Care of the patient with CKD/ESKD

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NEONA, 2023

Definition of CKD

- A patient is said to have chronic kidney disease (CKD) if they have abnormalities of kidney function or structure present for more than 3 months

- The definition of CKD includes all individuals with markers of kidney damage or those with an eGFR of less than 60 ml/min/1.73m2 on at least 2 occasions 90 days apart (with or without markers of kidney damage)

- Markers of kidney disease may include: albuminuria, hematuria (presumed or confirmed renal origin), electrolyte abnormalities due to tubular disorders, renal histological abnormalities, structural abnormalities detected by imaging (e.g. polycystic kidneys, reflux nephropathy) or a history of kidney transplantation

Item 103

A 55-year-old man is evaluated during a follow-up visit for newly diagnosed chronic kidney disease (CKD). He also has a 10-year history of hypertension treated with losartan.

On physical examination, blood pressure is 135/78 mm Hg. BMI is 32. The remainder of the vital signs and examination is unremarkable.

Laboratory studies:

Bicarbonate	22 mEq/L (22 mmol/L)
Blood urea nitrogen	27 mg/dL (9.6 mmol/L)
Creatinine	2.1 mg/dL (185.6 µmol/L)
Potassium	4.9 mEq/L (4.9 mmol/L)
Estimated glomerular filtration rate	34 mL/min/1.73 m^2
Urinalysis	No blood; 2+ protein

Which of the following additional measurement could best predict this patient's CKD progression?

(A) Serum albumin
(B) Serum calcium
(C) Serum phosphate
(D) Urine albumin-creatinine ratio

CKD is classified based on the eGFR and the level of proteinuria and helps to risk stratify patients

No CKD in the absence of markers of kidney damage

Prognosis of CKD by GFR and albuminuria categories: KDIGO 2012

GFR categories (ml/min/1.73 m^2), description and range				Persistent albuminuria categories, description and range		
				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			
	G2	Mildly decreased	60–89			
	G3a	Mildly to moderately decreased	45–59			
	G3b	Moderately to severely decreased	30–44			
	G4	Severely decreased	15–29			
	G5	Kidney failure	<15			

green, low risk (if no other markers of kidney disease, no CKD); yellow, moderately increased risk; orange, high risk; red, very high risk.

Albuminuria is associated with increased renal and cardiovascular morbidity/mortality

Prevalence of CKD is heavily influenced by age and has increased severalfold in elderly persons over the past 20 years

Etiologies

- CKD results from various etiologies that cause damage to the glomeruli, tubulointerstitium or both
- Glomerular damage is reflected by proteinuria or albuminuria
- Tubulointerstitial damage can exist subclinically but eventually kidney function and GFR can drop

Diabetes and Hypertension are the leading causes of CKD

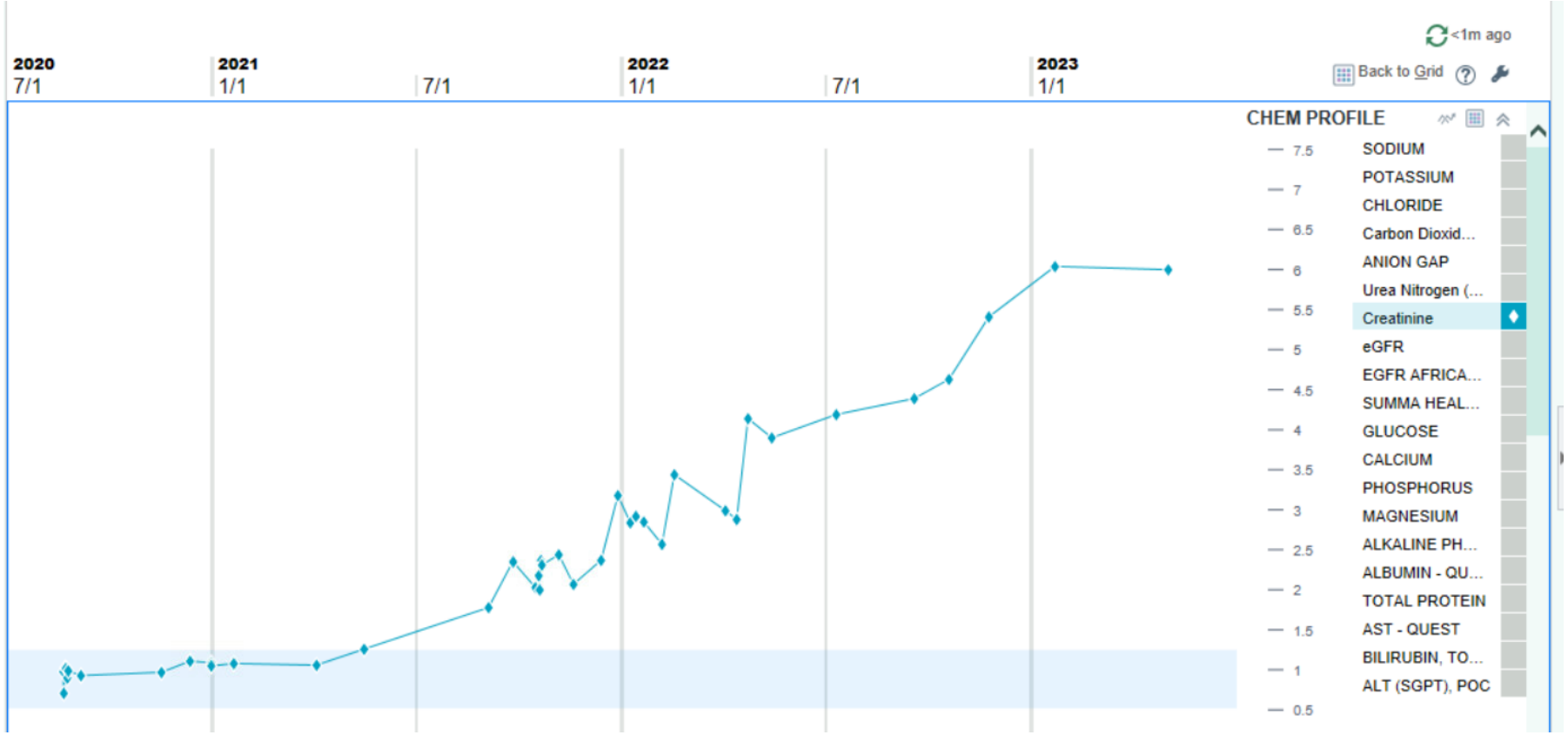
		Duration of pre-ESRD nephrology care					
	No. of cases	>12 months	6-12 months	0-6 months	None	Unknown /Missing	Unknown /Missing
Variable Category	**121,198**	**31.8**	**19.3**	**13.6**	**20.8**	**14.6**	**100**
Age							
0-21	1,412	43.8	14.5	15.9	18.8	6.9	100
22-44	13,487	28.4	18	14	26.7	13	100
45-64	45,766	29.6	19.8	14.1	22.3	14.2	100
65-74	32,687	33.6	19.7	13.4	18.4	14.9	100
75+	27,846	34.2	18.8	12.7	18.5	15.9	100
Sex							
Female	51,326	31.8	19.7	13.7	20	14.8	100
Male	69,872	31.8	19	13.4	21.4	14.4	100
Race							
White	81,985	33.6	19.4	13.4	20.1	13.5	100
Black	31,298	26.9	19.1	13.6	22.9	17.5	100
American Indian/Alaska Native	1,188	29.5	18.4	16.8	21	14.2	100
Asian	5,167	34	19.2	15.2	17.7	14	100
Native Hawaiian/ Pacific Islander	1,558	27.9	21.5	14.5	24	12.1	100
Other/Unknown	*	50	*	*	50	*	100
Ethnicity							
Hispanic	17,294	25.8	18.9	14.3	26.1	14.9	100
Non-Hispanic	103,904	32.7	19.4	13.4	19.9	14.5	100
Primary diagnosis							
Diabetes	58,308	32.2	21.4	13.9	18.3	14.2	100
Hypertension	34,906	29.1	18.7	13.2	21.7	17.3	100
Glomerulonephritis	9,189	40.3	17.7	13.6	19.7	8.7	100
Cystic kidney	3,546	55.8	16.9	10	9.7	7.6	100
Other/Unknown	15,249	25.4	14.5	14	31.4	14.8	100

Distribution (in %) of the reported duration of pre-ESRD nephrology care, by category of each demographic variable, among incident ESRD cases in the U.S. population, 2016

Volume 2 ESRD, Chapter 1

Progression of CKD

- Not all patients with CKD progress to ESKD
- Most important predictors are baseline eGFR and degree of albuminuria/proteinuria



Progression of CKD

- Patients with diabetic CKD usually progress faster than those with diabetes
- Rate of eGFR decline can range between -3 to -6 ml/min/1.73 m^2 per year in those with diabetes type 2 and high albuminuria.
- Other variants such as APOL1 prevalence in AA can be associated with higher rates of ESKD and progression of CKD

Item 3

A 56-year-old man is seen during a routine evaluation for stage G4 chronic kidney disease (CKD). History is also significant for hypertension. Medications are losartan, labetalol, furosemide, and amlodipine. He has no symptoms and remains physically active.

