WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Case Study: Essential Hypertension in Young Adult

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A B S T R A C T

Introduction. Hypertension is a major public health concern and a leading risk factor for cardiovascular diseases globally. While it is commonly associated with older adults, the prevalence of hypertension in younger populations is rising due to changes in lifestyle, diet, and stress levels. Early detection and management of hypertension in young adults are crucial to prevent long-term complications such as heart disease and stroke. This case report highlights a 21-year-old male diagnosed with essential hypertension, emphasizing the importance of timely intervention and comprehensive management in young patients.

Case Presentation. A 21-year-old male university student presented with frequent morning headaches, occasional dizziness, palpitations, and fatigue over the past three months. The patient, a non-smoker with occasional alcohol consumption and no significant past medical history, had elevated blood pressure readings consistently recorded at 155/98 mmHg. Physical examination was unremarkable except for hypertension. Laboratory investigations ruled out secondary causes of hypertension, and lipid profile results showed elevated cholesterol levels. An echocardiogram revealed mild concentric left ventricular hypertrophy. The diagnosis of essential hypertension was confirmed by 24-hour ambulatory blood pressure monitoring, which recorded an average blood pressure of 150/95 mmHg. Management included lifestyle modifications, such as adopting the DASH diet, increasing physical activity, and stress management, alongside pharmacological treatment with Lisinopril. At follow-up, the patient demonstrated significant improvement in blood pressure control and symptoms, with no progression of left ventricular hypertrophy.

Conclusion. This case underscores the increasing prevalence of hypertension among young adults and the importance of early detection and management to prevent long-term cardiovascular complications. The successful reduction in blood pressure and symptoms through a combination of lifestyle changes and pharmacological therapy highlights the effectiveness of a comprehensive approach. Routine screening and increased awareness of hypertension in young adults are essential for timely intervention and optimal long-term health outcomes.

Keywords: Hypertension, Essential, Young Adult

Introduction

All definitions of hypertension are consensus figures based on clinical evidence (evidence based) or based on consensus or based on epidemiological meta-analysis studies. If blood pressure is higher than the agreed normal figure, the risk of morbidity and mortality from cardiovascular events will increase. Hypertension is the persistence of blood pressure above or equal to 140/90 mmHg. Some patients only have increased systolic pressure, called isolated systolic hypertension (ISH), or only diastolic pressure, called isolated diastolic hypertension (IDH). There is also what is called white coat hypertension, namely blood pressure that increases when checked at the practice, while the blood pressure measured by yourself (home blood pressure measurement/HBPM) turns out to be normal. White coat hypertension is considered unsafe. Persistent hypertension is hypertension, whether measured in the clinic or outside the clinic, including at home, and also during normal daily activities. Even though they both increase, blood pressure in the clinic is often higher than outside the clinic. Resistant hypertension is blood pressure that does not reach the normal target even though you have received three different classes of anti-hypertension drugs at optimal doses (one of which is the diuretic class).

Blood pressure is determined by 2 main factors, namely cardiac output and peripheral vascular resistance. Cardiac output is the product of heart rate frequency and stroke volume, while stroke volume is determined by venous return and the strength of myocardial contraction. Peripheral resistance is determined by vascular smooth muscle tone, vascular elasticity and blood viscosity. All of these parameters can be influenced by several factors, including: the sympathetic and parasympathetic nervous systems, the renin-angiotensin-aldosterone (SRAA) system and local factors in the form of vasoactive substances produced by blood vessel endothelial cells.[1,2]

The sympathetic nervous system is pressive, namely increasing blood pressure by increasing heart rate, strengthening myocardial contractility, and increasing vascular resistance. The parasympathetic system is the opposite, namely it is depressive. If stimulated, it will lower blood pressure because it reduces heart rate. SRAA is also pressive because it can trigger the release of angiotensin II which has a vasoconstrictive effect on blood vessels and aldosterone which causes water and sodium retention in the kidneys thereby increasing blood volume. [1,3,4]. Blood vessel endothelial cells also play an important role in the occurrence of hypertension. Blood vessel endothelial cells produce various vasoactive substances, some of which are vasoconstrictors

