Systemic hypertension

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Definition:

- **Persistent** elevation of arterial BP greater than $^{140}/_{90}$ mmHg & above $^{130}/_{80}$ mmHg in the patients with diabetes or renal disease .

Classification of hypertension : *according to JNC 7*

Stage	Systolic BP (*mmHg*)	Diastolic BP (*mmHg*)
Prehypertension	120 - 140	80 - 90
I	140 - 160	90 - 100
II	> 160	> 100

Types:

1- Isolated systolic hypertension :

- systolic BP without ↑ diastolic BP .
- Etiology :
  - Atherosclerosis : ↓ aortic compliance .
  - stroke volume : hyperdynamic circulation , AR , PDA .

2- Systolic & diastolic hypertension :

↑ of both systolic & diastolic BP , this is the true hypertension .

I – Primary (essential) hypertension :

- It represents approximately 95% of all cases.
- It has no known cause .
- Age of onset : usually between 35 – 55 years.
- +ve family history.
- Predisposing factors : Genetic, obesity , **S**tress , **S**alt sensitivity, **S**moking .
- **Theories :**

1- Sympathetic over activity.

2- Activation of the renin system .

3- Increased adrenal gland activity → ↑ aldosterone secretion .

4- Multifactorial theory :

Stress → ↑ sympathetic → renal ischemia → ↑ rennin → ↑ aldosterone → ↑ BP .

5- Hyperinsulinemia due to peripheral insulin resistance .

6- Decreased atrial natriuretic peptide (ANP)

7- Barroreceptors resetting .

II – **Secondary hypertension :** (*curable hypertension*)

- Hypertension with a known underlying cause .
- It represents approximately 5% of all cases .
- Secondary hypertension is suspected when the patient has any of the following :

a. Age of onset : before 25 or after 55 years .

b. -ve family history .

c. Rapidly progressive hypertension with early complications .

1- Renal :

i – Parenchymal : (*volume dependent hypertension*)

GN , diabetic nephropathy , pyelonephritis , polycystic kidney , ...

Mechanism :

- Ineffective in disposing Na .
- Fail to produce necessary VD substances (PG).

ii – Renovascular : renal artery stenosis which by turn activate the renin system.

C/P : Generalized atherosclerosi & flank bruits.

2- Endocrinal :

- Pituitary : Acromegaly (endothelial hyperplasia , Na & water retention)
- Thyroid : - **Hypo**thyroidism.
  - Hyperthyroidism → isolated systolic hypertension .
- Parathyroid : Hyperparathyroidism .
- DM .
- SRG : - Conn's syndrome : never sever HTN ,muscle weakness &hypokalemia
  - Cushing syndrome .
  - Pheochromocytoma : paroxysmal HTN.

3- CNS :

- ↑ ICT .
- Lesions of the medulla .

4- Vascular :

- Polyarteritis nodosa .
- Polycythemia .
- Coarctation of the aorta .

5- Iatrogenic :

- **C**ontraceptive pills .
- **C**ortisone .
- **C**atecholamine .
- **C**alcium .

Clinical picture:

Symptoms :

1- Asymptomatic in most cases .

2- May discovered accidentally .

3- Headache after information .

4- Headache is usually occipital .

5- Blurring of vision , tinnitus , epistaxis , nausea & vomiting .

6- Complications of HTN may be the first presentation .

Hypertensive urgency:

Rapid rise of BP > 220/120 mmHg & not associated with target organ damage e.g. renal failure , heart failure .

Hypertensive emergency:

Rapid rise of BP > 220/120 mmHg & associated with target organ damage .

Malignant HTN : Hypertensive emergency with development of papilloedema .

Accelerated HTN : Similar to malignant HTN without papilloedema .

Complications :

1- Cardiac :

- LSHF : due to pressure overload .
- **Ischemic heart disease :** due to atherosclerosis & hypertrophy .

2- Cerebral :

- Cerebral atherosclerosis .
- Cerebral ischemia & thrombosis (infarction)
- Cerebral hemorrhage (stroke)
- **Hypertensive encephalopathy :**

  As a result of acute rise of BP , the cerebral blood vessels are no longer able to maintain the necessary degree of constriction (*failure of auto regulation*) & they begin to dilate → ↑ cerebral blood flow →↑ ICT , brain edema , coma & convulsion may occur .

