Hypertension

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What is Hypertension?

- **Hypertension (HTN)** is a systolic blood pressure (SBP) that is equal to or greater than 140 mmHg or a diastolic blood pressure equal to or greater than 90 mmHg.
- When the pressure of the systemic arterial blood being pumped through your arteries is higher than normal range (120/80 mmHg)
  - Ex: hypertension range (150/95 mmHg)
- There are two types:
  - **Primary hypertension** - high blood pressure without an identifiable cause in regards to what triggers it
  - **Secondary hypertension** - high blood pressure due to a specific cause
- High blood pressure is the most significant risk factor when it comes to CV disease & mortality
- **Isolated Systolic Hypertension (ISH)** - sustained elevation in SBP equal to or greater than 140 mmHg with a DBP of less than 90 mmHg = increase in pulse pressure
No Hypertension
Heart Pumping Normally

Blood flows easily through vessels

Hypertension
Heart Pumping Harder

Blood may not flow easily through vessels
The following video explains what high blood pressure is.

https://www.youtube.com/watch?v=aWu71fo5BM0
Primary Hypertension

- Elevated BP that has no identifiable cause, considered to be a complex interaction between genes & the environment
- Accounts for 90-95% of HTN cases
- Factors causing it:
  - Increased SNS activity
  - Overproduction of sodium-retaining hormones/vasoconstrictors
  - Increased sodium intake
  - Greater than ideal body weight
  - Diabetes mellitus
  - Excessive alcohol intake
Secondary Hypertension

- Elevated BP with a specific cause that can be identified
- Accounts for 5-10% of HTN in adults & +80% in children
- Factors causing it:
  - Coarctation or congenital narrowing of the aorta
  - Renal disease
  - Endocrine disorders
  - Neurological disorders
  - Sleep apnea
  - Medications
  - Pregnancy-induced HTN
Pathophysiology of Hypertension

- For BP to rise there has to be an increase in either CO or SVR, but persistently has been SVR
- Risk factors for the development of primary HTN:
  - Advancing age
  - Heavy alcohol consumption
  - Cigarette smoking
  - Glucose intolerance
  - Elevated serum lipids
  - High dietary sodium intake
  - Gender
  - Family history
  - Obesity
  - Ethnicity
  - Sedentary lifestyle
  - Socioeconomic status
  - Psychosocial stress
Pathophysiology of Hypertension Continued

- **Water and sodium retention**:  
  i. A high-sodium intake may alter the pressure–natriuresis relationship and cause water retention.

- **Altered renin-angiotensin-aldosterone mechanism**:  
  i. High plasma renin activity = increased conversion of angiotensinogen to angiotensin I -> causing arteriolar constriction, vascular hypertrophy, and aldosterone secretion.

- **Stress and increased SNS activity**:  
  i. Arterial pressure is influenced by factors such as anger, fear, and pain.  
  ii. Physiological responses to stress, may persist to a pathological degree = prolonged increase in SNS activity.  
  iii. Increased SNS stimulation produces increased vasoconstriction, increased HR, and increased renin release.
Pathophysiology of Hypertension Continued

● **Insulin resistance and hyperinsulinemia:**
  i. Abnormalities of glucose, insulin, and lipoprotein metabolism are common in primary hypertension.
  ii. High insulin concentration in the blood stimulates SNS and RAAS activity and impairs nitric oxide–mediated vasodilation.
  iii. Additional pressor effects of insulin include vascular hypertrophy and increased renal sodium reabsorption.

● **Endothelial cell dysfunction:**
  i. Some hypertensive people have a reduced vasodilator response to nitric oxide.
  ii. Endothelin produces pronounced and prolonged vasoconstriction.

● **Obesity:**
  i. Obesity is a well-known risk factor for HTN.
  ii. Hypertension and central (visceral) obesity are major components of the cardiometabolic syndrome.
  iii. Several hormone abnormalities that are associated with obesity are linked to the development of HTN.
Normal Regulation of Blood Pressure

- **Blood pressure (BP)** - the force exerted by the blood against the walls of the blood vessel for proper blood distribution so tissues can function
- Requires systemic factors & local peripheral vascular effects for maintenance of normal BP
- **Arterial BP** = cardiac output and systemic vascular resistance (CO x SVR)
- **Cardiac Output** = total blood flow through systemic or pulmonary circulation per minute
- **Systemic Vascular Resistance** = the force opposing the movement of blood within blood vessels
- BP can affect either CO, SVR or both
- BP is regulated by **short term mechanisms** (effects exerted by the SNS & vascular endothelium) & **long term mechanisms** (renal & hormonal processes that regulate arteriolar resistance & blood volume)
Blood Pressure Monitoring

