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## **Hypertension: An Overview**

### **Purpose/Goals**

This course provides an overview of hypertension. The course explains the classification of hypertension. It will discuss the risks and complications associated with hypertension and review the treatment options for the hypertensive patient. Lastly, it will explain the nurse's role in the management of patients with hypertension.

### **Objectives**

1. Discuss the incidence of hypertension
2. List five risk factors that are associated with hypertension
3. List five complications of hypertension
4. Discuss three lifestyle interventions for the hypertensive patient
5. List five medications to treat hypertension

The American Heart Association estimates that approximately one-third of American adults are afflicted with hypertension<sup>1</sup>. Worldwide, more than 25 % of the adult population has hypertension, which is approximately one billion people. By 2025, a projected 1.56 billion people worldwide will have hypertension<sup>2</sup>. In addition, more individuals are afflicted and are unaware.

Hypertension has a tremendous impact on the health of the American public. The total estimated cost for hypertension in 2007 was 66.4 billion dollars<sup>3</sup>. Beyond cost, it leads to significant mortality and morbidity. Those with hypertension die more often, have more heart attacks, strokes and heart failure.

### **Who is at risk?**

Lifestyle factors are an important force in the development of hypertension. Increased body weight is correlated to hypertension and the rate of obesity is increasing in America. As of 2006, 34 percent of Americans - including 33.3 percent of men and 35.3 percent of women - are obese<sup>4</sup>. The increasing prevalence of obesity is one factor that increases the incidence of hypertension.

Blacks are at higher risk for hypertension than whites. The incidence of hypertension in black adults is 41.4 percent while the prevalence among white adults is 28.1 percent<sup>5</sup>.

Those who lack social support are at increased risk for hypertension. Lack of social support is a form of stress and affects blood pressure regulation leading to an increase in blood pressure. Those who have the lowest level of social support have the highest prevalence of non-dipping overnight blood pressure<sup>6</sup>.

Age is a major risk factor for hypertension. About two-thirds of those over the age of 60 have hypertension<sup>7</sup>. Systolic hypertension is much more common in the older population while diastolic hypertension is more common in those under the age of 50<sup>8</sup>.

Genetics are another risk factor for hypertension with high blood pressure being related to multiple genetic deficits. A family history of hypertension increases the risk of high blood pressure. The complex interaction between hypertension and lifestyle is not well understood at this time.

Sex is also a risk factor for hypertension. Before the age of 55 men are more prone to hypertension. After menopause, women are more likely to develop hypertension<sup>9</sup>. In addition, more women than men are unable to control their blood pressure. Of those with hypertension, only about 60 percent of women are treated, and of those only about one-third have blood pressure controlled to less than 140/80 mmHg<sup>10</sup>.

### **Complications of Hypertension**

The pressure exerted by the blood against the walls of the arteries is blood pressure. The higher the pressure, the more damage can be done. The pressure exerted on the vessel walls not only damages vessels but organs as well.

Hypertension significantly increases morbidity and mortality. Rates of cardiovascular disease doubles for each 20/10 mmHg increment of blood pressure over 115/75 mmHg<sup>11</sup>.

Atherosclerosis is one of the most dreaded and common complications of long-standing hypertension. High blood pressure decreases the coronary flow reserves and increases the myocardial oxygen demand. In addition, hypertension remodels the vessel, causes endothelial dysfunction and increases the collagen deposits in the artery<sup>12</sup>.

High blood pressure is a leading cause of heart failure. The increased afterload causes the myocardium to change structurally. The cardiac cells hypertrophy. While this initially helps compensate, allowing the heart to supply oxygen against increased pressure, it eventually leads to impaired cardiac function.

Stroke and encephalopathy are potential complications of long-standing hypertension. Stroke risk increases with proportional elevation in blood pressure – both systolic and diastolic. Controlling blood pressure is a major strategy in the reduction of stroke incidence.