N.B: ***How to differentiate between stroke & hypertensive encephalopathy ?***

Stroke *: Signs of lateralization (unilateral)*

Hypertensive encephalopathy *: No signs of lateralization (bilateral)*

3- Renal :

- Renal failure .
- Hematuria & proteinuria .

4- Retinal : 4 grades

- Grade I : Thickening of retinal arterioles (*silver wire appearance*).
- Grade II : Kinking of retinal veins .
- Grade III : Hemorrhage & exudates .
- Grade IV : Papilloedema .

5- Vascular :

- Atherosclerosis .
- Aortic dissection .

Investigations :

1- **Investigations for complications :**

- Cardiac : X ray , ECG , Echo , ...
- Cerebral : CT, MRI brain .
- Renal : urine analysis , renal function , renal imaging .

2- **Investigations for the cause :** when secondary HTN is suspected or in a case of refractory hypertension .

Treatment :

The target BP is lower than $^{140}/_{90}$ mmHg , unless the patient has diabetes or renal disease, in which case the target would be lower than $^{130}/_{80}$ mmHg.

A) Lines of treatment :

I – Non pharmacological (*lifestyle modification*) .

II – Pharmacological :

- Treatment of associated risk factors e.g. hyperlipidemia
- Treatment of the cause : in a case of secondary hypertension .
- Antihypertensive drugs

B) Choice of treatment.

A) Lines of treatment :

I – Non pharmacological (*lifestyle modifications*):

- Lose weight if overweight .
- Reduce salt intake .
- Reduce dietary fat intake .
- Stop smoking .
- Regular exercise .
- Avoid stressful condition as possible (meditation) .

Value :

- ✓ May normalize BP in prehypertension or in mild cases without any drug.
- ✓ Facilitate BP control by antihypertensive drugs.
- ✓ Control of risk factors .

II - *Antihypertensive drugs :*

1. Diuretics

- Types , action , side effects : *Refer to heart failure* .
- Thiazide is most commonly used in the treatment of hypertension .
- Lasix is not routinely used in a stable cases of hypertension .
- Indapamide (*natrilix*) : thiazide analogue which has dilator effect with minimal diuretic effect.
- K sparing diuretic is often used with thiazides (Aldactazide, Moduretic)

2. Sympathetic blockers

Centrally acting : **Clonidine** (*Catapress*)

- **Action :** stimulation of α_2 adrenergic receptors witch are sympathoinhibitors .
- **S/E :**
  - **Rebound hypertension** with sudden withdrawal .
  - Postrual hypotension .
  - Dry mouth .

Nerve ending blockers :

i. **α methyl dopa** (*Aldomet*) :

- **Action** :↓ synthesis of catecholamines ,also has central inhibiting actic
- **S/E** : Postural **h**ypotension , **H**epatitis , **H**emolysis . (**3 H**)

α blockers : **Prazosin** (*minipress*)

- **Action** : vasodilatation .
- **S/E** : First dose syncope , tachycardia .

β blockers :

Mechanism of action :

- Is still questionable .
- ↓ contractility , ↓ HR → ↓ COP .
- ↓ renin release .

Preparation :

- Propranolol (*indral*) : non selective β blocker .
- Atenolol (*ateno*) , Metoprolol (*betaloc*) , Bisoprolol (*concor*) : Selective β_1 blockers.
- Carvedilol (*cardilol*) ,Labetalol : Combined β & α blockers (β blockers with vasodilation)

- **Side effects :**
  - Lung : **B**ronchospasm.
  - Heart : **B**radycardia , Heart **b**lock.
  - Depression , Impotence.
- **CVS uses of β blockers :** Hypertension, Angina, Heart failure, Arrhythmia, F_4, Mitral valve prolapse.

3. Vasodilators

They are *classified* into:

Arteriolar	Venous	Both
♦ Hydralazine ♦ Minoxidil ♦ Diazoxide	Nitrates	♦ ACEIs. ♦ Na nitroprusside.

Hydralazine : (*Apresoline*) *used in hypertensive encephalopathy by infusion.*

S/E : ☠ Reflex tachycardia , *so it is almost always administered in combination with β blocker.*

☠ Precipitation of angina .

☠ Lupus like syndrome .

Minoxidil : *not used*

- **S/E :** The same as hydralazine + hypertrichosis (↑ *growth of body hair*)

Diazoxide : *100- 300 mg IV rapidly in hypertensive encephalopathy.* **S/E:** hyperglycemia.

