Nephrology and Hypertension: Question 1

A 59-year-old white male computer analyst is referred for evaluation of hypertension (185/95 mm Hg) discovered during a blood pressure screening at his workplace. The patient states that he is well and has not seen a physician in many years. He describes himself as "a fitness freak, as he is an active jogger, abstains from alcohol, and limits his salt and fat intake. He denies any knowledge of hypertension, cardiovascular disease, renal disease, or diabetes mellitus. He takes no medications regularly. Family history is significant in that his father was known to be hypertensive and died of a stroke at 64 years of age. His older brother is being treated for hypertension.

On examination, the patient appears well, with a blood pressure of 174/98 mm Hg while seated and standing. Body weight is 71 kg (157 lb), and height is 178 cm (70). Optic fundus examination is significant for grade II hypertensive retinopathy. The remainder of the examination is normal.

Complete blood count, electrolyte panel, blood urea nitrogen level, creatinine concentration, thyroid-stimulating hormone level, and results of urinalysis are normal. Electrocardiography demonstrates normal sinus rhythm with left ventricular hypertrophy. To reduce the patient's cardiovascular morbidity and mortality, which therapy would you prescribe?

A. Doxazosin  
B. Losartan  
C. Atenolol  
D. Hydralazine

Nephrology and Hypertension: Question 2

A 74-year-old man is hospitalized with cough and chest pain. He was previously healthy and has not been seen by a physician in more than 14 years. At a health fair 1 year ago, he had a blood pressure check and blood and urine tests, but he did not return for a scheduled office examination. He came to the office at the request of his wife.

On physical examination, the blood pressure is 148/92 mm Hg, with no orthostatic changes; heart rate, 75/min; respiratory rate, 18/min; and temperature 37.8 °C (100 °F). There is no neck vein distention or hepatojugular reflux. The cardiac examination is normal. The left lower lung field shows increased fremitus, dullness to percussion, and scattered basilar crackles. No lower extremity edema is present. The electrocardiogram is normal. Hematocrit is 34%, and leukocytosis is present with a normal platelet count. The serum creatinine concentration is 2.3 mg/dL. Urinalysis shows a pH of 6.0, 1 + proteinuria, and no hematuria or ketonuria. No formed elements appear on microscopic examination.

What is the most important next step in determining the diagnosis of the decreased renal function in this patient?

A. Calculate the ratio of blood urea nitrogen to creatinine  
B. Obtain renal ultrasonography  
C. Obtain previous serum creatinine concentration and urinary protein excretion  
D. Obtain previous hematocrit  
E. Order radiography of the hands

Nephrology and Hypertension: Question 3

A 50-year-old previously healthy man presents with acute shortness of breath, right pleuritic chest pain, and pink sputum. He has no fever or chills. For the past month, he has noticed swelling of the ankles. He has had no prior symptoms of dyspnea on exertion, paroxysmal nocturnal dyspnea, or orthopnea. He has had no joint pain or skin rash. He takes no medications and does not smoke.
On examination, the patient is alert but in mild respiratory distress. Blood pressure is 152/100 mm Hg, pulse rate is 100/min, and respiratory rate is 22/min. There is no jugulovenous distention and no rash. The lungs are clear. Cardiac examination shows regular sinus rhythm, with no gallop, murmur, or rub. Abdominal examination shows no hepatosplenomegaly. The patient has 2+ to 3+ edema of the ankles and legs.

Laboratory studies:
- Leukocyte count 8500/μL
- Platelet count 200,000/μL
- Hemoglobin 14 g/dL
- Hematocrit 42%
- Blood urea nitrogen 18 mg/dL
- Serum creatinine 1.4 mg/dL
- Serum sodium 138 meq/L
- Serum chloride 105 meq/L
- Serum potassium 4.1 meq/L
- Serum bicarbonate 23 meq/L
- Serum total protein 5.9 g/dL
- Serum albumin 1.9 g/dL
- Serum cholesterol 300 mg/dL

Urinalysis: Specific gravity 1.015; 4+ proteinuria; oval fat bodies, granular casts, 3-5 erythrocytes/hpf
- 24-hour urine protein 10g
- Arterial blood gases pH 7.46; Po2 80 mm Hg; Pco2 33 mm Hg

Serum C3 80 mg/dL
Serum C4 25 mg/dL
Antinuclear antibodies Negative

Which renal disease is most likely in this patient?
A. Goodpastures syndrome
B. Membranous nephropathy
C. Wegener's granulomatosis
D. Lupus nephritis
E. Microscopic polyangiitis

Nephrology and Hypertension: Question 4
A 62-year-old man with a nonhealing diabetic ulcer is seen in the hospital for preoperative clearance. He has a 10-year history of diabetes, hypertension, and severe peripheral vascular disease. He receives Humulin N insulin twice daily (30 U every morning and evening); amlodipine, 10 mg/d; and aspirin, 81 mg/d.

On physical examination, body weight is 70 kg (154 lb), height is 160 cm (62”). Blood pressure is 140/90 mm Hg. No cardiopulmonary abnormality and no volume overload are detected. Two weeks earlier, his serum creatinine concentration was 1.4 mg/dL. Urinalysis reveals a specific gravity of 1.015, 1+ hematuria, no proteinuria, and no glucosuria.

What is the most appropriate method to evaluate this patient's renal function?
A. Measure the serum creatinine
B. Perform 24-hour urine collection to assess creatinine and volume
C. Perform technetium-99m-diethylene triamine pentaacetic acid renal flow scanning
D. Measure the fractional excretion of sodium
E. Estimate by using a creatinine-based formula
**Nephrology and Hypertension:** Question 5

Postoperatively, the preceding patient develops a fever, and pyuria is noted. Laboratory studies show a leukocyte count of 12,000/μL, a blood urea nitrogen level of 24 mg/dL, and a serum creatinine concentration of 1.4 mg/dL. The urine culture grows Escherichia coli, and treatment with trimethoprim-sulfamethoxazole is started. Three days later, the pyuria and fever have resolved. The leukocyte count is 10,000/μL, blood urea nitrogen level is 24, serum creatinine is 1.8 mg/dL. Urinalysis shows no leukocytes in high-power fields. What is the most likely explanation for the elevated serum creatinine concentration?
A. Acute interstitial nephritis
B. Acute pyelonephritis
C. Obstructive uropathy
D. Reduced creatinine excretion
E. Acute tubular necrosis

**Nephrology and Hypertension:** Question 6

You see the preceding patient again in your office 4 months later. He read in the newspaper about a medicine that prevents diabetic kidney disease and stroke. Urinalysis by dipstick is negative for protein. What is the best test to evaluate the patient's risk for diabetic nephropathy and cardiovascular disease?
A. Microalbumin-to-creatinine ratio
B. Serum protein electrophoresis
C. Urine amino acid levels
D. 24-hour urine total protein
E. Annual urine dipstick analysis

**Nephrology and Hypertension:** Question 7

A 56-year-old man with a 25-pack-year smoking history, distant cerebrovascular accident, and a 10-year history of hypertension treated with hydrochlorothiazide presents with generalized fatigue. Blood pressure is 110/70 mm Hg. Laboratory studies:
- Serum sodium: 128 meq/L
- Serum potassium: 3.3 meq/L
- Serum chloride: 79 meq/L
- Serum bicarbonate: 38 meq/L
Arterial blood gases on room air pH 7.50, PCO2 250 mm Hg, PO2 74 mm Hg. What condition best explains the acid-base disturbance?
A. Metabolic alkalosis induced by diuretic use
B. Respiratory acidosis induced by chronic obstructive pulmonary disease
C. Neurogenic-induced respiratory alkalosis
D. Primary hyperaldosteronism

**Nephrology and Hypertension:** Question 8

A 65-year-old man who is known to have alcoholism is transferred from a local jail to the hospital because of generalized weakness and a witnessed seizure 1 hour ago, shortly after he was arrested for vagrancy. In the emergency department, he is lethargic but conversant and oriented. He reports a several-day history of diarrhea and has muscle cramps. He has no history of trauma or previous seizures. He is taking no medications but has smoked 1 pack of cigarettes daily for the past 30 years. On physical examination, blood pressure is 110/75 mm Hg, pulse rate is 100/min, and respiratory rate is 18/min. The neck is supple, and the carotids are
normal. The lungs are clear, and cardiac examination shows regular sinus rhythm and a G1-2/6 systolic murmur at the base. The abdomen is soft, with bowel sounds; the edge of the liver is palpable, but the spleen is not. Cranial nerves are normal, and the patient has 3+ reflexes. Carpal pedal spasm is noted intermittently during examination, and Chvosteks sign is present.

Laboratory studies:

- **Leukocyte count**: 9500/μL
- **Hemoglobin**: 12 g/dL
- **Hematocrit**: 37%
- **Blood urea nitrogen**: 35 mg/dL
- **Serum creatinine**: 1.4 mg/dL
- **Serum sodium**: 136 meq/L
- **Serum potassium**: 2.7 meq/L
- **Serum chloride**: 98 meq/L
- **Serum bicarbonate**: 23 meq/L
- **Serum calcium**: 7.6 mg/dL
- **Serum magnesium**: 0.5 mg/dL
- **Serum phosphorus**: 3.0 mg/dL
- **Serum total protein**: 7.2 g/dL
- **Serum albumin**: 3.5 g/dL

**Urinalysis**: Specific gravity 1.025; no proteinuria or hematuria; 1-3 erythrocytes/hpf and 5-7 leukocytes/hpf

What is the most appropriate therapy for this patient's electrolyte disorder?

A. Intravenous magnesium sulfate
B. Intravenous magnesium sulfate and potassium chloride
C. Oral magnesium and potassium chloride
D. Intravenous potassium chloride
E. Intravenous calcium

---

**Nephrology and Hypertension: Question 9**

A 33-year-old obese woman has four healthy children from three previous uncomplicated term pregnancies. She has a strong family history of hypertension but has never had hypertension in the presence or absence of pregnancy. She was first seen for prenatal care by a physician 2 months after her last menstrual period. Her pregnancy had been uneventful, and she had gained 3.6 kg (8 lb). She was seen 3 months after her last menstrual period. Blood pressure was 158/94 mm Hg, and she had trace edema. Laboratory values at the time were as follows:

- **Hematocrit**: 33.4%
- **Blood urea nitrogen**: 9 mg/dL
- **Serum creatinine**: 0.4 mg/dL
- **Serum uric acid**: 3.1 mg/dL
- **24-hour urinary protein**: 100 mg
- **Creatinine clearance**: 150 mL/min

**Urinalysis**: Trace proteinuria by dipstick

The patient is seen 1 week later. Her blood pressure is 162/92 mm Hg. She has trace proteinuria, and laboratory values have not changed significantly.

What is the best course of action?

A. Start ramipril therapy
B. Start methyldopa therapy
C. Start atenolol therapy
D. Check her blood pressure in 1 week and advise the patient that better control of blood pressure will reduce her risk for preeclampsia
E. Advise termination of pregnancy
Nephrology and Hypertension: Question 10

A 66-year-old man has had a several-week history of fatigue and ankle swelling. His appetite is normal, but his body weight has increased 4.5 kg (10 lb). There is no history of exertional dyspnea, paroxysmal nocturnal dyspnea, or orthopnea. He has had hypertension for 10 years, and diabetes was diagnosed 4 months ago. He takes hydrochlorothiazide, 25 mg/d, and metoprolol, 50 mg/d.

On examination, the patient is alert and in no distress. Blood pressure is 120/75 mm Hg, pulse rate is 82/min, and temperature is 36.9 °C (98.4 °F). Skin examination is normal, and he has no jugulovenous distention. Thyroid examination is normal. The lungs are clear.

Cardiac examination shows regular sinus rhythm, with no murmur or gallop. The abdomen is slightly protuberant with shifting dullness, but no hepatosplenomegaly is noted. There is 4+ edema of the legs and thighs and 1+ edema of the sacrum.

Laboratory studies:
- Complete blood count: Normal
- Hemoglobin A1c: 7.4%
- Blood urea nitrogen: 20 mg/dL
- Serum creatinine: 0.9 mg/dL
- Serum sodium: 141 meq/L
- Serum chloride: 104 meq/L
- Serum potassium: 4.3 meq/L
- Serum bicarbonate: 30 meq/L
- Serum total protein: 4.4 g/dL
- Serum albumin: 1.7 g/dL
- Serum cholesterol: 376 mg/dL
- 24-hour urine protein: 8.5 g

Urinalysis: pH 5.5; specific gravity 1.020; protein 4+, trace hemoglobin

Urine microscopy shows many granular and hyaline casts and oval fat bodies.

Monoclonal protein is identified on urine immunoelectrophoresis. Plasma immunoelectrophoresis shows an IgG level of 452 mg/dL, IgA of 284 mg/dL, IgM of 122 mg/dL, K of 550 mg/dL, and 2 of 193 mg/dL with a homogenous M band.

What renal disease is most likely in this patient?
A. Idiopathic membranous glomerulopathy
B. Diabetic nephropathy
C. Focal and segmental glomerulosclerosis
D. AA amyloidosis
E. AL amyloidosi

Nephrology and Hypertension: Question 11

A 60-year-old woman with adult polycystic kidney disease is seen urgently in the office for high fever. The illness started abruptly and involves chills and dysuria. She has had hypertension for the past 5 years, treated with quinapril and hydrochlorothiazide. She has lost approximately 8 kg (17 lb) of weight over the last 3 months.

On physical examination, the patient appears thin and frail. Body weight is 48 kg (106 lb). Blood pressure is 90/70 mm Hg, pulse rate is 110/min, respiratory rate is 24/min, and body temperature is 39 °C (102 °F). The kidneys are palpable bilaterally, and she has right costovertebral angle tenderness.

Serum creatinine concentration is 1.1 mg/dL, and urinalysis shows pyuria and bacteriuria.

The patient is admitted and prescribed intravenous ampicillin and gentamicin to treat pyelonephritis.
Why does the dosage of antibiotic need to be adjusted in this patient?
A. The infection is in a cyst
B. The glomerular filtration rate is reduced
C. The patient is septic
D. The patient has hypertension

Nephrology and Hypertension: Question 12
After 2 weeks of therapy, the acute illness in the preceding patient has resolved. However, she continues to lose weight and has developed gross hematuria. Which of the following studies would you choose to rule out a renal cancer?
A. Intravenous pyelography
B. Ultrasonography
C. Anteroposterior and lateral radiography
D. Computed tomography
E. Renal flow scanning

Nephrology and Hypertension: Question 13
A 39-year-old nurse has recurrent calcium nephrolithiasis due to idiopathic hypercalciuria (24-hour urinary calcium excretion of 350 mg and sodium excretion of 250 meq). You prescribe a low-sodium (100 meq/d), low-oxalate, normal-calcium diet and start therapy with hydrochlorothiazide, 50 mg/d. Two months later, you obtain the following laboratory studies:
- Serum sodium: 138 meq/L
- Serum potassium: 2.9 meq/L
- Serum chloride: 110 meq/L
- Serum bicarbonate: 33 meq/L
- Arterial blood pH: 7.43
- 24-Hour urine studies:
  - Creatinine: 900 mg
  - Calcium: 290 mg
  - Oxalate: 45 mg
  - Uric acid: 540 mg
  - Citrate: 356 mg
  - Potassium: 45 meq
  - Sodium: 225 meq
  - pH: 4

What is the most likely cause of the persistent hypercalciuria?
A. Distal renal tubular acidosis
B. Hyperoxaluria
C. Noncompliance with the normal-calcium diet
D. Surreptitious laxative use
E. Noncompliance with the low-sodium diet

Nephrology and Hypertension: Question 14
In a patient with hypercalciuric nephrolithiasis, which of the following is associated with increased risk for stone formation?
A. Low-sodium diet
B. Low-calcium diet
C. Low-oxalate diet
D. Low-protein diet
E. Low-purine diet
**Nephrology and Hypertension: Question 15**

A 46-year-old man with chronic kidney disease secondary to biopsy-proven focal and segmental glomerulosclerosis returns for routine follow-up. The hematocrit is 28%, and potentially correctable causes of anemia have been excluded. Therapy with recombinant human erythropoietin is recommended.

In patients with chronic kidney disease and pre-end-stage renal disease, what is a benefit of therapy with erythropoietin to effectively treat anemia?

A. Reduced mortality  
B. Decreased cardiovascular event rates  
C. Normalization of hypertension  
D. Regression of left ventricular hypertrophy

**Nephrology and Hypertension: Question 16**

A 26-year-old woman with type 1 diabetes mellitus presents to the emergency department because of abdominal pain for the past 24 hours. Her temperature is 38°C (101 °F).

Laboratory studies:
- Blood urea nitrogen: 20 mg/dL
- Serum creatinine: 1.2 mg/dL
- Serum sodium: 133 meq/L
- Serum potassium: 3.9 meq/L
- Serum chloride: 97 meq/L
- Serum bicarbonate: 10 meq/L
- Serum glucose: 450 mg/dL
- Arterial blood gases: pH 7.2, PCO2 23 mm Hg
- Blood cultures: Negative
- Whole-blood lactate: 0.6 mmol/L

What condition best explains the patient’s acid-base status?

A. Diabetic ketoacidosis alone  
B. Diabetic ketoacidosis complicated by a proximal renal tubular acidosis  
C. Diabetic ketoacidosis complicated by sepsis  
D. Diabetic ketoacidosis complicated by respiratory acidosis

**Nephrology and Hypertension: Question 17**

A 31-year-old white woman with diabetes presents for management of her hypertension. She developed type 1 diabetes mellitus at 9 years of age and claims that the condition is under reasonable control. However, she knows that she has diabetic retinopathy and proteinuria. Her blood pressure had been elevated in the range of 140 to 150/90 mm Hg at the last three visits to her family physician. The patient does not smoke, drink alcohol, or use recreational drugs. She adheres to a no-added-salt diet. The only medication that she takes is insulin.

On examination, blood pressure is 152/90 mm Hg seated and 146/88 mm Hg standing. Body weight is 82 kg (181 lb). The examination is normal other than nonproliferative diabetic retinopathy.

What is the most appropriate antihypertensive therapy for this patient?

A. Dihydropyridine calcium channel blocker  
B. Angiotensin receptor blocker  
C. Angiotensin-converting enzyme inhibitor  
D. Intensified lifestyle modification
**Nephrology and Hypertension: Question 18**

Two weeks after therapy is initiated in the preceding patient, her blood pressure decreases from 150/90 mm Hg to 128/80 mm Hg, and she feels well. Repeated laboratory testing reveals an increase in serum creatinine concentration from 1.9 mg/dL to 2.1 mg/dL. The potassium concentration is 4.2 mg/dL.

Which of the following is the most appropriate course of action?

A. Discontinue antihypertensive therapy
B. Perform noninvasive screening for possible renal artery stenosis
C. Perform renal angiography
D. Continue antihypertensive therapy and monitor kidney function

**Nephrology and Hypertension: Question 19**

A 61-year-old woman with diabetes mellitus for 6 years is admitted with headache and disorientation. Her glucose level has been controlled by diet and exercise. Neurologic examination is nonfocal, volume status is normal, and serum creatinine concentration is 1.2 mg/dL. Mucormycosis sinusitis is diagnosed after noncontrast computed tomography and lumbar puncture studies. She is treated with amphotericin B for 9 days.

On physical examination, the patient is somnolent but arousable and in pain. The blood pressure is 124/72 mm Hg, with no orthostatic changes; pulse rate 75/min; respiratory rate 18/min; and temperature 37.8 °C (100 °F). There is no evidence of retinopathy. No neck vein distention or hepatogenous reflux is present. The cardiac examination is normal. The left lower lung field shows scattered basilar crackles. The abdominal examination is normal. No lower extremity edema is present. Cranial nerves are normal.

Laboratory studies:
- Blood urea nitrogen 32 mg/dL
- Serum creatinine 2.4 mg/dL
- Serum sodium 147 meq/L
- Serum potassium 3.2 meq/L
- Serum chloride 109 meq/L
- Serum bicarbonate 15 meq/L
- Serum glucose 255 mg/dL

Hematocrit is 34%, and leukocytosis is present with a normal platelet count. Urinalysis shows a pH of 7.0 and 1+ proteinuria, but no hematuria or ketonuria. Scattered epithelial cells and cellular casts appear in most high-power fields on microscopic examination.

What is the appropriate option at this point?

A. Obtain amphotericin level
B. Reduce dose of amphotericin
C. Administer liposomal amphotericin
D. Discontinue amphotericin therapy

**Nephrology and Hypertension: Question 20**

A 23-year-old woman with type 1 diabetes mellitus presents to the emergency department because of a 2-day history of dysuria and urinary frequency. She has no gross hematuria, fever, or chills. She states that 3 years ago, she had ‘cystitis’ twice in 6 months; in both occasions, she was treated with antibiotics. She uses insulin to control diabetes and takes 1 or 2 ibuprofen tablets daily for headaches.

On physical examination, the patient is alert and in no distress. Blood pressure is 115/80 mm Hg, pulse rate 80/min, and temperature 37.4 °C (99.3 °F). Optic funduscopy reveals microaneurysms. The neck is supple, the carotids are normal, and the lungs are clear.
Cardiac examination reveals regular sinus rhythm and no murmur or rub. Abdominal examination is normal. No lower extremity edema or ulcers are present. Neurologic examination demonstrates diminished sensitivity to pinprick and light touch in the lower extremities.

Laboratory studies:
Leukocyte count 8400/μL
Polymorphonuclear cells 70%
Lymphocytes 20%
Hematocrit 40%
Hemoglobin 13.8 g/dL
Serum creatinine 1.8 mg/dL (was 1.6 mg/dL 1 month ago)
Serum sodium 140 meq/L
Serum chloride 106 meq/L
Serum potassium 6.2 meq/L
Serum bicarbonate 23 meq/L
Urinalysis Specific gravity 1.020; 2+ glucosuria, 1+ hematuria, 3+ proteinuria, no ketonuria, 3+ leukocyturia; 25 to 50 leukocytes/hpf, 10 to 20 erythrocytes/hpf, broad casts.

On renal ultrasonography, the right kidney is 11.0 cm and the left kidney is 10.9 cm. No hydronephrosis or stones are present.

What is the most likely cause of this patient's hyperkalemia?
A. Diabetic ketoacidosis
B. Hyporeninemic hypoaldosteronism
C. Acute renal failure
D. High potassium diet

Nephrology and Hypertension: Question 21
A 47-year-old man with autosomal dominant polycystic kidney disease presents with a recurrent urinary tract infection despite therapy with ampicillin for Escherichia coli infection 3 weeks earlier, which was sensitive to all antibiotics tested. During that urinary tract infection, there was concern about an infected cyst, since the patient had right flank discomfort. The serum creatinine concentration was 1.0 mg/dL, and renal ultrasonography did not identify obstruction, stones, or abscess. Currently, the patient describes a 3- to 4-day history of dysuria without fever or pain. He is taking no medications and is allergic to ciprofloxacin.

On examination, the patient appears well and is afebrile. Physical examination is normal, without tenderness over either polycystic kidney.

Urine culture grew E. coli sensitive to ampicillin, trimethoprim-sulfamethoxazole, ciprofloxacin, gentamicin, and ceftriaxone.

What would you recommend for this patient's urinary tract infection?
A. Oral trimethoprim-sulfamethoxazole for several weeks
B. Oral ampicillin at an increased dosage and duration
C. Intravenous therapy with ceftriaxone and gentamicin
D. Indium-labeled leukocyte scanning to detect abscess in polycystic kidney disease

Nephrology and Hypertension: Question 22
A 24-year-old graduate student has a several-week history of aching pains in knees, ankles, and elbows and intermittent abdominal pain. Three days ago, he had two episodes of painless hematuria. He has no fever, chills, or weight loss. There is no history of hair loss, but he has had an intermittent, nonpruritic rash located below the knees bilaterally. There has been no recent upper respiratory infection. He takes acetaminophen occasionally for the aching joints. He has no history of kidney disease or intravenous drug use.
On examination, the patient appears well. Weight is 84.4 kg (186 lb). Blood pressure is 120/84 mm Hg, pulse rate is 70/min, and temperature is 37.2 °C (99 °F). No jugulovenous distention is present. The lungs are clear, and cardiac examination shows regular sinus rhythm with no murmur. On abdominal examination, the liver and spleen are not palpable, and no mass or tenderness is present. Pulses in the extremities are normal and there is no edema, but the patient has a petechial macular papular rash over the lower extremities.

Laboratory studies:
- Leukocyte count: 8400/μL
- Hemoglobin: 14.1 mg/dL
- Hematocrit: 41%
- Blood urea nitrogen: 12 mg/dL
- Serum creatinine: 1.1 mg/dL
- Serum sodium: 138 meq/L
- Serum chloride: 104 meq/L
- Serum potassium: 4.0 meq/L
- Serum bicarbonate: 26 meq/L
- Serum antinuclear antibody: Negative
- Serum C3: 85 mg/dL
- Serum C4: 21 mg/dL

Urinalysis: Specific gravity 1.030, pH 5.0, 1+ proteinuria, 4+ hematuria

Urine microscopy reveals many dysmorphic erythrocytes and erythrocyte casts. The lung fields are clear on chest radiography. Biopsy of skin lesion shows IgA deposition and leukocytoclastic change.

What is the most likely cause of renal disease in this patient?
A. Lupus nephritis
B. Acute post—streptococcal glomerulonephritis
C. Henoch-Schönlein purpura
D. Allergic interstitial nephritis
E. Goodpastures syndrome

**Nephrology and Hypertension: Question 23**

A 63-year-old factory worker presents with upper and lower extremity cramps and diffuse muscle weakness over the past 2 weeks. For the past 6 months, he has had low back pain that was sufficiently severe to cause him to miss work on three occasions. Buffered salicylate therapy relieved the pain somewhat.

