

# Chronic Kidney Disease for the Family Physician\*

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\*who hates the kidneys

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## Conflicts of Interest/Disclosures

- I have no conflicts of interest and nothing to disclose.

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## Objectives

- The learner shall
  - Learn how to diagnose chronic kidney disease
  - Identify the main treatments of chronic kidney disease
  - Understand when to refer to nephrology for chronic kidney disease

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## Epidemiology

- More than 31 million Americans (15% of adults) have chronic kidney disease (CKD)
  - 468,000 dialysis patients
  - 193,000 with functioning kidney transplant
- Lack of awareness
  - 48% of those with severely reduced kidney function and not on dialysis are not aware of having CKD
  - 96% of people with kidney damage or reduced kidney disease are not aware of having CKD

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## Epidemiology

- Men (57%) > Women (43%)
- 45 to 65 years old most common age range
- Ethnicity
  - White (68%)
  - Black (31%)
  - Hispanic (17%)
  - Others (6%)

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## Epidemiology

- End-Stage Renal Disease (ESRD)
  - Overall declining since 2006
  - About 21,000 new cases per year
  - More likely to develop in minorities
- Kidney transplants
  - 17,600 performed per year
  - Median wait time of 3.6 years

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## Morbidity and Mortality

- Increased risk of death in most comorbid diseases
  - Cerebrovascular disease, cardiac/vascular disease, COPD, diabetes mellitus, others
- Hospitalizations
  - Risk of hospitalization increases as GFR declines
  - 1.7 hospital admissions per year for ESRD patients
  - Higher rates of readmission for patients with CKD
- Costs
  - \$50.4 billion in CKD
  - \$30.9 billion in ESRD

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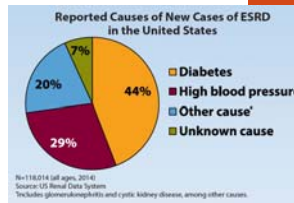
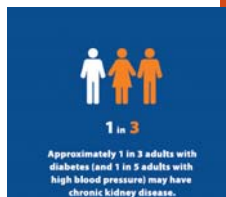
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## Causes

- Diabetes (44%)
- Hypertension (28%)
- Glomerulonephritis (8%)
- Cystic kidney disease (2%)
- Urologic disease (0.5%)
- Others (11%)
- Unknown/missing cause (6%)



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## Definitions

- Blood Urea Nitrogen (BUN)
  - Measure of urea in the serum
  - Can change independent of renal function
- Creatinine (Cr)
  - Muscle breakdown protein that is neither reabsorbed or metabolized by the kidney
  - Measured to estimate renal function
- Glomerular Filtration Rate (GFR)
  - Estimation of renal function using the creatinine along with some combination of age, sex, race, and body size
  - More accurate estimate of renal function than creatinine alone

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## Definitions

- Chronic kidney disease (CKD)
  - Presence of kidney damage or decreased renal function for  $\geq 3$  months regardless of cause
    - Kidney damage: albuminuria, urinary sediment abnormalities, imaging abnormalities
- End-Stage Renal Disease (ESRD)
  - Chronic kidney disease treated with dialysis or transplant
- Acute kidney injury (AKI)
  - Sudden and temporary loss of diminishment of kidney function
  - Increase in serum creatinine by  $\geq 0.3$  mg/dl in 48 hours
  - Increase in serum creatinine by 1.5 times above the baseline that occurs within the previous seven days

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## Stages

- Stage I
  - GFR  $\geq 90$  ml/min/1.73m<sup>2</sup> and persistent proteinuria ( $\geq 3$  months)
- Stage II
  - GFR 60-89 ml/min/1.73m<sup>2</sup> and persistent proteinuria ( $\geq 3$  months)
- Stage III
  - GFR 30-59 ml/min/1.73m<sup>2</sup>
- Stage IV
  - GFR 15-29 ml/min/1.73m<sup>2</sup>
- Stage V (ESRD)
  - GFR  $< 15$  ml/min/1.73m<sup>2</sup>

