkumar | Sabu Thomas
Editors

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VOLUME 2

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ABOUT THE EDITORS

Anne George, MD

Anne George, MD, MBBS, DGO, Dip Acupuncture, is an Associate Professor in the Department of Anatomy at the Government Medical College, Kottayam, Kerala, India. She has organized several international conferences, is a fellow of the American Medical Society, and is a member of many international organizations. Dr. George has worked in several different international labs, which include the laboratories at Laval University, Quebec, Canada; Faculty of Medicine, University of Vienna, Vienna, Austria; and the Department of Immunology, Katholieke University of Leuven, Leuven, Belgium. Dr. George has edited many books and published research articles and reviews in international journals and has presented many papers at international conferences. Her major research interests are human anatomy, polymeric scaffolds for tissue engineering, diabetes, nature cures, diet, and human health. She received her MBBS, Bachelor of Medicine, and her Bachelor of Surgery from Trivandrum Medical College, University of Kerala, India. She acquired a DGO (Diploma in Obstetrics and Gynecology) from the University of Vienna, Austria; a Diploma of Acupuncture from the University of Vienna; and her MD from Kottayam Medical College, Mahatma Gandhi University, Kerala, India.

Snigdha S. Babu

Snigdha S. Babu is pursuing her PhD at the International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, India. She has research experience in the field of biotechnology, polymer science, and nanotechnology. Her specialization is in microbiological applications of nanomaterials.

M. P. Ajithkumar, PhD

M. P. Ajithkumar, PhD, is a postdoctoral fellow of the International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam, India. He pursued his PhD in Chemistry

from Manipal University, India. He has more than 8 years of research experience in the area of chemistry and is an expert in polymer synthesis and materials chemistry. His current research is focused on developing carbon dots and graphene materials for imaging, sensing, and energy applications.

Sabu Thomas, PhD

Sabu Thomas, PhD, is currently the Pro-Vice Chancellor of Mahatma Gandhi University and Professor of Polymer Science and Engineering at the School of Chemical Sciences of Mahatma Gandhi University, Kottayam, Kerala, India. He is the Founder and Director of the International and Inter University Centre for Nanoscience and Nanotechnology, a center that was established to carry out intense research in the field of nanotechnology. He is an outstanding leader with sustained international acclaim for his work in polymer science and engineering, polymer nanocomposites, elastomers, polymer blends, interpenetrating polymer networks, polymer membranes, green composites and nanocomposites, nanomedicine, and green nanotechnology. Dr. Thomas's groundbreaking inventions in polymer nanocomposites, polymer blends, green bionanotechnological, and nano-biomedical sciences have made transformative differences in the development of new materials for the automotive, space, housing, and biomedical fields. Professor Thomas has received a number of national and international awards, which include Fellowship of the Royal Society of Chemistry, London, MRSI medal, Nano Tech Medal, CRSI medal, Distinguished Faculty Award, and Sukumar Maithy Award for the best polymer researcher in the country. He is in the list of most productive researchers in India and holds the No. 5 position. Very recently, Professor Thomas has been conferred Honoris Causa (DSc) by the University of South Brittany, Lorient, France and Universite de Lorraine, France. Professor Thomas has published over 750 peer-reviewed research papers, reviews, and book chapters. He has coedited 50 books and is the inventor of 5 patents. He has supervised 73 PhD theses and his h-index is 81 with nearly 31,574 citations. Professor Thomas has delivered over 300 Plenary/Inaugural and Invited lectures in national/international meetings over 30 countries. He has established a state of the art laboratory at Mahatma Gandhi University in the area of polymer science and engineering and nanoscience and nanotechnology.