Laboratory studies:
- Hemoglobin: 8 g/dL
- Hematocrit: 24%
- Platelet count: 106,000/μL
- Blood urea nitrogen: 10 mg/dL
- Serum creatinine: 1.0 mg/dL
- Serum sodium: 135 meq/L
- Serum potassium: 2.6 meq/L
- Serum chloride: 117 meq/L
- Serum bicarbonate: 15 meq/L
- Serum glucose: 88 mg/dL
- Serum calcium: 11 mg/dL

Arterial blood gases pH 7.30, PCO2 31 mm Hg

Measured serum osmolality: 277 mosmol/L

Urinalysis: Negative for albumin, dipstick positive for sulfosalicylic acid
What disease process best explains the patient's acid-base status?
A. Proximal renal tubular acidosis
B. Salicylate toxicity
C. Alcoholic-induced lactic acidosis
D. Ethylene glycol toxicity

Nephrology and Hypertension: Question 24
A 38-year-old black man presents for hypertension discovered during a pre-employment examination. He is healthy but has a family history of hypertension in both parents and two siblings. He has no history of cardiovascular disease and does not use tobacco, alcohol, or recreational drugs. He is taking no medications. The patient appears well. Height is 173 cm (68), body weight is 78 kg (172 lb), and blood pressure is 158/102 mm Hg seated and standing. The physical examination is otherwise normal. A complete blood count and electrolyte panel are normal. The serum creatinine concentration is 1.8 mg/dL, and urinalysis reveals 2+ proteinuria. Which is the most appropriate antihypertensive therapy for this patient?
A. Intensive lifestyle modification
B. Diuretic
C. Nondihydropyridine calcium channel blocker
D. Angiotensin-converting enzyme inhibitor

Nephrology and Hypertension: Question 25
A 58-year-old woman with a 4-year history of type 2 diabetes mellitus is evaluated in the emergency department for weakness. Six months ago, her serum creatinine concentration was 1.0 mg/dL. She now has polydipsia and polyuria. On physical examination, blood pressure is 120/60 mm Hg and heart rate is 98/min while supine; blood pressure is 108/50 mm Hg and heart rate was 112/min standing. The chest is clear, and cardiac examination is normal. The remainder of the examination is unremarkable.
Laboratory studies:
- Blood urea nitrogen: 32 mg/dL
- Serum creatinine: 1.6 mg/dL
- Serum sodium: 148 meq/L
- Serum potassium: 3.2 meq/L
- Serum chloride: 99 meq/L
- Serum bicarbonate: 19 meq/L
- Serum glucose: 405 mg/dL
- Urine creatinine: 35 mg/dL
- Urine sodium: 76 meq/L

Urinalysis: Specific gravity, 1.009; no hematuria; trace proteinuria; 1+ glucosuria; 1+ ketonuria

Microscopic urine examination was unremarkable.
Which statement is true regarding the evaluation of this patient with renal insufficiency?
A. The fractional excretion of sodium (FE Na) is incompatible with a diagnosis of prerenal azotemia
B. The FE Na is due to glycosuria
C. The history, physical examination, and laboratory evaluation are consistent with chronic renal insufficiency secondary to diabetic nephropathy
D. The FE Na is incompatible with a diagnosis of urinary tract obstruction
E. The FE Na is most reliable in evaluation of acute renal failure if oliguria is not present
Nephrology and Hypertension: Question 26
A 34-year-old woman presents to the emergency department because of recurrent episodes of palpitations, numbness of the hands, a generalized feeling of warmth, and muscle weakness. She has no chest pain or dyspnea. There is no history of weight loss, diarrhea, or vomiting. She does not smoke and drinks less than 1 ounce of alcohol per month. Graves’ disease was diagnosed 2 years ago and was treated with radioiodine; she now takes levothyroxine, 100 μg/d. She also takes paroxetine and norgestimate/ethinyl estradiol.

She has no family history of renal disease or diabetes. Cervical disc surgery was performed 1 year ago.

On examination, the patient is alert and oriented but is in mild distress from her symptoms. Blood pressure is 110/70 mm Hg, pulse rate 95/min, respiratory rate 15/min, temperature 36.7 °C (98 °F). No neck vein distention is present. The lungs are clear, and cardiac examination reveals regular sinus rhythm and no murmur. The abdomen is soft, without organomegaly or mass. In the lower extremities, pulses are normal and no edema is present.

Cranial nerves are intact. She has 2+ bilateral reflexes and mild generalized weakness but no Babinski reflex.

Laboratory studies:
- Complete blood count Normal
- Blood urea nitrogen 12 mg/dL
- Serum creatinine 0.9 mg/dL
- Serum sodium 138 meq/L
- Serum potassium 3.5 meq/L
- Serum chloride 103 meq/L
- Serum bicarbonate 24 meq/L
- Serum thyroid-stimulating hormone 3.2 mIU/L
- Serum calcium 9.2 mg/dL
- Serum magnesium 1.8 mg/dL
- Serum phosphorus 1.1 mg/dL (repeat, 0.9 mg/dL)
- Serum albumin 4.0 g/dL
- Serum glucose 98 mg/dL
- Arterial blood gases pH 7.4; PCO2 40 mm Hg

What is the most likely cause of this patient’s hypophosphatemia?
A. Hyperparathyroidism
B. Hyperventilation syndrome related to panic attacks
C. Renal phosphate wasting
D. Gastrointestinal malabsorption

Nephrology and Hypertension: Question 27
For the patient in the preceding question, what is the most appropriate treatment?
A. Magnesium oxide supplementation
B. Potassium phosphate supplementation
C. Reduction of levothyroxine dose
D. Daily use of a tranquilizer

Nephrology and Hypertension: Question 28
A 73-year-old frail white woman is seen for preoperative assessment of kidney function before aortic valve replacement. Body weight is 46 kg (101 lb). The serum creatinine concentration is 1.6 mg/dL, and results of urinalysis are normal.

In evaluating and classifying patients with chronic kidney disease, the National Kidney Foundation recommends estimating the patient’s glomerular filtration rate. Which of the following statements is true?
A. Measurement of serum creatinine is the best predictor of glomerular filtration rate, independent of the patient's age, body weight, and sex
B. Calculation of the timed 24-hour creatinine clearance is the clinical gold standard for estimating glomerular filtration rate, as it is simple and reproducible
C. Measurement of the clearance of 125I-iothalamate or inulin is the most accurate measurement of glomerular filtration rate and should be applied to all patients
D. The glomerular filtration rate should be estimated by using prediction equations (Cockcroft-Gault or Modification of Diet in Renal Disease) that take into account serum creatinine concentration, age, body weight, and sex

Nephrology and Hypertension: Question 29
A 25-year-old primigravida at 28 weeks of an uncomplicated pregnancy is found to have proteinuria and elevated blood pressure during a routine visit to her obstetrician. Her medical history is otherwise unremarkable, with no history of hypertension. She is admitted and delivers vaginally within 48 hours. Before delivery, her recorded blood pressure is 220/110 mm Hg while receiving clonidine and labetalol. She has had no seizure events. You are asked to see the patient 2 days postpartum to assist in managing persistently elevated blood pressure.

The patient's only symptom is mild frontal headache. She is alert and oriented, and she appears well. Blood pressure is 175/95 mm Hg, with no orthostatic changes; pulse rate is 84/min; respiratory rate is 18/min; and temperature is 38 °C (100.4 °F). She has no evidence of retinopathy. There is no neck vein distention or hepatocellular reflux. Cardiopulmonary examination is normal. No lower extremity edema is present.

You recommend increasing the dose of β-blocker and adding hydralazine. Blood pressure on day 3 postpartum is 130/75 mm Hg. You find the following laboratory studies in the chart:

<table>
<thead>
<tr>
<th></th>
<th>Postpartum day 2</th>
<th>Postpartum day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin</td>
<td>12.8 g/dL</td>
<td>11.0 g/dL</td>
</tr>
<tr>
<td>Platelet count</td>
<td>180,000/μL</td>
<td>120,000/μL</td>
</tr>
<tr>
<td>Serum glucose</td>
<td>89 mg/dL</td>
<td>97 mg/dL</td>
</tr>
<tr>
<td>Blood urea nitrogen</td>
<td>24 mg/dL</td>
<td>36 mg/dL</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>1.2 mg/dL</td>
<td>2.9 mg/dL</td>
</tr>
<tr>
<td>Serum sodium</td>
<td>134 meq/L</td>
<td>132 meq/L</td>
</tr>
<tr>
<td>Serum potassium</td>
<td>3.8 meq/L</td>
<td>4.2 meq/L</td>
</tr>
<tr>
<td>Serum chloride</td>
<td>99 meq/L</td>
<td>100 meq/L</td>
</tr>
<tr>
<td>Serum bicarbonate</td>
<td>24 meq/L</td>
<td>20 meq/L</td>
</tr>
</tbody>
</table>

You request a urine sample for microscopy, and the patient produces only 5 mL of blood-tinged urine. She comments that this is the first time she has urinated since last night. Urinalysis shows specific gravity of 1.009, positive dipstick hematuria, trace proteinuria, and small urobilinogen with no cellular casts.

What is the next appropriate step in management of this patient?
A. Aggressive intravenous saline infusion for volume repletion
B. Emergency renal ultrasonography to rule out obstructive uropathy
C. Repeat complete blood count and inspection of blood smear.
D. Two sets of blood cultures and ticarcillin-clavulanate therapy for empiric coverage of early sepsis.
E. Transfer to intensive care unit and start dopamine infusion

Nephrology and Hypertension: Question 30
A 67-year-old retired nurse presents because of a 6-month history of gradual-onset dementia. Aside from loss of recent memory and confusion about time and place, she has no symptoms or complaints. She has hypothyroidism that is treated with
levotyroxine, 100 μ/d, and hypertension treated with amlodipine, 5 mg/d. She also takes estrogen therapy. She has smoked 1 to 2 packs of cigarettes daily for the past 35 years, and she drinks less than 1 ounce of alcohol weekly. On examination, the patient's demeanor is pleasant. She is in no distress, but she is disoriented to time and place. Blood pressure is 142/88 mm Hg seated and 135/85 mm Hg, pulse rate 68/min, respiratory rate 12/min, temperature 37 °C (98.6 °F). There is no neck vein distention, and the carotids are normal. The lungs are clear. Cardiac examination reveals regular sinus rhythm, a grade 1/6 systolic murmur at the base, and no gallop. Abdominal examination is normal. There is no edema, and lower extremity pulses are present and normal. Neurologic examination is normal.

Laboratory studies:
- Complete blood count Normal
- Plasma glucose 84 mg/dL
- Blood urea nitrogen 6 mg/dL
- Serum creatinine 0.5 mg/dL
- Serum sodium 124 meq/L
- Serum potassium 4.2 meq/L
- Serum chloride 89 meq/L
- Serum bicarbonate 24 meq/L
- Serum thyroid-stimulating hormone 3.2 mIU/L
- Serum uric acid 2.3 mg/dL
- Serum cholesterol 182 mg/dL
- Serum triglyceride 60 mg/dL
- Serum total protein 7.5 g/dL
- Serum albumin 3.8 g/dL
- Serum osmolality 255 mosmol/kg H₂O

Urinalysis: Specific gravity 1.030; no hematuria or proteinuria

What is the most likely cause of this patient's hyponatremia?
A. Syndrome of inappropriate antidiuretic hormone secretion
B. Pseudohyponatremia
C. Surreptitious diuretic use
D. Cryptogenic cirrhosis
E. Psychogenic polydipsia

**Nephrology and Hypertension: Question 31**

A 54-year-old man is admitted with jaundice and edema. He has been healthy but has a 13-year history of habitual heavy alcohol use and intermittent binge drinking. He felt well until yesterday, when he experienced difficulty urinating and dysuria. On physical examination, the blood pressure is 122/72 mm Hg, without orthostatic changes; heart rate 98/min; respiratory rate 22/min; and temperature 38.8 °C (101.8 °F). Scleral icterus is present, but there is no neck vein distention or hepatojugular reflux. The cardiac and chest examinations are normal. The abdomen is distended, but there is no rigidity or rebound. Bilateral lower extremity edema is present. There is no asterixis.

Laboratory studies:
- Hematocrit 32%
- Leukocyte count Normal
- Platelet count Normal
- Blood urea nitrogen 24 mg/dL
- Serum creatinine 1.9 mg/dL
- Serum potassium 4.2 meq/L
- Serum chloride 99 meq/L
- Serum bicarbonate 25 meq/L
Direct bilirubin 6.5 mg/dL
Serum albumin 2.1 g/dL
Urine creatinine 105 mg/dL
Urine sodium 12 meq/L
Urinalysis pH 6.0; specific gravity, 1.023; trace proteinuria; no hematuria or ketonuria

Which of the following is true regarding the diagnosis of the decreased renal function in this patient?
A. The ratio of blood urea nitrogen to creatinine indicates chronic renal insufficiency
B. Renal ultrasonography is not necessary because the anemia is consistent with chronic renal disease
C. The urine electrolyte levels are diagnostic of the hepatorenal syndrome
D. Urine culture and sensitivity testing are critical to establishing the diagnosis of renal insufficiency
E. The response over the next several days to decreasing total body sodium overload and maximizing cardiac output will differentiate prerenal azotemia from the hepatorenal syndrome

Nephrology and Hypertension: Question 32
A 49-year-old man was well until 1 month ago, when he developed dyspnea, fatigue, decreased appetite, and cough that produces blood-tinged sputum. Three days ago, he had three episodes of frank hemoptysis. He has had no fever or chills. He has a 7-year history of hypertension and has been a smoker for 15 years. He takes no medications.

On examination, the patient is alert and in no distress but is pallid. Blood pressure is 155/88 mm Hg, pulse rate is 90/min, respiratory rate is 18/min, and temperature is 37 °C (98.6 °F). Skin examination is normal. Optic funduscopia shows mild sclerosis and constriction. The carotids and thyroid are normal. The pharynx is clear. Pulmonary examination reveals coarse crackles in the right mid-lung field. Cardiac examination shows regular sinus rhythm, with no gallop; S1 and S2 are normal. The abdomen is soft, with no organ enlargement. No redness or swelling of the joints is present.

Laboratory studies:
Leukocyte count 9200/μL
Hemoglobin 8.7 g/dL
Hematocrit 26%
Platelet count 443/μL
Serum creatinine 4.4 mg/dL (was 1.3 mg/dL 3 months ago)
Serum sodium 142 meq/L
Serum chloride 103 meq/L
Serum potassium 4.8 meq/L
Serum bicarbonate 21 meq/L
Serum total protein 6.3 g/dL
Serum albumin 3.7 g/dL
24-hour urine protein 3.5 g
Urinalysis 4+ proteinuria, 3+ hemoglobinuria

Urine microscopy shows 25 to 50 erythrocytes/hpf, 5 to 15 leukocytes/hpf, dysmorphic erythrocytes, and erythrocyte casts.
Kidney biopsy reveals proliferative glomerulonephritis, with 50% of glomeruli having crescents. Immunofluorescence shows linear staining with IgG.
What diagnostic term best describes the disease presentation in this patient?
A. Rapidly progressive glomerulonephritis
B. Nephrotic syndrome
C. Chronic renal failure
D. Acute tubular necrosis

**Nephrology and Hypertension: Question 33**
You suspect that the preceding patient has Goodpasture’s disease.
Which of the following tests would corroborate this syndrome?
A. Antinuclear antibody
B. c-ANCA
C. p-ANCA
D. Circulating antiglomerular basement antibody
E. Serum C3 and C4 levels

**Nephrology and Hypertension: Question 34**
A 39-year-old man who has been healthy presents to the emergency department with severe left flank pain and hematuria after participating in his company softball outing. The pain is sharp and radiates to the groin. He vomited eight times before presentation. He is found to have a nonobstructing, calcium-containing kidney stone at the ureteropelvic junction on the left side.
On presentation, blood pressure is 130/90 mm Hg and pulse rate is 110/min.
Laboratory studies:
- Blood urea nitrogen 24 mg/dL
- Serum creatinine 0.9 mg/dL
- Serum sodium 141 meq/L
- Serum potassium 4.0 meq/L
- Serum chloride 100 meq/L
- Serum bicarbonate 34 meq/L
- Urinary sodium 20 meq/L
- Urinary chloride 3 meq/L
- Urinary potassium 20 meq/L
Arterial blood gases pH 7.61, PCO2 36 mm Hg
What is this patient's acid-base disorder?
A. Metabolic alkalosis
B. Respiratory alkalosis
C. Metabolic and respiratory alkalosis
D. Metabolic and respiratory alkalosis, with hidden metabolic acidosis
E. Recognize a mixed acid-base disorder.

**Nephrology and Hypertension: Question 35**
The preceding patient is given intravenous infusion of 0.9% normal saline at 200 mL/h. Two days later, his flank pain worsens dramatically, but nausea and vomiting have resolved.
Blood pressure and pulse rate are unchanged.
Laboratory studies:
- Blood urea nitrogen 8 mg/dL
- Serum creatinine 0.9 mg/dL
- Serum potassium 4.0 meq/L
- Serum chloride 105 meq/L
- Serum bicarbonate 22 meq/L
Arterial blood gases pH 7.48, PCO2 30 mm Hg
What is the best therapy to resolve the alkalemia?
A. Increase infusion of 0.9% normal saline to 300 mL/h
B. Control the flank pain
C. Start treatment with acetazolamide, 125mg twice daily
D. Administer lactated Ringer's solution at 200 mL/h

Nephrology and Hypertension: Question 36
A 71-year-old man had non-Hodgkins lymphoma diagnosed 4 months ago. Treatment included chemotherapy with rituximab and cyclophosphamide, prednisone, and vinristine and doxorubicin, followed by radiation therapy. He has had persistent anemia. He has had hypertension for 15 years and prostatic hypertrophy, treated with doxazosin, for 10 years. He presents to the emergency department with polyuria, weakness, and lassitude.
On physical examination, blood pressure is 124/78 mm Hg, with no orthostatic changes; pulse rate, 96/min; respiratory rate, 18/min; and temperature 36.8 °C (98.2 °F). Mucous membranes are moist. There is no neck vein distention or hepatojugular reflux. The cardiac examination is normal, and the chest is clear. The abdomen is benign. No lower extremity edema is present.
The electrocardiogram is normal. Hematocrit is 31%, and leukocytosis is present, with a normal platelet count. The serum creatinine concentration, previously normal, is now 2.4 mg/dL. Urinalysis shows a pH of 6.0 and 1 + proteinuria, but no hematuria or ketonuria. No formed elements appear on microscopic examination. Urine sodium and osmolality values have been requested.
What is the most important next test to determine the reason for decreased renal function in this patient?
A. Calculate the ratio of blood urea nitrogen to creatinine
B. Perform renal ultrasonography
C. Perform renal scanning
D. Administer 1.5 L of normal saline as a fluid trial
E. Perform renal biopsy

Nephrology and Hypertension: Question 37
An 18-year-old white man is seen in your office because of blood on urine dipstick analysis during a sports physical. He has no history of gross hematuria, recent fever or chills, or upper respiratory illness. He has been in good health. He takes cetirizine for seasonal allergies. He has no family history of renal disease. Review of systems is negative. On examination, blood pressure is 140/98 mm Hg, weight is 80 kg (176 lb), and height is 170 cm (67'). He has a muscular build. The remainder of the physical examination is normal.
Repeated urinalysis at 2 p.m. reveals a pH of 5.0, specific gravity of 1.015, 2+ blood, 2+ protein.
Which test is the best option to assist in diagnosis?
A. Renal computed tomography
B. Renal ultrasonography
C. Cystoscopy
D. Magnetic resonance angiography of renal arteries
E. Urinary protein-to-creatinine ratio

Nephrology and Hypertension: Question 38
After the preceding patient undergoes kidney biopsy, the nurse calls your office to report gross hematuria that resolved spontaneously after two voids. The patient otherwise feels well. His vital signs are stable, and he is now voiding without difficulty. He has no flank pain.
What is the next step?
A. Reassure the patient
B. Obtain renal ultrasonography
C. Perform urinalysis
D. Admit for intravenous hydration
E. Place a Foley catheter for 72 hours

Nephrology and Hypertension: Question 39
A renal transplant recipient who has stable allograft function maintained with prednisone, mycophenolate mofetil, and cyclosporine A is seen for community-acquired pneumonia.
Which of the following antimicrobial therapies would be inappropriate and potentially harmful in a patient receiving cyclosporine?
A. Amoxicillin-clavulanate
B. Erythromycin
C. Cefuroxime axetil
D. Ciprofloxacin
E. Penicillin

Nephrology and Hypertension: Question 40
A 46-year-old man has recently moved to your community and presents for management of a 20-year history of hypertension. His previous physician told him he has had a low serum potassium concentration for several years. He took oral potassium chloride supplements in the past but is not taking them currently. He has irritable bowel syndrome and produces two semi-formed stools daily. He has no symptoms of cardiovascular disease. He currently takes amlodipine, 5 mg/d, for blood pressure control.
On examination, the patient is alert and healthy. He weighs 80 kg (176 lb). Blood pressure is 150/88 mm Hg, and pulse rate is 74/min. Optic funduscopy shows mild sclerosis and constriction. The lungs are clear, and the heart rhythm is regular, with no gallop or murmur. Abdominal examination is normal. Pulses in the lower extremities are normal, and no edema is present.
Laboratory studies:
Complete blood count Normal
Serum sodium 142 meq/L
Serum potassium 2.7 meq/L
Serum chloride 105 meq/L
Serum bicarbonate 30 meq/L
Urinalysis pH 5.0; specific gravity 1.020; dipstick negative for protein and blood
A 24-hour urine study yields the following data.
Creatinine 1200 mg
Sodium 100 meq
Potassium 82 meq
Calcium 200 mg
Microscopic examination of urine is normal.
What is the most likely cause of this patient’s hypokalemia?
A. Distal renal tubular acidosis
B. Primary hyperaldosteronism
C. Gitelman’s syndrome
D. Diarrhea
Nephrology and Hypertension: Question 41
A 48-year-old white male plumber transfers to your practice after a change of insurance status. His medical history is positive for primary hypertension without target organ damage. He has no history of renal or prostatic disease. Laboratory values obtained from his former primary care physician show normal results for blood urea nitrogen, serum creatinine, electrolytes, urinalysis, prostate-specific antigen, and electrocardiography. He takes the α-blocker doxazosin, 2 mg at bedtime.

On examination, blood pressure is 146/92 mm Hg seated and standing. Body weight is 84 kg (185 lb). The remainder of the examination is normal.

What is the appropriate course of action regarding the patient’s antihypertensive therapy?
A. Increase doxazosin to 4 mg
B. Advise high dietary intake of calcium and potassium
C. Discontinue doxazosin therapy and consider an alternative agent
D. Advise a low-sodium diet

Nephrology and Hypertension: Question 42
A 56-year-old man was admitted with fever, cough, chest pain, and leukocytosis. Evaluation revealed sputum with gram-positive diplococci, and radiography showed a right lower lobe infiltrate. Serum creatinine concentration was 0.9 mg/dL. He received intravenous penicillin, defervesced, and was sent home on the second hospital day with a prescription for a 10-day course of oral penicillin. The patient presents to your office 1 week later because he feels well but has anorexia and a rash on both legs.

On physical examination, the blood pressure is 130/90 mm Hg, with no orthostatic changes; pulse rate, 80/min; respiratory rate, 12/min; and temperature 39.0 °C (102.2 °F). There is no change in pulse rate on change in position. There is no neck vein distention or hepatojugular reflux. Cardiopulmonary examination is normal. No lower extremity edema is present. A diffuse erythematous macular rash is found on the volar aspects of both lower extremities from the ankles to the thighs.

Laboratory studies:
Hematocrit 39%
Leukocyte count 16,300/μL
Platelet count Normal
Blood urea nitrogen 46 mg/dL
Serum creatinine 3.4 mg/dL
Serum potassium 4.3 meq/L
Arterial blood gases pH 7.34, PCO2 32 mm Hg
Urinalysis pH 6.0, specific gravity 1.014, 1+ proteinuria, trace hematuria, no ketonuria
Urine microscopy 30 to 40 leukocytes/hpf

What is the most important next step in the evaluation of the decreased renal function in this patient?
A. Stop antibiotic therapy and obtain urine culture and sensitivities
B. Perform renal scanning
C. Obtain antineutrophil cytoplasmic antibody serology
D. Request nephrologic consultation for renal biopsy
E. Request nephrologic consultation for dialysis
**Nephrology and Hypertension: Question 43**

A 39-year-old male carpenter presents to the emergency department with a 4-hour history of gradually worsening right flank and right upper quadrant pain radiating to the right lower quadrant and into the right testicle. He vomits once shortly after arrival. He does not have fever or chills but has mild dysuria. On examination, the patient is restless because of pain. Blood pressure is 145/89 mm Hg, pulse rate is 92/min, and temperature is 37 °C (98.6 °F). Abdominal examination reveals mild right costovertebral angle tenderness, but no abdominal guarding. Genitalia are normal. The serum creatinine concentration is 0.9 mg/dL. Urinalysis shows a specific gravity of 1.025, 3+ hematuria, no proteinuria. Urine microscopy reveals more than 50 erythrocytes/hpf, 3 to 5 leukocytes/hpf, and occasional calcium oxalate crystals. You suspect that a renal stone is causing the colicky pain and hematuria.

What radiologic procedure is best to confirm the diagnosis?
A. Plain radiography of the abdomen
B. Intravenous pyelography
C. Renal ultrasonography
D. Noncontrast spiral computed tomography

**Nephrology and Hypertension: Question 44**

A 59-year-old woman presents because of a painful rash on the forehead for the past 24 hours. The medical history is significant for long-standing hypertension and subsequent renal transplantation with stable allograft function for the past 2 years. Medications include prednisone, mycophenolate mofetil, cyclosporine, and diltiazem. Examination shows an emerging vesicular rash encompassing the right forehead, without ocular involvement.

