

Review Article

The global epidemiology, risk factors and treatment of hypertension

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Abstract

High blood pressure, often known as hypertension, is a major cause of illness and mortality that is a global health concern. In-depth analysis of the global epidemiology, pathophysiology, risk factors, and therapy options for hypertension is provided in this review paper. The article provides a thorough knowledge of the complex nature of hypertension by synthesizing the most recent studies and data. The prevalence of hypertension is increasing globally, while there are significant regional and population-based variances. The complicated interplay between vascular dysfunction, neuro-hormonal control, and inflammation-related mechanisms, as well as genetic predisposition and environmental variables, all have a role in the etiology of hypertension. Age, obesity, sedentary behavior, salt consumption, and heredity are some of the risk factors that interact to enhance vulnerability to hypertension. Treatment methods range from pharmacological interventions to changes in lifestyle, emphasizing the value of customized management plans. Addressing the global burden of

hypertension requires a comprehensive strategy that includes awareness-raising, early identification, and individualized therapeutic interventions.

Key words

Hypertension, Epidemiology, Pathogenesis, Risk factors, Treatment.

Introduction

The significant incidence of hypertension, which varies across geographies, racial groups, and socioeconomic levels, highlights the disease's widespread burden. For designing effective preventative measures and targeted interventions, understanding epidemiological patterns and trends is essential. A trip through complex physiological pathways combining vascular dysfunction, neurohormonal dysregulation, and immune system activation is required to fully understand the pathophysiology of hypertension. These realizations open up new therapy possibilities that target the root causes of hypertension [1-3].

Risk factors are very important in the onset and development of hypertension. A comprehensive framework for preventive measures and individualized therapies is provided by a thorough examination of these risk variables, which range from genetic predisposition to lifestyle choices. Additionally, the spectrum of hypertension treatments is always changing and includes pharmaceutical interventions, lifestyle changes, and novel therapies. The key to obtaining optimal blood pressure control and lowering related cardiovascular risks is to take a holistic approach to therapy that takes into account the unique patient profiles.

In light of this, the goal of this review article is to bring together recent findings, synthesize clinical knowledge, and provide a comprehensive analysis of the effects of hypertension on the world. This article aims to provide healthcare professionals and researchers with a thorough resource that informs evidence-based practice, ultimately contributing to the global effort to mitigate the burden of hypertension and improve

cardiovascular health on a global scale. It does this by elucidating the epidemiology, pathogenesis, risk factors, and treatment modalities.

Epidemiology of hypertension

One of the most prevalent chronic medical illnesses in the world hypertension affects people of all ages, genders, and socioeconomic statuses. It's astounding prevalence around the globe. According to the World Health Organization (WHO), 1.13 billion people worldwide were predicted to have hypertension in 2019 (WHO, 2021). The severity of the issue and its significant negative effects on public health are highlighted by this high prevalence. Adults with hypertension are reportedly 46% less likely to be aware of their condition [4].

There are considerable regional and international differences in the prevalence of hypertension. According to NCD Risk Factor Collaboration's 2017 report, high-income countries—particularly those in North America and Europe—report lower prevalence rates than low- and middle-income ones—particularly those in South Asia, Africa, and portions of Southeast Asia. These gaps can be attributable to lifestyle, social, genetic, and healthcare access differences [5]. Age and hypertension go hand in hand, making it more prevalent as people age. The normal physiological changes that take place with ageing, such as changes in blood vessel flexibility and general cardiovascular health, are the cause of this age-dependent pattern. However, hypertension is not just a problem for elderly people; it may also affect younger age groups, like kids and teenagers, mostly as a result of things like obesity and leading sedentary lifestyles [6].

Across all age categories, there are disparities in the prevalence of hypertension by gender. Men are more likely than women to have hypertension in their early adult years. Women do, however, seem to have a larger prevalence as people age, especially after menopause. This shift is influenced by hormonal changes, particularly the drop in oestrogen levels during menopause [7]. It is generally known that there are racial and ethnic differences in the prevalence of hypertension. For instance, compared to other ethnic groups, African Americans in the United States have a much greater frequency of hypertension. Genetic, socioeconomic, healthcare access and cultural variables all have an impact on these discrepancies [8]. The large percentage of untreated and uncontrolled instances of hypertension is one of the on-going difficulties in controlling the condition. Many people with hypertension are uninformed that they have the condition, and even among those who are, many struggle to maintain appropriate blood pressure management [9]. This discrepancy emphasizes the necessity of raising hypertension awareness, early detection, and treatment regimen adherence.

Beyond only being common, hypertension has a significant impact on healthcare and public health. It carries a considerable chance of developing cardiovascular conditions such heart attacks, strokes, heart failure, and kidney problems. It adds to the overall burden of non-communicable diseases (NCDs), a major cause of death across the globe. Uncontrolled hypertension complications, like heart attacks and strokes, lead to high healthcare expenses, long-term incapacity, and early death. In addition to its negative effects on health, high blood pressure costs the healthcare system a lot of money due to an increase in hospital stays, medication use, and outpatient visits (NCD Risk Factor Collaboration, 2017). The need for improved hypertension prevention and management is urgent given this cost to society [10-12].

