Hypertension

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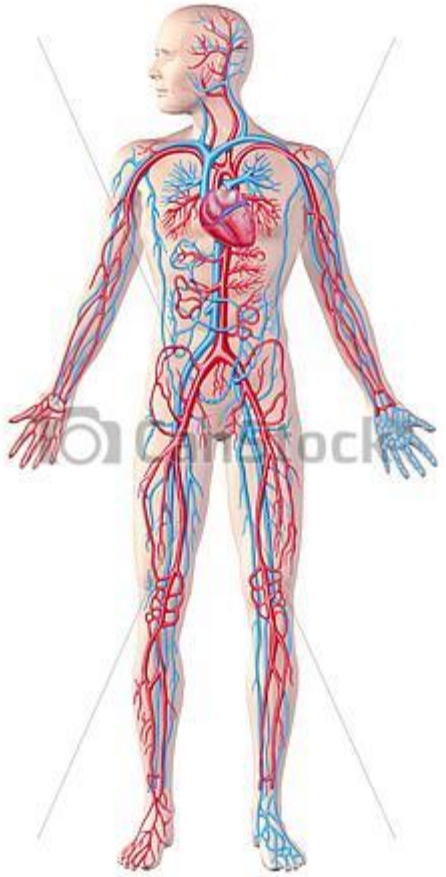
Blood pressure

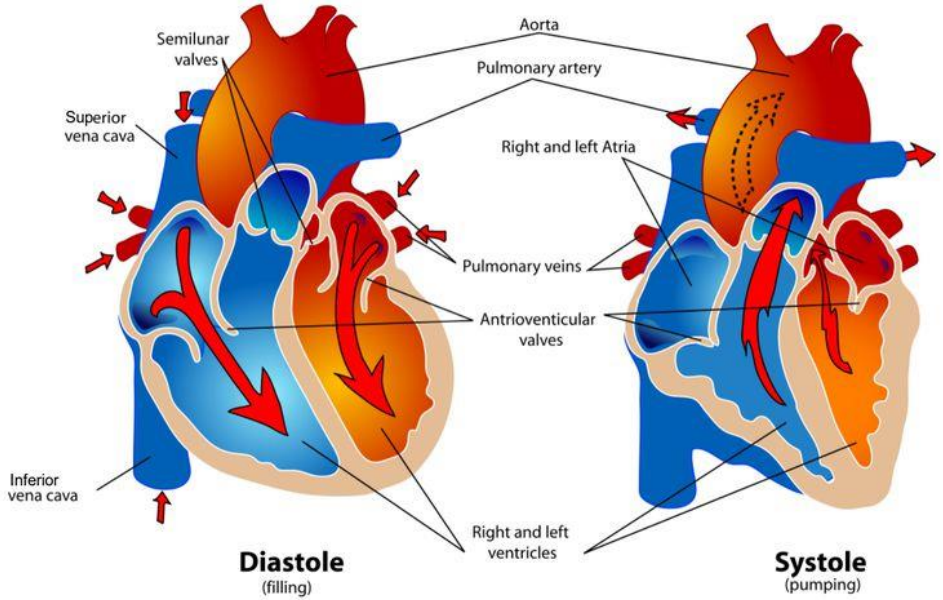
Pressure created by the heart as it pumps blood through the arteries and the circulatory system



- Blood pressure =
  Stroke volume x Peripheral resistance

Systolic and diastolic Blood Pressure

- Systolic = Pressure while heart is contracting
- Diastolic = Pressure while heart is relaxing between beats

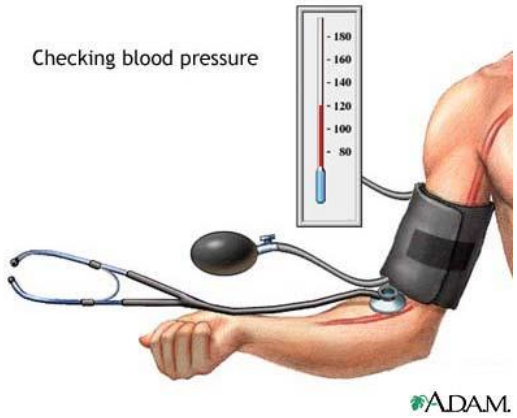


- Systolic Blood pressure depends mainly on Stroke volume and peripheral resistance

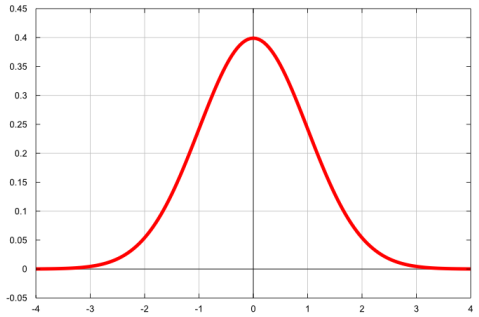
- Diastolic blood pressure depends mainly on peripheral resistance

Blood pressure measurement

- Avoid tobacco, caffeine 30 min before
- Should be seated in a quiet room for ~ 5min
- Avoid tight sleeves
- Arm muscles relaxed & forearm supported with cubital fossa at heart level
- Cuff size; to cover 2/3 of arm
- Inflate rapidly 30mm higher than disappearance of pulse
- Sys BP : Korotkoff sounds appear
- Dias BP: sounds disappear (phase V)
- Average of 2 or more readings
- Verify BP in contra-lateral arm



Blood pressure

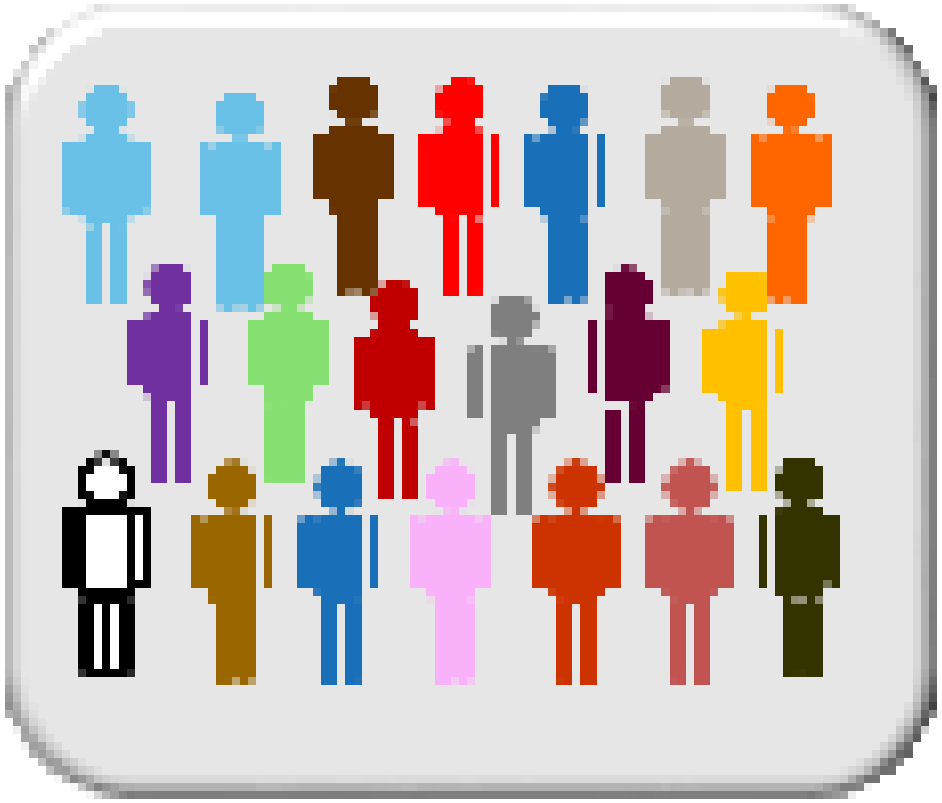


- Is normally distributed in the population (bell shaped)

- There is no natural cut-off point above which 'hypertension' definitively exists and below which it does not.

Blood pressure

- Is a characteristic of each individual
- Marked inter individual variation



Blood pressure

- Levels of blood pressure observed depends on the characteristics of the population under study
    - BP rises with age in industrialized countries
    - Rise in BP with age is more in males
    - Hypertension rates are higher among black population

Normal Blood Pressure

- Normal Blood Pressure 120/80mmHg

A Report of the American College of Cardiology /American Heart Association Task Force on Clinical Practice Guidelines

2017

Categories of High blood pressure in adults

BP Category	SBP		DBP
Normal	<120 mm Hg	and	<80 mm Hg
Elevated	120–129 mm Hg	and	<80 mm Hg
Hypertension			
Stage 1	130–139 mm Hg	or	80–89 mm Hg
Stage 2	≥140 mm Hg	or	≥90 mm Hg

*Individuals with SBP and DBP in 2 categories should be designated to the higher BP category.

