Epidemiology of

Hypertension (HT)
High Blood Pressure (HBP)

Hypertension is defined as systolic blood pressure (SBP) of 140 mmHg or greater, diastolic blood pressure (DBP) of 90 mmHg or greater, or taking antihypertensive medication.

VI JNC, 1997

Types of hypertension

Essential hypertension

90% - 95%

No underlying cause

Secondary hypertension

Underlying cause

- Renal
  - Parenchymal
  - Vascular
  - Others
- Endocrine
- Neurogenic
- Miscellaneous
- Unknown

Is it a disease or a Risk factor?

Introduction

- **Definition: Hypertension is defined as elevated arterial blood pressure.**
- **It is termed as “The Silent Killer”**
- **Hypertension is one of the most common disease in the world**
- **Hypertension as a disease is also a significant risk factor for many other diseases**

How to measure blood pressure?

Measuring Blood Pressure

- Patient should be seated in a chair back supported, with arm bared and at heart level
- Patient should refrain from smoking or caffeine intake 30 minutes prior to BP measurement
- Measurement should begin after at least 5 minutes of rest
- Appropriate cuff size should be used to ensure accurate measurement

Measuring Blood Pressure (cont.)

- Use of a mercury sphygmomanometer is preferred
- A recently calibrated aneroid manometer or a validated electronic device can be used
- Two or more readings should be averaged. If the first two readings differ by more than 5 mm Hg, additional readings should obtained and averaged

Errors in measurements

Observer Errors

Instrument Error

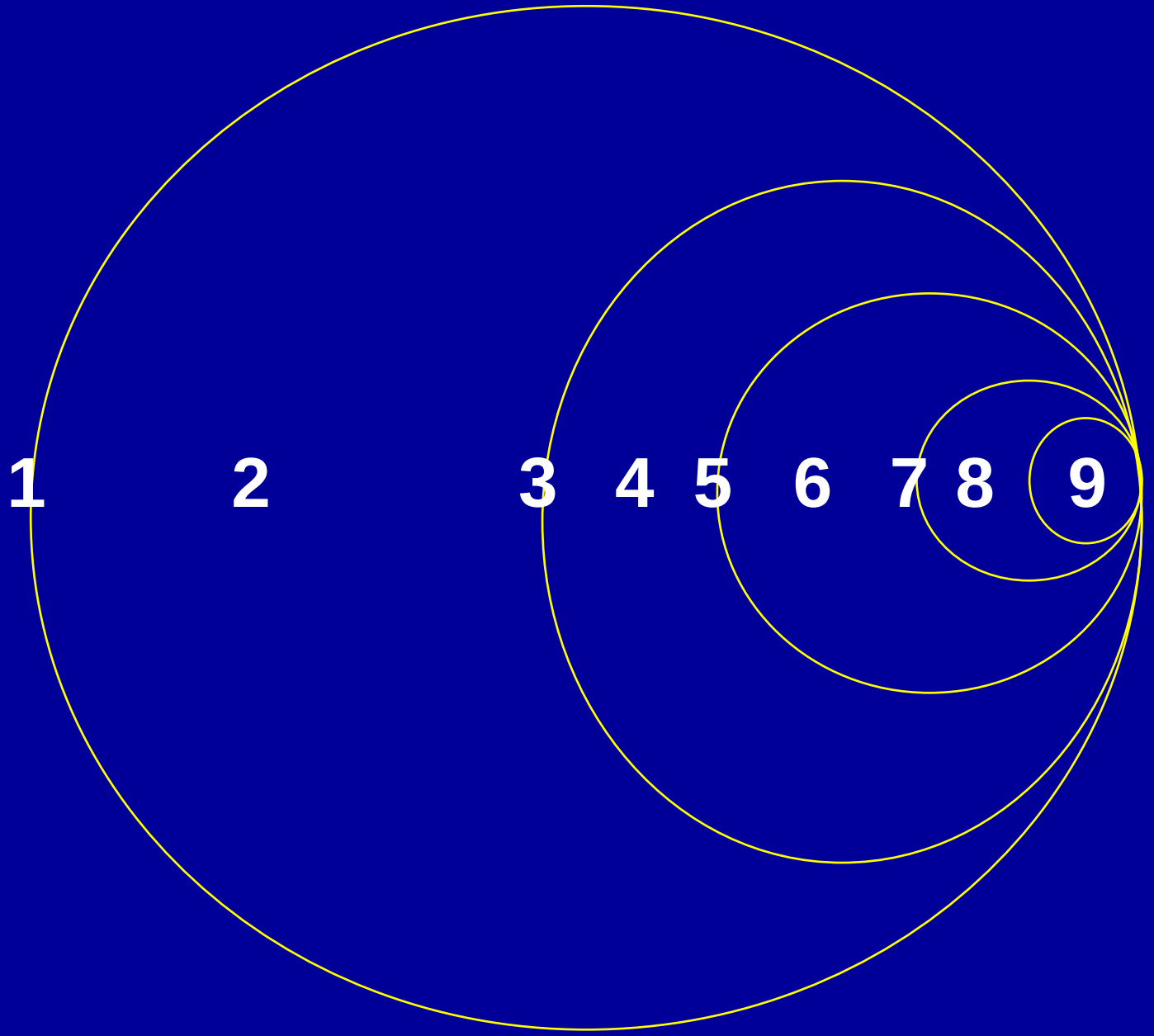
Subject Error

Magnitude of the problem

It is iceberg disease

Rule of Halves:

