Arterial Hypertension

LECTURE IN INTERNAL MEDICINE FOR V COURSE STUDENTS

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Plan of the Lecture

- Definition
- Epidemiology
- Risk factors
- Etiology
- Mechanisms
- Adaptation to arterial hypertension
- Classification
- Clinical investigation
- Diagnosis
- Treatment
- Prognosis
- Prophylaxis
- Abbreviations
- Diagnostic guidelines

https://edc2.healthtap.com/ht-staging/user_answer/avatars/926769/large/open-uri20130313-20044-zvrt8s.jpeg?1386577375

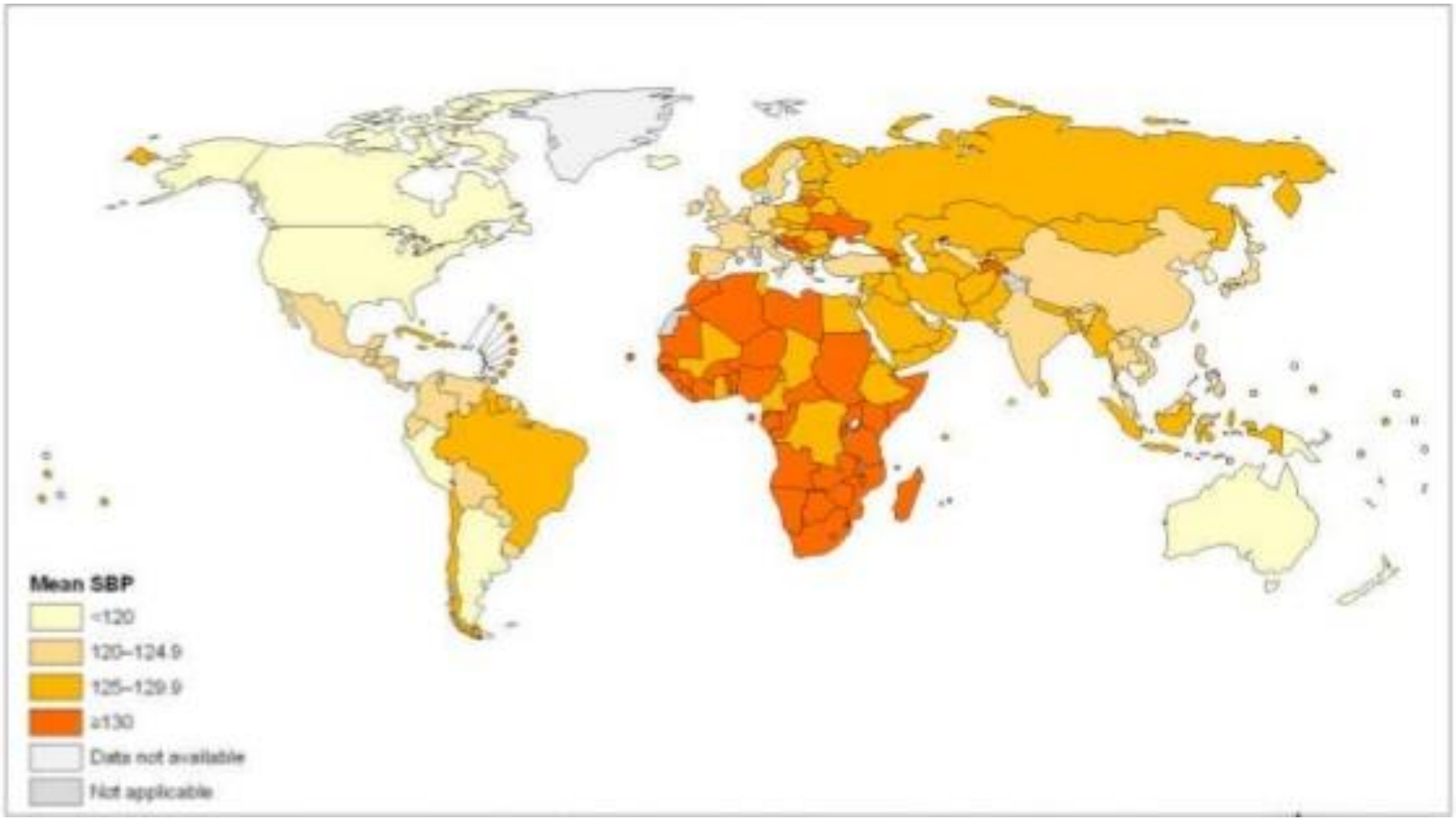
Definition

- Hypertension (HT), also known as high blood (BP) pressure, is a long term medical condition in which the blood pressure in the arteries is persistently elevated
- HT defined as values >140 mmHg systolic BP (SBP) and/or >90 mmHg diastolic BP (DBP), based on the evidence from randomized control trials (RCTs) that in patients with these BP values treatment-induced BP reductions are beneficial

https://en.wikipedia.org/wiki/Hypertension

Epidemiology 1

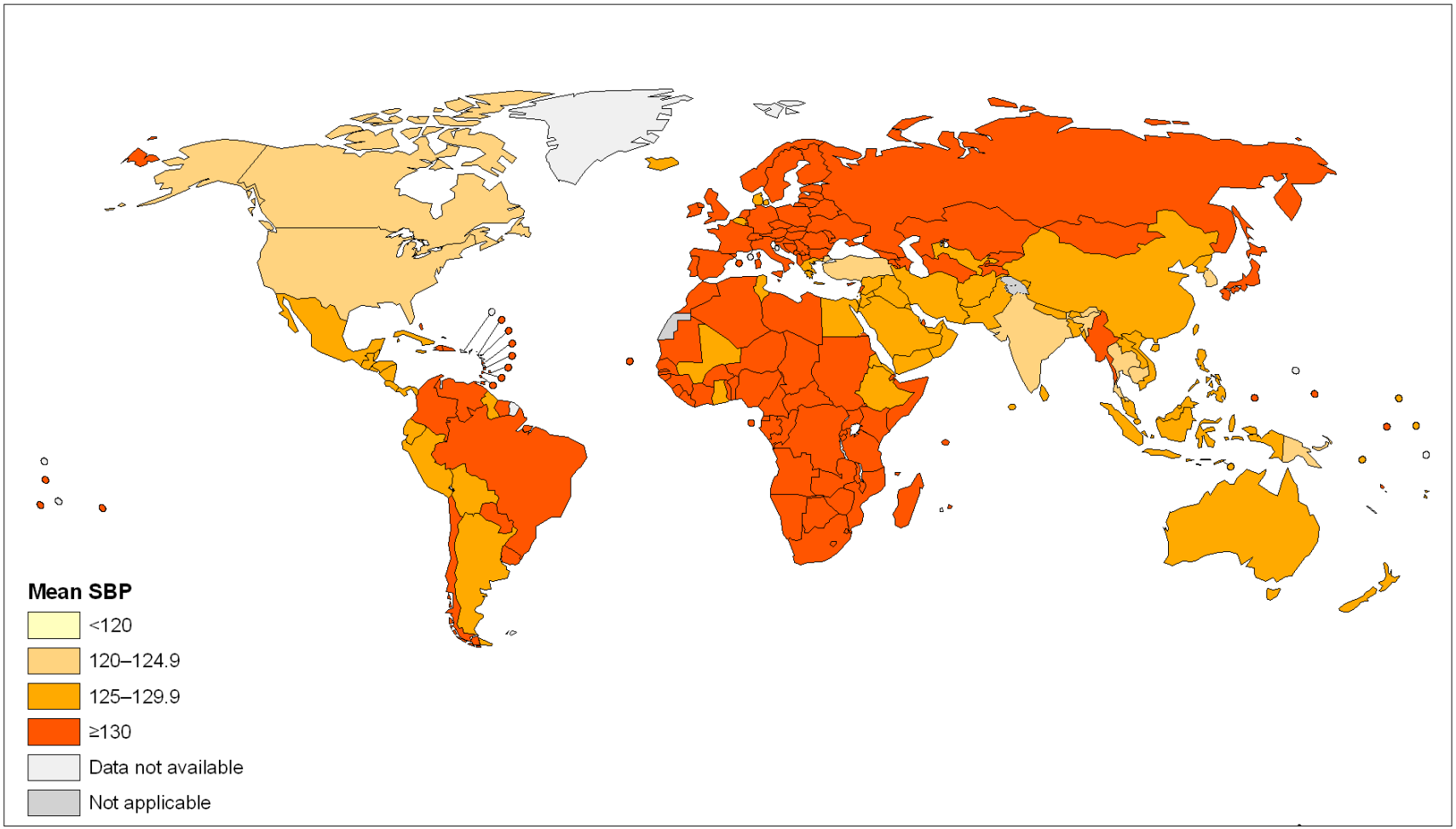
(Mean Systolic Blood Pressure, Females, Ages 25+)



http://image.slidesharecdn.com/bppowerpointwhd2013final-130411023015-phpapp02/95/blood-pressure-world-health-day-2013-13-638.jpg?cb=1365647502

