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A Review Article on–"Hypertension"

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Abstract: ***High blood pressure (hypertension) is the leading preventable cause of death and disability. It can lead to serious health problems such as stroke, heart disease, hardening of the arteries, heart failure, and kidney damage. Taking blood pressure medicine can help lower the risk of these problems by protecting important organs and reducing the chances of heart-related diseases.***

To help manage high blood pressure, several lifestyle changes are recommended:

- ***Eat less salt***
- ***Lose weight if you're overweight***
- ***Exercise regularly***
- ***Drink alcohol in moderation***
- ***Eat more foods rich in potassium, like fruits and vegetables***
- ***These healthy habits can help control blood pressure and improve overall health.***

High blood pressure is one of the main causes of hypertension, which affects more than a billion people around the world — especially older adults. To help manage this growing problem, the International Society of Hypertension (ISH) has created detailed, evidence-based guidelines for treating high blood pressure in adults. These guidelines are designed to be useful for doctors working in all types of healthcare systems, from low-resource to well-equipped settings.

There are two levels of care in the guidelines:

- ***Essential care: Basic treatment principles that can be followed in low-resource or underprivileged areas.***
- ***Optimal care: A higher standard of treatment based on the latest research, meant for healthcare settings with more resources.***

When starting treatment for high blood pressure, doctors usually choose one of four main types of medicines that are known to reduce the risk of heart problems. These include:

- ***Thiazide diuretics***
- ***ACE inhibitors***
- ***ARBs (angiotensin receptor blockers)***
- ***Calcium channel blockers***

In cases where high blood pressure doesn't respond well to regular treatment (called treatment-resistant hypertension), two special procedures may be used:

- ***Renal denervation***
- ***Baroreflex activation therapy***
- ***These methods help control blood pressure when medications alone are not enough.***

This paper looks at how high blood pressure (hypertension) can be diagnosed in patients and explores ways to prevent and treat it using lifestyle changes and medications.

Key words: Hypertension, Etiology of Hypertension, Pathophysiology (Machanisam) of Hypertension, Anti-Hypertensive drug, Medication, Complication's in Hypertension.

I. INTRODUCTION

Hypertension, or high blood pressure, happens when the pressure in the arteries stays above normal levels. It can involve a rise in the top number (systolic), the bottom number (diastolic), or both. This condition is common in both developed and developing countries and becomes more likely as people get older.High blood pressure means that the force of the blood against the artery walls is consistently too strong. Blood pressure is usually measured using two numbers:

- Systolic pressure – the pressure when the heart beats
- Diastolic pressure – the pressure when the heart rests between beats

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These two numbers are used together to describe a person's blood pressure.[1]

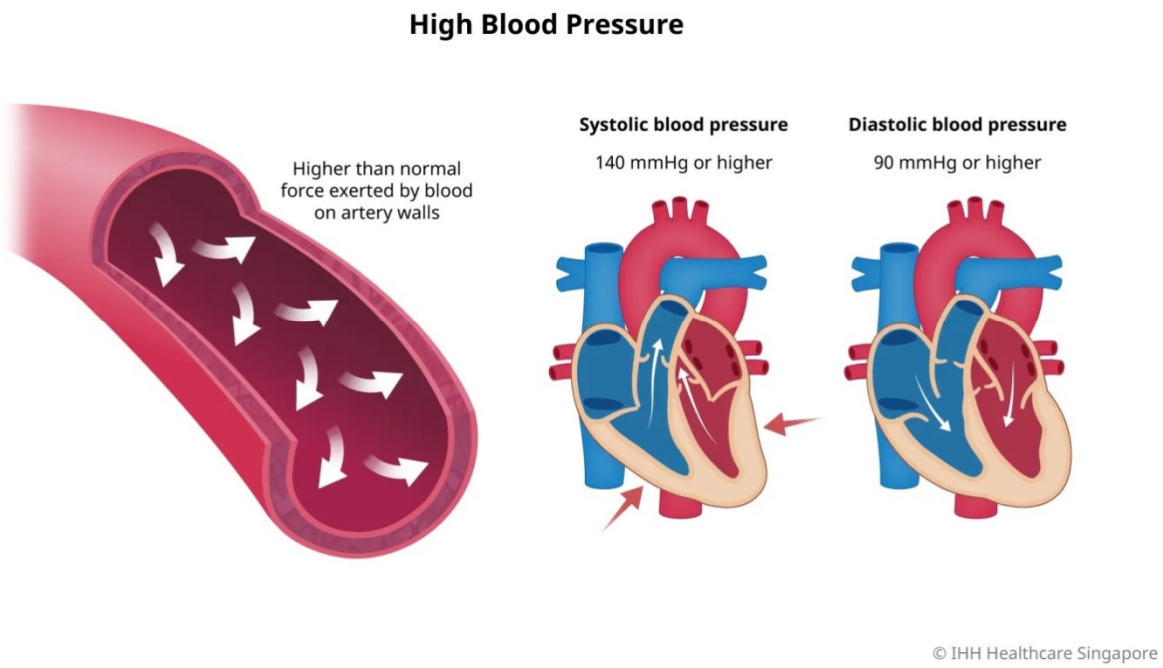
Systemic arterial hypertension (commonly called hypertension) means that a person's blood pressure stays too high over time in the body's main arteries. Blood pressure is usually shown as two numbers:The level at which blood pressure is considered "high" can vary depending on how it's measured.There are different causes of hypertension. In most cases (about 90–95%), people have what's called primary or essential hypertension, which happens due to a mix of genetic and environmental factors. Many people with high blood pressure also have a family history of the condition. Studies suggest that genetics may account for 35% to 50% of the differences in blood pressure among individuals.