On physical examination, blood pressure is 129/76 mm Hg, and pulse rate is 68/min; other vital signs are normal. The physical examination is otherwise unremarkable.

Laboratory studies:

Hemoglobin	11 g/dL (110 g/L)
Bicarbonate	19 mEq/L (19 mmol/L)
Creatinine	3.1 mg/dL (274 µmol/L)
Phosphorus	5.7 mg/dL (1.8 mmol/L)
Potassium	5.1 mEq/L (5.1 mmol/L)

The addition of which of the following will most likely slow progression of this patient's CKD?

(A) ACE inhibitor
(B) Erythropoiesis-stimulating agent
(C) Phosphate binder
(D) Sodium bicarbonate

Educational objective: Treat chronic metabolic acidosis in a patient with CKD

- ✓ Metabolic acidosis occurs due to defective acid excretion due to impaired ammoniagenesis
- ✓ If untreated can lead to bone and muscle loss
- ✓ In early CKD is typically a non anion gap but as GFR declines, organic and inorganic anions are retained leading to an anion gap
- ✓ Alkali therapy can delay progression of CKD. Usually started with bicarb levels <22

Timely and improved diagnosis improves opportunities to preserve renal function

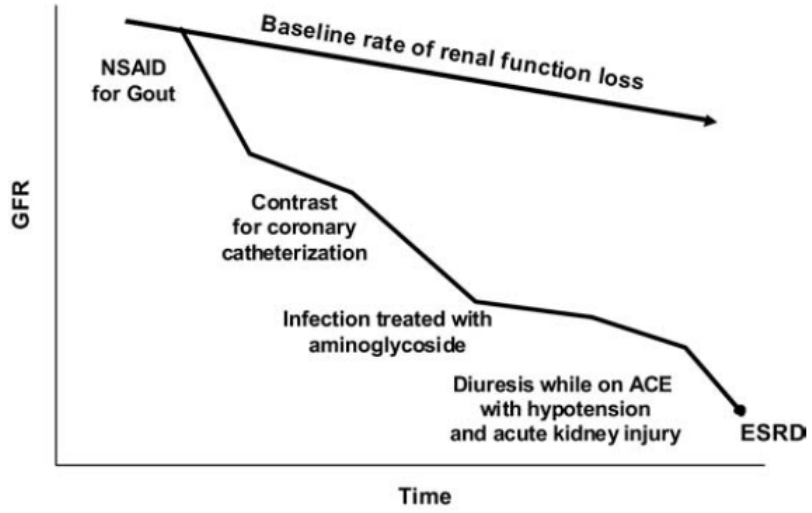


Figure 1. A theoretical patient with chronic kidney disease is subject to several events that might be classified as preventable and related to patient safety. These events contribute to an accelerated rate of kidney function decay. Abbreviations: ACE, angiotensin-converting enzyme (inhibitor); ESRD, end-stage renal disease; GFR, glomerular filtration rate; NSAID, nonsteroidal anti-inflammatory drug.

Fink et al. AJKD 2009, 53: 681-688

Avoid NSAIDs in patients with CKD

Clinical manifestations

- CKD is typically asymptomatic until advanced stages (4-5)

- Once GFR falls below 30, alterations in metabolic pathways, including 1,25 OH vitamin D and erythrocyte production become altered due to the lack of nephron mass and loss of 1^{α}-hydroxylase and erythropoietin synthesis

Clinical manifestations

- Moderate to severe CKD can result in impaired ability to excrete salt and water and can manifest as edema
- When CKD progresses to ESKD, severe non specific (‘uremic’) symptoms can occur, such as nausea, fatigue, loss of appetite, insomnia, confusion or pruritus
- Uremia can also manifest as serositis, including pleuritis and pericarditis

Item 35

A 26-year-old man is evaluated during a follow-up visit after presenting to an urgent care clinic for back pain 1 week ago. Laboratory studies at that time were significant for a serum creatinine level of 1.4 mg/dL (123.8 µmol/L); other laboratory studies, including urinalysis, were normal. A urine albumin-creatinine ratio obtained in preparation for this visit is 10 mg/g. He is a personal trainer, and his daily exercise regimen includes weightlifting. He states that his back pain has resolved. He occasionally takes ibuprofen; the last use was 1 week ago. He takes no over-the-counter supplements.

On physical examination today, vital signs are normal. BMI is 29. The patient is muscular, without signs of obesity. There is no muscle tenderness.

Which of the following is the most appropriate management?

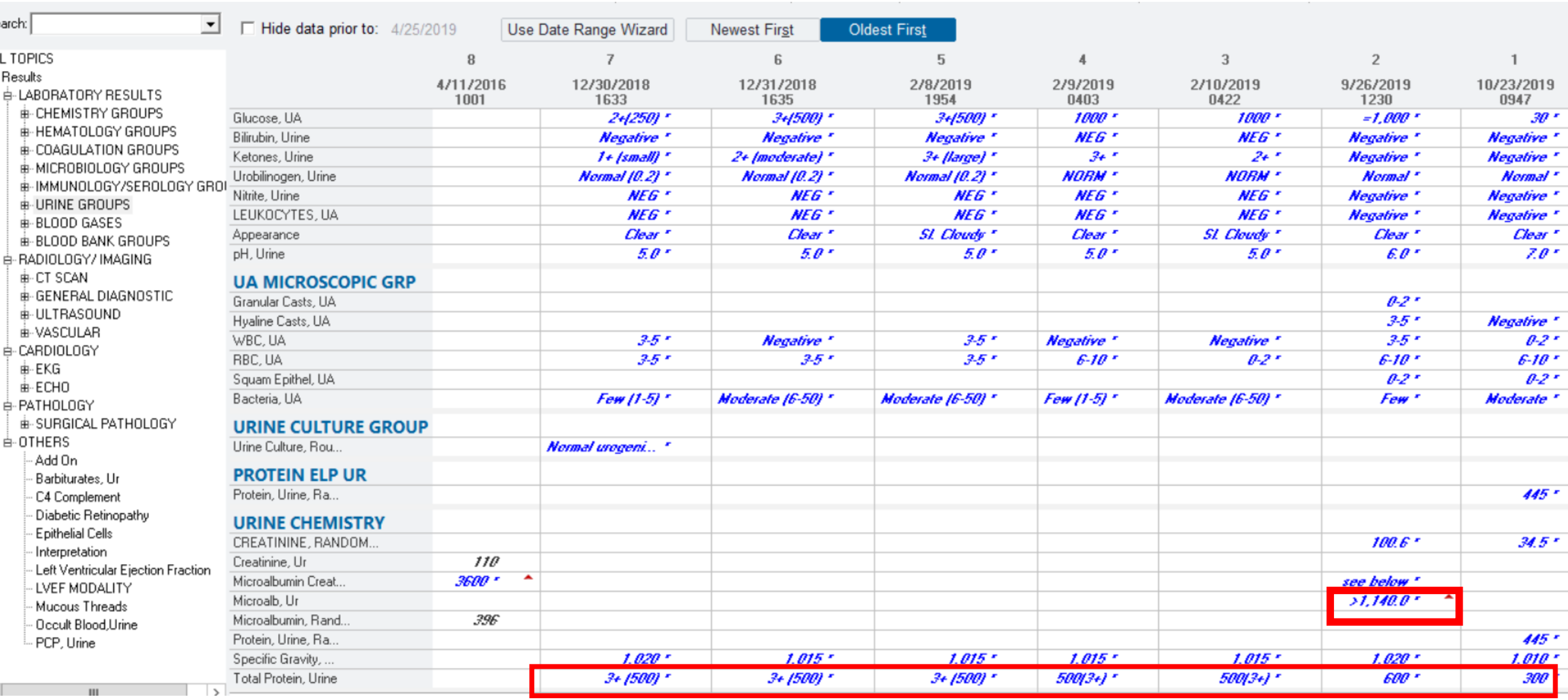
(A) Avoid all NSAID medications
(B) Measure the serum creatine kinase level
(C) Measure the serum cystatin C level
(D) Schedule a kidney biopsy

Educational objective: Identify muscle mass as a cause of an increase in serum creatinine

Diagnosis

- Initial assessment of GFR includes establishing eGFR based on serum creatinine, using the CKD-EPI equation (2021)
- There are conditions that can affect serum creatinine independent of GFR such as extremes of muscle mass or diet
- In this case cystatin C can be measured to estimate eGFR with the CKD-EPI creatinine-cystatin equation

