بسم الله الرحمن الرحيم

وبینار فشارخون- ۲۷مرداد۱۴۰۱

تعریف فشارخون و انواع آن

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دانشیار دانشگاه علوم پزشکی تهران

Definition and grading of hypertension

BP category	SBP (mmHg)		DBP (mmHg)
Normal	< 120	and	< 80
Elevated	120-129	and	< 80
Hypertension			
Grade 1	130-139	or	80-89
Grade 2	≥ 140	or	≥ 90

Home BP is one form of out-of-office BP; if measured correctly, can be used for diagnostic confirmation, identification of hypertension phenotypes (sustained hypertension, white-coat hypertension [effect], and masked [uncontrolled] hypertension), guidance of antihypertensive treatment, and improvement of hypertension control

Hypertension should be diagnosed if average home BP is ≥ 130/80 mmHg (the equivalent standardized office BP is ≥ 130/80 mmHg)

The “722” protocol for HBP monitoring modified from the TSOC/THS home BP consensus

The “722” protocol	Timing of HBP monitoring
“7”	7 (at least 4) consecutive days
“2”	2 occasions per day: in the morning (within 1 hour after awakening, after voiding, and before taking food and medications) and in the evening (within 1 hour before bedtime)
“2”	2 or more BP readings, 1 minute apart, taken per occasion (≥ 3 BP readings if atrial fibrillation)

BP ranges	Frequency of HBP monitoring with the “722” protocol
Normal blood pressure (< 120/80 mmHg)	Every 1 year
Elevated blood pressure (120-129/< 80 mmHg)	Every 6 months
Hypertension (≥ 130/80 mmHg)	

HBPM can therefore be considered as a strategy of choice to replace office BP monitoring for the diagnosis and treatment for hypertensive subjects.

ABPM should be considered in all patients with elevated BP, particularly those with unstable office or home BP, or whom are suspected to have white-coat or masked hypertension, or progressive HMOD.

ABPM needs to be performed using a validated device with good practice techniques, and has a role both in hypertension diagnosis and in monitoring the response to antihypertensive therapy to ensure strict BP control throughout the 24-hour period.

ABPM devices are typically programmed to take BP measurements every 15 to 30 minutes in the daytime and 30-60 minutes at night.

ABPM devices are typically programmed to take BP measurements every 15 to 30 minutes in the daytime and 30-60 minutes at night. **ABPM** Nocturnal hypertension could indicate the presence of comorbidities such as obstructive sleep apnea, and the riser pattern of nighttime BP is associated with a particularly poor prognosis with respect to the occurrence of stroke and cardiac events.

In addition, morning hypertension defined as elevation of averaged BP over the 2 hours after awakening was associated with higher risk of stroke.

Both HBPM and ABPM could be used to identify morning hypertension

Isolated systolic hypertension is defined as a blood pressure ≥130 mmHg systolic and <80 mmHg diastolic, and isolated diastolic hypertension is defined as a blood pressure <130 mmHg systolic and ≥80 mmHg diastolic. Patients with a blood pressure ≥130 mmHg systolic and ≥80 mmHg diastolic are considered to have mixed systolic/diastolic hypertension.

The diagnosis of hypertension requires integration of home or ambulatory blood pressure monitoring (ABPM), whereas routine measurements made in the clinical setting should be used primarily for detection purposes

meeting one or more of these criteria using ABPM qualifies as confirmation of hypertension

- A 24-hour mean of ≥125 mmHg systolic or ≥75 mmHg diastolic
- Daytime (awake) mean of ≥130 mmHg systolic or ≥80 mmHg diastolic
- Nighttime (asleep) mean of ≥110 mmHg systolic or ≥65 mmHg diastolic

We find the daytime (awake) average of ≥130 mmHg systolic or ≥80 mmHg diastolic to be the most useful of these definitions.

White coat hypertension — White coat hypertension is defined as blood pressure that is consistently elevated by office readings but does not meet diagnostic criteria for hypertension based upon out-of-office readings.

