*REDVET - Revista electrónica de Veterinaria*
ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:

# A Comprehensive Review On Hypertension

**Einab Ansari[1*], Shivani Lodha[2], Yusra Ahmad[3]**

[1*]M. Pharm Student, Faculty of Pharmacy, Veer Madho Singh Bhandari Uttarakhand Technical University, Dehradun, INDIA, einabansari131@gmail.com
[2]Assistant Professor, Faculty of Pharmacy, Veer Madho Singh Bhandari Uttarakhand Technical University, Dehradun, INDIA shivanilodha22@gmail.com
[3]Associate Professor, Faculty of Pharmacy, Veer Madho Singh Bhandari Uttarakhand Technical University, Dehradun, INDIA ahmadyusra@gmail.com

***Corresponding Author:** Einab Ansari
*E-mail: einabansari131@gmail.com

## 1. ABSTRACT
Hypertension is an international public health concern, which plays a major role in the development of cardiovascular disease (CVD), stroke, and renal failure. Due to its asymptomatic nature, it is frequently referred to as a "silent killer" and affects millions of people globally. Pharmacological therapies, such as the use of different antihypertensive medications, together with lifestyle change are essential for effective management. The epidemiology of hypertension, use of medications, and the complications of untreated or insufficiently controlled hypertension are all examined in this review. The effectiveness and side effects of many kinds of antihypertensive medications are also covered.

**Keywords:** Hypertension, antihypertensive drugs, complications, cardiovascular disease, stroke, chronic kidney disease

## 2. INTRODUCTION
Hypertension is the prominent source of increased global death rate and burden of disease worldwide. This ailment is widespread and persistent which is an age- related disorder and associated with severe cardiovascular and renal morbidities [1]. A variety of intricate and related factors can lead to this gradual cardiovascular disease [2]. High blood pressure has consistently been identified as a significant health challenge [3]. Hypertension is a worldwide epidemic. One of the main reasons of death in the globe is hypertension, estimated to affect one billion people. As people age, hypertension becomes more common. According to estimates from the World Health Organization (WHO) from 2013, hypertension is the third largest silent killer worldwide and is a serious public health concern that accounts for one in every eight mortalities. Worldwide hypertension is responsible for 17 billion deaths annually, the consequences of high blood pressure accounts for causing 9.4 million deaths annually around the globe. As stated by WHO (2013), it is to be blamed for minimum 45% of cardiac conditions fatalities and 51% of deaths from stroke [4].

**Definition for hypertension-** Hypertension is typically indicated by a persistent increase in systemic arterial pressure above a specific threshold [2]. According to the JNC7, less than 120 mm of Hg for the systolic magnitude and less than 80 mm of Hg for the diastolic measurement are indicative of regular arterial pressure. When the diastolic pressure gets 90 mm of Hg or more and the systolic pressure becomes 140 mm of Hg or more, hypertension is recognized [5].

**Types of hypertensions-**
**A. Essential hypertension-** It is the most widespread kind of hypertension. It can also be designated as essential hypertension or idiopathic hypertension [6], [7]. Ninety-five percent of instances of hypertension are due to essential hypertension [7].
Even in the absence of a known cause, a number of factors, such as an unhealthy lifestyle, smoking, stress, hypokalaemia (potassium deficiency), obesity, sensitivity to alcohol, and vitamin deficiencies, can result in hypertension.
Additionally, risk of hypertension can be greater due to family history of hypertension, aging, and certain inherited genetic mutations [8].
**B. Secondary hypertension-** It explains hypertension with a known etiology or underlying medical problem. This reports for less than 10 percent of all cases.
Most typically, hypertension has kidney failure as its secondary source. A number of other endocrine illnesses, including pheochromocytoma, renal artery stenosis (from fibromuscular dysplasia or atherosclerosis), hyperparathyroidism, and Acromegaly, can also result in hypertension. Oral contraceptive use is another potential cause [9], [1].
**C. Accelerated or malignant hypertension-** Intravascular thrombosis and fast microvascular degeneration, such as necrosis in the walls of arterioles and small arteries, are hallmarks of this clinical disease. Any etiology of hypertension may become worse with it. Hypertensive encephalopathy, renal impairment (particularly proteinuria), retinopathy (grade 3 or 4), and/or elevated blood pressure are indicators of fast progressing end organ damage. It can lead to death in few months if it is not treated immediately [6].

