

Hypertension in General Practice

Part I. Examination and Investigation of a Patient with Hypertension

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SUMMARY

During the history taking and physical examination, several important diseases should be searched for before diagnosing essential hypertension. A critical investigation is repetitive abdominal auscultation for a bruit. In young patients with significant hypertension, coarctation of the aorta must be excluded by clinical examination. Investigations will especially be aimed at uncovering renal artery disease (relatively common) or a phaeochromocytoma (relatively rare). The initial assessment must also diagnose associated diseases which will influence the type of therapy chosen. Thus asthma and heart failure contraindicate β -blockers, liver disease contraindicates methyldopa, severe depression contraindicates reserpine, methyldopa and β -blockade, while diabetes or gout may be precipitated or aggravated by thiazide diuretics.

S. Afr. med. J., 58, 955 (1980).

Investigation of a patient with hypertension starts with the history and clinical examination. In general, the younger the patient or the more severe the hypertension, the more active should one be in searching for remediable causes of hypertension (Fig. 1). In children, there is more frequently an underlying cause for the hypertension; especially, coarctation of the aorta must be considered. In the elderly, the diagnosis of hypertension needs to be made with some reserve, especially when it is the systolic value which is elevated. In perhaps 1 out of 10 patients the hypertension will have a remediable cause, usually a renovascular one, but occasionally a less familiar cause

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such as phaeochromocytoma or Cushing's syndrome or primary aldosteronism (Conn's disease). The purpose of this article is to give the general practitioner a practical approach to the distinction between primary (essential) and 120+ mmHg — severe hypertension (Table I).

DOES THE PATIENT HAVE HYPERTENSION REQUIRING TREATMENT?

Normal values for most South African populations are not known. A number of limited population surveys suggest that populations such as Natal Indians, Zulus, and Cape Coloureds have a marked incidence of hypertension (see below). In American adults (aged say 40 - 60 years), sustained diastolic values (phase V Korotkoff sounds) can be differentiated as follows:¹ 90 - 104 mmHg — mild hypertension; 105 - 120 mmHg — moderate hypertension; and 120+ mmHg — severe hypertension (Table I).

In addition, high diastolic pressures (130 - 140 mmHg) plus papilloedema are taken to indicate malignant hypertension. Systolic values are omitted, to simplify and also because treatment of systolic hypertension is controversial. Other definitions of the severity of hypertension are also available (Table I).

The treatment of mild hypertension remains controversial, with increasing evidence in favour of therapy if there is a sustained diastolic level of 95 - 100 mmHg.² The argument for treatment of mild hypertension is strongest if there is associated systolic hypertension, if there are other risk factors for ischaemic heart disease, if there is end-organ damage, and especially if the patient is likely to be compliant and co-operative.

In adolescence, lower values are taken: about 5 mmHg less for boys below 20 years of age, and in adolescent girls, 10 mmHg less (Table II).³

In the elderly, there are as yet no clear guidelines for the levels of blood pressure requiring treatment. Up to the age of 70, raised systolic or diastolic pressures are associated with increased mortality, but in otherwise healthy people above 70, there is some doubt that there

TABLE I. SOME DEFINITIONS OF SEVERITY OF HYPERTENSION ACCORDING TO SUSTAINED DIASTOLIC BLOOD PRESSURE LEVELS

| | Diastolic blood pressure (mmHg) | | | |
|----------|---------------------------------------|-------------------------|---|-----------------------|
| | Joint American Committee ¹ | NIH Study ²¹ | Australian multi-centre trial ²² | McMahon ²³ |
| Mild | 90 - 104 | 90 - 104 | 95 - 110* | 90 - 115 |
| Moderate | 105 - 119 | 105 - 114 | — | 115 - 130 |
| Severe | 120 + | 115 + | — | 130 + |

* With systolic of less than 200 mmHg.