Assessment of albuminuria includes a random albumin-creatinine ratio



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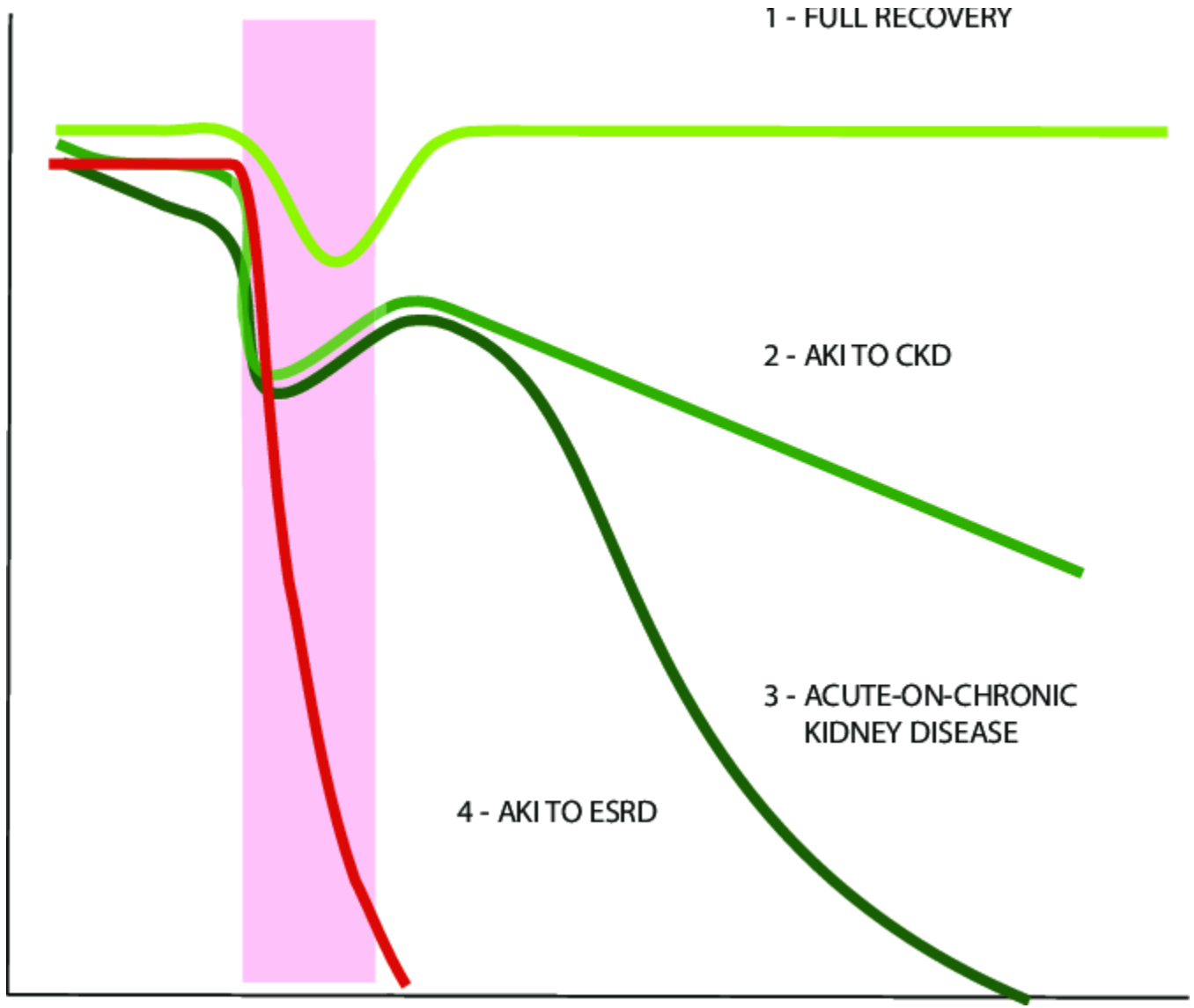
L TOPICS
Results
- LABORATORY RESULTS
  - CHEMISTRY GROUPS
  - HEMATOLOGY GROUPS
  - COAGULATION GROUPS
  - MICROBIOLOGY GROUPS
  - IMMUNOLOGY/SEROLOGY GROI
  - URINE GROUPS
  - BLOOD GASES
  - BLOOD BANK GROUPS
- RADIOLOGY/ IMAGING
  - CT SCAN
  - GENERAL DIAGNOSTIC
  - ULTRASOUND
  - VASCULAR
- CARDIOLOGY
  - EKG
  - ECHO
- PATHOLOGY
  - SURGICAL PATHOLOGY
- OTHERS
  - Add On
  - Barbiturates, Ur
  - C4 Complement
  - Diabetic Retinopathy
  - Epithelial Cells
  - Interpretation
  - Left Ventricular Ejection Fraction
  - LVEF MODALITY
  - Mucous Threads
  - Occult Blood,Urine
  - PCP, Urine

	8 4/11/2016 1001	7 12/30/2018 1633	6 12/31/2018 1635	5 2/8/2019 1954	4 2/9/2019 0403	3 2/10/2019 0422	2 9/26/2019 1230	1 10/23/2019 0947
Glucose, UA		2+(250) *	3+(500) *	3+(500) *	1000 *	1000 *	=1,000 *	30 *
Bilirubin, Urine		Negative *	Negative *	Negative *	NEG *	NEG *	Negative *	Negative *
Ketones, Urine		1+ (small) *	2+ (moderate) *	3+ (large) *	3+ *	2+ *	Negative *	Negative *
Urobilinogen, Urine		Normal (0.2) *	Normal (0.2) *	Normal (0.2) *	NORM *	NORM *	Normal *	Normal *
Nitrite, Urine		NEG *	NEG *	NEG *	NEG *	NEG *	Negative *	Negative *
LEUKOCYTES, UA		NEG *	NEG *	NEG *	NEG *	NEG *	Negative *	Negative *
Appearance		Clear *	Clear *	Sl. Cloudy *	Clear *	Sl. Cloudy *	Clear *	Clear *
pH, Urine		5.0 *	5.0 *	5.0 *	5.0 *	5.0 *	6.0 *	7.0 *
UA MICROSCOPIC GRP								
Granular Casts, UA							0-2 *	
Hyaline Casts, UA							3-5 *	Negative *
WBC, UA		3-5 *	Negative *	3-5 *	Negative *	Negative *	3-5 *	0-2 *
RBC, UA		3-5 *	3-5 *	3-5 *	6-10 *	0-2 *	6-10 *	6-10 *
Squam Epithel, UA							0-2 *	0-2 *
Bacteria, UA		Few (1-5) *	Moderate (6-50) *	Moderate (6-50) *	Few (1-5) *	Moderate (6-50) *	Few *	Moderate *
URINE CULTURE GROUP								
Urine Culture, Rou...		Normal urogeni... *						
PROTEIN ELP UR								
Protein, Urine, Ra...								445 *
URINE CHEMISTRY								
CREATININE, RANDOM...							100.6 *	34.5 *
Creatinine, Ur	110							
Microalbumin Creat...	3600 *						see below *	
Microalb, Ur							>1,140.0 *	
Microalbumin, Rand...	396							
Protein, Urine, Ra...								445 *
Specific Gravity, ...		1.020 *	1.015 *	1.015 *	1.015 *	1.015 *	1.020 *	1.010 *
Total Protein, Urine		3+ (500) *	3+ (500) *	3+ (500) *	500(3+) *	500(3+) *	600 *	300 *

Diagnosis

- Urinalysis can be checked looking for hematuria
- If significant proteinuria noted, additional evaluation can be obtained depending on the scenario
- Patients can be noted to have medical kidney disease, based on imaging showing increased echogenicity
- A kidney biopsy can be considered depending on the scenario

Natural history of AKI. Patients who develop AKI may experience (1) complete recovery of renal function, (2) development of progressive chronic kidney disease (CKD), (3) exacerbation of the rate of progression of preexisting CKD; or (4) irreversible loss of kidney function and evolve into ESRD



Clin J Am Soc Nephrol 3: 881-886, 2008.

Indications for referral to Specialist Kidney Care

- Acute kidney injury or abrupt sustained fall in GFR
- GFR <30 ml/min/1.73 m2
- Persistent albuminuria ACR >300 mg/g
- Atypical progression of CKD
- Urinary red cell casts or RBCs without an appropriate explanation
- Hypertension refractory to treatment with 4 or more agents
- Persistent abnormalities of serum potassium
- Recurrent or extensive nephrolithiasis
- Hereditary kidney disease

Adapted from NKF

Cardiovascular disease

- Leading cause of mortality among patients with CKD
- BP target <130/80 mmHg
- ACEI/ARB for treatment of HTN is preferred for those with CKD stage >3, and in those with CKD stage 1-2 and albuminuria
- Thiazide diuretics can lose efficacy as CKD progresses
- Studies have failed to demonstrate a mortality benefit for statins in ESKD on dialysis

Item 29

A 75-year-old man is evaluated in the hospital for an acute anterior ST-elevation myocardial infarction. He was hospitalized for chest pain and shortness of breath 45 minutes ago. History is significant for stage G4 chronic kidney disease (estimated glomerular filtration rate, 24 mL/min/1.73 m^2), hypertension, and peripheral vascular disease. Medications are lisinopril, metoprolol, furosemide, sevelamer, sodium bicarbonate, aspirin, clopidogrel, and unfractionated heparin.

