NON-PHARMACOLOGICAL INTERVENTION OF HYPERTENSION

Key Concepts

- Definition of hypertension
- Measurement of Blood pressure
- Regular exercises programme of blood pressure
- Life style modification of blood pressure
- Investigations of blood pressure

Abstract

Hypertension is a chronic medical condition in which blood pressure in arteries is elevated. Hypertension can be primary and secondary hypertension is diagnosed by presenting increased blood averse. There are multiple causes for hypertension, which is the basic of non-pharmacological treatment. These methods are lifestyle modifications, low sodium diet weightless, exercise, qent smoking certain dietary supplements of vitamin c omega-3 thioacids has been reported to reduce blood measure. Behaonial therapy is also helped.

Key words: Hypertension, DASH, Omega-3 fatty acids, Smoking cessation exercise.

Hypertension (HTN) or high blood pressure, sometimes arterial hypertension, is a chronic medical condition in which the blood pressure in the arteries is elevated. This requires the heart to work harder than normal to circulate blood through the blood vessels. Blood pressure involves two measurements, systolic and diastolic, which depend on whether the heart muscle is contracting (systole) or relaxed between beats (diastole). Normal blood pressure at rest is within the range of 100-140mmHg systolic (top reading) and 60-90mmHg diastolic (bottom reading). High blood pressure is said to be present if it is persistently at or above 140/90 mmHg.

Hypertension is classified as either primary (essential) hypertension or secondary hypertension; about 90–95% of cases are categorized as "primary hypertension" which means high blood pressure with no obvious underlying medical cause. The remaining 5–10% of cases (secondary hypertension) is caused by other conditions that affect the kidneys, arteries, heart or endocrine system.
Hypertension is a major risk factor for stroke, myocardial infarction (heart attacks), heart failure, aneurysms of the arteries (e.g. aortic aneurysm), and peripheral arterial disease and is a cause of chronic kidney disease. Even moderate elevation of arterial blood pressure is associated with a shortened life expectancy. Dietary and lifestyle changes can improve blood pressure control and decrease the risk of associated health complications, although drug treatment is often necessary in people for whom lifestyle changes prove ineffective or insufficient.

Signs and symptoms
Hypertension is rarely accompanied by any symptoms, and its identification is usually through screening, or when seeking healthcare for an unrelated problem. A proportion of people with high blood pressure reports headaches (particularly at the back of the head and in the morning), as well as lightheadedness, vertigo, tinnitus (buzzing or hissing in the ears), altered vision or fainting episodes.

On physical examination, hypertension may be suspected on the basis of the presence of hypertensive retinopathy detected by examination of the optic fundus found in the back of the eye using ophthalmoscopy. Classically, the severity of the hypertensive retinopathy changes is graded from grade I–IV, although the milder types may be difficult to distinguish from each other. Ophthalmoscopy findings may also indicate how long a person has been hypertensive.

Secondary hypertension:
Some additional signs and symptoms may suggest secondary hypertension, i.e. hypertension due to an identifiable cause such as kidney diseases or endocrine diseases. For example, truncal obesity, glucose intolerance, moon facies, a "buffalo hump" and purple striae suggest Cushing's syndrome. Thyroid disease and acromegaly can also cause hypertension and have characteristic symptoms and signs. An abdominal bruit may be an indicator of renal artery stenosis (a narrowing of the arteries supplying the kidneys), while decreased blood pressure in the lower extremities and/or delayed or absent femoral arterial pulses may indicate aortic coarctation (a narrowing of the aorta shortly after it leaves the heart). Labile or paroxysmal hypertension accompanied by headache, palpitations, pallor, and perspiration should prompt suspicions of pheochromocytoma.

Diagnosis:
Hypertension is diagnosed on the basis of a persistently high blood pressure. Traditionally, this requires three separate sphygmanometer measurements at one monthly interval. Initial assessment of the hypertensive people should include a complete history and physical examination. With the availability of 24-hour ambulatory
blood pressure monitors and home blood pressure machines, the importance of not wrongly diagnosing those who have white coat hypertension has led to a change in protocols. In the United Kingdom, current best practice is to follow up a single raised clinic reading with ambulatory measurement, or less ideally with home blood pressure monitoring over the course of 7 days.

Once the diagnosis of hypertension has been made, physicians will attempt to identify the underlying cause based on risk factors and other symptoms, if present. Secondary hypertension is more common in preadolescent children, with most cases caused by renal disease. Primary or essential hypertension is more common in adolescents and has multiple risk factors, including obesity and a family history of hypertension. Laboratory tests can also be performed to identify possible causes of secondary hypertension, and to determine whether hypertension has caused damage to the heart, eyes, and kidneys. Additional tests for diabetes and high cholesterol levels are usually performed because these conditions are additional risk factors for the development of heart disease and require treatment.

