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Global Epidemiology of Hypertension: Risk Factors, Public Health Implications, and Strategies for Prevention

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Abstract: Hypertension, recognized as a leading cardiovascular ailment globally, has garnered increasing concern and scrutiny within the medical community. Data from 2010 indicates that 31.1% of the global adult population is afflicted with hypertension, signifying a substantial proportion of individuals grappling with this cardiovascular condition. The pervasive issue of hypertension warrants heightened awareness and targeted preventative measures to curtail its prevalence and associated health implications. This review is structured into six sections: introduction to hypertension, epidemiological characteristics, risk factors, effect, prevention and control strategies, and conclusions. By reviewing the current literature, this paper contributes to the ongoing discourse on hypertension and outlines areas for further investigation in public health research.

Keywords: Hypertension, Cardiovascular disease, Epidemiology.

1. Introduction

Hypertension is the major cause of death and disability-adjusted lifespans around the world[1, 2], which is defined as systolic blood pressure (SBP) ≥ 140 mmHg or diastolic blood pressure (DBP) ≥ 90 mmHg[3]. The most prevalent risk factor for cardiovascular disease (CVD) is hypertension[4]. Systolic and diastolic blood pressure have been linked to an increased risk of CVD, according to a meta-analysis of 61 prospective studies. The risk of CVD rises log-linearly from SBP levels below 115 mmHg to >180 mmHg and from DBP levels below 75 mmHg to >105 mmHg[5, 6].

These findings underscore the importance of proper blood pressure management, as reflected in the 2017 ACC/AHA Hypertension Guidelines. These guidelines categorize blood pressure into four levels—normal, elevated, stage 1, and stage 2 hypertension—providing clinicians with a structured framework to assess and manage hypertension in adult populations[7]. This review will further explore the epidemiological trends, risk factors, and prevention strategies related to hypertension, highlighting its growing public health burden and the need for innovative approaches to manage and reduce its impact.

2. Epidemiological characteristics

Due to a 2005 global statistics analysis, 972 million adults worldwide, or 26.4% of the total population, suffered with hypertension in 2000[8]. In keeping with a comprehensive review of population-based

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research conducted in 90 nations, 1.39 billion adults worldwide, or 31.1% of the total population, suffered from hypertension as of 2010[9].

One sexually dimorphic characteristic is blood pressure, which can vary significantly in prevalence between men and women over the course of a lifetime[10]. As to the 2021 Heart Disease and Stroke Statistics Update, between 2015 and 2018, the age-adjusted prevalence of hypertension in Americans aged 20 and over was 42.8% for women and 51.7% for men[11]. Blood pressure is also related to different age groups of different sexes[12]. During adolescence, blood pressure between the sexes is similar, but after that, men's blood pressure is significantly higher than women of the same age[13]. After the age of 60, the prevalence of hypertension in women is higher than that in men because as they age, women lose their protective advantage against hypertension and the development of hypertension accelerates[12, 14].

National reports indicate that changes in the prevalence of hypertension around the world are not consistent. In high-income nations, the prevalence of hypertension has marginally decreased since 2000, whereas in low- and middle-income nations, it has dramatically grown[9]. These disparities suggest that health care systems for low- and middle-income populations may be facing a rapidly increasing burden of hypertension and blood pressure-related cardiovascular disease. To gain a more comprehensive understanding of this critical public health challenge, up-to-date estimates of the global burden of hypertension, particularly in low- and middle-income countries, are essential [9, 15].

3. Risk factors for hypertension

3.1. Lifestyle factors

3.1.1. Diet

Associations such as the European Society of Cardiology/European Society of Hypertension, the International Society of Hypertension[16], and the American College of Cardiology/American Heart Association[7] have published guidelines for the management and prevention of hypertension. These official associations have given dietary recommendations for hypertension, such as sodium restriction (daily intake should not exceed 5000 mg of sodium or 12.5 g of salt), moderate alcohol consumption (≤2 drinks per day for men and ≤1 drink per day for women for drinkers), the Mediterranean diet (moderate fat intake, low red meat intake and high vegetable intake), the DASH diet (a diet rich in fruits, vegetables, whole grains and low-fat dairy products, and reduced saturated fat and total fat), etc. This article mainly discusses the relationship between high sodium intake, alcohol intake and hypertension.

Among dietary factors, excessive sodium intake (i.e., more than 5000 mg sodium or 12.5 g salt per day) is the main cause of the development of hypertension, so sodium restriction is considered a popular recommendation to lower blood pressure[17, 18].Some evidence suggests a causal relationship between sodium intake and increased blood pressure[19]. Gupta et al. discovered that a 1-week low-sodium diet led to a mean decrease in systolic blood pressure of 8 mmHg in comparison to a high-sodium diet, with no side effects, in a prospectively assigned diet-sequential crossover research of 213 participants. When compared to the high-sodium diet, the low-sodium diet decreased systolic blood pressure by over 75%[20]. Some studies reported positive, linear, and significant associations of dietary intake or 24-hour sodium excretion with blood pressure or hypertension[21]. The Intersalt study, which examined the association between 24-hour urinary sodium excretion and blood pressure in 10,074 men and women aged 20-59 years in a population-based sample of 52 people from 32 countries, showed consistent patterns of regional differences in salt intake and blood pressure levels[21].

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Many epidemiological studies have shown that high alcohol consumption is a risk factor for elevated blood pressure[22, 23]. Alcohol use and the onset of hypertension were found to have a substantial positive dose-response association, with synergistic health effects, in a long-term longitudinal study of 7511 male workers in Japan[23]. In accordance with a systematic review and meta-analysis that included 36 trials and 2865 participants (2464 men and 401 women), lowering alcohol content did not significantly lower blood pressure in those who drank two drinks or less per day, but it did lower blood pressure in those who drank more than two drinks per day. After drinking every day, the diastolic blood pressure (−3·97, −4·70 to −3·25) and systolic blood pressure (mean difference −5·50 mm Hg, 95% CI −6·70 to −4·30) decreased. Participants' intake dropped by almost 50% after consuming six or more beers[22].