On physical examination, blood pressure is 145/88 mm Hg, pulse rate is 94/min, and respiration rate is 18/min. Cardiopulmonary examination reveals jugular venous distension, a grade 2/6 mitral regurgitation murmur, an S_4 gallop, and end-expiratory bilateral basilar crackles.

Which of the following is the most appropriate immediate management?

(A) Cardiac catheterization
(B) Cardiac magnetic resonance imaging
(C) Emergent dialysis followed by coronary catheterization
(D) Medical management

ESKD patients can receive iodinated contrast and don’t need a prophylactic dialysis session afterwards…But be mindful of residual renal function

-The effect of iodinated agents is immediate so there is no point on scheduling an urgent session of dialysis afterwards. The patient can be dialyzed according to the regular schedule.

-Remember: Residual renal function= better survival

-Be careful with gadolinium agents due to risk of NSF (Nephrogenic Systemic Fibrosis)

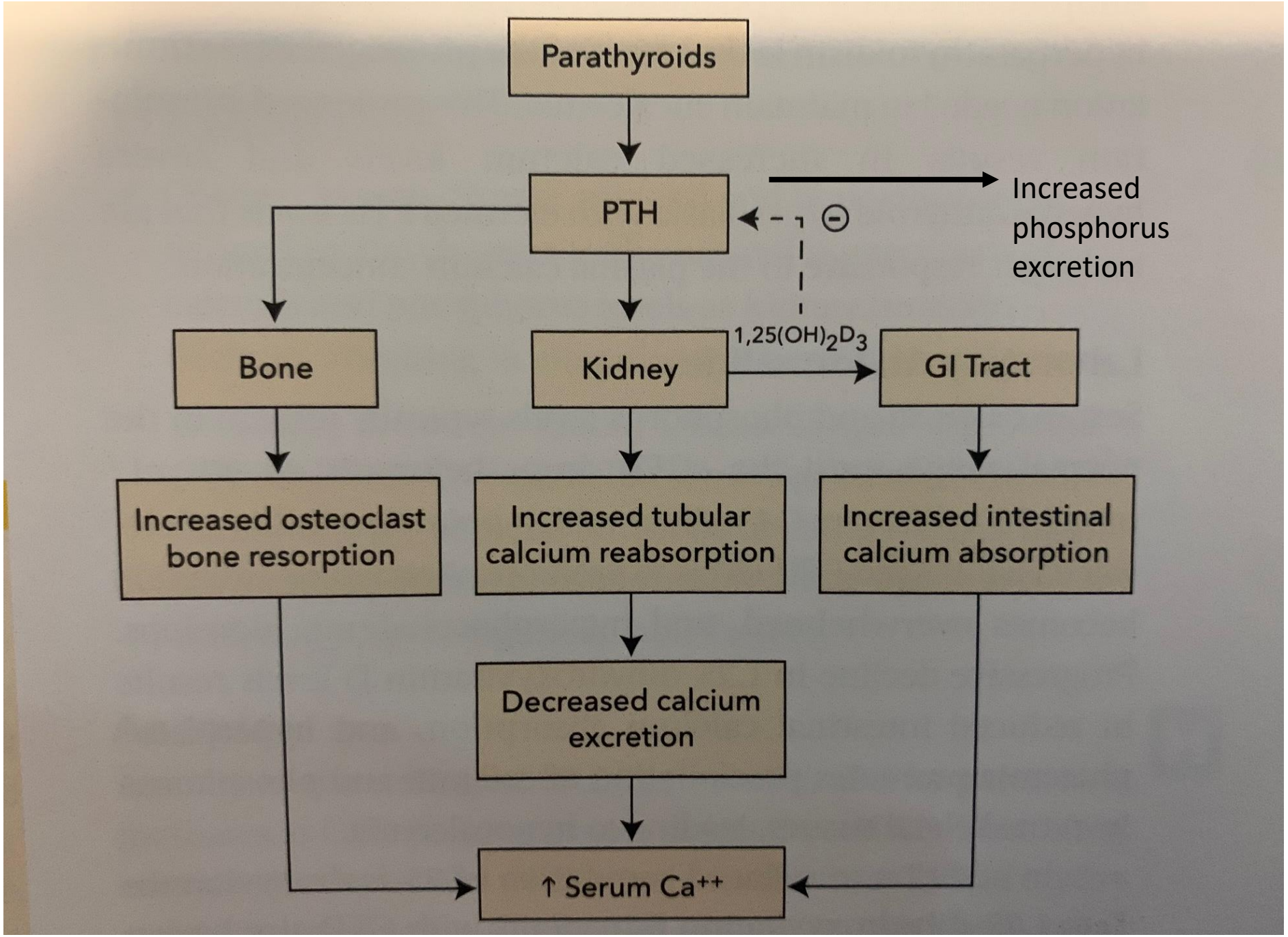
-Here we use MultiHance (gadobenate)

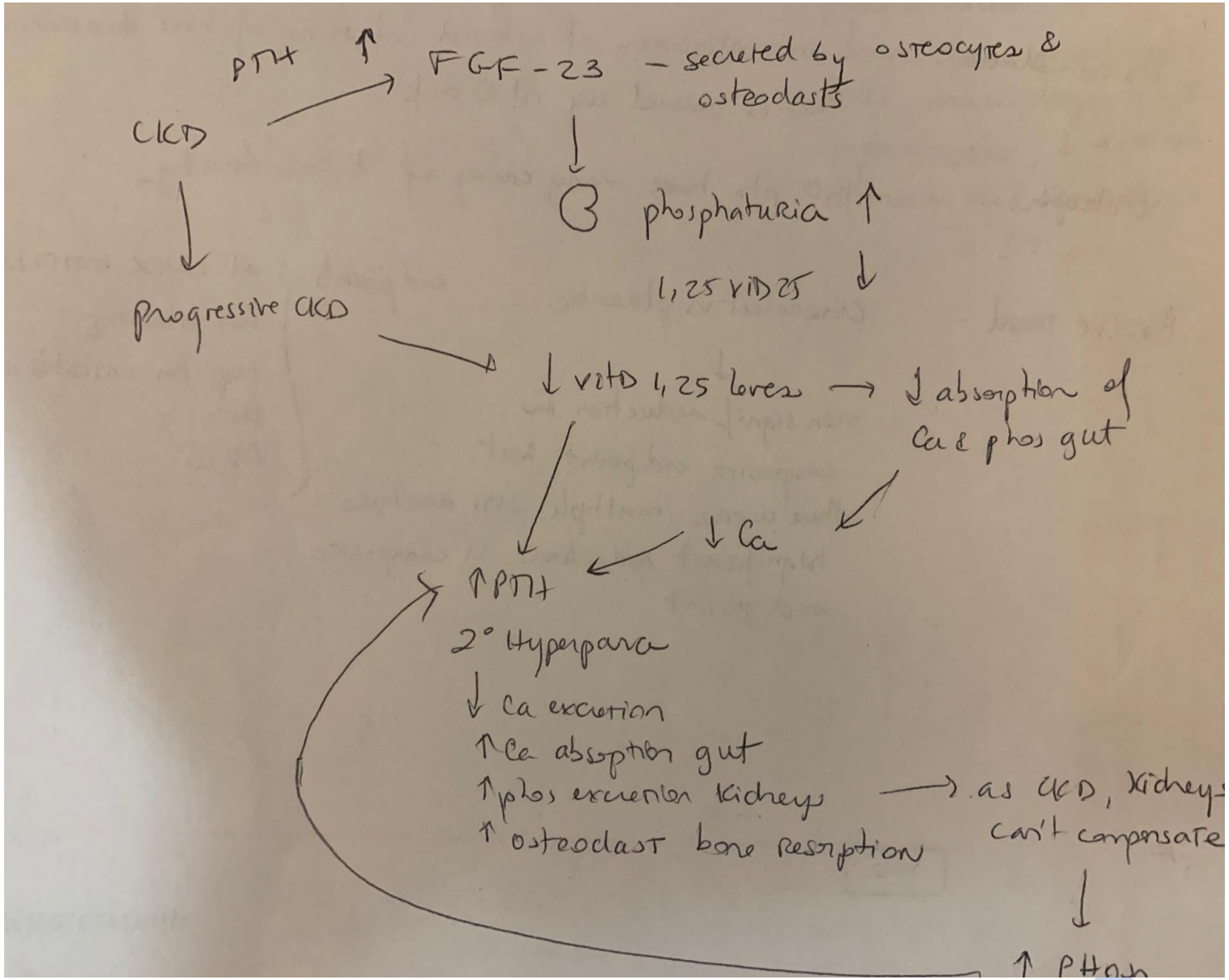
-If the patient is on hemodialysis, we can coordinate a dialysis session afterwards.

-With the newer agents, the risk of NSF is lower. However, this may be due to reduced overall use of gadolinium-based agents in this population, and therefore, there are no specific guidelines suggesting that the use of these agents is safe in patients with advanced kidney disease.