What is the most appropriate management plan?
A. Topical acyclovir ointment
B. Oral acyclovir, 200 mg five times daily
C. Oral acyclovir, 800 mg five times daily
D. Oral famciclovir, 500 mg three times daily
E. Intravenous acyclovir

**Nephrology and Hypertension: Question 45**

A 60-year-old woman with a history of essential hypertension is admitted to hospital after 7 days of severe vomiting. On presentation, she appears ill. The systolic blood pressure is 110 mm Hg seated and 70 mm Hg standing. The pulse rate while seated is 120/min. Abdominal examination reveals rebound tenderness and no bowel sounds. Laboratory studies:

- Blood urea nitrogen 90 mg/dL
- Serum creatinine 3 mg/dL
- Serum sodium 140 meq/L
- Serum potassium 3.2 meq/L
- Serum chloride 80 meq/L
- Serum bicarbonate 11 meq/L
- Serum glucose 90 mg/dL
- Arterial blood gases pH 7.29, PCO2 24 mm Hg

What state does the patient's acid-base status indicate?
A. Non-anion gap metabolic acidosis
B. Anion gap metabolic acidosis
C. Anion gap metabolic acidosis and metabolic alkalosis
D. Anion gap metabolic acidosis and respiratory alkalosis
Nephrology and Hypertension: Question 46
A 43-year-old woman presents with back pain and is evaluated for renal insufficiency. Infection with HIV was diagnosed 2 years ago, and the patient began taking highly active antiretroviral therapy with zidovudine, lamivudine, and indinavir 1 year later because of a decreasing CD4 count and development of oral candidiasis. Six months ago, she developed fasting hyperglycemia and hypercholesterolemia and was treated with rosiglitazone and atorvastatin. Physical examination reveals a blood pressure of 130/85 mm Hg and a pulse rate of 88/min that is regular, with no orthostatic changes. The respiratory rate is 18/min, and temperature is 37.8 °C (100 °F). There is no neck vein distention or hepatojugular reflux. The cardiac, pulmonary, and abdominal examinations are normal, but 2+ lower extremity edema is present.

Laboratory studies:
- Blood urea nitrogen 22 mg/dL
- Serum sodium 141 meq/L
- Serum potassium 6.0 meq/L
- Serum chloride 101 meq/L
- Serum bicarbonate 19 meq/L
- Serum creatinine 3.2 mg/dL
- Serum calcium 7.2 mg/dL
- Serum phosphate 8.3 mg/dL
- Serum uric acid 9.0 mg/dL
- Serum total cholesterol 177 mg/dL

Fasting blood glucose and glycosylated hemoglobin concentrations are elevated. Hematocrit is 31%, with an elevated mean corpuscular volume. Leukocyte count is 3300/μL, but platelet count is normal. Urinalysis reveals specific gravity 1.010, trace proteinuria, 2+ hematuria, and no ketonuria or glycosuria. Microscopic examination shows muddy brown casts and tubular epithelial cells, but no erythrocytes or crystalluria.

What is the most probable diagnosis?
A. Rhabdomyolysis caused by atorvastatin therapy
B. Indinavir nephrolithiasis
C. Indinavir tubulointerstitial renal disease and atrophy
D. HIV-associated nephropathy
E. Diabetic nephropathy

Nephrology and Hypertension: Question 47
In the preceding patient, what is the most appropriate first step in management after admission?
A. Discontinue atorvastatin and monitor
B. Discontinue indinavir and monitor
C. Request renal biopsy
D. Request plasmapheresis
E. Start angiotensin-converting enzyme inhibitor

Nephrology and Hypertension: Question 48
A 19-year-old woman has painless hematuria. Five days ago, she developed a sore throat, fever (temperature, 37.8 °C [100 °F]), and dry cough. Four days ago, she noted painless gross hematuria on two occasions. Six months ago, at the time of a college physical examination, she was told of microscopic hematuria and advised to have this rechecked. She does not use recreational drugs. She has taken acetaminophen for the past several days.

At presentation, the patients sore throat is improved and she no longer has fever. On
examination, she is alert and in no distress. Blood pressure is 135/85 mm Hg, pulse rate is 78/min, and temperature is 37 °C (98.6 °F). Skin examination is normal, and the fundi are normal. No exudate is present in the pharynx. Neck examination shows no significant lymphadenopathy. The lungs are clear. The heart is in regular sinus rhythm, with no murmur or rub. Abdominal examination is normal. The joints are normal.

Laboratory studies:
- Leukocyte count 9400/μL
- Hemoglobin 13.5 g/dL
- Hematocrit 39%
- Blood urea nitrogen 12 mg/dL
- Serum creatinine 1.0 mg/dL
- Serum antinuclear antibodies Negative
- Serum C3 90 mg/dL
- Serum C4 20 mg/dL
- Urine protein :creatinine ratio 0.5
- Urinalysis pH 5.5; specific gravity 1.012; trace proteinuria, 3+ hematuria
- Urine microscopy shows red blood cells, occasional red blood cell casts, and 1 to 3 leukocytes/hpf.

What is the most likely cause of renal disease in this patient?
A. Lupus nephritis
B. Post-streptococcal glomerulonephritis
C. Acute interstitial nephritis
D. IgA nephritis
E. Renal papillary necrosis

Nephrology and Hypertension:Question 49
A 58-year-old black woman presents for routine follow-up of diabetes mellitus and hypertension. She feels well but states that she stopped taking verapamil because of constipation. Current medications include glipizide, pravastatin, and aspirin; evidence of drug intolerance includes angiotensin-converting enzyme inhibitor cough. On examination, blood pressure is 156/92 mm Hg seated and standing. Except for the patient’s findings for background diabetic retinopathy, the remainder of the examination is normal. Recent laboratory values are a serum creatinine concentration of 1.6 mg/dL, 24-hour urinary protein excretion of 1.5 g/d, and creatinine clearance of 45 mL/min.

On the basis of recent evidence, what is the most efficacious therapy to slow the progression of the patient’s type 2 diabetic nephropathy?
A. Angiotensin-converting enzyme inhibitor
B. Angiotensin receptor blocker
C. Dihydropyridine calcium antagonist
D. α-Blocker

Nephrology and Hypertension:Question 50
A 31-year-old multiparous woman at 39 weeks of pregnancy is admitted in active labor with a breech presentation. She has had several episodes of nausea and vomiting in the past 3 days. She has no history of jaundice, alcohol abuse, or renal disease. Her prenatal care has been sporadic, and she had not seen a physician for 1 month before delivery. Preoperative laboratory studies are as follows:
- Hematocrit 36.9%
- Platelet count 168,000/μL
- Blood urea nitrogen 9 mg/dL
- Serum creatinine 1.7 mg/dL
Serum electrolytes  Normal
Serum glucose  45 mg/dL
Serum ALT  446 U/L
Serum AST  463 U/L
Serum total bilirubin  3.5 mg/dL
Serum direct bilirubin  2.5 mg/dL
Serum alkaline phosphatase  553 U/L
Serum lipase  83 U/L
Serum amylase  43 U/L

The patient undergoes cesarean section under general anesthesia. Estimated blood loss is 500 mL. She is given epinephrine, phenylephrine, meperidine, morphine, and fentanyl preoperatively. No perioperative hypotension is noted.

Postoperative urine output is 1.2 L. Five hours after surgery, she has vaginal hemorrhage. She undergoes transfusion and is given normal saline.

You are called to see the patient because of continued renal insufficiency. On physical examination, she is in no acute distress. Blood pressure is 112/72 mm Hg, with no orthostatic changes; pulse rate 140/min; respiratory rate 14/min; temperature 37.0°C (98.6 °F). She has scleral icterus. There is no neck vein distention or hepatojugular reflux. The cardiac examination is normal except for tachycardia. The pulmonary examination is normal. The abdomen is protuberant and soft, and bowel sounds are heard. Trace bilateral lower extremity edema is present.

Postoperative laboratory studies are as follows:
Hematocrit  27.9%
Leukocyte count  7400/μL
Platelet count  88,000/μL
Peripheral smear No schistocytes
Blood urea nitrogen  9 mg/dL
Serum creatinine  1.5 mg/dL
Serum electrolytes  Normal
Serum glucose  65 mg/dL
Serum ALT  240 U/L
Serum AST  210 U/L
Serum total bilirubin  2.5 mg/dL
Serum direct bilirubin  1.0 mg/dL
Serum alkaline phosphatase  250 U/L
Serum lipase  60 U/L
Serum amylase  35 U/L
Prothrombin time  15.2s
International normalized ratio  1.7
Partial thromboplastin time  44 s
D-Dimer  Positive
Plasma fibrinogen  78 μg/dL
Urine creatinine  45 mg/dL
Urine sodium  86 meq/L
Urinalysis pH 5; specific gravity 1.009; 2+ hematuria; no proteinuria, ketonuria or glucosuria. Urine microscopy Fine granular casts, rare erythrocytes

What is the most likely diagnosis?
A. Preeclampsia
B. Fatty liver of pregnancy
C. Pregnancy-associated microangiopathic hemolytic anemia
D. Acute cortical necrosis
E. Prerenal azotemia
Nephrology and Hypertension: Question 51
For the preceding patient, what is the indicated treatment?
A. Observation after immediate delivery
B. Plasma exchange
C. Peritoneal dialysis
D. Hemodialysis
E. Volume repletion

Nephrology and Hypertension: Question 52
A 45-year-old man is hospitalized after 5 days of severe diarrhea and anorexia. He has a history of renal failure secondary to chronic glomerulonephritis and received a living related renal transplant 2 years earlier. He takes cyclosporine, mycophenolate mofetil, and prednisone, as well as amiodipine to treat hypertension. He has had no rejection episodes or opportunistic infections. The remainder of his history is unremarkable.
On admission, blood pressure is 100/70 mm Hg and pulse rate is 100/min while supine; blood pressure is 80/50 mm Hg and pulse rate is 120/min while standing. Body temperature is 37.5°C (99.5 °F).
Physical examination reveals a thin man in no distress. Mucus membranes are dry, and neck veins are flat at 30-degree elevation. Cardiopulmonary examination is unremarkable except for resting tachycardia. Abdominal palpation reveals diffuse tenderness without peritoneal signs. No peripheral edema is present.
Laboratory studies:
- Blood urea nitrogen: 40 mg/dL
- Serum creatinine: 1.0 mg/dL
- Serum sodium: 134 mmol/L
- Serum potassium: 3.8 meq/L
- Serum chloride: 108 meq/L
- Serum bicarbonate: 16 meq/L
Which urinalysis results best correspond to this patient's condition?
Page 58
A. No protein, pH 7, specific gravity 1.005
B. No protein, pH 7, specific gravity 1.030
C. 1+ protein, pH 5, specific gravity 1.005
D. 1+ protein, pH 5, specific gravity 1.030
E. No protein, pH 5, specific gravity 1.005

Nephrology and Hypertension: Question 53
After appropriate therapy, the preceding patient improves and is discharged. Hyperlipidemia was diagnosed, and atorvastatin has been added to his medications. Five days after atorvastatin therapy is started, the patient develops severe muscle pain, malaise, and red urine.
What will urinalysis and microscopy usually reveal in a patient with myoglobinuria?
A. Positive for heme, red blood cells
B. Negative for heme, red blood cells
C. Positive for heme, no red blood cells
D. Positive for heme, red blood cell casts
E. Negative for heme, red blood cell casts
Nephrology and Hypertension:Question 54
A 63-year-old male executive with hypertension requests a conference with you to discuss the results of laboratory studies required by his company’s health insurers. The report states that he has 1+ proteinuria, a serum creatinine concentration of 1.6 mg/dL, and a calculated glomerular filtration rate of 48 mL/min, which are consistent with stage III chronic kidney disease. In doing his own research, the patient has come across the National Kidney Foundation’s efforts to publicize the increasing incidence and prevalence of chronic kidney disease. He requests more information from you on the prevalence of chronic kidney disease. Which of the following statements about chronic kidney disease in the United States is true?
A. Nearly 0.5 million patients have end-stage renal disease (i.e., requiring dialysis or transplantation)
B. Approximately 5% of the adult population has chronic kidney disease, as manifested by any combination of microalbuminuria, clinical proteinuria, or glomerular filtration rate less than 60 mL/min
C. Approximately 1.5 million adults have an elevated serum creatinine concentration of 1.5 mg/dL or greater
D. Approximately 3% of the adult population has abnormal urinary protein excretion, defined as microalbuminuria or clinical proteinuria

Nephrology and Hypertension:Question 55
A 17-year-old student presents with a 2-week history of periorbital and lower extremity swelling that developed over 3 to 4 days. The patient had been well until this point. He takes no medications and has no history of recreational drug use. On examination, blood pressure is 110/70 mm Hg, pulse rate is 92/min, and temperature is 37 °C (98.6 °F). Skin examination is normal. He has marked periorbital edema. No jugulovenous distention is present. The lungs are clear, and the heart is in regular sinus rhythm, with no murmur or gallop. The abdomen is nontender, and the liver and spleen are not palpable. Scrotal edema is present, as is 4+ edema of the legs and thighs.
Laboratory studies:
- Complete blood count Normal
- Blood urea nitrogen 25 mg/dL
- Serum creatinine 1.2 mg/dL
- Serum total protein 6.5 g/dL
- Serum albumin 2.0 g/dL
- Urine protein:creatinine ratio 18
- Urinalysis pH 6.0; specific gravity 1.020; 4+ proteinuria, trace hematuria; many hyaline, granular, and fatty casts
Renal biopsy shows 15 glomeruli. Light microscopy is normal. Immunofluorescence shows nonspecific staining for C3. Electron microscopy shows fusion of podocyte foot processes. What is the renal diagnosis in this patient?
A. Membranous nephropathy
B. Minimal change disease
C. Membranoproliferative glomerulonephritis
D. Focal and segmental glomerulonephritis
E. Alport’s disease

Nephrology and Hypertension:Question 56
A 63-year-old man is admitted with acute somnolence, disorientation, and right upper and lower extremity weakness. He has a 3-year history of renal insufficiency and congestive heart failure attributed to long-standing hypertension, which has
been poorly controlled in part because of poor adherence. On physical examination, the blood pressure is 160/96 mm Hg, pulse rate 110/min, respiratory rate 14/min, and temperature 38 °C (100.4 °F). There is three-fingerbreadth neck vein distention while sitting and hepatojugular reflux. Cardiac examination shows an S3 gallop; pulmonary examination reveals bilateral crackles. The abdomen is benign, and 2+ lower extremity edema is present. Right biceps and patellar reflexes are increased, and a right Babinski response is noted.

Laboratory studies:
- Hematocrit 33%
- Leukocyte count 10,700/μL
- Platelet count Normal
- Blood urea nitrogen 35 mg/dL
- Serum creatinine 2.3 mg/dL
- Serum sodium 128 meq/L
- Serum potassium 4.3 meq/L
- Serum chloride 93 meq/L
- Serum bicarbonate 16 meq/L
- Arterial blood gas pH 7.30, Pco2 33 mm Hg
- Urinalysis pH 6.0, specific gravity 1.014, 2+ proteinuria, no hematuria or ketonuria; no formed elements on microscopy
- Noncontrast computed tomography of the head shows only an ill-defined mass effect. Neurology and neurosurgical consultants request contrast computed tomography to more precisely demarcate the suspected tumor and thus pinpoint a site for biopsy or resection.

What is the most important next step to prepare this patient for a contrast study?
A. Administer acetylcysteine
B. Administer half-normal saline
C. Administer dopamine
D. Administer bicarbonate
E. Administer calcium channel blocker

**Nephrology and Hypertension:Question 57**
An 18-year-old male high school student presents to the emergency department with confusion, nausea, headache, and decreased vision after a camping trip. The patient’s friends state that he became ill 12 to 14 hours ago.

Laboratory studies:
- Blood urea nitrogen 14 mg/dL
- Serum creatinine 1.0 mg/dL
- Serum sodium 140 meq/L
- Serum chloride 100 meq/L
- Serum potassium 4 meq/L
- Serum bicarbonate 12 meq/L
- Serum glucose 108 mg/dL
- Measured serum osmolality 326
- Serum ketones Negative
- Serum lactate 0.7 meq/L
- Arterial blood gases pH 7.29, PCO2 26 mm Hg

What ingestion best explains the acid-base abnormalities?
A. Ethanol
B. Methanol
C. Isopropyl alcohol
D. Salicylate
**Nephrology and Hypertension:Question 58**

A 28-year-old woman presents for evaluation of recurrent kidney stones that she says ‘contain calcium.” She estimates that she has passed four stones during the past 4 years. She currently has no symptoms of renal colic. For several years, she has had dry eyes and dry mouth. She also describes symptoms of Raynauds phenomenon. Crohns disease was diagnosed 10 years ago; the patient is currently asymptomatic and passes one formed stool daily. She takes no medications. There is no family history of renal stone disease.

On examination, the patient is alert and healthy. Blood pressure is 115/74 mm Hg, pulse rate is 72/min, and temperature is 37 °C (98.6 °F). The skin is clear, and the joints are normal. The lungs are clear. Cardiac examination shows regular sinus rhythm and no murmur. The liver and spleen are not palpable, and the abdomen is not tender.

Plain abdominal radiography shows multiple calcifications overlying both renal shadows. Laboratory studies:

- Hemoglobin: 13.2 g/dL
- Hematocrit: 39%
- Leukocyte count: 7400/μL
- Blood urea nitrogen: 18 mg/dL
- Serum creatinine: 0.9 mg/dL
- Serum sodium: 138 meq/L
- Serum potassium: 2.8 meq/L
- Serum chloride: 109 meq/L
- Serum bicarbonate: 19 meq/L
- Serum calcium: 9.1 mg/dL
- Serum phosphorus: 3.2 mg/dL
- Urinalysis: pH 6.0; specific gravity 1.020; trace hematuria, no proteinuria
- Arterial blood pH 7.29

What is the most likely etiology of this patient's renal stone disease?

A. Idiopathic hypercalciuria
B. Primary hyperthyroidism
C. Distal renal tubular acidosis
D. Enteric hyperoxaluria

---

**Nephrology and Hypertension:Question 59**

A 49-year-old man is brought to the emergency department after being found unresponsive on a city street. His medical history is unknown.

The patient is comatose, with a Glasgow Coma Score of 3. Initial rectal temperature is 32 °C (89.6 °F), systolic blood pressure 70 mm Hg, respiratory rate 6/min, and pulse rate 120/min. Funduscopy shows no hemorrhage or papilledema. The patient has numerous superficial lacerations and ecchymoses on his extremities. There is no odor of alcoholic beverages. The remainder of the physical examination is unremarkable.

The patient is emergently intubated and supported aggressively with intravenous fluids. Shortly thereafter, the patients blood pressure increases to 207/131 mm Hg, requiring intravenous antihypertensive medication. Urine output is 100 to 200 mL/h. Results of noncontrast computed tomography of the head and portable chest radiography are normal.

Laboratory studies:

- Hematocrit: 41%
- Leukocyte count: 32,600/μL
- Platelet count: 422,000/μL
- Serum sodium: 151 meq/L
Serum potassium 5.3 meq/L
Serum chloride 112 meq/L
Serum bicarbonate 5 meq/L
Blood urea nitrogen 11 mg/dL
Serum creatinine 1.8 mg/dL
Serum glucose 152 mg/dL
Serum lactate 4.3 mmol/L
Serum osmolality 375 mosmol/kg H2O
Arterial blood gas pH 6.8, PaCO2 16 mm Hg, Po2 159 mm Hg, SaO2 99%
Urinalysis pH 5.0, specific gravity 1.012, trace glucosuria, moderate hematuria, trace ketonuria, proteinuria 100 mg/dL
Urinary microscopy Numerous erythrocytes
No salicylate, acetaminophen, or ethanol is detected on toxicology screening.
Intravenous infusion of bicarbonate is begun, and the patient is transferred to the medical intensive care unit. Repeated arterial blood gas analysis shows a pH of 6.8. What is the next most appropriate step in the management of this patient?
A. Continue bicarbonate supplementation and add insulin to control blood glucose
B. Initiate ethanol drip and hemodialysis
C. Institute plasma exchange to treat acidemia
D. Initiate ethanol drip and continue bicarbonate and insulin supplementation
E. Perform emergency contrast computed tomography of the abdomen and pelvis

Nephrology and Hypertension: Question 60
A 72-year-old white man returns for a follow-up visit subsequent to admission to another hospital for hypertension. He was seen in the local emergency department for severe musculoskeletal back pain, where the treating physician noted elevated blood pressure (200/92 mm Hg) and a serum creatinine concentration of 1.6 mg/dL. Results of other laboratory tests were normal. The patient was admitted for evaluation and management of back pain, and the attending physician obtained additional studies relating to the patient's hypertension.
Renal ultrasonography was negative for calculus, mass, or obstruction; kidney size was 11 cm on the right and 12 cm on the left. Renal artery duplex ultrasonography was suggestive of right renal artery stenosis. Renal angiography revealed a normal left renal artery and 50% stenosis in the right renal artery. Analysis of renal vein renin activity showed a low inferior vena cava value of 1.5 μg/L/h, right renal vein value of 2.0 μg/L/h, left renal vein value of 2.0 μg/L/h, and a high inferior vena cava value of 2.0 μg/L/h. The plasma renin activity is 1.0 mg/L/h, and the plasma aldosterone level is 8.0 ng/dL. The thyroid-stimulating hormone level is 1.0 μU/mL. Review of your office records confirms that the patient has a 22-year history of hypertension controlled with a β-blocker and diuretic therapy. The serum creatinine concentration has been stable at 1.6 mg/dL for more than 3 years, and urinalysis shows 1+ proteinuria.
What is the cause of this man's hypertension?
A. Primary hypertension
B. Hypothyroidism
C. Primary hyperaldosteronism
D. Renovascular hypertension
E. Pheochromocytoma
Nephrology and Hypertension: Question 61
A 28-year-old black woman has a 2-month history of arthralgia of knees, elbows, and hands and swelling of the lower extremities. She has noted increased fatigue. She takes no medications and has no history of drug abuse. Her only pregnancy, which occurred 1 year ago, ended in a spontaneous abortion at 4 months of gestation.

On examination, the patient is alert and in no distress. Blood pressure is 150/95 mm Hg, pulse rate 79/min, temperature 37.1 °C (98.8 °F). A malar rash is present on the skin. There is no jugulovenous distention. The lungs are clear, and the heart is in regular sinus rhythm, with no murmur or rub. The abdomen is nontender, and the organs are not palpable. The patient has 2+ pitting edema below the knees. She has no swelling or redness of the joints.

Laboratory studies:
- Leukocyte count: 4500/μL
- Hemoglobin: 11.5 g/dL
- Hematocrit: 35%
- Blood urea nitrogen: 30 mg/dL
- Serum creatinine: 1.9 mg/dL
- Serum antinuclear antibodies: <1.5
- Serum C3: 60 mg/dL
- Serum C4: 12 mg/dL
- Anti-double-stranded DNA antibodies: Positive
- 24-hour urine protein: 4.6 g
- Urinalysis: pH 6.0; specific gravity 1.010; 4+ proteinuria, 4+ hemoglobinuria

Urine microscopy shows many granular and erythrocyte casts, dysmorphic erythrocytes, and one mixed-cell cast.

What is the most likely diagnosis?
A. Post-streptococcal glomerulonephritis
B. Diffuse lupus nephritis (World Health Organization type IV)
C. Focal proliferative lupus nephritis (World Health Organization type II)
D. Polyarteritis nodosa
E. Rheumatoid arthritis with renal involvement

Nephrology and Hypertension: Question 62
What is the most appropriate treatment regimen for the renal disease in the preceding patient?
A. Prednisone and cyclophosphamide
B. High-dose prednisone
C. Mycophenolate mofetil
D. Cyclosporine and low-dose corticosteroids

Nephrology and Hypertension: Question 63
A 59-year-old man presents to the emergency department with a 3-day history of worsening weakness, decreased mental acuity and responsiveness, and slurred speech. The patient had been experiencing worsening weakness over the past 6 months.

The patient's medical history includes bipolar disorder (diagnosed 10 years ago) and hypothyroidism (diagnosed 5 years ago). His medications are lithium, 300 mg/d, and levothyroxine, 150 μg/d.

The patient is disoriented and lethargic, with slurred speech and periods of agitation. A fine tremor and hyperreflexia are present. On physical examination, supine blood pressure is 148/79 mm Hg, pulse rate 101/min, respiratory rate 16/min, temperature 37.7 °C (99.9 °F). While he is standing, his blood pressure is 142/80
mm Hg and heart rate is 108/min. The mucous membranes are dry, and the neck veins are flat. Cardiac, pulmonary, and abdominal examinations are normal. No lower extremity edema is noted.

Laboratory studies:
- Blood urea nitrogen 82 mg/dL
- Serum creatinine 9.2 mg/dL
- Serum sodium 162 meq/L
- Serum potassium 6.7 meq/L
- Serum chloride 131 meq/L
- Serum bicarbonate 17.2 meq/L
- Serum calcium 10.7 mg/dL
- Serum albumin 4.5 g/dL
- Serum lithium 4.5 meq/L
- Serum thyroid-stimulating hormone <0.08 μU/mL

Urinalysis: pH 7.5; specific gravity 1.007; 1+ proteinuria, no hematuria
- Urine microscopy: occasional cellular casts; 2 leukocytes/hpf
- Urine output: 4775 mL/24 h

Electrocardiography shows normal sinus rhythm and peaked T waves. Renal ultrasonography reveals normal echogenicity bilaterally, with a left kidney size of 9.9 cm and a right kidney size of 8.7 cm; no cyst, mass, or hydronephrosis is visualized.

What is the next step most appropriate in the management of this patient?
A. Begin intravenous infusion of normal saline for volume repletion
B. Administer 1 ampule of dextrose and 10 U of insulin intravenously for hyperkalemia
C. Transfer to the intensive care unit and perform emergent peritoneal dialysis
D. Begin intravenous infusion of half-normal saline followed by 80 mg of furosemide intravenously for hypercalcemia
E. Transfer to the intensive care unit and perform emergent hemodialysis

**Nephrology and Hypertension: Question 64**

A 32-year-old white woman with slowly progressive chronic kidney disease secondary to post-streptococcal glomerulonephritis is seen for routine follow-up. Her medical regimen includes dietary phosphorus restriction; oral calcium acetate, 667 mg three times daily with meals as a phosphorus binder; and ramipril, 10 mg/d.

The estimated glomerular filtration rate is stable, at 22 mL/min.

Laboratory studies:
- Serum creatinine 3.2 mg/dL
- Serum calcium 8.4 mg/dL
- Serum phosphorus 4.9 mg/dL
- Serum albumin 4.0 g/L
- Serum parathyroid hormone 256 pg/mL

What is the most appropriate management plan?
A. Add 1,25-dihydroxyvitamin D (calcitriol), to increase the serum calcium level to 9.5 to 10.5 mg/dL
B. Add calcium carbonate, 2 tablets with each meal
C. Add 1,25-dihydroxyvitamin D (calcitriol), to suppress parathyroid hormone to normal levels or below
D. Increase calcium acetate binder from two to three tablets three times daily with meals
E. Add 1,25-dihydroxyvitamin D (calcitriol), to suppress parathyroid hormone to two to three times the upper limit of normal
**Nephrology and Hypertension: Question 65**
A 39-year-old salesman is admitted for elective right inguinal hernia repair. He previously underwent left inguinal hernia repair. He has bipolar disorder, for which he takes lithium carbonate. He also takes a multivitamin daily. In preparation for surgery, he has received nothing by mouth for the previous 12 hours. He feels well but is thirsty.