TABLE II. BLOOD PRESSURE (MEAN) IN A JUVENILE AMERICAN POPULATION

| | Age group | | |
|-----------------|---------------|---------------|---------------|
| | 14 | 15 | 16 - 18 |
| Male | 114/64 | 117/67 | 120/70 |
| 90th percentile | 130/78 | 133/81 | 136/84 |
| 95th percentile | 133/82 | 138/86 | 140/87 |
| Female | 111/68 | } All groups | |
| 90th percentile | 124/80 | | |
| 95th percentile | 128/83 | | |

Hypertension may be defined as values sustained above the 95th percentile (see Goldring *et al.*³).

is any relation between the blood pressure and survival. On the other hand, the Framingham study suggests that even isolated systolic hypertension (systolic exceeding 160 mmHg, diastolic below 95 mmHg) is hazardous even in people over 55 years of age.⁴ A conservative point of view is not to treat elderly patients with systolic hypertension unless there is target organ damage. In practice, many physicians are now more aggressive.⁵ I support a recent recommendation to aim at a systolic value of 180 mmHg in asymptomatic patients over 60.⁶ Diastolic pressures are frequently unreliable in the elderly. What is clear is that, *in the elderly, over-vigorous treatment may cause cerebral ischaemia and postural hypotension is serious.*

Hypertension in **females** is said to be less serious than in males; in White American females, therapy of mild hypertension produced no benefit, in contrast to White male and Black males and females (all populations American).⁷ But in **Cape Coloured females**, not only is there a very high incidence of severe hypertension, but there are correspondingly severe ECG changes to show that the disease is not benign in this group.⁸

In urbanized **South African Blacks**, values tend to be about 10 mmHg higher than in age-matched London Whites;⁹ hypertension is probably very common in South African Blacks, with an incidence of 25% in urbanized Zulus.¹⁰ Of Durban Indians, 19% are hypertensive.¹¹ There is no evidence whatsoever that these Black, Coloured or Indian populations can 'tolerate' hypertension better than Whites.

The important point is that there is no strict cut-off point; for example, malignant hypertension is not necessarily present when there is papilloedema and the diastolic value is 131 mmHg, or necessarily absent when the diastolic value is 129 mmHg.

To assess the significance of hypertension, *three simple rules* are: (i) hypertension with end-organ damage is by definition serious and warrants therapy; (ii) in the absence of end-organ damage, blood pressure readings should be taken on three occasions with the patient relaxed, recumbent and warm before deciding what the true value is; (iii) if still in doubt, obtain a self-reading machine for the patient to take home readings. Then, taking age, sex and race into account, decide whether there is significant hypertension or not. If there is significant hypertension, a full history and examination must precede the institution of therapy.

HISTORY

The majority of patients with hypertension will have essential hypertension, but remediable causes must always be considered (Table III). In all patients, a **family history** of hypertension, strokes or diabetes must be enquired into; when this is present, the argument for treatment becomes stronger. Essential hypertension more usually has a familial basis, but even renal arterial disease can

TABLE III. SUMMARY OF HISTORY, PHYSICAL EXAMINATION AND INVESTIGATIONS IN SIGNIFICANT HYPERTENSION

General assessment

Age and sex; special assessment of adolescents, elderly patients, pregnant patients.

Female — is she pregnant? Does she take the *contraceptive pill*?

Obesity — is it endocrine? Can weight be reduced? Is there spurious hypertension?

History and physical examination: search for specific conditions

Renal artery stenosis — *epigastric bruit (listen repeatedly)*.*
Coarctation — usually in younger patients; *decreased femoral pulses**, leg blood pressure lower; may present with heart failure, rupture of aorta, bacterial endocarditis or intracranial haemorrhage.

Phaeochromocytoma — fluctuating clinical course, usually with headache, sweating and palpitations; in contrast, in about half the patients the hypertension is sustained. A rare condition.

Primary aldosteronism — weakness, low plasma potassium (see below). Another rare condition.

Cushing's syndrome — diabetes, characteristic *pattern of obesity**, hirsutism.

