



# Renal and Urological Disorders

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## **GENERAL APPROACH**

- Kidney pain is commonly located in the area of the costovertebral angle (CVA). Radiation to the umbilicus or the testicle or labia is possible.
- Pain associated with infection is typically constant.
- The normal urinary tract is sterile, and the immunocompetent patient is resistant to bacterial colonization. Urinary tract infection (UTI) is, however, the most common bacterial infection in all age groups.
- Urinary tract infection is also the most common nosocomial infection.
- UTI should be part of differential diagnoses in any febrile infant or child.
- UTI is a marker in young children for abnormalities of the urinary tract. Imaging tests should be conducted in all boys of any age with first UTI, in girls younger than 5 years with first UTI, older girls with recurrent UTI, and any child with pyelonephritis to identify abnormalities that may lead to renal damage (e.g., vesicoureteral reflux [VUR]).
- Limit antibiotics to category B if patient is pregnant or lactating; most antibiotics enter breast milk.
- Refer unusual presentations of disease as well as those that do not respond to standard treatment.

## Red Flags

- Wilms' tumor: Embryonal malignant tumor of the kidney in children <5 years can be asymptomatic and present with abdominal mass felt in flank over to midline. Consult with a physician for prompt work-up and appropriate referral. Do not be aggressive with abdominal exam in these patients.
- Patients with signs of UTI who are hemodynamically unstable, severely dehydrated, or unable to take oral medications require hospitalization
- Gross hematuria without evidence of acute UTI should be considered an indication of malignancy until proven otherwise

## Asymptomatic Bacteriuria

### Description

- Significant bacterial counts in urine of a patient who has no other symptoms; more common with female gender, aging, perimenopausal status, pregnancy, structural abnormalities in tract, prostatic hypertrophy, asymptomatic calculi, indwelling urinary catheter

### Etiology

- Most commonly caused by Gram-negative bacteria such as *E. coli*

### Incidence and Demographics

- Incidence increases with age: 1% in school-age females to 20% in women over 80
- Increased incidence in women with diabetes, 8%–14%
- Rare in men under age 75

### Risk Factors

- Indwelling catheters
- Pregnancy
- Diabetes mellitus
- Spinal cord injury

### Prevention and Screening

- Screen, culture, and treat asymptomatic bacteriuria in pregnant women, before TURP and other urologic procedures with mucosal bleeding, and to improve urinary incontinence in the elderly
- Increase fluids to flush urinary tract
- Empty bladder fully and frequently to avoid stasis

### Assessment

- Urinalysis reveals bacteria and white blood counts (WBC); urine culture may be positive for bacteria in absence of a contaminated specimen or symptomatic UTI

### Differential Diagnosis

- Cystitis
- Urethritis
- Acute pyelonephritis

**Management**

- Antibiotic therapy is controversial except in immunosuppressed patients (as in AIDS), malignancy, or pregnancy to prevent acute pyelonephritis
- 2005 Infectious Disease Society of America (ISDA) guidelines call for treating symptomatic women if two consecutive clean-catch voided urines have the same bacterial strain at 10<sup>5</sup> cfu/mL. In asymptomatic patients, treatment should be considered if a single cathed specimen contains one bacterial strain >10<sup>2</sup> cfu/mL.

**Special Considerations**

- U.S. Preventive Services Task Force recommends screening for asymptomatic bacteriuria with urine culture for pregnant women at 12–15 weeks of gestation

**When to Consult, Refer, Hospitalize**

- Consult urology if frequent recurrence or non-responsiveness to treatment
- Hospitalize for urinary sepsis may be necessary in elderly

**Follow-Up**

- If treated with antibiotics, follow up 1–2 weeks after completion of course with repeat urinalysis or culture

**Hematuria****Description**

- The presence of red blood cells (RBCs) in the urine
- May be microscopic (>3 RBCs/high-power field) or gross (visible to naked eye)

**Etiology**

- Infection: Proximal (renal) or distal (urethral) in location
- Renal calculi, tumors, trauma, polycystic renal disease, neoplasms in persons over 50, hydronephrosis, renal vascular diseases
- Most commonly seen in inflammation or infection of prostate or bladder, stones, and in older patients with malignancy or benign prostatic hypertrophy (BPH)
- Medications (anticoagulants-heparin, warfarin, aspirin)
- Benign prostatic hypertrophy, prostatitis, epididymitis
- Coagulopathies, sickle cell disease
- Strenuous exercise
- Vascular glomerular abnormalities, familial nephritis (Alport syndrome)
- Granulomatous diseases (tuberculosis)
- Connective tissue diseases (lupus)
- Trauma

**Incidence and Demographics**

- Ranges from 1%–16% in the general population
- Higher risk in elderly men who are at high risk for obstructive and other urologic diseases

**Risk Factors**

- UTIs

- Renal calculi
- Environmental exposure to elements that can cause bladder cancer

**Prevention and Screening**

- Urinalysis in high-risk patients at annual physical examination

**Assessment**

- Complete history and physical exam to determine underlying disorder
- Urinalysis, microscopic exam of urinary sediment, urine culture
  - If accompanied by red cell casts and/or marked proteinuria, glomerular origin probable
  - 3-tube test may help identify source of bleeding; tube 1 from initial stream, tube 2 from mid-stream and tube 3 from end-stream; blood in tube 1 indicates origin from urethral lesion, in tube 2 from bladder, and tube 3 from bladder trigone
- Renal function studies (BUN and creatinine)
- CBC/differential, erythrocyte sedimentation rate (ESR)
- Additional testing based on presentation: Intravenous pyelogram (IVP), renal ultrasound, or cystourethrogram
- STD cultures, gram stain

**Differential Diagnosis**

- Hemorrhagic cystitis
- Bladder cancer
- Ingestion of dyes and pigments
- Glomerulopathy
- Pyelonephritis
- Renal calculi
- Pelvic inflammatory disease

**Management**

- Determine cause using appropriate diagnostic tests, usually referred for treatment depending on cause.

**Special Considerations**

- Persons who ingest large amounts of beets and foods containing red dye may have pseudohematuria

**When to Consult, Refer, Hospitalize**

- Refer for persistent, unexplained hematuria, if it does not resolve with treatment for infection, need for invasive testing, or renal biopsy

**Follow-Up**

- Regular urinalysis to assess for signs of recurrence recommended. An isolated incidence is often an early sign of a more lethal problem.

## UROLOGIC DISORDERS

### Urinary Tract Infection (UTI, Cystitis)

#### Description

- Lower UTI is infection of one or more of the urinary tract structures but most commonly is used to refer to cystitis, inflammation or infection of the bladder. If acute, usually one organism is identified; if chronic, two or more organisms may be found.