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## Classification

- Prerenal
  - Decreased renal perfusion due to chronic or acute conditions
- Intrinsic
  - Diseases within the kidney or vascular disease
  - Nephritic
    - Abnormal UA of RBC casts, dysmorphic red cells, and variable proteinuria
  - Nephrotic
    - Heavy proteinuria ( $>3.5$  grams per 24 hours) and fairly normal UA
- Postrenal
  - Obstruction within the renal tract

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## Presentation

- Signs and symptoms
  - Often asymptomatic
  - Hematuria
  - Flank pain
  - Edema
  - Hypertension
  - Signs of uremia
- Usually diagnosed on routine labs or other bloodwork
  - Possible other findings
    - Anemia
    - Hyperkalemia
    - Metabolic acidosis
    - Hypocalcemia
    - Hyperphosphatemia

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## Diagnosis

- History and physical
  - Careful medical history looking for risk factors
  - Medication list evaluation for nephrotoxic drugs
  - Urine output
  - Abdominal and flank exam
- Disease duration
  - Chronic and stable or worsening for  $\geq 3$  months
  - Comparison to previous labs and UA
  - Helps to determine rate of progression

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## Diagnosis

- Initial testing
  - Repeat CMP
  - UA with microscopy
  - Urine protein: creatinine
  - CBC
  - Renal ultrasound
- Additional testing
  - Lipid panel
  - HgbA1C
  - SPEP and UPEP
  - Serum light chain assay
- Results will dictate next steps and need for additional testing
  - Renal biopsy

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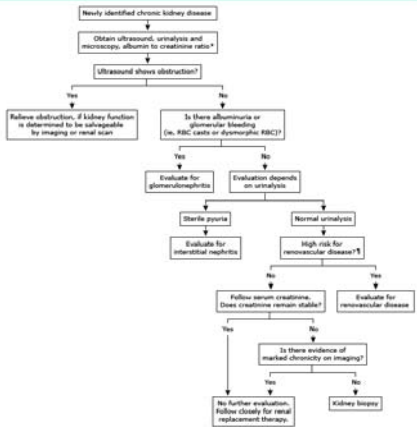
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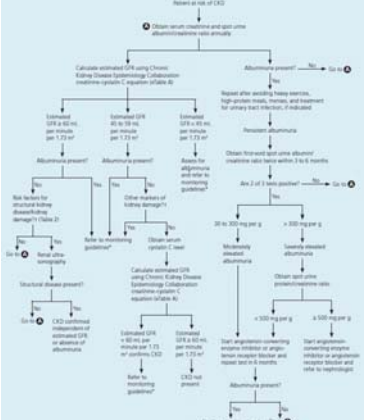
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### Overview of the evaluation of newly identified chronic kidney disease



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### Assessment of Patients at Risk of CKD



### Treatment

- General principles
- Treatment of reversible causes
- Preventing and slowing the progression of disease
- Treatment of complications
- Management of medication regimen
- Starting dialysis at the appropriate time

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## Treatment

- Treatment of reversible causes
  - Decreased renal perfusion
    - Avoid and aggressively treat hypovolemia
    - Avoid nephrotoxic medications
      - NSAIDs
      - Antibiotics
      - CT contrast
  - Evaluate for urinary tract obstruction if worsening disease

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## Treatment

- General principles
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## Treatment

- Preventing and slowing the progression of disease
  - Aggressive blood pressure control
    - ACEI and ARBs
    - Other blood pressure medications
  - Controlling proteinuria
    - ACEI and ARBs
  - Cardiovascular risk modification
  - Aggressive diabetes control
    - HgbA1C < 7
    - Proteinuria maintenance
  - Aggressive hyperlipidemia control
    - Statins
  - Smoking cessation
  - Management of other chronic medical conditions