CONTENTS

CHAPTER 3

MANAGEMENT AND PREVENTION OF HYPERTENSION IN THE ELDERLY: A YOGIC APPROACH

SATISH G. PATIL[1*] and SHANKARGOUDA S. PATIL[2]

[1]*Department of Physiology, BLDE University's Shri B.M. Patil Medical College, Hospital & Research Centre, Vijayapura 586103, Karnataka, India*

[2]*Department of Medicine, BLDE University's Shri B.M. Patil Medical College, Hospital & Research Centre, Vijayapura 586103, Karnataka, India*

[*]*Corresponding author. E-mail: sathupatil@yahoo.co.in*

ABSTRACT

As the life span of human is increasing, the population of elderly individuals is growing rapidly worldwide. Hypertension with vascular aging is one of the major risk factor for cardiovascular (CV) morbidity and mortality in elderly individuals. Apart from a risk factor for CV disease, hypertension is also a significant risk for stroke, chronic kidney disease, cognitive impairment, and dementia. Hypertension in older individuals is often accompanied by multiple comorbidities that not only affect their management tremendously but also their quality of life and longevity. In this chapter, evidence-based comprehensive holistic approach for the management of hypertension in the elderly by yogic life-style modality will be discussed.

3.1 INTRODUCTION

Hypertension with vascular aging is one of the major risk factors for cardiovascular (CV) morbidity and mortality in elderly individuals. It accounts for the third leading cause of global burden of disease. According to the WHO, hypertension is the most common cause of preventable death in both developed and developing countries.[1] As the life span of human is increasing, the population of elderly individuals is growing rapidly worldwide. Globally, the population of elderly is projected to increase from the present 901 million to 2.1 billion by 2050.[2] Projections beyond 2016 made by the United Nation have indicated that India will have about 198 million persons above 60 years of age in 2020 and 326 million in 2050.[3]

Elderly people being at high risk to develop hypertension and their increasing number implies that they represents the largest population of hypertensive subjects in India and worldwide. Apart from a risk factor for CV disease, hypertension is also a significant risk for stroke, chronic kidney disease, cognitive impairment, and dementia.[4,5] Studies have shown that reduction of systolic blood pressure (SBP) by 10 mmHg and diastolic blood pressure (DBP) by 5 mmHg in elderly hypertensive patients is associated with a decrease in myocardial infarction by 25%, stroke by 40%, congestive heart failure by 50%, and overall mortality by 10–20%.[6,7] Management of hypertension in elderly patients is challenging because they are often accompanied by multiple comorbidities. Multiple drug therapy and their side-effects affect the quality of life and longevity. Despite the available literature and evidence showing that lifestyle modalities such as yogic lifestyle can control blood pressure (BP) and improve quality of life, it is often overlooked in the management of hypertension.

3.2 EPIDEMIOLOGY

The prevalence of hypertension in the elderly ranges from 50% to 75%, and it is estimated that two out of three individuals over 75 years of age suffer from hypertension.[6,8] According to the Framingham Heart Study, about 60% of the population by age 60 years develops hypertension. In the same study, it was also estimated that the prevalence of hypertension may increase to about 65% in men and 75% in women by age 70. Also, it has been observed that nearly 85% of the individuals with normal BP

up to the age of 55 year were later developed hypertension over 20–25 years (their residual lifetime risk) of follow-up study.[9,10] According to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7), two-thirds of individuals after 65 years have hypertension.[11] In India, the prevalence of hypertension in the elderly above 60 years ranges from 40% to 60%.[12–14] Hypertension is more prevalent in elderly women than men.[6,14]

3.3 PATHOPHYSIOLOGY

Homeostatic regulation of BP within its normal range to ensure an adequate tissue blood flow to vital organs requires co-ordination of several complex interacting physiological systems. Age-associated changes in this complex regulatory system and vascular tissue results in change in the normal baseline of BP. The pattern of hypertension in the elderly is different from that of young and middle-aged individuals. After the age of 55 years, SBP increases while DBP falls or remains unchanged with age, resulting in isolated systolic hypertension (ISH). The hallmark of hypertension in the elderly is increased vascular resistance.[6] Essential hypertension in the elderly is multifaceted and involves complex mechanism.

