

Review Article

Comparative Evaluation of Major Hypertension Guidelines and Practical Implications

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ABSTRACT

Guidelines are important to guide management of hypertension. Although more than 200 guidelines are available globally, important ones for India are learned societies-based from North America, Europe, and international organizations. These guidelines are all the more important as governments and international organizations such as World Health Organization (WHO) have absolved their roles in formulating them. In this article, we discuss similarities and differences in guidelines from 4 major societies: 2017 American College of Cardiology/ American Heart Association, 2018 European Society of Cardiology/ European Society of Hypertension, 2019 UK National Institute of Clinical Excellence, and 2020 International Society of Hypertension. All the guidelines agree on the proper method of blood pressure measurement, use of home blood pressure (BP) monitoring, and importance of ambulatory blood pressure monitoring as important for diagnosis. They all have restricted the use of beta-blockers as first-line therapy in hypertension. The major disagreements are with the level of blood pressure for defining hypertension, flexibility in identifying blood pressure targets for treatment, and use of initial combination therapy.

Keywords: Blood pressure, Guidelines, Hypertension.

INTRODUCTION

Hypertension is a common disorder in the community and it is estimated that nearly 1.5 billion adults in the world will have hypertension in the decade ahead.¹ Guidelines on its management are issued periodically by the experts in the field and advocacy professional organizations. While professional medical societies have developed many hypertension guidelines, two major well established

documents from North America and Europe, respectively, are the 2017 American College of Cardiology/ American heart Association (ACC/AHA) guidelines and 2018 European Society of Cardiology/ European Society of Hypertension (ESC/ESH) guidelines.^{2,3} In August 2019, the UK-based National Institute for Health and Care Excellence (NICE) published its updated guideline on the diagnosis and management of hypertension.^{4,5} The scope of all the updated guidelines has increased from the previous guidelines and have included people with type 2 diabetes as well as people with chronic kidney disease, established cardiovascular disease, or hypertension in pregnancy. In this review, we will discuss the common features and explore some of the major differences between the three guidelines. Recently, International Society of Hypertension (ISH) has also developed its own hypertension management guidelines.⁶ However, these guidelines are not very dissimilar from the European guidelines and partially discussed. In the present review we have focused on evolution of hypertension guidelines and discuss similarities and differences between the three major guidelines which are important globally. This discussion is all the more important because all these three guidelines are known to influence Indian Guidelines on Hypertension⁷ and are widely applied in clinical practice in India.

EVOLUTION OF HYPERTENSION GUIDELINES

There is a continuous relationship between level of BP and cardiovascular outcomes and any classification of hypertension is arbitrary.⁸ Multiple observational studies have highlighted the nature of graded risks with increasing systolic as well as diastolic BP. A meta-analysis of 61 prospective studies with more than one million participants

was conducted by Oxford-based Prospective Studies Collaboration.⁹ The cardiovascular risk started at systolic BP of 115 mmHg and diastolic BP >70 mmHg and continued with increasing BP values. However, objective of defining and classifying hypertension is not simply to ascertain when hypertension starts but is necessary because it provides us with definitions and help us to assess risk, determine prognosis, and ascertain when and how aggressively to treat. If clinicians are better able to select individuals at high risk, their therapeutic efforts to prevent complications are much more likely to be effective and spare those at low risk from the potential harm of unnecessary or overaggressive therapy.¹⁰ The dictum “hypertension should be defined as the level of BP when risk (of BP) outweighs harms (of treatment)” applies.¹¹

The ideal classification scheme should be simple but comprehensive. It should identify those individuals at high risk and provide a guide to management. Since hypertension is both a disease and a risk factor, the scheme should provide a guide to prognosis and help identify people who can expect to benefit most from treatment, an especially valuable feature from medical and economic perspectives.¹¹ Beginning the middle of last century, guidelines have been developed, initially by the World Health Organization (WHO), followed by guidelines from governments of large countries such as US, UK, and other European countries, Australia-New Zealand, Japan etc.¹² However, in the current era of evidence based medicine, the function of creation of the guidelines has been delegated to learned local and international societies such

as American College of Cardiology/American Heart Association (ACC/AHA) and other groups in US, European Society of Cardiology, Asia-Pacific Society of Hypertension, and International Society of Hypertension.⁸

