

**Subspecialty  
Certifying  
Examination**

**CONTENT  
OUTLINE**

Subboard of  
**Pediatric Infectious Diseases**

## INTRODUCTION

This document was prepared by the American Board of Pediatrics (ABP) Subboard of Pediatric Infectious Diseases as a blueprint for the subspecialty certifying examination. Each ABP Subboard prepares a similar document as a first step in preparing an examination. The purpose is to define the knowledge a certified subspecialist should be expected to demonstrate on an examination consisting of multiple choice questions.

Program directors and candidates frequently request information about the content of subspecialty examinations. Although this document was not prepared to respond to such requests, the Subboard believes that it may be helpful.

Several caveats are important.

- This document is NOT intended to be a curriculum guide. There are many skills subspecialty trainees need to learn that cannot be tested in a multiple choice examination. And, there are many interesting but less important facets of knowledge that are not likely to be tested given the time constraints of an examination.
- This document is NOT designed to be a study guide; however, candidates may feel less anxious about a certifying examination if they know what to expect and they may be able to use this document to identify areas in which they are weak and need additional preparation.
- This document is intended to be a working blueprint. It has not been edited for publication.
- This document is a dynamic work-in-progress. The Subboard will be happy to consider any comments you might have about content.

## EXAM PERCENTAGE LIST

	Approximate Percent in <u>Examination</u>
I. Organ System Infections.....	21.0
II. Pathogens of Infectious Diseases .....	22.5
III. Use of Laboratory and Diagnostic Testing.....	3.0
IV. Treatment.....	16.0
V. Prevention of Infectious Diseases .....	13.0
VI. Immunity and Host Defense.....	2.0
VII. Mechanisms of Infectious Disease.....	2.0
VIII. Infections in Special Circumstances .....	6.0
IX. Infections in High-risk Hosts.....	9.5
X. Epidemiology.....	2.0
XI. Principles of Epidemiologic Research and Biostatistics.....	3.0

# **I. Organ System Infections**

## **A. Unspecific systemic infections**

### **1. Fever of unknown origin**

Know the most likely age-related causes of fever of unknown origin

Formulate the differential diagnosis of fever of unknown origin, including noninfectious causes and disorders of temperature regulation

### **2. Shock**

Evaluate the most likely infectious and noninfectious age-related causes of shock

Recognize the clinical manifestations of various causes of shock

Know the metabolic derangements associated with shock

Plan the anti-infective and supportive therapies of shock

### **3. Bacteremia**

Recognize risk factors for occult bacteremia, including host- and age-related factors

Know the organism-specific complications of occult bacteremia

Identify causes of occult bacteremia according to age and other risk factors

## **B. Upper respiratory tract infections**

### **1. Sinusitis**

Know the most likely infective agents that cause sinusitis, including acute, subacute, and chronic

Recognize the predisposing factors for sinusitis (cystic fibrosis, allergy, immune deficiency, mechanical and vasomotor factors, foreign body)

Recognize the clinical manifestations of sinusitis

Recognize the complications of sinusitis (epidural, subdural, lung, and brain abscesses)

Appreciate the relative value and accuracy of diagnostic tests for sinusitis

Plan antimicrobial and other aspects of therapy for acute sinusitis

Plan antimicrobial and other aspects of therapy for chronic sinusitis

## **2. Odontogenic infections**

Know the most likely etiologic agents of odontogenic infections

Recognize the clinical manifestations of odontogenic infections with regard to anatomic considerations (periapical abscess, periodontal infection, fascial space infections, osteomyelitis of the jaw)

Plan the initial management of a patient with suspected odontogenic infection

## **3. Stomatitis (including herpangina)**

Know the causes of stomatitis in normal and immunocompromised hosts

Recognize the causes of noninfectious stomatitis (Behcet syndrome, Stevens-Johnson syndrome, cancer chemotherapeutic drugs)

Recognize clinical manifestations in which stomatitis suggests and does not suggest immunodeficiency

Recognize the organism-specific clinical manifestations of viral stomatitis

## **4. Pharyngitis**

Know the common age- and season-specific causes of pharyngitis, including group A streptococcus, common viruses, herpes simplex, and *Mycoplasma pneumoniae*

Recognize the specific clinical manifestations and relative frequency of different pharyngeal infections, including diphtheria, *Arcanobacterium* (*Corynebacterium*) *haemolyticum*, *Neisseria gonorrhoeae*, herpes virus, *Mycobacteria*, adenovirus, EBV, and CMV

Recognize normal flora and likely pathogens isolated on throat culture from a patient with pharyngitis

Know the criteria for obtaining a bacterial throat culture in a patient with pharyngitis

Know the specific laboratory tests that identify uncommon agents as a cause of pharyngitis, including diphtheria, *Arcanobacterium* (*Corynebacterium*) *haemolyticum*, and *Neisseria gonorrhoeae*

Plan the treatment of uncommon causes of pharyngitis, including diphtheria, *Arcanobacterium* (*Corynebacterium*) *haemolyticum*, *Neisseria gonorrhoeae*

## **5. Parapharyngeal infections**

Identify the most likely agents of parapharyngeal infections, including peritonsillar or retropharyngeal abscess, and Ludwig angina

Know the age of occurrence and predisposing factors that contribute to pharyngeal and parapharyngeal infections, including peritonsillar, retropharyngeal, and Ludwig angina

Recognize the clinical manifestations of abscesses at different sites in the parapharyngeal areas following peritonsillar and retropharyngeal infection and Ludwig angina

Anticipate the complications (eg, obstruction, pulmonary embolic infection, jugular thrombophlebitis) of parapharyngeal infections, including peritonsillar or retropharyngeal abscess, and Ludwig angina

Plan the treatment of parapharyngeal infection, including peritonsillar or retropharyngeal abscess and Ludwig angina

## **6. Otitis externa**

Know the most likely predisposing factors and causes of otitis externa, including malignant otitis externa

Differentiate the clinical manifestations of uncomplicated otitis externa from those of chronic suppurative otitis media and malignant otitis externa

Recognize the complications of malignant otitis externa

Interpret culture results obtained from drainage from the external ear

Plan the management of a patient with malignant otitis externa

Plan the management of a patient with uncomplicated otitis externa

## **7. Acute otitis media**

Know the natural history of acute otitis media

Recognize the common and less common age-related infectious causes of acute otitis media

Know the predisposing factors for acute otitis media

Recognize the complications associated with acute otitis media (mastoiditis, facial palsy, sinus thrombosis, hydrocephalus, otitis media with effusion), including their relative frequencies

Know the indications for tympanocentesis or other diagnostic tests in a patient with otitis media

Plan the management of a patient with acute otitis media in whom initial antimicrobial therapy has been ineffective

Know the indications for prophylaxis against recurrent acute otitis media

## **8. Chronic suppurative otitis media**

Identify the etiologic agents most likely responsible for chronic suppurative otitis media

Recognize the complications associated with chronic suppurative otitis media

Plan the management for chronic suppurative otitis media (antibiotic, surgical)

## **9. Mastoiditis**

Identify the most likely infectious causes of mastoiditis

Recognize the clinical manifestations of mastoiditis

Plan the evaluation of a patient with suspected mastoiditis

Plan the management of a patient with mastoiditis, including empiric antibiotic therapy, further diagnostic tests, and surgery

Anticipate the complications of mastoiditis

## **10. Parotitis**

Know the etiologic agents most likely responsible for parotitis according to predisposing factors and clinical presentation

Identify the clinical manifestations of viral versus suppurative parotitis

Recognize the association between parotitis and HIV infection

Formulate the differential diagnosis in a patient in whom parotitis is suspected, including infectious and noninfectious entities

## **11. Tracheitis and epiglottitis**

Recognize the predisposing causes of bacterial tracheitis (eg, laryngotracheobronchitis, trauma)

Know the most likely etiologic agents of bacterial tracheitis

Recognize the clinical manifestations of bacterial tracheitis

Anticipate the complications of bacterial tracheitis

Formulate a differential diagnosis of a patient with fever and stridor (epiglottitis versus croup versus bacterial tracheitis)

Plan the management of a patient with suspected bacterial tracheitis

Plan the evaluation of a patient with fever and stridor

Know the most likely infectious causes of epiglottitis

Recognize the clinical manifestations of epiglottitis

Anticipate the complications of epiglottitis

Plan the management of a patient with epiglottitis

## **12. Laryngotracheobronchitis**

Recognize the age- and season-related etiologic agents of laryngotracheobronchitis and related entities

Differentiate laryngotracheobronchitis from other causes of croup by clinical manifestations and results of diagnostic tests

Plan the management of a patient with laryngotracheobronchitis, including indications for hospitalization and for epinephrine and/or corticosteroid therapy

## **13. Thrush**

Differentiate among the causes of thrush, including age-specific differences and predisposing factors

# **C. Lower respiratory tract infections**

## **1. Bronchiolitis**

Identify the most likely etiologic agents in a patient in whom bronchiolitis is suspected, based on age and season

Formulate a differential diagnosis in a patient in whom bronchiolitis is suspected, including infectious and noninfectious entities

Plan the management of a patient with bronchiolitis

## **2. Acute pneumonia**

Know the factors and etiologic agents predisposing to the development of acute pneumonia (age, anatomic abnormalities, immune deficiency, exposures)

Identify the clinical manifestations of specific infectious causes of pneumonia (eg, Chlamydia, Mycoplasma, M. tuberculosis, S. pneumoniae, viral)

Recommend specific diagnostic laboratory tests in patients with suspected acute pneumonia according to clinical manifestations and host factors

Interpret the results of diagnostic laboratory tests obtained from a patient with suspected acute pneumonia to determine etiology

Plan the empiric treatment of acute pneumonia (drugs, procedures)

according to age, clinical setting, and exposure history

### **3. Chronic or recurrent pneumonia**

Know the predisposing factors for chronic and for recurrent pneumonia

Plan the evaluation of a patient with chronic or recurrent pneumonia based on clinical and laboratory manifestations

Formulate a differential diagnosis for a patient with suspected chronic or recurrent pneumonia, including anatomic and immunologic abnormalities, and underlying diseases including cystic fibrosis and foreign body

### **4. Pneumonia in the compromised host**

Recognize specific predisposing factors (eg, immunologic, anatomic) for pneumonia in an immunocompromised host

Plan the initial treatment of pneumonia in an immunocompromised host

Determine the most likely causes of pneumonia according to specific immune deficiency

### **5. Empyema and pleural effusions**

Identify the most likely infectious causes of pleural fluid (empyema, effusion)

Interpret results of pleural fluid analysis (eg, cell count, protein, Gram stain)

Formulate the differential diagnosis of a patient with suspected pleural effusion, including infectious and noninfectious entities

Plan the management of a patient with suspected empyema or effusion (drugs, duration, procedures)

Plan the management of a patient with proven empyema (drugs, procedures, duration of therapy, conservative approach to decortication)

### **6. Pulmonary abscess/necrotizing pneumonia**

Identify the most likely infectious causes of lung abscess and/or necrotizing pneumonia according to clinical course (eg, duration of illness, tempo of illness)

Plan the evaluation of a patient with pulmonary abscess for predisposing factors and underlying abnormalities

Plan the management of a patient with pulmonary abscess or necrotizing pneumonia (drugs, procedures)

### **7. Aspiration pneumonia**

Identify the risk factors for aspiration pneumonia

Identify the most likely infectious causes of aspiration pneumonia

Plan the management of a patient with aspiration pneumonia

## **D. CNS infections**

### **1. Acute meningitis**

Know the common and uncommon age- and host-related etiologic agents of meningitis

Recognize the clinical manifestations of bacterial meningitis in the neonate versus an older child

Recognize the infectious and noninfectious etiologies of "aseptic" meningitis

Recognize the specific clinical manifestations of uncommon infectious causes of meningitis

Identify the most likely etiologic agents of bacterial meningitis based on age (infant versus child) and immunization history

Develop a differential diagnosis in a patient with meningitis whose fever is persistent or recurrent

Formulate the differential diagnosis of a patient with fever and change in mental status

Recognize of the complications of meningitis (eg, subdural effusions, seizures, empyema, cerebral venous thrombosis/infarction, fever)

Know the manifestations and frequency of sequelae of bacterial meningitis

Know which laboratory studies are helpful in defining etiologic agents causing meningitis

Interpret Gram stains of cerebrospinal fluid from patients with meningitis

Plan the management of a patient with suspected bacterial meningitis (antimicrobials, fluids, anticipation of complications)

Know the possible indications for corticosteroid therapy in a patient with meningitis

Know the manifestations and frequency of sequelae of viral or bacterial meningitis

Recognize the clinical manifestations of acute disseminated encephalomyelitis, and manage appropriately

## **2. Subacute/chronic and recurrent meningitis**

Formulate a differential diagnosis in a patient with subacute/chronic meningitis, including infectious and noninfectious entities

Know the predisposing factors for recurrent meningitis (eg, congenital, anatomic, immunologic, traumatic)

Recognize the clinical manifestations of subacute/chronic meningitis

Recognize the clinical manifestations of recurrent meningitis

Plan the evaluation of a patient with recurrent meningitis (eg, anatomic, immunologic)

Plan special laboratory tests to detect unusual etiologies in a patient with suspected subacute/chronic meningitis (eg, cryptococcal antigen, Lyme antibody, mycobacterial culture)

## **3. Viral infections of the central nervous system**

Know the common and less common viral etiologies of encephalitis, including epidemic causes

Differentiate viral from partially treated bacterial meningitis

Recognize the importance of the occurrence of focal vs nonfocal clinical or neurodiagnostic features in the etiologic differential diagnosis of infectious causes of encephalitis

Formulate a differential diagnosis for a patient with suspected viral meningoencephalitis according to age, season, and exposure

Know the diagnostic tests for determining a specific cause of viral meningoencephalitis

Formulate a differential diagnosis for a 2-week-old infant with "aseptic" meningitis, including herpes simplex, enterovirus, syphilis

## **4. Unusual causes and manifestations of meningitis**

Formulate a differential diagnosis of a patient with eosinophilic meningitis

Recognize the clinical and laboratory findings of fungal meningitis

Formulate a differential diagnosis in a patient with CSF findings characteristic of fungal meningitis to include infectious and noninfectious causes

Plan treatment for a patient with fungal meningitis, including *Candida*, *Cryptococcus*, *Aspergillus*, and *Rhizopus*

Plan the clinical and laboratory evaluation of a patient at risk for fungal

meningitis

## **5. Parameningeal infections**

Identify the most likely etiologic agent(s) of brain abscess by clinical setting

Identify the most likely etiologic agent(s) of epidural abscess by clinical setting

Recognize the predisposing factors and clinical manifestations of parameningeal infections (brain abscess, epidural abscess, empyema)

Know the complications of parameningeal infections (brain abscess, epidural abscess, subdural empyema)

Plan the appropriate diagnostic evaluation of a patient with suspected parameningeal infection (brain abscess, epidural abscess, subdural empyema)

Plan appropriate management of a patient with suspected parameningeal infection (brain abscess, epidural abscess, subdural empyema)

Formulate the differential diagnosis for a patient with manifestations of a space-occupying lesion in which parameningeal infection is a consideration

## **6. Reye syndrome**

Recognize the clinical manifestations and differential diagnosis of a patient with possible Reye syndrome

Know the appropriate diagnostic tests in a patient with suspected Reye syndrome

Identify infections and other factors predisposing to Reye syndrome

## **7. Transverse myelitis**

Formulate a differential diagnosis in a patient with suspected transverse myelitis

Recognize the clinical manifestations of transverse myelitis

## **8. Epidural infections**

Identify the likely etiologic agents causing spinal epidural infection by clinical setting

Recognize the predisposing factors and clinical manifestations of spinal epidural infection

Plan an appropriate laboratory evaluation of a patient with suspected spinal epidural infection

Plan management for a patient with suspected spinal epidural infection (drugs, surgery, urgency)

## **9. Neuritis/neuropathy**

Recognize the clinical manifestations of Guillain-Barre syndrome

Recognize the clinical manifestations of peripheral neuropathy/neuritis

Formulate a differential diagnosis of weakness in a patient with findings suggestive of Guillain-Barre syndrome

Identify the organism most commonly associated with Guillain-Barre syndrome (eg, Campylobacter in gut, Mycoplasma)

Identify the organism most commonly associated with peripheral neuropathy/neuritis (eg, Borrelia, virus)

## **E. Urinary tract infections**

### **1. Urinary tract infection**

Differentiate asymptomatic bacteriuria from urinary tract infection based on epidemiology and natural history

Recognize when asymptomatic bacteriuria is significant

Recognize the clinical manifestations of urinary tract infections, including cystitis and pyelonephritis

Know how to interpret microbiologic test results for urinary tract infection

Know the appropriate imaging studies and when to order them in patients with suspected or proven urinary tract infection

Plan the appropriate treatment of urinary tract infection (drugs, duration of treatment, prophylaxis), including initial empiric therapy

Recognize the complications of urinary tract infection (renal abscess, perinephric abscess, reflux uropathy)

Recognize and manage a patient with xanthogranulomatous pyelonephritis

### **2. Renal and perinephric abscess**

Recognize the most likely infectious causes of renal or perinephric abscess by clinical presentation

Recognize the clinical manifestations of renal or perinephric abscess

Recognize the predisposing factors for renal/perinephric abscess, including endocarditis

Formulate the differential diagnosis of a patient with suspected perinephric or renal abscess

Plan appropriate diagnostic tests in a patient with possible renal or perinephric abscess

Recognize and manage a patient with lobar nephronia

## **F. Cardiovascular infections**

### **1. Endocarditis**

Recognize the common and less common organisms causing endocarditis (eg, *H. aphrophilus*, *K. kingae*, *E. corrodens*, *A. actinomycetemcomitens*)

Know the pathogenesis of endocarditis

Know the predisposing factors for the different infectious causes of endocarditis

Recognize the clinical manifestations of endocarditis or endovascular infections

Identify the typical features of fungal endocarditis

Recognize complications of endocarditis (eg, septic emboli, valve dysfunction, nephritis, thrombocytopenia, stroke)

Plan the diagnostic evaluation of a patient with suspected endocarditis

Formulate the differential diagnosis of a patient with persistent bacteremia, to include endocarditis

Formulate a microbiologic differential diagnosis of "culture-negative" endocarditis

Recognize the indications for surgery in the management of endocarditis

Plan empiric therapy for treatment of suspected endocarditis by clinical setting

Plan definitive antibiotic therapy for endocarditis once the etiology is established

Plan therapy for treatment of known etiology of endocarditis in a patient allergic to the drug of choice or who has a toxic reaction to the drug of choice

Know the indications for prophylaxis against bacterial endocarditis

Choose drug of choice and alternative prophylactic drugs for endocarditis for different clinical settings and procedures in the presence of a prosthetic

valve

Choose alternative prophylactic drugs for endocarditis for different clinical settings and procedures in the presence of a prosthetic valve

## **2. Myocarditis**

Know the microbial etiologies of myocarditis

Know the epidemiologic features of viral myocarditis

Recognize the clinical manifestations of infectious myocarditis

Plan appropriate tests to identify the etiology of infectious myocarditis

Formulate the differential diagnosis in a patient with an enlarged heart, poor myocardial function, and a dysrhythmia

Distinguish viral myocarditis from acute rejection in a patient who has undergone cardiac transplantation

## **3. Acute rheumatic fever**

Know the pathogenesis of acute rheumatic fever

Recognize acute rheumatic fever by the presence of predisposing factors and clinical manifestations (eg, chorea, arthritis)

Plan the evaluation of a patient with suspected acute rheumatic fever

Plan the management of a patient with acute rheumatic fever

Know choice of drugs and indications for prophylaxis against acute rheumatic fever

## **4. Pericarditis**

Know the microbial causes of acute pericarditis

Recognize the clinical manifestations of pericarditis

Formulate the differential diagnosis in a patient with an enlarged heart and a narrow pulse pressure

Plan diagnostic studies for pericarditis, including those to identify the pathogen

Plan the management of a patient with infectious pericarditis

## **5. Mediastinitis**

Know the causes and predisposing factors of mediastinitis

Recognize the clinical manifestations of mediastinitis

Formulate the differential diagnosis for a patient with possible mediastinitis

Plan the treatment (antibiotics and surgery) of mediastinitis

## **G. Bone and joint infections**

### **1. Osteomyelitis**

Know the infectious causes of acute osteomyelitis according to age

Recognize the risk factors for sequelae from osteomyelitis (neonate or young infant, delay in diagnosis and initiation of therapy, failure to effect proper surgical drainage when indicated)

Identify the clinical manifestations of osteomyelitis, including multiple sites and the variations according to age

Recognize clinical manifestations of *Pseudomonas aeruginosa* osteomyelitis following a puncture wound through sneakers (time elapsed since injury, lack of systemic toxicity, mild local findings, changes on imaging studies)

Appreciate the situations (eg, trauma, IV drug abuse, diabetes, sickle cell disease) in which less common organisms may be the cause of osteomyelitis (eg, *Mycobacterium tuberculosis*, *Pseudomonas aeruginosa*)

Formulate the differential diagnosis in a patient with fever, pain, and swelling around a major joint

Know the appropriate laboratory tests for establishing the infectious cause of osteomyelitis (eg, site aspirate, surgical drainage culture)

Know the appropriate laboratory tests for establishing a diagnosis of osteomyelitis (eg, radionuclide bone scan, blood culture, biopsy, MRI)

Recognize the indications for surgical drainage in osteomyelitis

Know the appropriate drugs for initial presumptive treatment of acute osteomyelitis, considering possible agents, age, and mode of acquisition

Know the appropriate duration of treatment for osteomyelitis: parenteral/oral

Know the criteria for changing from parenteral to oral therapy in the treatment of acute osteomyelitis

Plan the management of a patient with chronic osteomyelitis

Recognize the clinical features of recurrent multifocal osteomyelitis, and manage appropriately

## 2. Pyogenic arthritis

Recognize the clinical manifestations of pyogenic arthritis, particularly with regard to the joint involved and the age of the patient

Formulate the differential diagnosis for a patient with fever, refusal to bear weight, limp and/or decreased range of motion of the hip

Plan appropriate laboratory tests to establish the diagnosis of pyogenic arthritis

Interpret results of joint fluid analysis in a patient with suspected pyogenic arthritis

Identify the causes of arthritis when culture results are negative (eg, viral, reactive, rheumatic fever, Lyme)

Know likely/unlikely etiologic agents of pyogenic arthritis by age, site of infection, and underlying conditions (eg, *Borrelia*, *Neisseria*, *Salmonella*)

Identify likely etiologies of pyogenic arthritis when more than one joint is involved (eg, *Salmonella*, *Staphylococcus aureus*, *N. gonorrhoeae*)

Plan the initial presumptive treatment of bacterial arthritis, based on the joint involved, the age of the patient, mode of acquisition, and clinical manifestations

Know the indications for surgical drainage of pyogenic arthritis

Plan management of patient with uncomplicated bacterial arthritis (drainage, duration of therapy, oral therapy)

Know the criteria for changing from parenteral to oral antimicrobial therapy for pyogenic arthritis

Recommend the appropriate duration of antimicrobial therapy for pyogenic arthritis based on clinical features

Know the risk factors for sequelae from pyogenic arthritis (neonate versus young infant, hip and shoulder versus other joints, failure to effect surgical drainage when indicated, concurrent osteomyelitis)

## 3. Diskitis

Recognize the clinical manifestations of diskitis

Formulate the differential diagnosis for a patient with an abnormal gait and a painful, stiff lower back

Plan the management of a patient with diskitis

Plan a diagnostic evaluation to establish the etiology of diskitis

## **H. Skin/soft tissue/muscle infections**

### **1. Superficial skin infections (eg, impetigo, furuncle, ecthyma)**

Know the most frequent causes of superficial skin infections according to clinical manifestations

Plan a diagnostic evaluation to establish the cause of superficial skin infections

Understand possible serious consequences of superficial skin infection (eg, systemic spread, glomerulonephritis)

Interpret results of culture obtained from a superficial skin infection

Recognize the dermatologic manifestations (eg, epidermal necrolysis, erythroderma, erythema gangrenosum, scarlatiniform exanthems) of bacterial toxins

Identify the pathogens most commonly associated with petechiae (eg, coxsackievirus A, echovirus, Neisseria, Rickettsia)

Recognize pathogens most commonly associated with urticaria (eg, S. pyogenes, Epstein-Barr virus)

Recognize pathogens most commonly associated with erythema multiforme (eg, herpes simplex virus, Mycoplasma)

### **2. Subcutaneous infections/abscess/cellulitis**

Know the most likely organisms that cause subcutaneous infections/abscesses/cellulitis

Recognize the clinical manifestations and clinical clues of the pathogens causing subcutaneous infections/abscesses/cellulitis

Know appropriate means of determining the etiologic agents of subcutaneous infections/abscesses/cellulitis and the indications for their use (eg, aspiration/surgical drainage/biopsy)

Plan the appropriate treatment for most likely organisms causing subcutaneous infections/abscesses/cellulitis according to age and clinical manifestations

Appreciate the relative likelihood of complications of subcutaneous infections/abscesses/cellulitis by location and organism

Recognize the clinical manifestations and etiologic agents (infectious and noninfectious) of erythema nodosum

### **3. Myositis/Pyomyositis/Fasciitis**

Understand the predisposing causes of muscle infections (ie,

myositis/pyomyositis/fasciitis)

Know the appropriate methods to diagnose myositis/pyomyositis/fasciitis

Know the most likely pathogens responsible for muscle infections based on predisposing and clinical factors (eg, bacterial, fungal, viral, parasitic)

Recognize the indications for surgical drainage and debridement of myositis/pyomyositis/fasciitis

Plan the appropriate presumptive treatment of myositis/pyomyositis/fasciitis according to history and clinical presentations

Formulate the differential diagnosis for a patient in whom myositis/pyomyositis/fasciitis is suspected (infectious vs noninfectious entities)

#### **4. Omphalitis and funisitis**

Know the most likely agents and the associated relative clinical severity of omphalitis/funisitis

Differentiate bacterial colonization from omphalitis/funisitis

Plan appropriate presumptive treatment of omphalitis/funisitis

### **I. GI/Intra-abdominal infections**

#### **1. Infectious colitis and secretory diarrhea**

Differentiate the pathogenic mechanisms involved in infectious colitis versus secretory diarrhea

Know the epidemiologic features that help distinguish microbiologic etiology of infectious colitis versus secretory diarrhea: age, season, exposures

Know the major etiologies of infectious colitis versus secretory diarrhea: bacteria, viruses, protozoa

Plan the diagnostic evaluation to determine the etiology of infectious gastroenteritis (eg, Giardia, Norwalk agent, calicivirus, enteric adenovirus, Salmonella, C. difficile)

Know the clinical indication and choice of antimicrobial agents in infectious colitis versus secretory diarrhea

