ANTIBIOTICS FROM HEAD TO TOE: PART 5 - URINARY TRACT INFECTIONS

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ACTIVITY DESCRIPTION
Antibiotic use in the safest and most efficacious manor possible is critically important for multiple reasons. Appropriate antibiotic use decreases the morbidity and mortality associated with infectious diseases. However, in an era where antibiotic resistance is becoming increasingly more problematic, this must be balanced with judicious use to preserve antibiotic effectiveness. In the series titled, "Antibiotics from Head to Toe" we will review appropriate antibiotic use by disease state.

TARGET AUDIENCE
The target audience for this activity is pharmacists, pharmacy technicians, and nurses in hospital, community, and retail pharmacy settings.

LEARNING OBJECTIVES
After completing this activity, the pharmacist and nurse will be able to:

- Define complicated and uncomplicated urinary tract infection
- Identify the most common organisms seen in urinary tract infections
- Identify signs and symptoms of urinary tract infections
- Select appropriate empiric antibiotic therapy for a patient with a urinary tract infection

After completing this activity, the pharmacy technician will be able to:

- Identify the symptoms of urinary tract infections
- List ways to treat urinary tract infections

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Universal Activity No.: 0798-0000-13-223-H01-P&T
Credits: 1 contact hour (0.1 CEU)
Release Date: June 4, 2014
Expiration Date: June 4, 2016

ACTIVITY TYPE
Knowledge-Based, Home-Study Webcast

FINANCIAL SUPPORT BY
Pharmaceutical Education Consultants, Inc.
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Antibiotics from Head to Toe: Part 5 – Urinary Tract Infections

Objectives

1. Define complicated and uncomplicated urinary tract infection
2. Identify the most common organisms seen in urinary tract infections
3. Identify signs and symptoms of urinary tract infections
4. Select appropriate empiric antibiotic therapy for a patient with a urinary tract infection

Definitions

- Urinary tract infection (UTI): the presence of microorganisms in the urinary tract that cannot be accounted for by contamination
  - Uncomplicated: occur in individuals who lack structural or functional abnormalities of the urinary tract that interfere with the normal flow of urine or voiding mechanism (generally females 15 to 45 years of age)
  - Complicated: result of a predisposing lesion of the urinary tract or neurologic deficit that interferes with the normal flow of urine and urinary tract defenses
Definitions

- Urethritis: infection of the urethra
- Cystitis: infection of the lower urinary tract infection
- Pyelonephritis: infection of the upper urinary tract
- Prostatitis: infection of the prostate

Epidemiology

- Urinary tract infections are considered to be the most common bacterial infection
  - ~7 million office visit annually
  - ~1 million emergency department visits
  - ~100,000 hospitalizations
- Catheter associated- bacteriuria: most common healthcare-associated infection worldwide
  - 40% of hospital acquired infection
  - ~900,000 patients with nosocomial bacteriuria annually

Etiology

- Uncomplicated
  - *Escherichia coli* (80 to 90%)
  - *Staphylococcus saprophyticus*
  - *Klebsiella pneumoniae*
  - *Proteus species*
  - *Pseudomonas aeruginosa*
  - *Enterococcus spp.*

- Complicated
  - *Escherichia coli* (<50%)
  - *Staphylococci*
  - *Klebsiella pneumoniae*
  - *Proteus species*
  - *Pseudomonas aeruginosa*
  - *Enterobacter*
  - *Enterococcus spp.*

Pathophysiology

- Entry into the urinary tract via the following routes
  - Ascending
  - Hematogenous (descending)
  - Lymphatic
- Factors that determine the development of infection
  - *Inoculum*
  - *Virulence*
  - *Host defenses*
Clinical Presentation: Subjective

**Lower UTI**
- Dysuria
- Urgency
- Frequency
- Nocturia
- Suprapubic heaviness

**Upper UTI**
- Flank pain
- Fever
- Nausea
- Vomiting
- Malaise

Clinical Presentation: Elderly Patients Subjective

- Frequently do not present with specific urinary symptoms
- Common presenting symptoms include
  - Altered mental status
  - Change in eating habits
  - GI symptoms

Clinical Presentation: Objective

- Physical Exam:
  - Costovertebral (CV) tenderness
- Laboratory Tests:
  - Bacteriuria
  - Pyuria (WBC > 10/mm³)
  - Nitrite-positive urine (with nitrite reducers)
  - Leukocyte esterase-positive urine
  - Antibody-coated bacteria

Laboratory Evaluation and Diagnosis

- Urine collection
  - Midstream clean-catch
  - Catheterization
  - Suprapubic bladder aspiration
- Bacterial count
- Urine culture
Risk Factors

- Structural abnormalities
  - Prostatic hypertrophy
  - Urethral strictures
  - Calcui
  - Tumors
  - Bladder diverticula
  - Medications
- Neurologic malfunctions
  - Stroke
  - Diabetes
  - Spinal cord injuries
  - Vesicoureteral reflux
  - Catheterization

Case Study

- TM is a 72 yo female who is brought to the ER from her nursing home for altered mental status. TM has no complaints and appears relatively stable on arrival, however, she is unable to tell you her name or where she lives. The nursing home staff indicate that she is able to provide this information at baseline.

