A practical approach to chronic kidney disease in primary care

Diagnosis

- Definition :CKD can be defined as any abnormality of kidney structure and/or function that has been present for at least 3 months.

Table 1: Criteria for diagnosis of CKD

Markers of kidney damage (1 or more)	• Albuminuria (AER >30 mg/24 hours; ACR >30 mg/g [>3 mg/mmol]) • Urine sediment abnormalities • Electrolyte and other abnormalities due to tubular disorders • Abnormalities detected by histology • Structural abnormalities detected by imaging • History of kidney transplantation/donation
Decreased GFR	GFR <60 ml/min/1.73 m^2 (GFR categories G3a-G5)
CKD may be diagnosed when either criterion is present for 3 months or more	

*AER: albumin excretion rate, ACR: albumin-to-creatinine ratio

Diagnosis

- Staging

Table 2: Staging of CKD based on GFR

GFR category	GFR (ml/min/1.73 m²)	Term
G1	≥90	Normal or high
G2	60-89	Mildly decreased
G3a	45-59	Mild to moderately decreased
G3b	30-44	Moderately to severely decreased
G4	15-29	Severely decreased
G5	<15	Kidney failure

Table 3: Staging of CKD based on albuminuria

Category	AER (mg/24 hours)	ACR		Terms
		mg/mmol	mg/g	
A1	<30	<3	<30	Normal to mildly increased
A2	30-300	3-30	30-300	Moderately increased*
A3	>300	>30	>300	Severely increased**

*relative to young adult level.**including nephrotic syndrome.

Diagnosis

- Screening for CKD

Table 4: Risk factors for CKD that require CKD screening

	Risk factors
Sociodemographic factor	Age > 65 Family history of kidney disease
Comorbid conditions	Diabetes mellitus Hypertension Obesity Gout Metabolic syndrome Cardiovascular disease Autoimmune disease Recurrent urinary tract infection Previous AKI[14]
Structural abnormalities	Structural renal tract abnormalities Benign prostatic hypertrophy Renal calculi
Drugs	Chronic non-steroidal anti-inflammatory drugs Chronic nephrotoxic agents Chronic use of proton pump inhibitor[13]

Evaluation of CKD

- Clinical evaluation
- Blood test
- Urine examination
- Ultrasound
- Causes of CKD
- Referral to nephrologist

Clinical evaluation

Table 5: Approach to CKD

Establish the diagnosis of CKD – persistent kidney damage for >3 months
Stage the CKD by GFR
Look for the cause of CKD
Provide treatment according to stage and cause
Monitor for CKD progression and CKD-related complications
Employ risk stratification and management of cardiovascular risk factors

Blood test

Serum creatinine is affected by many factors, such as age, gender, muscle mass and protein meals. That said, it is an insensitive marker of GFR early in the course of CKD, as an initial rise in serum creatinine indicates about 50% loss of GFR.16 Hence, detection of CKD based on estimated GFR is a more accurate assessment of renal function than serum creatinine.

Table 6: Equation to derive eGFR

Equation for GFR estimation	Variables	Notes	Online calculator
4 variable MDRD	Age, sex, race, and creatinine level	Reasonably accurate in non-hospitalised patients with CKD. Less accurate in normal or obese individuals.	https://qxmd.com/calculate/calculator_140/mdrd-egfr
CKD-EPI	Age, sex, race, and serum creatinine level	More accurate assessment for normal individuals or individuals with mildly reduced GFR.	https://qxmd.com/calculate/calculator_251/egfr-using-ckd-epi
Cockcroft-Gault formula	Age, weight, sex, serum creatinine	Medication dosage adjustment.	https://qxmd.com/calculate/calculator_51/crcl-cockroft-gault
Cystatin C	Age, sex, race, serum cystatin C level	Beneficial when false positive decreased GFR is suspected.	https://www.mdcalc.com/ckd-epi-equations-glomerular-filtration-rate-gfr

Urine examination

Table 7: Different tests that can be used to detect proteinuria or albuminuria

Test	Significant proteinuria
Urine dipstick	Positive when proteinuria >500-1000 mg per day
Automated urinalysis	Positive when proteinuria ≥300 mg per day
Urine albumin-to-creatinine ratio	≥30-300 mg/g – moderately increased albuminuria >300 mg/g – severely increased albuminuria
Urine protein-to-creatinine ratio	>200 mg/g signify presence of proteinuria
24-hour urine protein	≥150 mg/day signify presence of proteinuria >3 g/day signify nephrotic range proteinuria

Ultrasound

- Renal size, shape and location – small kidney size may suggest chronicity of kidney disease. Renal size assessment is an important consideration prior to renal biopsy. It may detect abnormal anatomy,such as horseshoe kidney
- Renal cortex and echogenicity – a thin renal cortex and increased renal echogenicity are signs of CKD.
- Obstruction – the presence of hydronephrosis and hydroureter is suggestive of renal tract obstruction.
- Structural pathology – renal calculi and polycystic kidney disease can be diagnosed from an ultrasound.