Large-scale genetic studies (called genome-wide association studies or GWAS) have found around 120 genetic areas linked to blood pressure control. However, these only explain about 3.5% of the overall variation in blood pressure.[2]

High blood pressure is one of the leading causes of death worldwide, causing around 10 million deaths each year (Stanaway et al., 2018). A study in 2010 showed that nearly 1.5 billion people around the world had high blood pressure at that time. In the United States alone, about 517,000 people died from conditions related to high blood pressure in 2019 (Stanaway et al., 2018; Mills et al., 2015; Zhou et al., 2017).[3]

Hypertension (high blood pressure) is now defined as having a systolic blood pressure (SBP) of 130 mm Hg or higher and/or a diastolic blood pressure (DBP) of more than 80 mm Hg. It is one of the most common long-term health conditions and is marked by constantly high pressure in the arteries.High blood pressure has been widely researched over the last century and is a major risk factor for serious health problems such as stroke, heart attack, heart failure, and kidney failure.[4]

In the past, high blood pressure was defined as 140/90 mmHg or higher. However, the 2017 guidelines from the American College of Cardiology and the American Heart Association (ACC/AHA) changed this definition.



According to the new guideline, a person is considered to have hypertension if their systolic pressure is 130 mmHg or higher or diastolic pressure is 80 mmHg or higher.Based on the older definition (140/90 mmHg), 31.9% of adults in the United States had high blood pressure. But under the newer 2017 definition (130/80 mmHg), the number increased to 45.6%.[1]

For those already receiving treatment, 61% had their blood pressure under control using the old target of less than 140/90 mmHg. However, only 46.6% met the newer, lower target of under 130/80 mmHg.Using medications to lower blood pressure not only reduces the pressure itself but also helps prevent damage to vital organs, lowering the health risks linked to high blood pressure.[1]

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BLOOD PRESSURE CATEGORIES

CATEGORY	SYSTOLIC (MM HG)		DIASTOLIC (MM HG)
NORMAL	LESS THAN 120	AND	LESS THAN 80
ELEVATED	120-129	AND	LESS THAN 80
HYPERTENSION STAGE 1	130-139	OR	80-89
HYPERTENSION STAGE 2	140 OR HIGHER	OR	90 OR HIGHER
HYPERTENSIVE CRISIS	HIGHER THAN 180	AND/OR	HIGHER THAN 120

II. CAUSE OF HYPERTENSION (ETIOLOGY)

In most people, the exact cause of high blood pressure is unknown. This type is called essential or primary hypertension.
One well-known factor linked to high blood pressure is eating too much salt. Some people have a genetic tendency that makes their blood pressure respond more strongly to salt in their diet.
Studies show that 50% to 60% of people with high blood pressure are salt-sensitive, meaning their blood pressure increases when they consume more salt, which puts them at a higher risk of developing hypertension.[4]
High blood pressure (also called hypertension) is a complex condition that can be caused by many different factors. These include:

1) Genetic Factors

- Family history: If close family members have high blood pressure, your chances of developing it are higher.
- Genetic traits: Some people inherit genes that make them more likely to develop hypertension.