Masked hypertension — Masked hypertension is defined as blood pressure that is consistently elevated by out-of-office measurements but does not meet the criteria for hypertension based upon office readings.

if AOBP measurement is not available, office measurements should be performed with the patient positioned properly and allowed to rest comfortably for at least five minutes, and measurements should be repeated at least twice

Changes in recommendations	
2015/2017	2022
Definition and grading	
The diagnosis of hypertension depends on office BP measurements, complemented by HBPM and ABPM.	• HBPM is recommended as the foundation for the diagnosis and grading of hypertension, and also for the treatment thresholds and targets.
	• Routine office BP should not be used for the diagnosis and management of hypertension unless the recommended BP measurement protocol is followed.
Hypertension should be diagnosed if estimatedoffice BP is ≥140/90 mmHg.	Hypertension should be diagnosed if average home BP is ≥ 130/80 mmHg (the equivalent standardized office BP is ≥ 130/80 mmHg).
Corresponding to office BP of 140/90 and 130/80 mmHg, the equivalent HBP values are 135/85 and 130/80 mmHg, respectively.	All three cut-off values for grading, 120/80 mmHg, 130/80 mmHg, and 140/90 mmHg, are recommended for both home BP and standardized office BP.
Document the average of all BP readings taken on one occasion.	If more than three BP readings are taken on one occasion, document the average of the two readings with the lowest SBP values to provide a more reliable BP estimate.

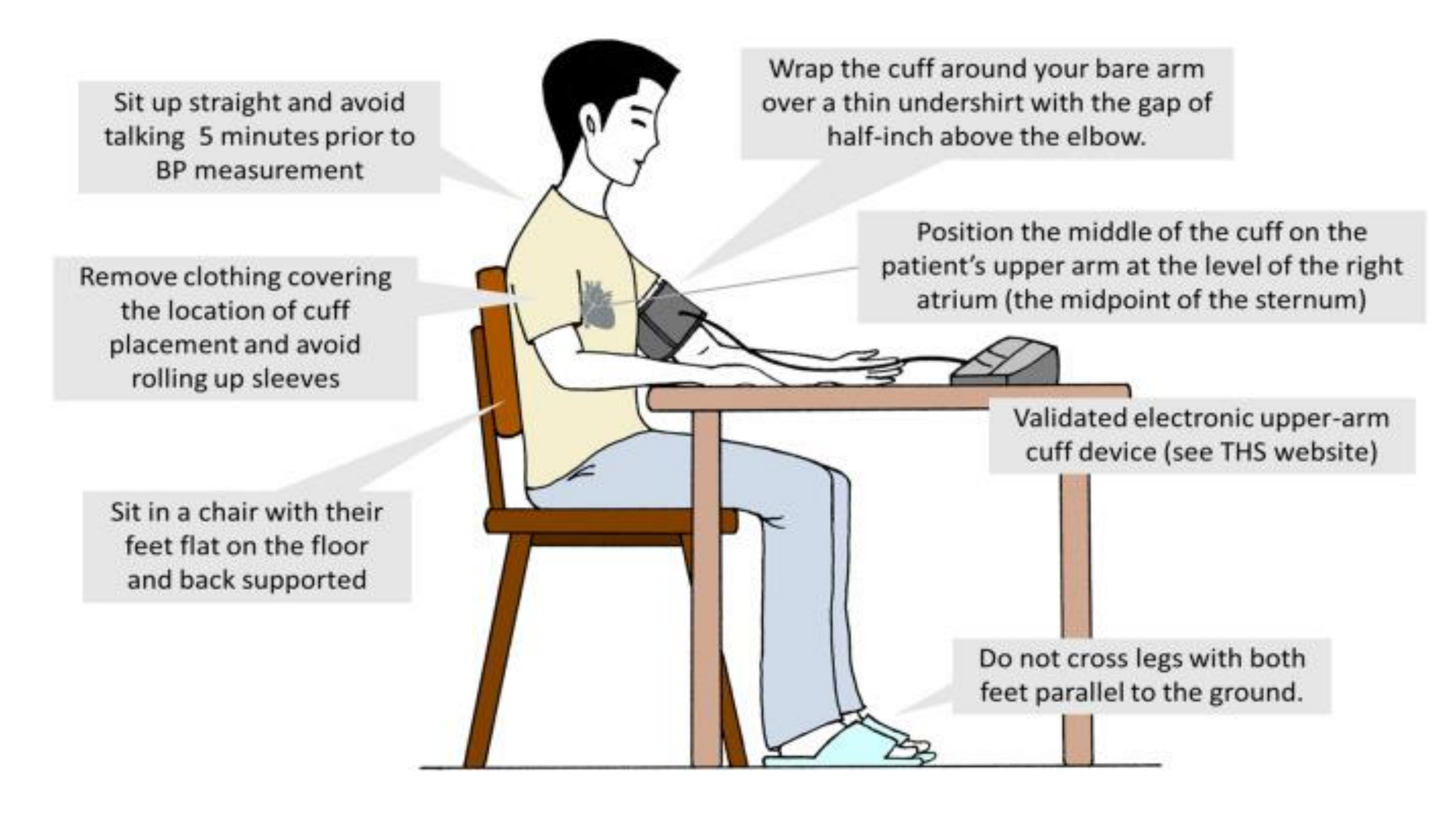
blood pressure should be measured in both arms, at least at the initial visit. In older individuals or those with potential orthostatic symptoms, postural measurements should also be taken:

Systolic blood pressure readings in the left and right arms should be roughly equivalent. A discrepancy of more than 15 mmHg may indicate subclavian stenosis and, hence, peripheral arterial disease. If there is a significant difference in blood pressure between the two arms, the higher of the two should be used for measurement at subsequent visits.

Postural hypotension, defined as a 20 mmHg or greater fall in systolic pressure upon rising from supine to an unassisted upright position, should be pursued in patients over age 65 years, those experiencing dizziness or weakness upon standing, or those with diabetes or Parkinson disease.

In addition to patients with suspected white coat hypertension, ABPM should be considered in the following circumstances:

- Suspected episodic hypertension (eg, pheochromocytoma)
- Determining therapeutic response (ie, blood pressure control) in patients who are known to have a substantial white coat effect)
- Hypotensive symptoms while taking antihypertensive medications
- Resistant hypertension
- Autonomic dysfunction
- Suspected masked hypertension


Sit up straight and avoid talking 5 minutes prior to BP measurement
Wrap the cuff around your bare arm over a thin undershirt with the gap of half-inch above the elbow.
Position the middle of the cuff on the patient's upper arm at the level of the right atrium (the midpoint of the sternum)
Remove clothing covering the location of cuff placement and avoid rolling up sleeves
Validated electronic upper-arm cuff device (see THS website)
Sit in a chair with their feet flat on the floor and back supported
Do not cross legs with both feet parallel to the ground.

Stage 1: **Preparation**	**Empty bowel and stomach.**
	Before the measurement procedure, subjects should avoid caffeine, exercise, and smoking for at least 30 minutes.
	Sit calmly for at least 5 minutes and avoid talking during the rest period and the whole measurement process.
	Avoid conversation during the rest period and during the measurement.
	Remove clothing covering the location of cuff placement. Be sure to avoid rolling up sleeves; this may cause a (partial) tourniquet effect.
	Sit in a calm and comfortable place.
Stage 2: **Measurement equipment and position**	**Use validated BP devices and ensure that the device is calibrated at recommended intervals (at least every 12 months), and the device is better if equipped with capabilities of automatic data recording and/or auto-transmission.**
	Obtain and record subject's mid-arm circumference.
	Support the patient's arm with resting on a desk.
	Position the middle of the cuff on the patient's upper arm at the level of the right atrium (the midpoint of the sternum).
	Use the correct cuff size, following the manufacturer's instructions (cuff bladder width and length are at least 40% and 80% of the mid-arm circumference, respectively).
	Sit for 5 minutes without talking or moving around prior to recording the first BP reading in a chair with their feet flat on the floor and back supported