*REDVET - Revista electrónica de Veterinaria*
ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:

**3. EPIDEMIOLOGY**

In the year 2000, it was estimated that universally, 972 million adults suffered from hypertension, which represented about 26.4% of the global adult population, 333 million of them lived in economically developed nations, whereas 639 million lived in nations that were in economic development. There will be 1.56 billion people with hypertension globally by 2025, according to statistics marking a 60% increase from 2000. Most of this growth is expected to occur in developing nations. Consequently, approximately 75% of people with high blood pressure worldwide are anticipated to be from these developing countries [10].

In 2004 deaths of 7.5 million people occurred due to hypertension, making up 12.8% of the global total of 58.8 million deaths. The incidence of high blood pressure in India has been observed to rise over time. Research conducted in the 1960s found that 5 percent of the population was affected, while research done in the 1990s revealed a higher prevalence of 12-15 percent [10]. According to estimates from the World Health Statistics from 2012, hypertension affects 24.8% and 29.2% of women and men globally. In India, the percentage of females who have hypertension is 22.60% and 23.10 percent in males [11]. In India, ischemic heart disease and stroke are responsible for approximately 1.6 million deaths annually, contributing significantly to the total death toll of around 10 million each year. Hypertension is a prevalent non-communicable disease in the country, affecting 29.8% of the adult population. This condition is more common in urban areas, where the prevalence is 33.8%, compared to 27.6% in rural areas, based on recent data [12]. 2.3 million deaths in India in 1990 were attributable to cardiovascular illnesses. One significant contributing factor was found to be hypertension, which was found to be responsible for 24% of coronary heart disease fatalities and 57% of stroke-related deaths nationwide. 28% of female executives and 27% of male executives have hypertension, according to 2000 Mumbai research. By comparison, 4.5% of people with the syndrome were found in 1999 research conducted in rural Haryana. There appears to be a substantial correlation between the rising incidence of hypertension in India and changes in way of life. Hypertension affects 10% of Indians living in rural regions and 25% of Indians living in cities, according to epidemiological data. Approximately 31.5 million people with hypertension live in rural areas, while about 34 million reside in urban areas. By 2025, there should be an increased occurrence of hypertension dramatically, potentially impacting over 1.7 billion individuals worldwide, or over 31% of the adult population [8].

**4. ETIOLOGY**

There are two types of cardiovascular risk factors: modifiable and non-modifiable. The following are examples of modifiable risk factors: smoking, obesity, inactivity, abuse of alcohol, and high use of sodium. Conversely, non-modifiable risk factors are those that are unaffected by existing therapies, such as an individual or familial background of cardiovascular disease [13].

The various risk factors include-

**A. Age –** Growing older escalates a person's risk of arising high blood- pressure. After the age of 65, women are typically more vulnerable to increased BP, though it usually affects men more frequently up to the age of 64.

**B. Obesity-** After a certain weight is reached, the body requires more blood to provide tissues with necessary oxygen and nutrients. The pressure on the arterial walls grows in proportion to the volume of blood flowing through your vessels [8] .

**C. Physical Inactivity-** People who don't get enough exercise frequently have faster heart rates. The heart pumps harder with each beat, which puts greater pressure on the arteries. Being overweight is also more likely when one does not exercise.

**D. A nutrition high in sodium-** Blood pressure might rise when there is an excess of salt in the diet because it leads to fluid retention in the body.

**E. A diet rich in potassium-** Potassium aids in keeping your cells' sodium levels in check. An excessive amount of sodium may build up in your blood if your diet is deficient in potassium.

**F. Excessive alcohol consumption**- Prolonged heavy drinking may cause cardiac problems.

**G. Tobacco use-** Tobacco toxins have the potential to damage the arterial wall lining in addition to momentarily raising blood pressure when a person smoke or chew. Artery narrowing may lead to an elevated risk of a heart attack. Risk of heart attack can also be enhanced due to second hand smoke.

