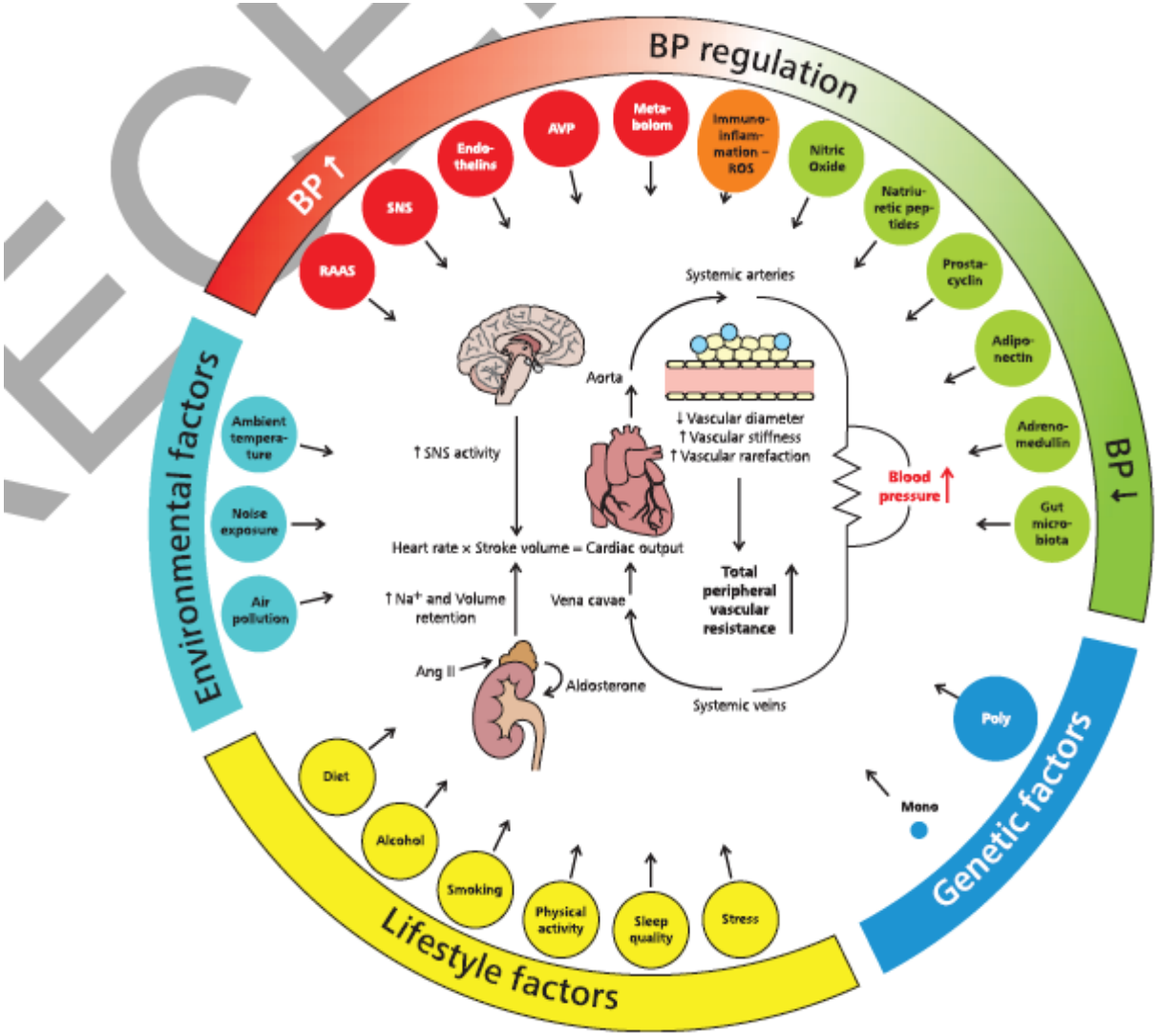
Mechanisms involved in regulation of BP & the pathophysiology of HTN



Classification of office BP & definitions of HTN grades

Category	Systolic (mmHg)		Diastolic (mmHg)
Optimal	<120	and	<80
Normal	120–129	and	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[a]	≥140	and	<90
Isolated diastolic hypertension[a]	<140	and	≥90

The BP category is defined by the highest level of BP, whether systolic or diastolic.
[a]Isolated systolic or diastolic hypertension is graded 1, 2 or 3 according to SBP and DBP values in the ranges indicated. The same classification is used for adolescents ≥16 years old (Section 15.1).