CKD-Mineral and bone disorder (CKD-BMD)

- As kidney function declines, the normal homeostasis of calcium and phosphorus levels by the kidney becomes compromised, resulting in alterations in bone mineralization

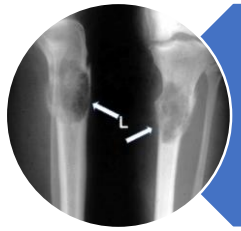

Parathyroids
PTH
Increased phosphorus excretion
Bone
Kidney
1,25(OH)2D3
GI Tract
Increased osteoclast bone resorption
Increased tubular calcium reabsorption
Increased intestinal calcium absorption
Decreased calcium excretion
↑ Serum Ca++


PTH ↑
FGF-23 – secreted by osteocytes & osteoclasts
CKD
phosphaturia ↑
1,25 VitD 25 ↓
Progressive CKD
↓ vitD 1,25 loves → ↓ absorption of Ca & phos gut
↓ Ca
↑PTH
2° Hyperpara
↓ Ca excretion
↑ Ca absorption gut
↑ phos excretion kidneys → as CKD, kidneys can't compensate
↑ osteoclast bone resorption
↑ PTH

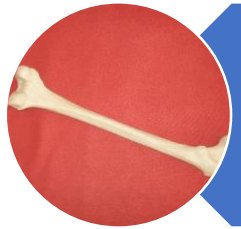
Lab abnormalities

- High phosphorus
- Low calcium
- Elevated PTH
- CKD patients also have a high prevalence of vit D25OH deficiency

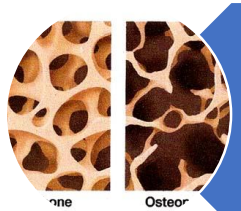
Renal osteodystrophy refers to alteration of bone morphology in patients with CKD



Osteitis Fibrosa Cystica



Adynamic Bone Disease



Osteomalacia

Osteoporosis

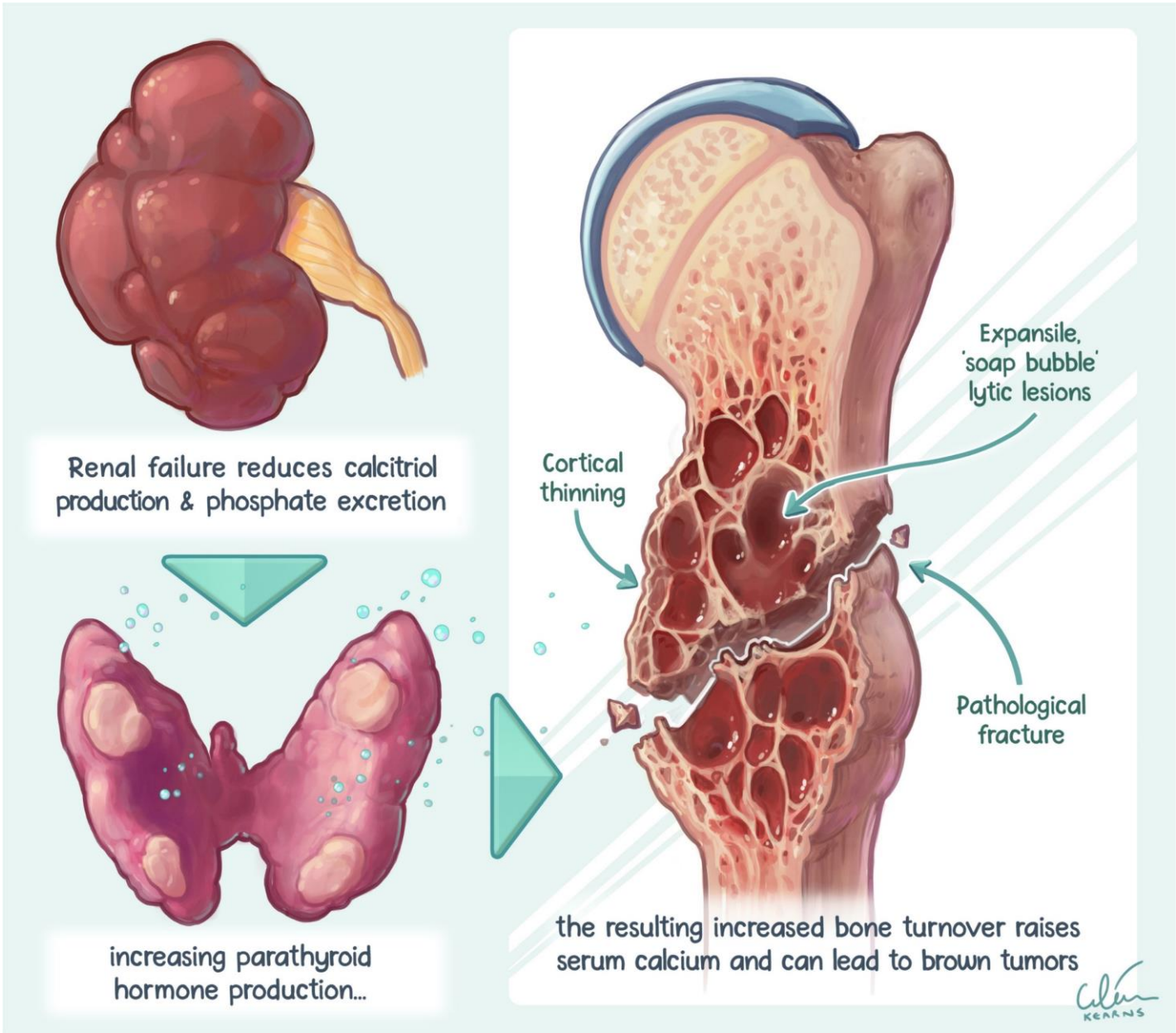


Table 15. Target Range of Intact Plasma PTH by Stage of CKD

CKD Stage	GFR Range (mL/min/1.73 m²)	Target "intact" PTH (pg/mL [pmol/L])
3	30-59	35-70 [3.85-7.7 pmol/L] (OPINION)
4	15-29	70-110 [7.7-12.1 pmol/L] (OPINION)
5	<15 or dialysis	150-300 [16.5-33.0 pmol/L] (EVIDENCE)

NKF KDOQI Guidelines

Item 50

A 78-year-old woman is evaluated in the emergency department for severe pain in the left hip after a fall. History is significant for end-stage kidney disease as of 18 months ago, hypertension, and peripheral vascular disease. Medications are lisinopril, amlodipine, sevelamer, and epoetin alfa. She is also receiving morphine for the hip pain.

On physical examination, blood pressure is 132/70 mm Hg, and pulse rate is 72/min; other vital signs are normal. The left lower extremity is externally rotated at the hip. Peripheral pulses are diminished. The remainder of the physical examination is noncontributory.

Laboratory studies:

Alkaline phosphatase	78 U/L
Calcium	9.7 mg/dL (2.4 mmol/L)
Phosphorus	4.2 mg/dL (1.4 mmol/L)
Parathyroid hormone	62 pg/mL (62 ng/L)
25-Hydroxyvitamin D	32 ng/mL (80 nmol/L)

Radiographs of the hips show a left hip fracture and calcified arteries.

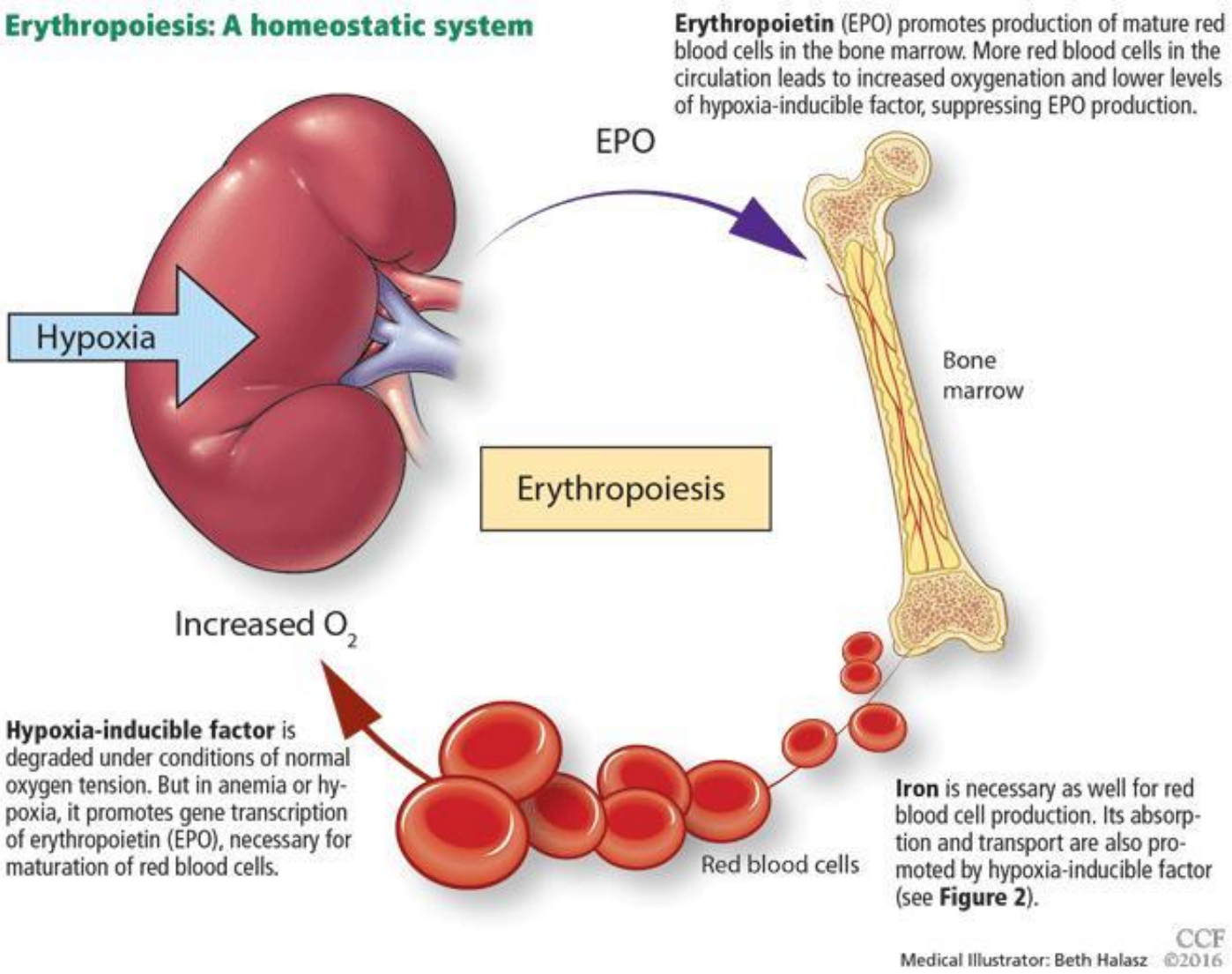
Which of the following is the most likely diagnosis for the underlying bone disease?