On examination, the patient is alert and in no distress. Blood pressure is 135/85 mm Hg seated and standing, pulse rate 70/min, respiratory rate 12/min, temperature 36.9 °C (98.4 °F). No neck vein distention is present. The lungs are clear. Cardiac examination shows regular sinus rhythm and no murmur. Abdominal examination is normal. Right inguinal hernia is present. There is no lower extremity edema and no evidence of volume depletion.

Laboratory studies:
- Leukocyte count: 7800/μL
- Hemoglobin: 16.5 g/dL
- Hematocrit: 45%
- Blood urea nitrogen: 18 mg/dL
- Serum creatinine: 1.1 mg/dL
- Serum sodium: 150 meq/L
- Serum potassium: 4.5 meq/L
- Serum chloride: 112 meq/L
- Serum bicarbonate: 26 meq/L
- Serum glucose: 85 mg/dL

Urinalysis: Specific gravity 1.006; no proteinuria, hematuria, or cymuria

What is the cause of the elevated serum sodium level?
A. Syndrome of inappropriate antidiuretic hormone secretion
B. Renal concentrating defect
C. High dietary sodium intake
D. Fluid restriction

**Nephrology and Hypertension: Question 66**
A 24-year-old man who formerly used injection drugs is found to have a blood urea nitrogen concentration of 24 mg/dL, a serum creatinine concentration of 2.5 mg/dL, and a urine protein-to-creatinine ratio of 8. Tests are positive for HIV and negative for hepatitis B and C.

Renal ultrasonography shows kidneys of 11 cm right and 10.5 cm left. Renal biopsy is performed.

What is the most likely pattern of glomerular injury in this patient?
A. Minimal change disease
B. Membranous glomerulopathy
C. Membranoproliferative glomerulonephritis
D. Allergic interstitial nephritis
E. Collapsing focal and segmental glomerulosclerosis

**Nephrology and Hypertension: Question 67**
A 70-year-old woman is admitted because she has had malaise and anorexia for 1 week. She has been previously healthy, except for hypertension and hypercholesterolemia, treated with hydrochlorothiazide and atorvastatin.

On physical examination, the supine blood pressure is 150/95 mm Hg, pulse rate 80/min, respiratory rate 20/min, and temperature 37.4 °C (99.3 °F). The blood pressure is 125/80 mm Hg and the pulse rate 96/min while standing. There is no neck vein distention or hepatojugular reflux. Cardiac, breast, abdominal, and pulmonary examinations are normal. No lower extremity edema is present.
Laboratory studies:
Hematocrit 29%
Leukocyte count 3,200/μL
Platelet count 90,000/μL
Blood urea nitrogen 62 mg/dL
Serum creatinine 4.6 mg/dL
Serum sodium 134 meq/L
Serum potassium 5.0 meq/L
Serum chloride 114 meq/L
Serum bicarbonate 15 meq/L
Serum glucose 105 mg/dL
Serum calcium 12.5 mg/dL
Serum inorganic phosphate 8.5 mg/dL
Urine creatinine 25 mg/dL
Urinary sodium 50 meq/L
Urinalysis Specific gravity 1.007; trace proteinuria; no glucosuria or ketonuria
Arterial blood gas pH 7.30, PCO2 28 mm Hg
Microscopic analysis shows scattered tubular epithelial cells. Posteroanterior and lateral films of the chest are normal.

What is the most likely diagnosis?
A. Milk-alkali syndrome
B. Sarcoidosis
C. Multiple myeloma
D. Primary hyperparathyroidism
E. Clinical consequence of hydrochlorothiazide therapy

Nephrology and Hypertension: Question 68
What is the most important next step in confirming the diagnosis of the decreased renal function in the preceding patient?
A. Serum and urine protein immunoelectrophoresis
B. Measurement of circulating 25-hydroxycholecalciferol level
C. Measurement of angiotensin-converting enzyme level
D. Measurement of N-terminal parathyroid hormone level
E. Urine toxicology screen

Nephrology and Hypertension: Question 69
A 69-year-old white man is referred for worsening hypertension over the past 2 to 3 months. He has had hypertension for the past 18 months. It had been controlled by β-blocker therapy, which was begun after he had an inferior myocardial infarction. A recent blood pressure measurement was 200/120 mm Hg, requiring additional therapy with amlodipine. His medical history is significant for the myocardial infarction and a right femoral popliteal bypass. He smokes two packs of cigarettes daily and drinks alcohol socially.
On examination, blood pressure is 178/104 mm Hg seated and standing, and body weight is 72 kg (159 lb).
Optic funduscopy reveals background hypertensive retinopathy. A left carotid bruit is heard.
Cardiopulmonary and neuromuscular examinations are normal. Abdominal examination showed no organomegaly, but an epigastric bruit is present. No peripheral edema is noted.
Serum creatinine concentration is 2.3 meq/dL, and serum potassium concentration is 3.9 mg/dL. Urinalysis shows 1+ proteinuria without hematuria. Electrocardiography is positive for left ventricular hypertrophy.
What is the most appropriate noninvasive screening test for possible renal artery stenosis in this patient?
A. Magnetic resonance angiography with gadolinium
B. Computed tomographic angiography with contrast
C. Captopril renography
D. Captopril plasma renin activity test

Nephrology and Hypertension: Question 70

A 66-year-old woman is hospitalized after a right hip fracture requiring open reduction and internal fixation. She received intravenous hydration through postoperative day 3. On presentation, her blood pressure was 160/90 mm Hg. Three years earlier, her blood pressure at a routine office visit was 128/82 mm Hg. The patient is discharged on postoperative day 4 to an inpatient extended care center. On postoperative day 10, a consultation is obtained to help manage her persistent hypertension. Her only medication is celecoxib.

Laboratory studies:

<table>
<thead>
<tr>
<th></th>
<th>Value at presentation</th>
<th>On postoperative day 2</th>
<th>On postoperative day 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td>160/90 mmHg</td>
<td>180/104 mmHg</td>
<td>160/95 mmHg</td>
</tr>
<tr>
<td>Serum sodium</td>
<td>141 meq/L</td>
<td>142 meq/L</td>
<td>141 meq/L</td>
</tr>
<tr>
<td>Serum potassium</td>
<td>3.0 meq/L</td>
<td>2.4 meq/L</td>
<td>2.9 meq/L</td>
</tr>
<tr>
<td>Serum chloride</td>
<td>100 meq/L</td>
<td>98 meq/L</td>
<td>99 meq/L</td>
</tr>
<tr>
<td>Serum bicarbonate</td>
<td>31 meq/L</td>
<td>32 meq/L</td>
<td>32 meq/L</td>
</tr>
<tr>
<td>Arterial blood gas pH</td>
<td>7.46</td>
<td>7.46</td>
<td>7.46</td>
</tr>
</tbody>
</table>

What condition best explains the patient's status?
A. Essential hypertension
B. Pheochromocytoma
C. Hypertension induced by use of nonsteroidal anti-inflammatory drugs
D. Primary hyperaldosteronism

Nephrology and Hypertension: Question 71

A 34-year-old pregnant woman with a 5-year history of biopsy-diagnosed hypertensive nephropathy has been followed in obstetric clinic for 3 months after her last menstrual period. One year ago, her serum creatinine concentration was 1.6 mg/dL. Her pregnancy has been uneventful. Her blood pressure has been well controlled on a combination of methyldopa and hydralazine and is currently 130/85 mm Hg. She has trace edema.

Laboratory studies:

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematocrit</td>
<td>37%</td>
</tr>
<tr>
<td>Leukocyte count</td>
<td>Normal</td>
</tr>
<tr>
<td>Platelet count</td>
<td>Normal</td>
</tr>
<tr>
<td>Peripheral smear</td>
<td>No schistocytes</td>
</tr>
<tr>
<td>Blood urea nitrogen</td>
<td>14 mg/dL</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>1.8 mg/dL</td>
</tr>
<tr>
<td>Serum uric acid</td>
<td>4.9 mg/dL</td>
</tr>
<tr>
<td>Urinalysis</td>
<td>Specific gravity, 1.010; urinary protein 4+ by dipstick; no glucosuria, hematuria, or ketonuria</td>
</tr>
<tr>
<td>Microscopic urine examination</td>
<td>Shows rare broad casts. Liver function tests are normal.</td>
</tr>
</tbody>
</table>

Which one of the following statements about the patient's course is true?
A. She has developed preeclampsia.
B. The course is most consistent with progression of her chronic renal disease.
C. She has developed microangiopathic hemolytic anemia.
D. She has developed prerenal azotemia.
E. Her blood pressure is likely to improve during the course of her pregnancy.
**Nephrology and Hypertension: Question 72**

A 55-year-old man presents with malaise, anorexia, and weight loss of 10 kg over 3 months. Physical examination reveals a thin man in no distress. Blood pressure is 140/90 mm Hg, pulse rate is 88/min, and body temperature is 37 °C. He has temporal wasting, normal findings on cardiopulmonary examination, no hepatosplenomegaly, and 1+ edema of the ankles.

**Laboratory studies:**
- Hemoglobin 8.5 g/dL
- Serum creatinine 2.0 mg/dL
- Serum sodium 134 mmol/L
- Serum chloride 110 mmol/L
- Serum bicarbonate 22 mmol/L
- Serum calcium 11.0 mg/dL
- Total protein 9 g/dL
- Serum albumin 3.0 g/dL
- Serum total cholesterol 150 mg/dL
- Urinalysis: No protein

Which state is most likely present?
A. Normal proteinuria
B. Heavy albuminuria
C. Nonalbumin proteinuria
D. Normal immunoglobulin light chain excretion

**Nephrology and Hypertension: Question 73**

A 61-year-old woman with a previously normal serum creatinine concentration is admitted with abdominal pain. Abdominal aortic aneurysm was diagnosed after an intravenous contrast study, and the patient underwent emergency aneurysmectomy. On the third hospital day, in the intensive care unit, the patient was oliguric. She was given an intravenous furosemide infusion but was still oliguric several hours later. On physical examination, the blood pressure is 90/62 mm Hg, with no orthostatic changes; pulse rate 115/min; respiratory rate 22/min; and temperature 36.8 °C (98.2 °F). Three-fingerbreadth neck-vein distention at 45 degrees and hepatojugular reflux are present. Cardiac examination shows an S3 gallop. There are scattered bibasilar rales.

The abdomen has a fresh surgical scar. Bowel sounds are not heard, and there is diffuse tenderness. The patient has 2+ lower extremity edema. She is arousable but somnolent and moves all extremities in response to commands. She complains of dyspnea.

**Laboratory studies:**
- Hematocrit 37%
- Leukocyte count: Leukocytosis
- Platelet count: Low
- Blood urea nitrogen 75 mg/dL
- Serum creatinine 4.4 mg/dL
- Serum sodium 130 meq/L
- Serum potassium 6.3 meq/L
- Serum chloride 90 meq/L
- Serum bicarbonate 16 meq/L
- Arterial blood gas pH 7.26, Pco2 25 mm Hg, Po2 65 mm Hg
- Urinalysis: pH 6.0, specific gravity 1.009, 2+ proteinuria, no hematuria or ketonuria

There are muddy brown casts on microscopic examination. The electrocardiogram shows prominent, peaked T waves.
What is the next step in treatment of this patient with acute renal failure?
A. Administer fenoldopam
B. Start ultrafiltration
C. Start continuous venovenous hemofiltration
D. Start peritoneal dialysis
E. Initiate plasma exchange

Nephrology and Hypertension:Question 74
Which of the following statements is true regarding glomerular disease in HIV infection?
A. It occurs equally in all races
B. It may progress rapidly to end-stage kidney disease
C. Ultrasonography of the kidneys typically shows small echogenic kidneys
D. There is no therapy for this disease

Nephrology and Hypertension:Question 75
A 56-year-old black man with diabetic nephropathy is seen in clinic for routine follow-up. Laboratory studies:
- Serum calcium: 9.6 mg/dL
- Serum phosphorus: 6.0 mg/dL
- Serum parathyroid hormone: 387 pg/mL
- Serum albumin: 3.9 g/dL
- Serum creatinine: 2.6 mg/dL
- Estimated glomerular filtration rate: 38 mL/min
Because the patient has adhered to a phosphate-restricted diet, phosphate binder therapy with calcium acetate, 667 mg, two tablets three times daily with meals is begun. Three weeks later, repeated calcium and phosphorus measurements are 11.9 mg/dL and 5.4 mg/dL, respectively.
What would be the most appropriate action?
A. Refer for parathyroidectomy as definitive therapy for secondary hyperparathyroidism
B. Discontinue calcium acetate therapy and avoid use of phosphate binders in the future
C. Discontinue calcium acetate therapy and, once calcium normalizes, start sevelamer therapy as a non-calcium-based phosphate binder
D. Discontinue calcium acetate and, once calcium normalizes, restart phosphate binder therapy with aluminum hydroxide

Nephrology and Hypertension:Question 76
A 40-year-old man has recurrent nephrolithiasis due to idiopathic hypercalciuria. He has had more than 40 calcium oxalate stones in the past 5 years. He is started on hydrochlorothiazide therapy and a low-sodium diet. During treatment, his 24-hour urinary calcium concentration decreases from 385 mg/d to 180 mg/d. No new stones have formed in the past 6 months; however, hypokalemia has developed (serum potassium level, 2.9 meq/L).
Taking the hypokalemia into account, what therapy should the patient receive for hypercalciuric stone disease?
A. High-potassium diet plus hydrochlorothiazide
B. Acetazolamide plus hydrochlorothiazide
C. Magnesium oxide plus hydrochlorothiazide
D. Amiloride plus hydrochlorothiazide
**Nephrology and Hypertension: Question 77**

A 52-year-old man is referred by his primary care physician for hypertension and hypokalemia over the past 6 months. Blood pressure and routine chemistries were normal last year at the time of an executive physical. He has no history of cardiovascular disease, stroke, or renal disease. Family history is negative for hypertension. He uses alcohol socially and does not smoke but chews tobacco. He takes no medications regularly.

On examination, the patient weighs 77 kg (168 lb). Blood pressure is 164/102 mm Hg seated and standing. Except for trace pedal edema, the remainder of examination is normal.

The primary care physician provides the following laboratory values:

- Blood urea nitrogen: 21 mg/dL
- Serum creatinine: 0.9 mg/dL
- Serum sodium: 141 meq/L
- Serum potassium: 3.1 meq/L
- Serum chloride: 100 meq/L
- Serum bicarbonate: 28 meq/L

A 24-hour urine test during salt loading reveals the following values:

- Creatinine: 1.1 g
- Sodium: 252 meq
- Potassium: 128 meq

The daily aldosterone excretion rate is 6 mg (normal, 5 to 15 mg), plasma renin activity is 1 μg/L/h, and plasma aldosterone level is 9 ng/dL.

Which diagnostic test would you order next?

A. Computed tomography of the adrenal glands
B. Serum cortisol and urinary free cortisol measurement
C. Magnetic resonance angiography with gadolinium
D. Adrenocorticotropic hormone stimulation test

---

**Nephrology and Hypertension: Question 78**

A 62-year-old woman with coronary artery disease and atherosclerotic peripheral vascular disease is hospitalized because of pain in her left leg. She has had hypertension for 17 years and hypercholesterolemia for 13 years, both of which are well controlled by various medications.

On physical examination, the pulse rate is 90/min and regular, and blood pressure is 148/94 mm Hg. The chest is clear. No murmurs or gallops are heard. The abdomen is not tender. There is trace bilateral lower extremity edema. The left leg is cooler than the right, and no popliteal or dorsalis pedis pulse is detected. Blood urea nitrogen is 29 mg/dL, and serum creatinine is 1.4 mg/dL. Urinalysis shows a specific gravity of 1.018, trace protein, and no glucose or ketones. Microscopic examination of the urine is normal.

The patient undergoes arteriography with a limited amount of iopamidole and receives acetylcysteine and hydration. Laboratory tests are ordered for the next day. On physical examination, her pulse rate is 98/min and regular, and blood pressure is 142/90 mm Hg. Chest, abdominal, and cardiac examinations are normal. The lower extremities are unchanged.

Laboratory studies:

- Blood urea nitrogen: 43 mg/dL
- Serum creatinine: 1.9 mg/dL
- Serum sodium: 141 meq/L
- Serum potassium: 3.7 meq/L
- Serum chloride: 100 meq/L
- Serum bicarbonate: 21 meq/L
Urinalysis: Specific gravity 1.009; trace proteinuria; no glucosuria, ketonuria, or hematuria;
Urine microscopy: Tubular epithelial cells, rare granular casts.
Which of the following should be done?
A. Administer dopamine
B. Administer bicarbonate
C. Administer half-normal saline and readminister acetylcysteine
D. Start dialysis to clear contrast medium
E. Observe for complications of acute renal failure

Nephrology and Hypertension: Question 79
A 42-year-old man develops the nephrotic syndrome and hypertension. Renal biopsy shows changes consistent with idiopathic focal and segmental glomerulosclerosis. At the time of biopsy, serum creatinine is 2.2 mg/dL, 24-hour urine protein is 9 g, total cholesterol is 360 mg/dL, triglycerides are 450 mg/dL, low-density lipoprotein cholesterol is 168 mg/dL, and high-density lipoprotein cholesterol is 32 mg/dL. Despite a 6-month trial of high-dose steroid therapy, proteinuria does not decrease, and the patient continues to be nephrotic. Blood pressure is controlled with furosemide and ramipril.
Which of the following is true regarding the hyperlipidemia in this patient?
A. Hyperlipidemia is a marker for responsiveness to cyclosporine therapy
B. Hyperlipidemia is harmless in nephrotic syndrome
C. Hyperlipidemia should be treated with a statin
D. Hyperlipidemia can usually be corrected by a low-cholesterol diet

Nephrology and Hypertension: Question 80
A 19-year-old man with known epilepsy that had been well controlled with phenytoin therapy is brought to hospital by emergency medical personnel. His roommate called while witnessing a tonic-clonic generalized seizure. The roommate informed the medical technicians that the patient had stopped taking phenytoin about 3 weeks earlier. The emergency medical personnel witnessed a second seizure shortly before arrival at the emergency department.
On presentation, the patient is postictal and his airway is patent.
Laboratory studies:
- Serum sodium: 140 meq/L
- Serum potassium: 4.0 meq/L
- Serum chloride: 104 meq/L
- Serum bicarbonate: 10 meq/L
- Serum creatine kinase: 45 U/L
- Arterial blood gases: pH 7.05, Pco2 38 mm Hg
Phenytoin is administered, and intravenous hydration is begun. The patient is controlling his own secretions.
In terms of the patient’s acid-base status, what is the most appropriate course of action?
A. Start mechanical ventilation
B. Administer 0.45% intravenous fluids, 75 mL/h
C. Observe
D. Administer acetazolamide, 125 mg twice daily
E. Administer 2 ampules of intravenous bicarbonate
Nephrology and Hypertension: Question 81
Why is hypomagnesemia associated with hypocalcemia?
A. Hypomagnesemia causes a shift of calcium into bone
B. Hypomagnesemia inhibits the secretion and action of parathyroid hormone
C. Hypomagnesemia causes renal calcium wasting
D. Hypomagnesemia impairs the peripheral actions of vitamin D

Nephrology and Hypertension: Question 82
A 58-year-old nun comes to your office because of lethargy, mild nausea, and weakness for the past 2 weeks. Three years ago, pulmonary sarcoidosis was diagnosed by biopsy. Three months ago, the patient began taking oral calcium (1500 mg/d) and 25-hydroxyvitamin D as treatment for osteoporosis that was diagnosed by screening bone density testing. She has chronic hypertension that is well controlled with metoprolol, 50 mg/d.

On examination, the patient appears thin but well nourished and is in no distress. She is oriented to time, date, and place. Blood pressure is 140/80 mm Hg, pulse rate 80/min, temperature 37 °C (98.6°F). The thyroid is normal, and the neck veins are not distended. The lungs are clear. Cardiac examination shows regular sinus rhythm, no murmur, and normal first and second heart sounds. The abdomen is not tender, the liver and spleen are not palpable, and no mass is present. There is no edema in the lower extremities, and reflexes are 1+ and symmetrical.

Laboratory studies:
- Hemoglobin 13.8 g/dL
- Hematocrit 38%
- Leukocyte count 5600/μL
- Blood urea nitrogen 24 mg/dL
- Serum creatinine 2.2 mg/dL (was 1.0 mg/dL 3 months ago)
- Serum sodium 141 meq/L
- Serum potassium 4.4 meq/L
- Serum chloride 105 meq/L
- Serum bicarbonate 24 meq/L
- Serum calcium 12.8 mg/dL
- Serum phosphorus 3.5 mg/dL
- Serum parathyroid hormone 18 pg/mL
- Urinalysis pH 5.5; specific gravity 1.010; no proteinuria, hematuria, or glucosuria; no cells on microscopy

Serum and urine immunoglobulins showed no monoclonal protein. A polyclonal increase in IgG is present. Renal ultrasonography demonstrates no hydronephrosis and no calculi.

What is the most likely cause of this patient's acute renal failure?
A. Myeloma kidney
B. Acute interstitial nephritis
C. Hypercalcemia
D. Acute glomerulonephritis
E. Bilateral renal artery stenosis

Nephrology and Hypertension: Question 83
For the patient in the preceding question, what is the most appropriate treatment of the hypercalcemia?
A. Administer hydrochlorothiazide
B. Stop oral calcium and vitamin D treatment
C. Refer for surgical parathyroid exploration
D. Start a high-sodium diet
**Nephrology and Hypertension: Question 84**
A 47-year-old man calls Monday morning seeking help with “the worst headache ever” Friday night and Saturday. The headache was associated with severe lethargy and intermittent confusion. He recovered and has felt well for the past 24 hours. He states that he does not have fever or neurologic or cardiovascular symptoms. His medical history is significant for hypertension and recurrent urinary tract infections related to his known autosomal dominant polycystic kidney disease. He is concerned because his father died of a stroke during dialysis. The serum creatinine concentration is 2.6 mg/dL.

What do you recommend for this patient?
A. Make an office appointment for him to see you this week
B. Arrange a consultation with the neurology/headache clinic
C. Order computed tomography of the head without contrast
D. Arrange urgent magnetic resonance angiography of the head

**Nephrology and Hypertension: Question 85**
A 35-year-old man had HIV infection diagnosed 2 months ago. His serum creatinine concentration was 0.6 mg/dL. Treatment with highly active antiretroviral therapy with zidovudine, lamivudine, and abacavir was recommended, but he wished to wait before starting treatment. He is brought to clinic by a friend who states that the patient has had fever, confusion, and disorientation for 1 day. Physical examination reveals blood pressure 110/70 mm Hg and pulse rate 100/min that is regular supine and standing. The chest is clear, without cardiac murmur or gallop, and the abdomen is normal. Moderate bilateral lower extremity edema is present.

Laboratory studies:
- Hemoglobin: 7.8 g/dL
- Leukocyte count: 10,200/μL
- Platelet count: 19,000/μL
- Blood urea nitrogen: 37 mg/dL
- Serum creatinine: 2.7 mg/dL
- Serum sodium: 136 meq/L
- Serum potassium: 5.2 meq/L
- Serum chloride: 99 meq/L
- Serum bicarbonate: 22 meq/L
- Urinalysis: Specific gravity 1.030; 3+ hematuria, trace proteinuria, trace ketonuria, no glucosuria
- Urinary microscopic examination: shows a few erythrocytes, but no erythrocyte casts.
- The lactate dehydrogenase level is elevated. Peripheral blood smear shows many schistocytes.

What is the most likely cause of this patient’s renal failure?
A. Thrombotic thrombocytopenic purpura
B. HIV-associated nephropathy
C. Surreptitious ingestion of antiretroviral drugs
D. Outpatient acute tubular necrosis
E. HIV-associated immune-mediated glomerulonephritis

**Nephrology and Hypertension: Question 86**
A 64-year-old black woman has had hypertension for 25 years. On therapy, her blood pressure has been in the range of 140 to 160/95 to 100 mm Hg. She presents for blood pressure management. Review of past laboratory data shows that the serum creatinine concentration was 1.2 mg/dL 10 years ago, 1.7 mg/dL 5 years ago, 2.0 mg/dL 1 year ago, and 1.9 mg/dL 2 months ago. Recent urinalysis shows...
2+ proteinuria, no hematuria, and occasional granular and hyaline casts. Urine protein:creatinine ratio is 0.5. Renal ultrasonography shows no hydronephrosis with kidney sizes at 9.5 cm bilaterally.

On examination, body weight is 84 kg (185.2 lb) and temperature is 36.9 °C (98.4°F). Blood pressure is 148/96 mm Hg in both arms. Optic funduscopy shows moderate arteriolar sclerosis and constriction.

No jugulovenous distention is present. The lungs are clear. Cardiac examination shows regular sinus rhythm, S4 but no S3, and no murmur. There is no edema of the extremities.

What is the most likely cause of this patient’s renal disease?

A. Membranous glomerulopathy
B. Obstructive uropathy
C. IgA nephritis
D. Nephrosclerosis
E. Obesity-related glomerular disease

Nephrology and Hypertension: Question 87

A 64-year-old man is admitted with a 5-day history of lethargy and mild confusion. He is known to have alcoholic cirrhosis, nonbleeding esophageal varices, and ascites. There is no history of recent alcohol consumption, melena, or hematemesis. He has no abdominal pain and had not fallen. He takes a 2-g sodium diet and multivitamins daily. On examination, the patient is lethargic and confused to time and place but not date. Blood pressure is 110/70 mm Hg, pulse rate 87/min, temperature 36 °C (96.8 °F). Icteric sclerae and spider angiomata are present. The neck veins are not distended. The lungs are clear, with decreased breath sounds at both bases. Cardiac examination reveals regular sinus rhythm and no gallop or rub. The abdomen is protuberant but nontender, with a shifting dullness; the liver is not palpable. The lower extremities have 1 + ankle edema. Asterixis is present, but the patient has no focal neurologic signs.