Serum creatinine is measured to assess for the presence of kidney disease, which can be either the cause or the result of hypertension. Serum creatinine alone may overestimate glomerular filtration rate and recent guidelines advocate the use of predictive equations such as the Modification of Diet in Renal Disease (MDRD) formula to estimate glomerular filtration rate (eGFR). eGFR can also provide a baseline measurement of kidney function that can be used to monitor for side effects of certain antihypertensive drugs on kidney function. Additionally, testing of urine samples for protein is used as a secondary indicator of kidney disease. Electrocardiogram (EKG/ECG) testing is done to check for evidence that the heart is under strain from high blood pressure. It may also show whether there is thickening of the heart muscle (left ventricular hypertrophy) or

### Typical tests performed in hypertension

<table>
<thead>
<tr>
<th>System</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal</td>
<td>Microscopic urinalysis, proteinuria, serum BUN(blood urea nitrogen) and/or creatinine</td>
</tr>
<tr>
<td>Endocrine</td>
<td>Serum sodium, potassium, calcium, TSH(thyroid-stimulating hormone).</td>
</tr>
<tr>
<td>Metabolic</td>
<td>Fasting blood glucose, total cholesterol, HDL and LDL cholesterol, triglycerides</td>
</tr>
<tr>
<td>Other</td>
<td>Hematocrit, electrocardiogram, and chest radiograph</td>
</tr>
</tbody>
</table>
whether the heart has experienced a prior minor disturbance such as a silent heart attack. A chest X-ray or an echocardiogram may also be performed to look for signs of heart enlargement or damage to the heart.

**What causes hypertension?**

Though the exact causes of hypertension are usually unknown, there are several factors that have been highly associated with the condition. These include:

- Smoking
- Obesity or being overweight
- Diabetes
- Sedentary lifestyle
- Lack of physical activity
- High levels of salt intake (sodium sensitivity)
- Insufficient calcium, potassium, and magnesium consumption
- Vitamin D deficiency
- High levels of alcohol consumption
- Stress
- Aging
- Medicines such as birth control pills
- Genetics and a family history of hypertension
- Chronic kidney disease
- Adrenal and thyroid problems or tumors

**How is blood pressure measured?**

Blood pressure is measured with a blood pressure cuff and recorded as two numbers, for example, 120/80 mm Hg (millimeters of mercury). Blood pressure measurements are usually taken at the upper arm over the brachial artery.

The top, larger number is called the systolic pressure. These measures the pressure generated when the heart contracts (pumps). It reflects the pressure of the blood against arterial walls.

The bottom, smaller number is called the diastolic pressure. This reflects the pressure in the arteries while the heart is filling and resting between heartbeats.

The American Heart Association has recommended guidelines to define normal and high blood pressure.

- Normal blood pressure less than 120/80
- Pre-hypertension 120-139/80-89
- High blood pressure (stage 1) 140-159/90-99
- High blood pressure (stage 2) higher than 160/100
- As many as 60 million Americans have high blood pressure.

Uncontrolled high blood pressure may be responsible for many cases of death and disability resulting from heart attack, stroke, and kidney failure.

According to research studies, the risk of dying of a heart attack is directly linked to...
high blood pressure, particularly systolic hypertension. The higher your blood pressure, the higher the risk. Maintaining lifelong control of hypertension decreases the future risk of complications such as heart attack and stroke.

**Eat Healthy, Balanced Meals:**
Although everyone should adhere to a healthy diet, those with hypertension should pay special attention to the foods they consume. Whole, unprocessed foods that are low in fat are the healthiest, so hypertension patients should try to avoid fast food as much as possible. Specific foods that have been shown to reduce blood pressure levels include whole grains, fresh fruits, fresh vegetables and cold-water fish. It is also important to consume the daily recommended amount of potassium.

**Reduce Sodium Intake:**
A diet that is high in sodium can greatly contribute to high blood pressure. The National Institutes of Health issued a special news release on sodium and blood pressure in 1998. This release states that people "should consume no more than 2,400 mg of sodium a day." This is equal to 6 g of salt. Since salt is hidden in many processed foods, it is best for patients with high blood pressure to stay away from table salt altogether.

**Exercise Regularly:**
Regular physical activity will improve a patient’s overall health, particularly the cardiovascular system. When the heart is healthy and strong, it can pump blood with ease. This lightens the stress on arteries and naturally lowers blood pressure. The Mayo Clinic recommends about 30 minutes of aerobic activity on most days of the week. This doesn't have to take place in a gym, however. Activities such as mowing the lawn, climbing stairs and walking will suffice.