Devices for measurement of BP

Recommendations and statements	CoR	LoR
Automatic electronic, upper-arm cuff devices are recommended for office and out-of-office BP measurement (home and ambulatory).	I	B
Hybrid manual auscultatory devices with LCD or LED display, or digital countdown, or shock-resistant aneroid devices can be used for office BP measurement if automated devices are not available.	I	B
Only properly validated devices should be used. www.stridebp.org	I	B
Cuffless BP devices should not be used for the evaluation or management of hypertension in clinical practice.	III	C

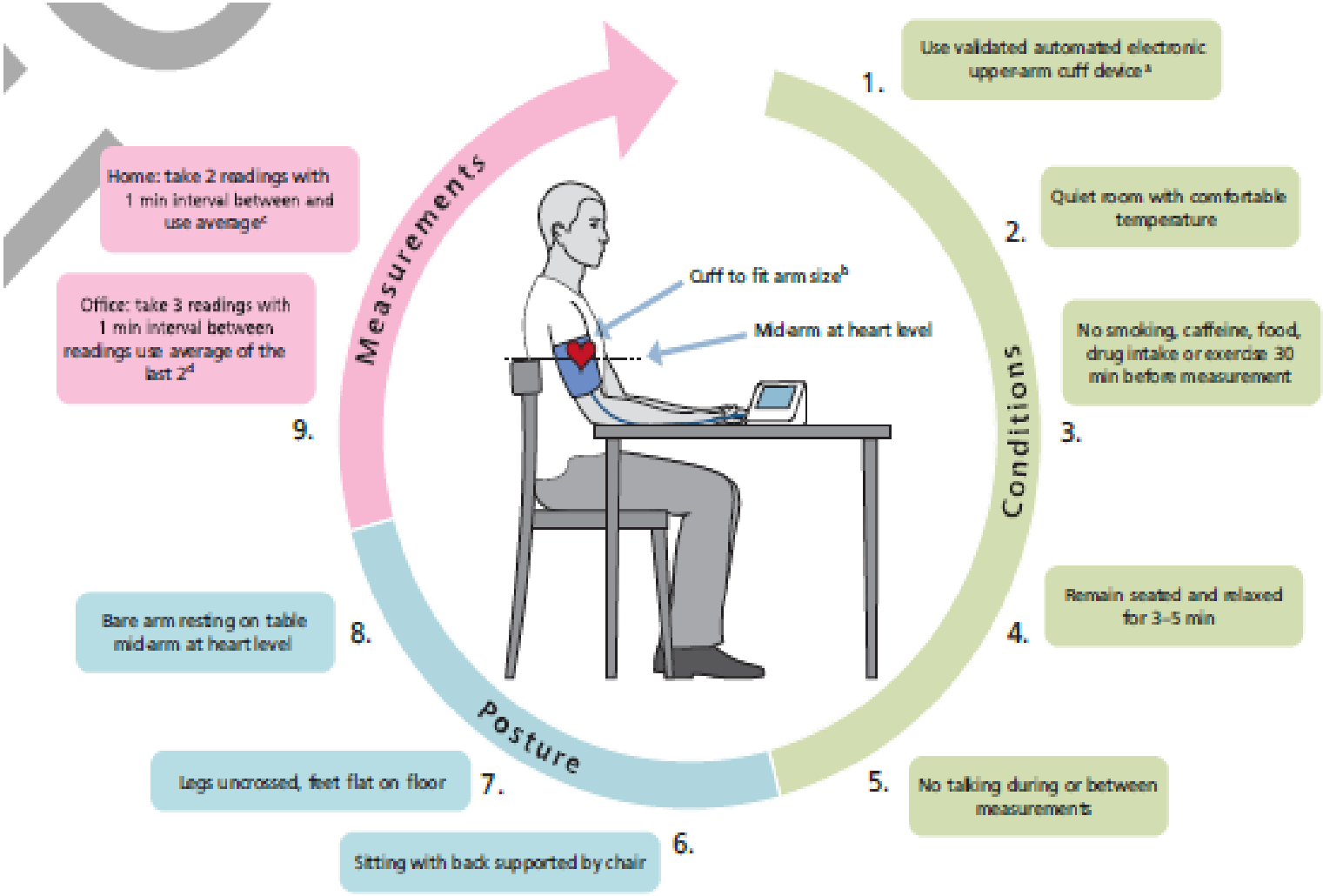
Office BP measurements OBPM

Recommendations and statements	CoR	LoE
Ofiice BP is recommended for diagnosis of hypertension, because it is the one method by which hypertension-related risk, benefits of antihypertensive treatment, and treatment-related BP thresholds and goals are based.	I	A
Office BP measurements should be performed in standardized conditions, using a standard measurement protocol. Triplicate measurements should be taken and the average of the last two should be referred to as the representative value.	I	C
It is recommended to diagnose hypertension during at least 2 separate office visits (within 4 weeks) unless office BP indicates grade 3 hypertension (≥180/110 mmHg) or patients presents with hypertension related symptoms or there is evidence of HMOD or CVD.	I	C
At the first office visit, BP should be measured in both arms. A consistent between-arm SBP difference >15-20 mmHg suggests atheromatous disease and is associated with increased CV risk. All subsequent measurements should be made on the arm with the highest BP readings.	I	C
Out-of-office BP is a source of multiple BP-related information before and during treatment. It is therefore recommended to obtain additional information on BP values by ABPM or HBPM or both if available.	I	C