(A) Adynamic bone disease
(B) β_2-Microglobulin–associated amyloidosis
(C) Osteitis fibrosis cystica
(D) Osteomalacia

Treatment of CKD-BMD

- Avoid significant hyperphosphatemia: restrict use of calcium based binders-lower mortality risk with non-calcium based binders
- Avoid hypercalcemia
- Calcitriol and other vitamin D analogues
- Calcimimetics for patients on dialysis –EVOLVE trial-cinacalcet

Anemia



Cleveland Clinic Journal of Medicine August 2016

Item 52

A 62-year-old woman is evaluated for fatigue and weakness. History is significant for stage G4 chronic kidney disease and hypertension. Her only medication is amlodipine.

On physical examination, blood pressure is 135/85 mm Hg; other vital signs are normal. There is no jaundice. Conjunctival rim pallor is noted, and there is no scleral icterus.

Laboratory studies:

Hemoglobin	8.5 g/dL (85 g/L)
Leukocyte count	Normal
Mean corpuscular volume	80 fL
Platelet count	Normal
Reticulocyte count	1% of erythrocytes
Ferritin	30 ng/mL (30 µg/L)
Transferrin saturation	10%
Estimated glomerular filtration rate	18 mL/min/1.73 m^2
Stool testing for occult blood	Negative

Colonoscopy performed at age 60 years was normal.

H CONT. **Which of the following is the most appropriate treatment?**

(A) Blood transfusion
(B) Bone marrow biopsy
(C) Erythropoietin-stimulating agent
(D) Iron supplementation

All patients with CKD and anemia should have iron profile assessed

KDIGO recommends maintaining target tsat >30% and ferritin >500

Item 75

H

A 65-year-old woman is evaluated for a 3-month history of increasing fatigue. History is significant for stage G4 chronic kidney disease and hypertension. Medications are sodium bicarbonate, sevelamer, furosemide, losartan, and amlodipine.

On physical examination, blood pressure is 120/60 mm Hg, and pulse rate is 75/min; other vital signs are normal. Conjunctival rim pallor is noted.

Laboratory studies:

Hemoglobin	8.5 g/dL (85 g/L)
Mean corpuscular volume	90 fL
Ferritin	600 ng/mL (600 µg/L)
Transferrin saturation	40%
Estimated glomerular filtration rate	25 mL/min/1.73 m^2

Stool guaiac testing is negative.

Colonoscopy performed within the past 5 years was normal.

Which of the following is the most appropriate treatment?

(A) Discontinue losartan

(B) Schedule packed red blood cell transfusion

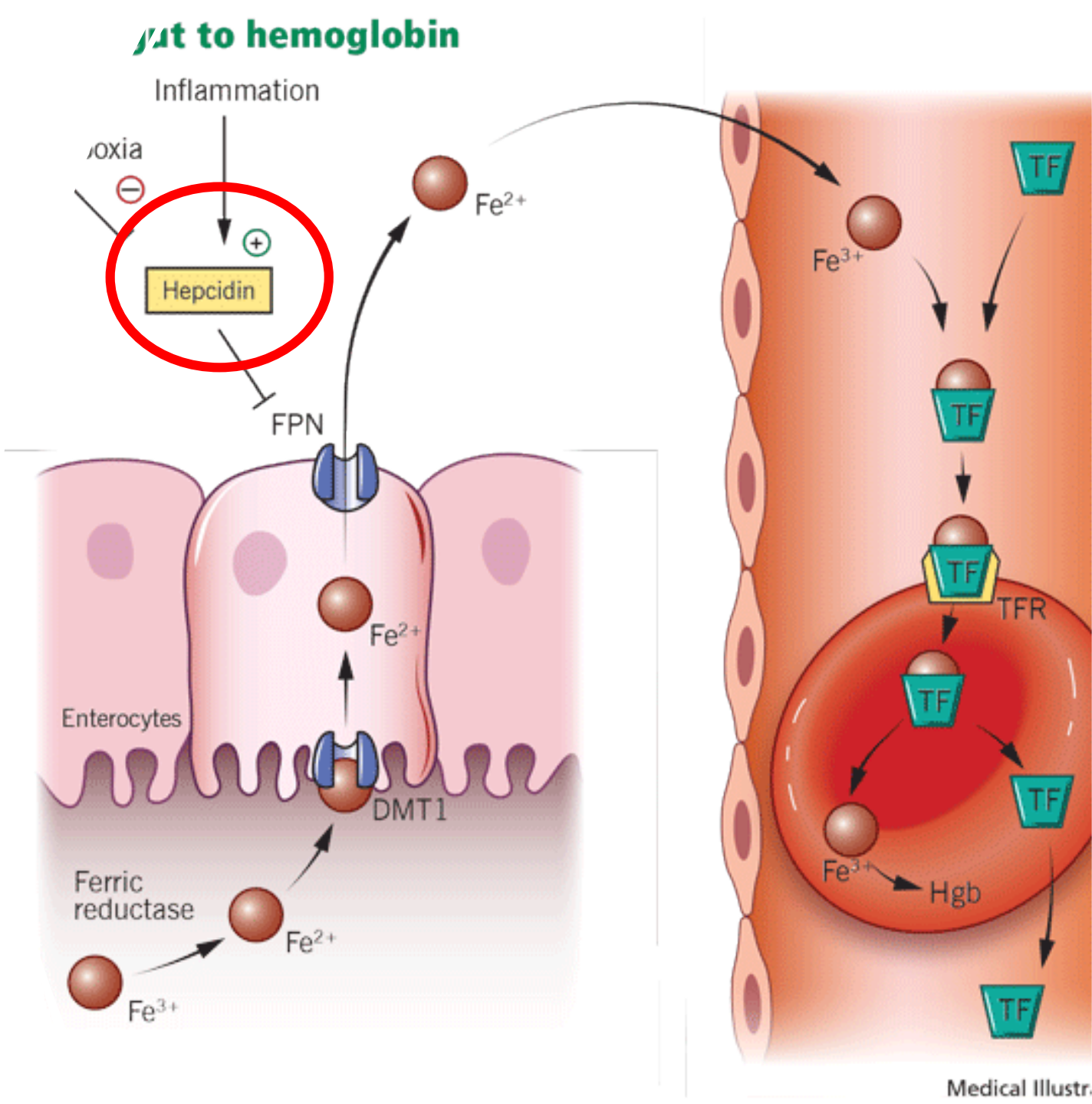
(C) Start an erythropoiesis-stimulating agent

(D) Start intravenous iron

Treat ESKD-related iron deficiency anemia with intravenous iron instead of po iron in dialysis patients

- -In hemodialysis patients, parenteral iron therapy is preferred to oral iron therapy because it is more effective in increasing hemoglobin concentrations and iron stores.

- -Go ahead and d/c that po iron sulfate. We will give IV iron with HD !



Cleveland Clinic Journal of Medicine August 2016


RRT preparation

Item 69

A 52-year-old woman is hospitalized for a toe ulcer and foot pain occurring for 1 month. History is significant for stage G4 chronic kidney disease (estimated glomerular filtration rate, 22 mL/min/1.73 m^2) and type 2 diabetes mellitus. Medications are lisinopril, sevelamer, sodium bicarbonate, insulin glargine, and insulin aspart.

