

Interpreting blood tests and other investigations

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Learning outcomes

- ❑ To understand which blood tests are needed in patients with hypertension
 - ❑ To understand the role of the ECG in hypertension
 - ❑ To appreciate the need for a holistic approach to the management of patients with hypertension
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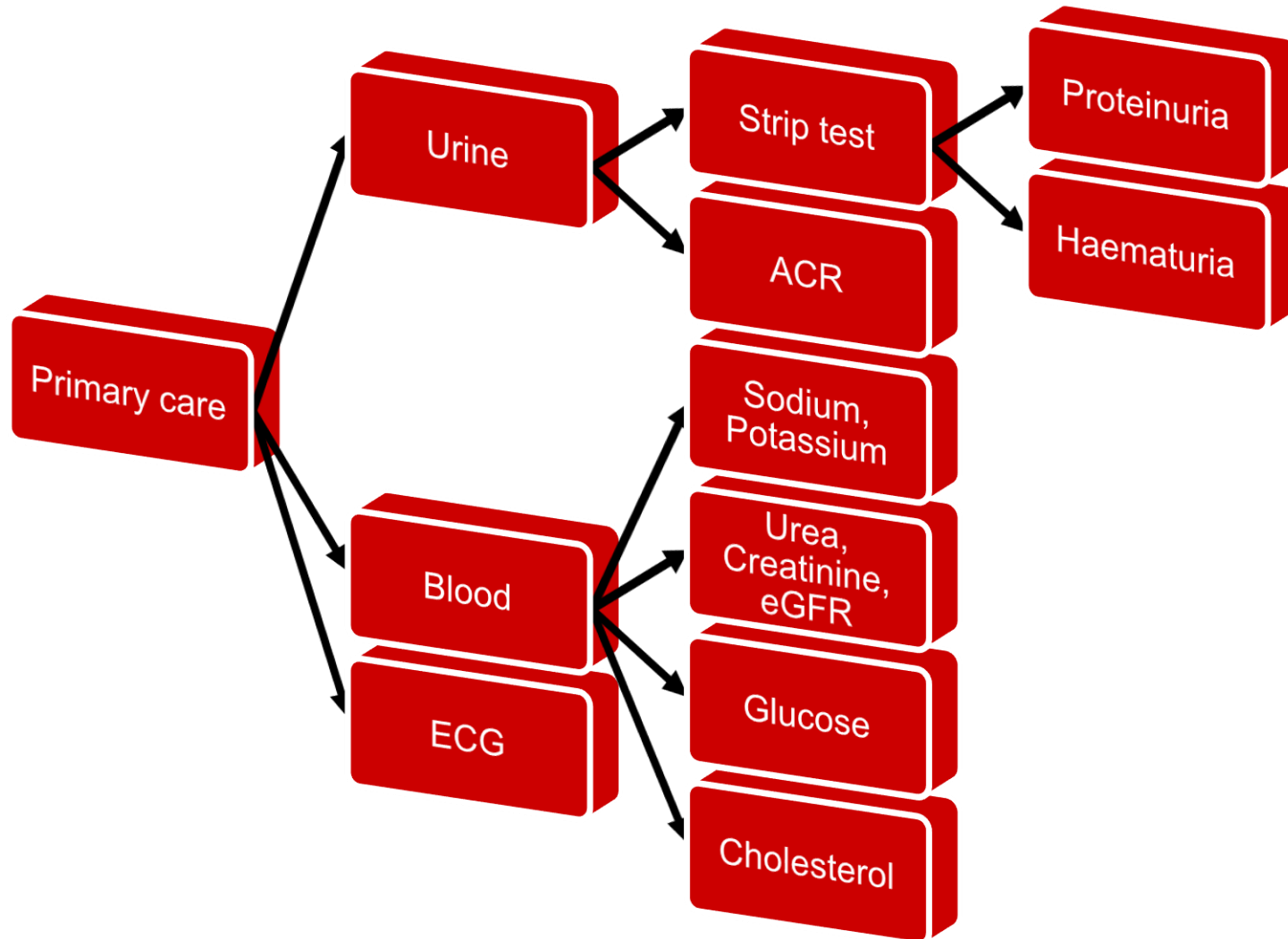
Routine clinical investigations

- Routine primary care tests are used for 2 reasons:
 1. Alerting clinicians to possible secondary causes of hypertension
 2. Monitoring purposes
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Routine clinical investigations