Blood pressure during exercise

BP increases during dynamic and static exercise, and the increase is more pronounced for SBP than for DBP[99], although only exercise SBP can be measured reliably with noninvasive methods. The increase in SBP during exercise is related to pre exercise resting BP, age, arterial stiffness and abdominal obesity, and is somewhat greater in men than in women [100]. There is some evidence that an excessive rise in BP during exercise predicts the development of hypertension, independently from BP at rest [100]. There is currently no consensus on the normal BP elevation during exercise. According to a consensus document of the European Association of Preventive Cardiology, a BP above 220mmHg in male and 200mmHg in female measured at peak exercise during cycle ergometry warrants further clinical evaluation including ABPM[101]. Two interesting recent findings are that (i) the BP response to sub maximal exercise may have a greater prognostic significance than BP measured at peak [101] and (ii) exercise hypotension may also be a sign of an underlying CV disease [100]. Nevertheless, exercise testing is not recommended as part of the routine evaluation of hypertension because of various limitations, including lack of standardized methodology and definitions. The BP rise accompanying exercise should not discourage patients with treated or untreated hypertension from engaging in regular exercise, especially aerobic exercise, except in the presence of very high BP values (grade 3 hypertension). Regular exercise represents an important lifestyle intervention to chronically lower BP

Home blood pressure monitoring (HBPM)



Home blood pressure monitoring (HBPM)

Recommendations and statements	CoR	LoE
HBPM is recommended in addition to OBPM to improve CV risk prediction due to better reproducibility and prognostic value than OBPM, although lacking data on treatment benefit from RCTs.	IIa	B
HBPM is recommended to identify white-coat hypertension or masked hypertension.	I	B
HBPM is recommended for long-term follow-up of treated hypertension because it improves BP control, especially when combined with education and counselling.	I	B
HBPM should be performed using automated upper arm-cuff BP monitors validated according to an established protocol. www.stridebp.org	I	C
Home BP should be monitored for 7 (not fewer than 3) days with duplicate morning (with 1 minute between them) and evening measurements before office visits. Average home BP should be calculated after discarding readings of the first day.	I	C

Ambulatory blood pressure monitoring (ABPM)

TABLE 4. Definitions of hypertension according to the correspondence of home and ambulatory BP values with office BP

Method	SBP (mmHg)		DBP (mmHg)
Office BP[a]	≥140	and/or	≥90
Ambulatory BP			
Awake mean	≥135	and/or	≥85
Asleep mean	≥120	and/or	≥70
24 h mean	≥130	and/or	≥80
Home BP mean	≥135	and/or	≥85

[a]Refers to standard office BP measurements (not unattended measurements). Data compare the averages from cohorts of untreated and treated individuals. Given the low correlation between office and out-of-office BP values, individuals can have considerable discrepancies from the averages.

Ambulatory blood pressure monitoring (ABPM)

Specific recommendations and statements	CoR	LoE
ABPM is recommended in addition to OBPM to improve CV risk prediction due to better reproducibility and prognostic value than OBPM, although lacking data on treatment benefit from RCTs.	IIa	B
ABPM is recommended to identify white-coat hypertension, masked hypertension and nocturnal BP phenotypes. Repeated ABPM may be necessary because these phenotypes have a limited reproducibility.	I	B
ABPM should be used to diagnose true resistant hypertension.	I	B
ABPM should be measured using upper arm-cuff automated BP monitors validated according to an established protocol. www.stridebp.org	I	C
The recommended frequency of measurements is 20 minutes during day and night to minimize the risk of missing day or night periods.	I	C

Comprehensive physical examination for hypertension

Body habitus

- Weight and height measured on a calibrated scale, with calculation of BMI
- Waist circumference

Signs of hypertension-mediated organ damage

- Neurological examination and cognitive status
- Fundoscopic examination for hypertensive retinopathy in emergencies
- Auscultation of heart and carotid arteries
- Palpation of carotid and peripheral arteries
- Ankle–brachial index

Signs of secondary hypertension (Section 6)

- Skin inspection: cafe-au-lait patches of neurofibromatosis (pheochromocytoma)
- Kidney palpation for signs of renal enlargement in polycystic kidney disease
- Auscultation of heart and renal arteries for murmurs or bruits indicative of aortic coarctation, or renovascular hypertension
- Signs of Cushing's disease or acromegaly
- Signs of thyroid disease

Selected standard laboratory tests for work-up of hypertensive patients

- Hemoglobin and/or hematocrit
- Fasting blood glucose and HbA1c
- Blood lipids: total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides
- Blood potassium and sodium
- Blood uric acid
- Blood creatinine (and/or cystatin C) for estimating GFR with eGFR[a] formulas
- Blood calcium
- Urine analysis (first voided urine in the morning), multicomponent dipstick test in all patients, urinary albumin/creatinine ratio, microscopic examination in selected patients

Assessment of hypertension-mediated organ damage (HMOD)

Basic screening tests for HMOD recommended for all hypertensive patients	Aim
12 lead ECG	Measure HR and AV conduction, detect cardiac arrhythmias, myocardial ischemia and infarction, screen for LVH
Urine albumin : creatinine ratio (UACR)	Detect and classify CKD
Serum creatinine and eGFR	Detect and classify CKD
Extended screening for HMOD	
Echocardiography	Evaluate structure and function of the ventricles and left atrium, detect valvular disease, aortic root diameter and ascending aortic aneurysm
cfPWV or baPWV	Evaluate aortic/large artery stiffness
Carotid artery ultrasound	Determine carotid intima-media thickness, plaque and stenosis
Coronary artery calcium scan	Determine the presence and extent of coronary calcium to predict CAD events
Abdominal aorta ultrasound	Screen for aortic aneurysm
Kidney ultrasound	Evaluate size and structure of kidney, detect renovascular disease, determine RRI (by spectral doppler ultrasonography)
Spectral doppler ultrasonography	Diagnosis of renovascular disease and determination of RRI
ABI	Screen for LEAD
Retina microvasculature	Detect microvascular changes
Cognitive function testing (MMSE, MoCA)	Screen for early stages of dementia
Brain imaging (CT, MRI)	Detect structural brain damage

