National Guideline For Management of Hypertension For Secondary and Tertiary Health Care Level

Directorate of Non-Communicable Diseases
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Ministry of Health

National Hypertension guideline
for Secondary and Tertiary Healthcare level

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to serve as a reference to the doctors managing this common condition at secondary and tertiary healthcare level.
This document was reviewed by the Directorate of NCD to be in line with the National policies, strategies and regulations.
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Abbreviations

ABI	Ankle-brachial index
ABPM	Ambulatory blood pressure monitoring
ACEI	Angiotensin- converting enzyme inhibitors
ALT	Alanine transaminase
APCKD	Adult polycystic kidney disease
ARB	Angiotensin receptor blocker
AST	Aspartate transaminase
BB	Beta blockers
BMI	Body mass Index
CAD	Coronary artery disease
CCB	Calcium channel blocker
CKD	Chronic kidney disease
CKD T	Chronic kidney disease transplant recipients
CT	Computed tomography
CV	Cardiovascular
CVD	Cardiovascular disease
DASH	Dietary approaches to stop hypertension
DBP	Diastolic blood pressure
DHP-CCB	Dihydropyridine calcium channel blockers
eGFR	Estimated glomerular filtration rate
ECG	Electrocardiogram
ESKD	End stage kidney disease
ESR	Erythrocyte sedimentation rate
FBC	Full blood count
GDMT	Guideline directed medical therapy
GTN	Glyceryl trinitrate
HbA1c	Haemoglobin A1c
HBPM	Home blood pressure monitoring
HDL-C	HDL cholesterol
HF	Heart failure
HFpEF	Heart failure with preserved ejection fraction
HFrEF	Heart failure with reduced ejection fraction
HMOD	Hypertension mediated organ damage
ICP	Intra cranial pressure
IGF	Insulin-like growth factor
IOP	Intra ocular pressure
IRD	Inflammatory rheumatic diseases
IUD	Intra-uterine device
IV	Intravenous
LMP	Last menstrual period
LVH	Left ventricular hypertrophy
MAOIs	Monoamine oxidase inhibitors
MAP	Mean arterial pressure
MetS	Metabolic syndrome
MI	Myocardial infarction
MRA	Mineralocorticoid receptor antagonists
MRI	Magnetic resonance imaging

ND	Non-dialysis
NSAIDs	Non-steroidal anti-Inflammatory drugs
OCP	Oral contraceptive pill
PDE 5 I	Phosphodiesterase 5 inhibitors
POG	Period of gestation
RAAS	Renin- angiotensin aldosterone system
RAS	Renin- angiotensin system
RCT	Randomized controlled trials
SBP	Systolic blood pressure
SLE	Systemic lupus erythematosus
SGLT2	Sodium glucose co transporter 2
SNRIs	Serotonin-norepinephrine reuptake inhibitors
SSRI	Selective serotonin reuptake inhibitors
TCAs	Tricyclic antidepressants
TIA	Transient ischaemic attack
TSH	Thyroid stimulating hormone
UFR	Urine full report
UPCR	Urine protein creatinine ratio
USS	Ultra sound scan
GFR	Categories
G1	Normal or high GFR>90
G2	mildly decreased GFR 89-60
G3a	Mildly to moderately decreased GFR 59-45
G3b	Mildly to moderately decreased GFR 44-30
G4	Severely decreased GFR 29-15
G5	Very severely decreased (end – stage) GFR<15
mtor inhibitors	The class of drugs those inhibit mammalian target of rapamycin
A1	Normal / mildly increased albuminuria
A2	Moderately increased albuminuria
A3	Severely increased albuminuria

ND	Non-dialysis
NSAIDs	Non-steroidal anti-Inflammatory drugs
OCP	Oral contraceptive pill
PDE 5 I	Phosphodiesterase 5 inhibitors
POG	Period of gestation
RAAS	Renin- angiotensin aldosterone system
RAS	Renin- angiotensin system
RCT	Randomized controlled trials
SBP	Systolic blood pressure
SLE	Systemic lupus erythematosus
SGLT2	Sodium glucose co transporter 2
SNRIs	Serotonin-norepinephrine reuptake inhibitors
SSRI	Selective serotonin reuptake inhibitors
TCAs	Tricyclic antidepressants
TIA	Transient ischaemic attack
TSH	Thyroid stimulating hormone
UFR	Urine full report
UPCR	Urine protein creatinine ratio
USS	Ultra sound scan

Introduction

The 'Clinical Practice Guideline on Hypertension' developed by the Ceylon College of Physicians defines a set of specific recommendations in the diagnosis and management of patients with hypertension. The project has been coordinated by the "Standards of care, quality improvement and patient safety committee" of the College.

Hypertension is one of the commonest preventable causes of premature morbidity and mortality worldwide. Hypertension is a major risk factor for stroke, myocardial infarction, heart failure, chronic kidney disease cognitive decline, peripheral vascular disease and premature death. Primary hypertension is known to affect one out of every four Sri Lankan adults and the prevalence is strongly influenced by advancing age and lifestyle factors. As the demographics of Sri Lanka is shifting towards an older population, the prevalence of hypertension and requirement for its treatment will continue to rise.

Among known hypertensives, approximately 20% are not on antihypertensive medication and only 30% achieve blood pressure targets. Early diagnosis, optimal treatment and regular follow-up of patients with hypertension is one of the most important public health interventions in Sri Lanka.

Methodology and Evidence Review

The guideline document is the result of many hours of discussions by the committee and is based on updated information on hypertension in the literature and also from recently published international guidelines from International Society of Hypertension (2020), ESH/ESC (2018), ACC/AHA (2017). However, the recommendation has been modified to suit local context based on local data and resource limitations. The hypertension guideline is aimed at guiding doctors who are involved in the management of hypertension in secondary and tertiary health care facilities in Sri Lanka.

The methodology and evidence review was based on systematic methods to evaluate and classify evidence to collate current and updated information on hypertension in the literature and relied heavily on recently published international guidelines from International Society of Hypertension (2020), ESH/ESC (2018), ACC/AHA (2017). An extensive evidence review was done which included other literature published in English, and indexed in MEDLINE (through PubMed), the Cochrane Library, Google Scholar, Clinical Key and other selected databases.

Literature searches focused on randomized controlled trials (RCTs) but also included registries, nonrandomized comparative and descriptive studies, case series, cohort studies, systematic reviews, and expert opinion. Only key references are cited in the guideline document.

Class of Recommendation and Level of Evidence

The Class of Recommendation (COR) indicates the strength of the recommendation, encompassing the estimated magnitude and certainty of benefit in proportion to risk. The Level of Evidence (LOE) rates the quality of scientific evidence that supports the intervention based on the type, quantity, and consistency of data from clinical trials and other sources. The committee has extensively considered the class of recommendations and level of evidence in each statement although the COR and LOE have not been explicitly stated.

The recommendations have been made in consideration of local context, available local data and resource limitations.

Intended Use

This guideline serves as a resource for doctors who manage this common condition in the secondary and tertiary care facilities of Sri Lanka. While being comprehensive, it provides practical reference for prevention, detection, evaluation, and management of high blood pressure. It should be a significant aid in improving quality of care in patients with hypertension.

Clinical implementation

Adherence to recommendations in the guideline can be enhanced by shared decision making between clinicians and patients. Efforts at increasing public awareness of hypertension and continuous medical education and training of healthcare providers will complement towards greater adoption of these recommendations.

However, this document is not intended to preclude clinical judgment and must be applied in the context of excellent clinical care, with adjustments for individual preferences, comorbidities, and other patient factors.

Epidemiology

Blood pressure and subsequent end organ damage constitute a continuum. Any given blood pressure value is associated with some degree of cardiovascular, cerebrovascular and renal pathology. Setting a cut off value above which true hypertension should be defined becomes arbitrary unless definite criteria for the definition are first laid down.

As end organ damage is the major adverse effect of hypertension which gives rise to alarm, preventing these effects would be the prime objective of blood pressure control. The blood pressure value which would define the population which could be most cost-effectively targeted for therapy and prevention would be an appropriate value for the diagnosis of hypertension. The lowest accepted value for minimal end organ effects is 115/75 mmHg. However, accepting this value for the definition of hypertension would encompass a large number of patients as hypertensive which would be an unacceptable burden on health care resources of most countries.

Numerous studies in Sri Lanka have shown that the prevalence of hypertension in this county follows that of most other developed and developing countries. Hence approximately 25-30% of the adult population would be hypertensive needing therapeutic intervention. It is further noted that 25-30% of Sri Lankan patients do not have adequate blood pressure control, and this would contribute to the population at risk for end organ damage.

As hypertension would be the leading non communicable disease condition in Sri Lanka which would lead to ischaemic heart disease, strokes and renal dysfunction, it is vital to address the problem of hypertension at the community level and not only at the health institution, the guidelines must be simple with practical import.

Chapter 1

Definition and Grading of Hypertension

1.1 Definition and Grading of Hypertension

Hypertension is defined as clinic systolic BP (SBP) values ≥140 mmHg and/or diastolic BP (DBP) values ≥ 90 mmHg following repeated examination. This is based on evidence from multiple RCTs that the benefits of treatment of patients with these BP values unequivocally outweigh the risks of treatment. This definition applies to all adults over 18 years old.

1.2 Grading of hypertension

There is a continuous association between higher BP and increased cardiovascular disease (CVD) risk. The classification is based on the BP- related CVD risk and the benefit of BP reduction seen in clinical trials.

Recommendations

2.2.1 BP should be categorized as normal, elevated, or Grade 1 or 2 hypertension to prevent and treat high BP.

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

Table 1.1: Grading of Hypertension

Category	Systolic (mmHg)		Diastolic (mmHg)
Normal BP	<130	and	<85
High-normal BP	130–139	and/or	85–89
Grade 1 hypertension	140–159	and/or	90–99
Grade 2 hypertension	≥160	and/or	≥100
Isolated systolic hypertension	≥ 140	and	<90

1.3 High-normal blood pressure

A systolic blood pressure 130-139mmHg and/or a diastolic blood pressure 85-89mmHg identifies people with high-normal blood pressure who would benefit from lifestyle intervention to prevent progression to established hypertension. Assessment of cardiovascular disease risk is important in this group during evaluation to decide on optimum management and patients with high-normal blood pressure require follow-up to detect development of hypertension.

Recommendations:

1.3.1 Consider excluding masked hypertension in patients with high-normal BP.

1.3.2 Patients with high-normal blood pressure and low-moderate CVD risk should be offered lifestyle changes. This group should not be offered blood pressure lowering pharmacological treatment.

1.3.3 Pharmacological treatment may be considered in patients with high-normal blood pressure with high CVD risk (estimated 10-year risk ≥20% with WHO/ISH risk assessment tool) and/or established CVD especially coronary artery disease. Monotherapy is sufficient as early therapy for these patients.

1.3.4 Monitor blood pressure at least annually in these patients to detect progression to established hypertension.

Isolated systolic hypertension

Isolated systolic hypertension is defined as elevated SBP (≥ 140mmHg) in the presence of normal/low DBP (<90mmHg). This entity is common among elderly and young individuals including children and adolescents.

Recommendation:

- Treatment of isolated systolic hypertension should be the same as for people with both raised systolic and diastolic blood pressure (*refer sections 5.3 and 8.8*).

Chapter 2

Classification of Hypertension

2.1 Classification of hypertension

Classification of hypertension could usefully be done under three main headings

1. Aetiology
2. Response to therapy
3. Duration of hypertension

1. Aetiology based classification is useful in investigation of a hypertensive patient
    1. Primary hypertension
    2. Secondary hypertension

The majority of patients with hypertension have no specific underlying cause and are classified as primary hypertension. Secondary hypertension refers to hypertension due to an identifiable cause and affects about 5-10% of the hypertensive population. The two forms may also coexist, and some patients remain hypertensive even following successful treatment of their secondary cause.

2. Response based classification is useful in selecting drugs for control of hypertension i.e. resistant hypertension

3. Duration – temporary forms of hypertension must be recognized so that unnecessary treatment is prevented.

- Stress induced
- Drug /chemical induced (Table 2.4)
- Transient gestational HT

All these classifications would be useful for health care providers in their clinical work.

2.1.1 Primary hypertension

Primary hypertension develops over time and a combination of risk factors may play a role.

Risk factors associated with primary hypertension

- Male sex
- Aging
- Overweight or obesity
- Dyslipidaemia
- Diabetes/ insulin resistance
- Family history of early-onset hypertension
- Sedentary lifestyle
- Stress
- High sodium intake
- High alcohol intake
- Low potassium intake
- Low calcium intake

2.1.2 Secondary hypertension

Secondary hypertension is defined as hypertension due to a specific cause of increased blood pressure, which may be treatable with an intervention specific to the cause

- Screening all hypertensive patients for secondary hypertension is not feasible or cost-effective.
- There are some patient characteristics that suggest an increased likelihood to have secondary hypertension as described below:

  - Young (<40 years of age)
  - Acute worsening of hypertension in a previously well-controlled blood pressure
  - Disproportionate HMOD for the degree of hypertension
  - Resistant hypertension (refer chapter 6)
  - Hypertensive emergency (refer chapter 7) as the first presentation
  - Onset of diastolic hypertension in older adults (≥ 65 y)
  - Unprovoked or excessive hypokalaemia
  - Clinical features suggestive of obstructive sleep apnoea
  - Clinical or biochemical features suggestive of endocrine causes of hypertension or CKD

Causes of secondary hypertension

- Causes of secondary hypertension will vary according to the age. The typical age distribution of these causes of secondary hypertension is shown in table 2.1
- The most common types of secondary hypertension in adults are renal parenchymal disease, obstructive sleep apnoea, renovascular hypertension and primary aldosteronism.
- In adults, common causes and rare causes of secondary hypertension, clinical history and investigations are described in table 2.2 and 2.3 respectively.
- Several medications and substances may increase BP or antagonize the BP-lowering effects of antihypertensive therapy in individuals (table 2.4). These agents should be excluded in the history before investigations for secondary hypertension.
- Single gene disorders (monogenic disorders) of hypertension are rare.

Recommendations

2.1.2.1 Basic screening for secondary hypertension should include a thorough assessment of history, physical examination, basic blood biochemistry (including serum sodium, potassium, eGFR, TSH) and UFR (refer tables 2.2 and 2.3)

2.1.2.2 For further investigations and management of suspected secondary hypertension, the patient should be referred to a specialist centre. Some of the screening tests mentioned in table 2.2 and 2.3 may only be available at specialist centres.

Causes of secondary hypertension according to age groups

Table 2.1: Causes of secondary hypertension according to age groups

Age group	Common causes
Young children (<12 years)	Renal parenchymal disease Coarctation of the aorta Monogenic disorders (Refer section 2.2.2)
Adolescents (12–18 years)	Renal parenchymal disease Coarctation of the aorta Monogenic disorders (Refer section 2.2.2)
Young adults (19–40 years)	Renal parenchymal disease Fibromuscular dysplasia (especially in women) Undiagnosed monogenic disorders
Middle-aged adults (41–65 years)	Primary aldosteronism Obstructive sleep apnoea Cushing's syndrome Phaeochromocytoma Renal parenchymal disease Atherosclerotic renovascular disease
Older adults (>65 years)	Atherosclerotic renovascular disease Renal parenchymal disease Thyroid disease

Common causes of secondary hypertension with clinical or laboratory indications and diagnostic workup

Table 2.2: Common causes of secondary hypertension with clinical or laboratory indications and diagnostic work up

Cause	Clinical or laboratory indication	Screening test	Additional / confirmatory tests
Obstructive sleep apnoea	Increased BMI, Snoring, daytime sleepiness, Gasping or choking at night, Witnessed apneas during sleep	Berlin Questionnaire, Epworth Sleepiness Score, Overnight oximetry	Polysomnography
Renal parenchymal disease	Mostly asymptomatic; May present with: Haematuria proteinuria renal mass (APCKD) family history of CKD	UFR (for blood, protein and casts), urinary albumin: creatinine ratio, plasma creatinine and eGFR	Renal ultrasound
Primary aldosteronism	Symptoms of hypokalaemia (muscle weakness, muscle cramps, tetany)	Elevated plasma aldosterone/ renin ratio	IV saline infusion test with plasma aldosterone, adrenal CT scan, Adrenal vein sampling
Renovascular disease Atherosclerotic- Older; widespread atherosclerosis; diabetes; smoking; recurrent flash pulmonary oedema; Fibromuscular dysplasia -Younger; more common in women	Abdominal bruit Drop in estimated GFR >30% after introduction of ACEI /ARBs	Renal duplex doppler ultrasound	Abdominal CT, Magnetic resonance angiogram Bilateral selective renal intraarterial angiography

Rare causes of secondary hypertension with clinical or laboratory indications and diagnostic workup

Table 2.3: Rare causes of secondary hypertension with clinical or laboratory indications and diagnostic work up

Cause	Clinical or laboratory indications	Screening test	Additional / confirmation tests
Pheochromocytoma/ paraganglioma	Episodic symptoms (5'Ps') o Paroxysmal hypertension o Pounding headache o Perspiration o Palpitations o Pallor BP surges precipitated by drugs (e.g. BB, metoclopramide, sympathomimetics, opioids and TCA)	Plasma or 24 h urinary fractionated metanephrines	CT or MRI scan of abdomen/pelvis
Cushing's syndrome	Moon face, central obesity, skin atrophy, striae and bruising; chronic steroid use	Overnight 1 mg dexamethasone suppression test	24-h urinary free cortisol excretion, midnight salivary cortisol
Thyroid disease (Hyperthyroidism / Hypothyroidism)	Signs and symptom of hyper or hypothyroidism	Thyroid function test	Further investigations to find aetiology especially in hyperthyroidism
Aortic coarctation	Usually detected in children or adolescence Difference in BP (≥20/10 mmHg) between upper–lower extremities and/or between the right-left arm Delayed radial- femoral pulsation Low ABI Inter scapular ejection murmur Rib notching on chest X-ray	Echocardiogram	Thoracic and abdominal CT or Magnetic resonance angiogram
Acromegaly	Acral features, enlarging shoe, headache, visual disturbances diabetes mellitus	Serum growth hormone ≥1 ng/mL during an oral glucose load	Elevated age and sex-matched IGF-1 level MRI scan of the pituitary
Primary hyperparathyroidism	Hypercalcemia	Serum Calcium	Parathyroid hormone Further evaluation to identify the aetiology

Drugs and substances that may cause raised BP

Table 2.4: Drugs and substances that may cause raised BP

Drugs/substance	Recommendation
NSAIDs	NSAIDs can antagonize the effects of RAAS inhibitors and BB No increase in blood pressure with low dose of aspirin Avoid regular or prolonged use of NSAIDs
Combined OCP	Use low-dose (e.g.:20–30 mcg ethinyloestradiol) agents or a progestin-only form of contraception and /or consider alternative forms of birth control where appropriate (e.g. barrier, IUD) Avoid use in women with uncontrolled hypertension
Antidepressants SNRIs-e.g.; duloxetine, venlafaxine TCAs – e.g.; amitriptyline, imipramine MAOIs- e.g.: selegiline, phenelzine	Consider alternative agents (SSRIs- e.g. fluoxetine) depending on the indication Avoid tyramine containing foods with MAOIs
Atypical antipsychotics- e.g. clozapine, olanzapine	Discontinue or limit use when possible
Acetaminophen (paracetamol)	Increase of BP with almost daily acetaminophen use Avoid daily regular use
Immunosuppressants	Steroids Avoid or limit use when possible Consider alternative modes of administration (e.g., inhaled, topical) when feasible Cyclosporin May use tacrolimus which has less effect on BP and rapamycin which has almost no effect on BP
Ma-huang, ginseng at high doses, liquorice at high doses, St. John's wort	Avoid use
Nasal decongestants (e.g., phenylephrine, pseudoephedrine)	Use for shortest duration possible and avoid in severe or uncontrolled hypertension Consider alternative therapies (e.g., nasal saline, intranasal corticosteroids, antihistamines) as appropriate
Recreational drugs [cocaine, amphetamine (Ecstasy)]	These substances usually cause acute rather than chronic hypertension
Angiogenesis inhibitor (e.g. bevacizumab) and tyrosine kinase inhibitors (e.g. sunitinib, sorafenib)	Initiate or intensify antihypertensive therapy
Other drugs that may raise BP erythropoietin, leflunomide, antimigraine serotonergic, diet pills (phenylpropanolamine and sibutramine)	Reduce dosage / withdraw and use alternatives

2.2.2 Genetic causes of secondary hypertension

There are some rare single-gene disorders (monogenic disorders) such as Liddle syndrome, apparent mineralocorticoid excess, Gordon syndrome and Geller syndrome that may present as hypertension in children and adolescents. Other disorders such as congenital adrenal hyperplasia and mineralocorticoid excess syndromes other than primary aldosteronism may also present as hypertension.

Chapter 3

Measuring Blood Pressure

3.1 Devices of measurement of BP

Accurate multiple BP measurements are the key to the diagnosis of hypertension. BP measurements are mainly done in clinic setting but home and ambulatory BP measurements are increasingly used in the diagnosis of hypertension.

Measurement of BP can be performed by an indirect, non-invasive method either by using auscultatory devices or automated oscillometric devices. BPs taken manually in the clinic can differ from those taken using an automated device. Often, readings taken from an automated device are lower than manual readings and correlates more closely to ambulatory BP than does manual BP. This factor needs to be considered in the management of hypertension.

Auscultatory devices

- Auscultatory devices include mercury sphygmomanometers, aneroid devices or hybrid devices. These devices need auscultation to measure BP. These methods have observer errors in general.
- Auscultatory method using a mercury sphygmomanometer is still the commonly used method of BP measurements in the clinics in Sri Lanka, although the use of mercury sphygmomanometer is banned in many countries due to the concerns about toxicity and environment. BP measurement using mercury sphygmomanometers are subject to the observer and methodological errors. The maintenance of mercury sphygmomanometers is also difficult compared to the other devices.
- Aneroid devices do not contain liquid and usually, desk mounted or attached to a hand bulb. These devices can be easily damaged and lose calibration and should be validated and calibrated according to standardized conditions and protocols.
- Hybrid (automated auscultatory method) devices have a pressure sensor and an electronic display which replaces the function of mercury manometer. The display may be a numerical, circular or linear bar graph. These devices too need frequent calibrations.

Automated oscillometric devices

- Oscillometric devices use a sensor that detects oscillations in pulsatile blood volume during cuff inflation and deflation. BP is indirectly calculated from maximum amplitude algorithms that involve population-based data. For this reason, only devices with a validated measurement protocol can be recommended for clinical use. Only a small proportion of available devices have published evidence on accuracy performance and these unvalidated BP devices are more likely to be inaccurate.
- These devices can be subject to errors with mechanical vibration and need frequent calibration.

- These devices cannot be used in patients with arrhythmia. Many of the newer oscillometric devices automatically inflate multiple times (in 1to 2-minute intervals), allowing patients to be alone and undisturbed during measurement.
- Validated oscillometric devices have no observer errors.

Novel devices

- Devices that measure blood pressure at the wrist are increasingly found in the marketplace. These devices have not being evaluated for reliability for routine management of hypertension.
- Finger-worn oscillometric BP devices featuring miniaturized finger cuff have been developed yet the reliability of the finger-based measurement is not established yet.
- A variety of new BP measurement technologies using sensors and cuff less techniques are also now emerging and these too need to be validated using appropriate standards for accurately testing them before use in the clinical setting.

Recommendations

- When available, BP measurement with oscillometric devices is preferable.
- If oscillometric devices are unavailable BP measurement can be done with hybrid devices or mercury sphygmomanometer.
- Aneroid devices are best to avoid in routine clinical use.
- A list of validated electronic devices is available in www.stridebp.org/www.bhsoc.org

3.2 Clinic based measurements

Commonly, clinic-based BP measurements are used for the diagnosis of hypertension. Health care professionals taking blood pressure measurements should have adequate initial training. Unattended self-measurement of BP in the clinic set up can also be encouraged.
There are several steps to be taken before and during the measurement of blood pressure. (Figure 3. 2.1)

3.2.1 Steps to be taken prior to the measurement of BP:

- The patient should avoid caffeine, exercise, and smoking for at least 30 min before BP measurement.
- Ensure the patient has emptied the bladder.
- Patient should be seated comfortably on a chair, feet touching the floor in a quiet environment for 5 min before beginning BP measurements.
- Remove all the clothing covering the location of cuff placement.
- Neither patient nor observer should talk during the period of rest and measurement
- Use a standard bladder cuff (12-13cm wide and 35cm long) for most patients but have longer and smaller cuffs available as the inappropriate cuff size can lead to inaccurate BP reading.
- The cuff should be positioned at the level of the heart, with the back and arm supported to avoid muscle contraction and legs uncrossed.
- For manual auscultatory devices, the cuff should cover 75-100% of the individual's upper arm circumference. For electronic devices, the device instructions should be followed.