BP indicates blood pressure (based on an average of ≥2 careful readings obtained on ≥2 occasions

Blood Pressure Categories

American Heart Association | American Stroke Association

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)		DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120

Hypertension

- When a patients SYS & DIA BPs fall into different categories, higher category should apply
- Check BP in every individual seeking health care
- Obtain average of 2 or more readings in 2 or more visits

Table 12. BP Patterns Based on Office and Out-of-Office Measurements

	Office/Clinic/ Healthcare Setting	Home/Nonhealthcare/ ABPM Setting
Normotensive	No hypertension	No hypertension
Sustained hypertension	Hypertension	Hypertension
Masked hypertension	No hypertension	Hypertension
White coat hypertension	Hypertension	No hypertension

ABPM indicates ambulatory blood pressure monitoring; and BP, blood pressure.

Automated BP measurements

- Devices for measuring blood pressure should be properly validated, maintained, regularly recalibrated, an appropriate cuff size for the person's arm is used

Automated BP measurements

- Automated devices may not measure blood pressure accurately if there is pulse irregularity (Eg: atrial fibrillation)

- Palpate the radial or brachial pulse before measuring blood pressure

- If pulse irregularity is present, measure blood pressure manually using direct auscultation over the brachial artery

Diagnosis of hypertension, measure blood pressure in both arms.

- BP difference between arms is more than 20 mmHg? : repeat the measurements.

- If the difference between arms remains more than 20 mmHg on the second measurement: measure subsequent blood pressures in the arm with the higher reading.

Postural dizziness: measure BP supine and standing

- If the systolic blood pressure falls by 20 mmHg or more when the person is standing:
- measure subsequent blood pressures with the person standing
- consider referral to specialist care if symptoms persist

24 hr Ambulatory BP monitoring (ABPM)

- Indications
  - Unusual variability of BP over same / different visits
  - Office HT in patients with low cardiovascular risk
  - Symptoms suggestive of hypotensive episodes
  - Hypertension resistant to drug treatment

Symptoms: Hypertension

- Usually NO SYMPTOMS!
  - "The Silent Killer"
  - May have:
    - Blurry vision
    - Chest Pain
    - Frequent urination at night
    - Headache (when severe)

Hypertension

- Is the commonest cardiovascular disorder
- Is one of the most important preventable causes of premature morbidity and mortality
- The risk associated with increasing blood pressure is continuous.

- Each 2 mmHg rise in systolic blood pressure is associated with a 7% increased risk of mortality from ischaemic heart disease and a 10% increased risk of mortality from stroke.

- Hypertension is a major risk factor for
  - ischaemic and haemorrhagic stroke
  - myocardial infarction
  - heart failure
  - chronic kidney disease,
  - cognitive decline and
  - premature death

Hypertension

- Hypertensive heart disease accounts

  ~ 10% cardiovascular deaths
- Lowering of
  - Systolic BP by 10-12mmHg
  - Diastolic BP by 5-6mmHg
    - Reduction of relative risk of stroke ~ 40%
    - Reduction of coronary disease ~ 15%

Untreated hypertension

- Is usually associated with a progressive rise in blood pressure

- Results in vascular and renal damage and that may cause a treatment-resistant state

Hypertension

- In Sri Lanka only ~ 20% of diagnosed hypertensives are adequately controlled
- Only 6-15% are evaluated for cardiovascular disease and target organ damage

Cause of hypertension

- 90-95%- essential hypertension;
  - no cause for high blood pressure can be found
  - Genetic, fetal, environmental, obesity, alcohol, salt

- 5-10%- secondary hypertension
  - Renal- accounts > 80% of 2ry HT
  - Endocrine
  - Cardiovascular
  - Pregnancy
  - Drugs

Hypertension

- Risk factors
  - Modifiable Risk Factors
    - Increased salt intake
    - Obesity
    - Alcohol
    - Stress
    - Lack of exercise

Hypertension

Non-modifiable Risk Factors

- Heredity
- Age
  - Men between age 35 and 50
  - Women after menopause
- Race
  - 1 out of every 3 African Americans
  - Higher incidence in non-Hispanic blacks and Mexican Americans

Hypertension

- Women and High Blood Pressure
  - Birth Control Pill
  - Pregnancy
  - Overweight
  - After Menopause
  - African Americans

Hypertension
Evaluation of the patient

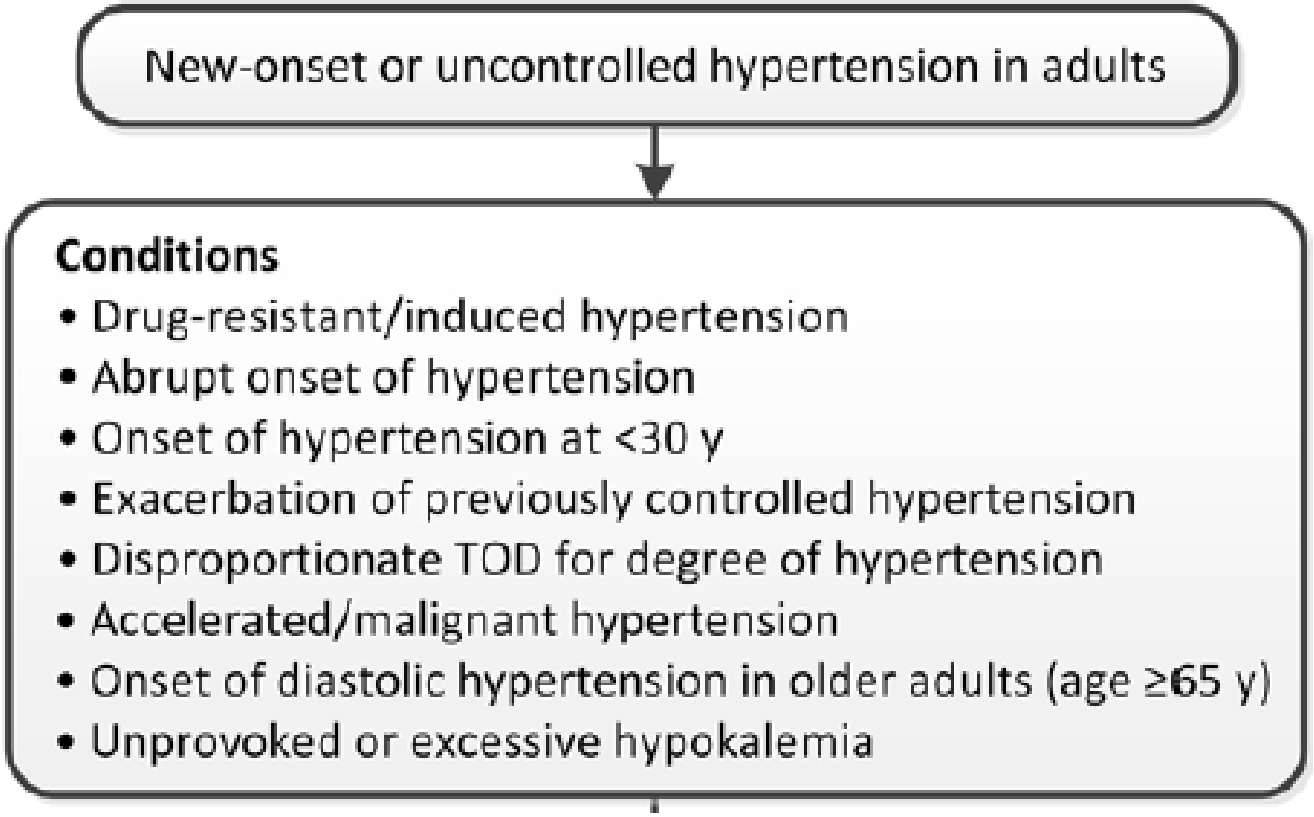
Hypertension - history

- Assessment of hypertensive state
- Symptoms suggestive of 2ry HT
- Symptoms suggestive of target organ damage
- Identify risk factors for cardiovascular disease
- Identify concurrent diseases
- Important past medical history
- Family history
- Relevant personal & social history

Hypertension - history

- Assessment of hypertensive state
  - Duration of hypertension
  - Previous levels of blood pressure
  - Treatment

Suspect 2ry hypertension- History



- TOD: target organ damage (eg, cerebrovascular disease, hypertensive retinopathy, left ventricular hypertrophy, left ventricular dysfunction, heart failure, coronary artery disease, chronic kidney disease, albuminuria, peripheral artery disease).