Laboratory studies:
- Hemoglobin 11.5 g/dL
- Hematocrit 32%
- Leukocyte count 5400/μL
- Platelet count 84,000/μL
- Blood urea nitrogen 20 mg/dL
- Serum creatinine 1.2 mg/dL
- Serum sodium 114 meq/L
- Serum potassium 4.1 meq/L
- Serum chloride 80 meq/L
- Serum bicarbonate 28 meq/L
- Serum total protein 6.9 g/dL
- Serum albumin 2.5 g/dL
- Cholesterol 186 mg/dL
- Serum osmolality 241 mosmol/kg H2O
- Urine osmolality 200 mosmol/kg H2O
- Spot urine sodium 10 meq/L

What is the cause of this patient’s hyponatremia?

A. Nonosmotic stimulation of antidiuretic hormone
B. Hepatorenal syndrome
C. Low-sodium diet
D. Reset osmostat
E. Pseudohyponatremia
Nephrology and Hypertension:Question 88
A 38-year-old man with a history of idiopathic focal and segmental glomerulosclerosis developed end-stage renal disease and subsequently underwent a cadaveric renal transplant 28 months ago. He presents to your office for a routine follow-up visit. His transplantation was uncomplicated, without delayed graft function or clinically apparent acute rejection episodes. His immunosuppression regimen consisted of prednisone, cyclosporine, and azathioprine. His serum creatinine concentration on discharge was 1.4 mg/dL. He was given colchicine for a gouty attack 4 months ago.

At a follow-up clinic appointment 3 months ago, his blood pressure was elevated, and his serum creatinine concentration was 1.7 mg/dL. The urinary protein-to-creatinine ratio was less than 0.3. He was given diltiazem for better control of blood pressure. His immunosuppressive regimen remained unchanged.

At the current visit, physical examination reveals a mild tremor and blood pressure of 150/90 mm Hg. Cardiac, pulmonary, and abdominal examinations are unremarkable. There is no tenderness at the transplant site, and the patient has trace bilateral edema.

Laboratory studies:
- Serum creatinine: 2.2 mg/dL
- Serum uric acid: 12 mg/dL
- Urinalysis: Specific gravity 1.010; trace proteinuria; no glucosuria, hematuria, or ketonuria
- Urine microscopy: Few broad casts, scattered renal epithelial cells
- Urine protein-to-creatinine: 0.4
- Urine uric acid-to-creatinine: 0.6

What is the most likely cause of this patient's current renal dysfunction?
- A. Transplant renal artery stenosis
- B. Recurrent focal and segmental glomerulosclerosis
- C. Cyclosporine toxicity
- D. Uric acid nephropathy
- E. Polyoma virus nephropathy

Nephrology and Hypertension:Question 89
A 21-year-old man presents for a preemployment examination. He feels well and takes no medications. He does not smoke, and he drinks 1 ounce of alcohol weekly. His medical history is significant for bilateral vesicoureteral reflux at birth that required surgical correction on one side. He was treated for urinary infection at 6 years of age. He has had no follow-up since then.

On examination, the patient appears healthy. He weighs 78 kg (172 lb). Blood pressure is 140/85 mm Hg, pulse rate is 70/min, and temperature is 37° C (98.6° F). There is no jugulovenous distention, and the fundi are normal. The lungs are clear. The heart is in regular sinus rhythm, with no murmur or gallop. The abdomen is soft, with no organ enlargement. There is no edema of the extremities.

Laboratory studies:
- Complete blood count: Normal
- Blood urea nitrogen: 24 mg/dL
- Serum creatinine: 1.9 mg/dL
- Serum sodium: 140 meq/L
- Serum chloride: 100 meq/L
- Serum potassium: 4.6 meq/L
- Serum bicarbonate: 23 meq/L
- Urine protein:creatinine ratio 0.4
- Urinalysis: Specific gravity 1.015; 4+ proteinuria, 1+ hematuria
Urine microscopy shows many granular casts, 5 to 7 erythrocytes/hpf, and occasional leukocytes. Renal ultrasonography shows a 7.5-cm right kidney and 8.0-cm left kidney. There is no hydronephrosis.

What is the most likely cause of this patient's renal disease?
A. Focal and segmental glomerulosclerosis
B. Membranous glomerulopathy
C. Minimal change disease
D. Nephrosclerosis

**Nephrology and Hypertension: Question 90**
In the preceding patient, what is the most likely mechanism for his renal disease?
A. Nephron loss with subsequent glomerular hyperfiltration
B. Immune complex deposition from urinary infection
C. Recurrent asymptomatic urinary infection
D. Hypertension

**Nephrology and Hypertension: Question 91**
Which of the following statements about microalbuminuria is true?
A. Microalbuminuria is a predictor of cardiovascular risk only in patients with diabetes
B. Microalbuminuria is present when the “spot” urine albumin-to-creatinine ratio is greater than 500 mg/g
C. Microalbuminuria is a cardiovascular risk factor independent of traditional Framingham risk factors
D. To be of clinical value, microalbuminuria must be measured in a timed 12- to 24-hour sample

**Nephrology and Hypertension: Question 92**
A 63-year-old man is hospitalized with chest pain. The patient has had hypercholesterolemia for 10 years and hypertension for 8 years. He has been treated most recently with atorvastatin, furosemide, and losartan. His last serum creatinine concentration as an outpatient 2 months ago was 0.9 mg/dL. Evaluation in the cardiac care unit with coronary angiography revealed right and left coronary artery disease, and he underwent emergent percutaneous angioplasty and stenting of the involved coronary arteries. During the procedure, he developed chest pain, and a dissection of the right coronary artery was noted, along with acute increased ST-segments in the inferior leads. He underwent immediate coronary artery bypass. On the day after the procedure, he is alert and oriented. His pulse rate is 106/min supine and 108/min seated. Blood pressure is 96/70 mm Hg supine and 100/75 mm Hg seated. Neck vein distention is not noted when the patient is lying flat, and there is no hepatojugular reflux. The chest is clear. No murmur or gallop is present. The abdomen lacks rebound and rigidity. There is no abdominal bruit and no sacral or lower extremity edema. Distal pulses and the skin of the lower extremity digits are normal.

Laboratory studies:
- Blood urea nitrogen: 30 mg/dL
- Serum creatinine: 1.9 mg/dL
- Serum sodium: 145 meq/L
- Serum potassium: 3.4 meq/L
- Serum chloride: 109 meq/L
- Serum bicarbonate: 21 meq/L
- Urinalysis: Specific gravity 1.013, trace proteinuria, trace ketonuria, no glucosuria
- Urine microscopy: Rare tubular cells, muddy brown casts, cellular debris
- Urinary sodium: 36 meq/L
Urinary creatinine 13 mg/dL
Urine osmolality 110 mosmol/kg H2O

What is the correct therapy?
A. Administer endothelin antagonist
B. Administer insulin-like growth factor
C. Administer low-dose dopamine
D. Administer thyroxine
E. Observe

Nephrology and Hypertension: Question 93

A 49-year-old woman presents with a 4-week history of low-grade fever, fatigue, and occasional reddish brown urine. She has had no vomiting or nausea. There is no history of joint pain or skin rash. For the past 5 years, she has received total parenteral nutrition because of a surgical complication requiring almost total removal of both small and large intestine. During this time, her serum creatinine has been 0.6 to 0.9 mg/dL, and urinalysis has been normal. She drinks 2 to 3 L of fluid daily and has a daily ostomy output of 2 to 3 L.

On examination, the patient is alert but fatigued. She weighs 58 kg (128 lb). Blood pressure is 100/85 mm Hg, pulse rate is 92/min, and temperature is 38 °C (100.4 °F). There is no jugulovenous distention. The lungs are clear, and the heart is in regular sinus rhythm, with no murmur or gallop. Abdominal examination shows well-healed surgical scars. No edema of the extremities or skin rash is present. The ostomy looks clean, and the central line is clean, without signs of infection.

Laboratory studies:
- Leukocyte count \( 9500/\mu L \)
- Polymorphonuclear cells 87%
- Lymphocytes 10%
- Eosinophil 3%
- Hemoglobin 11 g/dL
- Hematocrit 31%
- Platelet count 190,000/\( \mu L \)
- Blood urea nitrogen 38 mg/dL
- Serum creatinine 3.6 mg/dL
- Serum antinuclear antibodies Positive, 1:160
- Anti-double-stranded DNA antibodies Negative
- Serum C3 90 mg/dL
- Serum C4 10 mg/dL
- Urine protein:creatinine ratio 1.8
- Urinalysis 3+ proteinuria, 3+ hematuria
- Urine microscopy shows many dysmorphic red blood cells and red blood cell casts.
- Urine culture has no growth. Blood cultures are positive for Staphylococcus epidermidis

What is the most likely cause of this patient’s renal disease?
A. Lupus nephritis
B. Acute tubular necrosis
C. IgA nephritis
D. Infection-associated glomerulonephritis
Nephrology and Hypertension: Question 94
What is the most appropriate initial treatment for a patient with a nonobstructing radiolucent stone in the right renal pelvis?
A. Hydrochlorothiazide
B. Low-sodium diet
C. Allopurinol
D. Oral sodium bicarbonate or potassium citrate
E. Extracorporeal shock-wave lithotripsy

Nephrology and Hypertension: Question 95
A 49-year-old woman is hospitalized because of weakness and diarrhea. The diarrhea began 2 days ago, in association with coryza, myalgias, and fever. She has a 4-year history of hypertension that is treated with valsartan. She had taken ibuprofen for tendinitis until the morning of admission. Her renal function was previously normal. On physical examination, the supine blood pressure is 122/72 mm Hg, pulse rate 98/min, respiratory rate 22/min, and temperature 39.6 °C (103.2 °F). While standing, the blood pressure is 90/60 mm Hg and pulse rate is 116/min. There is no neck vein distention or hepatojugular reflux. Cardiac and chest examinations are normal. The abdomen is diffusely tender, but there is no rigidity or rebound and no organomegaly. Gynecologic and rectal examinations show no mass or tenderness; stool is negative for occult blood. The rest of the examination is normal.

Laboratory studies:
Hematocrit 32%
Leukocyte count 13,400/μL
Platelet count 200,000/μL
Blood urea nitrogen 50 mg/dL
Serum sodium 143 meq/L
Serum potassium 5.9 meq/L
Serum chloride 99 meq/L
Serum bicarbonate 21 meq/L
Urine creatinine 185 mg/dL
Urine sodium 6 meq/L
Urinalysis pH 6.0; specific gravity 1.023; no hematuria, proteinuria, or ketonuria
Urinary microscopy No formed elements, casts, or debris
Which action is NOT appropriate in the treatment of this patient with acute renal failure?
A. Discontinue valsartan
B. Discontinue ibuprofen
C. Obtain renal ultrasonography
D. Administer normal saline
E. Administer acetylcysteine
ANSWERS

Nephrology and Hypertension: Question 1
The correct answer is B

Educational Objectives
Recognize the superiority of therapy with an angiotensin receptor blocker over a traditional β-blocker cardiovascular morbidity and mortality in treating patients with primary hypertension and electrocardiographic evidence of left ventricular hypertrophy.

Critique
Most previous antihypertensive trials that demonstrated reductions in cardiovascular morbidity and mortality were based on a “stepped-care” approach using diuretics and β-blockers. The recent Losartan Intervention For Endpoint Reduction in Hypertension Study compared the angiotensin receptor blocker losartan with the β-blocker atenolol in patients with primary hypertension who had evidence of left ventricular hypertrophy. Despite similar reductions in blood pressure between the groups, losartan recipients had fewer primary cardiovascular events (death, myocardial infarction, and cerebrovascular accident), experienced a lower rate of new-onset diabetes mellitus, and tolerated the medication with fewer side effects. These data suggest that the newer class of angiotensin receptor blockers (losartan) reduces cardiovascular morbidity and mortality more than does an established antihypertensive drug (atenolol).

However, losartan is not formally recommended as first-line monotherapy by the Sixth Joint National Committee.

Doxazosin is incorrect because the α-blocker arm of the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial was truncated owing to more cardiovascular events (especially congestive heart failure) in doxazosin recipients than diuretic recipients. Hydralazine is not recommended as monotherapy.

Nephrology and Hypertension: Question 2
The correct answer is C

Educational Objectives
Diagnose acute renal failure.

Critique
Although many evaluations remain to be performed to establish a diagnosis in this patient with a decreased glomerular filtration rate, the first step must be to determine whether he has a history of renal insufficiency. This allows the clinician to distinguish between acute and chronic renal failure. Although information indicating normal renal function 1 year ago may not enhance diagnostic accuracy, a previously elevated serum creatinine concentration can establish the diagnosis of chronic renal disease. Ultrasonography provides information on size and symmetry of the kidneys and detects hydronephrosis; however, renal ultrasonography may be abnormal in the presence of a slightly decreased glomerular filtration rate due to chronic renal disease. The ratio of blood urea nitrogen to creatinine is not diagnostic. The previous hematocrit may suggest chronic renal disease, but it is nondiagnostic. Abnormal radiographs of the hands suggesting hyperparathyroidism can establish the diagnosis of chronic renal disease, but the meaning of a normal radiograph would be unclear in this case.
Nephrology and Hypertension: Question 3
The correct answer is B

Educational Objectives
Know about the thromboembolic complications associated with membranous glomerulopathy.

Critique
Nephrotic syndrome of any cause can be associated with venous thromboembolism, although idiopathic membranous and diffuse lupus nephritis are the most commonly associated renal diseases. The exact cause for the increased occurrence of thromboemboli in the nephrotic syndrome is unknown, but many patients have low levels of antithrombin III, in part due to urinary losses. This patient has membranous nephropathy. The lack of antinuclear antibodies and the C3 and C4 levels argue against a diagnosis of lupus. Goodpasture’s syndrome and Wegener’s granulomatosis rarely produce severe nephrotic syndrome, and typical pulmonary infiltrates are lacking. Microscopic polyangiitis is not associated with the nephrotic syndrome.

Nephrology and Hypertension: Question 4
The correct answer is E

Educational Objectives
Recognize the appropriate method for evaluation of renal function.

Critique
The National Kidney Foundation, in the guideline Kidney Disease Quality Outcomes Initiative, defines and suggests therapies for patients with chronic kidney disease. The staging of chronic kidney disease is based on the glomerular filtration rate. The estimated glomerular filtration rate is therefore paramount for correct diagnosis and treatment. To eliminate error and ensure widespread availability, the National Kidney Foundation suggests using creatinine-based formulae to estimate the glomerular filtration rate, such as the Cockcroft-Gault formula. The serum creatinine concentration alone is not recommended for estimation of the glomerular filtration rate, but accurate measurement of serum creatinine is crucial. This concentration represents the balance between production of creatinine, which is relatively constant, and elimination through glomerular filtration, tubular secretion, and nonrenal pathways (usually negligible in healthy persons). Muscle mass; comorbid conditions, such as malnutrition; and amputations can cause the serum creatinine concentration and the glomerular filtration rate to diverge. A 24-hour urine collection may be useful in selected groups; however, daily and diurnal variation in creatinine excretion and problems with collection can cause error in the estimate of glomerular filtration rate. Technetium-99m-diethylenetriamine pentaacetic acid scanning is a reliable test for glomerular filtration rate but is not widely available. The fractional excretion of sodium is not useful in estimating the glomerular filtration rate.

Nephrology and Hypertension: Question 5
The correct answer is D

Educational Objectives
Recognize interference of drug therapy with laboratory testing of renal function.

Critique
Trimethoprim and other organic cations, such as cimetidine, competitively inhibit creatinine secretion in the distal tubule. Although acute interstitial nephritis can occur secondary to treatment with trimethoprim-sulfamethoxazole, it is less commonly seen in the absence of other systemic allergic symptoms, such as rash and fever. Acute pyelonephritis is not likely, given that systemic symptoms resolved.
Obstructive uropathy can occur; however, it causes the glomerular filtration rate to decrease and, therefore, the blood urea nitrogen level would also be elevated. Unlike aminoglycosides or amphotericin B, trimethoprim has not been associated with acute tubular necrosis.

**Nephrology and Hypertension: Question 6**

_The correct answer is A_

**Educational Objectives**

Recognize the urine dipstick threshold for the lower limit of detection of albumin.

**Critique**

Excretion of an abnormally high amount of albumin on a daily basis has been correlated with increased risk for overt nephropathy and cardiovascular disease in diabetic and nondiabetic patients. The urine dipstick test does not detect albumin excretion until it reaches a level of 300 to 500 mg/d. Therefore, specific testing for lower amounts of albumin excretion must be performed. The Council on Diabetes Mellitus of the National Kidney Foundation recommends yearly screening for microalbuminuria and treatment with an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker if possible. The risk for microalbuminuria increases with longer duration of diabetes and higher levels of glycosylated hemoglobin. In patients with type 1 diabetes, the relative risk is about 9.0 for overt nephropathy and about 3.0 for death from cardiovascular causes. In patients with type 2 diabetes, microalbuminuria has been correlated with cardiovascular disease, development of overt nephropathy, and renal failure.

Serum protein electrophoresis can separate protein of different molecular weights on an agarose gel medium. This method is traditionally used when production of a monoclonal protein is suspected. The urine amino acid concentration can sometimes be useful in differentiating renal tubular acidoses. A 24-hour urine protein measurement is a nondiscriminatory test for all protein excretion and does not reliably differentiate albumin from nonalbumin protein. Urinary dipstick analysis is not sufficiently sensitive to detect microalbuminuria.

**Nephrology and Hypertension: Question 7**

_The correct answer is A_

**Educational Objectives**

Recognize the presence and etiology of a metabolic alkalosis

**Critique**

The low blood pressure and hypochloremia suggest volume-sensitive metabolic alkalosis due to diuretic therapy. Metabolic alkalosis is indicated by the high serum bicarbonate level and pH greater than 7.4. Respiratory compensation for the metabolic alkalosis is appropriate. The PCO2 is 50 mm Hg, showing the expected 10-mmHg increase that compensates for the 14-meq/L increase in serum bicarbonate level. The anion gap and its change relative to the change in the serum bicarbonate level do not need to be calculated because these values are only relevant in anion gap metabolic acidosis.

Both primary hyperaldosteronism and diuretic use may cause metabolic alkalosis. However, a patient with primary hyperaldosteronism who is taking a diuretic would have more severe hypokalemia, with a serum potassium level less than 3.0. The normal arterial-to-alveolar oxygen gradient makes underlying chronic obstructive pulmonary disease unlikely, and blood gas values do not indicate concurrent respiratory acidosis.
**Nephrology and Hypertension: Question 8**

**Educational Objectives**
Understand the appropriate management of symptomatic hypomagnesemia.

**Critique**
Hypomagnesemia is frequently seen in alcoholics and in persons with severe diarrhea. If the serum magnesium level is less than 1.0 mg/dL and carpopedal spasm, Chvostek's or Trousseau's sign, or seizures are present, intravenous treatment with magnesium is indicated. This patient should receive both magnesium and potassium intravenously. The hypokalemia is due to diarrhea and to the renal potassium wasting induced by hypomagnesemia. Correction of the hypokalemia will be ineffective unless hypomagnesemia is also corrected. Oral magnesium will not provide sufficiently rapid correction. The hypocalcemia is due to reduced secretion and peripheral effects of parathyroid hormone, which are caused by the hypomagnesemia. When the hypomagnesemia is corrected, the parathyroid hormone levels will return to normal and the serum calcium level will normalize.

**Nephrology and Hypertension: Question 9**

**Educational Objectives**
Evaluate and treat hypertension during pregnancy.

**Critique**
This patient has gestational hypertension. Treatment must be individualized, because there are few studies to guide therapy. Treatment of patients with gestational hypertension will not decrease their risk for preeclampsia or maternal or fetal mortality. In addition, treatment does not affect perinatal or neonatal outcomes. However, treatment improves blood pressure and decreases the incidence of hospitalization and of proteinuria at delivery. Methyldopa is the recommended oral therapy with the longest track record of safety and efficacy. Angiotensin-converting enzyme agents (for example, ramipril) are contraindicated after the second trimester because of fetal complications, such as oligohydramnios, renal and maturational failure, and death. Atenolol has been associated with adverse fetal outcomes, such as intrauterine growth retardation and low placental weight in the second trimester. There is no indication for termination of pregnancy.

**Nephrology and Hypertension: Question 10**

**Educational Objectives**
Recognize the clinical features of amyloidosis.

**Critique**
The patient has AL amyloidosis, a disease that is usually caused by a plasma cell disorder in which deposition of amyloid light chain proteins infiltrate the kidney and other organs. Almost all patients have a monoclonal protein (γ in 75% of the cases) in serum and urine or a monoclonal population of plasma cells in the bone marrow. Although membranous nephropathy, focal segmental glomerulosclerosis, and diabetic renal diseases can produce the nephrotic syndrome, they are not associated with the plasma cell disorder. AA amyloidosis, also called reactive amyloidosis, is usually seen after chronic inflammatory conditions and is caused by deposition of amyloid protein A in tissues.
Nephrology and Hypertension: Question 11
The correct answer is B
Educational Objectives
Recognize a reduced glomerular filtration rate in the setting of a normal serum creatinine concentration.

Critique
Despite a serum creatinine concentration in the normal range, the glomerular filtration rate is greatly reduced, based on the patient's low body weight and age. Approximately 50% of women with a creatinine concentration of 1.0 mg/dL have an abnormally low glomerular filtration rate. Glomerular filtration rate should be calculated by using creatinine-based equations.

Not all antibiotics penetrate renal cysts equally well. Antibiotics often must enter a cyst by diffusion. Quinolones, trimethoprim-sulfamethoxazole, and chloramphenicol have good cyst penetration. Penicillins do not penetrate cysts well. This patient, however, has urinary symptoms as well as signs of pyelonephritis. She probably has pyelonephritis rather than a cyst infection.

Nephrology and Hypertension: Question 12
The correct answer is D
Educational Objectives
Understand the sensitivity of renal imaging tests for small masses.

Critique
Computed tomography detects very small cysts (< 1.5 cm) and surrounding cysts that may mask underlying cancer. Computed tomography has a detection rate of 47% for masses smaller than 5 mm, whereas ultrasonography has a detection rate of zero. Computed tomography and ultrasonography are equally effective in detecting lesions that are 2.0 cm to 3.0 cm. Intravenous pyelography often misses lesions smaller than 5 cm. Anteroposterior and lateral radiography do not reliably show kidneys unless tomography is performed. Renal flow scanning is useful in determining appropriate uptake and excretion of radioactive tracer injected into the bloodstream.

Nephrology and Hypertension: Question 13
The correct answer is E
Educational Objectives
Recognize the reasons for failure of thiazide treatment in hypercalciuric stone disease.

Critique
The urinary sodium excretion is an accurate reflection of dietary sodium intake in patients taking long-term thiazide therapy (longer than 3 to 4 weeks). In other words, the patient is in a new steady state. Her urinary calcium level remains elevated because high dietary sodium intake has blunted the diuretic-induced volume depletion, resulting in increased urinary calcium reabsorption. Failure to observe a low-sodium diet is a frequent cause of persistent hypercalciuria despite use of thiazide diuretics. Renal tubular acidosis and surreptitious laxative use cause metabolic acidosis, which is not present. Hyperoxaluria does not influence the amount of urinary calcium excretion.
The correct answer is B

Educational Objectives
Know which treatments increase the risk for stone formation in patients with idiopathic hypercalciuria.

Critique
Risk factors for calcium nephrolithiasis include low daily fluid intake, high dietary sodium and oxalate, hyperoxaluria, hypercalciuria, hypocitraturia, and hyperuricosuria. Several studies in men and women have shown that a high dietary calcium intake is associated with reduced risk for calcium stone disease. In a recent study, men with hypercalciuric nephrolithiasis placed on a low-calcium versus a high-calcium diet had greater risk of subsequent stone formation. This reduced rate of stone formation occurred in the absence of a reduction in urinary calcium excretion. Although not proven, it is believed that the risk for stone formation is lower with high dietary calcium because higher amounts of dietary calcium bind with dietary oxalate and lessen oxalate absorption and excretion. A low-protein diet reduces urinary calcium excretion. A low-purine diet reduces uric acid excretion and lessens stone formation in hyperuricosuric stone disease.

The correct answer is D

Educational Objectives
Recognize the benefits of erythropoietin therapy for anemia in patients with pre-end-stage renal disease.

Critique
Therapy with recombinant human erythropoietin results in regression of left ventricular hypertrophy in patients with pre-end-stage renal disease (ESRD) and those undergoing dialysis. In a cross-sectional study of patients with chronic kidney disease, anemia was an independent predictor of left ventricular hypertrophy, and subsequent trials demonstrated that correction of anemia led to regression of left ventricular hypertrophy. In patients with pre-ESRD and those undergoing dialysis, successful correction of anemia is associated with significant improvement in quality of life, overall well-being, work, aerobic capacity, and cognitive and sexual function. Although prevalent in pre-ESRD patients, anemia is undertreated: Less than one third of eligible patients receive erythropoietin before dialysis. In a recent survey, nephrologists prescribed erythropoietin in the majority of patients with pre-ESRD, whereas general internists prescribed erythropoietin approximately 20% of the time. Early detection and treatment of anemia should be a key component of chronic kidney disease management for both the generalist and the nephrologist. Long-term data in patients with pre-ESRD are not available to document reduced cardiovascular morbidity and mortality with erythropoietin therapy. Erythropoietin therapy may be associated with an elevation of systemic blood pressure, which is usually responds to medical therapy.

The correct answer is A

Educational Objectives
Recognize simple anion gap metabolic acidosis due to diabetic ketoacidosis.

