

## Hypertension

**Theresa Lowry Lehnen, RGN, GPN, RNP, BSc, MSc, M. Ed, PhD**  
**Clinical Nurse Specialist and Associate Lecturer Institute of Technology Carlow**

Hypertension is the most common cause of cardiovascular disease (CVD) and the leading risk factor for premature death worldwide. Approximately 55% of ischaemic heart disease, 50% of ischaemic stroke, 58% of haemorrhagic stroke and 58% of other cardiovascular diseases including rheumatic and hypertensive heart disease, cardiomyopathy, rhythm disorders, aortic aneurysms and peripheral vascular disease have been attributed to hypertension.<sup>1</sup>

The Global Burden of Disease study (2015) identified that non-optimal BP continues to be the single greatest risk factor contributing to the global burden of disease and to 'all-cause mortality' worldwide, leading to 9.4 million deaths and 212 million healthy life years lost (8.5% of the global total) each year.<sup>2</sup> More than one billion adults worldwide have hypertension with up to 45% of the adult population affected. The high prevalence of hypertension is consistent across all socio-economic and income strata, and the prevalence rises with age accounting for up to 60% of the population above 60 years of age. Recent estimates suggest the number of patients with hypertension could increase by as much as 15 to 20%, and reach close to 1.5 billion by 2025.<sup>4</sup>

Ireland has one of the highest rates of high blood pressure internationally, but among the lowest levels of diagnosis, treatment and control of the condition, according to a study carried out at Imperial College London which looked at 123 national surveys conducted over 40 years, involving more than 525,000 people aged 40-80. A study of people from 12 high-income countries found that men and women from Ireland were least likely to have been diagnosed with high blood pressure, given medication to treat the condition or have it controlled. Irish men ranked 2nd at 56% and Irish women ranked 4th at 43%, according to the study, which was published in the *Lancet*.<sup>6</sup> The Irish Longitudinal Study on Ageing (TILDA) published in the *Journal of Public Health* in 2016, reported that 64% of the over-50s, equivalent to 797,000 people in Ireland had high BP.<sup>8</sup>

The aetiology of hypertension involves the complex interplay of environmental and pathophysiological factors that affect multiple systems, as well as genetic predisposition.<sup>3</sup>

The pathogenesis of essential hypertension is multifactorial and complex. The kidneys are both the contributing and the target organ of the hypertensive processes, and the disease involves the interaction of multiple organ systems and numerous mechanisms of independent or interdependent pathways. Factors that play an important role in the pathogenesis of hypertension include genetics, activation of neuro-hormonal systems such as the sympathetic nervous system and renin-angiotensin-aldosterone system, obesity, and increased dietary salt intake.<sup>5</sup> Primary hypertension involves multiple types of genes. Some allelic variants of several genes are associated with an increased risk of developing primary hypertension and are linked in almost all cases to a positive family history. Malfunction or disruption of factors

involved in BP control can directly or indirectly lead to increases in mean BP, BP variability or both, over time resulting in target organ damage and CVD outcomes. <sup>7</sup>

Blood pressure (BP) is commonly expressed as the ratio of the systolic and the diastolic BP. While normal values can vary geographically, blood pressure is measured in mmHG. The European Society of Cardiology/European Society of Hypertension (ESC/ESH) 2018 guidelines express the normal BP value as < 120 systolic over < 80 diastolic. <sup>11</sup>

In 2017, new guidelines from the American Heart Association, the American College of Cardiology, and nine other health organisations lowered the numbers for the diagnosis of hypertension to 130/80 mm Hg and higher for all adults. The new guidelines stem from the 2017 results of the Systolic Blood Pressure Intervention Trial (SPRINT), which studied more than 9,000 adults aged 50 and older who had systolic blood pressure of 130 mm Hg or higher and at least one risk factor for cardiovascular disease. <sup>9</sup>