**Quit Smoking/Drinking:**
Tobacco smoke and excessive alcohol intake are bad for the system in many ways. However, these habits are even more detrimental to those with hypertension, as they greatly increase the risk of stroke and heart attack. Those who are looking to naturally lower their blood pressure should give up smoking altogether. Although drinking in moderation is usually fine, anything more than one or two drinks a day is considered unhealthy.

**Manage Stress:**
The long-term effects of stress on hypertension are not clear, but it is known that stress can cause temporary spikes in blood pressure. Those who deal with a lot stress, whether at home or work need to learn to relax in order to get their blood pressure under control. Breathing exercises, meditation and positive daily affirmations are but a few ways to manage stress. In some cases, it might be best to make a major life change, such as finding a new career path that is less stressful.
Nonpharmacologic Strategies for Managing Hypertension:

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recommends lifestyle modification for all patients with hypertension or prehypertension. Modifications include reducing dietary sodium to less than 2.4 g per day; increasing exercise to at least 30 minutes per day, four days per week; limiting alcohol consumption to two drinks or less per day for men and one drink or less per day for women; following the Dietary Approaches to Stop Hypertension eating plan (high in fruits, vegetables, potassium, calcium, and magnesium; low in fat and salt); and achieving a weight loss goal of 10 lb (4.5 kg) or more. Alternative treatments such as vitamin C, coenzyme Q10, magnesium, and omega-3 fatty acids have been suggested for managing hypertension, but evidence for their effectiveness is lacking.

Despite all that is known about its adverse health consequences, high blood pressure still is poorly controlled in the United States. Only about one third of patients with hypertension have achieved the National High Blood Pressure Education Program goal of 140/90 mm Hg or lower. With the mainstay of hypertensive therapy in the United States being pharmacotherapy, interventions such as lifestyle and dietary modification often are overlooked. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) recommends lifestyle modification for all patients with hypertension (i.e., blood pressure of 140/90 mm Hg or higher) or prehypertension (i.e., blood pressure of 120/80 to 139/89 mm Hg), a new category developed by JNC 7 to draw attention to earlier intervention. Although some lifestyle modifications may seem to offer only minimal blood pressure-lowering effects, they should not be discounted. A reduction in systolic blood pressure of 5 mm Hg has been associated in observational studies with reductions of 14 percent in mortality caused by stroke, 9 percent in mortality caused by heart disease, and 7 percent in all-cause mortality.

## SORT: KEY RECOMMENDATIONS FOR PRACTICE

<table>
<thead>
<tr>
<th>Clinical recommendations for persons with hypertension of prehypertension</th>
<th>Evidence rating</th>
<th>References</th>
<th>Systolic blood pressure reduction (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain a normal body weight (i.e., body mass index less than 25 kg per m²).</td>
<td>C</td>
<td>1,7</td>
<td>5 to 20</td>
</tr>
<tr>
<td>Eat a diet high in fruits and vegetables and low in fat.</td>
<td>C</td>
<td>1,9,12,15</td>
<td>8 to 14</td>
</tr>
<tr>
<td>Consume less than 2.4 g of sodium per day.</td>
<td>C</td>
<td>1,9,11,12</td>
<td>2 to 8</td>
</tr>
<tr>
<td>Get 30 minutes of aerobic activity at least four days per week</td>
<td>C</td>
<td>1,13</td>
<td>4 to 9</td>
</tr>
<tr>
<td>Men should have no more than two alcoholic drinks per day, and women no more than one alcoholic drink per day.</td>
<td>C</td>
<td>1,14</td>
<td>2 to 4</td>
</tr>
</tbody>
</table>
In addition, a weight loss of 10 lb (4.5 kg), a realistic goal for most individuals who are overweight, can reduce or prevent hypertension.

NOTE: All recommendations are rated C because, although there is good evidence that they lower blood pressure, there is no direct evidence of mortality or morbidity benefit from clinical trials.

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series.

**Recommended Lifestyle Modifications:**
Five lifestyle modifications are recommended by JNC 7 for reducing blood pressure: (1) reducing sodium intake, (2) increasing exercise, (3) moderating alcohol consumption, (4) following the Dietary Approaches to Stop Hypertension (DASH) eating plan and (5) losing weight. These modifications have been proven to reduce blood pressure, although their direct impact on morbidity and mortality is not yet known.

**The DASH Eating Plan:**
*High in:*
- Fruits and vegetables (four to five servings each per day)
- Fiber (seven or eight servings per day)
- Low-fat dairy products (two or three servings per day)
- Lean meat (two servings per day)
- Calcium
- Magnesium
- Potassium

*Low in:*
- Saturated fat
- Cholesterol
- Salt*

DASH = dietary approaches to stop hypertension.

*— Low sodium intake was a later addition to the plan.

Information from references through.