Kidney failure is another complication of long-standing hypertension. Hypertension is at times the primary cause of renal failure, but even if it is not, its presence increases the rate of kidney damage. Hypertension is second only to diabetes as the leading cause of renal failure in the United States<sup>13</sup>.

Hypertension may increase the incidence of memory impairment. A recent study suggested that a history of hypertension is associated with an increase risk of mild cognitive impairment<sup>15</sup>.

In addition, hypertension increases the incidence of aortic dissection, retinopathy and peripheral artery disease.

## **Definition of Hypertension**

Blood pressure is reported as a systolic number over a diastolic number. The systolic number is the amount of pressure generated during a heart beat while diastolic pressure is the amount of pressure generated when the heart is relaxing between beats.

Blood pressure is classified in one of four ways: normal, prehypertensive, stage I or stage II. According to the Seventh Report of the Joint National Committee on Detection, Education and Treatment of High Blood Pressure (JNC VII) <sup>11</sup> normal blood pressure is below 120/80 mmHg. Values between 120-139/80-89 mmHg are categorized as prehypertensive. Readings between 159-140/90-99 mmHg delineate stage I hypertension and readings more than 160/100 mmHg are considered to be stage II hypertension. After an initial screening, blood pressure classification is based the average of at least two readings.

Patients with hypertension are classified as having the stage of hypertension which correlates with their highest reading. For example, if a patient has an average blood pressure reading of 162/60 mmHg he would be classified as having stage II hypertension. This is because his systolic reading is stage II even though his diastolic reading is classified as normal.

Older adults are at greater risk for developing problems with the systolic number in a condition known as isolated systolic hypertension. The reading of 162/60 mmHg would also be classified as isolated systolic hypertension.

Hypertension can be broken down into two separate categories: primary or essential and secondary. Primary hypertension accounts for 90-95% of the cases. There are no identifiable factors causing the hypertension. Secondary hypertension is high blood pressure related to another cause such as renovascular hypertension. This will be discussed further below.

### **Signs and Symptoms**

Hypertension is called the silent killer because it typically is present without signs or symptoms. While no symptoms are often present it is imperative for the clinician to perform a good history, physical exam and targeted diagnostic tests.

The first step in evaluating the hypertensive patient is to look for cardiovascular risk factors and treat if necessary. Secondly, attempt to determine if there is a specific cause of the hypertension. Lastly, evaluate for any complications of hypertension.

The history should draw out any signs or symptoms associated with complications of hypertension. The patient should be questioned about any chest or abdominal pain, shortness of breath or dyspnea on exertion, vision changes, edema, weight gain, intermittent claudication, or orthopnea. Risk factors for cardiovascular disease should also be looked for and include: smoking, dyslipidemia, age, physical inactivity, obesity, family history and diabetes.

In addition to checking blood pressure, which should be checked in both arms, the physical exam should look for any causes or complication of hypertension. All peripheral pulses should be felt to assess for any evidence of

peripheral vascular disease. The legs should be evaluated for femoral bruits. The practitioner should look at the back of the eyes fundoscopically for any evidence of hypertensive retinopathy. The abdominal exam should look for any bruits, enlargement of the kidneys, masses or an abnormal aortic pulsation. The neck should be examined for carotid bruits as well as any abnormality of the thyroid gland. The heart and cardiovascular system should be assessed for congestive heart failure as evidence by a displaced point of maximal impulse, a S<sub>3</sub> or S<sub>4</sub> gallop, fluid in the lungs, peripheral edema or elevated jugular venous pressure.

The history and physical exam should also look for secondary causes of hypertension. Kidney disease, anemia or an abdominal mass may suggest a renal pathology causing hypertension. Pheochromocytoma presents with labile blood pressure, sweating and palpitations. Hyperaldosteronism may be suggested by weakness and unexplained hypokalemia. Thyroid dysfunction may be manifested by heat or cold intolerance, slow or fast heart rates, low energy levels or sweating. Coarctation of the aorta may be considered if the pulses in the legs are diminished or delayed when compared to the upper extremities. Renal artery stenosis may be suggested by an abdominal bruit. Reviewing the medications is important as many medications can lead to elevations in blood pressure including: non-steroidal anti-inflammatory medications, nasal decongestants or oral contraceptives. Sleep apnea is another cause of secondary hypertension. If the patient snores excessively or has daytime drowsiness than a referral for a sleep study may be warranted.

