الجمعية السعوديه لرعاية ضغط الدم

Saudi Hypertension Management Society Guidelines

2011

Synopsis

Honorary President, His Highness Prince Sultan Bin Mohammad Bin Saud Alkabeer
The **Saudi Hypertension Management Society (SHMS)**, under the supervision of the **Saudi Commission for Health Specialties**

King Fahd National Library Cataloguing-in-Publication Data

Saudi Arabia. Saudi Hypertension Management Society
Saudi Hypertension Management Guidelines, 2011:
Synopsis/Saudi Arabia,
Saudi Hypertension Management Society—
Riyadh, SA, 2011

ISBN: 9960-9518-6-3

1-Hypertension-Management-SA
2-Lifestyle Modifications
3-Cardiovascular Risk Factors
1-Title 616.13209531 dc
1425/4131L.D. no. 1425/4131
ISBN: 9960-9518-6-3

Third Edition, 2011

Saudi Hypertension Management Society Guidelines

2011

Synopsis

The Society appreciates the unconditional and professional support of Novartis.

Abbreviations

αBs	Alpha-Blockers	ECG	Electrocardiogram
ACCs	Associated Clinical Conditions	HDL-c	High Density Lipoprotein Cholesterol
ACE-Is	Angiotensin-Converting Enzyme Inhibitors	HTN	Hypertension
ARBs	Angiotensin Receptor Blockers	IS-HTN	Isolated Systolic Hypertension
βBs	Beta-Blockers	I.V.	Intravenous
BMI	Body Mass Index	LA-DHP	Long-Acting Dihydropyridine
BP	Blood Pressure	LDL-c	Low Density Lipoprotein Cholesterol
CBC	Complete Blood Count	LSM	Life Style Modification
CCBs	Calcium Channel Blockers	LV	Left Ventricle
CHD	Coronary Heart Disease	LVH	Left Ventricular Hypertrophy
CHF	Congestive Heart Failure	MetSyn	Metabolic Syndrome
CKD	Chronic Kidney Disease	MI	Myocardial Infarction
CPGs	Clinical Practice Guidelines	NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
CV	Cardiovascular	OCs	Oral Contraceptives
CVD	Cardiovascular Disease	OSA	Obstructive Sleep Apnea
CVRD	Cardiovascular Renal Disease	PAD	Peripheral Arterial Disease
CV-RFs	Cardiovascular Risk Factors	SBP	Systolic Blood Pressure
DASH	Dietary Approaches to Stop Hypertension	THZ-D	Thiazide Diuretic
DBP	Diastolic Blood Pressure	TIA	Transient Ischemic Attack
DM	Diabetes Mellitus	TOD	Target Organ Damage

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

Table of Contents*

*Please refer to our website for more information: www.saudi-hypertension.org
E-mail address: main@saudi-hypertension.org

Preface by the Minister of Health

Our country aspires to establish a sustainable, systematic health development process to all its citizens, including prevention of common diseases and their complications, to ensure public well-being. Therefore, the ***Government of the Custodian of the Two Holy Mosques*** is keen to focus on creating mechanisms with a view to improve and implement an adequate range of comprehensive health services programs through the Ministry of Health and other related health institutions.

As a result, the Ministry of Health has adopted many health policies and programs to prevent, detect, evaluate, and treat noncommunicable diseases, one of which is HTN. This disease affects 20% of the Saudi population, children and adults alike, and is the leading cause of CV, cerebrovascular, and renal morbidities and mortalities.

The ***Saudi Hypertension Management Society (SHMS)*** plays an important role in translating CPGs and programs into practical plans of action, unified in a protocol for early diagnosis and proper management of this health dilemma and its complications. Another role for ***SHMS*** is the development of national awareness and educational programs addressed to healthcare professionals and the general public for primary prevention of HTN and the MetSyn complex.

SHMS, in collaboration with the ***Ministry of Health*** and interested groups, aims to develop research and an evidence-based knowledge database specific for issues related to our culture and heritage, such as the relation of this disease to Ramadan fasting and Hajj, to reduce the spread of the disease in children and adolescents.

SHMS shall develop locally adopted rules and regulations to measure and control HTN based on scientific evidence and local circumstances. Such rules and regulations will be disseminated throughout the country with the support and participation of existing programs and organizations.

The ***Ministry of Health*** intends to integrate national CPGs for HTN throughout the country at governmental and nongovernmental organizations as a means of continuous quality improvement on the prevention, detection, and control of HTN.

In this regard, I would like to express my appreciation to the members of ***SHMS*** for their efforts in developing these CPGs for direct use by healthcare providers.

May all of us pray to Allah, the Almighty, for more success.

Professor Abdullah Al Rabeeah, MD, FRCSC
Minister of Health
Kingdom of Saudi Arabia

Prologue

The World Health Organization has indicated that elevated BP is the leading risk for death, predicting an epidemic of HTN and advocating for prevention and treatment programs as a priority. Worldwide, over 7 million deaths in the year 2000 were attributed to suboptimum BP control.

HTN affects more than 20% of the adult Saudi population, with expected increasing prevalence. It is an important modifiable RF for CV. Despite overwhelming evidence that lowering BP reduces morbidity and mortality, its management remains frequently suboptimal. This is largely due to a sinister combination of poor patient compliance and healthcare providers' indifference. ***SHMS*** was established in 2001 to develop CPGs for the management of HTN in Saudi Arabia. The following CPGs were based on the best available evidence in the literature and in accordance with the recent national and international CPGs for management of HTN at the end of 2010.

A special chapter each is devoted to the correct measurement of BP; for example, the pediatric group with age-specific recommendations, elderly hypertensive patients, and patients with other diseases. A list of medications for the treatment of HTN is currently available in the market in Saudi Arabia has been updated. Diagnosis of HTN is the most important factor in the population-related effort to control the disease and, as an implementation of any CPGs, remains the most critical step. Gaining support of the health authorities is mandatory to accomplish our goals. The ***Ministry of Health***, represented by its General Directorate for Non-Communicable Diseases, welcomed the establishment of the Society and supported these CPGs and the ***SHMS*** mission.

The ***Ministry of Health*** issued an order to integrate the national CPGs for the management of HTN throughout all institutions of the Ministry. Our Society worked on the translation of updated CPGs into practical actions and protocols to optimally prevent, detect, and treat HTN in Saudi Arabia. Collaboration with the ***Ministry of Health***'s national program for the prevention and management of MetSyn and its complications (Taj Al Seha) is ongoing.

Our Society was honoured by the Saudi Commission for Health Specialties in 2008 and recognized as the professional society for the management of HTN in Saudi Arabia.

We received a welcome affiliation with the International Society of Hypertension.

It is up to our members to help put life into the CPGs with steady work to implement them in the daily routines of physicians caring for hypertensive patients.

Dr. Osman Alfurayh, MD, CPE
Chairman, Saudi Hypertension Management Society

The Need for Specific Guidelines for the Management of Hypertension in Saudi Arabia

This is our third updated Saudi HTN CPGs. Our experience over the last six years, since our first release of the first CPGs, has enhanced the need for CPGs specific to our country. This update gives several public organizations a key instrument to recommend our CPGs to be the official CPGs for their healthcare facilities. It has been used as the basis for a nationwide program for prevention of HTN and for a long-term study on HTN and the impact of the implementation of the CPGs on the spread of knowledge of HTN among healthcare providers and the general public on the leading RFs for mortalities.[1] HTN, which affects about 21% of all Saudi adults between the ages of 18 and 64 years,[2] is an important modifiable RF for CVD. Despite evidence that controlling HTN lowers the risk of CV events and death,[3] its management frequently remains suboptimal (both nationally and internationally). Unfortunately, there is inconsistent application of scientific evidence and significant interphysician variability in the management of individuals with HTN in a country where practicing physicians have a broad training background.

CPGs have become increasingly popular in the literature and are commonly cited as potential means to close such gaps between scientific evidence and clinical practice.[4] However, several surveys have shown a limited enthusiasm for CPGs among practicing physicians. In keeping with this limited enthusiasm, the evidence is mixed as to whether CPGs affect physicians' prescribing patterns. The only study evaluating physicians' use of antihypertensives directly before and after the publication of CPGs surprisingly demonstrated a decline in the prescription of the CPG-recommended drugs (THZ-D and ßBs) and a concomitant increase in the prescriptions of newer agents.[5] Although a similar study has not been undertaken in Saudi Arabia, the patterns observed in practice suggest resistance to change in antihypertensive prescribing preferences among local physicians.

A Summary of Current Relevant Hypertension Guidelines

The most relevant CPGs considered here are the 2009 CHEP Canadian Recommendations for the Management of Hypertension[6]; the 2003–2007 World Health Organization–International Society of Hypertension Guidelines for the Management of Hypertension[7]; the VII Report of (US) Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure;[5] the 2009 European Society of Hypertension guidlines[8]; and the Latin American Guidelines on Hypertension 2009.[9] These CPGs concur on such issues as the use of LSMs as a first-line treatment, varying the pretreatment observation period depending on the severity of HTN, and treating those hypertensive patients with TOD or other CV-RFs more aggressively. The Latin American CPGs suggest specific advice to promptly start medical treatment on the socially disadvantaged hypertensive population who are uneducated and poor. This might be the right strategy to practice for certain areas and desert dwellers in our country. Conversely, these CPGs disagree on other key issues, such as indications for ambulatory BP monitoring or echocardiography, thresholds for initiation of antihypertensive therapy, choice of agents, the role of ßBs, and the combination therapy of ACE-Is with ARBs. In recent updates of all national and international CPGs, increasing emphasis is placed on the primary prevention of HTN and the need to give more attention to factors that can improve adherence to HTN treatment.

Shortcomings of Current Hypertension Guidelines

Many potential barriers may interfere with the application of CPGs in clinical practice in Saudi Arabia.

First, HTN is one of the conditions for which disease-specific CPGs generated by different organizations offer discordant recommendations. Although this may be because different values are placed on the prevention of certain outcomes by different organizations, concerns have been raised that the variability among CPGs may reflect methodological deficiencies during their development. Because CPGs developed without a systematic review of the literature and without critical appraisal of the supporting evidence would be more likely to reflect the biases of participants from a certain geographical region, it would not be surprising if they were dissimilar to other CPGs in other areas developed by different individuals. Reviews of published CPGs (even those developed by national specialty societies) confirm that adherence to methodological standards is generally poor. In particular, substantial deficiencies were noted in the identification, evaluation, and synthesis of scientific evidence. Applying this condition to the most recent Canadian CPGs, the British CPGs, the Joint National Committee–VII, and the ESH/WHO/ISH CPGs revealed marked differences in the evaluation and synthesis of the evidence, leading to different recommendations.

Second, until recently, HTN CPGs have tended to emphasize BP levels and have neglected the role of other RFs that define an individual's absolute CV risk in a specific cultural and economic environment. Atherosclerotic RFs tend to cluster in hypertensive individuals (over 75% of hypertensive individuals have other CV-RFs, most commonly dyslipidemia), and CV risk increases exponentially with the number of RFs. Because most clinicians tailor their treatment recommendations according to each patient's associated RFs and absolute CV risk, recent CPGs have emphasized initiating drug treatment at specific BP measurements, with consideration to other RFs addressing clinically relevant comorbidities. It remains to be seen whether the latest CPGs, with their emphasis on absolute risk profiles, are better implemented than earlier versions. We agree with the WHO recommendations to pay attention to evidence-based practice and less costly drug treatment for those at high risk to develop CVDs on one side and promote widespread LSMs to achieve maximal effect in improving life expectancies for those at high risk.

Third, the format and local applicability of CPGs are crucial to their success. Clinicians consistently identify endorsement by a respected colleague or organization and the user-friendliness of a CPG as the most important factors in determining its acceptability, with short and concise formats being favoured. Members of ***SHMS*** hope to develop local/practical CPGs, taking into account recommendations of several international CPGs and addressing the needs of our local population, practitioners, and environment.

Finally, the emphasis in HTN CPGs until now has been on diffusion rather than implementation. Diffusion of a CPG refers to the simple distribution of information, such as publication in a peer-reviewed journal. On the other hand, implementation is the process of actually putting a CPG into practice and involves overcoming specific barriers to change. In particular, implementation strategies are designed to deal with the clinician, environmental, and patient barriers. It must be added that for most developing countries, deficient strategies for primary healthcare are the major obstacle for control of HTN.[10]

Specific implementation strategies are of vital importance in that practice is unlikely to be influenced by traditional continuing medical education seminars, conferences, publications in peer-reviewed journals, or unsolicited mailings of CPGs.[4]

Implications for Saudi Hypertension Guidelines

Although some of the shortcomings previously listed have been at least partially dealt with in the most recent versions of the HTN CPGs, a number of areas still exist that require increased attention from us as we address the professionals practicing in Saudi Arabia, who come from diverse backgrounds, and the public, with their significant economic, cultural, and educational diversity and varying access to primary healthcare.

First, specific implementation strategies are as follows:

- Academic detailing (one-to-one educational sessions) with local opinion leaders or face-to-face with educators.
- Train-the-trainer programs with limited number of participants (including healthcare educators, nurses, pharmacists, and physicians) to enable direct interaction.
- Multifaceted interventions (involving reminder systems at the point of care) and development of easy-to-use CPGs for primary care practitioners to detect and treat HTN, with emphasis on a holistic approach to all aspects of care for all comorbidities and RFs.
- Patient-mediated methods (such as pamphlets, videos in waiting areas in clinics, and grassroots action events at schools, shopping areas, and sport facilities), which appear to hold significant promise for improving CPG implementation.
- Community educational programs year-round at workplaces and shopping centers, among other locations.
- Educational efforts to teach children and young adults about healthy lifestyles through schools, sports arenas, and mass media.

Second, attempts must be made to incorporate patients' and clinicians' values in CPGs, particularly with regard to setting treatment thresholds, significant side effects, customs, and cultural values relevant to the users. Until now, thresholds in HTN CPGs have tended to be set by expert consensus. However, marked individual variations exist in treatment preferences, and preliminary evidence suggests that expert panels do not accurately reflect the preferences of patients or front-line clinicians.

Third, recommendations that are vital from a public health perspective must be clearly outlined. The bottom line that must be emphasized in this CPG is that lowering BP and other atherosclerotic RFs will provide clinical benefits in the management of HTN. Arguments about which drugs are more effective have obscured the most important issue in HTN management in a developing country, namely initial detection of patients at risk in our community, as many hypertensive patients are either unaware of their diagnosis or treated improperly.

Similar to other countries, only a minority of those prescribed treatment achieves target levels. Detection and control of HTN in those who are unaware of their condition remains the main goal of our society. This goal can be achieved through strategic and continual attempts to implement our CPGs by all practical means, as mentioned previously, in cooperation with healthcare authorities in our country, medical schools, and other healthcare societies that promote our objectives.

Furthermore, even those with well-controlled BP exhibit higher rates of CV events than age-matched controls because of the undertreatment of their other atherosclerotic RFs (obesity, dyslipidemia, DM, and particularly smoking).

To address these problems, a group of professionals has initiated a process to provide continually updated evidence-based HTN CPGs tailored to meet the needs of local communities. This process involves conducting annual systematic reviews of relevant literature by experts. These updated recommendations will be presented regularly at appropriate congresses and scientific meetings and published broadly in journals for healthcare professionals, on ***SHMS***'s website **(www.saudi-hypertension.org),** and on web links at hospitals and other health institutions.

We believe that more important than all the activities to manage HTN and other RFs for CV events is its primary prevention through sustained LSM across the entire society. Prevention through LSM is the cornerstone of success in reducing the prevalence of HTN in any society, but specifically ours, with its 39% prevalence of pre-hypertensives.[2] LSMs should not be given as lip service[8] but rather instituted with adequate behavioural support from experts and reinforced regularly. LSMs include:

1. Reduction of salt intake to less than 6g daily for adults
2. Weight reduction
3. Daily physical exercise
4. Smoking cessation
5. Increase in fruit, vegetable, and dates intake
6. Reduction in saturated and total fat intake.

In this context, it is obvious that a tremendous need exists for far-reaching, systematically driven, cost-effective prevention and treatment, and for more effective control strategies at all levels of healthcare systems.

However, a holistic, comprehensive, strategic approach must not only target HTN as a pathological entity, but must also take into account the broader environment in which HTN is a major RF for CVD and its interplay in the constellation of other well-known modifiable RFs.