RECENT INTERNATIONAL GUIDELINES

In the past, all the guidelines used almost similar criteria for diagnosis and identical approaches to hypertension management.^{12,13} It has been commented that “the multiplicity and diversity of expert guidelines emphasize some of the concerns that have been expressed about the impact of such official advice even when the authors state expressly that the objective of guidelines is to guide and not to instruct”.¹⁴ In response to such criticisms, the US government withdrew from its participation in guidelines development and instructed learned societies for development of guidelines. A certain set of rules was to be followed.¹⁵ The JNC-8 group, which was formed before this ruling came into place, suggested a novel form of classification based on age-groups, with older people having higher systolic BP targets than younger. Targets for diabetes and chronic kidney disease were revised in view of the evidence of harm for too tight lowering BP in diabetes patients.¹⁶ An important development during these years was development of better evidence-based guidance from UK-NICE and ESC/ESH.^{17,18} These guidelines followed the guidance on guidelines and although the hypertension classification was not different from US and other guidelines, focused on new technology and newer medicines.

Table 1: Proper blood pressure measurement technique

Conditions	<p>Quiet room with comfortable temperature</p> <p>Avoid smoking, caffeine, and exercise 30' before measurement; empty bladder; remain seated for 3-5 minutes before measurement</p> <p>Neither patient nor staff should talk during measurement</p>
Positions	Sitting, arm resting on table with back supported
Device and cuff	<p>Validated electronic upper-arm cuff device</p> <p>Alternate use of calibrated auscultatory device (aneroid, hybrid, or mercury). 1st Korotkoff sound for systolic and 5th phase for diastolic BP</p> <p>Cuff size according to arm circumference</p>
Protocol	At each visit take 3 measurements with 1 min intervals. Calculate average of last 2 measurements
Interpretation	BP of 2-3 office visits >140/90 indicates hypertension

BLOOD PRESSURE (BP) MEASUREMENT

All the three recent guidelines currently recommend office blood pressure measurement (OBPM) on repeated visits and ambulatory blood pressure monitoring (ABPM) or home blood pressure monitoring (HBPM) to confirm the diagnosis of hypertension, especially to exclude white-coat hypertension and diagnose masked hypertension.²⁻⁴ Measurement process is crucial for diagnosis of hypertension and to assess the efficacy of treatment. Recent guidelines stress on proper measurement techniques and is shown in table 1.

The UK-NICE guidance was one of the first national guideline to incorporate ABPM in its diagnostic algorithm of hypertension and its classification.¹⁷ It recommended ABPM in all patients whose clinic BP was 140/90 mmHg or greater. The rationale was that this strategy would improve the accuracy of the diagnosis compared with extant practice and would not only be cost-effective but also cost-saving for British National Health Service.⁴ ABPM has also been found to be superior to other methods of BP measurements and for predicting BP-related clinical events. The guidance also suggests that in case where ABPM is not suitable such as those with learning disabilities or physical disability or intolerance to ABPM, a home BP monitoring (HBPM) should be offered.^{4,17}

NICE guidance provides additional guidance for BP measurements.^{4,5} These include ensuring that healthcare professionals taking BP measurements have adequate initial training and periodic review of their performance. Because automated devices may not measure BP accurately if there is pulse irregularity (for example, due to atrial fibrillation), palpation of radial or brachial pulse before measuring BP is recommended. If pulse irregularity is present, BP should be measured manually using direct auscultation over the brachial artery. It should be ensured

by healthcare providers that devices for measuring are properly validated, maintained, and regularly recalibrated according to manufacturers' instructions. BP measurement should follow the proper protocol (Table 1). These and subsequent guidelines also recommend that in people with symptoms of postural hypotension (falls or postural dizziness) BP should be measured with the person either supine or seated and then measure blood pressure again with the person standing for at least 1 minute before measurement.^{4,6}