**SODIUM REDUCTION:**
In the Trial Of Nonpharmacologic interventions in the Elderly (TONE) study, patients were randomized to a low-sodium diet (80 mEq per L [1.9 g; 80 mmol per L] per day) or usual care (i.e., no study-related counseling in lifestyle change). The intervention group had a 2.8 mm Hg greater reduction in systolic blood pressure than the control group. A later study assessed the impact on blood pressure of three levels of daily sodium intake: 150, 100, and 50 mEq per L (3.6, 2.4, and 1.2 g; 150, 100, and 50 mmol per L), representing a typical American diet, the upper end of recommended intake, and a limited intake, respectively. Results demonstrated a graded blood pressure response, with a correlation between greater reduction in blood pressure and lower sodium consumption. The recommended sodium intake is less than 100 mEq per L per day for all patients with hypertension or prehypertension.

**EXERCISE:**
Aerobic exercise has positive effects on blood pressure whether or not a person has hypertension, producing average reductions of 4 mm Hg in systolic blood pressure and 3 mm Hg in diastolic blood pressure. Physicians should help patients...
find an activity that they enjoy, because enjoyment will increase their adherence. If a patient finds it difficult to make time to exercise, one suggestion might be a brisk walk at lunch, which helps break up the day and requires no additional time commitment. Physicians also could suggest that patients listen to books on tape while walking, which may help to maintain interest level. It is recommended that patients with prehypertension or hypertension exercise for 30 minutes on most days of the week.

**LIMITING ALCOHOL CONSUMPTION:**
Limiting alcohol consumption is an important lifestyle modification for reducing blood pressure. One meta-analysis indicated a dose-response relationship between decreased alcohol consumption and blood pressure reduction. Pooled results showed reductions of 3 mm Hg in systolic blood pressure and 2 mm Hg in diastolic blood pressure for patients in the alcohol reduction groups (average reduction of 67 percent from an average intake of three to six drinks per day at baseline). As part of a comprehensive lifestyle program, men should have no more than two alcoholic drinks per day and women any more than one per day.

**DIETARY CHANGES:**
The DASH eating plan outlines a diet rich in fruits and vegetables; high in low-fat dairy products, potassium, magnesium, and calcium; and low in total saturated fat. Following this plan has been shown to produce mean reductions of 6 mm Hg in systolic blood pressure and 3 mm Hg in diastolic blood pressure and combining the plan with a reduction in sodium intake produces additional blood pressure reduction.

In the PREMIER clinical trial, researchers assessed the impact on blood pressure of comprehensive lifestyle changes (i.e., reduced sodium intake, increased activity, moderate alcohol consumption, and weight loss) in addition to the DASH eating plan, compared with lifestyle changes alone or usual care (i.e., advice only). Participants in the lifestyle changes only group had a greater reduction in blood pressure than those in the usual care group, and this was further enhanced with the addition of the DASH eating plan. This was the first trial to demonstrate that all recommended lifestyle changes can be combined to reduce blood pressure successfully.

**Potassium and sodium fluctuate antagonistically**—a decrease in potassium leads to sodium retention, whereas an increase in potassium leads to sodium excretion, thereby promoting diuresis and natriuresis. Although the mechanism by which a diet low in potassium contributes to increased blood pressure is not known, it has been estimated that, in persons with essential hypertension, a diet low in potassium results in a systolic increase of 7 mm Hg because of increased sodium retention. Additionally, potassium supplementation appears to play an enhanced role in individuals with an initially high sodium intake. A meta-regression analysis of randomized trials that assessed blood pressure response to changes in potassium and sodium intake showed that increased intake of potassium could play a major role in the prevention of hypertension. Increased potassium resulted in a reduction of 2.42 mm Hg in systolic blood pressure and a drop of 1.57 mm Hg in diastolic blood pressure. Current recommendations, however, are to obtain
adequate potassium intake through a healthy diet. Some of the organizations that provide helpful information about and support for the implementation of lifestyle modifications are listed in Table 2.

**WEIGHT LOSS:**
Weight loss is an important lifestyle modification in reducing blood pressure. A reduction of 10 lb can help reduce blood pressure or prevent hypertension. A reduction of approximately 20 lb (9 kg) may produce a reduction in systolic blood pressure of 5 to 20 mm Hg.

**Other Lifestyle Interventions:**

**SMOKING CESSATION:**
Nicotine released while smoking cigarettes is believed to impact blood pressure through arousal of the sympathetic nervous system followed by the release of norepinephrine and epinephrine. Cigarette use causes a 4-mm Hg increase in systolic blood pressure and a 3-mm Hg increase in diastolic blood pressure compared with placebo.

