MCQs

MCQs in INFECTIOUS DISEASES

for DM Students

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Contents

1. **Sepsis in 2020: Is it only Antibiotics?** 1
   Gaurav Kochar, Yatin Mehta
2. **Gram-negative Crisis** 12
   Pradip Kumar Bhattacharya
3. **Emerging Fungal Infections in Non-neutropenic Patients** 25
   Ketan Kargirwar, Mayur Patel, Darshana Rathod, Mehul Shah, Vivek Kumar
4. **Fungal Infections in Neutropenia** 38
   Vasant C Nagvekar
5. **Infection-related Malignancies** 46
   Pritam Kataria
6. **Fever in Non-infection Settings** 52
   Reena Sharma
7. **Immune Dysfunction and Infections** 63
   Om Shrivastav
8. **Approach to Cutaneous and Soft-tissue Infections** 71
   Om Shrivastav
9. **Sexually Transmitted Infections** 82
   Surabhi Madan, Sneha Gohil
10. **Tuberculosis and Its Variants** 93
    Amita Athavale, Rahul Bahot
11. **Central Nervous System Infections** 100
    Joy Desai, Azad Irani
12. **Respiratory Infections** 123
    Rahul Bahot
13. **Genitourinary Tract Infections** 144
    MM Bahadur, Ashay Shingare
14. **Bone and Joint Infections** 155
    Gautam Zaveri, Harshad Argekar
15. **Human Immunodeficiency Virus** 167
    Om Shrivastav
16. **Infections of Liver** 175
    Prasanna Shah
17. **Infections and Metabolic Sequelae** 182
    Rajesh Chandra Mishra, Reena Sharma
18. **Zoonosis** 192
    Om Shrivastav

19. Parasitic Infections 202
Ajay Jhaveri, Om Shrivastav

20. Fever in the Returning Traveler 212
Juhi Dhar, Meghna Kabra, Raj Kumar Mani

21. Pyrexia of Unknown Origin 233
Altaf Patel, Hasnain Patel

22. Outbreaks 240
Laxman Jessani

23. Nosocomial Infections 247
Ayesha J Sunavala, Indraneel Raut, Krutarth Kanjiya

24. Hematological Disorders and Infections 272
VP Antia, Dipsha Kriplani

25. Infections in Renal Transplants 278
Rushi Deshpande, Rishit K Harbada, Sukanya Verma

26. Infections in Liver Transplants 302
Parikshit S Prayag, Sujata Rege

27. Infections in Bone Marrow Transplants 314
Samir Shah

28. Infections in the Eye 323
TP Lahane, Pooja D Chaturvedy

29. Vector-borne Diseases 338
Mala V Kaneria

30. Pregnancy and Gynecological Infections 353
Duru Shah, Sabahat Rasool

31. Imaging in Infectious Diseases 368
Shrinivas B Desai, Ritu K Kashikar, Shraddha Sinhasan, Chandresh Karnavat

32. COVID-19 405
Rahul Bahot, Om Shrivastav

Index 423

CHAPTER

2

Gram-negative Crisis

Pradip Kumar Bhattacharya

1. A 47-year-old man with alcoholic liver cirrhosis and ascites is admitted to hospital. He is febrile with abdominal pain and delirium. Routine blood tests show increased white blood cell (WBC) and C-reactive protein (CRP) with normal electrolytes and renal function. An ascitic tap shows 500 WBCs/µL and organisms visible on microscopy.

What is the most likely organism?

A. *Klebsiella pneumoniae*
B. *Escherichia coli*
C. Enterobacteriaceae
D. *Streptococcus pneumoniae*
E. *Staphylococcus aureus*

2. A 64-year-old woman has been in the intensive care unit (ICU) for 12 days. She was initially admitted from the operation theater after an emergency laparotomy for colonic perforation and fecal peritonitis. She is currently sedated, ventilated, and requires hemodynamic support and hemofiltration. Results of a blood culture from 2 days ago show a gram-negative bacilli. Which of the following newer antibacterial agents is likely to be the most effective against a gram-negative bacillus?

A. Teicoplanin
B. Ertapenem
C. Tigecycline
D. Daptomycin
E. Linezolid

3. A 79-year-old nursing home patient presents with fever, confusion, productive cough, and shortness of breath. He has diabetes, hypertension, and dementia. He takes insulin, metoprolol, and aspirin. He is allergic to eggs, sulpha, and angiotensin-converting enzyme inhibitors. He is diagnosed with a left lower lobe healthcare-associated pneumonia (HAP). On admission, he is given linezolid, meropenem, and levofloxacin. His condition improves markedly, and on the fifth hospital day, he is ready to be discharged back to his nursing home. His sputum and blood cultures grow *K. pneumoniae*. It is resistant to ampicillin and cefazolin but susceptible to ceftriaxone, piperacillin/tazobactam, meropenem, ciprofloxacin, and trimethoprim (TMP)/sulfamethoxazole (SMX). Which of the following statements regarding discharge antibiotics is correct?

A. Discharge the patient on the same intravenous antibiotics since his condition improved on them
B. Discharge the patient on oral TMP/SMX
C. Discharge the patient on oral amoxicillin
D. Discharge the patient on oral ciprofloxacin
E. Discharge the patient on intravenous piperacillin/tazobactam

4. Burn patients are at risk for multiple infections. What is the most common organism to cause infection in burn patients?

A. *S. aureus*
B. *S. pyogenes*
C. *S. agalactiae*
D. *P. aeruginosa*
E. *Candida albicans*

5. A 56-year-old woman comes to the outpatient clinic for a postoperative visit 1 week after open fixation of an ankle fracture and complains of pain and swelling in her foot. She states that she first noticed a patch of redness and some pain near the surgical incision last night but woke up to find it had spread to encompass her entire foot. She reports that she "just does not feel well," and chills overnight. On physical examination, her temperature is 101°F (38.3°C), blood pressure 118/78 mm Hg, and heart rate (HR) 86 beats per minute (bpm). The right foot is edematous, erythematous, warm, and tender to the touch with no crepitus or fluctuance present. The incision site is intact, and no purulent material is noted. Which of the following infectious organisms should be suspected in this patient?

A. Group A hemolytic streptococci
B. *P. aeruginosa*
C. *S. aureus*
D. *E. coli* and other gram-negative species
E. All except B

6. A 72-year-old woman saw her general practitioner with a 2-week history of general malaise. She mentioned that over the last 3 years, she occasionally leaked urine when coughing, laughing, or lifting things, but had never suffered from urgency of micturition, dysuria, or hematuria. Examination of her abdominal, cardiac, and respiratory systems

were normal. There was no lymphadenopathy. She was on no medication. Dipstick testing of her urine was positive for nitrites only. 3 days later, the following normal test results were seen: Full blood count (FBC), urea and electrolytes (U&E), serum calcium, liver and thyroid function. Urine culture showed >100,000 colony-forming units/mL of *E. coli*. What is the next most appropriate step in her management?