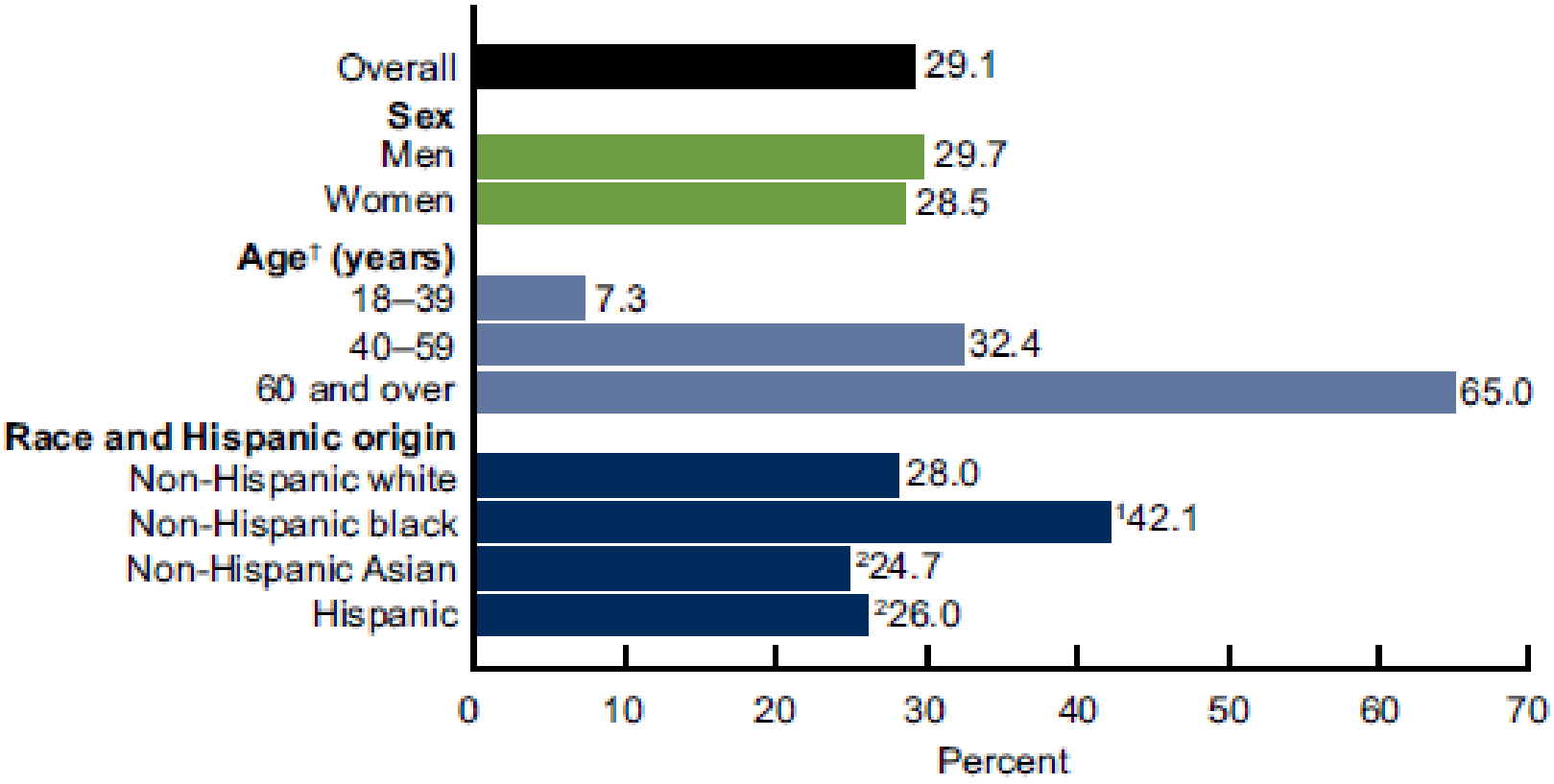
Epidemiology 2

(Mean Systolic Blood Pressure, Males, Ages 25+)



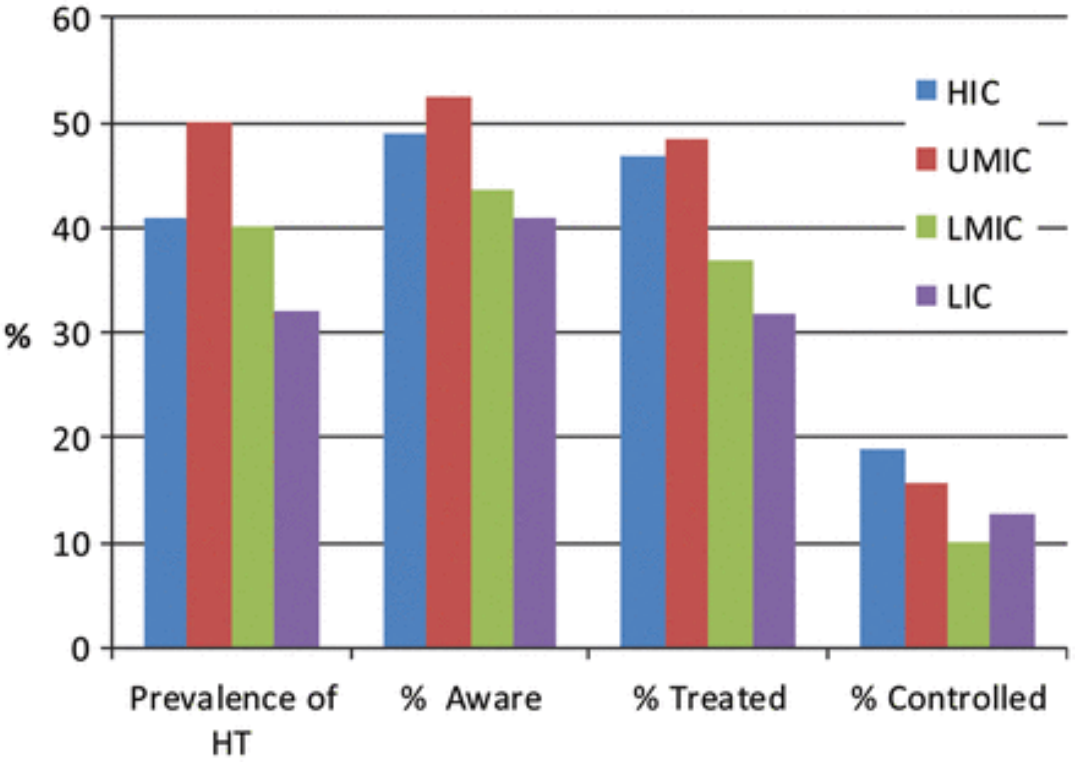
http://www.bettycjung.net/BG2013/GlobalBPmen2008.png

Epidemiology 3
(Prevalence of High Blood Pressure in USA)



cdc.gov

Epidemiology 4



Percent prevalence, awareness, treatment, and control of HT in urban and rural communities from high-, middle-, and low-income countries. HT controlled is defined as the proportion of participants with HT with SBP < 140 and DBP < 90 mmHg. HIC, high-income countries; UMIC, upper middle-income countries; LMIC, lower middle-income countries; LIC, low-income countries

http://eurheartj.oxfordjournals.org/content/35/6/353

Risk Factors

healthy-ojas.com/assets/highbp/highbp-risk-factors.jpg

Etiology 1

- HT is classified as either primary (essential) or secondary
- About 90–95% of cases are primary, defined as high blood pressure due to nonspecific lifestyle and genetic factors (lifestyle factors that increase the risk include excess salt, excess body weight, smoking, and alcohol)
- The remaining 5–10% of cases are categorized as secondary HT, defined as HT due to an identifiable cause, such as chronic kidney disease, narrowing of the kidney arteries, an endocrine disorder, or the use of birth control pills

https://en.wikipedia.org/wiki/Hypertension

Etiology (?) 2

http://www.dietkundali.com/images/hypertension.jpg

Mechanisms 1
(The Control Of Blood Pressure Systems)