*Retinopathy** — papilloedema of malignant hypertension or haemorrhage and exudates of premalignant hypertension; micro-aneurysms of diabetes.

Arteritis — unequal pulses, elevated ESR.

Diseases not directly causing hypertension but associated with it include obesity and gout.

Side-room investigations

1. Urinalysis (proteinuria, *glycosuria**, spun deposit for micro-organisms).
2. Blood haemoglobin (polycythaemia) and ESR*.

Special investigations

1. *Chest radiography** (rib notching in coarctation; heart enlargement or failure).
2. *Electrocardiography** (left ventricular hypertrophy; silent ischaemic heart disease).
3. Rapid sequence intravenous pyelography† especially in younger patients or those with serious hypertension; occasionally isotopic renography and renal arteriography even if IVP negative.
4. Urine aliquot: biochemical determination of catecholamine metabolites† (VMA and metanephrines).
5. *Blood chemistry**: potassium (low in primary aldosteronism), creatinine (high in renal failure), glucose (suspected diabetes), uric acid (suspected gout).

* Routine in significant hypertension.

† In selected patients.

occur in families. A family history of diabetes mellitus requires a search for micro-aneurysms in the fundi and for glycosuria, and indicates the need for care in giving thiazide diuretics, which may precipitate overt diabetes. Familial gout argues against therapy with thiazide diuretics.

In females, a history of amenorrhoea may indicate pregnancy, which can either cause or complicate hypertension; contraceptive pill-takers are unlikely to be pregnant, but may have diastolic pressures 5-10 mmHg higher than their baseline. Frequent pregnancies predispose to repetitive attacks of renal infection and renal hypertension.

A history of smoking is important; more patients with malignant hypertension smoke than those with ordinary hypertension²² and smoking is also associated with renal artery stenosis. Smoking acts in part by promoting arterial disease, thereby aggravating the hypertension; additional harmful effects are also possible (increase of cardiac output; arrhythmias).

Episodic symptoms of catecholamine discharge (sweating, tachycardia, headache) may indicate pheochromocytoma or strong emotional factors. **Muscular weakness** is rare but suggests primary aldosteronism. The **occupational history** is important in the overall evaluation of the patient. A young patient in a stressful occupation is usually a good candidate for β -blockade therapy, both to reduce the effects of sympathetic discharge and to avoid the drowsiness sometimes associated with methyldopa therapy. 'Stress' is not limited to the young male executive. Male doctors frequently forget that running a home with young children is an extremely stressful occupation.

The history should also probe into the **complications of hypertension**. Is there a story of left ventricular failure or renal impairment? Is there evidence of cerebral vascular insufficiency or stroke? These complications will govern treatment; cerebral vascular insufficiency in particular indicates the need for gradual and smooth antihypertensive treatment.

PHYSICAL EXAMINATION

General Assessment

General assessment frequently reveals endocrine causes of hypertension, such as obesity. Rarely, endocrine causes of hypertension such as Cushing's syndrome or acromegaly are found (Table III, Fig. 1). The rash of lupus erythematosus is also rare. Gouty tophi in the ears or the joints might indicate renal disease. Pregnancy is not always evident from the history and may need careful exclusion, but usually pre-eclamptic toxemia occurs in the last trimester when pregnancy is obvious. Severe psychological depression is a contraindication to reserpine therapy, as well as to methyldopa and β -blockers (especially propranolol).

