

Chronic Kidney Disease (CKD) Algorithm

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(See NICE Clinical Guideline CG73¹ and Quality Standards²)

Who should have their kidney function checked?

- Diabetes (*See local Diabetes pathway*)
- Hypertension
- Cardiovascular disease (*ischaemic heart disease, chronic heart failure, peripheral vascular and cerebrovascular disease*)
- Structural renal tract disease, renal calculi or prostatic hypertrophy
- Multisystem diseases with potential kidney involvement – e.g. systemic lupus erythematosus
- Family history of kidney disease
- Opportunistic detection of haematuria or proteinuria
- People prescribed nephrotoxic drugs such as calcineurin inhibitors (*Ciclosporin, Tacrolimus*), Lithium and long term systemic NSAIDs

If none of the above do not use age gender or ethnicity as risk markers.

How should it be done?

Measure eGFR

- If eGFR in the first test $< 60\text{ml}/\text{min}/1.73\text{m}^2$ (*Adjust for ethnicity if necessary. Multiply by 1.21 if Africo- Caribbean ethnicity*) repeat within 14 days to exclude acute kidney injury
- To identify progression take at least 3 eGFRs over at least 90 days

Advise patient not to eat meat for 12 hours prior to eGFR blood test. Cooked meat increases serum creatinine concentration and affects eGFR calculation. Ensure CKD classification is based on samples taken fasting or when there has been no ingestion of meat.

If blood sample taken fasting advise patient to drink water normally.

Check urine for Albumin in all at risk groups

- Do not rely on reagent strips to identify proteinuria
- Use a reagent strip to detect haematuria **See Box 8**
- Send urine for albumin:creatinine ratio (ACR)
- If first result is abnormal repeat on an early morning urine sample **See Box 7**
- In patients with diabetes 2 out of 3 abnormal results confirm albuminuria

First steps & staging

Is there evidence of active renal disease or acute kidney injury? **See Box 1**

YES

Consider referral to nephrologist or urologist for inpatient / urgent outpatient assessment

NO

Stage the CKD

- In people aged > 70 years, an eGFR in the range 45–59 ml/min, if stable over time and without any other evidence of kidney damage, is unlikely to be associated with CKD-related complications
- Test eGFR annually in at risk groups, during intercurrent illness and perioperatively in all patients with CKD
- Exact frequency depends on the clinical situation

Stage	eGFR ml/in/1.73m ²	Stages of CKD and frequency of eGFR testing	Typical testing frequency
1	> 90	Normal or increased GFR, with other evidence of kidney disease	12 monthly
2	60-89	Slight decrease in GFR, with other evidence of kidney disease	12 monthly
3A	45-59	Moderate decrease in GFR, with or without other evidence of kidney disease	6 monthly
3B	30-44	Moderate decrease in GFR, with or without other evidence of kidney disease	6 monthly
4	15-29	Severe decrease in GFR, with or without other evidence of kidney damage	3 monthly
5	< 15	Established renal failure	6 weekly

Box 1 - Features of active renal disease / acute kidney injury

Are there features that cause particular concern? e.g.:

- Oliguria
- Loin pain
- Hyperkalaemia ($K > 7 \text{ mmol/l}$)
- Severe hypertension
- Nephrotic syndrome
- Haematoproteinuria (*urinalysis in all cases*) (NICE CG 73 page 8)¹
- Lower urinary tract symptoms and signs (*dysuria, obstructive symptoms*)
- Acute systemic symptoms (*rash, arthritis, vomiting, diarrhoea, rigors, confusion*)

Repeat eGFR within 3 days if any of the above are present.

Refer urgently if eGFR has fallen by $> 5 \text{ mL/min}$.