1. Urine strip test for blood and protein
 2. Blood tests for electrolytes, creatinine and eGFR
 3. Blood glucose
 4. Serum total and HDL cholesterol
 5. 12 lead ECG
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Routine clinical investigations



Understanding the tests

Urine testing for proteinuria

- ❑ Proteinuria identifies patients with kidney damage
 - ❑ Albumin is the principal component of proteinuria in glomerular disease
 - ❑ Reagent strips in current clinical practice predominantly detect albumin, not total protein
 - ❑ Albumin/creatinine ratio (ACR) has far greater sensitivity for the detection of low levels of proteinuria and enhances early identification of CKD
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Albumin/creatinine ratio (ACR)

- ❑ For the initial detection of proteinuria, if the ACR is ≥ 30 mg/mmol and < 70 mg/mmol this should be confirmed by a subsequent early morning sample
- ❑ If the initial ACR is ≥ 70 mg/mmol a repeat sample need not be tested

	Clinically significant proteinuria
Diabetic (man)	ACR > 2.5 mg/mmol
Diabetic (woman)	ACR > 3.5 mg/mmol
Non-diabetic	ACR ≥ 30 mg/mmol

Urine testing for haematuria

- ❑ When testing for the presence of haematuria, use reagent strips rather than urine microscopy
 - ❑ Evaluate further if there is a result of 1+ or more
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Blood tests

- ❑ Na⁺ and K⁺ are checked to exclude hypertension resulting from adrenal disease
 - ❑ Urea and creatinine or eGFR are checked to exclude hypertension resulting from renal disease
 - ❑ Glucose is checked to evaluate diabetes
 - ❑ Cholesterol is used to assess cardiovascular risk
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Glomerular filtration rate (GFR)

- GFR measurement is not practical so eGFR is used instead

$$\text{eGFR} = 186 \times (\text{Creat} / 88.4)^{-1.154} \times (\text{Age})^{-0.203} \times (0.742 \text{ if female}) \times (1.210 \text{ if African-Caribbean})$$

- An elevated creatinine or reduced eGFR indicates renal disease
 - Where indicated, apply a correction factor for ethnicity
 - In cases where there are extremes of muscle mass interpret the eGFR with caution
 - Advise people not to eat any meat in the 12 hours before having a blood test for GFR estimation
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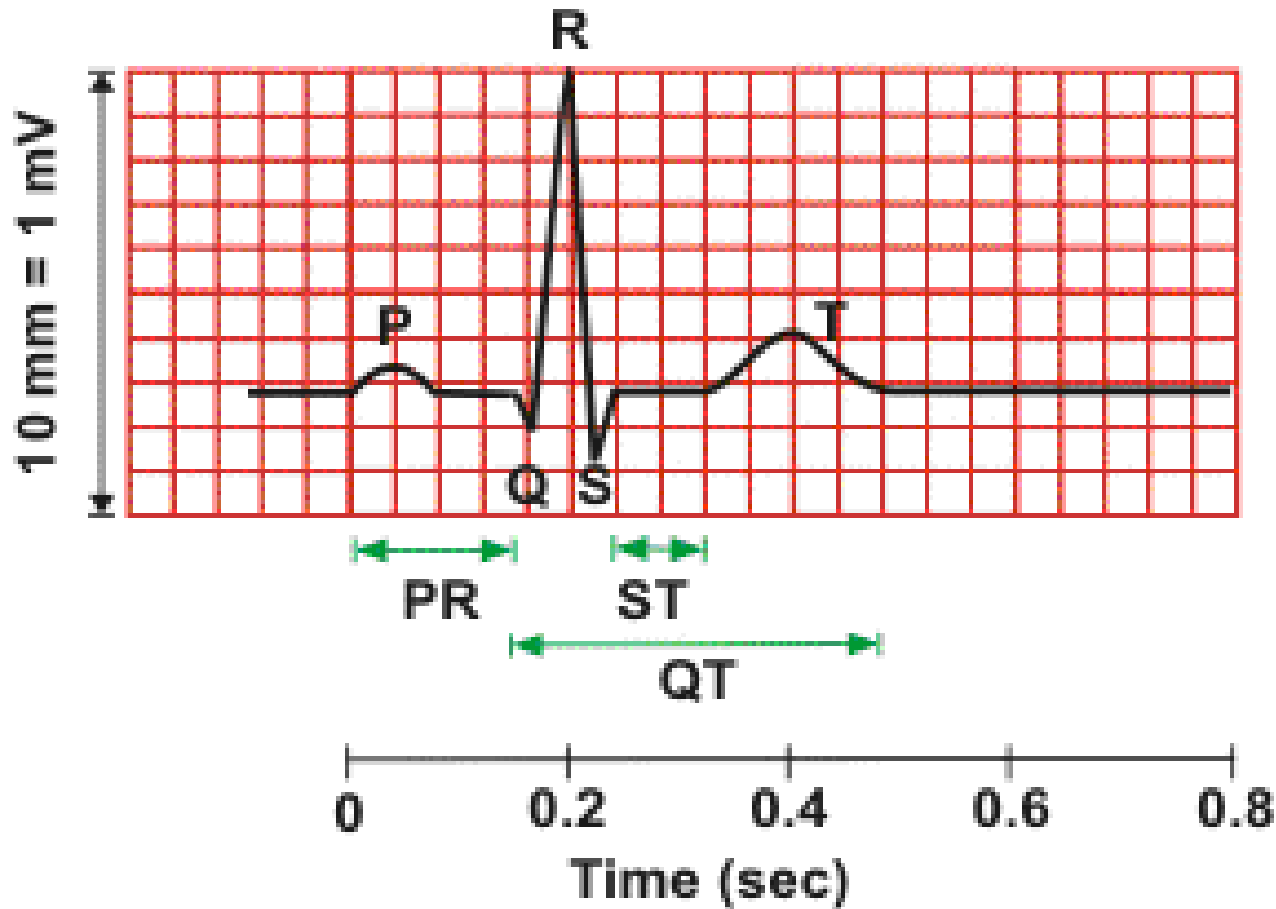
Electrocardiography (ECG)