? Secondary hypertension

- Symptoms suggestive of 2ry HT
  - Episodes of sweating / headache /palpitations / anxiety
  - Episodes of muscle weakness and cramps
  - History suggestive of chronic renal disease, UTI, haematuria, analgesic abuse
  - Drug intake; steroids, OCP, nasal drops, cocaine, cold remedies, erythropoietin, alcohol

Target organ damage

- Symptoms suggestive of organ damage
  - Brain; TIAs, Strokes
  - Eye; transient blindness, blurring of vision
  - Heart; symptoms of heart failure, IHD
  - Kidney; symptoms of chronic renal disease
  - Peripheral arteries; intermittent claudication

Past medical history

- Coronary artery disease
- Cerebrovascular disease
- Peripheral vascular disease
- Diabetes
- Gout
- Dyslipidaemia
- Bronchospasm
- Sexual dysfunction
- Renal disease

Family history

- Hypertension
- Diabetes mellitus
- Dyslipidaemia
- Cardiovascular disease
- Renal disease
- Endocrine diseases

Personal & social history

- Smoking
- Alcohol
- Narcotic use
- Dietary habits
- HRT
- Exercise
- Factors influencing management and outcome of hypertension

Hypertension - examination

- Anthropometric measurements
- Signs suggestive of 2ry hypertension
- Signs of target organ damage

Anthropometric measurements

- Height & weight
- Body mass index Wt (kg)/ Ht $(m)^2$

Signs- 2ry hypertension

- Features of Cushing's / Acromegaly
- Skin stigmata of neurofibromatosis
- Features of hyper / hypothyroidism
- Enlarged kidneys (polycystic renal disease)
- Renal artery bruits (renal artery stenosis)
- Features of coarctation of aorta

Signs of target organ damage

- Fundoscopic examination
- Hypertrophy heart;
  - cardiomegaly, heaving apex, 3rd / 4th heart sounds
- Peripheral arterial disease
- Signs of chronic renal disease
- Signs of cerebrovascular disease

Hypertension - investigations

- Basic investigations
- Additional investigations
- Ixs for 2ry hypertension

Basic and optional Ixs for essential HT

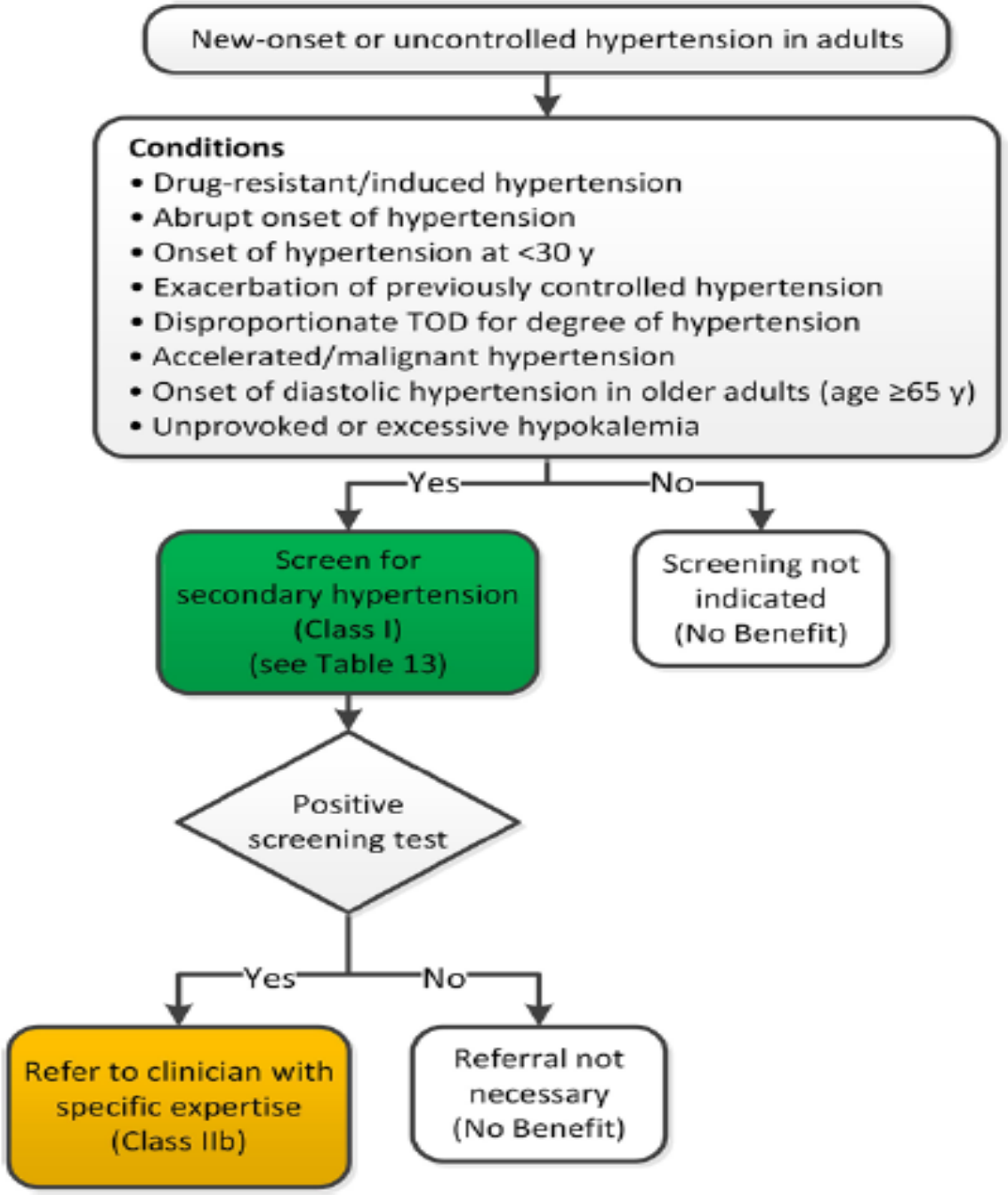
Basic testing	Fasting blood glucose*
	Complete blood count
	Lipid profile
	Serum creatinine with eGFR*
	Serum sodium, potassium, calcium*
	Thyroid-stimulating hormone
	Urinalysis
	Electrocardiogram
Optional testing	Echocardiogram
	Uric acid
	Urinary albumin to creatinine ratio

*May be included in a comprehensive metabolic panel.
eGFR indicates estimated glomerular filtration rate.

Basics Ixs to -Suspect 2ry hypertension

- Haemoglobin
  - Low or High
- UFR
  - RBCs, Albumin, Active sediment
- K
  - Hypokalaemia

2ry HT?


New-onset or uncontrolled hypertension in adults
Conditions
• Drug-resistant/induced hypertension
• Abrupt onset of hypertension
• Onset of hypertension at <30 y
• Exacerbation of previously controlled hypertension
• Disproportionate TOD for degree of hypertension
• Accelerated/malignant hypertension
• Onset of diastolic hypertension in older adults (age ≥65 y)
• Unprovoked or excessive hypokalemia
Yes
No
Screen for secondary hypertension (Class I) (see Table 13)
Screening not indicated (No Benefit)
Positive screening test
Yes
No
Refer to clinician with specific expertise (Class IIb)
Referral not necessary (No Benefit)

Hypertension

- Investigations for 2ry hypertension
  - Ixs for Cushings
  - Plasma renin, aldosterone levels
  - Catecholamine and metabolites
  - Thyroid function tests
  - Renal angiography
  - Aortography

Hypertension

- Risk stratification

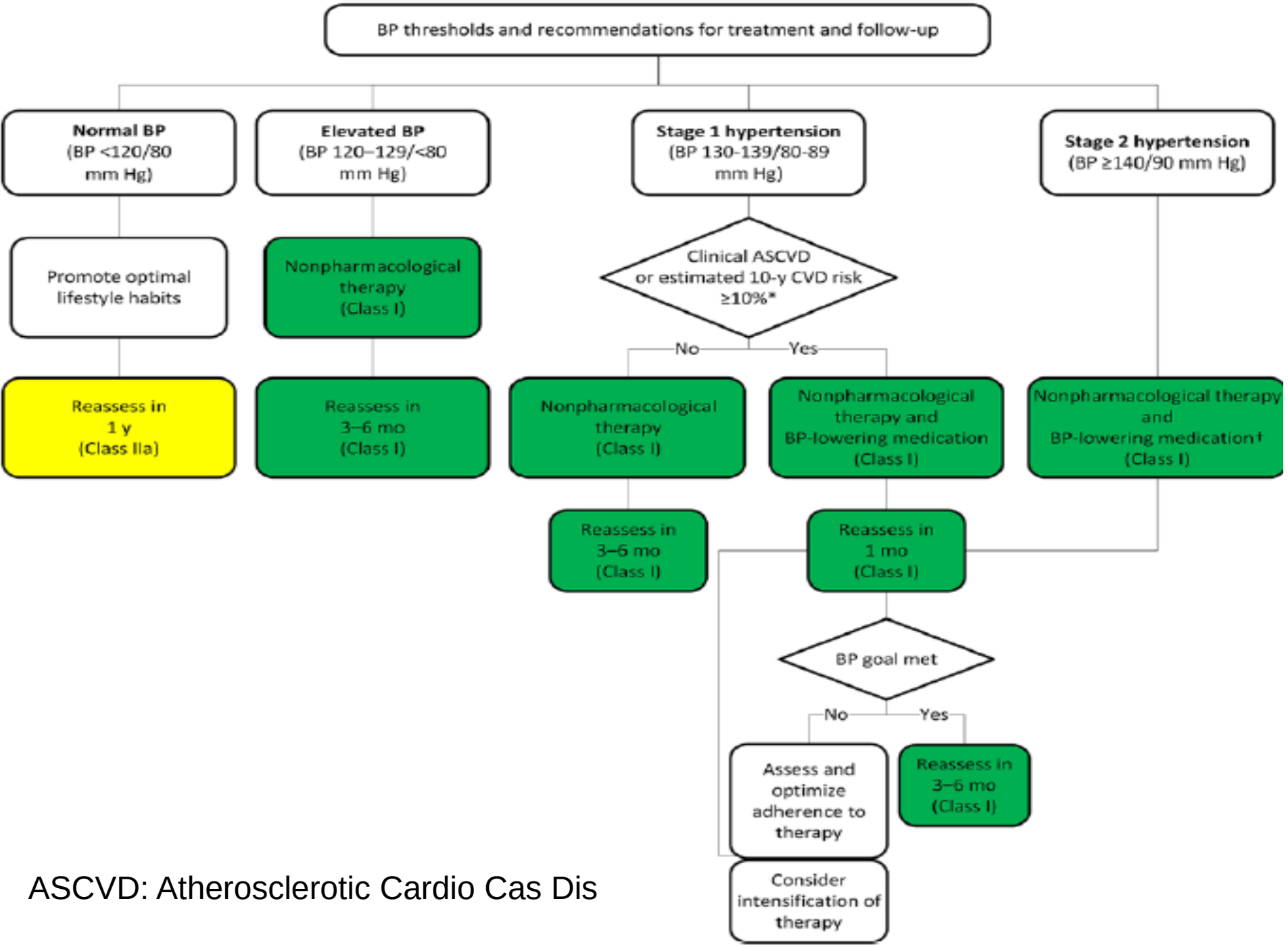
  – Decisions about management should not be based on level of BP alone