Recognize the complications of infectious diarrhea (eg, bacteremia in Salmonella, hepatic abscess in amoebiasis, Guillain-Barre in Campylobacter)

#### **2. Antibiotic-associated colitis**

Formulate the differential diagnosis in a patient receiving antibiotic therapy in whom diarrhea has developed

Know the etiology of antibiotic-associated colitis

### **3. Appendicitis**

Formulate the differential diagnosis of a patient with right lower quadrant pain and leukocytosis

Plan appropriate initial presumptive antimicrobial therapy of ruptured appendicitis

Recognize the complications of acute appendicitis

Recognize periappendiceal, hepatic, or subphrenic abscess as a complication of appendicitis

### **4. Peritonitis**

Formulate the differential diagnosis in a patient with fever, a diffusely tender and rigid abdomen, and absent bowel sounds

Recognize the factors that predispose to peritonitis, eg, nephrotic syndrome, peritoneal dialysis, perforated bowel

Recommend diagnostic tests for a patient with suspected peritonitis

Recognize the microbial etiology of peritonitis and how it is influenced by predisposing factors

Plan appropriate initial presumptive antimicrobial therapy for a patient with suspected peritonitis

Know when surgery should be avoided in patients with peritonitis (ie, Gram positive diplococci on peritoneal aspirate)

## **J. Lymphoid tissue infections (lymphadenitis, lymphangitis)**

Know the most likely infectious causes of lymphadenitis/lymphangitis according to clinical manifestations (including anatomic location) and age

Recognize infections most frequently associated with regional lymphadenitis

Recognize infections most frequently associated with generalized lymphadenitis

Plan the evaluation and management of a patient with suspected lymphadenitis and/or lymphangitis, including the indications for surgical management (eg, aspiration, biopsy, surgical drainage, excision)

Plan empiric therapy for a patient with lymphadenitis and lymphangitis for the most likely organisms according to age and clinical manifestations

Recognize the complications and sequelae of lymphadenitis/lymphangitis according to age, location, and organisms (eg, fistulae, facial nerve palsy, postoperative)

## **K. Hepatic/biliary infections**

### **1. Viral hepatitis**

Formulate the differential diagnosis for a patient with nausea, vomiting, icterus, and right upper quadrant pain

Know the factors that predispose to hepatitis and how they differ depending on the particular virus

Know the particular diagnostic tests for each of the causes of viral hepatitis, as well as the interpretation of results

Know the long-term outcome from hepatitis caused by the various hepatotropic viruses

Know the indications for antiviral therapy in patients with chronic viral hepatitis

Know the means for prevention of each of the agents of viral hepatitis: public health, immunoprophylaxis, blood donor screening

Know the agents other than the hepatotropic viruses (hepatitis A,B,C, D,E,G) that can cause hepatitis

### **2. Ascending cholangitis**

Know the factors and diseases that predispose to ascending cholangitis in children

Identify the microbial etiology of ascending cholangitis in children

Plan the initial presumptive antimicrobial therapy for children with ascending cholangitis

Recognize the clinical course in a patient with ascending cholangitis

## **L. Ocular infections**

### **1. Conjunctivitis**

Identify the most likely organisms causing conjunctivitis according to age, clinical manifestations, and predisposing factors

Recognize which pathogens and situations are associated with epidemics of conjunctivitis (eg, adenoviral infections, nosocomial transmission by

contaminated eye devices)

Plan a diagnostic evaluation to determine the infectious cause in a patient with conjunctivitis

Plan the appropriate presumptive therapy for patients with conjunctivitis according to age, clinical manifestations, and laboratory findings

Recognize complications and sequelae of conjunctivitis according to age and organism (eg, gonococcal, chlamydial, adenoviral)

Formulate a differential diagnosis in a patient with conjunctivitis, including Kawasaki, Stevens-Johnson, toxic shock syndromes, as well as infectious causes

Formulate a differential diagnosis of a neonate with conjunctivitis, considering age, clinical, and laboratory findings

Know the prophylactic drugs for ophthalmia neonatorum, and their relative limitations

Plan the evaluation of and therapy for a neonate with conjunctivitis

## **2. Keratitis**

Know the most frequent etiologic agent for keratitis according to age, clinical manifestations, and predisposing factors (eg, adenovirus 8, HSV, fungus, Pseudomonas, Fusarium)

Identify the organisms and situations associated with epidemics of keratitis (eg, adenovirus, pseudomonas from swimming pools; Acanthamoeba from contact lenses)

Plan the appropriate treatment of keratitis according to causative organism

Recognize the complications and sequelae of keratitis according to causative organism, including HSV, Pseudomonas, and Acanthamoeba

## **3. Endophthalmitis**

Recognize the predisposing factors for endophthalmitis (eg, immunodeficiency, trauma, systemic fungal or mycobacterial infection)

Identify the most likely etiologic agents causing endophthalmitis according to clinical manifestations and predisposing factors, including surgery, trauma, septicemia

Plan the appropriate presumptive and specific therapy for a patient with endophthalmitis

## **4. Uveitis**

Differentiate acute (non-granulomatous) from chronic (granulomatous)

uveitis according to clinical features, epidemiology, and causes (Toxoplasma, fungus, virus, tuberculosis)

Formulate a differential diagnosis for a patient in whom uveitis is suspected (eg, Kawasaki, JRA, Lyme disease, sarcoidosis)

## **5. Periorbital cellulitis, sinus-related swelling, infection from trauma**

Distinguish periorbital cellulitis from sinusitis-related eye swelling based upon clinical manifestations and results of diagnostic tests

Understand the pathogenesis and predisposing causes of periorbital cellulitis and sinusitis-related eye swelling

Identify the most frequent infectious causes of bacteremic peri-orbital cellulitis from a break in skin integrity, sinusitis-related eye swelling, or orbital cellulitis from penetrating trauma

Know the indications for surgical intervention in a patient with orbital abscess

Plan the appropriate antibiotic therapy for presumptive treatment of periorbital cellulitis (bacteremic or as a result of a break in skin integrity), sinusitis-related eye swelling, or orbital cellulitis from penetrating trauma

Recognize complications of orbital cellulitis (cavernous sinus thrombosis, optic nerve ischemia)

Formulate a differential diagnosis of eye swelling and redness

Formulate a differential diagnosis of the infectious causes of preseptal cellulitis, including conjunctivitis, hordeolum, dacryoadenitis, dacryocystitis, bacterial cellulitis (complicating trauma), and inflammatory edema

## **M. Reproductive system infections/sexually transmitted diseases**

### **1. Urethritis**

Formulate the differential diagnosis for male and female adolescents with frequency, urgency, dysuria, and a urethral discharge

Plan appropriate diagnostic tests to define the infectious cause of urethritis in males and females

Identify the infectious causes of urethritis in males and females

Plan initial presumptive antimicrobial therapy of urethritis in males and females

Know which of the agents causing urethritis in males and females can be shed asymptotically and can be transmitted by sexual contact

Recognize the complications of urethritis in males (eg, epididymitis)

## 2. Cervicitis

Identify the microbiologic etiologies of cervicitis in a sexually active adolescent female (eg, *C.trachomatis*, *N.gonorrhoeae*, herpes simplex virus)

Plan the appropriate diagnostic tests to define microbial etiology of cervicitis

Know which cervical infections (based on microbiologic etiology) warrant screening and antimicrobial therapy in at-risk pregnant women

Plan the initial presumptive antimicrobial therapy of cervicitis

Identify the acute and long-term complications of cervicitis: salpingitis, infertility, tubal pregnancy

Plan the management of a neonate born to a mother with known cervical carriage of certain pathogens (eg, *C.trachomatis*, *N. gonorrhoeae*, group B streptococci, herpes simplex virus)

## 3. Salpingitis/pelvic inflammatory disease

Formulate the differential diagnosis in a sexually active adolescent female with pelvic pain

Identify the microbial etiologies of pelvic inflammatory disease

Plan appropriate diagnostic tests to establish microbial etiology of pelvic inflammatory disease

Know the initial presumptive antimicrobial therapy of pelvic inflammatory disease

Recognize the acute and long-term complications of pelvic inflammatory disease: tubal pregnancy, infertility

## 4. Genital vesiculoulcerative disease

Formulate the differential diagnosis of vesiculoulcerative genital lesions

Recognize clinical clues that suggest particular microbiologic etiologies in a patient with vesiculoulcerative genital lesions: painful versus painless, single versus multiple, regional adenopathy

Plan the laboratory diagnosis of vesiculoulcerative genital lesions

Know the risk for transmission of pathogens causing vesiculoulcerative genital lesions: between sexual partners, from mother to newborn regardless of symptoms

Plan the treatment of primary or recurrent vesiculoulcerative genital lesions

Understand the likely clinical course and prognosis of vesiculoulcerative genital lesions

## **5. Vaginitis**

Formulate the differential diagnosis of vaginitis in prepubertal females and in sexually active pubertal females, including bacterial vaginosis

Plan the laboratory tests for etiologic diagnosis of vaginitis in prepubertal females and in sexually active pubertal females

Choose the initial presumptive antimicrobial therapy of vaginitis in prepubertal females and in sexually active pubertal females

Know that vaginitis in prepubertal girls can be a manifestation of sexual abuse, which diagnostic tests are appropriate, and which pathogens confirm sexual abuse

Know the implications for transmission of the major etiologic agents to sexual partners, the neonate during vaginal delivery

## **N. Kawasaki syndrome**

Recognize the clinical manifestations and the expected time course of the various clinical signs and symptoms of Kawasaki syndrome

Know the epidemiology of Kawasaki syndrome, including age, race, geography

Understand the constellation of clinical and laboratory findings for the diagnosis of Kawasaki syndrome

Formulate a differential diagnosis in a patient in whom Kawasaki syndrome is suspected, including infectious and noninfectious etiologies

Recognize prognostic factors for potential complications of Kawasaki syndrome

Plan laboratory evaluation to aid in the diagnosis and management of Kawasaki syndrome

Know the appropriate treatment of Kawasaki syndrome, including the time in which each must be initiated, the duration, and the expected response

Recognize the complications of Kawasaki syndrome, including time of occurrence and method of detection (eg, echocardiography early, stress test later)

## **II. Pathogens of Infectious Diseases**

### **A. Gram-positive bacteria**

## 1. **Staphylococcus aureus**

Know the epidemiology of *Staphylococcus aureus*, including normal sites of colonization, routes of transmission, and predisposing factors to infection

Know the epidemiology, prevention and control of hospital-acquired *Staphylococcus aureus* infections, including nursery and MRSA outbreaks

Recognize clinical manifestations of toxic shock syndrome

Plan therapy for a patient with toxic shock syndrome, including recognition of the need for aggressive fluid replacement

Plan investigation of a patient with persistent staphylococcal bacteremia (eg, endocarditis, other intravascular focus, secondary sites of infections)

Know the likely in vitro antimicrobial susceptibilities of *Staphylococcus aureus*

Plan antimicrobial and adjunctive therapy for a patient with *Staphylococcus aureus* infection

Formulate a differential diagnosis in a patient with recurrent staphylococcal infections

Formulate a differential diagnosis in a patient with suspected toxic shock syndrome

Recognize clinical manifestations of exfoliative toxin syndromes

Recognize the increasing prevalence of community-acquired methicillin-resistant *Staphylococcus aureus* infections

## 2. **Coagulase-negative staphylococci**

Compare the epidemiology and routes of transmission of coagulase-negative staphylococci with those of *Staphylococcus aureus*

Recognize that coagulase-negative staphylococci encompass multiple species that have differing predilections for types of infection (eg, *S. saprophyticus* and UTI)

Know the factors predisposing to coagulase-negative staphylococcal infection (eg, newborn infants, immunocompromised host, and implanted foreign bodies)

Identify the characteristic features of coagulase-negative staphylococcal infection in different hosts, such as bacteremia in very-low-birth weight infants and urinary tract infections in adolescent females (eg, *S. saprophyticus*)

Know the in vitro antimicrobial susceptibilities of coagulase-negative

staphylococci

Interpret the significance of a single blood culture isolate of coagulase-negative staphylococci in different clinical circumstances, including normal host, low-birth-weight infant, intravascular device

Plan the therapy of different types of coagulase-negative staphylococcal infections (eg, CNS shunt, indwelling catheter, osteomyelitis following insertion of foreign body for repair of fracture)

Identify the clinical settings in which coagulase-negative staphylococci are the most likely pathogens

### **3. Group A streptococcus**

Know the routes of transmission, sites of colonization, and communicability of persons harboring or infected with group A streptococcus

Identify the microbiologic characteristics of group A streptococcus and methods of laboratory diagnosis

Recognize the major cell wall constituents of group A streptococcus and exotoxins associated with disease-producing strains

Know the different sites of common and uncommon group A streptococcal infections

Recognize the clinical manifestations of group A streptococcal infections, including skin, pharynx, and invasive disease

Know the indications and limitations of diagnostic tests for group A streptococcus, including cultures, rapid antigen detection tests, and serologic tests

Know the major antimicrobial drugs to which group A streptococci may be resistant

Plan the antimicrobial treatment of the different types of group A streptococcal infections according to clinical manifestations, including drugs, duration, and alternate drugs in penicillin-allergic patients

Understand the epidemiology and management of children with recurrent group A streptococcal pharyngitis

Plan the management of persons with group A streptococcal infection and those exposed, including indications for exclusion from school and child-care attendance and hospital infection control

Recognize the suppurative complications of pharyngeal and skin infections with group A streptococcus

Know the manifestations of nonsuppurative complications of group A streptococcal pharyngitis and impetigo

Recognize the clinical manifestations of streptococcal toxic shock-like syndrome

Recognize the clinical manifestations of streptococcal necrotizing fasciitis and myositis

Know the prognosis and appropriate management of streptococcal toxin syndromes

Understand how to distinguish streptococcal carriers from infected individuals

#### **4. Group B streptococcus**

Know the epidemiology of group B streptococcal infection in newborn infants and children, including sites of colonization and rates of transmission

Know the role of serotype-specific antibody in susceptibility to group B streptococcal infection

Recognize the relative frequency and the clinical manifestations of early- and late-onset group B streptococcal infection in infancy

Understand the value and limitations of group B streptococcal rapid antigen tests of cervical secretions in pregnant women

Plan an appropriate intrapartum chemoprophylactic regimen for the prevention of group B streptococcal infection (eg, choice of drugs, route of administration)

Know the optimal methods and the site for recovery of group B streptococci from mucous membrane sites in pregnant women

Know the potential value and limitations of rapid antigen testing for group B streptococcus in urine and CSF in newborn infants

Plan the antimicrobial therapy and management, including drug(s) and duration of therapy in patients with different types of group B streptococcal infections

Understand the rationale and indications for maternal chemoprophylaxis for neonatal group B streptococcal infection and for management of her newborn infant after intrapartum chemoprophylaxis

#### **5. Group D streptococcus and Enterococcus**

Identify the sites of colonization for group D streptococcus and Enterococcus

Recognize those infections that are likely to be caused by group D streptococcus or Enterococcus

Plan the antimicrobial therapy for group D streptococcal or enterococcal infections

Recognize the existence of vancomycin-resistant isolates of *Enterococcus*

Interpret antimicrobial susceptibility test results for *Enterococcus* (eg, ampicillin, trimethoprim with sulfamethoxazole, high-level susceptibility to aminoglycosides)

Know when synergistic combination therapy for enterococcal infection is indicated (eg, indications for aminoglycosides)

Know the in vitro antimicrobial susceptibilities of *Enterococcus*

## 6. **Groups C and G streptococci**

## 7. **Viridans streptococci**

Recognize the different species of viridans (eg, *intermedius*) and other non-A, B, or D streptococci and their usual sites of colonization

Know the infections associated with viridans and other non-A, B, or D streptococci

Plan the therapy of infections caused by viridans and other non-A, B, or D streptococci

Know the significance of nutritionally-deficient streptococci and the laboratory characteristics by which they can be identified

Interpret the significance of a single blood culture isolate of a viridans streptococcus in different clinical circumstances

## 8. ***Streptococcus pneumoniae***

Know the epidemiology of *Streptococcus pneumoniae* infections, including the sites of normal colonization, routes of transmission, and predisposing factors

Know the limitations of rapid antigen testing for early diagnosis of pneumococcal infections

Know the role of polysaccharide capsule in the pathophysiology of pneumococcal infection and induction of immunity

Interpret the laboratory susceptibility test results necessary to identify strains of *Streptococcus pneumoniae* with intermediate and high-level resistance to penicillin and other drugs

Understand the mechanism of antimicrobial resistance (eg, alteration of penicillin binding protein), macrolide resistance, and vancomycin tolerance

Plan the treatment of pneumococcal infections according to site and susceptibility to penicillin and third-generation cephalosporins

Know the indications for penicillin chemoprophylaxis for pneumococcal infection

Recognize that repeated or severe pneumococcal infections may be indicative of certain types of immune dysfunction (eg, splenic dysfunction, HIV)

Investigate penicillin resistance by pneumococcus as the cause of persistent or recurrent symptoms in patients with meningitis or acute otitis media

Know the likely in vitro antimicrobial susceptibilities of penicillin-resistant *Streptococcus pneumoniae*

Understand the risk factors for a patient with an antibiotic-resistant *Streptococcus pneumoniae* infection

Differentiate laboratory susceptibility data based on site of isolate (eg, CSF, blood, middle ear) of *Streptococcus pneumoniae*

## **9. Other gram-positive cocci**

Understand the clinical significance of infections with *Pediococcus*, *Leuconostoc*, or *Gemella* species, and the antimicrobial susceptibilities

## **B. Gram-negative cocci**

### **1. *Neisseria meningitidis***

Understand the epidemiology of meningococcal disease (epidemic disease, serogroups by age, time trends, military, carrier state)

Know the microbiology of *Neisseria meningitidis* (serogroups, lipooligosaccharide)

Recognize common clinical manifestations of meningococcal infection (meningitis, petechial and purpuric eruption, shock)

Recognize less commonly encountered clinical manifestations of meningococcal infection (pharyngitis, pneumonia, pericarditis, myocarditis, chronic meningococemia, conjunctivitis)

Recognize clinical manifestations of immunologically mediated post-meningococcal polyserositis (pericarditis, arthritis)

Plan the treatment for a patient with immunologically mediated post-meningococcal polyserositis (pericarditis, arthritis)

Plan the diagnostic evaluation for *Neisseria meningitidis* infection

(isolation, Gram-stain skin lesions, antigen detection)

Plan treatment for a patient with meningococcal infection (meningococemia, meningitis, purulent pericarditis, hypopyon)

Plan chemoprophylaxis for *Neisseria meningitidis* infection, considering rationale, criteria, and effective and ineffective drugs

Evaluate public health measures for outbreak of meningococcal infection (vaccine, chemoprophylaxis)

Recognize that complement deficiencies predispose to recurrent meningococcal infection

Know the in vitro antimicrobial susceptibilities of *Neisseria meningitidis*

## 2. ***Neisseria gonorrhoeae***

Understand the epidemiology of gonococcal infections (perinatal transmission, sexual transmission, risk factors, resistance patterns)

Recognize common clinical manifestations of gonococcal infection (cervicitis, urethritis, pelvic inflammatory disease, disseminated gonococcal disease)

Recognize less common clinical manifestations of gonococcal infection (pharyngitis, proctitis, epididymitis, perihepatitis, arthritis)

Plan treatment for patients with uncomplicated or disseminated gonococcal infection (urethritis, pharyngitis, pelvic inflammatory disease)

Know that sexually active patients with gonococcal infection are treated for chlamydia as well as *Neisseria gonorrhoeae*

Know that a significant percentage of strains of *Neisseria gonorrhoeae* are resistant to penicillin (mechanisms, laboratory identification, effective drugs)

Plan the management for sexual partner(s) of a patient with gonococcal infection

Plan a prophylactic treatment regimen for an infant whose mother has a gonococcal infection

Understand the importance of terminal complement components in preventing recurrent *Neisseria meningitidis* infections

## 3. ***Moraxella catarrhalis***

Recognize the diseases commonly caused by *Moraxella catarrhalis* (acute otitis media, tracheitis, sinusitis, pneumonia)

Know that the majority of isolates of *Moraxella catarrhalis* produce

beta-lactamase

Plan the treatment of a patient with *Moraxella catarrhalis* infection (drug of choice, alternative drugs)

## C. Gram-positive bacilli

### 1. *Arcanobacterium haemolyticum*

Recognize *Arcanobacterium* as a cause of pharyngitis with scarletini- form rash predominantly in adolescents, and manage appropriately

### 2. *Bacillus* species

Recognize the settings and clinical manifestations of anthrax

Know the usual sources from which *Bacillus* organisms can be recovered in the absence of a pathogenic role, including food-borne disease

Recognize the characteristic clinical manifestations in patients with *Bacillus cereus* infection

Recognize the circumstances in which *Bacillus* species can be the cause of invasive infection

Plan initial therapy for a patient seriously ill with suspected *Bacillus* infection

Recognize the risk factors for *Bacillus cereus* endophthalmitis, and manage appropriately

### 3. *Corynebacterium* species

Know the epidemiology of diphtheria, including acquisition, routes of transmission, and communicability

Order microbiologic tests for identification of toxigenic *Corynebacterium diphtheriae*

Interpret the isolation of a diphtheroid from blood and CSF of patients with different clinical features (eg, foreign body, young infant, immunocompromised host)

Identify the clinical manifestations of diphtheria, including skin disease and complications of pharyngeal infection

Plan the management of a patient with diphtheria, including antitoxin and chemoprophylactic therapy

Plan the management of contacts of a patient with diphtheria

Plan drug of choice therapy (eg, vancomycin) for a non-diphtheria *Corynebacterium* infection

#### **4. Erysipelothrix rhusiopathiae**

Know the epidemiology, risk factors, and clinical manifestations of Erysipelothrix rhusiopathie infection

Identify the microscopic appearance of Erysipelothrix rhusiopathie on Gram stain

Plan therapy for a patient with suspected Erysipelothrix rhusiopathie infection

#### **5. Gardnerella vaginalis**

Know that Gardnerella vaginalis is a normal inhabitant of the vaginal flora

Recognize the role of Gardnerella in bacterial vaginosis

Plan the treatment of bacterial vaginosis caused by Gardnerella vaginalis infection (effective drugs)

#### **6. Listeria monocytogenes**

Know the possible sources of Listeria monocytogenes infection in perinatal period, in pregnant women, and in outbreaks

Recognize factors predisposing to Listeria monocytogenes infection

Differentiate Listeria monocytogenes from other Gram-positive organisms including diphtheroids and group B streptococci on the basis of microbiologic tests

Identify the clinical manifestations of Listeria monocytogenes infection in various patients (eg, at different ages, during pregnancy, and in patients with immunodeficiency)

Plan the antimicrobial therapy for a patient with Listeria monocytogenes infection, including the use of synergistic drug regimens and therapy for patients allergic to penicillin

#### **7. Nocardia species**

Know the epidemiology of Nocardia species, including the sources of the organism, modes of transmission, and risk factors for infection

Identify the growth characteristics (routine culture media) and microscopic features of Nocardia species, including morphology and staining characteristics

Know the likely sites of Nocardia species infection, resulting characteristic clinical manifestations, and possible complications

Recognize that nocardiosis may be indicative of certain types of immune

dysfunction (eg, chronic granulomatous disease)

Plan antimicrobial therapy for a patient with nocardiosis

## **D. Gram-negative bacilli: Enterobacteriaceae**

### **1. Citrobacter species**

Recognize the clinical signs and complications of *Citrobacter diversus* meningitis (eg, brain abscesses) in the neonate

Plan the management of a neonate with *Citrobacter diversus* meningitis (effective drugs, ineffective drugs, duration of therapy, use of computed tomography, repeated examinations of cerebrospinal fluid)

### **2. Edwarsiella tarda**

Recognize *Edwarsiella tarda* as a cause of rapidly progressive wound or skeletal infection and meningitis, particularly in immuno-compromised hosts

### **3. Escherichia coli**

Understand the modes of transmission and the mechanisms of diarrhea due to *Escherichia coli*, including the clinical manifestations and epidemiologic characteristics

Recognize that *Escherichia coli* serotype O157:H7 is associated with endemic and epidemic hemorrhagic colitis and hemolytic-uremic syndrome

Know that enterohemorrhagic *Escherichia coli* produce Shiga-like toxin

Recognize the epidemiologic and clinical manifestations of *Escherichia coli* meningitis

Recognize that ventriculitis commonly occurs in neonates with *Escherichia coli* meningitis, and understand its consequences

Plan the management of a neonate with *Escherichia coli* meningitis or ventriculitis (effective drugs, ineffective drugs, duration of therapy, repeated examinations of cerebrospinal fluid)

Understand that *Escherichia coli* O157:H7 can be transmitted from person to person

Plan laboratory screening evaluation for Shiga-like toxin producing *Escherichia coli*

Recognize the risk of ileus following antibiotic treatment of *Escherichia coli* O157:H7 infection

Recognize the role of surface fimbriae of *Escherichia coli* (eg, P fimbriae)

in facilitating urinary tract infections

#### **4. Klebsiella, Enterobacter, and Serratia species**

Recognize that Klebsiella/Enterobacter/Serratia species are nosocomial pathogens, especially in intensive care units and in patients with indwelling vascular catheters

Recognize that resistance to multiple antibiotics commonly occurs with Klebsiella/Enterobacter/Serratia, and that amikacin is the aminoglycoside most likely to be effective

Recognize the usual antibiotic susceptibility pattern of Klebsiella species, including that associated with extended-spectrum beta- lactamase drugs

Recognize that Serratia, Pseudomonas, Acinetobacter, Citrobacter, E. cloacae, and Yersinia have inducible beta-lactamases that can lead to resistance to third-generation cephalosporins

#### **5. Proteus, Providencia, Morganella species**

Recognize that Proteus/Providencia/Morganella primarily cause nosocomial and urinary tract infections

#### **6. Salmonella species**

Understand the epidemiology of non-typhoidal Salmonella infections (animal reservoirs, sanitation, summer peaks)

Understand transmission and acquisition of Salmonella infections (fecal-oral, environmental incubation, infectious dose, gastric acidity)

Understand the pathophysiology of Salmonella infection (small intestinal penetration, reticulo-endothelial seeding, intracellular foci, prolonged bacteremia)

Understand risk factors for metastatic foci of bacteremic infection (necrotic tissue, tumor, sluggish blood flow)

Know the commonly used microbiologic classification of Salmonella (somatic antigens, Vi antigen, seroepidemiologic typing)

Know that Salmonella meningitis occurs almost exclusively in young infants and that treatment failures are common

Recognize clinical manifestations of typhoid fever

Plan management for a patient with Salmonella meningitis, taking into consideration that treatment failure is common