**H. Family history-** High blood pressure typically runs in families.

**5. PATHOPHYSIOLOGY OF HYPERTENSION**

**A. Cardiac output in relation to peripheral resistance-** Peripheral vascular resistance and cardiac out-put need to be controlled in order to maintain stable blood pressure. Both cardiac output and systemic vascular resistance affect it. Greater cardiac output, upraised systemic vascular resistance, or both can be seen in high blood pressure patients. While elderly folks frequently experience increased arterial stiffness and systemic vascular resistance, younger people typically have better cardiac output. Peripheral resistance is increased in many hypertension situations, yet cardiac output stays normal. Higher intracellular calcium levels are expected to cause smooth muscle cells to contract, which may explain why medications that block calcium channels cause vasodilation. Chronic smooth muscle contraction may lead to structural changes in arteriolar walls, possibly driven by angiotensin, resulting in a persistent increase in peripheral

*REDVET - Revista electrónica de Veterinaria*
ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:

resistance. When hypertension is first developing, peripheral resistance may not be elevated, and the increase in blood pressure may have resulted from increased cardiac output linked to heightened sympathetic activity. To prevent excessive pressure from reaching the capillary beds and disrupting cellular function, there may be a compensatory increase in peripheral arteriolar resistance [14], [15].

**B. Renin Angiotensin Aldosterone System –** Via a number of processes, the RAAS controls blood pressure (BP). It contributes to sodium retention, pressure natriuresis (a process where increased renal blood pressure results in reduced reabsorption of sodium and enhanced excretion of sodium, salt sensitivity, vasoconstriction, endothelial dysfunction, and vascular damage. These factors collectively assist in the emergence of hypertension. Glomerular cells inside the kidneys create and store renin and pro renin which is its predecessor, which are released in rection to different triggers. Kidneys' juxtaglomerular apparatus is responsible for secreting renin when there is reduced glomerular perfusion or decreased sodium intake. Additionally, Renin is also released when the sympathetic nervous system is activated.

Renin mostly transforms angiotensinogen to angiotensin I. Then, ACE changes angiotensin 1 into angiotensin 2, a key component in the RAAS pathway that contributes to hypertension [16]. Due to its strong vasoconstrictor properties, angiotensin 2 causes hypertension [15]. Angiotensin II affects the musculature of the arteries, which contributes significantly to peripheral resistance and blood pressure elevation. The proximal tubule's $Na^+/K^+$ ATPase, the $Na^+/K^+/2Cl^-$ transporter of Henle's loop, the Na+/H+ exchanger, and numerous additional distal nephrons and the collecting duct ion transporters are all activated which impacts sodium retention. Moreover, the adrenal glands produce aldosterone in response to angiotensin II, which enhances the kidney's epithelial cells capacity to reabsorb salt and water. Blood volume as well as pressure increase as a result of this elevated renin levels, which are connected to angiotensin II synthesis, are frequently seen among individuals having hypertension and are thought to promote to the advancement of increased blood pressure [17].

**C. Sympathetic nervous system**- As a result of sympathetic nervous system stimulation, arterioles can dilate or constrict. Because of this, the autonomic nervous system is essential for controlling blood pressure. Increased sympathetic activity is linked to pulse rate, output from the heart, resistance in the peripheral region, plasma and urine norepinephrine (NE) levels, regional NE spillover, and peripheral post-ganglionic sympathetic neuronal discharge. Peripheral circulation changes are also noticeable, including vascular architecture and alpha-adrenergic receptor-controlled vasoconstriction. Sympathetic hyperactivity is a feature of many other kinds of hypertension, including those associated with obesity, sleep apnoea, early type 2 diabetes, pre-diabetes, chronic renal disease, and heart -failure. It is also present in early primary hypertension. Stress that is equally physical and emotional can trigger sympatho-adrenal reactions that raise blood pressure, and both central and peripheral pathways can contribute to this increased sympathetic activity. Generally, people with hypertension have more sympathetic nervous system (SNS) activity than people with normal blood pressure. Moreover, men, younger adults, obese persons, and those with advanced kidney disease all exhibit increased SNS activity. High sympathetic and low parasympathetic activity are common signs of autonomic dysregulation in hypertensive individuals. Microneurography measures of sympathetic activity in hypertensive individuals show an increase with increasing severity of hypertension. The release of catecholamines into the bloodstream from sympathetic nerves innervating blood vessels is known as systemic catecholamine spillover.

