Chronic Kidney Disease (CKD)

These Clinical Practice Guidelines are guidelines only. In no way should these be used as a substitute for clinical or medical judgment. For specialty patient populations such as elderly or post-partum patients, refer to evidenced based practice guidelines to best serve these populations' unique needs.

Patients at risk for CKD include adults with
- Diabetes
- Hypertension
- Heart failure
- Cardiovascular disease
- Obesity
- Family history of CKD
- Age > 60 years

Screen annually adults at risk

- Basic metabolic panel for estimated glomerular filtration rate (eGFR)
- Urine albumin random for urine albumin-creatine ratio (uACR)

eGFR ≥ 60 mL/min/1.73m^2 and uACR < 30 mg/g → Continue annual screening

eGFR < 60 mL/min/1.73m^2 or uACR > 30 mg/g → Assess for acute cause; Repeat test at least 3 months after initial abnormal result

Diagnose CKD if > 3 months presence of:
Kidney damage (uACR ≥ 30 mg/g)
or
Decreased kidney function (eGFR < 60mL/min/1.73m^2)

Evaluate CKD stage and prognosis
C - Cause
G - GFR
A - Albuminuria

Labs at baseline and follow-up visits
- BMP
- Urine albumin, random

Common Causes of CKD
- Diabetes
- Hypertension
- Autoimmune disorder
- Chronic infection
- Malignancy
- Genetic disorder
- Kidney abnormality

CKD "Heat Map" (based on KDIGO, 2012)

GFR categories (ml/min/1.73 m^2)				Persistent albuminaria categories Based on urine albumin-to-creatinine ratio (uACR)		
				A1	**A2**	**A3**
				Normal to mildly increased	Moderately increased	Severely increased
				< 30 mg/g < 3 mg/mmol	30-300 mg/g 3-30 mg/mmol	> 300 mg/g > 30 mg/mmol
	G1	Normal or high	≥90	**Screen** 1 visit/year	**Treat CKD** 1 visit/year	**Treat and Refer** 2 visits/year
	G2	Mildly decreased	60-89	**Screen** 1 visit/year	**Treat CKD** 1 visit/year	**Treat and Refer** 2 visits/year
	G3a	Mildly to moderately decreased	45-59	**Treat CKD** 1 visit/year	**Treat CKD** 2 visits/year	**Treat and Refer** 3 visits/year
	G3b	Moderately to severely decreased	30-44	**Treat and Refer** 2 visits/year	**Treat and Refer** 3 visits/year	**Treat and Refer** 3 visits/year
	G4	Severely decreased	15-29	**Treat and Refer** 3 visits/year	**Treat and Refer** 3 visits/year	**Treat and Refer** >4 visits/year
	G5	Kidney failure	< 15	**Treat and Refer** >4 visits/year	**Treat and Refer** >4 visits/year	**Treat and Refer** >4 visits/year

ICD 10 Code	CKD Stage
N18.1	CKD 1
N18.2	CKD 2
N18.31	CKD 3a
N18.32	CKD 3b
N18.4	CKD 4
N18.5	CKD 5
N18.6	ESRD

TREAT (see details on pages below)

Primary Care CKD Management Checklist:
- ☐ Educate patient
- ☐ Monitor labs and kidney function 1-4 times/year (see table)
- ☐ Refer to Nephrology if high risk (see table)
- ☐ Diabetes: goal HbA1c 6.5% - 8% range per ADA guidelines
- ☐ Hypertension: goal BP < 130/80 per ACC/AHA guidelines
- ☐ Hyperlipidemia: treat if CVD risk or > 50 years
- ☐ Vaccination: Influenza, Pneumococcus, COVID-19
- ☐ Lifestyle:
  - ☐ Heart healthy diet
  - ☐ Physical activity
  - ☐ Smoking cessation
- ☐ Advanced Directives
- ☐ Fall prevention: screen for risk and educate

Medication Management for eGFR 30 or above
- ☐ Maximize RAAS-I (ACE/ARB) for hypertension
- ☐ SGLT2-I and GLP-1 RA
- ☐ NSAIDS: Avoid prolonged use
- ☐ Metformin: reduce if eGFR 30 - 44
- ☐ Finerenone: if T2D, CKD, eGFR ≥ 30 and uACR >30 mg/g
- ☐ Aspirin: recommended for secondary CVD prevention; weigh benefits vs. bleeding risks
- ☐ Renal- excreted drugs: Caution or dose adjustment

