saudi commission for health specialities

Saudi Hypertension Guidelines 2018

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saudi hypertension management society

Saudi Hypertension Guidelines 2018

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Table of Contents

Preface

Hypertension is a disease that has a huge impact on the health of communities. It is widespread in the Arabian Gulf area, middle East region, and the whole world. In the year 2025, it is expected that it may affect about 1.56 billion people worldwide. Therefore, we need urgent methods and programs to prevent, detect, evaluate, and treat hypertension. As such, the Saudi Hypertension Management Society (**SHMS**) has taken up the leading role of spreading the knowledge and care for hypertension in the country. The aim was to reach both the health care providers and the public in all cities and communities in the kingdom. The message was simple: know all the facts on hypertension. Only then, we can conquer the battle against this major risk factor.

The Ministry of Health (**MOH**) is a strong and dependable alley in this mission. It has supported, encouraged, and used all it resources to help in this mission. We believe that without the efforts and support of the MOH, we will not succeed in our mission.

We will extend our partnership to other institutes including university hospitals, military and national guard facilities, and the private sector.

This is the fourth version of the guidelines to be released in 2018. This version will include updated knowledge on hypertension management with an easy format to implement in the clinic. It is especially designed for general practice.

I like to seize this opportunity to thank all authors, reviewers, and secretaries who worked hard and dedicated a lot of their time and efforts to finalize this newest version of the guidelines.

Finally, we are looking forward to the year 2018 and the following years with optimism, determination, and great desire to accomplish our goals.

Saleh Al Shurafa, MBBS, MD, DCH, CABP, PNF
Consultant Pediatric Nephrologist
Head of Pediatric Nephrology Unit-QCH
Director of Out Reach Program
Former President of Pan Arab Pediatric Nephrology Association
General Secretary-PAPNA
President of Saudi Hypertension Management Society

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Contributors

1. Abdul-Hameed Hassan, MD, ABFM
   Consultant Family Physician,
   International Medical Center, Jeddah.
2. Abdulhamid Kashgari, MD
   Consultant Endocrinologist & SHMS Founder,
   Jeddah
3. Adel Alsinan, MD
   Consultant, General Pediatrics,
   Qatif Central Hospital, Qatif
4. Ali Almubarak, MD
   Neurology consultant
   Qatif Central hospital, Qatif.
5. Ammar Al Kawi, MD, FAAN, FACP
   Head of Neurology
   Consultant, Vascular & Interventional Neurology
   King Faisal Specialist Hospital & Research Center, Riyadh.
   Associate Professor, College of Medicine, Al Faisal University, Riyadh.
6. Bader Ali Almustafa, MBBS, DPHC(RCGP), ABFM, SBFM, ECHS®
   Senior Consultant of Family Medicine & Chronic Care
   Clinical Hypertension Specialist
   Qatif Primary Health Care..
   General Secretary, Saudi Hypertension Management Society.
   Middle East Executive, World Hypertension League (WHL).
7. Eman Alsalman, MD
   Consultant Family Physician,
   Agrabiyah Postgraduate Primary Health Care Center, Al Khobar
8. Faiza Qari, MD
   Professor of Medicine & Consultant Endocrinologist,
   College of Medicine, King Abdulaziz University, Jeddah.
9. Hala Aboulkhair, MD
   Associate Consultant, Sleep Medicine & Internal Medicine,
   International Medical Center, Jeddah.
10. Hasan Alfaraj, MD
    Senior Consultant, Urology and Andrology,
    Qatif Central Hospital, Qatif.
11. Hassan Aleid, MD
    Senior Consultant, Nephrology,
    King Faisal Specialist Hospital & Research Center, Riyadh.
12. Hayat Mohamed Saleh Aljumah
    Senior Consultant, Obstetrics, Gynecology & Obstetric ultrasound
    Qatif Central Hospital, Qatif.
13. Ibrahim Gosadi
    Prince Sattam Chair for Epidemiology and Public Health Research,
    Department of Family and Community Medicine,
    College of Medicine, King Saud University, Riyadh.
14. Ibrahim Hamasna,
    Head, Pharmacy.
    King Faisal Specialist Hospital & Research Center, Riyadh.
15. Khalid Al Nemer, MD, FRCPC, FACC, FASCI, FASNC, FSCCT
    Ass. Professor of Cardiology at College of medicine Al Imam University
    Interventional, CT/Nuclear Cardiologist
    Member of the National Pharmacovigilance and Drug Safety Committee SFDA
    Advisory board member, Saudi Heart Association
    Founder of Cardiac Imaging Committee in Saudi Heart Association.
16. Mohammed Basheikh, MD
    Ass. Professor in Internal Medicine and Geriatric Medicine,
    King Abdulaziz University, Jeddah.
17. Mona Almaghasla, MD
    Consultant Family Physician & Gerontologist.
    John Hopkins Dhahran Medical Center, Dhahran.

18. Nawal Ahmed Basri, MBBCh, MSc. IM (Lon.), MSc. Neph. & HTN (Lon.), JB Neph. (Amman).
Consultant Nephrologist and medical director,
Al-Madinah Hemodialysis Center, Madinah.
King Abdullah Bin Abdulaziz International Foundation for Hemodialysis Project (KAIFHP).
19. Osman Alfurayh, MD, CPE
Senior Consultant, Nephrology,
King Faisal Specialist Hospital & Research Center, Riyadh.
Founding member, SHMS
20. Saleh Al Shurafa, MBBS, DCH, cABP, PNF
Senior Consultant Pediatric Nephrologist
Head Pediatric Nephrology Unit,
Director Out Reach Program
Qatif Central Hospital. Former President of Pan Arab Pediatric Nephrology Association.
General Secretary - PAPNA.
President, Saudi Hypertension Management Society
21. Shukri Merza AlSaif FRCP(Edin), FESC
Consultant Cardiologist
Department of Cardiology
Saud Albabtain Cardiac Center, Dammam.
22. Siraj O. Wali, MD
Professor of Medicine, Respiratory and Sleep Medicine
Director, Sleep Medicine and Research Center,
King Abdulaziz University Hospital, Jeddah.
23. Sulaiman A Alshammari, MBBS,MSc,FRCGP,MFPH
Consultant family physician
Chairman, Health Education Center, Supervisor, Research Chair on Health Education & Health Promotion Family & community medicine Department,
College of medicine,
King Saud University,
Riyadh.
24. Tawfik Albassam, MD
Senior Consultant, Internal Medicine,
Clinical Hypertension Specialist,
Medical Reference Clinic, Jeddah.
25. Walid Bsata MD FRCPI FACP
Professor of Cardiology
Consultant, Cardiology department
IMC, Jeddah.
26. Wesam Kurdi, FRCOG
Professor, College of Medicine, Al Faisal University
Head, Section of Maternal Fetal Medicine, Department of Obstetrics & Gynecology
King Faisal Specialist Hospital & Research Center, Riyadh.

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Methods

This guideline is an update of the 2011 edition. It involved a broad group of professionals, including physicians, pharmacists, dieticians, guideline development experts and methodologists.

The physicians belong to many disciplines and sectors working in Saudi Arabia. This is clearly shown in the contributors' list on page 8.

In general, the evidence analyses used were published evidence-based guidelines and reviews, concerned with the screening, management, and prevention of hypertension and related common comorbidities such as diabetes mellitus, dyslipidemia, and obesity published in the period from 2010 to 2017.

In addition, members of the group were asked to identify any more recent publications relevant to the section of the guideline allotted to them.

Each section underwent 4 steps of review. The first was by the steering committee for fulfillment of authorship criteria, including the scope of the manuscript, its size, references, and clarity. Further, it was reviewed for content validity by one to two coauthors followed by a subgroup of the editorial board, and finalized by the steering committee.

The editorial subgroup developed a final consensus statement that considers the clinical evidence, applicability, cost effectiveness, and cultural values.

Levels of Evidence

Source of Evidence	Level of Evidence
Systematic Review of Randomized Controlled Trials	1a
Individual Large Randomized Controlled Trial	1b
Systematic Review of Cohort Studies	2a
Individual Cohort Study	2b
Systematic Review of Case-Control Studies	3a
Individual Case-Control Study	3b
Case Series	4
Expert Opinion	5

Abbreviations

- a.c.; before meal
- A1C; glycosylated hemoglobin
- AAA; Abdominal Aortic Aneurysm
- ABG; Arterial Blood Gaseous
- ABI; Ankle Brachial Index
- ACCs; Associated Clinical Conditions
- ACEIs; Angiotensin Converting Enzyme Inhibitors
- AD; Alzheimer's Disease
- AF; Atrial Fibrillation
- ANP; Atrial Natriuretic Peptide
- ARBs; Angiotensin Receptor Blockers
- ßBs; Beta Blockers
- bid; 2 times a day
- BMI; Body Mass Index
- BP; Blood Pressure
- Ca; Calcium
- CAD; Coronary Artery Disease
- CBS; Complete Blood Count
- CCBs; Calcium Channel Blockers
- CHD; Coronary Heart Disease
- CHF; Congestive Heart Failure
- CKD; Chronic Kidney Disease
- Cm; centimeter
- CNS; Central Nervous System
- COPD; Chronic Obstructive Pulmonary Disease
- CPGs; Clinical Practice Guidelines
- CT; Computed Tomography
- CV RF; Cardiovascular Risk Factors
- CV; Cardiovascular
- CVD; Cardiovascular Disease
- CVRD; Cardiovascular & Renal Diseases
- DASH; Dietary Approach to Stop Hypertension
- DBP; Diastolic Blood Pressure
- DM; Diabetes Mellitus
- ECG; Electrocardiogram
- GFR; Glomerular Filtration Rate
- Hb: Hemoglobin
- HDL-c; High Density Lipoprotein Cholesterol
- Hg; Mercury
- HTN; Hypertension
- I.V.; Intra Venous
- IHD; Ischemic Heart Disease
- INR; International Normalized Ratio
- ISH; Isolated Systolic Hypertension
- Kg; Kilogram
- L; Liter
- LA-DHP; Dihydropyridine Long Acting
- LDL-c; Low Density Lipoprotein Cholesterol
- LSM; Life Style Modification
- LV; Left Ventricle
- LVH; Left Ventricle Hypertrophy
- mEq; Milliequivalent
- MetSy; Metabolic Syndrome
- MI; Myocardial Infarction
- mL; Millimeter
- mmol; Millimol
- MOD; Multi organ damage
- MRI; Magnetic Resonance Imaging
- NSAID; Non-Steroidal Anti Inflammatory Drug
- O2; Oxygen
- OC; Oral Contraceptive
- OSA; Obstructive Sleep Apnea
- OTC; Over the Counter
- PAD; Peripheral Arterial Disease
- po; orally
- PT; Prothrombin Time
- PTT; Partial Thromboplastin Time
- q; Every
- qid; 4 times a day
- RAAS; Renin Angiotensin Aldosterone System
- RVH; Renovascular Hypertension
- SBP; Systolic Blood Pressure
- sc; Subcutaneously
- TIA; Transient Ischemic Attack
- tid; 3 times a day
- TOD; Target Organ Damage
- TZD; Thiazide Diuretic
- UTI; Urinary Tract Infection
- wt; Weight

Chapter 1

EPIDEMIOLOGY OF HYPERTENSION IN SAUDI ARABIA

Several large scale cross-sectional studies conducted in Saudi Arabia, provided several variable estimates of the prevalence of hypertension. This variation is likely influenced by geographical, sampling, and methodological factors (Table 1).

Table 1: National cross-sectional studies estimating the prevalence of hypertension in Saudi Arabia.

Year of publication	Author (reference)	Prevalence	Sample size	Age group
1997	Al-Nozha MM et al	SBP: 9.1% DBP: 8.7%	13700	0–75+
2007	Al-Nozha MM et al	Total: 26.1% Males: 28.6% Females: 23.9%	17230	30–70
2011	Saeed AA et al	Total: 25.5 % Males: 27.1% Females: 23.9%	4758	15–64
2013	Saudi Health Interview Survey- MoH	Total:15.2% Males: 17.8% Females:12.5%	10735	15–65+

National Health Survey, 2013 had showed that among participants diagnosed with hypertension, 78.9% reported taking medication for their condition. About 45% of them had their blood pressure controlled. Among all hypertensive individuals, 57.8%, 20.2%, 16.6%, and 5.4% were undiagnosed, treated uncontrolled, treated controlled, and untreated, respectively (Figure 1).

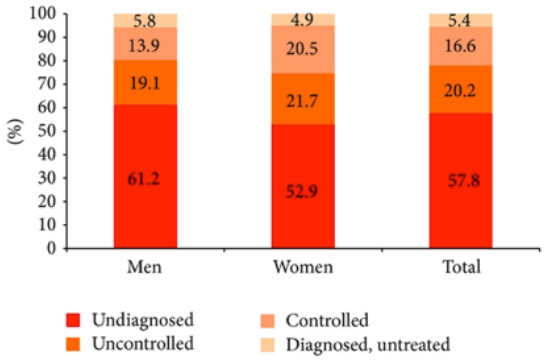

Figure 1. Percent distribution of diagnosis and treatment status among hypertensive Saudis aged 15 years or older, 2013.

Hypertension was more frequently observed in in obese (AOR 2.24; CI 1.89–2.65), diabetic (AOR 1.95; CI 1.57–2.43), and hypercholesterolemic (AOR 1.94; CI 1.51–2.47) individuals.

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Chapter 2

HYPERTENSION PREVENTION

In view of the continuing epidemic of hypertension and its complications, efforts should be directed toward primary prevention through advocating a healthy life style and controlling other cardiovascular risk factors.

The proven efficacy of a healthy life style in the prevention of hypertension is summarized in Table 8 (page 33).

These behavioral modifications can help prevent elevation of blood pressure and can help to decrease elevated blood pressure levels. Therefore, lifestyle of all patients should be routinely assessed[32], including prehypertensive individuals and those at higher cardiovascular risk such as overweight and obesity.

Blood pressure should be measured periodically[5], and lifestyle counseling[23] should be offered accordingly by a trained healthcare professional.

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Chapter 3

SCREENING RECOMMENDATION

A. Measure blood pressure in each visit for all adults aged 18 years and older.

B. Measurement of blood pressure should be performed using a properly validated blood pressure monitor that is maintained and regularly calibrated per the manufacturer's instructions.

C. Follow the proper technique of blood pressure measurement as mentioned in page 11.

D. Children aged 3 years and older should have their BP measured during every healthcare visit, especially with the growing prevalence of obesity in children.

E. Screening is recommended annually for adults aged 40 years or older and for those who are at increased risk of high blood pressure including those who have high-normal blood pressure (130–139/85–89 mm Hg) and those who are overweight or obese. Adults aged 18–39 years with normal blood pressure (<130/85 mm Hg) who do not have other risk factors should be re-screened every 3–5 years.

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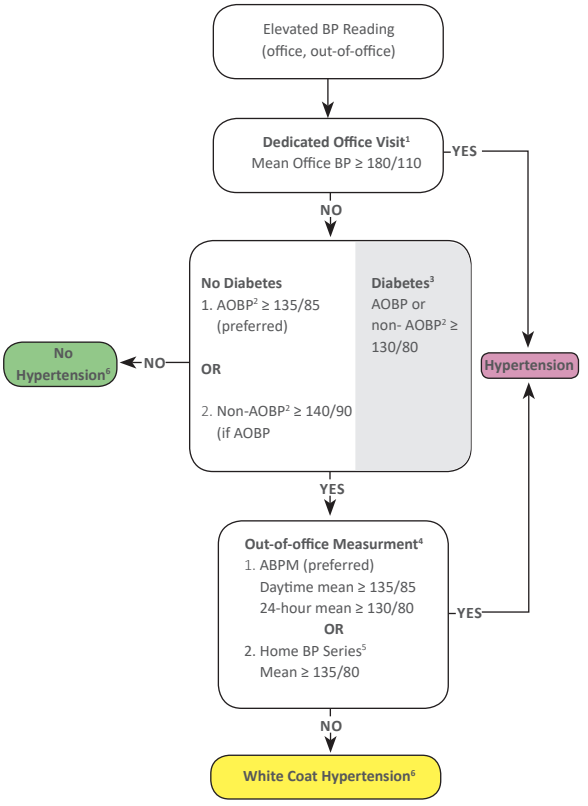
Chapter 4

DEFINITION AND CLASSIFICATION OF HYPERTENSION

HTN is defined as persistent SBP and/or DBP (office or out-of-office) levels above which harm and significant increment of morbidity and mortality are observed if left untreated. For children refer to page 62.

Diagnosis of HTN

- HTN may be diagnosed in the office or out-of-the-office setting (including home and ambulatory). ABP is preferable if available. HBPM may be used as an alternative, provided it is performed according to the guidelines.



Notes:

1. If AOBP is used, use the mean calculated and displayed by the device. if non-AOBP (see note 2) is used, take at least three readings, discard the first and calculate the mean of the remaining measurements. A history and physical exam should be performed and diagnostic tests ordered.
2. **AOBP** = Automated office BP. This is performed with the patient unattended in a private area. **Non-AOBP** = Non-automated measurement performed using an electronic upper arm device with the provider in the room.
3. Diagnostic thresholds for AOBP, ABPM and home BP in patients with diabetes have yet to be established (and may be lower than 130/80 mmHg).
4. Serial office measurements over 3-5 visits can be used if ABPM or home measurement not available.
5. Home BP Series: Two readings taken each morning and evening for 7 days (28 total). Discard first day readings and average the last 6 days.
6. Annual BP measurement is recommended to detect progression to hypertension.

Classification of HTN

Category	SBP (mm Hg)		DBP (mm Hg)
Normal	<120	and	<80
Pre-HTN	120–139	and/or	80–89
HTN Grade I	140–159	and/or	90–99
HTN Grade II	160–179	and/or	100–109
HTN Grade III	≥180	and/or	≥110

Isolated Systolic Hypertension:

Persistent high Office SBP ≥140 mm Hg and Office DPB <90 mm Hg.

White-coat hypertension (isolated office HTN, isolated clinic HTN):

- White coat HTN is defined as an elevated BP in the office at repeated visits, while it is normal out of the office, using either ABPM or HBPM.
- Prevalence of white-coat hypertension averages 13%.
- Target organ damage and cardiovascular events are less prevalent than those in sustained HTN. However, follow up is required.

Masked (isolated ambulatory) hypertension:

- Masked HTN is defined as normal BP in the office at repeated visits and elevated out of the office, either on ABPM or HBPM.
- Possible causes: anxiety, stress.
- Prevalence of masked hypertension averages about 13%.
- CV events are 2 times higher than those in true normotension.

Malignant Hypertension

Presentation of acute very high BP with multi organ damage. Stage III or IV retinopathy is common in this group. It is considered as a hypertensive emergency.

Hypertensive Urgency: see page 85.

Hypertensive Emergency: see page 85.

Resistant Hypertension: see page 42.