A. Advise pelvic floor exercises
B. External vaginal examination
C. Nothing more needs to be done
D. Refer to the continence adviser
E. Treat with antibiotics

7. A 59-year-old man undergoes coronary bypass surgery. He receives vancomycin prophylactically for 24 hours. On the ninth postoperative day, he develops a fever of 39.8°C (103°F) with an HR of 115 bpm and a blood pressure of 105/65 mm Hg. The surgical site is healing well with no redness or discharge. His white blood cell count is 14,000/mm^3 and urinalysis reveals many white blood cells per high-power field. Blood and urine cultures grow a nonlactose-fermenting oxidase-positive gram-negative rod. Which of the following antibiotics is most appropriate to treat this infection?

A. Moxifloxacin
B. Ceftriaxone
C. Imipenem
D. TMP-SMX
E. Tigecycline

8. A 36-year-old man with history of acute myelogenous leukemia is admitted to the ICU with neutropenic fever and low blood pressure that requires norepinephrine drip. The patient finished his first cycle of chemotherapy 10 days ago. He denies respiratory, gastrointestinal, or urinary symptoms. Complete blood count (CBC) reveals mild thrombocytopenia and an absolute neutrophil count of 100/µL. Urinalysis is within normal limits and chest X-ray (CXR) does not show any infiltrate. Awaiting culture results, which of the following antibiotic regimens is most appropriate?

A. Imipenem
B. Vancomycin
C. Vancomycin, piperacillin/tazobactam, and tobramycin
D. Cefepime, levofloxacin, and amphotericin B
E. Continue supportive measures awaiting culture results

9. A 70-year-old ICU patient complains of fever and shaking chills. The patient develops hypotension, and blood cultures are positive for gram-negative bacilli. The patient begins bleeding from venipuncture sites and around his Foley catheter. Laboratory studies are as follows:

- **Hematocrit (Hct): 38%**
- **WBC: 15,000/µL**
- **Platelet count: 40,000/µL (normal 150,000–400,000)**
- **Peripheral blood smear: Fragmented RBCs**
- **Prothrombin time (PT): Elevated**
- **Partial thromboplastin time (PTT): Elevated**
- **Plasma fibrinogen: 70 mg/dL (normal 200–400)**

Which of the following is the best course of therapy in this patient?

A. Begin heparin
B. Treat underlying disease
C. Begin plasmapheresis
D. Give vitamin K
E. Begin red blood cell transfusion

10. A 30-year-old man has developed fever, chills, and neck stiffness. Cerebrospinal fluid (CSF) shows gram-negative diplococci. He has had a past episode of sepsis with meningococcemia.

The most likely immunologic deficiency is:

A. Complement deficiency C5-C9
B. Postsplenectomy
C. Drug-induced agranulocytosis
D. Interleukin-12 receptor deficit
E. Hyper-IgE (Job) syndrome
F. Adenosine deaminase deficiency

11. A 43-year-old undomiciled man is brought to the emergency department (ED) after being found intoxicated on the street. He is currently rousable and expresses a request to be left alone. Initial vitals include an HR of 92 bpm, a BP of 125/80 mm Hg, and a respiratory rate (RR) of 14 breaths/min with an oxygen saturation of 93% on room air. His rectal temperature is 101.2°F. A chest radiograph shows infiltrates involving the right lower lobe. Given this clinical presentation, what initial antibiotic coverage is most appropriate for this patient?

A. Gram-negative coverage only
B. Gram-positive coverage only
C. Broad-spectrum with anaerobic coverage
D. *Pneumocystis carinii* pneumonia (PCP) coverage
E. Antifungal therapy

12. A 48-year-old man with a past medical history of hepatitis C and cirrhosis presents to the ED complaining of acute-onset abdominal pain and chills. His BP is 118/75 mm Hg, HR is 105 bpm, RR is 16 breaths/min, temperature is 101.2°F rectally, and oxygen saturation is 97% on room air. His abdomen is distended and diffusely tender.

You decide to perform a paracentesis and retrieve 1 L of cloudy fluid. Laboratory analysis of the fluid shows a neutrophil count of 550 cells/mm^3. Which of the following is the most appropriate choice of treatment?

A. Metronidazole
B. Vancomycin
C. SMX/TMP
D. Neomycin and lactulose
E. Cefotaxime

13. A 59-year-old woman presents to the ED complaining of worsening lower abdominal pain over the previous 3 days. She describes feeling constipated recently and some burning when she urinates. Her BP is 135/75 mm Hg, HR is 89 bpm, temperature is 101.2°F, and her RR is 18 breaths/min. Her abdomen is mildly distended, tender in the left lower quadrant, and positive for rebound tenderness. CT scan is consistent with diverticulitis with a 7 cm abscess. Which of the following is the most appropriate management for this condition?

A. Reserve the operating room (OR) for emergent laparotomy
B. Start treatment with ciprofloxacin and metronidazole and plan for CT-guided draining of the abscess
C. Give an IV dose of ciprofloxacin and make the patient follow-up with her primary physician
D. Start treatment with ciprofloxacin and metronidazole and plan for an emergent barium enema
E. Start treatment with ciprofloxacin and metronidazole and prepare for an emergent colonoscopy

14. Which of the following statements is true regarding pertussis infection?

A. Infection is more severe in adults than children
B. The organism is identified in routine sputum culture
C. Treatment is with a macrolide antibiotic
D. Antibiotics do not alter the course of illness
E. The first phase of illness involves paroxysms of cough

15. Regarding febrile neutropenia in cancer patients, which of the following is true?

A. Gram-negative enteric bacteria currently account for 60–70% of microbiologically confirmed infections
B. *S. epidermidis* cultured in the blood is usually not a contaminant
C. Indwelling vascular catheters should immediately be removed if no other source of infection is found on initial examination
D. *Pseudomonas* is the most common pathogen

16. An 18-year-old male has presented to the ED with a rapid-onset febrile illness associated with myalgia. You consider meningococcemia as a potential diagnosis. Which of the following is incorrect regarding meningococcemia?

A. The rash of meningococcemia may be urticarial, macular, or maculopapular
B. Carriers have some immunity against invasive disease
C. Serogroup B causes most of the diseases in India
D. The mortality of a patient with meningococcal meningitis is higher than that of patients with invasive meningococcal disease

17. A patient presents with cellulitis of the lower limb. Which of the following is true regarding cellulitis?

A. *Aeromonas* species are implicated in infections associated with fresh water
B. Mild-to-moderate chronic diabetic foot infections should be treated with amoxicillin-clavulanate 875/125 mg orally bd or ciprofloxacin 500 mg bd in penicillin-allergic patients
C. Laboratory tests can accurately differentiate between cellulitis and deep venous thrombosis (DVT) of the lower limb
D. Previous venous harvest is not a risk factor for cellulitis

18. A 25-year-old man is evaluated in the ED for fever, headache, and mental status changes of 4 hours' duration. He underwent a cadaveric kidney transplantation 10 months ago, and his immunosuppressive regimen includes prednisone and azathioprine. He has no allergies. On physical examination, his temperature is 38°C (101.6°F), HR is 115 bpm, RR is 25 breaths/min, and blood pressure is 100/60 mm Hg. He is oriented as to the year and his name but cannot recall the month. His neck is supple, and Kernig and Brudzinski signs are absent. The neurologic examination is normal. His peripheral leukocyte count is 20,000/mm^3. A CT scan of the head shows no sign of hemorrhage, hydrocephalus, mass effect, or midline shift. An lumbar puncture (LP) is performed and examination of the CSF shows leukocyte count 2,000/mm^3 (60% neutrophils, 40% lymphocytes), glucose 25 mg/dL, protein 150 mg/dL, and a negative Gram stain. The opening spinal pressure is normal. Results of blood, urine, and CSF cultures are pending. Which of the following is the most appropriate empiric antibiotic therapy?