such as endothelin, thromboxane A2 and local angiotensin II. Others are vasodilators such as endothelium-derived relaxing factor (EDRF), which is also known as nitric oxide (NO) and prostacyclin (PGI2). Apart from that, the heart, especially the right atrium, produces a hormone called atriopeptin (atrial natriuretic peptide, ANP) which tends to be a diuretic, natriuretic and vasodilator which tends to lower blood pressure.[2] Secondary angiotensin activity stimulates aldosterone secretion from the adrenal cortex. Aldosterone is a steroid hormone that has an important role in the kidneys. To regulate the volume of extracellular fluid, aldosterone will reduce the excretion of NaCl (salt) by reabsorbing it from the renal tubules. The increase in NaCl concentration will be diluted again by increasing the volume of extracellular fluid which in turn will increase blood volume and pressure.[4]

The role of renin-angiotensin is very important in renal hypertension or which is caused by kidney disorders. If there is a disruption in blood circulation to the kidneys, the kidneys will secrete large amounts of renin. According to Guyton and Hall (1997), renin is an enzyme with a small protein that is released by the kidneys when arterial pressure falls very low. According to Klabunde (2007), renin release can be caused by activation of the sympathetic nerves (activation via β1-adrenoceptors), a decrease in renal artery pressure (caused by a decrease in systemic pressure or renal artery stenosis), and a decrease in salt intake into the distal tubule.[4,5]

Renin works enzymatically on another plasma protein, namely angiotensinogen, to release angiotensin I. Angiotensin I has mild vasoconstrictor properties, then it will be activated by angiotensin II by an enzyme, namely a converting enzyme, which is found in the endothelium of pulmonary vessels called Angiotensin Converting Enzyme (ACE). Angiotensin II is a very powerful vasoconstrictor, and has other effects that also affect circulation. Angiotensin II remains in the blood for only 1 or 2 minutes because it is quickly inactivated by various blood and tissue enzymes which are collectively called angiotensinase. As long as angiotensin II is in the blood, it has two main effects that can increase arterial pressure. The first effect, namely vasoconstriction, occurs quickly. Vasoconstriction occurs mainly in arterioles and is slightly weaker in veins. Constriction of the arterioles will increase peripheral resistance, resulting in increased arterial pressure. Mild constriction of the veins will also increase the return flow of venous blood to the heart, thereby helping the heart pump to fight the increase in pressure.[2,4]

The second major way in which angiotensin increases arterial pressure is by acting on the kidneys to decrease salt and water excretion. When blood pressure or blood volume in the efferent arterioles falls (sometimes as a result of decreased salt intake), the enzyme renin initiates a chemical reaction that converts a plasma protein called angiotensinogen into a peptide called angiotensin II. Angiotensin II functions as a hormone that increases blood pressure and blood volume in several ways.[4,6] For example, angiotensin II increases pressure by constricting arterioles, decreasing blood flow to many capillaries, including renal capillaries. Angiotensin II stimulates the proximal tubule of the nephron to reabsorb NaCl and water. This will reduce the amount of salt and water excreted in the urine and the result will be an increase in blood volume and blood pressure. Another effect of angiotensin II is the stimulation of the adrenal glands, which are organs located above the kidneys, which release the hormone aldosterone. The hormone aldosterone acts on the distal tubule of the nephron, which makes the tubule reabsorb more sodium ions (Na+) and water, and increases blood volume and pressure. This will slow the increase in extracellular fluid volume which then increases arterial pressure for hours and days. This long-term effect works through an extracellular fluid volume mechanism, even stronger than the acute vasoconstriction mechanism which eventually returns arterial pressure to normal values.[4,5,7]

Hypertension is a cardiovascular disease continuum that will last a lifetime until the patient dies due to target organ damage (TOD). Starting from blood pressure of 115/75 mmHg, for every systolic/diastolic increase of 21/10 mmHg the risk of cardiovascular disease morbidity and mortality will double. Untreated hypertension increases: 35% of all cardiovascular deaths, 50% of stroke deaths, 25% of CHD deaths, 50% of congestive heart disease, 25% of all premature deaths, and is the most common cause of chronic kidney disease and failure. terminal kidney.