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Chapter 5

CLINICAL EVALUATION

Clinical evaluation aims to:

- Establish the diagnosis of HTN[6]
- Identify secondary HTN[9]
- Detect additional RFs of CVDs[20]
- Determine TOD and ACCs[20]

Clinical evaluation includes:

- History
- Physical examination
- BP measurement
- Basic investigations

History:

1. Presence of CV-RFs (DM, dyslipidemia, obesity, etc.) and other concomitant diseases
2. History or current symptoms suggestive of CVDs (CHD, MI, stroke, CHF, renal disease, and PAD)
3. Symptoms suggestive of secondary HTN
4. Lifestyle: smoking, physical inactivity, alcohol intake, sodium intake, and psychosocial stress
5. Past experience with antihypertensive drugs
6. Medication history: oral contraceptives, NSAIDs, steroids, etc.
7. Family history of HTN and associated diseases (DM, dyslipidemia, CAD, stroke, or renal disease).

Physical Examination:

Physical examination must be thorough enough to detect signs of comorbidity, organ damage, and secondary causes. It must include:

1. Weight, height, BMI, and waist circumference
2. Chest exam for rales
3. Abdominal exam for organomegaly and bruit
4. Central nervous system: motor or sensory defects
5. Cardiac: arrhythmia, murmur, rales, peripheral edema
6. Retina examination for hypertensive changes. However, a dilated fundoscopic examination by an ophthalmologist is recommended afterwards.
7. Vascular: absent arterial pulses, carotid bruit, radio-femoral delay

Signs suggesting secondary HTN

- Age of HTN diagnosis <20–30 or >55–60 years
- Family history of premature CV disease (<55 years)
- Early TOD
- Symptoms & signs suggestive of 2ry HTN (Table 2)

Table 2: Symptoms & signs suggestive of 2ry Hypertension

Causes	Clinical Features
Nephropathy	Kidney disease in the family (polycystic kidney disease)Episodes of blood or proteins in the urine, urinary infections, swelling of body Elevated S. creatinine, urinary sediment or casts.Abnormal renal USS.
Renovascular HTN	Initial onset before age 30 or after age 50 years. BP over 180/110. Hemorrhages and exudates in the fundi. Presence of abdominal bruit over renal arteries. Diminishing BP control. Women of child bearing age. Sudden worsening of previously controlled hypertension. Unexplained episodes of pulmonary edema. Acute decline in renal function (↑ S. Cr.) with ACEI or ARB. Unexplained decline in renal function.
Pheo-chromocytoma	Episodic symptoms: headache, flushing, sweating and palpitations. Extremely labile BP.Skin stigmata of neurofibromatosis.
Cushing's syndrome	Typical general appearance: truncal obesity, stretch marks
Conn's syndrome (primary aldosteronism)	Weakness, cramps, polyuria. K+ < 3.5 or diuretic-induced ↓K+ (< 3.0). Incidental adrenal mass.
Acromegaly	Tall stature, typical facies with prominent lower jaw, broad spade shaped hands
Coarctation of the aorta	High BP in upper limbs but not in lower limbs. Delayed or weak femoral pulses
Drugs	Contraceptive pill, anti-inflammatory drugs, steroids, sympathomimetics, nasal decongestants, appetite suppressants, cyclosporine, erythropoietin, licorice, antidepressants, tacrolimus, cocaine, amphetamines, other illicit drugs, dietary supplements and medicines (e.g., ephedra, ma huang, bitter orange)
Thyroid disease	Symptoms and signs of hyper- or hyopthyroid.Thyromegaly or thyroid nodule
Obstructive sleep apnea (OSA)	A history of snoring during sleep and irresistible sleep and tiredness during daytime.

Basic Investigations:

1. Urinalysis (protein, glucose, blood, casts)
2. Blood chemistry: potassium, sodium, creatinine with e-GFR, fasting blood glucose, and serum uric acid
3. Complete fasting lipid profile
4. Hemoglobin and hematocrit
5. Electrocardiography (ECG)

Additional Optional Investigations, if needed:

1. TSH, Free T4
2. Chest X-ray
3. Abdominal sonography
4. Echocardiography

Cases with signs suggesting secondary HTN (Table 2) should be referred to the proper specialty or to a clinical hypertension specialist. Meanwhile, proper general management must be started.[31]

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Chapter 6

BLOOD PRESSURE MEASUREMENT

HTN can be diagnosed only by correct BP measurement. It is made after the measurement of BP on 3-5 different visits.

Methods of BPM:

A. Auscultatory:

a. Mercury sphygmomanometer: It is the classical measurement instrument for BP. However, it has been increasingly removed from clinical areas because of safety concerns and potential toxic effects associated with mercury.
b. Aneroid sphygmomanometer: It measures BP mechanically, needs periodic calibration every 6–12 months, and it is less accurate than the mercury sphygmomanometer.
c. Hybrid sphygmomanometer: It inflates automatically and uses a digital column instead of mercury.

B. Oscillometric:

a. **Automated arm sphygmomanometers:** They are good alternative, for both office-based and home-based measurements. However, they must be validated and approved per the international standard test protocols, http://www.dableducational.org.
b. **Automated wrist sphygmomanometers** are widely used by patients, but they are less reliable. Minimal position changes can result in variable readings. Measurement of BP at the upper arm is preferred.
c. **Automated unattended office sphygmomanometers** is automated office BP (AOBP), taken without patient-health provider interaction using a fully-automated device.

Automated devices may not measure blood pressure accurately in case of pulse irregularity. Thus, palpation of the pulse before measuring blood pressure is required. In that case, the auscultatory method is recommended.

STANDARDS FOR BP MEASUREMENT:

For a reliable and valid BP measurement, it is essential to uphold the following standards:

I. Patient-Related Standards:

1. Patient should have 3–5 minutes of physical rest before measuring BP.
2. Patient should relax (legs should not be crossed) in a quiet environment (no talking) before measurement.
3. BP should be measured in sitting position with back support.
4. BP measurement should be taken in both arms at initial visit. The arm with the higher BP values should be noted in the chart and follow up should be performed on this arm.
5. Upper arm should not be covered by clothing.
6. Elbow should be supported and cuffed at heart level.
7. BP should be measured in standing position, if postural hypotension is suspected (e.g., diabetics and elderly patients).
8. Patient should avoid nicotine and caffeine one hour before BP measurement.
9. Patients should avoid BPM while the urinary bladder is distended.

II. Equipment-Related Standards

- (Steps 3–4 are specific to auscultatory method of BPM):

1. **Appropriate cuff size:** The cuff bladder should encircle 80% of the arm, and the cuff width should be 40% of the arm circumference. Standard cuff bladder size is 12 cm in width and 24 cm in length. If the upper arm circumference is 33–41 cm, a cuff bladder width of 15 cm and lengt1h of 30 cm are required. If the upper arm circumference is >42 cm, a cuff bladder width of 18 cm and length of 36 cm are required.

Table 3: Commercially available cuff sizes for evaluation of BP in Saudi Arabia

Bladder Length (cm)	*Bladder Width (cm)*	*Cuff Label**
5.0–9.0	2.5–4.0	***Newborn***
11.5–18.5	4.0–6.0	***Infant***
12.0–19.0	7.5–9.0	***Child***
22.0–26.0	11.5–13.0	***Adult***
30.5–33.0	14.0–15.0	***Large Adult***
36.0–38.0	18.0–19.0	***Thigh***

*The cuff label does not guarantee that the cuff will be of an appropriate size for the child within the age range.

2. **Correct cuff position:**

a. A distance of 2.5 cm (2 fingers) should be maintained between the lower end of the cuff and the antecubital fossa.
b. Cuff bladder should be centered over the brachial artery.
c. Cuff should be wrapped around the upper arm, firmly in contact with the arm, but not too tight and not too loose, allowing 2 fingers to be put under the cuff comfortably.

3. **Correct stethoscope position** *(for auscultatory BPM)***:** Preferably, the bell orifice of the stethoscope should be placed just above and medial to the antecubital fossa but below the edge of the cuff. The stethoscope bell orifice should not touch the cuff bladder or tubing.
4. **Correct manometer position:** *(for mercury BPM)* The position of the mercury manometer should be upright at examiner's eye level, and at zero level,

III. Examiner-Related Standards

(Steps 1-6 are specific to the auscultatory method of BPM):

1. Inflate the cuff bladder rapidly to 30 mm Hg above the level of the estimated SBP (too slow inflation can be uncomfortable for the patient).
2. Apply mild pressure on the stethoscope bell (steadily and gently, without excessive pressure).
3. Deflate the cuff bladder pressure at the rate of 2 mm Hg/sec.
4. Deflate the cuff bladder rapidly and completely at DBP to avoid venous congestion.
5. The SBP is defined as the cuff pressure at which the Korotkoff sound can be heard with the stethoscope (Phase I), and the DBP as the cuff pressure at which the Korotkoff sound disappears over the brachial artery (Phase V).
6. Avoid reinflation and correction of stethoscope position during the measurement.
7. BP should be measured at least twice at each visit and the mean value documented.
8. Record SBP and DBP immediately, rounded off to 2 mm Hg.
9. Repeat BP measurement if necessary after a break of 1 min.
10. BP measurements should always be associated with measurement of heart rate.

OUT-OF-OFFICE BLOOD PRESSURE MONITORING:

Proper Out-of-office BPM has a better prognostic value than Office Blood Pressure Monitoring (OBPM). It provides many BP measurements away from the medical environment. It helps to rule out white coat hypertension (WCH) and identifies Masked HTN. There are two forms of out-of-office BP monitoring:

I. Home Blood Pressure Monitoring (HBPM):

- HBP may be used for both diagnosis and monitoring of BP.
- Home SBP values ≥135 mmHg or DBP values ≥85 mmHg should be considered as elevated.
- Home BPM should be based on duplicate measurements (one minute apart), morning and evening, for an initial 7-day period. First-day home BP values should not be considered.
- SHMS strongly supports the use of HBPM as adjunctive in hypertension follow-up. It is cost effective and improves adherence and control.

II. Ambulatory BP Monitoring (ABPM):

- It is performed by a validated automated device over a period of 24 hours.
- BP is measured at repeated intervals (every 15–30 mins while awake, and every 30–60 mins during sleep).
- The patient is instructed to engage in normal activities but to refrain from strenuous exercise and, at the time of cuff inflation, to stop moving and talking and keep the arm still with the cuff at heart level.
- At least 70% of BPs during daytime and nighttime periods should be satisfactory.
- ABPM is a more sensitive risk predictor of CV outcome than is office BPM.
- The incidence of CV events is higher in non-dippers.
- Normal average daytime BP is <135/85 mm Hg.
- Nocturnal BP is 10%–20% less than the average daytime BP (<120/75 mm Hg).
- A 24-hour average value of 130/80 mm Hg corresponds to a 140/90 mm Hg of office value.
- Possible reasons for the absence of dipping are: sleep disturbance, obstructive sleep apnea (OSA), CKD, and obesity.
- It is more expensive than self-monitoring.

III. Indications for ABPM:

1. Suspected white-coat HTN
2. Confirm diagnosis, if available
3. Suspected masked HTN
4. Resistance to drug therapy
5. Suspicion of nocturnal HTN
6. Obstructive sleep apnea
7. Assessing hypertension in children and adolescents
8. Assessing hypertension in pregnancy
9. Assessing hypertension in high-risk patients
10. Suspected drug induced hypotension
11. Assessment of BP variability
12. Assessing hypertension in the elderly

How to Choose a BPM Device?

- Electronic devices, if available, are preferred because they provide more reproducible results than the older methods and they are not influenced by variations in technique or by the bias of the observers.
- Automated devices should be Independently validated to one or more of the *Internationally Accepted Standards (Protocols). (ref to www.dableducational.org, ESH BHS ASH…)*
- Healthcare institutions and providers must ensure that these devices are properly validated, maintained, and regularly recalibrated.
- Upper arm devices are recommended. Wrist and finger monitors are less accurate.
- When selecting a BPM for the elderly, pregnant women or children, make sure that it is validated for these conditions.

Public Use of BP Kiosks

These refer to public stations where BP measurement is performed automatically. These stations are found in pharmacies and malls. Most of these devices use one cuff size in a non-sitting position and a non-quite environment. These factors lead to inaccurate readings. In addition, most kiosks are not validated by international agencies for their accuracy.

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Chapter 7

SECONDARY HYPERTENSION

About 10% of cases of HTN are owing to secondary causes such as renoparynchymal and renovascular diseases. The main causes of secondary HTN are:

1. Renoparenchymal disease
2. Renovascular disease
3. Primary hyperaldosteronism
4. Cushing syndrome
5. Pheochromocytoma
6. Thyroid or parathyroid disease
7. Substance-Induced (oral contraceptives, NSAIDs, steroids, licorice, erythropoietin, cyclosporine, cocaine, amphetamine, excessive alcohol)
8. Coarctation of the aorta
9. Obstructive sleep apnea

Certain clinical and biochemical features suggest the presence of a secondary cause for HTN and warrant further investigations. These include onset of HTN at a young age (<30 years) or old age (>65 years), severe or resistant HTN, associated symptoms or signs of possible secondary cause (see Table 4).

Table 4: Clinical indications and diagnostics of secondary hypertension, ESH 2013.

Clinical indications			Diagnostics		
Common causes	Clinical history	Physical examination	Laboratory investigations	First-line test(s)	Additional/ confirmatory test(s)
Renal parenchymal discase	History of urinary tract infection or obstruction, haematuria. analgesic abuse; family history of polycystic kidney disease	Abdominal masses (in case of polycystic Kidney disease).	Presence of protein, erythrocytes, or leucocytes in the urine, decreased GFR.	Renal ultrasound	Detailed work-up for kidney disease
Renal artery stenosis	Fibromuscular dysplasia: early onset hypertension (especially in women). Atherosclerotic stenosis: hypertension of abrupt onset, worsening or Increasingly difficult to treat; flash pulmonary oedema.	Abdominal bruit	Difference of >1.5 cm In length between the two kidneys (renal ultrasound), rapid deterioration In renal function (spontaneous or in response to RAA blockers).	Renal Duplex Doppler ultrasonography	Magnetic resonance angiography, spiral computed tomography, intraarterial digital subtraction angiography.

Clinical indications			Diagnostics		
Primary aldosteronism	Muscle weakness; family history of early onset hypertension and cerebrovascular events at age <40 years.	Arrhythmias (in case of severe hypokalaemia).	Hypokalemia (spontaneous or diuretic-induced): Incidental dlscovory of adrenal masses.	Aldosterone–renin ratio under standardized conditions (correction of hypokalaemia and withdrawal of drugs affecting RAA system).	Confirmatory tests (oral sodium loading, saline Infusion, fludrocortisone suppression, or Captopril test): adrenal CT scan; adrenal vein sampling.
Uncommon causes					
Pheochromo-cytoma	Paroxysmal hypertension or a crisis superimposed to sustained hypertension; headache, sweating, palpitations and pallor; positive family history of pheochromocytoma.	Skin stigmata of neurofibromatosis (café-au-lait spots, neurofibromas).	Incidental discovery of adrenal (or in some cases, extra-adrenal) masses.	Measurement of urinary fractionated metanephrines or plasma-free metanephrines.	CT or MRI of the abdomen and pelvis; 123 I-labelled metaiodobenzyl-guanidine scanning; genetic screening for pathogenic mutations.
Cushing's syndrome	Rapid weight gain, polyuria, polydipsia, psychological disturbances	Typical body habitus (central obesity, moon-face, buffalo hump, red striae, hirsutism).	Hyperglycaemia	24-h urinary cortisol excretion	Dexamethasone-suppression tests

CT, computed tomography, GFR. glomerular fitraton rate; MRI, magnetic resonance imaging; RAA, renin-angiotensin-aldosterone.

Hypertension Secondary to Reno-Parenchymal Diseases:

HTN is a frequent finding in patients with CKD—about 90% of patients with CKD have HTN. Its prevalence increases with the decrease of glomerular filtration rate. The pathogenesis is complex; including sodium and fluid retention, RAAS and sympathetic nervous system over-activity, arterial stiffness, increased intracellular calcium, loss of nocturnal decline in BP, and side effects of medications. A renoparenchymal disease is usually recognized by the presence of high blood urea nitrogen and creatinine levels or significant proteinuria.

Hypertension Secondary to Renovascular Diseases:

Renovascular disease is suspected in the following clinical situations: *(Class II Level D)*

1. Sudden onset or worsening of hypertension
2. Age of diagnosis >55 or <30 years.
3. The presence of an abdominal bruit.
4. Hypertension resistant to three or more drugs
5. A rise in serum creatinine level ≥30% after use of RAAS blocker
6. Other atherosclerotic vascular disease, particularly in patients who smoke or have dyslipidemia
7. Recurrent pulmonary edema associated with hypertensive surges

When two or more of the clinical clues listed above are available, the following tests are recommended to aid in the screening of renal vascular disease:

1. Captopril-enhanced radioisotope renal scan. It is not recommended for those with CKD (eGFR <60 mL/min/1.73 m^2)
2. Magnetic resonance angiography
3. CT- angiography (for those with normal renal function)

Hypertension Secondary to Endocrine Diseases:

The main causes of endocrine HTN are primary hyperaldosteronism, oral contraceptive-induced HTN, Cushing syndrome, and pheochromocytoma. Other rare causes of endocrine HTN include thyrotoxicosis, hypothyroidism, hyperparathyroidism, acromegaly, some types of congenital adrenal hyperplasia, Liddle syndrome, and apparent mineralocorticoid excess.

The diagnosis of ***primary hyperaldosteronism*** should be suspected in young patients (<40 years), in those with hypokalemia, in cases of resistant HTN, and in patients with family history of HTN at young age. The screening test is plasma aldosterone/renin ratio. Values >20 are suggestive of primary hyperaldosteronism, especially when plasma renin activity is quite low and plasma aldosterone level is high. Such cases should be referred to a specialist for confirmation of the diagnosis.

In ***oral contraceptive-induced HTN,*** the diagnosis is suggested by the history of temporal relationship with the use of oral contraceptive and by normalization of BP after discontinuation of the pills.

Cushing syndrome is often suggested by the typical cushingoid appearance. Overnight dexamethasone suppression testing is a good screening test and significantly elevated 24-hour urinary cortisol excretion (>2–3 times the upper limit of normal) is diagnostic.

Pheochromocytoma is suspected by the presence of the classical triad (episodes of headache, sweating, and palpations). Significantly high 24-hour urinary catecholamines or metanephrine excretion is diagnostic. Localization procedures include sonography, CT scan, magnetic resonance imaging, and meta-iodo-benzyl-guanidine scan.

Hypertension and Obstructive Sleep Apnea:

Sleep disordered breathing is important in the pathogenesis of HTN. OSA is common in patients diagnosed with resistant hypertension in about 70%–80% of cases. As such, OSA is considered a reversible and a modifiable factor in resistance HTN. The management of HTN in OSA include weight reduction, weight control, and CPAP. However, the treatment of OSA with CPAP has a modest but statistically significant beneficial effect on BP, even though this was not observed in all studies. Spironolactone is an effective therapy for HTN management in OSA.