HMOD in the heart

In hypertension, the heart is directly exposed to an increased load with consequent development of several structural and functional alterations, which are asymptomatic at an early stage but represent a potent risk factor for subsequent CV events, such as HF with HFpEF or HFrEF, AF, CAD, sudden death and also stroke. Preclinical or asymptomatic hypertensive heart disease includes LVH, LV geometric changes, impaired diastolic and systolic function, LA enlargement and greater incidence of arrhythmias. In clinical practice, most or all parameters indicatin hypertensive heart disease should be evaluated in a comprehensive examination, using the ECG and available imaging techniques

Methods to assess LVH

TABLE 10. Advantages and disadvantages of methods to assess LVH in clinical practice

	ECG	ECHO	3D ECHO	CMR
Sensitivity	++	+++	++++	++++
Specificity	+++	+++	++++	++++
Reproducibility	++++	+++	++++	++++
Prognostic significance	++++	++++	+	++++
Availability	++++	+++	++	++
Cost	+	++	++	++++

Criteria to define HMOD

Measurement	Parameter	Abnormality threshold
ECG		
LVH	$S_{V1} + R_{V5}$ (Sokolow–Lyon)	>35 mm
	R wave aVL	≥11 mm
	$S_{V3} + R_{aVL}$ (Cornell voltage)	>28 mm (M), >20 mm (W)
LVH	Cornell voltage (+6 mm in W) × QRS duration (Cornell duration product)	>2440 mm s
ECHO		
LVH	LVM/BSA (g/m^2)	>115 (M), >95 (W)
	LVM/height ($g/m^{2.7}$)	>50 (M), >47 (W)
RWT	LV conc. Remodeling	≥0.43
LV chamber size	LVDDim/height	>3.4 (M), >3.3 (W) cm/m
LV diastolic dysfunction	*e′* velocity septal	<7 cm/s
	e′ velocity lateral	<10 cm/s
LV filling pressure	*E*/*e′* average ratio	>14
	LAV/BSA	>34 ml/m^2
	LAV/$height^2$	>18.5 (M) or >16.5 (W) ml/m^2
LV systolic dysfunction	GLS	<20%
Kidney		
Function	eGFR	<60 ml/min/1.73 m^2
Albuminuria	UACR	>30 mg/g
Renal resistance index	RRI	<0.07
RRI ?		
Large artery stiffness		
Pulse pressure	Brachial PP (>60 years)	≥60 mmHg
Pulse wave velocity	baPWV (in people 60–70 years)	>18 m/s
	cfPWV (in people 50–60 years)	>10 m/s
Carotid atherosclerosis		
	Plaque	IMT ≥1.5 mm, or focal increase in thickness ≥0.5 mm, or 50% of surrounding IMT
	IMT	>0.9 mm
Coronary atherosclerosis		
	CAC	Age-specific and sex-specific reference value
LEAD		
	ABI	<0.9
Eye		
	KWB score	Grade III (hemorrhages, microaneurysms, hard exudates and cotton wool spots) and grade IV (papilloedema and/or macula edema)
Microvascular changes	Wall-to-lumen ratio	no established reference value

When to refer a hypertensive patient to a specialist or to hospital

- Patients in whom secondary hypertension is suspected
- Young patients (<40 years) with grade 2 or 3 hypertension in whom secondary hypertension should be excluded
- Patients with sudden onset or aggravation of hypertension when BP was previously normal
- Patients with treatment-resistant hypertension
- Need of more detailed assessment of HMOD, which might influence treatment decision
- Requirement of more in-depth specialist evaluation from the referring doctor
- Hypertensive emergencies (inpatient care will usually be needed)

Lifestyle interventions

Recommendations and statements	CoR	LoE
In adults with elevated BP who are overweight or obese, weight reduction is recommended to reduce BP and improve CV outcomes.	I	A
Preferred dietary products include vegetables, fruits, beans, nuts, seeds, vegetable oils, and fish and poultry among meat products. Fatty meats, full-fat dairy, sugar, sweetened beverages, and sweets should be limited. Overall, a healthy dietary patterns including more plant-based and less animal-based food is recommended.	I	B
In adults with hypertension consuming a high sodium diet (most Europeans), salt substitutes replacing part of the NaCl with KCl is recommended to reduce BP and the risk for CVD.	I	A
Dietary salt (NaCl) restriction is recommended for adults with elevated BP to reduce BP. Salt (NaCl) restriction to < 5 g (~2g sodium) per day is recommended.	I	B
Increased potassium consumption, preferably via dietary modification, is recommended for adults with elevated BP, except for patients with advanced CKD.	I	B
Daily physical activity and structured exercise is recommended for adults with elevated BP to reduce BP and improve cardiovascular risk profile. It is recommended to strive for at least 150-300 minutes of aerobic exercise a week of moderate intensity, or 75-150 minutes a week of aerobic exercise of vigorous intensity or an equivalent combination. Sedentary time should also be reduced and supplemented with dynamic resistance exercise (2-3 times per week).	I	B
Adult men and women with elevated BP or hypertension who currently consume alcohol (≥3 drinks[a]/day) should be advised that reduction of alcohol intake close to abstinence will lower their BP.	I	B
Alcohol should not be recommended for CVD prevention, as previous studies linking moderate consumption to lower CV risk are likely confounded.	III	B
It is recommended to avoid excessive (binge) drinking to reduce BP, and the risks particularly for haemorrhagic stroke and premature death.	III	B
Smoking cessation, supportive care and referral to smoking cessation programs are recommended for all smokers to avoid ambulatory BP increases, reduce the risk of masked hypertension, and improve CV health outcome.	I	B
Reduced stress via controlled breathing exercises, mindfulness-based exercise and meditation may be considered.	II	C