A. Ampicillin and ceftriaxone
B. Ampicillin, ceftriaxone, and vancomycin
C. Ceftriaxone and moxifloxacin

D. Ceftriaxone and vancomycin
E. Moxifloxacin

19. A 65-year-old man with a history of hepatitis C and progressive liver disease presents to the hospital with increasing low-grade fever, abdominal pain, and distension. He is currently on furosemide, spironolactone, and nadolol. On physical examination, his temperature is 37.5°C (99.5°F), and blood pressure is 100/50 mm Hg. Abdominal examination reveals distended abdomen and marked ascites. The abdomen is mildly tender upon palpation. Creatinine is 0.8 mg/dL and total bilirubin is 2.1 mg/dL.

Abdominal ultrasound is consistent with cirrhosis, splenomegaly, and large volume of ascites. Diagnostic paracentesis is scheduled. The most appropriate initial treatment is:

A. Cefotaxime
B. Cefotaxime and albumin
C. Furosemide and spironolactone
D. Large-volume paracentesis

20. A 66-year-old woman presents with a chief complaint of fever, nausea, and vomiting. On physical examination, she appears ill. Her temperature is 39.9°C, blood pressure is 127/878, and pulse rate is 120/min. Laboratory studies reveal a leukocyte count of 23,000 with 87% neutrophils. Urinalysis demonstrates >68 leukocytes/hpf and has a positive leukocyte esterase. Gram-negative rods are seen upon microscopic examination. She is admitted to the hospital with a diagnosis of probable urinary tract infection. On the second day of her hospitalization, her urine and blood cultures are positive for *E. coli*, susceptible to piperacillin/tazobactam, ciprofloxacin, imipenem, ampicillin, and ceftriaxone.

Which of the following is the most appropriate management?

A. Continue piperacillin/tazobactam
B. Discontinue piperacillin/tazobactam and begin ampicillin
C. Discontinue piperacillin/tazobactam and begin ciprofloxacin
D. Discontinue piperacillin/tazobactam and begin ceftriaxone

21. A 35-year-old man underwent a heart transplant 5 days ago. He is receiving immunosuppressive therapy with methylprednisolone, cyclosporine, and azathioprine. Today, he develops a temperature of 102°F. *Physical examination*: Ill-appearing man on the ventilator since surgery, BP 130/50 mm Hg, temperature 102°F, RR 30 breaths/min, and pulse rate 100/min. *Significant findings*: Chest—crackles and rhonchi heard over the right lung fields. *Laboratory*: Tracheal secretions are now yellow. FiO_2 requirements have increased from 35 to 50%. Pulmonary artery wedge pressure is 15 mm Hg (normal 6–12). *WBC*: 17,000/mm^3 with 90% neutrophils. *CXR*: Dense consolidation in right middle and lower lobes.

Which of the following is most likely the etiology for his pneumonia?

A. *Legionella pneumoniae*
B. *Pneumocystis jiroveci*
C. Cytomegalovirus (CMV)
D. *P. aeruginosa*
E. *Cryptococcus neoformans*

22. A 60-year-old woman who has been on mechanical ventilation for 1 week due to ARDS from a pneumococcal pneumonia is slowly being weaned. Clinically, she is doing well and you are pleased with her progress. *Medications*: Day 8 of ceftriaxone. *Physical examination*: Head, eyes, ears, nose, and throat (HEENT) examination—pupils responsive and equal. Mild thrush of her oral mucosa. *Neck*: Supple, no masses. *Heart*: RRR without murmurs, rubs, or gallops. *Lungs*: Still with basilar crackles right greater than left. *Abdomen*: Positive bowel sounds, tolerating tube feeds well; no masses. *Extremities*: No cyanosis, clubbing, or edema. *Laboratory*: CBC shows a mild increase in WBC to 11,000 from 9,500 yesterday with 80% lymph. Tracheal aspirate culture from 2 days ago returns today and shows *P. aeruginosa* sensitive only to amikacin, piperacillin/tazobactam, and ceftazidime. Aspartate transaminase (AST) 25, alanine transaminase (ALT) 26, bilirubin 0.2 mg/dL, creatinine 0.5 mg/dL, blood urea nitrogen (BUN) 10 mg/dL, *CXR*: Slow improvement from admission; no new infiltrates.

Based on clinical evaluation and laboratory results, which of the following is the most appropriate next step?

A. Switch antibiotic coverage to piperacillin/tazobactam alone
B. Add amikacin to ceftriaxone
C. Switch antibiotics to piperacillin/tazobactam + amikacin
D. Perform bronchoscopy and then start piperacillin/tazobactam + amikacin
E. Continue current therapy

23. A 24-year-old woman presents with persistent cough for 4 weeks. She had upper respiratory infection (URI)-like symptoms 2 weeks earlier and then developed a persistent cough for the next month.

She states she has had coughing fits many times during the day and "could not stop coughing" for almost a minute when she started. Which of the following is true regarding this patient?

A. The disease is caused by a gram-negative *Coccobacillus*
B. Antibiotic therapy should eliminate the symptoms within a few days
C. Bacterial culture is indicated to confirm the diagnosis
D. The disease is not contagious
E. Mortality is close to 30%

24. Pulmonary infections with which of the following may be transmitted from person to person?

A. *Coxiella burnetii*
B. *Yersinia pestis*
C. *Histoplasma capsulatum*
D. *Francisella tularensis*
E. *Bacillus anthracis*

25. A 26-year-old G2P2 presents to the ED 3 days after spontaneous vaginal delivery of a healthy male infant with a chief complaint of crampy low abdominal pain and a foul-smelling vaginal discharge. On examination, she has a fever of 102°F and a tender uterus on bimanual pelvic examination. Which of the following is true?

A. This condition is more common after vaginal delivery than cesarean section
B. She has postpartum pelvic inflammatory disease
C. *Chlamydia* and *Mycoplasma* are the most common etiologic agents
D. Premature rupture of membranes (PROM) is a risk factor for her condition
E. All of the above

26. A 20-year-old man presents with a painful, ulcerated lesion on his penis. He noticed it 3 days before and the pain became progressively worse. Examination shows a tender, 1 cm ulcerated lesion at the base of his penis with a single, large, tender inguinal lymph node. Gram stain of the ulcer shows gram-negative bacilli. Which of the following is the most likely cause?