Plan management for a patient with typhoid fever

Recognize discrepancy between in vitro and in vivo antibiotic

susceptibility for Salmonella (effective drugs, ineffective drugs)

Predict typical antibiotic susceptibility of Salmonella typhi and non- typhi Salmonella species

Recognize that intestinal carriage of Salmonella infection is especially prolonged in young infants

Recognize association of Salmonella osteomyelitis and other extraintestinal infections in certain hosts (sickle cell disease, galactosemia, iron overload states)

Recognize the different clinical manifestations and potential complications of Salmonella infection according to age

Judge the role of antibiotic therapy in changing the length of shedding of Salmonella

Know the genetic immunodeficiencies that predispose to severe or disseminated Salmonella infection

## **7. Shigella species**

Recognize the epidemiology and transmission of Shigella ( no animal reservoirs, person-to-person, fecal-oral, low inoculum)

Recognize clinical and laboratory manifestations of Shigella infection (CNS, systemic, GI)

Recognize the association between Shigella dysenteriae type 2 and hemolytic-uremic syndrome

Know that Shigella bacteremia is rare

Plan management of patient with shigellosis, taking into account that antibiotic therapy eliminates intestinal colonization with Shigella

Recognize the effects of antidiarrheal drugs that decrease intestinal motility on the clinical course of shigellosis (ie, worsening clinical course)

Know the in vitro antimicrobial susceptibilities of Shigella

## **8. Yersinia enterocolitica**

Know the epidemiologic features and mode of transmission of Yersinia enterocolitica

Recognize the age-associated clinical syndromes caused by Yersinia enterocolitica (enteritis, pseudoarthritis, reactive polyarthritis and Reiter syndrome especially in individuals with HLA-B27 antigen)

Recognize risk factors for Yersinia enterocolitica septicemia such as iron overload states, especially at the time of chelation therapy

Know the indications for and type of treatment for patients with localized or disseminated *Yersinia enterocolitica* infections

## 9. ***Yersinia pestis***

Recognize the epidemiologic features, including vectors and reservoirs, of *Yersinia pestis*

Recognize clinical syndromes caused by *Yersinia pestis* (bubonic, septicemic, and pneumonic plague; cutaneous and meningitic infections)

## E. **Gram-negative bacilli: Non-Enterobacteriaceae**

### 1. ***Acinetobacter* species**

Recognize that *Acinetobacter* species are normal inhabitants of skin and mucous membranes and cause nosocomial infections (eg, related to catheters, wounds)

### 2. ***Aeromonas* species**

Know that *Aeromonas hydrophila* causes septicemia in immunocompromised patients

Know that *Aeromonas hydrophila* can be cultivated from normally sterile body fluid but selective media is required to isolate the organism from stool

Identify the clinical manifestations of *Aeromonas* infection (eg, ecthyma gangrenosum)

### 3. ***Alcaligenes* species**

Recognize *Alcaligenes* as a cause of hospital-acquired pneumonia, bacteremia, meningitis, and urinary tract infection

### 4. ***Eikenella* species**

Recognize that *Eikenella corrodens* is a normal inhabitant of oral mucosa and is a pathogen in sinusitis, brain abscess, bite wounds

Know the special antimicrobial susceptibility of *Eikenella corrodens* (susceptible to penicillin, less susceptible to cephalosporins, uniformly resistant to clindamycin and metronidazole)

### 5. ***Flavobacterium* species**

Know that *Flavobacterium meningosepticum* is a water and soil organism that causes sporadic cases and outbreaks of meningitis in nurseries

### 6. ***Pasteurella multocida***

Recognize clinical manifestations of *Pasteurella multocida* infection

(rapid-onset cellulitis following cat/dog bite, excessive toxicity)

Plan treatment for patient with *Pasteurella multocida* infection (drug of choice, alternative drugs for patient allergic to penicillin)

## 7. ***Plesiomonas shigelloides***

Recognize *Plesiomonas* as an uncommon cause of bacterial gastroenteritis associated with contaminated food (eg, raw seafood) or water

## 8. ***Pseudomonas aeruginosa***

Recognize the epidemiologic characteristics of *Pseudomonas aeruginosa* (ubiquitous, colonize moist areas, not part of normal human flora in the majority of individuals, hand transmission)

Recognize that *Pseudomonas aeruginosa* is a major cause of nosocomial infection related to intravenous and urinary catheters, CNS shunts, surgical wounds, respiratory tract infection, and burn wounds

Recognize life-threatening "spontaneous" *Pseudomonas* septicemia in a neutropenic patient (ecthyma gangrenosum)

Differentiate clinically and diagnostically between *Pseudomonas aeruginosa* colonization vs infection of the respiratory tract

Recognize clinical manifestations of *Pseudomonas* infection of the eye (keratitis, corneal ulceration, endophthalmitis)

Plan management of neutropenic patient with ecthyma gangrenosum (effective drugs, combination therapy)

Recognize epidemiology, clinical manifestations, and self-limited course of *Pseudomonas* folliculitis

Know the special association of *Pseudomonas aeruginosa* sinusitis and pneumonia with cystic fibrosis

Predict the usual antibiotic susceptibility pattern of *Pseudomonas aeruginosa*

Recognize that *Pseudomonas aeruginosa* develops resistance to beta-lactam, ceftazidime, and aminoglycoside antibiotics during therapy

Recognize clinical settings in which synergistic combination antimicrobial therapy is indicated, and why

## 9. ***Burkholderia cepacia***

Recognize the clinical association between *Burkholderia cepacia* infection and severe cystic fibrosis

Plan the management of *Burkholderia cepacia* infection

## 10. **Stenotrophomonas maltophilia**

Plan appropriate management of a patient with *Stenotrophomonas maltophilia* infection, including consideration of antibiotic susceptibility

Know the epidemiology and mode of acquisition of *Stenotrophomonas maltophilia*

## 11. **Vibrio cholerae**

Know the epidemiology of *Vibrio cholerae* including the fact that toxigenic *V. cholerae* O1, serotype Inaba, biotype El Tor, is now endemic in the United States

Know the mechanism of action of enterotoxin of *Vibrio cholerae* (stimulates cAMP increasing activity of adenylate cyclase, secretion of chloride)

Recognize the characteristic clinical and stool manifestations of cholera

Recognize that noncholera vibrios and *Escherichia coli* can produce cholera-like enterotoxin

Know the method(s) of diagnosis of *Vibrio cholerae* (culture, characteristic rapid mobility of comma-shaped bacilli)

Plan the treatment for a patient with cholera (fluid therapy, effective and ineffective drugs)

Know the important factors in spread of cholera (sanitation, contaminated food and water)

Know the indications for doxycycline as prophylaxis against cholera

Know that non-O1 *Vibrio cholerae* (ie, serogroup O139) has been associated with outbreaks of diarrhea

## 12. **Other vibrios**

Recognize that history is the clue to the diagnosis of diarrheal disease due to *Vibrio parahaemolyticus* (geography, raw seafood, salt water)

Know that isolation on selective media is the method of diagnosis of *Vibrio parahaemolyticus* infection (hypertonic salt, taurocholate-tellurite)

Recognize the characteristics of disease due to *Vibrio parahaemolyticus* (self-limited, antibiotics of little benefit, carrier state rare)

Recognize that *Vibrio vulnificus* causes a life-threatening cellulitis-septicemia illness, especially in immunocompromised hosts and patients with hepatic cirrhosis

Recognize the likelihood of *Vibrio vulnificus* infection in a normal child with rapidly progressive necrotic cellulitis who has exposure to coastal areas

**13. Other gram-negative bacilli, including *Chromobacterium*, *Achromobacter***

Recognize the risk factors for *Chromobacterium violaceum* infection (eastern US seaboard, traumatic skin lesion, neutrophil dysfunction, chronic granulomatous disease), and the clinical manifestations of associated cellulitis

Identify the possible source of nosocomial infection with *Achromobacter* species (contaminated fluids, incubators and humidifiers, and disinfectants)

**F. Gram-negative coccobacilli**

**1. *Bartonella* species (cat-scratch disease)**

Recognize the clinical manifestations, course, and prognosis of cat scratch disease

Know the presumptive etiology (*Bartonella henselae*) and incubation period of cat scratch disease

Understand the typical history and possible modes of acquisition of cat scratch disease

Know the appropriate means of determining the diagnosis of cat scratch disease, including the indications for biopsy, aspiration of associated lesions, and serologic and microbiologic tests

Formulate a differential diagnosis in a patient in whom cat scratch disease is suspected

Plan appropriate management of cat scratch disease

Recognize unusual manifestations of cat scratch disease (visceral, CNS, erythema nodosum)

Recognize clinical manifestations of infection caused by *Bartonella henselae* in normal and immunocompromised hosts

Recognize clinical manifestations of infection caused by *Bartonella quintana* in immunocompromised hosts

Recognize typical histologic appearance and staining characteristics of *Bartonella* species in tissue specimens

**2. *Brucella* species**

Understand the epidemiology, risk factors, and clinical manifestations of *Brucella* infection

Know that serology is the primary method of diagnosis for brucellosis, but that *Yersinia*, *Brucella*, *Salmonella*, and *Francisella* share antigens that confound serologic diagnosis

Plan treatment for a patient with brucellosis (effective drugs, combination therapy)

Recognize that relapse of brucellosis is common when monotherapy is used

### **3. *Bordetella pertussis***

Know the diagnostic tests for *Bordetella pertussis* infection (antigen test, culture, serology), and their limitations

Recognize that clinical manifestations, course, and prognosis of pertussis are age-related and vaccination-status related

Recognize complications of pertussis and their relative frequency (bacterial pneumonia, necrotizing bronchitis, apnea, seizures, encephalopathy, hemorrhage)

Evaluate the need for chemoprophylaxis for *Bordetella pertussis* (indications, effective drug, duration)

Know that immunity to pertussis wanes, and that vaccinated adults are reservoirs of the pathogen

Formulate a differential diagnosis for a child with suspected pertussis and varying clinical findings (paroxysmal cough, persistent cough, post-tussive vomiting, lymphocytosis)

### **4. Other *Bordetella* species**

Understand the epidemiology of *Bordetella parapertussis*, and that it causes mild pertussis

Know that vaccination with whole-cell or acellular pertussis vaccine does not protect against *Bordetella parapertussis*

### **5. *Calymmatobacterium granulomatis***

Recognize the clinical and laboratory findings of granuloma inguinale, and manage appropriately

### **6. *Campylobacter* species**

Know that the reservoir of *Campylobacter jejuni* and *Campylobacter coli* infection is the gastrointestinal tract of wild and domesticated animals, especially young animals

Recognize that fecal-oral transmission is mode of acquisition of

Campylobacter jejuni or coli

Know that isolation by culture of Campylobacter jejuni is the definitive method of diagnosis and requires selective media, special temperature for incubation

Recognize the presentation of Campylobacter jejuni infection (eg, bloody stools without fever or diarrhea, or bloody diarrhea)

Plan the treatment of a Campylobacter jejuni infection (effective drugs, ineffective drugs, alternative drugs)

Recognize Campylobacter fetus septicemia in a newborn infant and in an immunocompromised host

Plan the antimicrobial treatment of Campylobacter fetus septicemia in a newborn infant

Recognize the association of Campylobacter with nonsuppurative disease (eg, Guillain-Barre syndrome, arthritis, erythema nodosum)

## **7. Capnocytophaga species**

Recognize clinical features of Capnocytophaga species (normally inhabit the mouth, associated with periodontal disease, cause septicemia in neutropenic hosts)

Identify patients in whom Capnocytophaga canimorsus (formerly CDC Group DF-2) infection can cause fulminating septicemia (asplenia, cirrhosis, those receiving corticosteroids)

Plan effective therapy for infection with Capnocytophaga species

## **8. Chlamydia trachomatis**

Know the epidemiology of Chlamydia trachomatis, including the major route of transmission, modes of acquisition, sites of colonization or infection, and prevalence of carriage according to age

Know the diagnostic tests for Chlamydia trachomatis, including rapid antigen/probe/PCR tests, and their reliability in evaluating specimens from different sites

Recognize the clinical manifestations of Chlamydia trachomatis infection by age and site (conjunctivitis, pneumonia, urethritis, cervicitis, pelvic inflammatory disease, lymphogranuloma venereum)

Plan antibiotic therapy for Chlamydia trachomatis infections

Know that source/sexual contact of neonates/adolescents with Chlamydia trachomatis infection should be treated

Know the complications of untreated Chlamydia trachomatis infection

## 9. **Chlamydia psittaci**

Know the major source and epidemiology of Chlamydia psittaci infections

Differentiate the laboratory methods of diagnosis for Chlamydia psittaci and Chlamydia trachomatis

Recognize the clinical manifestations of psittacosis

Plan therapy for a patient with psittacosis

## 10. **Chlamydia pneumoniae**

Recognize the limitations of laboratory diagnosis of Chlamydia pneumoniae infection

Know the setting (eg, relative frequency, epidemiology, clinical manifestations) of respiratory infection caused by Chlamydia pneumoniae

Formulate a differential diagnosis in a school-age child with "walking" pneumonia, including Chlamydia pneumoniae, Mycoplasma pneumoniae, and viral pneumonia

Plan antimicrobial therapy likely to be effective against Chlamydia pneumoniae

## 11. **Ehrlichia species**

Recognize the epidemiologic (vector), clinical, and laboratory characteristics of ehrlichiosis (lymphopenia, neutropenia, thrombocytopenia)

Plan the diagnostic testing (serology) and treatment for ehrlichiosis (tetracycline effective, chloramphenicol not recommended)

## 12. **Francisella tularensis**

Understand the epidemiology and modes of transmission of tularemia (tick, respiratory droplet, animal contact)

Know that the preferred method of diagnosis of tularemia is by serology

Recognize clinical and laboratory manifestations of tularemia (fever/lymphadenopathy, oculoglandular, pneumonia)

Formulate a differential diagnosis of granulomatous lymphadenitis with central necrosis, including cat scratch, tularemia, chlamydia

Plan treatment for a patient with tularemia (effective drugs)

## 13. **Hemophilus influenzae**

Understand the epidemiology of Hemophilus influenzae type b disease

Understand that non-typable *Hemophilus influenzae* are normal inhabitants of the oropharynx

Understand that non-typable *Hemophilus influenzae* is a significant pathogen in newborn infants and immunodeficient hosts and can cause invasive infection

Plan the treatment of *Hemophilus influenzae* infections

Recognize circumstances in which *Hemophilus influenzae* type b can cause invasive disease in fully immunized children (eg, immunocompromised host)

Recognize the clinical situations in which non-typable *Hemophilus influenzae* is the cause of acute infection (otitis media, sinusitis, conjunctivitis, otitis-conjunctivitis syndrome)

Know the mechanisms of resistance of *Hemophilus influenzae* to antimicrobial drugs

#### **14. Other *Hemophilus* species**

Recognize that *Hemophilus ducreyi* is a sexually transmitted disease (chancroid) of increasing incidence

Recognize the clinical manifestations of chancroid

Plan an appropriate treatment regimen for a patient with chancroid

#### **15. *Helicobacter pylori***

Know the epidemiology and pathophysiology characteristic of *Helicobacter pylori* infection

Distinguish the clinical situations in which *Helicobacter pylori* infection is a likely etiologic agent (eg, duodenal ulcer, peptic ulcer) or is associated (adenocarcinoma of the stomach, MALTOMA)

Plan the management of *Helicobacter pylori* infection (effective drugs, combination therapy, duration)

Know the effect of eradication/non-eradication of *Helicobacter pylori* on ulcer disease

#### **16. *Kingella kingae***

Recognize *Kingella kingae* as a causative pathogen in a suppurative skeletal infection, including diskitis, in an infant

Recognize the most appropriate blood culture system for isolation of *Kingella kingae*

Plan the most appropriate management for a patient with *Kingella kingae*

**17. Legionella species**

Know the method of isolation of Legionella species (eg, special media)

Recognize the distinctive clinical manifestations and laboratory findings in Legionella pneumonia

Plan treatment for a patient with Legionella pneumophila infection

Understand principles of prevention of Legionella infection (reservoir disinfection, prevention of aerosolization)

**18. Rickettsia**

**a. General characteristics**

Identify microbiologic characteristics of the Rickettsiaceae family

Know the arthropod vectors and animal hosts that are critical factors in human Rickettsia infection

**b. Rickettsia rickettsii**

Recognize the epidemiologic, clinical, and laboratory features of Rocky Mountain spotted fever

Formulate the differential diagnosis in a patient in whom Rocky Mountain spotted fever is suspected

Plan the diagnostic tests for Rocky Mountain spotted fever (serology, tissue immuno-staining, Proteus agglutinins)

Plan the management of a patient with Rocky Mountain spotted fever (fluid therapy, effective drugs)

**c. Other Rickettsia species**

Recognize the setting, vector, and clinical manifestations of Q fever (Coxiella burnetii)

Plan appropriate diagnostic testing for a patient in whom Q fever is suspected

Recognize the setting, vector, and clinical manifestations of rickettsial pox

Plan appropriate diagnostic testing for a patient in whom rickettsial pox is suspected

Recognize the setting, vector, and clinical manifestations of endemic typhus

Plan appropriate diagnostic testing for a patient in whom endemic typhus is suspected

Recognize the setting, vector, and clinical manifestations of epidemic typhus

Plan appropriate diagnostic testing for a patient in whom epidemic typhus is suspected

Plan appropriate therapy for a patient who has Q fever

## **19. Streptobacillus moniliformis**

Identify a patient with Streptobacillus moniliformis infection based on epidemiology, transmission, clinical manifestations, and laboratory findings

Plan the management of a patient with Streptobacillus moniliformis infection

Distinguish the clinical syndrome caused by Streptobacillus moniliformis from that caused by Spirillum minus

## **20. Actinobacillus, Cardiobacterium species**

Recognize that aerobic isolation of Actinobacillus actinomycetemcomitans from lung, pleural fluid or chest wall abscess is the clue to anaerobic infection with Actinomyces

## **G. Mycoplasma and Ureaplasma species**

### **1. Mycoplasma pneumoniae**

Know the epidemiology of Mycoplasma pneumoniae infection, including mode of transmission, ages of infection and disease, and incubation period

Contrast the microbiologic characteristics of Mycoplasma with those of Chlamydia, rickettsia, viruses, and pyogenic bacteria

Know the available diagnostic tests for Mycoplasma pneumoniae infection and their relative advantages and disadvantages

Recognize the characteristic clinical manifestations and epidemiologic features of patients with respiratory disease due to Mycoplasma pneumoniae

Recognize non-respiratory tract manifestations of Mycoplasma pneumoniae disease, including CNS illnesses and arthritis

Plan the therapy for a patient with Mycoplasma pneumoniae infection

### **2. Ureaplasma urealyticum and other genital mycoplasmas**

Know the epidemiology of genital mycoplasmas in adults and newborn infants

Know that special medium is necessary to recover *Ureaplasma urealyticum* and other genital mycoplasmas

Recognize the possible manifestations of *Ureaplasma urealyticum* disease in newborn infants

Recognize the possible association of *Ureaplasma urealyticum* and *M. hominis* with genitourinary tract infections, urethritis, and reproductive morbidity

Plan the management of a patient with a *Ureaplasma urealyticum* infection

## **H. Anaerobic bacteria**

### **1. General concepts**

Recognize that anaerobic bacteria are predominantly normal bacterial flora of mucous membranes from the oropharynx to the rectum

Interpret the significance of isolation of anaerobic bacteria from various culture specimens (eg, blood, skin, CSF, wound, tracheal aspirate)

Recognize that isolation of facultative normal flora from infection contiguous to a mucosal site predicts the presence of anaerobic bacteria as well

Interpret Gram stain showing multiple organism types from pleural empyema, or lung, pelvic, or abdominal abscess

Evaluate a patient with positive blood culture for *B fragilis* (primary gastrointestinal tract focus)

Know the technique necessary for specimen collection, transport, and inoculation for recovery of anaerobic bacteria

Know the clinical situations in which anaerobic infection is virtually always present (abscess following human bite, lung abscess in patient with swallowing dysfunction, chest empyema, periappendiceal abscess, recurrent pelvic inflammatory disease)

Know that anaerobic cocci are uniformly susceptible to penicillins, cephalosporins, clindamycin and vancomycin, but are sometimes highly resistant to metronidazole

Plan the treatment of a patient with suspected anaerobic infection according to clinical site

### **2. Clostridium tetani**

Recognize the clinical manifestations of *Clostridium tetani* wound

infection and tetanus

Formulate the differential diagnosis of a patient with possible tetanus (dental abscess, rabies, hypocalcemic tetany, antipsychotic drugs, extrapyramidal effects of prochloroperazine)

Know that diagnosis of tetanus is a clinical one

Plan the management of a patient with tetanus (effective drug, antitoxin, benzodiazepines)

Know the risk factors for tetanus-prone injuries (crush injury, soil contamination), and manage appropriately

Understand the pathogenesis of tetanus

### **3. Clostridium botulinum**

Know that Clostridium species other than botulinum are occasional causes of botulism

Know the different pathogeneses for food-borne, wound, and infant botulism

Know the epidemiologic and clinical features of food-borne, wound, and infant botulism (age, exposure, clinical onset)

Recognize the clinical manifestations of infant botulism (progressive descending weakness, autonomic dysfunction)

Plan laboratory tests necessary to diagnose botulism (isolation, mouse-lethality test)

Know how management differs for a patient with food-borne botulism (antitoxin), wound botulism (effective drug, antitoxin), or infant botulism (supportive measures)

Know that sudden infant death is occasionally due to infant botulism

### **4. Other Clostridium species**

Recognize clinical manifestations of soft tissue infection caused by Clostridium species

Recognize clinical manifestations of Clostridium septicum septicemia in neutropenic patients (gut focus, fulminant course, disseminated crepitus)

Recognize relative frequency, epidemiology and clinical manifestations (source, incubation, course) of Clostridium perfringens food poisoning

Know the diagnostic methods for Clostridium perfringens food poisoning (serology, enterotoxin stool assay, culture of food sources)

Understand the prevention and management of gas gangrene and other soft tissue infection caused by Clostridium species

## 5. Clostridium difficile

Understand the means of diagnosing Clostridium difficile colitis (cytotoxicity assay, antigen detection, culture)

Know the risk factors for Clostridium difficile disease (low-risk antibiotic use, age, underlying gastrointestinal disease, hospitalization)

Recognize the typical clinical settings, risk factors, and manifestations of Clostridium difficile colitis

Plan the management of a patient with Clostridium difficile disease (discontinuing antibiotic, drugs of choice, alternative drug)

Plan the management of a patient with relapses of Clostridium difficile colitis

Know that Clostridium difficile is a cause of acute diarrheal disease in infants and children without predisposing factors

Know the infection control measures used to prevent Clostridium difficile disease and to manage an outbreak

## 6. Bacteroides species

Know the microbiology and normal habitat of species of Bacteroides

Recognize the association between Bacteroides fragilis and abscess formation and phlebothrombosis

Know the in vitro antimicrobial susceptibilities of Bacteroides fragilis

## 7. Other anaerobic gram-negative bacilli

Know that Fusobacterium species are normal inhabitants of the oropharynx, respiratory tract, female genital tract

Recognize the association of Fusobacterium with Ludwig angina, suppurative phlebothrombosis of the great vessels in the neck, and secondary septic pulmonary emboli

Know the clinical setting and in vitro antimicrobial susceptibilities of Prevotella (Bacteroides) melaninogenicus

## 8. Actinomyces species

Know the source of Actinomyces and predisposing factors for actinomycoses

Know the culture requirements to isolate Actinomyces in the laboratory

Recognize clinical manifestations of Actinomyces infection (eg, pulmonary lesion, osteomyelitis of rib, soft tissue abscess)

Plan the antimicrobial therapy for a patient with actinomycosis (drug and duration of therapy)

## **I. Spirochetes**

### **1. Treponema/Leptospira species**

Know the modes of transmission of Treponema pallidum, including genital and oral sexual contact, placental, transfusion, accidental direct inoculation

Recognize features of the most contagious stages of syphilis (early infection, chancre, mucous patch, condyloma, papulosquamous lesions)

Know the natural history (timing), clinical manifestations, contagiousness for the stages of syphilis

Plan and interpret diagnostic tests for syphilis in different clinical settings (chancre, asymptomatic contact, secondary, CNS, congenital)

Understand the principles of antimicrobial therapy (prolonged course, CNS concentrations) for syphilis

Plan effective treatment for a patient with gonorrhea and probable incubating syphilis

Know that transmission rate for untreated syphilis to the fetus in any trimester of pregnancy is high, and is greater than 90% in the third trimester

Plan the diagnostic evaluation and treatment for a neonate whose mother has a positive syphilis serology

Interpret probable false-positive reagin test for syphilis in given clinical situation (eg, Lyme disease or tuberculosis, low titer only)

Interpret serologic tests in follow-up evaluation of a patient treated for syphilis (expectation of fall in reagin, unchanging specific treponemal test, indications for retreatment)

Recognize the clinical manifestations suggestive of leptospirosis

Recognize the clinical manifestations of congenital syphilis in infants who are beyond the neonatal period

Know what maternal treatments for spirochetal infection during pregnancy are likely to be effective/ineffective for treating the fetus

Know the modes of acquisition and epidemiology of leptospirosis

### **2. Borrelia species**

Recognize the clinical setting and laboratory features suggestive of relapsing fever (*Borrelia recurrentis*)

Know the risk (vectors, reservoirs, geography) for *Borrelia burgdorferi* infection

Know likelihood of negative serologic test in early *B. burgdorferi* infection

Recognize presentations of Lyme disease, especially arthritis, dysrhythmia, neuropathy, or meningitis

Know the risk of fetal *B. burgdorferi* infection

Plan therapy for a patient with Lyme disease (effective/ineffective drugs, route, duration)

Understand the means of diagnosis of *Borrelia burgdorferi* infection, the limitations, and likelihood of false-positive results in patients with certain conditions (eg, rheumatoid arthritis, inflammatory bowel disease, syphilis)

Order appropriate diagnostic tests (eg, routine, serologic) on CSF in a patient with suspected *Borrelia burgdorferi* infection of the central nervous system, and interpret the results

### **3. Southern tick-associated rash illness (STARI)**

Recognize the clinical manifestations of Southern tick-associated rash illness (STARI)

## **J. Viruses**

### **1. Poxvirus**

#### **a. Molluscum contagiosum**

Know means and source of spread of *Molluscum contagiosum*

Recognize the clinical manifestations of *Molluscum contagiosum*

Understand the usual course of the lesions associated with *Molluscum contagiosum* in normal and in immunocompromised hosts

#### **b. Smallpox (variola)**

Know the incubation period of smallpox (variola) for purposes of infection control management

Understand the immunity to variola virus

Know the classification of smallpox (variola) and their clinical differences (variola major, modified variola, hemorrhagic variola, variola sine eruptione, variola minor)

