

CASE ONE

Short case number: 3_1_1

Category: Cardiovascular

Discipline: General practice

Setting: Urban_Community

Topic: Hypertension – simple hypertension, new diagnosis, investigation and management

Case

Lucy Webster, aged 46 years, presents to her general practitioner for a Pap smear test. After taking a Pap smear, the doctor checks Lucy's blood pressure and notes a reading of 165/100. After 5 minutes, the blood pressure is measured again and the same reading is obtained. The practice records indicate that Lucy has had her blood pressure checked over the last few years and it has never been elevated in the past. Her reading from 2 years earlier is recorded as 135/85.

Questions

1. What is the definition of hypertension?
2. List the most likely diagnosis and differential diagnosis for the cause of Lucy's elevated blood pressure reading.
3. What is the pathogenesis of essential hypertension?
4. What is the histological structure of the aorta, and how is this altered by hypertension?
5. What symptoms may high blood pressure cause?
6. What further history and examination should be undertaken?
7. What investigations and further management would you perform on Lucy at this stage, and why?
8. What are the common classes of drugs used to treat hypertension, and what are the mechanisms of action?
9. What non-pharmacological methods are used to manage patients with hypertension?
10. What are common causes for treatment failure?

Suggested reading:

Newby, D.E et al. Cardiovascular disease. In: Davidson's Principles and Practice of Medicine 22nd edition. Churchill Livingstone, Philadelphia. Pages 525-642

ANSWERS

1. What is the definition of hypertension?

DEFINITION OF HYPERTENSION		
Category	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Blood pressure		
Optimal	< 120	< 80
Normal	< 130	< 85
High normal	130-139	85-89
Hypertension		
Grade 1 (mild)	140-159	90-99 confirm within 2 months
Grade 2 (moderate)	160-179	100-109 confirm within one month
Grade 3 (severe)	≥180	≥110 confirm within one week
Isolated systolic hypertension		
Grade 1	140-159	< 90
Grade 2	≥160	< 90

When a patient's Systolic and Diastolic blood pressures fall into different categories, the higher category should apply.

British Hypertension Society & Australian Heart Foundation.

2. List the most likely diagnosis and differential diagnosis for the cause of Lucy's elevated blood pressure reading.

It is most likely that Lucy has essential hypertension. Essential hypertension is the most common form of hypertension, affecting about 95% of diagnosed patients. However, to exclude a potential secondary cause of the disease, it is still important to conduct a thorough assessment of Lucy, including taking a complete history, and performing a physical examination and investigations as required.

CAUSES OF SECONDARY HYPERTENSION

Alcohol

Obesity

Pregnancy (pre-eclampsia)

Renal disease (most common cause of secondary hypertension)

- Renal vascular disease
- Parenchymal renal disease, particularly glomerulonephritis
- Polycystic kidney disease

Endocrine disease

- Pheochromocytoma
- Cushing's syndrome
- Primary hyperaldosteronism (Conn's syndrome)

- Hyperparathyroidism
- Acromegaly
- Primary hypothyroidism
- Thyrotoxicosis
- Congenital adrenal hyperplasia due to 11- β -hydroxylase or 17-hydroxylase deficiency
- Liddle's syndrome
- 11- β -hydroxysteroid dehydrogenase deficiency

Drugs

- e.g. Oral contraceptives containing oestrogens, anabolic steroids, corticosteroids, non-steroidal anti-inflammatory drugs, carbenoxolone, sympathomimetic agents

Coarctation of the aorta

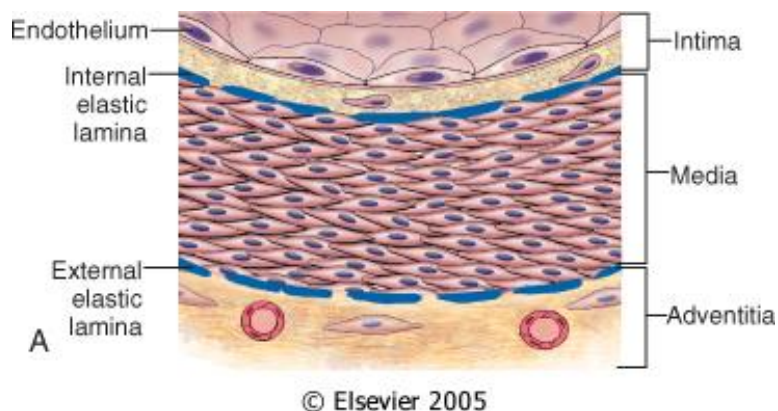
3. What is the pathogenesis of essential hypertension?

The pathogenesis of essential hypertension is not clearly understood. Investigators have proposed that the primary abnormality may involve the kidney, the peripheral resistance vessels, or the sympathetic nervous system. In reality, the problem is probably multifactorial. Hypertension is more common in some ethnic groups, particularly African Americans and the Japanese. Additionally, genetic factors play a role in approximately 40-60% cases. Important environmental factors include a high salt intake, heavy consumption of alcohol, obesity, lack of exercise and impaired intrauterine growth. There is very little evidence that 'stress' causes hypertension.

In about 5% of unselected cases, hypertension can be shown to be a consequence of a specific disease or abnormality leading to sodium retention and/or peripheral vasoconstriction (secondary hypertension)

4. What is the histological structure of the aorta and how is this altered by hypertension?

The aorta is described as a large elastic artery. As with other arteries, the aorta is comprised of three concentric layers: the intima, media and adventitia. The intima is in direct contact with the blood inside the vessel. It consists of a single layer of endothelial cells, separated from the media by a dense elastic membrane, called the internal elastic lamina. The media consists of connective and muscle tissue. The adventitia is comprised of connective tissue with nerve fibres and the vasa vasorum. The vasa vasorum ("the vessels of the vessels") is a network of small arterioles that course into the adventitia and outer two-thirds of the media. It supplies oxygen and nutrients to the smooth muscle cells (as diffusion from the lumen alone is inadequate for larger vessels).