A. Herpes simplex virus
B. *Chlamydia trachomatis*
C. *S. epidermidis*
D. *H. ducreyi*
E. *Treponema pallidum*

27. Which of the following findings is seen in most patients with meningococcemia?

A. Bilateral adrenal infarction
B. Skin lesions
C. Hypothermia
D. Seizure
E. Arthritis

28. Which of the following is most useful in differentiating a patient with acute cholangitis from a patient with acute cholecystitis?

A. Jaundice
B. Fever
C. Abdominal tenderness
D. Leukocytosis
E. Murphy's sign

29. Which of the following is the most common organism isolated in SBP?

A. *E. coli*
B. *S. aureus*
C. *S. pneumoniae*
D. *K. pneumoniae*
E. Anaerobic species

30. Oroya fever is caused by:

A. *Agrobacterium tumefaciens*
B. *Bartonella quintana*
C. *Rochalimaea quintana*
D. *B. bacilliformis*

31. Risk factors for multidrug-resistant enterobacteriaceae (MDRE) infection and colonization with carbapenemase and/or extended-spectrum β-lactamase (ESBL)-producing bacteria are all, *except*:

A. Prior and recent antibiotic (especially fluoroquinolone) use
B. Long-term use of steroid
C. Healthcare-associated risks including residence in long-term acute-care facilities, presence of feeding tubes, mechanical ventilation, or a central venous catheter
D. Obstructive uropathy
E. Organ and stem cell transplantation

32. Which of the following hand hygiene agent is best against gram-negative bacteria?

A. Chlorhexidine
B. Chloroxylenol
C. Hexachlorophene
D. Quaternary ammonium
E. Iodophors

33. According to the American Thoracic Society (ATS) guidelines for treatment of nosocomial pneumonia "core pathogens" include all, *except*:

A. *S. aureus*
B. *Pneumococcus*
C. *P. aeruginosa*
D. *E. coli*

34. Necrotic pancreas becomes secondarily infected with:

A. Gram-positive bacteria of alimentary origin

B. Gram-negative bacteria of alimentary origin
C. Gram-positive bacteria of hematogenous origin
D. Gram-negative bacteria of hematogenous origin

35. Limulus amebocyte lysate assay in CSF is diagnostic of:

A. Gram-negative bacterial meningitis
B. Fungal meningitis
C. Tuberculous meningitis
D. Carcinomatous meningitis

36. The spectrum for etiology of a pneumonia changes with patient's age. Which are probable pneumonia-causing agents in neonates?

A. Group B *streptococci*
B. *L. monocytogenes*
C. Enteric gram-negative bacilli
D. *Chlamydia*
E. Viral: Rubella, CMV, and herpes

37. The most common bacterial superinfection in association with *Aspergillus* pneumonia is caused by:

A. Gram-positive cocci
B. Gram-negative cocci
C. Gram-positive bacilli
D. Gram-negative rods

38. Epiglottitis is most commonly caused by:

A. *S. pyogenes*
B. *Pneumococcus*
C. *S. aureus*
D. *H. influenza*

39. Which of the following is responsible for pneumonia from cooling systems?

A. *Listeria*
B. *Mycoplasma*
C. *Legionella*
D. *Chlamydia*

40. Which of the following organism is responsible for bones and joint infections in children <4 years?

A. *C. burnetii*
B. *Shigella flexneri*
C. *B. fragilis*
D. *Kingella kingae*

ANSWERS WITH EXPLANATIONS

1. Ans. B

Spontaneous bacterial peritonitis (SBP) is typical of liver cirrhosis with ascites. It represents 10–30% of every bacterial disease in patients with cirrhosis and is there in around 10% of all cirrhotic inpatients. Earlier SBP had a death rate of 90%; however, this has enormously improved to roughly 20% for the first incidence. One-year mortality after the first incidence of SBP is somewhere in the range from 30 to 90% and thus should trigger an assessment for liver transplantation. Bacteria from the gut are the causative organisms of SBP. Patients with cirrhosis have expanded bacterial numbers in their gut because of diminished motility, decreased pancreatic secretions, and modified pH. Patients with cirrhosis also have expanded intestinal permeability and decreased immunological capacity. These variables increase the danger of bacterial translocation.

The most common causative organism is *E. coli*, which is found in over 40% of cases. Others are gram-negative bacilli, *Klebsiella* and *Enterobacteriaceae* species. Some gram-positive creatures are known to cause SBP, especially streptococcal and enterococcal species.

Treatment of SBP should begin following a positive ascitic tap and should not be delayed for microbiological culture results. 60% of SBP have no bacteria that are recognized in ascitic liquid. Wide range of anti-infection agents are prescribed. Third- and fourth-age cephalosporins, carbapenems, and penicillins, e.g., piperacillin/tazobactam, are conceivable treatments. Nephrotoxic anti-infection agents should be avoided initially.

2. Ans. B

Ertapenem is a carbapenem, a class of drugs that has good activity against gram-negative organisms. All of the other agents are newer antibacterials with predominantly gram-positive activity. Gram-negative organisms are common causes of infection in the ICU, many of which are resistant to various common antibiotics. In particular, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* species are widely drug resistant, forming part of the "ESKAPE" group of pathogens (also including *Enterococcus faecium*, *S. aureus,* and *K. pneumoniae*). The ESKAPE pathogens have been identified as one of the main current challenges in the battle against multidrug-resistant bacteria. Newer drugs that have been licensed and widely used in the past 15 years include linezolid, ertapenem, daptomycin, tigecycline, and doripenem. The majority of these agents have a particular activity against gram-positive organisms, possibly in response to the rise of methicillin-resistant *Staphylococcus aureus (MRSA)* over the same time period. The carbapenems are a class of drugs with good activity against both gram-positive and gram-negative organisms, although resistance to carbapenems is on the increase. More recent agents include telavancin and ceftaroline fosamil along with combinations of antibacterial drugs

with beta-lactamase inhibitors. Most of the new drugs are in the same class as existing agents with similar actions and a risk of cross-resistance; drugs with novel mechanisms of action are few and far between.

3. Ans. D

The patient has HAP. He was started on broad-spectrum antibiotics to cover likely pathogens, which include MRSA and resistant gram-negative bacteria such as *P. aeruginosa*. His condition improved markedly and the culprit bacterium in his case was not as resistant as feared. Furthermore, his pneumonia was not complicated by cavitation or empyema, and he did not have vomiting or diarrhea to preclude finishing his antibiotic course orally. This case represents an opportunity for antibiotic de-escalation, which involves the practice of starting with a broad-spectrum empiric antibiotic regimen (designed to avoid inadequate therapy) combined with a commitment to change from broad- to narrow-spectrum therapy and from multiple agents to fewer medications. Continuing all of the empirically chosen antibiotics puts this patient at risk for drug-drug interaction and *Clostridium difficile* infection and is not justifiable given the susceptible culprit isolated. De-escalation is an example of antimicrobial stewardship, a coordinated effort that aims at optimizing clinical outcomes while minimizing antibiotic toxicity, cost, and resistant bacteria selection. Discharging the patient on meropenem or piperacillin/tazobactam would have been an appropriate choice had this been a mixed infection (e.g., aspiration pneumonia). TMP/SMX is an inappropriate choice, given the reported sulfa allergy. This patient's *Klebsiella* is resistant to ampicillin and cefazolin.