Obesity

Obesity stands out as one of the most significant and changeable contributors among the many risk factors of hypertension. The excessive build-up of adipose tissue in the body, which is primarily caused by an imbalance between calorie intake and expenditure, is what is referred to as obesity. It is well acknowledged as a significant risk factor for the onset, development, and inadequate management of hypertension. There is no indication of a threshold, and epidemiological studies have repeatedly found a constant, nearly linear direct association between BMI and blood pressure [13, 14]. Numerous intricate physiological mechanisms underlie the link between obesity and hypertension. Adipose tissue's secretion of pro-inflammatory cytokines and adipokines is one such mechanism. Tumor necrosis factor-alpha (TNF-), leptin, and other bioactive chemicals encourage systemic inflammation and oxidative stress, which results in endothelial dysfunction and vascular remodelling [15]. Insulin signalling is interfered with by substances originating from adipose tissue, which is a condition closely related to obesity. Nitric oxide and endothelin-1 are two examples of the delicately balanced chemicals that are further upset by insulin resistance, impairing vasodilation and enhancing vasoconstriction, respectively [16]. Additionally, dyslipidaemia, which is linked to obesity and is characterized by high triglyceride levels and low levels of HDL cholesterol, is linked to atherosclerosis and hypertension. Another important factor in the connection between obesity and hypertension is the renin-angiotensin-aldosterone system (RAAS). Angiotensinogen and other RAAS constituents, such as adiponectin, are produced by adipose tissue, an active endocrine organ. Increased blood pressure, volume expansion, and salt and water retention are caused by the RAAS being overactive [17].

High sodium intake

High sodium consumption is one of the modifiable risk factors that has received the most

attention due to its important involvement in the onset and progression of hypertension. For cellular activity and fluid equilibrium to be maintained, sodium, an important electrolyte, is required. The PURE study indicated that in 2010, the world's daily sodium intake was 3,950 mg, which is significantly more than the 2,300 mg or less per day that is suggested in all published standards [18, 19]. However, an abundant diet of processed and salty foods, as well as excessive sodium consumption, has been identified as a significant risk factor for hypertension. The consumption of sodium has been linked to higher blood pressure in randomized clinical trials, observational epidemiologic research, and animal studies [20]. Most cross-sectional observational research on the relationship between blood pressure or hypertension and sodium intake or 24-hour urine sodium excretion found a substantial, positive, and favorable linear relationship [21, 21]. High sodium consumption and hypertension are mostly correlated because of how it affects fluid retention and vascular tone. The imbalance between sodium and potassium is upset by too much sodium, which causes intracellular sodium build-up. This build-up causes water retention, which raises blood volume and, as a result, blood pressure [23]. The renin-angiotensin-aldosterone system (RAAS) and sodium play a key role in hypertension. When the RAAS is activated by high sodium levels, aldosterone is secreted, which encourages sodium reabsorption and potassium excretion. This loop results in on-going fluid retention and raises blood pressure [24]. Increased sodium intake can also affect nitric oxide availability and impair endothelial function, which results in vasoconstriction and decreased arterial compliance. A characteristic of hypertension, increased peripheral resistance is a result of these vascular alterations [25].

Physical inactivity

Physical inactivity is one of the risk factors that can be modified because of its important role in the development and exacerbation of hypertension. Insufficient physical exercise and

sedentary lifestyles have been identified as significant risk factors for the onset and inadequate management of hypertension. Urbanized people in high-income countries have substantially higher rates of insufficient physical activity [26-27]. There is a reduction in the incidence of incident hypertension with even low amounts of physical activity (like walking to work) [28]. Physical activity lowers blood pressure in people with hypertension and norm tension, according to randomized controlled trials and meta-analyses [29-31]. Physical inactivity and hypertension are linked because of the complex interactions between many physiological processes. Through a number of mechanisms, regular physical activity supports cardiovascular health. Improved endothelial function is one of the main mechanisms. Nitric oxide, a vasodilator that promotes optimal blood channel dilatation and lowers blood pressure, is released while you exercise. Additionally, exercise is beneficial for maintaining the equilibrium of the autonomic nervous system. Regular exercise improves blood pressure regulation and heart rate variability by decreasing sympathetic nervous system activity and increasing parasympathetic activity. Along with obesity, insulin resistance, and metabolic syndrome, which all contribute to the development of hypertension, physical inactivity is also linked to these conditions. Being sedentary results in increased body weight and adiposity, this in turn causes inflammation, insulin resistance, and altered lipid metabolism, which eventually affects the control of blood pressure.