Hypertension is a well-documented risk factor for cardiovascular disease and stroke. In patients with hypertension, there is an increase in cardiovascular events in those who smoke compared with those who do not. Studies have shown that men with high blood pressure who smoke have an increased risk of total, ischemic, and hemorrhagic stroke, and that this risk is related to the number of cigarettes smoked. Smoking cessation should be part of any comprehensive lifestyle modification plan to reduce the risk of high blood pressure and cardiovascular disease.

**DIETARY SUPPLEMENTS:**

Vitamin C, omega-3 fatty acids, coenzyme Q10, and magnesium have been purported to reduce blood pressure. However, their use in management of hypertension is not recommended because of the lack of data from well-designed randomized controlled trials.

**MEDITATION:**
Meditation includes a variety of techniques, such as repetition of a word or phrase (the mantra) and careful attention to the process of breathing, to achieve a state of inner calm, detachment, and focus. Meditation was shown to reduce blood pressure in one well-designed study that addressed baseline blood pressure measurements adequately, although other studies have been inconsistent. Long-term follow-up of 202 patients in two small studies indicated that transcendental meditation may even reduce mortality in patients with hypertension. Meditation may have other benefits and does not appear to be harmful except to patients with psychosis.

**Effective Counselling for Patients with Hypertension**
Silent conditions, such as hypertension, that lead to devastating comorbidities (eg, cardiovascular diseases, stroke, and renal failure) require an arsenal of tailored, persuasive messages when counselling opportunities arise.

**Classification and Standards of Care:**
Hypertension (systolic blood pressure ≥ 140 mm Hg or diastolic pressure ≥ 90 mm Hg) is America’s most common primary diagnosis, prompting 35 million office visits annually. Risk increases with age: those who are normotensive at age 55 have a 90% lifetime risk of developing hypertension. Prevalence rates declined steadily from
1960 to 1998. From 1999 to 2000, however, prevalence surged by 31.3%, a surge many experts link to increasing obesity rates. Moreover, ~30% of sufferers are oblivious to their hypertension, and those receiving treatment often become no adherent.

Essential hypertension lacks identifiable causes. Secondary hypertension can occur as a result of drugs or biologics, disease states, or other causes. Systolic and diastolic readings demarcate 3 stages of hypertension (Table 1). People with prehypertension, a stage added in 2003, have doubled the risk for developing hypertension. Each increment of 20/10 mm Hg doubles cardiovascular disease risk.

Hypertension responds to both lifestyle changes and pharmacotherapy. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) recommends exercise, weight reduction, sodium restriction, moderation of alcohol intake, and a diet rich in fruits and vegetables and low in fat for all stages. Pharmacologic treatment options include > 50 agents, as well as combinations of agents, in 14 classes. Table 1 summarizes the JNC 7 recommendations. Generally, most patients require > 2 antihypertensive medications to achieve normal pressure.

Counselling Issues:
Counselling hypertensive patients requires insight, creativity, and ingenuity, because fixed messages will fall flat. Nevertheless, effective counselling covers 3 essential themes: improving health status with adherence, providing information on adverse effects and contraindications, and promoting healthy behaviours. Always begin by asking patients what prescribers told them previously, in order to save time and to identify information deficits quickly.
Emphasizing Medication Adherence:
Because patient adherence is lower for symptomless conditions, it is crucial to emphasize controlling blood pressure and to list the risks of medication no adherence. Inform patients about what to do if they miss a dose. Repeat the name of the medication frequently so that patients become familiar with it.

Make suggestions that incorporate multiple daily doses into the patient’s routine. Be cautious, however, about pairing medications with meals: some patients eat only 2 meals a day; others may have 4. Instead, specify the number of times per day to take the medication. Ask specific questions about the patient’s ability to follow directions, such as “This medication must be taken twice; when in your day do you think you would take it?”

Adverse Effects and Contraindications:
Make adequate counselling ideal by offering tips for coping with common adverse effects (Table 2). Note rare but serious side effects, and describe the circumstances under which patients should contact their provider. Warn patients about drug, food, or OTC product interactions and other contraindications.

Promoting Healthy Behaviours:
JNC 7 recommends lifestyle modifications, with good reason. Reducing weight by 10 kg (22 lb) reduces blood pressure by 5 to 20 mm Hg; exercising 30 minutes daily is associated with a reduction of 4 to 9 mm Hg; and reducing sodium intake can affect pressure by 2 to 4 mm Hg.

Effecting changes in health behaviours involves helping the patient set realistic, achievable goals. Suggest small changes that elicit firm commitments. Patients may balk at 30 minutes of exercise but be willing to commit to 10 minutes a day. They may roll their eyes at a 10% weight reduction but commit to losing 5 lb. Sometimes adding new behaviours (eg, exercising) is easier than eliminating old habits (e.g., eating salty chips).