In the presence of hypertension, the internal elastic lamina of the larger arteries (over 1mm) becomes thickened, smooth muscle is hypertrophied and fibrous tissue is deposited. The vessels dilate and become tortuous and their walls become less compliant. In smaller arteries (under 1 mm) hyaline arteriosclerosis occurs in the wall, the lumen narrows and aneurysms may develop.

5. What symptoms may high blood pressure cause?

Generally, high blood pressure is asymptomatic. However patients may complain of symptoms such as headache. Symptoms can also occur secondary to vascular disease, e.g. visual disturbance, chest pain (angina), breathlessness, calf pain. It is also important to enquire about symptoms which may be related to possible secondary causes of hypertension (as listed above)

6. What further history and examination should be undertaken?

History

- Known duration of elevated blood pressure and previous blood pressure levels.
- Previous therapy, adverse effects
- Past history or current symptoms of ischaemic heart disease, heart failure, cerebrovascular disease or peripheral vascular disease.
- Past history or current symptoms of kidney disease.
- Symptoms suggestive of secondary hypertension, e.g. paroxysmal headache, sweating, palpitations, (suggestive of Pheochromocytoma), sleep apnoea.
- Asthma, chronic obstructive pulmonary disease, diabetes, dyslipidaemia, gout, other significant illnesses.
- Family history of hypertension, diabetes, dyslipidaemia, stroke, coronary artery disease, kidney disease.
- Modifiable risk factors, obesity, alcohol intake, salt use, physical activity, smoking, saturated fat intake.
- Medications that may cause hypertension. (e.g. OCP, NSAIDs, nasal decongestants, corticosteroids).

Examination:

- Should pay particular attention to presence of other cardiovascular risk factors
- Body mass index
- Waist circumference
- CVS – heart size, evidence of heart failure, evidence of arterial disease carotid, peripheral, renal.
- Lungs – basal crackles, wheeze.
- Abdomen – renal size, other masses, bruits.
- Optic Fundi
- Nervous system – evidence of previous neurological disease.
- Endocrine system – evidence of Cushings, hypothyroidism, hyperthyroidism, acromegaly
- Taking blood pressure in sitting and standing position (Postural hypotension)

7. What investigations and further management would you perform on Lucy at this stage and why?

Initial investigations should be directed to determine the following:

- possible causes of hypertension
- presence of end organ disease
- cardiovascular risk factors
- baseline values for judging biochemical effects of therapy

HYPERTENSION: INVESTIGATION OF ALL PATIENTS

- Urinalysis for blood, protein and glucose
- Blood urea, electrolytes (including Calcium) and creatinine
- Fasting blood glucose
- Fasting serum total and high-density lipoprotein (HDL) cholesterol, LDL Triglyceride
- 12-lead ECG (left ventricular hypertrophy, coronary artery disease)

8. What are the common classes of drugs used to treat hypertension, and what are the mechanisms of action?

Main means of lowering blood pressure

- Reduce cardiac output (beta-blockers, Ca Channel blockers)
- Reduce plasma volume (diuretics)
- Reduce peripheral vascular resistance (vasodilators)

MAP = CO x TPR

Class of Anti-hypertensive	Mode of Action
Thiazide Diuretic	Act at the distal tubule in the kidney by blocking the transport of sodium and chloride into the cell. thereby increasing urinary sodium chloride and water losses (diuretic effect)
Beta-blockers	Beta-adrenergic receptor antagonists, thus they block the action of the beta receptor, which at a blood vessel level results in vasodilatation and reduced cardiac output.
Angiotensin converting enzyme inhibitors (ACEI)	Inhibit conversion of angiotensin I to angiotensin II by blocking the action of angiotensin converting enzyme (ACE), this reduces circulating angiotensin II and results in reduced vascular tone.
Calcium Channel blockers	Block the influx of calcium into the blood vessel cells walls which results in vasodilatation and reduced cardiac output.
Angiotensin II receptor blockers (ARB)	Competitively inhibit the AT ₁ receptors blocking the ability of the angiotensin to act.
Alpha - blockers	Alpha-adrenergic receptor antagonists, block the action of the alpha receptor which results in vaso-dilatation.

NICE Guideline 2011:

- Age<55 offer ACE inhibitor or ARB
- Age>55 offer Calcium channel blockers, or Thiazide like if calcium channel blockers not suitable

9. What non-pharmacological methods are used to manage patients with hypertension?

Smoking, Nutrition, Alcohol & physical activity (SNAP)

- Weight reduction (waist circumference of <94cm Males, < 80cm females, BMI < 25kg/m²)
- Regular physical activity (30 mins moderate activity, 5 times a week)
- Reduce & Limit intake of alcohol
- Reduce intake of salt (below 90mmol per day)
- Diet, increase plant based foods, reduce saturated fats.
- Smoking cessation

10. What are common causes for treatment failure?

The common causes of treatment failure in hypertension are:

1. non-adherence with drug therapy,
2. inadequate therapy, and
3. failure to recognise an underlying cause such as renal artery stenosis or phaeochromocytoma.
4. chronic use of medication such as NSAID, corticosteroid and OCP