- Neurogenic
- Renin-angiotensin
- Atrial natriuretic peptide
- Eicosanoids
- Kallikrein-kinin
- Endothelial
- Adrenal steroids
- Renomedullary vasodepression
- Sodium and water excretion

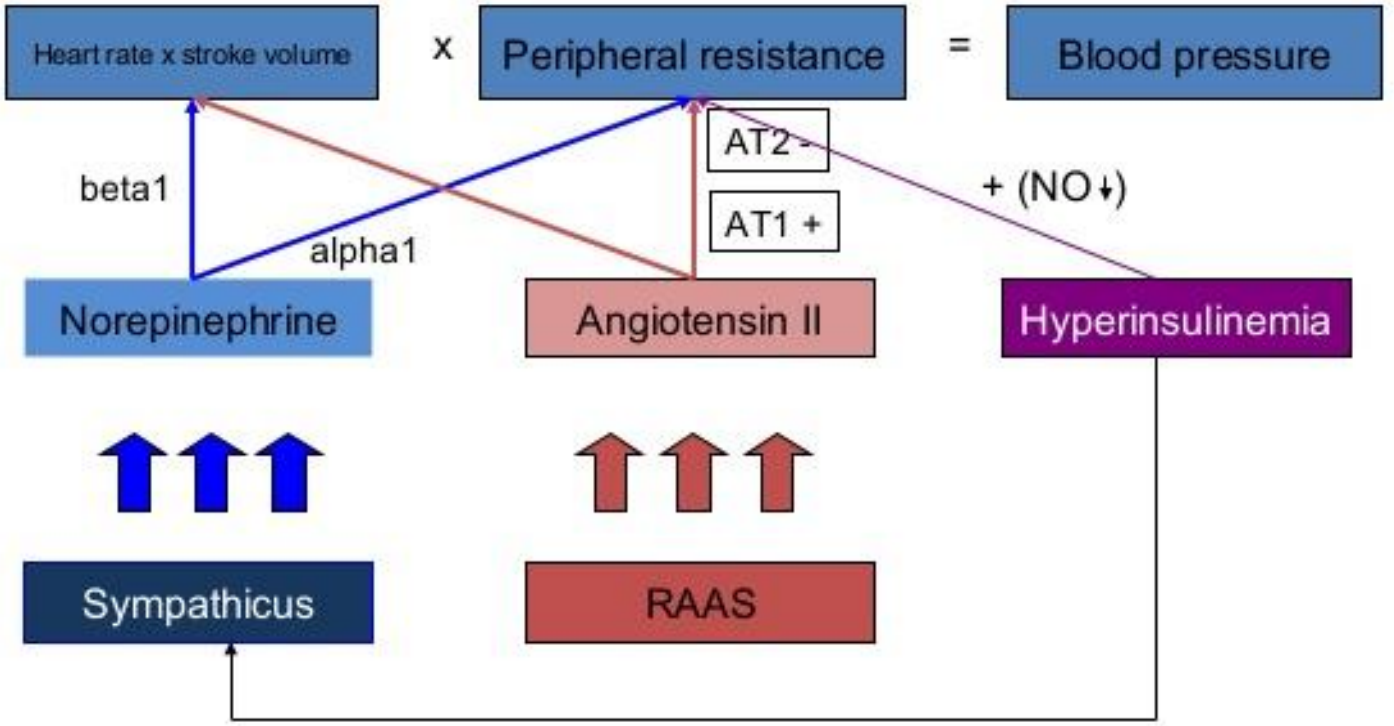
http://ceaccp.oxfordjournals.org/content/4/3/71.full

Mechanisms 2
(Multifactorial And Highly Complex)

- Humoral mediators
- Vascular reactivity
- Circulating blood volume
- Vascular caliber
- Blood viscosity
- Cardiac output
- Blood vessel elasticity
- Neural stimulation

http://emedicine.medscape.com/article/1937383-overview

Mechanisms 3
(Key Points)



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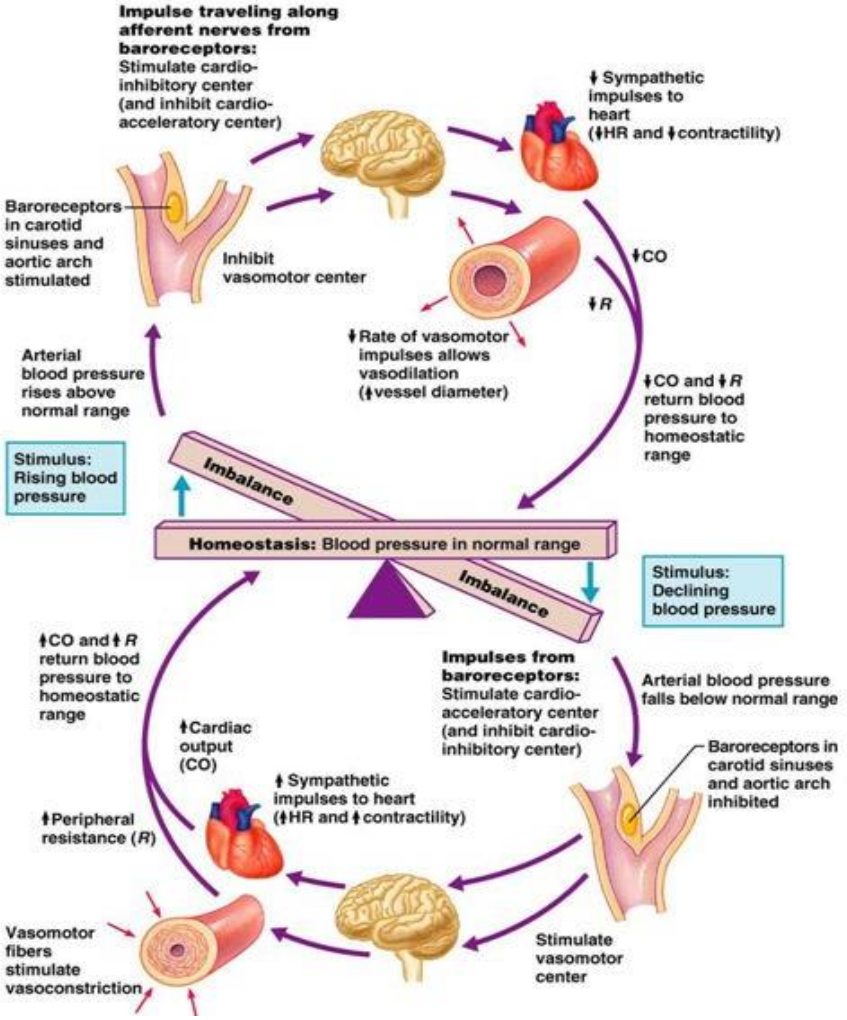
Mechanisms 4
(Short Term Nervous)

- Baroreceptor initiated reflex
  - located at carotid sinuses and aortic arch
  - monitors blood pressure
  - regulates the activity of the sympathetic nervous system (vascular tone)