  Consider

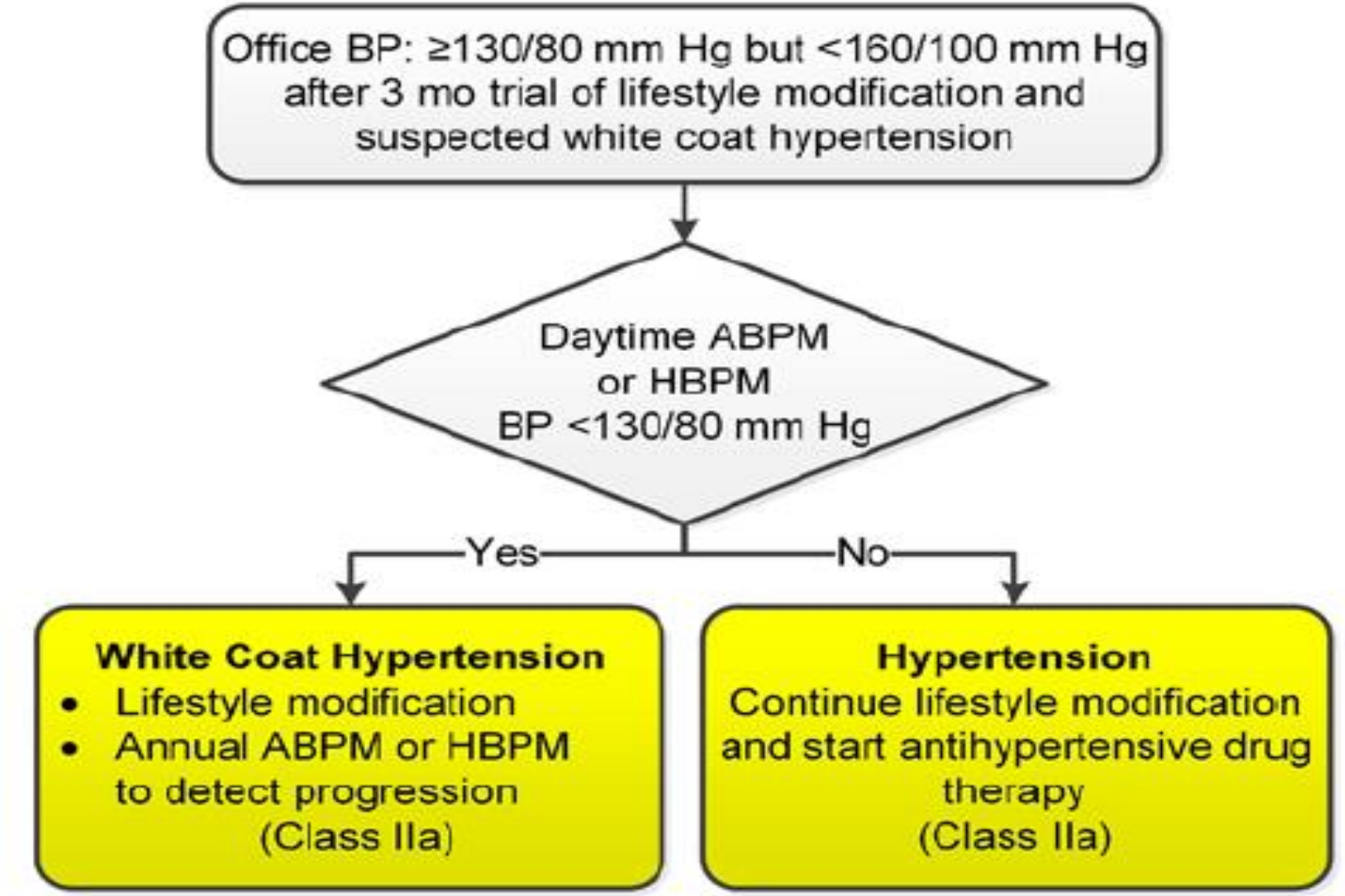
  – Presence of risk factors
  – Target organ damage
  – Associated diseases; DM, CVS, Renal
  – Personal, social and medical situations

Hypertension

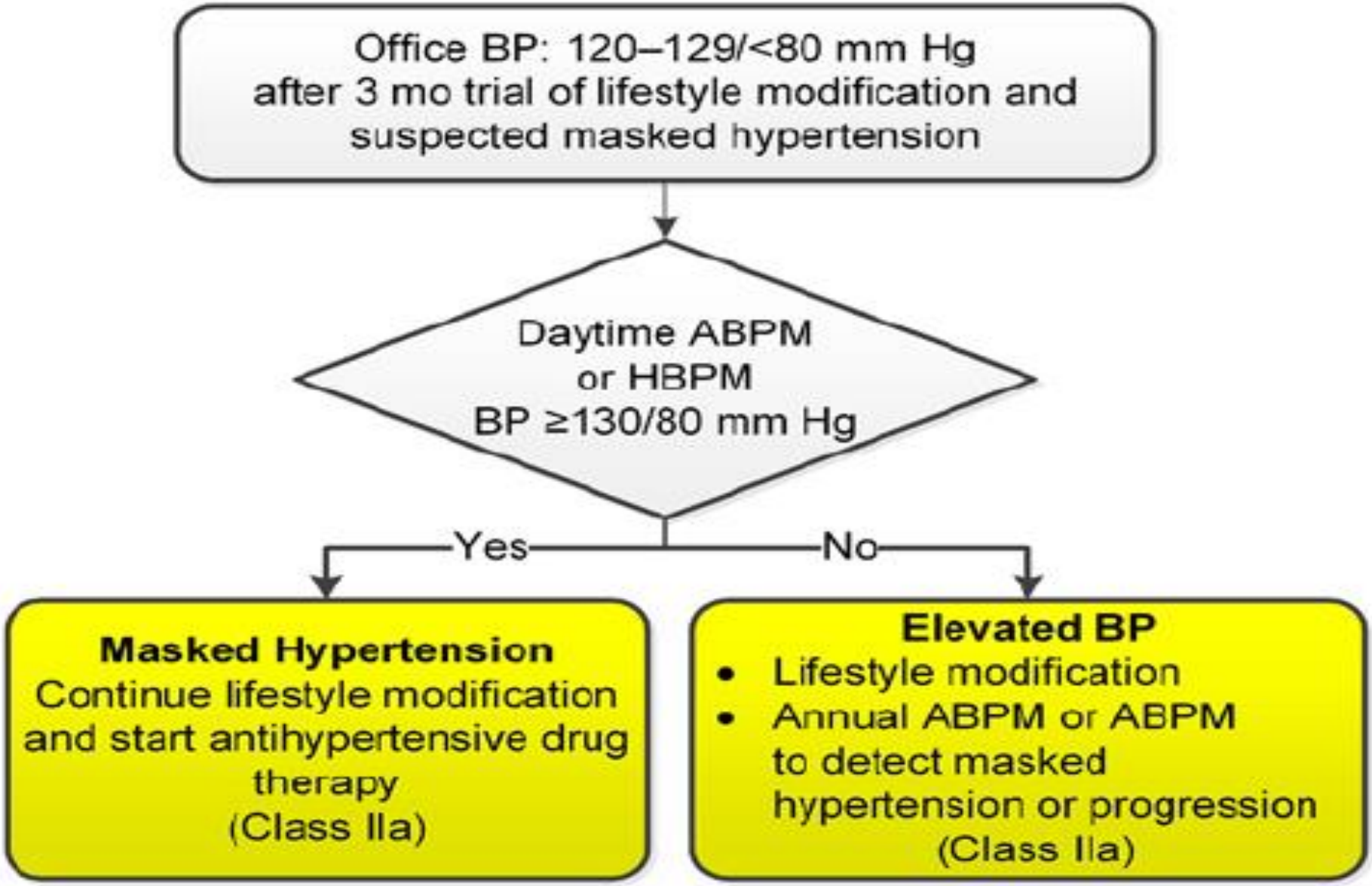
- Successful control of hypertension
  - Early diagnosis
  - Adequate treatment
  - Modification of global cardiovascular risk factors
  - Prevention of complications



