2013 ESH/ESC Guidelines for the management of arterial hypertension

Eur Heart J, 2013; 34: 2159-2219
J Hypertens, 2013; 31: 1281-1357
Blood Pressure, 2013: 193-278

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2013 ESH/ESC guidelines for the management of arterial hypertension

The Task Force on the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC)

Chairs: G. Mancia (ESH) & R. Fagard (ESC)

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Classes of recommendations and levels of evidence

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Classes of recommendations

Classes of recommendations	Definition	Suggested wording to use
Classe I	Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.	Is recommmended/ is indicated.
Class II	Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of the given treatment or procedure.	
Class IIa	*Weight of evidence/opinion is in favour of usefulness/efficacy.*	*Should be considered.*
Class IIb	*Usefulness/efficacy is less well established by evidence/opinion.*	May be considered.
Class III	Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.	Is not recommended.

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Levels of evidence

Level of Evidence A	Data derived from multiple randomized clinical trials or meta-analyses.
Level of Evidence B	Data derived from a single randomized clinical trial or large non-randomized studies.
Level of Evidence C	Consensus of opinion of the experts and/ or small studies, retrospective studies, registries.

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Epidemiological aspects on hypertension in Europe

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Epidemiological aspects

- Based on 21 reports from the last decade the prevalence of hypertension appears to be around 30-45% of the general population, with a steep increase with ageing.
- There also appear to be noticeable differences in the average BP levels across countries with no systematic trends towards BP changes in the last decade.
- However, it is difficult to obtain comparable results on BP among countries and over time, and therefore the use of a surrogate of hypertension status, such as stroke mortality, has been suggested.
- Based on WHO statistics, western European countries exhibit a downward trend in stroke mortality, whereas eastern European countries show a clear-cut increase.

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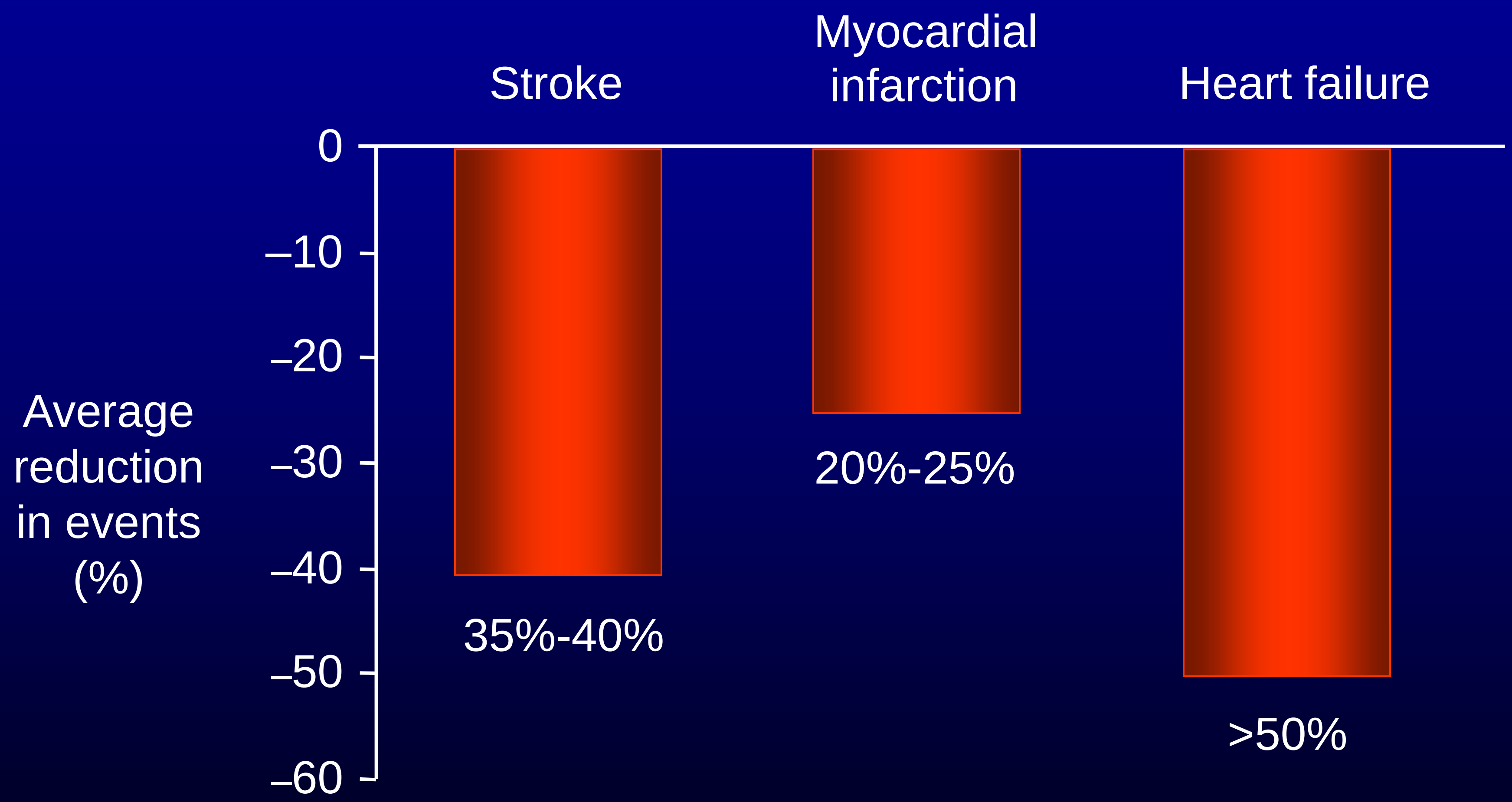
Long-Term Antihypertensive Therapy Significantly Reduces CV Events