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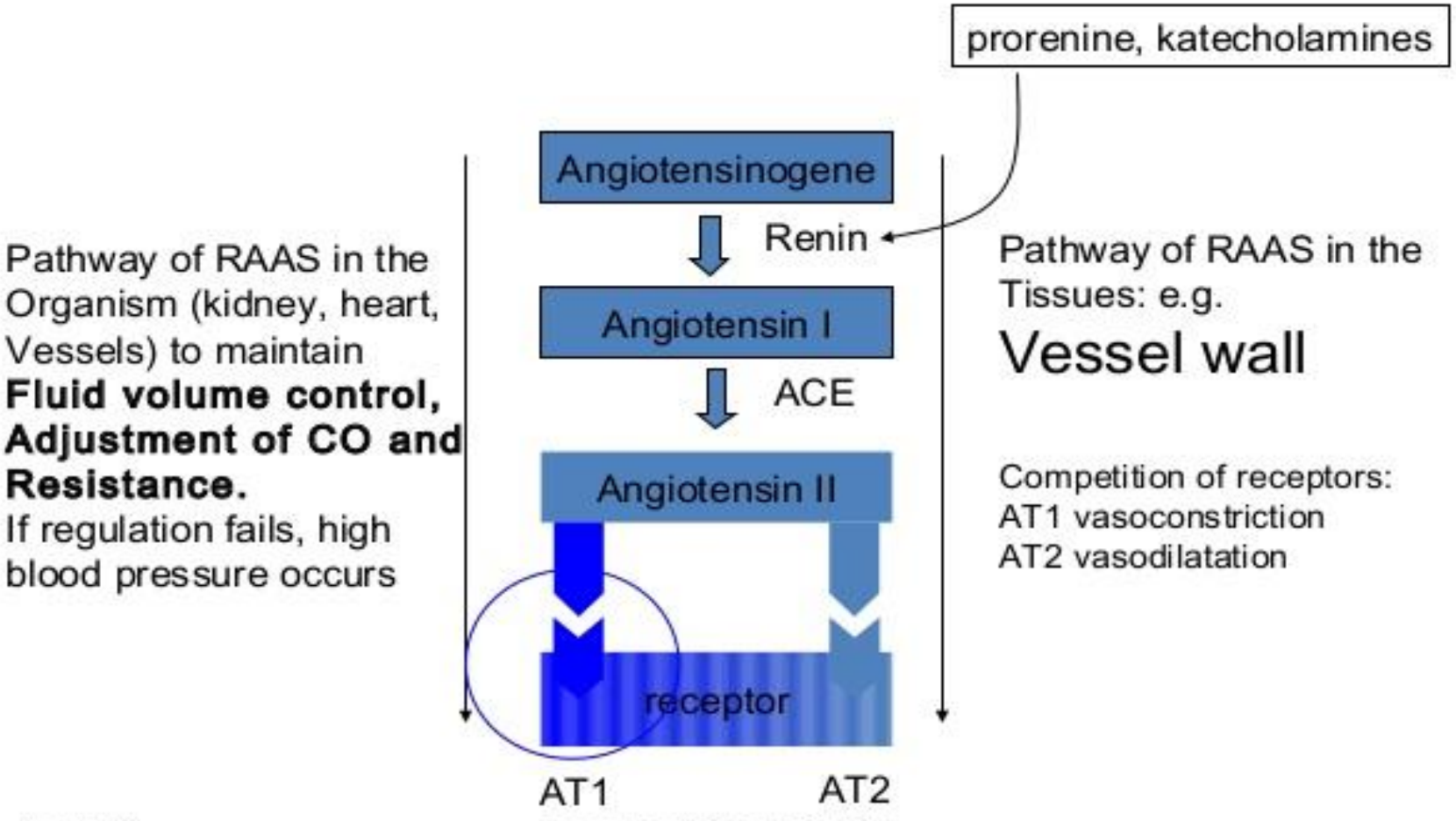
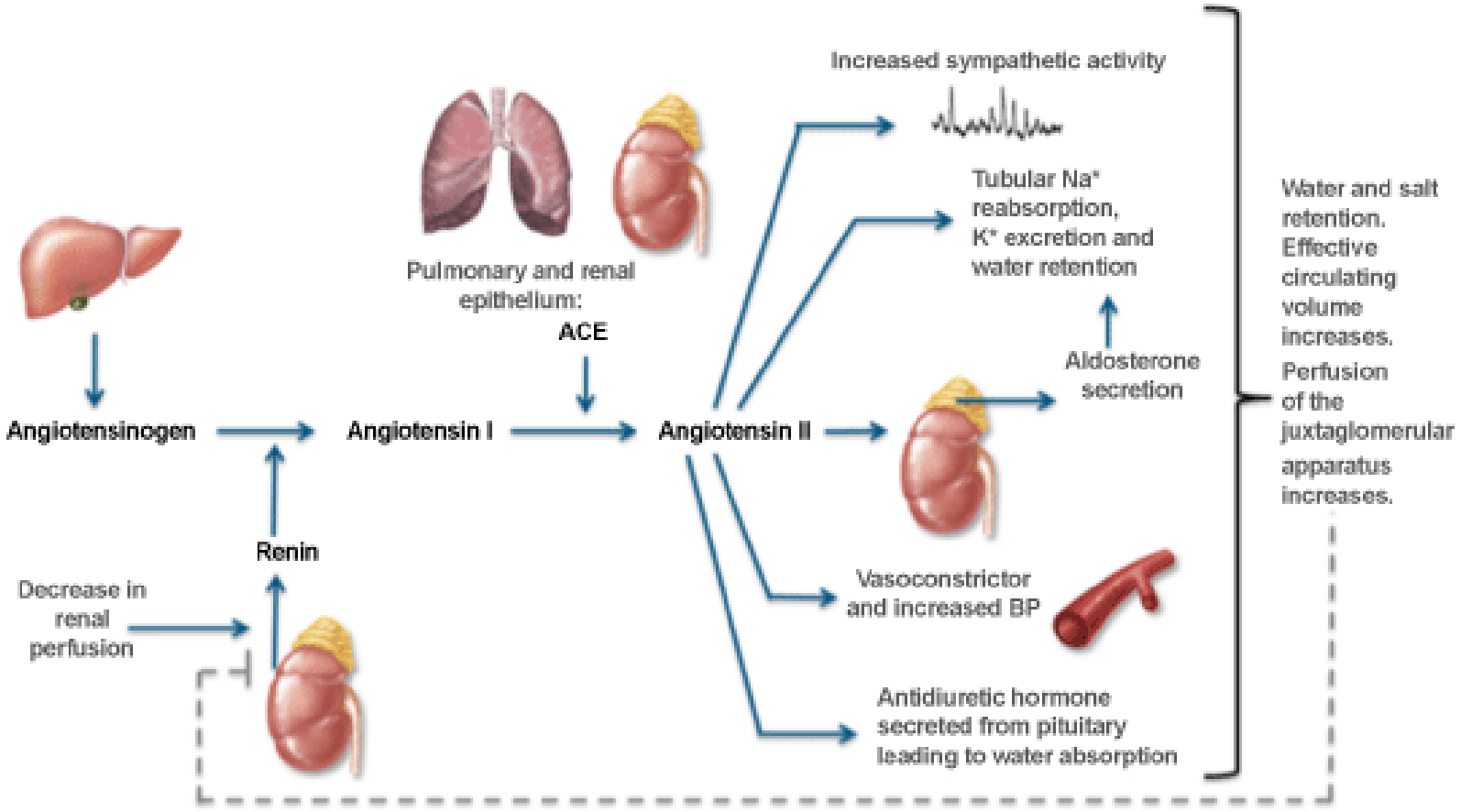
Mechanisms 5
(Long Term Humoral)



http://image.slidesharecdn.com/hypertension2006path-bw-130410081448-phpapp01/95/hypertension-2013-pathophysiology-14-638.jpg?cb=1366765977