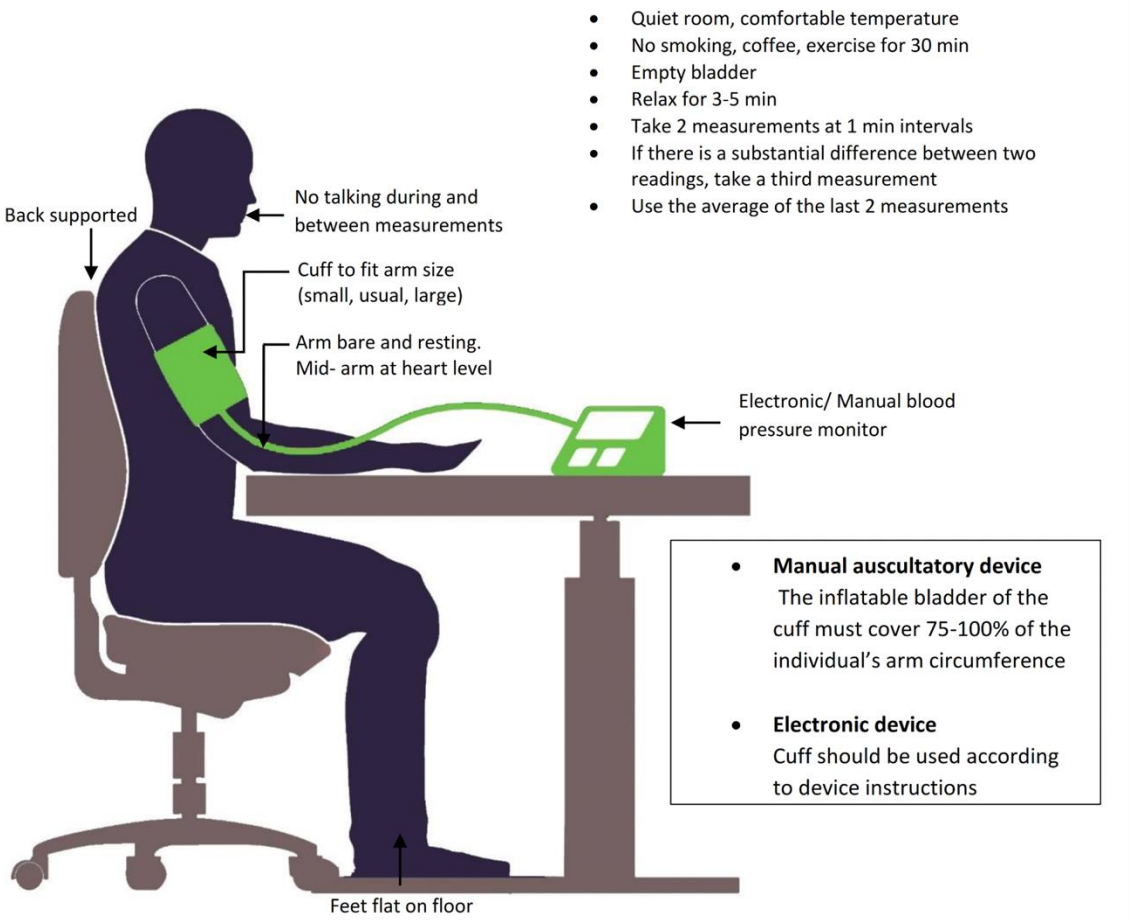

Figure 3.2.1 Steps to be taken before and during the measurement of blood pressure

3.2.2. Steps to be followed during BP Measurement:

- When using auscultatory methods, use phase I and V Korotkoff sound to identify SBP and DBP respectively.
- Two BP measurements should be recorded 1-2 minute apart and if there is a substantial difference between two readings, a third BP measurement should be taken. Record the average of the last two blood pressure measurements as the clinic blood pressure.
- BP should be measured in both upper arms. If there is a consistent and significant difference in BP between arms (i.e. >10 mm Hg) the arm with higher BP reading should be used for subsequent measurements. If the difference is >20 mm Hg consider further investigations.
- If the clinic BP is 140/90-180/110 mmHg, offer ABPM or HBPM to confirm the diagnosis, if available.
- If the pulse is irregular, BP should be measured using direct auscultation over the brachial artery.
- In older people, people with DM or people with symptoms of orthostatic hypotension, BP should be measured in a supine or seated position and 1 min and 3 min after

standing. A drop in SBP of ≥ 20 mmHg or in DBP of ≥ 10 mmHg within 3 minutes of standing is defined as orthostatic hypotension and is associated with an increased risk of CV events. In people with a significant postural drop or symptoms of postural hypotension blood pressure target should be based on standing blood pressure.

3.2.3 Unattended Clinic blood pressure:

Unobserved multiple automated BP measurements in the clinic can substantially eliminate the white coat effect. These unattended BP values are lower than those obtained from conventional clinic BP measurements and provide a more standardized evaluation of the BP. The evidence is limited whether the unattended clinic BP measurements can predict the outcomes as conventional clinic BP measurements.

3.3 Out of clinic measurements

Out of clinic measurement refers to the use of either HBPM or ABPM in the diagnosis and evaluation of hypertension. It provides a larger number of BP measurements than conventional clinic BP in conditions that are more representative of daily life. BP values are, on average, lower than clinic BP values. These measurements are more closely linked with hypertension induced organ damage and cardiovascular risks. It also helps to identify white coat hypertension and masked hypertension. Validated electronic (oscillometric) upper arm cuff devices are used for these measurements.

Out of clinic measurements are also necessary for accurate diagnosis of hypertension and for treatment decisions. In untreated subjects with clinic blood pressure classified as high normal BP or grade 1 hypertension, the BP levels need to be confirmed by home or ambulatory blood pressure measurements. The choice between the two methods depends on the availability, patient's preferences and convenience.

3.3.1 Home blood pressure measurement (HBPM)

- Home BP is the average of all BP reading performed with a semiautomatic, validated BP monitor, by the patient at home.
- For the diagnosis of HT, HBPM should be performed at least 3 days and preferably for 6-7 consecutive days with readings in the morning and in the evening taken in a quiet room after 5 min of rest, with the patient seated with their back and arm supported.
- Two measurements should be taken at each measurement session, performed 1-2 min apart.
- The measured BP needs to be recorded in a book by the patient for the purpose of references in the clinic
- Discard the measurements taken in Day 1 and use the average value of all remaining measurements.
- Long term follow-up of treated hypertension can be done with HBPM with 1-2 measurements per week or month.
- Compared with clinic BP, HBPM values are usually lower, and the diagnostic threshold for HTN is >135/85 mmHg (equivalent to clinic BP>140/90).

3.3.2 Ambulatory blood pressure measurement (ABPM)

- ABPM provides the average of BP readings over a defined period, usually 24 hours on a routine day. However, the daytime averages can be sufficient for the diagnosis of hypertension in many instances.
- The device is typically programmed to record BP at 15-30 min intervals.
- Average value of at least 20 measurements taken during the daytime and 7 measurements taken during the nighttime are required to confirm diagnosis.
- Average BP values are usually provided for daytime, nighttime and 24 hours.
- Diary of patient's activities and sleep time can also be recorded.
- Ambulatory average BP (24 hours) ≥ 130/80 mmHg, daytime (awake) ambulatory blood pressure ≥ 135/85mmHg or nighttime (asleep) blood pressure ≥ 120/70mmHg indicates hypertension.

Chapter 4

Diagnosis of hypertension

4.1 Diagnosis of hypertension and recommendations

Diagnosis of hypertension and follow up is commonly based on clinic blood pressure (BP) measurements. However, the diagnosis should be confirmed by out of clinic blood pressure measurements. i.e. HBPM or ABPM if logistically and economically feasible.

Recommendations

- The diagnosis of hypertension should not be made on a single clinic visit unless the BP is substantially elevated (≥180/110 mmHg) and/or there is evidence of hypertension mediated organ damage (HMOD).
- Repeat BP measurements at repeat clinic visits are required to confirm the diagnosis of hypertension. The number of clinic visits and the time interval between visits are determined by the degree of BP elevation.
- Patients with more substantial elevation of BP (e.g. Grade 2) require few clinic visits and shorter time intervals between visits (i.e. a few days or weeks) for the confirmation of the diagnosis. Conversely, repeat BP measurements extended over a few months may be required for the confirmation of diagnosis in patients with BP readings in the Grade 1 range (Table 4.1).

Table 4.1: Recommendations on repeating Blood pressure measurements according to clinic BP levels.

Clinic BP levels	Recommendation/action
<120/80mmHg	Repeat BP at least every 3 years
120-129/ 80-84 mmHg	Repeat at least every 3 years
130-139/ 85-89 mmHg	Repeat BP at least annually. Consider out of clinic BP measurements to exclude masked hypertension
140-159/ 90-99mmHg	Repeat office BP measurements or out of clinic BP measurements to confirm the diagnosis of hypertension.
160-179/ 100-109 mmHg	Confirm within few days/weeks
≥180/110 mmHg	Confirm diagnosis if there is evidence of HMOD Repeat measurements within 1-2 days if there is no evidence of HMOD to confirm diagnosis

4.1.1 Diagnosis of hypertension based on out of clinic blood pressure measurement

- Out-of-clinic BP measurements (HBPM and/or ABPM) can be used as an alternative strategy to repeat clinic BP measurements, when available. HBPM and ABPM are more reproducible than clinic measurements and more closely associated with HMOD and the risk of cardiovascular events.
- This approach is useful in detecting white-coat hypertension and masked hypertension. White-coat hypertension should be suspected in people with grade 1 hypertension on clinic BP measurement and in whom there is no evidence of HMOD or CVD. Clinical indications for out of clinic blood pressure monitoring is presented in section 4.2.

4.2 - Clinical indications for clinic blood pressure monitoring

- High normal clinic BP
- Normal BP in individuals with HMOD or high cardiovascular risk
- Substantially high clinic BP without HMOD
- Grade 1 hypertension on clinic BP measurement
- Considerable variability in the clinic BP measurements
- Postural and postprandial hypotension in treated and untreated patients
- Evaluation of BP control
- Evaluation of resistant hypertension
- Exaggerated BP response to exercise
- Evaluation of symptoms consistent with hypotension during treatment

4.3: Definitions of hypertension according to clinic, home and ambulatory blood pressure measurements

Table 4.2: Definitions of hypertension according to clinic, home and ambulatory blood pressure measurements

Category	Systolic BP (mmHg)		Diastolic BP (mmHg)
Clinic BP	≥ 140	and/or	≥ 90
Home BP mean	≥ 135	and/or	≥ 85
Ambulatory BP			
Daytime (awake) mean	≥ 135	and/or	≥ 85
Nighttime (asleep) mean	≥ 120	and/or	≥ 70
24 hours mean	≥ 130	and/or	≥ 80

White-coat hypertension

White-coat hypertension is the detection of elevated clinic blood pressure in untreated individuals in the presence of normal ABPM or HBPM. Studies reveal that 10-30% people attending clinics have white coat hypertension and it is commoner in grade 1 hypertension and in very old people (prevalence could be as high as >50%). These individuals have intermediate risk of CVD between normotensives and sustained hypertensives.

Recommendations:

- White coat hypertension should be suspected when:
  - Clinic BP is ≥ 140/90 mmHg on ≥ 3 separate occasions and
  - Absence of HMOD
  - ABPM or HBPM should be performed in suspected individuals and the average 24-hr ABPM <130/80 mmHg and/or average HBPM <135/85 mmHg confirms the diagnosis.
  - Assessment should be done to identify CVD risk factors and HMOD.
- Implement lifestyle changes aimed at reducing CVD risk. Routine pharmacological treatment is not indicated. Pharmacological treatment of hypertension may be considered if the CVD risk is high (estimated 10-year risk ≥20% with WHO/ISH risk assessment tool).

- Diagnosis should be reconfirmed at 3-6 months and these individuals should be followed up annually with ABPM to detect development of sustained hypertension.

Masked hypertension

Masked hypertension is diagnosed in individuals with normal/high-normal clinic blood pressure measurements (<140/90 mmHg), in the presence of high blood pressure measurements when taken outside the clinic using average daytime ABPM or average HBPM. Approximately 10-15% patients attending clinics have masked hypertension. The prevalence of masked hypertension in Sri Lanka is not known. Patients with masked hypertension have similar or greater CVD risk as sustained hypertensives.

Recommendations:

- Masked hypertension should be suspected when HMOD is detected with normal/high-normal BP in an untreated individual.
- Confirmation of the diagnosis requires out-of-clinic BP measurement.
- Patients should be treated with lifestyle changes and pharmacological therapy to normalize out-of-clinic BP

4.4 Hypertension-mediated organ damage (HMOD)

HMOD is the damage that occurs in the brain, the heart, the kidneys, central and peripheral arteries, and the eyes due to hypertension. HMOD is more common with longstanding hypertension and severe hypertension. However, HMOD can occur in patients with less severe hypertension.
HMOD can be reversed with the initiation of antihypertensive treatment, especially if the treatment is initiated early. However, with long standing hypertension HMOD may become irreversible despite improved blood pressure control.

Recommendations

- HMOD should be identified when patients present with suggestive symptoms and signs.
- Identification of HMOD helps to select the most appropriate antihypertensive medication.
- Basic screening for HMOD should be performed in all hypertensive patients and more detailed assessment is indicated when the treatment decisions are influenced by the presence of HMOD.
- Basic screening for HMOD should include fundoscopy, 12- lead ECG, urinalysis, serum creatinine and eGFR.
- When it is clinically indicated cognitive function testing, echocardiography, abdominal ultrasound, doppler studies, carotid ultrasound, ankle brachial index (ABI) and pulse wave velocity (PWV) should be included in the detail assessment of HMOD depending on availability. (Table 4.3)

4.4 Hypertension Mediated Organ Damage manifestation and assessment

Table 4.3: Hypertension mediated organ damage manifestation and assessment

Target organ	Manifestation	Assessment
Brain	Transient Ischaemic attacks (TIA) Stroke Intracerebral hemorrhage Aneurysmal subarachnoid hemorrhage Dementia: Vascular dementia, Mixed vascular dementia and dementia of the Alzheimer's type	CT/MRI: Not recommended for routine practice Should be considered in patients with neurologic disturbances, cognitive decline and memory loss.
Heart	Left ventricular hypertrophy Left ventricular dysfunction Ischaemic Heart Disease (Angina pectoris, Acute coronary syndromes)	A 12-lead ECG is recommended: LVH can be detected Two-dimensional transthoracic echocardiogram (TTE) can be done depending on availability
Kidney	Albuminuria Chronic kidney disease	Serum creatinine and eGFR Albuminuria: Micro/Macro (dipstick or urinary albumin creatinine ratio [UACR]) in early morning spot urine) Test for haematuria using a reagent strip
Arterial system	Peripheral vascular disease	The lower extremity arteries: the ankle-brachial index (ABI).
Eye	Retinal findings seen on fundoscopy: retinal arteriolar narrowing or sclerosis, arteriovenous crossings, exaggerated arterial light reflex, retinal hemorrhages, retinal exudates and cotton wool spots, papilloedema	Fundoscopy: to screen for hypertensive retinopathy

4.5. Cardiovascular risk stratification

More than 50% of hypertensive patients have additional CVD risk factors. The presence of additional CVD risk factors increases the risk of coronary, cerebrovascular, and renal diseases in hypertensive patients. The therapeutic options should target both the additional risk factors and hypertension. This reduces CVD beyond the BP control.
Factors influencing CVD risk in patients with HT include: male sex, advanced age, smoking, lipids (total cholesterol, HDL-C, low-density lipoprotein-cholesterol [LDL-C] and triglycerides), uric acid, diabetes, overweight, family history of premature CVD (men aged <55 years and women aged <65 years), family or parental history of early-onset hypertension , early-onset menopause , sedentary lifestyle , established cardiovascular or renal disease, microalbuminuria or albuminuria.

- Screening for and management of modifiable CVD risk factors are recommended in adults with hypertension.

- In assessing risk, the global cardiovascular risk of an individual should be assessed. i.e. the likelihood of a person developing a CV event (coronary heart disease, stroke or other atherosclerotic disease) over a defined period.
- In the absence of a scoring system specific for Sri Lankans, the WHO/ISH (World Health Organization/International Society of hypertension) risk prediction charts can be used as it has charts specifically for South East Asia including Sri Lanka.
- When using a risk calculator, clinic blood pressure measurements are to be used.
- *For further details on CVD risk assessment: Please refer guidelines on CVD risk assessment guideline.*

4.6 Clinical assessment

4.6.1 Medical History

A thorough history should be obtained from all patients. Most patients with hypertension are often asymptomatic. However, patients with secondary hypertension or hypertensive complications can have specific symptoms that require further investigation.

History should include following;

- **Blood pressure:** onset of hypertension, duration, previous BP levels, history of hypertension during pregnancy or while on oral contraceptives
- Medication: antihypertensive medication, other medications/over-the counter medicines, history of intolerance (side-effects) of antihypertensive medications, adherence to antihypertensive treatment.
- **Risk factors for HT:** diet, salt intake, smoking, alcohol intake, substance use, physical activity, psychosocial aspects, history of depression, family history of hypertension, premature CVD, hypercholesterolemia, diabetes.
- **Cardiovascular risk:** More than 50% of patients have additional risk factors for cardiovascular disease. Hence, cardiovascular risk should be assessed in all **hypertensive patients.**
- Personal history of CHD, stroke, PVD, CKD, smoking, diabetes, hyperlipidaemia, metabolic syndrome
- Family history of premature CVD and hyperlipidaemia
- Other risk factors include chronic inflammatory conditions, COPD, psychiatry disorders and psychosocial stressors.
- **Common symptoms of complications of hypertension:** Chest pain, shortness of breath, palpitations, claudication, peripheral oedema, headaches, blurred vision, nocturia, hematuria, dizziness.
- **Symptoms suggestive of secondary hypertension:** sweating, palpitations, frequent headaches, snoring, symptoms suggestive of flash pulmonary edema, symptoms suggestive of thyroid disease and features suggestive of CKD

4.6.2. Physical Examination

- A thorough physical examination provides important information to identify potential secondary causes of hypertension, CV risk factors and presence of HMOD.
- Physical examination should include,
- **Body habitus:** Weight, height and BMI, waist circumference, neck circumference
- **CVS examination:** Pulse (rate, rhythm, character, radio-femoral delay), jugular venous pressure, apex beat, extra heart sounds, basal crackles, bruits (carotid, abdominal, femoral)

- Features of **secondary hypertension** cafe-au-lait patches of neurofibromatosis, enlarged kidneys, signs of Cushing disease, acromegaly or thyroid disease
- Fundoscopy for features of HT retinopathy

4.6.3 Diagnostics

- Investigations should include basic laboratory tests and additional diagnostic tests when indicated.

4.6.3.1 Basic laboratory tests

Basic laboratory tests should be performed in all patients with hypertension.

- Haemoglobin and/or haematocrit
- Fasting blood glucose and glycated HbA1c
- Total cholesterol/ Lipid profile is preferred if available.
- Serum creatinine and eGFR
- Serum electrolytes
- ALT/AST
- Urine full report or urine dipstick
- 12- lead ECG

4.6.3.2. Additional diagnostic tests

- Additional investigations should be carried out in assessment and confirmation of HMOD, secondary hypertension and coexistent disease, if indicated.
- Echocardiography: LVH, systolic/diastolic dysfunction, atrial dilation, aortic coarctation.
- Carotid ultrasound: plaques (atherosclerosis), stenosis.
- Ultrasound/renal artery duplex and/or CT-/MR-angiography: renal parenchymal disease, renal artery stenosis, adrenal lesions, other abdominal pathology.
- Fundal photograph - tortuosity, nipping, retinal changes, hemorrhages, papilledema.
- Brain CT/MRI: Ischemic or hemorrhagic brain injury due to hypertension.
- Ankle-brachial index: Peripheral (lower extremity) artery disease.
- Further testing for secondary hypertension if suspected: Ref to section on secondary hypertension.

Chapter 5

Managing Hypertension

5.1 Therapeutic options for managing hypertension

Treatment of hypertension includes lifestyle and pharmacological interventions. The appropriate time of initiation of treatment and type of intervention, either lifestyle modifications alone or with drug therapy, depends on the grade of HT, CV risk level and presence of HMOD.

Recommendations

5.1.1 All those who are confirmed to have hypertension should receive appropriate lifestyle interventions.

5.1.2 Grade 1 hypertension in adults with low to moderate cardiovascular risk and no CVD, DM, CKD or HMOD – If BP is not controlled after 3-6 months of lifestyle interventions, start antihypertensive drug treatment.

5.1.3 Grade 1 hypertension in adults with high cardiovascular risk - Upon confirmation of hypertension, immediately start antihypertensive drug treatment in addition to lifestyle advice if any of the following are present:

- CVD
- DM
- CKD
- HMOD
- High CVD risk (estimated 10-year risk ≥20% with WHO/ISH risk assessment tool)

5.1.4 Grade 2 hypertension (BP ≥160/100mmHg) - Upon confirmation of Grade 2 hypertension immediately start antihypertensive drug treatment in addition to lifestyle advice.

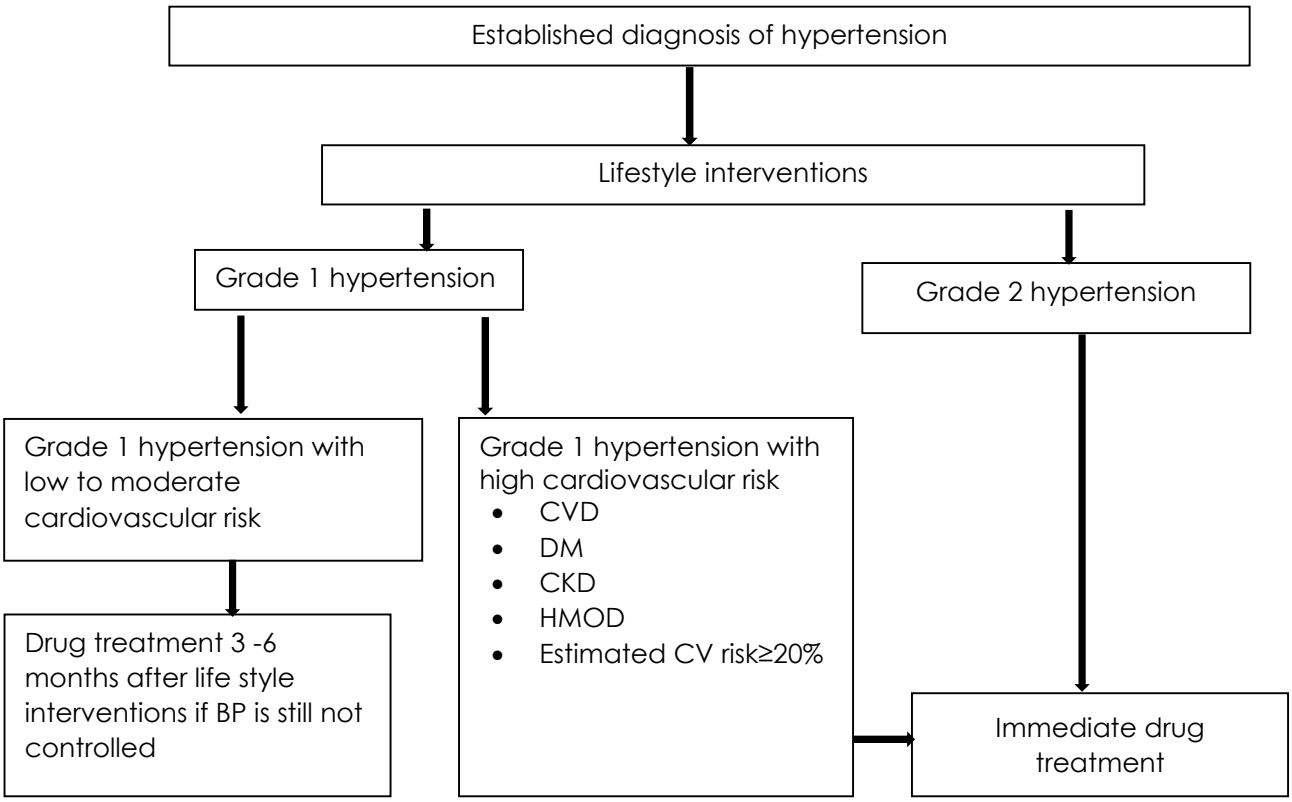

Figure 5. 1 Therapeutic options in hypertension management

5.2 Lifestyle modification

Lifestyle modification is the first line of treatment for hypertension and should be considered in all patients. Components of lifestyle modification are given below.

5.2.1 Healthy Eating

Currently there is a paucity of evidence regarding diet and hypertension in Sri Lanka. Therefore, the following two eating patterns which have been shown to be beneficial in hypertension is recommended where feasible.

- The Dietary Approaches to Stop Hypertension (DASH) diet, which emphasizes a high intake of fruits, vegetables, whole grains and low-fat dairy products with a decreased intake of saturated fat, is able to reduce systolic and diastolic blood pressure by 6 and 3 mmHg respectively in patients with hypertension.
- The Mediterranean diet, which emphasizes a high intake of vegetables, fresh fruits, whole grains, fish and seafood, legumes, nuts and extra virgin olive oil, a moderate intake of dairy products and a restriction of intake of red and processed meats is able to bring a modest reduction in systolic (3 mmHg) and diastolic (2 mmHg) blood pressure. Moreover, the Mediterranean diet is also associated with clinically meaningful reductions in rates of coronary heart disease, ischemic stroke, and total cardiovascular disease.

Recommendations

5.2.1.1 Encourage the intake of vegetables, fruits, whole grains and protein from plant sources or fish. Reduce intake of foods high in sugar, saturated and trans-fats.

5.2.1.1 Individualize the eating pattern in a locally and culturally acceptable manner, preferably in consultation with a clinical nutritionist where available. Examples of ways to increase intake of fruits, vegetables and whole grains in the Sri Lankan context are given in Annexure 1.

5.2.2 Reduction in salt intake

- A high salt (sodium) intake is strongly associated with hypertension and cardiovascular disease. Sodium reduction reduces both systolic (5 mmHg) and diastolic (3 mmHg) blood pressure in individuals with hypertension.

Recommendations

5.2.2.1 Limit the daily salt intake to 5g (1 teaspoon). This can be achieved by avoiding addition of salt to rice and minimizing intake of high-salt food items such as bread, soy sauce, yeast extract spreads, salt-added snacks, sausages and fast foods. When cooking dried fish it is advisable to cook it after washing several times or soaking it in water to remove salt

5.2.2.2 Educate patients that salt is found in many processed foods including bread. Look at the food label to identify the salt content in processed foods.