Stage 3: **BP measurement process**	If BP is measured for the first time, check the BP in right and left upper arms. If the between-arm BP difference is < 15 mmHg, use the higher BP for further management.
	Position the center of the cuff over the upper arm brachial artery at least 2.5 cm (2 finger breadths) above the crease of the elbow.
	Separate repeated measurements by 1 minute.
	For an auscultatory determination of the BP level, inflate the cuff 20-30 mmHg above the estimated SBP assessed using the radial pulse obliteration method.
	Place the head of the stethoscope over the brachial artery for auscultatory determination.
	For auscultatory readings, deflate the cuff pressure 2 mmHg per second, and listen for Korotkoff sounds.
	To assess whether classic and delayed orthostatic hypotension are present, measure BP 1 and 3 minutes after assuming an upright posture, respectively.
Stage 4: **Documentation of accurate BP readings**	Record SBP, DBP, and heart rate for each measurement using auto-transmission, an app on a digital device, or recording sheet.
	Use an average of ≥ 2 readings for each measurement.
	If more than 3 readings are taken, document the average of the 2 readings with the lowest SBP values to provide a more reliable BP estimate.
	Use an average of ≥ 2 readings obtained on ≥ 2 occasions to estimate the BP.
	If using the auscultatory technique, record SBP as onset of the first of at least 2 consecutive beats and the last audible sound as DBP, Korotkoff phases 1 and 5, respectively. In cases where the sounds are audible at full deflation or until very low DBP levels (< 40 mmHg), then Korotkoff phase 4 (muffling of sounds) should be recorded and reported for DBP.
	If using the auscultatory approach, record SBP and DBP to the nearest even number.
	Provide information to help the patients interpret their BP values.

Risk factors for primary (essential) hypertension

- **Age – Advancing age is associated with increased blood pressure, particularly systolic blood pressure, and an increased incidence of hypertension.**

- **Obesity – Obesity and weight gain are major risk factors for hypertension and are also determinants of the rise in blood pressure that is commonly observed with aging**

- **Family history – Hypertension is approximately twice as common in subjects who have one or two hypertensive parents, and multiple epidemiologic studies suggest that genetic factors account for approximately 30 percent of the variation in blood pressure in various populations**

- **Race – Hypertension tends to be more common, be more severe, occur earlier in life, and be associated with greater target-organ damage in Black patients.**

- **Reduced nephron number** – Reduced adult nephron mass may predispose to hypertension, which may be related to genetic factors, intrauterine developmental disturbance (eg, hypoxia, drugs, nutritional deficiency), premature birth, and postnatal environment (eg, malnutrition, infections).

- **High-sodium diet** – Excess sodium intake (eg, >3 g/day [sodium chloride]) increases the risk for hypertension, and sodium restriction lowers blood pressure in those with a high sodium intake.

- **Excessive alcohol consumption** – Excess alcohol intake is associated with the development of hypertension, and alcohol restriction lowers blood pressure in those with increased intake.

- **Physical inactivity** – Physical inactivity increases the risk for hypertension, and exercise (aerobic, dynamic resistance, and isometric resistance) is an effective means of lowering blood pressure

History — The history should search for those facts that help to determine the presence of precipitating or aggravating factors (including prescription medications, nonprescription NSAIDs, and alcohol consumption), the duration of hypertension, previous attempts at treatment, the extent of target-organ damage, and the presence of other known risk factors for cardiovascular disease.

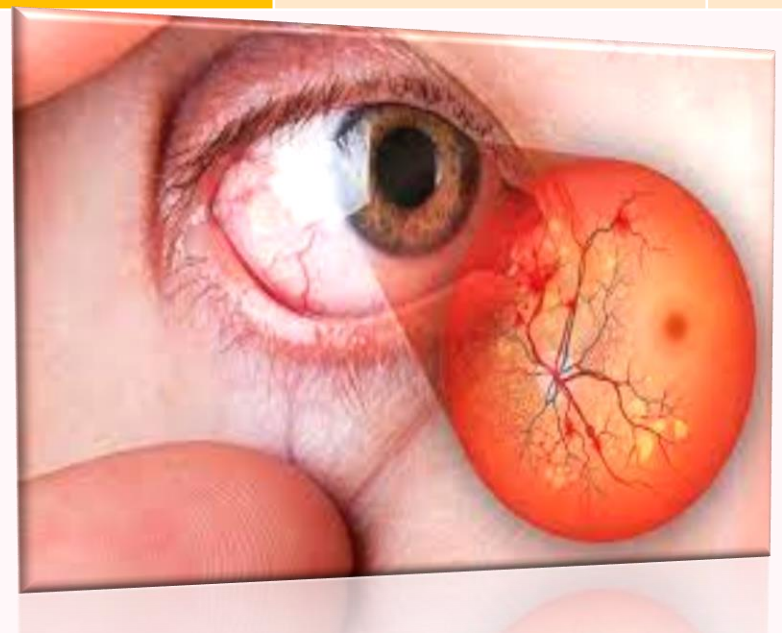
Physical examination — The main goals of the physical examination are to evaluate for signs of end-organ damage, for established cardiovascular disease, and for evidence of potential causes of secondary hypertension. The physical examination should include the underutilized but important funduscopic examination to evaluate for hypertensive retinopathy.

