(PBL) Chronic Kidney Disease and End-Stage Renal Disease Diagnosis and Management

Michael M. Braun, DO, FAAFP, RFPHM

FMX

ACTIVITY DISCLAIMER

The material presented here is being made available by the American Academy of Family Physicians for educational purposes only. Please note that medical information is constantly changing; the information contained in this activity was accurate at the time of publication. This material is not intended to represent the only, nor necessarily best, methods or procedures appropriate for the medical situations discussed. Rather, it is intended to present an approach, view, statement, or opinion of the faculty, which may be helpful to others who face similar situations.

The AAFP disclaims any and all liability for injury or other damages resulting to any individual using this material and for all claims that might arise out of the use of the techniques demonstrated therein by such individuals, whether these claims shall be asserted by a physician or any other person. Physicians may care to check specific details such as drug doses and contraindications, etc., in standard sources prior to clinical application. This material might contain recommendations/guidelines developed by other organizations. Please note that although these guidelines might be included, this does not necessarily imply the endorsement by the AAFP.

FMX

DISCLOSURE

It is the policy of the AAFP that all individuals in a position to control content disclose any relationships with commercial interests upon nomination/invitation of participation. Disclosure documents are reviewed for potential conflict of interest (COI), and if identified, conflicts are resolved prior to confirmation of participation. Only those participants who had no conflict of interest or who agreed to an identified resolution process prior to their participation were involved in this CME activity.

All individuals in a position to control content for this session have indicated they have no relevant financial relationships to disclose.

The content of my material/presentation in this CME activity will not include discussion of unapproved or investigational uses of products or devices.

FMX

Disclaimer

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of Defense.

FMX

Michael M. Braun, DO, FAAFP, RFPHM

Chief, Inpatient Medicine, Department of Family Medicine, Madigan Army Medical Center (MAMC), Tacoma, Washington; Director of the Medical Wards, MAMC, Tacoma, Washington

Dr. Braun earned his medical degree at the Philadelphia College of Osteopathic Medicine, Pennsylvania, and completed his residency in family medicine at Womack Army Medical Center, Fort Bragg, North Carolina. At Madigan Army Medical Center, he has served as family medicine and internal medicine residency faculty for nine years. He has been a practicing hospitalist for seven years. He earned the Recognition of Focused Practice in Hospital Medicine (RFPHM) from the American Board of Family Medicine (ABFM) and the American Board of Internal Medicine (ABIM).

FMX

Learning Objectives

1. Practice applying new knowledge and skills gained from Chronic Kidney Disease and End-Stage Renal Disease Diagnosis and Management sessions, through collaborative learning with peers and expert faculty.

2. Identify strategies that foster optimal management of chronic kidney disease and end-stage renal disease within the context of professional practice.

3. Formulate an action plan to implement practice changes, aimed at improving patient care.

FMX

Associated Sessions

- Chronic Kidney Disease and End-Stage Renal Disease Diagnosis and Management

FMX

Chief Complaint

"I feel tired and fatigued all the time"

History of Present Illness

- Tina– 57 yo Female
- Presenting to your clinic for routine well adult exam
- Complains of fatigue that has gotten worse over the past year

Past Medical History

- Hypertension
- Insulin dependent diabetes mellitus
- Hyperlipidemia
- CKD stage 3aA1 (Cr baseline 1.3 with eGFR of 46 mL/min/1.73m2)

Tina's CKD Stage:

GFR categories (ml/min/ 1.73 m²) 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		Monitor	Refer*
	G2	Mildly decreased	60–89		Monitor	Refer*
	G3a	Mildly to moderately decreased	45–59	Monitor	Monitor	Refer
	G3b	Moderately to severely decreased	30–44	Monitor	Monitor	Refer
	G4	Severely decreased	15–29	Refer*	Refer*	Refer
	G5	Kidney failure	<15	Refer	Refer	Refer

Medications

- Aspirin 81mg
- Lantus 20u QHS
- Metformin 1000mg BID
- Simvastatin 10mg daily
- Metoprolol succinate ER 50mg daily
- Lisinopril 20mg daily

Immunizations

- PCV-13
- PPSV-23
- TD
- Zoster

Family History

- Father: Diabetes, HTN, MI at age 67
- Mother: CKD, HTN, Diabetes, hyperlipidemia