REFER

Patient should complete tests prior to Nephrology visit:
- Kidney Ultrasound
- uACR
- Urinalysis with Microscopy
- BMP
- Phosphorus
- Serum Albumin

Goals of CKD Management in Primary Care:

- Identify patients with CKD
- Prevent or slow progression of kidney disease
- Reduce and manage risk of cardiovascular disease; cardiovascular-related mortality increases substantially with CKD

Screening for CKD

CKD is highly prevalent, estimated at 11% of the US population. CKD is often asymptomatic in early stages. Screening of asymptomatic adults is important to identify and manage CKD to prevent complications.

All patient with diabetes or hypertension should be screened annually.

The National Kidney Foundation (NKF) recommends CKD screening based on individual kidney and cardiovascular risk profiles and preferences, among adults with increased CKD risk (Inker, 2014; Shilpak, 2021):

- Age > 60 years
- Obesity
- Cardiovascular disease
- Family history of CKD
- Ethnic/racial minority
- History of acute kidney injury

Screening Tests

Two lab tests used concurrently to screen for CKD are eGFR and uACR (Skolnik, 2021)

Lab test to order	Result	Rationale
Basic or Comprehensive Metabolic Panel	Estimated Glomerular Filtration Rate (eGFR)	Indicates kidney function
Albumin, urine, random* or Urine albumin with creatinine ratio	Urine Albumin-Creatinine Ratio (uACR)	Indicates kidney damage

*24-hour urine collection can be used but is inconvenient and prone to collection errors.

If either test result is abnormal, assess for acute kidney injury and test again after at least 90 days.

Best Practice
Do both tests at each screening. In practice, the eGFR test is often done much more frequently, as it is included in common blood tests such as a basic metabolic panel (BMP) and comprehensive metabolic panel (CMP). However, albuminuria often shows up earlier than abnormal eGFR in kidney disease progression. Both tests are needed to assess stage and prognosis of CKD.

Diagnosis of CKD:

CKD is defined as the presence of kidney damage or decreased kidney function for 3 months (90 days) or more. Diagnosis of CKD can be made from either eGFR or albuminuria.

CKD is not diagnosed based on one abnormal eGFR result alone.

CKD is defined as abnormalities of kidney structure or function, present for >3 months, with implications for health (Stevens, 2013).

Markers of kidney damage (one or more)	• Albuminuria (uACR ≥30 mg/g [≥3mg/mmol]) • Urine sediment abnormalities • Tubular disorders with electrolyte or other abnormalities • Histology showing abnormalities • Imaging showing structural abnormalities • History of kidney transplantation
Decreased eGFR	eGFR <60 ml/min/1.73m^2

Prognosis and Risk Stratification

Prognosis refers to the likelihood that CKD will progress and result in kidney failure. Most patients with CKD will not progress to ESRD. Patients at highest risk:

- Severely abnormal eGFR or albuminuria
- Rapid worsening of eGFR or albuminuria

The Kidney Failure Risk Equation (www.kidneyfailurerisk.com) calculates a patient's risk of progressing to kidney failure at 2 and 5 years. The KFRE is available in the EMR and calculates based on:

- Age
- Sex
- GFR
- Urine albumin creatine ratio

Optional data, if available:

- Albumin (serum)
- Phosphorus
- Bicarbonate
- Corrected calcium

Patients with a 2 - year probability for ESRD of 1% or higher should be referred to Nephrology.

Management of Comorbidities and Underlying Conditions

Patients with Diabetes and CKD

Hb A1c goal < 7% for most nonpregnant adults; or <8% for those with limited life expectancy or elevated risk of hypoglycemia. Glycemic control reduces loss of kidney function and progression of albuminuria (Vassalotti, 2016). SGLT-2i and GLP-1 RA orders for eligible patients.

Hypertension

Blood pressure goal < 130/80 mm/Hg (Whelton, 2017)

Hyperlipidemia

Treat if CVD risk or age >50 years.
Prescribe statin per guideline.