5.2.3 Weight reduction

- A net weight reduction of 5 kg leads to a 5-mmHg reduction of systolic blood pressure and a 4-mmHg reduction of diastolic blood pressure. Weight reduction can be achieved by following a low-calorie diet and engaging in regular physical activity, preferably in consultation with a clinical nutritionist where available.

Recommendations

5.2.3.1 Individuals who are overweight or obese (body mass index more than or equal to 25 kgm^2) to lose 5-10% of their current body weight in 3 to 6 months and maintain it thereafter.

5.2.3.2 Minimize abdominal obesity by keeping waist circumference less than 80cm and 90cm in females and males, respectively.

5.2.4 Smoking cessation

Smoking increases the risk of ischemic stroke by two-fold. Further, smoking acts synergistically with other cardiovascular disease risk factors, increasing the risk of cardiovascular disease.

Recommendation

5.2.4.1 Recommend cessation of smoking for individuals who smoke tobacco.

5.2.5 Alcohol

Recommendation

6.2.5.1 No alcohol as a state policy

5.2.6 Physical activity

Regular physical activity (both aerobic and dynamic resistance exercise) is beneficial for both prevention and treatment of hypertension. Evidence suggests that the physical activity level of Sri Lankans is low.

Recommendation

5.2.6.1 Engage in moderate intensity aerobic exercise (e.g. brisk walking, cycling, swimming, and gardening) for 30 minutes at least on 5 days every week.

5.2.6.2 Engage in resistance exercises on 2-3 days per week.

5.2.7 Stress reduction

Chronic stress can lead to hypertension later in life. Encourage patients to follow a stress-relieving technique when possible. Currently, there is insufficient evidence to recommend a particular type of stress-relieving technique for this purpose.

5.2.8 Consumption of caffeine containing beverages

Moderate consumption of coffee, green and black tea (2-3 cups/day) is probably safe in patients with hypertension.

5.3 Pharmacological interventions

- Immediate initiation of pharmacological interventions is indicated for Grade 2 hypertension and in Grade 1 hypertension with high cardiovascular risk.
- First line medications include ACEI/ARB, DHP-CCB and thiazides/thiazide-like diuretics.
- Appropriate antihypertensive drugs should be selected considering compelling indications, contraindications, conditions that require the careful use of drugs and the presence or absence of complications.
- In the absence of such constraints, a step-wise approach to the selection of pharmacological agent is recommended

Recommendations

5.3.1 Stepwise approach to pharmacological management /interventions is recommended.

5.3.2 Before moving to the next step, check adherence to lifestyle and drug treatment

5.3.3 Monotherapy is recommended as Step 1 treatment in low-risk Grade 1 hypertension, very old (>80 years) and frail individuals.

5.3.4 Initial dual low-dose combination therapy is the optimal recommended treatment in other patient categories at Step 1 treatment.

5.3.5 Dual full-dose combination is recommended for Step 2 in those with inadequately controlled hypertension with Step 1 treatment.

5.3.6 Three and four-drug combination is required for patients with poorly controlled hypertension as in step 3 and 4, respectively.

5.3.1 Stepwise approach

5.3.1.1 Step 1 treatment

- **Dual low-dose combination**:
  Optimal step 1 treatment is dual low-dose combination *(low dose generally refers to half of the maximum recommended dose)* except in those with low-risk Grade 1 hypertension, those aged ≥ 80 years and those who are frail.

Desirable combinations of antihypertensive drugs include:

- ACEI/ARB and DHP-CCB*
- ACEI/ARB and thiazide**/thiazide-like diuretic
- Thiazide**/thiazide-like diuretic and -DHP-CCB*
- ACEI/ARB and thiazide**/thiazide-like diuretic are preferred in:
  - Post-stroke
  - Heart failure
  - CCB intolerance

- **Monotherapy**:
  - Monotherapy with an ACEI/ARB or a DHP-CCB* or a thiazide**/thiazide-like diuretic
  - Monotherapy is particularly indicated for,
    - Low risk Grade 1 hypertension
    - Patients ≥ 80 years
    - Patients with frailty

**use a non-DHP-CCB (e.g. diltiazem, verapamil) if a DHP-CCB is not available or not tolerated*
***use a thiazide if a thiazide-like diuretic is not available*

5.3.1.2 Step 2 treatment

- **Dual full-dose (i.e. maximum tolerated therapeutic dose) combination with**:
  - ACEI/ARB and DHP-CCB* *or*
  - ACEI/ARB and thiazide**/thiazide-like diuretic *or*
  - Thiazide**/thiazide-like diuretic and DHP-CCB*

**use a non-DHP-CCB (e.g. diltiazem, verapamil) if a DHP-CCB is not available or not tolerated*
***use a thiazide if a thiazide-like diuretic is not available*

- **Dual full-dose combination with ACEI / ARB + thiazide /thiazide-like diuretic is preferred in**
  - Post-stroke
  - Heart failure
  - CCB intolerance

5.3.1.3 Step 3 treatment

- **Three-drug combination with:**

ACEI/ARB + DHP-CCB* + thiazide** / thiazide-like diuretic
**use a non-DHP-CCB (e.g. diltiazem, verapamil) if a DHP-CCB is not available or not tolerated*
***use a thiazide if a thiazide-like diuretic is not available*

5.3.1.4 Step 4 treatment (for confirmed resistant hypertension)

- Four-drug combination with: ACEI/ARB + DHP-CCB* + thiazide**/thiazide-like diuretic + low dose spironolactone (12.5-50mg once daily) ***

- Alternatives to spironolactone include higher doses of thiazides/thiazide-like diuretics (or a loop diuretic if eGFR is <30ml/min/1.73m^2), amiloride, eplerenone, extended-release alpha blockers, beta-blockers

**use a non-DHP-CCB (e.g. diltiazem, verapamil) if a DHP-CCB Is not available or not tolerated*
***use a thiazide if a thiazide-like diuretic is not available*
**** caution is needed regarding serum K^+ when spironolactone, or other potassium sparing diuretic is prescribed to those with eGFR <45 ml/min/1.73m^2 or serum K^+ >4.5 mmol/L*

Important points related to drug treatment

In all the steps, **beta blockers** should be considered in the regimen in those with:
- Heart failure*
- Coronary artery disease
- Atrial fibrillation
- Pregnancy or planning to become pregnant**

**the beta blockers recommended in heart failure include carvedilol, metoprolol and bisoprolol only*
***the beta blocker recommended in pregnancy is labetalol*

- Those with isolated systolic hypertension should receive the same treatment as people with both raised systolic and diastolic blood pressure.
- Women considering pregnancy or who are pregnant should receive treatment in line with the recommendations on management of chronic hypertension in pregnancy.
- When choosing a drug, attention should be paid to the contraindications. (Table 5.2)
- Combination of an ACEI and an ARB is not recommended.
- Using once-daily regimen which provides 24-hour blood pressure control is ideal
- Use of single pill combinations (SPCs) is preferred; use free combinations if SPCs are not available or unaffordable
- Treatment should be affordable and/or cost-effective
- Treatments should be well-tolerated

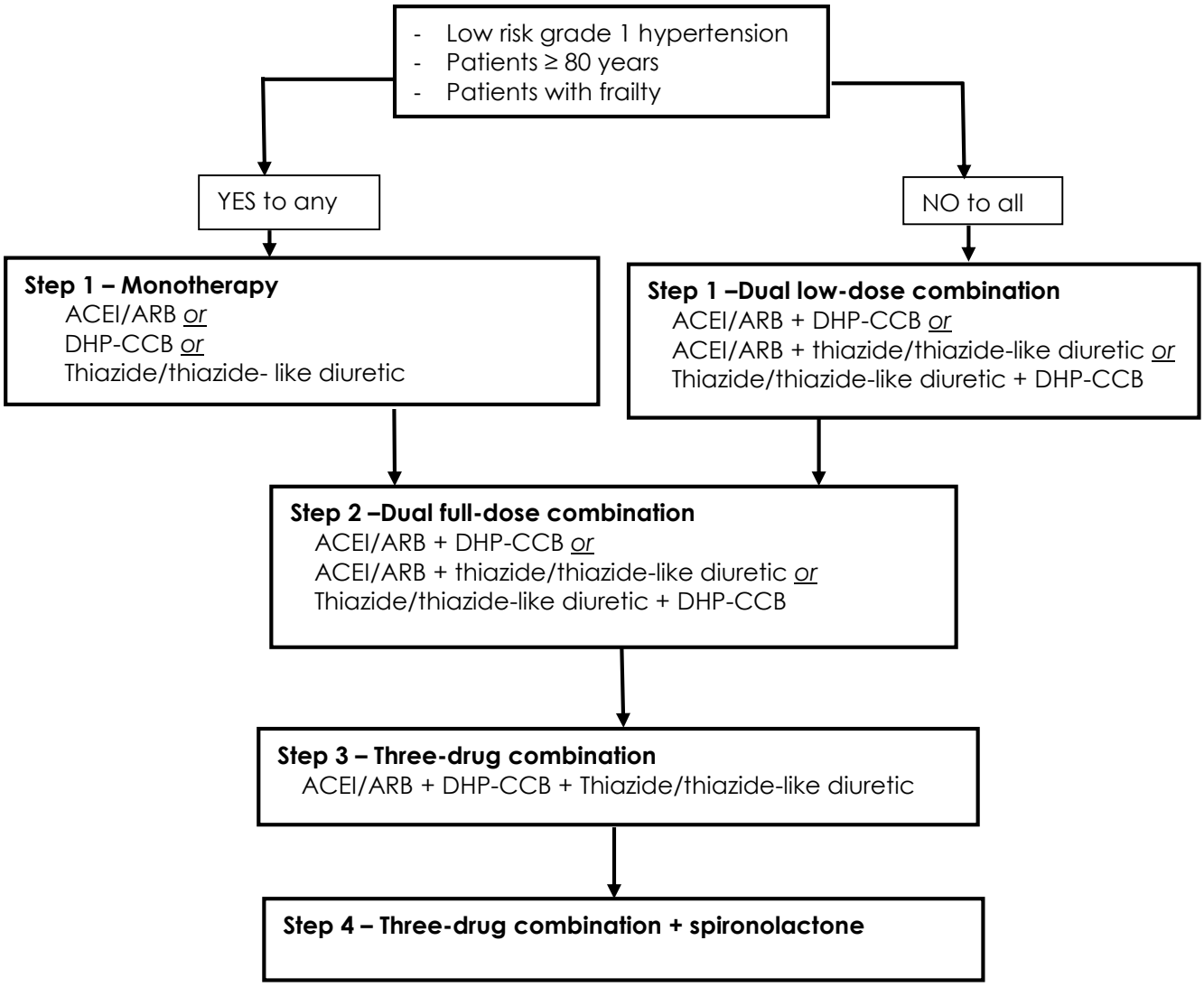

Figure 5.3.1 Drug treatment strategy

In all the steps, **beta blockers** should be considered in the regimen in those with:

- Heart failure*
- Coronary artery disease
- Atrial fibrillation
- Pregnancy or planning to become pregnant**

**the beta blockers recommended in heart failure include carvedilol, metoprolol and bisoprolol only*

Use a non-DHP-CCB (eg. diltiazem, verapamil) if a DHP-CCB is not available or not tolerated

Use a thiazide if a thiazide-like diuretic is not available

Caution is needed with regard to serum K^+ when Spironolactone, is prescribed to those with eGFR <45 ml/min/1.73m^2 or serum K^+ >4.5 mmol/L

Table 5.1: Antihypertensive drug choice

Drug class	Drugs	Starting dose	Maximum therapeutic dose
ACEI	Captopril	12.5mg BD	25mg to 50 mg to 75mg BD
	Enalapril	5mg OD	10mg to 20mg OD
	Imidapril	5mg OD	20mg OD
	Lisinopril	10mg OD	80mg OD
	Perindopril	5mg OD	10mg OD
	Ramipril	2.5mg OD	10mg OD
ARB	Candesartan	8mg OD	32mg OD
	Irbesartan	150mg OD	300mg OD
	Losartan	50mg OD	100mg OD
	Olmesartan	10mg OD	40mg OD
	Telmisartan	20mg OD	80mg OD
	Valsartan	80mg OD	320mg OD
DHP-CCB	Amlodipine	5mg OD	10mg OD
	Nifedipine extended-release	20mg OD/30mg OD	20mgBD to 40mg BD
Non-DHP-CCB	Diltiazem	30 mg TDS	60 mg TDS
	Diltiazem extended-release	90mg BD	180mg BD
	Verapamil	40mg TDS	80mg TDS
	Verapamil extended-release	240mg OD	240mg BD
Thiazides/thiazide like diuretics	Chlorthalidone	25mg OD	50mg OD
	Hydrochlorothiazide	12.5mg OD	25mg OD
	Indapamide	2.5mg OD	2.5mgOD
	Indapamide extended-release	1.5mg OD	1.5mg OD
Beta blockers	Atenolol	25mg OD	50mg OD
	Bisoprolol	5mg OD	20mg OD
	Carvedilol	12.5mg OD	50mg OD
	Labetalol	100mg BD	400mg BD
	Metoprolol	100mg OD	200mg BD
Aldosterone antagonists	Amiloride	5mg OD	10mg OD
	Eplerenone	25mg OD	50mg OD
	Spironolactone	12.5mg OD	50mg OD
Alpha blockers	Doxazosin	1mg OD	16mg OD
	Doxazosin extended-release	4mg OD	8mg OD
	Prazosin	0.5mg BD/TDS	6mg TDS
	Prazosin extended-release	2.5mg OD	20mg OD

OD= once daily; BD = twice daily; TDS = three times a day

Table 5.2: Contraindications for antihypertensive drugs

Drug class	Contraindications	Careful administration
ACE inhibitors	Pregnancy, Angioneurotic oedema Bilateral renal artery stenosis Severe hyperkalaemia	
ARBs	Pregnancy Bilateral renal artery stenosis Severe hyperkalaemia	
β-blockers	Asthma Pulse rate <50 bpm Second- and third-degree heart block Untreated pheochromocytoma	Impaired glucose tolerance Obstructive pulmonary disease Peripheral arterial disease
Dihydropyridine CCBs e.g. amlodipine, nifedipine	Tachyarrhythmia Myocardial infarction within 1 month Significant aortic stenosis	
Non-dihydropyridine CCBs e.g. verapamil, diltiazem	Pulse rate <50 bpm Second- and third-degree heart block Heart failure	
Thiazide diuretics	Conditions where sodium and potassium are markedly decreased	Gout Pregnancy Impaired glucose tolerance
Mineralocorticoid receptor antagonist e.g. spironolactone	Hyperkalemia eGFR <30ml/minute/1.73m^2	Concomitant use of ACEI/ARB
Alpha blockers	History of postural hypotension History of micturition syncope	

5.4 Device based therapies

Device-based therapies are used mainly for treating resistant hypertension. There are several forms of device-based treatment including renal sympathetic nerve denervation, electrical baroreflex activation therapy, transvenous carotid body ablation, central iliac arteriovenous anastomosis, deep brain stimulation, median nerve stimulation, and vagal nerve stimulation. Long-term data, including that of procedure and device-related adverse events, is still to be determined.

Recommendation

5.4.1 Use of device-based therapies for the routine treatment of hypertension is not recommended, until further evidence regarding their safety and efficacy becomes available.

5.5 Follow-up Management

Follow-up management includes:

5.5.1 Achieving BP targets
5.5.2 Follow up assessments
5.5.3 Emphasis on lifestyle interventions

5.5.1 Achieving BP Targets

Recommendations

5.5.1.1 It is recommended that the first objective of treatment should be to lower BP to < 140/90 mmHg in all patient

5.5.1.2. The systolic blood pressure target should be 120–129 mmHg in patients < 65 years.

5.5.1.3 The systolic blood pressure target should be 130–139 mmHg in patient's ≥ 65 years.

5.5.1.4 In those >80 years, the systolic blood pressure target should be 130-139 mmHg provided the treatment is well tolerated.

5.5.1.5 Diastolic blood pressure target should be < 80mmHg (not less than 70 mmHg) for all hypertensive patients independent of the CV risk and comorbidities

5.5.1.6 Measure standing as well as sitting blood pressure in people with hypertension and

- Diabetes mellitus or
- Symptoms of postural hypotension or
- Age ≥ 80 years.

In people with a significant postural drop or symptoms of postural hypotension, treat to a target blood pressure based on standing blood pressure.

5.5.2 Follow up assessments

- The response to drug treatment and lifestyle changes should be monitored in all patients with hypertension using clinic blood pressure values or records of HBPM monthly or every 2 months, depending on the level of BP, until readings on 2 consecutive visits are at target. Shorter intervals between visits will be needed for symptomatic patients and those with severe hypertension (≥180/110mmHg), intolerance to antihypertensive drugs, or HMOD.
- In addition to the clinic blood pressure monitoring ABPM or HBPM should be considered in patients with white coat effect or suspected masked hypertension
- Once the BP target is reached, frequency of reviewing blood pressure depends on the cardiovascular risk, HMOD and stability of BP control; HBPM is advisable whenever feasible.
- Persons who are able to use HBPM should be trained and advised on use of automatic blood pressure monitors. They should be informed of their blood pressure targets and advice to contact their healthcare professionals when the target blood pressure is not achieved. Patients should be advised to maintain a record of the measurements and bring it to the clinic.
- The frequency of follow up assessments should be individualized regarding cardiovascular risk and HMOD and depends on the baseline level of cardiovascular risk
- Investigations indicated in the follow up assessments include urinalysis, serum creatinine, serum electrolytes, blood glucose, lipid profile/total cholesterol and ECG

- In those with renal impairment, more frequent monitoring of serum creatinine and serum electrolytes should be done as guided by clinical assessment
- When ACEI, ARB, diuretics and aldosterone antagonist are used, serum creatinine and serum electrolytes should be done at baseline and 2 weeks after initiation of treatment or dose increment*. Thereafter it should be repeated as clinically indicated.

**Significant rise in serum creatinine after starting / dose increment of an ACEI /ARB is suggestive of renovascular hypertension; appropriate evaluation and adjustment of treatment is advised.*

5.5.3 Emphasis on lifestyle interventions

- At each follow up visit the patients should be educated regarding the importance of lifestyle interventions.
- It is advisable to record progress of lifestyle interventions and achievement of targets

5.5.4 Indications for management by a specialist (out-patient specialist care)

The following conditions require further evaluation and management by a specialist

- Suspected secondary cause
- Hypertension in young (age <40 years)
- Resistant hypertension
- White-coat hypertension / masked hypertension (when ABPM is required)

5.6 Managing concomitant cardiovascular disease risk

Hypertension alone is not an indication for the use of statins or antiplatelet drugs.

5.6.1 Statin therapy

CV risk assessment should be carried out with the WHO/ISH risk prediction charts in hypertensive patients who are not already at high risk due to established CVD.

Recommendations

- 10-year cardiovascular risk ≥20% (estimated with WHO/ISH risk estimation tool)
- Chronic kidney disease

**CVD includes acute coronary syndromes, stable angina, coronary or other arterial revascularization, stroke, TIA or peripheral arterial disease presumed to be of atherosclerotic origin*

5.6.2 Antiplatelet therapy

Recommendations

5.6.2.1 Antiplatelet therapy is indicated for the secondary prevention in patients with CVD*

5.6.2.2 In hypertension, antiplatelets are not recommended for the primary prevention of CVD*.

**CVD includes acute coronary syndromes, stable angina, coronary or other arterial revascularization, stroke, TIA, or peripheral arterial disease presumed to be of atherosclerotic origin*

5.7 Engagement, Education and Empowerment

- Communication strategies to manage hypertension
- Effective physician-patient communication is the heart of medicine in the delivery of healthcare and serves as a prerequisite for any successful encounter between patient and physician.
- Clinic visits provide an important opportunity for physicians to reinforce key hypertension-related educational messages.
- Good physician communication improves adherence.
- Physicians must first understand their patients' health literacy limitations and tailor hypertension control messages to the patients' understanding and individual needs.
- The initial clinical encounter with the patient with suspected or established hypertension should be used as a teachable moment of hypertension.
- The initial encounter provides the opportunity to set the tone for the physician-patient relationship, assess the patient's literacy level, the social, cultural, and environmental support systems available to the patient to self-manage the condition and barriers.
- This opportunity is taken to discuss the targets for blood pressure control, advice on lifestyle measures, need for dietician and family support.
- The widespread implementation of adherence assessment has remained challenging for physicians because of the lack of cheap, cost-effective, and reliable adherence assessment methods.
- Workflow constraints and insufficient time to comprehensively assess patients at each visit during the clinical encounter may also impact patient education and treatment intensification.
- A strategy to shift part of the burden of BP control from physicians to other clinical professionals, including nurses and pharmacists should be developed and tested for feasibility before implementation.
- *Refer to Annexure 2 to see a Specific list of actions during patient encounters*

Chapter 6

Resistant Hypertension

Resistant hypertension is defined as hypertension not controlled (SBP >140 mmHg and/or DBP >90) by appropriate lifestyle measures and treatment with optimal or best-tolerated doses of three or more drugs, which should include a diuretic, typically an ACE inhibitor or an ARB, and a CCB.

6.1 Diagnosis

In order to make the diagnosis of resistant hypertension, pseudo resistance, and secondary hypertension need to be excluded.

6.1.1 Causes of pseudo resistance

- Poor BP measurement technique
- White-coat hypertension
- Non-adherence
- Inadequate medication dose
- Clinical inertia
- Inappropriate drug combination
- Co-administration of drugs causing hypertension (see Table 2.4)
- Substance abuse
- Excess alcohol
- Excess salt intake

6.1.2 Secondary causes to be excluded (See Tables 2.1, 2.2 and 2.3)

Common: CKD, obstructive sleep apnoea, primary hyperaldosteronism, atherosclerotic renovascular disease
Uncommon: phaeochromocytoma, fibromuscular dysplasia, aortic coarctation, Cushing syndrome, hyperparathyroidism

6.2 Treatment of Resistant Hypertension

Recommendations

6.2.1. Reinforcement of lifestyle measures in particular salt restriction is recommended.

6.2.2. Recommended pharmacological management is addition of low dose spironolactone (12.5 - 50 mg daily) to existing treatment

6.2.3. If intolerant to spironolactone: Addition of further diuretic therapy with eplerenone / amiloride / higher dose of thiazide/thiazide like diuretic (hydrochlorothiazide 50mg daily) / a loop diuretic (furosemide) when eGFR is <30 ml/min/1.73m^2

6.2.4. Addition of a beta blocker (bisoprolol/metoprolol) or sustained release alpha blocker (doxazosin/prazosin) should be considered.

6.2.5 Refer to a specialist if resistant hypertension persists.

Chapter 7

Hypertensive emergencies

7.1 Hypertensive urgency or emergency

Hypertensive emergency is defined as an elevated SBP ≥180 mmHg and/or DBP ≥120 mmHg, confirmed on repeated measurements with evidence of acute HMOD.
In contrast, if the patient remains asymptomatic with elevated SBP ≥180 mmHg and/or DBP ≥120 mmHg with no evidence of acute HMOD, the term hypertensive urgency is used.
The rate of BP increase appears to be more important than the absolute BP value in the development of hypertensive emergencies.

7.2 Assessment of acute HMOD

A targeted history, physical examination and basic investigations should be carried out in search for an acute HMOD. The features that will point towards a diagnosis of hypertensive emergency in a patient with SBP ≥180 mmHg and/or DBP ≥120 mmHg is summarized in Table

Table 7.1: Clinical features of HMOD

HMOD	Clinical features
Central nervous system damage	Sudden onset of confusion, blurred vision and/or papilloedema suggestive of hypertensive encephalopathy; clinical features of ischemic or hemorrhagic stroke or subarachnoid hemorrhage
Renal damage	Sudden appearance of gross proteinuria or oliguria suggestive of acute kidney injury
Cardiac damage	Acute chest pain or dyspnoea suggestive of an acute coronary syndrome, heart failure or an aortic dissection
Retinal damage	A sudden and progressive deterioration of vision with accompanying retinal haemorrhages and/or exudates

7.3 Hypertensive emergency or hypertensive urgency

This is seen in specific clinical situations where the severe rise in BP may compromise the existing clinical status such as:

- Immediately following acute coronary bypass surgery or other revascularization procedures, renal transplantation or any other major surgical procedures
- Immediately preceding any emergency surgical procedure

These patients should also be appropriately managed in an intensive care setting with drugs, including parenteral therapy, to reduce the BP as rapidly as required by the clinical state.

7.4 Treatment of hypertension urgency

Rapid lowering of blood pressure in these patients offers no benefit and carries the theoretical risk of causing relative hypotension and end-organ hypoperfusion, especially in those individuals who have long standing severely elevated blood pressure.

Recommendations

7.4.1 Rapid BP lowering is not recommended in patients without acute hypertension-mediated organ damage.

7.4.2 A controlled BP reduction to safer levels using oral BP lowering medications without risk of hypotension and cardiovascular complications should be the therapeutic goal.

7.4.3 Careful monitoring over the next few days and weeks and appropriate dose adjustments should be made with the aim of reaching the final target blood pressure as determined by the patient's clinical status.

7.5 Treatment of Hypertensive emergency

Recommendation:

7.5.1 As this is considered a medical emergency, the patient should be treated with one of the parenteral antihypertensive agents to lower the diastolic blood pressure to 100-105 mmHg within a period of 2-6 hours.