ASCVD: Atherosclerotic Cardio Cas Dis



- ABPM: ambulatory BP monitoring
- HBPM: Home based pressure monitoring


Office BP: 120–129/<80 mm Hg
after 3 mo trial of lifestyle modification and
suspected masked hypertension
Daytime ABPM
or HBPM
BP ≥130/80 mm Hg
Yes
No
Masked Hypertension
Continue lifestyle modification
and start antihypertensive drug
therapy
(Class IIa)
Elevated BP
• Lifestyle modification
• Annual ABPM or ABPM
to detect masked
hypertension or progression
(Class IIa)

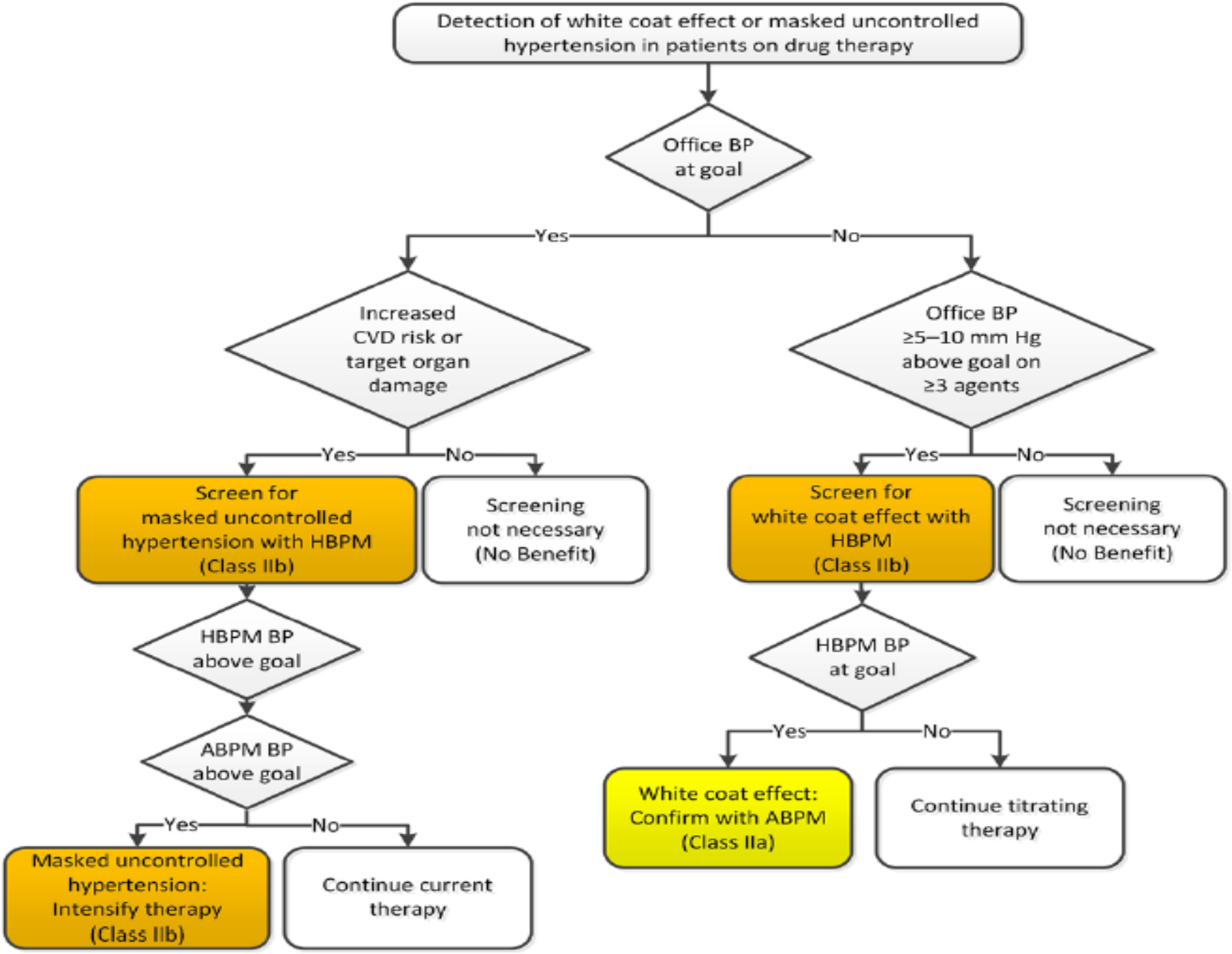
Lifestyle modifications

Table 15. Best Proven Nonpharmacological Interventions for Prevention and Treatment of Hypertension*

	Nonpharmacological Intervention	Dose	Approximate Impact on SBP		
			Hypertension	Normotension	Reference
Weight loss	Weight/body fat	Best goal is ideal body weight, but aim for at least a 1-kg reduction in body weight for most adults who are overweight. Expect about 1 mm Hg for every 1-kg reduction in body weight.	–5 mm Hg	–2/3 mm Hg	S6-1
Healthy diet	DASH dietary pattern	Consume a diet rich in fruits, vegetables, whole grains, and low-fat dairy products, with reduced content of saturated and total fat.	–11 mm Hg	–3 mm Hg	S6-6,S6-7
Reduced intake of dietary sodium	Dietary sodium	Optimal goal is <1500 mg/d, but aim for at least a 1000-mg/d reduction in most adults.	–5/6 mm Hg	–2/3 mm Hg	S6-9,S6-10
Enhanced intake of dietary potassium	Dietary potassium	Aim for 3500–5000 mg/d, preferably by consumption of a diet rich in potassium.	–4/5 mm Hg	–2 mm Hg	S6-13
Physical activity	Aerobic	90–150 min/wk 65%–75% heart rate reserve	–5/8 mm Hg	–2/4 mm Hg	S6-18,S6-22
	Dynamic resistance	90–150 min/wk 50%–80% 1 rep maximum 6 exercises, 3 sets/exercise, 10 repetitions/set	–4 mm Hg	–2 mm Hg	S6-18
	Isometric resistance	4 × 2 min (hand grip), 1 min rest between exercises, 30%–40% maximum voluntary contraction, 3 sessions/wk 8–10 wk	–5 mm Hg	–4 mm Hg	S6-19,S6-30
Moderation in alcohol intake	Alcohol consumption	In individuals who drink alcohol, reduce alcohol† to: Men: ≤2 drinks daily Women: ≤1 drink daily	–4 mm Hg	–3 mm Hg	S6-22–S6-24