#### Etiology

- Most commonly caused by *E. coli* (80%–90%), other Gram-negative bacteria from gastrointestinal tract (*E. coli*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Enterobacter sp.*).
- A Gram-positive organism (*Staphylococcus saprophyticus*) is common in sexually active young women but an uncommon cause of infection in men. If found in men it is truly a urinary pathogen.
- Symptomatic women with pyuria but without significant bacteriuria (“sterile pyuria”) may have infection with *Chlamydia trachomatis*.
- Viruses may be associated with hemorrhagic cystitis.
- Most UTIs (>95%) are caused by ascending infections from urethra.

#### Incidence and Demographics

- Most common of all bacterial infections in women
- In first 2 months of life, incidence is higher in males, especially (95%) those uncircumcised
- May be associated with bacteremia in the first 3 months of life
- After 1–2 years of age, females are 10–20 times more likely to experience a UTI than males secondary to shorter urethra, closer proximity to perirectal area
- Recurrence will occur in 50%–75% of females
- Vesicoureteral reflux is found in approximately 20% of females after first UTI, 40%–45% of those with recurrent UTIs

#### Risk Factors

- Female; sexual activity; history of prior UTI; diabetes mellitus or other immunocompromised state; pregnancy; use of spermicides, diaphragm, or oral contraceptives
- Structural urinary tract abnormalities (strictures, stones, tumors, neuropathic bladder)
- Procedures such as catheterization or recent surgery
- Aging issues: Relaxation of pelvic supporting structures, BPH or prostatitis, incontinence of urine/stool, cognitively impaired
- Dysfunctional voiding pattern or infrequent voiding
- Chronic constipation in children

#### Prevention and Screening

- In women who experience three or more UTIs, voiding immediately after intercourse and avoiding use of a diaphragm may be helpful
- Drinking cranberry juice or taking cranberry pills to reduce pyuria and bacteriuria
- Education of parents and children regarding hygiene, tips on toilet training; education of adolescents regarding sexual intercourse
- Low-dose oral antimicrobial prophylaxis can be considered for recurrent infections

- Post-coital treatment with a single-dose antibiotic is an option
- In post-menopausal women, systemic or topical estrogen therapy markedly reduces the incidence of recurrent UTI

### **Assessment**

#### HISTORY

- Dysuria, urgency, frequency, nocturia, hematuria, suprapubic discomfort
- Low-grade fever and enuresis in children
- Lower abdominal or back pain, fever, chills, and lassitude (may indicate pyelonephritis)
- Presence of vaginal or urethral discharge or odor, pruritus, dyspareunia, external dysuria without frequency may indicate vaginitis or urethritis
- Perianal itching (may indicate pinworms)
- Mental status change in the elderly may be the only symptom of UTI

#### PHYSICAL EXAM

- Fever (in children), suprapubic tenderness to palpation
- CVA tenderness if pyelonephritis
- Assess signs of hydration status in children
- Inspection of genitalia in children for trauma, anomalies, meatal stenosis, phimosis
- Pelvic examination recommended in adolescents and adults to rule out vaginitis
- In elderly, mental status changes or new onset of falls may be the only signs of infection

#### DIAGNOSTIC STUDIES

- First infection: Clean catch urinalysis, treat if positive; in children, always obtain culture from mid-stream
- May obtain urine by catheterization or SPA (suprapubic bladder aspiration) in infants and children
- Hematuria is common in women with UTI, not in women with vaginal infections
- Repeat or refractory infections: Consider urine culture and sensitivity, renal/bladder ultrasound, cystourethroscopy, or IVP; nonresponse to appropriate antimicrobial therapy is the most useful indicator for radiologic/urologic examinations
- Radiographic follow-up with a renal and bladder ultrasound and a voiding cystourethrogram (VCUG) should be obtained for all children under 5 years with a documented UTI, all males with a UTI, and all females with a febrile UTI to evaluate for vesicoureteral reflux and structural abnormalities; the VCUG should be done after 3–4 weeks since mucosal changes (edema) during an infection may result in a transient reflux
- Dimercaptosuccinic acid (DMSA) scan may be recommended for patients with pyelonephritis to detect renal scarring
- Voiding cystourethrogram is a dynamic test for stricture/reflux; a normal renal ultrasound does not exclude VUR
- For systemic symptoms, CBC and possibly BUN and creatinine

### Differential Diagnosis

- Urethritis
- Diabetes
- Pyelonephritis
- Renal calculi
- Vaginitis
- Encopresis
- Female urethral syndrome
- Chemical vaginitis
- Prostatitis
- Meatal stenosis
- Dysfunctional voiding
- STDs
- Balanitis
- Sexual abuse
- Foreign body
- Pinworms
- Diaper dermatitis

### Management

#### NONPHARMACOLOGIC TREATMENT

- Hygiene measures (front-to-back wiping, care of uncircumcised penis)
- More frequent and complete voiding, voiding after coitus
- Hydration, cranberry juice (will help prevent strains of *E. coli* from adhering to bladder)

#### PHARMACOLOGIC TREATMENT

- Adolescents and adults:
  - See Table 10–1 for antibiotic regimens
  - Short-course treatment with trimethoprim-sulfamethoxazole or a fluoroquinolone are the treatments of choice and are superior to the beta lactams (Augmentin)
  - For pain relief, consider use of urinary analgesic phenazopyridine (Pyridium), 100–200 mg tid or Uristat, 190 mg tid po; for 2 days maximum therapy; inform patient drug will turn urine orange and possibly affect contact lenses; not recommended for children
- Infants and children:
  - See Table 10–2 for antibiotic regimens
  - It is important to know antimicrobial susceptibility profile of uropathogens causing uncomplicated UTIs in community to guide therapeutic decisions; there is an increasing resistance among uropathogens to Bactrim
  - Fluoroquinolones not recommended in children <18 years because of possible adverse effects on developing cartilage
  - Prophylaxis of UTIs in infants and young children during vesicoureteral reflux work up and, if reflux is confirmed, with low-dose sulfa, nitrofurantoin, or other antibiotic in consultation with a physician

**Table 10-1. Standard UTI Treatment in Adults**

Drug	Dosage
Trimethoprim-sulfamethoxazole (Bactrim)	160/800 mg po single dose or DS bid
Cephalexin (Keflex)	250–500 mg po q6h
Ciprofloxacin (Cipro)	250–500 mg po q 12 h
Nitrofurantoin (Macrochantin)	100 mg po q 12 h or 50 mg po qid
Norfloxacin (Noroxin)	400 mg po q 12 h
Ofloxacin (Floxin)	200 mg q 12 h