Table 7.2 Drugs used in the management of hypertensive emergencies

Drug	Mechanism of action	Dose	Indicated clinical situations	Cautions / Contraindication
Labetalol	Combined alpha- and beta-adrenergic blocker	IV loading dose of 20 mg over 2 min; Incremental doses of 20–80 mg at 5-10-minute intervals Max total dose 200mg IVI 1-2mg/min	Aortic dissection Neurological emergencies Pre-eclampsia and eclampsia	Severe bradycardia, Phaeochromocytoma Acute left ventricular failure
Glyceryl trinitrate	Venous vasodilator	IV infusion 5-200 mcg/min 5-50µg/min increments	Acute coronary syndromes Acute left ventricular failure	Concomitant use of PDE 5 inhibitors Raised intracranial pressure
Nicardipine	Dihydropyridine CCB	IV infusion 5mg/h, 2.5 mg/hr increments every 5 min to a max 30mg/hr,	Cerebral events	Severe aortic stenosis
Sodium Nitroprusside	Direct arterial and venous vasodilator	IV infusion 0.3-10 mcg/kg/min	All clinical situations of HE	Raised ICP, Renal and hepatic impairment, Monitor for cyanide toxicity
Hydralazine	Direct arterial vasodilator	IV bolus 5-10 mg Repeated after 20-30 minutes	Pre-eclampsia and eclampsia	Dissecting aortic aneurysm
Fenoldopam	Peripheral dopamine type 1 (D1) agonist	IV infusion Starting dose 0.1–0.3 µg/kg/min. Increments of 0.05–0.1 µg/kg/min every 15 min. Max, infusion rate 1.6 µg/kg/min	AKI with severe HT	Raised ICP or IOP
Phentolamine	Competitive antagonist of peripheral a1- and a2-receptors	IV Bolus dose of 5–15 mg	Catecholamine excess; Pheochromocytoma Cocaine toxicity amphetamine overdose, or clonidine withdrawal	Coronary artery disease

Chapter 8

Hypertension in special populations and circumstances

8.1 Hypertension and Metabolic Syndrome (MetS)

Metabolic syndrome is a state of metabolic dysregulation characterized by visceral fat accumulation, insulin resistance, hyperinsulinemia, and hyperlipidemia, as well as predisposition to type 2 DM, hypertension, and atherosclerotic CVD.

8.1.1 Criteria for diagnosis of MetS:

8.1.1.1 Require at least three of the following criteria for the diagnosis:

Table 8.1: Criteria for diagnosing MetS

Measure	Cut off point
Elevated waist circumference	≥90 cm in men or ≥80 cm in women
Elevated fasting blood glucose	≥100 mg/dL or HbA1C ≥5.7 or on treatment for diabetes mellitus.
Elevated blood pressure	≥130 systolic or ≥85 diastolic or on treatment for hypertension.
Elevated triglyceride level	≥150 mg/dL or on treatment for hypertriglyceridemia
Reduced HDL cholesterol	<40 in men or <50 in women or on treatment for low HDL-C

- It has been estimated that approximately 10%-30% of the world's adult population has MetS
- According to a Sri Lankan study, MetS is common among Sri Lankan adults affecting nearly one-fourth of the adult population (males: 18.4%, female: 28.3%)
- Arterial hypertension is highly prevalent among those with MetS. The Pressioni Arteriose Monitorate E Loro Associazioni (PAMELA) population study revealed that high normal BP values and hypertension were present in 80% of individuals with MetS.
- The blood pressure levels required to initiate antihypertensive treatment and goal to be achieved in those with MetS are still under discussion.
- The treatment of hypertension and MetS should include BP control as in the general population and treatment of additional risk factors based on the overall cardiovascular risk.
- Early and more aggressive therapy in subjects with MetS will result in a decrease in future cardiovascular morbidity and mortality.

8.1.2 Management of MetS

8.1.2.1 Lifestyle modification

Recommendations

8.1.2.1.1 Lifestyle modification by means of dietary modification, weight reduction, and exercise is important with an emphasis on improving insulin sensitivity.

8.1.2.1.2 In patients with MetS having overweight and obesity, 5-10% of weight reduction over 3-6 months is recommended.

For more details see Section 5.2 on Lifestyle modification

8.1.2.2 Antihypertensive treatment

Recommendations

8.1.2.2.1 It is recommended to start antihypertensive treatment if lifestyle measures are not enough to reach BP targets depending on the severity of hypertension and overall cardiovascular risk.

8.1.2.1.2 It is recommended to focus on inhibition of the renin–angiotensin system with either ACE inhibitors or ARBs as first line treatment.

- *If combination therapy is needed, combination of an ACEI /ARB and a CCB is recommended.*
- There is increased risk of developing new-onset diabetes in these patients. Therefore, the choice of antihypertensive treatment must take this additional risk into account.
- It has been clearly established that diuretics increase the risk of new-onset diabetes compared to placebo by 23%. Conversely, calcium-channel blockers and, especially, renin–angiotensin system blockers (ARBs and ACE inhibitors) decrease this risk (33% with ACE inhibitors and 43% with ARBs).
- Thus, it seems reasonable to focus on inhibition of the renin–angiotensin system with either ACE inhibitors or ARBs as first line treatment.
- There is no evidence to support a preference for ACE inhibitors over ARBs in the treatment of hypertension in patients with MetS.
- If combination therapy is needed to achieve BP control, a Calcium-Channel Blocker is recommended
- Use of conventional beta blockers may lead to dyslipidemia or deterioration of glucose tolerance, and ability to lose weight.
- However, the vasodilating beta blockers (e.g., carvedilol, nebivolol, labetalol) have shown neutral or favorable effects on metabolic profiles compared to the conventional beta blockers.
- Thiazides also cause impaired glucose tolerance.

8.2 Hypertension in diabetes mellitus

8.2.1 HT and diabetes- Introduction

Hypertension is a common diagnosis in patients with both type 1 and type 2 diabetes, but the time course in relation to the duration of diabetes is different. Patients with diabetes and hypertension are at increased risk for cardiovascular morbidity and mortality.

In patients with type 1 diabetes, the prevalence of hypertension rises with the development of albuminuria. The blood pressure typically begins to rise at or within a few years after the onset of moderately increased albuminuria and increases gradually with the progression of the renal disease.

In patients with type 2 diabetes, hypertension is strongly associated with obesity. At the time of diagnosis of type 2 diabetes, two-fifth of patients are already diagnosed to have hypertension and one-half of those patients, the elevation in blood pressure occurs before the onset of moderately increased albuminuria.
Local data on hypertension in diabetes is lacking.

Early treatment of hypertension is particularly important in diabetic patients both to prevent cardiovascular disease and to minimize progression of renal disease, albuminuria and diabetic retinopathy.

8.2.2 Screening

Recommendations

8.2.2.1 It is recommended to measure the blood pressure at every clinical visit.

8.2.2.2 It is recommended to measure both sitting/supine and standing (3 minutes after) blood pressure on the initial visit and as indicated in subsequent visits.

Postural changes in blood pressure and pulse may be evidence of autonomic neuropathy.

8.2.3 Blood Pressure targets

For patients with diabetes and hypertension, blood pressure targets should be individualized through a shared decision-making process that addresses cardiovascular risk, potential adverse effects of antihypertensive medications, and patient preferences.

Recommendations

8.2.3.1 It is recommended to start antihypertensive drug treatment with lifestyle modification for people with diabetes when office BP is >140/90 mmHg.

8.2.3.2 It is recommended that BP targets for people with diabetes on antihypertensive medications are as follows;

- People <65 years - SBP target is <130 (129-120) mmHg, should not lower below 120 mmHg
- In older people (>65 years), SBP target <140 (139-130) mmHg
- Irrespective of age - DBP target is <80 (79-70) mmHg. The blood pressure should not be lowered below 70 mmHg

8.2.3.3 It is recommended to maintain a BP target of <140/90 mmHg for patients with a history of adverse effects of intensive BP control or at high risk of such adverse effects.

Table 8.2: Blood Pressure targets

Age	Systolic BP	Diastolic BP
<65 years	<130 (129-120) *	<80 (79-70) #
>65 years	<140 (139-130)	<80 (79-70) #

* should not lower <120mmHg
# should not lower <70mmHg

Patients with older age, advanced chronic kidney disease, and frailty have been shown to be at higher risk of adverse effects of intensive BP control. In addition, patients with orthostatic hypotension, substantial comorbidity, functional limitations, or polypharmacy may be at high risk of adverse effects, and some patients may prefer higher BP targets to enhance quality of life.

8.2.4 Pharmacological treatments

8.2.4.1 Diabetes mellitus without albuminuria

Recommendations

8.2.4.1.1 It is recommended for patients with confirmed office-based BP >140/90 mmHg should, in addition to lifestyle therapy, have prompt initiation and timely titration of single pharmacologic therapy to achieve BP targets.

8.2.4.1.2 It is recommended to initiate treatment with a RAAS blocker (ACEI/ARB) or a CCB or thiazide/thiazide-like diuretic as the first line treatment.

8.2.4.1.2 It is recommended for patients with confirmed office-based BP >160/100 mmHg should, in addition to lifestyle therapy, have prompt initiation and timely titration of two drugs or a single-pill combination of drugs demonstrated to reduce cardiovascular events in patients with diabetes.

8.2.4.1.2 It is recommended to initiate treatment with a combination of a RAAS blocker (ACEI/ARB) with a CCB or thiazide/thiazide-like diuretic as multiple-drug therapy is generally required to achieve BP targets.

8.2.4.2 Diabetes mellitus and albuminuria

Recommendation

8.2.4.2.1 It is recommended an ACEI/ARB, at the maximum tolerated dose indicated for blood pressure treatment, is the first-line treatment for hypertension in patients with diabetes and albuminuria. If one class is not tolerated, the other should be substituted.

8.2.5 Anti-hypertensive medications with special interest to diabetes

8.2.5.1 Monitoring for adverse effects

Recommendation

8.2.5.1.1 It is recommended to monitor serum creatinine/estimated glomerular filtration rate and serum potassium levels soon after starting the initial dose/increments of the dose and at least annually thereafter for patients treated with an ACEI, ARB, or diuretic. The frequency of monitoring is guided by the clinical status of the patient.

8.2.5.1.2 The metabolic side effects (hyperglycemia, hyperuricemia, visceral adiposity) of thiazide /thiazide-like diuretics are recognized and should be considered in patients at risk of metabolic syndrome.

8.2.5.3 Beta-blockers as well as diuretics, and particularly their combination, are also associated with increased risk of new-onset diabetes in predisposed subjects (mostly those with the metabolic syndrome).

8.2.5.4 Beta blocker therapy is known to increase the risk of severe or prolonged hypoglycemia and hypoglycemic unawareness.

8.2.5.5 Recent RCTs have shown that SGLT2 inhibitors may lower the blood pressure and be beneficial in achieving blood pressure control in diabetes

8.3 Hypertension in Chronic kidney disease (CKD)

8.3.1 Introduction

Hypertension is common in patients with chronic kidney disease (CKD), both as a cause and consequence of CKD.

The mechanisms of hypertension in CKD include volume overload, sympathetic overactivity, salt retention, endothelial dysfunction, and alterations in hormonal systems that regulate blood pressure.

While CKD contributes to the development of hypertension, it is also a major factor in the progression of CKD. Regardless of the cause of CKD, uncontrolled hypertension accelerates loss of GFR. However, whether intensive lowering of BP slows GFR decline is less clear.

8.3.2 Albuminuria in CKD

The level of albuminuria in CKD predicts not only the prognosis with respect to kidney function but also morbidity and mortality from CVD events including stroke.

The concept of using albuminuria as a surrogate marker for CKD progression and CVD outcomes is widely accepted, with the reduction of urine albumin levels often being regarded as a therapy target.

Some BP-lowering agents are particularly effective at reducing albuminuria or proteinuria, suggesting that BP management should differ depending on the amount of albumin or protein in the urine.

There is also uncertainty as to whether the dose of a particular agent that is required to achieve BP control is necessarily the same as the dose required for albuminuria reduction.

8.3.3 BP targets

In CKD non- dialysis (CKD-ND) patients, a higher BP is generally associated with a higher CVD risk, making BP-lowering an attractive goal to reduce cardiovascular morbidity and mortality.

Recommendations

8.3.3.1. It is recommended to start on antihypertensive treatment for patients with CKD-ND when the BP>140/90 mmHg.

8.3.3.2 It is recommended that adults with CKD-ND and high BP be treated with a target BP of 130/80 mmHg using standardized office BP measurements.

The presence of diabetes and/or the albuminuria do not change the BP targets in patients with CKD-ND.

For more advanced CKD (G4-G5), there is no robust evidence to demonstrate a benefit for renal (eGFR decline or ESKD risk) or CV outcomes when blood pressure is lowered to <130/80 mmHg except when proteinuria exceeds 1g/day (ref MDRD)
The BP targets vary from one guideline to another as the consensus are based on the interpretation of available evidence from various studies.

8.3.4 Non-pharmacological management

Nonpharmacologic therapy should be the first step to the treatment of hypertension, even among patients with CKD, and the mainstays of nonpharmacologic therapy are dietary interventions.

Recommendations

8.3.4.1 It is suggested targeting salt intake to <5 g of sodium chloride (<2 g per day of sodium) among CKD patients with high BP.

8.3.4.2 It is suggested that patients with high BP and CKD undertake moderate-intensity physical activity for a cumulative duration of at least 150 minutes per week, or to a level compatible with their cardiovascular and physical tolerance unless limited by severe cardiovascular intolerance.

8.3.5 Pharmacological management of CKD in non-dialysis (CKD-ND) patients

Recommendation

8.3.5.1 It is recommended to commence on a RAAS blocker (ACEI or ARB) for patients with concomitant CKD with or without diabetes, with or without albuminuria (G1-G4, A1, A2, A3), and high BP.

Table 8.3: ACEI/ARB therapy in non-dialysis (CKD-ND) patients

CKD ND + high BP		
No Diabetes	**Diabetes**	**Diabetes**
Moderately-severely increased albuminuria (≥30 mg/g; A2, A3)	Moderately-severely increased albuminuria (≥30 mg/g; A2, A3)	Normal/mildly increased albuminuria (<30 mg/g; A1)
ACEI/ARB (2C)	ACEI/ARB (1B)	ACEI/ARB (2C)

Evidence to support benefits of the RAAS blocker over other classes of antihypertensive agents in those without proteinuria is less robust

Recommendation

8.3.5.2 It is recommended not to combine ACEI with ARB, or with direct renin inhibitor therapy in patients with CKD with or without diabetes.

Most patients will require two or more antihypertensive agents to achieve these targets.

8.3.6 BP target & management in kidney transplant recipients (CKD-T)

Recommendations

8.3.6.1 It is suggested to treat adult CKD-T with high BP to a target BP of <130/80 mm Hg using standardized office BP measurement.

8.3.6.2 It is recommended that a dihydropyridine calcium channel blocker (CCB) or an ARB be used as the first-line antihypertensive agent in adult kidney transplant recipients.

Non-dihydropyridines might interfere with the metabolism and excretion of the calcineurin inhibitors (cyclosporine and tacrolimus), and the mTOR inhibitors (sirolimus and everolimus).

8.3.7 Antihypertensive medications with special interest to CKD

8.3.7.1 RAAS blockers

On initiation of therapy a reversible reduction in GFR of up to 30% (accordingly a 30% increase in serum creatinine concentration) has been regarded as reasonably attributable to this physiological mechanism. Greater reductions may indicate underlying renal artery stenosis.

8.3.7.2 Aldosterone antagonists

In patients with CKD, aldosterone antagonists have been shown to decrease urine albumin excretion when added to ACEI or ARB therapy. Small reductions in GFR are noted with aldosterone antagonists and hyperkalemia is a limiting side effect.

Aldosterone antagonists are potassium-sparing diuretics and thus may be combined with thiazide or loop diuretics that enhance potassium loss in the urine.

Great care should be exercised when aldosterone antagonists are combined with ACEI, ARBs, or other potassium-sparing diuretics as the risk of hyperkalemia is increased with declining renal function.

Caution should be exercised when aldosterone antagonists are combined with NSAIDs or COX-2 inhibitors.

8.3.7.3 Diuretics

8.3.7.3.1 Thiazides and thiazide-like diuretics

- Thiazides and thiazide-like diuretics initially produce their antihypertensive effect by salt and water excretion.
- Although thiazides are excreted by the kidney, no dose adjustment is recommended in patients with reduced GFR. As the GFR falls below about 30–50ml/min/1.73m^2, the ability of thiazides to overcome fluid retention is diminished, although their antihypertensive benefit may be preserved.

- It is suggested to stop thiazide/thiazide-like diuretics and switch to loop diuretics when eGFR is lower than 30 ml/min/1.73m2.

- Thiazides are known to potentiate the effect of other antihypertensive agents, particularly ACE-Is and ARBs and may also reduce the risk of hyperkalemia.

8.3.7.3.2 Loop diuretics

- In primary hypertension loop diuretics are effective in the short term but less so than thiazides in long term.

- Loop diuretics are particularly useful when treating edema and high BP in CKD stage 4–5 (eGFR <30) patients in addition or as an alternative to thiazide diuretics.

8.3.7.3.3 Potassium-sparing diuretics

- Triamterene and amiloride are usually avoided in patients with CKD because of the risk of hyperkalemia.

8.3.7.4 Beta blockers

- Beta-blockers are used in CKD patients with heart failure, but do not provide any definitive benefit in preventing mortality, cardiovascular outcomes or renal disease progression in CKD patients without heart failure.

- In patients with CKD, the accumulation of beta-blockers or active metabolites could exacerbate concentration-dependent side effects such as bradycardia (accumulation occurs with atenolol and bisoprolol, but not with carvedilol, propranolol or metoprolol)

8.3.7.5 Calcium channel blockers

- It is wise to avoid dihydropyridine calcium channel blockers in CKD patients with already increased urinary albumin excretion, particularly if there is not concomitant use of ACEI or ARB. The combination of nonhydropyridine CCB to RAS blockers lowers the BP and reduces albuminuria.

8.3.7.6 Centrally acting alpha-agonists

- Centrally acting alpha-agonists cause vasodilatation by reducing sympathetic outflow from the brain. Therefore, combination of alpha-agonists with thiazides is probably advantageous to reduce vasodilatation-induced fluid retention.

- Combination with other antihypertensive drugs is usually trouble-free, but caution is advised if the agents have similar side effects.

8.3.7.7 Alpha-blockers

- Alpha-adrenergic blockers selectively act to reduce BP by causing peripheral vasodilatation.

- Alpha-blockers are an adjunctive treatment for elevated BP in CKD patients in whom ACEIs, ARBs, diuretics, calcium-channel blockers, and beta-blockers have failed or are not tolerated. Alpha-blockers may also be advantageous if symptoms of prostatic hypertrophy are present.

8.3.8 Erythropoietin

Erythropoietin is known to increase BP. Caution should be exercised when prescribing erythropoietin in CKD patients with high blood pressure.

8.4 Hypertension with coronary artery disease (CAD)

Hypertension is a major independent risk factor for CAD for all age/race/sex groups. The management of hypertension in patients with chronic CAD and chronic stable angina is directed towards the prevention of death, MI, and stroke, a reduction in the frequency and duration of myocardial ischemia and the amelioration of symptoms.

8.4.1 Target BP in adults with CAD and hypertension

Recommendations

8.4.1.1 In patients who are <65 years, BP target of less than 130/80 mmHg is recommended but it should not be <120/70mmHg

8.4.1.2 In older patients (aged ≥65 years), it is recommended to target to a SBP of 130–140 mmHg and DBP of 70 mmHg - 79 mmHg

8.4.1.3 When decreasing SBP to target levels in patients with established CAD (especially if isolated systolic hypertension is present), it is recommended to be cautious when the DBP is ≤60 mmHg as myocardial ischemia might be exacerbated, especially in patients with left ventricular hypertrophy (LVH).

8.4.2 The management of hypertension

8.4.2.1 Lifestyle changes

Lifestyle changes are recommended (smoking cessation, diet and exercise etc.) (Refer 5.2)

8.4.2.2 Antihypertensive Medications

- To achieve the BP target, they should be treated with medications (e.g. guideline-directed management and therapy (GDMT)).
- Treating hypertensive patients with CAD with beta-blockers and RAS blockers (ACEI/ARB) improves post-myocardial infarction outcomes.
- Because of beta blockers' compelling indications for treatment of CAD, these drugs are recommended as a first-line therapy in the treatment of hypertension when it occurs in patients with CAD.
- Beta blockers for CAD which are also effective in lowering BP include carvedilol, metoprolol tartrate, metoprolol succinate, nadolol, bisoprolol, propranolol, and timolol. Atenolol is not as effective as other antihypertensive drugs in the treatment of hypertension.
- Dihydropyridine CCBs are effective anti-anginal drugs that can lower BP and relieve angina pectoris when added to beta blockers in patients in whom hypertension is present and angina pectoris persists despite beta blocker therapy.
- Short-acting nifedipine should not be used because it causes reflex sympathetic activation and worsening myocardial ischemia.
- The combination of a beta blocker and a non-dihydropyridine CCBs (diltiazem or verapamil) should be used with caution to avoid excessive bradycardia or heart block

- CCBs (nondihydropyridine and long acting dihydropyridine) can be used in patients after acute coronary syndrome when b-blockers are contraindicated, intolerant or not effective. Nondihydropyridine CCBs should not be used when there is heart failure.

Recommendation

8.4.2.1 Lifestyle changes are recommended (smoking cessation, diet and exercise etc.) in managing hypertension with CAD.

8.4.2.2 The recommended first line antihypertensive medications include beta blockers, ACE inhibitors, or ARBs if intolerant to ACEI (GDMT).

8.4.2.3 With angina and persistent uncontrolled hypertension addition of dihydropyridine CCBs to GDMT is recommended.

8.4.2.4 With persistent uncontrolled hypertension without angina, addition of dihydropyridine CCBs, Thiazide/thiazide-like diuretics and MRA is recommended.

8,4.2.5 In adults who have had an acute coronary syndrome, it is reasonable to continue GDMT beta blockers beyond 3 years as long-term therapy for hypertension.

8.4.2.6 For hypertensive patients with CAD, with or without coexisting systolic heart failure, the combination of an ACE inhibitor and ARB is not recommended.

8.5-Hypertension with chronic heart failure

8.5.1 Introduction

Hypertension is the leading risk factor for the development of heart failure. Persistent hypertension causes left ventricular hypertrophy, heart failure with reduced ejection fraction (HFrEF), heart failure with preserved ejection fraction (HFpEF), coronary artery diseases and microvascular diseases of small and large arteries.

8.5.2 Treatment of Hypertension in heart failure

Treatment of Hypertension in heart failure has a major impact on reducing the risk of incidence of heart failure and heart failure hospitalization, especially in old and very old patients. Reducing BP can also lead to the regression of LVH, which has been shown to be accompanied by a reduction of CV events and mortality.

8.5.2.1 The magnitude of LVH regression is associated with baseline LV mass, duration of therapy, and SBP reduction.

8.5.2.2 ACE inhibitors, ARBs and CCBs induce more effective LVH regression than beta-blockers or diuretics.

Reducing BP is probably the most important factor in HF prevention

8.5.3 In patients with HFrEF

8.5.3.1 Antihypertensive drug treatment should be started (if not already initiated) when BP is >140/90 mmHg. It is unclear how low BP should be reduced in patients with heart failure.

8.5.3.2 Outcomes for patients with heart failure have repeatedly been shown to be poor if BP values are too low, which suggests that it may be wise to avoid actively lowering BP to <120/70 mmHg.

8.5.3.3 Some patients may achieve even lower BP levels than the recommended values when on guideline-directed heart failure medications, which, if tolerated, should be continued because of their protective effect.

8.5.3.4 Heart failure guideline-directed medications are recommended for the treatment of hypertension in patients with HFrEF.

- All HF medications that have favorable effects on HF outcomes lower BP to some extent.
- ACE inhibitors, ARBs, beta-blockers, MRAs (e.g. Spironolactone and eplerenone), are all effective in improving clinical outcome in patients with established HFrEF.
- Angiotensin receptor- neprilysin inhibitor (ARNI) and some SGLT2 inhibitors used in HFrEF also lowers blood pressure.

8.5.3.5 The evidence with diuretics is limited to symptomatic improvement in heart failure.

8.5.3.6 If further blood pressure reduction is needed dihydropyridine CCB may be considered.

8.5.3.7 ARNI(Sacubutril/valsartan) lowers BP, has also been shown to improve outcomes in patients with HFrEF, and is indicated for the treatment of HFrEF as an alternative to ACE inhibitors.

8.5.3.8 Non-dihydropiridine CCBs (diltiazem and verapamil), alpha-blockers, and centrally acting agents, such as moxonidine, should not be used.

Recommendation

8.5.3.9 In hypertension patients with heart failure (HFrEF &HFpEF) BP lowering treatment should be considered if BP>140/90 mmHg.

8.5.3.10 It is recommended that BP should not be actively lowered below 120/70 mmHg.

8.5.3.11 In patients with HFrEF, it is recommended that BP lowering treatment comprises an ACEI or ARB and a beta blocker and diuretic and/or MRA required.

8.5.3.12 Dihydropyridine CCBs may be added if BP control is not achieved.

8.5.3.13 In all patients with LVH, it is recommended to treat with an RAS blocker in combination with CCB or diuretic and SBP should be lowered to a range of 120-130-mmHg.

8.5.4 In patients with HFpEF

Antihypertensive treatment thresholds and targets for patients with HFpEF is similar to those with HFrEF. The optimal treatment strategy for hypertensive patients with HFpEF is not known, but the strategy outlined for HFrEF patients can be adopted in HFpEF patients.

HFpEF patients commonly have multiple comorbidities that may adversely affect outcomes and complicate management.