Preventative Care

- Smoking cessation
- Vaccinations for influenza, pneumonia, Covid
- Advanced Directives
- Fall risk screening and prevention

HCC Coding: Comorbidities

DM I (E10)	DM II (E11)	DM with kidney complications *Coding documentation is needed for both conditions in the combination code*
E10.21	E11.21	DM with diabetic nephropathy
E10.29	E11.29	DM with other diabetic kidney complication
E10.22	E11.22	DM with CKD

ICD 10 Code	Hypertension with kidney complications	Code Instruction
I12.0	Hypertensive chronic kidney disease with stage 5	Always use CKD stage 5 code.
I12.1	Hypertensive chronic kidney disease	Always use CKD stage code from GFR results.
I12.9	Hypertensive chronic kidney disease with stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease	Always use CKD stage code from GFR results.

Nutrition and Physical Activity

Nutrition

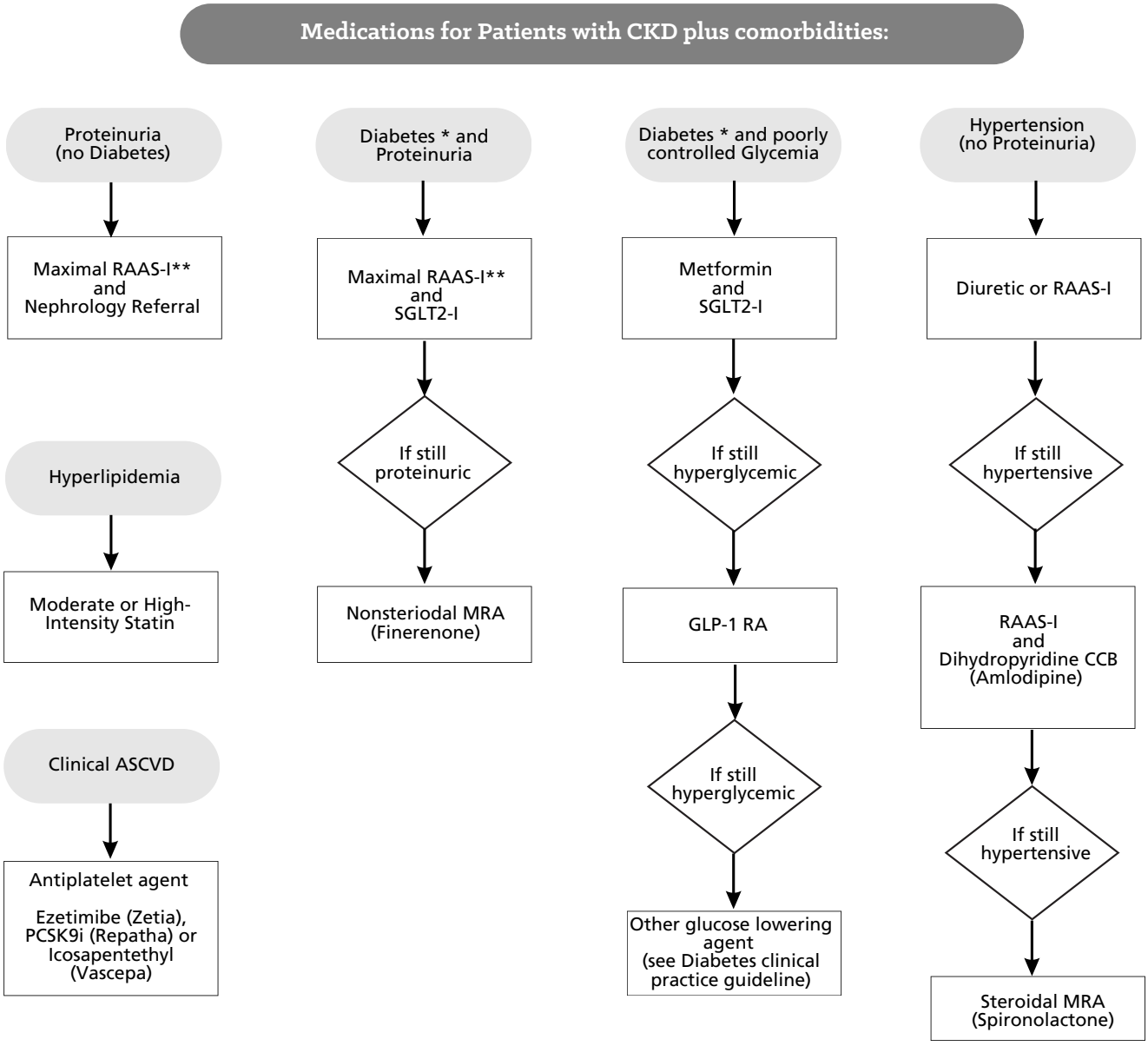
- Medical Nutrition Therapy (MNT) referral is recommended for nutrition assessment and tailored meal planning.
- All patients with CKD should follow heart-healthy diets such as Mediterranean or plant-based
- Modify for other diseases such as Diabetes
- Avoid processed meats, refined carbohydrates, sweetened beverages
- Fiber 25-34g/day recommended
- Be aware of dietary potassium, phosphorus, and sodium; restrictions may be needed if lab values out of normal range
- Avoid excessive protein intake (i.e., Keto diet, protein supplements)
- CKD with dialysis: higher amounts of protein necessary to help maintain blood protein levels and improve health