- Hypertension identified through routine screening procedures (i.e., insurance, pre-employment examinations).
- BP taken 2-3 times, 2 minutes apart, with the average pressure recorded as the value for that visit; size and placement of cuff are important for accuracy.
- BP measurements of both arms should be performed initially; arm with the higher reading should be used for all subsequent BP measurements.
- Orthostatic changes in BP & pulse should be measured in older adults, people taking antihypertensive drugs, and patients who report symptoms with reduced BP when standing.
- **Orthostatic hypotension** is defined as a decrease of 20 mm Hg or more in SBP, a decrease of 10 mm Hg or more in DBP.
CAUSES FOR HYPERTENSION

- Salt
- Obesity
- Inactivity
- Alcohol
- Stress
- Hypertension
- Low K Ca Mg
- Genetics
- Smoking
Clinical Manifestations & Diagnostics

- HTN is a silent disease because it is frequently asymptomatic until it becomes severe and target organ disease occurs.
- Target organ diseases occur in the
  1. heart (hypertensive heart disease)
  2. brain (cerebrovascular disease)
  3. peripheral vasculature (peripheral vascular disease)
  4. kidney (nephrosclerosis)
  5. eyes (retinal damage).
- Major risk factor for coronary artery disease (CAD).
- Sustained high BP increases the cardiac workload and produces left ventricular hypertrophy (LVH). Progressive LVH, especially in association with CAD, is associated with the development of heart failure.
- Major risk factor for cerebral atherosclerosis and stroke; speeds up the process of atherosclerosis in the peripheral blood vessels = development of peripheral vascular disease, aortic aneurysm, and aortic dissection.
Clinical Manifestations & Diagnostics Continued

- Routine urinalysis and serum creatinine levels are used to screen for renal involvement and to provide baseline information about kidney function
- Measurement of serum electrolytes, especially potassium levels, is done to detect hyperaldosteronism, a cause of secondary hypertension
- Blood glucose levels assist in the diagnosis of diabetes mellitus
- Lipid profile provides information about additional risk factors that predispose to atherosclerosis and cardiovascular disease
- ECG and echocardiography provide information about the cardiac status
- Ambulatory blood pressure monitoring measures BP at preset intervals over a 24-hour period.
  - Some patients with hypertension do not show a normal, nocturnal dip in BP and are referred to as “nondippers”
  - The absence of diurnal variability has been associated with more target organ damage and an increased risk for cardiovascular events; presence or absence determined by continuous ambulatory BP monitoring
Drug Therapy

- Goals:
  1. achievement and maintenance of the goal BP
  2. acceptance and implementation of the therapeutic plan
  3. minimal or no unpleasant side effects of therapy; and
  4. ability to manage and cope with illness.

- Drugs work by decreasing volume of circulating blood, and/or reducing SVR
  - Diuretics promote Na and H2O excretion, reduce plasma volume & decrease Na in the arteriolar walls

- Adrenergic-inhibiting drugs diminish SNS effects that increase BP. Include drugs that act centrally on the vasomotor centre and peripherally to inhibit NE release or to block the adrenergic receptors on blood vessels
  - Direct vasodilators decrease BP by relaxing vascular smooth muscle and reducing SVR
  - CCB’s increase Na excretion and cause arteriolar vasodilation by preventing the movement of extracellular Ca into cells
  - ACE inhibitors prevent conversion of angiotensin I to angiotensin II and reduce angiotensin II (A-II)–mediated vasoconstriction, & Na and water retention.
  - Thiazide-type diuretics used as initial therapy for most patients
  - Most patients will require two or more antihypertensive medications to achieve goal
Drug Therapy Continued

- Adverse effects may be so severe that the patient does not comply with therapy
- Common adverse side effects with thiazide & loop diuretics: Hyperuricemia, hyperglycemia, and hypokalemia
- ACE inhibitors lead to high levels of bradykinin = coughing
- Hyperkalemia due to potassium-sparing diuretics and ACE inhibitors
- Impotence with some diuretics
- Orthostatic hypotension and sexual dysfunction due to adrenergic-inhibiting agents
- Tachycardia and orthostatic hypotension due to both vasodilators and angiotensin inhibitors
Complications of Hypertension

Brain Stroke
Reduced blood supply to the brain can lead to rapid loss of brain function or stroke.

Vision Loss
Hypertensive Retinopathy
High blood pressure can damage blood vessels in the retina, resulting in loss of vision.