4. Ans. D

Infections in burn patients can be problematic for multiple reasons. It may delay wound healing, encourages scarring, and can result in bacteremia which may lead to sepsis. *P. aeruginosa* is a gram-negative bacillus and is considered to be the most common cause of infections in burn patients. (A) MRSA is also commonly seen in burn patients and is difficult to treat due to a large number of virulence factors. (B) *S. pyogenes* is more of a concern in pediatric burn patients because they may have colonization of *S. pyogenes* in their oropharynx. (C) *S. agalactiae* is not an organism thought to infect burn patients. This organism can colonize the genitourinary tract and be transmitted to the neonate during birth which may result in bacteremia, pneumonia, or meningitis. Fungal infections tend to occur in burn patients during the later stages of recovery because by this time the majority of bacteria have been eliminated by the use of antibiotics. The most common cause of fungal infection in burn patients is by (E) *C. albicans*.

5. Ans. E

This patient has cellulitis that she developed after a surgical procedure. The defect in the skin barrier and any metal hardware implanted during the procedure are risks for developing this type of infection. She has the classic findings of edema, erythema, warmth, and pain. The lack of crepitus and fluctuance is reassuring that this infection is not necrotizing fasciitis or an abscess. Common pathogens for cellulitis include group A β-hemolytic streptococci and *S. aureus* species; however, this patient is also at risk for *E. coli* and gram-negative infection because the wound is below the waist. Thus initial antibiotic coverage should have activity against these pathogens and can be adjusted later if the pathogen(s) can be identified.

6. Ans. B

She has asymptomatic bacteriuria (clinically significant bacteriuria without symptoms related to the urinary tract), which does not require antibiotic treatment. This occurs in approximately 20% of females at this age. *Antibiotic treatment risks*: Bacterial resistance, candidiasis, and *C. difficile*. Asymptomatic bacteriuria may be associated with urge incontinence, but not stress incontinence (which she has had for several years anyway). Before referral to the continence adviser, who might well advise pelvic floor exercises, an external pelvic floor examination needs to be performed to exclude a cystocele or vaginal prolapse.

7. Ans. C

The patient has a healthcare-associated urinary tract infection (UTI) complicated by gram-negative bacteremia. The complete identification of gram-negative rods might take 48 hours. Knowing the ability of the growing bacteria to ferment lactose might help in the early prediction of the likely pathogen at hand. Among lactose-fermenting gram-negative rods, Enterobacteriaceae such as *E. coli* are most common. Among nonlactose-fermenting oxidase positive gram-negative bacteria, *P. aeruginosa* is the most common. Ceftriaxone, imipenem, and TMP/SMX can be used to treat UTIs while moxifloxacin and tigecycline do not achieve high enough concentration in urine to be used for this indication. Of the listed antibiotics, imipenem, which is a carbapenem beta-lactam antibiotic, is the only one with antipseudomonal activity. Antibiotics with antipseudomonal activity include certain penicillins (piperacillin/tazobactam and ticarcillin/clavulanate), cephalosporins (ceftazidime and cefepime), carbapenems (imipenem, meropenem, and doripenem), fluoroquinolones (ciprofloxacin and levofloxacin), and aminoglycosides (gentamicin, tobramycin, and amikacin).

8. Ans. C

Neutropenic fever is a medical emergency. Infections, most commonly caused by gram-negative bacteria such as *P. aeruginosa*, are responsible for most cases. Prompt empiric antibiotic therapy with two antibiotics from two different antibiotic classes (double coverage) that have antipseudomonal activity is most appropriate. Adding an antibiotic with anti-MRSA activity to the initial antibiotic regimen is indicated if the patient was on antibiotic prophylaxis before the onset of the neutropenic fever or if he has any of the following conditions: Skin infection, moderate-to-severe mucositis, central venous catheter, or shock (as in this case). Imipenem alone is not enough because it lacks anti-MRSA activity. Vancomycin does not provide gram-negative coverage and should never be used alone in the treatment of neutropenic fever. Awaiting culture results without initiating empirical antibiotic coverage is inappropriate because it increases the patient's mortality risk. Antifungal therapy is often added in the subsequent days if the patient fails to respond to broad-spectrum antibiotics.

9. Ans. B

This patient with gram-negative bacteremia has developed disseminated intravascular coagulation (DIC), as evidenced by multiple-site bleeding, thrombocytopenia, fragmented red blood cells on peripheral smear, prolonged PT and PTT, and reduced fibrinogen levels from depletion of coagulation proteins. Initial treatment is directed at correcting the underlying disorder—in this case, infection. Although heparin was formerly recommended for the treatment of DIC, it is now used rarely and only in unusual circumstances (such as acute promyelocytic leukemia). For the patient who continues to bleed, supplementation of platelets and clotting factors (with fresh frozen plasma or cryoprecipitate) may help control life-threatening bleeding. Red cell fragmentation and low platelet count can be seen in microangiopathic disorders such as thrombotic thrombocytopenic purpura (TTP), but in these disorders the coagulation pathway is not activated. Therefore, in TTP the PT, PTT, and plasma fibrinogen levels will be normal. Plasmapheresis, vitamin K therapy, and RBC transfusion will not correct the underlying cause.

10. Ans. A

Patients who have a deficiency of one of the terminal components of complement have a remarkable susceptibility to disseminated *Neisseria* infection, particularly meningococcal disease. This association with meningococcal disease is related to the host inability to assemble the membrane attack complex a single molecule of complement components that creates a discontinuity in the bacteria's membrane lipid bilayer. The complement deficiency results in inability to express complement-dependent bactericidal activity. The pneumococcus is the most important cause of postsplenectomy sepsis, making up about 67% of all cases (*Haemophilus influenzae* is the second most common organism). The spleen serves a variety of immunologic functions, but as it is the main production site for opsonizing antibody, it is specially important for the clearance of encapsulated bacteria from the bloodstream. A polysaccharide capsule surrounds all invasive pneumococci, and a deficiency in opsonizing antibody postsplenectomy can result in overwhelming sepsis with pneumonia, bacteremia, meningitis, and death. Drug-induced agranulocytosis causes acute pharyngitis ("agranulocytic angina"), fever, and sepsis. Absolute neutrophil count is close to 0; recovery occurs 7–10 days after withdrawal of the offending drug. Antibiotics, antithyroid, or antiepileptic drugs are the common offenders. Interleukin-12 receptor deficiency impairs production of interferon-gamma, leading to disseminated mycobacterial infection, often with nontuberculous species. The hyper-IgE syndrome causes recurrent staphylococcal abscesses, sometimes leading to pneumatoceles in the lung. The genetics of this syndrome is not well understood. Adenine deaminase deficiency accounts for 50% of cases of autosomal recessive severe combined immunodeficiency (SCID). Accumulation of purine metabolites leads to rapid apoptosis of both T- and B- cells.