**Table 10-2. Standard UTI Treatment in Infants and Children**

Drug	Dosage	Recommendations & Comments
Trimethoprim-sulfamethoxazole (Bactrim/Septra)	8–12 mg/kg/day TMP and 40–60 mg/kg/day SMZ q 12 h	Not recommended for infants <2 months
Nitrofurantoin (Furadantin Suspension)	5–7 mg/kg/d q6h	Must give with food; not recommended for infants <2 months
Cephalexin (Keflex)	500 mg bidh	Increasing resistance; use in children over age 15 years
Cefixime (Suprax)	8 mg/kg/day one dose	Expensive
Ceftriaxone sodium (Rocephin)	50–75 mg/kg/day IM q 12 h (2 divided doses)	May start febrile, ill-looking child on this, pending culture
Amoxicillin (Amoxil)	40 mg/kg/day q8h	Increasing resistance
Amoxicillin and clavulanate potassium (Augmentin)	30–50 mg/kg/day q 12 h	Abdominal discomfort; generic, diarrhea common

**LENGTH OF TREATMENT**

- In healthy young women, a 3-day course of therapy is superior to single-dose since early recurrence is more common after single-dose therapy; Nitrofurantoin requires a 5-day course; amoxicillin and Augmentin require 7–10 days.
- Short-course therapy is not recommended if symptoms have been present for >7 days, if there is a high probability of deep-tissue infection, for any man with UTI, in presence of underlying structural or functional defect of the urinary tract, immunosuppressed individuals, or patients with indwelling catheters
- In cases of recurrent infection, assume patient has covert renal infection and retreat for a minimum of 14 days
- Males <50 years with the following risk factors usually receive 10–14 day course; homosexual, men having intercourse with women colonized with uropathogens, AIDS with CD4+ lymphocyte count <200/mm<sup>3</sup>
- Males >50 years may require 4–6 weeks and as many as 12 weeks of treatment to sterilize the urinary tract if the prostate is source of infection
- Infants and children: Treat for 10 days or until imaging studies are completed and assessed

**Special Considerations**

- Geriatric patients: May or may not demonstrate symptoms other than mental status change
- Pregnancy/lactation: Consult with OB for management in pregnancy. Always obtain urine culture and sensitivity. Treat with amoxicillin 500 mg po qid for 7–14 days, amoxicillin 500 mg po tid for 7–10 days, or cephalexin (Keflex) for 10–14 days. May need prophylactic antibiotics for duration of pregnancy (history of acute pyelonephritis during pregnancy, bacteriuria during pregnancy with recurrence after treatment, and history of recurrent UTI before pregnancy requiring prophylaxis in past)

**When to Consult, Refer, Hospitalize**

- Consult or refer to adult/pediatric urologist for recurrent infections if suspect anatomic abnormality
- Hemodynamically unstable patients, or those in whom urosepsis is a potential concern, may require hospitalization or intravenous antibiotics
- Hospitalize if signs of pyelonephritis in children or pregnant woman for IV antibiotics

**Follow-Up**

- Repeat urine culture 3–4 days after completion of therapy in children
- Radiographic follow-up with a renal and bladder ultrasound and a VCUG should be obtained for all children under 5 years with a documented UTI, all boys of any age with a UTI, and all girls with a febrile UTI to evaluate for vesicoureteral reflux

**EXPECTED COURSE**

- If using correct antibiotic (per culture and sensitivity), signs and symptoms should dissipate within 48–72 hours
- Many providers routinely check urinalysis after therapy for test of cure; helps differentiate inadequately treated infection from recurrence

**COMPLICATIONS**

- Pyelonephritis, recurrent or relapse of infection, sepsis (esp. in elderly), renal abscess
- In children, VUR graded according to the International Reflux Study, grade I–V; grade IV–V usually requires surgical correction and should be referred to a pediatric urologist; grade I–III have an 80%–85% chance of spontaneous resolution; VUR can result in renal scarring and loss of renal function

**Acute Pyelonephritis****Description**

- Acute bacterial infection of soft tissue of the renal parenchyma and pelvis, or other portion of upper urinary tract, typically producing signs and symptoms of systemic toxicity

**Etiology**

- 75% due to *E. coli* organism
- 10%–15% are due to other Gram-negatives (*P. mirabilis*, *K. pneumoniae*, *Enterobacter*)
- 10%–15% due to *S. aureus* or *saprophyticus*
- Most common route of infection is ascension from bladder

**Incidence and Demographics**

- 15.7/100,000 cases annually in U.S.
- Frequently in women 18–40

**Risk Factors**

- Urinary tract abnormalities or instrumentation, stones, catheters, diabetes or other immunocompromised states, recent pyelonephritis, BPH, pregnancy, fecal incontinence
- Recent lower UTI

**Prevention and Screening**

- Hygiene, hydration, voiding after coitus
- Prophylactic antibiotics if infected recurrently or frequently
- Screening pregnant women for asymptomatic bacteriuria

**Assessment**

## HISTORY

- Fever often >102°F, shaking chills, flank pain, myalgias, abdominal pain
- Hematuria, dysuria, frequency, urgency
- Nausea and vomiting

## PHYSICAL EXAM

- CVA tenderness, fever

## DIAGNOSTIC STUDIES

- Urinalysis: Bacteria and WBCs visible on microscopy, may also see casts; leukocyte esterase and nitrites on dipstick, possible proteinuria, pyuria
- CBC: May have elevated WBCs
- Urine culture and sensitivity should be performed on all patients
- A Gram stain should be performed prior to instituting therapy to determine if Gram-negative as well as Gram-positive organisms are present
- Voiding cystourethrogram, IVP, renal scan, cystoscopy may be indicated if structural abnormality suspected; if renal abscess suspected, order abdominal/pelvic CT

**Differential Diagnosis**

- Stones
- Prostatitis
- TB of the kidney
- Acute low back pain
- Tumors

**Management**

## NONPHARMACOLOGIC TREATMENT

- Fluids

## PHARMACOLOGIC TREATMENT

- See Table 10–3 for oral doses of antibiotic therapy
- Parenteral antibiotics may be indicated for Gram-positive cocci, complicated

histories, previous episodes of pyelonephritis, or recent urinary tract manipulations

- If no nausea or vomiting, may use Ceftriaxone 1 gm IM or Gentamycin 3–5 mg/kg body weight IM in office to avoid hospitalization; **MUST** see patient back in office in 24 hours

#### LENGTH OF TREATMENT

- Treat 14 days
- In the otherwise healthy patient with mild disease, outpatient treatment with oral antimicrobials (trimethoprim-sulfamethoxazole or a fluoroquinolone for 14 days) is possible if the patient has no nausea or vomiting, no signs of volume depletion, no evidence of septicemia, and is reliable in following medical advice
- Otherwise, parenteral therapy should be initiated, then switch to oral therapy for 14 days once the patient has been afebrile for 24 hours (usually within 72 hours of starting treatment)
- Infants, children, pregnant women usually hospitalized for initial therapy with IV antibiotics
- If develops chronic pyelonephritis, therapy required for 3–6 months