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Chapter 8

CARDIOVASCULAR RISK ASSESSMENT

Global cardiovascular risk should be assessed. This involves assessment of not only BP levels, but also the presence or absence of other CV-RFs, TOD, or **Associated Clinical Conditions** (ACCs) (Table 5). CVR assessment tables and calculators are recommended for use to predict cardiovascular events (Grade A) and to use antihypertensive therapy more efficiently (Grade D). Table 6 is a simple, easy to follow and remember stratification tool. However, multiple other CVR calculators are widely available, including online and smartphone applications. Alternatively, they may be used.

The presence of several CV risk factors in an individual is not only a simple additive, but results in a multiplicative effect that is greater than the sum of its individual components. Consider informing patients of their global risk to improve the effectiveness of risk factor modification (Grade B). Consider also using analogies that describe comparative risk such as "cardiovascular age," "vascular age," or "heart age" to inform patients of their risk status (Grade B).

Table 5: Cardiovascular Risk Factors Assessment

A.	Risk Factors for Cardiovascular Diseases (CVD)
•	Levels of SBP and DBP
•	Age: men >55 years; women >65 years
•	Smoking
•	Obesity: [BMI ≥30 kg/m2] or high waist circumference (men ≥102 cm; women ≥88 cm).
•	Dyslipidemia:
	• Total cholesterol >4.9 mmol/L (190 mg/dL) and/or
	• Low-density lipoprotein cholesterol (LDL) >3.0 mmol/L (115 mg/dL), and/or
	• High-density lipoprotein cholesterol(HDL): men <1.0 mmol/L(40 mg/dL); women <1.2 mmol/L (46 mg/dL), and/or
	• Triglycerides >1.7 mmol/L (150 mg/dL)
•	Diabetes: Fasting plasma glucose ≥7.0 mmol/L (126 mg/dL) on two repeated occasions, and/or HbA1c >6.5%).
•	Pre- diabetes: Fasting plasma glucose 5.6–6.9 mmol/L (102–125 mg/dL) OR HbA1c (5.7%–6. 4%)
•	Family history of premature CVD (men aged <55 years; women aged <65 years)
B.	**Asymptomatic (Subclinical) Target Organ Damage (TOD)**
•	Pulse pressure in the elderly ≥ 60 mmHg
•	LVH (ECG, echocardiogram, or chest X-ray)
•	Elevated plasma creatinine (men: 115–133 µmol/L [1.34–1.6 mg/dL]), (women: 107–124 µmol/L [1.25–1.45 mg/dL] OR eGFR 30-60 mL/min/1.73 m2 (BSA) or microalbuminuria (30–300 mg/24 h), or albumin–creatinine ratio (ACR)(30–300 mg/g; 3.4–34 mg/mmol) (preferentially on morning spot urine).
•	Ultrasound or radiological evidence of atherosclerotic plaque (aortic, carotid, iliac, or femoral); generalized or focal narrowing of retinal arteries.
C.	**Associated Clinical Conditions (Established Clinical Cardiovascular Diseases)**
•	Cerebrovascular Disease: ischemic stroke, cerebral hemorrhage, or TIA
•	Heart Disease: MI, angina, coronary revascularization, or CHF
•	Renal Disease: diabetic nephropathy or chronic kidney disease (CKD) (creatinine: men, >133 µmol/L (1.6 mg/dL); women, >124 µmol/L)1.45 mg/dL) or eGFR <30 mL/min/1.73 m2 (BSA) or proteinuria (>300 mg/24 h).
•	Vascular Disease: dissecting aneurysm or symptomatic arterial disease
•	Advanced hypertensive retinopathy: hemorrhages, exudates, or papilledema
	SBP, systolic blood pressure; DBP, diastolic blood pressure; BMI, body mass index; BSA, body surface area; LVH, left ventricular hypertrophy; eGFR, estimated glomerular filtration rate; HbA1c, glycated hemoglobin.

Other Factors Adversely Influencing Prognosis, but Not Used for Risk Stratification:

- Sedentary lifestyle
- Raised fibrinogen
- High-risk socioeconomic group
- High-risk ethnic group
- High-risk geographic region

Table 6: Cardiovascular Risk Stratification

Other risk factors (RFs)Asymptomatic organ damage (OD) or disease	BLOOD PRESSURE LEVEL (mm Hg)			
	High normal SBP 130–139 or DBP 85–89	Grade 1 HT SBP 140–159 or DBP 90–99	Grade 2 HT SBP 160–179 or DBP 100–109	Grade 3 HT SBP ≥180 or DBP ≥110
No other RFs	Average Risk	Low added Risk	Moderate Risk	High Risk
1–2 RFs	Low added Risk	Moderate Risk	Moderate to High Risk	High Risk
≥3 RFs	Low to Moderate Risk	Moderate to High Risk	High Risk	High Risk
OD, CKD stage 3 or diabetes	Moderate to High Risk	High Risk	High Risk	High to very High Risk
Symptomatic CVD, CKD stage ≥4 or diabetes with OD/RFs	Very High Risk	Very High Risk	Very High Risk	Very High Risk

OD, organ damage; CKD, chronic kidney disease; CV, cardiovascular; CVD, cardiovascular disease.
Adopted from: The Task Force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). 2013 ESH/ESC Guidelines for the management of arterial hypertension. Journal of Hypertension 2013, 31:1281–1357.

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Chapter 9

GOALS OF TREATMENT

Primary goal of treating hypertensive patients is to achieve the maximum reduction in total risk of cardiovascular and renal morbidity and mortality (Grade A). This requires two steps:

1. Reducing blood pressure to the target level
2. Controlling all other reversible cardiovascular risk factors, which include but not limited to:
   - Diabetes,
   - Smoking,
   - Dyslipidemia,
   - Obesity,
   - Alcoholism,
   - Physical inactivity,
   - Stressful life style, and
   - Unhealthy diet.

The target BP should be <140/90 mm Hg for most patients with HTN.

For patients with specific co-morbidities, the target BP should be as that shown in Table 7.

Table 7: BP Targets Based on Associated Co-Morbidities.

Co-Morbidity	*Target BP (less than)*
Age <80 years	140/90
Age >80 years	150/90
Diabetes	140/90 (130/80 may be warranted)
CKD without Protienuria*	140/90
CKD with Protienuria**	130/80
IHD	140/90
CHF	140/90
Old Stroke	140/90

* Patients <18 years target is below 95th percentile.
** Patients <18 years target is below 90th percentile.

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Chapter 10

HYPERTENSION MANAGEMENT

NON-PHARMACOLOGICAL APPROACH:

Current evidence supports the role of healthy lifestyle in reducing blood pressure for those with established hypertension and prehypertension. It enhances antihypertensive drug efficacy, reduces overall cardiovascular risk, and improves the general wellbeing of individuals (Table 8 and 9).

Therefore, lifestyle assessment of patient with prehypertension or hypertension in the initial encounter and during follow up visits should be evaluated and thoroughly explored. A healthy lifestyle is the cornerstone of HTN management.

Table 8: Impact of lifestyle therapies on blood pressure in hypertensive patients

Intervention	Target	Effect
Sodium reduction	<1500 mg/day	−5.8/−2.5 mm Hg
Weight loss	4.5 kg	−7.2/−5.9 mm Hg
Dietary pattern	DASH Diet	−11.4/−5.5 mm Hg
Exercise	3 times/week	−10.3/−7.5 mm Hg
Alcohol intake	2.7 drinks/day	− 4.6/−2.3 mm Hg

The Canadian Hypertension Education Program, 2004

Recommended Lifestyle Modifications:

A. Healthy Eating Habits:

1. Dietary Approach to stop hypertension (DASH) Diet:

DASH Eating plan includes the intake of fruits and vegetables; legumes; whole grains; low-fat dairy products; moderate amounts of unprocessed meat, poultry, and fish; and moderate amounts of polyunsaturated and monounsaturated fats. In terms of nutrition, DASH diet is low in saturated and *trans* fats and rich in potassium, calcium, magnesium, fiber, and proteins.

Current evidence supports that DASH diet can independently lower SBP and DBP and this is more pronounced when combined with salt reduction. See Table 10 for advice on meal planning.

2. Dietary Sodium Restriction:

Dietary sodium restriction is strongly advocated as a lifestyle behavioral change for the prevention and treatment of hypertension and consequently cardiovascular morbidity and mortality. Salt sensitivity has been found to have a higher prevalence in certain populations: older age, blacks, and patients with insulin resistance, micro-albuminuria, and chronic kidney disease (CKD).

See Table 11 for practical tips to reduce dietary salt in the diet.

3. Potassium Chloride, Calcium and Magnesium Supplementation:

Potassium chloride, calcium, and magnesium supplementation are not recommended to prevent or control hypertension as current evidence is insufficient. However, a potassium rich diet is encouraged to ensure adequate intake by dietary means (from fresh fruits and vegetables) rather than by supplements. Adopting DASH diet should satisfy these needs.

B. Weight Reduction:

BMI and waist circumference should be checked. See Table 12 for classification and cardiovascular risk of obesity based on BMI and waist circumference.

On average, for each 10 kg increase over the ideal bodyweight, SBP increases 2–3 mm Hg and DBP rises 1–3 mm Hg. The healthiest way to lose weight and achieve long-term success is to lose weight gradually, not more than 0.5–1 kg per week through a well-balanced diet and increased physical activity. See Table 13 for estimated daily caloric need based on age, gender, and physical activity level.

C. **Regular Physical Activity** of moderate intensity for 30 minutes on most days of the week is encouraged (e.g., brisk walking, low-speed swimming, cycling, and gentle aerobics). Regular physical activity lowers SBP by an average of 4 mm Hg and DBP by an average of 2.5 mm Hg.

D. **Smoking cessation** reduces overall cardiovascular risk factors. Therefore, inquiries and advice to stop smoking should be given by healthcare professionals.

See Table 14 for the 5 A's approach for counseling on smoking cessation.

Summary of Recommendations:

- Weight reduction to ideal body weight (Level Ib)
- Adopt DASH dietary plan (Level IIb)
- Restrict sodium intake to <1500 mg/day (1/2 to 3/4 teaspoon) (Level Ib)
- Regular moderate-intensity physical activity (Level Ia)
- Smoking cessation (Level IIb)

Table 9: Recommended lifestyle to prevent cardiovascular risk factors including HTN.

RECOMMONDED LIFE STYLE	COUNSELING TIPS/Evidence of recommendations	Level of evidence
Be more active[3]	Physical activity for 50–60 minutes, 3-4 times/week	A
Maintain ideal body weight	- Weight loss should be encouraged for all overweight patients; even moderate weight loss. - This can be achieved by increasing physical activity and reducing daily caloric intake.	Ib
Stop smoking	Use the 5 As approach for smoking cessation counseling*	IIb
Reduce sodium[3] **intake**	- Reduction of daily salt intake to less than 5g/day (about one tea spoon; 2g of sodium).	A**
Adequate K intake	- Foods rich in potassium are vegetables, fruit, dairy products, nuts, and so forth. Natural source of potassium is preferable. - Pharmacological potassium supplementation is not recommended.	
Consume diet rich in fruit and vegetables, low-fat dairy products and reduced in saturated and total fat[3]	- The DASH diet is a diet rich in fruits and vegetables (4–5 servings/day) and low-fat dairy products (2-3 servings/day) and includes whole grains, poultry, fish, and nuts. - This diet is rich in potassium, magnesium, calcium, dietary fiber, and proteins and has reduced fat (total and saturated) and cholesterol (<25%), red meat, sweets, and sugar-containing beverages[4].	A

Table 10: Advice on meal planning

Nutrient	Daily Serving	Advice
Grains and grain products	7–8	Consume at least half of all grains as whole grains. Increase whole-grain intake by replacing refined grains with whole grains.
Vegetables & fruits	4–5	Eat a variety of vegetables, especially dark green and red and orange vegetables and beans and peas.
Low fat or fat free dairy foods	2–3	Increase intake of fat-free or low-fat milk and milk products, such as milk, yogurt, cheese, or fortified soy beverages
Lean meats, poultry, and fish	0–2	-Choose a variety of protein foods, which include seafood, lean meat and poultry, eggs, beans and peas, soy products, and unsalted nuts and seeds. -Increase seafood consumption over red meat.
Fats (solid at room temperature) and oils (liquid at room temperature)	3	-Consume less than 10% of calories from saturated fatty acids by replacing them with monounsaturated and polyunsaturated fatty acids. -Animal fats tend to have a higher proportion of saturated fatty acids (seafood being the major exception) and higher intake of saturated fatty acids is associated with higher levels of blood total cholesterol and low-density lipoprotein (LDL) cholesterol. -Plant foods tend to have a higher proportion of monounsaturated and/or polyunsaturated fatty acids (coconut oil, palm kernel oil, and palm oil being the exceptions). -Several studies have observed an association between increased trans fatty acid intake and increased risk of cardiovascular disease because of LDL cholesterol-raising effect. Therefore, avoid trans fatty acid consumption by limiting foods such as partially hydrogenated oils, and by limiting other solid fats.
Sweets	5/week	Consume fewer sugar sweetened beverages and/or smaller portions since they provide excess calories and few essential nutrients to the diet

Table 11: Salt facts: Important Patient Instructions

Salt added at the table and in cooking provides only a small proportion of the total sodium that is consumed.
Most sodium comes from salt added during food processing so consume more fresh foods and fewer processed foods that are high in sodium.
Read the Nutrition Facts label for information on the sodium content of foods and purchase foods that are low in sodium.
Eat more home-prepared foods, where you have more control over sodium, and use little or no salt or salt containing seasonings when cooking or eating foods.
When eating at restaurants, ask that salt not be added to your food or order lower sodium options, if available.

Table 12: Combining BMI and waist measurement to assess overweight and obesity and disease risk in adults.

	BMI (kg/m^2)	Disease Risk	
		Waist circumference Men <102 cm Women <88 cm	Waist circumference Men >102 cm Women >88 cm
Ideal	18.5–24.9	-	High
Overweight	25–29.9	Increased	High
Obesity	30–39.9	High-very high	Very high
Morbid obesity	40 and above	Extremely high	Extremely high

Table 13: Estimated calorie need by age, gender, and physical activity level. A*

Gender	Age (years)	Sedentary B*	Moderately active C*	Active D*
Female		(Kcal)/Day	(Kcal)/Day	(Kcal)/Day
	19–30	1800–2000	2000–2200	2400
	31–50	1800	2000	2200
	51+	1600	1800	2000–2200
Male				
	19–30	2400–2600	2600–2800	3000
	31–50	2200–2400	2400–2600	2800–3000
	51+	2000–2200	2200–2400	2400–2800

A. Based on estimated energy requirements (EER) equations, using reference heights (average) and reference weights (healthy) for each age/gender group. The reference man is 5 feet 10 inches tall and weighs 154 pounds. The reference woman is 5 feet 4 inches tall and weighs 126 pounds. EER equations are from the Institute of Medicine (Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington (DC): The National Academies Press; 2002.)
B. Sedentary lifestyle includes only light physical activity associated with typical day-to-day life.
C. Moderately active means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.
D. Active means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.
Adopted from dietary guidelines for americans, 2010 | chapter two

Table 14: The "5 A's" model for treating tobacco use and dependance

Action	Intervention
Ask about tobacco use	Identify and document tobacco use status for every patient at each visit
Assess willingness to quit	How do you currently feel about your smoking? Are you ready to quit?
Advice to quit	In a clear, strong, and personalized manner, urge every tobacco user to quit. eg. 'The best thing you can do for your health is to quit smoking'.
Assist in quit attempt	Counsel the patient and use pharmacology to help in the quitting process.
Arrange for follow up	Schedule follow up visits to: • congratulate and affirm decision • review progress and problems • encourage continuance of pharmacotherapy • discuss relapse prevention • encourage use of support services

The Royal Australian College of General Practitioners (RACGP), Supporting smoking cessation: a guide for health professionals; July 2014

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Chapter 11

PHARMACOLOGICAL APPROACH

Current evidence from randomized controlled trials indicates that several classes of drugs, including low- dose thiazides (Level Ia), ACEI (Level Ia), long-acting dihydropyridine CCBs (Level Ia), and ARBs (Level Ia) will lower BP and reduce the complications of HTN.

Low-dose thiazide/thiazide-like agents are still considered among the first-line agents for the treatment of most patients with HTN. In addition, diuretics enhance the efficacy of other antihypertensive drugs and are affordable and widely available.

Beta blockers (BBs) are no longer recommended as first-line agents in patients over 60 years of age with uncomplicated HTN. Recent evidence described trend toward worse outcomes in patients treated with ßBs compared to those treated with other antihypertensive agents/classes, in addition to an associated risk of diabetes mellitus. Patients who have been on BBs, with stable and well-controlled HTN, may continue treatment regimen unchanged. However, if there was a compelling indication to use BB, such as CAD, then it should be used.

Principles of drug treatment:

1. **Hypertension without any compelling indications (Target BP <140/90 mm Hg):**
   - Thiazide diuretics, ACEI, ARBS, or long-acting dihydropyridine CCBs are considered first-line antihypertensive agents. Combination of first line agents (2-3 agents) should be considered if SBP ≥20 mm Hg or DBP ≥10 mm Hg above target or in patients at high CV-R.
   - Combination of ACEI and ARBs is contraindicated. ACEI and ARBs are potential teratogens. Avoid use in pregnancy, and use with caution for females of child bearing potential.
   - Isolated systolic hypertension without other compelling indications (target BP for age <80 is <140/90 mm Hg; for age ≥80 the target systolic BP is <150 mm Hg): Thiazide/thiazide-like diuretics, ARBs, or long-acting dihydropyridine CCBs. For isolated diastolic HTN follow the same treatment isolated systolic HT in addition to ACEIs.

2. **Diabetes Mellitus (Target BP <140/90; however, <130/80 may be warranted)**
   - a- Diabetes mellitus with microalbuminuria*, renal disease, cardiovascular disease, or additional cardiovascular risk factors: ACE inhibitors or ARBs. Addition of long-acting dihydropyridine CCBs is preferred over thiazide/thiazide-like diuretics. A loop diuretic could be considered in hypertensive CKD patients with extracellular fluid overload.
   - b- Diabetes mellitus without microalbuminuria or other comorbidities: ACE inhibitors, ARBs, long-acting dihydropyridine CCBs or thiazide/thiazide-like diuretics. Combination of ACEI with CCB is preferred over combination with thiazide/thiazide-like diuretic.