HYPERTENSION DIAGNOSIS

A major difference in the latest American and European guidelines is that while European and British retain the previous definition of hypertension,^{2,4} defined as either systolic BP ≥ 140 and/or diastolic BP ≥ 90 mmHg, the 2017 American guidelines have lowered the threshold to define hypertension to systolic ≥ 130 and/or diastolic ≥ 80 mmHg.³ The American guidelines (proposing new definition of hypertension) are driven largely by meta-analyses of important outcome trials including SPRINT (Systolic Blood Pressure Intervention Trial).¹⁹ On the other hand, the European guidelines are assembled largely on the basis of population attributable risk.² Yet, all the three sets of guidelines recommend the same therapeutic BP goal of $< 130/80$ mmHg.^{2,4}

BP diagnostic criteria using OBPM, ABPM, and HBPM is shown in table 2. The average 24-hour BP criteria are taken as important although 12-hour day-time and night-time BP provide important prognostic information. However, in view of the cumbersome procedure and costs this technology has not found widespread application. Subsequently, many national and international guidelines have recommended use of ABPM or HBPM for diagnosis, classifi-

Table 2: Hypertension diagnosis based on office, ambulatory, and home blood pressure measurements^{2-4,6}

	ACC/AHA 2017	ESC/ESH 2018	NICE-UK 2019	ISH 2020
Clinic (OBPM)	130/80	140/90	140/90	140/90
Home (HBPM)	130/80	135/85	135/85	135/85
Daytime (ABPM)	130/80	135/85	135/85	135/85
24 hour (ABPM)	125/75	130/80		130/80
Night time (ABPM)	110/65	120/70		120/70

ABPM: ambulatory BP measurement; HBPM: home BP measurement; OBPM: office BP measurement

cation, and monitoring of BP in patients with suspected or clinical hypertension. The Indian guidelines also recommend ABPM for better assessment of hypertension especially for white-coat hypertension and masked hypertension.

TREATMENT THRESHOLDS AND RISK ESTIMATION

The treatment thresholds for initiation of hypertension management are shown in table 3. Persistently raised BP above these levels are indication of interventions including drug therapy, in all the guidelines. However ACC/AHA guidelines recommend lifestyle management only if the BP is 130-139 and/or 80-90 mmHg or Stage I hypertension. Guidelines also differ slightly in staging of hypertension. Hypertension that needs pharmacotherapy is defined in all guidelines as BP 140-159 mmHg systolic and/or 90-99 mmHg diastolic (ESC/ESH, NICE, ISH Stage I; ACC/AHA Stage II). Previous classification in multiple stages of hypertension has been rejected by all, except the NICE guidelines (Table 3).

It is essential to assess cardiovascular risk in patients with hypertension to provide cardiovascular benefit among these patients beyond BP control. All the current guidelines focus on overall cardiovascular risk for achieving this benefit (table 4). ESC guidelines utilize the Systematic Coronary Risk Evaluation (SCORE) system to estimate cardiovascular risk for patients with hypertension at the time of initial diagnosis prior to initiation of pharmacotherapy or whenever changes occur to BP readings.² The ACC/AHA guidelines recommend use of the Atherosclerotic Cardiovascular Disease Risk (ASCVD)

calculator using the Pooled Cohort Equation (PEC) for determination of BP targets.³ The Europeans also identify hyperuricemia and elevated heart rate as CV disease risk factors but the American guidelines do not recognize them due to limited evidence that treatment improves clinical outcomes.

NICE guidelines recommend a formal estimation of cardiovascular risk to discuss prognosis and healthcare options with people with hypertension, both for raised BP and other modifiable risk factors.⁵ These guidelines recommend estimation of cardiovascular risk in line with the recommendations on identifying and assessing cardiovascular disease risk in NICE's guideline on cardiovascular disease and recommend use of clinic BP measurements to calculate cardiovascular risk. It is also recommended for all people with hypertension to test for the presence of protein in the urine by sending a urine sample for estimation of the albumin: creatinine ratio and test for haematuria using a reagent strip; blood sample to measure glycated haemoglobin (HbA_{1c}), electrolytes, creatinine, estimated glomerular filtration rate, total cholesterol and HDL cholesterol; examine the fundi for the presence of hypertensive retinopathy and a 12-lead electrocardiograph.