Secondary hypertension is uncommon and not usually worked up for extensively unless a secondary cause is strongly suspected based on history and physical exam. Other indications a secondary cause of hypertension may be causing the high blood pressure include: sudden onset of high blood pressure after the age of 55, physical exam findings suggestive of a secondary cause of hypertension, drug resistant hypertension, severe hypertension, or previously well controlled blood pressure.

Laboratory evaluation looks for causes of hypertension, cardiovascular risk factors and target organ damage. Routine laboratory evaluation should include a urinalysis, kidney function test, lipoprotein levels, hematocrit, blood glucose level and serum potassium level. An electrocardiogram should be done to evaluate for any underlying cardiovascular disease<sup>11</sup>.

Low potassium levels may suggest hyperaldosteronism. Decreased kidney function may suggest damage done to the kidney due to the effects of hypertension. Hematuria or proteinuria on urine analysis implies damage to the tubules of the kidney. Fasting blood sugar evaluates for the presence of diabetes which, when combined with hypertension, significantly increases the risk of kidney damage and cardiovascular disease. Red blood cell count with hemoglobin and hematocrit levels will detect an underlying anemia which may propose a possible anemia related to kidney disease. Electrocardiogram is done to assess for abnormal heart rhythms, increased size of the heart or evidence of an old heart attack.

## **Interventions**

Hypertension can be treated with both pharmacological and non-pharmacological interventions. It is important for those afflicted with hypertension to work on non-pharmacological interventions even when medications are being used to treat the disease. Working in close collaboration with the health care provider, hypertensive patients need to monitor their blood pressure, medications and non-pharmacological interventions.

During treatment of hypertension, monthly follow up should occur until control is reached. If blood pressure is more severe, follow up may be more frequent. Laboratory monitoring is a key feature of hypertension treatment with kidney and potassium levels being monitored closely. Those with controlled hypertension may follow up 2-4 times a year<sup>11</sup>.

### **Non-pharmacological Interventions**

Non-pharmacological interventions are lifestyle modifications. Non-pharmacological interventions used to treat hypertension can also be used to prevent hypertension.

Weight loss (if overweight) or the maintenance of a healthy weight can help manage high blood pressure. A weight loss of 10 kilograms may lead to a reduction in blood pressure of approximately 5-20 mmHg<sup>14</sup>.

Exercise is a critical part of the treatment plan of hypertension. Aerobic exercise improves blood pressure both acutely and chronically. Blood pressure is lowered about 5-7 mmHg after exercise for up to 22 hours, with the greatest effect occurring in those with the highest blood pressure<sup>16</sup>.

Those with controlled hypertension without heart or renal disease can exercise, but should be evaluated by their doctor. Assessment for complications of hypertension such as target organ damage, evaluation of control, family history, evaluation of secondary causes of hypertension, evaluation of medications, any limitations and obtaining physician approval are all part of the initial evaluation. Pre-training screening may be more intense in those who have cardiovascular symptoms, high risk for cardiovascular disease, other risk factors or established disease<sup>16</sup>.

Some individuals need exercise tests. It is meant to identify any coronary heart disease and help determine how intense exercise should be carried out. The following hypertensive patients should get exercise tests prior to initiating an exercise program<sup>16</sup>:

- Those wanting to engage in hard or very hard exercise
- Men over 45 and women over 55 who want to exercise vigorously
- Known or suspected heart disease
- Hypertension above 180/110 mmHg for moderate exercise
- Those with target organ damage (left ventricular hypertrophy, angina, previous heart attack, prior percutaneous coronary intervention and heart failure) for moderate exercise
- Those with clinical cardiovascular disease (stroke, heart failure, heart disease, peripheral artery disease and retinopathy) for moderate exercise
- Any diabetic who wishes to engage in moderate exercise

### *Aerobic Exercise*

Aerobic exercise is helpful in the reduction of blood pressure and the prescription can be broken down into frequency, intensity, time, and type of exercise. This section will provide some guidelines into how to recommend exercise to hypertensive patients. The exercise plan must be tailored to the initial level of fitness, individual goals and overall health status.