- Heart rate
 - Heart rhythm
 - Conduction abnormalities
 - Left ventricular size
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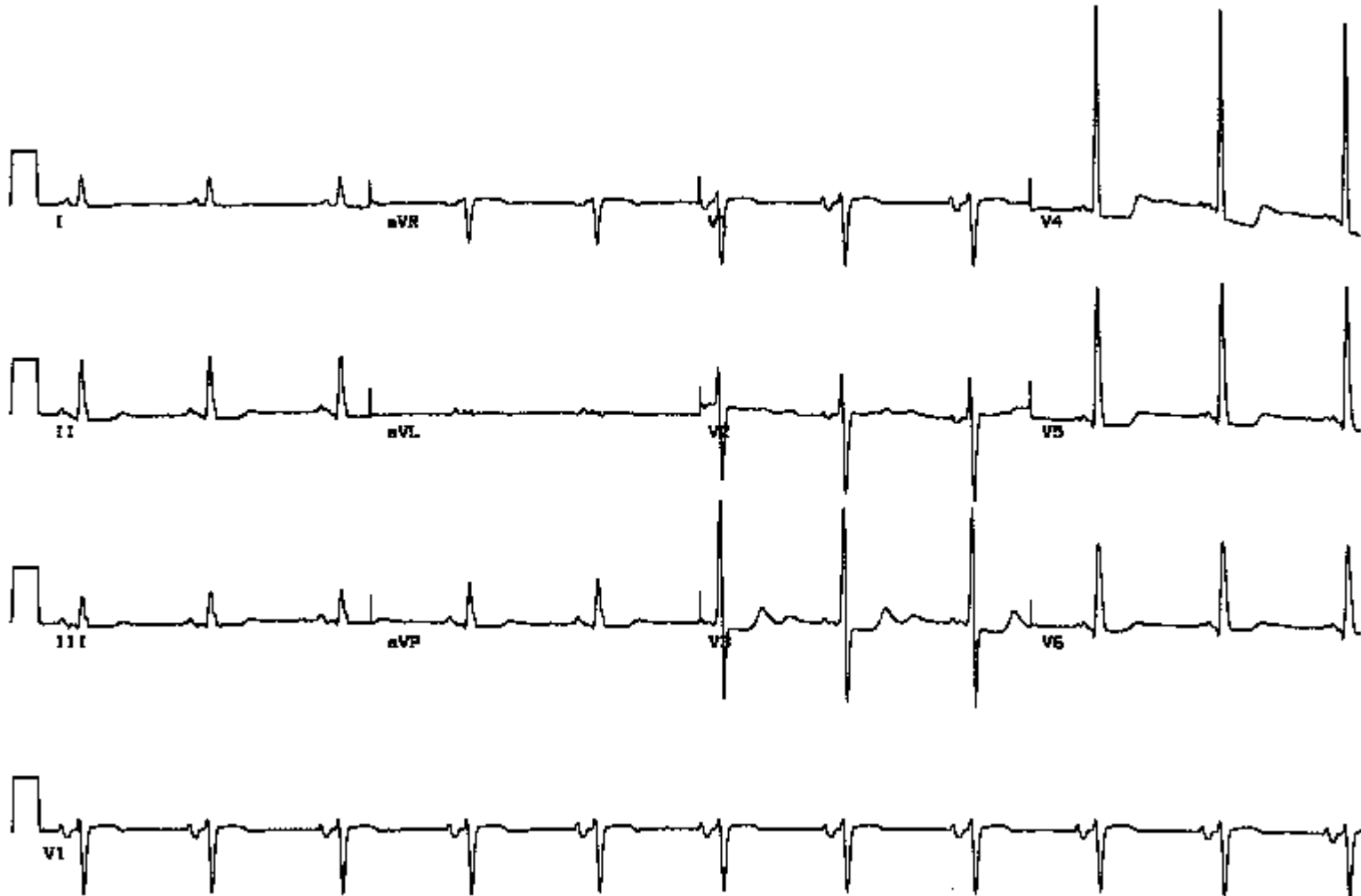
Electrocardiography (ECG)