Physical Activity

- Goal of moderate-intensity physical activity for at least 150 minutes per week
  - Tailor intensity for baseline activity level, frailty and fall risk
- Reduce sedentary behavior

Medications

Medications for CKD are selected to optimize kidney function and reduce cardiovascular risks.



Drug brand or generic names listed only as examples of the drug class

For more info, refer to UH Clinical Practice Guidelines for Diabetes and Hypertension

*Diabetes Type 2 only

**Maximal RAAS-I means maximally tolerated dose of ACE inhibitor or ARB, with no limiting /hyperkalemia/rise in sCr < 30%

Abbreviations

RAAS-I: Renin Angiotensin Aldosterone System Inhibitor, ARB: Angiotensin Receptor Blocker, SGLT2 I: SGLT-2 Inhibitor, Nonsteroidal MRA: Nonsteroidal Mineralocorticoid Receptor Antagonist (Fineronone), GLP-1 RA: GLP-1 Receptor Antagonist, ASCVD: Atherosclerotic Cardiovascular Disease, CCB: calcium channel blocker; Steroidal MRA: Steroidal Mineralocorticoid Receptor Antagonist (spironolactone, eplerenone)

SGLT-2i

Practical provider guide to initiating SGLT-2 inhibitors in patients with type 2 diabetes and CKD.

	Assessment		Intervention	Follow-up
Patient selection	**Eligible patients:** • eGFR ≥ 20 mL/min/1.73m² **High-priority features:** • ACR ≥ 200 mg/g • Heart failure **Potential contraindications:** • Genital infection risk • Diabetic ketoacidosis • Foot ulcers • Immunosuppression		**SGLT-2 inhibitor with proven benefits:** • Canagliflozin 100 mg • Dapagliflozin 10 mg • Empagliflozin 10 mg **Education:** • Sick day protocol* • Perioperative care* • Foot care	• Assess adverse effects • Review knowledge • Anticipate an acute drop in eGFR, which is generally not a reason to stop the SGLT-2 inhibitor
Glycemia	**Hypoglycemia risk?** • Insulin or sulfonylurea • History of severe hypoglycemia • HbA1c at or below the goal	If high risk →	**Education:** • Hypoglycemia symptoms • Glycemia monitoring Consider insulin/sulfonylurea dose reduction	• Ask about hypoglycemia • Reduce sulfonylurea or insulin if needed
Volume	**Volume depletion risk?** • Concurrent diuretic use • Tenuous volume status • History of AKI	If high risk →	**Education:** • Volume depletion symptoms Consider diuretic dose reduction	• Re-assess volume • Reduce concomitant diuretic if needed

*Sick day protocol (for illness or excessive exercise or alcohol intake): temporarily withhold SGLT2i, keep drinking and eating (if possible), check blood glucose and blood ketone levels more often, and seek medical help early. Periprocedural/perioperative care: inform patients about risk of diabetic ketoacidosis, withhold SGLT2i the day of day-stay procedures and limit fasting to minimum required, withhold SGLT2i at least 2 days in advance and the day of procedures/surgery requiring one or more days in hospital and/or bowel preparation (which may require increasing other glucose-lowering drugs during that time), measure both blood glucose and blood ketone levels on hospital admission (proceed with procedure/surgery if the patient is clinically well and ketones are, 1.0 mmol/l), and restart SGTL2i after procedure/surgery only when eating and drinking normally.