Critique
The patient has an anion gap metabolic acidosis with appropriate respiratory compensation consistent with a diabetic ketoacidosis. Metabolic acidosis is indicated by a low serum bicarbonate level and an arterial blood pH less than 7.4. The expected Ro2 for this decrease in serum bicarbonate level is 23 ± 2 mm Hg (10 X
The respiratory compensation is appropriate; thus, there is not a concomitant respiratory disorder accompanying this metabolic acidosis, as would probably be seen in sepsis. The patient has an anion gap of 26 (133 - [97 + 10]). The change in the anion gap is 1, calculated as the anion gap minus the expected normal anion gap. The change in bicarbonate level is 14, calculated as the normal bicarbonate concentration (24 meq/L) minus the measured bicarbonate concentration (10 meq/L). Thus, the ratio between the change in the anion gap and the change in the serum bicarbonate (delta-delta) is 1, suggesting that a concurrent non-anion gap metabolic acidosis or a concurrent metabolic alkalosis is not present. Proximal renal tubular acidosis causes a non-anion gap metabolic acidosis, and if it were present with ketoacidosis, we would expect both a non-anion gap and an anion gap metabolic acidosis. That is the ratio between the change in the anion gap to the change in the serum bicarbonate level would be less than 1.

**Nephrology and Hypertension:** Question 17

**Educational Objectives**

Identify the most appropriate class of antihypertensive therapy in a patient who has type 1 diabetes with proteinuria.

**Critique**

A sentinel study documented a renoprotective effect of angiotensin-converting enzyme inhibitors in patients who had type 1 diabetes with nephropathy. Despite similar control of blood pressure as the placebo group, the captopril group had a nearly 50% reduction in the primary end points of doubled serum creatinine concentration, need for dialysis, need for transplantation, or death. This randomized controlled trial established angiotensin-converting enzyme inhibitors as a standard of care for type 1 diabetes with nephropathy. More recently, two trials demonstrated a renoprotective effect of two angiotensin receptor blockers (irbesartan and losartan) in type 2 diabetes with nephropathy. Data from a randomized controlled trial of angiotensin receptor blockers in type 1 diabetes are not available. One of the two aforementioned trials of an angiotensin receptor blocker in type 2 diabetes was designed with three therapeutic arms: angiotensin receptor blocker versus placebo versus amlodipine. In that trial, therapy with the angiotensin receptor blocker irbesartan offered a renoprotective effect over placebo and amlodipine. In that study and other trials, therapy with dihydropyridine calcium antagonists, such as amlodipine or nifedipine, has not reduced proteinuria or helped to preserve kidney function. The patient has already optimized her lifestyle by being fit, avoiding alcohol, and limiting dietary salt intake.

**Nephrology and Hypertension:** Question 18

**Educational Objectives**

Recognize that minor increases in serum creatinine concentration with angiotensin-converting enzyme inhibitor therapy do not necessitate discontinuation of this therapy.

**Critique**

Minor increases in the serum creatinine concentration are common after normalization of blood pressure by angiotensin-converting enzyme (ACE) inhibitors and other therapies. This decrease in glomerular filtration rate probably indicates
that the renovasculature is readjusting to a lower renal perfusion pressure. This finding is usually reversible.

Concern may exist that an increase in serum creatinine concentration due to ACE inhibitor therapy indicates occult bilateral renal artery stenosis. The degree of the increase in serum creatinine concentration is a possible clue for renal artery stenosis.

In a recent study, 108 patients suspected of having renal artery stenosis were exposed to ACE inhibitor therapy in a controlled manner, and blood pressure and serum creatinine were measured at days 4 and 14. An increase in serum creatinine concentration greater than 20% after ACE inhibitor therapy was highly suggestive of renal artery stenosis. In the 52 patients with proven high-grade bilateral or unilateral renal artery stenosis, sensitivity and specificity were 100% and 70%, respectively, and the average increase in serum creatinine concentration was approximately 40% after exposure to ACE inhibitors. Hence, answer A is incorrect, as the patient in this question had only a 10% increase in serum creatinine concentration, which is likely to improve and stabilize over time.

The patient has few other indications of occult renal artery stenosis. The hypertension is most likely attributable to diabetic nephropathy, a condition which should benefit from ongoing ACE inhibitor therapy.

**Nephrology and Hypertension: Question 19**

**The correct answer is C**

**Educational Objectives**

Treat a patient with infection and acute renal failure.

**Critique**

This patient was treated appropriately with amphotericin B, which is indicated for definitive therapy of mucormycosis. The course is consistent with amphotericin nephrotoxicity. Liposomal amphotericin preparations, although expensive, have been shown to decrease the incidence of nephrotoxicity compared with conventional amphotericin B, although severe adverse reactions have been reported sporadically with this preparation. Amphotericin B is not cleared by the kidneys; therefore, dose adjustment is not indicated. Measurement of amphotericin levels will not be important unless the dosage was incorrect or the drug was given inconsistently. Although renal ultrasonography is an important procedure to rule out post-renal causes of azotemia, there is no obvious reason why urinary tract obstruction should have occurred in the past 9 days, decreasing the priority of this test.

**Nephrology and Hypertension: Question 20**

**The correct answer is B**

**Educational Objectives**

Recognize that hyperkalemia in patients with diabetes mellitus is often due to hyporeninemic hypoaldosteronism.

**Critique**

The most likely cause of hyperkalemia is hyporeninemic hypoaldosteronism, a condition that occurs in 20% to 30% of diabetic persons. Hyperkalemia occurs most often in diabetic patients who have mild to moderate renal failure (as in this case) superimposed on the hyporenin hypoaldosterone state. The latter condition seems to be due to unresponsiveness of the adrenal zona glomerulosa to stimulation by angiotensin II, renin, and hyperkalemia itself. Many diabetic patients with hyperkalemia have low renin levels, caused by impaired conversion of prorenin to renin. Since prostaglandins stimulate renin, use of ibuprofen (a prostaglandin inhibitor) may contribute to the hypoaldosterone state, but by itself rarely causes hyperkalemia. Diabetic ketoacidosis is not present, as evidenced by the lack of urinary ketones and the normal serum anion gap. A change in serum creatinine
concentration from 1.6 mg/dL to 1.8 mg/dL would not cause hyperkalemia in a patient who had normal renin-aldosterone function. At this patient's level of renal function, a high-potassium diet would not cause hyperkalemia if the renin-aldosterone system were intact.

**Nephrology and Hypertension: Question 21**

**Educational Objectives**
Identify antibiotics with acceptable penetration into renal cysts to treat urinary tract infection in patients with autosomal dominant polycystic kidney disease.

**Critique**
Effective treatment of urinary tract infection in patients with autosomal dominant polycystic kidney disease may be challenging because of the variable penetration of common antibiotics into a renal cyst that might harbor pathogens. In this case, the prior urinary tract infection caused by E. coli was probably inadequately treated because of poor penetration of ampicillin into cysts harboring the organism. Further therapy with ampicillin is thus not warranted. Trimethoprim-sulfamethoxazole is the best choice because E. coli is sensitive to this therapy and oral trimethoprim-sulfamethoxazole has good penetration into polycystic kidney disease cysts. A longer course of antibiotics may be prescribed to ensure eradication of pathogens harbored in a cyst. Other antibiotics that have good cyst penetration are ciprofloxacin and chloramphenicol.

Intravenous therapy is not warranted because the patient is afebrile and not septic on presentation and should respond to an appropriate course of oral trimethoprim-sulfamethoxazole. Leukocyte scanning is not necessary because renal abscess is unlikely in this patient, who appears to not be in a toxic state.

**Nephrology and Hypertension: Question 22**

**Educational Objectives**
Recognize the clinical features of Henoch-Schönlein purpura.

**Critique**
This patient has the typical clinical features of Henoch-Schönlein purpura, including joint pain, abdominal pain, rash on the lower extremities showing vasculitis and IgA deposition, and renal disease with nephritic sediment. Normal complement levels and lack of antinuclear antibodies make lupus and post-streptococcal glomerulonephritis unlikely. Allergic interstitial nephritis caused by a drug may be associated with a vasculitic skin rash, but the urine does not show erythrocyte casts and, most important, the patient has no history of drug exposure. The absence of pulmonary symptoms or hemoptysis rules out Goodpasture’s syndrome.

**Nephrology and Hypertension: Question 23**

**Educational Objectives**
Recognize the presence and differential diagnosis of a non-anion gap metabolic acidosis.

**Critique**
The electrolyte and arterial blood gas patterns are consistent with a non-anion gap metabolic acidosis. Metabolic acidosis is indicated by a low serum bicarbonate level and an arterial blood pH less than 7.4. Respiratory compensation is appropriate, as the expected Pco2 for this decrease in serum bicarbonate level is 30.5 ± 2 mm Hg (15 X 1.5 + 8 ± 2). The low anion gap, calculated as 135 - (117 + 15), is consistent with myeloma. The ratio of the change in anion gap to the change in bicarbonate
level (delta-delta) does not need to be examined, as it is relevant only in anion gap metabolic acidosis.
Salicylate toxicity, alcoholic-induced lactic acidosis, and ethylene glycol toxicity cause anion gap metabolic acidosis. In addition, ethylene glycol toxicity is often associated with a positive osmolar gap, which is not present. The calculated serum osmolality is 279 mosmol/L (2 X 135 + 88/18 + 10/2.8), which is similar to the measured value of 277 mosmol/L. Proximal renal tubular acidosis often causes hypokalemia and a non-anion gap metabolic acidosis.
One cause of renal tubular acidosis is the presence of a monoclonal light chain. Proximal renal tubular acidosis due to a monoclonal light chain may occur before multiple myeloma is diagnosed. The presence of a light chain is suggested by the discrepancy between the negative urine dipstick and the positive urine sulfosalicylic acid test. Evaluation for multiple myeloma is therefore warranted.

**Nephrology and Hypertension: Question 24**
The correct answer is D
**Educational Objectives**
Recognize the renoprotective effect of angiotensin-converting enzyme inhibitor therapy in black patients with hypertensive nephrosclerosis.

**Critique**
The African American Study of Kidney Disease demonstrated a renoprotective effect of the angiotensin-converting enzyme (ACE) inhibitor ramipril in black patients with modest renal insufficiency secondary to hypertensive nephrosclerosis. This randomized controlled trial documented a significant reduction in proteinuria and composite renal end points (halving of the glomerular filtration rate, end-stage renal disease, and death) with ACE inhibitor therapy compared with the dihydropyridine calcium antagonist amlodipine. The findings were demonstrated most conclusively in patients with urinary protein excretion greater than 300 mg/d, but the benefits may extend to patients with lesser degrees of proteinuria. Although diuretics may control hypertension in black patients, data from randomized controlled trials are insufficient on the ability of diuretic therapy to reduce target organ damage in the kidney. However, diuretic therapy may be a powerful addition to ACE inhibitor therapy in obtaining optimal blood pressure goals in black patients. Lifestyle modifications have not been shown to reduce target organ damage in the kidney.

**Nephrology and Hypertension: Question 25**
The correct answer is B
**Educational Objectives**
Understand the use and limitations of the fractional excretion of sodium to diagnose the cause of acute renal failure.

**Critique**
This patient's fractional excretion of sodium is 2.2%, yet she has prerenal azotemia. The assumption that a fractional excretion of sodium (FENa) less than 1.0% represents prerenal azotemia has several limitations. This concept is based on the fact that the ratio of filtered to excreted sodium in patients with a normal glomerular filtration rate is less than 1%, and that patients with prerenal azotemia with oliguria avidly retain sodium because of volume depletion. The main indication for calculating the FENa is to determine whether renal handling of sodium is physiologic in patients with oliguria. This patient with prerenal azotemia has volume depletion due to abnormal urinary sodium losses, which were secondary to osmotic diuresis caused by hyperglycemia, and she has polyuria rather than oliguria. The FENa is elevated because of the abnormal renal sodium loss. Diabetic nephropathy typically complicates diabetes of more 10 years' duration and is associated with proteinuria.
The FENa is unreliable in patients with obstructive nephropathy because, in such cases, the renal tubules may not reabsorb sodium normally in response to usual hormonal signals.

Nephrology and Hypertension: Question 26
The correct answer is C
Educational Objectives
Recognize common causes of hypophosphatemia.

Critique
The patient has hypophosphatemia due to renal phosphate wasting. Hyperventilation is not present, based on the arterial PCO2 and pH. Hyperparathyroidism is not present because the serum calcium level is normal in view of the normal serum albumin level. Gastrointestinal malabsorption that is sufficiently severe to cause hypophosphatemia would be accompanied by diarrhea, which this patient does not have.

Nephrology and Hypertension: Question 27
The correct answer is B
Educational Objectives
Recognize the treatment of hypophosphatemia.

Critique
Symptomatic patients with a serum phosphorus level less than 1.0 mg/dL require urgent treatment, usually with intravenous potassium phosphate. In asymptomatic hypophosphatemia, oral phosphate supplementation is appropriate. Reduction in the levothyroxine dose or administration of magnesium oxide would not correct the hypophosphatemia. Since the patient has no evidence of hyperventilation associated with panic disorder, a tranquilizer is not indicated.

Nephrology and Hypertension: Question 28
The correct answer is D
Educational Objectives
Recognize the preferred method of estimating the glomerular filtration rate in patients with chronic kidney disease.

Critique
Prediction equations improve on estimation of glomerular filtration rate from serum creatinine concentration because they also take into account age, sex, ethnicity, and body weight. Two such equations are the Cockcroft-Gault formula and the Modification of Diet in Renal Disease (MDRD) formula. The Cockcroft-Gault formula is as follows:

\[ \text{GFR} = \frac{(140 - \text{age}) \times \text{weight in kg}}{\text{serum creatinine} \times 72} \times 0.85, \text{if female} \]

The MDRD formula is more complex than the Cockcroft-Gault equation, but it is accurate and precise for patients with a glomerular filtration rate less than 90 mL/min. This MDRD formula should be available at most clinical laboratories in the near future. Serum creatinine concentration is affected by factors other than glomerular filtration rate, such as creatinine production, secretion, and tubular secretion. Thus, the serum creatinine concentration varies greatly in healthy persons, and the glomerular filtration rate must decrease by almost half before the serum creatinine concentration increases above the upper limit of normal. This is particularly true in elderly persons because of the age-related decline in creatinine production. Timed 24-hour urine samples are inconvenient and frequently inaccurate. The National Kidney Foundation recommends the prediction equations because they are superior to 24-hour clearances compared with the standard of 1251-iothalamate.
clearance. Measurement of iothalamate or inulin clearance is the most accurate indicator of glomerular filtration rate, but the technique is cumbersome and costly and should not be applied to all patients in the clinical setting.

Nephrology and Hypertension: Question 29
The correct answer is C
Educational Objectives
Diagnose peripartum acute renal failure due to microangiopathic hemolytic anemia.
Critique
Examination of the blood smear for schistocytes and repeated complete blood count to assess progression of anemia and thrombocytopenia should be done to rule out postpartum hemolytic uremic syndrome. This syndrome and thrombotic thrombocytopenic purpura are multisystem disorders characterized by thrombocytopenia and microangiopathic hemolytic anemia resulting from platelet aggregation in the microvasculature. Endothelial cell injury and a deficiency of the plasma protease responsible for the degradation of von Willebrand factor have been suggested to play pathogenic roles in some forms of thrombotic thrombocytopenic purpura. The hemolytic uremic syndrome and thrombotic thrombocytopenic purpura are associated with multiple triggers including HIV, shiga toxins, medications, cancer, systemic lupus erythematosus, and pregnancy. Neurologic dysfunction is usually more prominent in thrombotic thrombocytopenic purpura, whereas renal dysfunction predominates in the hemolytic uremic syndrome. Patients with preeclampsia or eclampsia may have microangiopathic hemolytic anemia, seizures, and thrombocytopenia; however, hematologic manifestations are usually milder. This patient was subsequently found to have schistocytes on blood smear, elevated serum lactate dehydrogenase and liver enzyme levels, thrombocytopenia (40,000 platelets/μL), and a serum creatinine concentration that peaked at 5.0 mg/dL within 48 hours of the initial presentation. She responded favorably to emergent daily plasma exchange. The history, physical examination, and laboratory studies do not suggest renal insufficiency secondary to volume depletion. Renal ultrasonography would be appropriate to evaluate for hydronephrosis, but urinary tract obstruction would not explain the change in hemoglobin level or platelet count. Disseminated intravascular coagulopathy and early sepsis are differential diagnoses; however, the patient does not appear clinically septic. Dopamine has not been proven beneficial in oliguric acute renal failure.

Nephrology and Hypertension: Question 30
The correct answer is A
Educational Objectives
Recognize the syndrome of inappropriate antidiuretic hormone secretion.
Critique
This patient has the syndrome of inappropriate antidiuretic hormone secretion, which was found to be due to a small-cell carcinoma of the lung. The physical examination; normal serum potassium level; and low concentrations of blood urea nitrogen, serum creatinine, and serum uric acid are consistent with euolemic hyponatremia (syndrome of inappropriate antidiuretic hormone secretion) and not with diuretic use or cirrhosis. The normal levels of cholesterol, triglycerides, and total proteins rule out pseudohyponatremia. In a patient with psychogenic polydipsia, ingestion of large amounts of water would result in hyponatremia. However, the appropriate compensatory response would be suppression of antidiuretic hormone, which results in a dilute urine (excretion of free water); this phenomenon is not present in this patient.
The correct answer is E

Educational Objectives
Diagnose renal disease in a patient with hepatic failure.

Critique
The fractional excretion of sodium of approximately 0.16 is consistent with avid sodium retention but does not discriminate between prerenal azotemia and the hepatorenal syndrome. Although patients with the hepatorenal syndrome often have urinary sodium concentrations less than 10 meq/L, the diagnosis in a patient with decompensated hepatic function can be established only by ascertaining that a volume disorder is not present, either by fluid trial or by measuring central venous pressures or cardiac hemodynamics. Although patients with prerenal azotemia often have a ratio of blood urea nitrogen to creatinine greater than 20, this ratio does not differentiate between acute and chronic renal disease. In this case, a relatively low blood urea nitrogen level may be a consequence of decreased protein intake or decreased urea generation by a diseased liver. Anemia can complicate both acute and chronic renal disease, and ultrasonography is necessary to exclude obstruction as a cause of azotemia in this patient. Although pyelonephritis involving the renal parenchyma may be complicated by renal insufficiency and interstitial nephritis can present with sterile pyuria, there is little clinical evidence to implicate these as primary entities in the differential diagnosis of the renal insufficiency in this case. Culture and sensitivity would be important in diagnosing a urinary tract infection.

The correct answer is A

Educational Objectives
Know the clinical presentation of rapidly progressive glomerulonephritis.

Critique
The patient’s renal presentation is rapidly progressive glomerulonephritis which consists of glomerulonephritis with nephritic urine sediment, acute renal failure developing over a few days to weeks, and glomerular crescents on renal biopsy. Nephrotic syndrome is present here but is not usually associated with acute renal failure. The patient has acute renal failure, but acute tubular necrosis would not produce a nephritic sediment.

The correct answer is D

Educational Objectives
Know that Goodpasture’s syndrome is associated with circulating antiglomerular basement antibody.

Critique
Goodpastures syndrome, lupus nephritis, Wegener’s granulomatosis, and infection-associated glomerulonephritis and vasculitis can present with a picture of rapidly progressive glomerulonephritis. However, the finding of circulating antibody against glomerular basement membrane in serum makes the diagnosis almost certain.

The correct answer is C

Educational Objectives
Recognize a mixed metabolic and respiratory alkalosis.

Critique
Arterial blood gas values demonstrate a mixed metabolic and respiratory alkalosis. Metabolic alkalosis is indicated by the high serum bicarbonate level and a pH greater
than 7.4. Respiratory compensation for the metabolic alkalosis is not appropriate; the PCO2 would be expected to increase in compensation for the elevated serum bicarbonate level, but instead, the Ro2 has decreased to 36 mm Hg, indicating the presence of a respiratory alkalosis. The anion gap is 7, calculated as (141 -[100 + 34]); thus, there is no hidden but detectable metabolic acidosis. The compensated respiratory alkalosis is most likely due to pain from the kidney stone, and metabolic alkalosis is probably a result of vomiting.

**Nephrology and Hypertension: Question 35**

The correct answer is B

**Educational Objectives**

Treat a mixed acid-base disorder.

**Critique**

The patient has persistent respiratory alkalosis, as indicated by a low Ro2 and a pH greater than 7.4. The condition is most likely due to hyperventilation in response to pain from the kidney stone; thus, control of the flank pain will help to resolve respiratory alkalosis.

The metabolic alkalosis was most likely initiated by vomiting; infusion of 0.9% normal saline resolved the condition by restoring intravascular volume. Metabolic compensation for the respiratory alkalosis is appropriate. The serum bicarbonate level would be expected to decrease by 2 meq/L for each 10-mm Hg decrease in Pco2. The decrease in serum bicarbonate to 22 meq/L thus suggests appropriate metabolic compensation for the primary respiratory alkalosis.

Administration of more normal saline or of Ringers solution is not needed, as the patient no longer has a volume-responsive metabolic alkalosis. Acetazolamide should not be given to patients with respiratory alkalosis because it does not correct the underlying disorder.

**Nephrology and Hypertension: Question 36**

The correct answer is B

**Educational Objectives**

Diagnose and evaluate renal disease in a patient undergoing therapy for cancer.

**Critique**

There are several potential causes of acute renal failure associated with cancer and its treatment. The differential diagnosis in this case includes urinary tract obstruction, perhaps related to prostatic hypertrophy, and radiation nephritis. Urinary tract obstruction must be ruled out, especially in patients with cancer of the genitourinary tract or pelvic organs. Lymphoma may involve the prostate, leading to urinary tract obstruction, or pelvic lymphadenopathy may obstruct the outflow of the bladder. The ratio of blood urea nitrogen to creatinine is not a sufficiently sensitive measure on which to base clinical decision making in this case. Renal scanning is most useful in evaluating asymmetric blood flow and yields valuable information in selected patients with evidence of renal arterial disease, which is not a consideration in this case. There is no evidence of volume depletion. Renal biopsy, even with its relatively low risk, is an invasive procedure and is best deferred until later in the course.
Nephrology and Hypertension: Question 37
The correct answer is E
Educational Objectives
Differentiate glomerular hematuria from nonglomerular hematuria.

Critique
Microscopy of this patient’s urine would probably show dysmorphic red blood cells and red blood cell casts and would confirm the suspicion of glomerulonephritis. The next best test to determine the extent of evaluation needed and possible treatment is measurement of protein excretion. The urinary protein-to-creatinine ratio closely approximates 24-hour excretion of protein when normalized for body surface area. The specific gravity of 1.015 indicates the urine is neither overly dilute nor concentrated; therefore, the protein value obtained by dipstick analysis should be considered valid. Nonglomerular microscopic hematuria is usually not accompanied by proteinuria. Therefore, the presence of abnormal proteinuria along with hematuria strongly implies a glomerular source of blood loss. Because the hematuria is probably glomerular in origin, evaluation of the upper tract and renal parenchyma with computed tomography or ultrasonography, or of the bladder with cystoscopy, is not necessary. Renal artery stenosis can occasionally present with hypertension and proteinuria but should not result in hematuria.

Nephrology and Hypertension: Question 38
The correct answer is A
Educational Objectives
Determine appropriate management of a complication of kidney biopsy.

Critique
Minor complications that require no action, such as self-limited gross hematuria or a perinephric hematoma, occur in less than 10% of patients. In a review of 544 biopsies, transient gross hematuria occurred in 4.4% of patients. No patient lost renal function, and there were no deaths. In a review of 394 percutaneous renal biopsies in adult patients, minor complications occurred in 6.6% of cases. Ninety-five percent of all complications, whether major or minor, were clinically apparent at 12 hours after biopsy. Major complications have been associated with a high blood urea nitrogen level and a lower prebiopsy hemoglobin level. The other options are plausible but not necessary. Renal ultrasonography is useful if clinically significant bleeding or obstruction from a hematoma is suspected. Urinalysis will reveal microscopic hematuria in almost all patients after renal biopsy. The patient is not hemodynamically unstable and does not need volume replacement. Placement of a Foley catheter would be useful if the patient were passing blood clots and at risk for urinary tract obstruction.

Nephrology and Hypertension: Question 39
The correct answer is B
Educational Objectives
Recognize that antibiotic therapy may interfere with cyclosporine metabolism and have side effects.

Critique
Erythromycin inhibits cyclosporine metabolism because both are metabolized in the liver by the same cytochrome P-450 isoenzyme CYP3A system. Therapy with erythromycin without a concomitant reduction in the cyclosporine dose could result in markedly elevated cyclosporine concentrations and, therefore, such adverse side effects as nephrotoxicity. Other drugs that inhibit the CYP3A enzyme and increase cyclosporine levels include antibiotics and antifungal agents (clarithromycin, ketoconazole, itraconazole, and fluconazole), some calcium channel blockers.
Drugs that induce the cytochrome CYP3A4 enzyme and decrease cyclosporine levels include anticonvulsants (phenytoin, phenobarbital, and carbamazepine), antituberculosis agents (rifampin), and antiobesity agents (orlistat); their use requires an increase in the cyclosporine dose. In addition, cyclosporine may affect the metabolism of certain drugs and increase concentrations of digoxin and several of the 3-hydroxy-3-methylglutaryl coenzyme A (HMG-C0A) reductase inhibitors (but not pravastatin or fluvastatin). Drug-induced rhabdomyolysis has been noted as a function of the latter drug-drug interaction. Amoxicillin-clavulanate, cefuroxime, penicillin, and ciprofloxacin do not substantially interfere with the CYP3A isoenzyme or metabolism of cyclosporine.

**Nephrology and Hypertension: Question 40**
The correct answer is B
**Educational Objectives** Recognize the urinary electrolyte pattern in primary aldosteronism.
**Critique** Primary hyperaldosteronism is associated with hypertension; hypokalemia; and renal potassium wasting, usually defined as 24-hour urinary potassium excretion greater than 30 meq in the setting of a serum potassium concentration less than 3.0 meq/L. All of these features are present in this patient. Distal renal tubular acidosis is incorrect because the patient is not acidic and has an acid urine pH. Gitelman syndrome is associated with hypokalemia, renal potassium wasting, and hypocalciuria (which is not present in this patient) and normotension. Diarrhea would cause metabolic acidosis and may cause hypokalemia but would not be associated with renal potassium wasting.

**Nephrology and Hypertension: Question 41**
The correct answer is C
**Educational Objectives** Recognize that withdrawal of monotherapy with an α-blocker is recommended to treat hypertension.
**Critique** The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial documented an increased risk of cardiovascular events (especially congestive heart failure) with use of α-blockers. This adverse finding was published before completion of the full trial. The authors recommended that clinicians discontinue use of α-blocker monotherapy for hypertension and consider alternative therapy. Use of α-blocker therapy in combination with other antihypertensive agents and as therapy for symptomatic benign prostatic hyperplasia were not precluded. The dose of α-blocker as monotherapy should not be increased. The Sixth Joint National Committee did not find sufficient evidence to recommend nondrug treatments, such as high dietary intake of calcium and potassium or meditation, as effective therapy for hypertension.