Management

Stages 1 & 2

eGFR > 60 and ACR < 30

If no other risk factors for CKD, consider normal. If risk factors for CKD repeat eGFR in 12 months

eGFR > 60 and ACR < 30-69

See Box 2

Management in Primary Care

Stages 3A & 3B

eGFR > 30 and < 60

ACR > 30 - 69

No haematuria

See Box 2

Management in Primary Care

eGFR > 30 and < 60

ACR 30 - 69

With haematuria

See Box 2

Management in Primary Care

See Haematuria box
Consider referral for renal specialist opinion

Stages 4 & 5

eGFR < 30

Consider referral for renal specialist opinion

Albuminuria

ACR > 70 Irrespective of eGFR

Consider referral for renal specialist opinion unless diabetic on appropriate treatment

Management in Primary Care

Box 2

- Optimise blood pressure control **Box 3**
- Use ACEI/ARBs where indicated **Box 4**
- Reduce cardiovascular disease risk **Box 5**
- Identify progressive CKD **Box 6**
- Evaluate albuminuria and haematuria **Box 7** & **Box 8**
- Consider renal ultrasound **Box 9**
- Offer lifestyle advice – exercise, healthy weight and stop smoking
- Refer to appropriately trained professional for advice on salt and healthy eating. Refer to Dietitian for advice on potassium or any other dietary issue where appropriate
- Review medication – avoid NSAIDs and other nephrotoxic agents
- Immunisations **Box 10**
- Anaemia **Box 11**
- Potassium **Box 12**
- Bone conditions **Box 13**
- Diabetes **Box 14**
- **Refer in a timely manner to a nephrologist** **Box 15**

Box 3 - Optimise blood pressure control (NICE CG 73 p13)¹

- Aim to keep blood pressure below 140/90 mmHg in all patients with CKD (*target systolic 120-139*)
- Aim to keep BP below 130/80 mmHg in people with CKD and diabetes or when the ACR is > 70mg/mmol (*target systolic 120-129*)

Box 4 - Use of ACEI/ARBs (NICE CG 73 p14)¹

- Treat with ACEI first; move to ARBs if ACEIs are not tolerated
- Titrate to maximum tolerated dose in all diabetic and non-diabetic patients with proteinuria
- Test eGFR and serum potassium before treatment starts and repeat after 1- 2 weeks and each dose increment
- If eGFR remains stable or shows a small decrease (*up to 15%*)* continue to titrate dose to maximum
- If eGFR decreases 15 - 25%* following introduction or dose increase:
 - do not modify dose
 - repeat the test after 1 – 2 weeks. Continue to titrate dose if eGFR stable
- If eGFR decreases by more than 25% or plasma creatinine increases more than 30% following ACEI/ARB introduction or dose increase:
 - investigate for other causes of deterioration in renal function, eg volume depletion due to diuretics or NSAIDs. Consider referral
- If no other cause: - stop ACEI/ARB therapy or reduce dose to a previously tolerated lower dose - add alternative antihypertensive medication if required
- ACEI and ARB should not routinely be combined in CKD without specialist advice

Box 5 - Reduce cardiovascular disease risk

- Offer statins for the primary prevention of cardiovascular disease in the same way as in people without CKD
- Use statins for the secondary prevention of cardiovascular disease irrespective of baseline lipids. Use statins in people with diabetes (*NICE CG 67*)⁷
- Patients with CKD are at high risk of cardiovascular disease. The Framingham risk tables significantly underestimate CV risk. All should be considered for statins taking into account individual factors
- Use antiplatelet drugs for the secondary prevention of cardiovascular disease

Box 6 - Identify progressive CKD (*NICE CG 73 p5*)¹

- Define progressive as a decline in eGFR of >5ml/min per year, or >10ml/min in 5 years
 - For a new finding of reduced eGFR, repeat test within 2 weeks to exclude acute kidney injury
 - To identify progression take at least 3 eGFRs over at least 90 days
 - Consider whether progression at the observed rate would lead to renal replacement therapy within the person's lifetime
- Chronic use of NSAIDs may be associated with progression; exercise caution and monitor GFR annually in those taking them long-term