Office BP thresholds for drug treatment initiation

Recommendations and statements	CoR	LoE
In patients 18 to 79 years, the recommended office threshold for initiation of drug treatment is 140 mmHg for SBP and/or 90 mmHg for DBP.	I	A
In patients ≥80 years, the recommended office SBP threshold for initiation of drug treatment is 160 mmHg.	I	B
However, in patients ≥80 years a lower SBP threshold in the range 140 – 160 mmHg may be considered.	II	C
The office SBP and DBP thresholds for initiation of drug treatment in frail patients should be individualized.	I	C
In adult patients with a history of CVD, predominantely CAD, drug treatment should be initiated in the high-normal BP range (SBP ≥130 or DBP ≥80 mmHg).	I	A

Office BP targets for drug treatment

Recommendations and statements	CoR	LoE
Patients 18 to 64 years old		
The goal is to lower office BP to <130/80mmHg	I	A
Patients 65 to 79 years old		
The primary goal of treatment is to lower BP to <140/80mmHg	I	A
However, lowering BP to below 130/80mmHg can be considered if treatment is well tolerated.	I	B
Patients 65 to 79 years old with ISH		
The primary goal of treatment is to lower SBP in the 140 to 150 mmHg range.	I	A
However, a reduction of office SBP in the 130 to 139 mmHg range may be considered if well tolerated, albeit cautiously if DBP is already below 70 mmHg.	II	B
Patients ≥80 years old		
Office BP should be lowered to a SBP in the 140 to 150 mmHg range and to a DBP <80mmHg.	I	A
However, reduction of office SBP between 130 to 139 mmHg may be considered if well tolerated, albeit cautiously if DBP is already below 70 mmHg.	II	B
Additional safety recommendations		
In frail patients, the treatment target for office SBP and DBP should be individualised.	I	C
Do not aim to target office SBP below 120 mmHg or DBP below 70 mmHg during drug treatment.	III	C
However, in patients with low office DBP, i.e. below 70 mmHg, SBP should be still lowered, albeit cautiously, if on-treatment SBP is still well above target values	II	C
Reduction of treatment of can be consider in patient aged 80 years or older with a low SBP (< 120 mmHg) or in the presence of severe orthostatic hypotension or a high frailty level	III	C