Taking the Blood Pressure

Especially in young subjects, hypertension may be labile (sometimes above 140/90 mmHg and sometimes

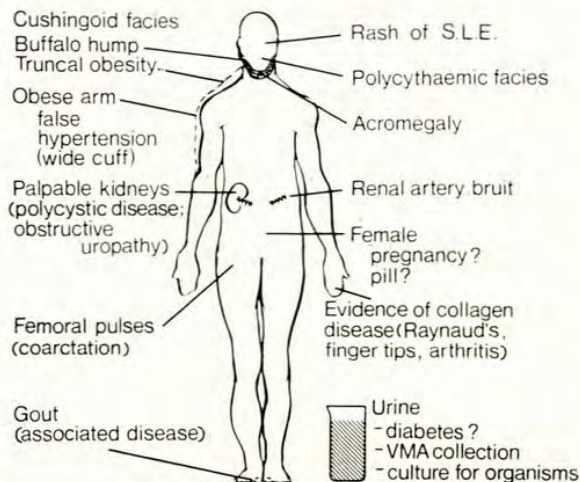


Fig. 1. Hypertension: looking for a cause.

below). Repeated measurements in relaxed warm conditions are useful; it is important that the doctor should also be relaxed and not rushed. The patient's arm should be resting and the muscles relaxed, because isometric tension increases the blood pressure. The diastolic pressure is best taken as phase V, to allow comparison with American and Australian surveys. If phase IV is taken, as is customary in the UK, then 10 mm must be subtracted from the diastolic reading.²³

Assessment of Obesity

Three important questions as regards obese hypertensive patients are:

Is this simple obesity or an endocrine obesity such as Cushing's syndrome? Obesity, diabetes mellitus, and hypertension are all common diseases and may occur together by random association or because obesity predisposes to diabetes and hence to hypertension. Not every patient with the triple combination will have Cushing's syndrome.

Is there true hypertension? If an ordinary cuff is used, the degree of blood pressure recorded is likely to be falsely elevated. Correction tables (Table IV) can be

TABLE IV. CORRECTION TABLE FOR ARM CIRCUMFERENCE USING A CUFF 13 cm BROAD AND 30 cm LONG (PICKERING²⁴)

| Arm circumference (to nearest cm) | Diastolic pressure (mmHg) |
|--------------------------------------|------------------------------|
| 15 - 20 | No correction |
| 21 - 26 | - 5 |
| 27 - 31 | -10 |
| 32 - 37 | -15 |
| 38 - 43 | -20 |
| 44 - 47 | -25 |

NB.: These corrections are only approximate.

used if a special large cuff is not available to give an idea of the true blood pressure reading. If an ordinary sized cuff is used on a patient with a really obese arm, the apparent diastolic blood pressure can be as much as 25 mmHg above normal; normotension can sometimes falsely become 'dangerous hypertension'.

Is the hypertension likely to respond to weight reduction? Once simple obesity plus hypertension is diagnosed, the practitioner must assess the patient's personality. Is a weight-reducing programme really feasible? If it is, the patient should receive sustained advice and encouragement which will make it easier to lose weight and thereby to control the hypertension.^{34,35}

Retinopathy

The classic retinopathy of malignant hypertension (papilloedema) and of premalignant hypertension (haemorrhages and exudates) must be searched for. Nowadays with increased awareness of hypertension and earlier treatment, severe retinopathy is rare. But papilloedema, if found in a patient with a severe diastolic hypertension (usually in excess of 130-140 mmHg), indicates malignant hypertension and special care in therapy; such patients run the danger of hypertensive encephalopathy, and here the differential diagnosis from a cerebral tumour is not always easy.

Examination of the Cardiovascular System

Cardiac features of hypertension include cardiomegaly and extra heart sounds. If there is **heart failure**, therapy is directed towards 'unloading' the heart and β -blockers are avoided (see Part III later).

The classic feature of **coarctation of the aorta** is the delayed and decreased femoral pulse; in some patients with coarctation, there are visible collateral vessels and an audible bruit down the back. In cases of doubt, measurement of the leg pressure (which also needs a large cuff) is very useful (the leg pressure is decreased in coarctation).

Sometimes a check of all the pulses and pressures in each leg and arm confirms a widespread **arteritis**; such patients are rare, but may present with a severe renal hypertension.

Examination of the Abdomen

This can be vital in establishing the aetiological diagnosis and merits much care. Specifically, a **renal artery bruit** must be listened for repetitively, as it may be the only sign of renal artery stenosis; especially important is a high-pitched systolic or diastolic bruit radiating laterally. The bruit is usually best heard anteriorly between the umbilicus and the flank; its intensity may vary from day to day.