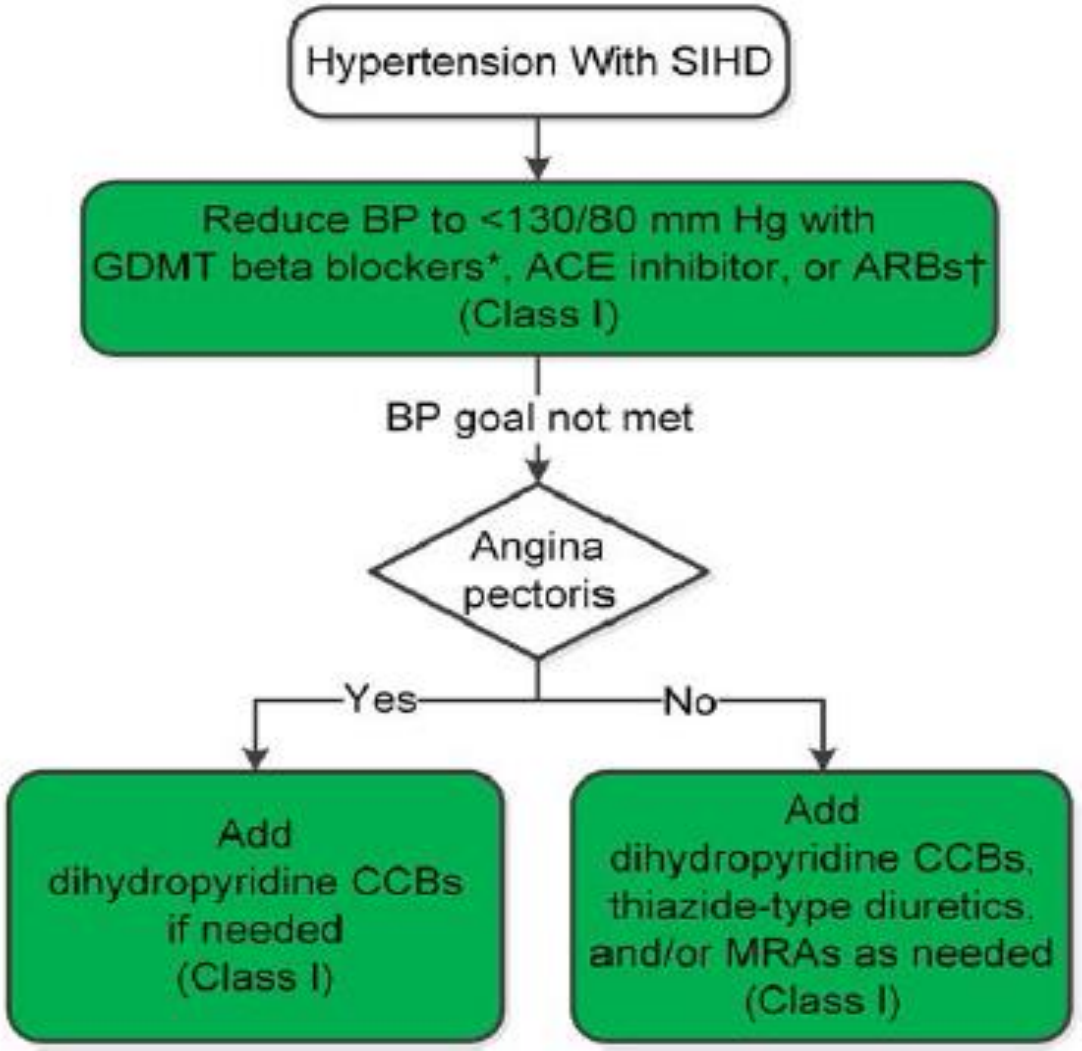
Patients already on anti HT Rx

- Detected uncontrolled BP during visits


Detection of white coat effect or masked uncontrolled hypertension in patients on drug therapy
Office BP at goal
Yes
No
Increased CVD risk or target organ damage
Office BP ≥5–10 mm Hg above goal on ≥3 agents
Yes
No
Yes
No
Screen for masked uncontrolled hypertension with HBPM (Class IIb)
Screening not necessary (No Benefit)
Screen for white coat effect with HBPM (Class IIb)
Screening not necessary (No Benefit)
HBPM BP above goal
HBPM BP at goal
ABPM BP above goal
Yes
No
Yes
No
Masked uncontrolled hypertension: Intensify therapy (Class IIb)
Continue current therapy
White coat effect: Confirm with ABPM (Class IIa)
Continue titrating therapy

HT in illness

Management of hypertension in patients with Stable IHD



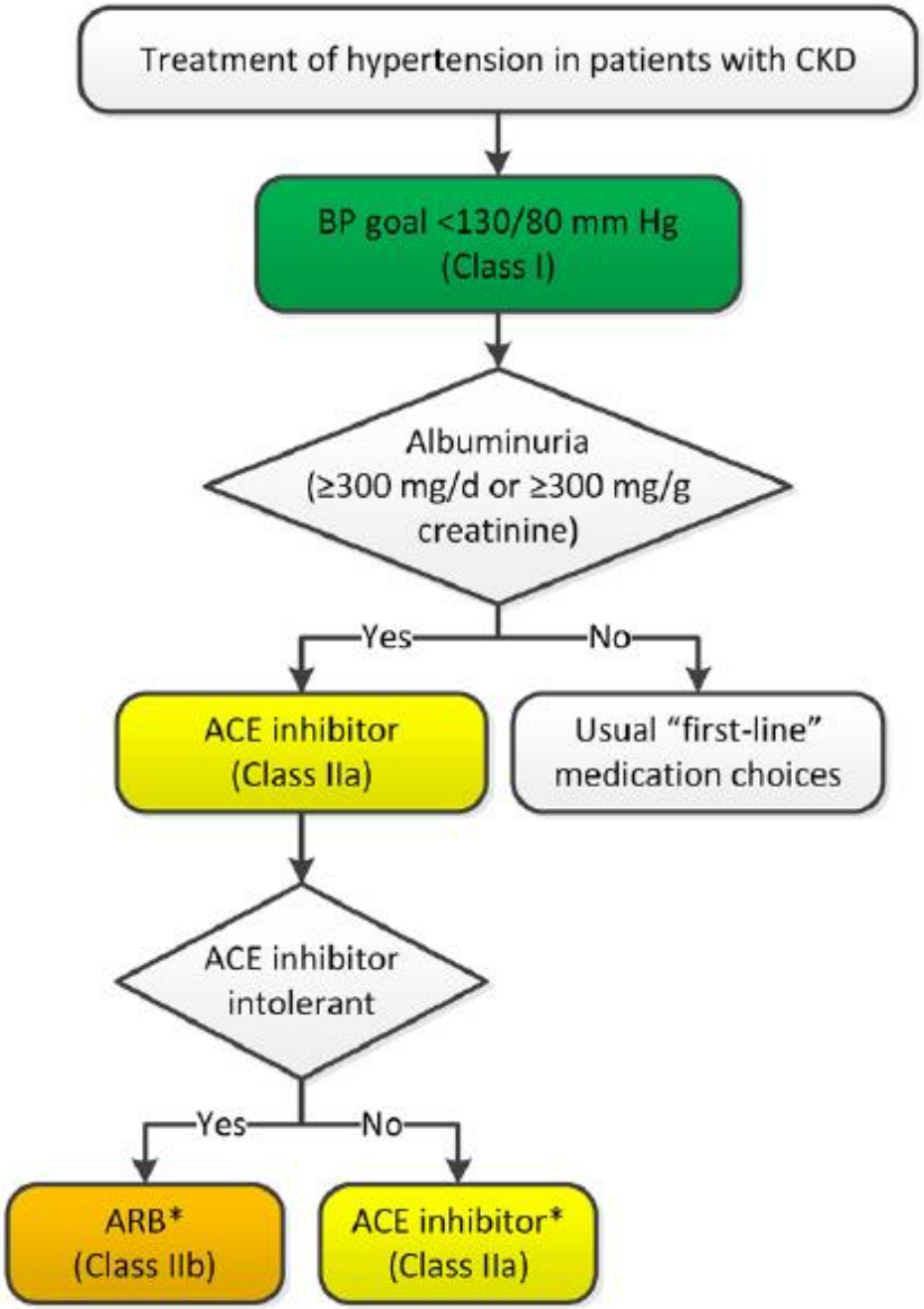
ACE indicates angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker;

Management of hypertension in patients with Stable IHD

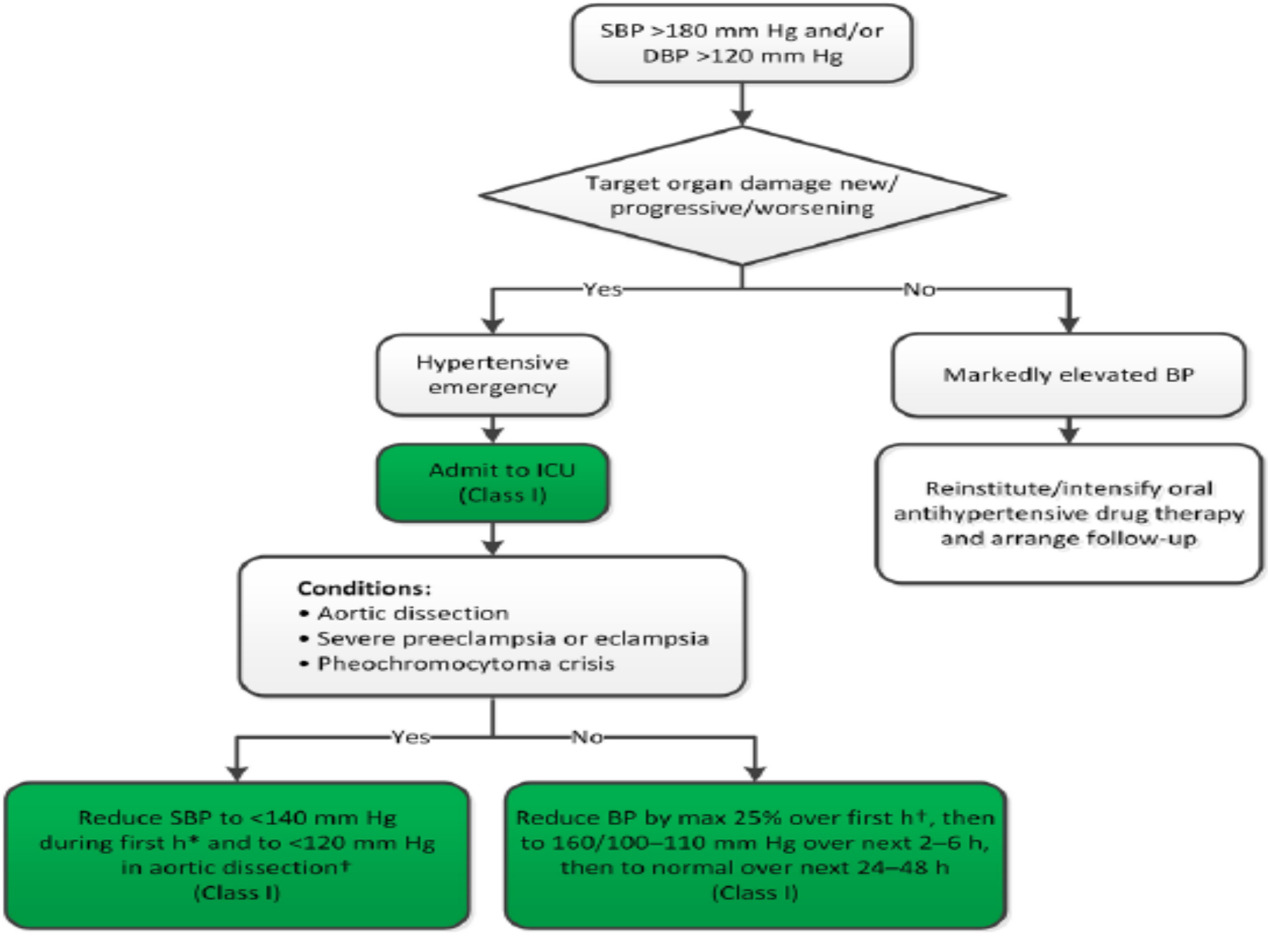
- Beta blockers for BP control or relief of angina include carvedilol, metoprolol tartrate, metoprolol succinate, nadolol, bisoprolol, propranolol, and timolol. Avoid beta blockers with intrinsic sympathomimetic activity.

