



In the Name of God

HYPERTENSION IN DIFFERENT DEMOGRAPHIC SITUATIONS

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Blood pressure in children, adolescents and transition period

Hypertension in children and adolescents

Hypertension in the age range of 1–15 years is diagnosed when office BP values are found to be equal

or above the 95th percentile of the normative BP distribution for age, sex and height percentile, persistently on at least three

separate occasions. Because of its superior reproducibility and association with HMOD compared to office BP

ABPM can be a valuable source of additional information, its elevation being also based on 24-h mean

values 95% percentile .ABPM is also indicated for the evaluation of BP control during treatment, the confirmation

of resistant hypertension and the identification of WCH and MH, which are also not uncommon in children

Stricter

BP targets, i.e. below the 75th percentile or below the 50th percentile for 24 h mean BP, are recommended for CKD either

with or without proteinuria, respectively. Treatment should start with lifestyle changes, within which loss of

body weight has a primary importance because of the close association of hypertension and obesity in adolescents

.The decision to use antihypertensive drugs should be based on failure to reach BP control and also,

concomitantly with lifestyle interventions, on the BP level (grade 2 or 3 hypertension), the presence of signs or symptoms

related to the BP elevation and the evidence of HMOD.

Transition period to adulthood

In hypertensive adolescents aged 16 years or older, the consensus is to shift to the diagnostic and treatment criteria largely similar to those used in adult hypertensive patients. That is, to (i) identify hypertension by office BP values 140mmHg for SBP and/or 90mmHg for DBP, (ii) pursue an office BP target of <130/80mmHg aiming at <125/75mmHg in the presence of HMOD or CKD [4] and (iii) lower BP by the same nonpharmacological and pharmacological treatment strategies used in adults.

Recommendations and statements	CoR	LoE
BP levels should be screened in children starting from the age of three years.	I	C
BP screening in children younger than three years is recommended in the presence of risk factors for high BP (e.g. congenital heart disease, CKD, solid organ transplantation, treatment with BP increasing drugs, history of preterm birth and others)	I	C
For BP measurement only devices validated for children should be used. www.stridebp.org	I	B
It is recommended to define hypertension as BP \geq 95th percentile for individuals aged 0-15 years, or BP \geq 140/90 mmHg in those aged \geq 16 years.	I	B
Diagnosis of hypertension should be established on repeated measurements using a manual auscultatory device. Data from automated devices should be confirmed by using a manual auscultatory device.	I	B
ABPM can be a source of a variety of important information and its use is recommended whenever possible.	II	C
HBPM may be considered for the long-term follow-up of children treated for hypertension.	II	C

Hypertension in young adults

In a subgroup of young patients (n¼5000, age <40 years) from the CARDIA study

followed for about 19 years, the risk of CV events increased progressively with a BP increase, and in hypertension, (SBP 140 mmHg) it was 8.4 times greater than in normotension

Hypertension in older persons

In old people, SBP is prognostically much more important than DBP, and ISH is the predominant hypertension phenotype, particularly above 70 years of age. Some studies have shown that in old people, a pulse pressure $>65\text{mmHg}$ could be an independent risk factor for CV morbidity and mortality. Although chronological age is not invariably the most important criterion for defining diagnostic and therapeutic strategies for hypertension, a number of considerations suggest that two age thresholds might be usefully considered. One age threshold is 65 years, i.e.

Nevertheless, in a meta-analysis of 32 RCTs in 96 549 patients largely confined to a 65–80 years of age group (i) antihypertensive treatment was associated with a reduction of CV outcomes when patients had a baseline SBP 140mmHg; (ii) reducing SBP to <130mmHg was associated with an incremental reduction of CV events and mortality compared to patients in whom the SBP reduction left on-treatment SBP values in the 139–130mmHg range and (iii) this was also the case when DBP was reduced to <80mmHg compared with remaining in the 80–89mmHg range. Data in older patients were similar to what was seen in younger patients and indeed, the linear relationship between BP reductions and outcomes over a 40mmHg SBP change was almost superimposable in the two age groups. Thus, it seems appropriate for the present guidelines to somewhat modify the previously recommended BP targets in hypertensive patients aged 65–79 years.