Evaluate Albuminuria

Box 7 - Albuminuria (Nice CG 73 p5)¹

Urinary protein concentration and approximate equivalent values

ACR mg/mmol (albumin:creatinine ratio)	PCR mg/mmol (protein:creatinine ration)	Urinary protein excretion (g/24hrs)
30	50	0.5
70	100	1

Treatment

No diabetes

- ACR < 30 mg/mmol and hypertension: offer a choice of antihypertensive treatment (see NICE CG 127)⁸
- ACR > 30 mg/mmol and hypertension: offer ACEI ACR > 30 and < 70 mg/mmol without hypertension: consider ACEI inhibitor and monitor
- ACR > 70 mg/mmol with or without hypertension: offer ACEI

Diabetes

- ACR > 2.5 (men) with or without hypertension: offer ACEI
- ACR > 3.5 (women) with or without hypertension: offer ACEI

Evaluate Haematuria

Box 8 - Haematuria (see *Joint Consensus Statement*³)

- Use reagent strips
- Evaluate further if there is a result of 1+ or more
- Confirm persistent invisible haematuria by two out of three positive sticks
- Check eGFR in all patients
- Do not use urine microscopy to confirm a positive result

Refer to Urology all Patients with

- Visible haematuria (*any age*)
- Invisible haematuria associated with lower urinary tract symptoms, if infection excluded (*any age*)
- Asymptomatic invisible haematuria aged > 40 years

Refer to Nephrology

- Patients with rapidly declining renal function (*see progressive CKD box*)
- Patients with CKD who have had a urological cause excluded
- Patients with ACR > 30 mg/mmol

Monitor in Primary Care

Persistent invisible haematuria without proteinuria follow up annually, repeat testing for haematuria, ACR, eGFR and blood pressure as long as the haematuria persists.

Box 9 - Renal Ultrasound (NICE CG 73 p12)¹

- Offer a renal ultrasound to all people with CKD who:
 - have progressive CKD
 - have visible or persistent invisible haematuria
 - have lower urinary tract symptoms
 - have a family history of polycystic kidney disease and are aged over 20yrs
 - have stage 4 or 5 CKD
- Advise people with a family history of inherited kidney disease about the implications of an abnormal result before arranging the scan

Box 10 - Immunisation

- Offer annual influenza vaccination to all patients with confirmed CKD stage 3 (eGFR < 60 ml/min)
- Pneumococcal vaccination and revaccinate according to DH Guidelines (*Green Book*)⁴
- Hepatitis B vaccination if there is a possibility of renal replacement

Box 11 - Anaemia (NICE CG 114)⁵

- Check haemoglobin in people with eGFR < 45 ml/min to identify anaemia
- Exclude other causes of anaemia
- Consider referral for erythropoietin if haemoglobin < 10 g/dl
- NICE guidance target haemoglobin for patients on erythropoietin 10 -12 g/dl. Higher haemoglobins may be harmful

Box 12 - Potassium (NICE CG 73 p14)¹

- Repeat if raised
- If > 5.5 mmol/l
 - do not start ACEI/ARB
 - exclude other factors that cause hyperkalaemia & recheck
 - refer for dietary advice
- If > 6.0 mmol/l and other drugs that promote hyperkalaemia have been discontinued, stop ACEI/ARBs
- If > 7.0 mmol/l, repeat test and refer urgently
- If taking drugs that cause hyperkalaemia, more frequent monitoring of potassium is required

(ACE Inhibitor, ARBs, Potassium sparing diuretics, Beta Blockers, trimethoprim, non-steroidal anti inflammatory drugs)