Contributors

Yousif Asiri, MS, PhD
Associate Professor of Clinical Pharmacy
Dean, College of Pharmacy, King Saud University, Riyadh
yasiri@ksu.edu.sa

Tawfik Albassam, MD
Consultant, Internal Medicine
Clinical Hypertension Specialist
King Fahd Hospital, Jeddah
albassamt@hotmail.com

Saleh Bawazir, PhD
Professor of Clinical Pharmacy
Vice President for Drug Affairs
Saudi Food and Drug Authority, SA
sbawazir@ksu.edu.sa

Walid Bsata, MD, FRCPI, FACP
Consultant Physician/Cardiologist
General Director, Aleppo University Heart Hospital
Aleppo, Syria
walidina@hotmail.com

Hassan Al-Eid, MD
Consultant Transplant Nephrologist
Renal Transplant Unit
King Faisal Specialist Hospital and Research Centre, Riyadh
heid@kfshrc.ed.sa

Osman Alfurayh, MD, CPE
Consultant Nephrologist/Internist
Department of Medicine
King Faisal Specialist Hospital and Research Centre, Riyadh
Chairman of the Board, SHMS
osman@kfshrc.edu.sa

Ibrahim Hamasni, RPh
Manager, Inpatient Pharmacy, Clinical Pharmacist–Nephrology
King Faisal Specialist Hospital and Research Centre, Riyadh
hmasni@kfshrc.edu.sa

Abdul-Hameed Hassan, MD
Consultant Family Physician
International Medical Centre Hospital, Jeddah
ahma_hassan@yahoo.com

Wafaa Jad, MD
Pediatrician
Quality Consultant
King Abdul-Aziz University, Jeddah
Wafaa_jad@hotmail.com

Charu Kartik, LD, PhD
Senior Clinical Nutritionist
King Faisal Specialist Hospital and Research Centre, Riyadh
Charukartik2000@yahoo.com

Abdulhamid Kashgari, MD, Facharzt, Germany
Consultant, Internal Medicine, Diabetology and Endocrinology
Chairman of Medical Affairs, Bridging for Health, Jeddah
drabdulhamidkashgari@yahoo.de

Abdullah Alkhenizan, CCFP, ABHPM, MSc
Consultant, Department of Family Medicine and Polyclinic
King Faisal Specialist Hospital and Research Centre, Riyadh
akhenizan@kfshrc.ed.sa

Wesam Kurdi, MD
Consultant, Perinatology
Head, Section of Perinatology
Department of Obstetrics and Gynecology
King Faisal Specialist Hospital and Research Centre, Riyadh
kurdi@kfshrc.edu.sa

Bader Almustafa, MBBS, DPHC (RCGP), ABFM, SBFM, ECHS
Consultant, Family Physician and Clinical Hypertension Specialist
Medical Director, Qatif District PHC
Coordinator, SHMS International Relations, SA
bader.almustafa@gmail.com

Aljohara Al Quaiz, MSc, MRCGP
Associate Professor of Family Medicine
Department of Family and Community Medicine
College of Medicine, King Saud University, Riyadh
jalquaiz@yahoo.com

Sulaiman Al-Shammari, FRCP-UK
Professor of Family Medicine
Department of Family and Community Medicine
College of Medicine, King Saud University, Riyadh
sulaiman@ksu.edu.sa

Saleh Al-Shorafa, MBBS, DCH, ABPC
Consultant, Pediatrician, Nephrology
Head, Section Pediatric Nephrology Unit
Qatif Central Hospital, SA
Former President, Pan Arab Nephrology Association
sfrqch@yahoo.com

Ali Al-Zahrani, MD, FRCP, FACE, FACP
Consultant Endocrinologist
Department of Medicine
King Faisal Specialist Hospital and Research Centre, Riyadh
aliz@kfshrc.edu.sa

SHMS Board Members

Sulaiman Al-Shammari, FRCP-UK
Professor of Family Medicine
Department of Family and Community Medicine
College of Medicine, King Saud University, Riyadh
sulaiman@ksu.edu.sa

Saleh Al-Shorafa, MBBS, DCH, ABPC
Consultant Pediatrician, Nephrology
Head, Section Pediatric Nephrology Unit
Qatif Central Hospital, Qatif
Former President, Pan Arab Nephrology Association
sfrqch@yahoo.com

Ali Al-Zahrani, MD, FRCP, FACE, FACP
Consultant Endocrinologist
Department of Medicine
King Faisal Specialist Hospital and Research Centre, Riyadh
aliz@kfshrc.edu.sa

Part I: Definition and Classification

Definition

HTN is defined as persistent elevation of SBP ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg in adults not on antihypertensive medications.

Classification of Blood Pressure Levels

Based on the most recent evidence, BP levels may be classified as follows:

Table 1. Classification of Blood Pressure Levels in Adults

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

IS-HTN is associated with significant increase in CV morbidity and mortality.[11] The prevalence of IS-HTN in Saudi Arabia is 5.3%, and 15% of Saudis over the age of 60 have IS-HTN.[12] In a large meta-analysis, treatment of IS-HTN was associated with a significant reduction of CV morbidity and mortality. Treatment of IS-HTN significantly reduces the rate of dementia.[13] Diuretic-based therapy in IS-HTN patients is associated with a significant reduction in CV mortality.[14]

Part II: Evaluation and Assessment

Clinical Evaluation

Clinical evaluation aims to:

- Establish the diagnosis of HTN
- Identify secondary HTN
- Detect additional RFs of CVDs
- Determine TOD and ACCs.

Clinical evaluation includes:

- History
- Physical examination
- BP measurement
- Basic investigation.

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 psycho-social 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, CHD, stroke, or renal disease)

Physical Examination

1. Weight, height, BMI, and waist circumference
2. Signs of organ damage:
    a. Brain: motor or sensory defects
    b. Cardiac: arrhythmia, murmur, rales, peripheral edema
    c. Retina: fundoscopic abnormalities
    d. Vascular: absent arterial pulses, carotid bruits
3. Signs suggesting secondary HTN:
    a. Renal mass (polycystic kidney disease)
    b. Striae
    c. Cushingoid appearance

Blood Pressure Measurement

HTN is a silent disease and can be diagnosed only by correct BP measurement. The diagnosis of HTN is made after the measurement of BP on three different visits. Indirect BP measurement, according to the principles of Riva-Rocci and Korotkoff, is a simple and cost-effective medical intervention. Accurate BP measurement is extremely important in initiating and monitoring

antihypertensive treatment. BP can be measured by a mercury sphygmomanometer or by validated auscultatory or oscillometric semiautomated or fully automated devices.

For reliable and valid BP measurement, it is essential to follow these standards:

Patient-Related Standards

1. Patient should have 3 to 5 minutes of physical rest before measuring BP.
2. Patient should relax in a quiet environment before measurement.
3. BP should be measured in sitting position with back supported.
4. BP measurement should be taken in both arms at initial visit.
5. Upper arm should not be covered by clothing.
6. Elbow should be supported at heart level.
7. BP should be measured in standing position, if indicated (e.g., diabetics and elderly patients).
8. Patient should avoid nicotine and caffeine one hour prior to BP measurement.

Equipment-Related Standards

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 to 41 cm, a cuff bladder width of 15 cm and length 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.
2. ***Correct cuff position***: A distance of 2.5 cm (2 fingers) between the lower end of the cuff and the antecubital fossa should be maintained.
    a. Cuff bladder should be centered over the brachial artery.
    b. Cuff should be wrapped around the upper arm, firmly in contact with the arm, but not too tight (smooth) and not too loose (snug), allowing 2 fingers to be put under the cuff comfortably.
3. ***Correct stethoscope position***: 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***: The position of the mercury manometer should be upright at examiner's eye level.
5. Cuffs with complete and steady compression on the brachial artery (adhesive cuffs, Velcro with grip on the adjoining surfaces) should be used. Rolling up the sleeve cuff on the arm results in a tourniquet effect.

Examiner-Related Standards

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 (firmly but 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 prevent venous congestion.
5. BP should be measured at least twice at each visit and the mean value documented.
6. 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).

7. Record SBP and DBP immediately, rounded off to 2 mm Hg.
8. Repeat BP measurement if necessary after a break of 1 min.
9. Avoid reinflation and correction of stethoscope position during measuring procedure.

Out-of-Office Blood Pressure Monitoring

- It is supplementary to and not a substitute for clinic measurement.
- It provides useful additional information to clinic readings.
- Device should be calibrated and checked regularly for accuracy and reliability against a mercury sphygmomanometer.
- It is indicated for selected patients and in special circumstances, and not recommended for routine clinical use for all patients.

There are two forms of out-of-office BP monitoring:

Home Blood Pressure Measurement (Self-Monitoring)

Self-monitoring is usually performed by the patient with a suitable (aneroid, digital) manometer. Home readings of 130/85 mm Hg correspond to clinic readings of 140/90 mm Hg. Multiple readings can be taken over a prolonged period of time. Multiple readings are indicated in suspected instances of office-induced increases in BP ("white-coat" HTN).

Wrist sphygmomanometers are widely used by patients, but they are less reliable because minimal position changes can result in variable readings.

Benefits of Home Measurement of Blood Pressure

Home self-measurement produces better BP control. It is associated with a reduction of SBP by 4.1 mm Hg, a reduction of DBP by 2.4 mm Hg, and a reduction of mean arterial BP by 4.4 mm Hg.[15] Home BP measurement has also been shown to be correlated with and predictive of stroke and TOD.[16,17]

Ambulatory BP Monitoring

BP measurement and recording can be done by an automated device with a portable recorder over a period of 24 hours. Normal average daytime BP is 135/85 mm Hg. Nocturnal BP is 10% to 20% less than the average daytime BP. A twenty-four-hour average value of 125/80 mm Hg corresponds to 140/90 mm Hg of office value. It is more costly than self-monitoring but provides a more realistic overall BP profile and is more closely correlated to daytime average BP. It is indicated in suspected white-coat HTN, resistance to drug therapy, and suspicion of nocturnal HTN.[18,19]

Basic Investigations

1. Urinalysis (protein, glucose, blood)
2. Blood chemistry: potassium, sodium, creatinine, fasting glucose
3. Lipid profile
4. CBC
5. ECG

Additional Optional Investigations

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

Secondary Hypertension

About 10% of cases of HTN are due to secondary causes such as renoparynchymal and renovascular diseases. The main causes of secondary HTN are shown in Table 2.

Certain clinical and biochemical features suggest the presence of a secondary cause for HTN and warrant further investigation. These include onset of HTN at a young age (< 40 years) or old age (> 65 years), severe or resistant HTN, associated symptoms or signs of possible secondary cause (e.g., bruits over the renal arteries, hypokalemia, or metabolic alkalosis).

Table 2. Causes of Secondary Hypertension

Renoparenchymal disease
Renovascular disease
Primary hyperaldosteronism
Cushing's syndrome
Pheochromocytoma
Thyroid or parathyroid disease
Substance-induced (oral contraceptives, NSAIDs, steroids, licorice, erythropoietin, cyclosporine, cocaine, amphetamines, excessive alcohol)
Coarctation of aorta
OSA

Hypertension Secondary to Renoparenchymal Diseases

HTN is a frequent finding in patients with CKD—about 70% of patients with CKD have HTN, and the prevalence increases with the decrease of glomerular filtration rate. HTN is an important factor in the progression of kidney disease, and its pathogenesis is complex: sodium and fluid retention, overactivity of renin-angiotensin system and sympathetic nervous system, arterial stiffness, increased intracellular calcium, loss of nocturnal decline in BP, and side effects of medications. A renoparyenchymal disease is usually recognized by the presence of high blood urea nitrogen and creatinine level and/or significant proteinurea.

Hypertension Secondary to Renovascular Diseases

It should be suspected in children or young women (fibromuscular dysplasia) or old men (atherosclerotic disease). Magnetic resonance angiography is becoming a standard approach to the investigation of renal artery stenosis. Other diagnostic tests include captopril-enhanced renal scanning, Doppler ultrasonography, and CT angiography.

Hypertension Secondary to Endocrine Diseases

The main causes of endocrine HTN are primary hyperaldosteronism, oral-contraceptive-induced HTN, Cushing's syndrome, and pheochromocytoma. Other rare causes of endocrine HTN include

thyrotoxicosis, hypothyroidism, hyperparathyroidism, acromegaly, some types of congenital adrenal hyperplasia, Liddle's 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 those with a family history of HTN at a young age. The screening test is plasma aldosterone/renin ratio. Values of >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 contraceptives and by recovery of BP with discontinuation of the pills.

Cushing's 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 to 3 times the upper limit of normal) is diagnostic.

Pheochromocytoma is suspected by the presence of the classical triad (episodes of headache, sweating, and palpitations). 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
OSA is a relatively common sleep disorder. This condition is characterized by repetitive obstruction of the upper airway during sleep and associated with oxygen desaturation and interruption of sleep. The two cardinal symptoms of OSA are snoring and excessive daytime sleepiness. Around 50% of OSA patients have HTN, and 25% to 30% of patients with HTN have OSA. Treating OSA successfully might result in a reduction in BP level; however, the data on the impact of treating OSA on HTN are quite limited. Older obese men and those with upper airway abnormalities are at high risk of developing OSA.

Cardiovascular Risk Stratification in Patients with Hypertension

CVD risk is determined not only by BP levels, but also by the presence or absence of CV-RFs, TOD, or ACCs (Table 3). Also, a patient's personal, medical, and social situation merits consideration.

Factors Influencing Prognosis*
Risk Factors for Cardiovascular Diseases

- Levels of SBP and DBP
- Men > 55 years of age
- Women > 65 years of age
- Smoking
- Obesity
- Dyslipidemia: (LDL-c > 3.36 mmol/l [i.e., 130 mg/dl] and/or HDL-c < 1.0 mmol/l [i.e., 40 mg/dl])
- DM**

- Family history of premature CVD***
- C-reactive protein > l mg/dl

Target Organ Damage
- LVH (ECG, echocardiogram, or chest X-ray)
- Proteinuria or elevated plasma creatinine (men:115–133 µmol/l [i.e., 1.34–1.6 mg/dl], women: 107–124 µmol/l [i.e., 1.25–1.45 mg/dl])
- Ultrasound or radiological evidence of atherosclerotic plaque (aortic, carotid, iliac, or femoral)
- Generalized or focal narrowing of retinal arteries

Associated Clinical Conditions
- Cerebrovascular disease: ischemic stroke, cerebral hemorrhage, or TIA
- Heart disease: MI, angina, coronary revascularization, or CHF
- Renal disease: diabetic nephropathy or renal failure (creatinine—men: > 133 µmol/l [i.e., 1.6 mg/dl], women: > 124 µmol/l [i.e., 1.45 mg/dl])
- Vascular disease: dissecting aneurysm or symptomatic arterial disease
- Advanced hypertensive retinopathy: hemorrhages, exudates, or papilledema

*Modified from 1999 WHO/International Society of Hypertension Guidelines for the Management of Hypertension and 2003 European Society of Hypertension-European Society of Cardiology Guidelines for the Management of Arterial Hypertension
**DM is considered a CHD equivalent.
***First-degree relative: male < 55 years or female < 65 years

Table 3. Stratification of Risk to Quantify Prognosis

Levels of BP / ***Other RFs***	***Normal SBP < 120 and DBP < 80***	***Pre-HTN SBP 120–139 or DBP 80–89***	***HTN Grade I SBP 140–159 or DBP 90–99***	***HTN Grade II SBP 160–179 or DBP 100–110***	***HTN Grade III SBP ≥ 180 or DBP ≥ 110***
No other RFs	Average Risk	Average Risk	Low Added Risk	Moderate Added Risk	High Added Risk
1–2 RFs, except DM	Low Added Risk	Low Added Risk	Moderate Added Risk	Moderate Added Risk	Very High Added Risk
3 or more RFs–MetSyn, TOD, or DM	Moderate Added Risk	High Added Risk	High Added Risk	High Added Risk	Very High Added Risk
ACCs	High Added Risk	Very High Added Risk	Very High Added Risk	Very High Added Risk	Very High Added Risk

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

- Micro-albuminuria in diabetic patient
- Impaired glucose tolerance
- Obesity
- Sedentary lifestyle
- Raised fibrinogen
- High-risk socioeconomic group
- High-risk ethnic group
- High-risk geographic region

Part III: Therapeutic Approaches

Management Strategies

Strategies to manage hypertensive patients include therapeutic interventions to treat high BP and other reversible CV-RFs. This is achieved through LSM and, in most cases, drug therapy. Table 4 and Figure 1 provide a summary of recommended strategies.

Table 4. Management Strategy According to CV Risk Stratification

Other RFs and Disease History	*Blood Pressure (mm Hg)*			
	Pre-HTN SBP 120–139 or DBP 80–89	***HTN Grade I SBP 140–159 or DBP 90–99***	***HTN Grade II SBP 160–179 or DBP 100–109***	***HTN Grade III SBP > 180 or DBP > 110***
No other RFs	Assure healthy life style	LSM for several months, then drug treatment if BP uncontrolled	LSM for several weeks, then drug treatment if BP uncontrolled	Immediate drug treatment and LSM
1–2 RFs, except DM	LSM	LSM for several weeks, then drug treatment if BP uncontrolled	LSM for several weeks, then drug treatment if BP uncontrolled	Immediate drug treatment and LSM
3 or more RFs–MetSyn, TOD, or DM	LSM, EXCEPT when BP is 130–140/80–90: Add drug treatment	Drug treatment and LSM	Drug treatment and LSM	Immediate drug treatment and LSM
CVRD	Drug treatment and LSM	Immediate drug treatment and LSM	Immediate drug treatment and LSM	Immediate drug treatment and LSM

Goals of Treatment

The primary goal of treatment of patients with high BP is to achieve the maximum reduction in the total risk of CV and renal morbidity and mortality. This requires treatment of all identified reversible CV-RFs such as smoking, dyslipidemia, or DM, the appropriate management of ACCs, and treatment of the raised BP per se. Since the relationship between CVR and BP is continuous, without a lower threshold, the goal of antihypertensive therapy should be to restore BP to levels defined as “normal” (Table 1). The major determinant of risk reduction conferred by antihypertensive therapy is the level of BP achieved. Evidence supports achieving BP in patients with DM or renal disease below 130–140/80–90 mm Hg, and less than 140/90 mm Hg in others.