11. Ans. C

Aspiration pneumonia occurs secondary to the aspiration of either oropharyngeal or gastric contents into the lower airways. Aspiration of gastric juices may cause a pulmonary inflammatory response. This type of mechanism of acquiring pneumonia is commonly seen in those with *swallowing difficulties* or *a relaxed lower esophageal sphincte*r because of *alcohol*. Given these factors, this patient is in a high-risk category for aspiration pneumonia. The small degree of angulation of the right mainstem bronchus makes the right lung at higher risk. Most particles easily travel down this route, ending up in the *right middle or lower lobe* of the lung. *Antibiotic coverage* should be *broad*, covering for both *gram-positive* and *gram-negative organisms including anaerobes*, which are commonly present in the mouth. Given the severity, these patients may go on to develop acute respiratory distress syndrome (ARDS), an inflammatory response to infection, and, subsequently, respiratory failure. (A) Gram-negative organisms, such as *H. influenzae, P. aeruginosa, K. pneumoniae,* and *E. coli,* are the most frequent causes of nosocomial pneumonia. (B) Gram-positive organisms such as *S. pneumoniae* and *S. aureus* are most commonly associated with

community acquired pneumonia. (D) *PCP* is found in immunocompromised patients, such as those with AIDS, or those receiving immunosuppressants secondary to organ transplantation. They are also at risk for fungal pneumonias (E); however, treatment should not be initiated unless there is high clinical suspicion.

12. Ans. E

Analysis of abdominal fluid and clinical presentation are consistent with *SBP*. It is recommended to start antibiotic treatment for SBP if the neutrophil count is >250 cells/mm^3. Causative organisms include gram-negative Bacteriaceae such as *E coli* and *Klebsiella*, as well as *Streptococcus* sp, and *S. pneumoniae*. Therefore, the most appropriate antibiotic for treatment is *a third-generation cephalosporin* such as *cefotaxime*.

13. Ans. B

Management for *complicated acute diverticulitis* involves *admission* and *antibiotic treatment*. Treatment is directed against both anaerobic and gram-negative bacteria. Intra-abdominal *abscess* formation secondary to diverticulitis requires prompt surgical consultation and should be *drained* using CT or ultrasound-guided percutaneous draining. Abscesses < 5 cm in diameter may be treated with antibiotics alone. The patient's vital signs are stable and there is no evidence for peritonitis; therefore, she does not require an emergent laparotomy (A). The patient should not be discharged from the hospital (C). Because of the risk for bowel perforation, barium enema and colonoscopy are contraindicated (D and E); however, once the diverticulitis is controlled, the patient should undergo one of the procedures to look for other pathology and exclude complications, such as fistula formation.

14. Ans. C

Bordetella pertussis is a gram-negative bacillus, which causes a respiratory illness most commonly in the summer and fall months. Over time, immunity conferred by the vaccine loses its effectiveness and as a result, we have seen a resurgence of this infection recently.

There are *three stages* of illness: (1) catarrhal—characterized by sneezing, rhinorrhea, and coughing; (2) paroxysmal—frequent coughing episodes followed by an inspiratory "whop," post-tussive emesis; and (3) convalescent—chronic cough lasting several months. Treatment is with *macrolides*, preferably erythromycin for 14 days. Azithromycin, an TMP/SMX, may also be used. Pertussis infections in the adult population (A) are less severe than that in infants and children. The organism is not easily identified on routine sputum culture (B) and requires nasopharyngeal swab and culture, which takes about 1 week to grow. Antibiotics (D) impact the course of illness but only when they are prescribed early. After 2 weeks of infection, the role of antibiotics is primarily to decrease transmission to others. As mentioned earlier, the first phase of illness (E) is the catarrhal phase. The paroxysms of cough occur in phase 2.

15. Ans. B

Approximately 85% of the initial pathogens are bacterial. Gram-negative bacilli, particularly *P. aeruginosa*, used to be the most common pathogens found in the blood of febrile neutropenic patients until the 1980s. However, the administration of prophylactic antibiotics primarily active against gram-negative pathogens during chemotherapy, the widespread use of indwelling intravascular devices, and newer chemotherapy regimens have led to an increase in gram-positive pathogens and currently gram-positive bacteria account for 60–70% of microbiologically confirmed infections in these patients. *S. aureus*, *S. epidermidis* and *S. epidermidis* are the predominant gram-positive organisms. Once believed to be a contaminant, S. epidermidis has arisen as a major pathogen. *E. coli*, *P. aeruginosa,* and *K. pneumoniae* remain the most common gram-negative pathogens. Fungal, viral, and parasitic infections are also important primary and secondary complications. Vascular access can be challenging in patients receiving chemotherapy. Therefore, indwelling vascular catheters should be retained as far as possible. Even when catheter infection is suspected, the infection can be successfully treated in most cases without removing the catheter. The collection of a blood culture from vascular catheter lumen in addition to peripheral blood cultures may further assist in the diagnosis of clinically relevant catheter-related blood stream infections (CRBSI) by allowing the time necessary for blood culture from the peripheral vein to become positive to be compared with the time until blood culture from a central venous catheter becomes positive. A differential time to positivity of ≥120 minutes has been shown to be predictive of CRBSI. This approach is particularly useful in patients in whom catheter retention is desirable. Removal of the line is indicated in the context of tunnel infections, persistent bacteremia despite adequate treatment, atypical mycobacteria infection, and candidemia. Vancomycin should be added when infection of the line is suspected and should be administered through the line when possible.

16. Ans. D

Neisseria meningitidis, a gram-negative intracellular diplococcus, is classified into serogroups according to their capsular polysaccharides. Group A is the most common serotype in India. Cases occur when organisms are transmitted to a susceptible individual

from the nasopharynx of a carrier, who often have some immunity from invasive disease caused by the organisms they carry. Clinical disease typically takes the form of meningitis or meningococcemia; the two may coexist. Meningococcal disease has a wide spectrum of presentation including nausea, vomiting, myalgias, abdominal pain, leg or joint pain, pharyngitis, septic shock, pneumonia, myopericarditis, and DIC. The rash associated with meningococcal infection may be petechial or purpuric, but also may be urticarial, macular or maculopapular, particularly early in the disease. Patients with meningococcemia without meningitis have a greater mortality than those with meningitis.

17. Ans. A

Predisposing factors for cellulitis are:

- Arterial or venous disease/harvest
- Diabetes
- Previous significant fracture
- Dermatological conditions including eczema and dry skin
- Trauma, bites, and clenched fist injuries.