- Left ventricular hypertrophy (LVH) is an important risk factor in patients with hypertension, leading to a 5-10-fold increase in cardiovascular risk
 - Accurate and early diagnosis of left ventricular hypertrophy is therefore an important component of the care of patients with hypertension
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Electrocardiography (ECG)



Electrocardiography (ECG)



Indexes commonly used in LVH diagnosis

- ❑ Sokolow-Lyon index — sum of $SV_1 + RV_5$ or $V_6 > 3.5$ mV
 - ❑ Cornell voltage index — men: $RaVL + SV_3 > 2.8$ mV; women: $RaVL + SV_3 > 2.0$ mV
 - ❑ Cornell product — men: $(SV_3 + RaVL) \times \text{QRS duration} \geq 2440$ ms; women: $(SV_3 + (RaVL + 8 \text{ mV})) \times \text{QRS duration} > 2440$ ms
 - ❑ Gubner — $RI + S_{III} \geq 25$ mV
 - ❑ Romhilt-Estes scoresa
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 - Gubner — RI+SIII ≥ 25 mV
 - Romhilt-Estes score
-

Electrocardiography (ECG)

- ❑ ECG has high specificity but poor sensitivity
 - ❑ ECG criteria should not be used to exclude left ventricular hypertrophy in patients with hypertension
 - ❑ Referral for echocardiography may be justified in some patients
 - ❑ Echocardiography is needed for a comprehensive assessment of cardiovascular risk in hypertensive patients
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Assessing cardiovascular risk

- Holistic assessment is important
 - Clinicians should address a patient's overall profile of risk rather than treat one risk factor in isolation
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Assessing cardiovascular risk

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About you

Age (30-84): Sex: Male FemaleEthnicity:

UK postcode: leave blank if unknown

Postcode:

Clinical information

Smoking status: Diabetic? Angina or heart attack in a 1st degree relative < 60? Chronic kidney disease? Atrial fibrillation? On blood pressure treatment? Rheumatoid arthritis?

Leave blank if unknown

Cholesterol/HDL ratio: Systolic blood pressure (mmHg):

Body mass index

Height (cm): Weight (kg):

Welcome to the QRISK[®]2-2011 cardiovascular disease risk calculator

Welcome to the QRISK[®]2-2011 Web Calculator. You can use this calculator to work out your risk of having a heart attack or stroke over the next ten years by answering some simple questions. It is suitable for people who do not already have a diagnosis of heart disease or stroke.

The QRISK[®]2 algorithm has been developed by doctors and academics working in the UK National Health Service and is based on routinely collected data from many thousands of GPs across the country who have freely contributed data for medical research. It is updated annually each April, refitted to the latest data to remain as accurate as possible.

Whilst QRISK2 has been developed for use in the UK, it is being used internationally. For non-UK use, if the postcode field is left blank the score will be calculated using an average value. Users should note, however, that CVD risk is likely to be underestimated in patients from deprived areas and over-estimated for patients from affluent areas. All medical decisions need to be taken by a patient in consultation with their doctor. The authors and the sponsors accept no responsibility for clinical use or misuse of these score.