- The beta blocker atenolol should not be used because it is less effective than placebo in reducing cardiovascular events.

HT in CKD

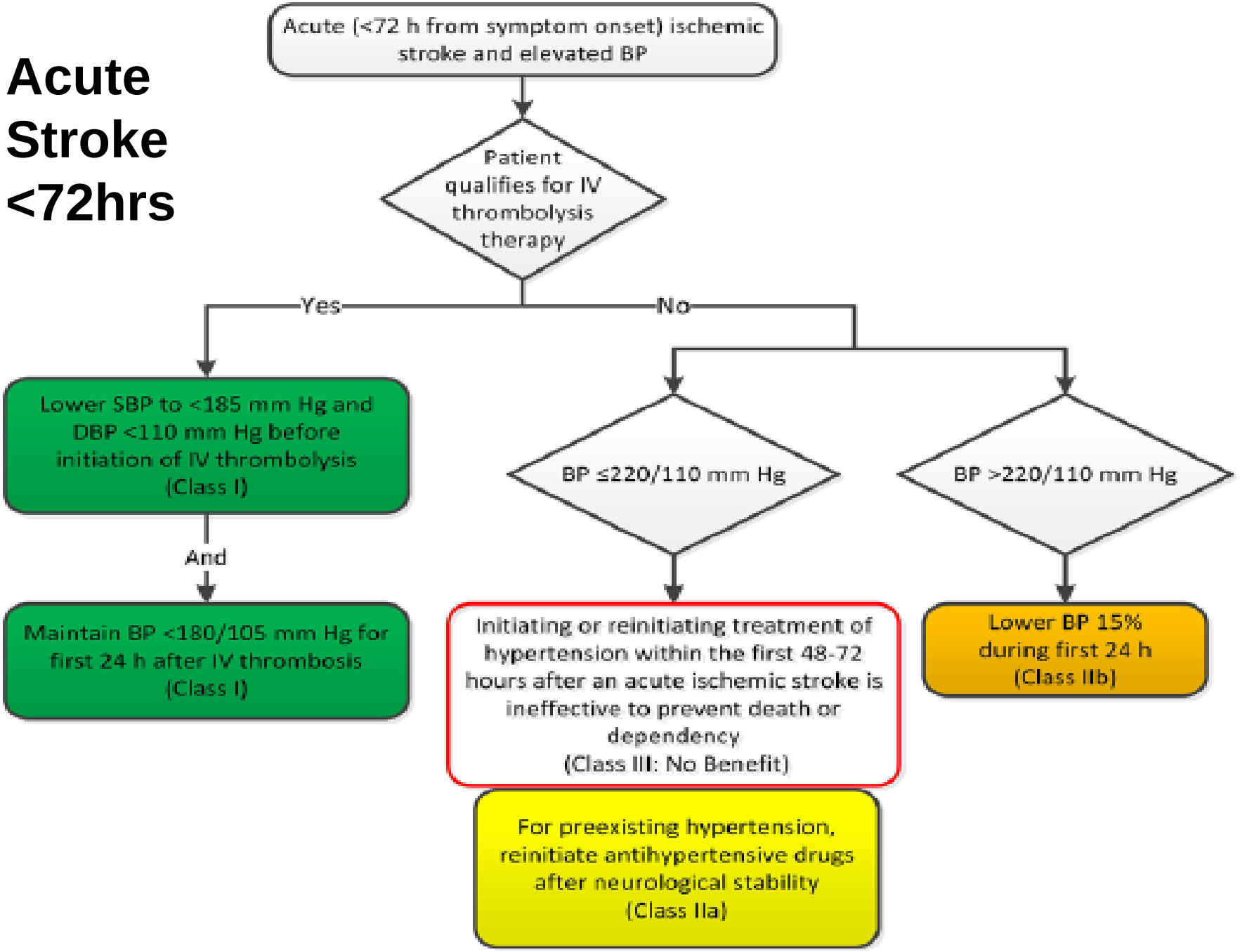

Treatment of hypertension in patients with CKD
BP goal <130/80 mm Hg (Class I)
Albuminuria (≥300 mg/d or ≥300 mg/g creatinine)
Yes
No
ACE inhibitor (Class IIa)
Usual "first-line" medication choices
ACE inhibitor intolerant
Yes
No
ARB* (Class IIb)
ACE inhibitor* (Class IIa)

Hypertensive emergencies

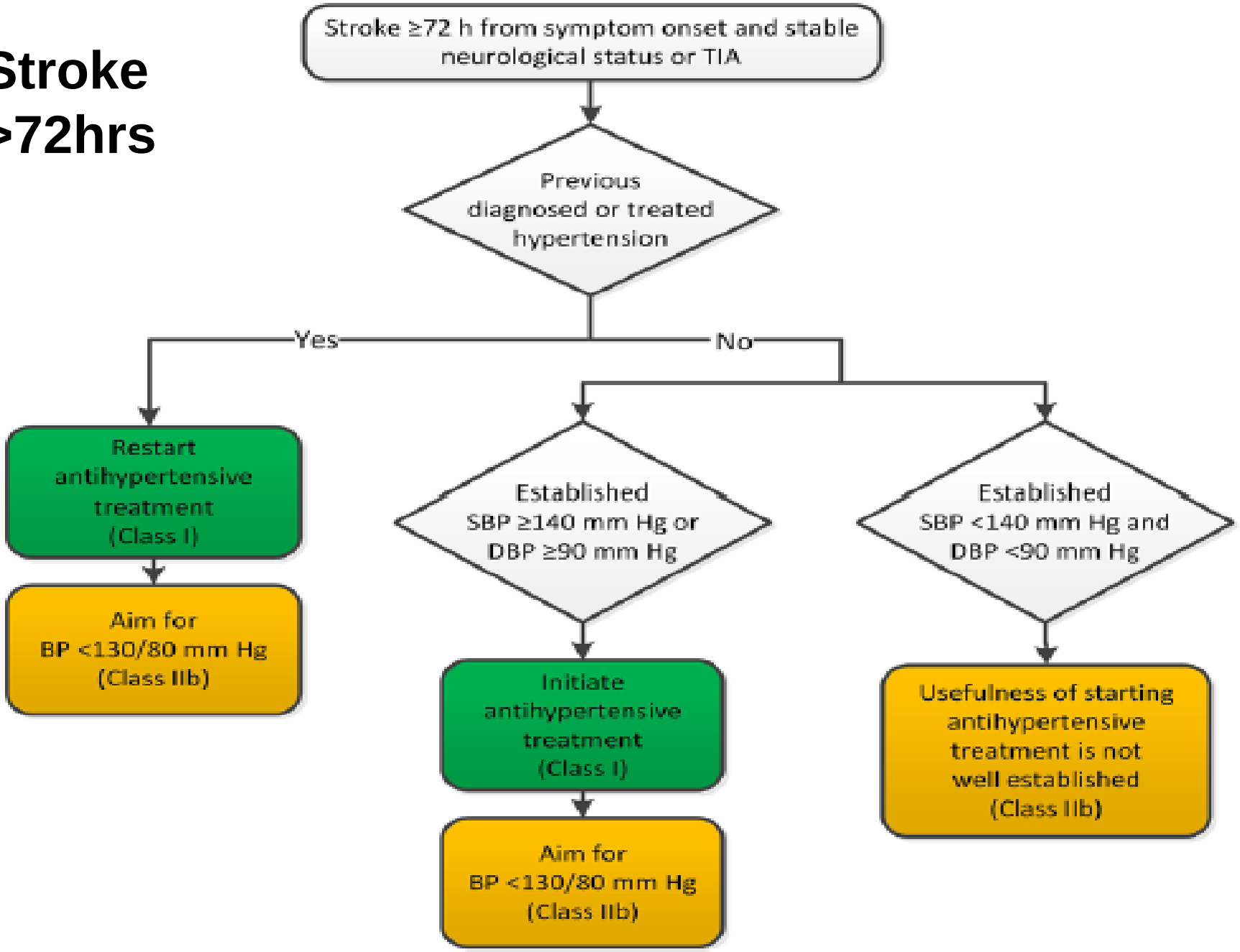

SBP >180 mm Hg and/or DBP >120 mm Hg
Target organ damage new/ progressive/worsening
Yes
No
Hypertensive emergency
Markedly elevated BP
Admit to ICU (Class I)
Reinstitute/intensify oral antihypertensive drug therapy and arrange follow-up
Conditions:
• Aortic dissection
• Severe preeclampsia or eclampsia
• Pheochromocytoma crisis
Yes
No
Reduce SBP to <140 mm Hg during first h* and to <120 mm Hg in aortic dissection† (Class I)
Reduce BP by max 25% over first h†, then to 160/100–110 mm Hg over next 2–6 h, then to normal over next 24–48 h (Class I)