- Only half are aware
  - Only half of them are treated
    - Only half of them are adequately treated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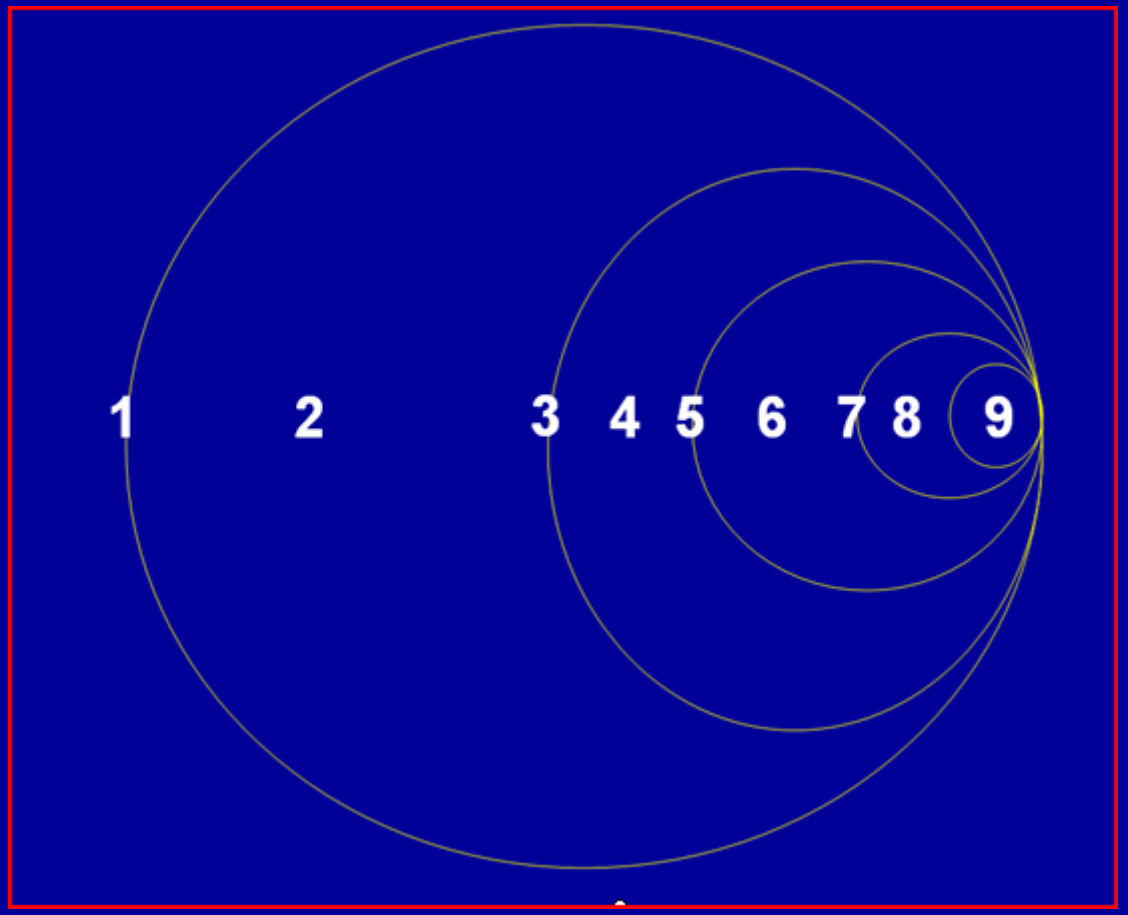
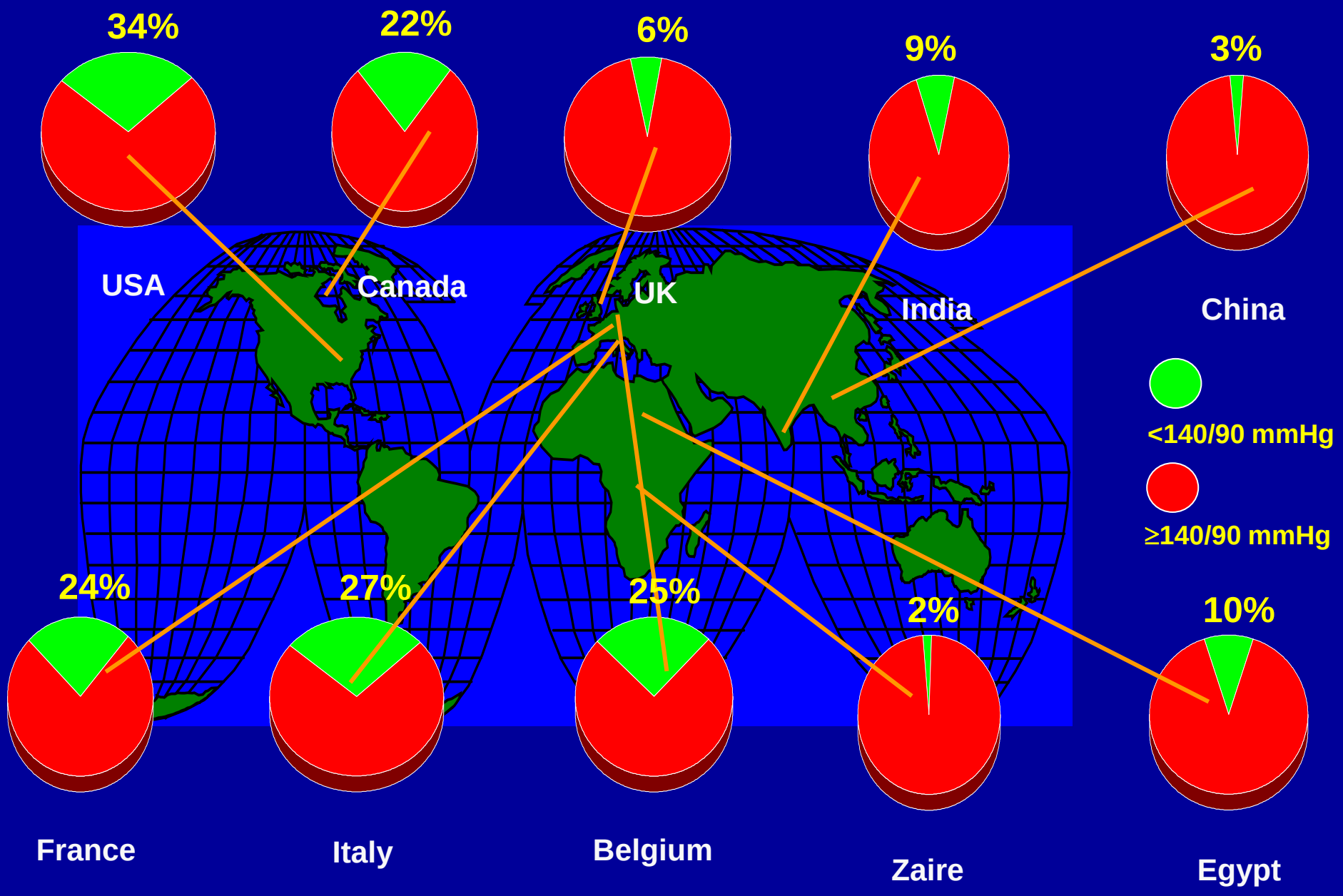
Rule of Halves