Blood Vessel Damage
Atherosclerosis
Hypertension is a leading cause of atherosclerosis, the artery-narrowing process that can result in heart attack and stroke.

Heart Attack
Hypertension causes the heart to pump against high blood pressure, making it work harder than necessary. Over time, this causes the heart muscle to thicken, restricting blood flow which can lead to heart failure.

Kidney Failure
Damaged blood vessels in the kidneys can't effectively filter your blood, resulting in a dangerous accumulation of fluid and waste.

Bone Loss
High blood pressure may increase the amount of calcium in your urine. That excessive elimination of calcium may lead to loss of bone density (osteoporosis).
Hypertensive Crisis

- A severe and abrupt elevation in BP; defined as a DBP above 120 to 130 mmHg
- Rate of the rise of BP is very significant rather than the value
- Pt with HTN can’t tolerate much higher BP
- Occurs most commonly in patients with a history of HTN who have failed to adhere to their prescribed medication regimen or who have been undermedicated
- Triggers endothelial damage & release of vasoconstrictor substances
- Vicious cycling of high BP can lead to life-threatening damage to organs
- Can lead to a hypertensive emergency which develops over hours or days and can cause damage to the CNS
- Below is an example of a hypertensive crisis case study
Hypertensive Emergencies:

- Stroke Symptoms
- Agitation/Delirium
- Head Injury
- Hyperadrenergic Drugs
- Visual Disturbance
- Papilloedema
- Flame Haemorrhages
- Eclampsia
- Chest Pain
- Myocardial Ischaemia
- Acute Kidney Injury
- Back Pain
- Aortic Dissection
- Dyspnoea
- Pulmonary Oedema

#EM3
Canadian Hypertension Education Program (CHEP)

- Global risk assessment program that targets health care providers in different settings & provides annually updated standardized recommendations/guidelines to detect, control & treat HTN
- Individuals who have a high-normal blood pressure (130-139/85-89 mmHg) are at a higher risk for developing HTN
- Below are the listed guidelines by CHEP:
**Table 35-14 Hypertension**

<table>
<thead>
<tr>
<th>Patient &amp; Caregiver Teaching Guide</th>
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<tr>
<td>When presenting information to the patient or caregiver, the nurse should do the following:</td>
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<tr>
<td>1. Provide the numerical value of the patient’s BP and explain what it means.</td>
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<td>2. Inform the patient that hypertension is usually asymptomatic and symptoms do not reliably indicate BP levels.</td>
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<td>3. Explain that hypertension means elevated BP and does not relate to a “hyper” personality.</td>
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<td>4. Explain that long-term follow-up and therapy are necessary to treat hypertension.</td>
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<td>5. Explain that therapy will not cure, but should control, hypertension.</td>
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<td>6. Tell patient that controlled hypertension is usually compatible with an excellent prognosis and a normal lifestyle.</td>
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<td>7. Explain the potential dangers of uncontrolled hypertension.</td>
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<td>8. Be specific about the names, the actions, the dosages, and the adverse effects of prescribed medications.</td>
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<td>9. Tell the patient to plan regular and convenient times for taking medications.</td>
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<td>10. Tell the patient not to discontinue drugs abruptly because withdrawal may cause a severe hypertensive reaction.</td>
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11. Tell the patient not to double up on doses when a dose is missed.
12. Inform the patient that, if BP increases, the patient should not take an increased medication dosage before consulting with the health care provider.
13. Tell the patient not to take a medication belonging to someone else.
14. Inform the patient that adverse effects of medication often diminish with time.
15. Tell the patient to consult with the health care provider about changing drugs or dosages if impotence or other sexual problems develop.
16. Tell the patient to supplement diet with foods high in potassium (e.g., citrus fruits and green leafy vegetables) if taking potassium-losing diuretics.
17. Tell the patient to avoid hot baths, excessive amounts of alcohol, and strenuous exercise within 3 hr of taking medications that promote vasodilation.
18. Explain that, to decrease orthostatic hypotension, the patient should arise slowly from bed, sit on the side of the bed for a few minutes, stand slowly, not stand still for prolonged periods, do leg exercises to increase venous return, sleep with the head of the bed raised or on pillows, and lie or sit down when dizziness occurs.
19. Caution about potentially high-risk over-the-counter medications, such as high-sodium antacids, appetite suppressants, and cold and sinus medications. Advise the patient to read warning labels and to consult with pharmacist.
The following video explains WHY hypertension is a silent killer:

https://www.youtube.com/watch?v=ATLXgeKG9y0

High blood pressure is called "The silent killer" because many people suffer from it and don't even know they have it.