Recommendation

8.5.4.1 In patients with HFpEF, BP treatment threshold and target value should be the same as for HFrEF.

8.5.4.2 All major classes of antihypertensive drugs can be used.

8.6-Hypertension with stroke

Stroke is the second most common cause of mortality and the third most common cause of disability worldwide. Overall, 71% of these stroke deaths and 78% of disability-adjusted life years lost occur in low and middle-income countries. The burden of stroke in Sri Lanka is on the increase with the current demographic transition toward an ageing population. The prevalence of stroke was 10.4 per 1000 with a 2:1, male: female ratio in Sri Lanka. Beyond the age of 65 years, the prevalence was higher by 6-fold among men and by 2-fold among women.

Hypertension is a major risk factor for haemorrhagic and ischaemic stroke, and for recurrent stroke. Stroke can be largely prevented by blood pressure (BP) control. Blood pressure management during the acute phase of haemorrhagic and ischaemic stroke remains an area of uncertainty. The management of BP in stroke patients is complex and requires an accurate diagnosis and precise definition of therapeutic goals.

8.6.1 Acute Intracerebral Haemorrhage (ICH)

In acute intracerebral haemorrhage, an increased BP is common and is associated with a greater risk of haematoma expansion, increased risk of death, and a worse prognosis for neurological recovery.

Recommendations

8.6.1.1 In patients with ICH, within first 6 hours, BP lowering is not recommended for patients with SBP< 220 mmHg.

8.6.1.2 In patients with SBP ≥ 220 mmHg, immediate BP lowering with IV therapy to <180 mmHg should be considered.

8.6.1.3 This target (140-180mmHg) should be maintained for at least 7 days.

8.6.1.4 Consider rapid blood pressure lowering with IV therapy for patients with acute ICH presenting beyond 6 hrs of symptom onset and aim for a SBP target 140 mmHg and maintained for 7 days.

8.6.1.5 Patients with ICH, oral antihypertensive treatment should be considered once they are medically stable and can take medications orally.

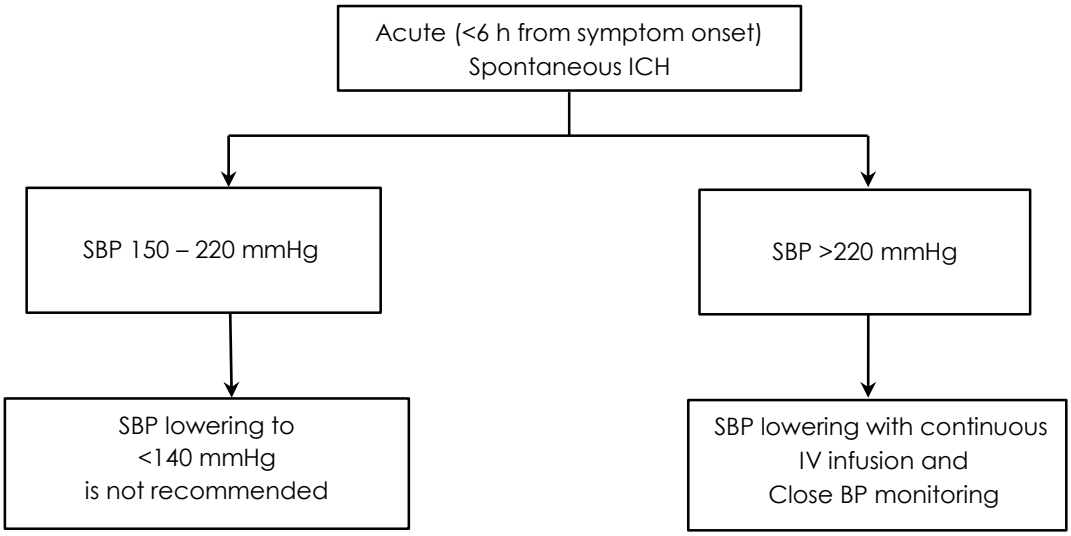

Figure 8.6.1 Management of HT in Acute Intracerebral Hemorrhage

Choice of antihypertensive agent

- In the acute phase of stroke, there is no clear evidence to support the use of any specific antihypertensive agent to achieve recommended blood pressure goals.
- Titratable intravenous agents are best suited for precise blood pressure lowering.
- Intravenous labetalol and nicardipine are the preferable first-line antihypertensive agents if pharmacologic therapy is necessary in the acute phase, since they allow rapid and safe titration to the goal blood pressure.
- Intravenous nitroprusside should be considered second-line therapy.
- Nitrates should be best avoided given the potential for cerebral vasodilation and elevated intracranial pressure
- Medications likely to cause a prolonged or precipitous decline in blood pressure (e.g. rapid-acting formulations of nifedipine) should be avoided.

Table 8.4: Administering of antihypertensive agent

Drug	**Dose**	**Onset of action**	**Duration of action**
Labetalol hydrochloride	20 – 80 mg IV bolus every 10 min 0.5 – 2 mg/min IV infusion	2 - 5 min	2 - 4 hr
Nicardipine hydrochloride	5 mg/h IV infusion increase by 2.5 mg/hr every 5 min to a maximum of 15 mg/hr	5 - 10 min	4-6 hr
Sodium nitroprusside	0.3 – 0.5 µg/Kg/min as IV infusion increase by 0.5 µg /Kg/min up to 10 µg/Kg/min	Immediate	min

8.6.2 Subarachnoid haemorrhage

- The management of BP in the acute phase of subarachnoid haemorrhage is based on less clinical evidence.
- Observational studies suggest that aggressive treatment of BP may reduce the risk of aneurysmal rebleeding, but with an increased risk of secondary ischaemia.
- Guidelines from different clinical societies agree that it is reasonable to treat BP if the aneurysm is not yet secured.

8.6.3. Acute Ischaemic Stroke

Elevated blood pressure is common during acute ischaemic stroke (occurring in up to 80% of patients), especially among patients with a history of hypertension. However, BP often decreases spontaneously during the acute phase of ischaemic stroke, as soon as 90 minutes after the onset of symptoms.

Recommendations

8.6.3.1 In acute ischaemic stroke, routine BP lowering with antihypertensive therapy is not recommended.

8.6.3.2 In patients with acute ischaemic stroke who are eligible for IV thrombolysis, BP < 180 /105 mmHg for at least the first 24 h after thrombolysis.

8.6.3.3 In patients with markedly elevated BP ≥220/120 mmHg who do not receive thrombolysis, drug therapy may be considered, based on clinical judgment (e.g. underlying CAD, HF or aortic dissection), to reduce MAP by 15% during the first 24 h after the stroke onset.

8.6.3.4 Stopping previously used antihypertensive therapy is recommended during the acute phase (72 hr from symptom onset).

8.6.3.5 Starting or restarting antihypertensive therapy during hospitalization in patients with BP greater than 140/90 mmHg who are neurologically stable is safe and reasonable to improve long-term BP control, unless contraindicated.

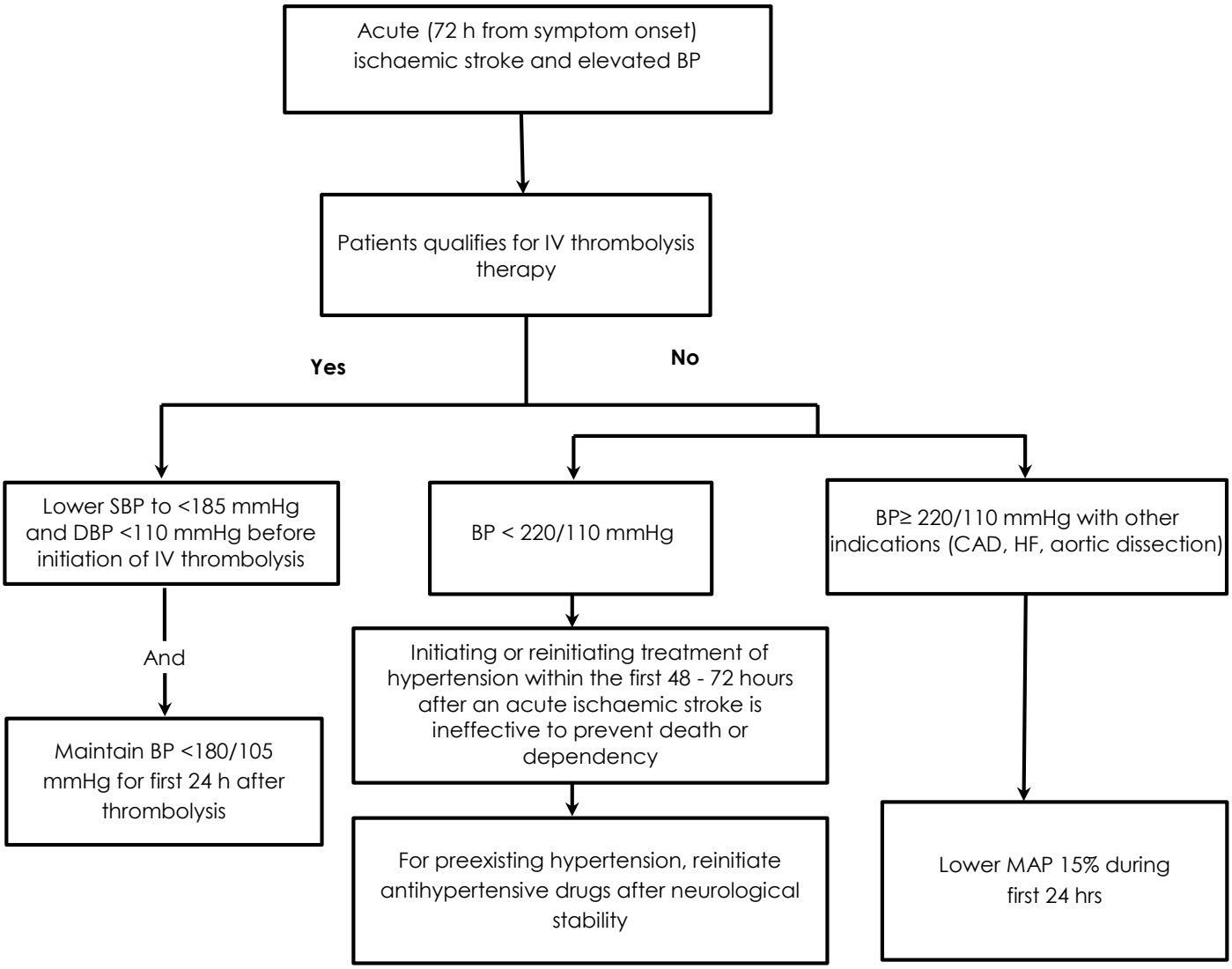

Figure 8.6.3 Management of hypertension in acute ischemic patients

8.6.4. Secondary Stroke Prevention

Recommendations

8.6.4.1 Adults with previously treated hypertension who experience a stroke or transient ischaemic attack (TIA) should be restarted on antihypertensive treatment after the first few days of the index event in ischaemic stroke and in immediately for TIA to reduce the risk of recurrent stroke and other vascular events.

8.6.4.2 The recommended antihypertensive drug treatment strategy for stroke prevention is a RAS blocker plus a CCB, thiazide or a thiazide like diuretic.

8.6.4.2 Several lifestyle modifications have been associated with blood pressure reduction and should be part of a comprehensive antihypertensive therapy.

8.6.4.3 Adults not previously treated for hypertension who experience a stroke or TIA and have an established BP of 140/90 mm Hg or higher should be prescribed antihypertensive treatment a few days after in ischaemic stroke and immediately for TIA to reduce the risk of recurrent stroke.

8.6.4.4 In all hypertensive patients with ischaemic stroke or TIA, a SBP target range of 120–130 mmHg should be considered

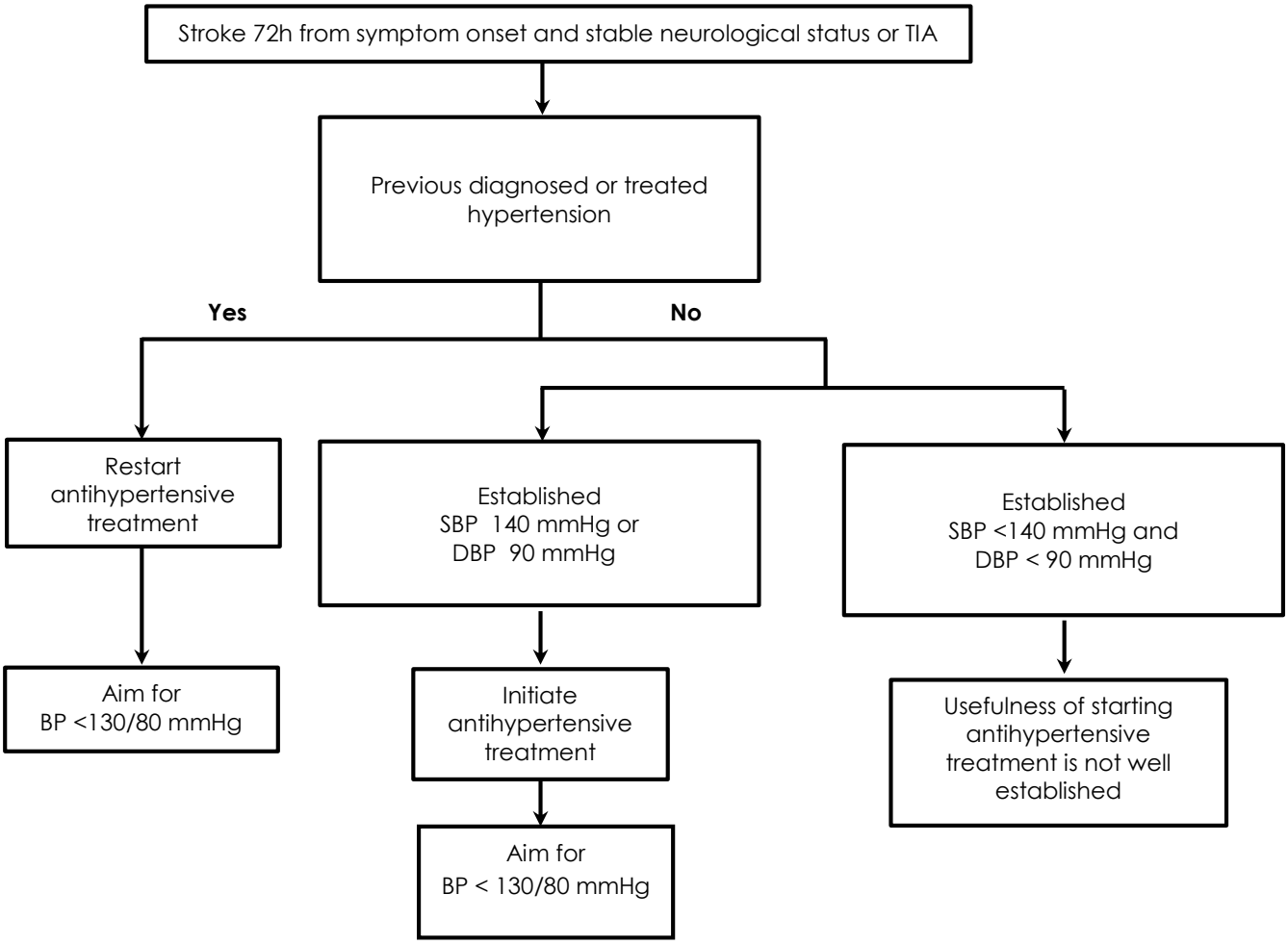

Figure 8.6.4 Management of hypertension in patients with a previous history of stroke (Secondary prevention)

8.7-Hypertension in other medical conditions (rheumatological conditions and psychiatric conditions)

8.7.1 Hypertension in Inflammatory rheumatological conditions (IRD)

- IRD (rheumatoid arthritis, psoriasis-arthritis, etc.) are associated with an increased prevalence of hypertension underdiagnosed and poorly controlled. Rheumatoid arthritis is predominant among IRD. The presence of IRD increases the cardiovascular risk compared with the general population. Therefore, CVD risk assessment is recommended for all patients with IRD at least once every 5 years.

- Hypertension is a major modifiable risk factor contributing to increased CVD risk in IRD. Several mechanisms may lead to the development of hypertension, including the use of certain antirheumatic drugs such as corticosteroids, NSAIDs, ciclosporin and leflunomide.

- For the management of hypertension and hyperlipidaemia, there is no evidence that treatment thresholds should differ in patients with IRD compared with the general population.

Recommendations

8.7.1.1 BP should be lowered as in the general population, preferentially with ACEI/ ARB and CCBs.
8.7.1.2 Underlying disease activity should be effectively treated by reducing inflammation and by avoiding high doses of NSAIDs.
8.7.1.3 Lifestyle recommendations should emphasize the benefits of a healthy diet, regular exercise and smoking cessation.
8.7.1.4 Lipid-lowering drugs should be used according to cardiovascular risk profile.

9.7.2 Hypertension in Psychiatric Diseases

The prevalence of hypertension is increased in patients with psychiatric disorders and in particular depression. Psychosocial stress and major psychiatric disorders increase the cardiovascular risk. Depression has been associated with cardiovascular morbidity and mortality, suggesting the importance of BP control.

Recommendations

8.7.2.1 BP should be lowered as in the general population, preferentially with ACEI/ARB and diuretics with a lesser rate of pharmacological interactions under antidepressants. CCBs and alpha1-blockers should be used with care in patients with orthostatic hypotension.
8.7.2.2 The risk of pharmacologic interactions, ECG abnormalities and postural BP changes must be considered.
8.7.2.3 Beta-blockers (except metoprolol) may be used in the presence of drug-induced tachycardia (antidepressant, antipsychotic drugs).
8.7.2.4 Additional risk factors should be managed according to cardiovascular risk profile.

8.8 Hypertension in the elderly

- Hypertension is a major risk factor for cardiovascular events and mortality in older persons. Hypertension is highly prevalent among older persons with myocardial infarction, stroke, congestive heart failure and peripheral arterial disease. Prevalence of hypertension increases with age. It is around 60% at the age of 60 years and 75% at the age of 75 years.[1]
- In Sri Lanka, 65% of adults more than 70 years of age are found to be hypertensive.[2]
- Elders are categorised into two groups in relation to hypertension management; age more than 65 years as 'elderly' and age more than 80 years as 'very old'.
- With increasing age, the arteries become stiffer and lose elasticity affecting the aorta and major arteries resulting in the elevation of systolic blood pressure and decline of diastolic blood pressure. Isolated systolic hypertension is a common form of hypertension in the elderly. Approximately 30% of people aged 60 years and above have isolated systolic hypertension. Despite being an age-related change, elevated blood pressure is a major cause of cardiovascular diseases and all-cause mortality in elderly. Also, hypertension in elderly is associated with cognitive impairment and dementia.
- Treatment of hypertension in the elderly and very old people has reduced the risk of cardiovascular disease and dementia. Postural hypotension is common in elderly.

There is growing evidence that indicate an increase in blood pressure in the upright position (orthostatic hypertension) is also an independent risk factor of cerebrovascular disease and other hypertension mediated target organ damage.

Table 8.5: Diagnostic thresholds and treatment of hypertension in elderly

Age group	Threshold for diagnosis	Treatment target
65-80 years	≥ 140/90[1]	*<130/80
> 80 years	≥ 150/90[8]	*<140/90

* If tolerated

Recommendations

8.8.1.1 It is recommended to maintain the blood pressure around 140/90 mmHg in 'very old' people and to use clinical judgement for people with frailty or multimorbidity.

8.8.1.2 Measurement of standing as well as seated blood pressures are recommended in elders with symptoms of postural hypotension and age more than 80 years.

8.8.1.3 In people with a significant postural drop of blood pressure (systolic >20 mmHg and diastolic >10 mmHg) or symptoms of postural hypotension, it is recommended to target standing blood pressure during treatment.

8.8.1.4 Lifestyle interventions are recommended for all elderly patients with hypertension.

8.8.1.5 Calcium channel blocker or a thiazide diuretic are recommended as initial antihypertensives in the absence of compelling disease-specific indications. In addition, ACEI and ARB can also be used in elderly to treat hypertension. Beta blockers are considered to be less effective in the elderly person.

When starting antihypertensive treatment in elderly, following general guidelines are applicable.

- To start with lowest available doses.
- For 'very old' people to start with monotherapy (not combined pills).
- Alpha blockers and loop diuretics to be avoided in the absence of compelling indication (e.g. alpha-blockers for benign prostatic hyperplasia and loop diuretics in cardiac failure).
- To check for postural hypotension and renal function at the introduction of treatment and at each dose increment.

8.9 Hypertension in the young

Elevated blood pressure of people between 18-40 years of age falls into the young hypertension category. Prevalence of young hypertension varies according to the geographical region, ethnicity, sex and lifestyle. In 2013-2014, 7.3% of US young adults had hypertension. The prevalence of hypertension among adults 30-39 years of age is around 12% in Sri Lanka. About 5-10% of hypertensive patients are found to be having a secondary cause for elevated blood pressure. Obesity and metabolic syndrome are identified as risk factors for higher prevalence of hypertension in Sri Lanka. About 30% of males and 20% of females of age 16-40 years in Sri Lanka are found to be having metabolic syndrome.

Cardiovascular risk assessment scores often underestimate the risks in younger adults due to shorter projections, such as 10 years. Hypertension in the young is an important area of interest because of increased risks of cardiovascular diseases and mortality in later years of life.

8.9.1 Diagnosis of hypertension in young

Same as per general hypertension diagnosis (refer to the relevant section).
Primary hypertension is still the most common aetiology in the young. It is important to distinguish primary versus secondary hypertension to avoid extensive investigation of the aetiology of hypertension in young with primary hypertension, yet without missing the detection of secondary hypertension.

8.9.2 Secondary hypertension in young

Metabolic syndrome is an important risk factor of young hypertension (refer to the metabolic syndrome section for further details). Renovascular disease(Fibromuscular dysplasia), renal parenchymal disease, primary aldosteronism, phaeochromocytoma, coarctation of aorta, Cushing syndrome, hyperthyroidism, hypothyroidism, obstructive sleep apnoea, oral contraceptives and drug-induced are also encountered as secondary hypertension aetiologies.
It is recommended to consider specific investigations in people with symptoms and signs suggesting a secondary cause of hypertension. Also, resistant hypertension in young people needs evaluation for a secondary cause. Consider referring for further investigation and management of suspected secondary hypertension patients to a specialist centre for expertise and resources when necessary.
Refer to the section on secondary hypertension for more information.

8.9.3. Treatment

Treatment thresholds and targets remain the same as for adults with hypertension. However, management of hypertension in young persons is an evolving area of research particularly related to blood pressure thresholds to start treatment, treatment goals and risk assessment strategies.

Recommendation

8.9.3.1 It is recommended to use the same treatment thresholds and treatment targets as for adults with hypertension when managing hypertension in the young.

8.10 Ethnicity, Race and Hypertension

8.10.1 The continuous relationship between blood pressure and risk of events has been shown at all ages and in all ethnic groups.

8.10.2 Hypertension disproportionately affects African Americans, having a higher burden of hypertension-related complications than whites.

8.10.3 South Asians although genetically diverse, as a group is known to have a high cardiovascular risk compared to whites with hypertension occurring at a younger age and with more severe and earlier end organ damage.

8.10.4 The epidemiology of hypertension in the different ethnic groups in Sri Lanka is poorly studied.

8.10.5 The occurrence and severity of target organ damage, hypertensive complications, response to treatment if any and overall cardiovascular risk if different among the different ethnic groups is largely unknown.

8.10.6 Justification to use different blood pressure treatment targets for Sri Lankans would need to be validated in prospective studies.

8.10.7 The limited studies reported have shown significant differences in prevalence among different ethnic groups living in the same community. These differences may be explained by disparities in body weight, physical activity levels and dietary habits as data were not adjusted for these confounding factors.

8.10.8 Based on the currently available information, there is no evidence of different efficacy of antihypertensive drugs among South Asians, but there is a need for trials with morbidity and mortality outcomes.

8.10.9 The approach to managing blood pressure should be determined by age, level of blood pressure, presence of target organ damage, cardiovascular risk and comorbid conditions. There are insufficient evidence that ethnic and racial factors per se should determine the choice of antihypertensive drug treatment.

8.10.10 The different ethnic groups may face cultural, linguistic, educational and social barriers during communication of risk and treatment strategies which calls for special attention in the management of hypertension.

Recommendation

8.10.11 The treatment threshold, treatment targets of hypertension and choice of antihypertensive agents should not be different among local ethnic groups but be determined by factors as in the rest of the adult population.

8.11 Perioperative management of hypertension

8.11.1 Introduction

- Hypertension and its treatment, especially antihypertensive drugs, have an important impact on perioperative management of patients scheduled for surgery. Blood pressure is one of the major determinants of hemodynamic stability, an important goal of intraoperative anesthesia management.
- With the increasing number of patients undergoing surgery, management of hypertension in the perioperative period has emerged as an important factor to prevent undesirable patient outcome.

8.11.2 Blood pressure response during anesthesia

- Sympathetic activation during the induction of anesthesia can cause the blood pressure and heart rate to rise in normotensive individuals.
- The mean arterial pressure tends to fall as the period of anesthesia progresses causing episodes of intraoperative hypotension.
- Blood pressure and heart rate slowly increase as patients recover from the effects of anesthesia during the immediate postoperative period.
- These responses may be more pronounced in patients with untreated and preexisting hypertension which may lead to myocardial ischemia.

8.11.3 HMOD/CV risk assessment

While a BP elevation is per se not a strong risk factor for CV complications in non-cardiac surgery, overall CV risk assessment, including the search for HMOD, is important in treated and untreated hypertensive patients, and mandatory when a BP elevation is newly detected.

Recommendation

8.11.3.1 All patients who will undergo surgery should be carefully evaluated by an anesthesiologist and or a physician/cardiologist for the assessment of the perioperative overall risk and their general condition, along with the organization of an effective anesthesia plan.