Table 8: Common causes of CKD

a)	Pre-renal causes 1. Cardiorenal syndrome – chronic heart failure may lead to CKD 2. Liver cirrhosis
b)	Renal vascular causes 1. Hypertensive nephrosclerosis 2. Renal artery stenosis 3. Vasculitis 4. Renal vein thrombosis
c)	Glomerular disease – characterised by proteinuria and haematuria from urine examination 1. Primary glomerular disease • Membranous nephropathy • Ig A nephropathy • Focal segmental glomerulosclerosis • Minimal change disease 2. Secondary glomerular disease • Lupus nephritis • Diabetic nephropathy • Rheumatoid arthritis • Amyloidosis • Light chain deposition disease • Neoplasia
d)	Tubulointerstitial disease 1. Drug induced 2. Infection 3. Multiple myeloma cast nephropathy
e)	Cystic/hereditary disease 1. Alport syndrome 2. Autosomal dominant polycystic kidney disease 3. Fabry disease
f)	Urinary tract obstruction of any causes, such as renal stone disease, benign prostatic hyperplasia, etc.

Referral to nephrologist

Table 9: Indication for nephrology referral

CKD with rapid decline in eGFR >5 ml/min/1.73 m^2 in 1 year or >10 ml/min/1.73 m^2 within 5 years
CKD with heavy proteinuria (urine protein >1 g/day) despite optimal treatment
Persistent unexplained microscopic haematuria and proteinuria (proteinuria >0.5 g/day)
CKD of unknown cause
CKD stage 4 (eGFR<30 ml/min) for preparation of RRT
CKD in pregnancy or when planning for pregnancy
CKD with refractory hypertension
Isolated microscopic haematuria after excluding urological causes
Suspected hereditary cause of CKD (eg, polycystic kidney disease)
Metabolic workup for recurrent renal stones
Persistent abnormalities of serum potassium

Management of CKD

- General management
- CKD progression
- Life style modification
- Hypertension and proteinuria
- Glycaemic control
- Dyslipidaemia
- Risk for AKI and infection

General management

- To delay progression of CKD
- To reduce cardiovascular risk
- To reduce further kidney injury, avoidance of nephrotoxic drugs
- To identify patients who need renal replacement therapy
- To manage complications of CKD
- To adjust medications based on GFR

Table 10: Management of CKD according to stage

Stage	Management plan
Stage 1	Treat comorbid condition, manage cardiovascular risk factors and delay progression of CKD
Stage 2	Delay progression of CKD
Stage 3	Delay progression of CKD and treat CKD complications
Stage 4	Refer to hospital for RRT preparation and treatment of CKD complications
Stage 5	Initiate RRT

CKD progression

Risk factors for progression of CKD include:

a) Proteinuria

b) Suboptimal BP control

c) Suboptimal glycaemic control

d) Smoking

e) Cardiovascular disease

f) Acute kidney injury

g) Anaemia

Table 11: Strategies to delay CKD progression

Lifestyle	Physical activity compatible with cardiovascular tolerance (aim for at least 30 minutes, 5 times/week) Smoking cessation Weight reduction
Dietary	Low-salt diets (<2 g/day) Low-protein diet (0.6 g-0.8 g/kg/day)
BP and proteinuria	Target BP for diabetic patient is ≤130/80 mmHg For non-diabetic patient with CKD, the target is - ≤140/90 mmHg if the proteinuria is <1 g/day - ≤130/80 mmHg if the proteinuria is >1 g/day ACEI/ARB is first choice antihypertensive
Glycemic control	Aim for HbA1C of 6.5% to 7.0%
Drug	Avoid nephrotoxic drugs Use of sodium-glucose co-transporter-2 (SGLT2) inhibitors can help delay CKD progression

Management of complications of CKD

- Anaemia : The treatment of anaemia in CKD includes iron supplementation, use of an erythropoietin-stimulating agent (ESA) and blood transfusion. All CKD patients with iron deficiency should be treated with iron supplementation. Once iron deficiency has been corrected, the use of an ESA can be considered after discussion with a nephrologist. The optimal Hb target in CKD is 10-12 g/dl.
- Mineral bone disease :Initial treatment starts with dietary phosphate restriction when phosphate and PTH levels begin to rise. Dietary phosphate restriction also involves a low-protein diet. Patients who can comply with a low-protein diet will usually exhibit a lower phosphate level.32 Drug therapy with phosphate binders should be considered if a patient demonstrates persistent hyperphosphatemia despite dietary restriction. Excess calcium supplementation and a vitamin D analogue should be avoided, as this combination may increase the risk of vascular calcification.

Management of complications of CKD

- Fluid overload : assessing the fluid status in the clinic setting is essential, looking for symptoms and signs of fluid overload such as uncontrolled BP, raised jugular venous pressure, crepitation in the lungs and pedal edema. Patients exhibiting fluid overload may be treated with fluid and salt restriction and loop diuretics
- Cardiovascular risk : Management of cardiovascular risk in patients with CKD is similar to that for those without CKD, involving BP control, glycemic control and lipid-lowering therapy.
- Metabolic acidosis