### *Frequency*

The American College of Sports Medicine (ACSM) recommends exercising three to five days a week but daily or almost daily exercise is beneficial<sup>16</sup>. Daily exercise is not a recommended starting point for the novice exercise, but it could be considered in those who want to decrease the risk of inactivity related chronic diseases associated with hypertension.

### *Intensity*

Intensity is a fancy way of saying how hard to exercise. The general recommendation from the ACSM is that moderate-intense exercise is best to control blood pressure while minimizing the risks of more vigorous exercise<sup>16</sup>. Some hypertensive patients may be able to participate in vigorous exercise, but the risk of cardiovascular and musculoskeletal complications must be considered. Moderately intensive exercise is defined as an intensity of 40-60 percent of the maximal oxygen consumption.

### *Time*

Thirty to sixty minutes of aerobic exercise a day should be carried out. It may be challenging for a novice exercise to participate in 30 minutes of sustained aerobic exercise, but the exercise does not have to be accomplished all at the

same time. Breaking up exercise sessions into three 10-minute blocks is just as effective as one 30-minute block.

More than thirty minutes a day results in better fitness, decreases risk of chronic diseases, improves weight management and decreases rates of disability. Caution must be used with long duration exercise as it is associated with higher injury rates and higher rates of exercise burnout.

### *Type*

The last component to an aerobic exercise program is the type of exercise. Aerobic exercise involves increasing the heart and respiratory rate, which is best accomplished with exercises using big muscle groups such as the legs. Aerobic exercises include: walking, biking, exercise classes and swimming.

Many factors – that are beyond the scope of this article - must be considered when deciding which mode of exercise to choose. There is no perfect exercise. Personal preference is an imperative consideration; exercises that are enjoyable will be complied with better.

Resistance training should also be carried out by the hypertensive patient. The goals of strength training are to improve strength and endurance, improve the quality and quantity of life, reduce body fat, improve flexibility and decrease risk for cardiovascular disease.

While still recommending strength training, the ACSM states there is little evidence to suggest that resistance training is helpful in control of blood pressure either acutely or chronically<sup>16</sup>.

Strength training should be done 2-3 times a week with at least 48 hours rest between each session. Muscles need to recuperate after being stressed with weights and if one lifts weights with less than 48 hours rest between sessions muscles will be overworked. Complete eight to ten exercises for the major muscle groups with 8-15 repetitions per exercise. One set of each exercise should be done, and for greater strength gains one may work up to 3 sets per exercise.

**Table 1: Key Points to Strength Training**

- Lift weights 2-3 times a week
- Execute movements slow and under control
- Warm up before and cool down after every weight training session
- Start low; go slow
- Exercise each major muscle group
- Begin with one set per exercise
- Work up to two to three sets per exercise
- Get at least 48 hours rest between weight lifting sessions
- Select a weight that can be performed 8-15 times

Dietary interventions have been shown to reduce blood pressure. The DASH diet also known as Dietary Approaches to Stop Hypertension should be implemented in anyone with hypertension or at risk for hypertension.

Unfortunately, since the introduction of the DASH guidelines the compliance with the diet has plummeted among Americans<sup>17</sup>.

Eating a diet low in sodium is a primary goal. Individuals who eat less than 50 (2.9 grams of sodium chloride) mmol of sodium chloride per day rarely have hypertension. Sodium that exceeds 50-100 mmol per day (2.9-5.9 grams) is necessary to cause hypertension; but eating this quantity of sodium does not guarantee hypertension. There are other factors present in addition to sodium intake that predisposes to hypertension<sup>18</sup>. Low salt diets are effective at reducing blood pressure. Eating a diet with of sodium content of less than 50 mmol reduced blood pressure by 4.0/2.5 mmHg in those with hypertension and by 2/1 mmHg in those without hypertension<sup>19</sup>.