8.11.4 Perioperative BP goals

8.11.4.1 Preoperative

Postponing non-cardiac surgery is usually not warranted in patients with SBP <180 mmHg and/or DBP <110 mmHg. In those with an SBP >_180 mmHg and/or DBP >_110 mmHg, deferring surgery until BP is reduced or controlled is advisable, except in emergency situations.

8.11.4.2 Intraoperative

It is important to avoid large intraoperative BP fluctuations, as evidenced from a recent RCT which kept BP values within a 10% difference from the preoperative office SBP, resulted in reduced risk of postoperative organ dysfunction.

8.11.4.3 Postoperative

Blood pressure goal in patients treated for postoperative hypertension is similar to the general population.

Recommendation

8.11.4.3.1 Any patient who experiences a marked and sustained rise in blood pressure following surgery (sustained increase in systolic pressure greater than 180 mmHg not due to severe pain) should be treated immediately with intravenous antihypertensive therapy.

8.11.4.3.2 In patients treated for postoperative hypertension who did not have preexisting hypertension, discontinue antihypertensive therapy once the patient is surgically stable and the blood pressure is at goal for at least 24 hours, and observe them over a period of 48 to 72 hours. Antihypertensive

therapy should be resumed if the blood pressure remains consistently elevated.

8.11.5 Antihypertensive medication during perioperative period

Antihypertensive drug treatment used previously will need review prior to surgery.
There is no clear evidence to support the use of one class over another antihypertensive treatment in the perioperative period of patients undergoing non-cardiac surgery.
An individualised approach to managing hypertension perioperatively may be required due to conflicting data on the safety of several antihypertensive agents.

Recommendation

8.11.5.1 In preparation for elective noncardiac surgery, continuation of antihypertensive medication until the surgery is reasonable. Most antihypertensive agents can be continued until the time of surgery, taken with small sips of water on the morning of surgery.

8.11.6 A brief summary of various classes of antihypertensive drugs.

8.11.6.1 CCB

Calcium channel blockers are safer compared to other antihypertensive agents in managing preoperative hypertension.

8.11.6.2 Diuretics

Chronic diuretic therapy induced hypokalaemia may potentiate the effects of muscle relaxants used during anesthesia, as well as predisposition to cardiac arrhythmias and paralytic ileus. These potential perioperative risks call for close attention to volume and potassium replacement.

8.11.6.3 Beta Blockers

Perioperative use of beta blockers has been controversial for many years, and the concern has recently been revived by meta-analyses showing increase in the risk of hypotension, stroke, and mortality in patients on perioperative beta blockers compared to placebo.
Abrupt discontinuation may lead to BP or heart rate rebounds and may cause angina, myocardial infarction, or sudden death in patients with underlying coronary disease.

Recommendation

8.11.6.3.1 Perioperative continuation of beta blockers is recommended in hypertensive patients currently on chronic beta-blocker treatment.

8.11.6.3.2 Starting beta-blockers on the day of surgery in beta-blocker naive patients should however be avoided

8.11.6.4 ACEI/ARB

More recently, the questions have been raised whether RAS blockers should be discontinued before surgery to reduce the risk of intraoperative hypotension.
These drugs can theoretically blunt the compensatory activation of the renin-angiotensin system during surgery and result in prolonged hypotension.
Several studies have reported a higher incidence of hypotension in patients who were on ACE inhibitors or ARBs prior to undergoing surgery.

Preoperative discontinuation of these drugs has also been supported by a recent study, where withholding ACE inhibitors or ARBs 24 h before non-cardiac surgery was associated with a significant reduction in CV events and mortality.

Recommendation

8.11.6.4.1 Transient preoperative discontinuation with the aim of reducing the risk of intraoperative hypotension should be considered before noncardiac surgery unless there is a compelling reason to continue such as stable patients with heart failure.

8.11.6.4.2 ACEI/ARB can be resumed safely as early as the second postoperative day provided there are no contraindications for its resumption.

8.12 Hypertension in pregnancy

Hypertension in pregnancy is a leading cause of direct maternal death in Sri Lanka and a major cause of fetal, and neonatal morbidity and mortality. Hypertension increases the maternal risks for placental abruption, stroke, multiple organ failure, and disseminated intravascular coagulation while increasing the fetal risk for intrauterine growth retardation, pre-maturity, and intrauterine death.

Hypertension during pregnancy has negative implications for a woman's cardiovascular health later in life with increased risk for cardiovascular mortality, coronary artery disease (CAD), and development of heart failure when compared with normal cohorts.

A significant proportion of women with preeclampsia and gestational hypertension is at higher risk of progression to hypertension in the immediate period after pregnancy, compared with women with normotensive pregnancy.

8.12.1 Classification of hypertension in pregnancy

1. Chronic Hypertension*

(a)Onset of hypertension (≥ 140/90 mmHg) and being on treatment for hypertension before conception,

OR

(b)Onset of hypertension (≥ 140/90 mmHg) first detected after gestation but before 20 weeks of gestation in the absence of trophoblastic disease, and continues more than 6 weeks postpartum,

OR

(c)Hypertension (≥ 140/90 mmHg) first detected after 20 weeks of gestation, which requires drug treatment to control blood pressure beyond 6 weeks postpartum.

**Chronic hypertension includes primary hypertension, secondary hypertension, white-coat hypertension and masked hypertension, which are not directly related to pregnancy.*

2. Gestational hypertension

Gestational hypertension is characterized by a new onset of hypertension ≥ 140/90 mmHg after 20 weeks of gestation, without proteinuria or features of preeclampsia, followed by return of blood pressure ≤ 140/90 mmHg without drugs, usually within 6 weeks postpartum[6]. If the blood pressure does not return to normal after 6 weeks postpartum, it is regarded as chronic hypertension.

3. Transient gestational hypertension

Transient gestational hypertension is seen in the second or third trimester, having transient elevation of blood pressure ≥ 140/90 mmHg, for a shorter duration, usually for a few hours, which usually resolves on its own, without drug treatment. The elevated blood pressure, which is usually detected at the clinic, soon settles with repeated readings, in several hours. In 40 % of the patients, true gestational hypertension or preeclampsia can be seen with the progression of pregnancy. Therefore, careful follow-up of this group of patients is necessary.

4. Preeclampsia

Preeclampsia is new onset hypertension ≥ 140/90 mmHg, which occurs after 20 weeks of gestation, with one or more of the following conditions (A, B, or C) and resolves within 6 weeks, postpartum.

(A) Significant proteinuria (UPCR ≥ 30 mg / mmol creatinine or urine protein ≥ 2+ on urine dipstick or 24-hour urine protein ≥ 300 mg), in the absence of other cause for proteinuria.[2]

(B) Dysfunctions of maternal organs include:

- Neurological complications: severe headache, scotomas, blindness, hyperreflexia, clonus, confusional states, cerebrovascular accident or eclampsia
- Hepatic impairment: Upper quadrant or epigastric abdominal pain with or without elevated Liver transaminases. (AST / ALT ≥ 40 IU/L)
- Renal insufficiency: reduced urine output with evidence of acute kidney injury (creatinine ≥ 90umol/L or ≥ 1 mg/dL)
- Haematological complications: thrombocytopenia (platelet count < 150,000/ µL), hemolysis or disseminated intravascular coagulation

(C) Uteroplacental dysfunctions: fetal growth restriction, abnormal umbilical artery doppler waveform analysis or stillbirth.

However, proteinuria can be absent in some patients.

There can be clinical and laboratory features of preeclampsia without hypertension, in a minority of patients.

Rarely, the onset of preeclampsia can be in the postpartum period up to 6 weeks. Postpartum onset of preeclampsia is usually seen after 48-72 hours following a physiological drop in blood pressure, in the first 2 days, after delivery.

5. Eclampsia

Eclampsia is the complicated manifestation of preeclampsia and it is defined by new-onset seizures, or unexplained coma, in the absence of other causative conditions.

6. Preeclampsia superimposed on chronic hypertension

When a woman with chronic hypertension, develops features suggestive of preeclampsia with or without difficulty of controlling the previously controlled blood pressure, is termed as preeclampsia superimposed on chronic hypertension.

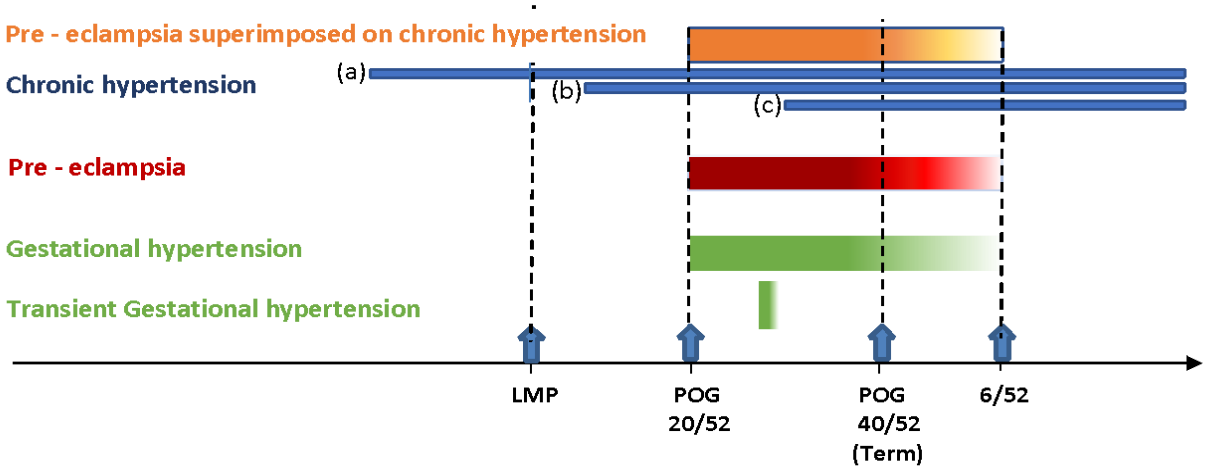

Figure 8.12.1 Hypertensive disorders in relation to the stage of pregnancy

- *In general, the term Pregnancy Induced Hypertension (PIH) is used only to denote gestational hypertension without features of preeclampsia.*
- Hypertension in pregnancy is defined as blood pressure 140/90 mmHg to 159/109 mmHg, having either diastolic or systolic or both values elevated.
- Severe hypertension in pregnancy is defined as blood pressure ≥ 160/110 mmHg, having either diastolic or systolic or both values elevated[3].

8.12.2 Chronic Hypertension in pregnancy

Pre-gestational care

Recommendation

8.12.2.1 Stop angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARB), thiazide-like diuretics, spironolactone, beta blockers (except labetalol) and statins if a woman is planning for pregnancy.

8.12.2.2 Advise the woman to practice a reliable contraceptive method if she is in childbearing age while on treatment with ACE inhibitors, ARBs, thiazide like diuretics, spironolactone, beta blockers (except labetalol), and statins.

8.12.2.3. Investigate appropriately as a young hypertensive, if not done previously (Refer section on Young hypertension: e.g.; renal profile, USS Abdomen & Genito Urinary Tract, FBC, ESR, 2D Echocardiogram, S.TSH)

8.12.2.4. Look for evidence of hypertension associated target organ damage and arrange appropriate referrals to specialist care for advice, if the woman is planning for pregnancy.

8.12.2.5. Start antihypertensive therapy, safe in pregnancy, if the woman is planning to become pregnant, found to have persistently high blood pressure (≥ 140/90 mmHg). (Table 8.6)

8.12.2.6. Lifestyle modifications are recommended prior to conception.

Antenatal Care (Ref; 8.12.4)
Intrapartum care (Ref; 8.12.6)
Postnatal care (Ref; 8.12.7)

8.12.3 Screening for Gestational hypertension and preeclampsia in pregnancy

Recommendations

8.12.3.1 Blood pressure should be measured accurately in the sitting position, with an appropriately sized arm cuff at heart level, using mercury sphygmomanometer at each clinic visit. It is recommended to use Korotkoff phase "V" to determine the diastolic value.

8.12.3.2 If the sitting position is not feasible, blood pressure should be measured in the left lateral recumbent position during late third trimester or in labour.

8.12.3.3 The blood pressure values should be documented in the pregnancy record and if it is ≥ 140/90 mmHg on two occasions at least 2 hours apart, the woman needs to be immediately referred to specialized care.

Blood pressure monitoring (ABPM) and home blood pressure monitoring (using validated home blood pressure apparatus in pregnancy), is helpful to diagnose white coat hypertension or masked hypertension.

8.12.3.4 At every clinic visit, proteinuria should be tested and quantified, preferably using dipstick test.

8.12.3.5 Risk assessment for development of preeclampsia should be done at the booking visit.

High risk factors for preeclampsia:

- Hypertensive disease during previous pregnancy
- Chronic kidney disease
- Autoimmune disease such as systemic lupus erythematosus or antiphospholipid syndrome
- Type 1 or type 2 diabetes
- Chronic hypertension
- Assisted reproductive therapy

Moderate risk factors for preeclampsia:

- First pregnancy
- Age ≥ 40 years
- Pregnancy interval > 10 years
- BMI of ≥ 30 kg/m^2 at first visit
- Family history of preeclampsia
- Multiple pregnancy

8.12.4 Management of hypertension in pregnancy

8.12.4.1Non-pharmacological management

Recommendations

8.12.4.1.1 Once the woman is pregnant, lifestyle modifications must be assessed and individualized to the patient, by the treating physician and / or obstetrician.

8.12.4.1.2 Depending on obstetricians and physician's evaluation of the patient's physical capacity, planned exercise at least > 30 minutes per day, is recommended.

8.12.4.2 Pharmacological Management

The objective of pharmacological management is to reduce maternal morbidity and mortality while providing maximum safety for the fetus.

Recommendations

8.12.4.2.1 ACE inhibitors, ARBs, thiazide-like diuretics, beta blockers and statins should be withheld immediately, if the woman is found to be pregnant and should be offered alternative treatment.

8.12.4.2.2 Start and continue antihypertensive treatment, if the blood pressure is persistently elevated ≥ 140/90 mmHg, with repeated measurements.

8.12.4.2.3 When using medicines to treat hypertension in pregnancy, aim for a target upper limit of blood pressure of ≤ 135/85 mmHg and lower limit of blood pressure ≥ 110/70 mmHg.

8.12.4.2.4 Oral labetalol, if available, is recommended as the first line treatment for hypertension in pregnant women. Slow release nifedipine (nifedipine SR) can be started if labetalol is not available or suitable. Methyldopa may be useful, if both labetalol and nifedipine are not available[3].

8.12.4.2.5 If blood pressure cannot be controlled with one class of oral medications, Labetalol, Nifedipine SR and methyldopa can be added and can continue in combination, to control the blood pressure.

8.12.4.2.6 If the blood pressure is ≥ 160/110 mmHg in chronic hypertension, intravenous magnesium sulfate may be considered by the treating team, if clinically indicated, to provide neuroprotection and to prevent seizures.

8.12.4.2.7 Chronic hypertension is not an indication for early delivery before 37 weeks, if the blood pressure is maintained ≤ 160/110 mmHg, unless there are other medical or obstetric indications.

8.12.4.2.8 If early delivery (before 34 weeks of maturity) is planned, a course of intravenous corticosteroids is indicated for fetal lung maturation.

8.12.4.2.9 Aspirin 75–150 mg at night, should be started from 12 weeks of gestation, for pregnant women with chronic hypertension, if not contraindicated.

8.12.4.2.10 If found to have at least one high risk factor or more than one moderate risk factors for preeclampsia, it is recommended to start aspirin 75 – 150 mg at night, if not contraindicated, from 12 weeks of gestation, to prevent preeclampsia, or as decided by the treating obstetrician. (8.12.3.5)

8.12.4.2.11 It is recommended to start oral calcium supplementation 1000 mg/day (1.5–2 g/day), for the prevention of preeclampsia.

8.12.4.2.12 Vitamins C and E do not decrease preeclampsia risk and routine use is not recommended.

Table 8.6: Oral drugs used in hypertension in pregnancy

Drug	Dosage	Action	Contraindication	Remarks
Labetalol	100 – 200 mg tds	Beta blocker with mild a vasodilator effect	Asthma, chronic airways limitation.	Bradycardia, bronchospasm, headache, nausea, scalp tingling.
Nifedipine (SR)	20 – 30 mg BD	Calcium channel blocker	Aortic stenosis	Severe headache in first 24 hours, flushing, tachycardia, peripheral oedema, constipation
Methyldopa	250 – 500 mg tds	Central	Depression	Slow onset of action over 24 hours, dry mouth, sedation, depression, blurred vision
Hydralazine	25-50mg tds	Vasodilator	SLE	Flushing, headache, nausea, lupus-like syndrome

8.12.4.3 Monitoring

Recommendations

8.12.4.3.1 If the pregnant woman has hypertension (BP ≥ 140/ 90 to ≤ 159/109 mmHg) without preeclampsia, blood pressure should be closely monitored every other day, or more frequently in an admitted patient. Monitor full blood count, liver and renal function tests twice a week.

8.12.4.3.2 Women with preeclampsia when first diagnosed, should be initially treated in hospital and managed until they are stable.

8.12.4.3.3 If the pregnant woman has hypertension, (BP ≥ 140/ 90 to ≤ 159/109 mmHg), with features of preeclampsia, the blood pressure should be monitored at least 6-hourly, while being inward. Monitor full blood count, liver function, coagulation and renal function tests three times a week.

8.12.4.3.4 If the pregnant woman has severe hypertension (BP ≥ 160/110 mmHg), with or without features of preeclampsia, she should be admitted and blood pressure checked every 15–30 minutes following treatment, until blood pressure is ≤ 159/109 mmHg. Then it should be monitored at least 6 - hourly. Monitor full blood count, liver function, coagulation and renal function tests three times a week[3]. Initial target blood pressure in this setting is ≤ 150/95 mmHg.

8.12.4.3.5 Testing for urine protein should be repeated as clinically indicated.

8.12.5 Management of preeclampsia with severe features.

(Severe preeclampsia / impending eclampsia)

Presence of following severe features, with or without severe hypertension (blood pressure ≥ 160 / 110 mmHg), is a medical emergency in preeclampsia.

- Severe headache, visual disturbances, epigastric or right hypochondrial pain, liver tenderness +/- nausea & vomiting
- Abnormal liver enzymes (ALT or AST rising to above 70IU/L), Features of HELLP syndrome
- Altered mental status, stroke, clonus (3 beats or more), exaggerated tendon reflexes
- Oliguria (less than 400 ml per day or 0.5 ml/Kg/hour over a 4-hour period)
- Evidence of acute kidney injury (rising creatinine; ≥ 90 µmol/L or ≥ 1mg/dL)
- Uteroplacental dysfunction (fetal growth restriction, abnormal umbilical artery Doppler waveform analysis, or stillbirth.)

Recommendations

8.12.5.1 Immediate steps should be taken to control the blood pressure, if elevated, and to prevent progression to eclampsia. Delivering of the baby should be done as early as possible, once the woman is stabilised.
Blood pressure control in severe hypertension in pregnancy (BP ≥ 160/110 mmHg)

8.12.5.2 If the blood pressure is ≥ 180 / 110 mmHg, it is recommended to start treatment with intravenous antihypertensives. If blood pressure is ≥ 160/ 110 mmHg to ≤ 179/110 mmHg, oral medications may be tried first, in the absence of severe features of preeclampsia.

Table 8.7: Intravenous drugs used in hypertension in pregnancy

Drug	Bolus Dosage	Maintenance Infusion	Onset of Action	Adverse effects
Labetalol	20 – 50mg bolus 5mg/ml solution over 2 min, Repeat every 10 mins. prn. Up to four doses. (Max up to 200mg)	20mg/hour, can go up to 160 mg/hour (double the rate every 30 minutes)	Maximal effect usually occurs within 5 minutes after each dose.	Bradycardia Hypotension Fetal Bradycardia Bronchospasm
Hydralazine	5 – 10 mg bolus over two mins. Can repeat again after 10 mins. (Max up to 20 mg) Need IV fluid bolus 200ml to prevent sudden vasodilatation.	2-3 mg / hour	20 mins	Flushing Headache Nausea Hypotension Tachycardia Lupus like syndrome

- Sodium nitroprusside should only be used as the drug of last choice as prolonged treatment is associated with an increased risk of fetal cyanide poisoning.

- The drug of choice when preeclampsia is associated with pulmonary oedema is glyceryl trinitrate (GTN), given as an i.v. infusion of 5µg/min, and gradually increased every3–5min to a maximum dose of 100µg/min.

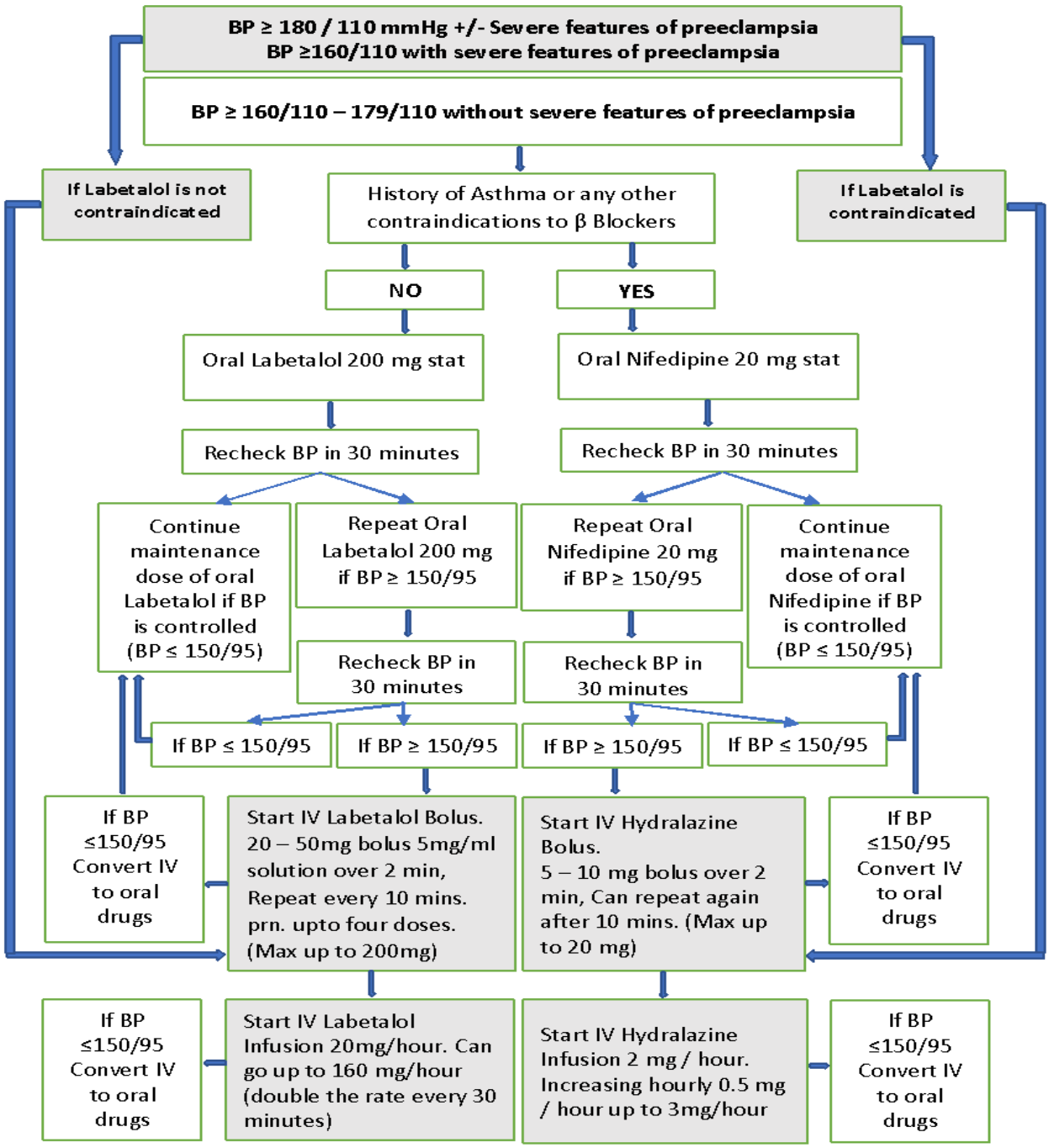

Figure 8.12. 2 Pharmacological management of severe hypertension in pregnancy

Use of magnesium sulphate:

Recommendations

8.12.5.3 Intravenous magnesium sulfate is recommended if a woman has severe hypertension or severe preeclampsia or previously had an eclamptic fit, within the present pregnancy.

8.12.5.4 A loading dose of IV magnesium sulfate 4 g should be given intravenously over 5 to 15 minutes, followed by an infusion of 1 g/hour maintained for 24 hours. If the woman has had an eclamptic fit, the infusion should be continued for 24 hours after the last fit.

8.12.5.5 It is strongly not recommended to use diazepam, phenytoin or other anticonvulsants as an alternative to magnesium sulfate in women with eclampsia.

8.12.6 **Intrapartum care in hypertension in pregnancy**

Recommendations

8.12.6.1 During labour, monitor blood pressure hourly, in women with controlled hypertension (BP ≤ 135/85) and every 15–30 minutes until blood pressure is less than 150/95 mmHg, in women with severe hypertension.

8.12.6.2. Continue the antenatal antihypertensive treatment during labour.

Mode of Delivery

Recommendation

8.12.6.3 Mode of delivery for women with severe hypertension, severe preeclampsia or eclampsia must be decided according to the clinical circumstances, obstetric indications and the woman's preference.

8.12.7 Postnatal care in hypertension in pregnancy

In preeclampsia, significant numbers of mothers have post-natal eclamptic seizures especially during the first 48 - 72 hours after delivery.

Recommendations

8.12.7.1 Close monitoring of the mother should be done, despite the blood pressure control appearing to be satisfactory during this period.