(The clinical value of abdominal auscultation was shown by the recent presentation at our Hypertension Clinic of a young female patient with severe hypertension. An intermittent abdominal bruit was heard. Hence, even though the intravenous pyelogram showed no abnormality,

we investigated further by renography and angiography; both revealed renal artery stenosis, which was curable.)

Abdominal palpation is required to exclude hepatomegaly (consider cardiac failure, avoid methyl dopa therapy) and splenomegaly (consider collagen disease, polycythaemia vera). Occasionally, enlarged polycystic kidneys or a unilateral enlargement of the kidney will be discovered. Rarely, during abdominal palpation, patients with phaeochromocytoma will develop a hypertensive episode because palpation stimulates the tumour to liberate catecholamines.

If there are any signs of liver disease, methyl dopa must not be used as an antihypertensive agent.³⁶

Urine Examination

Proteinuria is usually a rather nonspecific finding except in hypertensive pregnant women in whom pre-eclampsia must be suspected and the hypertension treated vigorously. Occasionally there is a heavy proteinuria; a nephrotic syndrome with an added nephritic element must be suspected. Sometimes features of chronic renal failure are detected or the diagnosis of porphyria is made. An occult **urinary tract infection** should always be considered (microscopy of spun deposit; urine culture and sensitivity testing of any organisms found). In practice the yield is disappointing, unless there is a suggestive history.

Blood Count and Erythrocyte Sedimentation Rate

A high ESR may be caused by an arteritis (whether 'idiopathic' and of obscure origin, or reflecting an underlying collagen vascular disorder such as lupus erythematosus). Rarely, polycythaemia can be a manifestation of unilateral renal disease, or part of a 'stress polycythaemia' (reduced blood volume responds to β -blockers rather than to diuretics).

SPECIAL INVESTIGATIONS

Biochemical Investigations

The single most useful blood test in a patient with hypertension is measurement of **serum creatinine**. If the value is elevated, it is relatively simple to undertake a creatinine clearance test which is a good reflection of overall renal function. Impaired renal function indicates either a renal cause of the hypertension or the involvement of the kidneys as a secondary event; it is frequently not possible to separate these two possibilities. The degree of elevation of the serum creatinine level indicates the severity and stage of the hypertension. Less usually, the serum creatinine level is high for other reasons, such as haemoconcentration following a furosemide (Lasix)-induced diuresis.

The **plasma potassium** value is a very useful measurement, acting as a screening test for primary aldosteronism.³⁷ In a patient who has not been receiving diuretic therapy, a low plasma K^+ level (below 3.5 mmol/l) suggests excess aldosterone secretion or excess renal K^+ loss (Cushing's syndrome usually has other diagnostic fea-

tures). Further very specialized investigations at a specialist hospital are required to differentiate renal disease from an aldosterone-secreting tumour. In principle, renal disease causes a high peripheral blood renin activity which calls for the aldosterone secretion; in contrast, in primary aldosteronism the peripheral renin activity is suppressed by the aldosterone secretion. Thus unilateral renal artery stenosis may sometimes present with hypokalaemia, a result of secondary hyperaldosteronism.

Investigation of Renal Function

Intravenous pyelography with a rapid sequence examination is a very important special investigation that can readily be undertaken even in a peripheral hospital or clinic. The patients selected for pyelography should be either young or have severe hypertension, or (especially) the combination of these.