**Table 10-3. Oral Treatment for Acute Pyelonephritis (Mild)**

Drug	Dosage
Trimethoprim-sulfamethoxazole (Bactrim)	160–800 mg bid
Ciprofloxacin (Cipro)	500 mg bid or 1 g extended release (XR) daily
Ofloxacin (Floxin)	200–300 mg q 12 h

#### Special Considerations

- Elderly patients should be hospitalized and started on an aminoglycoside with dosage adjusted for weight and renal function
- Pregnancy: Sulfa drugs and fluoroquinolones contraindicated; use beta lactams, aminoglycosides, or both

#### When to Consult, Refer, Hospitalize

- Inpatient management required if patient appears toxic or is elderly, hemodynamically unstable, immunocompromised, pregnant, or unable to tolerate oral antibiotic therapy
- If fever persists >3 days, suspect abscess or obstruction, refer to urologist

#### Follow-Up

- Recheck patient in office in 24 hours
- Repeat culture 2 weeks after completion of therapy and again at 12 weeks
- In children, after completion of treatment course, a prolonged 1–3 month course of oral therapy is then instituted with follow-up urine cultures at frequent intervals for the next year

#### EXPECTED COURSE

- Good prognosis: Should resolve within 72 hours of institution of appropriate therapy

**COMPLICATIONS**

- Sepsis, preterm labor in pregnancy, chronic renal insufficiency, chronic pyelonephritis, renal abscess, death
- Without demonstrable obstruction or recurrent acute infection, asymptomatic renal bacteriuria has not been clearly established as harmful and repeated courses of antimicrobials or suppression therapy are not indicated
- If obstruction cannot be eliminated and recurrent UTI is common, long-term therapy is useful

**Urinary Incontinence (UI)****Description**

- A general term used to describe the involuntary loss of urine; further classified based upon causation
- 5% will have infections or other diseases causing urinary incontinence
- 10%–25% will also have fecal incontinence

**Etiology**

- Urge incontinence: Involuntary loss of large amount urine preceded by strong, unexpected urge to void
  - Unrelated to activity or position and indicative of detrusor instability
  - May be due to aging, Parkinson's, stroke
- Stress incontinence: Involuntary loss of small amounts of urine
  - Associated with activities that increase intra-abdominal pressure including coughing, sneezing, lifting, and certain exercises
  - Urine does not leak when patient is lying down
  - May be due to aging, pelvic floor muscle weakness (e.g., cystocele, rectocele), perineal trauma, prostatitis/pelvic surgery, and estrogen deficiency in women
- Overflow incontinence: From chronic urine retention
  - Results from the chronically distended bladder receiving an additional increment of urine to exceed intravesical pressure and release small amount of urine
  - May be due to prostatic enlargement, anticholinergics, tricyclic antidepressants, diabetic neuropathy, outflow obstruction, multiple sclerosis
- Functional incontinence
  - Physical or cognitive disability, sedating medications that make it difficult to use the bathroom
- Total incontinence
  - Loss of urine at all times in all positions
  - Due to sphincteric inefficiency from surgery, nerve damage, tumor infiltration, or fistula formation
- Transient incontinence
  - May be due to delirium, infection, atrophic vaginitis, urethritis, or drugs (sedatives, hypnotics, diuretics, opioids, calcium channel blockers, anticholinergics, antidepressants, antihistamines, decongestants, and others)
  - Other less common etiologies include diabetes mellitus or insipidus, restricted mobility, stool impaction, depression
- Mixed: Two causes present
  - Stress and urge incontinence
  - Urge and functional

### Incidence and Demographics

- Problem for 5%–15% of elderly patients in community setting and up to 50% of nursing home residents
- Overall affects 12 million adults; females affected more than males; 22%–45% of persons with incontinence ever seek care

### Risk Factors

- Elderly, estrogen deficiency, prostatic hypertrophy, multiparity, dementia, diabetes, Parkinson's, myelodysplasia, multiple sclerosis (MS), spinal cord injury or lesion, stroke, immobility, pregnancy, use of diuretics

### Prevention and Screening

- Kegel exercises, regular pelvic examination to detect pathology early
- Avoid constipation
- Regular rectal exam for detection of BPH and initiation of therapy before symptom presents

### Assessment

- Confirm urinary incontinence and identify factors that might contribute or exacerbate symptom

#### HISTORY

- Urgency, leaking, dribbling, burning, hesitancy, nocturia, irritation
- Double vision, muscle weakness, paralysis, or poor coordination suggest neurologic disorders
- Assess exposure to medications (particularly potassium-sparing diuretics) and other provoking factors (caffeine, alcohol, physical activity, cough, laughing, sounds of water, hands in water)
- 3 IQ tool aids provider in differentiating stress and urge incontinence; ask patient, “In past 3 months have you leaked urine?”, “How often?”, and “Which of the above provoking factors caused leakage more often?”

#### PHYSICAL EXAM

- To detect anatomic and neurological abnormalities
- Examine abdomen (with full bladder if possible) for masses, suprapubic tenderness or fullness
- Pelvic exam to assess perineal skin, cystocele/rectocele, uterine prolapse, pelvic mass, perivaginal muscle tone, atrophic vaginitis
- Estimate post-voiding residual by abdominal palpation and percussion and/or bimanual exam
- Rectal exam for perineal sensation, resting and active sphincter tone, rectal mass, and fecal impaction; assess consistency, size, and contour of prostate
- Neurological exam with deep tendon reflex, sensation, gait
- Mental status exam in elderly
- Musculoskeletal exam for secondary causes such as weakness, ambulation problems

#### DIAGNOSTIC STUDIES

- Provocative stress testing if stress incontinence is suspected
- Urinalysis, and culture to rule out UTI
- 24-hour voiding record: Include type of fluid ingested and when, time and volume voided
- Observe voiding to detect problems with hesitancy, dribbling, or interrupted stream
- Renal function studies may reveal decreased function
- Urine cytology
- Cystograms may demonstrate fistula sites
- Stress cystograms may show descent of bladder neck on straining
- Measure post-void residual urine (<50 mL is normal)
- Pelvic ultrasound may reveal source of obstruction
- Cystometry with flow rates may be needed

#### Differential Diagnosis

- Vaginal reflux
- UTI
- Vaginitis
- Urethritis
- Effect of medication or psychiatric illness

#### Management

##### NONPHARMACOLOGIC TREATMENT

- Use a voiding diary for 3 days to provide information about voiding habits as a diagnostic technique
- General:
  - Good personal hygiene
  - Dietary modifications (avoid caffeine and alcohol)
  - Limit use of diuretics
  - Eliminate constipation
- Behavioral techniques:
  - Bladder training for urge UI, may also work for stress UI
  - Pelvic muscle exercises (Kegel) for stress UI
    - » Biofeedback for stress UI
    - » Vaginal cone for stress UI
  - Habit training or timed voiding for functional UI
- Surgical:
  - Overflow incontinence from anatomic obstruction (e.g., BPH)
  - Stress incontinence from anatomically reversible condition (prolapse, cystocele)
- Other measures:
  - Intermittent catheterization; useful in overflow incontinence
  - External collection catheters
  - Incontinence pads or garments
  - Pessaries for prolapsed uterus