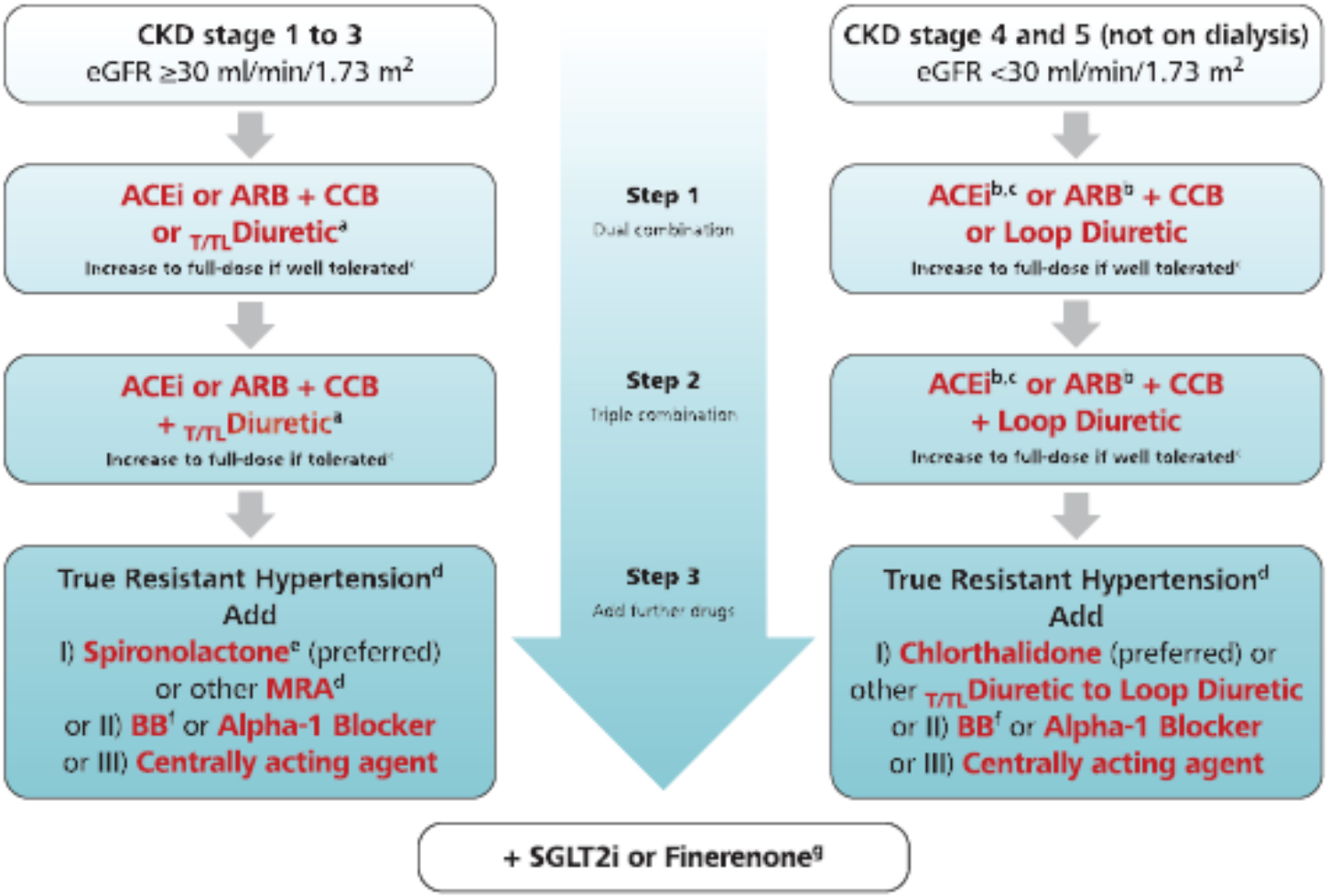
Recommendations of antiplatelet therapy in hypertension

Recommendations and statements	CoR	LoE
Low-dose aspirin is not recommended for primary prevention in patients with hypertension.	III	A
Antiplatelet therapy is recommended for secondary prevention in hypertensive patients.	I	A
Use of a polypill containing low-dose aspirin can be considered in hypertensive patients for secondary prevention.	II	A

Treatment strategies in diabetes

Recommendations and statements	CoR	LoE
BP should be monitored to detect hypertension in all patients with diabetes, because it is a frequent comorbidity associated with an increase CV risk and risk for kidney events.	I	A
Non-dipping or elevated night-time BP are frequent in type 2 diabetes and should be monitored by ABPM or HBPM.	I	B
Antihypertensive treatment in type 2 diabetes is recommended to protect against macrovascular and microvascular complications.	I	A
Immediate lifestyle interventions and antihypertensive drug treatment are recommended for people with type 2 diabetes when office SBP is ≥ 140 mmHg and DBP is ≥ 90 mmHg.	I	A
Drug treatment strategies in patients with type 2 diabetes should be the same as for patients without diabetes but the primary aim is to lower BP below <130/80 mmHg	I	A
BP control is difficult in diabetes and combination treatment is almost always necessary.	I	B
SGLT2is are recommended to reduce cardiac and kidney events in type 2 diabetes. These agents have a BP lowering effect.	I	A
The non-steroidal MRA finerenone can be used, because of its nephroprotective and cardioprotective properties in patients with diabetic CKD and moderate to severe albuminuria. Finerenone has a BP lowering effect.	I	A
There are only limited data on the potential benefits of combining SGLT2is and finerenone.	II	C

Treatment of hypertension in CKD



Treatment strategies in patients with kidney disease

Recommendations and statements	CoR	LoE
BP should be monitored at all stages of CKD, because hypertension is the second most important risk factor for end-stage kidney disease (ESKD).	I	A
Non-dipping or elevated night-time BP are frequent in CKD patients and should be monitored by ABPM or HBPM.	I	B
In both diabetic and non-diabetic CKD with hypertension, BP-lowering treatment slows the decline of kidney function and reduces the risk of ESKD and CV outcomes.	I	A
Immediate lifestyle interventions and antihypertensive drug treatment are recommended in most patients with CKD independently of the CKD stage if SBP≥ 140mmHg or DBP ≥90mmHg.	I	C
In all patients with CKD the primary goal is to lower office BP to <140 mmHg systolic and <90 mmHg diastolic.	I	A
In most CKD patients (young patients, patients with an albumin/creatinine ratio ≥ 300 mg/g, high CV risk patients) office BP should be lowered to <130/80 mmHg if tolerated.	II	B
In kidney transplant patients with hypertension, office BP should be lowered to <130 mmHg systolic and <80 mmHg diastolic.	II	B
In patients with CKD regardless of the presence of albuminuria, BP should not be lowered below 120/70 mmHg.	III	C
An ACEi or an ARB, titrated to the maximum tolerated doses is recommended for patients with CKD and moderate (UACR 30 to 300 mg/g) or severe (UACR > 300 mg/g) albuminuria.	I	A