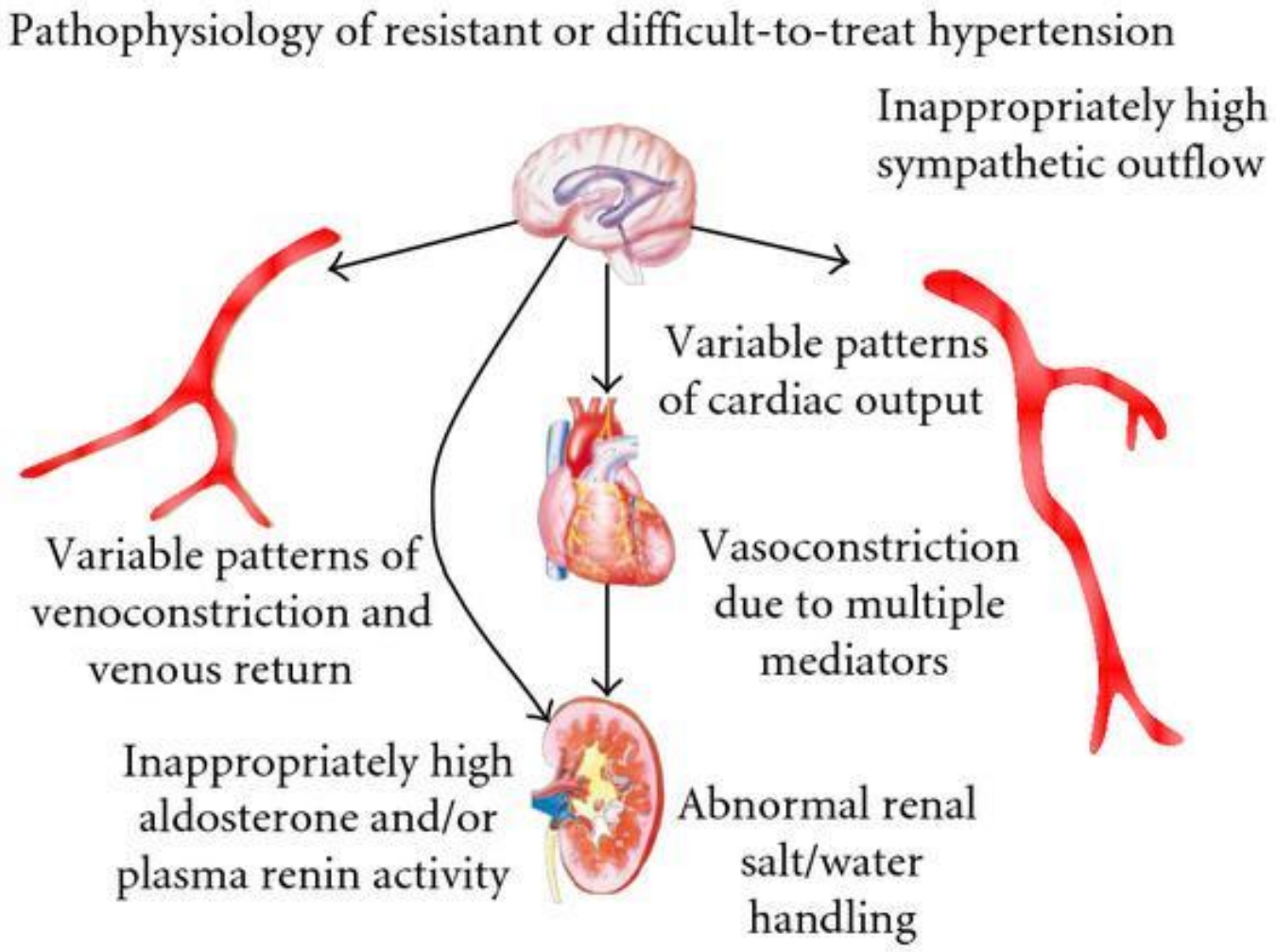
Mechanisms 6

(Combine Peripheral Humoral And Nervous)



http://www.poweroverpressure.com/wcm/groups/mdtcom_sg/@mdt/documents/images/pop_angiotensin.gif

Mechanisms 7
(Nature of Resistant Hypertension)



http://www.hindawi.com/journals/ijhy/2011/196518.fig.001.jpg

Adaptation to Arterial Hypertension

It lies on the surface (cardiac and vascular remodelling)

- Cardiac
  - structural remodeling of the left ventricle
    - wall thickening (ventricular hypertrophy)
    - luminal dilatation
- Vascular
  - structural remodeling of muscular and elastic arteries
    - wall thickening (hypertrophy)
    - luminal dilatation

In reality changes take place in all systems and structures

http://circ.ahajournals.org/content/86/6/1909.full.pdf

Classification
(European Society of Cardiology)

Category	Systolic		Diastolic
Optimal	<120	and	<80
Normal	120 - 129	and/or	80 - 84
High normal	130 - 139	and/or	85 - 89
Grade 1 hypertension	140 - 159	and/or	90 - 99
Grade 2 hypertension	160 - 179	and/or	100 - 109
Grade 3 hypertension	≥180	and/or	≥110
Isolated systolic hypertension	≥140	and	<90

The BP category is defined by the highest level of BP, whether systolic or diastolic.

Isolated systolic hypertension should be graded 1, 2, or 3 according to systolic BP values in the ranges indicated.

Office BP is the average of at least 2 BP measurements (with a validated device), spaced 1-2 min apart, after the patient has been sitting for 3-5 min, on at least 2 visits.

eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Classification
(JNC-7 Blood Pressure Classification)

Blood Pressure Classification	Systolic blood pressure (mm Hg)	Diastolic blood pressure (mm Hg)
Normal	< 120	< 80
Pre-hypertension	120-139	80-89
Stage 1 hypertension	140-159	90-99
Stage 2 hypertension	≥ 160	≥ 100

Chobanian AV et al. *JAMA* 2003;289:2560-72.

Classification
(Due to Cause)

- Essential HT *up to 95%*
- Secondary (inessential) HT
  - Renovascular (fibromuscular dysplasia, atheromatous stenosis, diabetes)
  - Secondary to other renal disorders (cronic renal failure, renal artery stenosis, renal segmental hypoplasia
  - Secondary to endocrine disorders (pheochromocytoma, hyperaldosteronism (Conn's syndrome), Cushing's syndrome, hyperparathyroidism, acromegaly, hyperthyroidism, hypothyroidism)
  - Other (hormonal contraceptives, neurologic disorders, obstructive sleep apnea, liquorice, scleroderma, neurofibromatosis, pregnancy, cancers, drugs, etc.)

en.wikipedia.org/wiki/Secondary_hypertension

Classification
(Resistant HT)

- Resistant HT is defined as HT that remains above goal blood pressure in spite of using, at once, three antihypertensive medications belonging to different drug classes
- Low adherence to treatment is an important cause of resistant HT
- Resistant HT may also represent the result of chronic high activity of the autonomic nervous system (neurogenic hypertension)

https://en.wikipedia.org/wiki/Hypertension

Clinical Investigation
(Symptoms)

- HT is rarely accompanied by any symptoms, and its identification is usually through screening, or when seeking healthcare for an unrelated problem
- Some with high blood pressure report headaches (particularly at the back of the head and in the morning), as well as lightheadedness, vertigo, tinnitus (buzzing or hissing in the ears), altered vision or fainting episodes
- These symptoms, however, might be related to associated anxiety rather than the high blood pressure itself

en.wikipedia.org/wiki/Hypertension

Clinical Investigation
(Physical Examination)

- Physical examination aims to establish or verify the diagnosis of HT, establish current BP, screen for secondary causes of HT and refine global CV risk estimation
- BP should be repeatedly measured to confirm the diagnosis of HT
- All patients should undergo auscultation of the carotid arteries, heart and renal arteries
- Murmurs should suggest further investigation (carotid ultrasound, echocardiography, renal vascular ultrasound, depending on the location of the murmur)
- Height, weight, and waist circumference should be measured with the patient standing, and BMI calculated
- Pulse palpation and cardiac auscultation may reveal arrhythmias
- Heart rate should be measured while the patient is at rest

http://eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Clinical Investigation

(Physical Examination: Signs of Secondary HT)

- Features of Cushing syndrome
- Skin stigmata of neurofibromatosis (pheochromocytoma)
- Palpation of enlarged kidneys (polycystic kidney)
- Auscultation of abdominal murmurs (renovascular hypertension)
- Auscultation of precordial or chest murmurs (aortic coarctation; aortic disease; upper extremity artery disease)
- Diminished and delayed femoral pulses and reduced femoral blood pressure compared to simultaneous arm BP (aortic coarctation; aortic disease; lower extremity artery disease)
- Left–right arm BP difference (aortic coarctation; subclavian artery stenosis)

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Clinical Investigation
(Physical Examination: Signs of Organ Damage)

- Brain: motor or sensory defects
- Retina: fundoscopic abnormalities
- Heart: heart rate, 3rd or 4th heart sound, heart murmurs, arrhythmias, location of apical impulse, pulmonary rales, peripheral oedema
- Peripheral arteries: absence, reduction, or asymmetry of pulses, cold extremities, ischaemic skin lesions
- Carotid arteries: systolic murmurs

http://eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Clinical Investigation
(Physical Examination: Evidence of Obesity)

- Weight and height
- Calculate BMI: body weight/height 2 (kg/m2)
- Waist circumference measured in the standing position, at a level midway between the lower border of the costal margin (the lowest rib) and uppermost border of the iliac crest

http://eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Clinical Investigation
(Hypertensive Crisis)

- Severely elevated blood pressure (equal to or greater than a SBP 180 or DBP 110) is referred to as a hypertensive crisis
- Hypertensive crisis is categorized as either hypertensive urgency or hypertensive emergency, according to the absence or presence of end organ damage, respectively
- In hypertensive urgency oral medications are used to lower the BP gradually over 24 to 48 hours
- In hypertensive emergency, the BP must be reduced more rapidly to stop ongoing organ damage, however, there is a lack of randomised controlled trial evidence for this approach

https://en.wikipedia.org/wiki/Hypertension

Clinical Investigation
(Outcomes)