Patient Self-Monitoring:
Many patients monitor their own blood pressure. They should be told to keep a log and to record their pressure at the same time each day. Additionally, they should take their cuff with them when they visit their doctor to ensure that they are taking readings correctly and that the machine is calibrated accurately.

Conclusion:
End counselling sessions by eliciting commitment. Prod patients gently by saying “What problems do you anticipate with the things we discussed today?” Patients who have confidence and trust in their care providers are more likely to follow directions than those who do not. Building confidence begins with demonstrating a genuine interest in what happens to the patient, and communicating your concern by saying “See you next month, OK?”

Monitoring of Blood Pressure: Patient Counseling:
Whether the patient is purchasing a home BP monitor on recommendation of a healthcare provider or on his or her own initiative, patient education should be provided. Counseling should focus on device selection, self-measurement procedure, monitoring schedule, blood pressure variability, interpretation of results, and the
### Table 2

#### Side Effects Associated with Major Drug Classes Treating Hypertension

<table>
<thead>
<tr>
<th>Class</th>
<th>Potential Side Effects</th>
<th>Counseling Points</th>
</tr>
</thead>
</table>
| Diuretics                    | • Decreased potassium levels, leading to weakness, leg cramps, or fatigue  
|                              | • Long-term use associated with gout  
|                              | • Potential to increase blood sugar levels, a concern for diabetics  
|                              | • Impotence  
| Beta-blockers                | • Insomnia, cold hands and feet  
|                              | • Asthma-like symptoms  
|                              | • Impotence  
| ACE inhibitors               | • Chronic dry cough  
|                              | • Skin rash, loss of taste  
|                              | • Acute or chronic kidney damage (fluid retention/swelling in the legs [or other areas] or under the eyes on awakening; unusual urine "foaming" during excretion, due to elevated protein; confusion, fatigue, intestinal bleeding, coma, seizures)  
| Angiotensin II receptor blockers | • Dizziness  
| Calcium channel blockers     | • Dizziness, headaches, constipation, palpitations, edema  
| Alpha-blockers               | • Increased heart rate, dizziness  
| Combined alpha- and beta-blockers | • Orthostasis  
| Central agonists             | • Dryness of mouth, constipation  
|                              | • Drowsiness  
|                              | • Fever, anemia  
|                              | • Impotence  
| Peripheral adrenergic inhibitors | • Stuffy nose, diarrhea, heartburn, insomnia, nightmares, impotence, orthostasis  
| Blood vessel dilators        | • Headaches, aches and pains in the joints, swelling around the eyes  

• Notify physician if muscle pain, weakness or cramps, nausea, vomiting, restlessness, excessive thirst, tiredness, drowsiness, increased heart rate or pulse, diarrhea, or dizziness occurs  
• Contact physician if significant sudden joint pain occurs  
• Increase glucose monitoring at drug initiation or dosage change  
• Dress warmly and be careful during prolonged exposure to cold  
• Consult health professional before using nasal decongestants, OTC cold preparations  
• Notify physician; a dose reduction or different drug may help  
• Consult physician if cough is annoying  
• Notify physician  
• Rise carefully from lying down or sitting to standing; be careful when performing tasks requiring attention  
• Notify physician  
• Notify physician  
• Same as for dizziness  
• See above  
• Chew sugarless gum, suck sugarless candy, increase water intake  
• Be careful when performing tasks requiring attention  
• Notify physician  
• See above  
• Notify physician; see points above  
• Notify physician
need for calibration.

**Devices:**

Accuracy is the most important factor in selecting a device. A device that passes independent validation testing is preferred. The limitations of wrist and finger monitors should be explained to the patient. Ease of use, display readability, machine portability, and cost should be considered, as well as the need or desire for special features.

**Cuffs:**

The patient should purchase an appropriately sized cuff. An inappropriately sized cuff can lead to incorrect blood pressure measurements. If the size of the bladder is too narrow or too short, overestimation of the blood pressure may occur. Conversely, if the bladder is too wide or too long, the blood pressure may be underestimated. Generally, standard-size cuffs are for arms 9 to 13 inches in circumference. Most large cuffs are designed for arms 13 to 17 inches. Because cuff sizing varies slightly among manufacturers, product specifications should be consulted. Cuffs with a metal ring, known as a D-ring, are easiest to operate. The ring makes it possible to put the cuff on properly without assistance.

**Self-Measurement Procedure:**

The monitoring procedure for home blood pressure monitoring is very similar to the procedure for office blood pressure measurement described in the SIDEBAR. Manufacturers' instructions should be followed for specific models.