3. **Cardiovascular Disease (Target <140/90 mm Hg):**
   - a- Coronary artery disease: ACE inhibitors or ARBs; ßBs and LA-DHP-CCBs for patients with stable angina. When combination therapy is being used for high risk patients, an ACE inhibitor with dihydropyridine CCB is preferred. Avoid short-acting nifedipine. Combination of an ACEI with an ARB is contraindicated. Exercise caution when lowering SBP to target if DBP is ≤60 mm Hg.

b- Recent myocardial infarction: ßBs and ACE inhibitors (ARBs if ACE inhibitor intolerant). Long-acting CCBs if ßB contraindicated or not effective. Non-dihydropyridine CCBs should not be used with concomitant heart failure.

c- Heart failure: ACE inhibitors (ARBs if ACE inhibitor intolerant) and BBs. Aldosterone antagonists may be added for patients with recent cardiovascular hospitalization, acute myocardial infarction, elevated Brain natriuretic peptide (BNP), or N-terminal pro BNP level or NYHA Class II to IV symptoms. Second-line agents may include hydralazine/isosorbide dinitrate combination if ACE inhibitor and ARB contraindicated or not tolerated. Thiazide/thiazide-like or loop diuretics are recommended as additive therapy. Dihydropyridine CCB can also be used.

Careful monitoring of potassium and renal function if combining either ACEI or ARB with aldosterone antagonist.

d- Left ventricular hypertrophy: ACEI, ARB, long acting CCB, or thiazide /thiazide-like diuretics. Combination with other agents may be used. Hydralazine and minoxidil should not be used as they can increase left ventricular hypertrophy.

e- Past stroke or TIA: ACEI and a thiazide /thiazide-like diuretic combination.

Combination with other agents may be used. Treatment of hypertension should not be routinely undertaken in acute stroke unless extreme BP elevation is observed.

4. Non-diabetic chronic kidney disease—Target <140/90 mm Hg:

a- Nondiabetic chronic kidney disease with proteinuria: ACEI (ARBs if ACEI intolerant). Diuretics as additive therapy. Combinations with other agents may be used. Carefully monitor renal function and potassium for those on an ACEI or ARB. Combinations of an ACEI and ARB are not recommended.

b- Renovascular disease: Does not affect initial treatment recommendations. Combinations with other agents may be used. Avoid ACEI or ARBs if bilateral renal artery stenosis or unilateral disease with solitary kidney.

4. To achieve optimal blood pressure targets:

- Multiple drugs are often required to reach target levels, especially in patients with type 2 diabetes
- Replace multiple antihypertensive agents with fixed dose combination therapy when available
- Low doses of multiple drugs may be more effective and better tolerated than higher doses of fewer drugs
- Reassess patients with uncontrolled blood pressure at least every 2 months
- The most preferable combinations are ACEIs or ARBs plus LA-DHP-CCBs and/or thiazide diuretics as required

Table 15: Antihypertensive Medications: Indications and Contraindications

Drug Class	Conditions Favoring Use	Contraindications	
		Compelling	Possible
Thiazide diuretics	CHF; Elderly Hypertensives; Isolated S/D hypertension; Osteoporosis; Hypertensive patients of African origin	Gout; Hyponatremia	Dyslipidemia; Sexually Active Males; Pregnancy; Glucose intolerance
Loop Diuretics	Renal Insufficiency; CHF		
Aldosterone antagonist diuretics	CHF; Post-MI	Renal Failure; Hyperkalemia	
BBs	Angina Pectoris; Post- MI; CHF; Pregnancy; Migraine; Essential Tremors; Tachyarrhythmias; Thyrotoxicosis	Asthma; COPD, AV Block (Grade 2 or 3)	Peripheral artery disease, Glucose Intolerance; Athletes and Physically Active Patients; Dyslipidemia
Long-acting dihydropyridine CCBs	Elderly Patients; Angina; PAD; Pregnancy		AV Block (Grade 2 or 3); CHF; Tachyarrhythmias
Non-dihydropyridine CCBs	Angina Pectoris; Supraventricular Tachycardia	CHF; Patients Taking BBs	
ACEIs	CHF; LV Dysfunction; Post- MI; DM; CKD	Pregnancy; Hyperkalemia; Bilateral Renal Artery Stenosis Angioedema	
ARBs	CHF; LV Dysfunction; Post- MI; DM; CKD	Pregnancy; Hyperkalemia; Bilateral Renal Artery Stenosis	
Alpha-blockers	Benign Prostatic Hypertrophy; Dyslipidemia	Orthostatic Hypotension	CHF

Please refer to the online Saudi National Formulary (SNF) for product availability and drug cost http://www.sfda.gov.sa

Combination Therapy:

Many reasons play roles in inadequate BP control, and ineffective medication remains an important factor. Data have shown that combination therapy is five times more effective than increasing the dose of a single drug, up to 80% of patients require multiple medications to reach BP goals and almost 15%–20% need 3 or more medications.

Therapy with two drug combination may be considered in patients with markedly high baseline BP or at high or very high CV risk. Fixed pill combination, if preferable to separate combination of two antihypertensive drugs, may be recommended and favored.

The rationale for combination is synergy at molecular and clinical levels, neutralization of counter-regulatory mechanisms, better compliance, and improving efficacy-tolerability ratio and with less cost. Compliance is a very important factor; it is improved with decreasing the number of medications and it leads to lower risk of hospitalization.

Many factors are considered when choosing an antihypertensive drug. Multiple studies have compared different drug combinations in the management of HTN. It appears that the most preferable combinations are ACEIs or ARBs plus LA-DHP-CCBs and/or thiazide diuretics as required.

Renal Denervation:

This involves destruction of the renal sympathetic nerves close to the renal arteries on both sides.

The first trials of RDN performed via radiofrequency catheter based ablation of renal nerves were uncontrolled with no sham done, and showed impressive BP lowering effect in patients with RH. It was efficacious and safe. However, after Simplicity HTN 3 trial with sham procedure performed in the USA and other trials and meta-analyses, RDN showed no efficacy in BP reduction. More studies and improvements for the technique are currently underway.

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Chapter 12

FOLLOW UP AND MONITORING

Follow up of patients with HTN is aimed to achieve BP control and minimize other CVR factors. The proposed follow up scheme is shown in Table 16.
Reassessment visit should include full clinical evaluation in addition to lab work, which must include fasting lipid, FBG, serum creatinine and eGFR, serum potassium, serum uric acid, urinary ACR (if not available, other methods of albuminuria measurement) and ECG.

Table 16: Recommended Follow up Scheme for Patients with HTN.

Which visit?	Condition*	FU Frequency	What to monitor?
HTN Urgency	HTN Urgency	1–3 days till BP <160/100	Tolerance**, Compliance & Response***
Initial visit	New Non-Emergency Non-Urgency	1–4 weeks	Tolerance**, Compliance & Response***
Follow-up Visit	Uncontrolled BP	Monthly until controlled	Tolerance**, Compliance & Response***
	Controlled BP	3–6 months	Tolerance**, Compliance & Response***
Full re-assessment Visit	High CVR	6–12 months	General Health exam, CVR assessment Ref to CVR
	Low-Mod CVR	Annually	

- ** Tolerance includes patient's acceptance, symptoms, clinical side effects, and biochemical side effects (e.g., K+ and Cr and eGFR; in response to change of ACEI/ARB dosages)
- *** Response implies more than 5–10 mm Hg decrement in BP.
- * In the absence of any other clinical condition that may mandate earlier follow-up.

Acceleration of Rx:

Management plan must be evaluated monthly until the target achieved. Regimen must be adjusted accordingly. Every effort must be made to avoid inertia toward change or step-up of the pharmacological and non-pharmacological plan.

Reducing the Medications:

If the BP of the patients is persistently on the low side with symptoms of hypotension arising frequently, dose reduction and reevaluation of the treatment regimen must be considered. This should be performed slowly with careful monitoring and follow up.

Stopping the Medications:

HTN is lifelong and progressive disease and therapy is also lifelong. However, there are few situations where stopping the anti HTN medications may be considered and tried with careful follow up. These situations may include those whose BP is below 120/80 mm Hg with postural symptoms, on a single medication for long period and no target organ damage. The patient should be well informed and able to undergo HBPM in addition to OBPM. Lifestyle modifications should be continued and stressed upon. Careful monitoring is recommended.

Referral to specialist:

Referral to a specialist should be considered in the following situations:

1. Resistant HTN
2. Suspicion of secondary HTN
3. Sudden onset of HTN
4. HTN diagnosed at young age (30 years old)
5. Worsening of HTN
6. Malignant HTN

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Chapter 13

RESISTANT HYPERTENSION

Resistant Hypertesion (RH) can be defined as office BP above goal of 140/90 mm Hg despite implementing lifestyle modification and three drug therapy, one of them is a diuretic in optimal doses. Recently the definition was expanded to include those patients whose BP is controlled on four or more drugs.

Prevalence rate of RH is about 10%.

Evaluation of RH include several steps;

- ABPM is essential to diagnosis RH.
- History should be thorough including interfering substances, secondary causes, lifestyle factors.
- Exam should include waist circumference measurements, signs of secondary causes, fundus exam.
- Laboratory investigation should include the basic tests mentioned before and further tests if a secondary cause is suspected. Genetic tests may be rarely required.

Management of RH;

- Implement the non-pharmacological therapy as mentioned in the management of HTN chapter.
- Review drug regimen and doses;
  - Add spironolactone as the 4th line therapy. Careful monitoring of potassium level, kidney function, and adverse effects.
  - Add BB, alpha blocker, vasodilator (hydralazine, minoxidil), or centrally acting agents (methyldopa, clonidine).
- Refer to a tertiary center or to a hypertension specialist
- Interventional therapies;
  - Renal sympathetic denervation is not recommended therapy for RH following recent trials. It is used only as research therapy.
  - Baroreceptor activation therapy is still under study and not FDA approved.

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Chapter 14

SUPPORTIVE THERAPY IN HYPERTENSION

ANTIPLATELET THERAPY

The use of aspirin and other antiplatelet agents, have been well documented to reduce the risk of fatal and nonfatal coronary events, stroke, and CV death in patients with established coronary or cerebro-vascular disease (Level Ia). Considering the results of the HOT Study, it is reasonable to recommend the use of low-dose aspirin in hypertensive patients whose BP has been rigorously controlled, who are at high risk of CVD R, and who are not particularly at risk of bleeding from the gastro-intestinal tract or from other sites (Level Ia).

Evidence shows that low-dose aspirin use is most beneficial for adults ages 50 to 59 years, should be individualized for adults aged 60–69 years for the prevention of CVDs and colorectal cancer.

Cholesterol Lowering Therapy

Statin therapy is recommended for patients with high cardiovascular risk[R] or atherosclerotic disease, irrespective of cholesterol level (Level Ia).

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Chapter 15

COMPLEMENTARY TREATMENT IN HYPERTENSION

Herbs and Hypertension:

The use of some spices to minimize salt intake can, however, be of benefit in helping reduce the amount of sodium in food.

Garlic and onion may have some BP lowering effects, but the evidence is not strong and only few trials were performed. Patient should be informed and shared in the decision making. On the other hand, there is no clear benefit from other herbal products. Licorice and ephedra containing products should be avoided in hypertensive patients as they increase blood pressure.

Table 17: The role of complementary therapy in hypertension management.

Complementary Item	Current Evidence
Garlic	Current evidence suggests that garlic preparations may lower BP in hypertensive individuals, but the evidence is not strong. A well-conducted and powered trial of longer duration is required to confirm these findings. Additionally, product preparation and formulas are not standardized. This leads to a non-conclusive message regarding garlic use in hypertensive patients[4].
Vitamin D	Increased plasma vitamin D may reduce hypertension risk[5]. Large randomized trials are required before recommendation of vitamin D for the prevention and treatment of hypertension[6].
Green Tea	Current limited evidence suggests that tea has favorable effects on CVD risk factors. However, further high quality trials with longer-term follow-up are required to confirm these effects[7].
Fish Oil	Omega-3 (omega-3) polyunsaturated fatty acids (PUFAs) from fish and fish oils appear to protect against coronary heart disease partly owing to a small but significant reduction in blood pressure[8]. The American Heart Association recommends eating fish (particularly fatty fish) at least two times (two servings) a week. Each serving is 1/2 cup cooked fish. Fatty fish like salmon, mackerel, herring, lake trout, sardines, and albacore tuna are high in omega-3 fatty acids. When a fish oil supplement is used, it should contain both EPA and DHA; a 1 g/day supplement (containing 200–800 mg of EPA and DHA) is a reasonable option.

EPA (eicosapentaenoic acid) is long-chain omega-3 fatty acid. DHA (docosahexaenoic acid) is short-chain omega-3 fatty acid.

Chapter 16

SOCIAL ASPECTS IN TREATING HYPERTENSION

Exploring patient's socioeconomic profile helps to establish rapport and facilitate patient-physician communication for more patient centered care. It may also uncover emotional concerns and reactions to illness.

Table 18: Psychosocial aspects that should be addressed in hypertensive patients.

Psychosocial aspects	Rational
Economic Status	Consider medication cost, individualize lifestyle advice, healthy diet affordability.
Social Support	The presence of caregiver especially for elderly who may have cognitive dysfunction will improve patient's adherence to treatment as well as life style and healthy food preparation.
Marital Status	- Consider pregnancy and lactation to guide for the best drug regimen. - The presence of spouse, divorce or widow status or those who are living alone will provide valuable information and background about the degree of family support that might affect management plan. - The contraceptive method (hormonal methods)
Level of education	Assessment will guide the treating physician how to deliver the advices that match patient's level of understanding.
Occupation	Loss of job, sedentary work environment, occupational stress, nightshift, work hazards, or physical work load may guide physician for proper timing of medication in a convenient way, match the best treatment regimen and life style advices.
Stress	Reaction to stress might be correlated with suboptimal control of blood pressure and level of patient motivation[1].
Alcohol drinking/Substance abuse	They may increase blood pressure.
Smoking	For cardiovascular risk assessment and opportunity for initiating smoking cessation plan to reduce global cardiovascular risk.
Physical activity/ Habits	Explore the current level of activity, patient's tolerance and preferences, to guide the advice toward being physically active.
Functional and cognitive status among elderly	It will reflect the level of patient's independence and the need for caregiver to supervise management plan.
Cultures, believes and concerns	Once explored, it will help uncover hidden agendas, believes that may affect patient motivation and compliance to the management plan.

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Chapter 17

HYPERTENSION IN HAJJ AND RAMADAN

HYPERTENSION in HAJJ (PILGRIMAGE)

Based on the scarce available data, the following recommendations can reasonably be made (expert opinion, level 5):

- Hypertensive pilgrims should have a medical checkup before they leave home for Hajj, particularly the elderly and those with other comorbidities. Patients with severe HTN should achieve BP control before starting the Hajj journey.
- Once-daily medication regimens are preferable.
- Adequate fluid intake is generally recommended for pilgrims particularly for patients on diuretic therapy.
- To keep BP under control, patients should take their HTN medications as directed.
- Patients should check their BP regularly and try to reduce stress during Hajj.

HYPERTENSION in RAMADAN

Fasting the month of Ramadan is a religious obligation practiced by Muslim population all over the world, where they refrain from eating, drinking, smoking, and sex from dawn until sunset. Several studies have looked at the effects of fasting on BP among hypertensive patients. These studies showed slight benefit in BP control with no detrimental effects.

Based on the available data, the following recommendations can reasonably be made *(expert opinion, level 5)*:

- Hypertensive patients are encouraged to seek medical advice before fasting to adjust their medications (If needed), and their management should be individualized.
- Majority of patients with controlled hypertension can endure fasting. However, patients with uncontrolled hypertension should achieve BP control before fasting. Careful monitoring of home blood pressure readings during Ramadan is recommended.
- Patient education should emphasize the need to maintain compliance with non-pharmacological and pharmacological measures.
- Patients should maintain adequate fluid intake specially if on diuretics.
- A once-daily dosage schedule with long-acting preparations is recommended.
- Patients with hypertensive emergencies and urgencies should be treated appropriately irrespective of fasting, including intravenous medications.

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Chapter 18

HYPERTENSION IN DIABETICS & DYSLIPIDEMIA

HYPERTENSION IN DIABETICS

Almost half of patients with DM will develop HTN. Strict control of BP in these patients is as important as the control of blood sugar. In addition, it is more determinant of CV morbidity. Studies have shown that BP above 130–140/80–90 mm Hg is associated with a significant risk of microvascular and macrovascular complications. Patients with DM should be treated targeting a BP <140/90 mm Hg. Other authorities recommend a BP <130/80 mm Hg. This may be targeted if tolerated and easily-achieved. Lifestyle measures are important for both DM and HTN. All classes of anti HTN agents (ACEI, ARB, CCB, and TZD) can be used in DM. RAAS blockers are preferred especially in the presence of proteinuria or microalbuminuria. Diabetic hypertensive patients tend to develop orthostatic hypotension and an increased sensitivity to sodium in the diet. Multiple drug therapy is eventually required to control BP.

HYPERTENSION AND DYSLIPIDEMIA

Hypertensive patients with DM or Metabolic Syndrome often have dyslipidemia characterized by elevated triglyceride, elevated LDL-c, or low HDL-c. Statin is beneficial in hypertensive patients with atherosclerotic disease or high CV risk scores.

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Chapter 19

HYPERTENSION AND OBESITY

Obesity is defined as an increase in body fat. It is an epidemic worldwide. The prevalence of obesity in Saudi Arabia is 28% in males and 44% in females. It increases the risk of HTN, DM, CVD, CKD, and others. Therefore, it should be considered as a chronic disease like HTN rather than a cosmetic entity. Assessment of obesity includes measurement of weight, height, BMI, and waist circumference. Classification of obesity based on BMI and waist circumference should be established in all patients (Table 19). Management of HTN in obesity includes lifestyle modifications to attempt weight loss. Preferred anti HTN therapy are RAAS blockers (ACEI, ARB) and CCB. ßBs are not first-line of treatment but can be included in the treatment regimen. Vasodilating ßBs are preferred. Diuretics can be added to the latter if BP is not controlled.

Table 19: Classification of Overweight and Obesity by BMI, Waist Circumference, and Associated Disease Risk*

Obesity class	BMI (kg/m^2)	Disease Risk* (Relativeto Normal Weight and Waist Circumference)		Action
		Men ≤ 40 in (≤ 102 cm)#	> 40 in (> 102 cm)	
		Women ≤ 35 in (≤ 88 cm)#	> 35 in (> 88cm)	
Underweight	<18.5	–	–	Advice for Good Lifestyle[88]
Normal†	18.5–24.9	–	–	Advice for Good Lifestyle[88]
Overweight	25.0–29.9	Increased	High	Advice for Lifestyle Change[78]
Obesity I	30.0–34.9	High	Very High	Evaluate within 2 months[27]
Obesity II	35.0–39.9	Very High	Very High	Evaluate within 2 months[27]
Obesity III	≥40	Extremely High	Extremely High	Evaluate within 2 months27

* Disease risk for Type-2 diabetes, hypertension, and CVD.
† Increased waist circumference can also be a marker for increased risk even in persons of normal weight.
# These values have not been validated in Middle Eastern Population

BARIATRIC SURGERY

Very few bariatric surgery studies have reported a long-term effect on the prevention and remission of hypertension. However, one meta-analysis showed a hypertension risk reduction of 0.54 (95% confidence interval [CI], 0.46–0.64; I(2) = 68%). Another review showed hypertension remission rates (blood pressure <140/90 mm Hg without medication) in the range 17.4%–38.2%.