## PHARMACOLOGIC TREATMENT

- Treat UTI if present; otherwise, see Tables 10–4 and 10–5

## LENGTH OF TREATMENT

- Indefinitely or until surgical correction

**Table 10–4. Pharmacologic Treatment for Urge Incontinence**

Class	Drug	Dosage
Anticholinergic & Antispasmodic	Oxybutynin (Ditropan) or Tolterodine (Detrol)	2.5–5.0 mg tid or qid or 2 mg bid
	Darifenacin (Enablex)	7.5–15 mg daily
	Tropium chloride (Santura)	20 mg daily to bid
	Solifenacin succinate (VESicare)	5–10 mg daily
	Oxytrol patch 0.3 mg patch	twice a week
Anticholinergic Agent	Dicyclomine	10–20 mg tid
Tricyclic Agents	Imipramine (Tofranil)	Initial: 10–25 mg qd, bid, or tid
SSRIs	Duloxetine (Cymbalta)	40 mg bid

**Table 10–5. Pharmacologic Treatment for Stress Incontinence**

Class	Drug	Dosage
Hormone Therapy	Conjugated estrogen (Premarin)	0.5–2 mg/day po vaginally daily, then 3 x per week, then 2 x per week
	Progestin (Medroxyprogesterone) (if uterus present)	2.5–10 mg/day either continuously or intermittently
Tricyclic Antidepressant	Imipramine (Tofranil)	10–25 mg qd to qid, may not tolerate due to sedation

**Special Considerations**

- More central nervous system (CNS) effects with oxybutynin (headaches, cognitive impairment) plus dry mouth, constipation. Caution patient to avoid alcohol when taking this medication.
- Tolterodine does not cross blood-brain barrier; less constipation, dry mouth
- Pregnancy: Stress incontinence is common in pregnancy. It should be treated with good hygiene, frequent voiding, and Kegel exercises
- Lactation: Avoid pharmacologic agents that could be transmitted via breast milk
- Overactive bladder (OAB) without incontinence (OAB-dry) may be part of the urge incontinence continuum. Limited data on behavioral or pharmacologic treatment.
- OAB-dry may respond to lifestyle changes, bladder retraining, and antimuscarinics

**When to Consult, Refer, Hospitalize**

- Consult specialist for patients with stress and urge incontinence who fail to respond to behavioral therapy and initial drug treatment
- Refer if any neurologic abnormalities coexist
- Refer for overflow incontinence evaluation and treatment
- Refer to urologist for cystoscopy for persistent RBCs on urinalysis

**Follow-Up**

- Weekly visits until most symptoms controlled, then as needed

## EXPECTED COURSE

- Long-term prognosis depends on patient compliance and follow-up

## COMPLICATIONS

- UTI, renal failure, skin breakdown, hydronephrosis, depression, social isolation

**Enuresis****Description**

- Persistent involuntary loss of urine in girls older than 5 and boys older than 6 years
- Most commonly occurs during sleep
- Termed “primary enuresis” in a child who has never achieved nighttime continence
- Secondary enuresis is return of involuntary urination after nighttime continence has been achieved

**Etiology**

- Usually multifactorial
- Appears to run in families. Has been linked to specific genetic markers (e.g., chromosome 8, 12, 13, 22, and ENUR 1 gene on chromosome 13). 77% risk if both parents had enuresis, 44% for one parent, and 15% if neither.
- 20% of children with nighttime incontinence also have daytime problems
- Primary enuresis may be due to food allergies, disorders of the urinary or nervous systems, psychological factors, reduced bladder capacity, lack of normal increase in nocturnal antidiuretic hormone (ADH) secretion
- Primary nocturnal enuresis (PNE) is primarily an arousal disorder with failure of the CNS to recognize bladder fullness or contraction and/or failure to inhibit bladder contraction or sphincter relaxation, detrusor instability
- Secondary enuresis may be due to bacteriuria, UTI, inability to concentrate urine secondary to insufficient ADH or a renal tubular defect, a pelvic mass or spinal cord malformation, meatal stenosis, ectopic ureter, glycosuria as in diabetes mellitus or diabetes insipidus, possible sleep disorder

**Incidence and Demographics**

- Occurs in approximately 15% of children; by age 18, incidence has decreased to 1%
- Multifactorial, though most children outgrowing monosymptomatic nocturnal enuresis (MNE) indicate maturational delay
- Genetic predisposition: If both parents have a history then child has approximately 75% chance of developing enuresis; one parent, 45% chance; neither parent, 15% chance

**Risk Factors**

- Males > females; first born
- Family history in at least one parent
- Institutionalized

**Prevention and Screening**

- Ask patient and parent at each well-child visit

**Assessment**

## HISTORY

- Bed-wetting at least one night per month, with no daytime wetting (PNE)
- May increase during times of emotional stress
- Family's/child's response to PNE
- Family history
- Social history may contribute to secondary NE

## PHYSICAL EXAM

- Genitourinary exam (abnormal structure or function), perianal excoriation or vulvovaginitis (may be caused by pinworms)
- Abdominal exam (palpable bladder, stool)
- Neurological exam (reflexes, perineal sensation, gait; examine lower back/spine for sacral dimpling, cutaneous abnormalities)
- Poor growth patterns
- Hypertension may indicate renal disease

## DIAGNOSTIC STUDIES

- Urinalysis, culture, include specific gravity
- If abnormal PE or complicated UTI: 24-hour urine, intravenous pyelogram (IVP)/sonogram of kidneys, CT, or MRI
- Voiding cystourethrogram with significant daytime complaints

**Differential Diagnosis**

- Urinary tract structural abnormalities
- UTI
- Neurologic dysfunction
- Spinal cord malformations (hair tuft, abnormal gluteal folds)
- Tumors
- Diabetes mellitus or insipidus
- Pinworms
- Psychogenic polydipsia
- Encopresis
- Unrecognized medical disorders: sickle cell anemia
- Seizures, hyperthyroidism,
- Chronic renal failure (CRF)

## Management

- If normal exam, positive UTI, treat UTI
- If history consistent with secondary enuresis, and post-treatment urinalysis is normal, return only if enuresis continues
- If abnormal exam, complicated UTI, consult/refer
- If normal exam, negative urinalysis, treatment below