Arterial stiffness: The reduction of vascular compliance with age due to stiffening of arteries is the major contributor for the development of hypertension in the elderly. Stiffness and dilatation are two major changes that occur in elastic arteries, particularly in the aorta. Due to aortic stiffening, it fails/decline to expand and recoil during ventricular systole and diastole, respectively. Decline/failure in optimum expansion of aorta leads to elevation in SBP, while failure/decline in recoiling results in lowering of DBP causing widening of pulse pressure (PP) with advancing age. PP is the best marker of arterial stiffness.[15]

Endothelial dysfunction: Endothelial cell structure and functional integrity are important for various vital CV functions including homoeostatic regulation of BP.[16] Vascular endothelium regulates several physiological properties of the blood vessel including vasodilatation, vascular permeability, and antithrombotic properties. One of the key molecules of endothelium that maintains vascular homoeostasis and integrity is nitric oxide (NO). Nitric oxide is a strong vasodilator. Sufficient bioavailability of NO is critical due to normal functioning of endothelium. With advancing age,

bioavailability of NO is decreased resulting in endothelial dysfunction. Endothelial dysfunction is characterized by a shift of the normal endothelial function toward reduced vasodilator capacity, a proinflammatory state, and prothrombotic properties.[17] Impaired NO-mediated vasodilatation is a potential contributor for stiffening of arteries and increasing peripheral vascular resistance, a pathognomonic characteristic of hypertension in the elderly.[18,19] Vascular oxidative stress plays an important role in the mechanism of reduction of bioavailability of NO and endothelial dysfunction. Hence, age-associated increase in oxidative stress has been implicated as one of the underlying causes of hypertension.[20–23]

Autonomic dysfunction: An age-related increase in sympathetic nervous system activity has been demonstrated by higher plasma nor-epinephrine levels[24] and muscle sympathetic nerve activity.[6,25] This rise in plasma nor-epinephrine levels with age is thought to be a compensatory mechanism for age-related decrease in beta-adrenergic response.[25] Age-related decline in baroreceptor sensitivity leads to relatively greater activation of sympathetic nervous system (compensatory mechanism) for a given level of BP.[6] Sympathetic overactivity increases vascular tone, vascular stiffness, and, thus, hypertension. Age-related arterial stiffness has been linked with increased sympathetic activity in hypertensive[26] and also in healthy subjects.[27] Increased sympathetic activity is also associated with endothelial dysfunction.[28,29]

Impaired neurohormonal regulation: Age-associated decline in neurohormonal mechanisms such as the renin–angiotensin–aldosterone system contributes to elevation in BP in the elderly. Elderly individuals have 40–60% lower levels of plasma renin activity than younger ones.[30] This decreased plasma renin activity has been attributed to the effect of age-related nephrosclerosis on the juxtaglomerular apparatus.[31] Plasma aldosterone levels also declines with age. Age-related changes in kidney function associated with decreased ability to excrete sodium load may also contribute to an elevation of BP in the elderly.

Molecular mechanisms: Epigenetic studies the interaction of DNA and its expression with the environment. Environmental factors such as diet, stress, obesity, smoking aging, and inactivity or sedentary lifestyle directly affect the incidence of hypertension.[32] A strong link between shorter telomere length and hypertension has been reported. Telomere shortening can be used as predictor for developing hypertension.[32]

3.4 DIAGNOSIS AND CLASSIFICATION OF HYPERTENSION IN THE ELDERLY

3.4.1 DIAGNOSIS OF HYPERTENSION

Since BP is more variable in the elderly individuals, hypertension should never be diagnosed on the basis of a single measurement of BP. A strong association between arterial stiffness and auscultatory gap has been reported, particularly in the elderly.[33] Normally, the measurement of BP depends on measuring on how much force it takes to compress an artery. To compress the stiffened arteries, the sphygmomanometer reading is falsely increased leading to false measurement of BP and misdiagnosis of hypertension. Hence, it has been recommended that the diagnosis of hypertension should be based on the average of a minimum of nine BP readings that have been measured on three separate visits.[6] A diagnostic evaluation for finding the secondary causes of hypertension should be done as per the standard guidelines.[11,34,35]