**Monitoring Schedule:**

There is no consensus on when and how often patients should measure blood pressure. Several schedules for home

<table>
<thead>
<tr>
<th>Measurement Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>- A validated blood pressure monitoring device should be used. Arm monitors are preferred. Finger monitors should not be used.</td>
</tr>
<tr>
<td>- The appropriate cuff size must be used to ensure accurate measurement. The bladder within the cuff should encircle at least 80% of the arm. Many adults will require a large adult cuff. Measure blood pressure in the arm with the highest pressure.</td>
</tr>
<tr>
<td>- Patients should be seated in a chair with their back supported. The cuffed arm should be supported at heart level. Patients should refrain from smoking or ingesting caffeine during the 30 minutes preceding the measurement.</td>
</tr>
<tr>
<td>- Measurement should begin after at least 5 minutes of rest.</td>
</tr>
<tr>
<td>- Measurement timing and frequency: patient specific. Typically, initiate with 2 readings twice a day.</td>
</tr>
<tr>
<td>- Systolic and diastolic blood pressure and heart rate should be recorded. Healthcare professionals should assess values stored in memory function, if available. Because patient diaries may be unreliable.</td>
</tr>
<tr>
<td>- Patients should be trained to perform self-measurement of blood pressure and reevaluated annually.</td>
</tr>
<tr>
<td>- Home blood pressure readings should be reported to and interpreted by medical personnel. Patient with physical or mental disabilities may be unsuited for home blood pressure monitoring.</td>
</tr>
</tbody>
</table>
monitoring of blood pressure have been used in clinical research and practice. Many studies used single or duplicate measurements twice a day. The ad hoc panel of the American Society of Hypertension recommended that readings be taken in the morning and the evening, preferably including both work and non-work days. Others have suggested measuring blood pressure for seven consecutive days and only using data for the last five days, or measuring three workdays only and using average data from the second and third days. In patients whose condition is diagnosed and stable, readings may be taken less often.

If the home readings are being taken to determine the average blood pressure for diagnostic purposes, the readings should be made at different times, e.g., when the patient is either relaxed or stressed, anytime throughout the day or evening. If the readings are being taken to determine the adequacy of antihypertensive therapy, the readings should be taken at the same time of day, preferably in the early morning soon after arising from bed, to ensure 24-hour control with the regimen being prescribed. Readings should occasionally be taken repeatedly throughout the interval of a dose of therapy to determine both the peak effect and the duration of effect. The patient’s clinical situation should be considered in determining the frequency and timing of monitoring.

**Variability of Blood Pressure:**
Patients should be educated about the variability of blood pressure and potential causes of variability. A multitude of factors may contribute to the variability of blood pressure seen on repeated measurements, both at a single reading and on separate occasions. Blood pressures may be higher with a distended urinary bladder, during defecation, during coitus, during ordinary conversation, on the day after sleep deprivation, with pain, when among strangers rather than family, or at work. Meals, alcohol, and caffeinated beverages may affect blood pressure for a short period of time. Readings may be lower after a meal, especially in the elderly.

Acute ingestion of large amounts of alcohol can cause a definite rise in blood pressure. However, with chronic alcohol intake greater than two ounces per day, there may be considerable and persistent rises in blood pressures. In the case of coffee, blood pressure is increased within about 15 minutes of intake and this elevation can last as long as 3 hours. Thus it is best if patients take the self-measurements prior to meals and before drinking coffee, tea, or colas. Since smoking a cigarette can raise blood pressure and pulse rate for about 1530 minutes, it is best to avoid smoking before measuring the blood pressure at home. Blood pressure elevations following the use of smokeless tobacco can be even more prolonged. Also, blood pressures may be lower than usual for a few hours after dynamic exercise. Diurnal variability, or variability over a 24-hour period, is substantial, with an average fall in pressure of about 15% during sleep. Although it is not always possible to modify many of these factors, their effect can be minimized by considering them in the interpretation of blood pressure measurements.

**Interpretation of Results:**
Patients should be educated about the long-term benefits of home monitoring. Home blood pressure monitoring is not intended
to be used as a tool to make daily adjustments the way patients with diabetes use home blood glucose monitoring to modify insulin doses or food intake. With hypertension, changing lifestyle generally does not immediately translate into blood pressure effect, and using antihypertensive drug therapy “as needed” should be discouraged. Patients should be advised to not be concerned by unusual fluctuations in blood pressure but to inform the healthcare provider’s office if sustained changes occur. Patients should be encouraged to record BP results and be reminded that home measurement is not a substitute for periodic evaluation by their primary care provider. Differences in the upper limit of normal of home and office BP measurements may be explained.

**Maintenance:**
The accuracy of the patient’s device should be checked initially and then annually by comparing readings with simultaneously recorded auscultatory readings taken with a mercury device. If the error is more than 4 mmHg the device should be recalibrated, if possible. The blood pressure machines commonly found in pharmacies, such as the AvitaStat machine, are not suitable for verifying accuracy. These machines have been found to be less accurate than office sphygmomanometry.