2) Lifestyle Factors

- Lack of exercise: Not being physically active can lead to higher blood pressure.
- Being overweight: Extra body weight puts more strain on the heart and raises blood pressure.
- Unhealthy diet: Eating too much salt, sugar, and unhealthy fats can increase the risk.
- Too much alcohol: Drinking large amounts of alcohol regularly can raise blood pressure.
- Smoking: Smoking damages blood vessels, which can lead to increased blood pressure.

3) Health Conditions

- Kidney problems: Diseases affecting the kidneys can lead to high blood pressure.
- Sleep apnea: Breathing interruptions during sleep can increase blood pressure.
- Hormonal disorders: Conditions like Cushing's syndrome or adrenal gland issues can raise blood pressure.
- Thyroid problems: An overactive thyroid (hyperthyroidism) can also lead to hypertension.

4) Other Factors

- Age: The risk of high blood pressure goes up as you get older.
- Stress: Ongoing stress can contribute to increased blood pressure over time.

III. PATHOPHYSIOLOGY (MACHANISMS)

Blood pressure (BP) is controlled by several factors in the cardiovascular system. These include:

- Blood volume – the total amount of blood in the body

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- Cardiac output – the amount of blood the heart pumps each minute
- Arterial tone – how tight or relaxed the blood vessels are, which is influenced by fluid levels in the blood vessels and signals from the nervous and hormonal systems

All of these work together to maintain and regulate blood pressure.[2]

Main Causes:

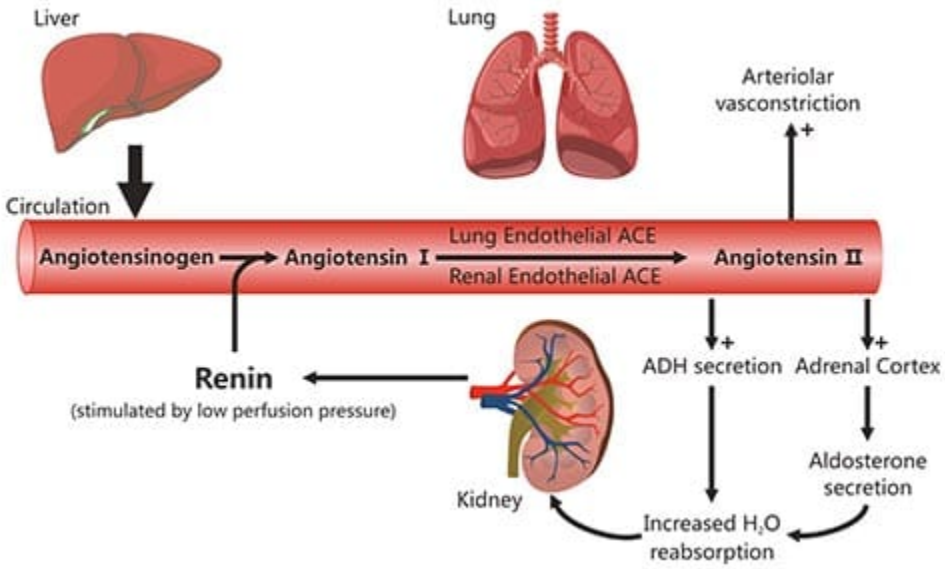
- Resistance in blood vessels: When small blood vessels (arterioles) become tighter or narrower, it makes it harder for blood to flow, raising blood pressure.
- Increased heart activity: If the heart pumps more blood than usual (higher cardiac output), blood pressure can go up.
- Renin-angiotensin-aldosterone system (RAAS): This system controls blood vessel tightness and fluid balance. When it's overactive, it causes blood vessels to tighten and the body to hold onto more salt and water—both of which raise blood pressure.
- Nervous system overactivity: Too much activity from the sympathetic nervous system can raise heart rate, increase how hard the heart pumps, and tighten blood vessels—all leading to higher blood pressure.