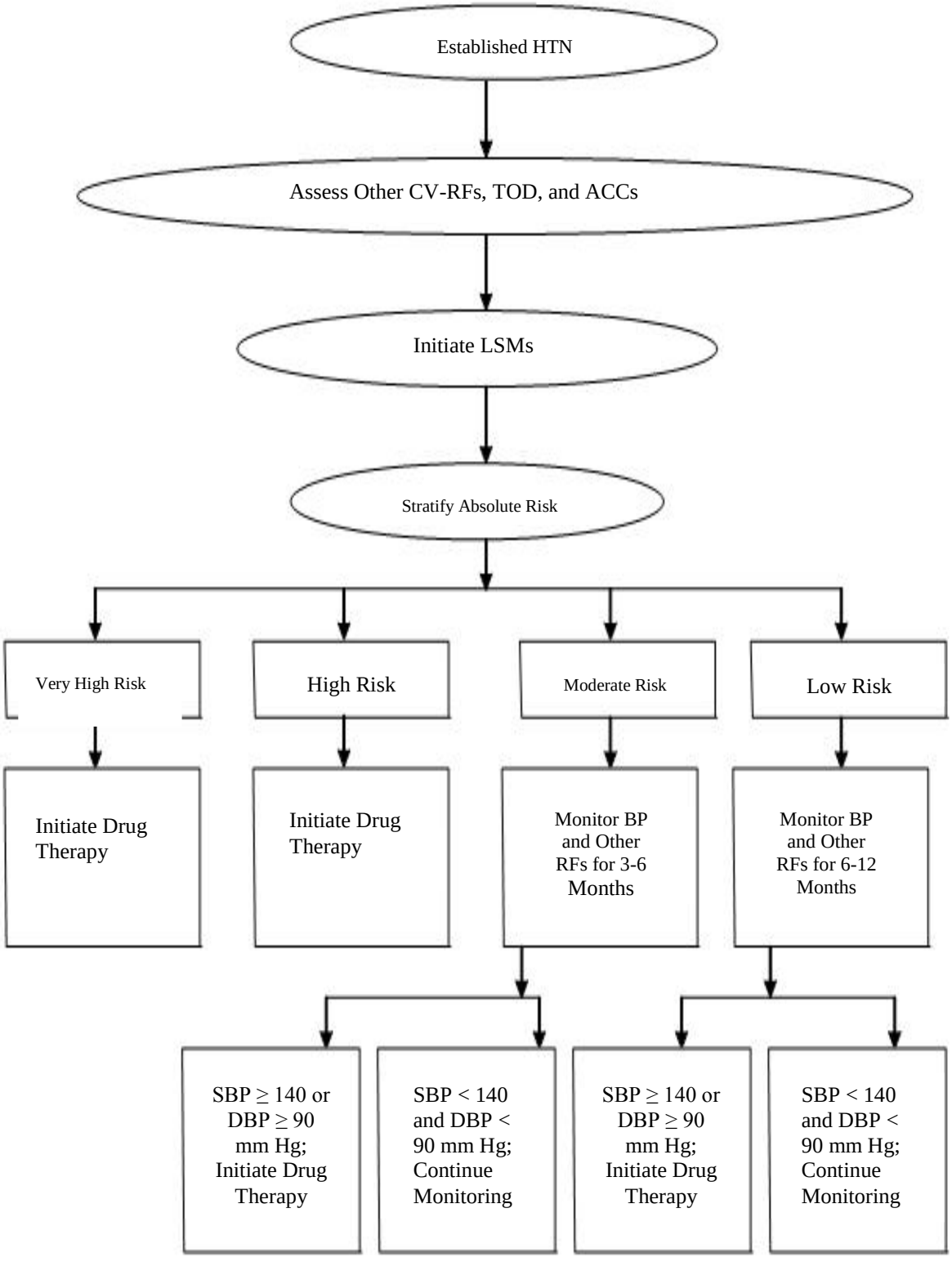


Figure 1: Initiation of Therapeutic Interventions

Non-Pharmacological Approach

LSM is an important component for the prevention and management of high BP. It decreases BP, enhances antihypertensive drug efficacy, and reduces CVR.

Recommended Lifestyle Modifications

1. Weight reduction for abdominal obesity (waist circumference ≥ 94 cm for men and ≥ 80 cm for women), overweight (BMI > 25 kg/m^2), and obese patients (BMI ≥ 30 kg/m^2). On average, for each 10 kg increase over ideal body weight, SBP rises 2 to 3 mm Hg and DBP rises 1 to 3 mm Hg.[20]
2. Healthy eating habits by adopting the DASH diet,[21] in addition to restriction of salt intake. 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. Sodium should be restricted to < 2.4 g/day (100 mmoles/day) or 6 g/day sodium chloride (equivalent to a small teaspoon). This has been shown to lower SBP by 3.7 mm Hg and DBP by 2 mm Hg.[22] Potassium chloride supplementation, preferably from fresh fruits and vegetables, of 60 to 100 mmol/day decreased SBP by 4.4 mm Hg and DBP by 2.5 mm Hg.[23] Evidence is insufficient to recommend calcium and magnesium supplements.[24]
3. 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.[25]
4. Smoking cessation reduces overall CV-RFs.[26] Advice to stop smoking should be given by healthcare professionals.

Recommendations

- Weight reduction to ideal body weight (Level Ib)
- Adopt DASH dietary plan (Level IIb)
- Restrict sodium intake to < 100 mmol/day (< 2.4 g/day) (Level Ib)
- Regular moderate-intensity physical activity (Level Ia)
- Smoking cessation (Level IIb)

Pharmacological Approach

Current evidence from randomized controlled trials indicates that several classes of drugs, including low-dose THZ-Ds (Level Ia), ACE-Is (Level Ia), CCBs (Level Ia), βBs (Level Ia), and ARBs (Level Ib), will lower BP and reduce the complications of HTN.

Low-dose THZ-Ds are still considered among the first-line agents for the treatment of most patients with HTN. Evidence indicates that diuretics are effective in preventing CV complications of HTN. In addition, diuretics enhance the efficacy of other antihypertensive drugs and are affordable and widely available.

βBs are no longer recommended as first-line therapy in patients over 60 years of age with uncomplicated HTN, because of the recently described trend toward worse outcomes in patients treated with βBs compared with those treated with other classes of antihypertensive drugs and increased risk of developing DM. However, for patients with stable, well-controlled HTN who are already taking a βB, it is reasonable to continue the regimen unchanged.

A new class of antihypertensive medication called direct renin inhibitors has been approved recently for treatment of HTN.. Their future role in the management of HTN will depend on their impact on morbidity and mortality, as well as their specific nephro- or CV-protective outcomes. Therefore, these agents can only be used as third-line drugs in selected patients.[27]

Principles of Drug Treatment

Strong evidence supports the following principles in initiating and modifying drug regimens in patients with HTN:

- Therapy should be initiated for patients with uncomplicated HTN with any of these agents:
    - THZ-Ds (Level Ia)
    - ACE-Is (Level Ia)
    - CCBs (Level Ia)
    - βBs (for patients < 60 years of age)
    - ARBs (Level Ib).
- The choice to initiate therapy with any of these classes will depend on the patient's age, the presence of ACCs or TOD, tolerability, concomitant diseases, associated RFs, patient preferences, the presence of other coexisting conditions that either favour or limit the use of a particular drug class, potential interactions with other drugs, implications for adherence, and cost.
- When BP is more than 20/10 mm Hg above goal, consideration should be given to initiating therapy with two drugs.
- For patients with HTN grade II and III, drug treatment should be instituted within a few days as soon as repeated measurements have confirmed the patient's BP.
- Due to the risk of DM associated with long-term use, THZ-Ds are considered for young patients with low risk of developing DM (Level Ia) and patients 55 years or older, either alone or in combination with agents from other classes.
- βBs are no longer recommended as first-line therapy in uncomplicated HTN for patients over 60 years of age (Level Ia).
- αBs are no longer recommended as first-line therapy for HTN.
- Addition of a second drug from a different class should be initiated when use of a single drug in adequate dose fails to achieve control of BP.
- When considering adding a second drug, it is recommended to consider the following combinations:
- ACE-I or ARB + CCB (Level Ib) or ACE-I or ARB + low-dose THZ-D (Level Ib)
- ACE-Is and ARBs have been shown to be equally efficacious in prevention of CV end points and in lowering BP.
- For patients who were classified as prehypertensive who also have DM and/or renal insufficiency, early and active drug treatment should be started in addition to LSM. This has been shown to reduce the rate of loss of renal function.
- Caution should be exercised in combining a non- DHP CCB and a βB (Level IV).
- The combination of an ACE-Is and ARB is not recommended (Level Ib) for the treatment of HTN.
- Treatment of isolated HTN should follow the same guidelines for the treatment of essential HTN.

Consider the Following When Starting Drug Treatment for Hypertension:

1. Most patients with HTN will require two or more antihypertensive medications to control their BP.
2. The use of two drugs when initiating therapy will achieve BP control in a more timely fashion, but particular caution is advised in those at risk of orthostatic hypotension, such as patients with DM or elderly patients.
3. Initiate therapy with the lowest available dose of the particular agent in an effort to reduce adverse effects. If the initial drug is not well tolerated, change to a drug from a different class, starting with the lowest recommended dose.
4. Prescribe long-acting drugs that provide 24-hour efficacy on a once-daily basis.
5. Use of generic drugs or combination drugs should be considered to reduce prescription cost.

Table 5 summarizes indications and contraindications for the most commonly used antihypertensive medications.

Figure 2 and Tables 6 and 7 illustrate drug selection recommendations for treating HTN with or without other coexisting diseases and for special situations and populations.

Appendices 1 and 2 provide lists of commonly used antihypertensive agents in Saudi Arabia and their package sizes and prices.

Table 5. Antihypertensive Medications—Indications and Contraindications

Drug Class	*Conditions Favoring the Use*	*Contraindications*	
		Compelling	***Possible***
THZ-Ds	CHF; Elderly Hypertensives; IS-HTN; Osteoporosis; Hypertensive patients of African origin	Gout; Hyponatremia	Dyslipidemia; Sexually Active Males; Pregnancy; Young Patient with Risk of Developing DM
Loop Diuretics	Renal Insufficiency; CHF		
Anti-Aldosterone Diuretics	CHF; Post-MI	Renal Failure; Hyperkalemia	
βBs	Angina Pectoris; Post-MI; CHF; Pregnancy; Migraine; Essential Tremors; Tachyarrhythmias; Thyrotoxicosis	Asthma; Chronic Obstructive Pulmonary Disease; Atrio-Ventricular Block (Grade 2 or 3)	PAD; Glucose Intolerance; Athletes and Physically Active Patients; Dyslipidemia
DHP CCBs	Elderly Patients; Angina; PAD; Pregnancy		Atrio-Ventricular Block (Grade 2 or 3); CHF; Tachyarrhythmias
Non-DHP CCBs	Angina Pectoris; Supraventricular Tachycardia	CHF; Patients Taking βBs	
ACE-Is	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	
αBs	Benign Prostatic Hypertrophy; Dyslipidemia	Orthostatic Hypotension	CHF

Table 6. Treatment Recommendations for Hypertension with Coexisting Diseases

Coexisting Diseases	*Treatment Choice*
Ischemic Heart Disease Most common form of TOD associated with HTN. The target BP goal is < 140/90 mm Hg.	
• Stable angina pectoris	βBs; LA DHP CCBs (Level Ib)
• Unstable angina or MI • Post MI	βBs and ACE-Is (Level Ib) ACE-Is, βBs (Level Ib)
CHF HTN and ischemic heart disease are the major causes of CHF. Therefore, BP and cholesterol control are primary preventive measures.	
• Asymptomatic with demonstrable ventricular dysfunction	ACE-Is and βBs (Level Ib)
• Symptomatic ventricular dysfunction or end-stage heart disease	ACE-Is, βBs, ARBs, and Aldosterone Blockers with Loop Diuretics (Level Ib)
DM Combinations of two or more drugs are usually required to achieve the target BP goal of < 130–140/80–90 mm Hg.	
• Reducing CVD and stroke incidence	THZ-Ds, ACE-Is, ARBs, and CCBs (Level Ib)
• Reducing progression of diabetic nephropathy and albuminuria • Reducing progression to macroalbuminuria	ACE-Is or ARBs (Level Ib) ARBs (Level Ib)
CKD Therapeutic goals are to slow 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 < 130–140/80–90 mm Hg (< 125/75 in proteinuric patients).	
• Reducing diabetic and non-diabetic renal disease	ACE-Is or ARBs (Level Ib)
Cerebrovascular Disease The risks and benefits of acute lowering of BP during an acute stroke are still unclear; control of BP at intermediate levels (approximately 160/100 mm Hg) is appropriate until the condition has stabilized or improved.	
• Reducing recurrent rate of stroke	ACE-Is and THZ-Ds or ARBs (Level Ib)
LVH LVH is an independent RF that increases the risk of subsequent CVD. Regression of LVH occurs with aggressive BP management. The target BP goal is < 140/90 mm Hg.	
• Reducing LVH	All classes of antihypertensive agents (Level Ib), EXCEPT direct vasodilators, hydralazine, and minoxidil.
PAD PAD is equivalent in risk to ischemic heart disease. The target BP goal is < 140/90 mm Hg.	
• Reducing the risk of PAD	Any class of antihypertensive drugs can be used (Level Ib)