In trials documenting the benefit of antihypertensive treatment in ISH, initial SBP was 160mmHg while on-treatment SBP was confined to the 149–140mmHg range which supports the recommendation to treat patients with grade 2 or 3 ISH and to reduce their SBP to <150 mmHg, a conservative target that might diminish the risk of an excessive DBP reduction.

Antihypertensive treatment strategies

Treatment of older patients should make use of lifestyle interventions as in younger patients. However, in subjects 80 years or older the measures indicated for younger patients may have to be adapted. Although overweight and obesity remain deleterious for CV and metabolic health, weight loss programs may lead to muscle mass loss, sarcopenia and malnutrition. Therefore, except for the case of severe obesity or with robust old people, weight loss is not recommended

in old patients and particularly frail patients, initial monotherapy should be considered the first treatment step more frequently than in younger patients, especially with grade 1 hypertension. Combination treatment is necessary in the vast majority of the patients with grade 2 or 3 hypertension, and in these patients, it can usually be considered as first step treatment because initial combination treatment favors better adherence to treatment and reduced treatment inertia [608], also in old patients

Antihypertensive drugs

older patients are more susceptible to side effects associated with BBs, most importantly fatigue, sleep-related disorders (unusual dreams or insomnia) and depression [959] that can negatively impact on the quality of life. Therefore, in older individuals, BBs should not be a general first choice for treatment in the absence of GDMT indications or other conditions where their use is recommended

Recommendations and statements	CoR	LoE
Patients 65 to 79 years old		
The recommended office threshold for initiation of drug treatment is 140/90 mmHg.	I	A
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
In dedicated RCTs in older patients with ISH, CCBs and Thiazide/Thiazide-like diuretics have been mainly used. However, all other major drug classes can be used, because of the frequent co-existence of compelling indications and the need of combination therapy to control SBP.	I	A
Initiation of treatment with a two-drug combination is also recommended in most older patients with ISH, who are not frail.	I	C

Patients ≥ 80 years old		
The recommended office SBP threshold for initiation of drug treatment is 160 mmHg.	I	A
However, a lower SBP threshold in the 140 to 160 mmHg range may be considered.	II	C
Office BP should be lowered to a SBP in the 140 to 150 mmHg range and to a DBP < 80 mmHg.	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 recommendations		
In frail patients, initiation of drug treatment and the treatment	I	C
Do not aim to target office SBP below 120 mmHg or DBP below target for office SBP and DBP should be individualised. 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 can be considered in patients age 80 years or older with a low SBP (<120mmHg or in the presence of severe orthostatic hypotension or a high frailty level	III	C
Withdrawal of BP-lowering drug treatment on the basis of age, even when patients attain an age of ≥ 80 years, is not recommended, if treatment is well tolerated.	III	B
In older patients, treatment should start with lower doses and uptitration should be slower.	I	C
The search for orthostatic hypotension in old patients should be systematic, even in the absence of symptoms. Back titration or discontinuation of BP lowering drugs should be considered in patients with orthostatic hypotension.	I	C
In old patients with hypertension there should always be an assessment of functional/autonomy status including cognitive function.	I	C
In patients with reduced functional/autonomy status and/or dementia treatment should be individualized.	I	C

Sex and gender aspects in hypertension

Epidemiology and pathophysiology

In hypertension, as in many other diseases, there are sex (a biological characteristic) and gender (a social construct)

differences that have an important impact on its pathophysiology, epidemiology and clinical management. In 2019, the

worldwide age-standardized prevalence of hypertension, defined by SBP 140mmHg and/or DBP 90mmHg, or taking

medication for hypertension, was 32% in women and 34% in men.

In premenopausal female individuals, estrogens contribute to lower BP in the context of their general vascular protective effect. Protection is mediated through different mechanisms including endothelial vasodilatation via upregulation of the nitric oxide pathway and inhibition of the activity of SNS and RAS. Moreover, estrogens decrease endothelin production, decrease oxidative stress and reduce inflammation.