Social History

- Occasional EtOH usage – socially (1 glass of wine/week)
- No tobacco usage
- No Recreational drugs
- Marries 20 years, one sexual partner during that time

Review of Systems

- Denies:
  - Fever
  - Chills/sweats
  - Weight loss
  - Chest pain or pressure
  - Shortness of breath
  - Headache
  - Visual changes
- Reports
  - Fatigue
  - Sluggishness

Physical Examination

- VS: 98.9, 78, 152/88, 18, 99%, BMI 34
- Gen: alert, oriented, no acute distress
- HEENT: EOMI, PERRLA, normal hearing, no PND
- CV: RRR, no M/R/G
- Lungs: CTAB, No W/R/R
- Abd: nl BS, NT, ND, no TTP, no masses
- Neuro: Grossly intact neuro exam

Laboratory/Radiology

- HbA1C: 7.2%
- BMP: 135/4.5/105/27/38/1.3
- eGFR: 46 mL/min1.73m2
- Urine protein/cr ratio: 1.5

Question 1

What is your blood pressure target?

Question 2

How would you like to treat Tina's hypertension?

Medications

- Aspirin 81mg
- Lantus 20u QHS
- Simvastatin 10mg daily
- Metoprolol succinate ER 50mg daily
- Lisinopril 40mg daily

Hypertension Management (Non-dialysis)

- Blood pressure
  - Goal is <130/80
  - ACEI/ARBS recommended at first line in ≥ Stage 3 or stage 1-2 with albumin/creatinine ≥300 mg/g
  - Sodium restriction of <2G/day
- Proteinuria
  - Goal spot protein/cr ratio if <1.0
  - Check at each visit to trend

Question 3

How would your management change if she was on dialysis?

Hypertension Management (Dialysis)

- Do not use pre- and post dialysis BP measurements to make decisions
- Ambulatory Blood pressure monitoring is preferred
- BP target is <140/80
- Achieve target dry weight before start BP medications
- Beta blockers are preferred first line
- Dihydropyridine calcium blockers are second line (i.e. amlodipine)
- ACEI/ARBS may decrease risk of CV events – they do no confer the same mortality benefit as in non-dialysis patients

Question 4

Are there any other labs you would like to order today?

Tina's additional labs

- PTH: 44 ng/dL (Normal)
- CBC: 8.0/13/38/205
- 25-Hydroxy-Vitamin D: 55 nmol/L
- Calcium: 8.5 mg/dL
- Phosphorous: 3.5 mg/dL
- Alkaline Phosphatase: 100 IU/L (Normal)

Clinical Evaluations Recommendations

- Stage 3a/b
  - Alk Phos every 12 months
  - Calcium and Phos check 6-12 months
  - Vitamin D 6-12 months
  - PTH every 6-12 months
  - CBC Yearly
- Stage 4
  - Alk Phos every 1-6 months
  - Calcium and Phos every 3-6 months
  - Vitamin D every 6-12 months
  - PTH check 6-12 months
  - CBC every 6 months
- Stage 5
  - Alk Phos every 1-3 months
  - Calcium and Phos every 1-3 months
  - Vitamin D every 6-12 months
  - PTH check 3-6 months
  - CBC every 6 months
    - Every 3 months for dialysis

Case Continued

Tina returns to your office one year later. Her BP is better controlled. She reports significant weight gain of 20lbs with increased SOB. VS: BP 142/85, 16, 96% RA, and 70 bpm. PE reveals 3+ pitting edema to thighs bilaterally. Lungs CTAB. No JVD. You order repeat labs and order an ECHO.

Tina's labs at 1 year

- HbA1C: 6.8
- BMP: 135/4.0/110/22/30/2.0
- eGFR: 27mL/min/1.73m2
- Previous Cr 1.3
- Spot protein/cr: 0.8 mg/G
- CBC: 9.0/13.5/39/255
- Pro-BNP: 300 pg/dL
- Calcium: 8.5 mg/dL
- Albumin: 3.5 g/dL
- Phosphate: 4.5 mg/dL
- PTH: 50 pg/dL
- ECHO: No wall motion abnormalities with of EF 55%, no diastolic dysfunction
- Vitamin D: 35 ng/L

Question 5

What are your concerns about Tina's labs?

Question 6

What do you want to do about her worsening edema?