### NONPHARMACOLOGIC TREATMENT

- Behavioral or motivational therapy: Behavior modification with reward system (25% success rate)
- Conditioning therapy: Bladder stretching and strengthening exercises (encourage less frequent urination by holding as long as possible at least once a day, have patient start and stop flow of urine when urinating) have a 30% success rate
- Voiding and stooling diaries, fluid intake diary
- Enuresis alarms: Requires a committed and motivated family and takes 12–16 weeks to be effective; alarms have a 70% success rate and the lowest rate of relapse (30%)
- Counseling and behavior modification
- Anticipatory guidance in relation to toilet training
- Encourage daytime fluids and encourage less frequent urination to help increase bladder size
- Avoid fluids 2 hours prior to bedtime
- Protect bed; use diapers, pull-up pants to reduce laundry load when necessary
- Bladder stretching exercises may be helpful

### PHARMACOLOGIC TREATMENT

- Tricyclic antidepressants: imipramine (Tofranil) or desipramine (Norpramin) 1–2 mg/kg hs to maximum of 50 mg. Not recommended and seldom used today because of CNS toxicity and narrow therapeutic range where toxic effects are easily reached with minor dose adjustments.
- Desmopressin (DDAVP): Decreases urine production; now comes in pill form, which is preferred over intranasal route (inconsistent dosage, frequent nasal irritation, nosebleeds). Not for children <6 years old. Starting dose: 0.2 mg at hs. For children >6 years who have difficulty swallowing pills, 20 mcg intranasally hs depending on product availability. May take several days to begin working. Safety has been shown for use up to 6 months. However, check blood pressure, serum electrolytes if used beyond 3 months. Stress importance of continuing to restrict nighttime fluids to decrease risk of fluid overload that rarely can cause water intoxication and hyponatremia. Side effect is primarily headache.

### LENGTH OF TREATMENT

- Taper medications when problem seems to be resolving
- DDVAP may be used for a 3-month trial to break the cycle of intermittent wetting and allow child to develop the habit, feelings associated with dry nights
- DDVAP may be used short-term for camping trips, vacations, sleepovers; start a few days in advance

**When to Consult, Refer, Hospitalize**

- Emotional disturbance may require referral
- Genitourinary dysfunction or neurological symptoms warrant referral to specialist if clinical or radiographic findings suggest renal or urologic abnormality or bladder instability
- Neurosurgery should be consulted if evidence of occult spinal dysraphism

**Follow-Up**

## EXPECTED COURSE

- Usually self-limiting problem

## COMPLICATIONS

- Emotional distress, social isolation, depression

**Urolithiasis/Nephrolithiasis****Description**

- Stones occurring within the urinary tract; nephrolithiasis is stones within kidney
- Stones are initially formed in the proximal urinary tract and then pass distally
- Usually arrested in the ureter and cause pain, infection, and obstruction
- Most composed of calcium (80%), uric acid (5%), cystine (2%), or struvite

**Etiology**

- Supersaturation of urine with stone-forming salts
- In many instances, may be a manifestation of systemic disease (e.g., bone diseases, immobilization, hyperthyroidism, primary hyperparathyroidism, hypervitaminosis D, renal tubular acidosis, mild-alkali syndrome, gout, others), but idiopathic hypercalciuria responsible for about 50% in adults
- Up to 98% of stones <0.5 cm in diameter will pass spontaneously, especially in the distal ureter
- Calcium stones are the most common. When they cause obstruction it tends to be acute and intermittent, producing no long-term effects on renal function
- Cystine and struvite stones are more likely to be associated with renal damage
- Struvite stones form in alkaline urine; may be seen with chronic proteus species infections

**Incidence and Demographics**

- 1%–3% of population present with urolithiasis at some point during lifetime
- Most occur at age 30–50 years
- Male-to-female ratio 3:1 (calcium stones; struvite stones are more common in females)

**Risk Factors**

- Cystinuria, genetic defects, renal tubular acidosis, low water intake, high-protein diet, excessive oxalate intake, sedentary lifestyle
- Middle age, Whites, family history, obesity, diabetes mellitus, chronic diarrhea, malabsorption, history of bowel or bariatric surgery, pathologic skeletal fractures, gout, Paget's
- Certain medications: Vitamins A, C, D, loop diuretics, ammonium chloride, acetazolamide, alkali, antacids

**Prevention and Screening**

- Adequate fluid intake
- If prone to calcium stones, restrict protein, sodium, dairy products and other oxalate rich foods
- If prone to uric acid stones, alkalization of urine may prevent formation

**Assessment****HISTORY**

- May be asymptomatic even with severe obstruction or present with acute back and flank pain that comes and goes
- Obstruction of the ureter: Acute, colicky flank pain which may be episodic in nature; anterior radiation of pain; nausea and vomiting; diaphoresis; patient constantly moving to relieve pain
- Progression of stone: Pain referred to ipsilateral testis or labia; urinary urgency or hesitancy
- Ingestion of large amounts of fluids or diuretic use may precipitate an attack
- May be associated with dysuria, frequency, hematuria, diaphoresis, restlessness, chills and fever, nausea, and/or vomiting

**PHYSICAL EXAM**

- Acute obvious discomfort, pacing, grimacing, unable to get comfortable
- Fever, tachycardia, tachypnea, diaphoresis, restlessness, CVA tenderness
- Be alert to signs of systemic disease (e.g., lymphadenopathy, organomegaly, adenopathy)

**DIAGNOSTIC STUDIES**

- Urinalysis, culture, CBC, BUN, creatinine
- Urinalysis that shows hematuria with or without proteinuria suggests calculus or tumor
- Plain film of the abdomen (KUB) will show calculi (85%–90% of which are radiopaque) in the renal pelvis, along the course of the ureter or in the bladder; Limitations: Overlying bowel gas and rib cartilage calcification may make interpretation difficult
- Ultrasound is the preferred screening modality when obstruction is suspected (high sensitivity for hydronephrosis) and in pregnancy to assess renal colic; however, it can only suggest (not reveal) the presence of obstruction
- Spiral CT is now preferred imaging because it visualizes both radiopaque and radiolucent stones
- If recurrent, refer/consult for additional work-up

**Differential Diagnosis**

- Acute pyelonephritis
- Lower urinary tract infection

**Management**

- For small stones (<0.5 cm), observe and treat pain
- Strain urine by pouring through gauze (or coffee filter) to collect stones or sediment as they pass; stone analysis is required

- For larger stones, may refer for extracorporeal shock wave lithotripsy, ureteroscopy, percutaneous nephrolithotomy, or open surgery for removal of stone
- Difficulties in tolerating pain or other factors may mandate treatment with shock wave lithotripsy or ureteroscopy in a patient who otherwise might be expected to pass the stone

#### NONPHARMACOLOGIC TREATMENT

- Increase fluid intake to maintain urinary output at 2–3 L/day, increase fiber in diet
- Decrease animal fat in diet