Differences in clinical phenotypes

White-coat hypertension and masked hypertension

The IDACO study reported that WCH exponentially increased from individuals aged 18–30 years to individuals aged 70 years, with limited differences between men and women (8.0 versus 6.1%; $P=0.0003$). However, data from national and international registries consistently report a higher prevalence of WCH in women [980]. A high prevalence of WCH was observed in older individuals and pregnant women. In contrast, MH is generally more prevalent in men than in women as shown by the Spanish ABPM registry (43 versus 26%) and the IDACO registry (21.1 versus 11.4%).

Sex differences in hypertension outcomes Clustering of female patients was observed among patients with HfpEF, where females represent 55–70% of patients. This is different for HfrEF, in which females have been reported to be 30–40% of the overall number of patients with HfrEF. Although differences in the age distribution of the patients at risk (because of the longer life expectancy of female individuals) may have contributed, hypertensive female patients have been reported to develop more LVH, vascular and myocardial dysfunction compared with hypertensive male patients, with, thus, a possible sex-related contribution to the development of CAD and HF.

A Norwegian study reported a stronger association of an elevated SBP with incident AF in female than in male patients, but this finding has not been consistently confirmed by other studies. Recent studies also suggest that, in line with previous evidence, stroke risk starts to increase at a lower BP in female patients]. Hypertension also seems to be a stronger risk factor for dementia in female individuals for cognitive decline.

Adverse effects from antihypertensive drugs are reported more often for women than for men, even when women are taking fewer drugs ,and women have a 50% greater risk of suffering from adverse reactions compared to men .A higher incidence of ACEi –induced cough and CB-induced ankle edema has been observed in women.

Women were more likely to experience hypokalemia and hyponatremia with diuretics, although less likely to experience gout

Oral contraceptive pills and hypertension In newly diagnosed women with grade 1 hypertension or treated

hypertensive women with BP levels within the target range, a combined estrogen–progestin pill may be considered, if no

other method is appropriate. Newly diagnosed women with (i) higher hypertension grades, (ii) on-treatment uncontrolled

hypertension or (iii) a history or a high risk of CV disease, should not receive estrogen-based contraceptive pills

Hormone-replacement therapy and hypertension

current evidence suggests that the use of hormone-replacement therapy is not associated with an increase in BP. If

BP levels can be controlled with antihypertensive medications, women may receive hormone-replacement therapy.

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HYPERTENSION IN SPECIFIC SETTINGS

Hypertension disorders in pregnancy

Hypertension disorders affect almost 10% of pregnancies worldwide and are the major cause of maternal, fetal or neonatal morbidity and mortality .Maternal risks include the following: placental abruption, stroke, pulmonary edema, thromboembolic events, multiple organ failure and disseminated intravascular coagulation. The fetus is at high risk of intrauterine growth retardation (25% of cases of preeclampsia), prematurity (27% of cases of preeclampsia) and intrauterine death (4% of cases of preeclampsia).

TABLE 22. Classification of hypertensive disorders in pregnancy

A. Preexisting (chronic) hypertension

Hypertension either preceding pregnancy or developing before 20 weeks gestation, usually persisting for more than 42 days postpartum, and may be associated with proteinuria.

1. Primary hypertension
2. Secondary hypertension
3. White-coat hypertension
4. Masked hypertension

B. Gestational hypertension

Hypertension develops after 20 weeks gestation and usually resolves within 42 days postpartum.

Transient gestational hypertension

– Usually detected in the clinic but then settles with repeated BP measurements taken over several hours, it is associated with a 40% risk of developing true gestational hypertension or preeclampsia in the remainder of the pregnancy, thus requiring careful follow-up.

Preeclampsia is gestational hypertension accompanied by one or more of the following new-onset conditions at or after 20 weeks gestation:

- Proteinuria (urinary albumin excretion in a 24 h urine sample >0.3 g/day or UACR in a random spot urine sample >30 mg/mmol (0.3 mg/mg))
- Other maternal organ dysfunction
- Acute kidney injury (serum creatinine ≥ 90 $\mu\text{mol/l}$; 1 mg/dL)
- Liver involvement (elevated ALT or AST >40 IU/l; 0.67 $>\mu\text{kat/l}$ with or without
- right upper quadrant or epigastric abdominal pain)
- Neurological complications (e.g. eclampsia, altered mental status, blindness, stroke, clonus, severe headaches, persistent visual scotomata)
- Hematological complications (platelet count $<150000/\mu\text{l}$, DIC, hemolysis)
- Uteroplacental dysfunction (fetal growth restriction, abnormal umbilical artery Doppler waveform analysis, or stillbirth)