In many clinical trials, administration of antihypertensive drugs was accompanied by a 35% to 40% reduction in stroke incidence; myocardial infarction 20% to 25%; and more than 50% heart failure. It is estimated that patients with stage 1 hypertension (BP, 140-159 mmHg and/or BP, 90-99 mmHg) with additional cardiovascular risk factors, if they succeed in achieving a reduction in BP of 12 mmHg that can last for 10 years, will prevent one death from every 11 patients who have been treated. However, there have been no studies on the results of therapy in pre-hypertension sufferers (120-139/80-89 mmHg). Although it is known that from the TROPHY study providing therapy for prehypertension can reduce the occurrence of actual hypertension, even though the drug has been stopped for one year.[8] This article aimed to present clinical manifestation and management of essential hypertension in young adult.

Case Presentation

A 21-year-old male university student with no significant past medical history and no family history of hypertension or cardiovascular diseases presented to the university health clinic. The patient, a non-smoker who occasionally consumes alcohol, reported frequent morning headaches, occasional dizziness over the past three months, and episodes of palpitations and fatigue, particularly after minimal exertion. His childhood medical history was unremarkable, and his immunization status was up to date. The headaches were described as a dull, bilateral pressure that sometimes became throbbing. These symptoms were often alleviated by resting in a quiet environment but were unresponsive to over-the-counter analgesics. The patient did not experience any visual disturbances, nausea, vomiting, or neurological deficits alongside the headaches. The episodes of dizziness were transient, without any association with changes in position or loss of consciousness.

On physical examination, the patient appeared well-nourished and in no apparent distress. His vital signs revealed elevated blood pressure readings, with measurements of 155/98 mmHg taken in both arms on three separate occasions. His heart rate was 82 beats per minute, regular, and his respiratory rate was 16 breaths per minute, with a body temperature of 36.8°C. The patient's BMI was 24.3 kg/m². Cardiovascular examination revealed normal heart sounds with no murmurs, gallops, or rubs, and peripheral pulses were normal and symmetrical. The respiratory examination was unremarkable, with clear

breath sounds bilaterally, and the abdominal examination showed a soft, non-tender abdomen with no palpable masses or organomegaly. The neurological examination was normal, with no focal deficits.

Given the consistently elevated blood pressure readings, a series of investigations were ordered. Blood tests showed a complete blood count within normal limits, normal renal function tests, and normal electrolyte levels. The patient's fasting blood glucose was 5.2 mmol/L. His lipid profile indicated elevated total cholesterol (6.0 mmol/L), high LDL cholesterol (3.9 mmol/L), normal HDL cholesterol (1.2 mmol/L), and triglycerides at 1.8 mmol/L. Urinalysis was normal, with no signs of proteinuria or hematuria. An ECG showed a normal sinus rhythm with no signs of left ventricular hypertrophy or ischemic changes. An echocardiogram revealed mild concentric left ventricular hypertrophy, but the ejection fraction remained within normal limits. Ambulatory blood pressure monitoring (ABPM) confirmed persistent hypertension, with an average 24-hour blood pressure of 150/95 mmHg. Based on these findings, the patient was diagnosed with essential hypertension. This diagnosis was supported by the persistently elevated blood pressure readings, the absence of secondary causes of hypertension such as renal or endocrine disorders, and the mild left ventricular hypertrophy observed on the echocardiogram.

The management plan for the patient included both lifestyle modifications and pharmacological therapy. He was advised to follow a low-sodium, heart-healthy diet, specifically the DASH diet, which emphasizes the consumption of fruits, vegetables, whole grains, and lean proteins. The patient was also encouraged to engage in at least 150 minutes of moderate-intensity aerobic exercise per week and to maintain a healthy weight. Stress management techniques, such as deep breathing exercises, yoga, and mindfulness, were suggested to help reduce stress levels. Additionally, he was advised to limit alcohol intake to no more than 2 standard drinks per day.