Figure 2. Algorithm for Treatment of Hypertension

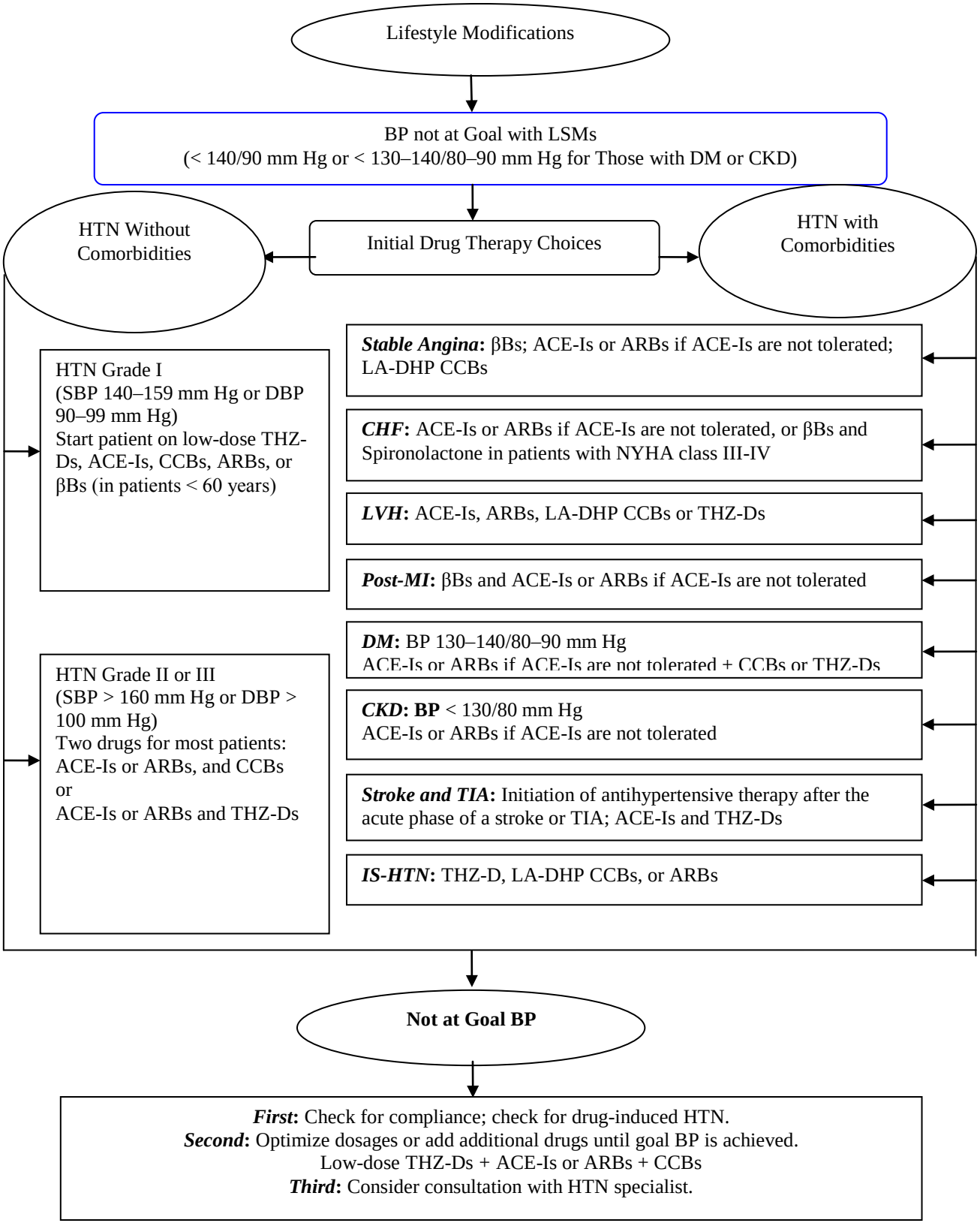


Table 7. Drug Treatment for Special Situations/Populations

Health Problem/Disease	*Target BP*	*Drugs to Use*	*Drugs to Avoid*
Angina	< 130/85	βBs, ACE-Is, LA-DHP CCBs	Short-Acting DHP-CCBs
Asthma	< 140/90	THZ-Ds, Potassium Sparing Diuretics	βBs
Atrial Fibrillation	< 140/90	βB, ARBs, Non-DHP CCBs	NSR
CHF	< 130/85	ACE-Is, Diuretics, ARBs, Isosorbide Dinitrate with Hydralazine, LA-DHP CCBs, Aldosterone Antagonists, some βBs (page 37)	βBs
Conduction Defects	< 140/90	NSR	βBs
Depression	< 140/90	NSR	βBs, Reserpine
DM	130–140/ 80–90	ACE-Is, Cardioselective βBs, Low-Dose Diuretics, LA-DHP CCBs, ARBs, Loop Diuretics	High-Dose THZ-Ds
Dyslipidemia	< 140/90	Low-Dose Diuretics, ACEIs, βBs with Intrinsic Sympathomemtic Activity, ARBs, DHP CCBs, αBs	βBs without Intrinsic Sympathomimetic Activity, High-Dose THZ-Ds
Elderly	< 140/90	Low-Dose Diuretics, LA-DHP CCBs, ACEIs, ARBs	High-Dose Diuretics
Gout	< 140/90	NSR	THZ-Ds, Loop Diuretics
Hyperthyroidism	< 140/90	βBs	NSR
Liver disease	< 140/90	NSR	Labetalol, Methyldopa
LVH	< 140/90	ACE-Is, ARBs, LA-DHP CCBs, THZ-Ds	Hydralazine, Minoxidil
MI	< 130/85	βBs without Intrinsic Sympathomimetic Activity, ACE-ls, LA-DHP CCBs, ARBs	Short-Acting DHP CCBs
Migraine	< 140/90	Non-Cardioselective βBs, Non-DHP CCBs	NSR
Osteoporosis	< 140/90	THZ-Ds	NSR
Preoperative	< 140/90	βBs	NSR
Proteinuria > 1 gm/d	< 125/75	ACE-Is, THZ-Ds, Loop Diuretics, Non-DHP CCBs, ARBs	NS
PAD	< 140/90	LA-DHP CCBs	βBs
Renal disease	< 130/80	ACE-Is, Loop Diuretics, Non-DHP CCBs, ARBs	NSR
Smoking	< 140/90	THZ-Ds, ACE-Is	βBs
Stroke—old	< 140/90	ACE-Is, LA-DHP CCBs, ARBs, Diuretics	NSR
Stroke—recovery	< 140/90	ACE-Is	NSR

NSR: No Specific Recommendations

Follow-Up and Monitoring

- During the period of evaluation and stabilization of treatment, patients need to be seen at approximately monthly intervals to monitor changes in BP and in RFs, clinical conditions present, and to observe the effects of treatment.
- Follow-up visits should be utilized to establish a good doctor–patient relationship, monitor BP control, educate the patient, and manage other RFs.
- For successful drug therapy, it is important to explain the possible adverse effects and emphasize the need for regular medication, with early reporting of any side effects.
- The frequency of visits will depend on the overall risk category of the patient as well as on the grade of HTN.
- Once the goals of therapy have been reached, including the control of other RFs and the achievement of goal BP, the frequency of visits can be scheduled every three to six months.
- Patients with a low CVR profile who are managed on a single drug may be seen every six months.
- Patients not on drug treatment need regular monitoring and follow-up.
- Patients with HTN Grades II and III or with complicated coexisting conditions should be seen at shorter intervals.
- If the therapeutic goals, including the control of BP, have not been reached within six months, the physician should consider referral to an HTN specialist.
- Serum potassium and creatinine should be monitored at least one to two times per year.

Resistant Hypertension

Definition

Failure to reach a BP goal after initiating a therapeutic plan that includes LSM measures and the prescription of at least three antihypertensive drugs. Ideally one of the drugs should be a diuretic, and all agents should be prescribed at optimal doses.

Causes

- Poor adherence
- Failure to modify lifestyle, including weight gain and heavy alcohol intake
- Medications and substances that may interfere with BP control:
    - NSAIDs, nonselective and selective sympathomimetic agents, decongestants, diet pills, cocaine, stimulants, amphetamines, oral contraceptives, steroids, cyclosporine, erythropoietin, licorice, herbal compounds, ephedra
- Volume overload
- Inadequate drug regimen or combination
- Secondary causes:
    - OSA
    - Renal parenchymal disease
    - Primary aldosteronism
    - Renal vascular HTN
    - Pheochromocytoma
    - Cushing’s disease
    - Aortic coarctation
- Spurious resistant HTN
    - White-coat HTN
    - Cuff HTN

- Pseudo-HTN

Diagnostic and Treatment Recommendations

1. Confirm treatment resistance.
2. Exclude pseudo-resistance.
3. Identify and reverse contributing factors.
4. Discontinue or minimize interfering substances.
5. Screen for secondary causes.
6. Pharmacological treatment:
    a. Combine agents from different classes.
    b. Maximize diuretic dose.
    c. Add spironolactone in small dose
    d. Use loop diuretics in patients with CKD.
7. Refer to specialist.

Specialist Referral

Specialist referral is indicated if there is a possible underlying cause or presenting as:

- Sudden onset
- Worsening of HTN
- Resistance to multidrug regimen—three or more drugs
- HTN diagnosed at young age (< 35 years)
- Persistent noncompliance.

Other Therapeutic Approaches

Since the aim of treatment is the reduction of total CVR, it is important to treat the other RFs and clinical conditions present in the individual hypertensive patient. This means that physicians should either refer the patient to appropriate clinics and specialists, or institute an appropriate regimen of lifestyle factors and drug treatment for associated conditions such as DM, dyslipidemia, CVD, cerebrovascular disease, or renal disease.[9,10]

Antiplatelet Therapy

The use of aspirin and other antiplatelet agents has been well documented to reduce the risk of fatal and nonfatal coronary events, stroke, and CV death in patients with established coronary or cerebrovascular disease (Level Ia).[28] In light of the results of the HOT Study,[29] 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 CHD, and who are not particularly at risk of bleeding from the gastrointestinal tract or from other sites (Level Ia).

Cholesterol-Lowering Therapy

Cholesterol reduction with a variety of agents has been shown to reduce the risk of initial and recurrent CV events among patients with a wide range of initial cholesterol levels (Level Ia). Trials of HMG CoA reductase inhibitors, conducted primarily among patients with CHD, have also reported reductions in stroke risk. The relative effects of cholesterol-lowering therapy appear to be similar in those with or without HTN. In these circumstances, the use of cholesterol-lowering therapy can be recommended for hypertensive patients who have elevated cholesterol or in patients with normal cholesterol who are for other reasons at high risk of CVDs (Level Ia).[30]

Herbs and Hypertension
It is suggested to exercise caution about recommending herbal remedies to treat HTN because the complexity of plant products is unproven, and they could even have harmful effects. Also, dosing regimens are difficult to adjust, and their intake might jeopardize the regular intake of prescribed medications.

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

It has not been proven that garlic or onions have any benefit in the treatment of HTN. Hypertensive patients should avoid licorice and ephedra because they elevate BP.

Part IV: Hypertension during Ramadan and Hajj

Hypertension and Ramadan Fasting

Some small-scale studies have looked at the effects of fasting on BP in hypertensive patients. One study looked at the changes in the CV system and its regulatory mechanisms in 150 patients with HTN Grade II. Iakovlev et al. observed a beneficial effect of fasting on BP. They hypothesized that this effect is due to the inhibition of the basic metabolism and the weakening of sympathetic influences on the myocardium and smooth muscle cells of the resistant vessels, with reduced contractility.

In another study with 11 moderately obese hypertensive women who fasted for 48 hours, SBP decreased from 158 to 146 mm Hg and DBP from 96 to 89 mm Hg. The differences were statistically significant. Vertes and Hazelton studied the effects of weight reduction and fasting on BP in 99 morbidly obese hypertensive women. Reduction in BP was noted in 85 of these women by the end of one week of in-hospital fasting.

Goldhammer et al. studied the effect of medically supervised fasting, except for water, on BP in 174 patients with HTN. The duration of fasting was 10 to 11 days. Almost 90% of the subjects achieved a BP less than 140/90 mm Hg. They concluded that medically supervised, water-only fasting appears to be a safe and effective means of normalizing BP.

The most relevant study in this regard with 99 hypertensive patients was carried out by Habbal et al. in Casablanca (Morocco) during Ramadan in the winter of 1998. All patients had ambulatory BP measurements before and during Ramadan. No statistically significant difference was noted between these two periods, either for SBP or DBP, for the overall 24-hour BP, or for the diurnal and nocturnal periods. They concluded that in patients with uncomplicated essential HTN, Ramadan fasting was well tolerated. The variations of BP were minimal and were probably related to the changes in sleep, activity, and eating patterns.

In addition, another study that was conducted in Jerusalem in 1998 looked at the effects of fasting on a small number of treated hypertensive patients. A 24-hour BP monitoring was carried out twice, before Ramadan and during the last week of the month. All patients continued their medications, which were all administered once daily. A 24-hour average BP, as well as average awake and average sleep BP, was compared. There was no difference between the average BP before or during Ramadan. The authors concluded that treated hypertensive patients might be assured that, with continuation of prescribed medications, fasting during Ramadan could be safely undertaken.

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

- Physician's advice and management should be individualized.
- Patient education should emphasize the need to maintain compliance with non-pharmacological and pharmacological measures.
- Diuretics are better avoided, especially in hot climates, or should be administered in the early evening.
- Patients are encouraged to seek medical advice before fasting in order to adjust their medications if needed.
- A once-daily dosage schedule with long-acting preparations is recommended.
- Patients with HTN should be advised to eat a low-salt, low-fat diet.

- Patients with difficult-to-control HTN should be advised not to fast until their BP is reasonably controlled.
- Patients with hypertensive emergencies should be treated appropriately regardless of fasting, including intravenous medications.

Hypertension and 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, especially the elderly and those with other comorbidities. Patients with severe HTN should be considered unfit for a long journey such as Hajj.
- Once-daily medication regimens are preferable.
- Due to the hot climate in the Makkah region and the possibility of dehydration, diuretics are better avoided (unless indicated for other reasons).
- To keep BP under control, patients should take their BP medications as directed.
- Patients should check their BP regularly and try to reduce stress during Hajj.

Part V: Hypertension and Comorbidities

Hypertension and Diabetes Mellitus

Almost half of diabetic patients will develop HTN.**Error! Reference source not found.** Strict control of BP in these patients is as important as the control of blood sugar. Studies have shown that BP above 130-140/80–90 mm Hg is associated with significant risk for microvascular and macrovascular complications.[8,31]

- Patients found to have persistent SBP ≥ 130–140 mm Hg or DBP ≥ 80–90 mm Hg confirm the diagnosis of HTN.
- The goal BP in diabetic patients is 130–140/80–90 mm Hg.
- Patients with a SBP of 130–139 mm Hg or a DBP of 80–89 mm Hg may be given lifestyle therapy alone for a maximum of three months and then, if targets are not achieved, be treated with additional pharmacological agents.
- Patients with SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg should receive pharmacologic therapy in addition to lifestyle therapy.
- Pharmacologic therapy should include either an ACE-I or an ARB, if ACE-I is not tolerated. If BP targets are not achieved, a THZ-D should be added to those with an e Glomerular Filtration Rate ≥ 30, or a loop diuretic for those with an e Glomerular Filtration Rate < 30.
- Multiple drug therapy is usually required to achieve BP targets.

Hypertension and Chronic Kidney Disease

HTN is a frequent finding in patients with CKD. Around 70% to 95% of these patients are hypertensive.[32] In KSA, kidney failure of 28% of patients starting dialysis is attributed to HTN.[2] In addition, HTN hastens the progression of CKD caused by other pathology. Treatment of HTN is of extraordinary importance to prevent, stabilize, and regress CVRD in these patients.

BP has to be checked during each clinic visit. The BP target is < 130/80 mm Hg in all patients with CKD. However, patients with heavy proteinuria (> 1 g/day) should achieve BP < 125/75 mm Hg.[33]

Treatment of HTN should start with LSM, particularly sodium restriction of < 100 mmol/day (6 g of salt). Daily exercise helps to control BP in addition to other health benefits.

ACE-Is or ARBs are the recommended first-line agents, aiming to decrease proteinuria to < 60% of the baseline with the lowest achievable level targeted.[34] Serum creatinine and potassium should be monitored within one to two weeks after initiation of therapy. Doses of these agents should be titrated up with small doses gradually to the maximum dose level to achieve BP and proteinuria targets.

The combination of ACE-Is and ARBs is more effective in reducing proteinuria and blocking the renin-angiotensin system than either agent alone. However, this is associated with a higher risk of adverse effects (hyperkalemia and increase in serum creatinine).[35,36] This combination should be reserved for patients with heavy proteinuria (> 1g/ day) and for patients with advanced CHF who cannot be managed by either agent alone, provided that the glomerular filtration rate is above 30 ml/min and the potassium level is normal. These patients should be referred to a specialist to have appropriate evaluation. Additional therapy with non-DHP CCBs, diuretics, and βBs could be used. Labetolol is the agent of choice for pregnant women with CKD.[37]

Additionally, control of hyperlipidemia, cessation of smoking, and moderate protein restriction should be followed to decrease the rate of progression of CKD.

Kidney Transplant Patients
Kidney transplant patients should achieve the same BP target. LA-DHP CCBs may be the first agents to be used. Use of non-DHP CCBs should be cautioned for their interaction with immunosuppressive medications.

ACE-Is or ARBs are better avoided in the first three months after transplantation unless there is another complicating indication (e.g., heart failure).

Dialysis Patients
Target pre-dialysis BP should be < 140/90 mm Hg. Sodium intake and fluid restriction are pivotal in HTN management. Fluid removal with dialysis to achieve target BP and desirable post-dialysis weight is the most effective method to control BP. This should be carried out gradually and regularly in these patients.

ACE-Is or ARBs help to maintain residual kidney function. Maintenance of residual kidney function improves survival and quality of life of these patients. βBs like carvedilol improve survival in dialysis patients with cardiomyopathy.[38]

Hypertension and Coronary Heart Diseases

A direct relationship exists between CHD and high BP. The higher the BP, the higher the risk of coronary events. The goal BP in CHD patients is < 130/80 mm Hg. Rapid and excessive lowering of BP should be avoided.

Hypertension and Angina

- First choice: βBs
- Second choice: LA-DHP CCBs

Hypertension and Recent Myocardial Infarction

- βBs, preferably without intrinsic sympathomimetic activity, and/or ACE-Is are first choices.
- Non-DHP CCBs could be used if βBs are contraindicated, especially in non-Q MI and normal LV systolic function.
- There is benefit to using ACE-Is or ARBs in all patients with CHD, even without HTN and normal LV systolic function.
- Aldosterone antagonist: Eplerenone only (currently not registered in SA) in small dose proved to be useful even without HTN.

Hypertension and Dyslipidemia

Plasma lipid profile should be screened annually in hypertensive patients.

The benefit of combining a statin with antihypertensive treatment in hypertensive patients is well established. It must be considered in hypertensive patients who have high CVR, regardless of LDL-c level. However, a target LDL must be reached in addition, based on CVD risk level as follows:[8,39]

Table 8. LDL-c Goals in Different Risk Categories

Risk Category	*LDL-c Goal*
Very High CV Risk	< 1.8 mmol/l, 70 mg/dl or ≥ 50% reduction of LDL
High CV Risk	< 2.6 mmol/l, 100 mg/dl or ≥ 50% reduction of LDL
Moderate CV Risk	< 3.4 mmol/l, 130 mg/dl or ≥ 50% reduction of LDL
Low Added Risk	< 4.1 mmol/l, 160 mg/dl

Effect of Antihypertensive Medications on Lipid Profile[40]

- Neutral effect: ACE-Is, ARBs, CCBs, and central adrenergic agonists
- Beneficial effect: αBs
- Transient adverse effect: THZ-Ds or βBs, especially in high doses

The choice of antihypertensive therapy should not be influenced by the patient's lipid profile because the beneficial effects of these drugs outweigh their minimal transient adverse effects.

Hypertension and Congestive Heart Failure

CHF is five times more common in hypertensive patients as compared to normotensive persons. LV dysfunction is related to the level of BP even within the normal range.