Blood Pressure Lowering Treatment Trialists' Collaboration. *Lancet*. 2000;355:1955-1964.

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Diagnostic evaluation

- **The initial diagnostic evaluation of the patient with hypertension should:**
  - confirm the diagnosis of hypertension,
  - assess CV risk, asymptomatic organ damage and concomitant clinical conditions, and
  - detect causes of secondary hypertension.

- **The diagnostic evaluation requires:**
  - medical history, including family history,
  - physical examination, including careful BP measurement,
  - laboratory investigations and diagnostic tests.

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Diagnostic evaluation

Recommendations on medical history and physical examination

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Recommendations on history and physical examination

Recommendations	Class	Level
It is recommended to obtain a comprehensive medical history and physical examination in all patients with hypertension to verify the diagnosis, detect causes of secondary hypertension, record CV risk factors, and to identify organ damage and other CV diseases.	I	C
Obtaining a family history is recommended to investigate familial predisposition to hypertension and CV diseases.	I	B
It is recommended that all hypertensive patients undergo palpation of the pulse at rest to determine heart rate and to search for arrhythmias, especially atrial fibrillation.	I	B

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Diagnostic evaluation

Office blood pressure measurement

Diagnostic evaluation
Office blood pressure measurement (1)

- At present BP can no longer be estimated using a mercury sphygmomanometer in many – although not all – European countries. Validated auscultatory or oscillometric semiautomatic sphygmomanometers are used instead.

- Measurement at the upper arm is preferred and cuff/bladder dimensions should be adapted to the arm circumference.

- At least two BP measurements are taken, spaced 1-2 min apart, after the patient has been sitting for 3-5 min, with additional measurements if the first two are quite different.

- Automated recording of multiple BP readings with the patient seated in an isolated room might be considered.

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Diagnostic evaluation
Office blood pressure measurement (2)

- In case of a consistent systolic BP difference of >10 mmHg between arms*, the arm with the higher BP values should be used.
- BP is taken 1 and 3 min after standing in elderly subjects, diabetic patients and in other conditions in which orthostatic hypotension may be frequent or suspected. Orthostatic hypotension* is defined as a reduction in systolic BP of ≥20 mmHg or in diastolic BP of ≥10 mmHg within 3 min of standing.
- Heart rate* should be assessed after the 2nd BP measurement.

* It is of note that all 3 variables independently predict CV risk

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Definition and classification of office blood pressure levels

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Definitions and Classification of Office Blood Pressure Levels (mmHg)

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.

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Diagnostic evaluation

Out-of-office BP measurement: ambulatory and home blood pressure

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Diagnostic evaluation
Out-of-office BP measurement (1)

- The major advantage of out-of-office BP monitoring is that it provides a large number of BP measurements away from the medical environment, which represents a more reliable assessment of the actual BP than office BP.
- Out-of-office BP is commonly assessed by ambulatory or home BP monitoring, usually by self-measurement.
- Interpretation of the results should take into account that the reproducibility of out-of-office BP is reasonably good for 24-h, day and night BP averages, but less for shorter periods within the 24 hrs and for more complex and derived indices.