- HT is the most important preventable risk factor for premature death worldwide
- HT increases the risk of ischemic heart disease, strokes, peripheral vascular disease, and other cardiovascular diseases, including heart failure, aortic aneurysms, diffuse atherosclerosis, chronic kidney disease, and pulmonary embolism
- HT is also a risk factor for cognitive impairment and dementia
- Other complications include hypertensive retinopathy and hypertensive nephropathy

https://en.wikipedia.org/wiki/Hypertension

Diagnosis

- The evaluation of HT involves accurately measuring the patient's blood pressure, performing a focused medical history and physical examination, and obtaining results of laboratory and instrumental studies
- These steps can help determine the following:
  - Presence of end-organ disease
  - Possible causes of HT
  - Cardiovascular risk factors
  - Baseline values for judging biochemical effects of therapy

emedicine.medscape.com/article/241381-overview

Diagnosis
(Blood Pressure Measurement)

- Office or clinic blood pressure
- Out-of-office blood pressure
  - Ambulatory blood pressure monitoring
  - Home blood pressure monitoring
- White-coat (or isolated office) HT - 13% (range 9–16%)
- Masked (or isolated ambulatory) HT - 13% (range 10–17%)

http://eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Diagnosis
(Office and Out-of-Office Blood Pressure Criteria)

Category	Systolic		Diastolic
Office BP	≥140	and/or	≥90
Ambulatory BP			
- Daytime (or awake)	≥135	and/or	≥85
- Nighttime (or asleep)	≥120	and/or	≥70
- 24-hour	≥130	and/or	≥80
Home BP	≥135	and/or	≥85

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Diagnosis
(from True Normotension to Sustained Hypertension)

		Office BP (mmHg)	
		SBP <140 **and** DBP <90	SBP ≥140 **or** DBP ≥90
Daytime ABP or home BP (mmHg)	SBP <135 **and** DBP <85	True normotension (NT)	White-coat hypertension (WCHT)
	SBP ≥135 **or** DBP ≥85	Masked hypertension (MHT)	Sustained hypertension (SHT)

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Diagnosis
(ABPM Derived Variables)

- Night-to-day BP ratio: ratio between average night-time BP and average day-time BP.
- Night-time dipping pattern:

Category	Night/day ratio
Absence of dipping	> 1.0
Mild dipping	> 0.9 and ≤ 1.0
Dipping	> 0.8 and ≤ 0.9
Extreme dipping	≤ 0.8

- Additional diagnostic indices such as BP variability, morning BP surge, BP load and ambulatory arterial stiffness index should be regarded as experimental with no routine clinical use, and are discussed in detail in ESH position papers and guidelines.

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Diagnosis
(Total Cardiovascular Risk Stratification)

Other risk factors (RF), asymptomatic organ damage (OD) or disease	Blood Pressure (mmHg)			
	High normal SBP 130-139 or DBP 85-89	Grade 1 HT SBP 140-159 or DBP 90-99	Grade 2 HT SBP 160-179 or DBP 100-109	Grade 3 HT SBP ≥180 or DBP ≥110
No other RF		Low risk	Moderate risk	High risk
1-2 RF	Low risk	Moderate risk	Moderate to High risk	High risk
≥3 RF	Low to moderate risk	Moderate to high risk	High risk	High risk
OD, CKD stage 3 or diabetes	Moderate to high risk	High risk	High risk	High to very high risk
Symptomatic CVD, CKD stage ≥4 or diabetes with OD/RFs	Very high risk	Very high risk	Very high risk	Very high risk

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Diagnosis
(Risk Factors)

- Male sex.
- Age (≥ 55 yrs in men; ≥ 65 yrs in women).
- Smoking.
- Dyslipidaemia:
  - TC >4.9 mmol/L (190 mg/dL), and/or
  - LDL-C >3.0 mmol/L (115 mg/dL), and/or
  - HDL-C <1.0 mmol/L (40 mg/dL) in men; <1.2 mmol/L (46 mg/dL) in women, and/or
  - TG >1.7 mmol/L (150 mg/dL)
- Fasting plasma glucose 5.6-6.9 mmol/L (102-125 mg/dL).
- Abnormal glucose tolerance test.
- Obesity (BMI ≥30 kg/m^2).
- Abdominal obesity: waist circumference ≥102 cm in men; ≥88 cm in women (in Caucasians).
- Family history of premature CV disease (<55 yrs in men; <65 yrs in women).

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Diagnosis
(Asymptomatic Organ Damage)

- Pulse pressure ≥60 mmHg (in the elderly).
- Electrocardiographic LVH (Sokolow-Lyon index >3.5 mV; RaVL >1.1 mV; Cornell voltage duration product >244 mm*ms), or
- Echocardiographic LVH (LVM index >115 g/m² in men; >95 g/m² in women).
- Carotid wall thickening (IMT >0.9 mm) or plaque.
- Carotid-femoral pulse wave velocity >10 m/s.
- Ankle-brachial index <0.9.
- Chronic kidney disease stage 3 (eGFR: 30-60 mL/min/1.73 m²).
- Microalbuminuria (30-300 mg/24 h), or albumin-creatinine ratio (30-300 mg/g or 3.4-34 mg/mmol) (preferentially on morning spot urine).

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Diagnosis
(Diabetes Mellitus)

- Fasting plasma glucose ≥7.0 mmol/L (126 mg/dL) on two repeated measurements, and/or
- HbA_{1c} >7% (53 mmol/mol), and/or
- Post-load plasma glucose >11.0 mmol/L (198 mg/dL).

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Diagnosis
(Established Cardiovascular or Renal Disease)

- Cerebrovascular disease: ischaemic stroke; cerebral haemorrhage; transient ischaemic attack.
- Coronary heart disease: angina; myocardial infarction; revascularization with PCI or CABG.
- Heart failure, including heart failure with preserved ejection fraction.
- Symptomatic lower extremities peripheral artery disease.
- Chronic kidney disease stage 4 (eGFR <30 mL/min/1.73 m^2).
- Proteinuria >300 mg/24 h.
- Advanced retinopathy: haemorrhages or exudates, papiloedema.

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Diagnosis
(from Predictive Value to Cost–Effectiveness of Some Markers of Organ Damage)

Marker	Cardiovascular predictive value	Availability	Reproducibility	Cost-effectiveness
Electrocardiography	+++	++++	++++	++++
Echocardiography, plus Doppler	++++	+++	+++	+++
Estimated glomerular filtration rate	+++	++++	++++	++++
Microalbuminuria	+++	++++	++	++++
Carotid intima–media thickness and plaque	+++	+++	+++	+++
Arterial stiffness (pulse wave velocity)	+++	++	+++	+++
Ankle–brachial index	+++	+++	+++	+++
Fundoscopy	+++	++++	++	+++
Additional measurements				
Coronary calcium score	++	+	+++	+
Endothelial dysfunction	++	+	+	+
Cerebral lacunae/white matter lesions	++	+	+++	+
Cardiac magnetic resonance	++	+	+++	++

Scores are from + to + + + +.

eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Diagnosis
(Routine Tests)

- Hemoglobin and/or hematocrit
- Fasting plasma glucose
- Serum total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol
- Fasting serum triglycerides
- Serum potassium and sodium
- Serum uric acid
- Serum creatinine (with estimation of GFR)
- Urine analysis: microscopic examination; urinary protein by dipstick test; test for microalbuminuria
- 12-lead ECG

http://eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Diagnosis
(Additional Tests)

- Hemoglobin A1c (if fasting plasma glucose is >5.6 mmol/L (102 mg/dL) or previous diagnosis of diabetes)
- Quantitative proteinuria (if dipstick test is positive); urinary potassium and sodium concentration and their ratio
- Home and 24-h ambulatory BP monitoring
- Echocardiogram
- Exercise testing, Holter monitoring in case of arrhythmias
- Carotid ultrasound
- Peripheral artery/abdominal ultrasound
- Pulse wave velocity
- Ankle-brachial index
- Fundoscopy

http://eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Diagnosis
(Extended Evaluation)

- Further search for cerebral, cardiac, renal, and vascular damage, mandatory in resistant and complicated hypertension
- Search for secondary hypertension when suggested by history, physical examination, or routine and additional tests

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Treatment
(Strategies)

- Patient education
- Lifestyle changes
- Pharmacological therapy

http://emedicine.medscape.com/article/198475-overview#a3

Treatment
(Lifestyle Changes)

- Salt restriction
- Moderation of alcohol consumption
- Other dietary changes (vegetables, low-fat dairy products, dietary and soluble fibers, whole grains and protein from plant sources, reduced in saturated fat and cholesterol)
- Weight reduction
- Regular physical exercise
- Smoking cessation

http://emedicine.medscape.com/article/198475-overview#a3

Treatment
(Pharmacotherapy)