Treatment of choice

- ACE-Is and diuretics
- Combined α/βBs (carvedilol) and βBs (Metoprolol, Bisoprolol, or Nebivelol) have been proven to be useful in the whole spectrum of LV systolic dysfunction.

Alternative treatment

- Isosorbid dinitrate+hydralzine, if ACE-Is are contraindicated.
- ARBs are alternatives for and/or additive to ACE-Is.
- Aldosterone antagonists are useful in severe CHF.
- LA-DHP CCBs may be added to control HTN.

Hypertension and Cerebrovascular Diseases

Reduction of BP in hypertensive patients is effective in the primary and secondary prevention of stroke.

Treatment of HTN in Acute Stroke Settings

In acute ischemic stroke: General agreement exists that these patients do not need fast, aggressive lowering of BP.

Early use of antihypertensive medications is warranted when:

- Mean BP is > 130 mm Hg
- DBP is > 120 mm Hg
- SBP > 200 mm Hg.

SBP should be < 180 mm Hg and DBP should be < 100 mm Hg if thrombolytic therapy is to be initiated. The best agent to be used is labetalol, starting with a bolus of 10 mg over 1 to 2 min. followed by an infusion of 2 to 8 mg/min. until the desired BP is achieved.

- BP should be lowered if hypertensive encephalopathy is suspected.
- Use of the sublingual BP-lowering agent nefidipine is contraindicated.

In hemorrhagic stroke: BP should also be lowered with caution. In patients with known HTN, an SBP ≤ 180 mm Hg or a DBP ≤ 105 mm Hg can be tolerated. Mean arterial BP should be lowered by 20% to 25%, especially in the case of subarachnoid hemorrhage.

Hypertension and Obesity

Obesity is an RF for HTN and other CVDs. As BMI increases, so does the risk of HTN. It is important to assess BMI and waist circumference in each individual. Using BMI, patients can be classified as normal weight (BMI 18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), or obese (≥ 30 kg/m^2). For obese patients, a weight management plan should be constructed and discussed. Options available include LSM (including behavioural therapy), pharmacotherapy, and bariatric surgery.

Hypertension and Metabolic Syndrome

Prevalence

- In KSA, the prevalence is about 39%.
- In the USA, the prevalence is about 32% and is increased in the elderly.

Diagnosis

Criteria for the diagnosis require three or more of the following:

- Waist circumference of > 80 cm in women or > 94 cm in men; less in certain populations (Southeast Asian ethnicity)
- Elevated triglycerides: 150 mg (1.7 mmol/l) or more, or receiving drug treatment for hypertriglyceridemia
- An HDL-c < 1.25 mmol/l (50 mg/dl) in women or < 1 mmol/l (40 mg/dl) in men, or receiving drug treatment for low HDL-c
- An SBP level of > 130 mm Hg or DBP > 85 mm Hg, or receiving antihypertensive therapy.
- A fasting blood sugar > 5.6 mmol/l (100 mg/dl) or more, or receiving drug treatment for raised glucose.

Treatment

- LSM (see section on lifestyle modification)
- Drug therapy for HTN
    - First choice is ACE-Is or ARBs.
    - Second choice is CCBs or βBs with vasodilatory activity.
    - THZ-Ds should be avoided as monotherapy.
- Statins and antidiabetic drugs should be given in the presence of dyslipidemia or DM, respectively.

Part VI: Hypertension in Special Populations

Hypertension in Children

BP increases gradually with age and height (Table 9); therefore, standard normograms are necessary for the interpretation of BP levels in children. Most children track in a constant percentile around the mean (see Appendix 3).

Table 9. 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	90th percentile to < 95th percentile, or if BP exceeds 120/80, even if bellow the 90th percentile up to < 95th percentile [for age, gender, and height]	Recheck in 6 months	Recommend weight management counseling if overweight; introduce physical activity and diet management	No
HTN Grade I	95th percentile to the 99th percentile, plus 5 mm Hg [for age, gender, and height]	Recheck in 1 to 2 weeks or sooner if the patient is symptomatic; if BP is persistently elevated on two additional occasions, evaluate or refer to source of care within 1 month	Recommend weight management counseling if overweight; introduce physical activity and diet management	Yes (if no improvement or symptomatic)
HTN Grade II	> 99th percentile, plus 5 mm Hg [for age, gender, and height]	Evaluate or refer to source of care within 1 week or immediately if the patient is symptomatic	Recommend weight counseling if overweight; introduce physical activity and diet management	Yes

The epidemic of childhood obesity, the risk of developing LVH, and evidential development of atherosclerosis in children would make the detection of and intervention in childhood HTN important in order to reduce long-term health risks. However, supporting data are lacking.

Secondary HTN is more common in young children, while essential HTN is more common in older children and adolescents, a steadfast reason why clinicians should be alert to the possibility of identifiable causes in young children.

The causes of secondary hypertension are many, but the most common ones are shown in Table 10.

Table 10. 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 to 6 years	Renal parenchymal disease (including structural, inflammatory diseases plus tumors), renal artery stenosis
6 to 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 (Table 11) should be part of the routine pediatric evaluation in every clinic visit for children 3 years or older. Children less 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 transplant
- Malignancy or bone marrow transplant
- Treatment with drugs known to raise BP
- Other systemic illnesses associated with HTN
- Evidence of elevated intracranial pressure

Table 11. Commercially Available Cuff Sizes for Evaluation of BP in Children in KSA

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

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

In general, hypertensive children should be referred to a specialized pediatrician. Evaluation involves a thorough history (Table 12) and physical examination (Table 13), ambulatory BP monitoring, laboratory investigations, and specialized tests. The primary investigations for hypertensive children should include

CBC, urinalysis, urine culture, blood urea nitrogen, creatinine, electrolytes, lipid profile, ECG, chest X-ray, echocardiogram, and renal ultrasound. Further investigations should be directed according to the expected cause.

Table 12. 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, hemolytic uremic syndrome
Medications: Sympathomimetics, 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)	Pre-eclampsia
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 13. 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's 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's syndrome, steroid treatment
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's 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/virilisation	Adrenal hyperplasia
Advanced puberty	Intracranial tumors

Target Blood Pressure Levels

- General
  - BP < 90th centile for age, height, and gender
- CKD
  - BP < 75th centile for age, height, and gender in CKD without proteinuria
  - BP < 50th centile for age, height, and gender in CKD with proteinuria
- DM
  - BP < 90th centile for age, height, and gender

Please note: The BP reduction in hypertensive emergencies should not exceed 25% to 30% over the first 6 to 8 hours, followed by a further gradual reduction.

Treatment Should Be Guided by the Following:

- Transient or persistent HTN.
- Treatment of the secondary cause might cure or eliminate HTN.
- LSM is highly recommended in pre-HTN, as well as HTN (weight loss, dietary modifications, and exercise).
- Selection of antihypertensive agent(s) should take into consideration the possible pathophysiology.
- In children, adjustment of the dosage of the antihypertensive drugs is imperative (Tables 14 and 15).
- HTN Grade II (BP > 99th percentile for age, gender, and height, plus 5 mm Hg) or malignant HTN (marked HTN with retinal hemorrhage/exudates, papilledema, or seizure with or without renal involvement) should be treated immediately, and the treatment itself should coincide with the investigations.

Table 14. Antihypertensive Agents for Neonates

Oral			
Drug	***Class***	***Dose***	
Hydrochlorothiazide	THZ-D	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	ACE-I	0.05–0.5 mg/kg per day divided three times a day	
Amlodipine	LA-DHP CCB	0.05–0.17 mg/kg per dose divided once or twice a day	
Isradipine	LA-DHP CCB	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	ACE-I	5–10 µg/kg per dose	I.V. Bolus

Table 15. 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.
	THZ-D	0.5–1 mg/kg per day	q.d.–b.i.d.
	Spironolactone	1 mg/kg per day	q.d.–b.i.d.
βBs	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.
ACE-Is	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.

Table 16. 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	6mg/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	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

Hypertension in Women

HTN is associated with more mortality in women than men. It is two to three times more common in women who take oral contraceptives. About 60% of hypertensive women are treated, and among those treated, only about a third had their BP controlled. Among patients with HTN, women were less likely than men to meet BP control targets.[41]

BP does not increase abruptly at menopause; it may take 5 to 20 years to develop.[42] Compared with hypertensive men, women with high BP are more likely to develop LVH, diastolic dysfunction, and a steep age-related increase in arterial stiffness.[43] In addition, HTN plays a greater role in the development of CHF in women than in men.[44]

Hypertension and the Use of Oral Contraceptive Pills

- Women age 35 and younger with well-controlled and monitored HTN are appropriate candidates for a trial combination OCs formulated with 35 µg or less of estrogen, provided they are otherwise healthy, nonsmokers, and with no evidence of end organ vascular disease. If BP remains well controlled several months after beginning OCs, use can be continued.[45]
- Approximately 5% of women using OCs develop overt HTN. This occurs within 6 to 12 weeks after starting OCs. The extent of the elevation varies. Early epidemiological studies using high-dose estrogen found a mean elevation in BP of 3–6/2–5 mm Hg, but serious or even malignant HTN, including nephrosclerosis, has been reported. Chronic use of OCs will slightly increase systemic BP in most women and may have other adverse effects on CVR. This is more likely to occur in patients who developed HTN during a prior pregnancy or who have a family history of HTN. Although the rise in BP is usually mild, malignant HTN can occur. Cessation of therapy typically leads to a return to baseline BP within 2 to 12 months, but proteinuria may persist.[46]
- It is important to keep track of BP in women taking OCs.
- The reported increase in relative risk with OC use is translated into only small increases in absolute risk. Thus, for most women, the dangers of OC use are far outweighed by the multiple benefits of effective contraception.

Hypertension during Pregnancy

Classification of hypertension during pregnancy:

1. ***Preexisting HTN***: Diagnosed before pregnancy or before the 20th week of gestation, or persists longer than 12 weeks post-delivery.
2. ***Preeclampsia***: New onset of HTN (two BP readings of > 140/90 mm Hg, six hours apart) with proteinuria after 20 weeks of gestation in a previously normotensive woman.
3. The following indicate severe disease and warrant hospitalization and consideration of urgent delivery: SBP > 160 or DPB > 110 mm Hg, 24-hour urine protein ≥ 2g (2+ or 3+ on qualitative testing), serum creatinine > 106 mmol/l (1.2 mg/dl), platelets < 100,000 cells/mm^3, evidence of microangiopathic hemolytic anemia, elevated hepatic enzymes, persistent headache or other cerebral or visual disturbances, persistent epigastric pain, and/or convulsions (eclampsia).
4. ***Preeclampsia superimposed on chronic HTN***: Worsening HTN with new onset proteinuria in a woman with pre-existing HTN.
5. ***Gestational HTN***: HTN occurs for the first time in the second half of pregnancy without proteinuria and normalizes by 12 weeks postpartum. Over time, some patients with gestational HTN will develop proteinuria and be considered preeclamptic, while others will be diagnosed with pre-existing HTN because of persistent BP elevation postpartum.[47]

Management Points to Consider

- Bed rest should not be recommended routinely for HTN during pregnancy because there is insufficient evidence to provide clear guidance for clinical practice.[48]
- Antihypertensive drug therapy for mild to moderate HTN during pregnancy would reduce the risk of developing severe HTN, but there is little evidence of a difference in the risk of preeclampsia.[38]
- Methyldopa has the longest record of use during pregnancy and often is considered a first-line choice for management. Follow-up of children born to mothers who used methyldopa during pregnancy revealed no negative effects on development at 7.5 years of age.
- βBs (avoid atenolol) and labetalol can be used, but may increase the risk of intrauterine growth restriction.[49]
- ACE-Is and ARBs are contraindicated.
- For hypertensive emergencies: I.V. hydralazine and I.V. labetalol are recommended.
- Nitroprusside I.V. has been used in hypertensive crises, but its use may be complicated by cyanide toxicity in the fetus or mother.[50]
- During lactation, drugs with high protein binding are preferred (e.g., labetalol and propranolol over atenolol and metoprolol).
- ACE-Is and ARBs are contraindicated with breast-feeding.

Treatment Recommendations

Preeclampsia:

- There are no proven benefits to mother or fetus other than reduction in risk of severe HTN with the use of antihypertensives for mild HTN associated with preeclampsia.
- Treatment of severe HTN is recommended to prevent maternal cerebrovascular complications**.** Antihypertensive therapy is needed at SBP ≥ 150 mm Hg and DBP ≥ 100 mm Hg, and can be initiated at a lower threshold in younger women and in those with symptoms that may be attributable to elevated BP (e.g., headache, visual disturbances, or chest discomfort).
- Labetalol is recommended as the first-line antihypertensive agent.
- Labetalol, given orally or intravenously, nifedipine orally, or hydralazine intravenously can be used for the acute management of severe HTN**.**
- The BP goal is SBP of 140-150 mm Hg and DBP of 90-100 mm Hg.

Preexisting Hypertension:

- In women with HTN Grade I, with no added risks, who are already on antihypertensive therapy, and who have an early pregnancy BP less than 120/80 mm Hg, tapering/discontinuing antihypertensive drugs and closely monitoring the BP response are appropriate. Reinstituting antihypertensives is indicated with persistent SBP ≥ 150 mm Hg, DBP of 95 to 99 mm Hg, or signs of hypertensive TOD.
- The recommended first-line medications are either methyldopa or labetalol. A LA-DHP CCB (e.g., nifedipine) can be added if needed.
- The BP goal in women without TOD is SBP 140–150 mm Hg and DBP 90–100 mm Hg. In women with TOD, the goal is < 140/90 mm Hg and as low as 120/80 mm Hg.

Table 17. Pharmacologic Therapy for Hypertension During Pregnancy

Agent	*Route of Administration*	*Contraindications*	*FDA Classification*[*]
Methyldopa	Oral	—	B
βBs	Oral	May exacerbate asthma and heart failure	C
Labetalol	Oral/I.V.	May exacerbate asthma and heart failure	C
CCBs	Oral	Caution when used with magnesium sulfate	C
Hydralazine	I.V.	—	C
Nitroprusside	I.V.	Risk of cyanide toxicity to mother and fetus	C
ACE-Is and ARBs	Oral	Risk of fetal or neonatal renal failure	D

United States FDA Pharmaceutical Pregnancy Categories[*]	
Category A	Adequate and well-controlled studies have failed to demonstrate a risk to the fetus in the first trimester of pregnancy, and there is no evidence of risk in later trimesters.
Category B	Animal reproduction studies have failed to demonstrate a risk to the fetus, and there are no adequate and well-controlled studies in pregnant women, OR animal studies have shown an adverse effect, but adequate and well-controlled studies in pregnant women have failed to demonstrate a risk to the fetus in any trimester.
Category C	Animal reproduction studies have shown an adverse effect on the fetus, and there are no adequate and well-controlled studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks.
Category D	There is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience or studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks.
Category X	Studies in animals or humans have demonstrated fetal abnormalities and/or there is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience, and the risks involved in use of the drug in pregnant women clearly outweigh potential benefits.

Hypertension and the Use of Hormone Replacement Therapy

- Hormone replacement therapy has the potential to worsen BP in hypertensive women.
- It should be withheld in women with resistant HTN in order to assess its contribution to the increase in BP.
- It is advisable to monitor BP after starting hormone replacement therapy.
- Hormone replacement therapy has been shown to increase CVR in postmenopausal women.[51,52]

Hypertension in the Elderly Population

The definition of HTN in the general adult population applies to the elderly (age > 65 years). Among older persons, elevation in SBP or increased pulse pressure is a better predictor of CV morbidity and mortality than elevated DBP. Primary HTN is by far the most common form of HTN in older persons. However, in the case of clinical suspicion (or when the onset of HTN occurs at old age), a secondary cause should be sought.

Renal parenchymal disease is the most common secondary cause to be considered, followed by renal artery stenosis. The latter is suspected in any patient with resistant HTN and known atherosclerosis in other arteries. The goal of treatment in older patients with no comorbidity should be the same as in the general population (i.e., < 140/90 mm Hg).

Special notes:

- Pseudo-HTN, orthostatic hypotension even without treatment, or white-coat HTN, especially among elderly women, is more common than in young patients.
- Sodium reduction is especially effective in the elderly because of their greater sensitivity to sodium intake.
- The starting dose of medications in older patients should be about half of that used in younger patients: Start low and go slow.
- Medications with once-daily dosage are preferred for better compliance and to keep the drug regimen as simple as possible.
- Low-dose THZ-D therapy (12.5–25 mg of HCTZ or equivalent) can be prescribed as the first-line treatment for HTN.
- LA-DHP CCBs are the second choice.
- βBs are less appropriate as first-line therapy for HTN in the elderly.
- Drugs that exaggerate postural hypotension (αBs, high-dose diuretics) or drugs that can cause cognitive dysfunction (central α-2 agonists) should be used with great caution.
- Presence of other comorbidities dictates the choice of first-line drugs.

Hypertension in Other Populations

Socioeconomic factors and lifestyle may influence BP control in some other patient populations. However, there are no studies published that address BP control in these populations in Saudi Arabia. American studies have indicated that prevalence, severity, and impact of HTN are increased in African-Americans, who also demonstrate somewhat reduced BP responses to monotherapy with βBs, ACE-Is, or ARBs compared with diuretics or CCBs. Three major clinical trials suggested that CCBs are most effective in African-Americans.