C. Preexisting hypertension + superimposed preeclampsia

Preexisting hypertension associated with any of the above maternal organ dysfunctions consistent with preeclampsia or a further increase in BP with new-onset proteinuria

D. Antenatally undassifiable hypertension

When BP is first recorded after 20 weeks gestation, and hypertension is diagnosed, reassessment is necessary at or after 42 days postpartum. If hypertension resolves, it should be reclassified as gestational hypertension, whereas if hypertension persists, it should be reclassified as preexisting hypertension.

Definition and classification of hypertension in pregnancy

The definition of hypertension in pregnancy is based on office BP values, i.e. SBP **140mmHg** and/or DBP **90mmHg**

and is classified as mild (140–159/90–109mmHg) or severe (**160/110mmHg**), at variance from the general hypertension grading

Accordingly, preeclampsia is a gestational hypertension in the presence of

one or more of the following new-onset conditions at or after 20 weeks of gestation: (i) significant proteinuria (ACR

30 mg/g or albuminuria 300 mg/24 hour), (ii) maternal organ dysfunction [i.e. acute kidney injury (serum creatinine

1 mg/dl; 90μmol/l); liver injury (elevated transaminases >40 U/l; 67μkat/l) with or without right upper quadrant or epigastric

pain; neurological manifestations (convulsions, altered mental status, blindness, scotoma or headache); hematological manifestations (platelet count $<150\,000/\text{ml}$, disseminated intravascular coagulation, hemolysis)] and (iii) uteroplacental dysfunction (i.e. fetal growth restriction, abnormal umbilical artery Doppler waves or stillbirth). The combination of hemolysis, thrombocytopenia and elevated transaminases defines the HELLP syndrome and, therefore, additional features of preeclampsia should be evaluated.

Blood pressure measurement in pregnancy

During pregnancy, BP should be measured in the sitting position (or in the left lateral recumbent position during labor)

with an appropriately sized arm cuff at heart level using the **manual auscultatory method** and Korotkoff phase V for DBP

Manual auscultation remains the gold standard for BP measurement in pregnancy, because automated devices tend

to under-record the BP and are unreliable in severe preeclampsia. Only devices validated specifically for pregnancy

should be used. ABPM is superior to office BP measurement for predicting pregnancy outcomes, and ABPM

devices recommended for use in pregnancy are more accurate than those used for office measurement or HBPM. ABPM

helps to avoid unnecessary treatment in WCH and is useful in the management of high-risk pregnant women with

hypertension and those with diabetic or hypertensive nephropathy. The BUMP-1 trial also suggests that HBPM and office BP measurements may be used alternatively or in complement to

diagnose hypertensive disorders during pregnancy in women at risk of preeclampsia

Laboratory examinations in pregnancy

Basic laboratory investigations are recommended for monitoring pregnant hypertensive women, including urine analysis, blood count, hematocrit, liver enzymes, serum creatinine and serum uric acid (increased in clinically evident preeclampsia). All pregnant women should be assessed for proteinuria in early pregnancy to detect preexisting renal disease and, in the second half of pregnancy, to screen for preeclampsia.

Prediction and prevention of preeclampsia

Women at high or moderate risk of preeclampsia should be advised to take 100–150mg of **aspirin** daily (at bedtime),

preferably before 16 weeks and ideally from weeks 11 to 14 until 36 weeks of gestation.