3.4.2 CLASSIFICATION OF HYPERTENSION

Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure defined criteria for normal BP and classified hypertension into prehypertension, Stage 1 hypertension, and Stage 2 hypertension. JNC classification of hypertension is shown in Table 3.1. Since isolated diastolic hypertension is so uncommon among older individuals, JNC classified an older patient's hypertension based entirely on the level of their SBP into: Stage-1 hypertension between 140 and 159 mmHg and Stage-2 hypertension, ≥160 mmHg.[11,35]

European Society of Hypertension and European Society of Cardiology[34, 36] classified BP into three categories: optimal, normal, and high normal, while hypertension has been classified into three grades: Grade-1 (mild), Grade-2 (moderate), Grade-3 (severe), and ISH. In the elderly, ISH is more common that can be graded into Grade-1, -2, and -3 on the basis of SBP values as shown in Table 3.2. JNC has omitted ISH in its 7th and 8th guidelines.

TABLE 3.1 Classification of Blood Pressure for Adults According to JNC7 Guidelines.

Classification	SBP (mmHg)	DBP (mmHg)
Normal	≤120	And ≤80
Prehypertension	120–139	or 80–89
Stage 1 hypertension	140–159	or 90–99
Stage 2 hypertension	≥160	or ≥100

TABLE 3.2 Classification of Blood Pressure for Adults According to ESH/ESC 2007 Guidelines.

Classification	SBP (mmHg)	DBP (mmHg)
Optimal	≤120	And ≤80
Normal	120–129	80–84
High normal	130–139	85–89
Hypertension		
Grade-1 (mild)	140–159	90–99
Grade-2 (moderate)	160–179	100–109
Grade-3 (severe)	≥180	≥100
Isolated systolic hypertension	≥140	≤90

3.4.3 TYPES OF HYPERTENSION

- *Essential hypertension:* A rise in BP of unknown cause is termed as essential, primary, or idiopathic hypertension. Essential hypertension is a heterogeneous disorder, with different patients having different causal factors that lead to high BP.[37,38] It accounts for 90–95% of all cases of hypertension.
- *Secondary hypertension:* A rise in BP of known underlying cause is termed as secondary hypertension. The prevalence of secondary hypertension ranges between 5% and 10%.[39] The etiology for secondary hypertension in the elderly are renal artery stenosis, coarctation of aorta, aldosteronism, pheochromocytoma, and hyperthyroidism.[40,41]
- *White-coat hypertension:* It is defined as the presence of an elevated BP (≥140/90 mmHg) in an office/clinic setting or in medical environment, but with normal BP when measured at home or normal day time ambulatory BP. It is more common in the elderly.[42,43]

- *Resistant hypertension*: It is more prevalent in elderly hypertensive patients. It is defined as BP that remains uncontrolled despite the concurrent use of three optimally dosed antihypertensive agents of different classes.[44,45] One of the three antihypertensive agents should be diuretic.[46]

3.5 MANAGEMENT OF HYPERTENSION IN THE ELDERLY

Hypertension in elderly individuals is often accompanied by multiple comorbidities that not only affect their management tremendously but also their quality of life and longevity.[6] Hypertension with multiple comorbidities requires multiple-drug prescription increasing the cost of treatment and economic burden on individuals, family, and country. Lifestyle modalities are strongly recommended in the management of hypertension and prevention of CV disease. It has also been recommended not to start drug therapy soon after the diagnosis of hypertension, if SBP is between 140 and 179 mmHg and not associated with any CV risk factors such as diabetes, cholesterolemia, etc.[34]

3.5.1 PHARMACOLOGIC APPROACH

The elderly individuals suffering from ISH are often resistant to pharmacological therapy. An attempt to reduce the SBP aggressively lowers DBP (normally decreased with age) resulting in decreased coronary blood flow.[46] It has been observed that antihypertensive drug can control BP but fails to check/control the progression of arterial stiffness. Furthermore, it has been documented that arterial stiffness increases at faster rate in well-controlled hypertensive patients when compared to individuals with normal BP.[47] Moreover, arterial stiffness is an independent and strong predictor of CV morbidity and mortality in hypertensive patients without any overt CV disease [48,49] as well as in healthy elderly individuals.[50] These information suggests that even after maintaining the BP at optimal level, elderly patients remain at CV risk due to increased arterial stiffness. Currently, pharmacological drugs are not available to reduce arterial stiffness in the elderly.