Consuming a diet that is high in fruits and vegetables, whole grains, low-fat dairy, fish, poultry and nuts while low in total fat, saturated fat and cholesterol is recommended as part of the DASH diet. Foods that are high in potassium, calcium, and magnesium are helpful in the reduction of blood pressure<sup>14</sup>. Potassium intake is correlated to lower blood pressure. Those who consume over 60 mmol per day of potassium lowered systolic and diastolic blood pressure by 4.4 and 2.5 mmHg respectively in those with high blood pressure and 1.8 and 1.0 mmHg in those without hypertension<sup>21</sup>.

Recent evidence suggests a link between low levels of serum vitamin D and hypertension. Systolic blood pressure was found to be higher in those with low levels of vitamin D in white but not black patients. More research needs to be done to determine if correcting vitamin D levels can correct high blood pressure<sup>20</sup>.

Women who have a high intake of dietary calcium have a lower blood pressure. This is true of those women who get their calcium from low-fat dairy. The decreased blood pressure did not apply to those who got their calcium from high fat dairy sources or those who got their calcium from supplements<sup>22</sup>.

It is recommended that men drink 2 or fewer drinks per day while women drink one or fewer. Limiting alcohol has the potential to lower systolic blood pressure 2-4 mmHg<sup>14</sup>. Recent evidence suggests women can tolerate more alcohol without negative effects on blood pressure when compared to men. Women who drank four or more drinks per day showed increased blood pressure, while it only took one or more drink per day in men<sup>23</sup>.

### **Pharmacological Interventions**

If lifestyle interventions are not able to lower blood pressure to an acceptable level than the addition of medications are helpful. Multiple classes of medications are available to combat hypertension. They attack different physiological systems; therefore, one medication that is effective for one individual may not be effective for another. Many hypertensive patients will not gain optimal control on just one medication.

The future may bring changes to the way hypertension is treated. Vaccines may be given to combat hypertension. A vaccine has been tested that will block the angiotensin receptor sites, thereby lowering blood pressure<sup>24</sup>.

In addition, medicine will be able to determine which medication will be most effective in the treatment of hypertension among different individuals. The current method for selecting a pharmacological agent includes looking at the age,

sex, or medical co-morbidities and utilizing the literature to choose a medication that typically works in that population or has benefits to other co-morbidities. For example, diabetics with hypertension get the extra benefit of renal protection with the use of an angiotensin converting enzyme inhibitors (ACE-I) and therefore ACE-I are often chosen to treat hypertension in diabetics. African Americans respond better to thiazide diuretics and calcium channel blockers (CCB) than ACE-I or beta-blockers (BB).

Currently only 36 percent of the population, who have diagnosed hypertension, over the age of 18 have their blood pressure controlled<sup>14</sup>. The reason for the shortcoming is not just drug selection, but if drug selection can be better this may improve the rates of blood pressure control. The future will bring genetic characteristics into determining which medication will be most effective at treating hypertension in a given individual. The implementation of genetic testing to determine which medication would be most suited for a given individual should be an improved strategy to assure blood pressure is controlled optimally.

#### *Angiotensin converting enzyme inhibitors*

This medication class affects the hormonal system and decreases the production of angiotensin II. Angiotensin II is a hormone that acts upon the blood vessel wall and causes constriction. Angiotensin-converting enzyme inhibitors (ACE-I) relax blood vessels by preventing an enzyme (angiotensin converting enzyme) in the body from producing angiotensin II; this leads to a reduction in blood pressure.