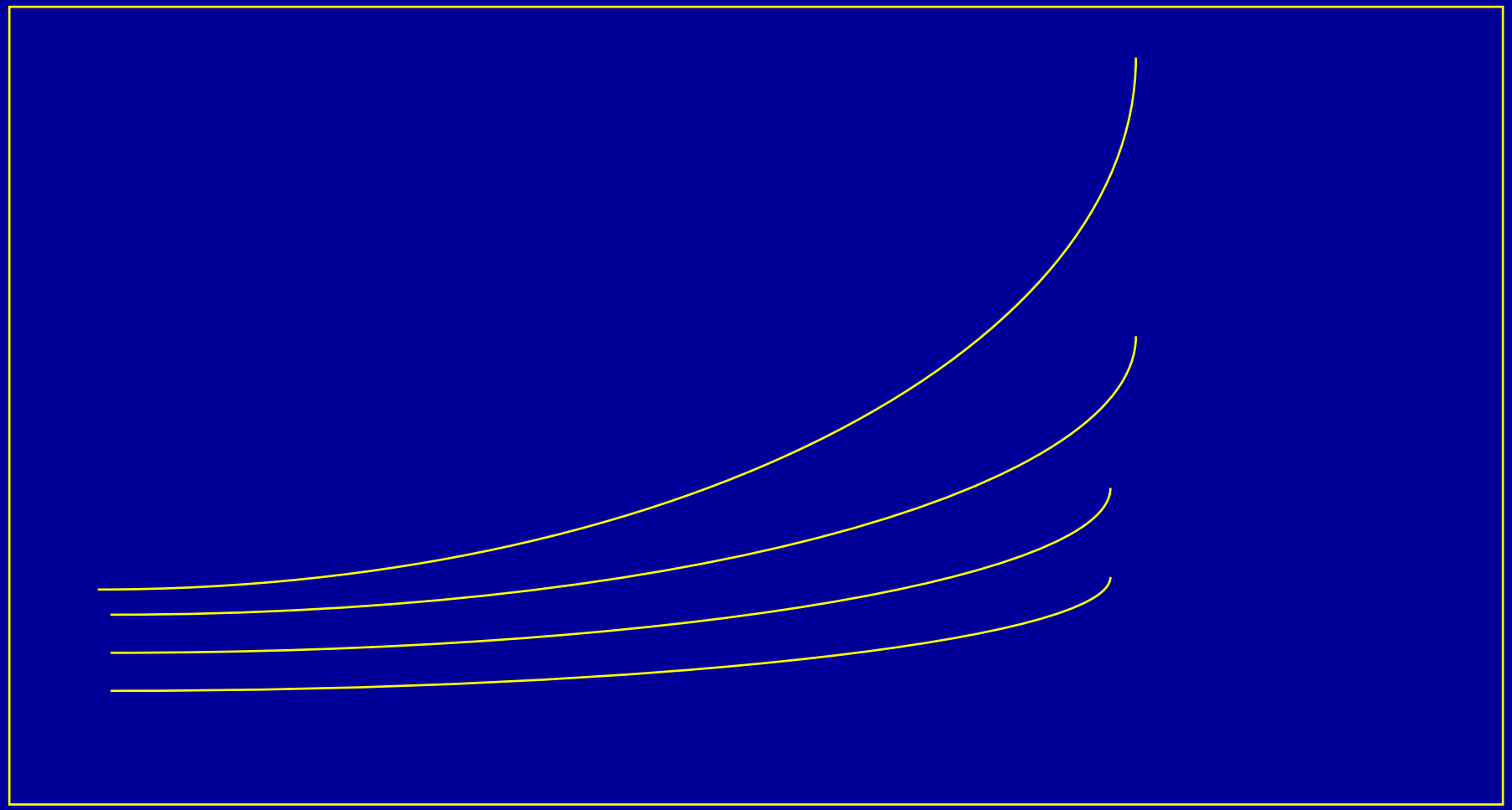


1. Community
2. Normotensive subjects
3. Hypertensive subjects
4. Undiagnosed hypertension
5. Diagnosed hypertension
6. Diagnosed but untreated
7. Diagnosed and treated
8. Inadequately treated
9. Adequately treated

Treated hypertensive subjects with BP <140/90 mmHg



Tracking of Blood Pressure (Predictability of blood pressure)



Incidence of hypertension

?

!!!

Prevalence of hypertension

Upto 25% in developed countries

10-20% in developing countries

Only a few communities living at very high altitude or belonging to primitive cultures have exceptionally low levels of blood pressure

India too on a high risk !!!

Defining Hypertension

Is it a true ***risk factor*** or a ***risk marker***?

A true ***risk factor*** is suspected of being causative of the disease process.

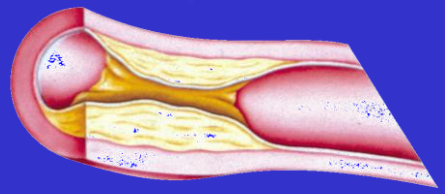
A ***risk marker*** is associated with the disease process without being in the causal pathway.

Complications of Hypertension

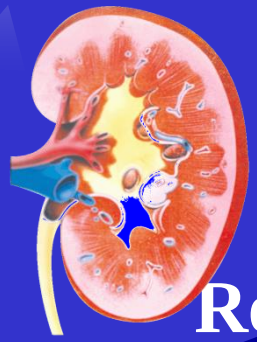
Hypertension is a risk factor

TIA, stroke

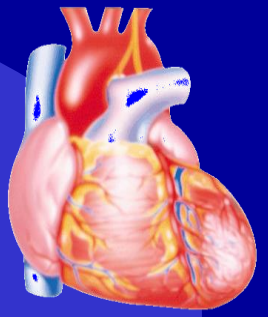
Retinopathy



Peripheral vascular disease



Renal failure



LVH, CHD, HF

TIA = transient ischemic attack; LVH = left ventricular hypertrophy; CHD = coronary heart disease; HF = heart failure.

Cushman WC. *J Clin Hypertens.* 2003;5(Suppl):14-22.

Risk factors for hypertension

Non-modifiable

- Age
- Gender (sex)
- Genetic factors
- Family histories shows that in normotensive parents possibility of developing hypertension is 3% while in hypertensive parents possibility is 45%.