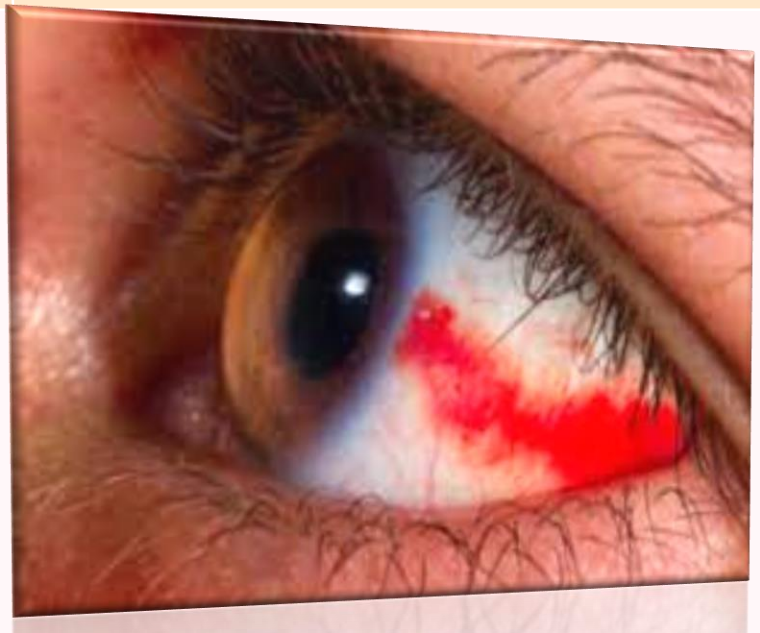
HMOD is defined by the presence of the structural or functional changes of end organ system caused by elevated BP.- The end organs include the brain, the eyes, the heart, the kidneys and the blood vessels. The existence of HMOD hallmarks the poor control of hypertension and is associated with increased CV risk and mortality.

Basic HMOD screening is recommended in all hypertensive patients during first visit and further detailed evaluation is required if necessary. Serial assessment of HMOD to monitor regression determines the efficacy of treatment.

Organ	HMOD	Screening test	Indication and interpretation
Brain	Stroke (ischemia/hemorrhage)	Brain imaging	To detect brain infarction, microbleeds and white matter lesions in hypertensive patients with neurological symptoms.
	Transient ischemic attack		Early subclinical changes can be identified by MRI with the highest sensitivity, but routine MRI is not recommended due to costs, and should be evaluated by a specialist.
	Cognitive impairment		
		Cognitive function testing	To assess cognition in hypertensive patients with symptoms suggestive of cognitive decline.

Organ	HMOD	Screening test	Indication and interpretation
Eyes	Hypertensive retinopathy	Fundoscopy or fundus camera	To detect hypertensive retinopathy (retinal changes, hemorrhages, microaneurysms, hard exudates, cotton wool spots, papilledema, tortuosity and nipping), especially in hypertensive urgencies and emergencies.