#### PHARMACOLOGIC TREATMENT

- Pain management with NSAIDs and opioids as required
  - Acetaminophen/codeine (Tylenol #3) 1–2 tabs q4h prn
  - Hydrocodone/acetaminophen (Vicodin) 1–2 tabs q4h prn
  - Oxycodone/acetaminophen (Percocet) 1–2 tabs q4h prn
  - Ketorolac (Toradol) 30–60 mg IM initially, then 30 mg tabs q6h prn
  - Morphine 5–10 mg IM q4h prn
  - Other drugs: Meperidine, dilaudid
- Antiemetics as needed

### Special Considerations

- For prevention of recurrence of all types of stones, stress importance of adequate hydration: 2–3 L per day, dividing intake evenly to produce dilute urine at all times
  - Avoid apple and grapefruit juices
  - Avoid long periods of immobilization
- To prevent recurrence of calcium stones, limit protein, oxalate, and sodium intake; HCTZ 50 mg qd (rule out hyperparathyroidism before prescribing)
- To prevent recurrence of oxalate stones, restrict dietary oxalate (tea, rhubarb, leafy green vegetables, peanuts)
- To prevent recurrence of uric acid stones, restrict protein, consider allopurinol if serum uric acid is elevated, sodium bicarbonate

### When to Consult, Refer, Hospitalize

- Refer to urologist if obstruction suspected or if symptoms persist over 3–4 days
- Hospitalize if infection present, stone is >6 mm in diameter, excessive nausea and vomiting, intractable pain, gross hematuria

### Follow-Up

- Plain films of abdomen at 1–2 week intervals to monitor progress of stone in ureter
- Continue to strain urine until stone is passed. Monitor potassium and blood pressure in patients taking hydrochlorothiazide

#### EXPECTED COURSE

- 98% will pass spontaneously
- Usually resolves within 4 weeks
- Recurrences within 5 years are common in up to 50% of patients

#### COMPLICATIONS

- Complete urinary obstruction, hydronephrosis, renal failure, infection

## RENAL DISORDERS

### Acute Glomerulonephritis

#### Description

- Glomerular injury and inflammation as a result of an immune response, usually to a streptococcal infection. Follows an immunologic injury (i.e., deposition of antigen-antibody complexes from the bloodstream in the glomeruli). Presents with hematuria, edema, hypertension, proteinuria.

#### Etiology

- Characterized by diffuse inflammatory changes in the glomeruli and clinically by the abrupt onset of hematuria with RBC casts and mild proteinuria 1–2 weeks after a streptococcal infection
- Range of latent period (from onset of infection to onset of nephritis) is 7–21 days

#### Incidence and Demographics

- 20/100,000 cases in U.S. annually
- On the decline in developed countries but continues to occur in undeveloped nations at same rate

#### Risk Factors

- More common in children (peak ages 2–6 years)
- Multiple causes: Most common in children is recent Group A beta hemolytic streptococcal infection, such as pharyngitis or impetigo; only a few strains cause this kidney problem (type 12 and type 49)

#### Prevention and Screening

- Early and aggressive treatment of streptococcal infections

#### Assessment

##### HISTORY

- Edema, particularly of face, hands and feet; malaise; fever; abdominal or flank pain
- Skin or pharyngeal streptococcal infection within past 2–3 weeks; often cannot identify exact cause
- Abrupt onset of hematuria, oliguria or anuria

##### PHYSICAL EXAM

- Edema (90%), hypertension (75%), fever, abdominal tenderness

##### DIAGNOSTIC STUDIES

- Urinalysis will demonstrate proteinuria, hematuria
- Throat and skin cultures may be positive for streptococcal organism
- Total serum complement is decreased
- Antistreptolysins O (ASO) titer is increased in 60%–80% of cases

**Differential Diagnosis**

- Systemic lupus
- Anaphylactoid purpura
- Subacute bacterial endocarditis
- Congestive heart failure

**Management**

## NONPHARMACOLOGIC TREATMENT

- Treat as inpatient until edema and hypertension are under control
- Restrict fluid: Restrict to replacement of insensible losses plus two-thirds of the urine output until diuresis; use no-salt-added diet
- Restrict protein in presence of azotemia and metabolic acidosis
- Avoid high-potassium foods
- May need dialysis

## PHARMACOLOGIC TREATMENT

- Streptococcal infection: Penicillin IM or po for 10 days
- Acidosis: Sodium bicarbonate 1.2–2.4 grams per day if symptomatic or if serum bicarbonate <15
- Hypertension:
  - Diuretics: Furosemide (Lasix) 0.5–1 mg/kg IV or 2 mg/kg po bid or tid
  - Vasodilators: Apresoline (Hydralazine) 0.25–1.0 mg/kg qid or nifedipine (Procardia) 0.25 mg/kg/po prn or qid

## LENGTH OF TREATMENT

- Usually a spontaneous diuresis occurs within 7–10 days after onset of illness; then supportive care is no longer required

**Special Considerations**

- Caution in elderly as frank heart failure occurs in 40%

**When to Consult, Refer, Hospitalize**

- Consult with physician for inpatient management in acute stage, or if significant edema/hypertension

**Follow-Up**

- Several times per week until resolves

## EXPECTED COURSE

- Most cases are self-limited and resolve in 2–3 weeks; second episodes are rare
- 95% of patients recover fully
- More morbidity in those with pre-existing renal disease
- Proteinuria may persist for as long as 2 years

## COMPLICATIONS

- The most common long-term sequelae is mild hypertension
- Hypertensive encephalopathy or retinopathy
- Rapidly progressive glomerulonephritis, acute renal failure, nephrotic syndrome, chronic heart failure (CHF)

## Renal Insufficiency and Failure

### Description

- Compromise of renal function as evidenced by a decrease in glomerular filtration rate (GFR)
- Characterized by elevated BUN and creatinine and greatly diminished capacity for dealing with water solute fluctuations, but otherwise can maintain homeostasis
- Chronic renal insufficiency: Serum creatinine 1.5–3.0 mg/dL
- Chronic renal failure: Serum creatinine >3.0 mg/dL
- First finding is often simply an abnormal urinalysis (proteinuria, hematuria, pyuria, casts)
- Patient may be asymptomatic, but may have extra-renal symptoms of edema, hypertension, or signs of uremia

### Etiology

- Diabetes, hypertension, glomerulonephritis, polycystic renal disease, obstructive uropathy, amyloidosis
- Congenital anomalies, infection, collagen vascular disease, nephrotoxins, ischemia, acute renal failure
- Deterioration may continue after initial insult resolves

### Incidence and Demographics

- 2.8 per 100,000 people in U.S. with renal insufficiency or failure
- Males > females, increased incidence in non-Caucasians

### Risk Factors

- Poorly controlled chronic conditions mentioned above, especially hypertension, diabetes
- Chronic NSAID use, especially in patients with hypertension
- Aging