Risk factors for hypertension

Modifiable

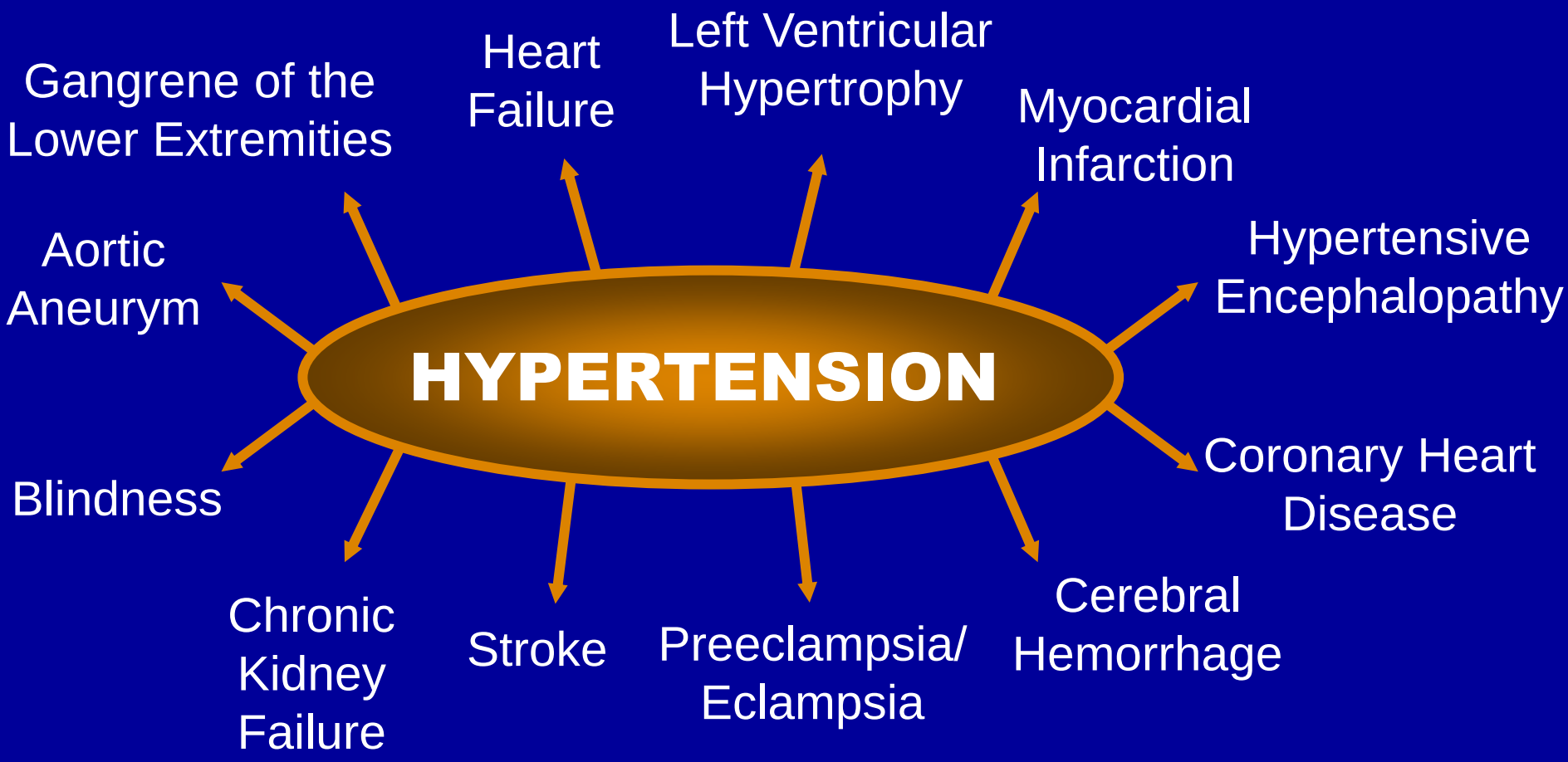
- Obesity
- Smoking
- Salt intake
- Saturated fats
- Alcohol
- Physical inactivity – sedentary lifestyle
- Stress
- Diabetes
- Environmental stress
- Other factors

Hypertension itself is a Risk Factor