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Chapter 20

METABOLIC SYNDROME

The Metabolic syndrome is a constellation of abnormalities that include abdominal obesity, hypertension, dyslipidemia, and elevated blood glucose (see Table 20).

Table 20: Metabolic Syndrome Criteria.

Measure	Categorical cut points	
	Men	Women
Elevated waist circumference (population- and country-specific cutoff points):		
• Canada, United States	≥102 cm	≥94 cm
• Europid, Middle Eastern, sub-Saharan African, Mediterranean	≥94 cm	≥80 cm
• Asian, Japanese, South and Central American	≥90 cm	≥80 cm
Elevated TG (drug treatment for elevated TG is an alternate indicatory) 1.7 mmol/L	≥1.7 mmol/L (150 mg/dL)	
Reduced HDL-C (drug treatment for reduced HDL-C is an alternate indicator)	<1 mmol/L (40 mg/dL) in males. <1.3 mmol/L (50 mg/dL) in females	
Elevated BP (antihypertensive drug treatment in a patient with a history of hypertension is an alternate indicator)	Systolic ≥130 mm Hg and/or diastolic ≥85 mm Hg	
Elevated FBS (drug treatment of elevated glucose is an alternate indicator)	≥5.6 mmol/L (100 mg/dL)	

Three or more criteria are required for diagnosis.
* Adapted from Alberti KGMM, Eckel R, Grundy S, et al. harmonizing the metabolic syndrome. Circulation. 2009;120:1640-1645.

Management of hypertension in the metabolic syndrome;

LSM modifications (especially weight loss and physical activity);

Improvement of BP and components of metabolic syndrome, and delay of diabetes onset is recommended as first-line therapy in the metabolic syndrome.

Drug therapy in the metabolic syndrome if no response to LSM;

- Hypertension; the threshold to start pharmacological therapy is a BP >140/90 mm Hg
- Goal for hypertension therapy is <140/90 mm Hg
- The drugs preferred for initial therapy are the RAAS blockers or CCB. ßBs and diuretics are not first-line of therapy but can be added to the therapy later, if required.

All patients require risk stratifications and adjunctive CV risk therapy such as statin, metformin, and ASA should be considered as required.

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Chapter 21

HYPERTENSION AND HEART

HYPERTENSION AND CONGESTIVE HEART FAILURE

Hypertension is the leading RF for heart failure and optimal treatment of HTN can lead to the prevention of CHF even in the very elderly patients.

While a history of HTN is common among patients with CHF, when CHF develops, the elevated BP may be reduced (Burned out HTN).

There are evidences from studies in favor of administration of β-Bs (metoprolol, bisoprolol, and carvidolol), ACEIs, and ARBs in doses used in clinical trials. In addition, thiazides or thiazide-like diuretics may be added (Grade B). Loop diuretics are recommended for associated volume overload (Grade D).

In patients with CHF class II-IV NYHA, having BNP level >400 or post MI, mineralocorticoid receptor antagonists have been used with great benefit on morbidity and mortality. (Grade A)

In hypertensive patients with preserved LV ejection fractions, no specific advice exists for the best treatment method different from those with reduced ejection fraction.

If ACEIs/ARBs are contraindicated or not sufficient, a combination of hydralazine and isosorbide dinitrate may be used. (Grade B)

LA-DHP CCB (amlodipine) is a good choice in some patients. The combinations of ACEI and ARB can be prescribed only in rare cases.

HYPERTENSION AND CORONARY HEART DISEASE

- Hypertension can be complicated or accompanied by CHD. Both SBP and DBP are associated with CHD; however, SBP >140 mm Hg has a steeper association with CHD.
- Hypertension accounts for about 25% of MI events.
- The BP goal is <140/90 mm Hg and caution should be observed to avoid J curve relationship between achieved BP and CV outcomes.
- β-Bs are advisable in hypertensive patients after acute MI, and in patients with angina. LA-DHP-CCBs is the alternative when β-B cannot be used. Short acting Nifedipine should be avoided. Short acting CCBs are to be avoided in case of associated LV systolic dysfunction.
- ACEIs have been successfully used in patients with high risk CHD and in those with recent MI. ARBs are reasonable alternatives.
- When combination therapy is being used, choices should be individualized. The combination of an ACEI and a long acting CCB is preferable to an ACEI and a thiazide/ thiazide-like diuretic in selected patients.

HYPERTENSION AND ATRIAL FIBRILLATION

Hypertension is a very prominent concomitant condition in patients with atrial fibrillation (AF). High blood pressure is likely to be a reversible causative factor.

Hypertensive patients with AF have increased overall mortality, stroke, heart failure, and hospitalization.

Hypertensive patients with AF should be assessed and managed as per the AF management guidelines. Majority of these patients are potential candidates to receive anticoagulants for the prevention of thromboembolism and stroke unless contraindicated.

New oral anticoagulants have shown to be either superior or non-inferior to warfarin in the management of these patients. Good control of blood pressure in patients receiving anticoagulants reduces the risk of bleeding.

ßBs and NDHP-CCB are recommended in the management of hypertension in AF patients with high ventricular rate. Caution should be exercised in combining both, due to their synergestic chronotropic effect.

Studies have shown that some ACEIs and ARBs (Losartan, Valsartan) are better in preventing first occurrence of AF than ßBs (atenolol) or CCBs (amlodipine), especially in the presence of structural hypertensive heart disease, such as LV hypertrophy or LV dysfunction.

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Chapter 22

HYPERTENSION AND CEREBROVASCULAR DISEASE

Ischemic Stroke

The current consensus statement states that blood pressure should be treated only if the systolic blood pressure is above 220 mm Hg or the diastolic blood pressure is above 120 mm Hg. When treatment is indicated, it should be done cautiously, with a goal to lower blood pressure by no more than 15%–25% within the first day. The exception is in patients who are candidates for treatment with thrombolytics. Excessively high blood pressure is associated with an increased risk of symptomatic hemorrhagic transformation in patients treated with thrombolytics, and with worse outcome. Thus, attention to management of blood pressure is critical before, during, and after the administration of the medication. A target systolic blood pressure of less than 180 mm Hg and diastolic blood pressure less than 105 mm Hg are recommended.

Intracerebral Hemorrhage

Current guidelines, though admittedly from incomplete evidence, suggest that if systolic blood pressure is above 200 mm Hg or the mean arterial pressure is above 150 mm Hg, aggressive blood pressure reduction with continuous intravenous infusion of an antihypertensive should be considered and blood pressure should be monitored every 5 minutes. In addition, if systolic blood pressure is above 180 mm Hg or mean arterial pressure is greater than 130 mm Hg and there is evidence of, or suspicion of, elevated intracranial pressure, intracranial pressure monitoring should be considered. Intermittent or continuous intravenous medications can be used to keep cerebral perfusion pressure at 60–80 mm Hg. If systolic blood pressure is above 180 mm Hg or mean arterial pressure is above 130 mm Hg and there is no evidence of or suspicion of elevated intracranial pressure, intermittent or continuous intravenous medications can be used to achieve a modest reduction of blood pressure (eg., a mean arterial pressure of 110 mm Hg or a target blood pressure of 160/90 mm Hg). Patients should be clinically reexamined every 15 minutes.

Blood pressure management in stroke:

Ischemic stroke and TIA	
Acute setting	
Patient eligible for acute reperfusion	For BP >185/110 mm Hg: administer labetalol 10–20 mg over 1-2 minutes, may repeat 1 time; or start nicardipine 5 mg/h IV, titrate up by 2.5 mg/h every 5–15 minutes for maximum 15 mg/h; or add other agents (hydralazine, enalaprilat)
During and after reperfusion therapy	BP goal ≤180/105 mmHg
Patients not eligible for acute reperfusion therapy	For SBP >220 mmHg or DBP 121–140 mmHg, administer labetalol IV or nicardipine as IV infusion, aiming for 10%–15% reduction of BP
	If DBP >140 mmHg, give sodium nitroprusside as IV infusion, titrating the dose for a 10%–15% reduction of BP.

Ischemic stroke and TIA	
Subacute setting	
Previously untreated patients with SBP ≥140 mmHg or DBP ≥90 mmHg	Initiate BP therapy (Class I, Level of evidence B).
Patients with SBP <140 mm Hg and DBP <90 mm Hg.	Initiate of BP therapy is of uncertain benefit (class IIb, Level of evidence C)
Previously treated patients with known hypertension	Resume BP therapy (class I; Level of evidence A)
	Reasonable to achieve BP < 140/90 mmHg as a target if patients do not have specific indications as below (class IIa; LoE B)

Specific Indications	
Recent lacunar stroke	SBP <130 mmHg (Class IIb; Level of evidence B)
Intracranial atherosclerosis (50%–99% stenosis of a major intracranial artery)	Target SBP <140 mmHg (Class I; Level of evidence B)

Intracerebral hemorrhage
When SBP is 150–220 mmHg acute lowering to 140 mmHg is reasonable

Medication Name	Dose	Onset Action	Duration of Action	Side effects
Labetalol	10–20 mg, IV bolus, over 1–2 min or 0.5–2.0 mg/min Infusion; may repeat at 10 min	5 min	8–12 h	Bradycardia, bronchospasm
Nicardipine	5–15 mg/h as IV infusion, increasing the rate 2.5 mg/h every 5 min (maximum dose: 15 mg/h)	1–5 min	15–120 min	Hypotension
Hydralazine	10–20 mg as IV bolus or intramuscular; repeat every 4–6h (maximum dose 40 mg)	10–20 min	3-8 h	Reflex tachycardia myocardial injury
Nitroglycerine	5–100 mg/min as IV infusion	2–5 min	5–10 min	Venous dilation can cause preload reduction
Sodium nitroprusside	0.25–10 µg/kg/min as IV infusion, maximal dose for 10 min only	Seconds to 2 min after initiation of infusion	1–3 min	Raised ICP
Esmolol	500 mg/kg as IV bolus over 1 min, followed by maintenance infusion of 50 mg/kg/min for 4 min (maximum dose: 300 mg/kg/min)	2–10 min	10–30 min	Hypotension
Enalaprilat	1 mg as IV bolus followed in 30 min by 10 mg	15 min	12-24 h	Onset of action and duration makes titration difficult, hypotension

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Chapter 23

HYPERTENSION AND KIDNEY DISEASE

Renovascular HTN (RVH)

There are two types of RVH; fibromuscular dysplasia and atherosclerotic RVH, which are the most frequently observed forms of RVH in the clinic. For criteria that indicates the presence of RVH, please refer to the section on secondary hypertension for clues of secondary causes. Renin Angiotensin Aldosterone System (RAAS) blockers are contraindicated in bilateral RVH or unilateral in a single kidney. The latest studies showed that there was no benefit from renal artery angioplasty and stenting for atherosclerotic hemodynamically significant RVH compared to medical therapy. As such, medical therapy is the preferred therapy for atherosclerotic RVH. However, surgical intervention may be performed in specific circumstances such as uncontrolled resistant HTN on maximally tolerated pharmacotherapy, progressive renal function loss, and acute PE.

Hypertension and Chronic Kidney Disease

HTN is frequent finding in CKD. Around 85%–95% of these patients have HTN. In KSA, kidney failure of 35.6% of patients starting dialysis is attributed to HTN. Therapeutic goals are to slow down the deterioration of renal function and prevent CVD. Patients should receive aggressive BP management, often with three or more drugs to reach target BP values of <140/90 mm Hg (<130/80 mm Hg in proteinuric patients). In addition, HTN hastens the progression of CKD caused by other pathologies. Treatment of HTN is a fundamentally important step to prevent, stabilize, and regress CVD in these patients. Assessment of HTN patients with CKD should include assessment of urinary protein excretion, since therapeutic recommendation differ if proteinuria is present. BP should be checked in each clinical visit. Treatment of HTN should start with LSM, particularly sodium restriction and physical activity. Please refer to the non-pharmacological section. ACEI or ARB are recommended as first-line agents irrespective of race or DM status with or without proteinuria. Serum Cr and K should be monitored within 1-2 weeks after initiation of therapy. Doses should be titrated up gradually to the maximal level to achieve the BP and proteinuria target. The combination of ACEI and ARB is not generally recommended; however, it may be done under specialized care with supervision. Second-line additional therapy is thiazide diuretic or non-DHP CCB and BB. Labetalol is the agent of choice for pregnant women with CKD.

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Chapter 24

HYPERTENSION AND ERECTILE DYSFUNCTION

Erectile dysfunction is not uncommon in HTN patients. It is a predictor of future CV events. It may be considered as an independent CV risk factor and require efficient screening and management. It is usually underdiagnosed, thus sexual history must be considered. It may be due to HTN itself, or caused by some anti HTN medications or other causes. Older anti HTN drugs (diuretics, non-vasodilating BBs, centrally acting drugs) exert negative effects whereas newer drugs have neutral or beneficial effects (ACEI, ARB, CCB, vasodilating ßBs such as nebivolol).

Lifestyle modifications may improve erectile dysfunction. Phosphodiesterase-5 inhibitors may be safely administered to HTN patients, even to those on multiple anti HTN drug regimens. However, care should be exercised in patients on α-blockers or patients with CAD on nitrates.

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Chapter 25

HYPERTENSION AND SURGERY

Some patients scheduled for cardiac or non-cardiac surgery are likely newly diagnosed hypertensives or known hypertensives on treatment. In addition, they may already be on treatment for hypertension.

In majority of hypertensive patients, surgery can be performed safely with adequate sedation and with continuation of previous medications.

However, in certain circumstances, it is important to control BP adequately and to avoid fluctuations of BP to minimize adverse events. Such procedures include carotid surgery, abdominal aortic surgery, peripheral vascular procedures, intraperitoneal surgery, intrathoracic surgery, neurosurgery and transplantations, surgeries for major trauma or burns, and cardiac surgery.

Hypotension may lead to cerebral hypoperfusion and myocardial ischemia. The fluctuation of BP can be avoided by minimizing withdrawal of antihypertensive medication and by continuation of antihypertensive medication except for ACEI or ARB.

The use of parenteral short acting medications during intraoperative and postoperative period is strongly recommended in some cases to achieve the safest perioperative results.

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Chapter 26

HYPERTENSION IN CHILDREN

BP increases gradually with age and height. Therefore, percentile charts (see Figures 2-5) should be used to interpret systolic blood pressure (SBP) and diastolic blood pressure (DBP) measurements and categorize them as normal, prehypertension, or hypertension (Table 21) based on the child's age, height, and sex for each year of the child's life from age 3 to 18 years.

Table 21: Classification of BP Levels in Children and Adolescents, with Measurement Frequency and Therapy Recommendations

	SBP or DBP Percentile	*Frequency of BP Measurement*	*Therapeutic LSM*	*Pharmacotherapy*
Normal	<90th percentile [for age, gender, and height]	Recheck at next physical examination	Encourage healthy diet, sleep, and physical activity	No
Pre-HTN	From 90th to <95th percentile [for age, gender, and height], or if BP exceeds 120/80 mm Hg,	Recheck every 6 months + ABPM confirmation if BP is high after 12 months	weight management if overweight; introduce physical activity and diet management	No
HTN Grade I	95th–99th percentile [for age, gender, and height] plus 5 mm Hg	Recheck in 1–2 weeks or sooner if the patient is symptomatic; if BP is persistently elevated on two additional occasions, refer to specialist within 1 month. ABPM is advised.	Same as above.	Yes (if no improvement or symptomatic)
HTN Grade II	>99th percentile, plus 5 mm Hg [for age, gender, and height]	Refer to specialist within 1 week or immediately if the patient is symptomatic	Same as above.	Yes

Secondary HTN is common in young children, while essential HTN is more common in older children and adolescents. The prevalence of hypertension in school-age children aged 3–18 years with normal weight is 3%–5%, with overweight 4%–14%, and in obese children 11%–33%. The overall prevalence of overweight, obesity, and severe obesity among healthy children aged 5–18 years in Saudi Arabia is 23.1%, 9.3%, and 2% respectively.

The causes of secondary hypertension are many, but the most common ones are summarized in Table 22. The provider should obtain a perinatal history, appropriate nutritional history, physical activity history, psychosocial history, and family history and perform a physical examination to identify findings suggestive of secondary causes of HTN .

Table 22: Most Common Causes of Secondary Hypertension by Age Group.

Age Group	*Etiology*
Neonate	Coarctation of the aorta, renal artery thromboembolism, renal artery stenosis, and congenital renal anomalies
Infancy to6 years	Renal parenchymal disease (including structural, inflammatory diseases plus tumors), renal artery stenosis
6–10 years	Renal parenchymal disease (including structural, inflammatory disease plus tumors), renal artery stenosis, and primary HTN
Adolescents	Primary HTN and renal parenchymal disease

Most hypertensive children are asymptomatic or have a variety of nonspecific symptoms.

Measurements of BP with an appropriately sized cuff (page 22) should be part of the routine pediatric evaluation in every clinic visit for children aged 3 years or older. Children younger than 3 years of age with the following conditions should have their BP measured:

Conditions under which children <3 Years old should have their BP measured

- History of prematurity, very low birth weight, or other neonatal complications requiring intensive care
- Congenital heart disease
- Recurrent urinary tract infections, hematuria, or proteinuria
- Known renal disease or urologic malformations
- Family history of congenital renal disease
- Solid organ or bone marrow transplant
- Malignancy
- Treatment with drugs known to raise BP
- Other systemic illnesses associated with HTN
- Evidence of elevated intracranial pressure

In general, hypertensive children should be referred to a specialized pediatrician. Evaluation involves a thorough history (Table 23) and physical examination (Table 24), ambulatory BP monitoring, laboratory investigations, and specialized tests. The primary investigations for hypertensive children should include CBC, urinalysis, urine culture, blood urea nitrogen, serum creatinine, electrolytes, lipid profile, ECG, chest X-ray, echocardiogram, and renal ultrasound.