High risk of preeclampsia includes any of the following:

1. Hypertensive disorders during a previous pregnancy
2. Chronic hypertension
3. Chronic kidney disease
4. Type 1 or type 2 diabetes mellitus
5. Autoimmune diseases such as systemic lupus erythematosus or antiphospholipid syndrome
6. Assisted reproductive therapy in the current pregnancy

Moderate risk of preeclampsia includes two or more of the following risk factors:

1. Nulliparity
2. Age 40 years or older
3. Pregnancy interval of more than 10 years
4. BMI of 35 kg/m² or more at the first visit
5. Family history of preeclampsia
6. Multifetal pregnancy

Lifestyle interventions

Unless contraindicated, aerobic exercise (three to four times per week for 30–60 min sessions until delivery) should be recommended in pregnant women to maintain ideal body weight and reduce adverse pregnancy outcomes, including hypertensive disorders. In addition, calcium supplementation at a dose of at least 1 g/day may be considered to reduce preeclampsia risk in women with low calcium intake (i.e. <600 mg/day). Finally, although salt restriction is not advised to reduce hypertensive disorders during pregnancy, it is reasonable that women with preexisting hypertension should continue pursuing a limited salt intake diet.

Clinical management of hypertension in pregnancy

Mild preexisting essential hypertension

During the first trimester, all RAS blockers, i.e. ACEis, ARBs or direct renin inhibitors should be stopped.

In the early first trimester, for a woman with office BP levels of <130/80mmHg, BP-lowering treatment

may be discontinued or de-escalated under a careful follow-up of BP levels until week 16. Antihypertensive treatment

should restart in case of BP >140/90mmHg at any gestational age.

we suggest that the threshold for BP-lowering treatment initiation or potentiation may be 140/ 90mmHg and that in general, intensified BP-lowering should not be pursued because of the risk of fetal hypoperfusion.

Labetalol and alpha-methyldopa are the first-choice drugs for BP control in women with preexisting hypertension

An alternative agent to use is extended-release nifedipine. However, the use of labetalol is

controversial and not a choice in several countries in which it was removed from market 30 years ago, because of

hepatotoxicity, which may also occur when used in pregnancy

Mild gestational hypertension

Although the CHIPS trial included a limited number of women with gestational hypertension, secondary analyses did not indicate a differential outcome effect between women with gestational and preexisting hypertension, both for primary and secondary outcomes. A treatment initiation at values 140/90mmHg appears to be reasonable, while a DBP reduction to <80mmHg is not recommended. The same drugs recommended for preexisting hypertension (see above) can be used in women with gestational hypertension

Preeclampsia

All women with preeclampsia should be hospitalized and carefully monitored at first diagnosis. A diagnosis of preeclampsia at or after 37 weeks of gestation underscores the need for hypertension control and prompt delivery. Clinically stable women with preeclampsia before 37 weeks of gestation can be managed on an outpatient basis. However, despite optimal antihypertensive treatment, delivery is indicated even before 37 weeks, whenever hypertension remains severe. Delivery induction before 37 weeks is also recommended with (i) emerging maternal (neurological, hematological or cardiovascular) manifestations or (ii) a nonreassuring fetal status

Preeclampsia with severe features (severe hypertension with or without proteinuria, any hypertension grade with neurological, hematological, or cardiovascular complications, liver dysfunction or renal dysfunction) should be managed with MgSO₄ infusion (and delivery) to prevent eclampsia. Infusion of MgSO₄ for the 24 h postpartum seems reasonable for prevention purposes], and MgSO₄ remains the treatment of choice for eclamptic seizures. Hypertension control can be achieved by labetalol (unless contraindicated) alone or with the combination of labetalol, nifedipine extended-release and/or alpha-methyldopa

Severe hypertension

In severe hypertension, hospitalization is mandatory to allow gradual BP reduction to $<160/105$ mmHg and exclude preeclampsia. Continuous cardiotocographic monitoring is also mandatory. A recent comprehensive network meta-analysis indicated that nifedipine could be recommended as a strategy for BP management in pregnant women with severe hypertension and that labetalol and hydralazine showed in fact limited efficacy

before delivery,

hydralazine should be avoided because of its association with more adverse perinatal effects than other drugs. Hydralazine

should be reserved to cases of unavailability of labetalol or urapidil, failure to reduce BP, II or III degree AV block, severe

HF, asthma, bradycardia or severe postpartum hypertension.

When preeclampsia is associated with pulmonary edema, the drug of choice is nitroglycerin, given as an i.v. infusion of 5 mg/min and a gradual increase every 3–5 min to a maximum dose of 100 mg/min. In a pregnant woman with severe hypertension living in a rural area away from a maternity hospital, 10mg short-acting nifedipine may be administered orally and a second dose should be given after 1 h if severe hypertension persists. Sublingual short-acting nifedipine is contraindicated.