Hypertension is a **significant** risk factor for:

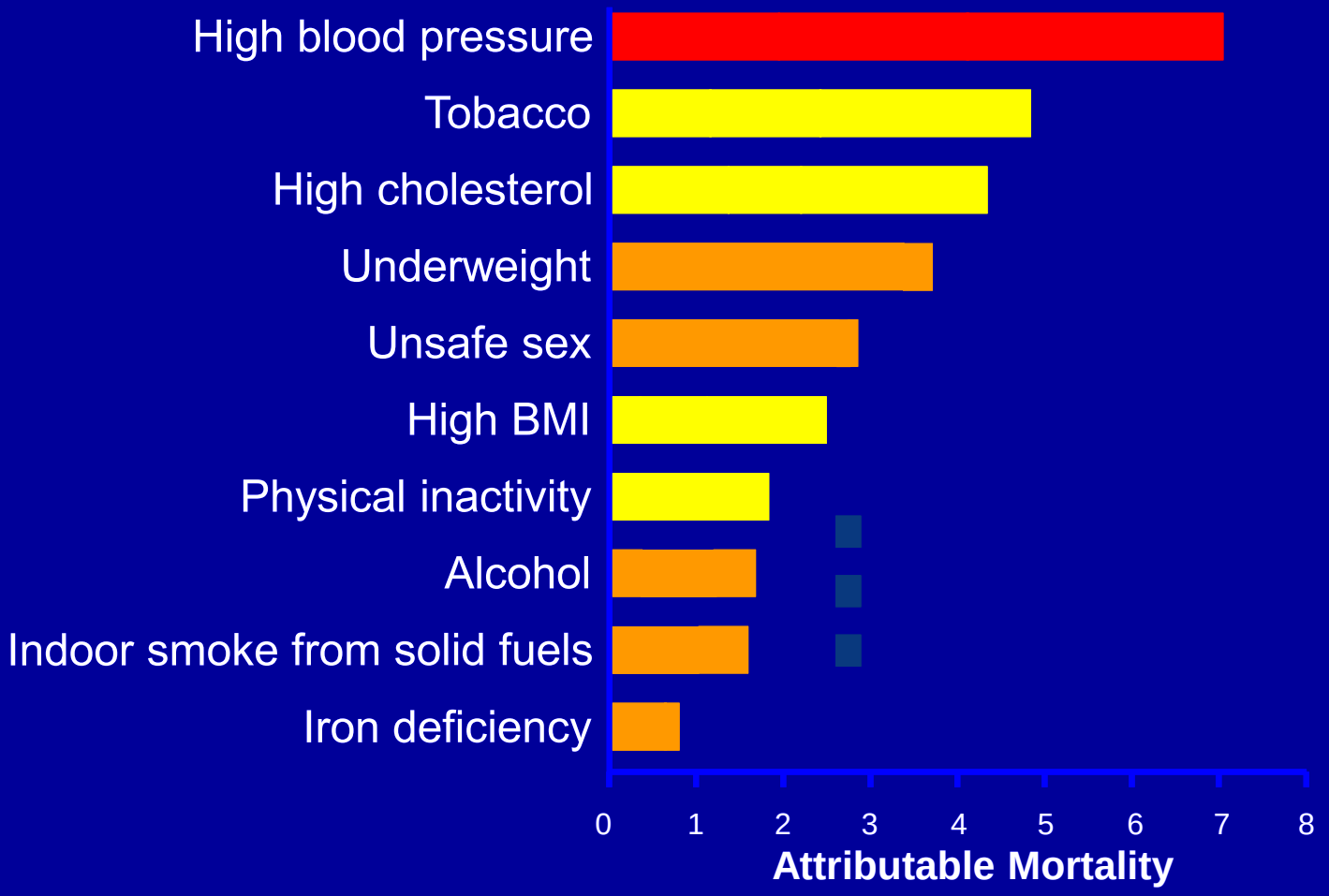
- cerebrovascular disease
- coronary artery disease
- congestive heart failure
- renal failure
- peripheral vascular disease
- dementia
- atrial fibrillation