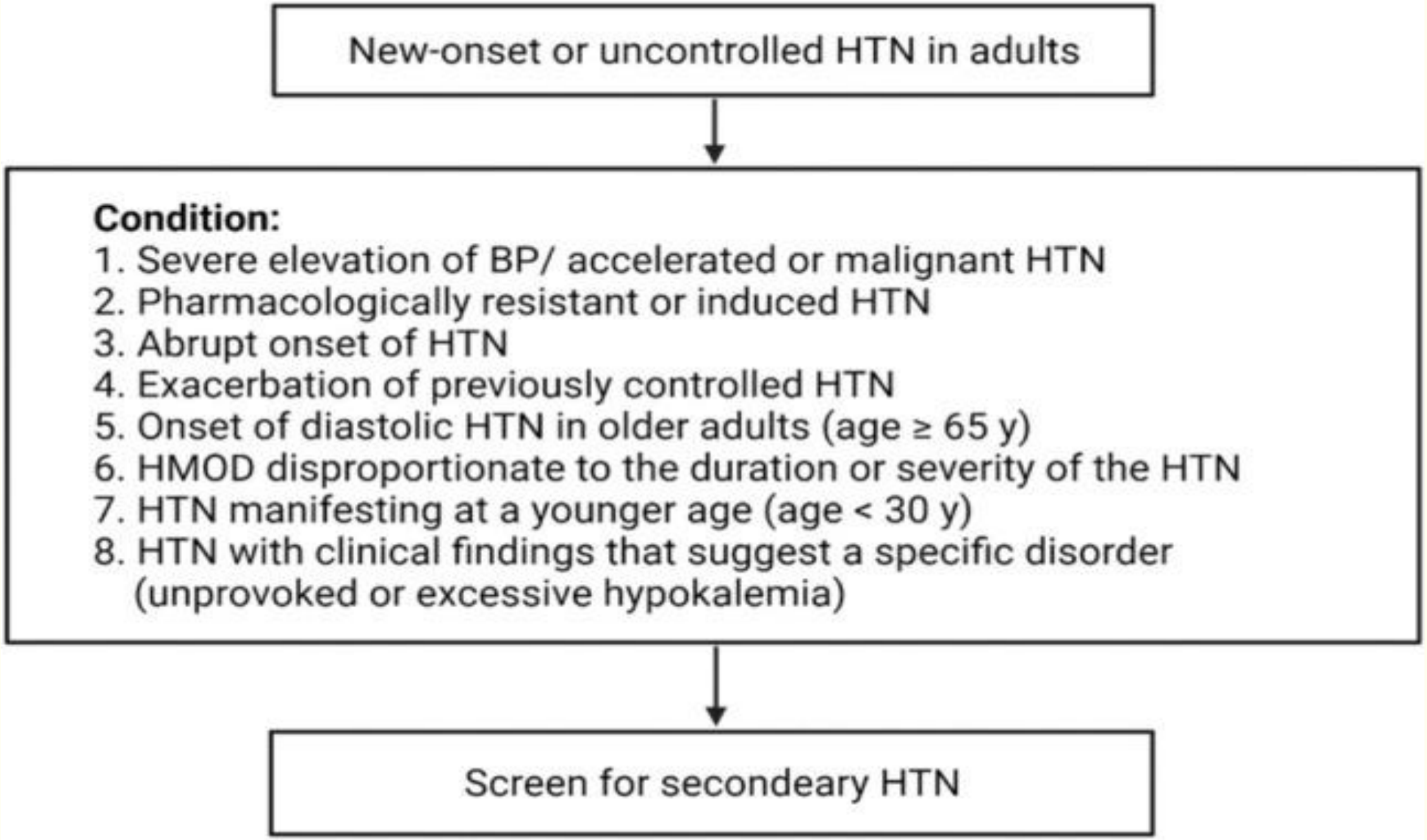
Organ	HMOD	Screening test	Indication and interpretation
Heart	LVH	ECG	To screen for LVH, atrial fibrillation, ischemic heart disease and other possible abnormalities, and to record baseline heart rate and rhythm.
	Atrial fibrillation		The sensitivity of ECG is limited and requires further echocardiography to confirm the diagnosis.
	Heart failure		
		Echocardiography	To evaluate cardiac structure and function (ventricular geometry, systolic and diastolic function, left atrial size, aortic root dimensions and subclinical systolic function impairment assessed by myocardial strain).

Organ	HMOD	Screening test	Indication and interpretation
Kidney	Chronic kidney disease	eGFR	To evaluate kidney function and detect renal disease.
	Proteinuria/albuminuria		
		Proteinuria	To assess albumin excretion in possible renal disease, the most commonly used tool is UACR in early morning spot urine.

Organ	HMOD	Screening test	Indication and interpretation
Blood vessels	Carotid atherosclerosis	Carotid ultrasound	To determine the carotid plaque burden (atherosclerosis), stenosis and IMT, especially in hypertensive patients with cerebrovascular disease.
	Aortic stiffness		
	Aortic aneurysm		
	Peripheral artery disease		
		Abdominal ultrasound	Evaluate abdominal aorta for the presence of aneurysmal dilatation and vascular disease.
			To evaluate renal size and structure in patients with chronic kidney disease. In addition, renal artery Doppler echo may help to screen for the presence of renovascular disease.
		ABI	To screen for peripheral arterial obstructive disease (lower extremities).
		PWV	To evaluate the degree of arterial stiffness.