HYPERTENSION MANAGEMENT

All the guidelines focus on 2 major strategies for BP control in hypertensive patients: lifestyle interventions and pharmacological therapy.

Lifestyle management: A summary of lifestyle management is shown in table 5. The main focus is not only on factors directly related to raised BP such as high dietary

Table 3: Classification of hypertension based on blood pressure levels (in mmHg) in various guidelines

Hypertension grade	ACC/AHA 2017	ESC/ESH 2018	NICE 2019	ISH 2020
High normal	SBP 120-129	SBP 130-139	---	SBP 130-139
	DBP 75-79	DBP 85-89	---	DBP 85-89
Stage I	SBP 130-139	SBP 140-159	SBP 140-159	SBP 140-159
	DBP 80-89	DBP 90-99	DBP 90-99	DBP 90-99
Stage II	SBP >140	SBP >160	SBP 160-179	SBP >160
	DBP >90	DBP >100	DBP 100-119	DBP >100
Stage III	---	---	SBP >180	---
			DBP >120	

sodium, low potassium and high fat intake, low physical activity, and obesity but also on reduction in overall cardiovascular risk by eliminating tobacco and alcohol use and promotion of healthy diet and physical activity. All the

guidelines support these recommendations.

Pharmacotherapy: Drug therapy is cornerstone of hypertension management. A step care approach was followed by various international guidelines in the past. However,

Table 4: Risk stratification and management strategies for BP management to reduce overall cardiovascular risk in various guidelines

	ACC/AHA 2017	ESC 2018	NICE 2019	ISH 2020
Diagnosis	Hypertension is defined by average BP of $\geq 130/80$ mmHg, with BP measured at multiple occasions.	Hypertension is defined by office BP of $\geq 140/90$ mmHg, ABPM of $\geq 130/80$ mmHg, or HBPM $\geq 135/85$ mmHg. Important to screen every individual for hypertension and diagnosis confirmed using out-of-office BP measurement	Hypertension is defined by office BP of $\geq 140/90$ mmHg, ABPM of $\geq 130/80$ mmHg, or HBPM $\geq 135/85$ mmHg.	Hypertension is defined by office BP of $\geq 140/90$ mmHg, ABPM of $\geq 130/80$ mmHg, or HBPM $\geq 135/85$ mmHg.
Risk stratification	In adults with an estimated 10 year risk of $\geq 10\%$ and systolic BP ≥ 130 mmHg or diastolic BP ≥ 80 mmHg, use of BP lowering medications is recommended for primary prevention. In adults with confirmed hypertension and a 10-year event risk of $\geq 10\%$, chronic kidney disease or diabetes a BP target $< 130/80$ mmHg is recommended. In adults with an estimated 10 -year cardiovascular disease risk of $< 10\%$ and systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg, initiation of BP lowering medication is recommended.	BP control targets of $< 140/90$ mmHg as initial target and $< 130/80$ mmHg in all high-risk categories recommended.	Reduce clinic BP $> 140/90$ mmHg and maintain in adults with hypertension aged < 80 . Reduce clinic BP $> 150/90$ mmHg and maintain in adults with hypertension aged ≥ 80 . Use clinical judgement for people with frailty or multimorbidity. When using ABPM or HBPM to monitor response to treatment, use the average BP during person's usual waking hours.	< 65 years age - BP target is $< 130/80$ mmHg if tolerated (but $> 120/70$). ≥ 65 years - BP target is $< 140/90$ mmHg if tolerated but consider an individualised BP target in the context of frailty, independence, and likely tolerability of treatment.
Risk factor control strategies	In adults with hypertension, including those requiring antihypertensive medication, non-pharmacological interventions are recommended to reduce BP. These include weight loss, heart-healthy dietary pattern, sodium reduction, potassium supplementation, increased physical activity with a structured exercise programme and limited alcohol consumption.	Lifestyle interventions are important.	Lifestyle interventions are important.	Lifestyle interventions are important.