Table 23: History Associated with Possible Etiology of Hypertension in Children and Adolescents

History in the Child or Adolescent with Elevated BP	*Possible Cause of HTN*
CNS: Head trauma, headache, visual disturbance, seizures, tremors, morning vomiting	Elevated intracranial pressure
Hearing: Hearing loss	Renal disease (i.e., Alport syndrome)
	Lead poisoning
CV: Palpitations, irregular pulse	Catecholamine excess
Renal: Edema, history of urinary tract infection or unexplained fever, abnormal urine color, enuresis, flank pain, dysuria	Reflux nephropathy
Skin: Rash, sweating, pallor	Catecholamine excess
	Thyroid dysfunction
Past medical history: Prior streptococcal infection of pharynx or skin, exposure to sources of enterohemorrhagic E. coli	Post-streptococcal glomerulonephritis-tis, hemolytic uremic syndrome
Medications: Sympathomimetic, oral contraceptives, corticosteroids	Side effects of medication
Substance use: Cocaine, amphetamines, anabolic steroids, phencyclidine, ephedra-containing alternative medications, caffeine	Drug-mediated effects
Family history: HTN, early MI, DM, stroke	Essential HTN
Sexual history: Actively engaged in sexual intercourse (females)	Preeclampsia
Neonatal history: Use of umbilical artery catheters	Renal artery stenosis
Growth history: Excessive weight gain or loss, change in growth percentiles	Obesity, thyroid dysfunction
Dietary history: Types and amount of food ingested, salt craving	Obesity, essential HTN
Social history: Stress factors at home and school	Stress

Table 24: Physical examination findings associated with possible etiology of hypertension in children and adolescents

Physical Examination Finding	*Possible Etiology*
General	
Height and weight	
Obesity	Essential HTN
Truncal obesity	Consider Cushing syndrome, steroid treatment
Growth retardation	Consider chronic renal disease
Vital Signs	
Tachycardia	Catecholamine excess or hyperthyroidism
BP in all extremities	If upper extremity BP >lower extremity BP, consider coarctation of aorta
Head and Neck	
Elfin facies	Williams syndrome
Moon face	Cushing syndrome, steroid treatment

Physical Examination Finding	*Possible Etiology*
Thyroid enlargement	Hyperthyroidism
Webbed neck	Turner syndrome
Tonsillar hypertrophy	Sleep-disordered breathing, sleep apnea
Eye	
Retinal changes	Suggest severe HTN and secondary etiology
Papilledema	Intracranial HTN
Skin	
Acne, hirsutism, striae	Cushing syndrome, steroid treatment
Café-au-lait spots and/or neurofibromas	Neurofibromatosis
Ash leaf spots and/or adenoma sebaceum	Tuberous sclerosis
Rash	Secondary renal disease: lupus
	Henoch-Schönlein purpura
Acanthosis nigricans	DM
Chest	
Murmur	Coarctation of the aorta
Apical heave	LVH
Abdomen	
Abdominal bruit	Renovascular disease
Mass	Hydronephrosis, polycystic kidney disease, renal tumors, neuroblastoma
Extremities	
Pulse	Lower-limb pulse <upper limb, coarctation of aorta
Traction/casts	Orthopedic manipulation
Asymmetry of limbs	Beckwith Wiedeman syndrome
Arthritis	Henoch-Schönlein purpura, collagen vascular disease (lupus)
Neurologic	
Muscle weakness	Liddle syndrome, hyperaldosteronism
Ascending paralysis	Guillain-Barre syndrome, polio
Diminished pain response	Familial dysautonomia
Genitalia	
Ambiguous/virilization	Adrenal hyperplasia
Advanced puberty	Intracranial tumors

Target Blood Pressure Levels in children

In general, the target should be Less than the 90th percentile for age, height, and gender, or < 130/80 mm Hg in adolescents ≥ 13 years old.

Hypertensive Crises among Children:

Please note: The BP reduction in hypertensive emergencies should not exceed 25% over the first 6–8 hours, followed by a further gradual reduction (Tables 25-27).

Table 25: Antihypertensive drugs for hypertensive emergencies and urgencies

Drug	*Minimum Dose*	*Maximum Dose*	*Route*
Sodium nitroprusside	0.5 pg/kg/min initially	10 pg/kg/min	I.V.
Phentolamine	0.02 mg/kg	0.1 mg/kg	I.V.
Diazoxide	Initial 2 mg/kg (1 mg/kg Q10 min)	5 mg/kg	I.V.
Hydralazine	0.15–0.6 mg/kg	6 mg/kg/d	I.V.
Esmolol	500 mcg/kg loading dose, then 200 mcg/kg/min; may increase by 50–100 mcg/kg every 5–10 min	1 mg/kg	I.V.
Labetalol	0.3 mg/kg/dose Q 20 min until BP is controlled, or 1 mg\kg\h as in Fusion	(3 mg/kg) 300 mg/day	I.V.
α-Methyldopa	10 mg/kg	50 mg/kg/d	I.V.
Enalapilat	25–100 mg/kg	Every 6 hours	I.V.
Minoxidil	0.1–0.2 mg/kg	1 mg/kg	PO
Nicardipine	Bolus 30 µg/kg (infusion O.5 µg/kg/min)	Bolus: 2mg/dose infusion: 4 µg/kg/min	IV
Clonidine	2-5 mg/kg/dose	10 mg/kg/ dose Q 6-8	PO

Table 26: Antihypertensive agents for neonates

Oral			
Drug	***Class***	***Dose***	
Hydrochlorothiazide	TZD	2–4 mg/kg per day divided twice a day	
Spironolactone	Aldosterone antagonist	1–3 mg/kg per day divided two to four times a day	
Hydralazine	Vasodilator	0.75–7.5 mg/kg per day divided three or four times a day	
Propranolol	βB	1.0–8.0 mg/kg per day divided three times a day	
Labetolol	α and βB	4.0–40 mg/kg per day divided two or three times a day	
Minoxidil	Vasodilator	0.2–5 mg/kg per day divided two or three times a day	
Captopril	ACEI	0.05–0.5 mg/kg per day divided three times a day	
Amlodipine	LA-DHPCCB	0.05–0.17 mg/kg per dose divided once or twice a day	
Isradipine	LA-DHPCCB	0.05–0.15 mg/kg per dose divided four times a day	
Intravenous			
Drug	***Class***	***Dose***	***Route***
Hydralazine	Vasodilator	0.15–0.6 mg/kg per dose	I.V. Bolus
Labetalol	α and βB	0.20–1.0 mg/kg per dose	I.V. Bolus
		0.25–3.0 mg/kg per hr	I.V. Infusion
Sodium nitroprusside	Vasodilator	0.5–10 µg/kg per min	I.V. Infusion

Enalaprilat	ACEI	5–10 µg/kg per dose	I.V. Bolus

Table 27: Recommended Initial Doses for Selected Antihypertensive Agents for the Management of Hypertension in Children and Adolescents

Class	*Drug*	*Dose*	*Interval*
Diuretics	Amiloride	0.4–0.6 mg/kg per day	q.d.
	Chlorthalidone	0.3 mg/kg per day	q.d.–b.i.d.
	Furosemide	0.5–2.0 mg/kg per dose	q.d.
	TZD	0.5–1 mg/kg per day	q.d.–b.i.d.
	Spironolactone	1 mg/kg per day	q.d.–b.i.d.
ßBs	Atenolol	0.5–1 mg/kg per day	q.d.–b.i.d.
	Metoprolol	0.5–1.0 mg/kg per day	q.d.
	Propanolol	1 mg/kg per day	b.i.d.–t.i.d.
LA-DHP CCBs	Amlodipine	0.06–0.3 mg/kg per day	q.d.
	Felodipine*	2.5 mg/day	q.d.
	Nifedipine Extended Release	0.25–0.5 mg/kg per day	q.d.–b.i.d.
ACEIs	Captopril	0.3–0.5 mg/kg per dose	b.i.d.–t.i.d.
	Enalapril	0.08–0.6 mg/kg per day	q.d.
	Fosinopril	0.1–0.6 mg/kg per day	q.d.
	Lisinopril	0.08–0.6 mg/kg per day	q.d.
	Ramipril*	2.5–6 mg/day	q.d.
ARBs	Candesartan	0.16–0.5 mg/kg per day	q.d.
	Irbesartan*	75–150 mg/day	q.d.
	Losartan	0.75–1.44 mg/kg per day	q.d.
	Valsartan	2 mg/kg per day	q.d.

Note: q.d., once daily; b.i.d., twice daily; t.i.d., three times daily. The maximum recommended adult dose should never be exceeded. No dose referenced to weight is available.

USING THE BLOOD PRESSURE TABLES in Children

1. Use the standard height charts to determine the height percentile.
2. Measure and record the child's SBP and DBP.
3. Use the correct gender table for SBP and DBP.
4. Find the child's age on the left side of the table. Follow the age row horizontally across the table to the intersection of the line for the height percentile (vertical column).
5. Find the 50th, 90th, 95th, and 99th percentiles for SBP in the left columns and for DBP in the right columns.
    - BP less than the 90th percentile indicates a normal blood pressure value.
    - BP between the 90th and 95th percentiles indicates the presence of prehypertension. In adolescents, BP equal to or exceeding 120/80 mmHg is an indication for prehypertension, even if this figure is less than the 90th percentile.
    - BP greater than 95th percentile indicates hypertension.
6. If the BP is greater than the 90th percentile, the BP should be repeated twice at the same office visit, and the average SBP and DBP should be used.
7. If the BP is greater than the 95th percentile, BP should be staged. If Stage 1 (95th percentile to the 99th percentile plus 5 mm Hg), BP measurements should be repeated on two more occasions. If hypertension is confirmed, evaluation should proceed as described in Table 24. If BP is Stage 2 (>99th percentile plus 5 mm Hg), prompt referral should be made for evaluation and therapy. If the patient is symptomatic, immediate referral and

treatment are indicated. Those patients with a compelling indication, as noted in Table 25, would be treated as the next high category of hypertension.

Key notes on HTN management in children and adolescents:

1. Children and adolescents with CKD and HTN should be evaluated for proteinuria.
2. Children and adolescents with CKD, HTN, and proteinuria should be treated with an ACE inhibitor or ARB.
3. Children and adolescents with T1DM or T2DM should be evaluated for HTN at each medical encounter and treated if BP is ≥95th percentile or >130/80 mm Hg in adolescents ≥13 years of age.
4. In children and adolescents with acute severe HTN and life-threatening symptoms, immediate treatment with short-acting antihypertensive medication should be initiated, and BP should be reduced by no more than 25% of the planned reduction over the first 8 hours.
5. Children and adolescents with HTN may participate in competitive sports once hypertensive target organ effects and risk have been assessed AND should receive treatment to lower BP below stage 2 thresholds before participating in competitive sports.

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Blood Pressure Levels for Boys by Age and Height Percentile

BP		Systolic BP(mm Hg)							Diastolic BP(mm Hg) BP						
		"Percentile of Height"							"Percentile of Height"						
(Year)		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	80	81	83	85	87	88	89	34	35	36	37	38	39	39
	90th	94	95	97	99	100	102	103	49	50	51	52	53	53	54
	95th	98	99	101	103	104	106	106	54	54	55	56	57	58	58
	99th	105	106	108	110	112	113	114	61	62	63	64	65	66	66
2	50th	84	85	87	88	90	92	92	39	40	41	42	43	44	44
	90th	97	99	100	102	104	105	106	54	55	56	57	58	58	59
	95th	101	102	104	106	108	109	110	59	59	60	61	62	63	63
	99th	109	110	111	113	115	117	117	66	67	68	69	70	71	71
3	50th	86	87	89	91	93	94	95	44	44	45	46	47	48	48
	90th	100	101	103	105	107	108	109	59	59	60	61	62	63	63
	95th	104	105	107	109	110	112	113	63	63	64	65	66	67	67
	99th	111	112	114	116	118	119	120	71	71	72	73	74	75	75
4	50th	88	89	91	93	95	96	97	47	48	49	50	51	51	52
	90th	102	103	105	107	109	110	111	62	63	64	65	66	66	67
	95th	106	107	109	111	112	114	115	66	67	68	69	70	71	71
	99th	113	114	116	118	120	121	122	74	75	76	77	78	78	79
5	50th	90	91	93	95	96	98	98	50	51	52	53	54	55	55
	90th	104	105	106	108	110	111	112	65	66	67	68	69	69	70
	95th	108	109	110	112	114	115	116	69	70	71	72	73	74	74
	99th	115	116	118	120	121	123	123	77	78	79	80	81	81	82
6	50th	91	92	94	96	98	99	100	53	53	54	55	56	57	57
	90th	105	106	108	110	111	113	113	68	68	69	70	71	72	72
	95th	109	110	112	114	115	117	117	72	72	73	74	75	76	76
	99th	116	117	119	121	123	124	125	80	80	81	82	83	84	84
7	50th	92	94	95	97	99	100	101	55	55	56	57	58	59	59
	90th	106	107	109	111	113	114	115	70	70	71	72	73	74	74
	95th	110	111	113	115	117	118	119	74	74	75	76	77	78	78
	99th	117	118	120	122	124	125	126	82	82	83	84	85	86	86
8	50th	94	95	97	99	100	102	102	56	57	58	59	60	60	61
	90th	107	109	110	112	114	115	116	71	72	72	73	74	75	76
	95th	111	112	114	116	118	119	120	75	76	77	78	79	79	80
	99th	119	120	122	123	125	127	127	83	84	85	86	87	87	88
9	50th	95	96	98	100	102	103	104	57	58	59	60	61	61	62
	90th	109	110	112	114	115	117	118	72	73	74	75	76	76	77
	95th	113	114	116	118	119	121	121	76	77	78	79	80	81	81
	99th	120	121	123	125	127	128	129	84	85	86	87	88	88	89
10	50th	97	98	100	102	103	105	106	58	59	60	61	61	62	63
	90th	111	112	114	115	117	119	119	73	73	74	75	76	77	78

BP		Systolic BP(mm Hg)							Diastolic BP(mm Hg) BP						
		"Percentile of Height"							"Percentile of Height"						
(Year)		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
	95th	115	116	117	119	121	122	123	77	78	79	80	81	81	82
	99th	122	123	125	127	128	130	130	85	86	86	88	88	89	90
11	50th	99	100	102	104	105	107	107	59	59	60	61	62	63	63
	90th	113	114	115	117	119	120	121	74	74	75	76	77	78	78
	95th	117	118	119	121	123	124	125	78	78	79	80	81	82	82
	99th	124	125	127	129	130	132	132	86	86	87	88	89	90	90
12	50th	101	102	104	106	108	109	110	59	60	61	62	63	63	64
	90th	115	116	118	120	121	123	123	74	75	75	76	77	78	79
	95th	119	120	122	123	125	127	127	78	79	80	81	82	82	83
	99th	126	127	129	131	133	134	135	86	87	88	89	90	90	91
13	50th	104	105	106	108	110	111	112	60	60	61	62	63	64	64
	90th	117	118	120	122	124	125	126	75	75	76	77	78	79	79
	95th	121	122	124	126	128	129	130	79	79	80	81	82	83	83
	99th	128	130	131	133	135	136	137	87	87	88	89	90	91	91
14	50th	106	107	109	111	113	114	115	60	61	62	63	64	65	65
	90th	120	121	123	125	126	128	128	75	76	77	78	79	79	80
	95th	124	125	127	128	130	132	132	80	80	81	82	83	84	84
	99th	131	132	134	136	138	139	140	87	88	89	90	91	92	92
15	50th	109	110	112	113	115	117	117	61	62	63	64	65	66	66
	90th	122	124	125	127	129	130	131	76	77	78	79	80	80	81
	95th	126	127	129	131	133	134	135	81	81	82	83	84	85	85
	99th	134	135	136	138	140	142	142	88	89	90	91	92	93	93
16	50th	111	112	114	116	118	119	120	63	63	64	65	66	67	67
	90th	125	126	128	130	131	133	134	78	78	79	80	81	82	82
	95th	129	130	132	134	135	137	137	82	83	83	84	85	86	87
	99th	136	137	139	141	143	144	145	90	90	91	92	93	94	94
17	50th	114	115	116	118	120	121	122	65	66	66	67	68	69	70
	90th	127	128	130	132	134	135	136	80	80	81	82	83	84	84
	95th	131	132	134	136	138	139	140	84	85	86	87	87	88	89
	99th	139	140	141	143	145	146	147	92	93	93	94	95	96	97

Blood Pressure Levels for Girls by Age and Height Percentile

BP		Systolic BP(mm Hg) "Percentile of Height"							Diastolic BP(mm Hg) BP "Percentile of Height"						
(Year)		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
I	50th	83	84	85	86	88	89	90	38	39	39	40	41	41	42
	90th	97	97	98	100	101	102	103	52	53	53	54	55	55	56
	95th	100	101	102	104	105	106	107	56	57	57	58	59	59	60
	99th	108	108	109	111	112	113	114	64	64	65	65	66	67	67
2	50th	85	85	87	88	89	91	91	43	44	44	45	46	46	47
	90th	98	99	100	101	103	104	105	57	58	58	59	60	61	61
	95th	102	103	104	105	107	108	109	61	62	62	63	64	65	65
	99th	109	110	111	112	114	115	116	69	69	70	70	71	72	72
3	50th	86	87	88	89	91	92	93	47	48	48	49	50	50	51
	90th	100	100	102	103	104	106	106	61	62	62	63	64	64	65
	95th	104	104	105	107	108	109	110	65	66	66	67	68	68	69
	99th	111	111	113	114	115	116	117	73	73	74	74	75	76	76
4	50th	88	88	90	91	92	94	94	50	50	51	52	52	53	54
	90th	101	102	103	104	106	107	108	64	64	65	66	67	67	68
	95th	105	106	107	108	110	111	112	68	68	69	70	71	71	72
	99th	112	113	114	115	117	118	119	76	76	76	77	78	79	79
5	50th	89	90	91	93	94	95	96	52	53	53	54	55	55	56
	90th	103	103	105	106	107	109	109	66	67	67	68	69	69	70
	95th	107	107	108	110	111	112	113	70	71	71	72	73	73	74
	99th	114	114	116	117	118	120	120	78	78	79	79	80	81	81
6	50th	91	92	93	94	96	97	98	54	54	55	56	56	57	58
	90th	104	105	106	108	109	110	111	68	68	69	70	70	71	72
	95th	108	109	110	111	113	114	115	72	72	73	74	74	75	76
	99th	115	116	117	119	120	121	122	80	80	80	81	82	83	83
7	50th	93	93	95	96	97	99	99	55	56	56	57	58	58	59
	90th	106	107	108	109	111	112	113	69	70	70	71	72	72	73
	95th	110	111	112	113	115	116	116	73	74	74	75	76	76	77
	99th	117	118	119	120	122	123	124	81	81	82	82	83	84	84
8	50th	95	95	96	98	99	100	101	57	57	57	58	59	60	60
	90th	108	109	110	111	113	114	114	71	71	71	72	73	74	74
	95th	112	112	114	115	116	118	118	75	75	75	76	77	78	78
	99th	119	120	121	122	123	125	125	82	82	83	83	84	85	86
9	50th	96	97	98	100	101	102	103	58	58	58	59	60	61	61
	90th	110	110	112	113	114	116	116	72	72	72	73	74	75	75
	95th	114	114	115	117	118	119	120	76	76	76	77	78	79	79
	99th	121	121	123	124	125	127	127	83	83	84	84	85	86	87