3.5.2 YOGIC APPROACH

Yoga is a psycho-somatic-spiritual discipline, which includes various mind–body techniques that help to achieve a harmony between our mind, body, and soul.[51] Yoga has been shown beneficial for CV health. It has many established health benefits and is emerging as an important lifestyle modality for prevention and management of CV risk. A meta-analysis of 3168 participants from 44 randomized controlled studies showed clinically important beneficial changes in CV risk factors with yoga.[52]

The goal of yogic management in the elderly with hypertension is (1) to control BP and associated CV risk factors; (2) to reduce number of antihypertensive drugs and their dosage (if patient is on drug therapy); and (3) to improve the quality of life. Yogic lifestyle management includes counseling on lifestyle habits (Yama and Niyama), dietary management (Pratyahara), exercises to improve endurance and flexibility (asana), breathing exercises (pranayama), physical and mental relaxation techniques (Dharana and Dhyana), and various techniques to purify mind and body (kriyas). Figure 3.1 shows the flowchart for yogic management of essential hypertension. Lifestyle changes have been recommended as the first line of intervention for subjects with high normal BP, Grade-1 and -2 hypertension, and as a complementary therapy for Grade-3 hypertensive patients associated with or without CV risk factors.[34] Elderly patients with high-normal BP/prehypertension can be managed by only yogic lifestyle.

Patients with Grade-1 and 2 hypertension should be managed initially by yoga therapy and wait for several months in case of Grade-1 hypertension and for several weeks in case of Grade-2 hypertension, if not associated with any CV risk factors. In cases of Grade-1 and 2 hypertension with 1 or 2 CV risk factors, the yoga therapy can be tried for several weeks. However, if yogic management fails to reduce the BP to the level of recommended target (SBP ≤140 mmHg) then drug (antihypertensive) therapy can be commenced with yoga therapy.[34]

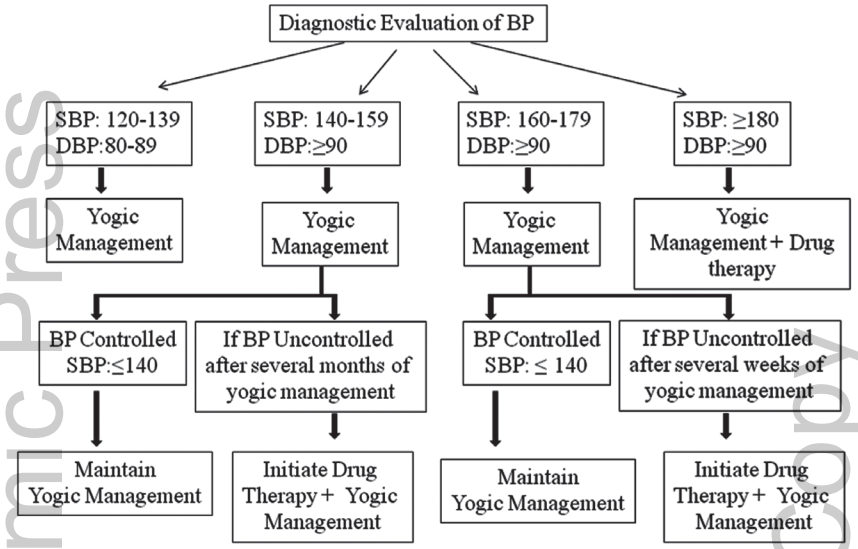

FIGURE 3.1 The flowchart for yogic management of essential hypertension in the elderly.