Laboratory tests Routine tests

Hemoglobin and hematocrit
Serum creatinine with estimated creatinine clearance (Cockroft-Gault formula) or glomerular filtration rate (Modification of Diet in Renal Disease formula)
Serum sodium, potassium and calcium
Fasting glucose and glycated hemoglobin A1c (HbA1c)
Total cholesterol, LDL-cholesterol, HDL-cholesterol and triglycerides
Serum uric acid
Urinalysis
Electrocardiogram
Chest X-ray


New-onset or uncontrolled HTN in adults
Condition:
1. Severe elevation of BP/ accelerated or malignant HTN
2. Pharmacologically resistant or induced HTN
3. Abrupt onset of HTN
4. Exacerbation of previously controlled HTN
5. Onset of diastolic HTN in older adults (age ≥ 65 y)
6. HMOD disproportionate to the duration or severity of the HTN
7. HTN manifesting at a younger age (age < 30 y)
8. HTN with clinical findings that suggest a specific disorder (unprovoked or excessive hypokalemia)
Screen for secondeary HTN

The overall prevalence of secondary hypertension is around 10% in hypertensive patients,- while in patients with resistant hypertension, the prevalence of secondary hypertension is significantly higher (up to 20 to 35%)

Patient characteristics that should be considered for primary aldosteronism screening

1. Persistent systolic/diastolic blood pressure > 150/110 mmHg
2. Resistant hypertension
3. Hypertension with spontaneous or diuretic-induced hypokalemia
4. Hypertension with adrenal mass
5. Early-onset hypertension (< 30 years old) or a family history of early-onset hypertension
6. Cerebral vascular accident at a younger age (< 40 years old)
7. Hypertension with first-degree relatives with primary aldosteronism

Renovascular disease and renal artery stenosis

Renal artery stenosis (RAS) results from narrowing of renal artery causing restricted kidney blood perfusion. The most common cause of RAS in adult patients is atherosclerotic disease. Nonatherosclerotic disease such as fibromuscular dysplasia is the most common cause of RAS in young adults.

Clinical conditions suggesting RAS include abdominal bruits, signs and symptoms of peripheral vascular disease, and multiple risk factors contributing to generalized atherosclerosis. Resistant hypertension, recent onset or progression of severe hypertension, recent renal function deterioration, acute renal function deterioration after ACE inhibitors or ARB usage, and flash pulmonary edema are other clinical

clues pointing to RAS.163 RAS could be screened with renal duplex and doppler ultrasound, abdominal MRA or CT, and further confirmatory tests