8.12.7.2 Target blood pressure control should be lower than 140/90 mmHg.

8.12.7.3 In chronic hypertension in pregnancy, plan to measure blood pressure daily, at least up to 5 days and appropriately, thereafter.

8.12.7.4 Review anti-hypertensive medication and adjust doses or stop appropriately after delivery. Some mothers depend on antihypertensives for a few weeks after delivery especially in chronic hypertension.

8.12.7.5 If the woman was on methyldopa during the antenatal period, it should be discontinued immediately and replaced with an alternative antihypertensive drug.

8.12.7.6 If the woman was on nifedipine SR, it can be continued during breastfeeding. Nifedipine SR can be replaced with amlodipine, if the preparation is not available.

8.12.7.7 Labetalol can be replaced by other beta blockers including atenolol, metoprolol or carvedilol.

8.12.7.8 If blood pressure is not controlled with nifedipine or beta blockers, an ACE inhibitor (enalapril or captopril) can be started as the third line medication during breastfeeding, with appropriate monitoring of renal function and serum potassium.

8.12.7.9. Thiazide-like diuretics, spironolactone, ARBs and ACE inhibitors other than enalapril and captopril should be avoided during breastfeeding.

8.12.7.10 A medical review should be arranged within 6–8 weeks after delivery, if blood pressure remains controlled in chronic hypertension in pregnancy.

8.12.7.11 Early medical referral should be done, if blood pressure remains poorly controlled especially in gestational hypertension or preeclampsia.

8.12.7.12 It is recommended to arrange appropriate contraceptive methods other than combination oral contraceptive pills.

Postnatal Follow-up Care

Recommendations

8.12.7.13 It is recommended to arrange an initial outpatient review within 1-2 weeks after delivery and thereafter up to 6 weeks as indicated for patients with gestational diabetes and preeclampsia.

8.12.7.14 Women should be advised regarding the future risk of developing hypertensive disease and increased risk for cardiovascular, cerebrovascular and chronic kidney disease associated with the hypertensive disease at the present pregnancy.

8.12.7.15 It is recommended to arrange screening for non-communicable diseases and to assess the cardiovascular risk of the woman, at regular intervals.

Key messages and summary of recommendations

Definition of hypertension

Hypertension is defined as clinic systolic BP (SBP) values ≥140 mmHg and/or diastolic BP (DBP) values ≥ 90 mmHg following repeated examination.

Grading of hypertension

- BP should be categorized as normal, elevated, or Grade 1 or 2 hypertension to prevent and treat high BP.
- Individuals with SBP and DBP in two categories should be designated to the higher BP category.

High normal blood pressure

- Consider excluding masked hypertension in patients with high-normal BP.
- Patients with high-normal blood pressure and low-moderate CVD risk should be offered lifestyle changes. This group should not be offered blood pressure lowering pharmacological treatment.
- Pharmacological treatment may be considered in patients with high-normal blood pressure with high CVD risk (estimated 10-year risk ≥20% with WHO/ISH risk assessment tool) and/or established CVD especially coronary artery disease. Monotherapy is sufficient as early therapy for these patients.
- Monitor blood pressure at least annually in these patients to detect progression to established hypertension.

Isolated systolic hypertension

- Treatment of isolated systolic hypertension should be the same as for people with both raised systolic and diastolic blood pressure

Secondary hypertension

- Basic screening for secondary hypertension should include a thorough assessment of history, physical examination, basic blood biochemistry (including serum sodium, potassium, eGFR, TSH) and UFR
- For further investigations and management of suspected secondary hypertension, the patient should be referred to a specialist centre. Some of the screening tests mentioned in table 2.2 and 2.3 may only be available at specialist centres.

Devices of measurement of BP

- When available, BP measurement with oscillometric devices is preferable.
- If oscillometric devices are unavailable BP measurement can be done with hybrid devices or mercury sphygmomanometer.
- Anaeroid devices are best to avoid in routine clinical use.
- A list of validated electronic devices is available in www.stridebp.org/www.bhsoc.org

Diagnosis, clinical assessment and diagnostics

- The diagnosis of hypertension should not be made on a single clinic visit unless the BP is substantially elevated (≥180/110 mmHg) and/or there is evidence of hypertension mediated organ damage (HMOD).
- Repeat BP measurements at repeat clinic visits are required to confirm the diagnosis of hypertension. The number of clinic visits and the time interval between visits are determined by the degree of BP elevation.
- Patients with more substantial elevation of BP (e.g. Grade 2) require few clinic visits and shorter time intervals between visits (i.e. a few days or weeks) for the confirmation of the diagnosis. Conversely, repeat BP measurements extended over a few months may be required for the confirmation of diagnosis in patients with BP readings in the Grade 1 range.

White-coat hypertension

- White coat hypertension should be suspected when:
- Clinic BP is ≥ 140/90 mmHg on ≥ 3 separate occasions and absence of HMOD
- ABPM or HBPM should be performed in suspected individuals and the average 24-hr ABPM <130/80 mmHg and/or average HBPM <135/85 mmHg confirms the diagnosis.
- Assessment should be done to identify CVD risk factors and HMOD.
- Implement lifestyle changes aimed at reducing CVD risk. Routine pharmacological treatment is not indicated. Pharmacological treatment of hypertension may be considered if the CVD risk is high (estimated 10-year risk ≥20% with WHO/ISH risk assessment tool).
- Diagnosis should be reconfirmed at 3-6 months and these individuals should be followed up annually with ABPM to detect development of sustained hypertension.

Masked hypertension

- Masked hypertension should be suspected when HMOD is detected with normal/high-normal BP in an untreated individual.
- Confirmation of the diagnosis requires out-of-clinic BP measurement.
- Patients should be treated with lifestyle changes and pharmacological therapy to normalize out-of-clinic BP

Hypertension-mediated organ damage (HMOD)

- HMOD should be identified when patients present with suggestive symptoms and signs.
- Identification of HMOD helps to select the most appropriate antihypertensive medication.
- Basic screening for HMOD should be performed in all hypertensive patients and more detailed assessment is indicated when the treatment decisions are influenced by the presence of HMOD.
- Basic screening for HMOD should include fundoscopy, 12- lead ECG, urinalysis, serum creatinine and eGFR.
- When it is clinically indicated cognitive function testing, echocardiography, abdominal ultrasound, doppler studies, carotid ultrasound, ankle brachial index (ABI) and pulse wave velocity (PWV) should be included in the detail assessment of HMOD depending on availability.

Cardiovascular risk stratification

- Screening for and management of modifiable CVD risk factors are recommended in adults with hypertension.
- In assessing risk, the global cardiovascular risk of an individual should be assessed. i.e. the likelihood of a person developing a CV event (coronary heart disease, stroke or other atherosclerotic disease) over a defined period.
- In the absence of a scoring system specific for Sri Lankans, the WHO/ISH (World Health Organization/International Society of hypertension) risk prediction charts can be used as it has charts specifically for South East Asia including Sri Lanka.
- When using a risk calculator, clinic blood pressure measurements are to be used.
- Evaluation and management of a patient with hypertension
- All those who are confirmed to have hypertension should receive appropriate lifestyle interventions.
- Grade 1 hypertension in adults with low to moderate cardiovascular risk and no CVD, DM, CKD or HMOD – If BP is not controlled after 3-6 months of lifestyle interventions, start antihypertensive drug treatment.
- Grade 1 hypertension in adults with high cardiovascular risk - Upon confirmation of hypertension, immediately start antihypertensive drug treatment in addition to lifestyle advice if any of the following are present:
    - CVD
    - DM
    - CKD
    - HMOD
    - High CVD risk (estimated 10-year risk ≥20% with WHO/ISH risk assessment tool)
- Grade 2 hypertension (BP ≥160/100mmHg) - Upon confirmation of Grade 2 hypertension immediately start antihypertensive drug treatment in addition to lifestyle advice.

Lifestyle modification

- Encourage the intake of vegetables, fruits, whole grains and protein from plant sources or fish. Reduce intake of foods high in sugar, saturated and trans-fats.
- Individualize the eating pattern in a locally and culturally acceptable manner, preferably in consultation with a clinical nutritionist where available. Examples of ways to increase intake of fruits, vegetables and whole grains in the Sri Lankan context are given in Annexure1
- Limit the daily salt intake to 5g (1 teaspoon). This can be achieved by avoiding addition of salt to rice and minimizing intake of high-salt food items such as bread, soy sauce, yeast extract spreads, salt-added snacks, sausages and fast foods. When cooking dried fish it is advisable to cook it after washing several times or soaking it in water to remove salt.
- Educate patients that salt is found in many processed foods including bread. Look at the food label to identify the salt content in these foods.
- Individuals who are overweight or obese (body mass index more than or equal to 23 kgm^2) to lose 5-10% of their current body weight in 3 to 6 months and maintain it thereafter.
- Minimize abdominal obesity by keeping waist circumference less than 80cm and 90cm in females and males, respectively.
- Recommend cessation of smoking for individuals who smoke tobacco.
- Engage in moderate intensity aerobic exercise (e.g. brisk walking, cycling, swimming, and gardening) for 30 minutes at least on 5 days every week.

- Engage in resistance exercises on 2-3 days per week.

Pharmacological interventions

- Immediate initiation of pharmacological interventions is indicated for Grade 2 hypertension and in Grade 1 hypertension with high cardiovascular risk.
- First line medications include ACEI/ARB, DHP-CCB and thiazides/thiazide-like diuretics.
- Stepwise approach to pharmacological interventions is recommended.
- Before moving to the next step, check adherence to lifestyle and drug treatment.
- Monotherapy is recommended as Step 1 treatment in low-risk Grade 1hypertesion, very old (>80 years) and frail individuals
- Initial dual low-dose combination therapy is the optimal recommended treatment in other patient categories at Step 1 treatment.
- Dual full-dose combination is recommended for Step 2 in those with inadequately controlled hypertension with Step 1 treatment.
- Three and four-drug combination is required for patients with poorly controlled hypertension in step 3 and 4, respectively.

Device-based therapies

- Use of device-based therapies for the routine treatment of hypertension is not recommended, until further evidence regarding their safety and efficacy becomes available.

Achieving BP targets

- It is recommended that the first objective of treatment should be to lower BP to <140/ 90 mmHg in all patients
- The systolic blood pressure target should be 120–129 mmHg in patients < 65 years.
- The systolic blood pressure target should be 130–139 mmHg in patient's ≥ 65 years.
- In those >80 years, the systolic blood pressure target should be 130-139 mmHg provided the treatment is well tolerated.
- Diastolic blood pressure target should be < 80mmHg (not less than 70 mmHg) for all hypertensive patients independent of the CV risk and comorbidities
- Measure standing as well as sitting blood pressure in people with hypertension and
    - Diabetes mellitus or
    - Symptoms of postural hypotension or
    - Age ≥ 80 years.
    - In people with a significant postural drop or symptoms of postural hypotension, treat to a target blood pressure based on standing blood pressure.

Statin therapy and antiplatelet therapy

- High intensity statin therapy (atorvastatin 40mg/ rosuvastatin 20mg daily) is recommended for secondary prevention in patients with established CVD.
- Moderate intensity statin therapy (atorvastatin 20mg/ rosuvastatin 10mg daily) is recommended for primary prevention in those with,
- LDL-C ≥190 mg/dL
- Diabetes along with hypertension
- 10-year cardiovascular risk ≥20% (estimated with WHO/ISH risk estimation tool)
- Chronic kidney disease

Antiplatelet therapy is indicated for the secondary prevention in patients with CVD.
In hypertension, antiplatelets are not recommended for the primary prevention of CVD.

Resistant hypertension

- Reinforcement of lifestyle measures in particular salt restriction is recommended.
- Recommended pharmacological management is addition of low dose spironolactone (12.5 - 50 mg daily) to existing treatment
- If intolerant to spironolactone: Addition of further diuretic therapy with eplerenone / amiloride / higher dose of thiazide/thiazide like diuretic (hydrochlorothiazide 50mg daily) / a loop diuretic (furosemide) when eGFR is <30 ml/min/1.73m^2
- Addition of a beta blocker (bisoprolol/metoprolol) or sustained release alpha blocker (doxazosin/prazosin) should be considered.

Hypertensive urgency

- Rapid BP lowering is not recommended in patients without acute hypertension-mediated organ damage.
- A controlled BP reduction to safer levels using oral BP lowering medications without risk of hypotension and cardiovascular complications should be the therapeutic goal.
- Careful monitoring over the next few days and weeks and appropriate dose adjustments should be made with the aim of reaching the final target blood pressure as determined by the patient's clinical status.

Treatment of Hypertensive emergency

- As this is considered a medical emergency, the patient should be treated with one of the parenteral antihypertensive agents to lower the diastolic blood pressure to 100-105 mmHg within a period of 2-6 hours.

Hypertension and Metabolic Syndrome (MetS)

- Lifestyle modification by means of dietary modification, weight reduction, and exercise is important with an emphasis on improving insulin sensitivity.
- In patients with MetS having overweight and obesity, 5-10% of weight reduction over 3-6 months is recommended.
- It is recommended to start antihypertensive treatment if lifestyle measures are not enough to reach BP targets depending on the severity of hypertension and overall cardiovascular risk.
- It is recommended to focus on inhibition of the renin–angiotensin system with either ACE inhibitors or ARBs as first line treatment.

Hypertension in diabetes mellitus

- It is recommended to measure the blood pressure at every clinical visit.
- It is recommended to measure both sitting/supine and standing (3 minutes after) blood pressure on the initial visit and as indicated in subsequent visits.
- It is recommended to start antihypertensive drug treatment with lifestyle modification for people with diabetes when office BP is >140/90 mmHg.
- It is recommended that BP targets for people with diabetes on antihypertensive medications are as follows;
- People <65 years - SBP target is <130 (129-120) mmHg, should not lower below 120 mmHg
- In older people (>65 years), SBP target <140 (139-130) mmHg
- Irrespective of age - DBP target is <80 (79-70) mmHg. The blood pressure should not be lowered below 70 mmHg
- It is recommended to maintain a BP target of <140/90 mmHg for patients with a history of adverse effects of intensive BP control or at high risk of such adverse effects.
- It is recommended for patients with confirmed office-based BP >140/90 mmHg should, in addition to lifestyle therapy, have prompt initiation and timely titration of single pharmacologic therapy to achieve BP targets.
- It is recommended to initiate treatment with a RAAS blocker (ACEI/ARB) or a CCB or thiazide/thiazide-like diuretic as the first line treatment.
- It is recommended for patients with confirmed office-based BP >160/100 mmHg should, in addition to lifestyle therapy, have prompt initiation and timely titration of two drugs or a single-pill combination of drugs demonstrated to reduce cardiovascular events in patients with diabetes.
- It is recommended to initiate treatment with a combination of a RAAS blocker (ACEI/ARB) with a CCB or thiazide/thiazide-like diuretic as multiple-drug therapy is generally required to achieve BP targets.
- It is recommended an ACEI/ARB, at the maximum tolerated dose indicated for blood pressure treatment, is the first-line treatment for hypertension in patients with diabetes and albuminuria. If one class is not tolerated, the other should be substituted.
- It is recommended to monitor serum creatinine/estimated glomerular filtration rate and serum potassium levels soon after starting the initial dose/increments of the dose and at least annually thereafter for patients treated with an ACEI, ARB, or diuretic. The frequency of monitoring is guided by the clinical status of the patient.

Management of Hypertension in chronic kidney disease (CKD)

- It is recommended to start on antihypertensive treatment for patients with CKD-ND when the BP>140/90 mmHg.
- It is recommended that adults with CKD-ND and high BP be treated with a target BP of 130/80 mmHg using standardized office BP measurements.
- It is suggested targeting salt intake to <5 g of sodium chloride (<2 g per day of sodium) among CKD patients with high BP.
- It is suggested that patients with high BP and CKD undertake moderate-intensity physical activity for a cumulative duration of at least 150 minutes per week, or to a level compatible with their cardiovascular and physical tolerance unless limited by severe cardiovascular intolerance.

- It is recommended to commence on a RAAS blocker (ACEI or ARB) for patients with concomitant CKD with or without diabetes, with or without albuminuria (G1-G4, A1, A2, A3) and high BP.
- It is recommended not to combine ACEI with ARB, or with direct renin inhibitor therapy in patients with CKD with or without diabetes.
- It is suggested to treat adult CKD-T with high BP to a target BP of <130/80 mm Hg using standardized office BP measurement.
- It is recommended that a dihydropyridine calcium channel blocker (CCB) or an ARB be used as the first-line antihypertensive agent in adult kidney transplant recipients.

Hypertension with coronary artery disease (CAD)

- In patients who are <65 years, BP target of less than 130/80 mmHg is recommended but it should not be <120/70mmHg
- In older patients (aged ≥65 years), it is recommended to target to a SBP of 130–140 mmHg and DBP of 70 mmHg - 79 mmHg
- When decreasing SBP to target levels in patients with established CAD (especially if isolated systolic hypertension is present), it is recommended to be cautious when the DBP is ≤60 mmHg as myocardial ischemia might be exacerbated, especially in patients with left ventricular hypertrophy (LVH).
- Lifestyle changes are recommended (smoking cessation, diet and exercise etc.) in managing hypertension with CAD.
- The recommended first line antihypertensive medications include beta blockers, ACE inhibitors or ARBs if intolerant to ACEI (GDMT).
- With angina and persistent uncontrolled hypertension addition of dihydropyridine CCBs to GDMT is recommended.
- With persistent uncontrolled hypertension without angina, addition of dihydropyridine CCBs, Thiazide/thiazide-like diuretics and MRA is recommended.
- In adults who have had an acute coronary syndrome, it is reasonable to continue GDMT beta blockers beyond 3 years as long-term therapy for hypertension.
- For hypertensive patients with CAD with or without coexisting systolic heart failure, the combination of an ACE inhibitor and ARB is not recommended.
- Hypertension with chronic heart failure
- In hypertension patients with heart failure (HFrEF &HFpEF) BP lowering treatment should be considered if BP>140/90 mmHg.
- It is recommended that BP should not be actively lowered below 120/70 mmHg.
- In patients with HFrEF, it is recommended that BP lowering treatment comprises an ACEI or ARB and a beta blocker and diuretic and/or MRA required.
- Dihydropyridine CCBs may be added if BP control is not achieved.
- In all patients with LVH, it is recommended to treat with an RAS blocker in combination with CCB or diuretic and SBP should be lowered to a range of 120-130-mmHg.
- In patients with HFpEF, BP treatment threshold and target value should be the same as for HFrEF.
- All major classes of antihypertensive drugs can be used.

Hypertension with stroke

Acute Intracerebral haemorrhage (ICH)

- In patients with ICH, within first 6 hours, BP lowering is not recommended for patients with SBP< 220 mmHg.
- In patients with SBP ≥ 220 mmHg, immediate BP lowering with IV therapy to <180 mmHg should be considered.
- This target (140-180mmHg) should be maintained for at least 7 days.
- Consider rapid blood pressure lowering with IV therapy for patients with acute ICH presenting beyond 6 hrs of symptom onset and aim for a SBP target 140 mmHg and maintained for 7 days.
- Patients with ICH, oral antihypertensive treatment should be considered once they are medically stable and can take medications orally.

Acute ischaemic stroke

- In acute ischaemic stroke, routine BP lowering with antihypertensive therapy is not recommended.
- In patients with acute ischaemic stroke who are eligible for IV thrombolysis, BP should be carefully lowered <185/110 mmHg before thrombolysis and maintained <180/105 mmHg for at least the first 24 h after thrombolysis.
- In patients with markedly elevated BP ≥220/120 mmHg who do not receive thrombolysis, drug therapy may be considered, based on clinical judgment (e.g. underlying CAD, HF or aortic dissection), to reduce MAP by 15% during the first 24 h after the stroke onset.
- Stopping previously used antihypertensive therapy is recommended during the acute phase (72 hr from symptom onset).
- Starting or restarting antihypertensive therapy during hospitalization in patients with BP greater than 140/90 mmHg who are neurologically stable is safe and reasonable to improve long-term BP control, unless contraindicated.

Secondary stroke prevention

- Adults with previously treated hypertension who experience a stroke or transient ischaemic attack (TIA) should be restarted on antihypertensive treatment after the first few days of the index event in ischaemic stroke and in immediately for TIA to reduce the risk of recurrent stroke and other vascular events.
- The recommended antihypertensive drug treatment strategy for stroke prevention is a RAS blocker plus a CCB, thiazide or a thiazide like diuretic.
- Several lifestyle modifications have been associated with blood pressure reduction and should be part of a comprehensive antihypertensive therapy.
- Adults not previously treated for hypertension who experience a stroke or TIA and have an established BP of 140/90 mm Hg or higher should be prescribed antihypertensive treatment a few days after in ischaemic stroke and immediately for TIA to reduce the risk of recurrent stroke.
- In all hypertensive patients with ischaemic stroke or TIA, a SBP target range of 120–130 mmHg should be considered.

Hypertension in rheumatological conditions

- BP should be lowered as in the general population, preferentially with ACEI/ ARB and CCBs.
- Underlying disease activity should be effectively treated by reducing inflammation and by avoiding high doses of NSAIDs.
- Lifestyle recommendations should emphasize on the benefits of a healthy diet, regular exercise and smoking cessation.
- Lipid-lowering drugs should be used according to cardiovascular risk profile.

Hypertension in psychiatric diseases

- BP should be lowered as in the general population, preferentially with ACEI/ARB and diuretics with a lesser rate of pharmacological interactions under antidepressants. CCBs and alpha1-blockers should be used with care in patients with orthostatic hypotension.
- The risk of pharmacologic interactions, ECG abnormalities and postural BP changes must be considered.
- Beta-blockers (except metoprolol) may be used in the presence of drug-induced tachycardia (antidepressant, antipsychotic drugs).
- Additional risk factors should be managed according to cardiovascular risk profile.

Hypertension in the elderly

- It is recommended to maintain the blood pressure around 140/90 mmHg in 'very old' people and to use clinical judgement for people with frailty or multimorbidity.[8,9]
- Measurement of standing as well as seated blood pressures are recommended in elders with symptoms of postural hypotension and age more than 80 years.
- In people with a significant postural drop of blood pressure (systolic >20 mmHg and diastolic >10 mmHg) or symptoms of postural hypotension, it is recommended to target standing blood pressure during treatment.[8]
- Lifestyle interventions are recommended for all elderly patients with hypertension.
- Calcium channel blocker or a thiazide diuretic are recommended as initial antihypertensives in the absence of compelling disease-specific indications. In addition, ACEI and ARB can also be used in elderly to treat hypertension. Beta blockers are considered to be less effective in the elderly person.

Hypertension in the young

- It is recommended to use the same treatment thresholds and treatment targets as for adults with hypertension when managing hypertension in the young.

Ethnicity, race and hypertension

- The treatment threshold, treatment targets of hypertension and choice of antihypertensive agents should not be different among local ethnic groups but be determined by factors as in the rest of the adult population

Perioperative management of hypertension

- All patients who will undergo surgery should be carefully evaluated by an anesthesiologist and or a physician/cardiologist for the assessment of the perioperative overall risk and their general condition, along with the organization of an effective anesthesia plan.
- Any patient who experiences a marked and sustained rise in blood pressure following surgery (sustained increase in systolic pressure greater than 180 mmHg not due to

severe pain) should be treated immediately with intravenous antihypertensive therapy.

- In patients treated for postoperative hypertension who did not have preexisting hypertension, discontinue antihypertensive therapy once the patient is surgically stable and the blood pressure is at goal for at least 24 hours, and observe them over a period of 48 to 72 hours. Antihypertensive therapy should be resumed if the blood pressure remains consistently elevated.
- In preparation for elective noncardiac surgery, continuation of antihypertensive medication until the surgery is reasonable. Most antihypertensive agents can be continued until the time of surgery, taken with small sips of water on the morning of surgery.
- Perioperative continuation of beta blockers is recommended in hypertensive patients currently on chronic beta-blocker treatment.
- Starting beta-blockers on the day of surgery in beta-blocker naive patients should however be avoided
- Transient preoperative discontinuation with the aim of reducing the risk of intraoperative hypotension should be considered before noncardiac surgery unless there is a compelling reason to continue such as stable patients with heart failure.
- ACEI/ARB can be resumed safely as early as the second postoperative day provided there are no contraindications for its resumption.

Hypertension in pregnancy

- Pharmacological treatment should be started if blood pressure is persistently elevated ≥ 140/90 mmHg. The target blood pressure is ≤ 135/85 mmHg.
- Oral labetalol is first line therapy. Slow release nifedipine and methyldopa are alternative drugs that can be safely use.
- Daily low-dose aspirin is recommended to prevent pre-eclampsia beginning in the first trimester for high-risk women
- It is recommended to lower the blood pressure with intravenous drugs when blood pressure exceeds 180/110 mmHg.
- Close monitoring of blood pressure is required in hospital when blood pressure remains high with or without pre-eclampsia.
- Intravenous magnesium sulfate is used to manage severe pre-eclampsia or eclampsia.
- Women with HTN who become pregnant should not be treated with ACEI or ARBs.

Management of HT at a Glance

Definition of hypertension

Hypertension is defined as clinic systolic BP (SBP) values ≥140 mmHg and/or diastolic BP (DBP) values ≥ 90 mmHg following repeated examination.

Grading of hypertension

Category	Systolic (mmHg)		Diastolic (mmHg)
Normal BP	<130	and	<85
High-normal BP	130–139	and/or	85–89
Grade 1 hypertension	140–159	and/or	90–99
Grade 2 hypertension	≥160	and/or	≥100
Isolated systolic hypertension	≥ 140	and	<90

Treatment of hypertension includes lifestyle and pharmacological interventions.