Diagnostic evaluation
Out-of-office BP measurement (2)

- ABPM and HBPM provide somewhat different information on the subject's BP status and risk, and the two methods should be regarded as complementary, rather than competitive or alternative.
- The correspondence between measurements with ABPM and HBPM is fair to moderate.
- Office BP is usually higher than ambulatory and home BP and the difference increases as office BP increases.
- Cut-off values for the definition of hypertension are different for office and out-of-office BP.

Definitions of hypertension by office and out-of-office blood pressure levels (mmHg)

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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Diagnostic evaluation
ABPM: Methodological aspects

- ABPM is performed with the patient wearing a portable BP measuring device, usually on the non-dominant arm for a 24-25 h period.
- In clinical practice, measurements are often made at 15 min intervals during the day and every 30 min overnight, but it may be recommended that measurements be made at the same frequency throughout, for example every 20 min.
- At least 70% of BPs during daytime and night-time periods should be satisfactory, or else the monitoring should be repeated.
- If there are sufficient measurements, editing is not considered necessary and only grossly incorrect readings should be deleted.

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Diagnostic evaluation
ABPM: Analyses

- In addition to the visual plot, average daytime, night-time and 24-h BP are the most commonly used variables in clinical practice.

- Definitions of daytime and night-time are based on:
  - the times of getting up and going to bed from the diary, or
  - short fixed time periods in which rising and retiring periods - which differ from patient to patient - are eliminated, for example:
    - **day**: from 10 am to 8 pm; **night**: from 0 am to 6 am, or
    - **day**: from 9 am to 9 pm; **night**: from 1 am to 6 am.

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Diagnostic evaluation
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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Diagnostic evaluation
Ambulatory BP: Relation with organ damage and prognostic significance

- Several markers of organ damage, such as left ventricular hypertrophy and intima-media thickness, correlate with ambulatory BP much more closely than with office BP.
- Ambulatory BP in general is a more sensitive predictor of clinical CV outcomes such as fatal and nonfatal coronary events and stroke than office BP.
- The superiority of ambulatory BP has been shown in the general population, in young and old, in men and women, in untreated and treated hypertensive patients, in patients at high risk and in patients with CV or renal disease.

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Diagnostic evaluation
Ambulatory BP: Prognostic significance of daytime and night-time BP

- Studies that accounted for daytime and night-time BP in the same statistical model found that night-time BP is a stronger predictor of morbidity and mortality than daytime BP.
- With regard to the dipping pattern, the incidence of CV events is higher in patients with a lesser or no drop in night-time BP than in those with a greater drop.

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Diagnostic evaluation
HBPM: Methodological aspects

- The technique usually involves self-measurement of BP, but in some patients the support of a trained health provider or family member may be needed.
- BP should be measured daily on at least 3 to 4 days and preferably on 7 consecutive days.
- BP is measured twice in the morning and twice in the evening, after 5 min rest in the sitting position, and 1-2 min between measurements.
- Home BP is the average of these readings, with exclusion of the first monitoring day.

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Diagnostic evaluation
Home BP: Relation with organ damage and prognostic significance

- Home BP is more closely related to hypertension-induced organ damage such as left ventricular hypertrophy than office BP.
- Meta-analyses of the few prospective studies in the general population, in primary care and in hypertensive patients indicate that the prediction of CV morbidity and mortality is significantly better with home BP than with office BP.
- Studies in which both ABPM and HBPM were performed show that home BP is at least as well correlated with organ damage than ambulatory BP, and that the prognostic significance of home BP is similar to that of ambulatory BP after adjustment for age and gender.

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Diagnostic evaluation

White-coat and masked hypertension

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Definitions according to office BP and out-of-office BP (daytime ambulatory or home BP)

		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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Diagnostic evaluation
WCHT: Prevalence and determinants

- Based on population-based studies, the overall prevalence of WCHT averages about 13% (range: 9-16%) in the population and about 32% (range: 25-46%) among hypertensive patients in these surveys.
- Factors related to the prevalence of WCHT:
  - **higher prevalence:** older age, female gender, non-smoking, no organ damage, grade 1 hypertension,
  - **lower prevalence:** repeated office BP measurements, measurements by a nurse or another healthcare provider, grade 3 hypertension.
- It is recommended that the diagnosis of WCHT be confirmed within 3 to 6 months.

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Diagnostic evaluation
WCHT: Organ damage and prognosis

- The prevalence of organ damage and the incidence of CV events is lower than in sustained hypertension.
- Meta-analyses concluded that prognosis is not significantly different from true normotension after adjustment for age, gender and other covariates.
- However, other factors to consider are that, compared with true normotension, out-of-office BP is higher, organ damage and metabolic risk factors may be more frequent, and the risk of new-onset diabetes and progression to sustained hypertension may be increased.