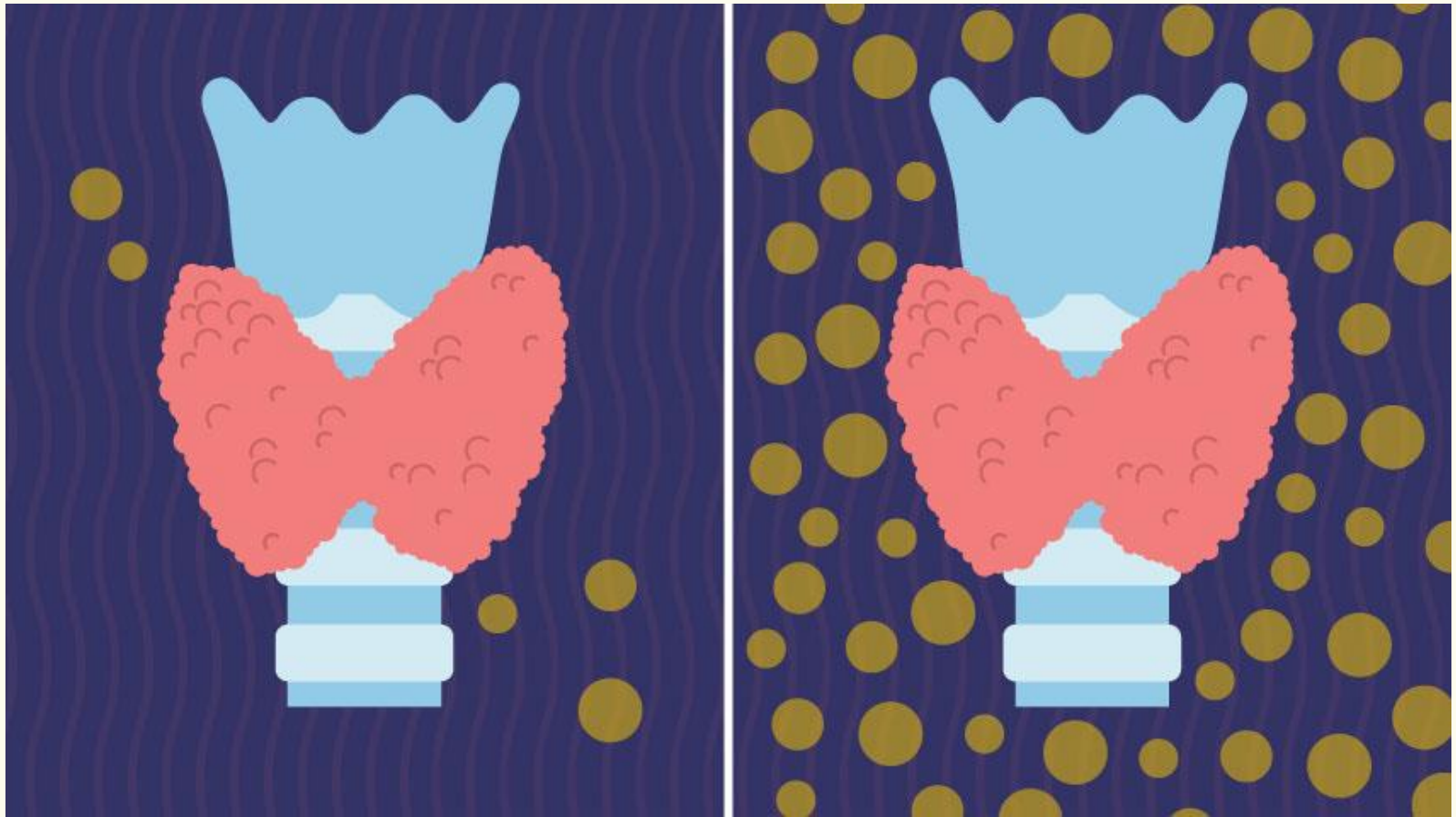
OSA is highly prevalent in hypertensive adults, especially in patients with resistant hypertension, with variant prevalence of 60-80% in different studies.

Clinically, patients with OSA often present with obesity, large neck, and macroglossia and complain of daytime somnolence, impaired concentration, snoring during sleep and witnessed apneas.

In addition, nocturnal non-dipper pattern, elevated daytime BP, tachycardia and/or bradycardia are frequently seen during ambulatory BP testing in OSA patients.

Hypertension is commonly found in 80% of patients with Cushing's syndrome. Long-term excessive endogenous or exogenous glucocorticoids can cause a typical body habitus with central obesity, facial plethora, buffalo hump, hirsutism, and purple striae. Overnight 1 mg dexamethasone suppression test and 24-hour urinary free cortisol excretion are both used as screening test

Both hypothyroidism and hyperthyroidism could cause secondary hypertension.



clinical findings that suggest a specific disorder

Alcohol

Amphetamines (eg, amphetamine, methylphenidate dexmethylphenidate, dextroamphetamine)

Angiogenesis inhibitor (eg, bevacizumab) and tyrosine kinase inhibitors (eg, sunitinib, sorafenib)

Antidepressants (eg, MAOIs, SNRIs, TCAs)

Atypical antipsychotics (eg, clozapine, olanzapine)

Caffeine

Decongestants (eg, phenylephrine, pseudoephedrine)

Erythropoietin

Herbal supplements (eg, Ma Huang [ephedra], St. John's wort [with MAOIs, yohimbine])

Immunosuppressants (eg, cyclosporine, tacrolimus)

Oral contraceptives

Nonsteroidal anti-inflammatory drugs

Recreational drugs (eg, "bath salts" [MDPV], cocaine, methamphetamine, etc.)

Systemic corticosteroids (eg, dexamethasone, fludrocortisone, methylprednisolone, prednisone, prednisolone)


Thankyou