Control of diet is a primary concern in yogic management, and it plays an important role in health and beneficial modulation of BP in elderly. Purity of food leads to purity of mind. Yoga emphasizes on consumption of sattvik (healthy) food in moderate (Mitahara) quantity. Seasonal foods, fresh fruits, fresh vegetables, nuts, seeds, legumes, whole grains, and dairy products (milk and curd) are sattvik foods. It is advisable to avoid ghee (clarified butter) and butter. Dietary approaches to stop hypertension (DASH) diet with rich fruits, vegetables, low-fat dairy foods, whole grains, and nuts was shown as an effective and beneficial in Stage-1 ISH. In this study, diet rich in fruits and vegetables, DASH diet, and control diet for 8 weeks was given to three groups, respectively. DASH diet lowered SBP by 11.2 mmHg when compared to control group.[53] In another study, a comprehensive approach including walk, yoga, and dietary modifications was more effective than DASH diet on BP control, medication use, and CV risk factors.[54] Patients should also be advised to avoid alcohol, smoking, meat, and reduce salt intake. Satisfactory sleep is very important for a health and to control hypertension. Early to bed and early to rise is good for health. However, time to bed and rise should be gradually modified.

A systematic review (6 studies involving 386 patients) on effect of yoga on essential hypertension has showed yoga as an effective modality

for lowering BP. The studies included in this review had a wide variation in the age of subjects from 20 to 75 years and total duration of intervention ranged from 6 to 12 weeks. They reported that yoga has significantly lowered SBP (–2 to –29.17 mmHg) and DBP (–0.74 to –23.67 mmHg) when compared to conventional treatment or no treatment.[55] However, studies demonstrating yoga effects on hypertension in elderly individuals are least available. There are few published studies on yoga effects on hypertension in elderly individuals (Table 3.3).[56–60] Data of these studies suggests that yoga therapy is effective and beneficial in the management of hypertension in the elderly.

The first randomized controlled trial (RCT) of yoga (transcendental meditation (TM)) on mild hypertension in older American-Africans demonstrated a reduction in SBP by 10.7 mmHg and DBP by 6.4 mmHg. This study had included three interventions: (1) TM, (2) passive muscle relaxation (PMR), and (3) lifestyle modification education control (EC) program. TM is yoga-based mental technique, while PMR is a physical-based technique for stress reduction. TM and PMR intervention consisted of 20 min session twice a day for 3 months. TM was twice better than progressive muscle relaxation.[56]

In another RCT, a clinically relevant BP reducing effect with yoga (integrated yoga program) in Indian elderly male subjects with increased PP (high normal BP/Grade-1 hypertension) was reported. This study has given an intervention of integrated yoga program and stretching exercise with walking for two groups of subjects, respectively. Yoga program included loosening practices (sukshama vyama for 10 min), maintaining postures (Asanas: Utkatasana, Padhastasana, Ardhachakrasana, Trikonasana, Bhujangasana, Ardha Salabasana, Ardha Ustrasana, Shashankasana for 15 min), breathing practices (Anuloma Viloma and Brahmari Pranayama for 5 min), and meditation (cyclic meditation for 25 min) for 1 h daily for 6 days in a week. A clinically significant reduction of SBP by 13.23 mmHg was documented.[57]

A complementary yoga therapy (Kundalini yoga) with antihypertensive drugs has been showed more effective in reducing BP and improving quality of life than only pharmacological therapy. Further, it has been shown that individuals who have practiced yoga at home were more benefitted that those who practiced in class.[58]

TABLE 3.3 Impact of Yoga on Hypertension in Elderly Individuals.