Diseases Attributable to Hypertension



Adapted from Dustan HP et al. Arch Intern Med. 1996; 156: 1926-1935

Proportion of deaths attributable to leading risk factors worldwide (2000)



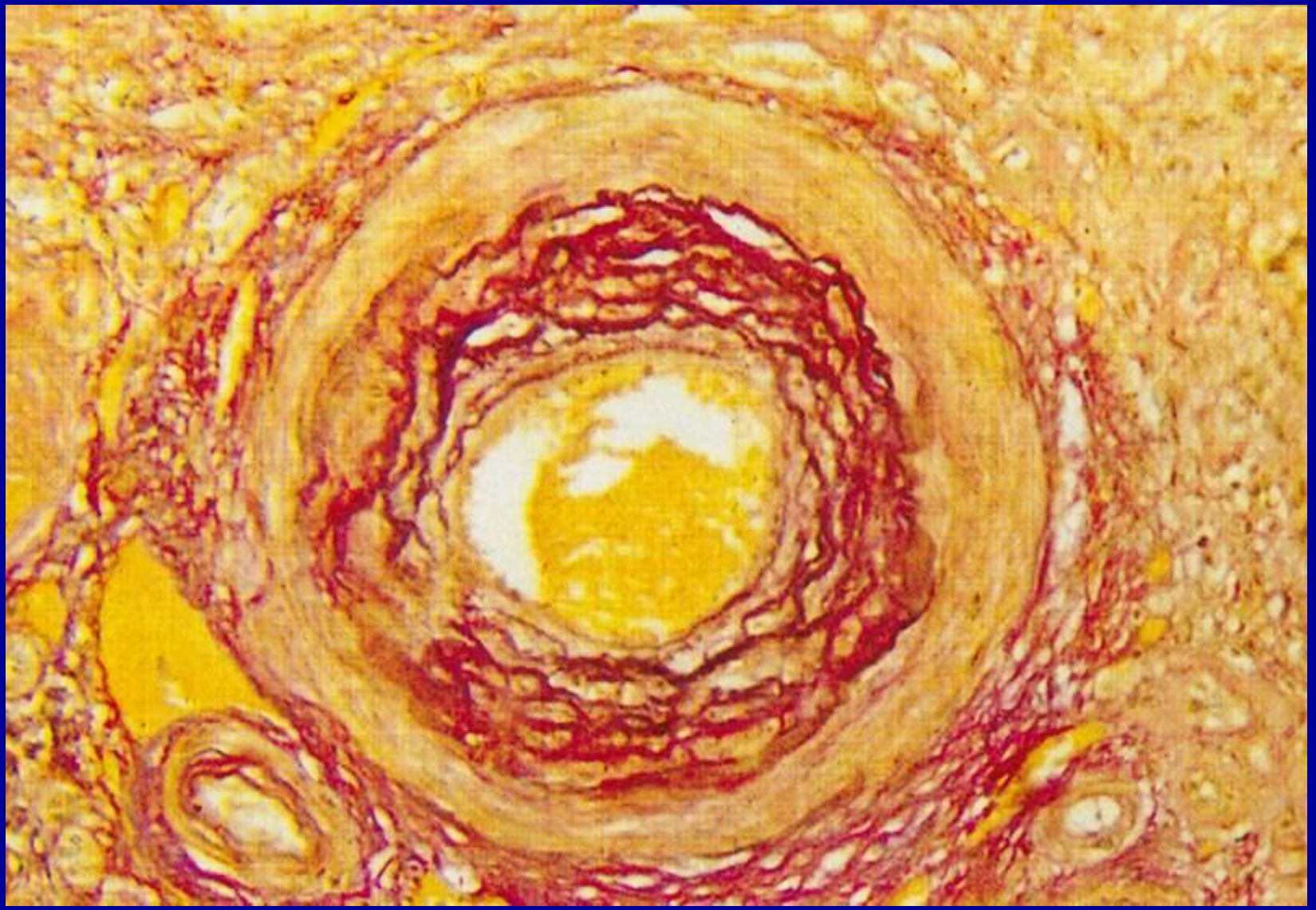
Etiology

- Genetic
- Environment
  - Dietary: Salt intake
  - Alcohol intake
  - Obesity
  - Nutritional