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## Treatment

- Preventing and slowing the progression of disease
  - Adaptive hyperfiltration
    - Increased filtration of remaining viable nephrons
    - Results in greater long-term damage to the kidney
      - Progressive proteinuria and renal failure
  - Try to reverse this process

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## Treatment

- Preventing and slowing the progression of disease
  - Angiotensin-converting enzyme inhibitor (ACEI) or angiotensin II receptor blocker (ARB)
    - Slow disease progress
      - Benefit is directly linked to when medication is started
    - Decrease proteinuria and requiring dialysis by 22-40%
    - Less effect in slowing progression of CKD without proteinuria
    - Questionable effect if combined
      - Increased risk of adverse effects (including worsening renal function)

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### **SORT: KEY RECOMMENDATIONS FOR PRACTICE**

<i>Clinical recommendation</i>	<i>Evidence rating</i>	<i>References</i>
Patients with nondiabetic kidney disease and a random urine total protein-to-creatinine ratio greater than 200 mg per g, and those with diabetic kidney disease, should be treated with an ACE inhibitor or an angiotensin II receptor blocker.	A	15
Concurrent use of ACE inhibitors and angiotensin II receptor blockers should be avoided because of symptomatic hypotension and worsening kidney function.	A	24
Hemoglobin goals should not exceed 11 g per dL (110 g per L) in patients receiving erythropoiesis-stimulating agents due to the risk of major cardiovascular events.	A	39
Sadolinium should be avoided in patients with a glomerular filtration rate less than 30 mL per minute per 1.73 m <sup>2</sup> , or with acute kidney injury caused by hepatorenal syndrome or in the perioperative liver transplantation period.	B	49

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## Treatment

- General principles
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## Treatment

- Treatment of complications
  - Volume overload
    - Dietary sodium restriction (< 2 g/day)
    - Loop diuretics
  - Hyperkalemia
    - Low-potassium diet (< 40-70 meq/day)
  - Mineral and bone disorders
    - Secondary hyperparathyroidism
      - Frequent checking of PTH
      - Dietary phosphate restriction
      - Phosphate binders
      - Cinacalcet
  - Hypertension
    - Unclear goal– 130/80?

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Goal blood pressure according to baseline risk for cardiovascular disease and method of measuring blood pressure

	Routine/conventional office blood pressure (manual measurement with stethoscope or oscillometric device)*	Unattended AOBPM, daytime ABPM, or home blood pressure†
<b>Higher-risk population‡</b>		
<ul style="list-style-type: none"> <li>• Known ASCVD*</li> <li>• Heart failure</li> <li>• Diabetes mellitus</li> <li>• Chronic kidney disease</li> <li>• Age ≥65 years‡</li> <li>• Calculated 10-year risk of ASCVD event ≥10%‡</li> </ul>	125 to 130/<80	120 to 125/<80
<b>Lower-risk§</b>		
<ul style="list-style-type: none"> <li>• None of the above risk factors</li> </ul>	130 to 139/<90	125 to 135/<90

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**Recommended dietary intake for chronic kidney and end-stage renal disease patients\***

	Chronic kidney disease <sup>1</sup>	Maintenance hemodialysis
Protein	0.8 to 1.0 g/kg/day <sup>2</sup> of high biological value protein	>1.2 to 1.3 g/kg/day
Energy	≥35 kcal/kg/day; if the body weight is greater than 120 percent of normal or the patient is greater than 60 years of age a lower amount may be prescribed	
Fat, percent of total energy intake	30 to 40	30 to 40
Polyunsaturated-to-saturated ratio (fatty acid ratio)	1.0:1.0	1.0:1.0
Carbohydrate	Balance of nonprotein calories	
Total fiber, g/day	20 to 25	20 to 25
Minerals, range of intake		
Sodium, mg/day	<2000	<2000
Potassium, meq/day	40 to 70	40 to 70
Phosphorus, mg/day	600 to 800 <sup>3</sup>	600 to 800 <sup>3</sup>
Calcium, mg/day	1400 to 1600	1400 to 1600
Magnesium, mg/day	200 to 300	200 to 300
Iron, mg/day	≥10 to 18 <sup>4</sup>	≥10 to 18 <sup>4</sup>
Zinc, mg/day	15	15
Water, mL/day	Up to 3000 as tolerated	Usually 750 to 1500