Alcohol consumption

Alcohol use has drawn a lot of attention among the modifiable risk factors because of its intricate relationship to the onset and worsening of hypertension. While moderate alcohol consumption may have some health benefits for the heart, heavy or excessive drinking increases the risk of hypertension. From 5.9 L per capita in 1990 to 6.5 L in 2017, the world's annual alcohol consumption increased [32]. High levels of

alcohol consumption have been linked to an increased risk of high blood pressure in numerous observational epidemiologic studies [33]. Alcohol consumption and hypertension are linked by intricate physiological pathways. It is well established that alcohol affects blood pressure regulation both acutely and continuously. Acute alcohol use causes vascular smooth muscles to relax, which causes vasodilation. This momentary vasodilation can initially drop blood pressure, but due to the cumulative effects of heavy drinking on the cardiovascular system, it can also cause blood pressure to rise for an extended period of time. While heavy drinkers had a higher risk of incident hypertension than either light to moderate drinkers or non-drinkers, light to moderate drinkers had a lower risk than neither group. Except for black men, for whom risk was similarly enhanced in light to moderate and heavy drinkers compared to non-drinkers, this pattern was seen in all racial and gender groups [34].

Treatment interventions of hypertension

Lifestyle modification

It is crucial to address food choices in the onset and treatment of hypertension. For instance, the DASH diet prioritises nutrient-dense foods such as fruits, vegetables, whole grains, lean meats, and low-fat dairy products. Excess sodium, saturated fats, and added sugars are discouraged by this approach. Because sodium has a connection to fluid retention and raised blood pressure, it is very important to reduce sodium intake. Following a heart-healthy diet helps decrease blood pressure and improves cardiovascular health in general [35].

Another essential component of treating hypertension is maintaining a healthy weight. Obesity, especially abdominal obesity, raises blood pressure through causing hormonal imbalances, inflammation, and insulin resistance. A healthy weight can be attained and maintained with regular exercise and a balanced diet. Even a little reduction in body weight, about 5–10% of

total weight, results in significant drops in blood pressure and lowers the likelihood of long-term cardiovascular issues. Regular physical activity should be incorporated into a hypertension-reducing lifestyle. Exercises that improve cardiovascular fitness and lower blood pressure include brisk walking, jogging, swimming, and cycling. Exercise increases the effectiveness of the cardiovascular system by enhancing heart health and lowering blood vessel resistance. For people with hypertension, the American Heart Association recommends performing at least 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity aerobic activity each week [36].

For the control of hypertension, dietary salt consumption must be reduced. Consumption of salt can be reduced by using methods including reading food labels, cooking at home, and choosing whole, fresh foods over processed ones. The World Health Organization advises keeping sodium intake under 2,000 mg per day since lower sodium levels are linked to better blood pressure management and a lower risk of cardiovascular events [37]. For people with hypertension, moderation is crucial when it comes to alcohol consumption. While some studies indicate that a moderate alcohol intake may have positive effects on the heart, excessive alcohol use can raise blood pressure and pose other health problems. Men should limit their alcohol consumption to no more than two drinks per day for heart health, and women to no more than one drink per day. Hypertension also results from on-going stress and high levels of the stress hormones [38]. It is possible to lessen the negative effects of stress on blood pressure by including relaxation practices such as regular rest and deep breathing exercises, yoga, and mindfulness meditation. Blood pressure levels are directly influenced by stress management, which also promotes general wellbeing. In conclusion, modifying one's lifestyle is an effective intervention for the management of hypertension. These adjustments not only aid in blood pressure control but also total

cardiovascular health, highlighting the value of leading a healthy lifestyle to reduce the risks related to hypertension.

Emerging therapies

Renal Denervation

A novel and less invasive therapy called renal denervation targets lowering blood pressure by inhibiting sympathetic nervous system activity in the kidneys. By boosting peripheral resistance and encouraging salt retention, this system contributes significantly to blood pressure control. The sympathetic nerves found in the renal artery walls are the target of radiofrequency energy given during the treatment. Renal denervation interferes with these nerves' ability to stimulate the blood arteries and the kidneys, lowering blood pressure as a result. For patients with resistant hypertension who do not respond well to conventional medications, the strategy attracted attention. Although there is significant patient heterogeneity, studies have demonstrated that after renal denervation, blood pressure levels have decreased in a promising manner. Although the procedure's long-term effectiveness and safety are still being studied, it offers an interesting new option for people who are having trouble lowering their blood pressure with conventional medications.

Conclusion

The public, policymakers, and healthcare professionals must all work together to address hypertension, which continues to be a serious worldwide health issue. The complexity of hypertension, which includes its epidemiology, aetiology, risk factors, and treatments, highlights the need for a multimodal strategy for managing it. The prevalence of hypertension is anticipated to increase further as populations continue to urbanize and lead sedentary lifestyles. But the knowledge gathered from this review serves as a basis for focused treatments. Emphasizing the importance of lifestyle changes, such as regular exercise, balanced diets, and a decrease in salt intake, can help people lower their chance of developing hypertension. Additionally, a viable

path to better management outcomes is the development of personalized treatment plans that take into account genetic predisposition and individual risk factors. To develop successful awareness campaigns, early detection programmes, and easily accessible treatment choices, medical practitioners, researchers, and public health organizations must work together. In the end, the fight against hypertension necessitates a global commitment to advancing cardiovascular health, assuring a higher standard of living for people everywhere.

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