The science underpinning the new QRISK[®]2 equations has been [published](#) in the British Medical Journal.

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Calculate risk over years.

Secondary causes of hypertension

Secondary causes of hypertension

- Up to 10% of hypertension cases
 1. Chronic renal disease (most common)
 2. Renovascular hypertension
 3. Pheochromocytoma
 4. Primary hyperaldosteronism
 5. Cushing syndrome

 - Current advice is simply to be aware of signs and symptoms and refer on the basis of a high index of suspicion and where the findings are likely to necessitate specialist management
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Renovascular hypertension

- ❑ Reduced blood flow to the kidneys
 - ❑ High serum urea or creatinine, reduced eGFR
 - ❑ Anaemia
 - ❑ A significant rise in serum creatinine when starting an ACEi or ARB may indicate renovascular hypertension
 - ❑ Avoid ACEi or ARBs (without specialist input)
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Pheochromocytoma

- ❑ Tumour of the adrenal gland
 - ❑ Rare (0.04%-0.1% of patients)
 - ❑ Tachycardia, headache, flushing, sweating
-

Primary hyperaldosteronism

- ❑ Excess aldosterone
 - ❑ Multiple causes (e.g. Conn's adenoma, adrenal hyperplasia)
 - ❑ Unclear prevalence (estimates between 1-15% of hypertensive patients)
 - ❑ Hypokalaemia and either normal or slightly elevated sodium
 - ❑ Often asymptomatic but possibly lethargy, muscle weakness, intermittent paraesthesiae
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Cushing's syndrome

- ❑ Excess glucocorticoids (Cushing's *disease* is secondary to a ACTH secreting pituitary gland adenoma)
 - ❑ Rare (0.1%-0.6% of patients)
 - ❑ Weight gain, central obesity, moon face, weakness, oligo/amenorrhoea, skin thinning, hyperpigmentation
 - ❑ Hyperglycemia, hypokalaemia, hyperlipidaemia
-

Cushing's syndrome



2006



May 2010

Monitoring



Monitoring with an ACEi/ARB

- Before initiating treatment
 - 1 week after starting treatment or any subsequent dose increase
- or...
- At 4 and 10 days after starting treatment or increase in dose in patients at higher risk of developing hyperkalaemia or deteriorating renal function
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Monitoring creatinine with ACEi/ARB