- If BP is not controlled after 3-6 months of lifestyle interventions in Grade 1 hypertensives, antihypertensive drug treatment is recommended.
- Drug treatment should be started without delay in Grade 1 hypertensives with high cardiovascular risk or HMOD, and in Grade 2 hypertensives in addition to lifestyle measures.
- Stepwise approach to pharmacological interventions is recommended.
- Four classes of antihypertensive drugs, including calcium channel blockers (CCBs), angiotensin receptor blockers (ARBs), angiotensin converting enzyme (ACE) inhibitors, diuretics are recommended as first-line drugs
- β-blockers, MRA, alpha-blockers may be used when blood pressure remains poorly controlled with a combination of first-line therapies.
- Appropriate antihypertensive drugs should be selected considering compelling indications, contraindications, conditions that require the careful use of drugs, and the presence or absence of complications.
- Monotherapy is recommended as Step 1 treatment in low-risk Grade 1, very old (>80 years), frail and in settings where low-dose single-pill combinations are not available
- Initial dual low-dose combination therapy is the optimal recommended treatment in other patient categories at Step 1 treatment
- Dual full-dose combination is recommended for Step 2 in those with inadequately controlled hypertension with Step 1 treatment
- Three and four-drug combination is required for patients with poorly controlled hypertension in step 3 and 4, respectively.
- When single-pill combination antihypertensive drugs at an economical price is available its use is recommended as it may improve adherence.
- When single-pill combination drugs are not available, free combination (multiple agents as separate pills) may be used.

Follow-up management includes, achieving BP targets, follow up assessments and emphasis on lifestyle interventions

- The systolic blood pressure target should be 120–129 mmHg in patients < 65 years
- The systolic blood pressure target should be 130–139 mmHg in patients ≥ 65 years
- For those > 80 years, the systolic blood pressure target should be 130-139 mmHg provided the treatment is well tolerated.
- Diastolic blood pressure target should be < 80mmHg for all hypertensive patients
- Hypertension alone is not an indication for the use of statins or antiplatelet drugs.
- Treatment thresholds and targets for those between 18-40 years remain the same as for adults with hypertension
- Individualization of BP treatment targets may be reasonable depending on comorbid conditions, life expectancy, and the presence of cognitive impairment.
- Secondary hypertension

Patient characteristics of secondary hypertension

- Young (<40 years of age)
- Acute worsening of hypertension in a previously well-controlled blood pressure
- Disproportionate HMOD for the degree of hypertension
- Resistant hypertension (refer section 6)
- Hypertensive emergency (refer section 7) as the first presentation
- Onset of diastolic hypertension in older adults (≥ 65 y)
- Unprovoked or excessive hypokalaemia
- Clinical features suggestive of obstructive sleep apnoea
- Clinical or biochemical features suggestive of endocrine causes of hypertension or CKD

Basic screening for secondary hypertension should include thorough assessment of history, physical examination and basic laboratory testing.

- Targeted testing should be done in early or late onset of hypertension, patients with resistant hypertension, accelerated course of hypertension and in patient with markedly elevated blood pressure with severe target organ damage to rule out any possible cause for secondary hypertension.

Resistant hypertension

- Resistant hypertension is defined as hypertension not controlled (SBP >140 mmHg and/or DBP >90) by appropriate lifestyle measures and treatment with optimal or best-tolerated doses of three or more drugs, which should include a diuretic in patients whose adherence to therapy has been confirmed.
- Causes for pseudo-resistance and secondary hypertension should be excluded.
- Recommended pharmacological management of resistant hypertension is addition

Hypertensive emergency

- Hypertensive emergency is defined as an elevated SBP ≥180 mmHg and/or DBP ≥120 mmHg, confirmed on repeated measurements with evidence of acute HMOD
- Parenteral treatment is recommended for management of hypertensive emergencies.

- The agents recommended for management of hypertensive emergencies include labetalol, glyceryl trinitrate, nicardipine, sodium nitroprusside, hydralazine, fenoldopam and phentolamine.

Metabolic Syndrome

- Arterial hypertension is highly prevalent among those with MetS
- It is recommended to focus on inhibition of the renin–angiotensin system with either ACE inhibitors or ARBs as first line treatment.
- If combination therapy is needed, combination of an ACEI / ARB and a CCB is recommended.

Hypertension in diabetes mellitus

- The guidelines recommend a SBP target< 130mmHg for diabetic mellitus patients <65 years of age and <140 mmHg for older persons (≥ 65 years).
- Irrespective of age, the recommended DBP target in diabetes mellitus is <80 (79-70) mmHg and not lower than 70mmHg.
- Blocking of the RAS should be recommended as initial BP-lowering therapy in hypertensive patients with diabetes, because of a moderately, but significantly greater reduction of cardiovascular events than with other drugs in diabetes. All BP-lowering drugs are effective and therefore can be used in patients with diabetes.

Hypertension in Chronic kidney disease (CKD)

- The management of hypertension in CKD with or without proteinuria is to lower BP to <130/80 mmHg.
- In patients with CKD, ACE inhibitors and ARBs are considered first-line antihypertensive agents, especially in the presence of concurrent albuminuria (albumin excretion > 300 mg/d).
- Non-dihydropyridine CCBs, diuretics (type depending on eGFR), MRA are second line agents.

Hypertension with coronary artery disease (CAD)

- For patients with hypertension and CAD, blood pressure targets are as same as for the general population.
- The recommended first line antihypertensive medications include beta blockers, ACE inhibitors, or ARBs if intolerant to ACEI (GDMT).
- With angina and persistent uncontrolled hypertension addition of dihydropyridine CCBs to GDMT is recommended.
- With persistent uncontrolled hypertension without angina, addition of dihydropyridine CCBs, Thiazide/thiazide-like diuretics and MRA is recommended

Hypertension with heart failure

- In patients with HFpEF, BP treatment threshold and target value should be the same as for HFrEF
- In hypertension patients with heart failure (HFrEF &HFpEF), BP lowering treatment should be considered if BP>140/90mmHg
- Because no specific drug has proven its superiority, all major agents can be used
- In patients with HFrEF, it is recommended that BP lowering treatment comprises an ACEI or ARB and a beta blocker and diuretic and/or MRA required.
- Dihydropyridine CCBs may be added if BP control is not achieved
- SBP should be lowered to a range of 120-130-mmHg.

Stroke with hypertension

- Immediate lowering of blood pressure to <180 mmHg is recommended in patients presenting within 6 hours with acute intracerebral haemorrhage SBP ≥ 220 mmHg, with IV antihypertensive therapy (labetalol >nicardipine>sodium nitroprusside).
- For patients who are not treated with intravenous fibrinolytic therapy or mechanical thrombectomy if BP is ≥220/120 mm Hg and there are no comorbid conditions requiring acute BP-lowering treatment, it is reasonable to initially reduce MAP by 15% during the first 24 h after the stroke onset.
- Before intravenous fibrinolytic therapy is administered, BP should be <185/110 mm Hg and <180/105 mm Hg in the first 24 hours after such treatment.
- It is reasonable to restart BP-lowering medication in patients who have a BP >140/90 mm Hg once the patient is neurologically stable.

Ethnicity, race and hypertension

- The continuous relationship between blood pressure and risk of events has been shown at all ages and in all ethnic groups.
- Limited evidence shows that there are some epidemiological differences between different ethnic groups though the epidemiology of hypertension in the different ethnic groups in Sri Lanka is poorly studied.
- There are insufficient evidence that ethnic and racial factors per se should determine the choice of antihypertensive drug treatment.

Perioperative management

- In those with an SBP ≥180 mmHg and/or DBP ≥110 mmHg, deferring surgery until BP is reduced or controlled is advisable, except in emergency situations.
- Most antihypertensive agents can be continued until the time of surgery, taken with small sips of water on the morning of surgery including betablockers, CCBs and diuretics.
- Transient preoperative discontinuation of ACEI/ARBs with the aim of reducing the risk of intraoperative hypotension should be considered before noncardiac surgery but may be resumed postoperatively early in the postoperative period once stable.

Hypertension in pregnancy

- Pharmacological treatment should be started if blood pressure is persistently elevated ≥ 140/90 mmHg. The target blood pressure is ≤ 135/85 mmHg.
- Oral labetalol is first line therapy. Slow release nifedipine and methyldopa are alternative drugs that can be safely use.
- Daily low-dose aspirin is recommended to prevent pre-eclampsia beginning in the first trimester for high-risk women
- It is recommended to lower the blood pressure with intravenous drugs when blood pressure exceeds 180/110 mmHg.
- Close monitoring of blood pressure is required in hospital when blood pressure remains high with or without pre-eclampsia.
- Intravenous magnesium sulfate is used to manage severe pre-eclampsia or eclampsia.
- Women with HTN who become pregnant should not be treated with ACEI or ARBs.

Drug classes with contraindications and cautions

Table 10.1: Drug classes with contraindications and cautions

Drug class	Contraindications	Careful administration
ACE inhibitors	Pregnancy, Angioneurotic oedema Bilateral renal artery stenosis Severe hyperkalaemia	
ARBs	Pregnancy Bilateral renal artery stenosis Severe hyperkalaemia	
β-blockers	Asthma Pulse rate <50 bpm Second- and third-degree heart block Untreated pheochromocytoma	Impaired glucose tolerance Obstructive pulmonary disease Peripheral arterial disease
Dihydropyridine CCBs Eg: amlodipine,nifedipine	Tachyarrhythmia Myocardial infarction within 1 month Significant aortic stenosis	
Non-dihydropyridine CCBs E.g. verapamil, diltiazem	Pulse rate <50 bpm Second- and third-degree heart block Heart failure	
Thiazide diuretics	Conditions where sodium and potassium are markedly decreased	Gout Pregnancy Impaired glucose tolerance
Mineralocorticoid receptor antagonist E.g. spironolactone	Hyperkalemia eGFR <30ml/minute/1.73m^2	Concomitant use of ACEI/ARB
Alpha blockers	History of postural hypotension History of micturition syncope	

Target SBP and DBP and recommended therapeutic agents

Table 10.2: Target SBP and DBP recommendation therapeutic agents

Patient category	BP target - mmHg	Drugs recommended in order of preference
Adults 18-40 years	SBP <130 (120-129) DBP <80 (70-79)	ACEI/ARB, CCB, Thiazide/Thiazide-like diuretic BB, MRA, alpha blocker
Adults 41-64 years	SBP <130 (120-129) DBP <80 (70-79)	ACEI/ARB, CCB, Thiazide/Thiazide-like diuretic BB, MRA, alpha blocker
Adults 65 years-80	*SBP <140 (130-139) DBP <80 (70-79)	CCB or a Thiazide/Thiazide-like diuretic preferred ACEI/ARB , BB
Adults 80 years and over	*SBP <140 (130-139) DBP <80 (70-79)	CCB or a thiazide diuretic ACEI/ARB BB
Patients with diabetes <65	SBP<130 (120-129) DBP <80 (70-79)	ACEI/ARB or a CCB or Thiazide/Thiazide-like diuretic
Patients with diabetes >65	SBP <140 (130-139) DBP <80 (70-79)	ACEI/ARB or a CCB or Thiazide/Thiazide-like diuretic
Patients with diabetes with albuminuria	SBP<130 (120-129) DBP <80 (70-79)	ACEI/ARB,non-DH-CCB, Thiazide/Thiazide-like diuretic
Patients with coronary heart disease <65 years	SBP <130 (120-129) DBP <80 (70-79)	BB, ACEI/ARBs DHP-CCB Thiazide/Thiazide-like diuretic, MRA
Patients with coronary heart disease >65 years	SBP ≤140 (130-140) DBP <80 (70-79)	BB, ACEI /ARBs DHP-CCB
Patients with heart failure HFrEF & HFpEF	SBP <130 (120-129) DBP <80 (70-79)	ACEI/ARB, beta blocker and Thiazide/Thiazide-like diuretic/loop-diuretic and/or MRA ARNI/SGLT2i if indicated
Patients with CKD	SBP 130 DBP 80	ACEI/ARB, Thiazide/Thiazide-like diuretic (>30 ml/min/1.73m2) / Loop diuretic (<30 ml/min/1.73m2) CCB **MRA
Patients with CKD with proteinuria (≥30 mg/g)	SBP 130 DBP 80	ACEI/ARB Non-DHP-CCB
Patients after renal transplant	SBP<130 (120-129) DBP <80 (70-79)	ACEI/ARB
Patients with cerebrovascular disease	SBP≤130 (120-130) DBP <80 (70-79)	ACEI/ARB, CCB, Thiazide/Thiazide-like diuretic
Patients with chronic hypertension in pregnancy	SBP (110-135) DBP (70-85)	Labetalol CCB (nifedipine SR) Centrally acting alpha-2 agonists (methyldopa) Vasodilators (hydralazine)
Patients with gestational hypertension	SBP (110-135) DBP (70-85)	Labetalol CCB (nifedipine SR) Centrally acting alpha-2 agonists (methyldopa) Vasodilators (hydralazine)

*If tolerated

**caution with hyperkalemia

Gaps in evidence

Hypertension is a major risk factor of non-communicable disease (NCD). Controlling hypertension is one of the most feasible methods to reduce cardiovascular, cerebrovascular and renal diseases. The Sri Lankan health system needs to be equipped to manage hypertension as the burden of NCDs is rising in Sri Lanka. To achieve that objective, more local research is needed. The following areas have been recognized as understudied areas in Sri Lanka.

The studies conducted in Sri Lanka concentrate on epidemiology and demographics. Most studies are done with small samples drawn from specialized clinics, service institutions or localized population pockets. The results have poor generalizability. Data from certain provinces are completely absent. The need therefore exists for a national database and a registry on hypertension in addition to well-designed larger field epidemiological studies.

The etiological aspects of hypertension in Sri Lanka is a poorly studied area.

The pathophysiological substrate of the Sri Lankan Hypertension population has not been studied.

There is a dearth of long-term follow-up cohort studies on outcomes of hypertension.

A validated CVD risk score especially for Sri Lanka is not available at present.

Standardized drug and dose-specific treatment protocols have been used successfully worldwide. These protocols facilitate staff training, availability of drugs and data collection to measure outcome. There are no studies done on treatment protocols used in routine care of hypertensives

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Annexure 1

Healthy eating tips for patients with hypertension

1. Follow the healthy plate model given below (note: this plate model is recommended for individuals with diabetes and dyslipidemia as well).

1. Fill half your plate with non-starchy vegetables*. Fill a quarter of your plate with grains (rice or foods made with flour). Fill the remaining quarter with a healthy protein (fish, sea food, skinless chicken, eggs, pulses like dhal, cowpea, chickpeas, green gram or soy. Avoid processed meats like sausages and minimize red meats like beef, pork and mutton).
   *non-starchy vegetables: green beans, cabbage, ladies fingers (bandakka), gourd (pathola), wetakolu, murunga, brinjal (batu), cucumber, broccoli, pumpkin and green leaves (mukunuwenna, kankun, gotukola, kathurumurunga, saarana, spinach)
2. Cooking techniques recommended: steaming / boiling, stir-frying with a small amount of oil, cooking with water and spices, baking and consuming raw as salads. Avoid deep-frying and minimize coconut milk usage.
3. Eat at least two fresh fruits a day. Fruits can be eaten as a dessert or as a snack in-between meals. Avoid adding sugar or salt to fruits.
4. Choose whole-grains whenever possible. Examples: under-milled (red) rice, whole wheat flour, whole grain bread etc.
5. Dairy products are not an essential part of the diet. However, they are a good source of calcium and protein. Try to select low-fat dairy products (e.g. non-fat milk) if possible.

Annexure 2

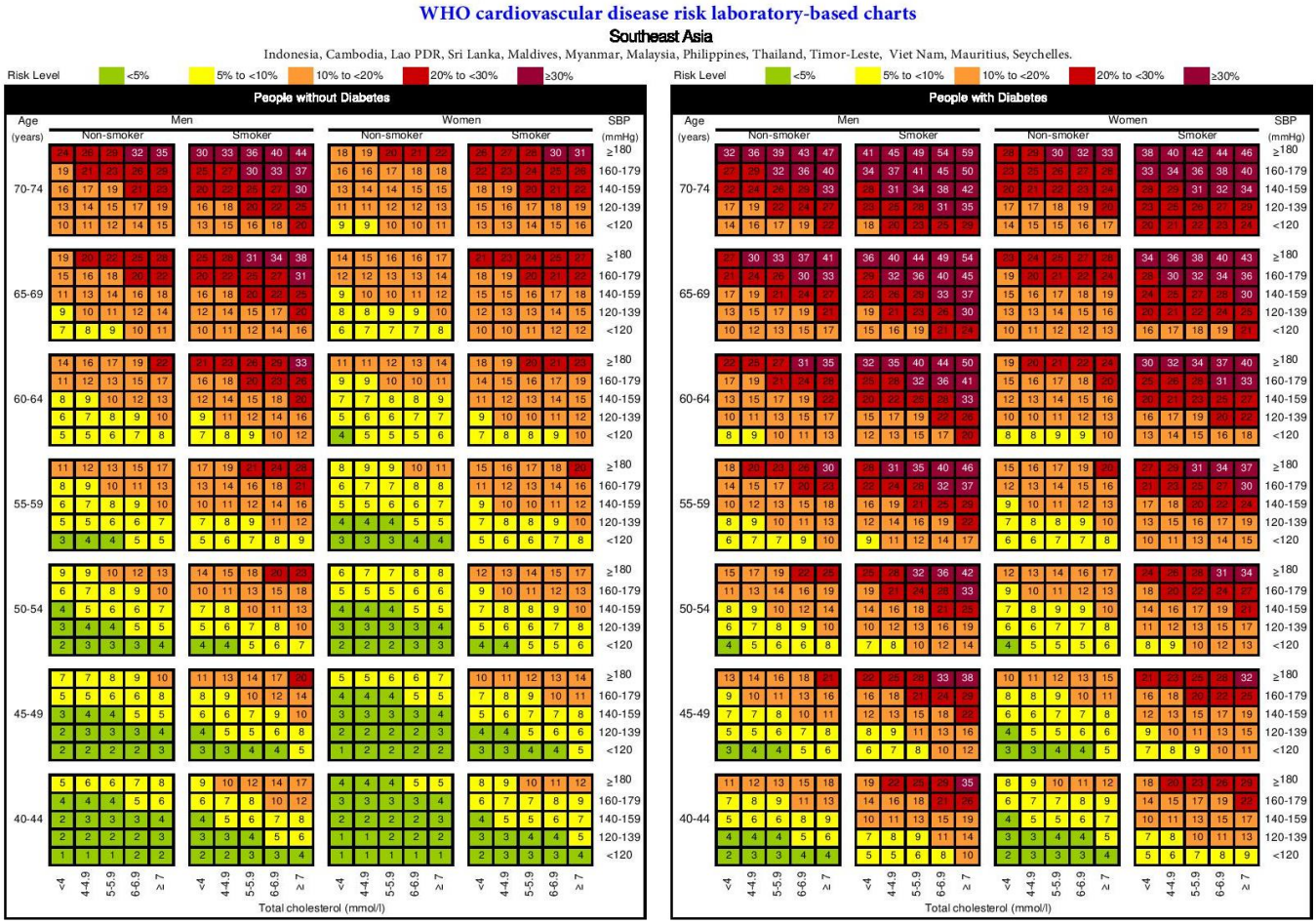
Specific list of actions during patient encounters

Specific list of actions

- Emphasis that hypertension has no symptoms.
- Educate on the health implications of hypertension, and the benefits of blood pressure control.
- Inform that hypertension is dangerous if left untreated with potential for serious consequences as a result of poor control of high blood pressure.
- Describe how high blood pressure affects the body and remind patients that high blood pressure is a silent killer.
- Encourage to make healthy lifestyle changes to lower the blood pressure as it is just as important as taking medication.
- Give practical advice on reducing salt, eat nutritiously, be physically active, reduce weight, have a good night sleep and cope with stress.
- Tell the patient what they need to know (e.g., when they should take the medication, expected side effects, importance of taking it as directed, managing missed doses). Use simple words and diagrams or pictures.
- Review blood pressure goal against current reading(s) at every visit.
- Start conversation at each visit by checking adherence to lifestyle and medication.
- Remind the patient of staying on medication although blood pressure is well controlled.
- Provide healthy diet information.
- Empower patients to manage their condition by showing them how to correctly check their blood pressure and record values.
- Urge your patients to reach out to friends and family members to help them achieve their goals.
    - Help patients manage their hypertension by providing community or online resources to assist them with lifestyle modification and blood pressure management.
    - The conversation should be done tactfully and compassionately, which should promote a more satisfying encounter.

Annexure 3

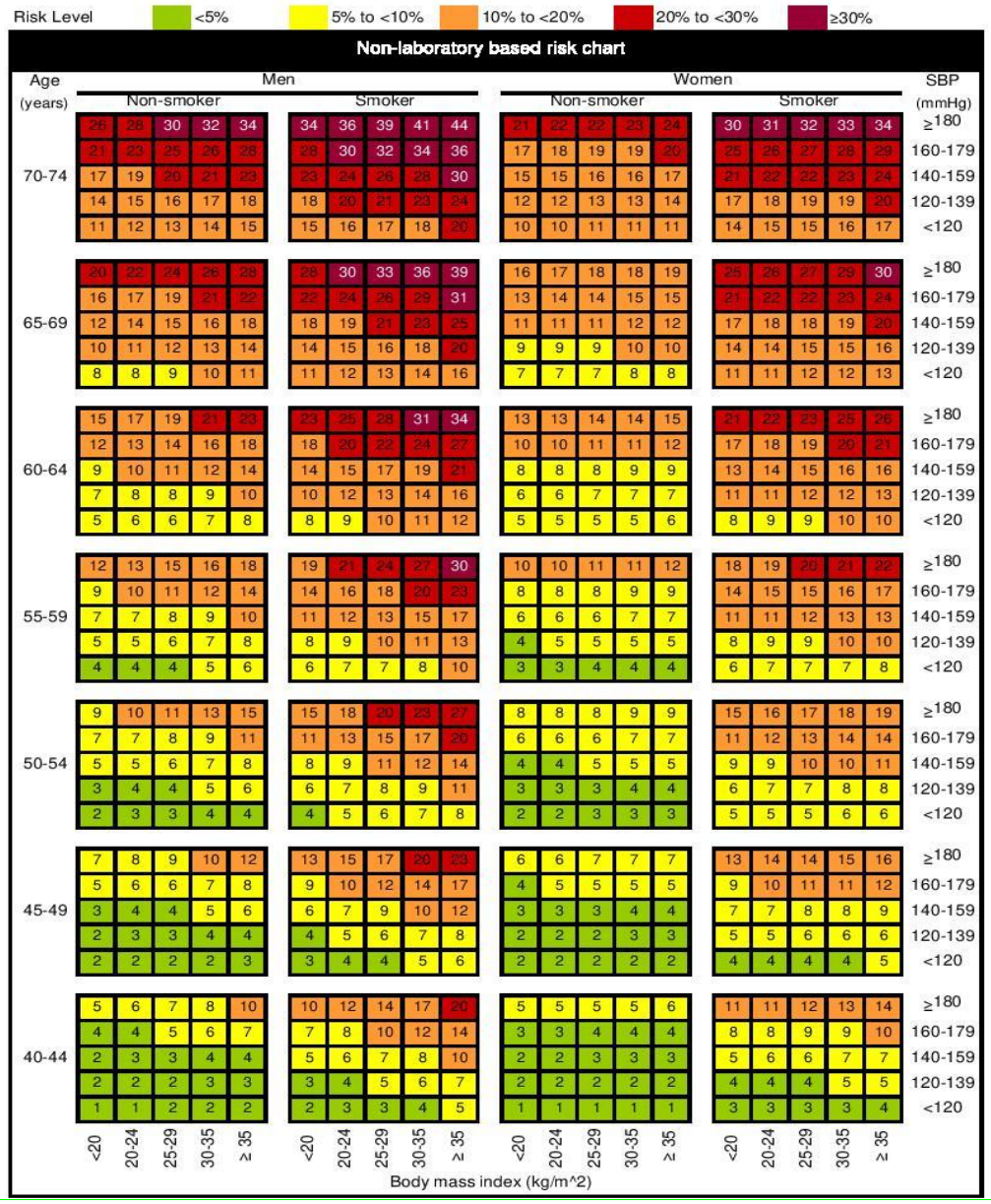
WHO/ISH (SEAR B) risk charts



WHO cardiovascular disease risk non-laboratory-based charts

Southeast Asia

Indonesia, Cambodia, Lao PDR, Sri Lanka, Maldives, Myanmar, Malaysia, Philippines, Thailand, Timor-Leste, Viet Nam, Mauritius, Seychelles.



Southeast Asia

- **Estimate the 10 year cardiovascular risk as follows using laboratory based charts;**

  Step 1 Select the appropriate chart depending on the presence or absence of diabetes

  Step 2 – Select male or female tables

  Step 3 – Select smoker or non-smoker boxes

  Step 4 – Select age group box (if age is 54; select 50-54, if age is 55; select 55-59)

  Step 5 – Within this box find the nearest cell where the individual's systolic blood pressure (mmHg) and the total blood cholesterol level (mmol/l) cross. The colour and the number of this cell determines the 10 year cardiovascular risk.

- **Estimate the 10 year cardiovascular risk as follows using non laboratory based charts;**

  Step 1 – Select male or female tables

  Step 2 – Select smoker or non-smoker boxes

  Step 3 – Select age group box

  Step 4 – Within this box find the nearest cell where the individual's systolic blood pressure (mmHg) and the Body Mass Index (kg/m^2) value cross. The colour and the number of this cell determines the 10 year cardiovascular risk.

< 5% **5 % - < 10 %** **10 % - < 20 %** **20 % - < 30 %** **≥ 30 %**