Complications – Volume Overload

- Maintain low sodium diet
- No NSAIDS in anyone with CKD3 or greater
  - Can interfere with function of diuretics
- Bowel mucosal edema may reduce absorption

Volume Overload

- Loop diuretics
  - Maximum effective bolus doses:
    - 160 to 200mg furosemide
    - 8 to 10mg bumetanide
    - 50 to 100mg torsemide
  - Partial response → Add thiazide diuretic
    - 30 minutes prior to loop diuretic
  - No response → Continuous drip, albumin
    - Minimal evidence
- Dialysis or ultrafiltration

Question 7

What would you like to do about his ACEI in light of her worsened Cr?

Tina's case continued

Tina returns to your office 3 months later. Her edema is improved since she was placed on furosemide 40mg daily. She has no complaints. You redraw more labs.

Tina's labs 6 months later

- HbA1C: 6.8
- BMP: 135/4.0/96/18/30/2.0
- eGFR: 27mL/min/1.73m2
- Previous Cr 2.0
- Spot protein/cr: 0.7 mg/G
- CBC: 9.0/13.5/39/255
- Calcium: 7.0 mg/dL
- Albumin: 2.0 g/dL
- Phosphate: 6.0 mg/dL
- PTH: 200 pg/dL
- Vitamin D: 25 ng/L

Question 8

How do you want to treat Tina's low bicarbonate?

Metabolic Acidosis

- Higher mortality rate
- Increased risk for progression of CKD
- Supplemental bicarbonate
  - Maintain normal range (23-29 mEq/L)
  - Generally 0.5-1.0 mEq/kg/day
  - Start when bicarb <22 mEq/L consistently
  - Dialysis

Question 9

What would you like to do about her elevated PTH and phosphorous?

CKD-MBD

- 1. Hyperphosphatemia
  - Persistently above >4.5mg/dL
  - Dietary changes
  - Phosphate binders (Goal <4.5 in non-dialysis, 3.5-5.5 in dialysis)
- 2. Secondary hyperparathyroidism
  - PTH Persistently above 150-200 pg/mL or 2-3x normal
  - Calcitriol 0.25mcg MWF to keep PTH level >30 but <150 pg/mL
  - No calcimimetics

CKD-MBD

- 3. Vitamin D deficiency
  - Only if PTH at target and vitamin D <30ng/mL
  - 600-800IU daily oral supplementation
  - Benefit to utilizing Vit D2 to keep vit D2 levels >30 and Vit D3

- 4. Hypercalcemia
  - Decreased excretion & phosphate binders
  - Extraskeletal calcifications and vascular changes
  - Calcium phosphate product <55

Question 10

Are you concerned about her calcium?

Corrected Calcium

- Corrected Calcium = (0.8 * (Normal Albumin - Pt's Albumin)) + Serum Ca
- Tina’s corrected calcium is 8.1 mg/dL
- This patient has metabolic acidosis.
- Ionized calcium: Normal at 4.5 mg/dL

Question 11

Should Tina be referred to Nephrology?

Early Referral

- Late referral = poor outcomes

- Discuss and plan for replacement therapy
  - GFR<30mL/min
  - Rapidly declining GFR
  - Abrupt sustained decline in GFR
  - Creatinine >4
  - Consistent A3 proteinuria
  - Inability to meet treatment goals

Tina's case finalized

Over the next few months, Tina's eGFR continues to decline. Her nephrologist refers her for renal transplant. 12 months later, Tina returns to your office with a successful kidney transplant.