Southeast Asian patients tend to consume large amounts of sodium monoglutamate salt that may interfere with BP control.

For people living in remote areas who are far from any medical facilities and who are unable to keep regular outpatient appointments, a different approach may be needed. If their BP is considerably high and they are at high risk, then initiating treatments with two-drug combinations along with LSM advice from the first encounter may be justified.

Part VII: Hypertensive Crises

Hypertensive crises include hypertensive emergencies and urgencies (25% and 75% of patient presentations, respectively).[53]

Hypertensive emergencies are those conditions with critically elevated BP (SBP > 200 mm Hg and/or DBP > 120 mm Hg) and evidence of acute TOD, or at least one of the following clinical presentations:

1. Hypertensive encephalopathy
2. Acute MI
3. Pulmonary edema
4. Dissecting aortic aneurysm
5. Intracerebral hemorrhage
6. Subarachnoid hemorrhage
7. Acute ischemic stroke
8. Eclampsia
9. Acute renal failure
10. Phaeochromocytoma
11. Vasculitis
12. Clonidine withdrawal
13. Drug abuse: amphetamines, LSD, cocaine, Ecstasy.

In hypertensive emergencies, critically elevated BP should be lowered rapidly within 15 to 30 min. to avoid and limit the risk of serious complications, but there should be controlled reduction of mean arterial pressure by 25%, aiming at SBP of 160 mm Hg and DBP 100–110 mm Hg to avoid sudden drop of BP and following reduction of perfusion to vital organs (brain and heart).

Hypertensive emergencies present an acute threat to a patient's life. In-patient treatment is required. Initial medical treatment of hypertensive emergencies depends on the clinical presentation as shown in Table 18.

Table 18. Initial Medical Treatment of Hypertensive Emergencies

Clinical Presentation	***Initial Treatment***
Clonidine withdrawal	Clonidine 0.1 mg I.V. slowly
Eclampsia	Hydralazine 10 mg I.V. slowly
Acute MI	Nitroglycerine 5 mg sublingual
Pulmonary edema	Furosemide 40 mg I.V.
Acute renal failure	Furosemide 40 mg I.V.
Phaeochromocytoma	Phenoxybenzamine 10 mg oral or Phentolamine 2.5 mg I.V.
Dissecting aortic aneurysm	Nitroprusside 0.25–0.5 mcg/kg/min + Esmolol 100 mcg/kg/min
Hypertensive encephalopathy, stroke, vasculitis	Labetalol 20 mg I.V or Captopril 25 mg sublingual

Hypertensive urgencies are those conditions with critically elevated BP (SBP > 200 mm Hg and/or DBP > 120 mm Hg) without evidence of acute TOD, but with at least one of the following clinical presentations:

1. TIA
2. CHF
3. CAD
4. Perioperative HTN
5. Status post renal transplantation
6. Severe diabetic retinopathy

In hypertensive urgencies, critically elevated BP should be lowered gradually within hours but controlled, aiming at SBP 160 mm Hg and DBP 100—110 mm Hg). Patients can be managed as outpatients.

Not every elevation of SBP > 200 mm Hg and DBP >120 mm Hg is automatically a hypertensive emergency or urgency. Differential diagnosis should be considered to avoid unnecessary and possibly risky treatment:

1. Hypertensive situation (pseudo emergency): severe HTN in asymptomatic patients without any clinical presentation of hypertensive emergencies and urgencies
2. Malignant HTN: vascular damage (fibrinoid necrosis) of small arterioles manifests as retinal hemorrhages and exudates.

References

1. Rodgers A, Vaughan P, Prentice T, Edejer TT-T, Evans D, et al. *The World Health Report*. WHO; Geneva: 2002.

2. Preliminary Report on the Results of Monitoring of Risk Factors for Non-Communicable Diseases in the Kingdom of Saudi Arabia. Riyadh: King Fahad National Library; 2005.

3. The Australian therapeutic trial in mild hypertension: report by the Management Committee. *Lancet.* 1980;1:1261-7.

4. McAlister FA, Campbell NRC, Zarnke K, Levine M, Graham ID. The management of hypertension in Canada: a review of current guidelines, their shortcomings and implications for the future. *CMAJ.* 2001;164:517-22.

5. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension.* 2003;42:1206-52.

6. Campbell N, Hill M, Khan N, Tremblay G. The 2009 Canadian Hypertension Education Program Recommendations. www.hypertension.ca/bpc.

7. Whitworth JA. 2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. *J Hypertens.* 2003;21:1983-92.

8. Mancia G, Laurent S, Agabiti-Rosei E, Ambrosioni E, Burnier M, et al.; Reappraisal of European guidelines on hypertension management: a European Society of Hypertension Task Force document. *J Hypertens.* 2009; 27:1-38.

9. Sanchez RA, Ayala M, Baglivo H, Velazquez C, Burlando G, et al.; for the Latin American Expert Group. Latin American guidelines on hypertension. *J Hypertens.* 2009;27:905-22.

10. Gaziano TA. Cardiovascular disease in the developing world and its cost-effective management. *Circulation*. 2005;112:3547-53.

11. Qureshi AI, Suri MF, Mohammad Y, Guterman LR, Hopkins LN. Isolated and borderline isolated systolic hypertension relative to long-term risk and type of stroke: a 20-year follow-up of the National Health and Nutrition Survey. *Stroke.* 2002;33:2781-8.

12. Al-Nozha MM, Abdullah M, Arafah MR, Khalil MZ, Khan NB, et al. Hypertension in Saudi Arabia. *Saudi Med J.* 2007;28:77-84.

13. Forette F, Seux ML, Staessen JA, Thijs L, Birkenhager WH, et al. Prevention of dementia in randomised double-blind placebo-controlled systolic hypertension in Europe (Syst-Eur) trial. *Lancet.* 1998;352:1347-51.

14. Alkhenizan A. Diuretic-based therapy reduced cardiovascular mortality in older patients with isolated systolic hypertension and diabetes. *ACP J Club.* 2005;142:64.

15. Cappuccio FP, Kerry SM, Forbes L, Donald A. Blood pressure control by home monitoring: meta-analysis of randomised trials. *BMJ.* 2004;329:145.

16. Gaborieau V, Delarche N, Gosse P. Ambulatory blood pressure monitoring versus self-measurement of blood pressure at home: correlation with target organ damage. *J Hypertens.* 2008;26:1919-27.

17. Asayama K, Ohkubo T, Hara A, Hirose T, Yasui D, et al. Repeated evening home blood pressure measurement improves prognostic significance for stroke: a 12-year follow-up of the Ohasama study. *Blood Press Monit.* 2009;14:93-8.

18. Graves JW, Bailey KR, Grossardt BR, Gullerud RE, Meverden RA, et al. The impact of observer and patient factors on the occurrence of digit preference for zero in blood pressure measurement in a hypertension specialty clinic: evidence for the need of continued observation. *Am J Hypertens.* 2006;19:567-72.

19. Pickering TG, Hall JE, Appel LJ, Falkner BE, Graves J, et al. Recommendations for blood pressure measurement in humans and experimental animals: part 1: blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research. *Circulation.* 2005;111:697-716.

20. Hypertension control: report of a WHO expert committee. *World Health Organ Tech Rep Ser.* 1996;862:1-83.

21. Sacks FM, Svetkey LP, Vollmer WM, Appel LJ, Bray GA, et al.; for the DASH-Sodium Collaborative Research Group. Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *N Engl J Med.* 2001;344:3-10.

22. Stamler R. Implications of the INTERSALT study. *Hypertension.* 1991;17:I16-20.

23. Whelton PK, He J, Cutler JA, Brancati FL, Appel LJ, et al. Effects of oral potassium on blood pressure: meta-analysis of randomized controlled clinical trials. *JAMA.* 1997;277:1624-32.

24. Dickinson HO, Mason JM, Nicolson DJ, Campbell F, Beyer FR, et al. Lifestyle interventions to reduce raised blood pressure: a systematic review of randomized controlled trials. *J Hypertens.* 2006;24:215-33.

25. Fagard RH, Cornelissen VA. Effect of exercise on blood pressure control in hypertensive patients. *Eur J Cardiovasc Prev Rehabil.* 2007;14:12-7.

26. Critchley JA, Capewell S. Smoking cessation for the secondary prevention of coronary heart disease. In *Cochrane Database Syst Rev* 2009, Issue 1.

27. Gradman AH, Schmieder RE, Lins RL, Nussberger J, Chiang Y, et al. Aliskiren, a novel orally effective renin inhibitor, provides dose-dependent antihypertensive efficacy and placebo-like tolerability in hypertensive patients. *Circulation.* 2005;111:1012-8.

28. Antiplatelet Trialists' Collaboration. Collaborative overview of randomised trials of antiplatelet therapy-I: prevention of death, myocardial infarction, and stroke by prolonged antiplatelet therapy in various categories of patients. *BMJ.* 1994;308:81-106.

29. Hansson L, Zanchetti A, Carruthers SG, Dahlof B, Elmfeldt D, et al.; for the HOT Study Group. Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: principal results of the hypertension optimal treatment (HOT) randomised trial. Lancet. 1998;351:1755-62.

30. Shepherd J, Cobbe SM, Ford I, Isles CG, Lorimer AR, et al.; for the West of Scotland Coronary Prevention Study Group. Prevention of coronary heart disease with pravastatin in men with hypercholesterolemia. *N Engl J Med.* 1995;333:1301-7.

31. Sowers JR, Epstein M, Frohlich ED. Diabetes, hypertension, and cardiovascular disease: an update. *Hypertension.* 2001;37:1053-9.

32. Jones CA, McQuillan GM, Kusek JW, Eberhardt MS, Herman WH, et al. Serum creatinine levels in the US population: Third National Health and Nutrition Examination Survey. *Am J Kidney Dis.* 1998;32:992-9.

33. Buckalew VM Jr., Berg RL, Wang SR, Porush JG, Rauch S, et al.; for the Modification of Diet in Renal Disease Study Group. Prevalence of hypertension in 1,795 subjects with chronic renal disease: the modification of diet in renal disease study baseline cohort. *Am J Kidney Dis.* 1996;28:811-21.

34. The GISEN Group (Gruppo Italiano di Studi Epidemiologici in Nefrologia). Randomised placebo-controlled trial of effect of ramipril on decline in glomerular filtration rate and risk of terminal renal failure in proteinuric, non-diabetic nephropathy. *Lancet.* 1997;349:1857-63.

35. Yusuf S, Teo KK, Pogue J, Dyal L, Copland I, et al. Telmisartan, ramipril, or both in patients at high risk of vascular events. *N Engl J Med.* 2008;358:1547-59.

36. Buchner N, Banas B, Kramer BK. To the editor: telmisartan, ramipril, or both in patients at high risk of vascular events. *N Engl J Med.* 2008;359:426.

37. Abalos E, Duley L, Steyn DW, Henderson-Smart DJ. Antihypertensive drug therapy for mild to moderate hypertension during pregnancy. *Cochrane Database Syst Rev* 2010, issue 10.

38. Cice G, Ferrara L, D'Andrea A, D'Isa S, Di Benedetto A, et al. Carvedilol increases two-year survival in dialysis patients with dilated cardiomyopathy: a prospective, placebo-controlled trial. *J Am Coll Cardiol.* 2003;41:1438-44.

49. Genest J, McPherson R, Frohlich J, Anderson T, Campbell N, et al. 2009 Canadian Cardiovascular Society/Canadian guidelines for the diagnosis and treatment of dyslipidemia and prevention of cardiovascular disease in the adult—2009 recommendations. *Can J Cardiol.* 2009;25:567-79.

40. Deshmukh M, Lee HW, McFarlane SI, Whaley-Connell A. Antihypertensive medications and their effects on lipid metabolism. *Curr Diab Rep.* 2008;8:214-20.

41. Hall JE, Granger JP, Reckelhoff JF, Sandberg K. Hypertension and cardiovascular disease in women. *Hypertension.* 2008;51:951.

42. Ong KL, Cheung BM, Man YB, Lau CP, Lam KS. Prevalence, awareness, treatment, and control of hypertension among United States adults 1999–2004. *Hypertension.* 2007;49:69-75.

43. Os I, Oparil S, Gerdts E, Hoieggen A. Essential hypertension in women. *Blood Press.* 2004;13:272-8.

44. Lloyd-Jones DM, Larson MG, Leip EP, Beiser A, D'Agostino RB, et al. Lifetime risk for developing congestive heart failure: the Framingham heart study. *Circulation.* 2002;106:3068-72.

45. Woods JW. Oral contraceptives and hypertension. *Hypertension.* 1988 (Suppl II);11(3):II 11-II 15.

46. Lim KG, Isles CG, Hodsman GP, Lever AF, Robertson JW. Malignant hypertension in women of childbearing age and its relation to the contraceptive pill. *Br Med J (Clin Res Ed).* 1987;294:1057-9.

47. Report of the National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy. *Am J Obstet Gynecol.* 2000;183:S1-S22.

48. Meher S, Abalos E, Carroli G. Bed rest with or without hospitalisation for hypertension during pregnancy. *Cochrane Database Syst Rev*. 2010, Issue 2.

49. Magee L, Duley L. Oral beta-blockers for mild to moderate hypertension during pregnancy. *Cochrane Database Syst Rev*. 2009, Issue 1.

50. Duley L, Henderson-Smart DJ, Meher S. Drugs for treatment of very high blood pressure during pregnancy. *Cochrane Database Syst Rev.* 2009, Issue 1.

51. Rossouw JE, Anderson GL, Prentice RL, LaCroix AZ, Kooperberg C, et al. Risks and benefits of estrogen plus progestin in healthy postmenopausal women: principal results from the Women's Health Initiative randomized controlled trial. *JAMA.* 2002;288:321-33.

52. The Writing Group for the PEPI Trial; for the Postmenopausal Estrogen/Progestin Interventions (PEPI) Trial. Effects of estrogen or estrogen/progestin regimens on heart disease risk factors in postmenopausal women. *JAMA.* 1995;273:199-208.

53. Ram CV, Silverstein RL. Treatment of hypertensive urgencies and emergencies. *Curr Hypertens Rep.* 2009;11:307-14.

Acknowledgement

Our Saudi Hypertension Management Society is deeply indebted to ***Dr. Sameer Bin Huraib*** (October 1954–April 2003) for his proposal of this foundation. He gathered with his excellent social and professional contacts, diverse professionals interested in HTN, to form our group. Thanks to his dynamic personality and his good relations with many of us, he was able to encourage many to join. In the spirit of his personality and character, our group shall continue his work and remember him with gratitude and thanks.

We owe ***Ms. Mona Hamdan*** and ***Ms. Sahar El Jamal***, our administrative coordinators, much thanks and appreciation for their energetic support and organization of our meetings, as well as the coordination of our various activities and the preparation of our guidelines and home page.

Our thanks also go to ***Ms. Sharon Hanington***, for editing the guidelines and chapters for our home page.