ACE-I are indicated in uncomplicated hypertension, post myocardial infarction (MI), those at high risk for coronary artery disease (CAD), for recurrent stroke prevention, in congestive heart failure (CHF), in renal insufficiency, and for diabetics. It should not be used in those with bilateral renovascular disease or pregnancy as they can cause life-threatening hyperkalemia and birth defects, respectively. Other side effects include: cough, dizziness, lightheadedness, rash and rarely angioedema. While on ACE-I it is important to monitor kidney function and potassium level.

#### *Angiotensin receptor blockers (ARB)*

Angiotensin receptor blockers stop the effect of angiotensin II on the blood vessel, resulting in vasodilatation of the peripheral blood vessels. These medications are used in those with uncomplicated hypertension and can be used as a secondary choice to ACE-I in diabetes, chronic kidney disease and congestive heart failure.

Side effects include: dizziness, lightheadedness, nasal congestion, headache, and rarely angioedema. It lacks the side effect of cough and is often used when the patient is unable to tolerate an ACE-I due to cough. Similar to ACE-I, it is important to monitor kidney function and potassium level.

#### *Beta-blockers*

Beta-blockers (BB) decrease the contraction force and the rate of the heart, thereby, reducing blood pressure. They also decrease blood pressure by suppressing renin release and work best in those with high renin levels such as young, white patients.

These medications are indicated in those with uncomplicated hypertension. Compelling indications for their use are in those with CHF, post MI, high risk for CAD or diabetes.

Side effects include fatigue, dizziness, nightmares, erectile dysfunction, depression, stomach upset, slow heart rate, low blood pressure, bronchospasm, CHF and insomnia. Caution must be used in those with severe peripheral vascular disease or asthma. They have the potential to mask the signs of low blood sugar so they should be used with caution in those with diabetes and on medications that lower the blood sugar.

Less frequently alpha-beta-blockers are used in the treatment of hypertension. They include the medications labetalol hydrochloride (Normodyne, Trandate) and carvedilol (Coreg).

### *Calcium Channel Blockers*

Calcium channel blockers (CCB) stop calcium from entering into the muscle cells of the blood vessel, which results in vasodilatation and lower blood pressure. CCB are broken down into two classes: nondihydropyridines and dihydropyridines.

The nondihydropyridine CCB verapamil (Calan) and diltiazem (Cardizem) – in addition to dilating the blood vessels - slow the heart rate and decrease its pumping action therefore caution must be used when combined with beta-blockers. The dihydropyridine CCB amlodipine (Norvasc), felodipine (Plendil), nifedipine (Procardia), and nifedipine (Procardia) dilate the blood vessels and can increase the heart rate.

They are used in uncomplicated hypertension. In addition, they are used for patients at high risk for heart disease and in diabetics. Nondihydropyridines are sometimes used for those with certain cardiac arrhythmias. CCB control blood pressure as effectively in patients with stable CAD and hypertension when compared with BB<sup>26</sup>.

African Americans have better blood pressure control with this class of drug when compared to ACE-I when used as a single agent. This difference in blood pressure control is minimized when ACE-I are combined with adequate doses of diuretics<sup>25</sup>.

Caution should be used in heart block or failure. Side effects vary by individual drug but common side effects include headache, edema, fatigue, dizziness, low blood pressure, constipation, GI upset and slow heart rate.

### *Diuretics*

Diuretics, also known as water pills, decrease the amount of fluid and sodium in the body. Initially, diuretics rid the body of excess fluid, but as therapy is continued there is a decrease in vasoconstriction. There are three classes of diuretics: loop, potassium-sparing and thiazide. Thiazide diuretics, indapamide (Lozol) and hydrochlorothiazide (Hydrodiuril), are dosed once a day and are recommended as first line agents for uncomplicated hypertension in patients without renal dysfunction (creatinine less than 1.8). When renal failure is present loop diuretics are more effective. Loop diuretics – furosemide (Lasix), torsemide (Demadex), and bumetanide (Bumex) – are more vigorous in their action to get rid of fluid and increase the risk of electrolyte (such as potassium and

magnesium) disturbances. Potassium sparing diuretics including triamterene and the aldosterone antagonists - aldactone (Spironolactone) - are more expensive but do not deplete potassium as readily. Caution must be used in those with renal failure as there is a potential for hyperkalemia.