Formulate the differential diagnosis in a school-age child with fever and a vesicular rash

Know the clinical differences between variola and varicella (eg, incubation period, distribution of lesions, size and depth of lesions)

Recognize the complications of severe smallpox (variola) (panophthalmitis, encephalitis, pneumonitis)

Plan the diagnostic approach to a child or adolescent with suspected smallpox (variola), and manage appropriately

Make recommendations for medical care personnel who have been exposed to a patient with smallpox (variola)

Know the potential antiviral therapies for smallpox

### **c. Monkeypox**

Recognize the usual clinical features of monkeypox infection

## **2. Herpes simplex virus**

Know that most mothers and fathers of neonates with neonatal herpes are asymptomatic or have unrecognized genital herpes

Plan the management of the neonate born vaginally to a mother discovered post delivery to have a positive genital culture for herpes simplex virus or to have vesiculoulcerative genital lesions

Know the advantages and disadvantages of the major methods used for laboratory diagnosis of mucocutaneous herpes simplex virus infections (culture, antigen detection, antibody titers)

Recognize the major diseases associated with each of the two herpes simplex virus serotypes: type 1 and type 2

Understand the clinical significance of acyclovir resistance of herpes simplex virus (immunosuppressed patient treated with several courses of acyclovir, thymidine kinase-deficient virus)

Know that herpes simplex virus causes recurrent infections primarily because of latent infections that become reactivated, and the relative role of cellular and humoral immunity in preventing reactivation

Understand that the primary site for latent infection with herpes simplex virus is the neuron in sensory or autonomic ganglia and that serum antibody does not prevent recurrent herpes simplex virus disease

Plan appropriate treatment of herpes simplex virus keratitis (ophthalmologic consultation, topical antiviral drug therapy)

Plan the management of herpes gingivostomatitis (symptomatic, antiviral)

Know the pathogenesis of and predisposing factors to recurrent herpes labialis (trigger factor-mediated stimulation of active replication of latent virus in trigeminal ganglia)

Plan antiviral therapy of recurrent herpes labialis in a normal host, with consideration of its limitations

Recognize that manifestations of recurrent herpes labialis in immunosuppressed patients can be severe and prolonged

Plan antiviral therapy for an immunocompromised patient with oral herpes (route of administration, treatment versus prophylaxis)

Recognize the clinical manifestations of herpes encephalitis

Formulate the differential diagnosis in a patient with fever, alteration of consciousness, and a focal seizure

Recognize the neurodiagnostic manifestations of herpes encephalitis (EEG, brain scan, CT scan or MRI of head)

Know the limitations of noninvasive means of definitive laboratory diagnosis of herpes encephalitis (serum antibody titers, cerebrospinal fluid viral culture/antigen detection/antibody titers/nucleic acid detection)

Plan the antiviral therapy management of herpes encephalitis

Know the neurologic sequelae of herpes encephalitis including the risk factors that are associated with a poor prognosis

Identify the clinical and laboratory manifestations of neonatal herpes, including relative frequency of findings

Formulate the differential diagnosis in a neonate suspected of having disseminated herpes simplex infection

Understand the implications of the frequency of recurrent skin lesions following treatment of neonatal herpes simplex infection

Know the risk factors for poor outcome in neonatal herpes (prematurity, disseminated disease, HSV-2 encephalitis, recurrent HSV-2 skin lesions)

Plan the antiviral therapy for neonatal herpes (mucocutaneous, disseminated, CNS)

Identify the clinical manifestations of herpes simplex virus infection of the finger: herpetic whitlow

Plan appropriate management of a pregnant woman with recurrent herpes simplex virus genital infections

Recognize the dermatologic manifestations (eg, erythema multiforme) of

### 3. **Varicella zoster virus**

Know the incubation period of varicella, including that in individuals who have received VZIG, for purposes of infection control management in the hospital

Know the risk factors for severe varicella (neonates, immunosuppressed patients, adults)

Formulate the differential diagnosis in a schoolage child with fever and a vesicular rash of the trunk or abdomen

Know the major complications of severe varicella (hepatitis, pneumonitis, encephalitis, DIC, secondary bacterial infection)

Recognize the major bacterial superinfections complicating varicella (streptococcal impetigo/cellulitis/gangrene, staphylococcal scalded skin syndrome)

Understand the indications for antiviral therapy, including timing, in a patient with severe varicella

Plan management of exposed patient at high risk of severe varicella (time for the use of varicella zoster immune globulin, indications for acyclovir if lesions occur)

Know the circumstances that contribute to herpes zoster occurring in children (third-trimester fetal varicella, postnatal varicella in neonate or young infant)

Understand the immunity to varicella-zoster virus, and that boosting of immunity may occur after exposure to infected individuals

### 4. **Cytomegalovirus**

Know the optimal specimens for isolation of infectious virus to demonstrate cytomegalovirus disease (as opposed to asymptomatic shedding) in patients beyond the neonatal period (eg, peripheral blood leukocytes, BAL, tissue)

Know the time frame in which urine is an acceptable specimen to diagnose congenital cytomegalovirus infection (within the first 10 days to 2 weeks after birth)

Understand the means to diagnose cytomegalovirus infection (serology, viral culture, antigen detection, nucleic acid detection)

Know that cytomegalovirus IgM antibody titer results may be false-positive (eg, presence of rheumatoid factor) or false-negative (eg, immunologically immature or immunosuppressed patients)

Know the major routes or means of transmission of cytomegalovirus: congenital (transplacental), natal (at time of delivery), breast feeding, infected urine or saliva to mouth, sexual, blood transfusion, organ transplantation

Recognize that congenital cytomegalovirus infection is usually asymptomatic (approximately 90%) in the neonatal period but that hearing loss, low IQ, or behavioral problems may occur in 10% to 30% of affected patients

Recognize the clinical features of symptomatic congenital cytomegalovirus infection in the neonatal period

Know the major sequelae of symptomatic congenital cytomegalovirus infection and their relative frequencies

Know that congenital cytomegalovirus infection occurs in both primary maternal infections (nonimmune mothers) and recurrent ones (immune mothers), but that severe fetal damage occurs almost exclusively with primary infections

Recognize the usual clinical manifestations when symptomatic cytomegalovirus infection occurs in normal hosts

Identify the usual clinical manifestations and complications of cytomegalovirus infections in immunosuppressed hosts

Plan the treatment of serious cytomegalovirus infection in immunosuppressed patients, including specific therapy for target organs (eg, ganciclovir alone for retinitis and colitis, ganciclovir plus cytomegalovirus immune globulin for pneumonitis)

Recognize cytomegalovirus as the major cause of post-perfusion syndrome following cardiothoracic surgery

Understand the goals, timing, and efficacy of prophylactic therapy for cytomegalovirus infection in transplant recipients

Know the risk factors for cytomegalovirus infection in transplant recipients (relationship to organ, donor, and recipient status)

Understand the role of antiviral therapy in an infant with congenital cytomegalovirus infection

## **5. Epstein-Barr virus**

Know that Epstein-Barr virus replicates in and becomes latent in B lymphocytes in vivo, and "immortalizes" B lymphocytes in vitro

Know that Epstein-Barr virus infections in infants and toddlers are usually asymptomatic and in school age children and young adults are more frequently symptomatic (classic infectious mononucleosis)

Interpret results of Monospot tests and Epstein-Barr virus serologic tests

(viral capsid antigen {VCA}, early antigen {EA}, and Epstein-Barr nuclear antigen {EBNA}) according to manifestations and clinical course

Formulate a differential diagnosis in a schoolage child with fever, pharyngitis, cervical adenopathy, and negative rapid streptococcal antigen test

Know the major acute complications of infectious mononucleosis

Know the malignancies associated with Epstein-Barr virus infection

Know the underlying diseases associated with a high risk of either acute or long-term complications of Epstein-Barr virus infection (X-linked lymphoproliferative syndrome, hemophagocytic syndrome, AIDS, transplant recipients)

Understand the basis for the rapid slide agglutination (Monospot) tests

Recognize the association of rashes with ampicillin in infectious mononucleosis

Manage a patient with complications of acute infectious mononucleosis, including appropriate use of corticosteroid therapy

Recognize the association between Epstein-Barr virus and hairy leukoplakia in AIDS patients, and that it may respond to therapy with acyclovir

Recognize lymphoproliferative syndrome caused by Epstein-Barr virus following transplantation, and manage appropriately (eg, reduction of immunosuppressive therapy)

Recognize the association between group A streptococcus and Epstein-Barr virus

Recognize the association between Epstein-Barr virus and lymphocytic interstitial pneumonitis (LIP) in patients with AIDS, and manage appropriately

## **6. Human herpesviruses (HHV-6, -7, -8)**

Be familiar with the epidemiology of HHV-6 infection, including the age of acquisition

Recognize features of HHV-6 infection in normal and immunocompromised hosts, including clinical manifestations, usual course of primary infection, and complications

Recognize the potential of HHV-6 for persistent and latent infections and the clinical situation in which HHV-6 may be reactivated (eg, immunosuppression, AIDS, other herpes infections)

Understand the epidemiologic features of HHV-7 infection

## **7. Adenoviruses**

Know the major clinical syndromes associated with adenoviruses (eg, conjunctivitis, pharyngitis, pneumonia, undifferentiated febrile illness, meningoencephalitis, gastroenteritis)

Differentiate the laboratory diagnosis of respiratory adenovirus infection from that of enteric adenovirus infection

Know that adenoviruses can cause severe disease in neonates and in immunosuppressed patients

Know that enteric adenovirus types 40 and 41 are important causes of pediatric gastroenteritis

Know that adenoviruses remain latent, confounding interpretation of isolation in certain circumstances

Understand the role of adenoviruses in acute rejection-like syndromes following cardiac transplantation

Recognize the epidemiologic and clinical features of HHV-8 infection, including its association with Kaposi sarcoma

## **8. Papillomaviruses (warts, laryngeal papillomatosis)**

Recognize the clinical manifestations of warts (eg, common, anogenital, laryngeal)

Understand the mode of transmission and sources of infection of HPV (eg, sexual abuse, maternal-newborn)

Recognize the clinical manifestations of papillomavirus infection according to source and mode of transmission

Understand the usual course of HPV disease and subclinical infection and disease

Know the methods of diagnosis of clinical and subclinical HPV infections

Recognize the epidemiologic associations between anogenital warts and the risk of malignancy

Understand the indications for and types of treatment of HPV infection

## **9. JC/BK and other polyomaviruses**

Understand the ability of polyomaviruses to cause latent and chronic infections and the association between polyomaviruses and progressive multifocal leukoencephalopathy

Understand the mode of transmission of polyomaviruses

Recognize the role of JC/BK viruses causing urinary tract disease in normal hosts and in renal transplant recipients

## **10. Hepatitis A virus**

Know that hepatitis A virus is an RNA picornavirus

Know the usual means of transmission of hepatitis A virus

Know that most children with hepatitis A virus infection are asymptomatic

Recognize day-care contact as the probable source of hepatitis A when jaundice develops in an adult contact

Recognize the characteristics of the hepatitis A virus (rarely causes acute fulminant hepatitis, does not cause chronic hepatitis, not associated with carrier state)

Know the laboratory methods used to establish a diagnosis of hepatitis A virus infection

Manage an outbreak of hepatitis A infection in food workers or in a dormitory/barracks setting

Understand the clinical course and management of a hepatitis A infection

## **11. Hepatitis B virus**

Know that hepatitis B virus is a major cause of chronic hepatitis, cirrhosis, and hepatocellular carcinoma worldwide

Know that hepatitis B virus carries its own DNA polymerase within the virion which can be used as a laboratory test to determine infectivity, prognosis, and/or response to antiviral therapy

Know the major sources and/or means of transmission of hepatitis B virus

Identify the high risk groups for acquiring hepatitis B virus infection

Know that etiology of hepatitis can rarely be determined by clinical features

Know the risk factors for acute fulminant hepatitis B (eg, immunosuppressed patients, genetics of the virus, presence of delta virus)

Know the risk factors for chronic hepatitis B (neonate born to e antigen positive chronic carrier mother, elderly patient, repeated exposures (eg, drug addict), immunosuppressed patient)

Interpret laboratory test results for hepatitis B (antigens, antibodies, nucleic acid detection) in the determination of (immunity, acute disease, chronic carrier chronic carrier at high risk for sequelae, prior vaccination)

Plan the evaluation and treatment of chronic active hepatitis B

Plan preventive measures for hepatitis B virus infection (infection control measures for blood-borne pathogens, blood donor screening, hepatitis B immune globulin, hepatitis B vaccine)

Know the rationale for universal screening of pregnant women for HBsAg

Recognize the association between both hepatitis B and C and hepatocellular carcinoma

Plan the management of a patient with a known or acute exposure to hepatitis B (ie, needlestick)

## **12. Hepatitis C virus and others**

Know that hepatitis C virus is an RNA virus, likely in the flavivirus family

Know the risk factors that predispose to the development of hepatitis C virus hepatitis infection, and that approximately 1/3 of patients with hepatitis C virus antibody have no known source or risk factor for acquisition

Know the most common cause of posttransfusion hepatitis in the US

Know that the majority of acute hepatitis C virus infections are mild, subclinical, or persistent and that the major complication is chronic hepatitis

Recognize the association of hepatitis C virus with cirrhosis and hepatocellular carcinoma

Understand the methods (and their limitations) for diagnosis of hepatitis C virus infection, including ELISA, recombinant immunoblot assay (RIBA), and PCR

Know that there may be a considerable delay (weeks to months) in the antibody response to hepatitis C virus infection

Know that hepatitis C virus infection followed by clinical recovery may result in an initial antibody response, followed by loss of detectable antibody despite persistence of infectious virus

Plan the treatment of chronic hepatitis C virus hepatitis

Recognize the epidemiologic and clinical manifestations of enterically transmitted hepatitis E virus

Recognize the epidemiology and lack of clinical manifestations of hepatitis G infection (hepatitis GB virus C)

Understand the utility of the hepatitis C viral load in the management of hepatitis C infection

Understand the utility of genotyping in hepatitis C infection

Understand the risk of mother-child transmission of hepatitis C, especially in a mother with HIV infection

### **13. Hepatitis delta virus**

Know that hepatitis delta virus uses HBsAg as its surface coat protein and requires current acute or chronic infection with hepatitis B virus

Know the usual routes or mode of transmission of hepatitis delta virus infection

Identify groups at high risk for hepatitis delta virus infection

Understand how to use laboratory markers available for diagnosis of hepatitis delta virus infection (HDag, anti-HD IgG, anti-HD IgM)

Know the preventive measures available for hepatitis delta virus infection (infection control, blood donor screening, hepatitis B vaccine)

### **14. Parvoviruses**

Know the epidemiology of parvovirus B19, including the age of acquisition, source, and means of transmission of parvovirus

Understand the pathogenesis of parvovirus infection, including the site and type of cell infected

Recognize the clinical manifestations of parvovirus in special hosts, including pregnant women, fetus, immunocompromised patients, and patients with hemoglobinopathies

Understand the potential complications and likelihood of complications of parvovirus infections according to host (eg, normal, with underlying disease, pregnant, fetus)

Know the special situations in which treatment of parvovirus infection may be considered, including the type of treatment

Plan appropriate infection control procedures for hospitalized patients who have parvovirus infection, and for which patients infection control procedures for parvovirus should be instituted

Recognize clinical and contagious aspects of acute parvovirus infection (fifth disease) in normal hosts

Predict the likelihood of adverse fetal outcome in a pregnant school teacher exposed to a child with fifth disease

Order appropriate diagnostic tests for parvovirus infection, with consideration of their limitations

## 15. **Coltivirus (Colorado tick fever)**

Know that Colorado tick fever virus is a reovirus transmitted by *Dermacentor andersoni*

Recognize that the clinical features of Colorado tick fever infection are nonspecific flu-like symptoms but that certain features suggest the diagnosis: tick exposure, biphasic clinical illness, neutropenia

Know that laboratory diagnosis of Colorado tick fever requires isolation of infectious virus from erythrocytes (blood clot) or antibody titer rise

Identify the epidemiologic features of Colorado tick fever

## 16. **Rotavirus**

Recognize the epidemiologic features of rotavirus infection, including geographical and seasonal patterns, attack rates by age

Know the source and mode of transmission of spread of rotavirus infection

Plan appropriate infection control procedures for rotavirus, incorporating knowledge of period of virus shedding

Understand differences in the clinical manifestations of rotavirus infection according to age (eg, primary versus recurrent infection)

Understand differences in clinical manifestations and complications of rotavirus infection between normal hosts and those with underlying diseases who are at risk for complicated or severe disease

Know the usual course of rotavirus infection, both clinical and virologic (shedding) in normal and compromised hosts

Appreciate the sensitivity and specificity of currently available diagnostic tests of rotavirus

## 17. **Alphaviruses, flaviviruses, bunyaviruses**

Know the major viruses associated with arbovirus encephalitis in the United States: St.Louis encephalitis, California encephalitis, Western equine encephalitis, Eastern equine encephalitis, West Nile virus

Know the geographic variations in the US in occurrence and vector for the major arboviruses causing encephalitis

Identify the characteristic clinical and laboratory features of arbovirus encephalitis, including fever, alteration of consciousness, nonfocal seizures, CSF pleocytosis

Order appropriate diagnostic tests to confirm the etiology of arbovirus encephalitis

Recognize characteristics of infection caused by hantavirus (eg, geographic distribution, vector, clinical manifestations)

Plan appropriate management of hantavirus infection (eg, ribavirin)

Recognize the characteristics of dengue virus infection (eg, geographic distribution, vector, clinical manifestations)

Recognize the clinical and laboratory manifestations of West Nile virus infection

## **18. Rubella**

Know the epidemiology of rubella infection in vaccinated and unvaccinated populations

Understand the means of transmission (acquired and congenital) and the relative contagiousness of rubella

Understand the mechanisms of immunity to rubella, including the completeness and duration in acquired and congenital infections

Recognize the clinical manifestations and course of acquired rubella infection, including the differences according to age (eg, increased frequency of arthritis with age)

Understand the pathogenesis and manifestations of congenital rubella, including gestational age at the time of infection, affected anatomic sites, and shedding of the virus

Understand the clinical course and the types and frequency of sequelae in infants with congenital rubella

Know the methods of diagnosis for rubella infection, including acute, past, and congenital infections

## **19. Human coronaviruses**

Understand the relative importance of human coronavirus infection in causing respiratory and enteric illnesses in various age groups and seasons

Recognize the clinical manifestations associated with the respiratory and enteric coronavirus infections

Know the epidemiology of human coronavirus infection, those circumstances in which outbreaks have occurred (eg, neonatal, SARS), and the infection control procedures required

Understand the diagnosis of various coronavirus infections (eg, culture, serology, EM)

## **20. Parainfluenza viruses**

Understand the epidemiology of parainfluenza viruses, including transmission, incidence by age, geographical and seasonal patterns

Appreciate the clinical manifestations of the parainfluenza viruses according to age and the relative importance of parainfluenza virus in causing the different types of respiratory illness (croup, pneumonia, bronchiolitis, URI)

Recognize the differences in clinical manifestations of parainfluenza infections between normal hosts and those with underlying disease or compromising conditions

Understand the mechanisms of immunity to parainfluenza infection, including the completeness and duration of immunity, and role of serotype

Plan appropriate infection control procedures for parainfluenza viruses and when to implement these procedures

Appreciate the sensitivity and specificity of currently available diagnostic tests for parainfluenza infection

## **21. Mumps virus**

Know the epidemiology of mumps in vaccinated and unvaccinated populations

Understand the mode and sources of transmission and the appropriate infection control procedures for mumps and when to implement these procedures

Understand the mechanisms of immunity against mumps

Recognize the clinical and pathologic manifestations of mumps, including the relative frequency and manifestations according to organ system and age

Know the course, complications, and prognosis of clinical and subclinical mumps by organ, including testes, ear, CNS, pancreas

Appreciate the sensitivity and specificity of the currently available diagnostic tests for mumps

## **22. Respiratory syncytial virus**

Appreciate the epidemiology of respiratory syncytial virus, including the geographic, seasonal, and strain patterns

Appreciate the relative importance of respiratory syncytial virus in causing various types of respiratory illness according to age in ambulatory and hospitalized patients

Understand the contagiousness, source, and means of transmission of respiratory syncytial virus

Appreciate the importance of respiratory syncytial virus as a nosocomial agent, situations conducive to the occurrence of nosocomial infections, and appropriate infection control procedures

Understand the pathogenesis of respiratory syncytial virus illness according to age and type of host, including the incubation period, the anatomic and cellular sites of infection, the pathology and shedding

Recognize the incompleteness and short duration of immunity to respiratory syncytial virus

Recognize the role of different components of the immune system in response to respiratory syncytial virus infection

Identify the clinical manifestations and course of primary and recurrent respiratory syncytial virus infection according to age and underlying disease (eg, immunosuppressed host)

Appreciate the relative sensitivity and specificity of the currently available diagnostic tests for respiratory syncytial virus

Know the efficacy and indications for use of ribavirin for treatment of respiratory syncytial virus infection and the lack of proven role for corticosteroids

Recognize the possible role of respiratory syncytial virus infection in the development of hyperreactive airway disease and recurrent wheezing

Plan appropriate prophylaxis for respiratory syncytial virus infection

### **23. Human metapneumovirus**

Recognize the epidemiologic and clinical features of human metapneumovirus infection

### **24. Rubeola (measles)**

Recognize the epidemiologic and clinical characteristics of outbreaks of measles in different populations, such as vaccinated, unvaccinated, preschool, and school populations

Understand the contagiousness, the methods and source of transmission of measles, and appropriate infection control procedures for inpatient and outpatient facilities when measles is diagnosed

Understand the completeness and duration of immunity to measles after natural infection and after immunization

Recognize the clinical manifestations of measles, including modified, atypical, and vaccine-associated measles

Appreciate the sensitivity and specificity of the currently available tests

for diagnosis of measles and for determining immune status

Know the means of prevention of measles in exposed and unexposed, susceptible patients, including the appropriate measures for control of a rubeola outbreak

## **25. Measles-like virus (SSPE)**

Understand the relationship of measles infection and immunization to the incidence and epidemiologic patterns of subacute sclerosing panencephalitis

Recognize the clinical manifestations and course of subacute sclerosing panencephalitis

## **26. Rabies virus**

Know the usual animal reservoirs for rabies in the US

Know the methods by which nonbite exposure to rabies can occur: aerosol in bat-infested cave and in laboratory, corneal transplant

Know the usual incubation period for rabies, including the short and long ends of the curve, and the factors that can influence the incubation period

Recognize the clinical features of rabies

Formulate a differential diagnosis in a patient in whom rabies is suspected

Know the means to establish a laboratory diagnosis of rabies: detection of viral antigen in tissues, demonstration of high titers of antibody in serum

## **27. Influenza**

Understand the antigenic variations of influenza viruses and the relation to the epidemiology and the development of immunity, including the role of hemagglutinin and neuraminidase

Differentiate the clinical manifestations of influenza in patients according to age, severity, and underlying disease

Understand the sources and modes of spread of the influenza viruses, including appropriate infection control procedures for influenza viruses (aerosolized, contact) and when they are indicated

Judge the relative value and accuracy of the currently available tests for the diagnosis of influenza virus infection

Know the treatment modalities for influenza infection and when indicated

Know the appropriate means of prevention and control of influenza infection for high-risk individuals, for outbreaks, and nosocomial infections

**28. Retroviruses (HTLV-1,-2 but not HIV; see IX.G)**

Identify the unique epidemiologic features of HTLV-1 infection, including risk factors for acquisition

Recognize the clinical syndrome associated with HTLV-1 infection

Identify the unique epidemiologic features of HTLV-2 infection, including risk factors for acquisitions

Recognize the clinical syndrome associated with HTLV-2 infection

**29. Poliovirus**

Understand the epidemiology and geographic occurrence of poliovirus infection and disease in vaccinated and unvaccinated populations, including the current epidemiology, cause, and incidence of paralytic polio in the United States

Understand the source and means of transmission of wild polio and vaccine poliovirus, including the duration of shedding, and the appropriate infection control procedures

Understand the principles of prevention and control of wild poliovirus in vaccinated and unvaccinated populations

Understand the pathogenesis and clinical manifestations of wild and vaccine poliovirus infections according to host factors, such as age and immunocompetence

Understand the major components of immunity of poliovirus, including duration and role of serotype

Understand the methods of diagnosis of wild and vaccine poliovirus infection

**30. Enteroviruses (other than polio)**

Recognize the epidemiologic features of nonpolio enteroviruses, including the geographic and seasonal patterns

Know the relative importance of the enteroviruses as a cause of the various syndromes according to age (eg, aseptic meningitis, pharyngitis, sepsis-like picture in neonates, exanthems)

Recognize the pathogenetic, virologic, and clinical manifestations and course of nonpolio enteroviruses according to age (including the newborn) and other host factors

Understand the major mechanisms of immunity to nonpolio enteroviruses, including duration and role of serotype

Recognize the distinctive syndromes caused by enterovirus infection (eg, pleurodynia, hand-foot-mouth, herpangina)

Appreciate the usefulness of the available laboratory tests for the diagnosis of enteroviral infection (eg, isolation from stool may not be the cause of clinical manifestations because of prolonged shedding and asymptomatic infection)

Plan the management of nonpolio enteroviral infections

Recognize the association of enterovirus 71 with encephalitis and a shock-like syndrome

### **31. Rhinovirus**

Know the epidemiology of rhinoviruses and the relative importance of rhinoviruses in causing the various types of respiratory illness according to age

Understand the major mechanisms of immunity of rhinoviruses, including the completeness, duration, and role of serotype

Understand the modes of transmission and the pathogenesis of rhinoviral infections

### **32. Caliciviruses**

Understand the epidemiology of calicivirus infections, including age-related factors and prevalence

Evaluate the relative importance of calicivirus in causing gastroenteritis and outbreaks of gastroenteritis in various age groups

Understand the immunologic relationships in classification of calicivirus and Norwalk agents

### **33. Astroviruses**

Know the types of illness and clinical manifestations associated with astrovirus infection, including the relative importance of astrovirus in causing gastroenteritis and outbreaks of gastroenteritis in various age groups

Understand the available methods for diagnosis of astrovirus infection

### **34. Norwalk agent and related agents of gastroenteritis**

Appreciate the epidemiology, incidence, and prevalence of infection with Norwalk/related agents of gastroenteritis according to age, relative importance in various age groups, open and closed populations, food- and water-borne outbreaks

Know the sources and various modes of transmission of Norwalk agent

and related agents of gastroenteritis (person-to-person, food- and water-borne)

Understand the pathogenesis, incubation period, clinical manifestations, and course of Norwalk agent and related agents of gastroenteritis in sporadic cases and in outbreaks