Box 13 - Manage bone conditions

(NICE CG 73 p13)¹

- Measure serum calcium and phosphate if eGFR < 30ml/min
- Seek specialist advice if renal bone disease suspected
- Do not routinely measure serum calcium, phosphate or parathyroid hormone (PTH) if eGFR > 30ml/min
- Offer bisphosphonates for the prevention and treatment of osteoporosis where appropriate in patients with eGFR > 30ml/min who are at risk for other reasons (*Manufacturers advise avoid if eGFR <30 ml/min*)
- For 25 OH Vitamin D deficiency use cholecalciferol or ergocalciferol (see *East Lancashire Guideline*⁶)
- Monitoring of serum calcium, phosphate and PTH is required for patients taking alfacalcidol, paricalcitol or calcitriol - seek specialist advice

Box 14 - Diabetes

(NICE CG 73 p10)¹

- People with diabetes with albuminuria should be treated with an ACE inhibitor or ARB unless contra-indicated
- Keep blood pressure below 130/80 mmHg in patients with albuminuria
- Refer to local guidelines for advice on diabetic control, other complications of diabetes and when to refer to diabetologist
- Refer to nephrologist patients with eGFR < 30 ml/min, progressive deterioration of kidney function and those with ACR > 200 mg/mmol despite treatment with maximum dose of ACE inhibitor/ARB
- Refer to either diabetologist or nephrologist if blood pressure is difficult to control despite three agents

Referral

Box 15

Referral to a kidney specialist	Routine	Information required
<ul style="list-style-type: none"> • Take into account the individual's wishes and co morbidities when considering referral • People with CKD in the following groups should normally be referred for specialist assessment: <p>Urgent</p> <ul style="list-style-type: none"> - Suspected Acute Kidney Injury - Newly detected eGFR < 15 ml/min with symptoms - Nephrotic Syndrome - Accelerated Hypertension - Severe hyperkalaemia (MAU) 	<ul style="list-style-type: none"> • Stage 4 and 5 CKD (<i>with or without diabetes</i>) • Proteinuria (<i>ACR > 70 mg/mmol</i>) unless known to have diabetes and already appropriately treated with ACE Inhibitor or ARB Box 14 • Proteinuria (<i>ACR > 30 mg/mmol</i>) together with haematuria • Declining eGFR (<i>> 5 ml/min in 1 year, or > 10 ml/min within 5 years</i>) • Poorly controlled hypertension despite four antihypertensive drugs at therapeutic doses • Suspected rare or genetic causes of CKD • Suspected renal artery stenosis • Urologically unexplained visible haematuria • Suspected renal anaemia Box 11 	<ul style="list-style-type: none"> • Symptoms and Reason for referral • Relevant medical and social history • Key examinations findings including blood pressure • Serial creatinine/eGFR and urinary albumin results • Renal ultrasound or other relevant test result

Key Messages

All patients with CKD have an increased risk of developing heart disease and other diseases of blood vessels, including stroke. For many, this is more important than the risk of developing more serious kidney disease.

Early identification and appropriate treatment for CKD can help reduce your risk of heart attack by prompting discussion about lifestyle issues and treatment of high blood pressure and high cholesterol.

Patients with advanced, progressive or proteinuric CKD require prompt specialist referral.

Strict blood pressure control is fundamental in the management of CKD.

Kidney failure accounts for 21% and 11% of deaths in type 1 and 2 diabetes respectively.

Further Resources

Useful websites for patient information:

UK National Kidney Federation.....www.kidney.org.uk

The Renal Association Patients Pages.....[www.renal.org/whatwedo/
InformationResources/Patients.aspx](http://www.renal.org/whatwedo/InformationResources/Patients.aspx)

British Kidney Patient Association.....www.britishkidney-pa.co.uk

Further advice is available via the renal extranet site - <http://nww.lancashireteachinghospitals.nhs.uk/renal>
or from the Renal Unit, North Cumbria University Hospitals.

We would welcome comments and feedback on the Algorithm

Comments & Feedback

Please follow link to forward comments to Lynda Smith,
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References

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*local consensus as opposed to NICE.