Pathogenesis

1. High activity of the SNS (Sympathetic Nervous System)
2. RAAS (Renin-Angiotension Aldosterone System)
3. Renal Sodium Handling
4. Vascular Remodelling
5. Endothelial Cell Dysfunction
6. Insulin Resistance

The pathological changes of small artery



The pathological change of the Heart

Left ventricular hypertrophy (LVH)

→ **Heart failure**

Coronary artery atherosclerosis

→ **Myocardial infarction**

Pathological change of the Brain

Stroke:

Ischemic stroke

Hemorrhagic stoke

Arterial Aneurysm

Pathological change of Kidney

Hypertension induced nephrosclerosis, atrophy of renal cortex

Clinical Features

- **The blood pressure varies widely over time, depending on many variables, including SNS activity, posture, state of hydration, and skeletal muscle tone.**
- **Symptoms:**

  Usually asymptomatic

  Symptoms often attributed to hypertension:

  headache, tinnitus, dizziness, fainting

Clinical Features

Complications of Hypertension

Heart: LVH, CHD, HF, MI

Brain: TIA, Stroke

Renal: Microalbuminuria, renal dysfunction

Vascular: PVD

Ratinopathy

Blood pressure measurement

Clinic Blood Pressure

Home Blood Pressure

Ambulatory monitoring

BP Measurement Techniques

Method	Brief Description
In-office	Two readings, 5 minutes apart, sitting in chair. Confirm elevated reading in contralateral arm.
Ambulatory BP monitoring	Indicated for evaluation of “white-coat” HTN. Absence of 10–20% BP decrease during sleep may indicate increased CVD risk.
Self-measurement	Provides information on response to therapy. May help improve adherence to therapy and evaluate “white-coat” HTN.

Ambulatory Measurement

- **Ambulatory monitoring can provide:**
  - readings throughout day during usual activities
  - readings during sleep to assess nocturnal changes
  - measures of SBP and DBP load
  - Exclude white coat or office hypertension
- **Ambulatory readings are usually lower than in clinic**

Laboratory Tests

- Routine Tests
  - Electrocardiogram
  - Urinalysis
  - Blood glucose, and hematocrit
  - Serum potassium, creatinine, or the corresponding estimated GFR, and calcium
  - Lipid profile, after 9- to 12-hour fast, that includes high-density and low-density lipoprotein cholesterol, and triglycerides
- Optional tests
  - Measurement of urinary albumin excretion or albumin/creatinine ratio
- More extensive testing for identifiable causes is not generally indicated unless BP control is not achieved

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)

Classification of BP for adults >18 years of age and older

Category	Systolic		Diastolic
Optimal	< 120	and	< 80
Normal	< 130	and	< 85
High-normal	130-139	or	85-89
HTN			
Stage 1	140-159	or	90-99
Stage 2	160-179	or	100-109
Stage 3	≥ 180	or	≥ 110

Classification of blood pressure for adult

Category	SBP (mmHg)	DBP (mmHg)
Normal	< 120	< 80
High normal	120-139	80-89
Hypertension	≥140	≥90
Stage 1	140-159	90-99
Stage 2	160-179	100-109
Stage 3	≥180	≥110
Systolic HBP	≥140	< 90

When the SBP and DBP fall into different categories, use the higher category

Remember

- When systolic and diastolic blood pressures fall into different categories, the higher category should be selected.
- Based on the average of two or more BP readings taken at each of the two or more visits following initial screening.

(High Normal) Prehypertension

Is not a disease,

Is not "hypertension",

Is not an indication for drug treatment of HTN,

Does predict a higher risk for developing CV events,

Does predict a higher risk for developing HTN,

Should be an incentive to improve lifestyle practices for prevention of HTN and CVD.