Plan prevention and control of outbreaks of infection with Norwalk agent and related agents of gastroenteritis

### **35. Prions**

Know that prions are the likely etiologic agents of Creutzfeldt-Jakob disease, bovine spongiform encephalopathy, and kuru in humans

Recognize the epidemiologic and clinical features and risk factors for nonfamilial spongiform encephalopathies

### **36. Filoviridae and Arenaviridae**

Know the epidemiology and modes of transmission of Ebola and Marburg virus infections

Know the epidemiology and modes of transmission of lymphocytic choriomeningitis virus infection

Recognize the clinical manifestations and cerebrospinal fluid findings suggestive of lymphocytic choriomeningitis virus infection

Plan appropriate laboratory evaluation for the diagnosis of lymphocytic choriomeningitis virus infection (eg, serology)

Plan appropriate management of Lassa fever virus infection (eg, ribavirin)

## **K. Fungi**

### **1. General**

Recognize that major embolic events are likely to be caused by fungemia in a patient with predisposing condition(s)

Identify the characteristics of pathogenic fungi that are classified as yeast-like and as molds

Know when susceptibility testing of fungal isolates is important

Predict usual in vitro antifungal susceptibility by class, genus, and species

### **2. Candida species**

Differentiate invasive candidiasis from mucocutaneous candidiasis based on predisposing factors

Recognize typical predisposing factors and clinical characteristics of

Candida esophagitis

Plan the treatment of Candida esophagitis (effective drugs, routes, duration)

Recognize the clinical manifestations and benign nature of generalized cutaneous candidiasis at birth in a term infant

Recognize clinical setting and manifestations of disseminated candidiasis in a patient in the NICU (older age, very-low-birth-weight, prolonged antibiotic therapy)

Plan the appropriate examination of cerebrospinal fluid in a neonate with disseminated candidiasis, and recognize abnormalities consistent with Candida infection

Plan management for a patient with catheter-related candidemia (remove catheter, amphotericin, follow-up blood cultures)

Evaluate a patient with persistent candidemia after removal of venous catheter (suppurative phlebitis, imaging for thrombosis or endocarditis)

Plan management for a patient with candidemia and cardiac valve vegetation

Plan management for a patient with Candida meningitis (effective drugs, combination therapy, duration of therapy)

Plan appropriate management of Candida suppurative phlebitis

Recognize Candida arthritis or osteomyelitis in a neonate days to weeks following catheter-related candidemia

Recognize visceral abscesses and mass lesions in renal pelvis in patients with candidiasis

Know that Candida infection related to any foreign body (ventriculostomy, venous catheter, prosthetic valve, urinary catheter) requires removal of the foreign body for control of infection

Plan management for a patient with neutropenia and candidemia (effective drugs, follow-up blood cultures, cerebrospinal fluid exam, imaging of liver and spleen)

Know in vitro susceptibility of candida species to antifungal agents (effective, ineffective, synergistic drugs)

Understand the diagnostic value of a positive culture for Candida according to site and predisposing factors in the host

### **3. Aspergillus species**

Evaluate the clinical significance of Aspergillus niger vs Aspergillus

fumigatus isolated from a tissue specimen (contaminant vs pathogen)

Recognize risk factors for disseminated aspergillosis (neutropenia, corticosteroids, T-cell abnormalities, foreign bodies)

Recognize the setting and clinical manifestations of disseminated aspergillosis (immunocompromised, persistent fever, negative blood cultures, major embolic evidents, infarction of lungs/spleen/liver/brain)

Know that tissue specimens are necessary for diagnosis of Aspergillus infections (histology, culture)

Plan management for a patient with disseminated aspergillosis (effective drugs, synergistic drugs)

Recognize that a patient with aplastic anemia has a high risk for disseminated aspergillosis and that infection usually begins in paranasal sinuses

Recognize the clinical and laboratory manifestations of hypersensitivity aspergillosis

Plan the management for a patient with hypersensitivity aspergillosis (corticosteroids, antifungal therapy)

Plan therapy for a patient with intracavitary fungus ball in the lung

#### **4. Zygomycetes, agents of Mucormycosis, and related species**

Recognize the predisposing factors for and clinical manifestations of rhinocerebral mucormycosis

Plan the management of a patient with rhinocerebral mucormycoses (surgical debridement, effective drugs, combination drugs)

#### **5. Cryptococcus neoformans**

Know the risk factors for cryptococcosis (phagocytic defects, cellular immune disorders)

Recognize characteristic clinical manifestations of cryptococcal meningoencephalitis (chronic, memory and judgement defects, cranial neuropathies, mass lesion)

Evaluate a patient with suspected cryptococcal meningitis (cerebrospinal fluid typical abnormalities, cryptococcal antigen, India ink, culture)

Plan management of an HIV-positive patient with cryptococcal meningitis, including acute therapy and chronic suppressive therapy (individual and synergistic drug therapy)

#### **6. Histoplasma capsulatum**

Recognize the predisposing factors for and clinical characteristics of pulmonary histoplasmosis

Recognize the clinical and laboratory findings in an infant with disseminated histoplasmosis (fever, hepatosplenomegaly, pancytopenia)

Know the methods of diagnosis of histoplasmosis (effective serologic test, isolation, histology especially bone marrow, ineffective skin test)

Plan management for a patient with disseminated histoplasmosis

Formulate a differential diagnosis for a patient with calcified granulomatous lesion in the lung, including Histoplasma, foreign body, Mycobacterium, Blastomyces

## **7. Blastomyces dermatitidis**

Know the methods of diagnosis of blastomycosis (histology pyogranuloma, yeast, culture isolation, not serology)

Plan the treatment for blastomycosis

Recognize the epidemiologic features of blastomycosis

Recognize the predisposing factors for and clinical characteristics of blastomycosis

## **8. Coccidioides immitis**

Recognize the clinical and radiographic characteristics of pulmonary coccidioidomycosis

Recognize the predisposing clinical (fever, headache, confusion, seizures) and laboratory characteristics of coccidioidal meningitis (cerebrospinal fluid: mononuclear, low glucose, high protein)

Know the methods of diagnosis of coccidioidomycosis (microscopic exam, culture, serology, cerebrospinal fluid antibody, skin test)

Know the indications and drugs used for acute and chronic suppressive therapy for coccidioidomycosis

## **9. Dermatophytes**

Recognize the infectious causes and clinical characteristics, including skin distribution, of tinea

Recognize a kerion and plan management

Know the diagnostic methods for dermatophytic infections (fluorescing characteristics with Wood light, examination and culture of scrapings)

Plan the management of dermatophytic infections (topical and systemic therapy)

## 10. Other fungi

Recognize the clinical manifestations of tinea versicolor, and manage appropriately

Know that *Malassezia furfur*, a normal inhabitant of skin, causes tinea versicolor

Recognize the predisposing conditions for and clinical characteristics of *Malassezia furfur* fungemia in low-birth-weight infants (catheter-related fevers, lipid infusions, negative blood culture)

Know that special laboratory procedures are necessary for isolation of *Malassezia furfur* (olive oil overlay)

Plan the management of *Malassezia furfur* fungemia (catheter removal)

Formulate a differential diagnosis for a patient with suspected lymphocutaneous sporotrichosis, including *Mycobacterium*, *Nocardia*, foreign body granuloma

Order appropriate tests to confirm the diagnosis of sporotrichosis (histologic examination, isolation of *Sporothrix schenckii*)

Plan the treatment of sporotrichosis

Recognize *Fusarium* and *Alternaria* as increasingly pathogenic in immunocompromised patients

Recognize the clinical manifestations and in vitro antifungal susceptibility of *Fusarium* and *Alternaria* infections

Recognize and manage *Scaedosporium* infection, especially in bones

## L. Parasites/Protozoa/Helminths

### 1. *Entamoeba histolytica*

Recognize the risk factors and methods of transmission of *Entamoeba histolytica*

Recognize the clinical manifestations and complications of *Entamoeba histolytica* infestation, including intestinal perforation, liver abscess, peritonitis, other organ system lesions

Formulate a differential diagnosis of a patient with dysentery, to include *Entamoeba histolytica* and *Shigella* species

Plan the diagnostic evaluation of a patient with suspected *Entamoeba histolytica* infestation, to include microscopy, serologic testing, and imaging studies

Plan the management of a patient with symptomatic extra-intestinal

manifestations of *Entamoeba histolytica* infestation

Differentiate the clinical manifestations of *Entamoeba histolytica* infestation from those of inflammatory bowel disease

## 2. ***Entamoeba dispar***

Recognize nonpathogenic *Entamoeba* (*E. dispar*) commonly identified on stool examination for parasites

## 3. ***Naegleria/Acanthamoeba***

Know the risk factors for acquiring amoebic infestations of the central nervous system (eg, brackish warm fresh water with coliform bacteria, seasonal occurrence, geographic distribution, no person- to-person)

Recognize that *Acanthamoeba* infestation frequently occurs in immunocompromised hosts

Understand the methods of diagnosis of *Naegleria fowleri* infestation (ie, hanging drop examination of cerebrospinal fluid)

Understand the method of diagnosis of *Acanthamoeba* infestation (eg, examination of brain or eye tissue, serologic tests)

Recognize the setting and clinical and CSF manifestations of *Naegleria fowleri* infestation involving the brain, leading to fatal encephalitis

Recognize the clinical manifestations of *Acanthamoeba* infestation involving the brain, (granulomatous encephalitis) that can be fatal

Recognize the clinical manifestations of *Acanthamoeba* infestation involving the eye (dendritic keratitis) that can cause blindness

## 4. ***Ascaris duodenale/Necator americanus***

Understand the importance and geographic distribution of hookworm infestation (*Ascaris duodenale*, *Necator americanus*)

Recognize the clinical manifestations of hookworm infestation involving major organ systems (skin, pulmonary, gastrointestinal)

Understand the method of diagnosis of hookworm infestation

## 5. ***Ascaris lumbricoides***

Recognize the mode of transmission of *Ascaris* infestations (ingestion of embryonated eggs in soil contaminated by human feces)

Understand the life cycle of *Ascaris lumbricoides*

Recognize the clinical and laboratory manifestations of ascariasis (eg, eosinophilia, fever, pulmonary and gastrointestinal symptoms)

Recognize the complications of ascariasis (eg, pneumonia, peritonitis, intestinal obstruction, bile duct obstruction)

Understand the methods of diagnosis for ascariasis, including eosinophil counts, microscopy of stool, and identification of adult worms

## **6. Giardia lamblia**

Know that the Giardia lamblia cyst is the infective form, that humans are the principal reservoirs, and that person-to-person transmission occurs

Know the epidemiology of Giardia infestation in child-care settings, including the frequency and asymptomatic states

Recognize the clinical manifestations of Giardia lamblia infestation (asymptomatic, acute and chronic gastrointestinal tract disease)

Understand the methods of diagnosis of Giardia lamblia infestation, including microscopy and rapid diagnostic tests

Plan the therapy of a patient with a symptomatic Giardia infection

## **7. Isospora, Cyclospora, and Microsporidia**

Recognize the clinical manifestations of Isospora or Cyclospora infestation, especially the protracted diarrhea produced in patients with AIDS

Plan an appropriate therapeutic regimen for Isospora belli infestation (sulfamethoxazole, pyrimethamine, sulfadiazine)

Recognize the epidemiologic and clinical manifestations of Enterocytozoon bienersi infestation

Recognize the epidemiologic and clinical manifestations of Septata intestinalis infestation

Recognize the epidemiologic and clinical features of infections due to microsporidia, and plan appropriate therapy

## **8. Pediculosis agents**

Manage an outbreak of pediculosis in a school

Recognize the role of fomites and hygiene in transmission of pediculosis

Recognize the clinical manifestations of lice infestation of the head, body, and pubic hair

Plan the treatment of lice infesting the scalp (permethrin, lindane, malathion)

## **9. Plasmodium species**

Know that *Plasmodium vivax* and *P. ovale* persist in a dormant stage (hypnozoite) that can cause relapses of malaria

Recognize the epidemiologic settings and clinical manifestations of malaria, including those seen with the severe disease caused by *P. falciparum*

Plan the therapy of malaria caused by various *Plasmodium* species, including chloroquine-resistant *P. falciparum*

Know that primaquine phosphate must be given to patients with malaria caused by *P. vivax* or *P. ovale* to prevent relapse

Plan the appropriate chemoprophylactic regimen for travelers at risk of acquiring malaria, including those going to areas where chloroquine-resistant species are found

Recognize the delayed presentation of malaria in a patient who was compliant with prophylaxis

Plan an appropriate diagnostic evaluation for malaria

Understand the need for prophylaxis for malaria for families returning to high-risk areas after living in the US

## **10. Pneumocystis jiroveci (carinii)**

Know the predisposing conditions for infection with *Pneumocystis jiroveci*

Recognize the setting and characteristic clinical and chest radiographic manifestations of *Pneumocystis jiroveci* infection

Differentiate *Pneumocystis jiroveci* pneumonia from other causes of lung disease (eg, interstitial pneumonia in infants, lymphocytic interstitial pneumonitis in a patient with AIDS)

Plan the diagnostic evaluation for a patient with suspected *Pneumocystis jiroveci* pneumonia

Plan the treatment for *Pneumocystis jiroveci* pneumonia, including the use of corticosteroids

Understand the indications for chemoprophylaxis of *Pneumocystis jiroveci* pneumonia, including the association between CD4 counts and age when considering prophylaxis for *P. jiroveci* pneumonia in infants and children with HIV infection

## **11. Scabies**

Understand the source and modes of transmission of scabies

Recognize the difference in clinical manifestations of scabies between younger and older children

Plan an appropriate treatment regimen for scabies, including clinically resistant disease

Order appropriate diagnostic tests for confirmation of scabies infestation

## **12. Schistosomiasis**

Know the principal (humans) and intermediate (snails) hosts of schistosomiasis

Know the geographic distribution of schistosomes, and that organisms gain entry through the skin

Distinguish the clinical manifestations of *S. mansoni* from those of *S. japonicum* and *S. haematobium* infestations

Plan an appropriate treatment regimen for schistosomiasis (praziquantel)

## **13. Strongyloides stercoralis**

Recognize that *Strongyloides* infestation involves penetration of the skin, and that autoinfection occurs

Recognize the clinical manifestations of *Strongyloides* hyperinfection in immunocompromised hosts (disseminated strongyloidiasis, diffuse pulmonary infiltrates, sepsis)

Plan an appropriate diagnostic evaluation for *Strongyloides* infestation

Plan an appropriate treatment regimen for a patient with strongyloidiasis

## **14. Cryptosporidium**

Recognize the clinical manifestations of *Cryptosporidium* infestation

Know that patients with AIDS can develop severe, chronic diarrhea caused by *Cryptosporidium*, with malnutrition and wasting

Know potential therapies for *Cryptosporidium* infestation (paromomycin, somatostatin, nitazoxanide)

Understand the epidemiology and modes of transmission of *Cryptosporidium* in child-care centers and in the community

Know the methods of diagnosis of *Cryptosporidium* infestation

## **15. Enterobius vermicularis**

Know that humans are the only host of *Enterobius vermicularis*

Recognize the common and uncommon (vaginitis and appendicitis) clinical manifestations of pinworm infestation

Plan the management of a family with *Enterobius vermicularis* infestation

## **16. Filariasis**

Identify the geographic distribution, vector, and clinical manifestations of filariasis

Know that microfilaria may remain in a patient's blood for more than one year after death of adult worms

Plan an appropriate treatment regimen for filariasis, including diethylcarbamazine, ivermectin, and corticosteroids

## **17. Taenia species**

Recognize the epidemiology, geographic distribution, clinical manifestations, and typical imaging findings of neurocysticercosis

Plan a diagnostic evaluation for intestinal tapeworm infestation

Plan therapy for intestinal tapeworm infestation (praziquantel, niclosamide)

Plan management of a patient with neurocysticercosis, including indications for antiparasitic drug therapy (albendazole, praziquantel)

Plan a diagnostic evaluation for neurocysticercosis

## **18. Toxoplasma gondii**

Predict outcome (likelihood of infestation, adverse effects) for a fetus whose mother had toxoplasmosis during various stages of pregnancy

Recognize the risk factors for and methods of transmission of toxoplasmosis

Recognize adverse outcome of congenital toxoplasmosis even when a neonate is asymptomatic

Recognize the clinical manifestations of intrauterine toxoplasmosis in newborn infants (including asymptomatic illness)

Recognize the clinical manifestations of toxoplasmosis in patients with HIV infection and other immunocompromised conditions

Plan a diagnostic evaluation of toxoplasmosis in a patient with HIV infection

Plan a diagnostic evaluation in a newborn infant suspected of having *Toxoplasma* infestation

Know the therapy for *Toxoplasma gondii* infestation in patients with congenital infestation, ocular disease, or AIDS

Recognize that ocular toxoplasmosis in older children and adults is reactivation of intrauterine infection

Recognize the role of international travel by pregnant women in the epidemiology of congenital toxoplasmosis

Plan a course of prophylactic therapy for toxoplasmosis in a patient who is undergoing immunosuppression

## **19. *Trichinella spiralis***

Recognize the epidemiologic and clinical manifestations of *Trichinella spiralis* infestation

Understand the methods of diagnosis of *Trichinella spiralis* infestation, including serology, microscopy of infected tissue, and blood eosinophil count

Plan therapy for *Trichinella spiralis* infestation (antiparasitic, corticosteroid)

## **20. *Trichomonas vaginalis***

Know that trichomoniasis is acquired primarily by sexual contact

Recognize the clinical and laboratory manifestations of *Trichomonas* infestation (wet-mount examination of vaginal fluid)

Plan the management of trichomoniasis

## **21. *Trichuris trichiura***

Know that *Trichuris trichiura* infestation occurs following ingestion of contaminated soil, not following person-to-person contact

Recognize the clinical manifestations of *Trichuris trichiura* infestation

## **22. *Toxocara species***

Know that human toxocaral infestation follows ingestion of soil contaminated with eggs of common roundworms of dogs (*T. canis*) and cats (*T. cati*)

Recognize the clinical manifestations of infestation with *T. canis* and *T. cati*, including the signs and symptoms dependent on the degree of allergic response

Recognize the laboratory clues in the diagnostic evaluation of patients with toxocariasis (hypereosinophilia, hypergamma- globulinemia, microscopic larvae in liver, serology)

Plan the management of patients with visceral larval migrans (thiabendazole, diethylcarbamazine), including those with cardiac or CNS manifestations (corticosteroids)

### **23. Trypanosoma**

Recognize the epidemiologic and clinical features of Trypanosoma infestation, and plan appropriate therapy

### **24. Miscellaneous Parasites/Protozoa/Helminths**

Know the vector, reservoir, geographic occurrence, clinical manifestations, and diagnostic tests for Babesia microti (babesiosis)

Recognize the dangers of babesiosis in asplenic individuals

Plan the management of a patient with severe babesiosis (atovaquone and azithromycin; chloroquine ineffective)

Recognize that most Balantidium coli infestations in humans are asymptomatic but that chronic intermittent episodes of diarrhea can occur  
Recognize that most Blastocystis hominis infestations are asymptomatic, but that clinical manifestations of diarrhea, abdominal pain, malaise, nausea, and weight loss can occur

Know that transmission and life cycle of paragonimiasis occurs when raw or uncooked freshwater crabs or crayfish containing larvae (metacercariae) are ingested

Recognize the clinical manifestations of paragonimiasis, including insidious onset, a chronic course, eosinophilic response, and pathologic lesions

Recognize geographic distribution, clinical manifestations, and etiology of cutaneous larval migrans

Recognize the epidemiologic and clinical features, and plan appropriate management for, Microsporidia infestation

Recognize clinical and computed tomographic characteristics of echinococcal cysts

Plan appropriate management for a patient with an echinococcal cyst

Recognize the epidemiologic and clinical features of paragonimiasis

Recognize the epidemiologic and clinical features of Dipylidirem caninum infestation in humans

Recognize the epidemiologic and clinical features of Diphyllbothrium latrum infestation in humans

Recognize the clinical features of Baylisascaris (raccoon ascaris) infestation in humans

## **M. Mycobacteria**

### **1. Mycobacterium tuberculosis**

Identify typical microbiologic characteristics of Mycobacterium tuberculosis (staining and growth features)

Recognize the epidemiologic and pathogenic features of Mycobacterium tuberculosis infection, including international travel

Know the risk factors for symptomatic Mycobacterium tuberculosis infection (infants and adolescents, immunosuppression, steroids, cellular immune defects)

Recognize the clinical and radiographic manifestations of primary tuberculous pneumonia

Recognize the clinical and cerebrospinal fluid characteristics of tuberculous meningitis

Recognize the clinical and radiographic manifestations of reactivated pulmonary tuberculosis

Recognize the history and clinical manifestations of miliary tuberculosis

Understand the indications for and interpretation of tuberculin skin tests, including why multiple puncture tests are not used

Evaluate a negative tuberculin skin test in a patient with suspected tuberculosis (timing, anergy, false-negative tests)

Recognize the special clinical and radiographic manifestations of endobronchial tuberculosis, and plan appropriate treatment based on findings

Evaluate a child with suspected pulmonary tuberculosis (culture, AFB stain expectation, skin test expectation)

Evaluate a patient with suspected tuberculous meningitis (cerebrospinal fluid findings, CT findings, AFB stain expectation, skin test expectation)

Plan treatment for a patient with tuberculous pneumonia (effective drugs, combination therapy, duration)

Plan treatment for a patient with tuberculosis (meningitis or pneumonia) (effective drugs, combination therapy, duration)

Understand mechanisms and patterns of antimicrobial resistance and interpretation of susceptibility tests for Mycobacterium tuberculosis

Plan follow-up evaluation for a patient undergoing treatment for tuberculous pneumonia (repeat cultures, sputum, radiographs, clinical assessment hepatotoxicity)

Recognize clinical manifestations of Mycobacterium tuberculosis lymphadenitis

Plan evaluation and management for a patient with Mycobacterium tuberculosis lymphadenitis

Plan evaluation for family members/siblings of patients with asymptomatic infection as well as various forms of clinical disease due to Mycobacterium tuberculosis

Know the indications for examination of the cerebrospinal fluid in a patient with symptomatic tuberculosis (eg, infancy, adolescence, subtle symptoms)

Compare infectivity of individuals with asymptomatic tuberculin skin test reactivity, and with various forms of clinical disease caused by Mycobacterium tuberculosis

Recognize clinical conditions (eg, HIV infection) that increase transmission of Mycobacterium tuberculosis

## **2. Other Mycobacterium species**

Know the basis for differentiating Mycobacterium species (growth characteristics)

Recognize the clinical manifestations of nontuberculous mycobacterial lymphadenitis

Evaluate a patient with suspected nontuberculous mycobacterial lymphadenitis, including interpretation of skin tests

Plan management for a patient with nontuberculous mycobacterial lymphadenitis (conservative vs surgery, relative inefficacy of drugs)

Formulate the differential diagnosis for a patient with the histologic examination of lymph node showing granuloma with necrosis (TB, nontuberculous mycobacteria, tularemia, lymphogranuloma venereum)

Recognize the clinical manifestations of nontuberculous mycobacterial disease in patients with AIDS (fever, wasting, diarrhea)

Know value of special blood culture techniques for the diagnosis of mycobacterial infection in HIV-infected patients

Know antituberculous drugs of potential benefit for treatment of nontuberculous mycobacterial infection in HIV-infected patients

Recognize the importance of nontuberculous mycobacterial infection related to foreign bodies (porcine heart valve, peritoneal dialysis catheter),

### III. Use of Laboratory and Diagnostic Testing

#### A. Bacteriology laboratory

Know optimal technique for handling of specimens for fastidious organisms (anaerobes, *Bordetella pertussis*, *Neisseria gonorrhoeae*)

Know that skin and mucosal sites are inappropriate locations from which to obtain specimens for isolation of anaerobic bacteria

Know how to disinfect the skin when obtaining blood for culture (effective agents, ineffective agents, technique)

Understand importance of collection method and transport time for culture of urine

Know for which pathogens the laboratory should use special precautions because of contagious risk (*Francisella*, *Yersinia pestis*, *Coccidioides*, *Histoplasma*)

Know situations when antigen, antibody, or nucleic acid detection in body fluids is superior to isolation (cryptococcal meningitis, CNS toxoplasmosis, CNS syphilis, partially treated meningitis, viral meningitis, HIV infection)

Know the appropriate microbiologic laboratory requests for cervical exudate specimen from patient with pelvic inflammatory disease

Know that cerebrospinal fluid and lesion scraping are excellent sources for isolation of *Neisseria meningitidis* and that blood cultured in media with sodium polyanethol sulfate is sometimes negative

Understand both the value and limitations of bacterial antigen testing (appropriate, inappropriate, better alternative, unnecessary expense)

Understand reasons for false-positive and false-negative bacterial antigen detection tests (intrinsic test problem, subjective interpretation, cross-reacting bacteria, recent Hib immunization, use of povidone/iodine, contaminated urine specimen)

Know the appropriate use of Gram stain (predicting polymicrobial anaerobic infection, predicting significance of sputum/leukocyte isolates, predicting etiology of cervicitis, planning initial antibiotic therapy)

Formulate a differential diagnosis of blood isolates of Gram-positive bacillus (*Listeria*, *Corynebacterium*, *Clostridium*, *Bacillus*)

Understand interpretation of testing for resistance to high-level streptomycin and gentamicin for *Enterococcus* isolates

Know the principles of reproducible antibiotic susceptibility testing

(standard medium, standard inoculum, standard incubation, non-fastidious organism, quality controls)

Know the principle of laboratory designation "susceptible" (ie, serum concentration of drug, given usual dose, exceeds minimal inhibitory concentration by 4 to 8)

Interpret laboratory susceptibility report based on site of infection (urinary tract vs CNS vs bone/joint)

Know when test of serum bactericidal titer is appropriate, and interpret results

Differentiate the staining characteristics of Nocardia vs those of Mycobacteria (Nocardia: fluorochrome positive, Ziehl-Neelsen and Kinyoun-negative)

Know for which clinical specimens refrigeration is appropriate (urine, stool for C.difficile toxin, cervical secretions in transport medium for Chlamydia and Ureaplasma, stool in transport solution for ova and parasites)

Know for which pathogens immediate inoculation onto growth medium is necessary

Understand the interpretation of an intravascular catheter tip culture  
Interpret multiple isolates from one blood culture (significant and insignificant situations)

Know pathogens for which laboratory isolation is not preferred method for diagnosis (Brucella, tularemia, leptospirosis, rickettsia, syphilis, psittacosis)

Recognize pathogens for which nucleic acid detection assays are available for clinical diagnosis and viral characterization (resistance, genotype)

Understand the advantages, limitations, and appropriate use of nucleic acid detection assays for identification, quantification, and characterization of pathogens (eg, DNA probe, PCR, branch chain assays, genotyping)