Contact Information

- Michael M. Braun
- Michael.m.braun.civ@mail.mil

Questions

References

- 1. GAITONDE DY, COOK DL.et al. Chronic Kidney Disease: Detection and Evaluation. *Am Fam Physician.* 2017 Dec 15;96(12):776-783.
- 3. Townsend RR. Stroke in chronic kidney disease: prevention and management. *Clin J Am Soc Nephrol*. 2008;3(suppl 1):S11–S16.
- 4. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu CY. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization [published correction appears in N Engl J Med 2008;18(4):4]. *N Engl J Med*. 2004;351(13):1296–1305.
- 5. Murphy D, McCulloch CE, Lin F, et al.; Centers for Disease Control and Prevention Chronic Kidney Disease Surveillance Team. Trends in prevalence of chronic kidney disease in the United States. *Ann Intern Med*. 2016;165(7):473–481.
- 6. United States Renal Data System. 2016 Annual Data Report. Vol 1, Ch 6: Medicare expenditures for persons with CKD. https://www.usrds.org/2016/view/v1_06.aspx. Accessed January 21, 2017.
- 7. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney Int Suppl*. 2013;3(1): 1–150.
- 8. Giatras I, Lau J, Levey AS; Angiotensin-Converting-Enzyme Inhibition and Progressive Renal Disease Study Group. Effect of angiotensin-converting enzyme inhibitors on the progression of nondiabetic renal disease: a meta-analysis of randomized trials. *Ann Intern Med*. 1997;127(5):337–345.
- 9. Pereira BJ. Optimization of pre-ESRD care: the key to improved dialysis outcomes. *Kidney Int*. 2000;57(1):351–365.
- 10. Centers for Disease Control and Prevention. Chronic kidney disease (CKD) surveillance system. https://nccd.cdc.gov/CKD/data.aspx. Accessed January 20, 2017.

References

- 11. American Diabetes Association. 3. Comprehensive medical evaluation and assessment of comorbidities [published correction appears in Diabetes Care. 2017;40(7):985]. *Diabetes Care*. 2017;40(suppl 1):S25–S32.
- 12. Moyer VA; U.S. Preventive Services Task Force. Screening for chronic kidney disease: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2012;157(8):567–570.
- 13. Qaseem A, Hopkins RH Jr, Sweet DE, Starkey M, Shekelle P; Clinical Guidelines Committee of the American College of Physicians. Screening, monitoring, and treatment of stage 1 to 3 chronic kidney disease: a clinical practice guideline from the American College of Physicians. *Ann Intern Med*. 2013;159(12):835–847.
- 14. American Academy of Family Physicians. Clinical practice guideline: chronic kidney disease. http://www.aafp.org/patient-care/clinical-recommendations/all/chronic-kidney-disease.html. Accessed October 26, 2017.
- 15. Chau K, Hutton H, Levin A. Laboratory assessment of kidney disease: glomerular filtration rate, urinalysis, and proteinuria. In: Skorecki K, et al., eds. Brenner & Rector's The Kidney. 10th ed. Philadelphia, Pa.: Elsevier; 2016:780–803.
- 16. Fan L, Inker LA, Rossert J, et al. Glomerular filtration rate estimation using cystatin C alone or combined with creatinine as a confirmatory test. *Nephrol Dial Transplant*. 2014;29(6):1195–1203.
- 17. Ninomiya T, Perkovic V, de Galan BE, et al.; ADVANCE Collaborative Group. Albuminuria and kidney function independently predict cardiovascular and renal outcomes in diabetes. *J Am Soc Nephrol*. 2009;20(8):1813–1821.
- 18. Cockcroft DW, Gault MH. Prediction of creatinine clearance from serum creatinine. *Nephron*. 1976;16(1):31–41.
- 19. Levey AS, Bosch JP, Lewis JB, Greene T, Rogers N, Roth D; Modification of Diet in Renal Disease Study Group. A more accurate method to estimate glomerular filtration rate from serum creatinine: a new prediction equation. *Ann Intern Med*. 1999;130(6):461–470.
- 20. Levey AS, Stevens LA, Schmid CH, et al.; CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration). A new equation to estimate glomerular filtration rate [published correction appears in Ann Intern Med 2011;155(6):408]. *Ann Intern Med*. 2009;150(9):604–612.