**D. Endothelial dysfunction -** Through the production of numerous strong localized vasoactive chemicals, including endothelin, a vasoconstrictor peptide, and nitric oxide, a vasodilator, vascular endothelial cells perform a critical responsibility in regulating the cardiovascular system. It is believed that human hypertension is caused by endothelial dysfunction [15]. Nitric oxide (NO), which causes relaxation, and endothelin (ET), which primarily drives constriction, are two significant molecules produced by the endothelium that help regulate vascular tone and blood pressure. Endothelial dysfunction in hypertension is indicated by a decrease in NO and other endothelium-derived relaxing factors and a rise in the development of constrictive, pro-inflammatory, pro-thrombotic, and growth-promoting substances. Among them are thromboxane, transforming growth factor-B, and endothelin. A lack of NO is thought to aggravate hypertension, as the NO pathway is thought to be essential in preventing the illness. In hypertension patients, reactive oxygen species (ROS) like superoxide can deactivate NO. Moreover, a number of growth factors generated by the vascular endothelium, including insulin-like growth factor, fibroblast growth factor, and platelet-derived growth factor, have an impact on atherogenesis and organ damage. Vasoconstrictor along with vasodilator properties are shared by endothelin, a powerful vasoactive peptide derived from endothelial cells. A key contributing element to the development of hypertension is believed to be the chronic activation of endothelin-1 (ET-1) and its ETA receptors in the kidneys. Consequently, maintaining endothelial function is essential on behalf of maintaining the health of blood vessels and is a vital line of defence against high blood pressure and atherosclerosis [17].

**E. Natriuretic Peptides-** In order to control hypertension and salt sensitivity, ANP and BNP are essential. Strong natriuretic and vasodilatory properties of these peptides aid in controlling blood pressure and sodium balance after sodium consumption. The stretch that occurs in the atrial and ventricular tissues when salt is added to the body causes an increase in the release of ANP and BNP, correspondingly. This process results in systemic vasodilation, reduction in blood pressure, and a decline in plasma volume when fluid escapes the blood vessels and enters the surrounding tissue. Natriuretic peptides raise the rate of glomerular filtration by toning efferent arterioles during conditions of volume expansion and have an impact on renal salt reabsorption through both direct and indirect processes.

*REDVET - Revista electrónica de Veterinaria*
ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:
A deficiency in natriuretic peptides can contribute to hypertension. Pro-ANP and pro-BNP, which are the precursors to ANP and BNP, are converted into their active forms by the enzyme corin, predominantly found in the heart. Heart failure, fluid overload, and salt-sensitive hypertension have all been linked to corin deficiencies [16].

**F. Sodium homeostasis regulation**- Blood volume regulation is significantly influenced due to sodium (Na+). The reason behind the rise in blood volume and blood pressure (BP) is increased water retention brought on by elevated serum Na+ levels. A rise in dietary Na+ causes compensatory physiological reactions in people with normal blood pressure, which maintain blood pressure stability. An appreciable increase in blood pressure (BP) following consuming 5 g or more of Na+ is indicative of salt sensitivity; the systolic BP rises by at least 10 mmHg in a matter of hours. This illness is frequently caused by endothelial dysfunction, which can be impacted by environmental or hereditary variables. When exposed to increased salt intake, people who are sensitive to salt typically show greater levels of TGF-beta. Sodium and water retention can lead to elevated blood pressure. It is hypothesized that sodium contributes to increased intracellular calcium levels in vascular smooth muscle through the sodium–calcium exchange mechanism, which in turn enhances vascular tone. The primary factor behind sodium and water retention may be an abnormal interaction between blood pressure and sodium excretion. This issue could arise from decreased renal blood flow, reduced nephron mass, or elevated levels of angiotensin and mineralocorticoids [14].

## 6. SYMPTOMS OF HYPERTENSION

Hypertension often doesn't show any symptoms, so it's usually discovered during routine check-ups or when someone visits the doctor for another reason. While some people with high blood pressure might get headaches, feel dizzy, have ringing in their ears called as tinnitus, see things oddly (visual disturbances), or even faint, these issues might actually be due to stress or anxiety rather than the high blood pressure itself [9].

## 7. DIAGNOSTIC EVALUATION

Before starting any kind of treatment, every patient should have a thorough physical examination and history taken. The following components ought to be included in the assessment:

### Medical background

- What kind of hypertension is it, and how long has it been present?
- Any past history of CVD
- Heart disease or hypertension in the family history
- Signs and symptoms that might indicate the cause of hypertension
- lifestyle elements like habits, nutrition, and exercise
- Both recent and previous prescription drugs

### Physical assessment

- To assure accuracy, take blood pressure measurements more than once—at least twice.
- Measure the blood pressure in each arm to ensure uniformity.
- To evaluate general health, take measurements of waist circumference, weight, and height.
- Examine the eyes (funduscopic exam) to look for indications of hypertension-related damage.
- Key regions to check for injury include the belly, heart, lungs, neck, and extremities.