Blood pressure during puerperium

Postpartum hypertension is common during the first week. Also, in women with a normotensive pregnancy, a BP elevation during the first-day postpartum is usually associated with (i) the use of vasoactive drugs to favor uterine contraction (oxytocin, methergine), (ii) blood transfusions, (iii) the physiological uterine 'auto-transfusion phenomenon' or (iv) an excessive fluid intake. During puerperium, BP levels usually normalize within the first 6 weeks in women with gestational hypertension or Preeclampsia. Methyldopa should be used with caution because of the risk of postpartum depression.

Postpartum hypertension and breastfeeding

Antihypertensive drugs taken by the nursing mother are excreted into breast milk, mostly in very low concentrations. Proper

information on prescribable drugs in breastfeeding women is important .Nifedipine and verapamil are

considered compatible with breastfeeding. Although diuretics are not contraindicated, they may be associated with

reduced milk production. Similarly, alpha-methyldopa is compatible with breastfeeding, although it is not a drug of first

choice during puerperium because it increases the risk of postpartum depression.

ACEis are compatible with breastfeeding

and can be used in women with HDP and underlying CVD or CKD. ARBs are not currently recommended in lactating

women because of a limited safety evidence.

Recommendations and statements	CoR	LoE
In women with hypertensive disorders in pregnancy, initiation or intensification of drug treatment is recommended when SBP is ≥ 140 mmHg and/or DBP ≥ 90 mmHg.	I	C
In women with pre-existing hypertension (with or without superimposed pre-eclampsia), BP should be lowered to a target below 140/90 mmHg.	I	A
In women with gestational hypertension (with or without pre-eclampsia), BP should be lowered to a target below 140/90 mmHg.	I	C
In women with hypertensive disorders in pregnancy, too marked BP-lowering should be avoided. On-treatment DBP <80 mmHg is not recommended.	III	C
Labetalol ^a and α -methyl-DOPA are the first choice BP-lowering agents for hypertensive disorders in pregnancy unless contraindicated.	I	B
Extended-release nifedipine is recommended as an alternative BP-lowering agent during pregnancy.	I	B
Up-titration of monotherapy should precede any combination drug treatment.	II	C

Combination drug treatment between labetalol, extended-release nifedipine, or α -methyldopa may be reasonable to achieve the desirable BP target after the failure of up-titrated monotherapy.	II	C
ACE inhibitors, ARBs, or direct renin inhibitors are not recommended during pregnancy.	III	C
Aspirin (100-150 mg, at bedtime, weeks 11-35) should be administered in pregnant women at high or moderate risk of pre-eclampsia.	I	A
Severe hypertension ($\geq 160/110$ mmHg) in a pregnant woman requires prompt hospital admission.	I	C
In pre-eclampsia with severe features, magnesium sulfate should be administered without delay.	I	C
HBPM can be a reasonable alternative to conventional office BP measurement to detect new-onset hypertension in women at risk for pre-eclampsia without pre-existing hypertension.	II	B
HBPM can be a reasonable alternative to conventional office BP measurement to achieve BP control in women with gestational or pre-existing hypertension.	II	B

Definitions of hypertensive urgencies and emergencies

Hypertension emergencies are conditions in which severe hypertension (grade 3) is associated with acute symptomatic HMOD. Hypertension emergencies, can be life-threatening and require immediate intervention to lower BP, usually with intravenous (i.v.) therapy .The rate of the increase in BP may be at least as important as the absolute BP level in determining the clinical severity of the situation and the magnitude of organ injury.

Typical clinical presentations of a hypertension emergency are:

1. Severe hypertension associated with conditions that need intensified BP management: acute stroke (hemorrhagic or ischemic/thromboembolic), aortic aneurysm or dissection, acute HF, acute coronary syndrome and kidney failure.

These emergency conditions are compatible also with a relatively modest BP increase, which is sufficient to precipitate organ failure.

2. Hypertension caused by phaeochromocytoma or exogenous sympathomimetics substances (e.g. substance abuse).

Ingestion of sympathomimetic drugs such as meta-amphetamine or cocaine may precipitate acute and severe BP

increases that may result in hypertension emergencies when there is evidence of acute HMOD.