Diagnostic evaluation
Masked HT: Prevalence, determinants, organ damage and prognosis

- Based on population-based studies, the overall prevalence of masked hypertension averages about 13% (range: 10-17%).
- Factors related to the higher prevalence of masked HT: younger age, male gender, smoking, alcohol consumption, exercise-induced hypertension, physical activity, anxiety, job stress, obesity, diabetes, chronic kidney disease, family history of hypertension, high normal BP.
- The condition is frequently associated with other risk factors, organ damage, increased risk of diabetes and sustained hypertension.
- Meta-analyses indicate that the incidence of CV events is about two times higher than in true normotension and is similar to the incidence in sustained hypertension.

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Diagnostic evaluation
Clinical indications for out-of-office BP

- Conventional office BP measurement currently remains the gold standard for screening, diagnosis and management of hypertension.
- Out-of-office BP is an important adjunct to office BP.
- Although there are important differences between ABPM and HBPM, the choice between the two methods will depend on indication, availability, ease, cost of use and, if appropriate, patient preference.
- It is advisable to confirm borderline or abnormal findings on HBPM with ABPM, which is currently considered the reference for out-of-office BP, with the additional advantage of providing night-time BP values.

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Clinical indications for out-of-office BP measurement for diagnostic purposes (1)

Clinical indications for HBPM or ABPM

- Suspicion of white-coat hypertension:
  - grade I hypertension in the office,
  - high office BP in individuals without asymptomatic organ damage and at low total CV risk.
- Suspicion of masked hypertension:
  - high normal BP in the office,
  - normal office BP in individuals with asymptomatic organ damage or at high total CV risk.
- Identification of white-coat effect in hypertensive patients.
- Considerable variability of office BP over the same or different visits.
- Autonomic, postural, post-prandial, siesta- and drug-induced hypotension.
- Elevated office BP or suspected pre-eclampsia in pregnant women.
- Identification of true and false resistant hypertension.

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Clinical indications for out-of-office BP measurement for diagnostic purposes (2)

Specific indications for ABPM

- Marked discordance between office BP and home BP.
- Assessment of dipping status.
- Suspicion of nocturnal hypertension or absence of dipping, such as in patients with sleep apnoea, chronic kidney disease, or diabetes.
- Assessment of BP variability.

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Diagnostic evaluation

Recommendations on blood pressure measurement

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Recommendations on BP measurement

Recommendations	Class	Level
Office BP is recommended for screening and diagnosis of hypertension.	I	B
It is recommended that the diagnosis of hypertension be based on at least two BP measurements per visit and on at least two visits.	I	C
Out-of-office BP should be considered to confirm the diagnosis of hypertension, identify the type of hypertension, detect hypotensive episodes, and maximize prediction of CV risk.	IIa	B
For out-of-office BP measurements, ambulatory BP monitoring or home BP monitoring may be considered depending on indication, availability, ease, cost of use and, if appropriate, patient preference.	IIb	C

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Diagnostic evaluation

Blood pressure measurement during exercise testing and mental stress testing

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Diagnostic evaluation
Blood pressure measurement during exercise testing and mental stress testing

- The overall results question the clinical utility of BP measurement during exercise testing for diagnostic and prognostic purposes in patients with hypertension.
- However, exercise testing is useful as a general prognostic indicator using exercise capacity and electrocardiography, and an abnormal BP response may warrant to perform ambulatory BP monitoring to detect masked hypertension.
- The overall results suggest that BP measurements during mental stress tests are currently not clinically useful.

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Assessment of cardiovascular risk

Recommendations on cardiovascular risk assessment

Recommendations	Class	Level
In asymptomatic subjects with hypertension but free of CV disease, chronic kidney disease, and diabetes, total CV risk stratification using the SCORE model is recommended as a minimal requirement.	I	B
As there is evidence that asymptomatic organ damage predicts CV death independently of SCORE, a search for organ damage should be considered, particularly in individuals at moderate risk.	IIa	B
It is recommended that decisions on treatment strategies depend on the initial level of total CV risk.	I	B

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The stratification of total cardiovascular risk in different categories in hypertension is based on:

- blood pressure category,
- other cardiovascular risk factors,
- asymptomatic organ damage,
- presence of diabetes mellitus,
- symptomatic cardiovascular disease or chronic kidney disease.