**Equipment for blood pressure measurement-** A mercury sphygmomanometer is frequently recommended, but other acceptable choices are an aneroid manometer that has recently been calibrated or an electronic device that has been validated and has an arm cuff.

It takes more than one evaluation to diagnose hypertension. After the initial evaluation, blood pressure should be checked three times over a few weeks in order to confirm the diagnosis.

### Lab Examinations and Additional Diagnostic Techniques:

Regular testing usually consists of a 12-lead ECG, potassium, salt, creatinine measurement, total and high dense triglyceride cholesterol, and a complete blood count. In some patients, tests such as measures of creatinine clearance, 24-hour urine protein, and microalbuminuria may be suggested as optional procedures for verifying two-degree hypertension or evaluating associated diseases. Assessments may also include limited echo cardiography, fasting triglycerides, glycosylated haemoglobin, calcium levels, and uric acid values. Aldosterone levels and plasma renin activity can also be assessed. [7].

All individuals with recently identified hypertension should have laboratory testing done to assess their CVD risk factors, set the baseline for drug use, and check for secondary causes of hypertension. Diagnostics which are optional can shed light on target organ damage. Urine albumin and serum creatinine levels help regulate diuretics or RAS blockers, whereas serum potassium and creatinine levels are helpful for tracking chronic kidney disease. Thyroid-stimulating hormone

*REDVET - Revista electrónica de Veterinaria*
ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:
(TSH) testing is also useful in detecting thyroid disorders that can be treated, such as hyper- or hypothyroidism, which can aggravate hypertension.
If there is increased severity of hypertension, insufficient response to traditional treatments, damage to target organs that is disproportionate to blood pressure levels, or if there are any clinical or history signs of a secondary cause, more laboratory testing would be necessary [18].

## 8. MANAGEMENT AND TREATMENT OF HYPERTENSION

Medication and non-medication approaches are the two primary methods for managing hypertension. Even if medication is later advised, lifestyle changes should always be the foremost step towards treating increased blood pressure, and it is beneficial to continue with these.

**Lifestyle management-**

For all patients with hypertension, lifestyle guidance is advised [16]. There are two main approaches to managing cardiovascular health. The first includes strategies aimed at lowering blood pressure, such as losing weight, cutting down on salt, limiting alcohol intake, engaging in regular physical activity, eating more fruits and vegetables, and reducing both total and saturated fat consumption. The second involves measures to decrease cardiovascular risk, including quitting smoking, substituting saturated fats with polyunsaturated and monounsaturated fats, increasing the intake of oily fish, and lowering overall fat consumption.

**Pharmacological management-**

**A. Angiotensin converting enzyme inhibitors-** As first-line treatment, ACE inhibitors are being utilized more frequently [14]. ACE inhibitors that are often used include trandolapril, Benazepril, Enalapril, Fosinopril, Lisinopril, Moexipril, Ramipril, Perindopril [19]. Because they help slow the course of kidney damage, ACE inhibitors are seen to be the best course of action for people with high blood pressure who are diabetics. Additionally, they are the best option for controlling the hypertension linked to heart failure. The majority of individuals tolerate ACE inhibitors quite well [16]. There aren't many adverse effects or contraindications to them [14]. Because hypotension is a typical side effect of ACE inhibitors, these should not be taken with other medications that decrease the RAAS, such as renin inhibitors or ARBs. Furthermore, patients who have a previous case of angioedema should not use ACE inhibitors since they may lessen the breakdown of bradykinin, which could cause the disorder. Pregnant women shouldn't be prescribed these drugs because they are known to be teratogenic. Given the possibility of abrupt renal failure, patients suffering from bilateral renal artery stenosis should use in caution when prescribed ACE medications. A dry cough and hyperkalaemia are common side effects. Agranulocytosis, eosinophilic pneumonitis, and gynecomastia are a few less frequent adverse effects that have also been reported [19].