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## Treatment

- Treatment of complications
  - Anemia
    - Check at least yearly in Stages I to III
    - Every 6 months in Stages IV and V
    - Every 3 months if on dialysis
  - Transfusions if < 8
  - Erythropoietin and darbepoetin alfa if < 10
  - Iron supplementation if < 10
- Dyslipidemia
  - Typically hypertriglyceridemia
  - Statin with or without ezetimibe
  - No need for routine surveillance

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## Treatment

- General principles
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  - Treatment of complications
  - Management of medication regimen
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## Treatment

- Management of medication regimen
  - Adjust medication dosage as kidney disease worsens
  - Avoid nephrotoxic medications if possible

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## Treatment

- General principles
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Table 4. Indications for Considering Nephrology Referral for Patients with CKD

<b>Diagnosis of CKD cause</b> Acute kidney injury (unresponsive to initial management)* Anemia of CKD Family history of kidney disease Presence of red blood cell casts in the urine Progression of CKD†
<b>Management of CKD complications</b> Anemia of chronic kidney disease when hemoglobin < 10 g per dL (100 g per L) CKD and refractory hypertension Mineral and bone disorder of CKD Persistent abnormalities in serum potassium Persistent elevated albuminuria (albumin/creatinine ratio > 300 mg per g [ $> 30$ mg per mmol]) or refractory proteinuria (urinary protein/creatinine ratio > 500 to 1,000 mg per g [ $> 50$ to 100 mg per mmol]) Recurrent nephrolithiasis or concern for nephrocalcinosis
<b>Preparation for renal replacement therapy</b> FR < 30 mL per minute per 1.73 m <sup>2</sup> (KDIGO GFR categories G4 and G5)

## Treatment

- Indications for nephrology referral
  - Stage IV disease (GFR < 30 mL/min/1.73m<sup>2</sup>)
  - Rapid progression of disease unresponsive to therapy
  - Anemia with Hgb <10
  - Refractory hypertension
  - Persistent electrolyte abnormalities

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## Advanced Care Planning in ESRD

- Pain management
  - Fentanyl, oxycodone, methadone, hydromorphone are generally okay
  - Avoid morphine and codeine
- Discussion of risks and benefits of initiating dialysis
  - Patients who refuse dialysis have a life expectancy of 6 to 24 months
  - Functional status remains stable until the last weeks of life
  - Delayed initiation
    - Waiting until renal function declines by 50% more
    - Three year follow up reveals no difference in mortality, cardiovascular events, infections, or dialysis complications
- Code status/Advance directives

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## Screening

- United States Preventative Services Task Force (USPSTF)
  - Insufficient evidence to recommend in asymptomatic adults
- American College of Physicians (ACP)
  - Recommends against screening in asymptomatic adults
- American Academy of Family Physicians (AAFP)
  - Recommends against screening in asymptomatic adults
- American Society of Nephrologists (ASN)
  - Strongly recommends regular screening in all adults

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## Screening

- No evidence that early initiation of therapy decreased risk of loss of GFR or development of ESRD
- Case-targeted screening
  - Diabetes mellitus
    - American College of Physicians
  - Hypertension in patients  $\geq 50$  years
  - Immunosuppressive disease
  - Sickle cell trait
  - Family history of kidney disease
  - Chronic use of nephrotoxic medication

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## Screening

- Methods
  - Urinalysis for albumin
  - Serum creatinine
  - GFR
- Frequency
  - No clear consensus
  - 1 to 3 years

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