On physical examination, vital signs are normal. A foul-smelling toe ulcer is present. Probe-to-bone test is positive.

A plain radiograph shows changes compatible with osteomyelitis. The patient undergoes wound débridement and bone biopsy.

Bone cultures are pending, and empiric antibiotic therapy is to be administered.

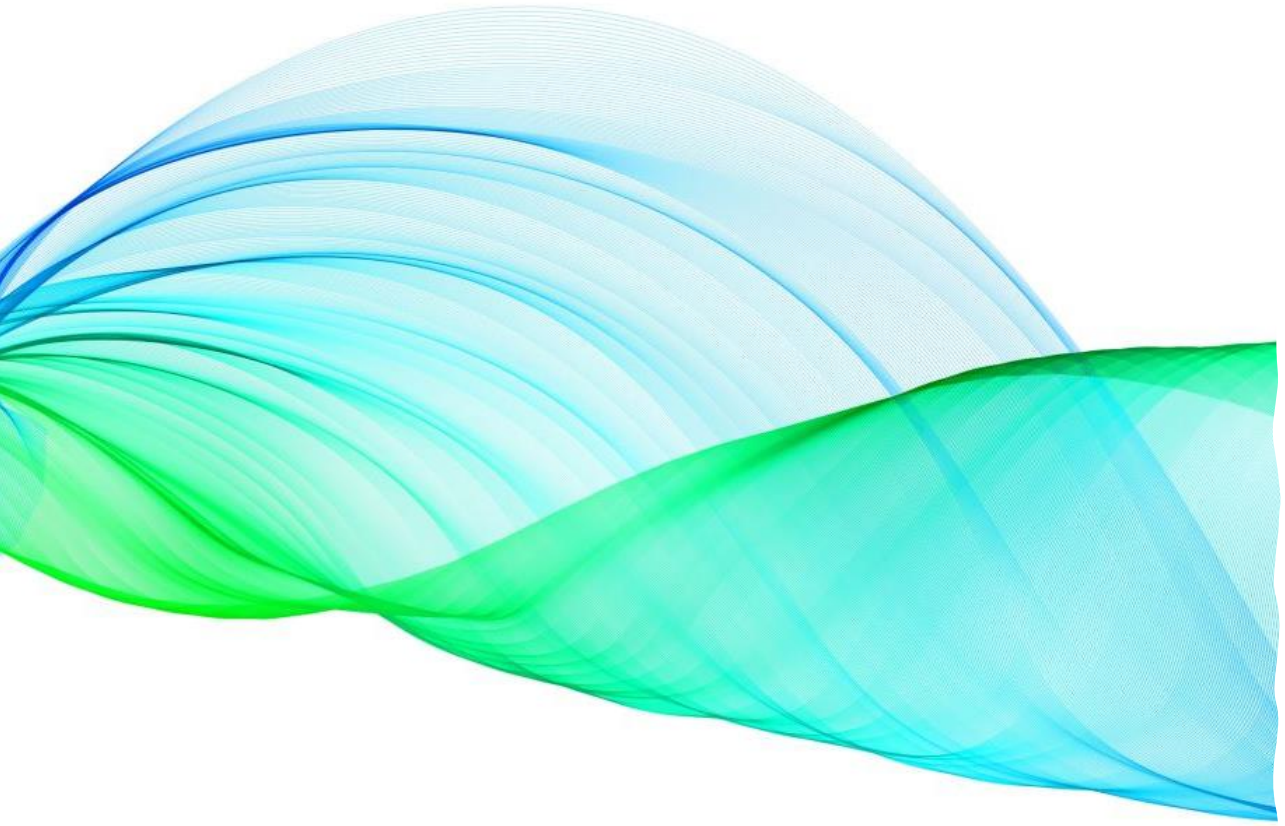
Which of the following is the most appropriate venous access strategy?

(A) Arteriovenous graft creation followed by peripherally inserted central catheter placement in opposite arm

(B) Peripherally inserted central catheter in the dominant arm

(C) Peripherally inserted central catheter in the nondominant arm

(D) Tunneled internal jugular central venous catheter



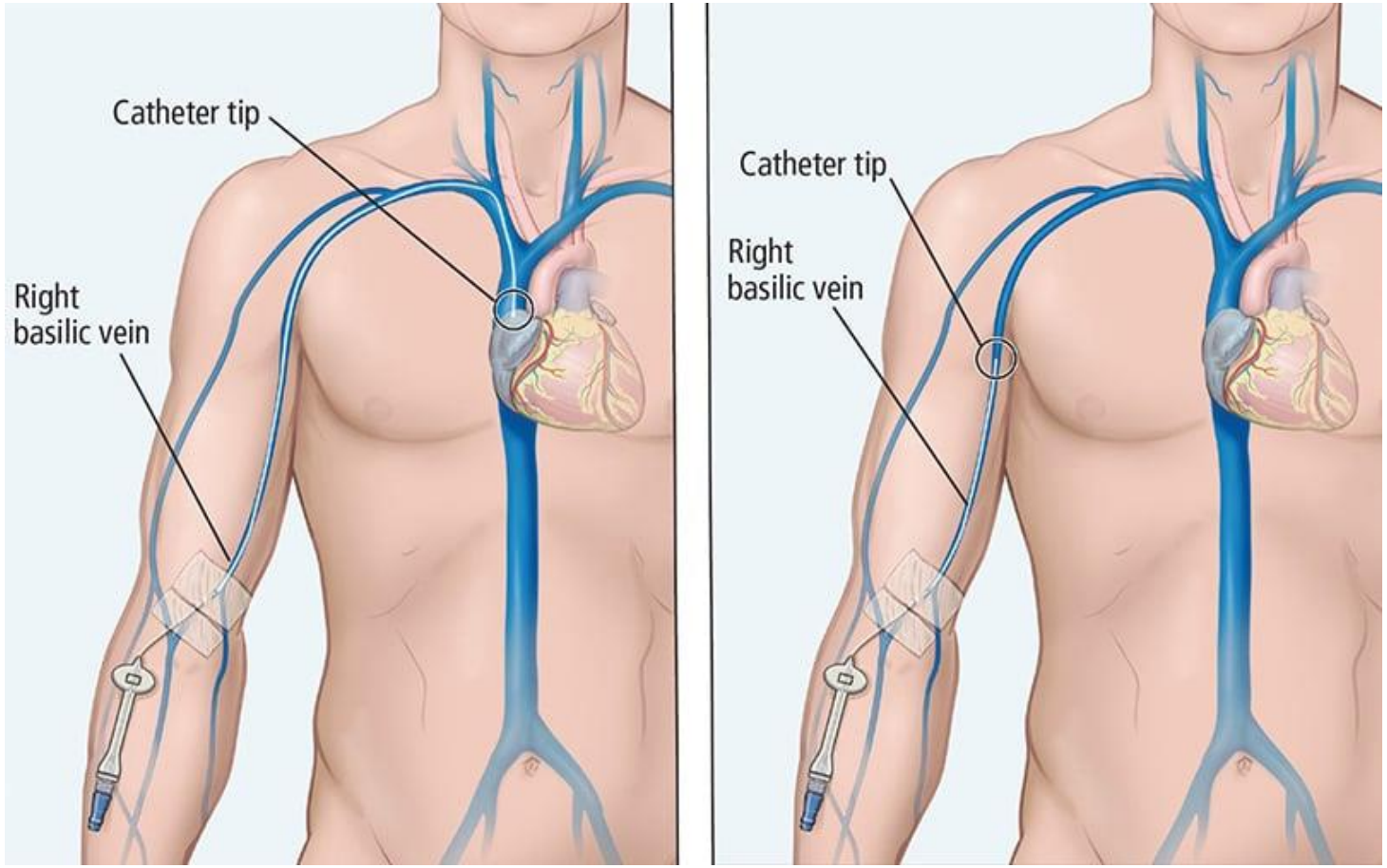
-Avoid placing a PICC line in patients with advanced CKD/ESKD

-PICC lines will destroy veins that can be used for future AVFs

-Here you can order a tunneled powerline or tunneled PICC. It's like a central line but tunneled into the IJ