**B. Angiotensin Receptor Blockers (ARBs)**- Telmisartan, Olmesartan, Azilsartan, candesartan, Eprosartan, Irbesartan, Losartan, and valsartan are examples of commonly used angiotensin receptor blockers (ARBs). These drugs have good tolerance, which makes them quite useful in controlling hypertension [19]. They should be provided to patients with heart failure and diabetic nephropathy preference because they enhance their survival rates and benefit these patients' diseases. Additionally, there is a decreased chance of type 2 diabetes mellitus [20]. Side effects may include headaches, vertigo, and hyperkalaemia. Less often occurring adverse effects include hypotension after the first dose, rash, diarrhoea, indigestion, altered functioning of metabolism, sore throat, spasms, discomfort in the back, sleeplessness, diminished haemoglobin levels, kidney problems, and nasal congestion. ARBs are far less likely to produce a dry cough than ACE inhibitors. When compared to people on ACE inhibitors, patients taking ARBs are generally less likely to stop their therapy because of side effects. However, patients who have bilateral renal artery stenosis should not use ARBs since they can cause renal failure [19].

**C. Diuretics-** Thiazides, loop diuretics, carbonic anhydrase inhibitors, potassium-sparing diuretics, and osmotic diuretics belongs to the subdivision of diuretics. Effective low-dose diuretic therapy lowers the risk of heart failure, stroke, coronary heart disease, and overall death. Although thiazides are the most often prescribed medication, loop diuretics can also be used with success, and their combination with a potassium-sparing diuretic lowers the risk of hypokalaemia and hypomagnesemia. Using potassium-sparing diuretics lowers the risk of sudden death. Over an extended period of time, spironolactone lowers morbidity and mortality in individuals suffering from heart failure, a common consequence of chronic hypertension [14]. Ototoxicity, hypokalaemia, hypomagnesemia and metabolic alkalosis are common side effects of loop diuretics. By contrast, thiazide diuretics frequently result in hyperglycaemia, hyperlipidaemia, hyponatremia, hyperuricemia, and hypercalcemia. They can also induce low sodium levels, high uric acid levels, and raised blood sugar and calcium levels. Potassium-sparing diuretics have a higher risk of hyperkalaemia and might cause adverse effects like gynecomastia and decreased libido. Those who are allergic to these diuretics or have liver or kidney disease shouldn't use them. Loop diuretics are generally not recommended in pregnant women or gout patients, and people with gout should

also avoid thiazide diuretics. Potassium-sparing diuretics should not be used in individuals who are pregnant, have hyperkalaemia, or are taking ACE inhibitors or ARBs [20].

**D. Beta-blockers-** β-blockers should be used in cases of high sympathetic tone, angina, and prior myocardial infarction. In recent years, β-blockers have been utilized more often to treat heart failure, a known side effect of arterial hypertension [14]. Atenolol, bisoprolol and metoprolol are certain examples of β1-selective BBs. Some side effects of beta-blockers include depression, visual hallucinations, bronchospasm in asthmatic patients, tiredness, lethargy, sleep problems, and nightmares. Additionally, they may result in peripheral vascular problems like Raynaud's phenomenon and chilly extremities, as well as sexual dysfunction [19].

**E. Calcium channel blockers-** Dihydropyridines, such as nifedipine, nimodipine, and amlodipine, and non-dihydropyridines, such as verapamil and diltiazem, are two categories of calcium channel blockers. Calcium channel blockers are a good substitute for people who cannot take β-blockers, especially the elderly. For those suffering from Raynaud's phenomenon, peripheral vascular disease, or asthma, they work well as a monotherapy. In instance, nifedipine works well for treating severe hypertension and can be taken sublingually. ACE inhibitors, diuretics, and/or β-blockers are frequently used in conjunction with calcium channel blockers [16]. Dihydropyridine calcium channel blockers (CCBs) might cause flushing, fast heartbeat, confusion, and limb oedema as side effects. Constipation is another side effect associated with verapamil, a non-dihydropyridine CCB. Non-dihydropyridine CCBs may cause atrioventricular block and cardiac depression due to their effects on heart tissue. Gum overgrowth, oesophageal problems, and a minor elevation in liver enzymes are uncommon side effects for both forms of CCBs. Furthermore, utilizing CCBs is not advised for people who are allergic to any of the medication's components.

**F. $\alpha_1$-Adrenergic blockers-** α-blockers which are non-selective involves phentolamine and phenoxybenzamine, while selective α1-blockers such doxazosin, prazosin, terazosin, and tamsulosin are frequently recommended. Benign prostatic hyperplasia (BPH) and secondary hypertension can be effectively treated with α-blockers, but they are not very effective in treating primary hypertension. One typical α-blocker adverse effect is known as the "first dose effect." This explains a precipitous decline in blood pressure that can happen following a patient's first administration of medication, combined with orthostatic hypotension and fainting (syncope). Due to the decrease in blood pressure, α-blockers also frequently cause other side effects like headaches, fatigue and dizziness. Before surgery, patients should avoid using α-blockers for a maximum of two weeks due to documented adverse effects such as priapism and intraoperative floppy iris syndrome (IFIS) [19].
**G. Direct vasodilators-** Minoxidil and hydralazine both function as direct vasodilators. The possibility of major adverse effects (hirsutism with minoxidil and lupus syndrome with hydralazine) has led to a decrease in their use [14].