Ischaemic stroke vs HT

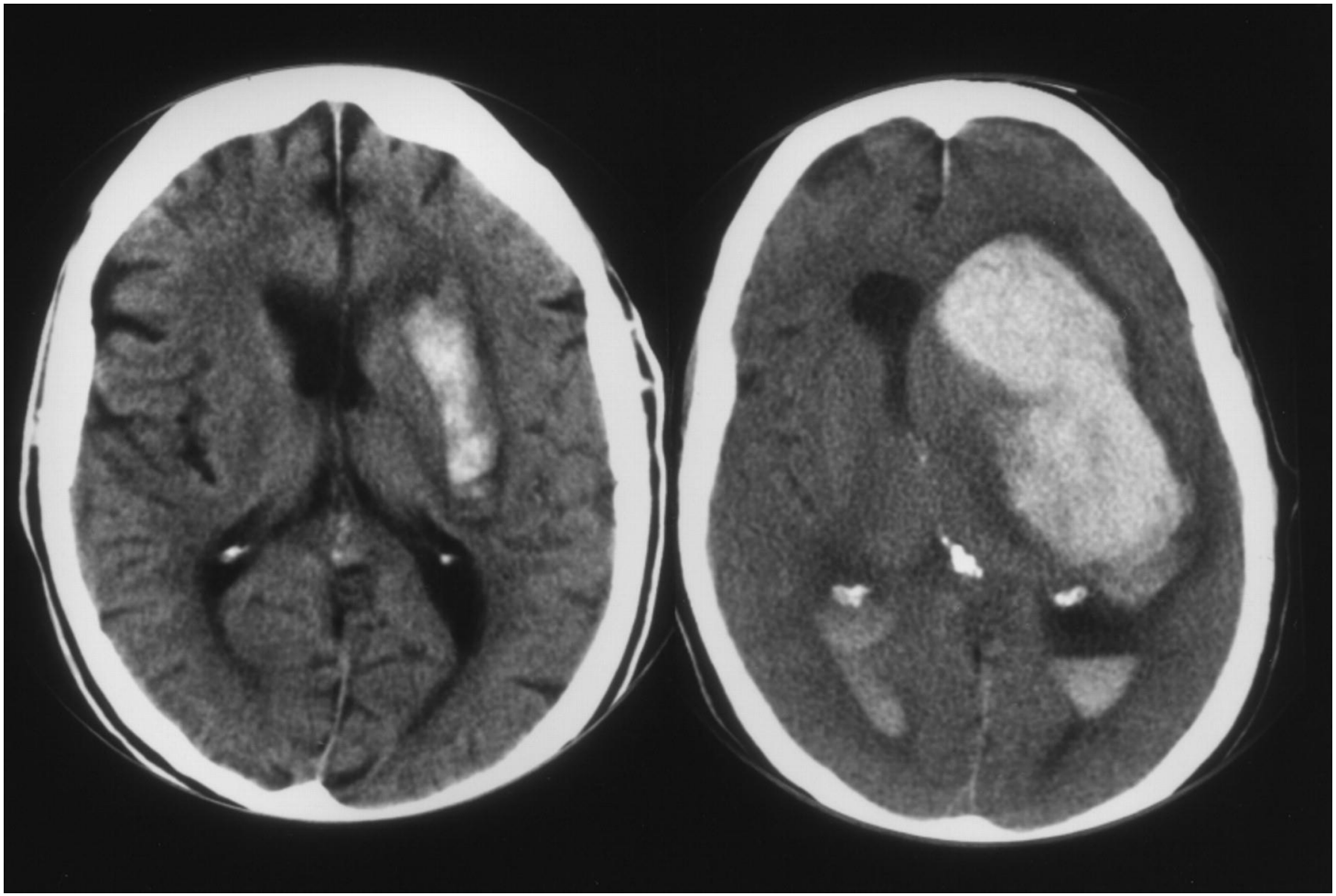
Acute Stroke <72hrs

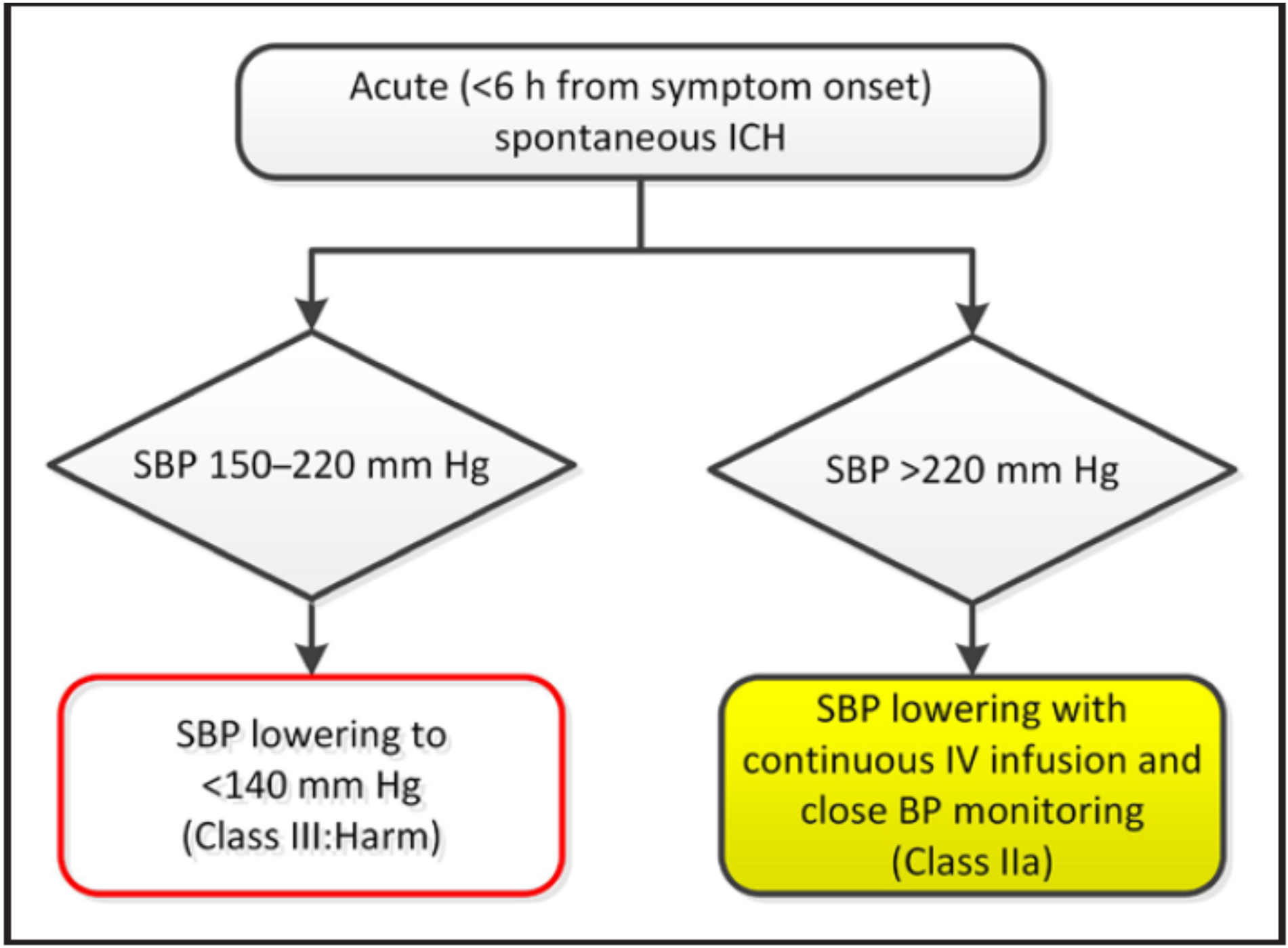


Stroke >72hrs



Haemorrhagic stroke




Acute (<6 h from symptom onset) spontaneous ICH
SBP 150–220 mm Hg
SBP >220 mm Hg
SBP lowering to <140 mm Hg (Class III:Harm)
SBP lowering with continuous IV infusion and close BP monitoring (Class IIa)

Drugs in the Mx of Hypertension
&
Hypertensive Emergencies