The majority of cellulites are caused by gram-positive bacteria, of which the most common pathogens are β-hemolytic streptococci, *S. pyogenes*, *S. aureus* and gram-negative aerobic bacilli. *Aeromonas* species are associated with fresh water exposure, whereas *Vibrio* species are seen in salt water-associated infections. *Pseudomonas* is seen in infected burns, and mixed gram-negative and gram-positive aerobes and anaerobes are seen in diabetic foot infections. Most uncomplicated cases can be managed with outpatient antibiotics and supportive care including elevation of the affected part and addressing underlying causes; patient education is important. Certain patients should be treated aggressively including surgical debridement where needed; such patients include those with clenched fist injuries, orbital cellulitis, and diabetic foot infections. Patients with diabetic foot infections will require anaerobic as well as aerobic cover. Suggested antibiotic regimes for mild-to-moderate diabetic foot infections include amoxicillin + clavulanic acid 875/125 mg PO bd plus metronidazole 400 mg bd. For patients with penicillin hypersensitivity, ciprofloxacin 500 mg bd plus clindamycin 600 mg tds can be given orally. Often it is difficult to distinguish clinically between cellulitis and deep vein thrombosis (DVT), especially when the erythema overlaps the path of the deep veins in the leg. Additionally, laboratory tests may not be specific enough to help differentiate between the two disease entities; there are no diagnostic laboratory tests for DVT and the white cell count may be normal or elevated in both conditions. An ultrasound is therefore indicated if any doubt exists regarding the diagnosis.

18. Ans. B

Risk factors for *Listeria meningitis* include immunosuppression, neonatal status, or age >50 years, alcoholism, malignancy, diabetes mellitus, hepatic failure, renal failure, iron overload, CVDs, and HIV infection. The most appropriate empiric therapy is ampicillin (the drug of choice for *Listeria*), with ceftriaxone and/or vancomycin. The CSF fluid supports a diagnosis of meningitis. Empiric vancomycin and ceftriaxone are recommended for the treatment of meningitis in patients 2–50 years of age. This covers *S. pneumoniae* and *N. meningitidis*, the most common organisms responsible for meningitis in this age group. The analysis of CSF in patients with *L. meningitis* often fails to reveal typical gram-positive rods with characteristic "tumbling motility" in wet mount preparations, but often shows pleocytosis and may demonstrate a significant number of lymphocytes in addition to neutrophils. Patients usually have increased CSF protein levels; decreased CSF glucose levels are found less commonly and less profoundly with *L. meningitis*. The fluoroquinolones may be effective but do not penetrate the CNS well. Gentamicin is synergistic with ampicillin, despite poor CNS penetration.

19. Ans. A

Spontaneous bacterial peritonitis is a common complication of end-stage liver disease. Initial treatment consists of antibiotics that have coverage of gram-negative bacteria. Common isolates are *E. coli* and *K. pneumonia*. There is no evidence that large-volume paracentesis improves outcomes in patients with SBP. Diagnostic paracentesis should be undertaken to confirm the diagnosis. SBP is confirmed when a WBC count of >250/μL is found. Additional paracentesis can be considered to determine the efficacy of treatment or to relieve symptoms.

20. Ans. B

In this patient, broad-spectrum antibiotics on presentation are indicated. However, once the specific organism is isolated and sensitivities are known, it is beneficial to de-escalate therapy to a limited-spectrum antibiotic. De-escalation strategies involve not only changing antibiotics but can reduce dosage as well. This may present as a challenge in a situation where a patient has responded well to a broad-spectrum antibiotic. However, failure to do so places the patient at additional risk for antibiotic-induced complications. Ciprofloxacin may be considered, but it provides unnecessarily broad-spectrum coverage. Studies have shown that appropriate de-escalation improves outcomes in cases of sepsis and ventilator-related pneumonia.

21. Ans. D

Note: He is only 5 days out from his transplant. The most common organisms to cause problems this early are hospital-acquired infections, particularly with gram-negative bacteria such as *Pseudomonas* or gram-positive bacteria such as *S. aureus*. CMV and *Pneumocystis* are likely 1–4 months out. *Cryptococcus* is a problem more often at 4 or more months out. *Legionella* does not have much more increased incidence, unless there were something wrong with the processing of water in the hospital.

22. Ans. E

Clinically, she is doing well. You are weaning her off the vent; her physical examination is stable; her laboratory is stable (*never base antibiotic therapy on a minor bump in WBC*). The sputum results are not unusual for a patient in the ICU; they will frequently become colonized with gram-negative organisms, particularly *Pseudomonas*. Never change therapy based on just a tracheal aspirate; you must have some other change in examination or laboratory that is significant for you to consider treating the organism found on a tracheal aspirate. Recognize that sputum results from a tracheal aspirate are rarely useful.

23. Ans. A

The patient has evidence of whooping cough caused by *B. pertussis*, a gram-negative *Coccobacillus* (like *H. influenzae*). The disease occurs in three phases—the catarrhal phase, a nonspecific URI-like syndrome lasting 1–2 weeks; the paroxysmal phase lasting up to 1 month, with paroxysms of coughing fits; and the convalescent phase lasting up to several months, with a chronic, intermittent cough. Antibiotic therapy with macrolides is usually only effective in the catarrhal phase, but should be given to patients to reduce the high degree of contagiousness. Corticosteroids and β-agonist nebulizers may be useful as adjunctive therapy. Cultures are useful only in the catarrhal phase, and have low sensitivity during the paroxysmal phase. Mortality is low.

24. Ans. B

Yersinia. pestis, the etiologic agent of bubonic plague, is a gram-negative Coccobacillus which can cause a number of different clinical syndromes. In this country, it is endemic in the southwestern United States but it has gained notoriety along with anthrax and tularemia because of its potential use as a possible biologic weapon. Pneumonic plague is caused by the inhalation of infective droplets from animals or *persons*. Rodents are the natural hosts but pets can "bring the disease home." After an incubation period of 1–6 days, pneumonic plague is an aggressive disease and many patients progress rapidly to septic shock and death without early treatment. Initially, patients may complain of typical symptoms of pneumonia, and their CXRs frequently show alveolar infiltrates. CXRs may also demonstrate an ARDS-like picture with diffuse patchy bilateral infiltrates and cavitation. None of the other agents demonstrate person-to-person transmission.

25. Ans. D

This patient has endometritis, which is the most common puerperal infection. The primary risk factor for endometritis is cesarean section, although young age, low socioeconomic status, prolonged stage 2 of labor, prolonged ruptured membranes, and multiple vaginal examinations are also risk factors. Patients typically present 2–3 days after delivery with fever, abdominal pain, and foul-smelling lochia. Infections are polymicrobial and most commonly caused by gram-negative enteric pathogens as well as *Bacteroides* and *Prevotella* species. *Chlamydia* is rarely responsible and may cause late-onset puerperal infection.

26. Ans. D

The patient has evidence of chancroid, caused by *H. ducreyi*, a gram-negative bacillus. A painful chancre-like lesion combined with a solitary tender unilateral lymph node which may also ulcerate is classic. Chancroid, unlike syphilis (caused by *T. pallidum*), is painful and tender. Treatment of chancroid is with azithromycin or ceftriaxone. Herpes simplex virus can cause ulcerated or vesicular lesions, but these are usually grouped and Gram stain of the lesions will be negative. *C. trachomatis*, a spirochete, may cause lymphogranuloma venereum, which is manifested by a painless ulcer combined with significant lymphadenopathy with a negative Gram stain. *S. epidermidis* may cause skin lesions in the genital region but Gram stain would show gram-positive cocci.