For pharmacological therapy, the patient was started on an ACE inhibitor, Lisinopril, at a dose of 10 mg once daily. This medication was chosen to control blood pressure and prevent the progression of cardiovascular complications. Regular follow-up appointments were scheduled to monitor blood pressure, assess for side effects, and adjust medication dosages as necessary. At the 4-week follow-up, the patient's blood pressure had reduced to an average of 135/85 mmHg. He reported a significant reduction in the frequency and intensity of headaches, with dizziness and palpitations also resolving. The patient was compliant with the medication and lifestyle recommendations. At the 3-month follow-up, his blood pressure had further decreased to 128/80 mmHg. Repeat echocardiography showed no progression of left ventricular hypertrophy. Additionally, there was a slight improvement in his lipid profile, with a reduction in total cholesterol and LDL levels.

Discussion

Hypertension is traditionally viewed as a condition affecting middle-aged and older adults, but it is increasingly recognized among younger populations. In recent years, lifestyle changes, including increased stress, sedentary behavior, and dietary patterns high in salt and processed foods, have contributed to rising rates of hypertension among young adults. According to the American Heart Association, about 7.5% of young adults aged 18 to 39 have hypertension. The early onset of hypertension is concerning due to its potential to cause premature cardiovascular disease and target organ damage if left unmanaged.[9,10]

The pressure required to move blood through the circulatory system is exerted by the pumping action of the heart (cardiac output/CO) and support from the arteries (peripheral resistance/PR). The working function of each blood pressure determinant is influenced by the interaction of various complex factors. Hypertension is actually an abnormality of these factors, which is characterized by increased cardiac output and/or peripheral resistance. More details can be seen in the chart.[4]

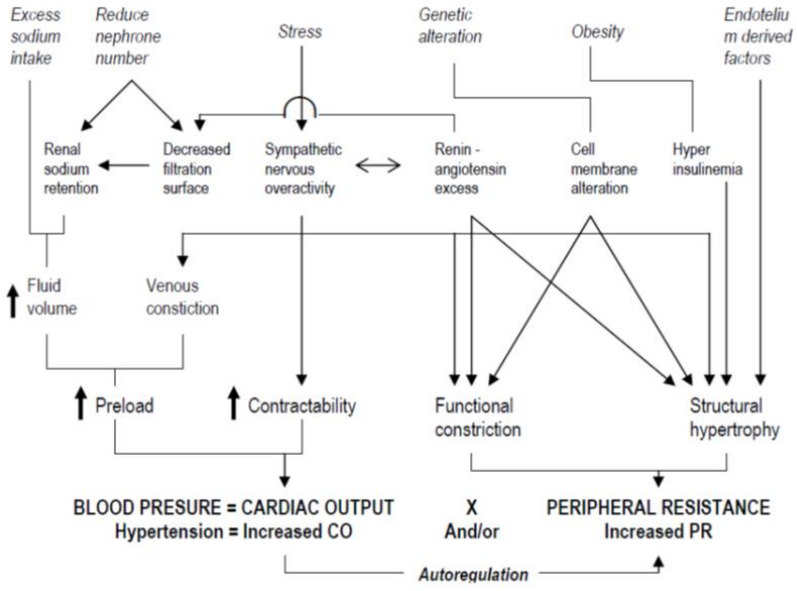

Figure 1. Several factors that influence blood pressure[4]

Essential hypertension, also known as primary hypertension, is characterized by elevated blood pressure without an identifiable secondary cause. It accounts for 90-95% of all hypertension cases. The pathophysiology involves a complex interplay of genetic, environmental, and lifestyle factors. Genetic predisposition can increase susceptibility, although the patient in this case had no family history of hypertension or cardiovascular disease. Lifestyle factors play a significant role in the development of essential hypertension. In this case, the patient's occasional alcohol consumption, though within moderate limits, could contribute to elevated blood pressure. His lack of regular physical activity and potential stress from university life are other modifiable risk factors. While the patient had a normal BMI, his dietary habits and sodium intake were not described in detail but are likely contributors to his condition.[11]

The patient's presenting symptoms, including morning headaches, dizziness, palpitations, and fatigue, are classic manifestations of hypertension. Headaches, particularly those occurring in the morning, may result from nocturnal hypertension, leading to increased intracranial pressure. The absence of visual disturbances or neurological deficits helps rule out secondary causes of headaches, such as brain tumors or neurological conditions. The dizziness and palpitations experienced by the patient can be attributed to increased systemic vascular resistance and cardiac output, common in hypertensive patients. Fatigue, particularly after minimal exertion, is also a common symptom resulting from the heart's increased workload and decreased efficiency in oxygen delivery.[12]