Identify bacteria by Gram stain and by morphology

Understand major advantages and disadvantages of a two-vial blood culture system

Differentiate a bactericidal antibiotic from a bacteriostatic antibiotic

## **B. Virology laboratory**

Know optimal techniques for collecting and handling specimens for virus culture (viral transport medium, storage and transport at 4.0 C)

Know optimal techniques for collecting and handling specimens for antigen detection (adequate number of cells present)

Know the advantages of virus isolation (eg, detection of more than one virus, definitive identification and typing, viral susceptibility)

Know the disadvantages of attempted virus isolation (eg, loss of infectivity in transport, too late in illness for detection)

Know the important causes of false positive and false negative results of viral culture, antigen identification, and nucleic acid detection

Know the clinical situations and the viruses where susceptibility testing may be clinically important

Know the advantages of rapid antigen detection of virus (eg, speed, less concern for specimen handling)

Know the disadvantages of rapid antigen detection of virus (eg, false positive and false negative results)

Know the factors that complicate interpretation of rapid antigen detection, nucleic acid detection, and viral isolation (asymptomatic or prolonged shedding)

Understand the viruses (eg, EBV, rubella, rubeola, hepatitis, arbovirus, HIV) that do not replicate in the battery of cultures generally used in diagnostic laboratories

Understand the laboratory detection methods for HIV infection (antibody, antigen, qualitative and quantitative nucleic acid, genotyping)

Know that nucleic acid detection methods may be the optimal diagnostic test for certain conditions (eg, HSV in CSF; HIV or parovirus in serum; HPV, EBV, hepatitis viruses in tissue)

Recognize the suspected clinical diagnoses for which culture of virus is the preferred laboratory test (eg, enteroviral septic meningitis, genital herpes)

Know the suspected diagnoses for which antigen detection of virus is the preferred laboratory test (eg, rotavirus diarrhea, respiratory syncytial virus bronchiolitis/pneumonia)

Understand the use of quantitative urologic tests in treatment and prognostic decisions

Understand the different methods for performing susceptibility testing of viruses (genotyping, phenotyping) and the limitations of each

Know the advantages of nucleic acid detection of viruses (speed, less concern for specimen handling, quantitative assays, genotyping)

Know the disadvantages of nucleic acid detection of viruses (false-positive and false-negative results)

Understand the diagnoses for which nucleic acid detection of virus is the preferred diagnostic method (eg, herpes encephalitis, HIV infection in a neonate)

### **C. Serology laboratory**

Know the important causes of false positive and false negative results of IgM serology (eg, rheumatoid factor, delayed response, immunosuppressed host, herpes virus reactivation)

Know the factors that complicate interpretation of IgG serology tests (eg, delayed response, age, maternal antibodies, heterologous, cross reactivity, IgG immunotherapy)

Interpret a negative IgG serologic test result in a clinical setting when the test results do not exclude a specific diagnosis (eg, acute phase, early treatment)

Interpret a positive IgG serologic test result in a clinical setting when the test results do not confirm a diagnosis (eg, CMV, herpes, maternal antibody)

Know the suspected diagnoses for which antibody titers (IgG or IgM) against viruses are the preferred laboratory tests (eg, arbovirus encephalitis, infectious mononucleosis, hepatitis)

Understand the use of common serologic tests (eg, complement fixation, hemagglutination inhibition, neutralization, immunofluorescence, EIA, Western blot)

### **D. Immunology laboratory**

Know the assays required for the screening evaluation of the major defects in host defense: immunoglobulins, antibodies, absolute neutrophil counts, CH50, PHA, neutrophil oxidative burst, lymphocyte surface markers

Recognize the implications of abnormal CD4, CD8, and CD4/CD8 counts

Recognize the implications of an abnormal serum complement concentration

Recognize the implications of an abnormal serum immunoglobulin (IgA, IgM, IgG, IgG subclass) concentrations

Recognize the implications of an abnormal neutrophil function test (eg, neutrophil oxidative burst, chemiluminescence)

### **E. Mycology laboratory**

Interpret isolation of mold from sterile body fluid (contaminant versus pathogen)

Know the appropriate source and collection method for identification of dermatophytes (scrapings, KOH, culture)

Understand the usefulness of susceptibility testing of antifungal drugs for various fungi

Recognize and identify invasive fungi histologically

Recognized common growth characteristics of common invasive fungi (eg, dimorphic forms, speed of growth)

## **F. Parasitology laboratory**

Know the optimal techniques for collecting and handling stool, blood, and other tissue samples for diagnosis of parasitic infestations using microscopy

Recognize commonly encountered pathogenic parasites in stool using microscopy (Giardia, E. histolytica, Isospora, Cryptosporidium, Strongyloides)

Recognize parasitic infestations for which antigen detection is useful

## **G. Delayed hypersensitivity skin tests**

Know what skin tests are available and appropriate for normal delayed hypersensitivity testing (eg, mumps, diphtheria toxin, tetanus toxin, TST, dermatophyton, Candida)

Interpret the results of delayed hypersensitivity skin tests (eg, mumps, diphtheria, tetanus, TST, dermatophyton), including induration at 24-48 hours as a marker of positive results

Know clinical settings when delayed hypersensitivity is transiently diminished (corticosteroid use, measles, varicella)

## **H. ELISPOT assays**

Understand how to use ELISPOT assays to diagnose specific infection (eg, M. tuberculosis)

# **IV. Treatment**

## **A. Antibacterial therapy**

### **1. General concepts**

Understand pharmacokinetic principles of half-life, including plateau effect with repetitive dosing

Recognize clinical circumstances when peak and trough concentrations of antimicrobial drugs are important

Distinguish clinical situations when bacteriostatic vs bactericidal drugs are indicated (host, site of infection)

Evaluate clinical uses for combination antibiotic therapy (prevention of emergence of resistance, polymicrobial infections, initial therapy, decreased toxicity, synergism, impaired host)

Recognize inappropriate uses of combination antibiotic therapy (antagonism, cost, adverse effects)

Recognize appropriate and inappropriate routes of administration of antibiotics in reference to site and severity of infection and drug absorption

Know the clinical situations when orally non-absorbed or less-well absorbed antibiotics are appropriate (*Clostridium difficile*, shigellosis, bowel decontamination)

Understand the mechanisms, and know examples, of antibiotic resistance (mutations, plasmids, transposable elements, alterations of binding proteins, efflux pumps, ribosomal methylation)

Understand that induction of beta-lactamase activity in Gram-negative bacilli by ceftiofur and third-generation cephalosporins leads to resistance to all third-generation cephalosporins and ureidopenicillins

Evaluate safety of antimicrobial drugs during pregnancy

Evaluate safety of antimicrobial drugs during breast-feeding

Evaluate safety of antimicrobial drugs in a newborn infant  
Understand the principles of pharmacokinetics and how they apply to antimicrobial drugs

Interpret bacteriostatic and bactericidal antibiotic concentrations

## **2. Aminoglycosides**

Understand the spectrum of antibacterial activity of various aminoglycosides

Understand the indications and dosage of aminoglycosides for synergy (high level aminoglycoside testing, host, type of infection, site of infection)

Know clinical situations when standard dosing predictably yields low serum concentrations of aminoglycosides (patients with burns, malnutrition, patients with cystic fibrosis)

Know that gestational and postnatal age and volume of distribution affect pharmacokinetics of aminoglycosides in neonates

Plan dosing schedule of an aminoglycoside for a patient with renal impairment

Know the circumstances in which nephrotoxicity of aminoglycosides is potentiated (concurrent use of amphotericin or "loop" diuretics)

Plan dosage adjustment of aminoglycoside for a patient for given peak and trough serum concentrations

Recognize the toxicities of aminoglycoside therapy (ototoxicity, nephrotoxicity)

Know that aminoglycosides can contribute to neuromuscular paralysis, especially in patients receiving succinylcholine, magnesium, and those with myasthenia gravis or botulism

Know the indications for the use of streptomycin (tuberculosis, tularemia, plague, brucellosis)

Know the circumstances in which aminoglycoside activity is impaired (in purulent material, low pH, anaerobic conditions)

Know the appropriate/inappropriate use and pharmacokinetics for intraventricular instillation of gentamicin

### **3. Tetracycline**

Know the indications for use of tetracyclines (Brucella, Chlamydia, Ehrlichia, Borrelia burgdorferi, Mycoplasma, Rickettsia, vibrios), including those in young children

Know the toxicity of tetracyclines (skin photosensitivity, enamel discoloration and hypoplasia, esophageal ulcers, hepatotoxicity)

Differentiate doxycycline from other tetracyclines by pharmacokinetics and toxicity

### **4. Chloramphenicol**

Identify the causes of abnormal (increased or decreased) serum chloramphenicol concentrations (liver dysfunction; hypotension; concomitant phenytoin, rifampin, or phenobarbital therapy)

Evaluate the clinical indications for appropriate use of chloramphenicol (Rickettsia, penicillin-allergic patient, typhoid/enteric fever, Y. pestis meningitis)

### **5. Rifamycins**

Know the pharmacologic properties of rifampin, including excretion, relative cerebrospinal fluid concentration, and gastrointestinal absorption

Know the spectrum of antibacterial activity of rifampin, including antimycobacterial properties

Know why clinical use of rifampin for treatment is always in combination

with another drug

Recognize the clinical indications for the use of rifampin for adjunctive treatment (tuberculosis, staphylococcal CNS infection, tolerant staphylococci, methicillin-resistant staphylococci, multiply-resistant *Pseudomonas aeruginosa*)

Know that rifampin reduces half-life of many drugs (barbiturates, oral contraceptives, cyclosporin, digoxin, phenytoin, theophylline)

Know that rifampin is contraindicated in pregnancy

Know the pharmacologic properties of rifabutin, including excretion, relative CSF concentration, and gastrointestinal absorption

Know the pharmacologic properties of rifapentene, including excretion, relative CSF concentration, and gastrointestinal absorption

## **6. Metronidazole**

Know the indications for the use of metronidazole (giardiasis, amoebiasis, vaginal trichomoniasis, *C. difficile* colitis, anaerobic infections of the CNS)

Know the effectiveness, including limitations as a single drug, of metronidazole in the treatment of polymicrobial anaerobic infections

Identify the adverse effects of metronidazole (peripheral neuropathy, cerebellar dysfunction, encephalopathy, pancreatitis, metallic taste, gastrointestinal disturbances, dark urine, gynecomastia, rashes, disulfuram-like reaction)

Know the precautions for use of metronidazole

## **7. Sulfonamides and trimethoprim**

Understand the mechanism of antibacterial activity of trimethoprim with sulfamethoxazole

Understand the importance of ability of sulfonamides to displace drugs from protein (potentiates methotrexate, thiazides, phenytoin and increases free bilirubin)

Know clinical uses of sulfonamides for treatment (*Nocardia*, rifampin-resistant *Mycobacterium kansasii*, *Escherichia coli*)

Know the clinical uses of sulfonamides for prophylaxis (urinary tract infection, otitis media, chronic granulomatous disease)

Know clinical uses of sulfonamide combination therapy for toxoplasma, *P. falciparum*

Know the clinical uses of trimethoprim with sulfamethoxazole for

treatment (Pneumocystis, enteric fever, Shigella, other Enterobacteriaceae, Chlamydia, Ureaplasma, Pseudomonas cepacia)

Recognize toxicities of trimethoprim with sulfamethoxazole (rashes, exfoliative dermatitis, Stevens-Johnson, neutropenia, megaloblastic anemia, thrombocytopenia, renal dysfunction in patients with pre-existing renal disease, aseptic meningitis)

Know that Streptococcus pneumoniae may be resistant to trimethoprim with sulfamethoxazole

Know that trimethoprim is contraindicated in pregnancy because of possible teratogenic effects

## **8. Quinolones**

Know the spectrum of antibacterial activity of quinolones, and their approved indications for use

Identify the organisms likely to be partially or completely resistant to quinolones (streptococci, enterococci, anaerobes)

Recognize that initially susceptible Pseudomonas strains are likely to develop resistance during treatment with quinolones

Know that quinolones are not approved for use in children younger than 18 years of age because of potential adverse effect on cartilage

## **9. Penicillins**

Know the mechanism of action of and bacterial resistance to penicillins

Know the host factors that necessitate dosage modifications, including age, prematurity, renal insufficiency, and hepatic disease for the different penicillins

Know the spectrum of antibacterial activity of the different penicillins (eg, penicillinase-resistant penicillins, amino- penicillins, and extended spectrum antipseudomonal penicillins)

Know the spectrum of antibacterial activity of penicillins in combination with beta-lactamase inhibitors (amoxicillin-clavulanate, ticarcillin-clavulanate, ampicillin-sulbactam, piperacillin-tazobactam)

Recognize the major adverse effects of penicillins (eg, hypersensitivity reactions; hematologic, renal, and CNS toxicity; hypokalemia)

Plan therapy for a patient who has had an adverse reaction to penicillin (alternate drug therapy, desensitization)

## **10. Cephalosporins and related drugs (cefamycins, carbacephens)**

Know the mechanisms of bacterial activity and resistance of the

cephalosporins

Know the relative cerebrospinal fluid drug concentrations of the cephalosporins in comparison to those in serum (eg, first- versus third-generation)

Know the spectrum of antibacterial activity and classification of the different cephalosporins (eg, first-, second-, third-, and fourth- generation, including those with anti-pseudomonal activity)

Recognize adverse effects of cephalosporins, including hypersensitivity reactions, toxicity, and gastrointestinal reactions of oral formulations

Plan therapy for a patient who has had an adverse reaction to a cephalosporin (safe alternate drug, desensitization)

Recognize the association of ceftriaxone with formation of biliary sludge and manifestations of cholecystitis

Recognize the association of ceftriaxone with fatal hemolysis

## **11. Imipenem, meropenem, ertapenem**

Know the pharmacologic properties of imipenem, including route of elimination and relative cerebrospinal fluid concentration

Know the spectrum of antibacterial activity of imipenem

Know the indications for use of imipenem in children and adolescents, including those with known or suspected penicillin or cephalosporin hypersensitivity

Recognize adverse effects and toxicity of imipenem (seizures)

Know the pharmacologic properties of meropenem, including route of elimination and relative cerebrospinal fluid concentration

Know the spectrum of antibacterial activity of meropenem

Know the indications for use of meropenem in children and adolescents, including those with known or suspected penicillin or cephalosporin hypersensitivity

Recognize adverse effects and manifestations of meropenem toxicity

Know the pharmacologic properties of ertapenem, including route of elimination and relative cerebrospinal fluid concentration

Know the spectrum of antibacterial activity of ertapenem

Know the indications for use of ertapenem in children and adolescents, including those with known or suspected penicillin or cephalosporin hypersensitivity

Recognize adverse effects and manifestations of ertapenem toxicity

## **12. Aztreonam**

Know the pharmacologic properties of aztreonam, including route of elimination and relative cerebrospinal fluid concentration

Know the indications for use of aztreonam in children and adolescents, including those with known or suspected penicillin or cephalosporin hypersensitivity

## **13. Vancomycin**

Know the mechanism of action of vancomycin

Know the pharmacology of vancomycin, including the route of elimination and relative cerebrospinal fluid concentration

Know the host factors that necessitate modification of vancomycin dosage

Understand the rationale of and timing for monitoring of serum vancomycin concentrations

Know the spectrum of antibacterial activity of vancomycin

Know the indications for vancomycin therapy

Recognize adverse effects and toxicity of vancomycin, including those from too-rapid infusion, and resulting management

Recognize the association of vancomycin use and the increase in vancomycin-resistant *Enterococcus*, and situations for restraint of use

## **14. Erythromycin and new macrolides**

Know the major site of action, the gastrointestinal absorption of the different preparations, and the route of elimination of erythromycin

Know the spectrum of antibacterial activity of erythromycin

Know the indications for erythromycin

Know the drugs whose excretion may be delayed by the concurrent administration with erythromycin

Know the adverse effects of erythromycin when given either orally or intravenously

Know the spectrum of activity, pharmacologic properties, indications, and adverse effects of clarithromycin

Know the spectrum of activity, pharmacologic properties, indications, and adverse effects of azithromycin

## **15. Clindamycin**

Know the major site of action, the gastrointestinal absorption, and the route of elimination of clindamycin

Know the spectrum of antibacterial and antiprotozoal activity of clindamycin

Know the indications for clindamycin therapy

Know the activity of clindamycin against penicillin-resistant *Streptococcus pneumoniae*

## **16. Oxazolidinones**

Recognize that linezolid inhibits bacterial protein synthesis through a mechanism of action different from that of other antibacterial agents (eg, unlikely cross-resistance with other antimicrobials)

Understand that linezolid is a therapeutic option for resistant gram-positive organisms

Plan appropriate monitoring (eg, blood counts) in patients receiving oxazolidinone therapy

## **17. Streptogramin**

Understand that quinupristin/dalfopristin is a therapeutic option for treating *Enterococcus faecium* infection

## **B. Antiviral therapy**

### **1. Acyclovir**

Understand the mechanism of action of acyclovir

Recognize that high-dose acyclovir is appropriate in the treatment of varicella zoster infections

Know the indications for acyclovir therapy

Identify the clinical manifestations of acyclovir toxicity (eg, renal failure, CNS symptoms)

Know the mechanism of resistance to acyclovir, and the circumstances under which it occurs

Plan alternative antiviral therapy when acyclovir resistance occurs

Know that valacyclovir may be an alternative to intravenous or oral acyclovir therapy

### **2. Ganciclovir**

Understand the mechanism of action of ganciclovir

Know the major adverse effects of ganciclovir

Know the mechanism of resistance of CMV to ganciclovir, and plan alternative antiviral therapy when it occurs

Know oral antiviral therapies are suitable for maintenance therapy of CMV retinitis in immunocompromised hosts

Know that valacyclovir may be an alternative to intravenous or oral ganciclovir therapy

### **3. Foscarnet**

Know the viruses against which foscarnet is active

Know the indications for use of foscarnet

Know the adverse effects of foscarnet, including in patients with ganciclovir-resistant cytomegalovirus infection

### **4. Trifluorothymidine**

Know the viruses against which trifluorothymidine is active

Know the indications for trifluorothymidine

### **5. Ribavirin**

Understand the mechanisms of action of ribavirin

Know the spectrum of activity of ribavirin and that resistance does not occur

Appreciate the differences between the deposition and systemic absorption of aerosolized ribavirin, and the relative concentrations of ribavirin during aerosolized treatment in the secretions compared to serum

Know the adverse effects associated with aerosolized and intravenously administered ribavirin

Understand the guidelines for ribavirin therapy, including types of patients and diseases for which it is and is not indicated and duration of therapy

### **6. Amantadine/Rimantadine**

Understand the mechanisms of action and spectrum of activity of amantadine/rimantadine

Know the indications for prophylactic and therapeutic uses of amantadine/rimantadine

Know the potential toxicity and adverse reactions to amantadine/rimantadine, including predisposing factors

Appreciate the importance (including frequency and timing) of the development of resistance by influenza A viruses during treatment and prophylaxis with amantadine/rimantadine

Evaluate the expected effectiveness of prevention of influenza infection in various circumstances by amantadine/rimantadine, including use with immunization against influenza A virus

## **7. Inhibitors of neuraminidase (eg, oseltamivir)**

Know the mechanism of action of neuraminidase inhibitors (eg, oseltamivir)

## **8. Cidofovir**

Understand the mechanism of action of cidofovir

Recognize the adverse effects and toxicity of cidofovir

Know the possible indications for cidofovir therapy

## **9. HIV-nucleoside analogue reverse transcriptase inhibitors**

### **a. Zidovudine (ZDV)**

Understand the mechanism of action of zidovudine (ZDV) against human immunodeficiency virus

Know the clinical indications for and anticipated efficacy of zidovudine (ZDV) therapy

Recognize the manifestations of adverse effects and toxicity versus resistance to zidovudine (ZDV)

Understand the disadvantages of single drug therapy with zidovudine (ZDV)(development of resistance, toxicity) and advantages of combination (ie, sequential) therapies

### **b. Dideoxyinosine (ddI)**

Know the mechanism of action of dideoxyinosine (ddI)

Know the adverse effects and toxicity of dideoxyinosine (ddI)

Know the clinical indication for administration and anticipated efficacy of dideoxyinosine (ddI) therapy in children

### **c. Dideoxycytidine (ddC) (Zalcitabine)**

Know the mechanism of action of dideoxycytosine (ddC)

Know the adverse effects and toxicity of dideoxycytosine (ddC) in children versus adults

Know the possible indications for dideoxycytosine (ddC) therapy for children

**d. Lamivudine (3TC)**

Know the mechanism of action of lamivudine (3TC)

Know the adverse effects and toxicity of lamivudine (3TC) in children versus adults

Know the possible indications for lamivudine (3TC) therapy for children

Understand the role of lamivudine (3TC) in the treatment of hepatitis B

**e. Abacavir**

Understand the mechanism of action of abacavir

Recognize the adverse effects and toxicity of abacavir

Know the possible indications for abacavir therapy

**f. Tenofovir**

Understand the mechanism of action of tenofovir

Recognize the adverse effects and toxicity of tenofovir

Know the possible indications for tenofovir therapy

**g. Stavudine**

Understand the mechanism of action of stavudine

Recognize the adverse effects and toxicity of stavudine

Know the possible indications for stavudine therapy

**10. HIV-non-nucleoside reverse transcriptase inhibitors**

**a. Efavirenz**

Understand the mechanism of action of efavirenz

Recognize the adverse effects and toxicity of efavirenz

Know the possible indications and contraindications for efavirenz therapy

## **b. Nevirapine**

Understand the mechanism of action of nevirapine

Recognize the adverse effects and toxicity of nevirapine

Know the possible indications for nevirapine therapy

## **11. Inhibitors of HIV-1 protease (eg, indinavir, ritonavir, saquinavir)**

Know the mechanism of action of HIV-1 protease inhibitors (indinavir, ritonavir, saquinavir, amprenavir, atazanavir, lopinavir, nelfinavir)

Know the adverse effects and toxicity of HIV-1 protease inhibitors (indinavir, ritonavir, saquinavir, amprenavir, atazanavir, lopinavir, nelfinavir)

Know the possible indications for HIV-1 protease inhibitor therapy (indinavir, ritonavir, saquinavir, amprenavir, atazanavir, lopinavir, nelfinavir) for children

## **C. Antifungal therapy**

### **1. Amphotericin**

Understand the mechanisms of action (sterol binding) for amphotericin

Understand the pharmacology for amphotericin, including lipid-complexed preparations, and the route of elimination

Evaluate indications for in vitro testing for fungal susceptibility to amphotericin (clinical failure)

Know the clinical situations/pathogens when amphotericin is the drug of choice (Aspergillus, systemic candidiasis, severe coccidioidomycosis, Cryptococcosis, disseminated histoplasmosis, mucormycosis)

Recognize adverse effects and toxicities of amphotericin (potassium loss, anaphylaxis, fever, nephrotoxicity)

Know topical use of amphotericin (peritoneal, bladder infections)

Identify amphotericin-resistant fungi (eg, *C. lusitaniae*, *Trichosporon*, *Fusarium*, *Pseudoallescheria boydii*)

Know the advantages/disadvantages of various amphotericin compounds

### **2. Flucytosine**

Know the spectrum of antifungal activity and pharmacologic properties of flucytosine

Recognize that flucytosine alone is not the drug of choice for any fungal

infection because of intrinsic resistance or development of resistance

Recognize the mechanism/manifestations of flucytosine toxicity (gastrointestinal, bone marrow)

Know the route of administration and elimination of flucytosine

Understand the indications for use of flucytosine (in combination with amphotericin B for treatment of cryptococcal and candidal meningitis)

Know the mechanism of action of flucytosine

### **3. Imidazoles**

Know the spectrum of activity, absorption, and pharmacokinetics of itraconazole

Know the spectrum of activity, pharmacokinetics, and interactions of fluconazole (IV and oral use, CNS penetration, need for gastric acidity, no effect on testosterone or cortisol)

Understand pathogens against which itraconazole has been used successfully (eg, Cryptococcus, Histoplasma, Aspergillus, Candida)

Recognize the clinical indications for the use of fluconazole

Recognize the clinical indications for the use of itraconazole

Know the spectrum of activity, absorption, and pharmacokinetics of voriconazole

Recognize the pathogens against which voriconazole therapy has been used successfully

Recognize the clinical indications for the use of voriconazole

### **4. Echinocandins**

Understand the mechanism of action of caspofungin acetate

Know the spectrum of antifungal activity and pharmacologic properties of caspofungin

Recognize the mechanism/manifestations of caspofungin toxicity

Know the route of administration and elimination of caspofungin

Understand the indications for use of caspofungin

### **5. Topical and other antifungal agents**

Know the use of topical drugs/treatments for superficial fungal infections (clotrimazole, ketoconazole, micronazole, cystatin, tolnaftate, terbinafine,

gentian violet, sodium thiosulfate)

Know the appropriate use of griseofulvin

Know the important drug interactions for and adverse effects of griseofulvin

Know the spectrum of activity, absorption, and pharmacokinetics of terbinafine

Recognize the pathogens against which terbinafine therapy has been successfully used

Recognize the clinical indications for the use of terbinafine

## **D. Antiprotozoal/antiparasitic therapy**

### **1. Albendazole**

Know the role of albendazole in the treatment of echinococcal infection and neurocysticercosis

### **2. Atovaquone and proguanil**

Know the pharmacologic properties of atovaquone

Know the spectrum of activity, pharmacokinetics, and interactions of atovaquone

Know the clinical indications for atovaquone therapy

Know the pharmacologic properties of proguanil (malarone)

Know the spectrum of activity, pharmacokinetics, and interactions of proguanil (malarone)

Know the clinical indications for proguanil (malarone) therapy

### **3. Chloroquine**

Know the adverse effects of chloroquine therapy

### **4. Dapsone**

Know the clinical indications for the use of dapsone therapy

### **5. Furazolidone**

Know the clinical indications for the use of furazolidone therapy (eg, giardiasis, cholera)

Recognize the clinical manifestations of furazolidone toxicity

**6. Iodoquinol**

Know the clinical indications for the use of iodoquinol therapy (eg, amoebiasis, D.fragilis)

Know that iodoquinol is lumenicidal for intestinal amoebiasis

Recognize the clinical manifestations of iodoquinol toxicity (optic neuritis)

**7. Lindane**

Recognize the clinical manifestations of lindane toxicity

**8. Mebendazole**

Know that mebendazole is effective therapy for echinococcosis, trichinosis, hookworm, Ascaris, and trichuris infestation

**9. Mefloquine**

Plan therapy for a patient with chloroquine-resistant malaria (mefloquine)

Understand the contraindications for the use of mefloquine therapy (eg, age, weight)