Appendices

Appendix 1. Oral Antihypertensive Drugs Available in Saudi Arabia: As of March 2010			
Drug Class: THZ-Ds			
Generic Name	***Brand Name, Package Size, and Price in Saudi Riyals***	***Usual Dose, Range, mg/d***	***Daily Frequency***
Chlorthalidone	Hygroton, 50 mg (20 tablets = 17.9 SR)	12.5–50	1
Hydrochlorothiazide	Esidrex 25 mg (20 tablets = 17.25 SR) Monozide 25 mg (30 tablets = 14.2 SR) Monozide 12.5 mg (30 tablets = 8.4 SR)	12.5–50	1
Indapamide	Natrillix 2.5 mg (30 tablets = 27.2 SR) Natrillix 1.5 mg S.R. (30 tablets = 37.9 SR)	1.25–2.5	1
Drug Class: Loop Diuretics			
Bumetanide	Burinex 1 mg (20 tablets = 10.6 SR)	0.5–2	2
Furosemide	Diusemide 40 mg (30 tablets = 7 SR) Impugan 40 mg (24 tablets = 7.95 SR) Lasix 40 mg (20 tablets = 23.65 SR) Lasix Liquid (150 ml = 22.85 SR) Oedemax 40 mg (10 tablets = 5.85 SR & 50 tablets = 28.4 SR) Fusix 40 mg (30 tablets = 18 SR) Salurin 40 mg (20 tablets = 14.15 SR) Salurin 5mg/5ml syrup (100 ml = 10 SR)	20–80	2
Drug Class: Potassium-Sparing Diuretics			
Amiloride	Available in combination products	5–10	1–2
Triamterene	Available in combination products	50–100	1–2
Drug Class: Aldosterone-Receptor Blockers Diuretics			
Spironolactone	Aldactone 25 mg (20 tablets = 18 SR) Aldactone 100 mg (10 tablets = 25.05 SR) Noractone 25 mg (30 tablets = 9.05 SR) Spiroctan 25 mg (20 tablets = 19.6SR) Spiroctan 50 mg (20 tablets = 22.45 SR)	25–50	1–2
Drug Class: βBs			
Atenolol	Atromin 50 mg (28 tablets = 9.5 SR) Atromin 100 mg (28 tablets = 16.65 SR) Apo-Atenolol 50 mg (30 tablets =	25–100	1

	23.65 SR, 100 tablets = 67.65 SR) Apo-Atenolol 100 mg (30 tablets = 38.3 SR,100 tablets = 107.85 SR) Bolkium 100 mg (15 tablets = 20.75 SR) Canar 50 mg (28 tablets = 18.45 SR) Canar 100 mg (28 tablets = 29.55 SR) Cardol 100 mg (20 tablets = 27.5 SR) Glormin 50 mg (28 tablets = 12.55 SR) Glormin 100 mg (28 tablets = 21.5 SR) Hypoten 50 mg (28 tablets = 22.4 SR) Hypoten 100 mg (14 tablets = 21.55 SR) Novo-Atenolol 50 mg (30 tablets = 26.05 SR, 100 tablets = 68.45 SR) Novo-Atenolol 100 mg (30 tablets = 42.55 SR,100 tablets = 118.95 SR) Normoten 100 mg (14 tablets = 16.8 SR, 28 tablets = 32.85 SR) Normoten 50 mg (28 tablets = 20.5 SR) Preslo 100 mg (30 tablets = 16.05 SR) Preslo 50 mg (30 tablets = 9.45 SR) Tenol 100 mg (30 tablets = 24.45 SR) Tenol 50 mg (30 tablets = 15.3 SR) Tenormin 100 mg (14 tablets = 26.1 SR, 28 tablets = 46.55 SR) Tenormin 50 mg (28 tablets = 30.7 SR) Atromin 50 mg (28 tablets = 9.8 SR) Atromin 25 mg (28 tablets = 16.65 SR) Betaten 100 mg (28 tablets = 18.5 SR) Betaten 50 mg (28 tablets = 11.3 SR) Betaten 25 mg (28 tablets = 6.65 SR) Glormin 25 mg (28 tablets = 7.4 SR) Glormin 50 mg (28 tablets = 12.55 SR) Glormin 100 mg (28 tablets = 21.5 SR) Tensotin 50 mg (28 tablets = 16.6 SR) Tensoten 100 mg (28 tablets = 26.55 SR)		
Nabivilol	Nebilet 5 mg (28 tablets = 64.9 SR)	5	1
Bisoprolol	Biscor 5 mg (30 tablets = 22.3 SR) Biscor 10 mg (30 tablets = 31.6 SR) Concor 2.5 mg (30 tablets = 21.25 SR) Concor 5 mg (30 tablets = 31.85 SR) Concor 10 mg (30 tablets = 45.15 SR)	2.5–10	1
Metoprolol	Lopressor 50 mg (40 tablets = 27.65	50–100	1–2

	SR) Lopressor 100 mg (20 tablets = 27.65 SR) Lopressor 200 mg (14 tablets = 34.8 SR)		
Propranolol	Inderal 10 mg (50 tablets = 6.3 SR) Inderal 40 mg (50 tablets = 15.85 SR) Inderal 80 mg (100 tablets = 59.1 SR) Indicardin 10 mg (50 tablets = 3.55 SR) Indicardin 40 mg (50 tablets = 7.3 SR)	40–160	2
Drug Class: βBs with Intrinsic Sympathomimetic Activity			
Pindolol	Visken 5 mg (30 tablets = 20.6 SR)	10–40	2
Drug Class: Combined α- and βBs			
Carvedilol	Dilatrend 25 mg (30 tablets = 52.05 SR) Dilatrend 6.25 mg (30 tablets = 27.8 SR) Riacavilol 6.25 mg (30 tablets = 24.1 SR) Riacavilol 12.5 mg (30 tablets = 15.95 SR) Riacavilol 25 mg (30 tablets = 27.8 SR) Carvidol 6.25 mg (30 tablets = 17.7 SR) Carvidol 12.5 mg (30 tablets = 27.9 SR) Carvidol 25 mg (30 tablets = 47.25 SR)	12.5–50	2
Labetalol	Trandate 100 mg (25 tablets = 16.2 SR, 100 tablets = 46.5 SR) Trandate 200 mg (25 tablets = 18.3 SR, 100 tablets = 63.6 SR	200–800	2
Drug Class: ACE-Is			
Benazepril	Cibacen 5 mg (14 tablets = 21.05 SR) Cibacen 10 mg (14 tablets = 34.85 SR) Cibacen 20 mg (14 tablets = 57.25 SR)	10–40	1–2
Captopril	Acetab 25 mg (30 tablets = 20.25 SR) Acetab 50 mg (30 tablets = 34.2 SR) Capocard 25 mg (20 tablets = 20.25 SR) Capocard 50 mg (20 tablets = 34.2 SR) Capoten 25 mg (20 tablets = 18.65 SR) Capoten 50 mg (20 tablets = 31.55 SR) Captophar 25 mg (30 tablet = 17.8 SR)	25–100	2

	Captophar 50 mg (30 tablets = 28.1 SR) Capril 25 mg (20 tablets = 16.1 SR) Capril 50 mg (20 tablets = 27.2 SR) Miniten 25 mg (20 tablets = 12.6 SR) Miniten 50 mg (20 tablets = 20.65 SR) Novo-Captopril 12.5 mg (20 tablets = 11.55 SR) Novo-Captopril 25 mg (20 tablets = 18.25 SR) Novo-Captopril 50 mg (20 tablets = 29.1 SR)		
Cilazapril	Inhibace 1 mg (30 tablets = 39 SR) Inhibace 2.5 mg (28 tablets = 53.95 SR) Inhibace 5 mg (28 tablets = 67.75 SR)	1–5	1
Enalapril	Angiotec 5 mg (30 tablets = 25.4 SR) Angiotec 10 mg (30 tablets = 34.55 SR) Angiotec 20 mg (30 tablets = 41.55 SR) Enapril 5 mg (30 tablets = 26.2 SR) Enapril 10 mg (30 tablets = 44.4 SR) Enapril 20 mg (30 tablets = 58.55 SR) Esopress 10 mg (30 tablets = 49.35 SR) Korandil 20 mg (10 tablets = 14.75 SR) Lapril 5 mg (20 tablets = 12.35 SR) Lapril 10 mg (20 tablets = 20.2 SR) Narapril 5mg (28 tablets = 19.8 SR) Narapril 10mg (28 tablets = 33.55 SR) Renitec 5 mg (28 tablets = 49.35 SR) Renitec 10 mg (28 tablets = 63.45 SR) Renitec 20 mg (14 tablets = 42.2 SR, 28 tablets = 75.3 SR) Riapril 5 mg (30 tablets = 23.6 SR) Riapril 10 mg (30 tablets = 39.95 SR) Riapril 20 mg (30 tablets = 52.7 SR) Vasopril 5 mg (30 tablets = 19.1 SR) Vasopril 10 mg (30 tablets = 32.35 SR) Vasopril 20 mg (30 tablets = 42.65 SR)	2.5–40	1–2
Fosinopril	Staril 10 mg (30 tablets = 64.55 SR) Staril 20 mg (30 tablets = 97.1 SR)	10–40	1
Lisinopril	Linopril 5mg (28 tablets = 18.7 SR) Linopril 10mg (28 tablets = 37.45 SR) Linopril 20mg (28 tablets = 56.6 SR) Lisdene 5mg (28 tablets = 16.25 SR)	10–40	1

	Lisdene 10mg (28 tablet=25.75 SR) Lisdene 20 mg (28 tablets = 40.45 SR) Lisino 5mg (28 tablets = 16.85 SR) Lisino 10mg (28 tablets = 28.55 SR) Lisino 20mg (28 tablets = 48.4 SR) Omace 5mg (28 tablets = 18.65 SR) Omace 10mg (28 tablets = 30.6 SR) Omace 20mg (28 tablets = 50.2 SR) Zestril 5 mg (28 tablets = 29.55 SR) Zestril 10 mg (28 tablets = 65.35 SR) Zestril 20 mg (28 tablets = 82 SR) Zinopril 5 mg (28 tablets = 20.75 SR) Zinopril 10 mg (28 tablets = 50.1 SR) Zinopril 20 mg (28 tablets = 62.85 SR) Zinopril 40 mg (28 tablets = 89.8 SR)		
Perindopril	Coversyl 5 mg (30 tablets = 68.95 SR) Coversyl 10 mg (30 tablets = 111.8 SR)	4–8	1–2
Quinapril	Acuitel 10 mg (30 tablets = 44.9 SR) Acuitel 20 mg (30 tablets = 63.45 SR)	10–40	1
Drug Class: ARBs			
Candesartan	Atacand 4 mg (28 tablets = 63.85 SR) Atacand 8 mg (28 tablets = 76.5 SR) Atacand 16 mg (28 tablets = 93.3 SR) Blopress 8 mg (28 tablets = 55.8 SR) Blopress 16 mg (28 tablets = 68.15 SR)	8–32	1
Eprosartan	Teveten 600 mg (28 tablets = 100.65 SR)		
Losartan	Cozaar 50 mg (28 tablets = 99.45 SR) Cozaar 100 mg (28 tablets = 174.1 SR) Lacine 50 mg (30 tablets = 63.8 SR) Sortiva 25 mg (30 tablets = 45.65 SR) Sortiva 50 mg (30 tablets = 70.9 SR) Sortiva 100 mg (30 tablets = 116.25 SR)	25–100	1–2
Irbesartan	Aprovel 150 mg (28 tablets = 98.1 SR) Aprovel 300 mg (28 tablets = 120.5 SR)		
Telmisartan	Micardis 40 mg (28 tablets = 87.9 SR) Micardis 80 mg (28 tablets = 88.4 SR)	20–80	1
Valsartan	Diovan 40 mg (28 capsules = 64.15 SR) Diovan 80 mg (28 capsules = 123.2 SR)	80–320	1

	Diovan 160 mg (28 capsules = 94.9 SR) Diovan 320 mg (28 capsules = 152.3 SR)		
Drug Class: Non-DHP CCBs			
Diltiazem	Apo-Diltaz 30 mg (30 tablets = 12.45 SR) Apo-Diltaz 60 mg (30 tablets = 15.2 SR) Bi-tildiem 90 mg (28 tablets = 26.35 SR) Bi-tildiem 120 mg (28 tablets = 38.85 SR) Dilzem 90 mg (30 tablets = 31.35 SR) Dilzem 60 mg (30 tablets = 19.75 SR) Mono-Tildiem SR 200 mg (28 tablets = 57.85 SR) Mono-Tildiem SR 300 mg (28 tablets = 73.65 SR) Novo-Diltazem 30 mg (30 tablets = 13.8 SR, 100 tablets = 38.55 SR) Novo-Diltazem 60 mg (30 tablets = 16.9 SR, 100 tablets = 56.35 SR) Riazem 30 mg (30 tablets = 8.75 SR) Riazem 60 mg (30 tablets = 14.85 SR) Riazem 120 mg (30 tablets = 24.3 SR) Riazem 180 mg (30 tablets = 31.5 SR) Riazem 240 mg (30 tablets = 37.85 SR)	120–420	1
Verapamil	Isoptin 40 mg (50 tablets = 21.3 SR) Isoptin 80 mg (20 tablets = 16.35 SR) Isoptin-Retard 120 mg (20 tablets = 23.7 SR) Isoptin-SR 240 mg (20 tablets = 41.95 SR)	80–320	1–2
Drug Class: DHP CCBs			
Amlodipine	Amlor 5 mg (30 tablets = 63.85 SR) Amlor 10 mg (30 tablets = 67.8 SR) Amlopine 5 mg (30 tablets = 38.85 SR) Amlopress 5 mg (28 tablets = 32.65 SR) Amvasc 2.5 mg (30 capsules = 27.45 SR) Amvasc 5 mg (30 capsules = 48 SR) Amvasc 10 mg (30 capsules = 70 SR) Amlozek 5 mg (30 tablets = 16.6 SR) Amlozek 10 mg (30 tablets = 34.7 SR) Duactin 5 mg (30 capsules = 31.45 SR)	2.5–10	1

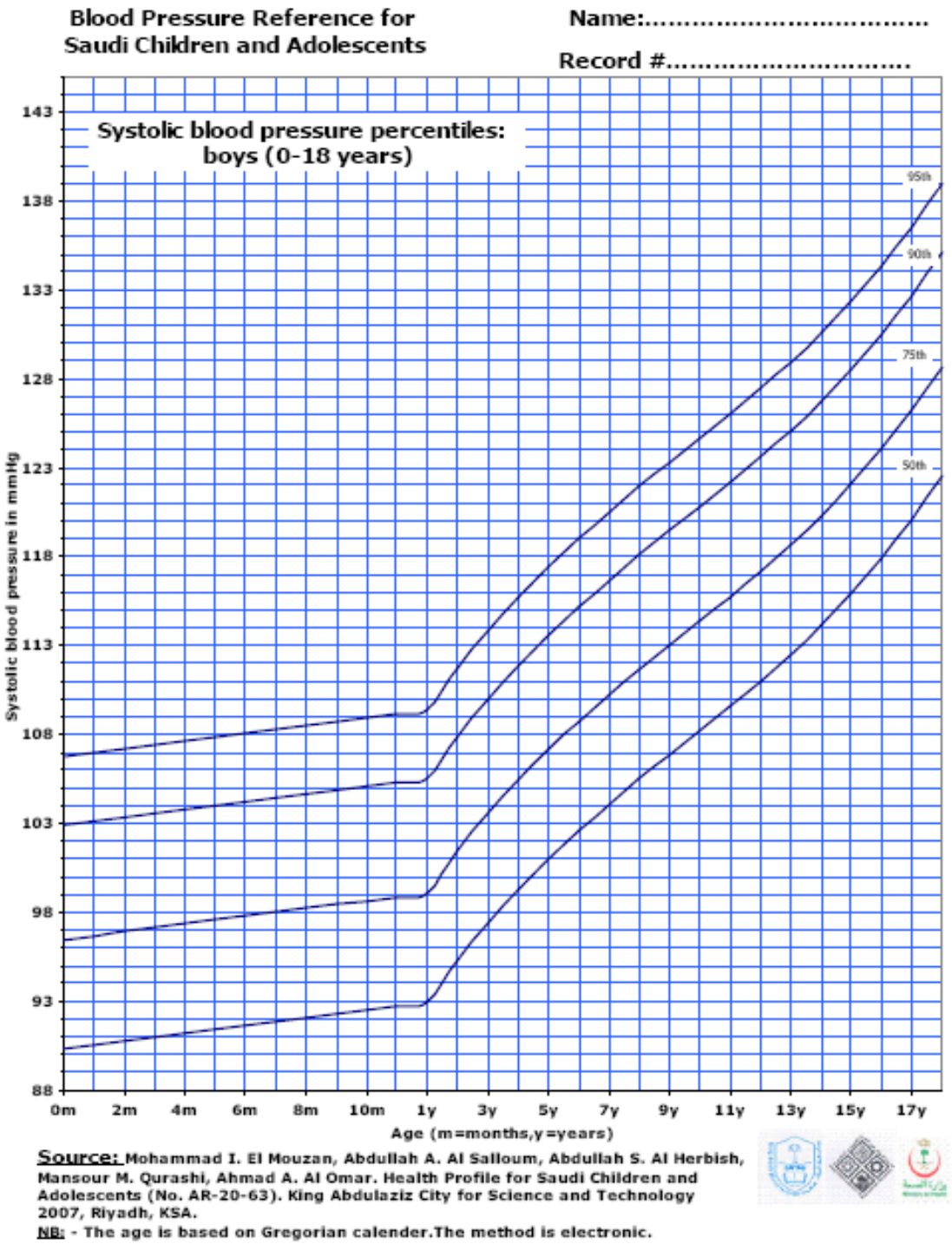
	Hypodipine 5 mg (28 capsules = 21.8 SR) Lofral 5 mg (30 tablets = 25.95 SR) Lofral 10 mg (30 tablets = 42.6 SR) Lowrac 5 mg (28 capsules = 26.4 SR) Lowvasc 5 mg (28 capsules = 32.65 SR) Lotense 5 mg (30 capsules = 53.35 SR) Lotense 10 mg (30 capsules = 56.70 SR) Vascodipine 2.5 mg (28 tablets = 24.7 SR) Vascodipine 5mg.(28 tablets=43.2 SR) Vascodipine 10 mg (28 tablets = 63 SR)		
Felodipine	Plendil SR 5 mg (30 tablets = 55.45 SR) Plendil SR 10 mg (30 tablets = 68.35 SR)	2.5–20	1
Isradipine	Lomir 2.5 mg (28 tablets = 43 SR, 56 tablets = 77 SR Lomir SR 5mg.(30 capsules=61.6)	2.5–10	2
Nifedipine	Adalat-Retard 20 mg (30 tablets = 49 SR) Adalat-LA 30 mg (30 tablets = 60 SR) Adalat-LA 60 mg (30 tablets = 70 SR)	10–60	1
Drug Class: αBs			
Doxazosin	Cardura 1 mg (20 tablets = 35 SR) Cardura 2 mg (20 tablets = 60 SR) Cardura 4 mg (20 tablets = 60 SR) Doxagen 1 mg (20 tablets = 23.7 SR) Doxagen 2 mg (20 tablets = 40.15 SR) Doxagen 4 mg (20 tablets = 53.7 SR)	1–16	1
Prazocin	Minipress 1 mg (30 tablets = 12 SR, 100 tablets = 23 SR) Minipress 2 mg (30 tablets = 20 SR, 100 tablets = 38 SR) Minipress 5 mg (30 tablets = 22.75 SR, 100 tablets = 67.7 SR)	2–20	2–3
Terazosin	Itrin 2 mg (30 tablets = 46.75 SR) Itrin 5 mg (14 tablets = 45.25 SR)	1–20	1–2
Drug Class: Central α-Agonists and Other Centrally Acting Drugs			
Clonidine	Catapres 0.150 mg (30 tablets = 9.85 SR)	0.1–0.8	2
Moxonidine	Physiotens 0.2 mg (28 tablets = 50 SR) Physiotens 0.4 mg (28 tablets = 72	0.2–0.4	1