**9. COMPLICATIONS OF HYPERTENSION**
**A. Cardiovascular Complications:** Hypertension is a major risk factor for a range of cardiovascular issues. It contributes to coronary artery atherosclerosis and left ventricular hypertrophy. Long-term high blood pressure is associated with an increased risk of coronary artery disease, which can lead to myocardial ischemia and infarction. Myocardial ischemia is primarily caused by two factors: increased oxygen demand due to elevated pressure and reduced oxygen delivery to the heart from atheromatous plaques. Hypertension is a significant risk factor for mortality related to coronary artery disease. Chronic high blood pressure can also lead to heart failure, starting with diastolic dysfunction and potentially progressing to severe systolic failure, often accompanied by cardiac congestion. [14].

**B. Stroke:** The risk of stroke is increased by hypertension, which destroys the blood vessels in the brain. An ischemic or haemorrhagic stroke may occur from high blood pressure's ability to exacerbate the rupture of fragile blood vessels or to induce the formation of blood clots. When a thrombus obstructs a cerebral blood vessel, it deprives the brain tissue of oxygen and nutrients, resulting in Ischemic stroke. This kind of stroke is the most prevalent and can cause serious neurological impairments. Haemorrhagic stroke results from a brain artery burst, which causes bleeding inside or outside the brain. This kind of stroke can have a high death rate and frequently causes a fast, sharp rise in blood pressure.

**C. Renal Complications:** Hypertension can have a negative impact on the kidneys because they are highly vascular organs with sensitive blood arteries. Chronic kidney disease (CKD) can result from damage to the kidneys' glomeruli, which serve as filter units, caused by eminent blood pressure. Over time, increased pressure damages the small blood vessels in the kidneys, impairing their ability to filter blood effectively. This may lead to hypertensive nephropathy, which can progress to end-stage renal disease (ESRD) requiring dialysis or kidney transplantation. Microalbuminuria, an early indicator of kidney disease, can progress slowly and may not present noticeable symptoms until later stages of life [14].
**D. Vision Loss:** The light-sensitive layer in the back of the eye called the retina might sustain damage from blood vessel damage due to hypertension. Hypertensive retinopathy is the term for this condition. Prolonged hypertension can lead to progressive problems such as retinal vein blockage and increasing risk of blindness over time.

*REDVET - Revista electrónica de Veterinaria*
ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:

**E. Cognitive Impairment:** Cognitive performance may be impacted by chronic hypertension's damage to the brain's tiny blood vessels. Cognitive impairment may result from decreased blood supply and brain tissue injury. Less blood flow results from damaged blood arteries in the brain, which is the cause for vascular dementia. Memory loss, confusion, and trouble reasoning are some of the symptoms. Chronically high blood pressure can hasten the onset of neurodegenerative illnesses like Alzheimer's and is related with a higher chance of decline of thought processes.

**F. Metabolic Syndrome:** Hypertension frequently occurs alongside other metabolic conditions like insulin resistance, elevated cholesterol levels, and abdominal obesity, all of which together heighten the risk of developing cardiovascular disease and diabetes.

**G. Sexual Dysfunction:** Hypertension may restrict blood flow to the reproductive organs, potentially causing erectile dysfunction in men and lowering sexual desire or function in women.

## 10. CONCLUSION-

Effective management of hypertension requires a careful balance between controlling blood pressure and minimizing complications associated with the disease and its treatment. Individualized treatment plans tailored to a patient's comorbidities, tolerability, and drug response are essential for optimizing outcomes. Regular monitoring for adverse effects, patient education, and adherence strategies can further improve long-term success in controlling hypertension. Future research should focus on identifying biomarkers that can guide personalized medicine, ensuring that patients receive the most appropriate therapy with the fewest side effects. Additionally, innovations in pharmacotherapy, such as the development of new drug classes and the refinement of combination therapies, may improve blood pressure control and reduce the burden of hypertension-related complications.