Continued

Dual combination of an ACEi with an ARB is not recommended.	III	A
BP control is difficult in CKD and resistant hypertension is very frequent. Therefore combination treatment is almost always recommended.	I	B
SGLT-2 inhibitors are recommended for patients with diabetic and non-diabetic nephropathies CKD if eGFR is at least 20 or 25 ml/min/1.73². [a]	I	A
The non-steroidal MRA finerenone is recomended in patients with CKD and albuminuria associated with type 2 diabetes mellitus if eGFR is at least 25 ml/min/1.73² and serrum potassium <5.0 mmo/L.	I	A
In CKD patients with hyperkalemia a potassium binder can be used to maintain normal or near normal serum potassium levels (<5.5 mmol/L) in order to allow optimal treatment with a RAS-blocker or a MRA to continue.	II	B

Additional eGFR and albuminuria criteria apply for initiation of treatment with different SGLT2is according to their respective approval.

Obesity

Obesity and arterial hypertension commonly occur in the same patients and often have type 2 diabetes has a third associated condition. Hypertensive obese patients may require more antihypertensive medications to have their BP controlled than non obese individuals and are more likely to exhibit treatment-resistant hypertension , and metabolic side effects of antihypertensive medications may be particularly relevant in this population.

Role of nonpharmacological weight loss intervention

Lifestyle interventions aimed at reducing body weight are recommended in patients with obesity and hypertension through low caloric diets and increased physical activity. Involvement in the treatment plan of dieticians may be helpful.

Role of weight loss medications

Overall, weight loss medications should not be primarily prescribed for the management of hypertension in patients with obesity.

However, when prescribed for other reasons, BP reduction can be an added benefit depending on the drug class.

Role of bariatric surgery

Considering the risks associated with surgery and the limited amount of data, bariatric surgery should not be considered primarily for the management of hypertension. However, improved BP control appears to be an added benefit in patients with obesity submitted to bariatric surgery.

Hypertension management in obesity

Recommendations and statements	CoR	LoE
In adults with elevated BP who are overweight or obese, weight reduction is recommended to reduce BP and improve CV outcomes.	I	A
Thiazide/Thiazide-like Diuretics and BBs have some unfavorable metabolic effects. However, since optimal BP control is the primary goal of antihypertensive treatment, combination therapy with these drug classes is frequently necessary and recommended.	I	A
Dual GIP/GLP-1 RA or GLP-1 RA should not be prescribed for BP control in patients with obesity.	III	C
Obese patients should not be referred to bariatric surgery for BP control.	III	C
Dual GIP/GLP-1 RA or GLP-1 RA or bariatric surgery lower BP indirectly in parallel with body weight reduction and contribute to BP control in obese patients.	II	B
In obese patients with diabetes and hypertension treatment with anti-diabetic drugs that reduce both body weight and BP could be preferred.	II	B

Obstructive sleep apnea (OSA)

Sleep disorders such as a reduction of sleep to <6 h per night are included in the list of risk factors for development of hypertension and increased CV risk. OSA can be found in a considerable number of patients with difficult-to-treat or resistant hypertension , which favors this condition via multiple and complex pathophysiological mechanisms

OSA continue

Hypertension mediated by OSA is often associated with MH, higher BP values during the night or nocturnal hypertension and a nondipping status. All major classes of antihypertensive drugs can be used. BP reduction has been reported also with the use of MRAs. Continuous positive airway pressure (CPAP) application has been shown to induce small reductions (about 3mmHg for) in office and 24 h SBP, the 24 h BP reduction including day-time and night-time BP values.

Asthma

Hypertension and asthma are common diseases frequently encountered together in the same patient. Epidemiological studies indicate an increased prevalence of hypertension in asthmatic patients compared with patient without asthma . It has also been reported that hypertension is associated with augmented asthma severity, reduced lung function and reduced forced expiratory volume in 1 s (FEV1) as a marker of CV mortality, independent of the smoking history.

Asthma continue

Obese patients with asthma experience more frequently severe exacerbations of the disease and a reduced response to asthma medications,

possibly via an increased production of pro-inflammatory cytokines and systemic inflammation . The OSA syndrome is another asthma-related factor associated with hypertension and systemic inflammation. OSA was found to more prevalent in asthma patients as well as an independent risk factor for poor asthma control.

Asthma continue

For the drug treatment of hypertension, CCBs appear to be particularly suitable, as they may favor bronchial smooth muscle relaxation. Among RAS blockers, ARBs should be preferred because of the risk of developing cough during treatment with ACEis, which may be particularly disturbing in asthmatic patients. It is recommended to avoid BBs for antihypertensive treatment in patients with asthma because the safety margin of these drugs is smaller than in chronic COPD, where BBs are safe. Treatment of asthma with beta-adrenergic agonists and corticosteroids may induce adverse CV effects by increasing heart rate and BP,

Obstructive pulmonary disease (COPD)

Hypertension is the most common comorbidity in patients with COPD and both comorbidities are independently associated with increased risk of CV events. treatment of patients with COPD and CVD with both ß1-selective and nonselective BBs significantly lowered heart rate (about 8 bpm) and reduced all-cause mortality as compared with COPD patients with no BB treatment. Additionally, use of ß1-selective BBs, but not of nonselective ones, reduced COPD exacerbations. Thus, in COPD patients, hypertension and CVD should be treated, if tolerated with more ß1-selective BBs, to reduce both mortality and COPD exacerbations .