3. Severe forms of HDP, including preeclampsia/eclampsia with a HELLP syndrome.

Malignant hypertension with or without thrombotic microangiopathy or acute kidney failure is a hypertensive emergency characterized by small artery fibrinoid necrosis in the kidney, retina and brain. There might be also funduscopic changes (flame hemorrhages and papilloedema), microangiopathy, disseminated intravascular coagulation, encephalopathy (15% of cases) or acute HF

The emergency symptoms depend on the organs affected and may include headache, visual disturbances, dizziness and other neurological deficits as well as chest pain and dyspnea.

In patients with hypertensive encephalopathy, the presence of somnolence, lethargy, tonic clonic seizures and cortical blindness may precede loss of consciousness.

The term 'hypertension urgency' has been used to describe severe hypertension in patients in whom there is no evidence of acute HMOD. The burden of hypertensive urgencies is not well defined mainly because of the different criteria used for the definition of this condition. Furthermore, the ambiguity of the term 'hypertension urgency' versus the so called 'hypertensive crisis' has influenced epidemiological data.

TABLE 23. Diagnostic work-up of hypertension emergencies and urgencies

Common tests

Fundoscopy

ECG 12 leads

Hemoglobin, platelet count, fibrinogen, peripheral smear

Creatinine, eGFR, electrolytes, LDH, haptoglobin

UACR, urine microscopy for red blood cells, leucocytes and/or casts

Pregnancy test in women of child-bearing age

Specific tests

Troponin, (suspected HF and/or acute coronary syndrome) NT-proBNP

Chest X-ray or ultrasound (pulmonary congestion and fluid overload)

Echocardiography (heart failure, acute ischemia, aortic dissection)

CT angiography of thorax and/or abdomen in suspected aortic disease (aortic dissection)

CT or MRI brain (nervous system involvement)

Kidney ultrasound (renal impairment or suspected renal artery stenosis)

Urine drug collection (cocaine or methamphetamine use)

Hospital work-up, treatments and follow-up

Hypertensive emergencies, including BP 170/110mmHg in a pregnant woman, should be hospitalized. Except for acute

BP lowering in stroke, there are no RCTs on the management of these conditions. It should first be established, which organs

are affected to determine whether (i) they require any specific intervention other than BP lowering and (ii) there is a

precipitating cause for the acute rise in BP that might affect the treatment plan (e.g. pregnancy). Then a decision should be

made on the timescale and magnitude of the BP lowering as well as on the type of drug treatment that might be appropriate.

Intravenous treatment with a drug that has a short half-life is ideal to allow careful titration of the BP response, keeping the

patient in a close clinical area under continuous hemodynamic monitoring. Rapid uncontrolled BP lowering is not recommended and, thus, low initial doses with cautious dose up-titration should be used. Oral therapy with ACEis,

ARBs or BBs (at low initial doses and cautious upward titration) is sometimes effective in malignant hypertension because

the RAS may be activated by the associated kidney ischemia.

TABLE 24. Hypertensive emergencies requiring immediate BP-lowering with i.v. drug therapy

Clinical presentation	Timing and BP target	First-line treatment	Alternative
Malignant hypertension with or without acute renal failure	Several hours Reduce MAP by 20–25%	Labetalol ^a Nicardipine	Nitroprusside Urapidil
Hypertensive encephalopathy	Immediately reduce MAP by 20–25%	Labetalol ^a Nicardipine	Nitroprusside
Acute coronary event	Immediate reduce SBP to <140mmHg	Nitroglycerine Labetalol ^a	Urapidil
Acute cardiogenic pulmonary edema	Immediately reduce SBP to <140mmHg	Nitroprusside or nitroglycerine (with loop diuretic)	Urapidil (with loop diuretic)
Acute aortic dissection	Immediately reduce SBP to <120mmHg and heart rate to <60bpm	Esmolol AND nitroprusside or nitroglycerine or nicardipine	Labetalol ^a or metoprolol
Eclampsia and severe preeclampsia/HELLP	Immediately reduce SBP to <160mmHg and DBP to <105 mmHg	Labetalol ^a or nicardipine and magnesium sulphate	Consider delivery