- Diuretics (including thiazides, chlorthalidone and indapamide)
- Beta-blockers
- Calcium antagonists
- Angiotensin-converting enzyme (ACE) inhibitors
- Angiotensin receptor blockers
- Renin inhibitors
- Other antihypertensive agents (alpha-receptor blockers)
- Monotherapy and combination therapy

http://emedicine.medscape.com/article/198475-overview#a3

Treatment
(Compelling and Possible Contra-Indications to the Use of Antihypertensive Drugs)

Drug	Compelling	Possible
Diuretics (thiazides)	Gout	Metabolic syndrome Glucose intolerance Pregnancy Hypercalcaemia Hypokalaemia
Beta-blockers	Asthma A–V block (grade 2 or 3)	Metabolic syndrome Glucose intolerance Athletes and physically active patients Chronic obstructive pulmonary disease (except for vasodilator beta-blockers)
Calcium antagonists (dihydropyridines)		Tachyarrhythmia Heart failure
Calcium antagonists (verapamil, diltiazem)	A–V block (grade 2 or 3, trifascicular block) Severe LV dysfunction Heart failure	
ACE inhibitors	Pregnancy Angioneurotic oedema Hyperkalaemia Bilateral renal artery stenosis	Women with child bearing potential
Angiotensin receptor blockers	Pregnancy Hyperkalaemia Bilateral renal artery stenosis	Women with child bearing potential
Mineralocorticoid receptor antagonists	Acute or severe renal failure (eGFR <30 mL/min) Hyperkalaemia	

A-V = atrio-ventricular; eGFR = estimated glomerular filtration rate; LV = left ventricular.

eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Treatment
(Drugs to be Preferred in Specific Conditions)

Condition	Drug
Asymptomatic organ damage	
LVH	ACE inhibitor, calcium antagonist, ARB
Asymptomatic atherosclerosis	Calcium antagonist, ACE inhibitor
Microalbuminuria	ACE inhibitor, ARB
Renal dysfunction	ACE inhibitor, ARB
Clinical CV event	
Previous stroke	Any agent effectively lowering BP
Previous myocardial infarction	BB, ACE inhibitor, ARB
Angina pectoris	BB, calcium antagonist
Heart failure	Diuretic, BB, ACE inhibitor, ARB, mineralocorticoid receptor antagonists
Aortic aneurysm	BB
Atrial fibrillation, prevention	Consider ARB, ACE inhibitor, BB or mineralocorticoid receptor antagonist
Atrial fibrillation, ventricular rate control	BB, non-dihydropyridine calcium antagonist
ESRD/proteinuria	ACE inhibitor, ARB
Peripheral artery disease	ACE inhibitor, calcium antagonist
Other	
ISH (elderly)	Diuretic, calcium antagonist
Metabolic syndrome	ACE inhibitor, ARB, calcium antagonist
Diabetes mellitus	ACE inhibitor, ARB
Pregnancy	Methyldopa, BB, calcium antagonist
Blacks	Diuretic, calcium antagonist

ACE = angiotensin-converting enzyme; ARB = angiotensin receptor blocker; BB = beta-blocker; BP = blood pressure; CV = cardiovascular; ESRD = end-stage renal disease; ISH = isolated systolic hypertension; LVH = left ventricular hypertrophy.

eurheartj.oxfordjournals.org/content/ehj/34/28/2159.full.pdf

Treatment
(Blood Pressure Goals)

SBP goal for "most" •Patients at low–moderate CV risk •Patients with diabetes •Consider with previous stroke or TIA •Consider with CHD •Consider with diabetic or non-diabetic CKD	**<140 mmHg**
SBP goal for elderly •Ages <80 years •Initial SBP ≥160 mmHg	**140-150 mmHg**
SBP goal for fit elderly Aged <80 years	**<140 mmHg**
SBP goal for elderly >80 years with SBP •≥160 mmHg	**140-150 mmHg**
DBP goal for "most"	**<90 mmHg**
DB goal for patients with diabetes	**<85 mmHg**

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Treatment
(for People with Diabetes)

Recommendations	Additonal considerations
Mandatory: initiate drug treatment in patients with SBP ≥160 mmHg	• Strongly recommended: start drug treatment when SBP ≥140 mmHg
SBP goals for patients with diabetes: <140 mmHg	
DBP goals for patients with diabetes: <85 mmHg	
All hypertension treatment agents are recommended and may be used in patients with diabetes	• RAS blockers may be preferred • *Especially in presence of preoteinuria or microalbuminuria*
Choice of hypertension treatment must take comorbidities into account	
Coadministration of RAS blockers *not recommended*	• *Avoid in patients with diabetes*

SBP, systolic blood pressure; DBP, diastolic blood pressure; RAS, renin–angiotensin system.

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Treatment
(for People with Nephropathy)

Recommendations	Additonal considerations
Consider lowering SBP to <140 mmHg	
Consider SBP <130 mmHg with overt proteinuria	• Monitor changes in eGFR
RAS blockers more effective to reduce albuminuria than other agents	• Indicated in presence of microalbuminuria or overt proteinuria
Combination therapy usually required to reach BP goals	• Combine RAS blockers with other agents
Combination of two RAS blockers	• *Not recommended*
Aldosterone antagonist *not recommended in CKD*	• Especially in combination with a RAS blocker • Risk of excessive reduction in renal function, hyperkalemia

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Treatment
(Comparison of Recent Guideline Statements)

	JNC 8	ESH/ESC	AHA/ACC	ASH/ISH
		≥140/90		
Threshold	≥140/90 < 60 yr	Eldery SBP ≥160		≥140/90 <80 yr
for Drug Rx	≥150/90 ≥60 yr	Consider SBP	≥140/90	≥150/90 ≥80 yr
		140-150 if <80 yr		
B-blocker	No	Yes	No	No
First line Rx				
Initiate Therapy	≥160/100	"Markedly	≥160/100	≥160/100
w/ 2 drugs		elevated BP"		

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Treatment
(Goal Blood Pressure)

Group	BP Goal (mm Hg)		
	General	DM*	CKD**
JNC 8:	<60 yr: <140/90	< 140/90	< 140/90
	≥60 yr: <150/90		
ESH/ESC:	< 140/90	< 140/85	< 140/90
Elderly	140-150/90	(SBP < 130 if proteinuria)	
	(<80 yr: SBP<140)		
ASH/ISH	< 140/90	< 140/90	< 140/90
	≥80 yr: <150/90	(Consider < 130/80 if proteinuria)	
AHA/ACC	< 140/90	< 140/90	< 140/90