Body Changes That Happen

- Blood vessel remodeling: The walls of the blood vessels may thicken or stiffen, making it harder for blood to flow.
- Endothelial dysfunction: The inner lining of blood vessels doesn't work properly, making it harder for them to relax and widen.
- Sodium retention: The body holds on to more salt, which pulls in more water, increasing blood volume and pressure.

Things That Can Contribute

- Family history: Inherited genes can make someone more likely to develop high blood pressure.
- Lifestyle choices: Poor diet, lack of exercise, and high stress levels can all raise blood pressure.
- Health problems: Conditions like kidney disease or sleep apnea can also lead to high blood pressure.



IV. ANTIHYPERTENSIVE MEDICATIONS

Antihypertensive drugs are a group of medicines used to treat high blood pressure (hypertension).

The main goal of this treatment is to prevent serious health problems caused by high blood pressure, such as:

- Heart attacks
- Strokes
- Heart failure
- Kidney damage

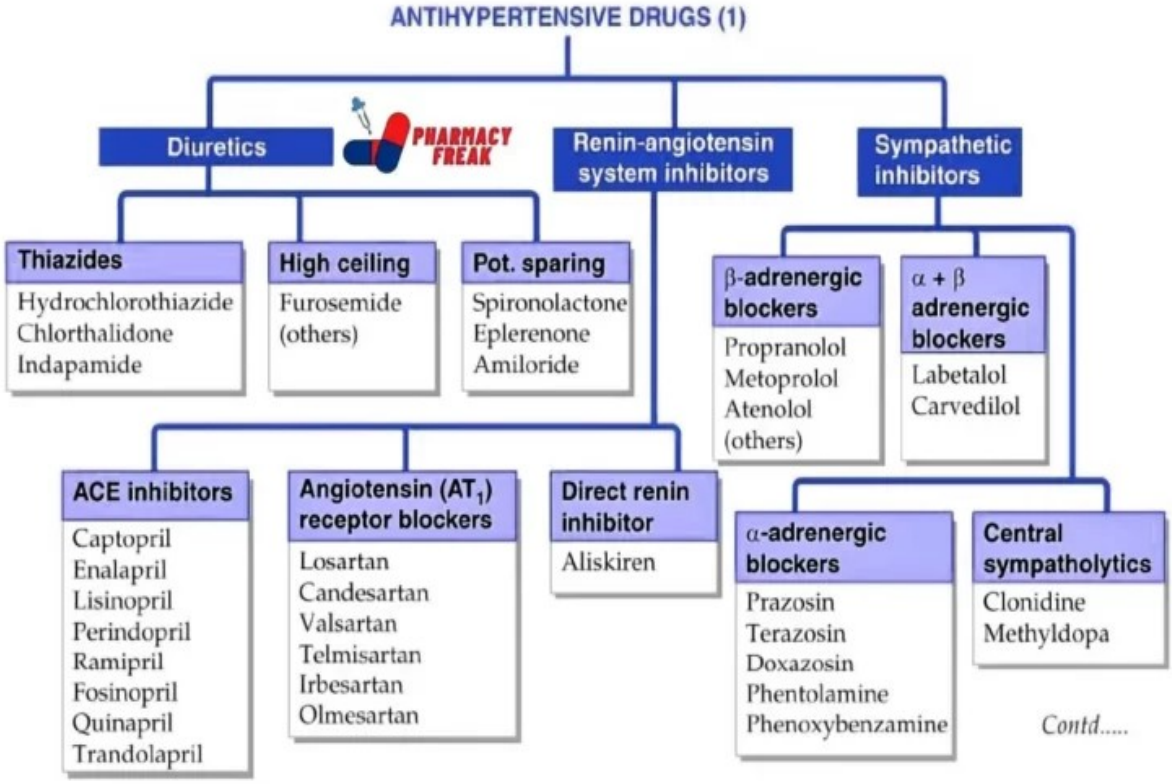
Research shows that even a small drop in blood pressure—just 5 mmHg—can reduce the risk of:

- Stroke by 34%
- Heart disease by 21%

And also lower the chances of developing dementia, heart failure, and dying from cardiovascular disease. There are different types (classes) of antihypertensive drugs, and each works in a different way to help lower blood pressure.[1]

