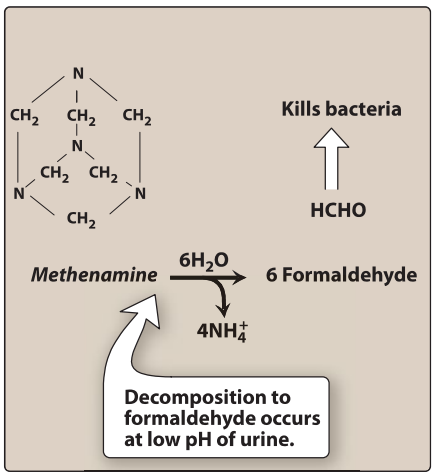

Figure 31.14
Formation of formaldehyde from *methenamine* at acid pH.

B. Nitrofurantoin

Nitrofurantoin [NYE-troe-fue-RAN-toin] was introduced into clinical practice for the management of cystitis in the early 1950s. For decades, it was rarely used, but was resurrected due to increasing antibiotic resistance among Enterobacteriaceae and is considered first-line therapy for uncomplicated cystitis. *Nitrofurantoin* works by inhibiting DNA and RNA synthesis. Susceptible organisms include E. coli, Klebsiella spp., Enterococcus spp., and Staphylococcus spp. Following oral administration, it is rapidly absorbed, with nearly 40% excreted unchanged in the urine. Overall, *nitrofurantoin* is well tolerated. Common adverse events include nausea, vomiting, and diarrhea. Use of the microcrystalline formulation decreases the incidence of gastrointestinal toxicity. Rare complications of therapy include pulmonary fibrosis, neuropathy, and autoimmune hepatitis. These events are observed with prolonged exposure greater than 1 month. Additionally, patients with impaired renal function should not receive *nitrofurantoin* due to an increased risk of adverse events.

Study Questions

Choose the ONE best answer.

31.1 A 32-year-old man presents to an outpatient clinic with a 5-day history of productive cough, purulent sputum, and shortness of breath. He is diagnosed with community-acquired pneumonia (CAP). It is noted that this patient has a severe ampicillin allergy (anaphylaxis). Which would be an acceptable treatment for this patient?

A. Levofloxacin
B. Ciprofloxacin
C. Penicillin VK
D. Nitrofurantoin

Correct answer = A. Streptococcus pneumoniae is a common cause of CAP, and the respiratory fluoroquinolones levofloxacin and moxifloxacin provide good coverage. Ciprofloxacin does not cover S. pneumoniae well and is a poor choice for treatment of CAP. Penicillin would be a poor choice due to allergy. Nitrofurantoin has no clinical utility for respiratory tract infections.

31.2 A 22-year-old woman presents with a 2-day history of dysuria with increased urinary frequency and urgency. A urine culture and urinalysis are done. She is diagnosed with a urinary tract infection caused by E. coli. Which agent should be avoided in the treatment of her UTI?

A. Levofloxacin
B. Cotrimoxazole
C. Moxifloxacin
D. Nitrofurantoin

Correct answer = C. Moxifloxacin does not concentrate in the urine and would be ineffective for treatment of a UTI. All other answers are viable alternatives, and the resistance profile for the E. coli can be utilized to direct therapy.

31.3 Which drug is correctly matched with the appropriate adverse effect?

A. Levofloxacin—hyperkalemia
B. Nitrofurantoin—pulmonary fibrosis
C. Cotrimoxazole—hepatic encephalopathy
D. Methenamine—nystagmus

Correct answer = B. Hyperkalemia may be caused by cotrimoxazole, not fluoroquinolones. Hepatic encephalopathy may be related to therapy with methenamine in patients with hepatic insufficiency. Nystagmus is not associated with methenamine therapy.

31.4 Cotrimoxazole provides activity against which organism?

A. MRSA
B. Pseudomonas aeruginosa
C. Anaerobes
D. Mycoplasma

Correct answer = A. Cotrimoxazole is effective against MRSA. It does not have activity against Pseudomonas, anaerobes, or Mycoplasma.

31.5 A 55-year-old man presents to primary care clinic with an erythematous and tender abscess on his left thigh. He has a history of MRSA skin infections. Which is an appropriate antibiotic for empiric treatment?

A. Ciprofloxacin
B. Cotrimoxazole
C. Pyrimethamine
D. Cephalexin

Correct answer = B. Cotrimoxazole is the only agent with reliable activity against MRSA. Ciprofloxacin does have some minor activity, but resistance has readily increased and it is no longer a valid recommendation. The other agents do not have activity against MRSA.

31.6 Which is a common adverse effect of cotrimoxazole?

A. Hyperkalemia
B. Pulmonary fibrosis
C. Tendon rupture
D. Blood glucose disturbances

Correct answer = A. Trimethoprim acts as a potassium-sparing agent, resulting in an increase in serum potassium concentrations. Pulmonary fibrosis is an adverse effect of nitrofurantoin. Tendon rupture and blood glucose disturbances are adverse effects of fluoroquinolones.

31.7 A 21-year-old marathon runner reports to the clinic with acute Achilles tendon rupture. The nurse noted that the patient recently took an antibiotic for community-acquired pneumonia. Which antibiotic may have contributed to tendon rupture?

A. Amoxicillin/clavulanate
B. Cefdinir
C. Levofloxacin
D. Minocycline

Correct answer = C. Levofloxacin is associated with tendon ruptures and tendinopathy. The other agents are not associated with this adverse effect.

31.8 A 70-year-old woman with acute cystitis presents to the Family Medicine clinic for assessment. She has a past medical history of hypertension and chronic kidney disease. The team recommends initiation of nitrofurantoin for cystitis. After reviewing her antimicrobial therapy, which actions should be taken prior to clinic discharge?

A. Continue current therapy and counsel on gastrointestinal effects of nitrofurantoin.
B. Change nitrofurantoin to alternative agent due to chronic kidney disease.
C. Reduce nitrofurantoin dose due to impaired renal function.
D. Counsel patient regarding neuropathy associated with short-term therapy.

Correct answer = B. The key issue with the antibiotic recommendation is that nitrofurantoin should not be administered in patients with poor kidney function. Adjusting the dose and continuing the current regimen are not acceptable modifications. Neuropathy is more common with therapy greater than 1 month.

31.9 Which recommendation should be provided to avoid phototoxicity associated with fluoroquinolone therapy?

A. Use sunscreen and avoid excessive exposure to UV light.
B. Take the medication at night to avoid high drug concentrations during the day.
C. Take with food.
D. Drink with 1 L of water per day to minimize drug buildup in skin tissue.

Correct answer = A. Patients taking a fluoroquinolone should apply sunscreen and take precautions to minimize risk of phototoxicity. Adjusting the timing of the dose or taking with food or additional water does not change the risk of an event.

31.10 What is the main benefit for prescribing methenamine for treatment of a urinary tract infection?

A. Safe to use in patients with hepatic failure.
B. Available in intravenous and oral formulations.
C. Broad spectrum of activity.
D. Minimal development of resistance.

Correct answer = D. Methenamine does not select for resistance. Due to its conversion to formaldehyde, this compound is the least likely compound to select for resistant isolates. Methenamine should be avoided in patients with hepatic failure. This agent is only available as an oral formulation, and it has a narrow spectrum of activity.