Thiazide diuretics are used as first line therapy for uncomplicated hypertension and as part of the initial combination of blood pressure medicines to treat blood pressure 20/10 mmHg over goal<sup>11</sup>. Compelling indications for the use of thiazide diuretics include CHF, high risk for CAD, diabetes and secondary stroke prevention.

Patients on diuretics need to be monitored for side effects. Dehydration, hypotension and orthostatic hypotension are common and increase the risk of falls. Other side effects of diuretics consist of abnormal electrolytes usually low potassium or low sodium, photosensitivity, GI upset and high blood sugars. Long-term use of thiazide diuretics may increase the risk of diabetes. In addition, they can increase the risk of gout or a flare of gout.

Drug interactions can occur with diuretics with such drugs as Digoxin, ACE-I or ARB and certain pain medicines such as ibuprofen, naproxen or celecoxib. Eating a diet high in sodium increases the risk for low potassium while on diuretics.

**Table 2: Compelling Indications for Various Blood Pressure Medications (adapted from US Department of Health and Human Services, 2004)**

Drug Class	Compelling indications
ACE-I	Diabetes, CKD, CHF, post MI, high risk for CAD, recurrent stroke

	prevention
ARB	Diabetes, CKD, CHF
BB	Diabetes, CHF, post MI, high risk for CAD
CCB	Diabetes, high risk for CAD
Diuretics	Diabetes, CHF, high risk for CAD, recurrent stroke prevention
Aldosterone Antagonists	CHF, post MI
	CKD – Chronic kidney disease; CHF- Congestive heart failure; MI – Myocardial infarction; CAD – Coronary heart disease

### **Other medications**

There are a variety of other medications that are used much less frequently in the treatment of hypertension. They are often used as treatment when other agents have failed or another medication is needed. Robust data is not available showing their efficacy and high incidence of side effects are two common reasons that these medications are not used often. The next section will briefly touch on a few of them.

Alpha-blockers such as doxazosin (Cardura) and prazosin (Minipres) result in vasodilatation of the peripheral vessels. They are also used for men with urinary symptoms secondary to benign prostatic hypertrophy. Side effects include sleepiness, dizziness, headache and fatigue. They are associated with a high incidence of dizziness and orthostatic hypotension and are linked to falls. The risk of syncope is highest 90 minutes after the first dose.

Central alpha agonists, which reduce blood vessel constriction, such as clonidine (Catapres), guanfacine (Tenex) and methyldopa (Aldomet) have significant side effects including sedation, dry mouth, and depression. Clonidine comes in a patch form (Catapres patch) and is changed one time a week. It can be beneficial in those with compliance issues because the oral form requires three times a day dosing.

Aliskiren (Tekturna) a newly approved renin inhibitor can be used to treat hypertension. It reduces plasma renin and therefore inhibits the production of angiotensin.

Side effects are generally minor with diarrhea and cough being the most prevalent. Angioedema is rare. By itself the drug rarely raises potassium levels but when used in combination with ACE-I the incidence of hyperkalemia is higher. The medication is dosed once a day between 150-300 mg.

While this drug has a unique mechanism of action, it has no proven unique role. It is expensive and lacks long-term data on its safety and efficacy. It is consequently not used often.

### **Combination therapy**

Using one or more drugs is often necessary to control blood pressure when readings are greater than 20/10 mmHg over target. After two years only a small number of people are able to be controlled on one agent. Only 16% of patients on verapamil and 15% on atenolol were still on one medication<sup>26</sup>.

Some medications work well together, others do not. The combination of ACE-I or ARB with thiazide diuretics has a robust action in lowering the blood

pressure. Side effects such as hypotension, electrolyte imbalance and renal failure need to be monitored for. Other effective combinations include:

- ACE-I or ARB with a CCB
- BB with a thiazide diuretics
- Centrally acting drugs with a diuretic
- Two different diuretics including a thiazide with a potassium sparing

Certain medications do not work together well. BB and ACE-I; thiazide diuretics and CCB are two combinations whose action do not complement one another.