Table 5: Risk factor control for hypertension management in ACC/AHA, ESC, and NICE guidelines

	ACC/AHA 2017	ESC 2018	NICE 2019	ISH 2020
Smoking and tobacco use	<p>All adults should be assessed at every health-care visit for tobacco use and their tobacco use status recorded to facilitate tobacco cessation.</p> <p>To achieve tobacco abstinence, all adults who use tobacco should be firmly advised to quit.</p> <p>In adults who use tobacco, add combination of behavioural interventions plus pharmacotherapy is recommended to maximize quitting.</p> <p>Tobacco abstinence is recommended to reduce risk.</p>	<p>No exposure to tobacco in any form.</p> <p>It is recommended to identify smokers and provide repeated advice on stopping with offers to help, by use of follow-up support, nicotine replacement therapies, vareniclin, and bupropion individually or in combination.</p> <p>To stop all smoking of tobacco or herbal products, as this is strongly and independently causal.</p> <p>Avoid passive smoking.</p>	<p>Stop smoking interventions and services delivered in primary care and community settings for everyone over the age of 12.</p> <p>Aims to ensure that everyone who smokes is advised and encouraged to stop and given the support they need.</p> <p>Importance of targeting vulnerable groups who find smoking cessation difficult.</p>	<p>Smoking cessation and referral to smoking cessation programs are advised.</p>
Healthy diet	<p>A diet emphasising intake of vegetables, fruits, legumes, nuts, whole grains, and fish is recommended to decrease risk factors</p>	<p>A healthy diet is recommended as a cornerstone of cardiovascular prevention, with a focus on whole grain products, vegetables, fruit, and oily fish.</p> <p>30 g unsalted nuts, >200 g fruits, and >200 g vegetables are recommended per day.</p>	<p>Ask about people's diet and exercise patterns because a healthy diet and regular exercise can reduce BP.</p> <p>Offer appropriate guidance and written or audiovisual materials to promote lifestyle changes.</p>	<p>Eating a diet that is rich in whole grains, fruits, vegetables, such as the DASH diet.²⁰ Increase intake of vegetables high in nitrates known to reduce BP, such as leafy vegetables and beetroot.</p>
Dietary fats	<p>Replacement of saturated fat with dietary monounsaturated and polyunsaturated fats can be beneficial.</p> <p>Intake of trans fats should be avoided and eliminated.</p>	<p>Low saturated fat diet <10% of total energy intake. Replace with polyunsaturated fats.</p> <p>Transunsaturated fatty acids should be avoided, with preferably no intake from processed food and <1% of total energy intake.</p>		<p>Encourage diet rich in polyunsaturated fats and dairy products and reducing food high in sugar, saturated fat and trans fats.</p>
Dietary sodium (Salt)	<p>Optimal goal of <1500 mg per day: aim for 1000 mg per day reduction in most adults</p>	<p>< 2000 mg per day.</p>	<p>Encourage people to keep their dietary sodium intake low, either by reducing or substituting sodium salt.</p>	<p>Reduce salt added when preparing foods, and at the table. Avoid or limit consumption of high salt foods such as soy sauce, fast foods and processed food including breads and cereals high in salt.</p>
Dietary potassium	<p>Aim for 3500-5000 mg per day, preferably by consumption of a diet high in potassium</p>	<p>Consume fruits and vegetables high in potassium.</p>	<p>Promote healthy foods containing potassium, calcium or magnesium.</p> <p>Do not promote supplements.</p>	<p>Other beneficial foods containing magnesium, calcium and potassium such as avocados, nuts, seeds, legumes and tofu.²¹</p>