**Nephrology and Hypertension: Question 42**
The correct answer is A
**Educational Objectives** Recognize the presentation of acute interstitial nephritis.
**Critique** The clinical course of new renal insufficiency with pyuria after treatment with antibiotics is most consistent with a diagnosis of acute interstitial nephritis. However, sterile pyuria must be confirmed. In many cases, renal dysfunction improves after
administration of the offending agent is discontinued. Renal scanning will demonstrate only decreased renal blood flow, which would be expected in this case, or asymmetric function, which would not be expected. Antineutrophil cytoplasmic antibody evaluation has primary utility in assessing suspected cases of vasculitis, which is not a consideration in this case. Renal biopsy may be considered if the patient does not respond to discontinuation of a suspected antigen. This patient has no obvious indication for acute dialysis.

**Nephrology and Hypertension:** Question 43

The correct answer is D

**Educational Objectives**

Know the most appropriate radiologic procedure to diagnose nephrolithiasis.

**Critique**

Noncontrast spiral computed tomography of the abdomen yields the most information on renal stone disease because it can detect both radiolucent and radio-opaque stones in the kidneys and ureters and can detect hydronephrosis. Computed tomography provides additional information about abdominal anatomy, which may be helpful if the test does not show a renal stone as the cause for the patient’s symptoms (an alternative diagnosis may be found as often as 10% of the time). Plain abdominal radiography does not show radiolucent stones. Ultrasonography can detect both types of stones and demonstrate hydronephrosis but cannot easily detect ureteral stones. Intravenous pyelography often misses small radiolucent stones.

**Nephrology and Hypertension:** Question 44

The correct answer is E

**Educational Objectives**

Identify the appropriate strategy for treating herpes zoster infection in an immunosuppressed renal transplant recipient.

**Critique**

The primary care physician must be able to recognize potential systemic dissemination or local extension of herpes zoster infection into the ophthalmologic tract in an immunocompromised renal transplant recipient. Such patients often contact their primary care physician first, and rapid recognition and response are crucial to preventing adverse consequences. Given the head and neck location of the herpes zoster infection in this patient, intravenous acyclovir is warranted to prevent ophthalmologic herpes zoster and its devastating consequences. Expert ophthalmologic examination and consultation are also needed. For immunocompromised renal transplant recipients who develop herpes zoster infection in dermatomes below the head and neck, higher doses of oral acyclovir (adjusted for glomerular filtration rate) or oral famciclovir would be appropriate. Topical and lower-dose oral acyclovir are more appropriate to treat herpes cold sores.

**Nephrology and Hypertension:** Question 45

The correct answer is C

**Educational Objectives**

To understand the relationship between the change in the anion gap and the change in serum bicarbonate level (delta-delta) in diagnosing a mixed metabolic acidosis and alkalosis.

**Critique**

The patient has an anion gap metabolic acidosis and a concurrent metabolic alkalosis. Metabolic acidosis is indicated by the low serum bicarbonate level and a pH less than 7.4. The distinctly abnormal anion gap of 49, calculated as 140 - (80 +
11), suggests the presence of an anion gap metabolic acidosis, perhaps due to ischemic bowel and resultant lactic acidosis. The change in the anion gap is 37, calculated as the anion gap (49) minus the expected normal anion gap (12). The change in serum bicarbonate level is 13, calculated as the normal serum bicarbonate level (24 meq/L) minus the actual serum bicarbonate level (11 meq/L). The ratio between the change in the anion gap and the change in the serum bicarbonate level, or the delta-delta, is greater than 2, thus suggesting a concurrent metabolic alkalosis. Vomiting is the most likely cause of the metabolic alkalosis. Respiratory compensation for the metabolic acidosis is appropriate. The expected PCO2 for this decrease in serum bicarbonate level is 24.5 ± 2 mm Hg (11 X 1.5 + 8 ± 2).

**Nephrology and Hypertension: Question 46**
The correct answer is A

**Educational Objectives**
Treat a patient with renal insufficiency and HIV infection.

**Critique**
Patients with HIV infection develop acute renal failure for reasons similar to those in patients without such infection. Complications related to superinfections seen in HIV-infected patients and complications related to antiretroviral therapy must be considered in the differential diagnosis. The hyperkalemia, hyperuricemia, hypocalcemia, and hyperphosphatemia are characteristic of rhabdomyolysis; hematuria on dipstick and lack of erythrocytes on microscopy are further diagnostic evidence. The absence of crystalluria and hematuria suggests against indinavir crystal nephrolithiasis, while the absence of proteinuria argues against HIV-associated nephropathy and diabetic nephropathy. In addition, diabetic nephropathy typically complicates diabetes of more than 10 years duration.

**Nephrology and Hypertension: Question 47**
The correct answer is A

**Educational Objectives**
Recognize statin-induced rhabdomyolysis in a patient with HIV infection.

**Critique**
Rhabdomyolysis is increasingly recognized as a cause of renal failure in patients with HIV infection. In this patient, treatment with a statin is most likely the cause of the rhabdomyolysis and renal failure. Typically, the course of renal disease is self-limited if the cause of the muscle injury is appropriately addressed. An oliguric phase is often followed by a diuretic phase. Monitoring the patient for need for renal replacement in the first phase and for fluid and electrolyte disorders in the second phase is advisable. Renal disease caused by indinavir is unlikely to be associated with this particular electrolyte pattern or with rhabdomyolysis. There is no indication for plasmapheresis. If the clinical diagnosis can be established with relative certainty, renal biopsy is not indicated. It is prudent to avoid the use of angiotensin-converting enzyme inhibitors, which are often administered to treat HIV-associated nephropathy, in patients with an acute decline in renal function.
Nephrology and Hypertension: Question 48
The correct answer is D
Educational Objectives
Recognize the clinical presentation of IgA nephritis.

Critique
Development of hematuria and nephritic urine sediment within 1 day or so of an upper respiratory infection is a common presentation of IgA nephritis. This would not be seen in post-streptococcal glomerulonephritis, in which renal disease appears 1 to 2 weeks after the respiratory infection. Usually, patients with IgA nephritis present with asymptomatic hematuria and trivial proteinuria. Lupus nephritis and post-streptococcal nephritis are often associated with low complement levels. Renal papillary necrosis is not associated with a nephritic sediment and occurs in association with severe renal infection or long-term analgesic use. Acute interstitial nephritis usually occurs after exposure to drugs, especially antibiotics, which this patient did not receive.

Nephrology and Hypertension: Question 49
The correct answer is B
Educational Objectives
Identify angiotensin receptor blockade as appropriate therapy for type 2 diabetes with nephropathy.

Critique
Two recent trials demonstrated that the angiotensin receptor blockers irbesartan and losartan exert a renoprotective effect in type 2 diabetes with nephropathy. Both agents reduced the primary renal end points of doubling of serum creatinine concentration, need for dialysis, and need for transplantation. However, the studies were relatively short and did not document a significant benefit in patient survival. Therapy with angiotensin receptor blockers also reduced proteinuria. Angiotensin-converting enzyme inhibitors should be avoided in this patient, who has had severe cough with this therapy. The renoprotective effect of angiotensin-converting enzyme inhibitors has been shown in type 1 diabetes with nephropathy in a randomized controlled trial. In one trial, amlodipine did not have the renoprotective effect noted with the angiotensin receptor irbesartan. Renal outcomes in the amlodipine group were inferior to those in the irbesartan group and similar to those in the placebo group. α-Blockers have not been shown to decrease proteinuria or preserve renal function in type 2 diabetes.

Nephrology and Hypertension: Question 50
The correct answer is B
Educational Objectives
Diagnose and treat acute renal failure in the peripartum setting.

Critique
Diagnoses associated with acute renal failure specifically related to pregnancy include preeclampsia, acute cortical necrosis, fatty liver of pregnancy, and acute renal failure secondary to amniotic fluid embolism. In the past, sepsis during the puerperium was often associated with acute tubular necrosis. This patient has fatty liver of pregnancy, a rare disorder of unknown etiology that may form part of a spectrum including preeclampsia and the HELLP (hemolysis, elevated liver enzyme levels, and low platelet count) syndrome. Fatty liver of pregnancy is characterized by nausea and vomiting, with jaundice and severe hepatic dysfunction in the third trimester and the peripartum period. As many as 60% of patients with fatty liver of pregnancy have acute renal failure associated with the disease, although this proportion may reflect findings in older case series. Laboratory examination may
demonstrate evidence of disseminated intravascular coagulation. Although acute fatty liver of pregnancy mimics some of the features of preeclampsia and the HELLP syndrome, hyperbilirubinemia and hypoglycemia may provide important differential clues to its presence. Although hepatic imaging studies may not be sensitive to provide discrimination among microangiopathic hemolytic anemia, preeclampsia, the HELLP syndrome, and acute fatty liver of pregnancy, liver biopsy can establish the latter diagnosis with certainty.

Acute cortical necrosis is most often characterized by oliguria. The urine indices, urinalysis results, and polyuria argue against prerenal azotemia as a unifying diagnosis, and the patient has no signs of volume depletion. Hyperbilirubinemia is usually not as prominent in preeclampsia as in this case. Microangiopathic hemolytic anemia is unlikely without characteristic findings on the peripheral smear.

Nephrology and Hypertension: Question 51
The correct answer is A
Educational Objectives
Manage acute renal failure associated with fatty liver of pregnancy.
Critique
The disorders associated with fatty liver of pregnancy typically resolve after expeditious delivery, and the prognosis for maternal and infant survival is good. Volume replacement is not indicated in this patient, who is volume overloaded. There is no indication for dialysis or plasma exchange.

Nephrology and Hypertension: Question 52
The correct answer is D
Educational Objectives
Recognize the expected urinalysis result in a patient with volume depletion.
Critique
The specific gravity estimates the solute concentration of urine. It is defined as the weight of the solution compared with that of an equal volume of distilled water. Plasma has a specific gravity of 1.008 to 1.010. A specific gravity of 1.010 usually represents a urine osmolality of about 300 mosmol/kg. In the setting of metabolic acidosis, urinary pH is usually less than 5.0. A pH greater than 5.3 indicates an abnormal acidification response, and renal tubular acidosis is probably present. The appropriate response to volume depletion and non-anion gap acidosis is to preserve volume and excrete excess acid, respectively. This is reflected in the urinalysis with a high specific gravity (1.030) and a low pH. In very concentrated urine specimens, the protein content may be sufficient to be measurable by dipstick, and trace to 1+ proteinuria can be seen. Options A and B have no proteinuria, which is consistent with a volume-depleted state with otherwise normal renal tubular function; however, the pH should be much lower, indicating appropriate acid secretion. Urinalysis B could be seen if an underlying acidification defect were present. Cyclosporine is sometimes associated with type IV renal tubular acidosis, in which hyperkalemia is the dominant feature. This occurs in approximately 20% of patients receiving cyclosporine. Since this patient’s laboratory values were normal 2 weeks earlier, he probably does not have type IV renal tubular acidosis associated with cyclosporine therapy. Options C and E have appropriate protein content and pH, but the specific gravity is inappropriate.
Nephrology and Hypertension: Question 53
The correct answer is C

Educational Objectives
Recognize the urinary characteristics of myoglobinuria.

Critique
Myoglobinuria secondary to rhabdomyolysis is one cause of red urine that tests positive for heme, with few or no red blood cells on microscopy. The supernatant of a centrifuged urine sample will also test positive for heme by dipstick analysis. If the supernatant tests negative for heme, other causes of red urine, such as beeturia, use of the urinary analgesic phenazopyridine, or acute porphyria, should be suspected. Dipstick analysis records a reaction between hydrogen peroxide and a chromogen, catalyzed by hemoglobin.
The syndrome of pigment-induced renal failure usually presents with an elevated serum creatine kinase level, red or brown urine, and granular casts. Red blood cell casts are not usually seen in the sediment analysis of a patient with rhabdomyolysis.

Nephrology and Hypertension: Question 54
The correct answer is A

Educational Objectives
Recognize the significant prevalence of chronic kidney disease in the United States.

Critique
The U.S. Renal Data System Annual Data Report 2002 indicated that approximately 400,000 patients were treated for end-stage renal disease in that year, twice the number treated in 1991. However, it appears that many more persons have earlier stages of chronic kidney disease. Awareness has increased that care for pre-end-stage renal disease is suboptimal and better care may improve patient outcomes. A first step toward better care is the National Kidney Foundation’s Kidney Disease Outcomes Quality Initiative (K/DOQI) Workgroup, which recently proposed a definition, nomenclature, staging, and action plan for treatment of chronic kidney disease. The magnitude of chronic kidney disease is emerging from data from the Third National Health and Nutrition Examination Survey (NHANES).
Answer B is incorrect because the K/DOQI Workgroup estimated that approximately 11% of the U.S. adult population (about 20 million persons) has chronic kidney disease, manifested by microalbuminuria, clinical proteinuria, or glomerular filtration rate of 60 mL/min or less.
Answer D is incorrect because approximately 10% of the U.S. population has microalbuminuria and 1% had clinical proteinuria on a single “spot” sample during screening of nearly 15,000 Americans for NHANES. The Workgroup estimates that nearly eight million Americans have stage III, IV, or V chronic kidney disease (defined as an estimated glomerular filtration rate ≤60 mL/min). The NHANES estimates that approximately 6.2 million Americans have a serum creatinine concentration greater than 1.5 mg/dL and more than 800,000 have a concentration greater than 2.0 mg/dL. Hence, answer C is incorrect because it underestimates the number of patients with an elevated serum creatinine concentration.
Nephrology and Hypertension: Question 55
The correct answer is B
Educational Objectives
Recognize the presentation and clinical features of minimal change disease.
Critique
Sudden onset of swelling and nephrotic syndrome in a young person with urine that shows oval fat bodies but not cellular casts is most often due to membranous nephropathy, minimal change disease, or focal and segmental glomerulonephritis. The renal biopsy shows no immune deposits by immunofluorescence or electron microscopy, thus excluding membranous nephropathy or membranoproliferative nephropathy. Results of normal light microscopy exclude focal and segmental glomerulosclerosis. Alport’s disease usually involves altered glomerular basement membrane characteristics, but it usually does not present with the nephrotic syndrome and is associated with a family history of renal disease.

Nephrology and Hypertension: Question 56
The correct answer is A
Educational Objectives
Treat a patient with renal insufficiency who will receive intravenous contrast for an angiographic study.
Critique
This patient is at relatively high risk for contrast nephropathy. If contrast must be administered, normalization of volume status is advisable. Acetylcysteine has been used successfully to diminish the decline in renal function in patients receiving intravenous contrast for computed tomography. Results may depend on the type and amount of contrast administered, the patient’s clinical status, and the type of procedure performed. The bulk of evidence does not favor dopamine as effective in reducing the incidence of contrast-induced renal failure. Although half-normal saline and the combination of half-normal saline and acetylcysteine have been used to prevent contrast nephropathy, sodium and water should be administered with caution in this patient with volume overload and hyponatremia. Bicarbonate and calcium channel blockers have not been shown in rigorously controlled randomized trials to be effective in decreasing the incidence of contrast-mediated nephropathy.

Nephrology and Hypertension: Question 57
The correct answer is B
Educational Objectives
Understand the differential diagnosis of an osmolar gap that occurs in conjunction with an anion gap metabolic acidosis.
Critique
The patient presents with an anion gap metabolic acidosis. The differential diagnosis of an anion gap metabolic acidosis can be narrowed by calculating the osmolar gap. The calculated serum osmolality is 291, but the measured osmolality is 326; thus, the osmolar gap is 35, suggesting that an osmotic substance is active in the serum but is not being measured. Methanol causes both an anion gap metabolic acidosis and an elevated osmolar gap. Metabolic acidosis is indicated by the low serum bicarbonate level and pH less than 7.4. The anion gap is 28, calculated as 140 - (100 + 12). The change in the anion gap is 16, whereas the change in the serum bicarbonate level is 12. The ratio of 1.3 between the change in the anion gap and the change in serum bicarbonate level suggests no concurrent non-anion gap metabolic acidosis or metabolic alkalosis. Respiratory compensation for the metabolic acidosis is appropriate. The expected
Fto2 for the decrease in serum bicarbonate is 26 ± 2 mm Hg, calculated as 12 X 1.5 + 8 ± 2.

Ethanol ingestion increases the osmolar gap but does not cause this degree of metabolic acidosis unless it is accompanied by concomitant lactic acidosis. Ingestion of isopropyl alcohol also increases the osmolar gap but does not produce anion gap metabolic acidosis. Use of salicylate causes anion gap metabolic acidosis but does not increase the osmolar gap.

Nephrology and Hypertension: Question 58
The correct answer is C

Educational Objectives
Recognize that renal tubular acidosis is a cause of nephrolithiasis.

Critique
This patient has renal tubular acidosis, as evidenced by hypokalemia and inappropriately alkaline urine in the presence of a metabolic acidosis. Nephrocalcinosis is consistent with renal tubular acidosis. Renal tubular acidosis can result from the tubulointerstitial renal disease that occurs with Sjogren's syndrome, a condition that is sometimes associated with Crohn's disease. The normal calcium and phosphate values make hyperparathyroidism unlikely. Enteric hyperoxaluria may be seen in inflammatory bowel disease, but usually only in the setting of significant gastrointestinal malabsorption and diarrhea. Idiopathic hypercalciuria does not cause metabolic acidosis or hypokalemia.

Nephrology and Hypertension: Question 59
The correct answer is B

Educational Objectives
Diagnose and treat a patient with metabolic acidosis.

Critique
This patient presents with obtundation, profound acidemia, and a large osmolar and anion gap, all of which are resistant to medical management. The differential diagnosis includes intoxication with ethanol, methanol, or ethylene glycol. Diabetic ketoacidosis and ingestion of mannitol can cause an osmolar gap, but not to the severe degree seen in this case. The calculated serum osmolality is 330 mosmol/kg H2O, indicating an osmolar gap of 45 mosmol/kg H2O. The normal osmolar gap of 10 to 15 mosmol/kg H2O is primarily accounted for by calcium anions, proteins, and lipids.

The lack of malodorous breath argues against ethanol intoxication, and no ethanol is detected in this patient's blood. The lack of papilledema argues against methanol intoxication. Given the clinical presentation and laboratory data, the presumptive diagnosis of ethylene glycol intoxication must be considered. Prompt intervention may improve patient outcome. Although most cases of ethylene glycol ingestion are accidental and only moderately serious, severe poisoning due to deliberate ingestion is occasionally seen. Ethylene glycol is usually used as an inexpensive substitute for ethanol or as an agent in a suicide attempt. The lactic acidosis in this patient is due to inhibition of the citric acid cycle, with subsequent increased conversion of pyruvate to lactate and decreased utilization of lactate. Accumulation of glycolic acid in the blood produces severe metabolic acidosis. A small proportion of ethylene glycol is metabolized to oxalate, which precipitates with calcium to form calcium oxalate crystals; these crystals, however, are seen in only about 50% of patients in the acute phase and may only appear after a latency period of 4 to 8 hours. Acute oliguric renal failure, which usually occurs 24 to 72 hours after ingestion, is due to intraluminal crystal deposition and acute tubular necrosis. Microscopic hematuria is often seen as well. Recovery of renal function is usually complete;
however, renal replacement therapy or renal transplantation may be necessary in a few patients. The goals of treatment of ethylene glycol intoxication are rapid restoration of acid-base status and clearance of the toxin and its toxic metabolites. Ethanol inhibits metabolism of ethylene glycol to its toxic metabolites by blocking the receptor sites of alcohol dehydrogenase. Ethanol is administered to facilitate renal elimination of ethylene glycol. In this patient, hemodialysis is indicated because of the severe acidemia that is refractory to standard medical therapies, especially in the face of renal insufficiency presumably due to acute renal failure. Hemodialysis removes both ethylene glycol and its toxic metabolites. Fomepizole has recently been introduced as another therapy for ethylene glycol intoxication. Although aspects of this case mimic diabetic ketoacidosis and alcoholic ketoacidosis, hyperglycemia is not a critical component of this patient's presentation, and administration of insulin will not ameliorate the acidemia. Confusion with diabetic ketoacidosis could delay proper therapy. The patient has no indication for plasma exchange. Exposure to contrast should be avoided in patients with acute renal failure unless absolutely necessary.

**Nephrology and Hypertension: Question 60**

The correct answer is A

**Educational Objectives**

Recognize that primary hypertension is more common than renovascular hypertension in elderly persons.

**Critique**

This patient has primary hypertension of more than 20 years’ duration with modest renal insufficiency, presumably secondary to hypertensive nephrosclerosis. His blood pressure was elevated on admission. Noninvasive studies suggested renal artery stenosis; however, the evidence does not suggest renovascular hypertension. The patient has a long duration of hypertension controlled on two drugs, nonsignificant narrowing of the right renal artery by angiography, and renal vein renins that do not lateralize to the side of questionable stenosis. Anatomic renal artery stenosis is not uncommon in elderly persons, but true renovascular hypertension is rare. Hypothyroidism is not present because the thyroid-stimulating hormone level is normal. Primary hyperaldosteronism is unlikely in the setting of normal serum potassium, plasma renin activity, and plasma aldosterone values. No clinical clues suggest pheochromocytoma.

**Nephrology and Hypertension: Question 61**

The correct answer is B

**Educational Objectives**

Recognize the clinical presentation of type IV lupus nephritis.

**Critique**

The clinical presentation of arthralgia, glomerulonephritis with nephritic urine sediment, nephritic-range proteinuria, positive antinuclear antibodies, and low C3 and C4 levels are all typical of diffuse proliferative lupus nephritis (World Health Organization type IV). Post-streptococcal glomerulonephritis would not involve prolonged depression of complement levels, nor would antinuclear antibodies or anti-double-stranded antibodies be positive. Clinically, the patient does not have chronic rheumatoid arthritis, which is the setting in which renal disease associated with rheumatoid arthritis occurs. It would be unusual for focal proliferative lupus nephritis (type II) to present with such severe degrees of proteinuria and azotemia. Polyarteritis is not associated with the presence of antinuclear antibodies or with complement abnormalities.
The correct answer is A

**Educational Objectives**

Know the basic treatment of type IV lupus nephritis.

**Critique**

Currently, a combination of corticosteroids and cyclophosphamide is more effective than high-dose prednisone alone in the treatment of diffuse proliferative lupus nephritis (World Health Organization type IV). Trials of small numbers of patients receiving mycophenolate mofetil have been performed, but this treatment is not considered the standard of care. No large trials of cyclosporine in lupus nephritis have been performed.

The correct answer is E

**Educational Objectives**

Manage a patient with acute renal failure secondary to treatment with lithium.

**Critique**

Treatment with lithium has a narrow therapeutic index. Acute toxicity in a patient receiving long-term lithium therapy typically presents as levels of 3 to 4 meq/L, in association with neurologic symptoms and renal insufficiency. Chronic lithium intoxication can manifest at concentrations only slightly greater than the therapeutic range (0.6 to 1.5 meq/L). Although not guided by results of randomized controlled trials, hemodialysis has been recommended to treat patients receiving long-term lithium treatment who have symptoms of toxicity and levels greater than 4.0 meq/L. This patient has renal insufficiency and hyperkalemia, both of which are relative indications for dialysis. The physical examination does not clearly demonstrate volume depletion. If the patient has intrinsic renal disease secondary to long-term lithium treatment, volume overload may result after administration of normal saline. Treatment with insulin and dextrose will not significantly change the lithium burden. Hemodialysis is superior to peritoneal dialysis in clearing lithium and potassium.

The correct answer is E

**Educational Objectives**

Recognize the role of 1,25-dihydroxyvitamin D therapy in treating secondary hyperparathyroidism in patients with chronic kidney disease.

**Critique**

This patient has biochemical evidence of secondary hyperparathyroidism due to chronic kidney disease, despite adequate control of the serum phosphorus level to less than 5.5 mg/dL with dietary phosphorus restriction and a calcium-based phosphate binder. Therapy with 1,25-dihydroxyvitamin D (calcitriol) is indicated as treatment for secondary hyperparathyroidism. This therapy should be administered to suppress parathyroid hormone and retard the development of renal bone disease. The goal of therapy is to maintain parathyroid hormone levels at two to three times normal, because excessive suppression to low levels of parathyroid hormone are associated with increased incidence of adynamic renal bone disease. Hence, answer E is correct and answers A and C are incorrect.

Calcium acetate or calcium carbonate taken with meals acts primarily as a calcium phosphate binder. The addition of either agent to the patient’s existing medical regimen is unlikely to increase calcium absorption from the gastrointestinal tract or further suppression of parathyroid hormone.
Nephrology and Hypertension: Question 65
The correct answer is B
Educational Objectives
Recognize that lithi um therapy can cause defects in renal concentration.
Critique
The patient probably has hypernatremia due to a renal concentrating defect caused by lithium therapy. The urine specific gravity is low despite an increased serum sodium level, indicating a renal concentrating defect. In healthy persons, 12 or more hours of fluid restriction would result in renal water conservation and high specific gravity of the urine and would not result in hypernatremia. High dietary sodium intake does not cause hypernatremia, and the syndrome of inappropriate antidiuretic hormone secretion results in hyponatremia.

Nephrology and Hypertension: Question 66
The correct answer is E
Educational Objectives
Know the clinical features of the most common type of glomerular disease in patients with HIV.
Critique
This patient has HIV nephropathy with collapsing focal and segmental glomerulosclerosis, manifested by nephritic-range proteinuria, azotemia, and normal-sized kidneys. Minimal change disease is rare in patients with HIV. Membranous nephropathy is sometimes associated with hepatitis B, and membranoproliferative glomerulonephritis with hepatitis C, in patients who have HIV; however, this patient tested negative for hepatitis B and C. Allergic interstitial nephritis does not cause nephritic-range proteinuria.