Gout and uric acid

The prevalence of hypertension in patients with gout is twice as high compared with patients without gout (36 versus 17%), while hyperuricemia (with or without gout) can be found in more than one out of four hypertensive patients. Gout is clearly associated with an increased risk of CV events (including myocardial infarction and stroke). Prevention of gout by lowering serum uric acid with allopurinol or xanthine-oxidase inhibitors has been reported to be associated with a small BP reduction and achievement of serum uric acid level <6.0 mg/dl are recommended by recent guidelines on gout treatment.

Gout and uric acid

Drugs used for the treatment of gout flares, i.e. colchicine, NSAIDs and corticosteroids, may negatively impact on BP values and control in hypertensive patients, which means that under these circumstances, both office and out-of office BP monitoring should be intensified. The recently reported preventive role of colchicine against atherosclerotic disease.

Gout and uric acid continue

This is required also for the CV protective effect of reducing serum uric acid by antiuricemic agents, which has been suggested by earlier studies but recently denied by a RCT with allopurinol in patients with CAD. Serum uric acid level increases with the use of Thiazide/Thiazide-like and loop diuretics. ACEis, ARBs, CCBs and BBs have no effect, although a reduction of kidney excretion of uric acid has been reported for BBs.

Gout and uric acid continue

Among ARBs, losartan has been shown to reduce serum urate levels through an uricosuric effect, with some favorable implications for CV outcome. Together with CCBs, losartan has also been shown to reduce the incidence of gout in hypertensive patients, regardless of the BP level, in a large nested case–control study. In line with other guidelines, these guidelines suggest to prescribe diuretics with caution in patients with gout but not to avoid them if diuretics are needed to achieve BP control. In general, physicians should try to use lower doses of diuretics because the effect of these drugs on serum uric acid is dose-related.

Immune-mediated inflammatory diseases

Immune-mediated inflammatory diseases, including diseases such as rheumatoid arthritis, psoriasic arthritis or lupus erythematosus, are associated with an increased prevalence of hypertension that is often underdiagnosed and poorly controlled. Rheumatoid arthritis is associated with an increased risk of CV disease. Most of the currently used disease-modifying antirheumatic drugs do not seem to have substantial effects on BP. However, several other agents used in the symptomatic treatment of rheumatoid arthritis patients appear to raise BP.

RA

NSAIDs and glucocorticoids raise BP and may cause clinically significant hypertension or impairment of BP control in treated hypertensive patients. BP should be lowered in rheumatoid arthritis as in the general population, preferentially with CCBs and RAS inhibitors because of the evidence of an overactive RAS in this disease. Underlying diseases should be managed by reducing inflammation and by avoiding high doses of NSAIDs.

Psoriatic arthritis

Psoriatic arthritis is associated with an increased cardiometabolic risk leading to an excess of CV disease. Psoriasis particularly if severe, may be an independent risk factor for atherosclerosis, myocardial infarction and stroke. Hypertension is prevalent in patients with psoriatic arthritis (20–25%).Treatment recommendations,preferentially with RAS inhibitors and CCBs.

BBs may trigger or worsen psoriasis and should be avoided if possible or carefully used in the presence of compelling indications.

Systemic lupus erythematosus

Patients with systemic lupus erythematosus have a higher burden of CV risk factors compared with the general population, and this is responsible for the high prevalence of premature CVD in the affected patients. In a recent meta-analysis, the relative risk of CVD was significantly elevated in patients with systemic lupus erythematosus compared with the general population.

Glaucoma and hypertension

Recommendations and statements	CoR	LoE
It is recommended that patients with hypertension >60 years old (or >40 years old in African Americans) may be screened for glaucoma.	II	C
In hypertensive patients with glaucoma, ABPM and closer ophthalmologic examinations should be associated with frequent BP measurements, including ABPM, particularly in patients with unexplained visual field deterioration.	I	C
In patients with glaucoma, both very low and very high BP should be avoided, particularly during the night.	I	B
In patients with glaucoma, bedtime administration of antihypertensive drugs should be avoided as it may increase the risk of excessive lowering of BP and thus visual field loss.	III	B
BBs, have been associated with lower intraocular pressure and decreased risk of primary open-angle glaucoma and maybe preferred in hypertensive patients with glaucoma.	II	B

Hypertension and its association with cancer

The association between hypertension and cancer is bidirectional with overlapping risk factors (e.g. unhealthy diet, alcohol intake, physical inactivity, smoking, increased BMI) and pathophysiological mechanisms (e.g. immunoinflammation and oxidative stress) involved in both conditions. Due to its high prevalence, preexisting hypertension is the most common comorbidity in patients with cancer, particularly in older patients, in parallel with the high prevalence of hypertension in the old age.

Hypertension induced by cancer treatments

Anticancer drugs and adjunctive therapy used in oncology can induce de novo hypertension or contribute to worsening preexisting hypertension. BP monitoring and general management before start of cancer treatment. In patients with uncontrolled hypertension and BP values ≥180 mmHg for systolic and/or ≥110 mmHg for diastolic BP, it is notn recommended to initiate anticancer therapy.