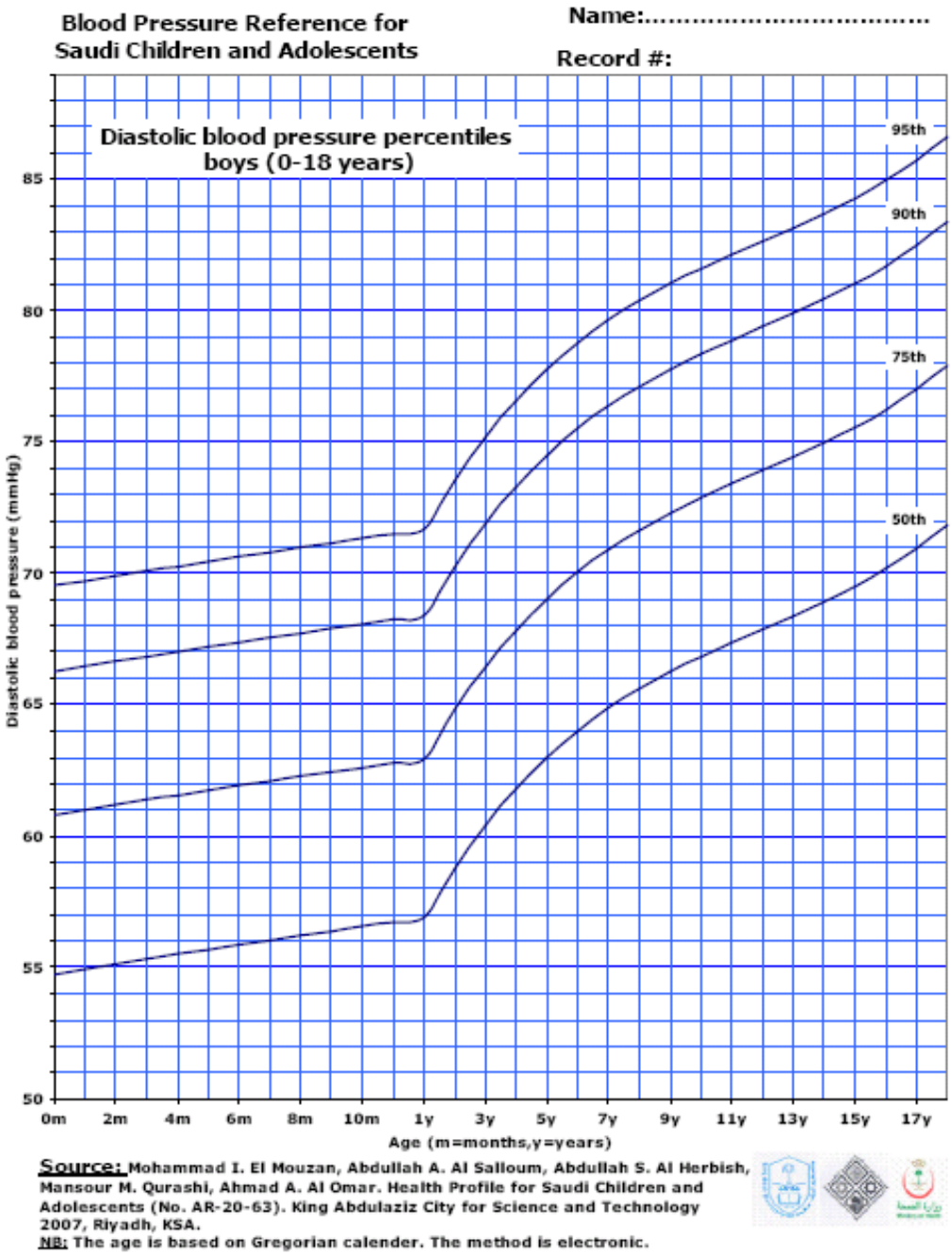
	SR)		
Rilmenedine	Hyperium 1 mg (30 tablets = 60 SR	1	1
Methyldopa	Aldomet 250 mg (30 tablets = 18 SR, 100 tablets = 52.80 SR Dopamet 250 mg (24 tablets = 21 SR, 100 tablets = 77 SR) Dopanore 250 mg (30 tablets = 5.05 SR) Sembrina 250 mg (30 tablets = 23 SR)	250–1000	2– 3
Drug Class: Direct Vasodilators			
Hydralazine	Hydralazine 25 mg (100 tablets = 13.35 SR)	25–100	2
Drug Class: Renin Inhibitor			
Aliskiren	Rasilez 150 mg (28 tablets = 98.1 SR) Rasilez 300 mg (28 tablets = 120.5 SR)	150–300	1

Appendix 2. Combination Drugs for Hypertension Available in Saudi Arabia	
Combination Type	***Brand Name, Package Size, and Price in Saudi Riyals***
ACE-Is and Diuretics	Accuzide (Quinapril 20 mg + Hydrochlorothiazide 12.5 mg) (30 tablets = 77.45 SR) Bi-preterax (Perindopril 4 mg + Indapamide 1.25 mg) (30 tablets = 71.80 SR) Capozide (Captopril 50 mg + Hydrochlorothiazide 25 mg) (28 tablets = 73 SR) Co-Renitec (Enalapril 20 mg + Hydrochlorothiazide 12.5 mg) (30 tablets = 102 SR) Preterax (Perindopril 2 mg + Indapamide 0.625 mg) (30 tablets = 59.85 SR) Zestoretic (Lisinopril 20 mg + Hydrochlorothiazide 12.5 mg) (28 tablets = 62.25 SR)
ARBs and Diuretics	Co-Aprovel (Irbesartan 150 mg + Hydrochlorothiazide 12.5 mg) (28 tablets = 101 SR) Co-Aprovel (Irbesartan 300 mg + Hydrochlorothiazide 12.5 mg) (28 tablets = 124 SR) Co-Aprovel (Irbesartan 300 mg + Hydrochlorothiazide 25 mg) (28 tablets = 124 SR) Co-Diovan (Valsartan 80 mg + Hydrochlorothiazide 12.5 mg) (28 tablets = 92.5 SR) Co-Diovan (Valsartan 160 mg + Hydrochlorothiazide 12.5 mg) (28 tablets = 110.65 SR) Co-Diovan (Valsartan 160 mg + Hydrochlorothiazide 25 mg) (28 tablets = 116.55 SR) Co-Diovan (Valsartan 320 mg + Hydrochlorothiazide 12.5 mg) (28 tablets = 160.7 SR) Co-Diovan (Valsartan 320 mg + Hydrochlorothiazide 25 mg) (28 tablets = 166.5 SR) Fortzaar (Losartan potassium 100 mg + Hydrochlorothiazide 12.5 mg) (28 tablets = 179.65 SR) Hyzaar (Losartan 50 mg + Hydrochlorothiazide 12.5 mg) (28 tablets = 107.25 SR) Sortiva (Losartan potassium 50 mg + Hydrochlorothiazide 12.5 mg) (30 tablets = 84.85 SR) Sortiva (Losartan potassium 100 mg + Hydrochlorothiazide 25 mg) (30 tablets = 139.15 SR)
βBs and Diuretics	Concor-5-Plus (Bisoprolol 5 mg + Hydrochlorothiazide 5 mg) (20 tablets = 30 SR) Concor-10-Plus (Bisoprolol 10 mg + Hydrochlorothiazide 5 mg) (20 tablets = 64.45 SR) Tenoretic (Atenolol 100 mg + Chlorthalidone 25 mg) (28 tablets = 53.6 SR) Lodoz 2.5/6.25 mg (Bisoprolol 2.5 mg + Hydrochlorothiazide 6.25 mg (30 tablets = 17.1 SR) Lodoz 5/6.25 mg (Bisoprolol 5 mg + Hydrochlorothiazide 6.25 mg (30 tablets = 30 SR)

	Lodoz 10/6.25 mg (Bisoprolol 5 mg + Hydrochlorothiazide 6.25mg (30 tablets = 45.1 SR) (28 tablets = 53.6 SR) Viskaldix (Pindolol 10 mg + Clopamide 5 mg) (30 tablets = 27.4 SR)
βBs and CCBs	Nif-Ten (Atenolol 50 mg + Nifedipine 20 mg) (28 capsules = 48 SR)
Centrally Acting Drugs and Diuretics	Isotriraupine (Reserpine 0.07 mg + Buthiazid)
Diuretics and Diuretics	Amuretic (Amiloride 5 mg + Hydrochlorothiazide 50 mg) (20 tablets = 8.65 SR) Apo-Amilzide (Amiloride 5 mg + Hydrochlorothiazide 50 mg) (30 tablets = 15.80 SR) Dyazide (Triamtrene 50 mg + Hydrochlorothiazide 25 mg) (20 tablets = 12.50 SR) Moduretic (Hydrochlorothiazide 50 mg + Amiloride 5 mg) (30 tablets = 17.6 SR)

Appendix 3. Pediatric BP Percentile Charts

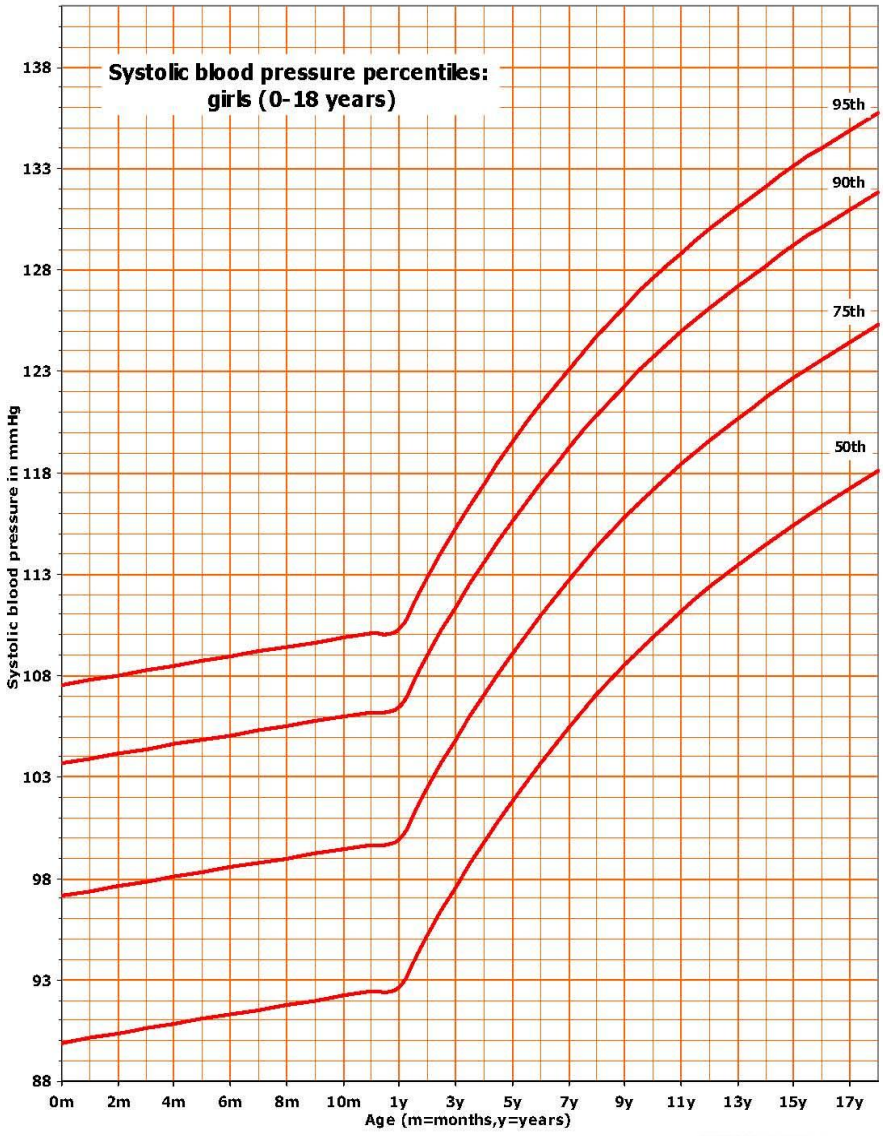



Blood Pressure Reference for
Saudi Children and Adolescents
Name:.....
Record #:
Diastolic blood pressure percentiles
boys (0-18 years)
95th
90th
75th
50th
Diastolic blood pressure (mmHg)
85
80
75
70
65
60
55
50
0m
2m
4m
6m
8m
10m
1y
3y
5y
7y
9y
11y
13y
15y
17y
Age (m=months,y=years)
Source: Mohammad 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.

Blood Pressure Reference for Saudi Children and Adolescents

Name:……

Record #:



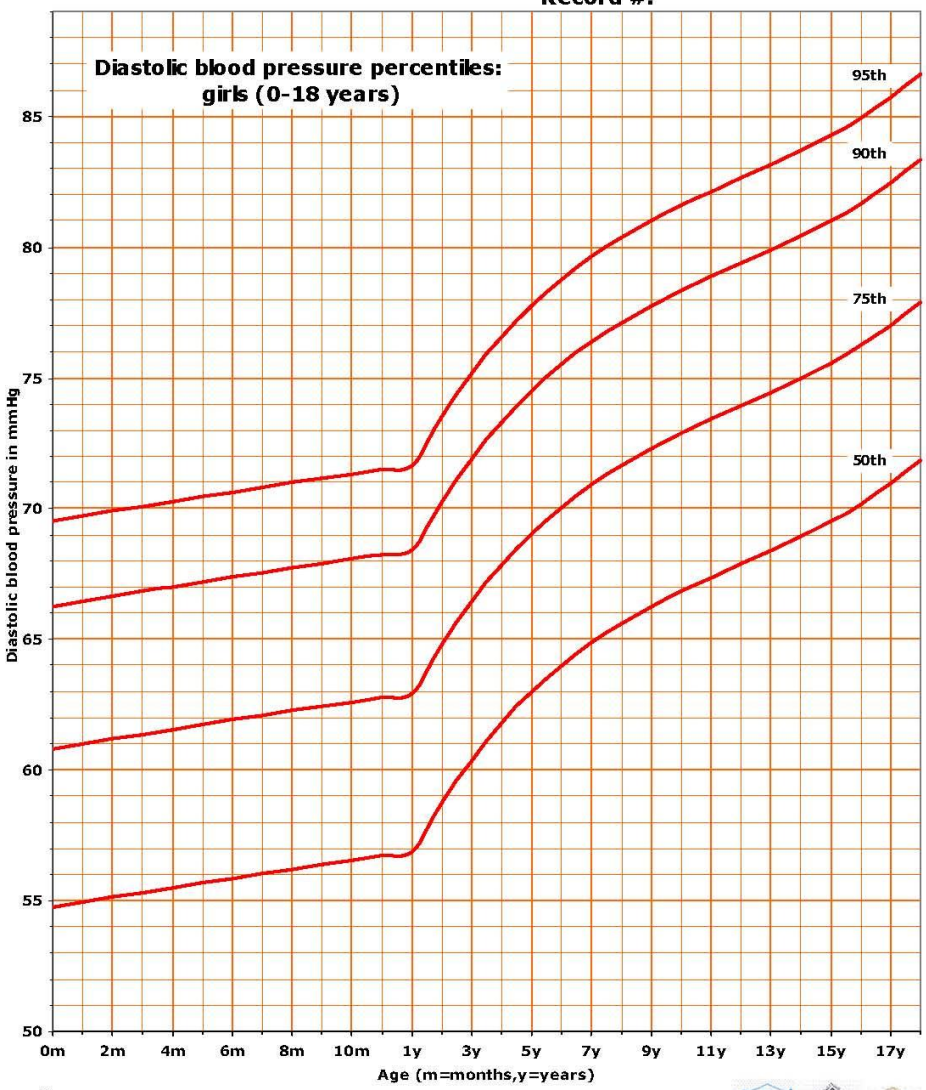
Source: Mohammad I. El Mouzan, Abdullah A. Al Salloum, Abdullah S. Al Herbish Mansour M. Qurashi, Ahmad A. Al Omar. Health Profile for Saudi Children and Adolescents (No. AR-20-63). King Abdulaziz City for Science and Technology 2007 Riyadh, KSA.

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

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.