3.1.2. Weight

With estimates that at least 75% of hypertension morbidity is directly linked to obesity, the Obesity Society and the American Society of Hypertension acknowledge that hypertension plays a significant role in obesity-related cardiovascular morbidity and mortality in light of the global obesity epidemic[24]. Fantin et al. analyzed studies from the past 10 years examining the effects of different weight loss strategies (such as dietary and lifestyle changes, drug interventions, and bariatric surgery) on blood pressure. Although positive effects of weight loss could be found in each study, the main differences appeared to be the magnitude and durability of the blood pressure reduction over time[25].

3.1.3. Exercises

Current epidemiological evidence shows that there is a consistent, time- and dose-dependent relationship between physical activity and the development of hypertension[26]. In recent years, there has been a lot of literature demonstrating the beneficial effects of exercise on lowering blood pressure and supporting the important role of physical activity in preventing hypertension. Aerobic exercise was linked to substantial decreases in mean systolic and diastolic blood pressure (-3.84 mmHg, respectively [95% CI, -4.97 to - 2.72 mmHg] and -2.58 mmHg [CI, -3.35 to -1.81 mmHg]), according to a meta-analysis of 54 randomized controlled studies with 2419 participants[27].

3.2. Psychological factors

Nowadays, stress is so prevalent that most people view it as a minor hardship, despite the fact that it has serious negative effects, such as cardiovascular disease. Stress raises the frequency and intensity of hypertension risk factors[28]. The central nervous system is typically where the processes that connect stress to illness start. The amygdala uses efferent neurons to tell the hypothalamus to raise sympathetic nervous system (SNS) activity, decrease parasympathetic nervous system (PSNS) activity, and start neurohormonal output through the hypothalamic-pituitary-adrenal (HPA) axis in order to trigger the stress response. Through so-called "top-down" regulation, the prefrontal cortex can give regulatory signals to lessen the stress response by cognitively evaluating the input. The brainstem and amygdala are downstream projections of the prefrontal cortex that control the functioning of the HPA and autonomic axis. Neural activity related to stress is influenced by additional signals from the hippocampus and anterior cingulate cortex. This activity triggers the "fight or flight" response and adaptive reactions of fear and anxiety in dangerous environmental situations[28]. A systematic review and meta-analysis of the impacts of mindfulness-based stress reduction (MBSR) on systolic and diastolic blood pressure (BP), anxiety, depression, and perceived stress in patients with hypertension or prehypertension found that the comparison of MBSR with a control condition for diastolic BP was statistically significant in favor of MBSR compared with the control condition, and the comparison of MBSR with a control condition for systolic BP was

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associated with a mean effect size that was only marginal[29]. It can be seen that the technical method of stress reduction has a certain effect on relieving hypertension and is a promising intervention method.

4. Effect

4.1. Health consequences

One of the most significant risk factors for dementia, chronic renal disease, ischemic heart disease, stroke, and other cardiovascular conditions is hypertension[3]. Many studies have found that as long as systolic and diastolic blood pressure increases, the risk of other cardiovascular diseases will increase. For example, a prospective observational study of 61 participants in different countries found that the risk of ischemic heart disease and stroke doubled for every increase of 20 mmHg and 10 mmHg in SBP and DBP, respectively, starting from 115 mmHg for SBP and 75 mmHg for DBP[5].

4.2. Financial burden

Compared to high-income countries, low- and middle-income countries have higher rates of hypertension[9]. Treating hypertension is a costly endeavor, especially in low- and middle-income countries, which can put pressure on ordinary people. In addition, if the proportion of hypertensive patients is too high, the productivity of the country will decline, which will further increase the economic burden on the country and the patients themselves.

5. Prevention and control strategies

Prevention and control of hypertension can start from the following aspects, which requires the joint efforts of the state, medical institutions, and ordinary people. The state needs to formulate a public health policy for hypertension, and each country and region needs to publish its own hypertension disease guidelines, which should include the prevention of hypertension. Hospitals in various regions can regularly organize hypertension risk screening, early detection, and early intervention, which can improve the general public's awareness of hypertension. Medical staff should provide health education to patients, such as improving diet structure, maintaining a healthy diet, quitting smoking, and drinking, and exercising more. The state can also popularize the risk factors of hypertension to the public through online media, tell people the importance of preventing hypertension, and educate people on how to correctly prevent the risk factors of hypertension and promote healthy living, such as: recommending the Mediterranean diet structure, eating more vegetables, reducing salt intake, increasing daily exercise, maintaining mental health, etc.

6. Conclusions

Hypertension is one of the diseases with a high prevalence and high mortality risk in the world. Hypertension can cause other diseases such as cardiovascular disease or kidney disease. Due to policy control, management, economic and other factors, the prevalence of hypertension in low- and middle-income countries is much higher than that in high-income countries, which has brought an economic burden to low- and middle-income countries. Risk factors for hypertension include high-sodium diet, high-fat diet and excessive drinking, obesity, lack of exercise, psychological factors, etc. Therefore, this article hopes that future studies will update the global prevalence data of hypertension and conduct in-depth research on other risk factors for hypertension. It is also hoped that different countries or regions will have better management and prevention measures for hypertension, formulate more complete and better policies, increase the frequency of screening, and strongly call on people to take action, emphasizing the urgent need for more research, especially in low- and

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middle-income countries, and emphasizing the importance of cooperation between governments, health care providers and individuals to fight hypertension.

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