The diagnosis of hypertension was confirmed through persistently elevated blood pressure readings and 24-hour ambulatory blood pressure monitoring. ABPM is considered the gold standard for diagnosing hypertension, as it provides a comprehensive assessment of blood pressure variations throughout the day, capturing nocturnal hypertension and avoiding the white coat effect. Laboratory investigations, including blood tests and urinalysis, ruled out secondary causes of hypertension, such as renal or endocrine disorders. The normal renal function and electrolyte levels further supported the diagnosis of essential hypertension. The lipid profile revealed elevated cholesterol levels, particularly LDL, which is a risk factor for cardiovascular disease, and underscores the need for lifestyle modifications and monitoring.[12]

The echocardiogram revealed mild concentric left ventricular hypertrophy, an early sign of cardiac remodeling due to sustained high blood pressure. This finding emphasizes the importance of timely intervention to prevent further cardiac damage and reduce the risk of future cardiovascular events. Management of essential hypertension in young adults involves a combination of lifestyle modifications and pharmacological therapy. In this case, the patient was advised to follow the Dietary Approaches to Stop Hypertension (DASH) diet, which is effective in lowering blood pressure. The DASH diet is rich in fruits, vegetables, whole grains, and low-fat dairy products while being low in saturated fats and sodium. Reducing sodium intake can lead to significant reductions in blood pressure, particularly in salt-sensitive individuals.[13]

Physical activity is a cornerstone of hypertension management. The patient was encouraged to engage in at least 150 minutes of moderate-intensity aerobic exercise per week, which can reduce systolic blood pressure by an average of 4 to 9 mmHg. Exercise also contributes to weight management, enhances cardiovascular fitness, and improves mental well-being. Stress management techniques, such as deep breathing exercises, yoga, and mindfulness, were recommended to reduce stress levels, which can contribute to elevated blood pressure through the activation of the sympathetic nervous system. Limiting alcohol intake and avoiding smoking are additional lifestyle modifications that reduce cardiovascular risk.[2,14]

Pharmacological therapy was initiated with an ACE inhibitor, Lisinopril, which is a first-line treatment for hypertension. ACE inhibitors reduce blood pressure by inhibiting the renin-angiotensin-aldosterone system (RAAS), leading to vasodilation and decreased sodium and water retention. Lisinopril also offers renoprotective benefits, making it an appropriate choice given the patient's age and risk profile. Regular follow-up appointments were scheduled to monitor blood pressure, assess medication efficacy, and check for any adverse effects. The patient’s response to treatment was positive, with significant reductions in blood pressure and symptom relief at the 4-week and 3-month follow-ups. This improvement highlights the effectiveness of the combined approach of lifestyle changes and pharmacotherapy. Continued follow-up is crucial to ensure long-term blood pressure control and prevent complications. Monitoring for potential side effects of medication, such as hyperkalemia or renal dysfunction, is essential. Regular re-evaluation of the patient’s lipid profile and cardiovascular risk factors is also important for adjusting the management plan as needed.[15]

The early detection and management of hypertension in young adults can significantly reduce the risk of future cardiovascular events, such as myocardial infarction, stroke, and heart failure. Educating patients about the importance of lifestyle modifications and medication adherence is vital for achieving and maintaining blood pressure control. This case underscores the need for increased awareness and screening of hypertension in young adults. Many young individuals may be unaware of their elevated blood pressure status due to a lack of regular health check-ups and the absence of overt symptoms. Routine screening and education about the risks of untreated hypertension are necessary to identify and manage the condition early.[15]

Conclusion

This case underscores the increasing prevalence of hypertension among young adults and the importance of early detection and management to prevent long-term cardiovascular complications. The successful reduction in blood pressure and symptoms through a combination of lifestyle changes and pharmacological therapy highlights the effectiveness of a comprehensive approach. Routine screening and increased awareness of hypertension in young adults are essential for timely intervention and optimal long-term health outcomes.

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