In 2019, NICE published a new clinical guideline on the diagnosis and management of hypertension in adults. The threshold for diagnosing and treating hypertension remained unchanged, at 140/90mmHg for clinic readings or 135/85mmHg for daytime ambulatory blood pressure monitoring (ABPM) or for home blood pressure measurement (HBPM). The definition for Stage 2 hypertension remained the same at 160/100mmHg but Stage 3 or severe hypertension changed to a new diastolic cut-off of 180/110mmHg. NICE continues to recommend that BP should be measured in both arms at the time of diagnosis but suggests a difference of 15mmHg should now be considered significant, compared to the previous 20mmHg. <sup>10</sup> Another notable change in the NICE guideline is to offer people < 80 years of age with Stage 1 hypertension treatment using a 10-year cardiovascular risk (QRISK2) threshold of 10% instead of the previous 20%.

The European Society of Cardiology/European Society of Hypertension (ESC/ESH) classification guidelines were issued in 2018 for use in all individuals  $\geq 16$  years of age. <sup>11</sup>

- Normal: SBP < 120mmHg and DBP < 80mmHg
- Pre-Hypertension: SBP 120 to 139mmHg and DBP 80 to 89mmHg
- Stage 1 Hypertension: SBP 140 to 159mmHg and DBP 90 to 99mmHg
- Stage 2 Hypertension: SBP  $\geq 160$ mmHg and DBP  $\geq 100$ mmHg

<b>Blood Pressure</b>	<b>SBP</b>	<b>DBP</b>
<b>Classification</b>	<b>mmHg</b>	<b>mmHg</b>
<b>Normal</b>	<120	and <80
<b>Prehypertension</b>	120–139	or 80–89
<b>Stage 1 Hypertension</b>	140–159	or 90–99
<b>Stage 2 Hypertension</b>	$\geq 160$	or $\geq 100$

*SBP, systolic blood pressure; DBP, diastolic blood pressure*

The ESC/ESH guidelines recommend that when blood pressure lowering medications are used, the first objective should be to lower BP to less than 140/90mmHg in all patients. Provided treatment is well tolerated, treated BP values should be targeted to 130/80mmHg or lower in most patients. In patients over 65 years of age, systolic BP should be targeted to between 130 and 140mmHg, and diastolic BP to less than 80mmHg. The European target for hypertension in special situations such as diabetes, CAD, and TIA is BP 120-130/70-79mmHg for 18-65-year-olds, and 130-139/70-79 for 65 to >80-year-olds. In CKD, the systolic target is <140 to 130mmHg, if tolerated.<sup>11</sup>

### **Symptoms, Diagnosis and Evaluation**

Essential or primary hypertension is usually asymptomatic, and hypertension is most commonly diagnosed based on repeated BP measurements in a clinical office setting. Investigation is based on clinical history, physical examination and routine laboratory investigations. Medical history assesses current and past BP measurements and antihypertensive medications if relevant. A history of pregnancy-related hypertension is an important factor in the assessment of women with hypertension. Physical examination aims to establish the diagnosis of hypertension and screen for target organ damage and secondary causes.

The patient should sit quietly for 5 minutes before a BP reading is taken and the BP cuff should be positioned at heart level. An average of three BP measurements obtained on two to three separate occasions provides an accurate basis for estimation of BP.<sup>7</sup> BP should be measured on both arms, and differences in SBP > 20 mmHg and/or in DBP > 10mmHg should initiate investigations of vascular abnormalities. Careful attention should be paid to choosing an appropriately sized cuff, particularly for patients with obesity. BP should be measured in both sitting and standing positions to rule out orthostatic hypotension, and this is particularly important in older patients.<sup>7</sup>

Investigation should include auscultation of the carotid arteries, heart and renal arteries. Detection of murmurs should lead to further investigations including carotid ultrasound, echocardiography and renal ultrasound. An irregular pulse frequently indicates atrial fibrillation, which should be confirmed by an electrocardiogram. Laboratory investigations are used to detect additional risk factors, to confirm or exclude secondary hypertension, to detect clinical or subclinical target organ damage and to estimate CVD risk.<sup>7</sup> Blood workup includes FBC, ESR, creatinine, eGFR, electrolytes, HbA1c, thyroid profile, blood cholesterol levels, and serum uric acid.<sup>4</sup>