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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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Total cardiovascular risk stratification
Blood pressure

- Total CV risk stratification is traditionally based on office BP.
- However, the 2013 update also provides for the consideration of out-of-office BP in the risk stratification model:
  - patients with high office BP may have normal out-of-office BP (white-coat hypertension) and their risk is lower than the risk in sustained hypertension, and
  - individuals with high normal office BP may have elevated out-of-office BP (masked hypertension) and their risk is in the hypertension range.

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Total cardiovascular risk stratification

- **Factors other than blood pressure influencing prognosis:**
  - other cardiovascular risk factors,
  - asymptomatic organ damage,
  - presence of diabetes mellitus,
  - symptomatic cardiovascular disease or chronic kidney disease.

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Total cardiovascular risk stratification
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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Total cardiovascular risk stratification
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/m^2 in men; >95 g/m^2 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 m^2).
- 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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Total cardiovascular risk stratification
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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Total cardiovascular risk stratification
Established CV 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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Recommendations on diagnostic evaluation of heart, arteries, kidney, retina and brain

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Diagnostic evaluation - Recommendations
Heart

Recommendations	Class	Level
An ECG is recommended in all hypertensive patients to detect left ventricular hypertrophy, left atrial dilatation, arrhythmias, or concomitant heart disease.	I	B
In all patients with a history or physical examination suggestive of major arrhythmias, long-term ECG monitoring, and, in case of suspected exercise-induced arrhythmias, a stress ECG test should be considered.	IIa	C
An echocardiogram should be considered to refine CV risk, and confirm ECG diagnosis of left ventricular hypertrophy, left atrial dilatation or suspected concomitant heart disease.	IIa	B
Whenever history suggests myocardial ischaemia, a stress ECG test is recommended, and, if positive or ambiguous, an imaging stress test (stress echocardiography, stress cardiac MRI or nuclear scintigraphy) is recommended.	I	C

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Diagnostic evaluation - Recommendations
Arteries

Recommendations	Class	Level
Ultrasound scanning of carotid arteries should be considered to detect vascular hypertrophy or asymptomatic atherosclerosis, particularly in the elderly.	IIa	B
Carotid-femoral pulse wave velocity should be considered to detect large artery stiffening.	IIa	B
Ankle-brachial index should be considered to detect peripheral artery disease.	IIa	B

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Diagnostic evaluation - Recommendations
Kidney

Recommendations	Class	Level
Measurement of serum creatinine and estimation of GFR is recommended in all hypertensive patients.	I	B
Assessment of urinary protein is recommended in all hypertensive patients by dipstick.	I	B
Assessment of microalbuminuria is recommended in spot urine and related to urinary creatinine excretion.	I	B

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Diagnostic evaluation - Recommendations
Retina and Brain

Recommendations	Class	Level
Retina		
Examination of the retina should be considered in difficult to control or resistant hypertensive patients to detect haemorrhages, exudates, and papiloedema, which are associated with increased CV risk.	IIa	C
Examination of the retina is not recommended in mild-to-moderate hypertensive patients without diabetes, except in young patients.	III	C
Brain		
In hypertensive patients with cognitive decline, brain magnetic resonance imaging or computed tomography may be considered for detecting silent brain infarctions, lacunar infarctions, microbleeds, and white matter lesions.	IIb	C

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Laboratory investigations and diagnostic tests

- **Laboratory investigations and diagnostic tests should progress from the most simple to the more complicated ones, hence the distinction between:**
  - routine tests,
  - additional tests, based on history, physical examination, and findings from routine tests, and
  - tests for extended evaluation, mostly domain of the specialist.

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Laboratory Investigations
Routine tests

- Haemoglobin and haematocrit.
- Fasting plasma glucose.
- Serum total, LDL and HDL 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 electrocardiogram.

Laboratory Investigations
Additional tests, based on history, physical examination, and findings from routine tests

- Haemoglobin A_{1c} (if fasting glucose >5.6 mmol/L (102 mg/dL) or previous diagnosis of diabetes).
- Quantitative proteinuria (if dipstick test positive); urinary potassium and sodium concentration and their ratio.
- Home and 24-h ambulatory BP monitoring.
- Echocardiogram.
- Holter monitoring in case of arrhythmias.
- Exercise testing.
- Carotid ultrasound.
- Peripheral artery/abdominal ultrasound.
- Pulse wave velocity.
- Ankle-brachial index.
- Fundoscopy.

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Laboratory Investigations
Extended evaluation (mostly domain of the specialist)

- 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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