Physical activity	<p>Adults should be routinely counselled in health-care visits to optimize a physically active lifestyle.</p> <p>All adults should engage in >150 min per week of accumulated moderate-intensity or >75 min per week of vigorous-intensity aerobic physical activity or an equivalent combination of moderate and vigorous activity.</p>	<p>At least 150 min/week of moderate aerobic physical activity or 75 min/week of vigorous aerobic activity or a combination thereof.</p> <p>For additional benefit, gradual increase to 300 min/week of moderate intensity or 150 min a week of vigorous intensity.</p>	<p>Regular exercise is advised to reduce BP.</p>	<p>Moderate intensity aerobic exercise (walking, jogging, cycling, yoga, or swimming) for 30 minutes on 57 days per week or HIIT (high intensity interval training) which involves alternating short bursts of intense activity with subsequent recovery periods of lighter activity. Strength training also can help reduce blood pressure. Performance of resistance/strength exercises on 23 days per week.</p> <p>Stress should be reduced and mindfulness or meditation introduced into the daily routine.</p>
Psychosocial interventions	<p>Important for increasing adherence to therapies</p>	<p>Multimodal behavioural interventions, integrating health education, physical exercise, and psychological therapy, for psychosocial risk and coping.</p>		
Obesity	<p>In overweight or obese persons, weight loss is recommended to improve risk factor profile.</p> <p>Counselling and comprehensive lifestyle interventions, including calorie restriction, are recommended for achieving and maintaining weight loss.</p> <p>Reasonable to measure waist circumference to identify those at higher cardiometabolic risk</p>	<p>Individuals with healthy bodyweight should maintain it, and people who are overweight or obese should strive to achieve a healthy bodyweight to reduce BP, dyslipidaemia, diabetes, and vascular risk</p>	<p>Adults who are overweight or obese, assess their lifestyle, comorbidities and willingness to change.</p> <p>Apart from lifestyle changes, consider drug treatment and surgery for obesity.</p>	<p>Body weight control is indicated to avoid obesity. Particularly abdominal obesity should be managed. Ethnic-specific cut-offs for BMI and waist circumference should be used.²² Alternatively, a waist-to-height ratio <0.5 is recommended for all populations.^{23,24}</p>

with advent of better evidence based therapies the focus has shifted to an *a la carte* approach and personalised medicine. Details of treatment for stage I and II hypertension in various guidelines are shown in table 6.

Target oriented control of BP is essential. All the guidelines focus on 2-stage control of hypertension. In first stage the target is >140/90 mmHg and if this is achieved, the second target is <130/85 mmHg. Lower targets have been recommended for certain specific comorbid conditions and diseases such as diabetes, chronic kidney disease, congestive heart failure, and left ventricular systolic dysfunction.

CONCLUSION

Hypertension is rapidly evolving into a major public health

issue and primary care management is essential to control this burgeoning epidemic. Guidelines are essential to guide therapy and provide useful context. In this article we have discussed similarities and differences in 4 major international guidelines: 2017 American College of Cardiology/ American Heart Association, 2018 European Society of Cardiology/ European Society of Hypertension, 2019 UK National Institute of Clinical Excellence, and 2020 International Society of Hypertension. All these guidelines agree on the proper method of blood pressure measurement, use of home blood pressure, and importance of ambulatory blood pressure monitoring as important for diagnosis. They also promote healthy lifestyles with tobacco cessation, alcohol moderation, healthy diet with plenty of fruits and vegetables, and regular moderate

Table 6: Evidence based pharmacotherapy for BP control in various guidelines

		ACC/AHA2017	ESC 2018	NICE 2019	ISH 2020
Stage I	Monotherapy	A, C, or D as monotherapy	A+C, A+D, or C+D as initial therapy as combination pill (SPC)	A or C in young C or D in older	A+C, A+D, or C+D as initial therapy as combination pill (SPC)
Stage II	Duotherapy	A+C, A+D, or C+D	High dose combination pill	A+C, A+D, or C+D	A+C+D
Resistant hypertension	Polytherapy	Triple drug Spironolactone	Triple drug Spironolactone	Triple drug Spironolactone	Triple drug Spironolactone
Other classes	Polytherapy	Add B if compelling indication	Add B if compelling indication	Add B if compelling indication	Add B at any step if specific indication
Comments					

A: ACEI/ARB; B: beta blockers; C: calcium channel blockers; D: diuretics; SPC: single pill combination.

physical activity. All the guidelines have restricted use of beta-blockers as first-line therapy in hypertension. The major disagreements are with the level of blood pressure used for defining hypertension- ≥ 130 or ≥ 140 mmHg systolic, flexibility in identifying blood pressure targets for treatment, and use of initial combination therapy. All the guidelines agree that control of BP to targets (depending on patient phenotype) is crucial and all pathways should be focussed on BP control.

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