**Posts Related to Monitoring of Blood Pressure: Patient Counseling:**

**Monitoring of Blood Pressure: Measurement of Blood Pressure:**
Blood pressure can be monitored at the healthcare practitioner’s office (or clinic) with a standard sphygmomanometer, throughout the day and night with a 24-hour ambulatory blood pressure monitor, or at home with a self-monitoring device. Office

The clinical standard for measurement of blood pressure for diagnostic and treatment purposes has long been office measurement.

**Monitoring of Blood Pressure: Issues in Self-Measurement of Blood Pressure:**
Why has home blood pressure monitoring not become as widely accepted by healthcare providers as home blood glucose monitoring? A number of issues in self-measurement of blood pressure have limited its clinical utility, including difficulties defining "normal" home blood pressure, lack of clinical data justifying its place in clinical practice, questionable accuracy of the values...

**Monitoring of Blood Pressure: Alternative Site Measurement:**
Alternative Site Measurement Manufacturers have developed blood pressure monitors that work on the wrist and the finger. These devices are gaining popularity because of their perceived advantages of greater portability, ease of use, and comfort. However, devices that work on the upper arm are still preferable to wrist and finger monitors because of superior accuracy...

**Monitoring health:**
Another important aspect in preventing and treating high blood pressure and other related conditions involves keeping track of and being informed about your health on an ongoing basis. This involves meeting with your doctor for regular check-ups and having your blood pressure measured on a regular basis, particularly if you have high blood pressure or...

**Monitoring of Blood Pressure: Types of Self-Monitors:**
Mercury although the mercury sphygmo-
manometer is still considered the most accurate device for clinical use, it is generally not practical for home use. The mercury sphygmomanometer works by gravity to give consistent and accurate readings. It has a long, tubular gauge made of glass or plastic connected to a reservoir of mercury. The reservoir is...

**Lifestyle Changes Beneficial in Reducing Weight:**
Decrease time insedentary behaviors such as watching television, playing video games, or spending time online.
Increase physical activity such as walking, biking, aerobic dancing, tennis, soccer, basketball, etc.
Decrease portion sizes for meals and snacks.
Reduce portion sizes or frequency of consumption of calorie containing beverages.

**Breathing Exercises Reduce High Blood Pressure:**

**Blood Pressure Control Method**
Breathing is work. We tend to get lazy in our breathing.
Step No. 1 - Breathe in deeply, sharply, and quickly using the chest and the diaphragm. Allow the tummy to expand as the diaphragm presses downward into the abdominal cavity. A tight belt, clothing, body fat or poor sitting position prevents deep breathing. Expanding the chest is more work but increases the amount of air inhaled even more. Breathing through the nose is fine, even though your nose may be slightly restricted. This method reduces the pressure within the chest cavity to less than the atmospheric air pressure. The difference in pressure drops the blood pressure accordingly. You will immediately notice that you rarely breathe in a full lung capacity of air. Taking in a full breath of air is the second key part of this breathing method. You must inhale a good supply of oxygen with each breath.

Step No. 2 - Breathe out in a slower, more relaxed way. Breathing out should take twice as much time as breathing in. Simply relax and let the air flow out. Do not force the air out sharply because the compression of the chest to expel the air also increases the blood pressure accordingly. Breathe out to dispel as much air from your lungs as possible. You will immediately notice that you rarely breathe out all of your air. Breathing out all of your air is a key part of this breathing method. You must ventilate as much of the old air and carbon dioxide as possible. Practice breathing out all of the air with each breath.

Step No. 3 - The breathing rate must be adjusted voluntarily. A more rapid breathing rate than necessary will cause hyperventilation from an excessive amount of oxygen in the blood. A slow breathing rate will deprive the body of oxygen and send the heart into action to increase the pulse rate and blood pressure. Our tendency is to not breathe enough volume and to not breathe at a high enough rate.

Step No. 4 - Breathing exercises are required many times a day to break the old breathing patterns. You will be distracted in your everyday events and forget about breathing. You will slump back into your old involuntary breathing pattern. Concentrate on the proper breathing technique at least once every hour. Breathe in deeply and exhale fully to place you back into a proper breathing pattern.

Step No. 5 - Over time your breathing pattern should automatically change as you
become accustomed to breathing properly. Watch out for relapses. Go back to Step No. 4 with hourly exercises to get back into the proper pattern that will become a new habit.

References:


31. Cardiology Channel on Natural Treatment of Hypertension

32. National Institutes of Health on Sodium and High Blood Pressure

33. National Heart Lung and Blood Institute on Treating Blood Pressure

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