Potassium Level Adjustments for Finerenone

$K^+ \leq 4.8$ mmol/l

- Initiate finerenone
  - 10 mg daily if eGFR 25-59 ml/min/1.73 m2
  - 20 mg daily if eGFR ≥ 60 ml/min/1.73 m2
- Monitor K+ at 1 month after initiation and then every 4 months
- Increase dose to 20 mg daily, if on 10 mg daily
- Restart 10 mg daily if previously held for hyperkalemia and K+ now ≤ 5.0 mmol/l

K^+ 4.9 - 5.5 mmol/l

- Continue finerenone 10 mg or 20 mg
- Monitor K^+ every 4 months

$K^+ > 5.5$ mmol/l

- Hold finerenone
- Consider adjustments to diet or concomitant medications to mitigate hyperkalemia
- Recheck K^+
- Consider reinitiation if/when $K^+ \leq 5.0$ mmol/l
- Consult Neprhology if persistent hyperkalemia

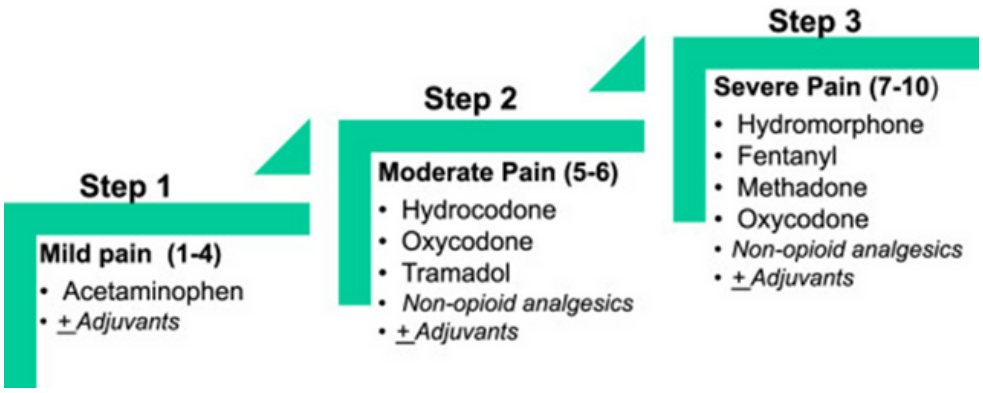
Medications to Limit or Avoid with CKD:

- Level of eGFR should be considered when prescribing renally excreted drugs, for example:
  - Metformin:
    - If eGFR 31-44, not recommended to start. If already in use, titrate slowly and do not exceed 500mg twice daily.
    - If eGFR <30, do not use.
  - Glyburide: if eGFR <30, do not use.
  - Atenolol: if eGFR <30, do not use.
  - Gabapentin: reduce dose for moderate or advanced CKD.
  - Direct oral anticoagulant (DOACs): consult current dosing guidelines.
  - Antibiotics: consult a pharmacist.
- Contrast dye: Discuss risk vs. benefit, including the indication, amount of contrast, history of recent contrast exposure/AKI/presence or absence of other potential nephrotoxic insults.
  - Gadolinium-based contrast media: Newer (group II and III) gadolinium based contrast media are now exclusively used at UH Cleveland Medical Center; the risk of Nephrogenic Systemic Fibrosis, which was a concern with older Gadolinium agents, with these newer agents in patients with advanced kidney disease is thought to be very low. (Weinreb, 2021)

NSAIDs and Pain Management

- Advanced CKD (stage 4-5): Do not use NSAIDs.
- eGFR > 45 with kidney disease that is stable and nonprogressing: Occasional NSAIDs after risk/benefit/shared decision making discussion between patient and provider.
- Alternatives to NSAIDs:
  - Over-the-counter acetaminophen/Tylenol is preferred
  - Local therapies: heat/ice/topical/massage/meditation
- Use a lower threshold for deciding to refer patient to pain management specialist. Patients with CKD are more likely to have adverse effects and multiple comorbidities that complicate pain management.