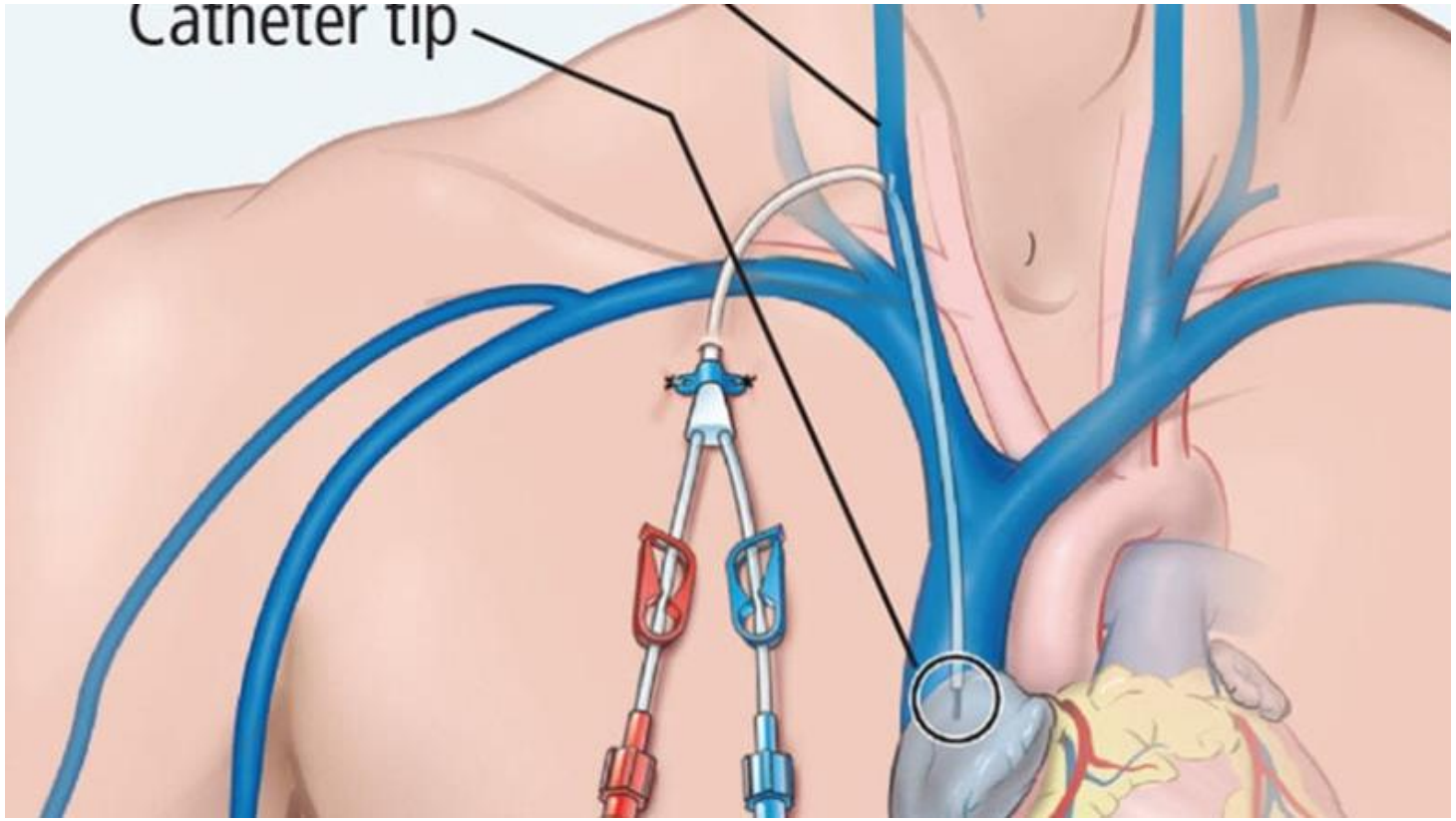
El Ters M, Schears GJ, Taler SJ, et al. Association between prior peripherally inserted central catheters and lack of functioning arteriovenous fistulas: a case-control study in hemodialysis patients. Am J Kidney Dis. 2012 Oct;60(4):601-8.

- **Figure 1.** A peripherally inserted central catheter (left) is inserted at the right basilic vein, through the axillary and subclavian veins and into the superior vena cava. The midline catheter (right) is also inserted at the right basilic vein with the tip just below the axilla



By Nora Hilda Hernandez Garcilazo, MD; Mohamed Hassanein, MD; Tushar J. Vachharajani, MD and Evamaria Anvari, MD

- **Figure 2.** A small-bore (Hohn) catheter placed in the internal jugular vein is an alternative to a peripherally inserted central catheter.



By Nora Hilda Hernandez Garcilazo, MD; Mohamed Hassanein, MD; Tushar J. Vachharajani, MD and Evamaria Anvari, MD

Item 95

A 60-year-old woman is evaluated for fatigue and weakness. She reports no nausea or vomiting. History is significant for hypertension, stage G4 chronic kidney disease, and type 2 diabetes mellitus. Medications are labetalol, amlodipine, insulin glargine, insulin lispro, and sodium bicarbonate.

On physical examination, blood pressure is 140/90 mm Hg; other vital signs are normal. A mature radiocephalic arteriovenous fistula (AVF) with a strong thrill and bruit is noted. There are no lung crackles. Trace pedal edema is present.

Laboratory studies show normal serum bicarbonate and potassium levels, a blood urea nitrogen level of 50 mg/dL (17.8 mmol/L), and an estimated glomerular filtration rate of 18 mL/min/1.73 m^2.

Which of the following is the most appropriate management?

(A) Clinical follow-up in 6 months
(B) Fistulography to evaluate patency of AVF
(C) Hemodialysis
(D) Kidney transplant evaluation

Item 99

An 82-year-old woman is evaluated during a follow-up visit for stage G5 chronic kidney disease. History is also significant for coronary artery bypass graft surgery 10 years ago, peripheral vascular disease, oxygen-dependent COPD, anemia, mild-moderate vascular dementia, and a transient ischemic attack 2 years ago. She has increasing difficulty with activities of daily living and mobility. She has an 80-pack-year history of smoking, having quit 10 years ago. Medications are albuterol, tiotropium, fluticasone-salmeterol inhalers, metoprolol, atorvastatin, iron, and low-dose aspirin. She currently lives in a nursing home.

On physical examination, the patient appears thin and frail. Vital signs include a blood pressure of 108/62 mm Hg, a respiration rate of 22/min, and an oxygen saturation of 92% on 2-L/min oxygen by nasal cannula. BMI is 19. Diminished breath sounds are present throughout the lungs. There is no edema or asterixis.

Laboratory studies:

Blood urea nitrogen	79 mg/dL (28.2 mmol/L)
Creatinine	4.6 mg/dL (406.6 µmol/L)
Potassium	4.6 mEq/L (4.6 mmol/L)
Estimated glomerular filtration rate	9.7 mL/min/1.73 m^2

Which of the following is the most appropriate care strategy for this patient?

(A) Creation of an arteriovenous fistula for dialysis access

(B) Discussion of non-dialytic options

(C) Placement of a double-lumen catheter for long-term hemodialysis

(D) Placement of a peritoneal dialysis catheter

Item 108

A 62-year-old woman is evaluated during a follow-up visit for stage G5 chronic kidney disease. She is not a transplant candidate. She has opted for hemodialysis for her eventual dialysis modality; an arteriovenous fistula was created 6 months ago. She is active, has a fair appetite, and is sleeping well. She reports no nausea or vomiting. History is also significant for hypertension and secondary hyperparathyroidism. Medications are furosemide, amlodipine, epoetin alfa, sevelamer, calcitriol, and sodium bicarbonate.

On physical examination, blood pressure is 144/85 mm Hg; other vital signs are normal. The left upper extremity arteriovenous fistula appears functioning. There is no asterixis. There is 2+ lower extremity edema.

Laboratory studies:

Bicarbonate	21 mEq/L (21 mmol/L)
Blood urea nitrogen	89 mg/dL (31.7 mmol/L)
Creatinine	4.8 mg/dL (424.3 µmol/L)
Potassium	4.8 mEq/L (4.8 mmol/L)
Estimated glomerular filtration rate	9.7 mL/min/1.73 m^2

Which of the following is the most appropriate management for this patient?

(A) Delay dialysis until uremic symptoms occur
(B) Discontinue diuretics
(C) Refer for palliative care
(D) Start dialysis now

RRT preparation

- eGFR <25 ml/min: Kidney class
- eGFR<20 ml/min: Prepare access, transplant referral
- eGFR <10-15 ml/min: watch closely

A few more things…

-Discontinue IVFs when no longer needed. If the patient is anuric, think twice before giving big boluses of IVFs

-Of course you can give IVFs if there is significant evidence of volume depletion-but be careful.

-There is no need for maintenance IVFs if a dialysis patient is NPO for a procedure.

-Be careful with lactate ringers in ESRD-it contains potassium (4 mEq/L).

-Let nephrology know if you are planning to give pRBC transfusion in your dialysis patient. We can give it during hemodialysis.

-Use pRBC transfusion just when necessary. Blood transfusions can sensitize patients to HLA antigens and make it harder to get a kidney transplant in the future.

-Make sure you look at renal function when ordering meds

-With gabapentin (commonly used), toxicity is seen in those with decreased renal function, especially in AKI

-Another one: opiates. Avoid morphine in these patients. Morphine metabolites accumulate easily. You can use dilaudid or Percocet with caution.

-Don’t overthink BUN/creatinine in patients on dialysis, with few exceptions

-We follow clearance in HD and PD by measuring and calculating a parameter called Kt/V.

-But we can suspect poor dialysis when the BUN, phosphate, etc are super high.

-What else can cause an increase in your BUN?

-Remove Foley catheters ASAP and avoid insertion in ESKD patients who don’t make urine

-If you didn’t know and it was placed in the middle of an emergency….take it out.

✓ Do call us if you have any questions.
We can figure it out together!