### Prevention and Screening

- Early treatment of above-mentioned conditions
- ACE inhibitors have been demonstrated to decrease progression to renal failure in both diabetic and nondiabetic patients. Hypertension need not be present to consider captopril (Catapres) 25 mg bid or tid early in the course of renal insufficiency, particularly for diabetic patients
- Protein restriction may reduce progression of chronic renal disease
- Blood pressure control is crucial

### Assessment

- Patients may remain asymptomatic until GFR is less than 10% of normal

#### HISTORY

- Early manifestations may include nocturia because of inability to concentrate urine
- Later patients may complain of anorexia, fatigue, weakness, edema, pruritus, nausea, vomiting, constipation or diarrhea, shortness of breath, hiccups, lethargy, insomnia, stocking-glove paresthesias

**PHYSICAL EXAM**

- Hypertension, increased skin pigmentation, edema, decreased deep tendon reflexes, pallor, uremic frost of skin, muscle twitching, stocking-glove sensory deficit

**DIAGNOSTIC STUDIES**

- Urine for micro albumin: First indication
- Urinalysis: Hematuria, proteinuria, casts
- Elevated 24-hour urine creatinine
- Elevated serum BUN, creatinine, potassium, phosphate, uric acid, and sodium
- Decreased serum calcium and hemoglobin/hematocrit
- Prolonged bleeding time due to platelet dysfunction
- Acidosis is usually present

**Management**

- Conservative management is designed to prolong the symptom-free period

**NONPHARMACOLOGIC TREATMENT**

- Dietary restrictions: Required to maintain appropriate fluid and electrolyte balance
- Maintain calorie intake at 40–50 cal/kg daily
- Protein is restricted to 20–25 g per day of balanced amino acids; may reduce acidosis and symptoms from elevated BUN (hiccups, nausea, pruritus) and may slow disease progression
- Monitor for both hypo- and hyperkalemia and avoid potassium-sparing diuretics; treat hyperkalemia  $>6$  mEq/L and watch for ECG changes, especially above 6.5 mEq/L
- Potassium restriction to 2 g/day may be required
- Monitor both serum phosphate and calcium levels; limit phosphate intake
- Mild to moderate renal insufficiency, no need to restrict fluids or sodium
- If poorly controlled hypertension or CHF present, restrict fluids and sodium (2 g daily)
- In presence of oliguria, restrict fluids and sodium; intake should equal urine output and insensible losses

**PHARMACOLOGIC TREATMENT**

- For nausea, 5–10 mg prochlorperazine po qid
- For CHF, diuretics such as furosemide to remove excess free water if kidneys lose ability to regulate sodium
- For CHF also consider use of an ACE inhibitor (12.5–25 mg captopril bid or tid) but monitor renal function closely
- CHF usually not problematic until late in course
- Acidosis may require treatment with sodium bicarbonate if symptomatic (fatigue, tachypnea, lethargy) or  $<15$  mEq/L with 600 mg of sodium bicarbonate bid initially; titrate to maintain levels of 16–20 mEq/L; be sure to follow serum potassium and calcium levels as both may decrease
- Patients may develop aldosterone resistance and may require more aggressive therapy such as fludrocortisone and potassium-binding resins
- Correct hyperphosphatemia with calcium citrate (667 mg tid before meals) to prevent development of renal osteodystrophy; if symptomatic or severe

hypocalcemia despite normal phosphate levels, add calcium carbonate 600 mg bid and vitamin D supplementation, calcitriol 25 mcg daily

- Anemia may require erythropoietin treatment, 1,000–6,000 units three times a week sq; monitor Hgb, hct, reticulocyte count and serum ferritin; make sure patient is not iron deficient before starting therapy; replace Fe<sup>+</sup> as needed with 325 mg ferrous sulfate daily; severe anemia (e.g., with angina, high output failure) may require transfusion
- Bleeding can be treated with FFP or cryoprecipitate
- Bleeding in uremia has been treated with conjugated estrogens

#### LENGTH OF TREATMENT

- May require indefinite treatment

#### Special Considerations

- Geriatric patients: highest incidence, highest morbidity and mortality, exacerbated by many age-related conditions

#### When to Consult, Refer, Hospitalize

- Consult with physician for patient with chronic renal insufficiency who has abnormal laboratory tests beyond baseline (creatinine, serum albumin, creatinine clearance, electrolytes, calcium, phosphate, CBC, platelets) and when patient's symptoms and physical exam indicate
- For increases in proteinuria, follow with 24-hour urine for protein; refer/consult if abnormal
- Refer to nephrologist for dialysis and/or transplantation when the above therapies are no longer effective

#### Follow-Up

- Monthly

##### EXPECTED COURSE

- Progressive disease

##### COMPLICATIONS

- Anemia, congestive heart failure, pericardial tamponade, electrolyte imbalance, acidosis

## CASE STUDIES

**Case 1.** A 49-year-old woman with a history of hypothyroidism complains of mid-back pain for 2 days. This is pain that she has never experienced in the past. She also complains of urinary frequency, dysuria, and intermittent nausea.

*PMH:* Gravida 2 Para 2. Multiple UTIs during early reproductive years. Medications include Synthroid 100 mcg, Prempro. She has a 15 pack-year smoking history.

1. What additional history will you need?

*Exam:* Vital signs stable, afebrile, appears in moderate distress, positive left-sided CVA tenderness.

2. What are the differential diagnoses?
3. What diagnostic studies will you consider?

*Results:* Urinalysis shows 2+ hematuria with 1+ proteinuria, negative leukocytes, negative nitrates. A KUB was then ordered and demonstrated a small stone in distal ureter, 4 mm.

4. What treatment will you consider?

**Case 2.** A 25-year-old female, recently married, comes in complaining of painful urination for 2 days. She has no fever. She uses a diaphragm for birth control.

*HPI:* No medications. Reports burning, frequency, hematuria, urgency. *PMH* significant for one urinary tract infection at age 19. Otherwise in good health.

1. What are the differential diagnoses?

*Exam:* Vital signs are stable, afebrile, mild suprapubic tenderness. Normal pelvic exam.

2. What diagnostic studies will you order?
3. What risk factors can you identify?
4. What treatment measures will you prescribe?
5. What follow-up is necessary?
6. What will you do if this patient follows up 2 weeks later with another UTI?

**Case 3.** A 10-year-old boy comes in with his parents to discuss bedwetting. He has daytime continence but has always had nocturnal enuresis once or twice a week. He has been diagnosed with attention-deficit disorder, but is not receiving any drug treatment; however, he has recently been placed in a special education class in school. Episodes of enuresis are now occurring almost nightly.

*HPI:* Normal gestation, normal labor and delivery. No serious childhood illnesses. No history of UTI. No medications, no allergies.

1. What additional history would you like?

*Exam:* Physical exam and neurological exam are normal (i.e. no anatomic abnormalities, normal gait and reflexes).

2. What are the differential diagnoses?
3. What diagnostic studies will you order?
4. What treatment would you consider?

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