- Patients with hypertension with raised serum creatinine $>200 \mu\text{mol/l}$ before starting treatment may have renal pathology and should be referred for specialist evaluation before receiving either diuretic or ACEi or ARB treatment
 - A limited elevation in serum creatinine ($<30\%$) is a common occurrence in patients after the initiation of ACEi or ARB, and if it occurs will happen within the first 2 weeks of treatment
 - Marked creatinine rise ($>30\%$) with large fall in blood pressure after starting ACEi or ARB may suggest renovascular disease that should be investigated
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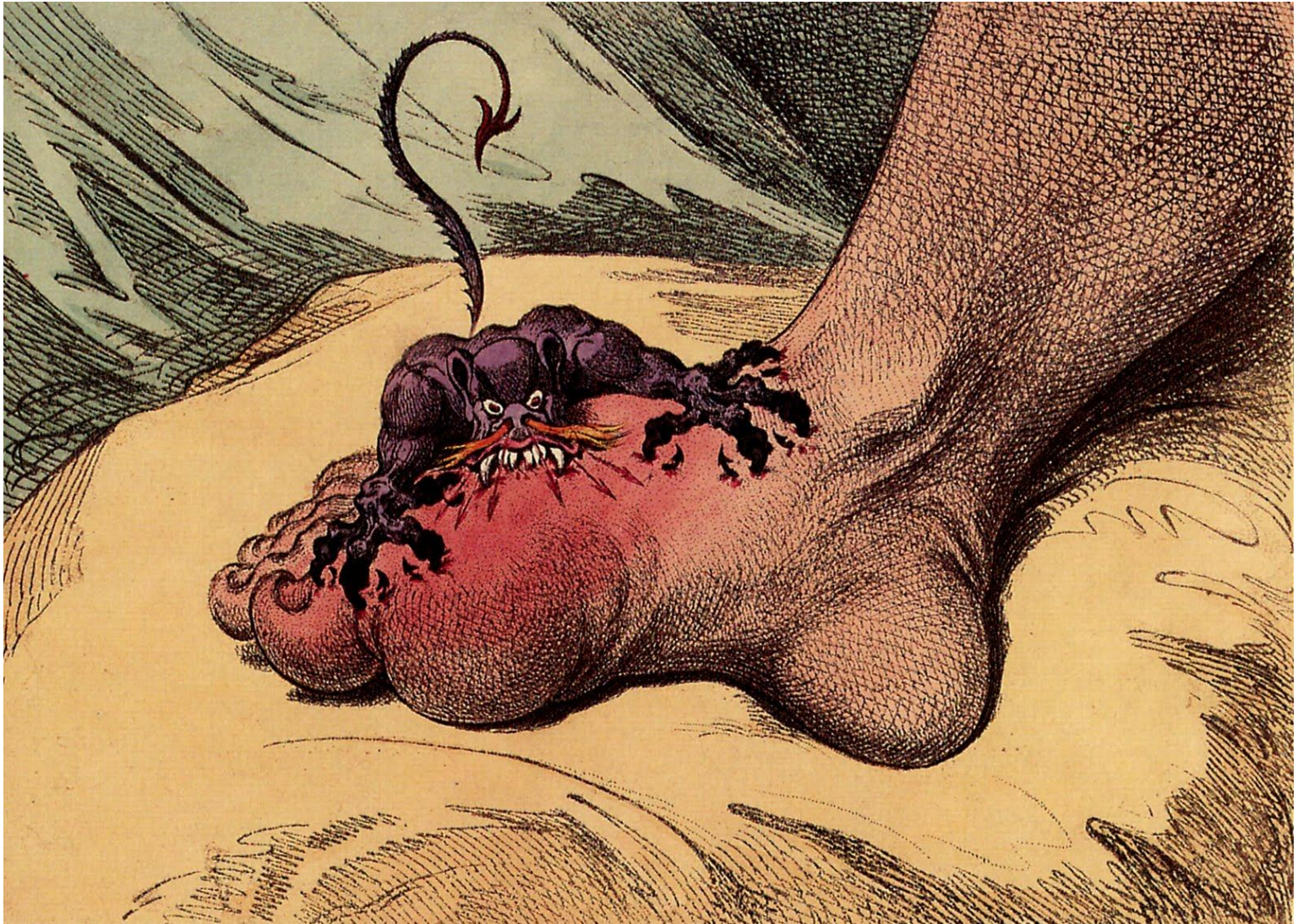
Monitoring potassium with an ACEi/ARB

- ❑ ACE inhibitor/ARB therapy should not normally be started if the pre-treatment serum potassium concentration is >5 mmol/L
 - ❑ Stop ACE inhibitor/ARB therapy if the serum potassium concentration rises to 6.0 mmol/litre or more and other drugs known to promote hyperkalaemia have been discontinued
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Monitoring electrolytes with a diuretic

- Thiazide or loop diuretics
 1. Within 4–6 weeks of starting low-dose thiazide diuretic treatment or loop diuretic treatment
 2. Thereafter every 6–12 months (in all patients)
 3. Sooner if a person's clinical condition changes or a potentially interacting drug is added
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Monitoring bloods with a diuretic



Monitoring electrolytes with a diuretic

- Spironolactone or potassium-sparing diuretics
 1. Before initiation of treatment
 2. After 5–7 days with dose titration if required
 3. Every 5–7 days until the potassium values are stable
 4. 1–2 times/year up to every 4–8 weeks during chronic treatment, depending on risk factors
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Monitoring potassium with a diuretic

- ❑ Spironolactone or potassium-sparing diuretics should not normally be started if the pre-treatment serum potassium concentration is >5 mmol/L
 - ❑ If potassium rises to >6 mmol/l, spironolactone or potassium-sparing diuretics should be stopped and specialist advice sought
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Questions?

References

- NICE 2011. **The clinical management of primary hypertension in adults.** Clinical Guideline 127. London: National Institute for Health and Clinical Excellence.
 - NICE 2008. **Early identification and management of chronic kidney disease in adults in primary and secondary care.** Clinical Guideline 73. London: National Institute for Health and Clinical Excellence.
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 - Pewsner D, Jüni P, Egger M, Battaglia M, Sundstrom J, Bachmann LM. **Accuracy of electrocardiography in diagnosis of left ventricular hypertrophy in arterial hypertension: systematic review.** BMJ. 2007 Oct 6;335(7622):711
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