27. Answer is B

Meningococcemia refers to systemic infection with *N. meningitidis*, a gram-negative *Diplococcus*. Mortality is as high as 50%, due to multiorgan failure from septic shock which can occur within hours. Fever and rash occur in most patients. About 50% of patients present with true petechiae, and another 20–30% exhibit a maculopapular rash which later turns into petechiae or purpura. Bilateral adrenal infarction, part of a constellation of signs known as the *Waterhouse-Friderichsen syndrome*, occurs in approximately 10% of cases. Hypothermia, seizure, and arthritis each occurs <10% of the time. Laboratory studies may demonstrate a significant leukocytosis (although leukopenia, when present, is a poor prognostic indicator), thrombocytopenia, and DIC. Treatment is with a third-generation cephalosporin and aggressive management of shock (fluids, vasoactive agents, and ICU monitoring).

28. Ans. A

There is considerable overlap in the clinical presentation of patients with acute cholecystitis and acute cholangitis. However, patients with acute cholecystitis rarely exhibit jaundice and tend to be less toxic-appearing. Although the cystic duct is usually blocked in acute cholecystitis, the hepatic and common bile ducts are patent and free of infection and inflammation. Charcot's triad (fever, right upper quadrant pain, and jaundice) is the hallmark of acute cholangitis. Fever is nearly universal, present in 95% of patients, right upper quadrant tenderness in 90% and jaundice in 80%. Hypotension and altered mental status are present in 15% of patients and suggest gram-negative sepsis. When present in concert with Charcot's triad, these findings are known as *Reynolds' pentad*. Although mildly elevated bilirubin levels may be present in patients with acute cholecystitis, these levels rarely rise above 4 mg/dL.

29. Ans. A

Escherichia coli is isolated in 47–55% of the cases of SBP and gram-negative organisms are the most common etiologic agents as a group. *K. pneumoniae* is the second most commonly isolated organism. This is followed by *S. pneumoniae*, and other *Streptococcus* and *Staphylococcus* species. Although there have been isolated reports of anaerobic and polymicrobial infections in SBP, they are generally not considered to be causes of SBP. Fever or abdominal pain in a patient with ascites should raise the suspicion of infection and prompt a paracentesis. The presentation of SBP may be subtle, however, and include only mental status changes without abdominal pain or tenderness upon examination. All patients with an ascitic fluid neutrophil count $\geq 250/mm^3$ and a clinical picture consistent with infection should be treated with antibiotic therapy.

30. Ans. D

The disease is restricted to the Andean cordillera in Peru, Ecuador, and Colombia with sporadic cases being reported in Bolivia, Chile, and Guatemala. This focality is mainly due to the characteristics of its putative principal sand-fly vector, Lutzomyia verruca rum, which has a weak, hopping flight and is intolerant of extreme temperatures. Young children under the age of 10 years are the most affected age group in endemic communities, partly because of a predominantly younger population but also due to the presumed protective immunity that develops with repeated infection. There are two well-described phases of the illness. The initial acute phase, known as Oroya fever, occurs typically around 2–6 weeks after inoculation of the microorganism by the bite of an infected sand-fly. It is characterized by fever, pallor, malaise, joint pain, headache, and anorexia. In severe cases, with high parasitemia, this progresses to severe hemolytic anemia. High-mortality rates of 44–88% have been reported in untreated individuals.

31. Ans. B

Risk factors for MDRE infection and colonization with carbapenemase and/or ESBL-producing bacteria are as follows: (1) Prior and recent antibiotic (especially fluoroquinolone) use; (2) healthcare-associated risks including residence in long-term acute-care facilities, presence of feeding tubes, mechanical ventilation, or a central venous catheter; (3) obstructive uropathy; (4) increased age; (5) receiving healthcare in, or travel to, endemic areas; and (6) organ and stem cell transplantation. The patient presented in this case possesses many of these risk factors; steroid is amongst the lowest-risk factor for MDRE.

32. Ans. E

Quaternary ammonium compounds, hexachlorophene, and chloroxylenol are minimally effective against gram-negative bacteria. Chlorhexidine is moderately effective whereas iodophors and alcohols are best effective.

33. Ans. B

The pathogens that are most frequently involved in HAP are aerobic gram-negative bacilli (*P. aeruginosa*, *E. coli*, *K. pneumoniae*, *Acinetobacter* spp., etc.) and *S. aureus*. These bacteria can be considered the "core" pathogens in HAP along with *S. pneumoniae*. The role of a polymicrobial etiology of HAP has been proposed in ~50% of cases.

34. Ans. B

Infection occurs as a complication in 20% of patients with necrotizing pancreatitis and is thought to result from bacterial translocation from the gut to adjacent necrotic pancreatic parenchyma. The most common bacterial organisms include *E. coli*, *S. aureus*, and *E. faecalis*, although several other organisms may be found. Infection can occur at any time during the course of the disease, but most commonly occurs 2–4 weeks after presentation.

35. Ans. A

Limulus amebocyte lysate test was a simple and cost-effective means to screen CSF for gram-negative agents of meningitis.

36. Ans. C

Pneumonia contributes to between 750,000 and 1.2 million neonatal deaths and an unknown number of stillbirths each year worldwide. The etiology depends on the time of onset. Gram-negative bacilli predominate in the first week of life, and gram-positive bacteria after that.

37. Ans. D

Superinfections are frequent in patients with documented invasive aspergillosis, and clinicians must be on the alert to detect these. In one series, nearly half of patients with documented aspergillosis had coinfections. In some cases, the other infection was present concomitantly with the aspergillosis diagnosis, underscoring the importance of bronchoscopic evaluation at the outset, even if the serum galactomannan is positive. Bacterial coinfections are most frequent, as with our patient, with three-fourths due to gram-negative rods. Viral copathogens are next in frequency with CMV and respiratory viruses being the most common. A small percentage may become coinfected by other fungi or mycobacteria.

38. Ans. D

A bacterial infection is the most common cause of epiglottitis. Bacteria can enter your body when you breathe it in. It can then infect your epiglottis. The most common strain of bacteria that causes this condition is *H. influenzae* type b, also known as Hib.

39. Ans. D

Legionella pneumophila usually causes sporadic cases of pneumonia but does occur in outbreaks, classically when an air-conditioning system's water supply becomes contaminated, particularly if this occurs in a public or highly populated building. *L. pneumophila* tends to affect males twice as often as females and has a preponderance for smokers. Point-source outbreaks occur when a group of people is exposed to the organism in aerosols from contaminated cooling systems or air-conditioning. Immunocompromised patients are particularly vulnerable to developing *Legionella* pneumonia.

40. Ans. D

Kingella kingae is a species of gram-negative facultative anaerobic β-hemolytic coccobacilli. First isolated in 1960 by Elizabeth O King, it was not recognized as a significant cause of infection in young children until the 1990s, when culture techniques had improved enough for it to be recognized. *K. kingae* is a common etiology of pediatric bacteremia and the leading agent of osteomyelitis and septic arthritis in children aged 6–36 months. This gram-negative bacterium is carried asymptomatically in the oropharynx and disseminates by close interpersonal contact. The colonized epithelium is the source of bloodstream invasion and dissemination to distant sites, and certain clones show significant association with bacteremia, osteoarthritis, or endocarditis.

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