The World Health Organization three-step analgesic ladder modified for patients with CKD - ESRD (Pellegrino & Schmidt, 2020)



Labs and Imaging for CKD

Situation	Lab test to order[1]	Results to focus on	Imaging
Screening (patient at risk for CKD)[1]	• Basic metabolic panel • Albumin, urine, random[2] *or* Urine albumin with creatinine ratio • Urinalysis	eGFR, potassium uACR Protein, blood	
Treatment (patient diagnosed with CKD)[1]	• Basic metabolic panel • Albumin, urine, random[2] *or* Urine albumin with creatinine ratio • Urinalysis with microscopy • Serum albumin • Hemoglobin • Vitamin D If stage 3b or higher, add: • Parathyroid (PTH intact) • Serum phosphorus	eGFR, potassium uACR Protein, blood, RBCs, WBCs	Ultrasound Kidney Bilateral[3] (once at time of diagnosis)
Referring to Nephrologist	• Basal metabolic panel • Albumin, urine, random[2] *or* Urine albumin with creatinine ratio • Urinalysis with microscopy • Serum albumin • Hemoglobin • Vitamin D • Serum phosphorus		Ultrasound Kidney Bilateral

1.The frequency of these tests is according to the heat map on page 1.

2. The test to order in UH Epic for obtaining urine albumin is Albumin, urine, random. Careful attention is advised in the interpretation of its result. The UH laboratory reports three values in the result: Albumin, urine spot (mg/L); albumin/creatinine ratio (micrograms/mg); and creatinine, urine spot (mg/dL). The result that is interpretable and clinically relevant is the albumin/creatinine ratio. While the laboratory uses reference ranges to report abnormal results for albumin and creatinine concentrations in a spot urine specimen, these are clinically hard to interpret because of variability in the hydration statuses of patients. The rationale for why the albumin/creatinine ratio is an interpretable test is that it estimates the amount of albumin excreted in the urine in 24 hours by using an assumption that on average, adults excrete 1 gram of creatinine in urine per day. For example, if our lab reports 100 mg/L for albumin, urine spot, and 50 mg/dL for creatinine urine spot for a given patient, it will mean per 100 ml of urine, this patient is excreting 50 mg of creatinine. If we want to estimate how much volume of urine this patient produces in 24 hours, if we use the assumption of 1g of creatinine excreted in 24 hours at the rate of 50 mg per hour, we will come up with 2L of urine. If the amount of albumin in 1L of urine per our result above is 100 mg, we will estimate that in 24 hours, in 2L of urine, it would be 200 mg. Another way to do this calculation is to do albumin/creatinine, which would give the same answer. However, our lab currently reports it in micrograms/mg.

3. Ultrasound of bilateral kidneys would be helpful in documenting the congenital absence of a unilateral kidney and evaluating for cortical echogenicity (which generally indicates chronic kidney disease), asymmetry in size, hydronephrosis, nephrolithiasis, masses, or cysts.

Reduce the Risk of Associated Complications

Complications of CKD typically occur in later stages, when the patient is already being managed by a Nephrologist. If signs of complications develop, refer the patient to Nephrologist for further work-up.