V. MEDICATIONS FOR HIGH BLOOD PRESSURE

There are several medicines available to help treat high blood pressure (hypertension). Doctors usually start with a low dose to reduce the risk of side effects, which are generally mild.Over time, many people may need to take two or more medications together to keep their blood pressure under control.[2]



Common types of blood pressure medications include:

1) ACE inhibitors (block a chemical that narrows blood vessels)
2) Calcium channel blockers (help blood vessels relax and widen)
3) Diuretics (help the body get rid of extra salt and water)
- Examples: Thiazides, Chlorthalidone, Indapamide

4) Beta-blockers and alpha-blockers (help relax the heart and blood vessels)
5) Central agonists (affect signals from the brain to help lower blood pressure)
6) Peripheral adrenergic inhibitors (reduce nerve signals that tighten blood vessels)
7) Vasodilators (directly relax blood vessel walls)
8) Angiotensin receptor blockers (ARBs) (prevent blood vessels from tightening)

A. ACE Inhibitors and ARBs

ACE inhibitors and angiotensin II receptor blockers (ARBs) are common medicines used to treat high blood pressure by targeting the renin-angiotensin-aldosterone system (RAAS), which helps control blood pressure.
Other drugs that also act on this system, such as:
Direct renin inhibitors

Mineralocorticoid receptor antagonists are usually kept as backup options. This is because there is less strong evidence from clinical studies to support using them as first-choice treatments for high blood pressure.[1]

B. Dihydropyridine Calcium Channel Blockers

Dihydropyridine calcium channel blockers help lower blood pressure by relaxing the muscles in the walls of blood vessels, allowing them to widen. They do this by blocking L-type calcium channels in the blood vessel muscles.

These medications are well-known and have been tested in many large clinical studies. One useful benefit is that they can be safely combined with other first-line blood pressure medicines.A common side effect is swelling in the legs or ankles (peripheral edema). This happens because the arteries widen, not because of problems with the heart or kidneys.[2]

C. Thiazide-Type and Thiazide-Like Diuretics

Thiazide-type diuretics, like hydrochlorothiazide, do not have a specific chemical structure called the benzothiadiazine ring. On the other hand, thiazide-like diuretics, such as chlorthalidone, metolazone, and indapamide, do contain this ring.Both types work in a similar way. They block sodium (Na^+) and chloride (Cl^-) transporters in the kidney's tubules. This causes the body to get rid of more salt and water through urine — a process called natriuresis — which helps lower blood pressure.

These diuretics have played an important role in treating high blood pressure for many years, and studies have shown they help reduce health risks linked to hypertension.[1]

D. Beta-Adrenoreceptor Blockers (Beta-Blockers)

Beta-blockers help lower blood pressure by slowing down the heart rate, reducing the amount of blood the heart pumps, and lowering the release of renin (a hormone that raises blood pressure). They also reduce the effects of the nervous system on the heart and blood vessels.

These medicines work especially well for people who have had a heart attack or have heart failure with reduced heart function.However, for people without these heart conditions, beta-blockers are not as effective as other first-line blood pressure medications in preventing heart disease and related deaths.[2]

VI. COMPLICATIONS OF UNCONTROLLED HIGH BLOOD PRESSURE

If high blood pressure is not controlled, it can lead to serious health problems, including:

1) Coronary heart disease (problems with the blood vessels supplying the heart)
2) Heart attack (also called myocardial infarction)
3) Stroke, which can be caused by a blocked blood vessel (ischemic) or bleeding in the brain (hemorrhage)
4) Hypertensive encephalopathy (brain swelling due to very high blood pressure)
5) Kidney failure, which can happen suddenly (acute) or over time (chronic)
6) Peripheral arterial disease (narrowing of blood vessels in the arms or legs)
7) Atrial fibrillation (irregular heartbeat)
8) Aortic aneurysm (bulging of the large artery from the heart)
9) Death, usually caused by heart disease, blood vessel problems, or stroke[4]

VII. CONCLUSION

High blood pressure (hypertension) is a serious health problem affecting over a billion people worldwide, but it can be treated with both lifestyle changes and medications.One of the biggest challenges is that many people are not aware they have high blood pressure. This lack of awareness leads to poor treatment and control, especially in countries with fewer resources.