Accurate measurement and recording of BP is essential to categorise the level of BP, ascertain BP-related CVD risk and guide management.<sup>7</sup> HBPM is the measurement of BP at regular intervals by an individual at home or outside the clinic setting. Ambulatory blood pressure measurement is the most accurate method to diagnose hypertension and also aids in identifying individuals with masked hypertension as well as white coat effect.<sup>4</sup> ABPM consists of an ambulatory device worn by the patient that measures and records the BP at regular

intervals usually every 20–30 minutes, typically for a 24-hour period, while the individual goes about their daily activities.<sup>7</sup>

Evaluation of a patient with hypertension requires more than the diagnosis of elevated BP. It should also include assessment of the CVD risk, target organ damage, and concomitant clinical conditions that may affect the BP or related target organ damage as well as recognition of features suggestive of secondary hypertension. Secondary hypertension should be considered in cases of a sudden worsening of hypertension, poor BP response to medication or severe target organ damage, which is out of proportion to the duration and severity of hypertension.<sup>7</sup>

### **Treatment and Management**

The treatment and management of hypertension can be divided into pharmacological and non-pharmacological interventions. Non-pharmacological and lifestyle management are recommended for all individuals with raised blood pressure regardless of age, gender, comorbidities or cardiovascular risk status. Lifestyle changes alone can account for up to 15% reduction in all cardiovascular-related events. Reducing blood pressure in adults with a high normal BP provides the potential to directly reduce CVD risk and to prevent or slow the age-related tendency for individuals to develop hypertension. Patient education is important for effective management and should include information regarding physical activity, weight management, salt restriction and alcohol reduction and smoking cessation if applicable.<sup>4,7</sup>

Pharmacological therapy consists of angiotensin-converting enzyme inhibitors (ACEi), angiotensin receptor blockers (ARBs), diuretics - usually thiazides, calcium channel blockers and beta-blockers, taking into account age, race and comorbidities such as the presence of renal dysfunction, LV dysfunction, heart failure and cerebrovascular disease.<sup>4</sup>

NICE recommends starting with monotherapy treatment, however, high blood pressure cannot be controlled with monotherapy in many patients, particularly those with severe hypertension, and polypharmacy is common. There are two main approaches to pharmacological therapy; initiating two or more drugs, such as an ACEi or an ARB with a thiazide diuretic and calcium channel blocker simultaneously, or a stepwise titration approach with single therapy being titrated up to maximum dosage before initiating a second drug. Both are successful in improving patient outcomes, provided there is adequate patient compliance and treatment adherence.<sup>4,7</sup>

Patients must be aware of the possibility and monitored closely for side effects, especially in the early stage of therapy. Side effects of anti-hypertensive medication include hypotension, electrolyte imbalances, pedal oedema and renal dysfunction. Renal dysfunction and electrolyte imbalance especially hyponatremia and hyperkalaemia are common with ACE inhibitors and ARBs, and electrolytes must be monitored closely. Angioedema is a lifelong contra-indication for ACEi or ARB usage. For patients with severe side effects such as

symptomatic hyperkalaemia or hyponatremia, syncope and acute kidney injury (AKI), treatment needs to be discontinued, nephrologist and cardiologist opinions sought and in-patient management considered. Once settled, treatment needs to be re-initiated slowly and cautiously with careful monitoring, and frequent follow-up. <sup>4</sup>

### **Prognosis and Outlook**

Although there is regional variability in the outlook for hypertension over the next five to ten years, it is clear that the prevalence and associated global burden attributable to hypertension will increase, with 1.5 billion people expected to be affected by 2025. Global population growth and aging will largely contribute to this increase. However, adverse trends in disease burden may invariably be offset by improvements in prevention, awareness and treatment. Improving the efficacy of drug treatment holds promise for reducing the associated disease burden of hypertension, and the greatest effect could be achieved by the delivery and distribution of affordable, effective single-pill combinations of two or three drugs to low-income and middle income countries where the burden of hypertension is considerable and where such therapies are currently either unavailable or unaffordable. Efforts to drive public health policy towards encouraging more healthy lifestyles must be encouraged and scientific research to allow precision medicine to be developed and applied continued.