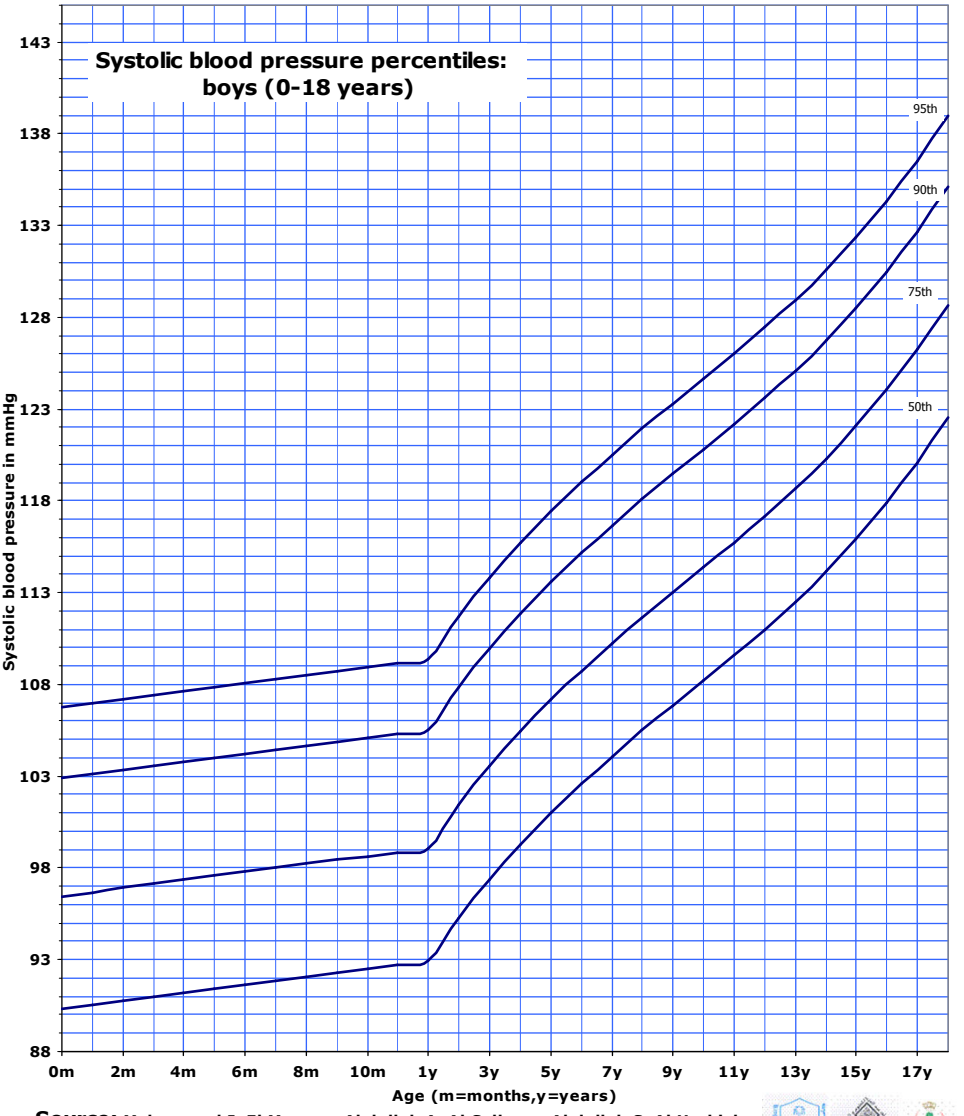
BP		Systolic BP(mm Hg) "Percentile of Height"							Diastolic BP(mm Hg) BP "Percentile of Height"						
(Year)		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
10	50th	98	99	100	102	103	104	105	59	59	59	60	61	62	62
	90th	112	112	114	115	116	118	118	73	73	73	74	75	76	76
	95th	116	116	117	119	120	121	122	77	77	77	78	79	80	80
	99th	123	123	125	126	127	129	129	84	84	85	86	86	87	88
11	50th	100	101	102	103	105	106	107	60	60	60	61	62	63	63
	90th	114	114	116	117	118	119	120	74	74	74	75	76	77	77
	95th	118	118	119	121	122	123	124	78	78	78	79	80	81	81
	99th	125	125	126	128	129	130	131	85	85	86	87	87	88	89
12	50th	102	103	104	105	107	108	109	61	61	61	62	63	64	64
	90th	116	116	117	119	120	121	122	75	75	75	76	77	78	78
	95th	119	120	121	123	124	125	126	79	79	79	80	81	82	82
	99th	127	127	128	130	131	132	133	86	86	87	88	88	89	90
13	50th	104	105	106	107	109	110	110	62	62	62	63	64	65	65
	90th	117	118	119	121	122	123	124	76	76	76	77	78	79	79
	95th	121	122	123	124	126	127	128	80	80	80	81	82	83	83
	99th	128	129	130	132	133	134	135	87	87	88	89	89	90	91
14	50th	106	106	107	109	110	111	112	63	63	63	64	65	66	66
	90th	119	120	121	122	124	125	125	77	77	77	78	79	80	80
	95th	123	123	125	126	127	129	129	81	81	81	82	83	84	84
	99th	130	131	132	133	135	136	136	88	88	89	90	90	91	92
15	50th	107	108	109	110	111	113	113	64	64	64	65	66	67	67
	90th	120	121	122	123	125	126	127	78	78	78	79	80	81	81
	95th	124	125	126	127	129	130	131	82	82	82	83	84	85	85
	99th	131	132	133	134	136	137	138	89	89	90	91	91	92	93
16	50th	108	108	110	111	112	114	114	64	64	65	66	66	67	68
	90th	121	122	123	124	126	127	128	78	78	79	80	81	81	82
	95th	125	126	127	128	130	131	132	82	82	83	84	85	85	86
	99th	132	133	134	135	137	138	139	90	90	90	91	92	93	93
17	50th	108	109	110	111	113	114	115	64	65	65	66	67	67	68
	90th	122	122	123	125	126	127	128	78	79	79	80	81	81	82
	95th	125	126	127	129	130	131	132	82	83	83	84	85	85	86
	99th	133	133	134	136	137	138	139	90	90	91	91	92	93	93

Figure 2: Pediatric SBP Percentile Chart for Males

Blood Pressure Reference for Saudi Children and Adolescents

Name:……

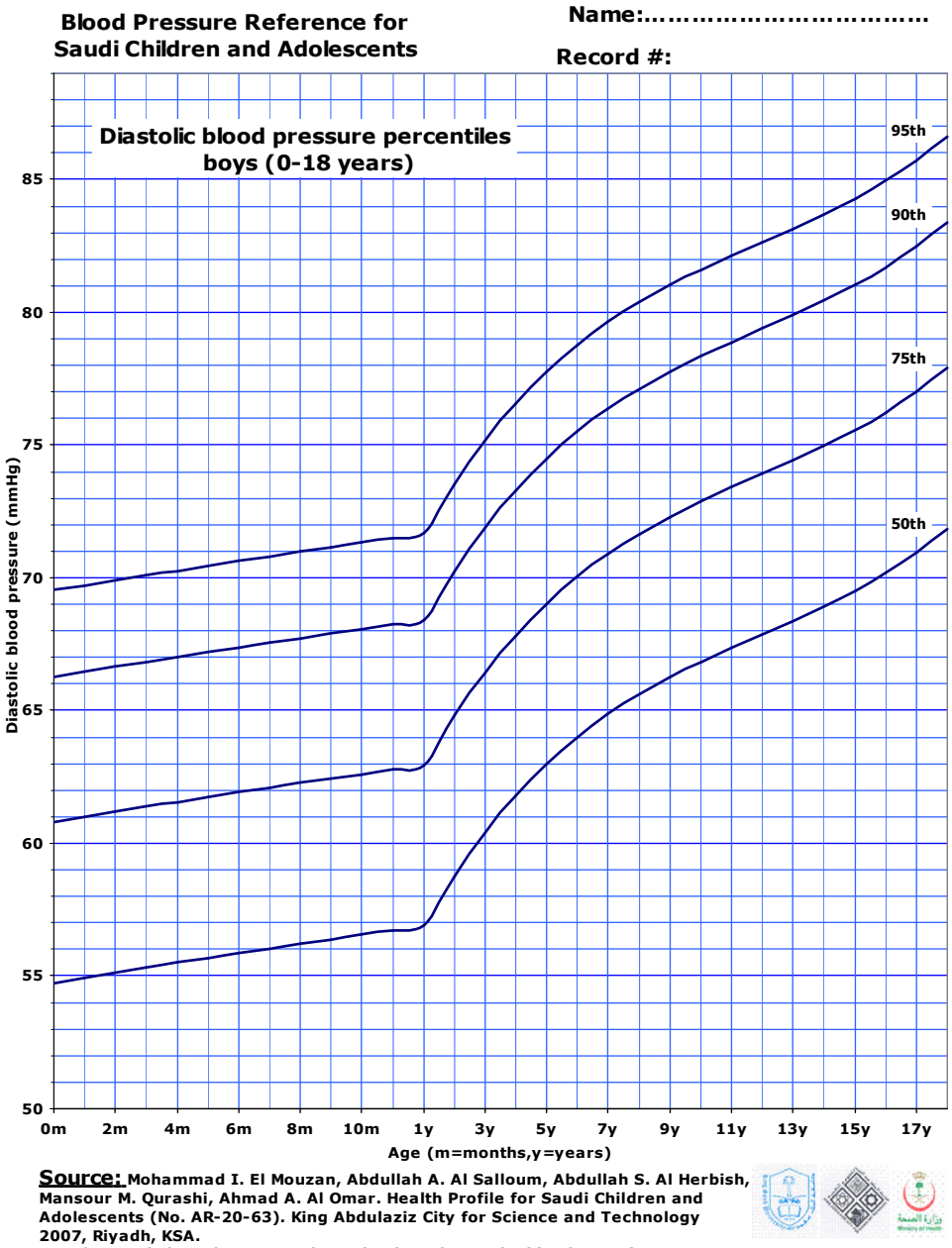
Record #……



Source: Mohammad I. El Mouzan, Abdullah A. Al Salloum, Abdullah S. Al Herbish, Mansour M. Qurashi, Ahmad A. Al Omar. Health Profile for Saudi Children and Adolescents (No. AR-20-63). King Abdulaziz City for Science and Technology 2007, Riyadh, KSA.

NB: - The age is based on Gregorian calender.The method is electronic.

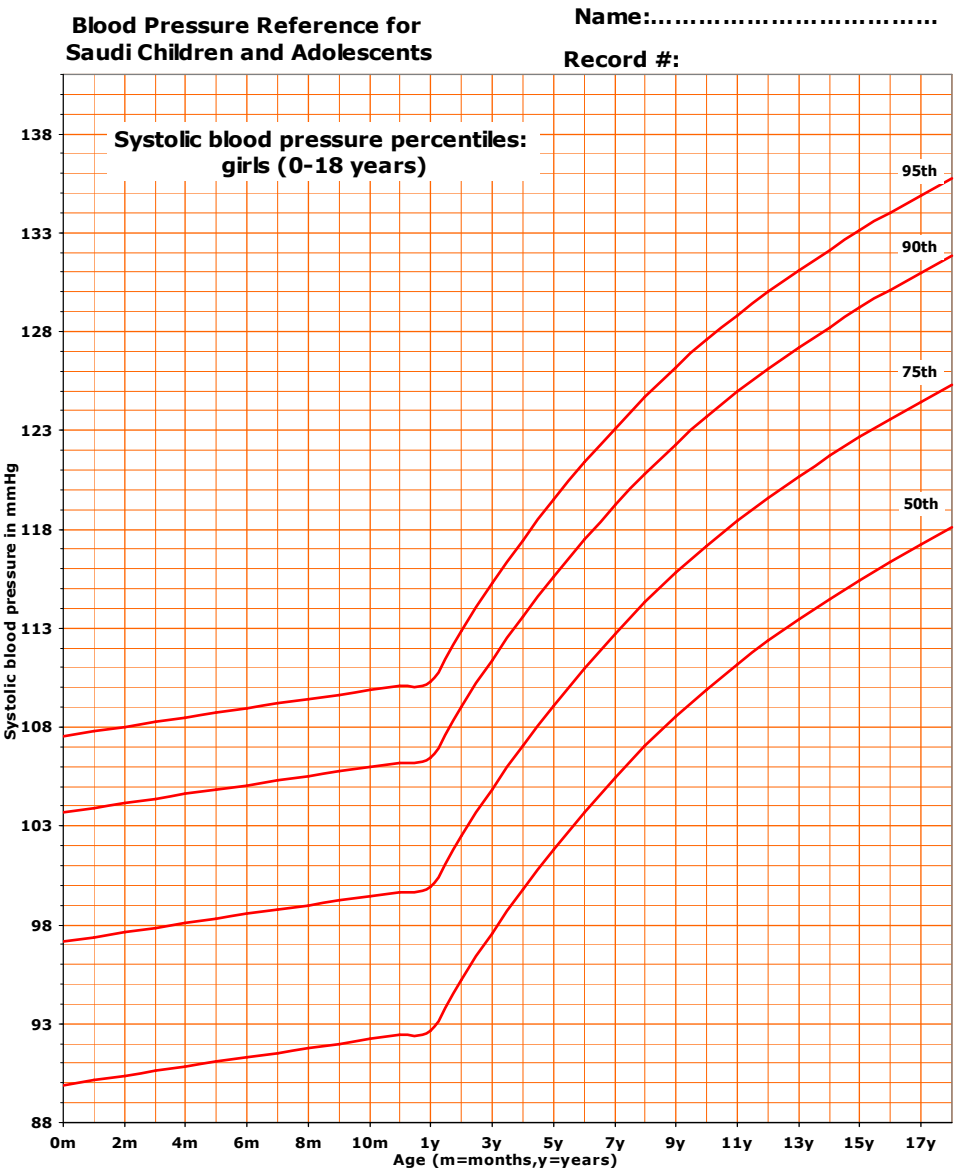
Figure 3: Pediatric DBP Percentile Chart for Males



Source: Mohammad I. El Mouzan, Abdullah A. Al Salloum, Abdullah S. Al Herbish, Mansour M. Qurashi, Ahmad A. Al Omar. Health Profile for Saudi Children and Adolescents (No. AR-20-63). King Abdulaziz City for Science and Technology 2007, Riyadh, KSA.

NB: The age is based on Gregorian calender. The method is electronic.

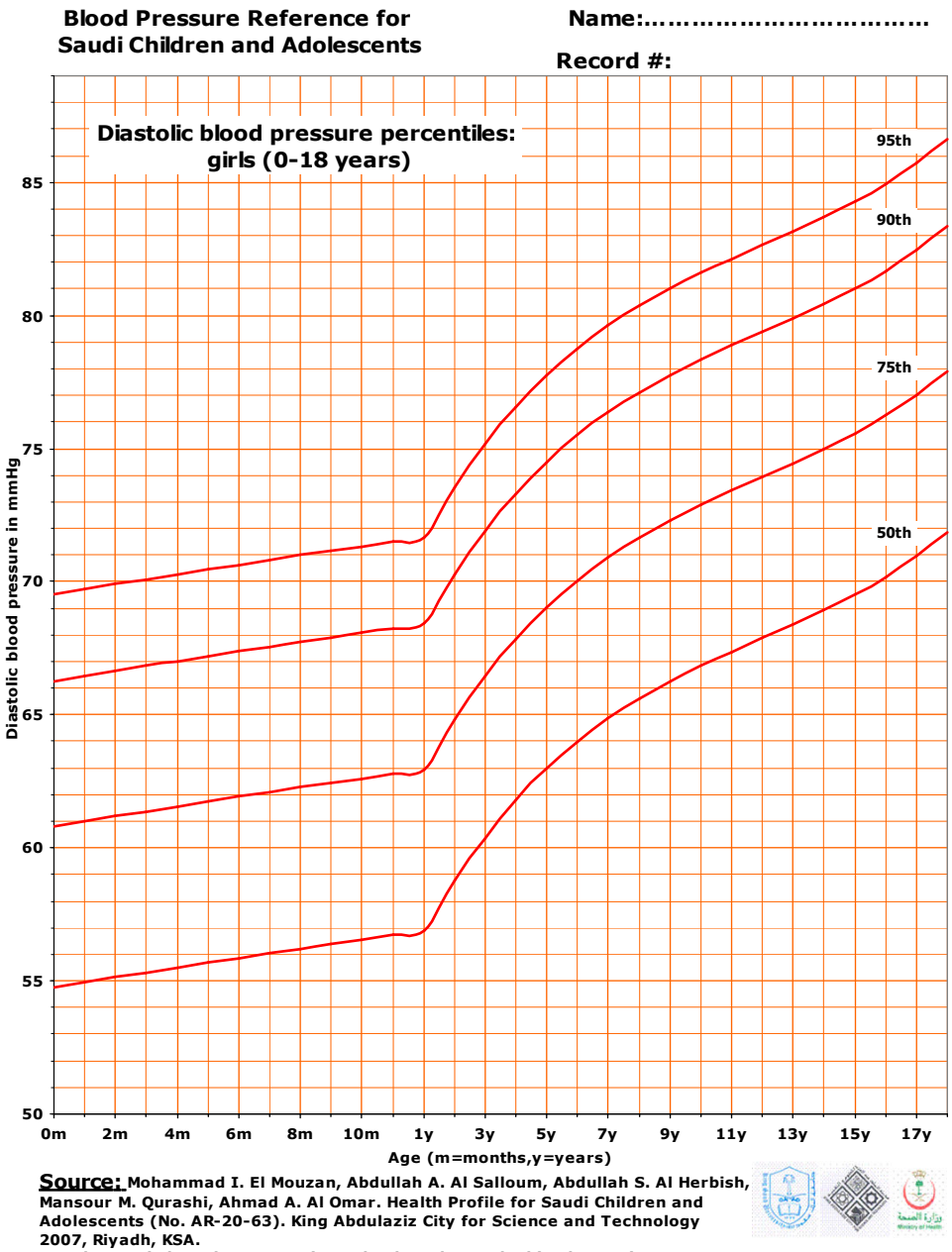
Figure 4: Pediatric SBP Percentile Chart for Females



Source: Mohammad I. El Mouzan, Abdullah A. Al Salloum, Abdullah S. Al Herbish Mansour M. Qurashi, Ahmad A. Al Omar. Health Profile for Saudi Children and Adolescents (No. AR-20-63). King Abdulaziz City for Science and Technology 2007 Riyadh, KSA.

NB: The age is based on Gregorian calender. The method is electronic.

Figure 5: Pediatric DBP Percentile Char for Females



Source: Mohammad I. El Mouzan, Abdullah A. Al Salloum, Abdullah S. Al Herbish, Mansour M. Qurashi, Ahmad A. Al Omar. Health Profile for Saudi Children and Adolescents (No. AR-20-63). King Abdulaziz City for Science and Technology 2007, Riyadh, KSA.