Nephrology and Hypertension: Question 67
The correct answer is C
Educational Objectives
Recognize the differential diagnosis of acute renal failure with hypercalcemia.
Critique
Hypercalcemia in the presence of acute renal failure is relatively unusual. Hyperphosphatemia and a decrease in renal 1-alpha hydroxylation of 25-hydroxycholecalciferol both act to predispose to hypocalcemia. Hypercalcemia may cause renal insufficiency through several mechanisms, including hemodynamic effects of vasoconstriction that mediate renal sodium and water retention, and direct effects on renal tubular sodium and water handling, resulting in prerenal azotemia secondary to volume depletion. The decreased anion gap in the presence of pancytopenia, metabolic acidosis, and acute renal failure suggests multiple myeloma. Acute renal failure is the initial presentation in as many as one half of patients with multiple myeloma. Hypercalcemia and use of nonsteroidal anti-inflammatory drugs are commonly associated with this presentation, as precipitants or concomitant conditions. The abnormal hypercalcemia that characterizes the milk-alkali syndrome depends on the presence of alkalemia, which mediates increased renal tubular calcium reabsorption; alkalemia is not present in this case. Sarcoidosis would be unusual in the absence of pulmonary disease. Primary hyperparathyroidism should be associated with hypophosphatemia and increased fractional excretion of phosphate. Although hydrochlorothiazide toxicity can present with volume depletion and prerenal azotemia, the presence of hematologic and metabolic complications makes this less likely as a unifying diagnosis.
Nephrology and Hypertension: Question 68
The correct answer is A
Educational Objectives
Diagnose multiple myeloma.
Critique
Abnormal findings on urine or serum electrophoresis with a monoclonal immunoglobulin can suggest the diagnosis of multiple myeloma. Although 1,25-dihydroxycholecalciferol levels should be high in sarcoidosis and hyperparathyroidism and low in the milk-alkali syndrome, the 25-hydroxycholecalciferol level reflects the patients nutritional status rather than acute pathophysiology. The N-terminal parathyroid hormone level is elevated in renal disease and secondary hyperparathyroidism and in renal disease mediated by the hypercalcemia associated with primary hyperparathyroidism. Although angiotensin-converting enzyme levels can be high in patients with sarcoidosis, they are also increased in patients with renal insufficiency. A urine screen for hydrochlorothiazide would have no diagnostic significance in this case.

Nephrology and Hypertension: Question 69
The correct answer is A
Educational Objectives
Recognize the appropriate noninvasive screening tests for renal artery stenosis in patients with azotemia.
Critique
On the basis of the patient’s clinical presentation with resistant hypertension, diffuse atherosclerosis, tobacco use, abdominal bruit, and unexplained azotemia, renal artery stenosis (and probably renovascular hypertension) is likely. Magnetic resonance angiography with gadolinium is a sensitive and specific noninvasive test to identify renal artery stenosis that does not expose the patient with azotemia to the potential nephrotoxicity of contrast agent, as is used with computed tomographic angiography or renal angiography. Hence, answer A is correct.
A recent meta-analysis of noninvasive tests for renal artery stenosis compared the results of magnetic resonance angiography, computed tomographic angiography, duplex ultrasonography, captopril renography, and plasma renin activity. The authors computed a receiver-operator characteristic curve and concluded the magnetic resonance angiography and computed tomographic angiography had significantly better diagnostic accuracy than the other screening tests. A cost-effectiveness analysis was not performed.
The same group of investigators also proposed a clinical prediction rule based on clinical clues of renal artery stenosis, such as age, sex, signs of atherosclerosis, smoking, onset of hypertension less than 2 years previously, body mass index, abdominal bruit, serum creatinine concentration, and cholesterol level. With a probability of 30% as a cut-off, the prediction rule had a sensitivity of 68% and specificity of 87%, similar to results of captopril renography in the same patients. In aggregate, the clinician should establish the likelihood of renal artery disease by using a predictive index and consider noninvasive testing with magnetic resonance angiography with gadolinium or computed tomographic angiography, since these methods have evolved as preferred noninvasive anatomic tests for renal artery disease. In patients with azotemia, magnetic resonance angiography with gadolinium is preferred because it does not expose the patient to potentially nephrotoxic contrast media.
Nephrology and Hypertension: Question 70
The correct answer is D
Educational Objectives
Recognize a cause of chloride-unresponsive metabolic alkalosis.
Critique
The patient has hypokalemia and an elevated serum bicarbonate level. Arterial blood gas values on day 2 suggest that she has metabolic alkalosis, which did not improve with intravenous hydration. She has appropriate respiratory compensation. Excess serum aldosterone leads to the development of sodium-sensitive hypertension, often with concomitant hypokalemia due to renal potassium wasting. The renal potassium wasting worsens with increased delivery of sodium chloride to the distal nephron, as occurs during intravenous hydration with normal saline. Thus, the patient most likely has primary hyperaldosteronism that induced metabolic alkalosis, hypokalemia, and hypertension. The day 10 laboratory values make essential hypertension unlikely. No historical evidence supports suspicion of pheochromocytoma. Although nonsteroidal anti-inflammatory drugs may cause volume-mediated hypertension, they are not commonly associated with either hypokalemia or metabolic alkalosis.

Nephrology and Hypertension: Question 71
The correct answer is B
Educational Objectives
Differentiate acute renal disease superimposed on chronic renal disease in a pregnant patient.
Critique
Women with serum creatinine concentrations greater than 1.4 mg/dL have a higher risk for worsening renal insufficiency than do women who do not become pregnant, and patients with chronic renal disease who become pregnant have a greater risk for preeclampsia than do women without renal insufficiency. Pregnant patients with preexisting renal disease develop both increased urinary protein excretion and worsening hypertension. The normal peripheral smear and platelet count and absence of signs of a systemic illness indicate that preeclampsia is unlikely at this early stage of pregnancy. However, differentiation between preeclampsia and chronic renal disease is challenging. Diagnosis of preeclampsia in patients with chronic renal disease who become pregnant is difficult because the markers for preeclampsia (hypertension, proteinuria, and renal insufficiency) are present before conception. Renal biopsy may be necessary if clinical decision making depends on establishing a diagnosis. The patient has no evidence of microangiopathic hemolytic anemia or prerenal azotemia.

Nephrology and Hypertension: Question 72
The correct answer is C
Educational Objectives
Recognize the limitations of dipstick measurement of protein in the urine.
Critique
This patient most likely has multiple myeloma, in which immunoglobulin light chains are overproduced. Dipstick for protein determination is a pH-dependent test in which a color change is induced in response to negatively charged proteins, which largely consist of albumin. Dipstick urinalysis is insensitive to the positively charged immunoglobulin light chains that are overproduced in multiple myeloma. The sulfosalicylic acid test will precipitate all proteins, including albumin. When nonalbumin proteinuria is present, the sulfosalicylic acid test will be positive and dipstick urinalysis will be negative. In this patient, dipstick urinalysis would be positive if heavy albuminuria were present. If a sulfosalicylic acid test were
performed, it would precipitate the light chains being excreted in the urine. In the setting of multiple myeloma or light chain overproduction, the normal resorptive capacity of the renal tubule is exceeded, and light chains appear in the urine in high quantity.

**Nephrology and Hypertension: Question 73**
The correct answer is C

**Educational Objectives**
Treat a patient with acute renal failure.

**Critique**
This patient has acute renal failure, probably secondary to acute tubular necrosis, and oliguria, congestive heart failure, metabolic acidosis, and hyperkalemia. In such patients, these complications of acute renal failure are best treated with renal replacement therapy, especially in the face of oliguria. A recent controlled trial suggested that continuous hemofiltration was superior to intensive peritoneal dialysis in patients with sepsis. Fenoldopam is not indicated as a treatment for acute renal failure. Ultrafiltration does not treat hyperkalemia and is not an efficient therapy for acidemia in patients with acute renal failure. Plasma exchange is not an efficient treatment for patients with acute renal failure and is not indicated in this case.

**Nephrology and Hypertension: Question 74**
The correct answer is B

**Educational Objectives**
Know the clinical features of the most common type of glomerular disease in patients with HIV.

**Critique**
Collapsing focal and segmental glomerulosclerosis may progress rapidly to end-stage renal disease and occurs more commonly in black persons. Such patients have normal-sized to large kidneys. The disease course may be modified by antiretroviral therapy, angiotensin-converting enzyme inhibitors, and steroids.

**Nephrology and Hypertension: Question 75**
The correct answer is C

**Educational Objectives**
Recognize that sevelamer is an appropriate alternative to phosphate binder therapy.

**Critique**
This patient developed moderate hypercalcemia in response to calcium-based phosphate binder therapy. Sevelamer is a resin that acts as a non-calcium-based phosphate binder with little risk of drug-induced hypercalcemia. In a comparative study of patients with end-stage renal disease, the phosphate-binding ability of sevelamer was nearly equal to that of calcium acetate. Specific indications for use of sevelamer include hypercalcemia induced by calcium-based binders and, possibly, vascular calcification. The latter indication is controversial; preliminary data suggest that sevelamer may halt the progressive vascular calcification (as assessed by electron-beam computed tomography) in patients with end-stage renal disease compared with calcium acetate therapy, but long-term data are lacking on clinical cardiovascular or peripheral vascular events. Although sevelamer is the most appropriate therapy in this case, a major barrier to its widespread use is its high cost. Few patients with severe secondary hyperparathyroidism resistant to dietary phosphate restriction, phosphate binders, and calcitriol therapy require parathyroidectomy. Patients with secondary hyperparathyroidism due to progressive loss of glomerular filtration require phosphate binders to keep the serum phosphorus level less than 5.5 mg/dL and the calcium X phosphorus product less than 55 to
retard the development of secondary hyperparathyroidism. Aluminum hydroxide is an effective phosphorus binder, but its use was discontinued because of aluminum-related dementia in patients undergoing dialysis.

Nephrology and Hypertension: Question 76

The correct answer is D

Educational Objectives

Know that amiloride therapy reduces urinary excretion of potassium and calcium.

Critique

Patients with hypercalciuric nephrolithiasis who develop hypokalemia while receiving a thiazide can be treated with amiloride. Amiloride has a potassium-sparing effect and directly increases distal calcium reabsorption. Furosemide would increase urinary calcium excretion. A high-potassium diet rarely corrects thiazide-induced hypokalemia. Acetazolamide induces bicarbonate wasting, worsens the tendency to hypokalemia, and provides no additional benefit in controlling hypercalciuria.

Nephrology and Hypertension: Question 77

The correct answer is B

Educational Objectives

Recognize corticoid excess in a patient with hypertension and hypokalemia.

Critique

This patient presents with hypertension, metabolic alkalosis with hypokalemia, and a low normal plasma and urinary aldosterone suggestive of corticoid excess due to tobacco chewing. Chewing tobacco is adulterated with licorice-containing glycyrrhizic acid. Licorice and its derivatives cause hypertension by inhibiting inactivation of cortisol by 11β-dehydrogenase. This results in increased activation of corticosteroid receptors by cortisol, an effect that is most obvious for renal mineralocorticoid receptors, resulting in sodium retention and kaliuresis. Modest increases in the serum cortisol level and urinary level of free cortisol are diagnostic of corticoid excess. The appropriate therapy is discontinuation of the licorice-containing products. The biochemical data do not support the diagnosis of primary hyperaldosteronism. The low plasma renin activity and clinical presentation do not suggest renal artery stenosis. No clues suggest Addison’s disease.

Nephrology and Hypertension: Question 78

The correct answer is E

Educational Objectives

Understand the correct management of a patient with acute renal failure after a cardiovascular procedure.

Critique

The differential diagnosis of acute renal failure after a vascular intervention in patients with heart disease is broad and includes atheroembolic disease, contrast nephropathy, and acute tubular necrosis. Usually, the acute renal failure induced by contrast media is self-limited, and patients can be observed to determine whether clinical criteria for dialysis emerge. Dialysis can be instituted if specific indications arise. This patient has no indications for dialysis. Administration of dopamine has not been shown in well-designed randomized controlled trials to improve the course of contrast nephropathy. Arterial blood gas should be measured to determine whether the patient has acidemia. Treatment with hydration and acetylcysteine after development of acute renal failure from contrast media has not been studied. Hemodialysis to remove contrast has not been shown to improve the course of contrast-induced nephropathy.
Nephrology and Hypertension: Question 79
The correct answer is C
Educational Objectives
Know the appropriate treatment of hyperlipidemia in the nephrotic syndrome.
Critique
Hyperlipidemia in the nephrotic syndrome is a risk factor for cardiovascular disease and should be treated with a statin. Diet therapy is almost never adequate to correct the high lipid levels. Cyclosporine worsens lipid abnormalities, and the presence of hyperlipidemia does not predict response to treatment.

Nephrology and Hypertension: Question 80
The correct answer is C
Educational Objectives
Recognize mixed acidosis after a seizure and understand the differential diagnosis and appropriate treatment.
Critique
The patient has an anion gap metabolic acidosis with concurrent respiratory acidosis. Lactic acidosis associated with the seizure is the most likely explanation for the metabolic acidosis. Since this state quickly reverses with cessation of the seizure, observation alone is warranted. Metabolic acidosis is indicated by the low serum bicarbonate level and pH less than 7.4. The expected PCO2 in metabolic acidosis with a serum bicarbonate level of 10 meq/L is 23±2 mm Hg; thus, the measured PCO2 of 38 mm Hg indicates concurrent respiratory acidosis. The calculated anion gap is 26, and the ratio of change in the anion gap (14) to the change in serum bicarbonate level (14) is 1, suggesting no concurrent non-anion-gap metabolic acidosis or metabolic alkalosis. Mechanical ventilation to correct the concurrent respiratory acidosis is not needed if the patient is controlling his airway. Acetazolamide may cause a proximal renal tubular acidosis and thus worsen the acidosis. Intravenous fluids are not contraindicated, but neither are they necessary to correct the acid-base disturbance. Although the patient has an arterial blood pH less than 7.2, the transient nature of the acidosis along with the ability to regenerate bicarbonate from lactate makes bicarbonate therapy unnecessary.

Nephrology and Hypertension: Question 81
The correct answer is B
Educational Objectives
Recognize the effect of hypomagnesemia on parathyroid hormone.
Critique
Many patients with severe hypomagnesemia also have hypocalcemia because hypomagnesemia inhibits the release and action of parathyroid hormone. Generally, increasing the plasma magnesium level to greater than 1.0 mg/dL protects against further neurologic symptoms and corrects hypocalcemia. Hypomagnesemia does not impair the action of vitamin D.
Nephrology and Hypertension: Question 82
The correct answer is C

**Educational Objectives**
Know some of the causes of acute renal failure.

**Critique**
Hypercalcemia can cause acute renal failure by interfering with renal concentrating function, leading to volume depletion; by calcium deposition in the renal parenchyma, causing fibrosis; and by direct hemodynamic effects, causing afferent arteriolar constriction. In this patient, the latter cause is most likely. Acute renal failure due to myeloma kidney is always associated with abnormal light chains in urine or plasma. The negative urinalysis excludes acute interstitial nephritis and glomerular disease. In the absence of hypertension, severe bilateral renal arterial stenosis is unlikely.

Nephrology and Hypertension: Question 83
The correct answer is B

**Educational Objectives**
Recognize treatment of hypercalcemia in the setting of sarcoidosis.

**Critique**
In this patient, stopping oral calcium and vitamin D will correct hypercalcemia. Patients with sarcoidosis have increased production of 1,25-dihydroxyvitamin D by granuloma cells. As many as 10% of patients with sarcoidosis develop hypercalcemia even in the absence of additional calcium or vitamin D intake. The supplemental calcium and vitamin D in this patient caused increased formation of 1,25-dihydroxyvitamin D and increased gastrointestinal absorption of calcium. Hydrochlorothiazide worsens hypercalcemia because renal calcium excretion decreases. No evidence of secondary or primary hyperparathyroidism exists in this patient, since the parathyroid hormone level is normal. Oral sodium chloride might increase renal calcium excretion but is unlikely to correct the hypercalcemia or the reason for the hypercalcemia.

Nephrology and Hypertension: Question 84
The correct answer is D

**Educational Objectives**
Recognize the presentation and diagnosis of berry aneurysm in a patient with autosomal dominant polycystic kidney disease.

**Critique**
The patients neurologic symptoms 48 hours earlier probably represent a “sentinel bleed” from a berry aneurysm. The likelihood of central nervous system bleeding after such an event is high and warrants urgent evaluation. Magnetic resonance angiography with gadolinium provides acceptable imaging of the carotids, circle of Willis, and central nervous system vasculature to identify or exclude berry aneurysm, which might require intervention. Overall, aneurysm is found in approximately 10% of all patients with autosomal dominant polycystic kidney disease and in about 25% of patients with polycystic kidney disease who have a positive family history of aneurysm. Routine screening with magnetic resonance angiography is often recommended in patients with this family history and autosomal dominant polycystic kidney disease. All patients with autosomal dominant polycystic kidney disease who have central nervous system symptoms should undergo magnetic resonance angiography evaluation to exclude a life-threatening condition.
Supportive treatment and neurology consultation do not address the potential urgency of the circumstances. Computed tomography of the head without contrast...
does not identify berry aneurysm with precision.

**Nephrology and Hypertension: Question 85**
The correct answer is A
**Educational Objectives**
Diagnose and treat acute renal failure in a patient with HIV infection.
**Critique**
The course and laboratory findings are consistent with thrombotic thrombocytopenic purpura, which can be a complication of HIV infection. A case series from France suggests that thrombotic thrombocytopenic purpura is a common cause of acute renal failure in HIV-infected patients. Plasma exchange is indicated, but a recent case report suggests an important role for concurrent administration of antiretroviral therapy to achieve desired therapeutic outcomes. Classic HIV-associated nephropathy or glomerulonephritis is unlikely in the absence of significant proteinuria. The urinalysis is incompatible with acute tubular necrosis.

**Nephrology and Hypertension: Question 86**
The correct answer is D
**Educational Objectives**
Recognize the clinical features of nephrosclerosis.
**Critique**
The patient has nephrosclerosis after many years of uncontrolled hypertension. Nephrosclerosis usually causes less than 1 g of proteinuria and slowly progressive kidney failure over many years. Membranous nephropathy usually has more proteinuria when it causes kidney failure. IgA nephritis has a nephritic urine sediment, which is not present here. Obstructive uropathy is seen after severe, prolonged bilateral obstruction, for which this patient has no history. Obesity-related renal disease is focal segmental glomerulosclerosis and is usually associated with nephritic-range proteinuria.

**Nephrology and Hypertension: Question 87**
The correct answer is A
**Educational Objectives**
Understand the cause of hyponatremia in cirrhosis.
**Critique**
This patient with hyponatremia and excess extracellular fluid volume has nonosmotic stimulation of antidiuretic hormone due to decreased arterial blood volume (decreased effective circulating volume) from splanchnic vasodilation. Hyponatremia may be seen in the hepatorenal syndrome, but the syndrome is not the cause of the hyponatremia. A low-sodium diet is almost never associated with hyponatremia, especially in a patient who is avidly retaining sodium. Patients with reset osmostat have appropriately dilute urine in the setting of hyponatremia; this patient’s urine is inappropriately concentrated for the level of serum hypotonicity. Pseudohyponatremia occurs in patients with very high serum levels of either protein or lipids.

**Nephrology and Hypertension: Question 88**
The correct answer is C
**Educational Objectives**
Diagnose and treat acute renal failure in a patient with a renal transplant.
**Critique**
Colchicine and diltiazem may exacerbate cyclosporine toxicity. The patients blood pressure elevation and hyperuricemia are probably due to treatment with
cyclosporine. Medications that compete for P-450A metabolism, such as diltiazem and colchicine, increase the circulating levels of cyclosporine and the risk of developing cyclosporine toxicity. Cyclosporine trough levels may not be reliable in determining the degree of toxicity in such cases. Recurrent focal and segmental glomerulosclerosis is unlikely in the absence of a high level of urinary protein excretion; in this case, the urinary protein-to-creatinine ratio suggests urinary protein excretion in the range of approximately 400 mg/24 h. Transplant renal artery stenosis is unlikely, since this usually occurs early in the course of transplantation. Uric acid nephropathy is unlikely to cause acute renal failure in the setting of a serum uric acid concentration less than 15 mg/dL and a relatively low uric acid-to-creatinine ratio. Polyoma virus is associated with overimmunosuppression, particularly in patients receiving mycophenolate, tacrolimus, and leukocyte-depleting agents for induction or for treatment of acute rejection.

Nephrology and Hypertension: Question 89
The correct answer is A
Educational Objectives
Know that focal and segmental glomerulosclerosis can occur secondary to remote renal injury in which significant loss of nephrons occurred.
Critique
This patient has focal and segmental glomerulosclerosis associated with severe nephron injury and loss early in life, related to vesicoureteral reflux. Membranous nephropathy and minimal change disease cause heavy proteinuria but are not associated with vesicoureteral reflux. Nephrosclerosis does not cause heavy proteinuria.

Nephrology and Hypertension: Question 90
The correct answer is A
Educational Objectives
Know the mechanism of renal injury in focal and segmental glomerulosclerosis.
Critique
The mechanism of injury is thought to be hyperfiltration after extensive nephron loss. Uncontrolled hypertension, which this patient does not have, may worsen kidney failure but does not cause reflux nephropathy. There is no evidence that immune complex deposition plays a role in this disease. Although vesicoureteral reflux may be associated with urinary infection, reflux nephropathy may occur in the absence of significant urinary infection.

Nephrology and Hypertension: Question 91
The correct answer is C
Educational Objectives
Identify microalbuminuria as a cardiovascular risk factor and appreciate its measurement in clinical practice.
Critique
Further analysis of data from the Heart Outcomes Prevention Evaluation trial demonstrated that microalbuminuria was an independent predictor of cardiovascular events in both diabetic and nondiabetic persons at risk for such events. Clinical measurement of microalbuminuria is an important tool for assessment of chronic kidney disease and estimation of cardiovascular risk. Recent guidelines from the National Kidney Foundation suggest that timed urine collections are not required and that a "spot" urine sample to calculate the albumin-to-creatinine ratio is preferred. The albumin-to-creatinine ratio varies by sex because of difference in
muscle mass. The established criteria for albumin-to-creatinine ratios for normal, microalbuminuria, and overt clinical proteinuria are as follows: In men, a normal albumin-to-creatinine ratio is less than 17 mg/g, whereas in women, less than 25 mg/g is normal. In microalbuminuria, the ratio is 17 to 250 mg/g in men and 25 to 355 mg/g in women; in clinical proteinuria, the ratio is greater than 250 mg/g in men, whereas in women, it is greater than 355 mg/g. The albumin-to-creatinine ratio greater than 500 mg/g indicates levels above the microalbuminuria range that are consistent with clinical proteinuria.

**Nephrology and Hypertension: Question 92**
The correct answer is E

**Educational Objectives**
Appreciate current lack of evidence for treatment of acute renal failure with biological response modifiers.

**Critique**
The differential diagnosis of acute renal failure in a patient with coronary artery disease after cardiac catheterization and surgery is broad and includes prerenal azotemia, contrast-induced nephropathy, atheroembolic renal disease, and drug-induced syndromes (in this case, rhabdomyolysis secondary to 3-hydroxy methylglutaryl coenzyme A [HMG COA] reductase inhibitors and change in the balance of glomerular arteriolar resistances secondary to blockage of angiotensin II). Such cases are usually multifactorial. The laboratory findings in this patient are consistent with acute tubular necrosis.

Approximately 3% of patients undergoing percutaneous coronary procedures at a large center developed acute renal failure, and about 0.3% required dialysis. Patients who had emergent procedures were more likely to develop acute renal failure. This patient has no indications for renal replacement therapy and should be observed. Prophylactic administration of dopamine, endothelin antagonists, and furosemide has not been demonstrated to improve outcomes in this setting. Thyroxine was not effective in a recently published clinical trial of patients with acute renal failure.

**Nephrology and Hypertension: Question 93**
The correct answer is D

**Educational Objectives**
Recognize the features of infection-associated glomerulonephritis.

**Critique**
This patient has infection-associated glomerulonephritis caused by a chronic endovascular infection that stems from the central line through which she receives total parenteral nutrition. The renal injury is caused by immune complex deposition and is associated with the alternative pathway of complement activation and nephritic urine sediment. Staphylococcus epidermidis is commonly encountered in shunt nephritis (infected ventriculojugular shunt), which closely resembles this patient’s illness. Lupus nephritis and IgA nephritis have nephritic urine sediment, but the clinical picture excludes these diagnoses. Acute tubular necrosis does not have significant proteinuria or a nephritic sediment. Positivity for anti-double-stranded antibodies is sensitive but not specific for lupus; furthermore, the patient does not have other clinical features suggestive of lupus.
Nephrology and Hypertension: Question 94
The correct answer is D
Educational Objectives
Recognize the appropriate treatment of uric acid stone disease.
Critique
Radiolucent renal stones are composed of uric acid. Uric acid is insoluble. The mechanism in many patients with uric acid stones is a very low urinary pH (<4.5), a milieu conducive to precipitation of uric acid. Therefore, alkalinization of the urine to a pH greater than 6.5 by administering sodium bicarbonate or potassium citrate is the treatment of choice to dissolve the stones. Allopurinol is not recommended unless hyperuricemia is present. A low-sodium diet neither dissolves uric acid stones nor alkalinizes the urine. Shock-wave treatment is not needed in most cases of nonobstructing uric acid stones.

Nephrology and Hypertension: Question 95
The correct answer is E
Educational Objectives
Evaluate a patient with renal insufficiency treated with several medications.
Critique
The fractional excretion of sodium of approximately 0.5% is consistent with avid sodium retention and prerenal azotemia. Angiotensin receptor blockers decrease glomerular filtration rate by preferential vasodilation of the efferent arterioles. Nonsteroidal anti-inflammatory drugs decrease renal blood flow and glomerular filtration rate by vasoconstriction of the renal circulation, although animal models have distinguished between responses of interruption of cyclooxygenases 1 and 2. These effects are intensified in patients with volume depletion. Discontinuation of the medications and administration of volume are usually sufficient to reestablish normal renal circulation and volume status. Although these effects are reversible, patients with azotemia treated with angiotensin receptor blockers should have evaluation of renal size and blood flow to exclude renal artery stenosis, which can exacerbate azotemia in patients receiving medications that interrupt the renin-angiotensin axis. In patients with established prerenal azotemia, there is no rationale for administration of acetylcysteine, which is used to prevent radiocontrast-induced nephropathy.