*ADA: < 140/80 or lower **KDIGO: ≤140/90 w/o albuminuria ≤130/80 if ≥30 mg/24hr

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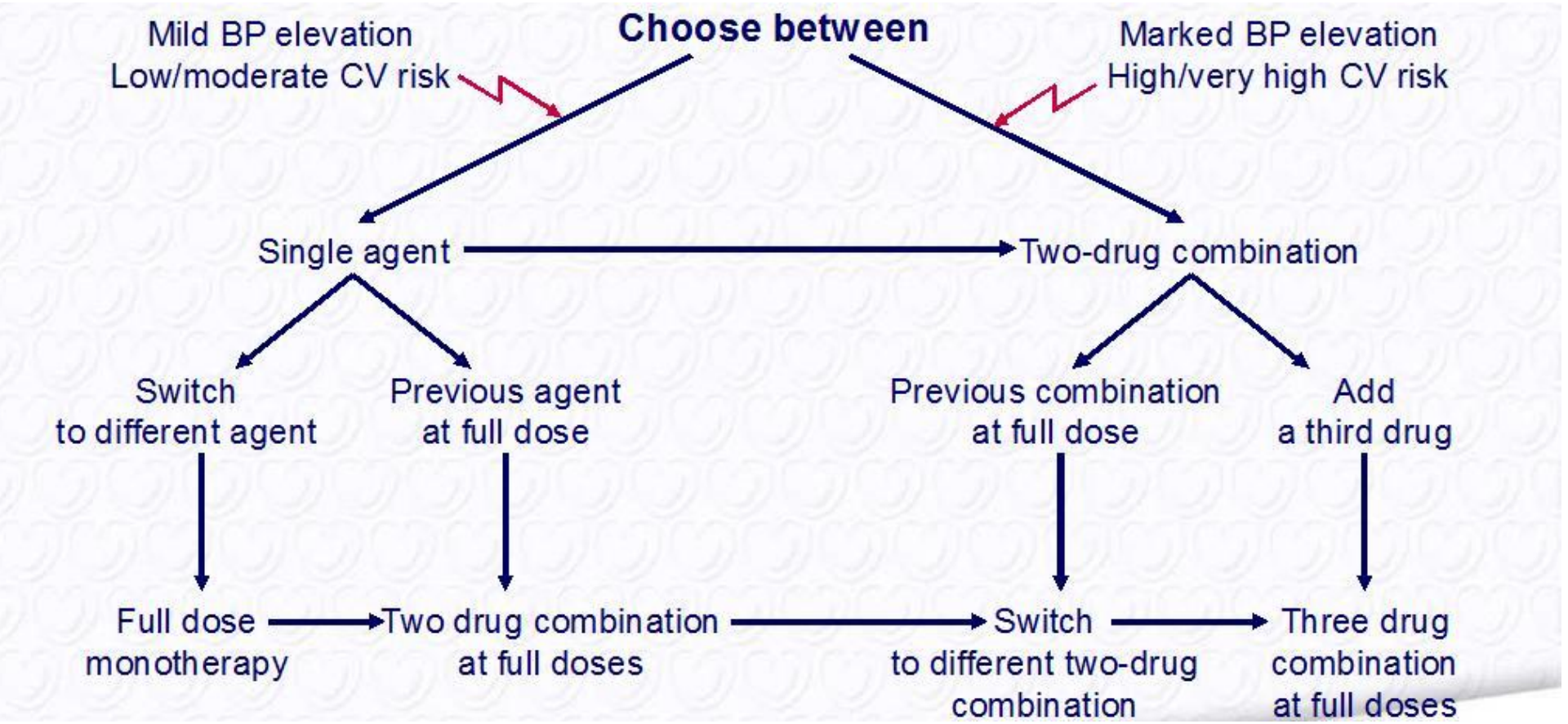
Treatment
(Monotherapy vs rug Combination Therapy)



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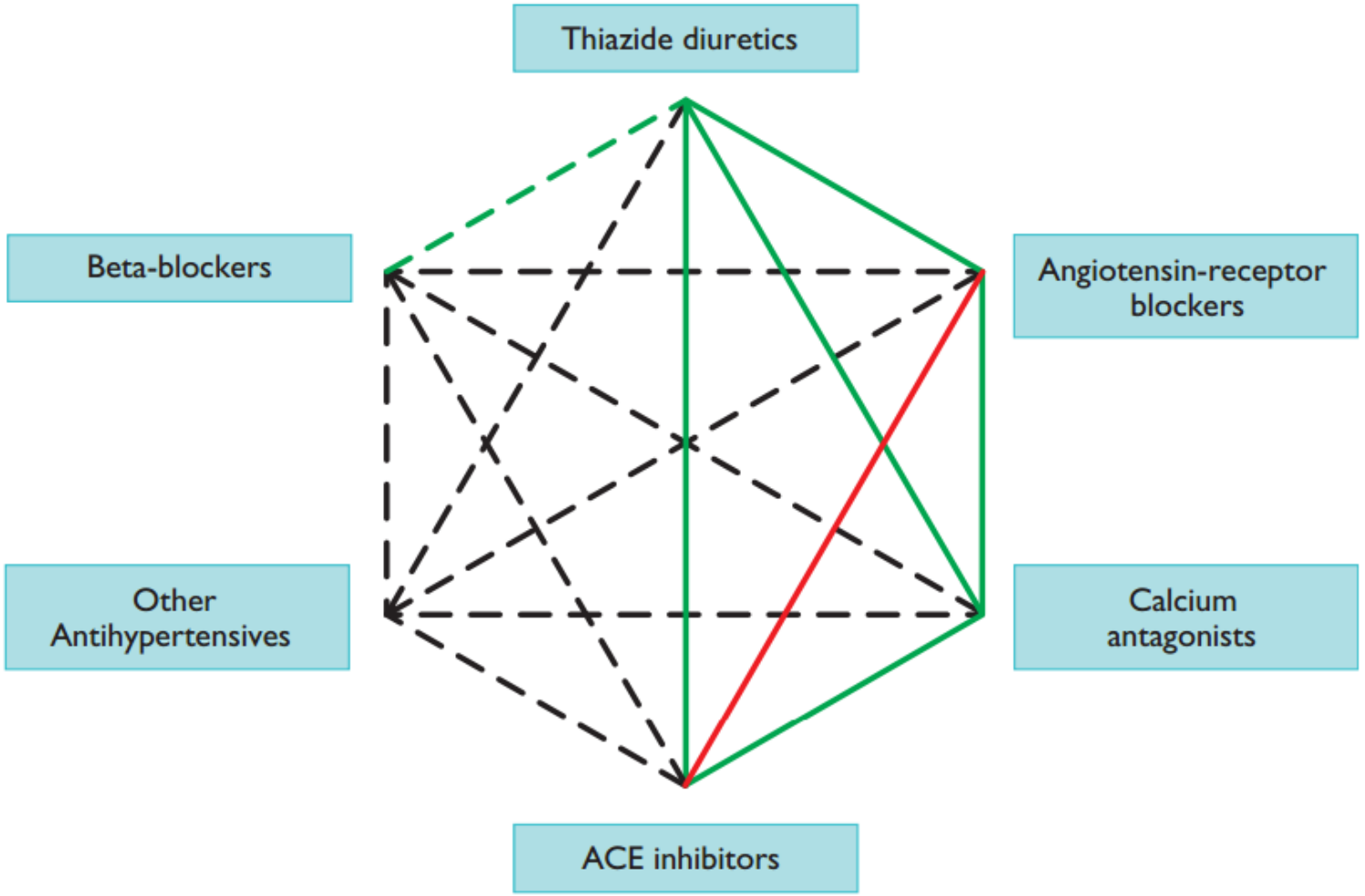
Treatment

(Possible Combination of Antihypertensive Drugs' Classes)



ACE = angiotensin-converting enzyme.

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Prognosis

- Untreated HT is notorious for increasing the risk of mortality and is often described as a silent killer
- Mild to moderate HT, if left untreated, may be associated with a risk of atherosclerotic disease in 30% of people and organ damage in 50% of people within 8-10 years after onset
- Death from ischemic heart disease or stroke increases progressively as BP increases (for every 20 mm Hg systolic or 10 mm Hg diastolic increase in BP above 115/75 mm Hg, the mortality rate for both ischemic heart disease and stroke doubles)

http://emedicine.medscape.com/article/241381-overview#a6

Prophylaxis

- Population strategies are required to reduce the consequences of high BP and reduce the need for antihypertensive drug therapy
- Lifestyle changes are recommended to lower BP, before starting drug therapy
- Effective lifestyle modification may lower blood pressure as much as an individual antihypertensive drug
- Combinations of two or more lifestyle modifications can achieve even better results

https://en.wikipedia.org/wiki/Hypertension

Abbreviations

- ABP - ambulatory blood pressure
- ACE - angiotensin converting enzyme
- ARB - angiotensin receptor blocker
- AT - angiotensin
- BMI - body mass index
- BB - beta blockers
- BP - blood pressure
- CKD - chronic kidney disease
- CO - carbon oxide
- CV - cardiovascular
- DBP - diastolic blood pressure
- DM - diabetes mellitus
- ECG - electrocardiography
- GFR - glomerular filtration rate
- HDL-C –high density lipoprotein cholesterol
- HIC -high-income countries
- HT - arterial hypertension
- LDL-C – low density lipoprotein cholesterol
- LIC -low-income countries
- LMIC - lower middle-income countries
- LVH - left ventricle hypertrophy
- LVM - left ventricle mass
- NO - nitrogen oxide
- OD - organ demige
- RAAS – renin angiotensin aldosterone system
- RF - risk factors
- RCTs - randomized control trials
- SBP - systolic blood pressure
- TC - total cholesterol
- TG - triglycerides
- UMIC - upper middle-income countries

Diagnostic and treatment guidelines

Europe

- 2013 ESH/ESC Guidelines for the management of arterial hypertension
- Hypertension - National Institute for Health and Care Excellence (nice) guidelines and related materials

North America

- 2014 Evidence-based guideline for the management of high blood pressure in adults. Report from the panel members appointed to the eighth joint national committee (JNC 8)
- British Columbia guidelines on detection, diagnosis and management of hypertension [2015]