The intravenous pyelogram (IVP) can be normal even when there is significant renal artery stenosis. Therefore, if the IVP is negative in a young patient with severe hypertension, further investigations should be arranged at a specialized centre. *The higher the diastolic value, the greater the chance of an underlying renal artery stenosis*, because renovascular hypertension is found in 20-30% of patients (average age 44 years) with grade III or grade IV retinopathy.¹⁸ In a British female population under 45 with established hypertension and angina, over half had renal artery stenosis.¹⁹

Renography and renal arteriography. Further investigations include renal isotopic scanning (renography) and renal arteriography; the latter is critical in diagnosing renal artery stenosis. This renogram and the arteriogram basically give different types of information, the renogram indicating the degree of perfusion of the kidney and the arteriogram indicating whether there is renal artery stenosis or not. Hence the surgeon is more interested in the results of the arteriogram. As a practical rule, if severe hypertension is caused by unilateral renal arterial disease, the renin output from that kidney should be one and a half times that of the other side.

In pheochromocytoma the IVP may show downward displacement of the kidney and the angiogram may delineate the blood supply to the adrenals, thereby usually identifying any adrenal tumour.

Urinary vanillylmandelic acid (VMA) and associated metabolites. Assessment of VMA and associated metabolites such as metanephrine should probably be undertaken routinely in any *young patient* with significant hypertension. Some patients with pheochromocytoma present with a sustained hypertension and without the classic features of pheochromocytoma such as tachycardia, arrhythmias or weight loss. It is relatively easy to send urine for VMA estimation from an outlying centre to a specialist hospital — all that is required is an aliquot of a 24-hour urine specimen collected into 10 ml of concentrated hydrochloric acid in a dark container. The well-known 'diet' before an estimation of VMA really means 3 days of avoiding vanilla-containing compounds (ice cream and custard), bananas, grain cereals, tea, coffee and chocolate. There are a host of drugs

which may alter the metabolism of catecholamines or interfere with the assay; these include methylidopa, quinidine, tetracycline, chlorpromazine, bronchodilators, levodopa, lithium and nitroglycerine. The simple rule is to avoid all drugs for the week before the assay.

If values for VMA and associated metabolites are normal, pheochromocytoma can be excluded with reasonable certainty, especially if urine has been collected during a hypertensive episode. In rare cases, the plasma catecholamine levels are elevated when the urine values are normal. The techniques for collection and analysis of plasma for catecholamine assay require the facilities of a specialist hospital.

The Electrocardiogram

The ECG is not important in differentiation between primary and secondary hypertension, but is of value from the following points of view. Firstly, definite left ventricular hypertrophy (high voltage plus ST depression in the absence of digitalis) may provide proof of target organ involvement before clinical signs are present; treatment must correspondingly be more vigorous and the electrocardiographic abnormalities will frequently return to normal. Secondly, left ventricular hypertrophy may indicate past hypertension, now 'burnt out'. Thirdly, in the middle-aged or elderly, silent ischaemic heart disease may be detected (Q waves of old infarction, left bundle-branch block), thereby pointing to a more limited prognosis. In such patients, better control of the blood pressure should theoretically prevent reinfarction, but the evidence is not yet firm.²⁰

Chest Radiography

The chest radiograph, like the ECG, is more useful to assess the cardiac effects of hypertension than to distinguish between primary and secondary hypertension. Only one cause of secondary hypertension can be diagnosed

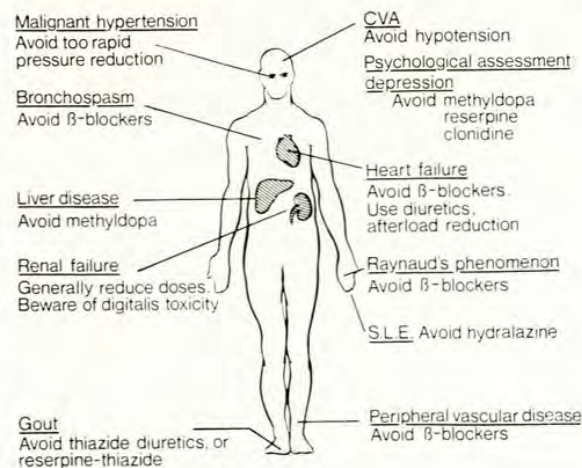


Fig. 2. Hypertension: some factors governing treatment.

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