Evaluation Components

- Medical history
- Physical examination
- Routine laboratory tests

Objectives of Evaluation of hypertensive patients

- To identify cardiovascular risk factors
- To assess presence or absence of target organ damage
- To identify other causes of hypertension

These evaluation may be used in stratification of the hypertension patients

Associated Clinical Condition

- **Cerebrovascular diseases:** Stroke, TIA
- **Heart diseases:** MI, AP, CHF, Coronary artery revasculation
- **Kidney diseases:** DN, Dysfunction of the kidney, Proteinuria, CRF
- **Diabetes**
- **Peripheral artery disease**
- **Retinopathy**

European Society of Hypertension Classification of Blood Pressure

Category	Systolic		Diastolic
Optimal	<120	and / or	<80
Normal	<130	and / or	<85
High-Normal	130-139	and / or	85-89
Grade 1 (mild hypertension)	140-159	and / or	90-99
Grade 2 (moderate hypertension)	160-179	and / or	100-109
Grade 3 (severe hypertension)	≥ 180	and / or	≥ 110
Isolated Systolic Hypertension (ISH)	≥140	and	<90

The category pertains to the highest risk blood pressure

*ISH=Isolated Systolic Hypertension. J Hypertens 2007;25:1105-87,

2009 **C**anadian **H**ypertension **E**ducation **P**rogram Recommendations

1999 WHO-ISH Guidelines : Definitions and Classifications of BP Levels

Category*	SBP (mm Hg)	DBP (mm Hg)
Optimal	< 120	< 80
Normal	< 130	< 85
High-normal	130-139	85-89
Grade 1 hypertension (mild)	140-159	90-99
Borderline subgroup	140-149	90-94
Grade 2 hypertension (moderate)	160-179	100-109
Grade 3 hypertension (severe)	≥ 180	≥ 110
ISH	≥ 140	< 90
Borderline subgroup	140-149	< 90

WHO-ISH Guidelines Subcommittee J Hypertens 1999; 17:151

1999 WHO-ISH Guidelines: Stratification of risk to Quantify Prognosis

Risk factors and disease history		Degree of hypertension (mm Hg)		
		Grade 1-mild (SBP 140-159 or DBP 90-99)	Grade 2-moderate (SBP 160-179 or DBP 100-109)	Grade3-severe (SBP ≥ 180 or DBP ≥ 110)
I	No other risk factors	Low risk	Med risk	High risk
II	1-2 risk factors	Med risk	Med risk	Very high risk
III	≥ 3 risk factors or target organ disease or diabetes	High risk	high risk	Very high risk
IV	Associated Clinical conditions	Very high risk	Very high risk	Very high risk

WHO-ISH Guidelines Subcommittee J Hypertens 1999;17:151

1999 WHO-ISH Guidelines: Desirable BP Treatment Goals

Optimal or normal BP (< 130/85 mm Hg) for

- Young patients
- Middle-age patients
- Diabetic patients

High-normal BP (< 140/90 mm Hg) desirable for elderly patients

Aggressive BP lowering may be necessary in patients with nephropathy, chronic renal failure, particularly if proteinuria is present

JNC: BP Risk Stratification

Risk Group A

No CV risk factors

No diabetes, target-organ damage, or clinical CVD

Risk Group B

At least one other risk factor: age >60, male gender or postmenopausal status, dyslipidemia, smoking, +FH

(No diabetes, target-organ damage, or clinical CVD)

Risk Group C

Diabetes or target-organ damage or clinical CVD with or without other risk factors

JNC. *Arch Intern Med* 1997;157:2413.

Differential Diagnosis

Should exclude Secondary Hypertension

Secondary Hypertension
Common Causes

- **Renal**

  Glomerulonephritis — Pyelonephritis
  Obstructive nephropathy — Collagen diseases,
  Congenital diseases — Diabetes nephropathy
  Renal tumor---- renin secreting tumor

- **Pheochromocytoma**
- **Primary aldosteronism**

Pheochromocytoma

- Ganglion-neurotomas and neuroblastomas
- Excretion of large amounts of catecholamines
- 90% arise in the adrenal medulla
- 10% are malignant.
- Paroxymal or persist HT
- Clinic features: Headache, sweating, palpitations, nervousness, weight loss, hypermetabolism, orthostatic hypotension, severe presser response

Primary Aldosteronism

- Mild or moderate hypertension
- Hypokalemia, muscle weakness, paralysis
- Polyuria, nocturia and polydipsia,
- Hypochloremic alkalosis
- Urine aldosterone elevation
- Plasma renin active decrease

Secondary Hypertension

- **Obstructive Sleep Apnea (OSA)**
- **Renal artery stenosis**
- **Cushing's syndrome**
- **Coarctation of the aorta**
- **Drug-induced:**

NSAIDs;
Prophylactic;
Mineralocorticoids;
Epogen
Sympathomimetic medications;
Monoamine oxidase inhibitors;
Immuno-inhibitors;

1. **Following is not a Target organ damaged due to hypertension:**

   (a) Brain
   (b) Retina
   (c) Kidney
   (d) Bladder

2. The systolic BP range of Grade II Hypertension:

(a)140-149
(b)150-159
(c)160-179
(d) 170-179

3. The Diastolic BP range of Grade III Hypertension:

(a)≥100
(b)≥150
(c)≥110
(d) ≥ 120

4. The following Diet is a not a risk factor for Hypertension:

(a) Rich in Sodium salts
(b) Rich in saturated fats
(c) Low in fibre
(d) High in potassium.

5. In India, the prevalence of hypertension has been estimated to be between:

(a) 20% - 40%
(b) 40 – 60%
(c) 60 - 70%
(d)<10%

6. Which mode of prevention does Opportunistic Screening fit in:

(a) Primordial
(b) Primary
(c) Secondary
(d) Tertiary