Na nitroprusside : (*Nipride*)

- used in hypertensive encephalopathy, *0.5 – 2 µg/kg/min (infusion)*
- **S/E :** Cyanide toxicity (*antidote is Na thiosulfate*).

4. Calcium channel blockers

Drugs , mechanism of action , side effects : **see angina** .

5. Angiotensin converting enzymes inhibitors (*ACE inhibitors*)

These drugs inhibit the angiotensin converting enzyme which converts angiotensin I into angiotensin II , These drugs also diminish the rate of bradykinin inactivation .

Decreased angiotensin II
- VD .
- ↓ secretion of aldosterone → ↓ retension of Na.

Decreased bradykinin inactivation → ↑ bradykinin which is vasodilator .

Short acting : Captopril (*capoten*) : ½ - 2 tablet t.d.s. (tab = 25 mg)

Long acting : 1 tab / day Enalapril (*Ezapril*) , Lisinopril (*Zestril*) , Ramipril (*Tritace*).

S/E : ☠ Dry cough . ☠ Hyperkalemia . ☠ Skin rash ☠ first dose phenomenon.

6. Angiotensin II receptor blockers (ARBs)

- Losartan (*CozAAr*)
- Valsartan (*Tareg*)

S/E : Similar to ACE inhibitors but no cough .

B) Choice of treatment :

- Non pharmacological measures (*lifestyle modification*) should be initiated in all hypertensive patients & those with prehypertension .
- The selection of a specific antihypertensive drug should take into consideration comorbid conditions associated with hypertension as well as the patient's personal, response & financial .

1- **Uncomplicated hypertension** : *Stepped antihypertensive therapy*

The treatment passes in steps & if there is not an adequate response go to the next step .

Step 1 : Initiate therapy with one of the following :

ACE inhibitors or β blockers or **C**a channel blockers or **D**iuretics .

Step 2 : Combination of 2 drugs of step 1 (*include a diuretic*) .

Step 3 : Combination of 3 drugs of step 1 (*include a diuretic*) .

Step 4 : Add α blocker or hydralazine .....to step 3 .

NB : The use of lower doses of 2 or more drugs may lower BP with fewer adverse effects than the use of higher dose of a single agent .

2- Hypertensive crisis:

- The aim of treatment is to lower the BP rapidly to terminate ongoing target organ damage (TOD).
- It is unwise to lower the BP too quickly as it may lead to organ hypoperfusion .
- Avoid initial reduction in BP more than 25 % & remember that the patients with chronic hypertension may not tolerate a normal BP so , be judicious when lowering the BP .

i. Rapid acting antihypertensive drugs :

- **Na nitroprusside** (Nipride) : *0.5 – 2 μg/kg/min (infusion)* .
- Nitroglycerine : *10 – 100 μg/kg/min.*
- Diazoxide : 100 – 300 mg rapidly IV .
- Hydralazine : 20 mg IV .
- Labetalol : 20 mg IV every 10 minutes until control of BP (maximum 200 mg)
- Fenoldopam : is a new dopamine receptor agonist .
- Lasix may be used with one of the above agents .

ii. Specific treatment :

a) Hypertensive encephalopathy : *add*

- Anticonvulsant : Diazepam IV .
- Cerebral dehydrating measures : 25 % Mannitol infusion with lasix .

b) Treatment of the target organ damage (TOD) :

- Cerebral stroke , acute LSHF & renal failure .

3- Tretment of hypertension with certain concomitant diseases :

Hypertension with heart failure

- Use : ACE inhibitors , Diuretics .
- Avoid : Ca channel blockers

Hypertension with ischemic heart disease

- Use: β blocker or Ca channel blocker .
- Avoid : Hydralazine .

Hypertension with DM

- Use: ACE inhibitors , Ca channel blockers .
- Avoid : β blockers (masking of warning signs of hypoglycemic coma).

Hypertension with renal impairment

- Use : β blockers , Ca channel blockers , Diuretics (Lasix) , α methyl dopa & ACE inhibitors but with monitoring of cretinin level .
- Avoid : ACE inhibitors in bilateral renal stenosis .

Hypertension with Asthma or COPD

- Avoid β blockers .

Hypertension with pregnancy

- Use : α methyl dopa , Ca channel blocker , Hydralazine or Labetalol .
- Avoid : ACE inhibitors , β blockers .Diuretics .

Hypertension with hyperthyroidism

- Use : β blocker .

Hypertension with peripheral vascular disease

- Use : Ca channel blockers , α blocker .
- Avoid : β blockers .

Thank you