References

- 21. Baumgarten M, Gehr T. Chronic kidney disease: detection and evaluation. *Am Fam Physician*. 2011;84(10):1138–1148.
- 22. National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *Am J Kidney Dis*. 2002;39(2 suppl 1):S1–S266.
- 23. National Kidney Foundation. KDOQI clinical practice guideline for diabetes and CKD: 2012 update [published correction appears in Am J Kidney Dis. 2013;61(6):1049]. *Am J Kidney Dis*. 2012;60(5):850–886.
- 24. Stevens LA, Coresh J, Schmid CH, et al. Estimating GFR using serum cystatin C alone and in combination with serum creatinine: a pooled analysis of 3,418 individuals with CKD. *Am J Kidney Dis*. 2008;51(3):395–406.
- 25. Inker LA, Schmid CH, Tighiouart H, et al.; CKD-EPI Investigators. Estimating glomerular filtration rate from serum creatinine and cystatin C [published corrections appear in N Engl J Med. 2012;367(7):681, and N Engl J Med. 2012;367(21):2060]. *N Engl J Med*. 2012;367(1):20–29.
- 26. Barr EL, Reutens A, Magliano DJ, et al. Cystatin C estimated glomerular filtration rate and all-cause and cardiovascular disease mortality risk in the general population: AusDiab study. *Nephrology (Carlton)*. 2017; 22(3):243–250.
- 27. Tangri N, Grams ME, Levey AS, et al.; CKD Prognosis Consortium. Multinational assessment of accuracy of equations for predicting risk of kidney failure: a meta-analysis [published correction appears in JAMA. 2016;315(8):822]. *JAMA*. 2016;315(2):164–174.
- 28. Hillege HL, Fidler V, Diercks GF, et al.; Prevention of Renal and Vascular End Stage Disease (PREVEND) Study Group. Urinary albumin excretion predicts cardiovascular and noncardiovascular mortality in general population. *Circulation*. 2002;106(14):1777–1782.
- 29. Astor BC, Matsushita K, Gansevoort RT, et al.; Chronic Kidney Disease Prognosis Consortium. Lower estimated glomerular filtration rate and higher albuminuria are associated with mortality and end-stage renal disease. A collaborative meta-analysis of kidney disease population cohorts. *Kidney Int*. 2011;79(12):1331–1340.
- 30. Moghazi S, Jones E, Schroepple J, et al. Correlation of renal histopathology with sonographic findings. *Kidney Int*. 2005;67(4):1515–1520.

References

- 31. Kidney Disease: Improving Global Outcomes (KDIGO) Lipid Work Group. KDIGO clinical practice guideline for lipid management in chronic kidney disease. *Kidney Int Suppl*. 2013;3(3):259–305.
- 32. Kidney Disease: Improving Global Outcomes (KDIGO) Anemia Work Group. KDIGO clinical practice guideline for anemia in chronic kidney disease. *Kidney Int Suppl*. 2012;2(4):279–335.
- 33. Kidney Disease: Improving Global Outcomes (KDIGO) CKD-MBD Update Work Group. KDIGO 2017 clinical practice guideline update for the diagnosis, evaluation, prevention, and treatment of chronic kidney disease–mineral and bone disorder (CKD-MBD). *Kidney Int Suppl*. 2017;7(1):1–59.
- 34. Kidney Disease: Improving Global Outcomes (KDIGO) Acute Kidney Injury Work Group. KDIGO clinical practice guideline for acute kidney injury. *Kidney Int Suppl*. 2012;2(1):1–138.
- 35. Snyder S, Pendergraph B. Detection and evaluation of chronic kidney disease. *Am Fam Physician*. 2005;72(9):1723–1732.
- 36. Rosenberg, Mark. "Overview of the Management of Chronic Kidney Disease in Adults." UpToDate, 25 Sept. 2017, www.uptodate.com/contents/overview-of-the-management-of-chronic-kidney-disease-in-adults?source=search_result&search=chronic%20kidney%20disease&selectedTitle=1~150#H28.
- 37. Fatehi, Pedram, and Chi-yuan Hsu. "Diagnostic Approach to the Patient with Newly Identified Chronic Kidney Disease." UpToDate, 26 Oct. 2017, www.uptodate.com/contents/diagnostic-approach-to-the-patient-with-newly-identified-chronic-kidney-disease?source=search_result&search=chronic%2Bkidney%2Bdisease&selectedTitle=2~150#H20003386.
- 38. "Chronic Kidney Disease." 2016 FP Comprehensive, American Academy of Family Physicians, www.aafp.org/test/fpcomp/FP-E_375/pt2.html.
- 39. "KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease." Kidney International, vol. 3, no. 1, Jan. 2013.
- 40. Qunibi, WY, et al. "Overview of chronic kidney disease-mineral and bone disorder." UpToDate, 19 Jan. 2017, https://www.uptodate.com/contents/overview-of-chronic-kidney-disease-mineral-and-bone-disorder-ckd-mbd?search=ckd%20mbd&source=search_result&selectedTitle=1~34&usage_type=default&display_rank=1.