Starting to manage high blood pressure early in life can help prevent it from becoming severe later on, leading to healthier communities.Along with medicines that lower blood pressure, making healthy changes in daily life is very important. These changes include:

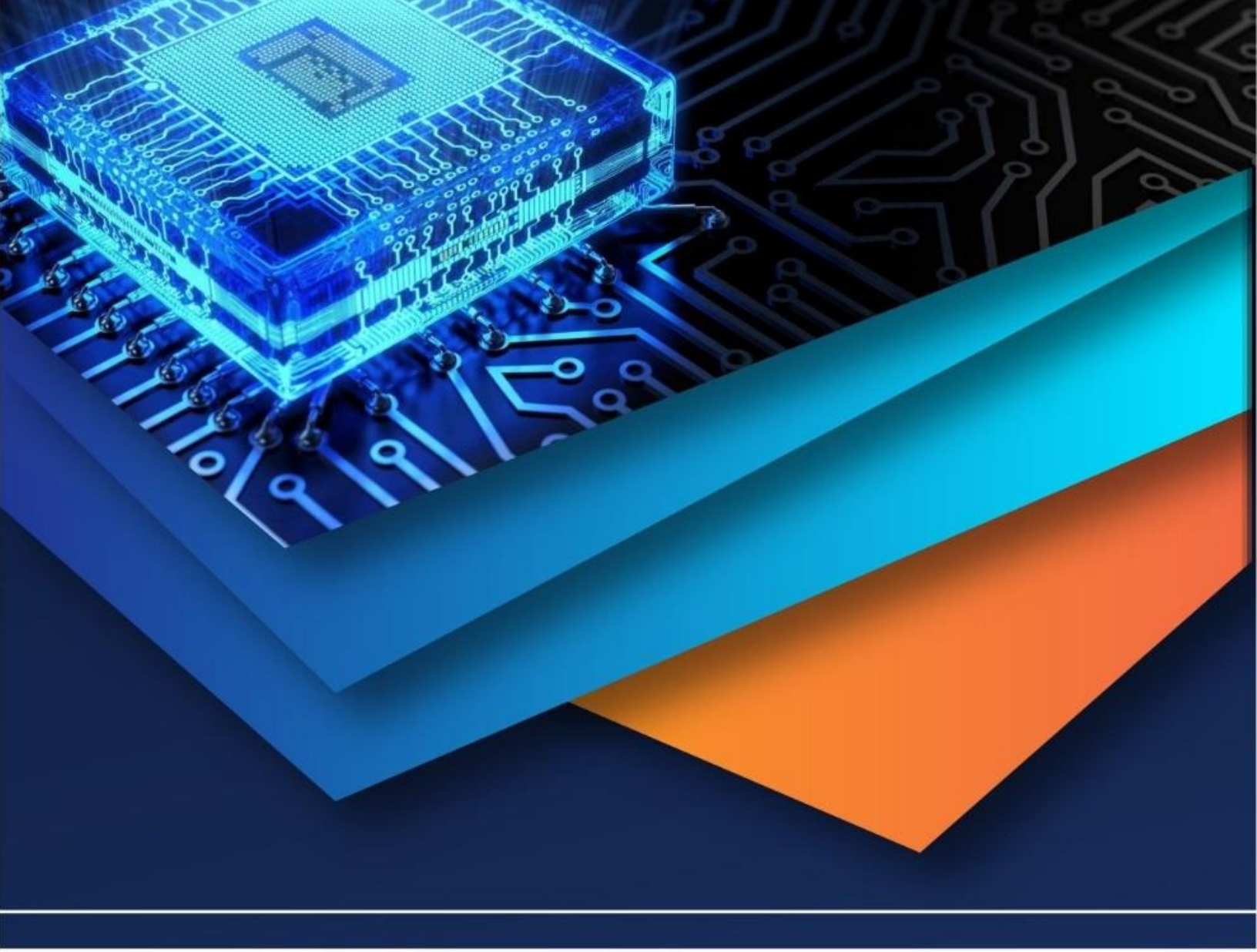
- Reducing salt intake
- Eating a healthy diet
- Losing extra weight
- Practicing deep breathing exercises

Deep breathing helps activate the body's relaxation system, which can lower blood pressure.To better control hypertension, it is important to raise awareness among young people and use treatments that do not always rely on medicines.

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