Combination medication warrants special attention to drug interactions, with greater risk noted in the older adult. Blood pressure medications can result in hypotension or orthostatic hypotension with subsequent falls and fracture.

Certain combinations are more prone to problems with hypotension including:

- CCB/alpha-blockers
- ACE-I or ARB/diuretics.

The combination of BB and CCB can elicit bradycardia or congestive heart failure. The combined use of CCB and diuretics are associated with an increased risk of cardiovascular vascular death when compared with ACE-I/diuretic or BB/diuretic in older women without heart disease<sup>27</sup>.

### **Resistant Hypertension**

Blood pressure that cannot be controlled to goal in the patient who is compliant with the medication regime that includes three drugs (one of which is a diuretic) is classified as resistant hypertension<sup>14</sup>. It is more common in those

over the age of 60 years old. Resistant hypertension is dangerous because it increases the risk of target organ damage.

Often times the blood pressure is not controlled because of inadequate dose, incorrect medications or a secondary cause of hypertension that has not been identified. Other causes of resistant hypertension may include: incorrect blood pressure measurement, high sodium intake, not adhering to the medication regime, high alcohol intake, use of other medications that lead to hypertension, pseudohypertension in the elderly secondary to sclerotic arteries and obesity.

Medications and alcohol can lead to elevated blood pressure. The use of non-steroidal anti-inflammatory drugs may reduce the action of ACE-I and loop diuretics.

### **Nursing Interventions**

Nurses have a large role in the identification, prevention and treatment of hypertension. Identifying patients who should be screened and screening them is important. It is recommended that patients 18 years and older are regularly screened for hypertension. No strong statement has been made to suggest how frequently testing should ensue. The previous report of the Joint National Committee (JNC VI) on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recommended that blood pressure should be checked at least once every 2 years for adults with a systolic blood pressure below 120 mm Hg and a diastolic blood pressure below 80 mm Hg, and annually if systolic blood pressure is between 120-139 and diastolic blood pressure 80-89 mm Hg<sup>28</sup>.

When checking patients it is important to use proper technique. The patient should be seated and resting for five minutes prior to checking the blood pressure. The feet should be on the floor with the arm at heart level. No smoking, alcohol or caffeine should be consumed for at least 30 minutes prior to checking blood pressure. It is also important to use an appropriate sized cuff.

When patients are identified as hypertensive they should be referred to their primary care provider for evaluation and treatment. If the patient's blood pressure is less than 120/80 mmHg teach the patient to be screened regularly. If it is above 120/80 mmHg than referral to a PCP is appropriate for monitoring.

In addition to the nurses role as outlined above, educating patients about their role in making lifestyle choices that will prevent and treat hypertension is critical. Teach patients about exercise, diet and lifestyle choices.

Educating patients about factors that raise blood pressure is another important job of the nurse. Stress has the potential to raise blood pressure and helping patients to identify it and treat it can help reduce blood pressure. Encourage patients to practice stress reduction techniques such as deep breathing, yoga or progressive relaxation.

**Table 3: Key Points for Patient Teaching**

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| <ul style="list-style-type: none"><li>• Know your blood pressure goal – ideally it is less than 120/80 mmHg.</li><li>• Understand which lifestyle changes are helpful in treating and preventing hypertension.</li><li>• Know how often you should follow up with your health care provider.<br/>Typically on a monthly basis until blood pressure is well controlled and</li></ul> |
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every three to six months thereafter. Know which blood tests are important to monitor based on the medications you are taking.

- Maintain a record of blood pressure readings
- Take medications as prescribed; do not stop if you are not feeling well.
- Understand common side effects and report them to the health care provider.
- Discuss other medical diagnoses with the prescriber to help determine which medication is most appropriate to treat hypertension.

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