Drug	Onset of action	Duration of action	Dose	Contraindications	Adverse effects
Esmolol	1 min	10–30 min	0.5–1 mg/kg i.v. bolus; 50–300 µg/kg/min i.v. infusion	Second-degree or third-degree AV block, systolic heart failure, asthma, bradycardia	Bradycardia
Metoprolol	1–2 min	5–8 h	2.5–5 mg i.v. bolus over 2 min; may repeat every 5 min to a maximum dose of 15 mg	Second-degree or third-degree AV block, systolic heart failure, asthma, bradycardia	Bradycardia
Labetalol ^a	5–10 min	3–6 h	10–20 mg i.v. bolus in 1 min; incremental doses ≥20 mg may be administered i.v. at 10 min intervals (max 80 mg) or 1–3 mg/min i.v. infusion until goal BP is reached	Second-degree or third-degree AV block; systolic heart failure, asthma, bradycardia	Bronchoconstriction, fetal bradycardia
Fenoldopam	5–15 min	30–60 min	0.1–0.3 µg/kg/min i.v. infusion, increase every 15 min with 0.1 µg/kg/min increments until goal BP is reached	Caution in glaucoma	
Clevidipine	2 min	10 min	1–2 mg/h i.v. infusion, increase every 2 min with 2 mg/h until goal BP, then titrate by smaller increments every 5–10 min		Headache, reflex tachycardia
Nicardipine	5–15 min	4–6 h	5–15 mg/h i.v. infusion, starting dose 5 mg/h, increase every 15–30 min with 2.5 mg until goal BP, maximum 15 mg/h	Liver failure	Headache, reflex tachycardia
Nitroglycerine	1–5 min	5–10 min	5–200 µg/min i.v. infusion, 5 µg/min increase every 5 min		Headache, reflex tachycardia
Nitroprusside	Immediate	1–3 min	0.3–0.5 µg/kg/min i.v. infusion, increase by 0.5 µg/kg/min every 5 min until goal BP (maximum dose 10 µg/kg/min)	Liver/kidney failure (relative)	Cyanide intoxication
Enalaprilat	5–15 min	4–6 h	0.62–1.25 mg i.v. bolus given over 5 min every 6 h	History of angioedema	
Urapidil	3–5 min	4–6 h	12.5–25 mg i.v. bolus; 5–40 mg/h as continuous infusion		
Clonidine	30 min	4–6 h	0.2–0.5 µg/kg/min i.v.		Sedation, rebound hypertension
Phentolamine	1–2 min	10–30 min	1–5 mg i.v. bolus or continuous i.v. infusion at a rate of 0.5–20 µg/kg/min		Tachyarrhythmia, chest pain

Patients with hypertensive urgencies do not usually require hospitalization. However, they require BP reduction, which can be obtained by oral administration of antihypertensive drugs, aimed at lowering BP gradually over 24–48 h. Oral treatment may include reinstitution or intensification of previous treatment or starting new treatment. DHP-CCBs are suggested as first choice in an untreated patient as they have few or no contraindications and do not interfere with the diagnostic work-up for secondary hypertension. Sublingual, rapidly acting, administration of nifedipine should be avoided because the degree of BP decrease cannot be anticipated and may often be too fast and larger than desirable

Perioperative hypertension and its management

Recommendations	CoR	LoR
It is recommended that newly diagnosed hypertensive patients who are scheduled for elective surgery should be preoperatively screened for HMOD (ECG, kidney function parameters, and evidence of heart failure) and CV risk.	I	B
Preexisting antihypertensive treatment should be continued in most patients. This helps to avoid large BP fluctuations in the perioperative period.	I	C
In selected patients, transient preoperative discontinuation of RAS-blockers or diuretics might be considered in patients with hypertension undergoing non-cardiac surgery.	II	C

Abrupt discontinuation of pre-existing therapy with beta-blockers or centrally acting agents (e.g. clonidine) is potentially harmful and is not recommended.

III

B

Non cardiac surgery should not routinely be deferred in patients with grade 1 or 2 hypertension (SBP < 180 mmHg and DBP < 110 mmHg).

III

C



Thanks For Your Attention