Hypertension is a chronic disorder that requires long-term care and management and a multi-disciplinary approach. Patient education and information regarding lifestyle modification and pharmacological therapy is the key to success for improved control and to prevent complications. Weight management, increased physical activity, limiting alcohol and smoking cessation are important factors to address, to decrease cardiovascular risk. All patients with hypertension should have an evidence-based care plan that ensures the achievement of treatment and self-management goals, effective management of comorbid conditions and timely follow-up with the healthcare team.

Inter-professional team communication is important in identifying cases of resistant or difficult to treat hypertension and inter-specialty approaches can benefit patients the most. Effective communication in a multi professional team including nurses, primary care physicians, cardiologists, nephrologists, pharmacists, dieticians and other healthcare professionals is essential for improving blood pressure control. A patient centered multi-professional team approach to treating and managing hypertension which monitors and identifies patient compliance, progress, potential toxicities and adverse effects, can result in fewer complications, reduced health care costs and improved patient outcomes.

## References

1. van Kleef, M., Spiering, W. (2017). Hypertension: Overly important but under-controlled. In *European Journal of Preventive Cardiology*. Available at: <https://doi.org/10.1177/2047487317709116>
2. Forouzanfar, M, *et al.* (2015). Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 388, 1659–1724 (2016)
3. Oparil, S., Acelajado, M. C., Bakris, G. L., Berlowitz, D. R., Cifková, R., Dominiczak, A. F., Grassi, G., Jordan, J., Poulter, N. R., Rodgers, A., & Whelton, P. K. (2018). Hypertension. *Nature reviews. Disease primers*, 4, 18014. <https://doi.org/10.1038/nrdp.2018.14>
4. Iqbal, A., Jamal, S. (2021). Essential Hypertension. In StatPearls. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK539859/>
5. Hamrahian, S., Batuman, V. (2017). Pathophysiology of Hypertension. Medscape. Drugs and Diseases; Nephrology. Available at: <https://emedicine.medscape.com/article/1937383-overview>
6. Cullen, P. (2019). Irish blood pressure problem revealed in international study. The Irish Times. Wednesday September 11<sup>th</sup> 2019. Available at: <https://www.irishtimes.com/news/health/irish-blood-pressure-problem-revealed-in-international-study-1.4013974>
7. Acelajado, M., Bakris, G., Berlowitz, D., Cifková, R., Dominiczak, A., Grassi, G., Jordan, J., Oparil, S., Poulter, N., Rodgers, A., & Whelton, P. (2018). Hypertension. *Nature reviews*. <https://doi.org/10.1038/nrdp.2018.14>
8. Murphy, C., Kearney, P., Shelley, E., Fahey, T., Dooley, C., Kenny, R. (2016). Hypertension prevalence, awareness, treatment and control in the over 50s in Ireland: evidence from The Irish Longitudinal Study on Ageing. *Journal of Public Health*, Volume 38, Issue 3, 17 September 2016, Pages 450–458 <https://doi.org/10.1093/pubmed/fdv057>.
9. Harvard Health Publishing (2021). Reading the new blood pressure guidelines. Available at: <https://www.health.harvard.edu/heart-health/reading-the-new-blood-pressure-guidelines>
10. National Institute for Health and Care Excellence. Hypertension in adults: diagnosis and management. NICE guideline 136. London. National Institute for Health and Care Excellence, 2019. Available from: <https://www.nice.org.uk/guidance/ng136>
11. ESC (2018). 2018 ESC/ESH Clinical Practice Guidelines for the Management of Arterial Hypertension. European Society of Cardiology. Available at: <https://www.escardio.org/Guidelines/Clinical-Practice-Guidelines/Arterial-Hypertension-Management-of>