NB: The age is based on Gregorian calender. The method is electronic.

Chapter 27

HYPERTENSION IN WOMEN

Cardiovascular disorders in women are underestimated because only 24% of all CV trials report sex-specific results and the representation of women in RCTs in hypertension is 44%.

The prevalence of HTN is lower in premenopausal women than men, whereas in postmenopausal women it is higher than that of men.

1) Hypertension in postmenopausal women:

Almost 50% of postmenopausal women are hypertensive. Mechanism of hypertension in these women include: loss of estrogen, increased oxidative stress, endothelial dysfunction, RAAS and sympathetic system activation.

2) Hypertension and the use of oral contraceptive pills:

Hypertension is two to three times more frequent in women who take oral contraceptives than those who do not.

Use of oral contraceptives (OCs) is associated with some small but significant elevation in BP and with the development of hypertension in about 5% of users of older-generation OCs, with relatively higher estrogen doses compared with those currently used.

Increased susceptibility to OC-induced HTN is associated with obesity, age >35 years, preexisting pregnancy induced HTN, CKD, progestin potency, and the duration of OC use (but with a return within 3 months of discontinuation to pretreatment values).

OCs should be selected and initiated by weighing risks and benefits for the individual patient.

3) Hypertension and the Use of Hormone replacement therapy:

Hormone replacement therapy (HRT) and selective estrogen receptor modulators should not be used for primary or secondary prevention of CVD.

If HRT is used by younger, perimenopausal women for severe menopausal symptoms, the benefits should be weighed against potential risks of HRT.

Recent data suggest that HRT is associated with only a small risk in menopausal hypertensive women. It is advisable to monitor BP after starting hormone replacement therapy.

4) HTN in Pregnancy and postpartum **(Refer to page 79).**

References

1. Leuzzi C, Modena MG. Hypertension in Postmenopausal Women. High Blood Pressure & Cardiovascular Prevention. 2011 Mar 1;18(1):13-8.
2. Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, Böhm M, Christiaens T, Cifkova R, De Backer G, Dominiczak A, Galderisi M. 2013 ESH/ESC practice guidelines for the management of arterial hypertension. Blood Pressure. 2014 Feb 1;23(1):3-16.

Chapter 28

HYPERTENSION AND PREGNANCY

Hypertension is a common medical problem faced in pregnancy. It complicates up to 10% of pregnancies, and it is a major contributor to perinatal and **maternal morbidity** and **mortality**.

The Society of Obstetricians and Gynecologists of Canada (SOGC) issued the following recommendations for the diagnosis of hypertension in pregnancy (1):

- The diagnosis of hypertension should be based on office or in-hospital BP measurements (Grade 2B).
- Hypertension in pregnancy should be defined as a diastolic BP of 90 mm Hg, based on the average of at least two measurements taken using the same arm (Grade 2B).
- Women with a systolic BP of 140 mm Hg should be followed closely for development of diastolic hypertension (Grade 2B).
- Severe hypertension should be defined as a systolic BP of 160 mmHg or a diastolic BP of 110 mm Hg (Grade 2B).
- For non-severe hypertension, serial BP measurements should be recorded before a diagnosis of hypertension is made (Grade 2B).
- For severe hypertension, a repeat measurement should be taken for confirmation in 15 minutes (Grade 3B).
- Isolated office (white coat) hypertension should be defined as office diastolic BP of 90 mm Hg, but home BP of <135/85 mm Hg (Grade 3B).

The American College of Obstetricians and Gynecologists (ACOG) continues to classify hypertension in pregnancy into four major disorders (2): **Preeclampsia-eclampsia, Chronic hypertension, Preeclampsia-eclampsia superimposed upon chronic hypertension, and Gestational hypertension.**

Diagnostic criteria for preeclampsia (2):

Blood pressure	• Greater than or equal to 140 mm Hg systolic or greater than or equal to 90 mm Hg diastolic on 2 occasions at least 4 hours apart after 20 weeks of gestation in a woman with a previously normal blood pressure. • Greater than or equal to 160 mm Hg systolic or greater than or equal to 110 mm Hg diastolic, hypertension can be confirmed within a short interval (minutes) to facilitate timely antihypertensive therapy.
AND	
Proteinuria	• Greater than or equal to 300 mg per 24-hour urine collection (or this amount extrapolated from a timed collection) Or • Protein/creatinine ratio greater than or equal to 0.3 • Dipstick reading of +1 (used only if other quantitative methods are not available)
OR, in the absence of proteinuria, new-onset hypertension with the new-onset of any of the following:	
Thrombocytopenia	• Platelet count less than 100,000/µL
Renal insufficiency	• Serum creatinine concentration greater than 1.1 mg/dL or a doubling of a serum creatinine concentration in the absence of other renal disease
Impaired liver function	• Elevated blood concentration of liver transaminases to twice the normal concentration
Pulmonary edema	
Cerebral or visual symptoms	

Chronic Hypertension

Chronic hypertension is observed in up to 5% of pregnant women. It is defined as either a systolic BP of 140 mm Hg or greater, and/or a diastolic BP of 90 mm Hg or greater. It is further categorized as mild to moderate: systolic 140–159 mm Hg or diastolic 90–109 mm Hg, or severe: systolic ≥160 mm Hg or diastolic ≥110 mm Hg.

Although pregnancy complications are more likely to occur in patients with preeclampsia/eclampsia superimposed upon chronic hypertension, chronic hypertension alone is still associated with pregnancy complications. These include 13%–40% risk of developing superimposed preeclampsia, increased risk of accelerated hypertension and resultant end organ damage, increase risk of cesarean section, postpartum hemorrhage, placental abruption, perinatal mortality, and fetal growth restriction. These risks were even higher in women with severe preexisting hypertension in the first trimester.

Management of Chronic Hypertension in Pregnancy

- SOGC recommends for women with chronic hypertension without comorbid conditions and blood pressure of 140–159/90–109 mm Hg, antihypertensive drug therapy should be used to keep systolic blood pressure at 130–155 mm Hg and diastolic blood pressure at 80–105 mm Hg. For women with chronic hypertension with comorbid conditions, antihypertensive drug therapy should be used to keep systolic blood pressure at 130–139 mm Hg and a diastolic blood pressure at 80-89 mm Hg (1).
- The goals of treatment of severe chronic hypertension in pregnancy are to protect the mother from serious complications such as stroke, heart failure, or renal failure (Grade 1B), to maintain a healthy pregnancy, and to reduce the risks to the fetus from uteroplacental insufficiency and medications.
- In patients entering the pregnancy with well controlled mild to moderate hypertension, discontinuing therapy in the first trimester and reinitiating it once the blood pressure starts to increase is a safe option.

Choice of medications

ACOG Task Force on Hypertension in Pregnancy recommends labetalol, nifedipine, or methyldopa as first-line therapy. They also suggest avoiding angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, renin inhibitors, and mineralocorticoid receptor antagonists (2).

Methyldopa has been extensively studied with a very good safety profile, even after up to 7 years follow up of exposed children.

Labetalol is a very good medication but should be avoided in patients with asthma, heart disease, and congestive heart failure. Its use is associated with an increased risk of small-for-gestational-age fetuses (SGA) with RR (3).

Calcium channel blockers appear to be safe for use in pregnancy. Sustained release long-acting nifedipine appears to be effective and safe. Administration of immediate release nifedipine, either orally or sublingually, is not recommended during pregnancy for treatment of hypertension because it may cause significant, rapid decreases in blood pressure.

Hydralazine can also be used; however, it causes reflex tachycardia and fluid retention, which limit its usefulness in pregnancy.

Thiazide diuretics use during pregnancy has been controversial, but some guidelines suggest that these agents can be continued in women with chronic hypertension who were taking them prior to pregnancy.

Management of Preeclampsia

The definitive treatment of preeclampsia is delivery, which is always beneficial for the mother, but might be hazardous for the fetus especially with early onset preeclampsia.

Therefore, conservative management might be considered in few selected cases to ensure fetal maturity.

Preeclampsia is a systemic disease and not only hypertension. The patient is at increased risk of many complications such as eclamptic fits, thrombocytopenia, cerebral hemorrhage, pulmonary edema, liver hemorrhage, and acute kidney injury. This is in addition to obstetric complications including placental abruption, intrauterine growth restriction, and stillbirth.

Drug therapy for Preeclampsia

- The only benefit of treating mild hypertension in preeclampsia is to reduce the risk of developing severe hypertension, and to prevent maternal vascular complications (eg, stroke, heart failure), but it does not affect the course of preeclampsia. The risk to the mother from no treatment should be weighed against the risk of the medications to the fetus.
- Antihypertensive therapy is usually initiated at systolic pressures ≥150 mm Hg or diastolic pressures ≥100 mm Hg.
- Treatment may be initiated earlier in women with signs of cardiac decompensation or cerebral symptoms (e.g., severe headache, visual disturbances, chest discomfort, shortness of breath, confusion) and in younger women whose baseline blood pressures were low (less than 90/75 mm Hg), and in patients remote from term where conservative management is planned.
- Target blood pressures are 130–150 mm Hg systolic and 80–100 mm Hg diastolic.
- Cerebral or myocardial ischemia or infarction can be induced by aggressive antihypertensive therapy if the blood pressure falls below the range at which tissue perfusion can be maintained by autoregulation. Therefore, care should be taken to avoid a sudden rapid drop in blood pressure (4).
- The indications for and choice of antihypertensive therapy in women with gestational hypertension are the same as for women with preeclampsia.

Choice of medications:

Antihypertensive therapy is used in preeclampsia in two settings:

- Long-term blood pressure control during expectant management of preeclampsia
- Acute management of severe hypertension

Long-term oral therapy for expectant management of preeclampsia:

The National Institute for Health and Clinical Excellence (NICE) (5) recommend labetalol as the recommended first-line therapy. The alternative therapy includes methyldopa and nifedipine.

Acute management of severe hypertension (1,6):

Labetalol or hydralazine are appropriate first-line therapy (Grade 2B).

- Labetalol: intravenous labetalol is a recommended first-line therapy because it is effective, has a rapid onset of action, and a good safety profile. The recommended dose is to begin with 20 mg intravenously over 2 minutes followed at 10-minute intervals by doses of 20–80 mg up to a maximum total cumulative dose of 300 mg.
- Hydralazine: 5 mg intravenously over 1 to 2 minutes; if the blood pressure goal is not achieved within 20 minutes, 5–10 mg bolus dose can be added. The maximum bolus dose is 20 mg. If a total dose of 30 mg does not achieve optimal blood pressure control, another agent should be used. The fall in blood pressure begins within 10–30 minutes and lasts 2–4 hours.
- Calcium channel blockers: Nifedipine 10 mg orally can be administered at 20-minute intervals until the target blood pressure is achieved. Usually only 2 doses will be required. Nicardipine can be administered intravenously. Experience with these drugs in pregnancy is more limited than for labetalol and hydralazine

- Nitroglycerin: is a good option for the treatment of hypertension associated with pulmonary edema. It is given as an intravenous infusion of 5 mcg/min and gradually increased every 3–5minutes to a maximum dose of 100 mcg/min (7).

Management of Eclampsia:

If the patient develops eclamptic fit, management should include control of seizures, correction of hypoxia and acidosis, control of severe hypertension, assessment of neurologic status, and if antepartum, delivery after maternal stabilization. The ideal anticonvulsant therapy is magnesium sulfate (MgSO4) infusion for seizure prevention when severe preeclampsia or eclampsia is suspected, and following an eclamptic fit to prevent further fits (8).

The usual dose for MgSO4 is as follows: 4–6 grams IV loading dose over 20 minutes, followed by 2gm/hour as a continuous intravenous infusion via pump, and to continue for 24 hours postpartum.

Drugs contraindicated in pregnancy

Angiotensin converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARBs), and direct renin inhibitors are contraindicated at all stages of pregnancy because they are associated with significant fetal renal abnormalities when maternal exposure has been in the latter half of pregnancy, and first trimester exposure has been associated with fetal cardiac abnormalities. Therefore, it is best to avoid initiating these drugs during pregnancy and to discontinue these agents in women planning pregnancy and switch to another agent (9).

There is limited clinical experience with Nitroprusside. There is possibility of fetal cyanide poisoning. It should be the agent of last resort for urgent control of refractory severe hypertension; its use should be limited to a short period in an emergency.

Drugs and breastfeeding

- BBs, alpha/beta-blockers, calcium channel blockers are compatible with breastfeeding.
- ACE inhibitors are transferred into milk at very low levels. Captopril and enalapril have been reviewed by the American Academy of Pediatrics (AAP) and are compatible for use in lactation, but should be avoided in newborns susceptible to hemodynamic instability.
- Diuretics may theoretically reduce milk volume, but the AAP considers their use compatible with breastfeeding.

Postpartum Hypertension

Postpartum hypertension may be owing to persistence of antepartum or intrapartum hypertension, or may be of new onset. Preeclampsia-related hypertension usually resolves spontaneously within a few weeks (average 16 ± 9.5 days) and is almost always gone by 12 weeks postpartum (10). Some cases may take as long as six months to resolve. Hypertension that persists beyond this period should be evaluated and treated as in any non-pregnant woman. Oral medications like those used in the non-pregnant population can be prescribed, with modifications if the woman is breastfeeding. Methyldopa is best avoided postpartum because of the risk of postnatal depression.

NICE guidelines (5) recommend to start antihypertensive treatment if blood pressure is 150/100 mm Hg or higher in the postpartum period in women with preeclampsia who did not receive antihypertensive medications during pregnancy. For women with preeclampsia who have taken antihypertensive treatment and have given birth, the recommendation is to continue antenatal antihypertensive treatment and to consider reducing antihypertensive treatment if their blood pressure falls below 140/90 mm Hg. Methyldopa, if used to treat preeclampsia, should be stopped within 2 days of birth (10).

Prevention of Preeclampsia

- The Society of Obstetricians and Gynecologists of Canada (1) recommend the following for the prevention of preeclampsia: low-dose aspirin (Grade IA) and calcium supplementation (of at least 1 g/d) for women with low calcium intake (Grade IA).
- The National Institute for Health and Clinical Excellence (NICE) (5) recommend 75 mg of aspirin daily from 12 weeks until the birth of the baby for all women at high risk of preeclampsia. They also recommend for women with more than one moderate risk factor for preeclampsia to take 75 mg of aspirin daily from 12 weeks until the birth of the baby (4).
- The American Heart Association (AHA)/American Stroke Association (ASA) endorsed these recommendations (11): women with chronic primary or secondary hypertension or previous pregnancy-related hypertension should take low dose aspirin during pregnancy to reduce the risk of developing preeclampsia. Calcium supplementation may be useful to decrease blood pressure and prevent preeclampsia in women with low dietary calcium intake.

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Chapter 29

HYPERTENSION IN ELDERLY & OTHER POPULATIONS

HYPERTENSION IN ELDERLY

- Elderly individuals are aged >65 years, while very elderly are aged >80 years.
- HTN is very common in elderly, reaching 70%.
- Isolated systolic HTN is the most common type of HTN in elderly. Arterial stiffness play a major role in pathogenesis.
- It is characterized by increased comorbidities, more white-coat effect, increased BP variability, poor adherence to medications, changes in pharmacokinetic and pharmacodynamic status, increased risk of postural hypotension, and polypharmacy.
- BPM should include standing BP in addition to sitting BP.
- BP threshold to start treatment is SBP ≥160 mm Hg.
- BP goal should be individualized with the aim of SBP <150 mm Hg. In healthy elderly SBP <140 mm Hg may be aimed, if tolerated.
- First line of therapy may include thiazide, CCB-DHP, and ARB.
- It is recommended to start medications in smaller doses. In addition, they should be titrated slowly to avoid postural hypotension.

HYPERTENSION IN OTHER POPULATIONS

Socioeconomic factors and lifestyle may influence BP control. Moreover, there are no published studies addressing BP control in some populations in Saudi Arabia.

American studies have indicated that prevalence, severity, and impact of HTN are increased in African-Americans, who also demonstrate reduced BP responses to monotherapy with βB, ACEI, or ARB compared with diuretics or CCB.

Southeast Asian patients tend to consume large amounts of monosodium glutamate that may interfere with BP control.

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Chapter 30

HYPERTENSIVE CRISES

Hypertensive emergency is a significantly, elevated blood pressure (SBP >180 mm Hg and/or DBP >120 mm Hg) with acute, ongoing target-organ damage. However, it is important to note that there is no BP threshold beyond which organ damage develop as patients differ in their autoregulation. In contrast; hypertensive urgency is elevated blood pressure (SBP >180 mm Hg and/or DBP >120 mm Hg) without acute organ damage.

Heart Failure, acute coronary syndromes and strokes are among the most common clinical presentations.

The need to lower blood pressure should be balanced with risk of reduced perfusion as some patients are accustomed to high perfusion pressure. In most hypertensive emergencies, the mean blood pressure should be lowered in the first hour by 10%–20% followed by a 5%–15% drop in the subsequent 23 hours. The main exceptions are:

- Patients with acute aortic dissection: SBP should rapidly be lowered to a goal of 100–120 mm Hg within 20 minutes.
- Patients with acute ischemic stroke: blood pressure should not be lowered unless it is >185/110 mm Hg for those who are candidates for reperfusion therapy, and >220/120 mm Hg for those who are not candidates for reperfusion therapy.

Hypertensive emergencies should be treated in intensive care unit followed by oral therapy in the general floor. The initial therapy is shown in Table 28. It is essential to note that the practice of administering sublingual nifedipine is dangerous and therefore should not be done at all.

In patients with hypertensive urgencies, blood pressure should be lowered over the next few hours to days. Hospital admission is not always required but may be considered in patients with adherence issues or in those suspected to have secondary hypertension. Therapy can be started with single drug or a combination of two drugs; drug choice should be guided by the presence of other co-morbidities as shown in *page 36*. Follow up within few days should be secured.

Table 28 Recommended initial therapy for hypertensive emergencies

Clinical Presentation	Initial Treatment
Heart Failure	Furosemide 40 mg IV followed by IV Nitroglycerine starting at 5 mcg/min
Acute coronary syndromes	Nitroglycerine 5 mg sublingual followed by IV Nitroglycerine starting at 5 mcg/min
Dissecting aortic aneurysm	Labetalol 20 mg IV or Nitroprusside 0.25–1 mcg/kg/min
Intracerebral or Subarachnoid hemorrhage	Labetalol 20 mg IV or Nitroprusside 0.25–1 mcg/kg/min or nicardipine 5 mg/ hr.
Eclampsia	Hydralazine 10 mg I.V. slowly or Labetalol 20 mg I.V
Hypertensive encephalopathy	Labetalol 20 mg IV or Nitroprusside 0.25–1 mcg/kg/min or nicardipine 5 mg/ hr.

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