## REFERENCES

[1] N. R. Poulter, D. Prabhakaran and M. Caulfield, "Hypertension," *Lancet,* vol. 386, pp. 801-812, 2015.
[2] T. . D. Giles, B. C. Berk, J. L. Izzo and M. A. Weber, "Expanding the Definition and Classification of Hypertension," *The Journal Of Clinical Hypertension,* vol. 7, no. 9, pp. 505-512, 2005.
[3] D. T. Lackland and M. A. Weber, "Global Burden of Cardiovascular Disease and Stroke:Hypertension at the Core," *Cnadian journal of cardiology.*
[4] J. Nachiya, P. and R. Rao, "Study on drug utilisation pattern of antihypertensive medications on out-patients and in-patients in a tertiary care teaching hospital: A cross sectional Study," *African Journal of Pharmacy and Pharmacology,* vol. 9, no. 11, pp. 383-396, 2015.
[5] S. Singh, R. Shankar and G. P. Singh, "Prevalence and Associated Risk Factors of Hypertension:A Cross-Sectional Study in Urban Varanasi," *International Journal of Hypertension,* 2017.
[6] P. H. C. Project, *Hypertension, Prevention, Diagnosis and Treatment,* Primary health care service Delivery guidelines Iraq , 2013.
[7] O. Carretero and S. Oparil, "Essential Hypertension," *Circulation,* vol. 101, pp. 329-335, 2000.
[8] P. Sharma, H. Beria, P. K. Gupta, S. Manokaran and A. Reddy, "Prevalence of hypertension and its associated risk factors," *Journal of Pharmaceutical Sciences and Research,* vol. 11, no. 6, pp. 2161-2167, 2019.
[9] J. Lee, "Signs and Symptoms of Hypertension," *Journal of Molecular Pathophysiology,* vol. 11, no. 9, 2022.
[10] F. Khurshid, M. Aqil, M. S. Alam, P. Kapur and K. K. Pillai, "ANTIHYPERTENSIVE MEDICATION PRESCRIBING PATTERNS IN A UNIVERSITY TEACHING HOSPITAL IN SOUTH DELHI," *International Journal of Pharmaceutical Sciences and Research,* vol. 3, no. 7, pp. 2057-2063 , 2012.
[11] J. Kumar, "Epidemiology of Hypertension," *Clinical queries:Nephrology,* vol. 2, no. 2, pp. 56-61, 2013.
[12] *Hypertension Screening, diagnosis, Assessment, and management of Primary Hypertension in Adults in India,* Ministry of Health and Family welfare Government of india, 2017.
[13] I. C. Pinto and D. Martins, "Prevalence and risk factors of arterial hypertension: A literature review," *J Cardiovasc Med Ther,* vol. 1, no. 2, 2017.
[14] P. Foex and J. W. Sear, "Hypertension: pathophysiology and treatment," *Continuing Education in Anaesthesia, Critical Care & Pain,* vol. 4, no. 3, 2004.
[15] G. Beevers, . G. Lip and . E. O. , " The Pathophysiology of hypertension," *ABC of Hypertension,* vol. 322, pp. 912-916, 2001.
[16] S. Oparil, M. Acelajado, G. Bakris, D. Berlowitz, G. Grassi and A. Rodgers, "Hypertension," *Nat Rev Dis Primers,* vol. 4, 2018.
[17] T. Saxena, A. Ali and M. Saxena, "Pathophysiology of essential hypertension: an Update," *Expert Review of Cardiovascular Therapy,* vol. 16, no. 12, pp. 879-887, 2018.
[18] Whelton, "Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults," *High Blood Pressure Clinical Practice Guideline.*

*REDVET - Revista electrónica de Veterinaria*
ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:

[19] U. Ojha, . S. Ruddaraju, . N. Sabapathy, V. Ravindran, P. Worapongsatitaya, J. Haq and R. Mohammed, "Current and Emerging Classes of Pharmacological Agents for the management of hypertension," *American Journal of Cardiovascular Drugs,* vol. 22, pp. 271-285, 2022.

[20] J. Jordan, . C. Kurschat and H. Reuter, "Arterial Hypertension," *Deutsches Ärzteblatt International,* vol. 115, pp. 557-58, 2018.

[21] B. Heidari, E. Avenatti and K. Nasir, "Pharmacotherapy for Essential Hypertension: A review," *Methodist DeBakey Cardiovasc Journal,* vol. 18, no. 5, pp. 5-16, 2022.