**10. Niclosamide**

Know the adverse effects of niclosamide

**11. Praziquantel**

Know the indications for the use of praziquantel (eg, neurocysticercosis, fluke infestation, schistosomiasis, tapeworm infestation)

**12. Primaquine**

Know the role of primaquine in malaria prophylaxis and treatment

**13. Pyrantel pamoate**

Know that pyrantel pamoate is effective therapy for pinworm, hookworm, ascaris infestation

**14. Pyrimethamine**

Know the adverse effects of pyrimethamine

**15. Quinacrine**

Know the role of quinacrine in the management of a patient with giardiasis and/or toxoplasmosis

Recognize side effects associated with quinacrine therapy

**16. Quinidine gluconate**

Know the indications for parenteral quinidine gluconate in the treatment of malaria

Recognize the clinical manifestations of quinidine gluconate toxicity

**17. Spiramycin**

Know the possible role for spiramycin in the treatment of toxoplasmosis

**18. Thiabendazole**

Know the indications for thiabendazole in patients with localized and disseminated Strongyloides infestation

**19. Ivermectin**

Know the clinical indications for the use of ivermectin therapy

**20. Paromomycin**

Know the pharmacologic properties of paromomycin

Know the spectrum of activity, pharmacokinetics, and interactions of paromomycin

Recognize the clinical indications for the use of paromomycin therapy

**21. Nitazoxanide**

Know the pharmacologic properties of nitazoxanide

Know the spectrum of activity, pharmacokinetics, and interactions of nitazoxanide

Recognize the clinical indications for the use of nitazoxanide therapy

**22. Artesunate**

Know the pharmacologic properties of artesunate

Know the spectrum of activity, pharmacokinetics, and interactions of artesunate

Recognize the clinical indications for the use of artesunate therapy

**E. Antimycobacterial drugs**

**1. Isoniazid**

Know the antimycobacterial properties of isoniazid, including action and

primary site of activity

Recognize that resistance to isoniazid can occur and those circumstances in which its incidence is increased

Know the pharmacologic properties of isoniazid, including relative cerebrospinal fluid concentration, metabolism, and elimination

Recognize the clinical manifestations, risk factors (including age), and indications for monitoring for hepatotoxicity caused by isoniazid therapy

Know the indications for pyridoxine supplementation for patients receiving isoniazid

Recognize the interaction of isoniazid with other drugs administered concomitantly (eg, phenytoin)

## **2. Pyrazinamide**

Know the antibacterial properties of pyrazinamide, including action and primary site of activity

Know the pharmacologic properties of pyrazinamide, including gastrointestinal absorption and distribution in body fluids

Know the adverse effects of pyrazinamide therapy

## **3. Other**

Know the indications for and toxicity of streptomycin therapy in patients with suspected or proven tuberculosis

Know the indications for and toxicity of ethambutol therapy in patients with suspected or proven tuberculosis

Know the indications for and toxicity of ethionamide therapy in patients with suspected or proven tuberculosis

Know the indications for and toxicity of capreomycin therapy in patients with suspected or proven tuberculosis

Know the indications for and toxicity of clofazimine therapy in patients with suspected or proven tuberculosis

Know the indications for and toxicity of para-aminosalicylic (PAS) therapy in patients with suspected or proven tuberculosis

Know the indications for and toxicity of cycloserine therapy in patients with suspected or proven tuberculosis

Plan therapy for a child with a multi-drug resistant strain of *Mycobacterium tuberculosis*

## **F. Immunomodulators/biologic modulators**

### **1. Monoclonal antibodies to inflammation-inducing cytokines**

Recognize the situations in which monoclonal antibodies to specific cytokines have potential benefits, and understand the potential immunologic mechanisms for such benefits

### **2. Antagonists to inflammation-inducing cytokines**

Recognize situations in which specific antagonists (eg, monoclonal antibodies, soluble receptor antibodies) to inflammation-inducing cytokines may have beneficial effects, and the potential complications of such therapy

### **3. Pharmacologic inhibitors of inflammation**

Recognize situations in which pharmacologic inhibitors of inflammation (eg, corticosteroids, cyclo-oxygenase inhibitors) have beneficial effects

### **4. Interferon**

Know the three types of interferon and their main cellular origins

Know the major mechanisms of action of interferons and their role in host response to infection

Know the indications for interferons for therapy of infectious diseases in humans

Recognize the adverse effects of interferon therapy

### **5. Interleukins**

Know the major effects of IL-2, -7, and -12 and the Th2 cytokines (IL-4, -5, -13), and their roles in the host response to infection

Know the roles of IL-2, -7, and -12 and the Th2 cytokines (IL-4, -5, and -13) in the treatment of infectious diseases

### **6. Colony stimulating factors**

Recognize the adverse effects of granulocyte- and granulocyte/macrophage-colony stimulating factor therapy and their roles in the treatment of infectious diseases

### **7. Activated protein C**

Understand the use of recombinant activated protein C (drotrecogin alfa (activated)) in the management of severe septicemia

## **V. Prevention of Infectious Diseases**

## A. General principles

### 1. Active immunization

Differentiate T-cell independent from T-cell dependent antigens

Know the generic contraindications for immunizations, including those for live-virus vaccines

Know the recommendations for immunization in a child in whom one or more vaccines may be contraindicated, such as in the case of egg allergy, neomycin allergy, or concurrent illness (eg, deferral, alternate schedules)

Know which vaccines are contraindicated in a child who has recently received immune globulin and for how long

Know the requirements for health care providers giving immunizations for record keeping, reporting of adverse events, and distribution of vaccine information materials (National Childhood Vaccine Injury Act)

Know the recommendations for immunization of preterm infants

Know the recommendations for immunization of immunocompromised patients and their household contacts, such as children with malignancy receiving chemotherapy, transplant recipients, or patients taking corticosteroids

Know the recommendations for immunization of an HIV-infected patient and their household contacts

Know the vaccines to be considered for foreign travel (eg, typhoid, Japanese encephalitis, cholera, yellow fever)

Know which vaccines can be administered concurrently and guidelines for appropriate spacing of vaccines given at separate times (ie, two live-virus vaccines)

Know the principles for planning a vaccine schedule for healthy infants and children not immunized or incompletely immunized in the first year after birth

Know how to proceed with vaccine administration if the schedule is interrupted

Know the effect of active immunization with available childhood vaccines on carriage of the related microorganisms

Recognize common adverse reactions to vaccines

### 2. Passive immunization

Know the differences in preparation and composition between immune globulin (IG) for intramuscular administration and that for intravenous

administration (IVIG)

Know the precautions in the use of IG and IVIG

Know the adverse reactions to IG and IVIG

Know the risk of administration of antibody-containing products prepared from animal sera

Know the duration of protection following IG or IVIG administration against specific diseases

Know the interval after IG or IVIG administration before specific vaccines (eg, live-virus vs protein vaccines) can be effectively given

Know the indications for use of IG or IVIG

Understand which classes of vaccines (ie, live vs attenuated) are affected by passive immunization

### **3. Chemoprophylaxis**

Know the indications and recommended duration of chemoprophylaxis for surgical wound infections

## **B. Active immunizations**

### **1. Diphtheria**

Know the efficacy of diphtheria vaccine for prevention of disease and effect on *C. diphtheriae* colonization/carriage

Plan a routine schedule for diphtheria immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if the schedule has been interrupted

Know the duration of immunity following diphtheria immunization, and the recommendations for routine booster doses

Recognize the adverse effects of diphtheria immunization at different ages

Know the contraindications and precautions for diphtheria immunization, including administration during concurrent illness

Manage a patient who has been exposed to diphtheria, including immunization and other therapy

### **2. Tetanus**

Know the composition of tetanus vaccine, including nature of antigen(s) and adjuvants

Know the efficacy of tetanus vaccine, assuming completion of the primary series and recommended booster doses

Plan a routine schedule for tetanus immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted

Know the duration of immunity following tetanus immunization, and the recommendations for booster doses

Recommend tetanus immunization for a patient preparing for foreign travel based on past history of immunization and nature of the patient's trip

Recognize the adverse effects of tetanus immunization, including risks from excessive immunization

Assess the need for tetanus immunization (including passive and active) in a patient with a wound, based on prior immunization history

### **3. Pertussis**

Know the composition of different pertussis vaccines, including major antigens, adjuvants, and different product(s), (ie, whole-cell and acellular vaccines)

Know the efficacy of pertussis vaccine, including differences based on definition of illness

Plan a routine schedule for pertussis immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted

Recognize the adverse effects of pertussis immunization, including their approximate frequency (common, occasional, rare) and their timing following immunization

Understand the temporal and possible causal (or lack thereof) relationship between pertussis immunization and acute and chronic neurologic events

Know the contraindications and precautions for pertussis (whole cell, acellular) immunization, including administration during concurrent illness

Recommend immunization for a patient who has a contraindication (or precaution) for pertussis immunization (whole cell, acellular)

Understand the limitations of current timing of pertussis immunization schedule in prevention of pertussis (eg, disease in very young infants and adolescents)

Know the clinical efficacy, safety, and appropriate use of acellular pertussis vaccines

### **4. Poliovirus**

Know the composition of oral (OPV) and inactivated (IPV) poliovirus vaccines, including nature of antigen(s) and vaccine constituents (eg, neomycin, streptomycin)

Know the efficacy of different poliovirus vaccines in prevention of disease and induction of gastrointestinal tract immunity (ie, prevention of carriage)

Interpret the finding of poliovirus in the stool of a patient in different circumstances (eg, recent vaccination, presence or absence of symptoms), and determine if further tests are indicated (eg, CDC testing)

Plan a routine schedule for poliovirus immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted

Know the duration of immunity following poliovirus immunization, and the resulting need (or lack thereof) for routine booster doses

Plan poliovirus immunization schedule for a patient preparing to travel to an endemic area

Know the adverse effects of poliovirus immunization, including relative frequency according to number of doses and from contact with vaccine recipient

Know the contraindications and precautions for poliovirus immunization, including administration during concurrent illness

Know the indications for poliovirus vaccines

Manage a patient who requires poliovirus immunization because of special circumstances (eg, exposure to disease, outbreak control, immunocompromised patient, HIV-infected patient and their siblings, pregnancy, prematurity, unimmunized adult contacts)

Recognize the adverse effects of inactivated poliovirus vaccine

Understand the possible effect of inactivated poliovirus vaccine on subsequent shedding of revertant vaccine poliovirus

Understand the epidemiology and the relative importance of vaccine-associated paralytic poliomyelitis (VAPP) and circulating vaccine-derived poliovirus (cVDPV)

## **5. Measles**

Know the composition of measles vaccine, including its nature, tissue culture source, and vaccine constituents

Know the immunogenicity and potential efficacy of measles vaccine in the prevention of infection

Know the indications for administering measles vaccine at different ages (12 to 15 months vs 6 to 9 months) in different epidemiologic circumstances

Plan a routine schedule for measles immunization, including age of the patient, number of doses, and intervals and their reasons

Understand the reasons for a second dose of measles vaccine

Recognize the reasons for measles vaccine failure, including the difference between primary and secondary failures

Recommend a measles immunization schedule for a patient preparing to travel to an endemic area

Recognize the frequency and timing of adverse effects of measles immunization

Know the contraindications and precautions for measles immunization, including administration during concurrent illness

Manage a patient who has a contraindication (or precaution) for measles immunization

Manage a patient who requires measles immunization because of special circumstances (eg, exposure to disease, outbreak control, immunocompromised patient, HIV-infected patient and their siblings, pregnancy, receipt of IG)

Recommend immunoprophylaxis (IG or vaccine) following measles exposure in the household and in a community outbreak

Understand possible benefits and adverse effects of high-titer Edmonston-Zagreb measles vaccine

## **6. Mumps**

Know the composition of mumps vaccine, including nature of antigen and vaccine constituents

Know the effectiveness of mumps vaccine in disease prevention

Know the recommended schedule for mumps vaccination

Know the reasons why young adults may be susceptible to mumps

Recognize the frequency and timing of adverse reactions to mumps immunization and their frequency

Know the contraindications and precautions for mumps immunization, including administration during concurrent illness

## **7. Rubella**

Know the composition of rubella vaccine, including nature of antigens and tissue culture source

Know the effectiveness of rubella vaccine in disease prevention

Plan a routine schedule for rubella immunization, including age of initiation

Know the duration of immunity following rubella immunization, and the resulting need (or lack thereof) for routine booster doses

Recognize the adverse reactions to rubella immunization, including timing of occurrence, age- and gender-related frequency (ie, arthritis/arthralgia), and prognosis (ie, duration)

Know the contraindications and precautions for rubella immunization, including administration during pregnancy

Counsel a pregnant woman who inadvertently receives rubella vaccine or whose child receives rubella vaccine (eg, risk or lack thereof)

Manage a patient who has a contraindication (or precaution) for rubella immunization

Manage a patient who is found to be seronegative for rubella during pregnancy (ie, postpartum immunization)

Recognize that rubella vaccine administered to a mother who is breast feeding her infant can be transmitted to the infant and know the consequences

## **8. Hemophilus influenzae type b**

Know the composition of Hemophilus influenzae type b vaccines, including nature of antigen(s), source, adjuvants, chemicals, and different product(s)

Know the efficacy of Hemophilus influenzae type b vaccine

Plan a routine schedule for Hemophilus influenzae type b immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted

Know the indications for Hemophilus influenzae type b vaccination in persons older than 60 months of age

Know the recommended schedule of Hemophilus influenzae type b (Hib) immunization for patients with underlying conditions predisposing to Hib disease

Recognize the adverse effects of Hemophilus influenzae type b immunization with polysaccharide and conjugate preparations

Recommend rifampin chemoprophylaxis for household and day-care

contacts of patients with invasive Hemophilus influenzae type b disease, based on the immunization status of the contacts

## 9. Hepatitis B

Know the composition of hepatitis B vaccine, including nature of antigen(s) and source

Know the recommended site of administration of hepatitis B vaccine for children and adults

Know the efficacy of hepatitis B vaccine

Understand the rationale of universal infant immunization against hepatitis B

Know the indications for serologic testing for hepatitis B in previously vaccinated persons

Know the indications for revaccination for hepatitis B for patients who do not respond to the initial series

Know the approach to patients who have the potential not to respond to hepatitis B vaccine

Know that hepatitis B immunization is ineffective in persons who are chronic carriers (HBsAg-positive)

Manage a patient who requires hepatitis B immunization because of exposure to disease or a chronic carrier in the household or through sexual contact

Know the indications for immunizing young adults against hepatitis B, including those traveling to areas with high incidences of hepatitis B infection

Know the proper use of hepatitis B immune globulin and hepatitis B vaccine in postexposure prophylaxis, including health care workers who have been previously immunized

Plan the schedule of immunization for hepatitis B (active and passive), including the specific timing of hepatitis B immune globulin and hepatitis B vaccine in the neonate born to a mother who is a chronic carrier (HBsAg-positive)

Plan a routine schedule for hepatitis B immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted

Know the duration of immunity following hepatitis B immunization, and the resulting need (or lack thereof) for booster doses

Recognize the possible adverse effects of hepatitis B immunization

## 10. Influenza

Know the composition of influenza vaccine, including nature of antigen(s) (split- vs whole-virus), source, and different product(s)

Know the effectiveness of influenza vaccine

Plan a routine schedule, including type of vaccine according to age, for influenza immunization, including age of the patient, number of doses and intervals and their reasons based on past history of immunization

Know the frequency and timing of adverse effects of influenza immunization

Know the contraindications and precautions for influenza immunization

Plan the management of a patient who has a contraindication (or precaution) for influenza immunization and is at increased risk for influenza

Manage a patient who requires influenza immunization because of special circumstances (eg, exposure to disease, outbreak control, immunocompromised patient, HIV-infected patient and their siblings, pregnancy)

Plan the appropriate use of cold-adapted influenza immunization

## 11. Streptococcus pneumoniae

Know the composition of pneumococcal vaccines, including nature of antigen(s)

Know the age-related immunogenicity and effectiveness of pneumococcal vaccines

Know the advantages/disadvantages of protein-conjugated and polysaccharide pneumococcal vaccines

Plan a routine schedule for Streptococcus pneumoniae immunization, including age of the patient, number of doses and intervals and their reasons, and recommendation if schedule has been interrupted

Recommend the schedule for pneumococcal immunization in a child 24 to 59 months of age who is at high risk of invasive pneumococcal disease, based upon the number of previous doses of pneumococcal vaccine received

Recommend the schedule for pneumococcal vaccination in a patient who will be undergoing splenectomy

## 12. Neisseria meningitidis

Know the composition of meningococcal vaccine, including nature of

antigen(s)

Know the indications for meningococcal vaccine, including use of the vaccine in outbreaks and as a possible adjunct to chemoprophylaxis (for close contacts of patients with invasive disease)

Know the age-related immunogenicity and effectiveness of meningococcal vaccine

### **13. Rabies**

Know the composition of rabies vaccine, including nature of antigen(s)

Know the indications for pre-exposure prophylaxis for rabies, including travel to endemic areas

Know the factors important in the decision about whether to initiate postexposure rabies prophylaxis: type of exposure (bite, saliva in open wound, etc), type of biting animal, particular geographic area, provoked or unprovoked attack

Plan the postexposure prophylaxis of rabies: washing of the wound with soap, administration of human rabies immune globulin (HRIG), initiation of the human rabies vaccine series

Know the frequency and timing of adverse reactions to rabies immunization

### **14. Salmonella typhi**

Know the composition of typhoid vaccines, including nature of antigens and different products

Know the indications for typhoid vaccines, including travel to an endemic area

Know the duration of immunity following typhoid immunization, and the resulting need (or lack thereof) for booster doses

Know the adverse reactions, contraindications, and precautions for typhoid immunization, including administration during concurrent illness

### **15. Mycobacterium tuberculosis**

Know the composition of BCG vaccine, including nature of antigen(s)

Know the possible efficacy of BCG vaccine when given at different ages for prevention of different types of tuberculosis (pulmonary vs extrapulmonary)

Know the indications for BCG immunization (eg, child born in another country), and the resulting need (or lack thereof) for booster doses

Recognize the adverse reactions to BCG immunization

Interpret the meaning of a TST in a patient who has received BCG vaccination

## **16. Varicella**

Know the composition of varicella vaccine

Know the immunogenicity and efficacy of varicella vaccine at different ages

Know the reasons for and concern about universal varicella immunization

Recognize the frequency and timing of adverse effects of varicella immunization

Know the contraindications and precautions for varicella immunization

## **17. Hepatitis A**

Know the composition of hepatitis A vaccine, including nature of antigens, source, adjuvants, chemicals, and different products

Know the efficacy of hepatitis A vaccine

Know the indications for hepatitis A vaccine

## **18. Smallpox vaccine (vaccinia)**

Know the composition of smallpox vaccine

Identify the clinical characteristics indicative of successful primary smallpox immunization

Recognize and manage the complications of smallpox vaccination

Know the contraindications and precautions for smallpox vaccination (severe eczema, immunosuppressed patients, pregnancy)

## **C. Passive immunoprophylaxis**

### **1. Hepatitis A**

Know the special products used for passive immunoprophylaxis for hepatitis A

Know the indications and timing for passive immunoprophylaxis for hepatitis A

Understand the efficacy of passive immunoprophylaxis for hepatitis A, including timing after exposure and duration of protection

Know the role of active and passive immunizations for hepatitis A

## **2. Hepatitis B**

Know the special products used for passive immunoprophylaxis for hepatitis B (ie, hyperimmune globulin)

Know the indications and timing for passive immunoprophylaxis for hepatitis B

Understand the efficacy of passive immunoprophylaxis for hepatitis B and the rationale for concurrent active immunization

## **3. Measles**

Know the products used for passive immunoprophylaxis for measles

Know the indications and timing for passive immunoprophylaxis for measles

Understand the rationale of passive immunoprophylaxis for measles following exposure

## **4. Varicella**

Know the special products used for passive immunoprophylaxis for varicella (ie, VZIG)

Know the indications and timing for passive immunoprophylaxis for varicella

Understand the efficacy and rationale of passive immunoprophylaxis for varicella, including newborn infants whose mothers have varicella

Recognize the effects of passive immunoprophylaxis for varicella on disease recurrence (ie, delay in onset, amelioration of infection)

## **5. Rabies**

Know the special products used for passive immunoprophylaxis for rabies

Know the indications and timing for passive immunoprophylaxis for rabies, in combination with active immunization

## **6. Tetanus**

Know the special products used for passive immunoprophylaxis for tetanus

Know the indications and timing for passive immunoprophylaxis for tetanus in wound management in combination with active immunization

## **7. Cytomegalovirus**

Plan the appropriate use of cytomegalovirus hyperimmune globulin in transplant recipients

**8. Respiratory syncytial virus**

Know the efficacy and potential uses of monoclonal antibodies in the prevention and treatment of respiratory syncytial virus infection

**9. Vaccinia immune globulin**

Know the indications for the use of vaccinia immune globulin (VIG) for the treatment of complications of smallpox vaccine and for the prevention of smallpox

**VI. Immunity and Host Defense**

**A. Barriers**

Know the mechanical barriers important to host defense (eg, cilia, nonspecific and secretory IgA on mucosa, vascular perfusion)

Know the physical barriers important to host defense (eg, skin, mucous membranes)

Know the chemical barriers important to host defense (eg, pH of vagina and stomach; fatty acids in skin and stomach; defensins and other peptides; nonspecific and secretory IgA on mucosa)

**B. Humoral**

**1. Secretory antibodies**

Understand the properties of secretory antibodies in host defense

Understand the mechanism of action of secretory antibodies in host defense

**2. Circulating antibodies**

Know the mechanism of action in host defense of circulating antibodies

Recognize age-related changes that occur in serum IgG, IgM, and IgA concentrations

Recognize age-related occurrence and laboratory abnormalities of transient hypogammaglobulinemia

Plan the laboratory evaluation in a patient with suspected X-linked agammaglobulinemia, and interpret the results

**3. Complement**

Understand the role of complement in host defense

Understand the mechanisms that initiate and control activity of the complement system

Know laboratory assays used to measure serum complement concentrations (eg, total hemolytic component vs specific component concentrations)

#### **4. Other**

Recognize that opsonization may be mediated by mannose-binding protein and C-reactive protein

Recognize humoral factors that are important in opsonization

### **C. Phagocyte function**

#### **1. General**

Understand the role of adherence in phagocyte function

Understand the role of chemotaxis in phagocyte function

Understand the mechanisms of phagocyte ingestion and killing

#### **2. Polymorphonuclear neutrophils**

Recognize the significance of a leftward shift of PMNs on blood smear

Understand the significance of release of PMNs from bone marrow and how it affects host defense

Understand the significance of release of PMNs from the marginal pool and how it affects host defense

Know the usual cause to consider when specific abnormalities occur in the peripheral blood leukocyte count (eg, lymphocytosis, atypical lymphocytes, eosinophilia, neutropenia, leukemoid reactions)

Plan an appropriate diagnostic evaluation for leukocyte adhesion defect

#### **3. Macrophages**

Understand the need for macrophage activation to mediate effective host defense

Understand how macrophages function and what diseases are associated with defective function

#### **4. Dendritic cells**

Understand the importance of dendritic cells in the initiation of adaptive immunity

## **D. Cell-mediated immunity**

Know that cell-mediated immunity is dependent upon the interaction of T cells with macrophages and dendritic cells

Recognize what T-cell, macrophage, and microbial factors are capable of inducing macrophage activation

Recognize the subsets of T cells and how they function

Plan an evaluation of T-cell function

Know the age-related ranges for various types of peripheral blood mononuclear cells

## **E. Toll-like receptors**

Understand the role of toll-like receptors in the recognition of pathogen-derived molecules (eg, lipopolysaccharide, bacterial flagellin) and in influencing the immune response to infection

## **F. Other**

Understand which of the mechanisms of host defense are active in protecting against extracellular bacteria (eg, pyogens)

Understand which of the mechanisms of host defense are active in protecting against fungi (neutrophils, cellular immunity)

Understand which of the mechanisms of host defense are active in protecting against Chlamydia

Understand which of the mechanisms of host defense are active in protecting against intracellular pathogens (eg, mycobacteria, viruses)

Understand which of the mechanisms of host defense are active in protecting against protozoa

Understand which of the mechanisms of host defense are active in protecting against toxin-mediated illnesses

## **VII. Mechanisms of Infectious Disease**

### **A. Normal flora**

Know the normal flora of a full-term newborn infant and the timing of colonization

Compare the intestinal and skin flora of infants in an intensive care nursery with the flora of full-term infants in a normal infant nursery

Identify possible factors in different patterns of neonatal colonization in patients receiving intensive care, including human milk

Recognize likely organisms in the normal flora at different body sites of normal hosts (eg, skin, oral mucous membranes, respiratory tract, conjunctivae, upper gastrointestinal tract, lower gastrointestinal tract, genitourinary tract)

Appreciate the difference between transient and resident skin flora of hands in hospital employees

Know the role of bacterial interference in the establishment of host flora

## **B. Bacteria**

Recognize the bacterial properties that promote evasion of or deter phagocytosis (eg, polysaccharide capsule)

Recognize the bacterial constituents particularly active in promoting inflammation (eg, teichoic acid, endotoxins)

Recognize intracellular bacteria (*Brucella*, *Pasteurella*, *Listeria*, mycobacteria), and how they resist elimination by the host

Recognize extracellular bacteria (eg, streptococci, pneumococci, *H. influenzae*) and how they resist elimination by the host

Understand the role of humoral immunity in bacterial infection

Understand the mechanism of clearance of bacteria by neutrophils and monocytes

## **C. Virus**

Know that viruses have proteins or glycoproteins on their surface which attach to specific receptor sites on cell surfaces, and that tropism for particular tissues is influenced by the surface attachment protein or glycoprotein and the cell surface receptor

Know that viruses may cause a lytic or nonlytic infectious cycle in a cell, yet still cause cell damage or immunoevasion

Know that the host immune response may be important in producing clinical disease by immunopathologic damage of tissues (eg, EBV, postinfectious encephalitis, RSV)

Know that viruses can become latent in cells by integrating into the host cell genome or by remaining as an episome in the cytoplasm of the cell

Understand how viruses cause disease: replicating in surface mucous membrane cells, reaching regional lymph nodes and then spreading through the blood stream (viremia) to seed target organs

Know the viruses that cause chronic and/or latent infection

Know the major steps in the viral replication cycle and which ones are targets for antiviral and interferon therapy

Know that humoral immunity is important for recovery from some viral infections, particularly enteroviruses

Know that cell-mediated immunity is important for recovery from most viral infections

Know the viral infections that can be severe and/or chronic in patients with antibody deficiency

Know the viral infections that can be severe and/or chronic in patients with impaired cell-mediated immunity