Management of Complications of CKD

Complications			Lab evaluations	Management
Anemia	Pathophysiology	○ Acute/chronic inflammation ○ Insufficient endogenous EPO ○ Iron deficiency	○ CKD 3 – annual screening w/ CBC ○ CKD 4-5 – every 3 months ○ Iron studies (ferritin, iron level, TIBC and TSAT)	Initiation of ESA for Hgb < 10 g/dL (Goal Hgb 9-11.5 g/dL): - Epoetin - Darbepoetin - Methoxy polyethylene glycol-epoetin beta Iron deficiency must be addressed before initiating ESA therapy - Oral formulations - IV iron
	Clinical Manifestations	○ Fatigue ○ Decreased cognitive function ○ Loss of libido ○ LVH		
Metabolic Acidosis	Pathophysiology	○ Defective acid secretion ○ Reduced bicarb regeneration	○ CKD 3A – BMP every 6 months ○ CKD 3B – BMP every 3-4 months ○ CKD 4 – BMP every 2 months ○ CKD 5 – BMP every 1-2 months	Initiation of alkali therapy when the serum bicarbonate is chronically < 22 mEq/L (22 mmol/L) - Sodium bicarbonate - Sodium citrate - Potassium citrate Recommend alkaline diet rich in fruits and vegetables
	Clinical Manifestations	○ Muscle loss ○ Increased bone resorption/bone formation		
Mineral Bone Disease	Pathophysiology	○ Secondary hyperparathyroidism ○ Reduction in active Vitamin D	○ CKD 3 – serum PTH every 12 months ○ CKD 4 – serum PTH every 6 -12 months ○ CKD 5 – serum PTH every 3-6 months ○ ALP level annually in CKD 4 and above	Controlling serum phos levels: - Restricting phos intake to 800 – 1000 mg/day (26-32 mmol per day) - Phosphorus binders Suppress PTH (goal 2-9x upper normal limit) - Aim for 25-OH vitamin D level of 50
	Clinical manifestations	○ Adverse cardiovascular outcomes ○ Vascular calcifications ○ LVH		
Cardiovascular Disease	Pathophysiology	○ Vascular calcifications ○ Hyperphosphatemia ○ LVH from volume overload and hypertension	○ Cardiac imaging to assess for cardiac ischemia i.e., exercise or pharmacological stress test ○ Coronary artery calcium scoring ○ Echocardiogram	- Control of BP (<130/80) and proteinuria - Lipid lowering therapy - Cessation of smoking - Glycemic control in diabetic patients with CKD - Use of SGLTs-I and GLP1-RA
	Clinical Manifestations	○ Cardiac ischemia ○ Heart failure ○ Arrythmia ○ Structural disease		

Abbreviations: EPO erythropoietin; LVH left ventricular hypertrophy; TIBC total iron-binding capacity; TSAT transferrin saturation; ESA erythropoietin stimulating agent; PTH parathyroid hormone; ALP alkaline phosphatase; CBC complete blood count; Hgb hemoglobin; IV intravenous; BMP basic metabolic panel; BP blood pressure; 25-OH 25-Hydroxy

Patient Education

- Basics about kidneys and kidney disease
- Blood glucose: Why and how diabetes control helps kidneys
- Blood pressure: Why and how blood pressure control helps kidneys
- Physical activity: Increase activity slowly with goal of 150 minutes per week
- Nutrition: Follow a heart-healthy diet
- Smoking cessation: For cardiovascular risk reduction
- New medication regimens (starting or stopping medications)
- Avoid nephrotoxins, including over-the-counter medications
- Risk for progressing to ESRD, lowering risks

Patient Communication

Many patients do not know much about CKD. When they have a new CKD diagnosis, they might feel scared and assume they'll soon be facing dialysis or transplant. It is important to educate patients about CKD. Offer information and engage patients to ask questions. Education about CKD can occur several ways:

- Conversation during visit, involving provider, nurse, and/or pharmacist
- Watch an educational video together, then discuss
- Phone conversation after visit by provider, nurse, and/or pharmacist
- Provide web link for educational video that patient can watch later
- Provide pamphlet or other written materials

Referral to Specialist

Patients should consult with a Nephrologist if their CKD is progressing or at risk for progressing toward ESRD, or if the treatment plan is unclear:

- eGFR < 45
- CKD "Heat Map" (p. 1) indicates referral by eGFR and uACR values
- Unstable or worsening eGFR over time
  - Kidney Failure Risk Equation shows 2-year probability for ESRD of 1% or higher (in Epic or www.kidneyfailurerisk.com)

- Acute kidney injury (abrupt decline in kidney function with Creatinine >1.5x baseline or urine output <0.5 ml/kg/hr x 6-12 hours) (KDIGO 2012)
- Hematuria
- Hereditary kidney disease
- Uncontrolled hypertension
- Unclear cause of CKD

Order Tests to be Completed Before Nephrology Visit

Urine tests

- uACR
- Urinalysis with microscopy

Blood tests

- eGFR (Basic Metabolic Panel)
- Phosphorus
- Serum albumin

Imaging

- Kidney ultrasound

Other Specialist Referrals

- Medical Nutrition Therapy
- Pharmacy
- Cardiology
- Endocrinology
- CINEMA

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