Study (year)	Total sample size (yoga/control)	Age (years) mean age ± SD (range)		Design	Duration	Intervention time per session per day/week	Forms of yoga	Control	Baseline blood pressure SBP/DBP (mmHg)	Mean change	
		Yoga	Control							SBP (mmHg)	DBP (mmHg)
Schneider et al. (1995)	127 (Yoga-36/ PMR-37, EC-38)	63.7 ± 7.0 (55–85)	1.69.2 ± 7.2 2. 67.4 ± 7.9 (55–85)	RCT	12 weeks	20 min twice daily	TM	1. PMR 2. EC	Yoga—145.4/93.7 PMR—144.3/89.2 EC—150.4/91.7	−10.7	−4.7
Patil et al. (2014)	42 (21/21)	69.42 ± 5.32 (60–80)	69.52 ± 6.59 (60–80)	RCT	6 weeks	60 min daily for 6 days per week	Asanas, pranayama, meditation	Walking exercise	Y—147.23/74.95 C—147.0/75.52	−4.14	0.38
Wolff et al. (2013)	83 Y1—28 Y2—28 C—27	Y1: 66.2 ± 7.7 Y2: 64.0 ± 10.3 (20–80)	60.8 ± 11.0 (20–80)	MC	12 weeks	30 min daily	1. Kundalini Yoga 2. Left nostril breathing, spinal flex	Treatment as usual (anti-hypertensives)	Y1—143.8/89.0 Y2—143.6/88.4 C—144.3/89.8	Y1: 2.6 Y2: −4.4	Y1: −0.6 Y2: −5.2
Patil et al. (2015)	60 (30/30)	68.5 ± 4.85 (60–80)	69.3 ± 5.9	RCT	12 weeks	60 min daily for 6 days per week	Asanas, pranayama, cyclic meditation	Walking exercise	Y—146.07/74.25 C—145.72 /75.5	−13.23	1.0

EC, education control; MC, matched control; PMR, passive muscle relaxation; RCT, randomized controlled trial; TM, transcendental meditation.

3.6 PREVENTION OF HYPERTENSION IN THE ELDERLY

Though there are few data, available evidence suggests that yoga can prevent hypertension in the elderly. As discussed in the pathophysiology above, age-associated changes in the structure (arterial stiffness) and function (endothelial dysfunction) of the artery contributes to the development of hypertension in the elderly. Reduction in arterial stiffness along with BP following yoga intervention for 12 weeks has been documented. The same study has also shown an enhancement in bioavailability of NO suggesting that yoga induce beneficial changes in the endothelial function.[57] A cohort on patients with coronary artery disease has shown an enhancement in the endothelial-dependent vasodilatation in yoga practitioners.[61]

Age-associated oxidative stress is also implicated in the development of hypertension possibly through the development of endothelial dysfunction. Yoga practice for 12 weeks has showed significant reduction in oxidative stress and enhancement in antioxidant capacity in elderly hypertensives.[62]

Sufficient data is available to prove that yoga can induce beneficial modulation in autonomic balance and reduce sympathetic activity.[57,63] A trial of yogic pranayama breathing called Bhastrika on a background of hatha yoga (4 months) on pulmonary function and autonomic function in 76 elderly individuals were studied. In the yoga group, there were significant reduction in sympathetic activity and improvement in the respiratory function.[63]

3.7 CONCLUSION

Yogic management covers all lifestyle modalities such as dietary control, lifestyle counseling, physical exercise with relaxation techniques to improve physical fitness and stability, voluntary regulation of breathing, and mental relaxation techniques to reduce stress and control mind. All these in total help to relax mind and body, reduce stress, and improve the coordination of complex BP regulatory systems and quality of life of the elderly. Data shown represent that a comprehensive approach with yogic diet, sukshama vyama (loosening practices), pranayama (slow breathing practices), and meditation can be prescribed for prevention and management of hypertension in the elderly. The proportion of practice of

sukshama vyama, pranayama, and meditation may be 2:1:4. Though there are few data on influence of yoga on hypertension in elderly population, it is recommended for the holistic management of hypertension. No adverse effect of yoga has been reported. However, large and high quality clinical trials on both therapeutic and preventive effects of yogic lifestyle on hypertension in the elderly are needed.

KEYWORDS

- **hypertension**
- **elderly**
- **yoga**
- **management**
- **prevention**

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