Recognize that new viral antigens appearing on cell surfaces are important triggers for host humoral and cell-mediated immunity

Understand the mechanism of mucosal and/or serum antiviral antibody in resistance to reinfection and efficacy of viral vaccines

Know the viruses etiologically associated with cancer in humans

## **D. Parasites**

Recognize the principles of induction of inflammation by parasites (eg, eosinophilia)

Know the mechanism of intracellular persistence of parasitic infestations

Identify immune deficiencies associated with parasitic infestations

## **E. Inflammation**

Know how cytokines (IL-1, IL-6, TNF-alpha) contribute to the inflammatory response

Understand the clinically relevant roles of neutrophils and macrophages and complement in inflammation

# **VIII. Infections in Special Circumstances**

## **A. Nosocomial infections**

### **1. Hospital environment**

Know the appropriate means of prevention (eg, effectiveness of various topically applied agents, infection control procedures to prevent nosocomial spread) of omphalitis/funisitis

Identify frequently encountered organisms that infect children in neonatal and pediatric intensive care units, and manifestations of infections they cause

Understand methods of transmission of bacterial pathogens in the hospital environment

Understand methods of transmission of viral pathogens in the hospital environment

Understand principles of standard precautions

Plan appropriate isolation procedures (strict, contact, airborne, and AFB isolation) to be used for hospitalized children with various categories of diseases

Understand the rationale for different isolation and barrier precautions for the prevention of transmission of microorganisms

Plan management of patients with draining lesions, including *S. aureus*, gut flora, chronic draining otitis media

Plan intervention in a hospital unit after patient exposure to pertussis

Plan intervention in various hospital units (eg, full-term nursery, NICU, general unit) after patient exposure to varicella

Plan intervention when an excessive number of cases of *C.difficile* or rotavirus infection occur

Know employee illnesses that preclude work (eg, conjunctivitis, diarrhea, vesicular rashes)

Plan investigation/intervention for hospital-associated gastroenteritis according to pathogen

Know predisposing factors to hospital-acquired infection (eg, catheter, intensive care exposure)

Know predisposing factors to surgical wound infections

Develop infection control strategies for neonatal nursery outbreaks of various infections (eg, MRSA, *Klebsiella*, varicella, RSV)

Know that bacteria causing nosocomial infection in neonatal and pediatric intensive care units may be resistant to commonly used antibiotics (eg, cephalosporin, aminoglycosides)

Develop infection control recommendations for management of patients with methicillin-resistant staphylococcal infections

Recognize infections caused by opportunistic pathogens in very-low-birth-weight infants in intensive care units (eg, coagulase-negative staphylococcus, *Candida*)

Recognize blood transfusion as a means of transmission of CMV to a very-low-birth-weight infant, and the means of prevention

Recommend infection control measures for a pediatric unit during an outbreak of RSV in the community

Recommend appropriate skin and cord care for a newborn infant

Recommend appropriate use of isolation rooms to prevent spread of infection

Know the risk of transmitting microbial agents via blood and blood products

Recognize the relative contamination rate for blood products

Know the importance of screening tests to detect microorganisms transmissible in blood products

Know the standard procedures for screening blood products for HIV

Develop infection control recommendations for a patient with a vancomycin-resistant enterococcal infection

## **2. Device-related infections**

Plan the management of a febrile patient with a prosthetic cardiac valve

Identify the organisms with which patients with urinary catheters become infected

Identify the organisms with which patients with intravascular catheters become infected

Identify the organisms with which patients with central nervous system catheters become infected

Identify the organisms with which patients with peritoneal catheters become infected

Recognize the clinical manifestations of infections in patients with urinary catheters

Recognize the clinical manifestations of infections in patients with intravascular catheters

Recognize the clinical manifestations of infections in patients with central nervous system catheters

Recognize the clinical manifestations of infections in patients with intraperitoneal catheters

Know the methods of diagnosis in patients with catheter-induced infection

Plan the management of a patient with a catheter-related infection (eg,

urinary, intravascular, central nervous system, peritoneal)

Recognize the complications of infection related to a catheter (eg, urinary, intravascular, CNS, peritoneal)

Know the prognosis, likelihood of cure, and complications depending on catheter site and organism causing catheter-related infection

Plan specific methods to control or prevent urinary catheter-related infections

Evaluate methods to control or prevent intravascular catheter-related infections (eg, relative risk by site, type of dressing)

Plan specific methods to control or prevent central nervous system catheter-related infections

Plan specific methods to control or prevent peritoneal catheter-related infections

Know the organisms to which patients undergoing hemo- or peritoneal dialysis are most susceptible (frequency or severity of infection)

Recognize the clinical manifestations of infections to which patients undergoing hemo- or peritoneal dialysis are most prone

Know specific measures, and their effectiveness, for prevention and control of infection and for chemoprophylaxis in patients undergoing hemo- or peritoneal dialysis

Evaluate methods to prevent or control infections as a result of mechanical ventilation

Recognize the clinical manifestations of infections as a result of mechanical ventilation, and manage appropriately

## **B. Child care**

Know the classification of child care and how it relates to infectious diseases (eg, center versus day-care home versus home care)

Know what diseases are acquired by adults from children who attend child-care centers (eg, CMV, hepatitis A, parvovirus), and the routes of transmission

Know what diseases are acquired by children from adults working in child-care centers (eg, tuberculosis)

Know the "exclusion policies" for child-care attendance and their rationale

Plan the management of child-care contacts when an attending child has hepatitis A

Plan the management of child-care contacts when an attending child has acute or chronic hepatitis B infection

Plan the management of child-care contacts when an attending child has diarrhea

Plan the management of child-care contacts when an attending child has bacterial meningitis

Recognize pathogens spread by respiratory secretions and the ability/inability to control spread in child-care center attendees

Recognize pathogens spread by the enteric route and the ability/inability to control spread in child-care center attendees

Recognize pathogens that can be spread by blood contact, including blood transfusion, in child-care center attendees

Recognize pathogens spread by skin contact and the ability/inability to control spread in child-care center attendees

Recognize the risks for adverse fetal outcome for a pregnant woman who is working in a child-care center and is exposed to children with transmissible infection (eg, parvovirus B19)

Plan outbreak control for a child-care center with multiple cases of diarrheal disease

Make recommendations, according to etiology, for a child-care center for control of herpes virus infections

Make recommendations for a child-care center for control of parvovirus B19 infections

Make recommendations for child-care center attendees and staff members for control of varicella

Make recommendations for a child-care center for control of lice infestation

Make recommendations to a child-care center for control of CMV infection

Make recommendations to a child-care center for control of varicella-zoster infection

Make recommendations for control of infectious diseases in a child-care center (eg, hand washing, food preparation, diaper changing)

### **C. Internationally adopted and immigrant children**

Know the infectious diseases which are of special importance to internationally adopted and immigrant children by country of origin (eg,

tuberculosis, hepatitis B, HIV)

Know what medical evaluation (including screening) internationally adopted and immigrant children should receive

Recognize the long-term consequences of infectious diseases that infect internationally adopted and immigrant children

Know the recommendations for family members after adoption of or immigration of an HBsAg-positive child

#### **D. Foreign travel**

Know indications for immune globulin for foreign travel

Recognize when malaria prophylaxis is necessary for foreign travel

Plan precautions to prevent enteric disease and hepatitis A during foreign travel

Know the most common etiologic agents and treatment for enteric disease during foreign travel

Recognize the likely pathogens causing enteric disease after return from foreign travel

Recommend specific vaccine administration prior to foreign travel (eg, MMR, Salmonella, cholera, Japanese encephalitis, poliovirus vaccines)

#### **E. Medical care personnel**

Make recommendations for medical care personnel who have had standard-care exposure to a patient with hepatitis A

Make recommendations for medical care personnel who have been exposed to a patient with hepatitis B

Make recommendations for medical care personnel who have been exposed to a patient with varicella

Make recommendations for medical care personnel who have been exposed to a patient with tuberculosis

Know methods to diminish needle-stick injury to medical personnel

Understand the risk of HIV transmission to medical care personnel by needle-stick injury

Make recommendations following needle-stick injury from a patient with HIV infection

Know risks of pregnant hospital care personnel for exposure to patients with CMV or parovirus B19 infections

Make recommendations for medical care personnel exposed to a patient with pertussis

Make recommendations for immunization of hospital personnel with varicella vaccine

## **F. Facilities for handicapped individuals**

Know what diseases children in facilities for the handicapped acquire in excess of the general population (eg, hepatitis A and B, diarrhea, CMV)

## **G. Bioterroristic threats**

Recognize the agents most likely to be used in bioterrorism (eg, smallpox, B. anthracis, C. botulinum, F. tularensis, Y. pestis) and their typical associated symptoms

Make recommendations for personnel regarding immunization and isolation of patients infected as a result of bioterrorism (eg, smallpox, B. anthracis, C. botulinum, F. tularensis, Y. pestis)

## **H. Zoonoses**

Plan the management of an animal bite, including wound care, immunoprophylaxis, and chemoprophylaxis (eg, by type of animal, site of bite, type of wound)

Identify infections acquired from direct or indirect contact with animals (eg, leptospirosis, tularemia, brucellosis)

Understand what animals characteristically carry infection-bearing vectors such as ticks and fleas (eg, rats/fleas/plague; deer/ticks/B. burgdorferi)

## **IX. Infections in High-risk Hosts**

### **A. Primary immunodeficiency**

#### **1. Leukocyte adhesion defects**

Recognize the usual presenting clinical features of leukocyte adhesion defects

Identify the usual microorganisms infecting patients with leukocyte adhesion defects

#### **2. Chronic granulomatous disease**

Recognize the usual presenting clinical features of chronic granulomatous disease

Identify the usual microorganisms infecting patients with chronic granulomatous disease

Plan a diagnostic evaluation for a patient with suspected chronic granulomatous disease

Plan specific long-term preventive therapy for a patient with chronic granulomatous disease (eg, trimethoprim with sulfamethoxazole, interferon-gamma)

### **3. Hyperimmunoglobulin E syndrome**

Recognize the usual presenting clinical features of hyperimmunoglobulin E syndrome

Identify the usual microorganisms infecting patients with hyperimmunoglobulin E syndrome

Plan a diagnostic evaluation for a patient with suspected hyperimmunoglobulin E syndrome

Plan specific long-term preventive therapy for a patient with hyperimmunoglobulin E syndrome

Recognize the usual presenting clinical features of and usual microorganisms infecting patients with Chediak-Higashi syndrome

### **4. Hyperimmunoglobulin M syndrome**

Recognize the usual presenting clinical features of hyperimmunoglobulin M syndrome

Identify the usual microorganisms infecting patients with hyperimmunoglobulin M syndrome

Plan a diagnostic evaluation for a patient with suspected hyperimmunoglobulin M syndrome

Plan specific long-term preventive therapy for a patient with hyperimmunoglobulin M syndrome

### **5. Neutropenia (congenital/cyclic)**

Recognize the usual presenting clinical features of congenital or cyclic neutropenia

Identify the usual microorganisms infecting patients with congenital or cyclic neutropenia

Recognize that neutropenia can be a manifestation of primary immunodeficiency involving B and T cells

### **6. Asplenia/hyposplenia**

Recognize conditions associated with asplenia/hyposplenia

Identify the usual microorganisms infecting patients with asplenia/hyposplenia

Plan a diagnostic evaluation for a patient with suspected asplenia/hyposplenia

Plan specific long-term preventive therapy for a patient with suspected asplenia/hyposplenia, including immunizations and antibiotics

## **7. X-linked agammaglobulinemia**

Identify the usual microorganisms infecting patients with X-linked agammaglobulinemia

Plan specific long-term preventive therapy for a patient with X-linked agammaglobulinemia

Recognize chronic enteroviral syndrome in a patient with X-linked agammaglobulinemia

Recognize chronic enteroviral syndrome in a patient with X-linked agammaglobulinemia

## **8. Selective IgA deficiency**

Identify the clinical manifestations suggestive of IgA deficiency

Understand the clinical significance of IgA deficiency

Recognize conditions associated with IgA deficiency

## **9. Common variable immunodeficiency**

Identify the usual microorganisms infecting patients with common variable immunodeficiency

Plan specific long-term preventive therapy for a patient with common variable immunodeficiency

Recognize the clinical manifestations of common variable immunodeficiency

## **10. Transient hypogammaglobulinemia of infancy**

Identify the usual microorganisms infecting patients with transient hypogammaglobulinemia of infancy

Recognize the laboratory abnormalities associated with transient hypogammaglobulinemia of infancy

## **11. Complement**

Recognize the usual presenting clinical features associated with complement component deficiency

Identify the usual microorganisms causing infection in complement deficient patients

Plan the laboratory diagnosis of complement deficiency

Plan specific long-term therapy for a patient with complement deficiency

## **12. Cell-mediated immunity**

Identify the clinical manifestations and usual microorganisms associated with severe combined immunodeficiency

Recognize the clinical manifestations and laboratory abnormalities associated with severe combined immunodeficiency

Identify the clinical manifestations and usual microorganisms associated with adenosine deaminase deficiency

Recognize the clinical manifestations and laboratory abnormalities associated with adenosine deaminase deficiency

Identify the clinical manifestations and usual microorganisms associated with purine nucleoside phosphorylase deficiency

Recognize the clinical manifestations and laboratory abnormalities associated with purine nucleoside phosphorylase deficiency

Identify the clinical manifestations and usual microorganisms associated with ataxia-telangiectasia syndrome

Recognize the clinical manifestations and laboratory abnormalities associated with ataxia-telangiectasia syndrome

Identify the clinical manifestations and usual microorganisms associated with Wiskott-Aldrich syndrome

Recognize the laboratory abnormalities associated with Wiskott- Aldrich syndrome

Recognize the laboratory abnormalities associated with thymic aplasia (eg, DiGeorge, velocardiofacial syndromes)

Plan the laboratory diagnosis of thymic aplasia (eg, DiGeorge, velocardiofacial syndromes)

Plan long-term management of a patient with severe combined immunodeficiency, including hematopoietic cell transplantation

Recognize the usual presenting clinical and laboratory features associated with intestinal lymphangiectasia

Recognize the clinical manifestations of DiGeorge syndrome and the need

for special precautions in the use of blood products in affected patients

### **13. Interferon and interleukin-12 pathway defect**

Recognize that patients who have genetic mutations have an increased susceptibility to infection (eg, nontuberculous bacteria, vaccine-associated BCG, Salmonella species, some viruses)

## **B. Congenital, natal, and postnatal infections**

Recognize the typical clinical syndrome of congenital infections (eg, small for gestational age, hepatosplenomegaly, petechiae/purpura, icterus, eye defects, cardiac defects, micro- or hydrocephaly)

Identify the specific etiologic agent responsible for congenital infections based on clinical manifestations (eg, CMV, rubella, Toxoplasma, parovirus, syphilis)

Recognize the typical clinical syndrome for organisms acquired natively (during the birth process) or postnatally (nosocomial or from family): acute illness days to weeks after birth, fever, pneumonitis, hepatitis, mucocutaneous lesions, aseptic meningitis

Know the nonbacterial etiologic agents commonly responsible for natively/postnatally acquired infections (eg, hepatitis B, enterovirus, HIV)

Plan the diagnostic evaluation for suspected congenital infection (eg, varies according to pathogen, routine IgG TORCH titers not useful except to rule out congenital infection)

Interpret the laboratory results for diagnostic evaluation for suspected congenital infection

Plan the diagnostic evaluation for suspected nonbacterial natal/postnatal infection

Interpret the laboratory results from diagnostic evaluation for suspected nonbacterial natal/postnatal infection

## **C. Premature, low-birth-weight infants, including those with BPD**

Understand the pathophysiologic mechanisms and iatrogenic factors that contribute to the susceptibility of premature, low-birth-weight- infants especially those with BPD to infection in the natal and post- natal periods and during the first years after birth (eg, respiratory)

Appreciate the increased frequency and prolonged complications of respiratory infections of infants with BPD compared to normal children of similar age

Know that presumptive therapy for the infections most likely acquired by premature, low-birth-weight-infants with BPD is indicated during the natal and post-natal periods and during the first years after birth

Know the specific measures for prevention and control of infection in premature, low-birth-weight-infants and evaluate their effectiveness

Recognize that premature infants have very low nadirs of serum immunoglobulin concentrations, but have little increased risk of infection

## **D. Conditions exacerbated by infection**

### **1. Cystic fibrosis**

Know the organisms to which the patient with cystic fibrosis is most susceptible (frequency or severity of infection)

Know the pathophysiologic mechanisms that contribute to susceptibility to infection in the patient with cystic fibrosis

Identify the clinical manifestations, site, course, and prognosis of various infections in the patient with cystic fibrosis, and how they differ from the normal host

Know the preferred presumptive therapy for various infections in the patient with cystic fibrosis, and how it differs from the normal host

Know specific measures, and their effectiveness, for prevention and control of infection in the patient with cystic fibrosis (eg, isolation, antibiotics, immunizations, nutrition)

### **2. Asthma**

Know the organisms to which patients with asthma are most susceptible (frequency or severity of infection)

Know the pathophysiologic mechanisms that contribute to susceptibility to infection in patients with asthma

Identify the clinical manifestations, course, and prognosis of various infections in patients with asthma, and how they differ from the normal host

Know specific measures, and their effectiveness for immuno- and chemoprophylaxis, of infection in patients with asthma (eg, influenza vaccine)

## **E. Burns**

Know the organisms to which a patient with burn injury is most susceptible (frequency, timing, severity of infection)

Know the pathophysiologic and immunologic mechanisms that contribute to susceptibility to infection in a patient with burn injury

Recognize the clinical manifestations of infection (bacterial or viral such

as CMV) in a patient with burn injury, and how they differ from the normal host

Recognize the major complications of infection of greatest concern in a patient with burn injury

Know specific measures, and their effectiveness, for prevention and control of infection and for chemoprophylaxis in a patient with burn injury

## **F. Contaminated wounds**

Recognize predisposing factors responsible for subcutaneous infections/abscesses/cellulitis caused by less common organisms, including those associated with contaminated wounds

## **G. HIV**

Recognize the risk factors for acquisition of HIV, and the timing of disease presentation

Understand patterns and frequency of transmission of HIV in adults and children

Recognize the immunologic aberrations and other laboratory abnormalities in patients with HIV infection according to the age of the patient

Identify the clinical manifestations and natural history of common pathogens in patients with HIV infection (eg, recurrent otitis media, pneumococcal septicemia, severe viral infection)

Recognize the specific manifestations of HIV infection in children (eg, interstitial pneumonia, encephalopathy, lymphadenopathy, hepatosplenomegaly)

Know the preferred means of diagnosis of opportunistic infection according to organ system involved in patients with HIV infection

Know specific measures, their indications, and their effectiveness for immuno- and chemoprophylaxis of infection in a patient with HIV (eg, *P. jiroveci* pneumonia, vaccines)

Know the relative value of serology, culture, and other laboratory tests (eg, p24 antigen, CD4 counts) in the diagnosis of HIV infection according to the age of the patient

Recognize the clinical course of HIV infection according to age and mode of acquisition

Know the indications for and limitations of antiviral therapy for HIV infection

Identify the clinical manifestations and natural history of opportunistic

infections in patients with HIV infection (eg, Pneumocystis, atypical mycobacteria, M. tuberculosis, CMV, intestinal protozoa)

Recommend infection control measures and vaccinations for family members of a patient with HIV infection

Plan appropriate management of an infant whose mother has a positive HIV test

Identify the causes of gastrointestinal tract ulcerations associated with HIV

Recognize malignancies associated with HIV infection in children

Identify appropriate methods (pharmacologic and obstetric) for prevention of maternal transmission of HIV to her fetus

## **H. Immunosuppressed patients**

### **1. Cancer**

Know the organisms to which the patient with cancer is most susceptible (frequency or severity of infection)

Know the types of immunocompromise that contribute to susceptibility to infection in patients with cancer

Identify the clinical manifestations, course, and prognosis of various infections in patients with cancer, and how they differ from the normal host

Know the pathogens and presumptive therapy for a patient with cancer who also has pneumonia (eg, diffuse, interstitial, localized)

Plan evaluation of a patient with cancer who also has pneumonia

Plan initial management of a neutropenic febrile cancer patient who has no focus of infection

Plan management of a neutropenic febrile cancer patient after initial broad-spectrum antibiotic therapy, including when fever continues, when a specific organism is identified, and when neutropenia resolves

Understand when specific antifungal therapy is required in a patient with cancer

Know specific measures, and their effectiveness for immuno- and chemoprophylaxis, of infection in patients with cancer

### **2. Transplantation**

Plan immunizations for a patient awaiting transplantation

Know the organisms to which a patient who has undergone transplantation is most susceptible according to period of time that has elapsed after transplantation and the site of infection (eg, pneumonia)

Know the causes of immunocompromise that contribute to susceptibility to infection in patients who have undergone transplantation

Identify the clinical manifestations, course, and prognosis of various infections in patients who have undergone transplantation, and how they differ from the normal host

Know the preferred presumptive therapy for various infections in patients who have undergone transplantation, and how it differs from the normal host

Know the treatment of choice for various infections in patients who have undergone transplantation, and how it differs from the normal host (eg, route and duration of therapy)

Plan the initial evaluation and management of an immunocompromised transplant patient in whom fever or a particular focus of infection develops

Know specific measures, and their effectiveness for immuno- and chemoprophylaxis, of infection in patients who have undergone transplantation

Understand the need to avoid antibiotics that suppress neutrophil production and maturation in patients who have recently undergone bone marrow transplantation

### **3. Corticosteroid therapy**

Know the organisms to which a patient receiving corticosteroid therapy is most susceptible (frequency or severity of infection)

Understand the relative risk of increased susceptibility to infection (eg, varicella) in a patient receiving corticosteroid therapy according to type, dose, mode, and duration

Know the preferred presumptive management for various infections in patients receiving corticosteroid therapy, and how it differs from the normal host

Know specific measures, and their effectiveness, indications, and contraindications for immuno- and chemoprophylaxis, of infection in patients receiving corticosteroid therapy (eg, live-virus vaccine)

### **4. Acquired neutropenia**

Plan the diagnostic evaluation and management of a previously normal patient who has the acute onset of neutropenia and fever and/or a particular focus of infection

Understand the relative risk of increased susceptibility to infection according to degree, duration, and cause of neutropenia (eg, suppression from viral, antibiotic, or cancer therapy or whether it is cyclic)

Know specific measures and their effectiveness, indications, and contraindications for immuno- and chemoprophylaxis of infection in patients with neutropenia

## **I. Malnutrition**

Know the organisms to which patients with malnutrition are most susceptible with regard to frequency or severity of infection, and that outcome is worse

Know that specific nutritional deficiencies (eg, vitamin A, zinc) contribute to increased severity of respiratory and gastrointestinal tract infections

Recognize the immunologic deficits associated with malnutrition (eg, cell-mediated immunity)

Identify the effects of infection on the nutritional status (eg, nitrogen loss with typhoid fever and tuberculosis)

## **J. Metabolic and liver disease**

Identify the organisms to which patients with chronic liver disease are most susceptible

Identify the organisms to which patients with metabolic disease (eg, galactosemia) are most susceptible

## **X. Epidemiology**

### **A. Principles of outbreak investigations**

Evaluate disease outbreaks (eg, newborn nursery, child-care center, school) to determine likely source, cause, mode of acquisition, and resulting recommendations

Calculate an incidence (attack) rate, prevalence rate, secondary attack rate, and case-fatality rate in an outbreak

Recognize the epidemiologic characteristics indicative of a common source outbreak (eg, contaminated vehicle)

Differentiate infection, disease, colonization, and carrier rate

### **B. Modes of transmission**

Know the major routes of transmission/acquisition of micro-organism (eg, type of contact, common vehicle, airborne, vectorborne)

Know major sources and reservoirs of different microorganisms, including

sites of colonization and shedding

Understand seasonal effects on infectious diseases and what is known about the basis for these effects

### **C. Infection control in hospitalized children**

Differentiate sterilization, disinfection, cleaning, and decontamination in hospital infection control procedures

Know the predisposing factors for hospital-acquired infection by organ system, including lung, urinary tract, skin, blood, CNS, and GI tract

Develop an immunization plan for health-care professionals

Formulate hospital policies for sibling visits for hospitalized children

Make recommendations for control of an epidemic/outbreak of hospital-acquired infection

Formulate hospital practices for visits of animals for hospitalized children

### **D. Surveillance**

Know diseases that should be reported to the relevant public health department, and the procedures to be used

Understand the clinical situations that should be reported to VAERS and the process of reporting them

## **XI. Principles of Epidemiologic Research and Biostatistics**

### **A. Causality and epidemiologic research**

Evaluate epidemiologic studies to assess likely causation, including differentiation of temporal and causal associations (eg, strength of association, biologic gradient, dose-response, biologic plausibility, consistency)

Understand Koch postulates and their limitations in assessment of disease causation

Know that a confounding factor is a variable that may affect the observed association between the independent and dependent variables and which should be accounted for in the design and/or analysis

Differentiate between dependent and independent variables

### **B. Study design**

Understand the design and application of different types of observational studies: survey, case-control, cohort

Understand "blinding" and randomization in experimental studies

Identify the major types of bias in epidemiologic studies (eg, selection bias, misclassification or ascertainment bias, confounding)

Recognize outcomes (dependent variables) and risk factors (independent variables)

Calculate prevalence, incidence, relative risk, attributable risk, case fatality rate, and odds ratio

Understand the design of a controlled study for which a placebo control cannot be used

### **C. Descriptive statistics**

Differentiate an arithmetic mean from a geometric mean

Understand the concept of normal and non-normal distribution of data

Know appropriate use of mean, median, and mode

Know methods of describing dispersion (range, standard error, standard deviation)

Interpret a Kaplan-Meier survival curve

Calculate vaccine efficacy

### **D. Sample size estimation**

Understand how to select an adequate sample size in double-blind controlled clinical trials

Differentiate a type I (alpha) from a type II (beta) error

Understand that a smaller sample size increases the risk of type II (beta) error

### **E. Hypothesis testing and application of statistical tests**

Understand the application of the null hypothesis

Understand that non-parametric tests (Fisher exact test, survival analysis, chi-square) are less powerful and more conservative, and that parametric tests (regression, t-test, ANOVA) are more likely to find significant differences

Choose an appropriate statistical test to evaluate the effect of several kinds of therapy (analysis of variance rather than pairwise t-tests)

Interpret values of correlation coefficients

Understand the application of paired and unpaired t-tests

Understand the application of chi-square analysis

Understand some of the potential strengths and weaknesses of meta-analysis

## **F. Sensitivity and specificity of tests**

Differentiate and interpret meaning of sensitivity, specificity, and positive and negative predictive values

Explain false-negative and false-positive results in terms of test characteristics of sensitivity, specificity, and positive and negative predictive values

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