- A urinalysis and urine culture are obtained and reveal the following;
- Yellow; cloudy; pH 5.0, WBC 15-20 cells/hpf; RBC 1-5 cells/hpf; leukocyte esterase 2+; nitrate positive; moderate bacteria

Treatment: General Principles

- Select an antibiotic that achieves high concentrations in the urine
- Local antibiotic susceptibility patterns
- Susceptibility

Treatment: Common Oral Antibiotics

- Trimethoprim-sulfamethoxazole
- Ampicillin
- Amoxicillin-clavulanic acid
- Cephalosporins (1st, 2nd and 3rd generation)
- Fluoroquinolones (ciprofloxacin and levofloxacin)
- Nitrofurantoin
- Fosfomycin
Treatment: Common IV Antibiotics

- Aminoglycosides
- Penicillins
  - Ampicillin-sulbactam
  - Ticarcillin-clavulanate
  - Piperacillin-tazobactam
- Cephalosporins (1st, 2nd and 3rd generation)
- Carbapenems
- Fluoroquinolones (ciprofloxacin and levofloxacin)

Treatment: Uncomplicated Cystitis and Pyelonephritis in Women

Cystitis

- Nitrofurantoin monohydrate/macrocystals 100 mg PO BID x 5 days
- Trimethoprim-sulfamethoxazole DS 1 tablet PO BID x 3 days
- Fosfomycin trometamol 3 g as a single dose

Pyelonephritis

- Ciprofloxacin 500 mg PO Bid x 7 days
- Ciprofloxacin ER 1000 mg PO daily or Levofloxacin 750 mg PO x 5 days
- Trimethoprim-sulfamethoxazole DS 1 tablet PO BID x 14 days

Treatment Alternatives: Uncomplicated Cystitis in Women

- Fluoroquinolones
  - Ciprofloxacin
  - Levofloxacin
- β-lactam antibiotics
  - Amoxicillin-clavulanate
  - Cefdinir
  - Cefaclor
  - Cefpodoxime

Treatment Alternatives: Uncomplicated Pyelonephritis in Women

- Long-acting parenteral
  - Ceftriaxone 1 g IV daily
  - Aminoglycoside IV daily
  - PO β-lactams


Treatment: Complicated and Catheter-Associated Cystitis and Pyelonephritis

- Consider local susceptibility patterns when selecting empiric therapy
- Obtain a urine culture and tailor antibiotics based on culture data
- Treat for 7-14 days depending on clinical response, location of infection and pathogen

Adjunct Therapies

- Cranberry juice
- Lactobacillus probiotics
- Estrogen products
- Phenazopyridine hydrochloride

Asymptomatic Bacteriuria

- Definition: isolation of a specified quantitative count of bacteria in an appropriately collected urine specimen
- ≥10⁵ cfu/mL in 2 consecutive urine specimens
- Etiology: *Escherichia coli*

In general treatment is not indicated unless
- The patient is pregnant OR
- The patient is going to undergo traumatic urologic intervention with mucosal bleeding

Summary

- Urinary tract infections are the most common bacterial infection
- Classification of UTI is important for determining likely pathogens, treatment and treatment duration
- When selecting an antibiotic regimen for a UTI the regimen should ideally be well tolerated, well absorbed, achieve high concentrations in the urine and have a narrow spectrum of activity for the causative organism
1. RB is a 70 yo Caucasian female who presents to the emergency room with her daughter with a chief complaint of altered mental status x 24 hours. PMH is significant for dyslipidemia and hypertension. At home RB takes simvastatin 10 mg PO daily, amlodipine 5 mg PO daily and HCTZ 25 mg PO daily. The general internal medicine team is concerned about a urinary tract infection and obtains a urinalysis which reveals; + nitrates, 2+ leukocyte esterase, 25-50 cells/hpf WBC, 0-5 cells/hpf squamous epithelial cells and moderate bacteria.

Based on the information provided in the case how would you classify RB’s UTIS?  
A. Uncomplicated, Cystitis  
B. Complicated, Cystitis  
C. Uncomplicated, Pyelonephritis  
D. Complicated, Pyelonephritis

2. What organism is most likely responsible for RB’s infection?  
A. Staphylococcus aureus  
B. Haemophilus influenza  
C. Klebsiella pneumonia  
D. Escherichia coli.

3. The team has looked at the antibiogram for the hospital and is considering use of nitrofurantoin empirically for RB’s infection. Prior to initiating the antibiotic the team asks for your opinion. Which of the following is the best response?  
A. You would need to know information about the patient’s renal function prior to making a recommendation  
B. Nitrofurantoin is not appropriate in a patient with complicated cystitis  
C. Nitrofurantoin in not appropriate in a patient with complicated pyelonephritis  
D. Nitrofurantoin is an excellent choice

4. Which of the following antibiotics would be the BEST empiric therapy for the treatment of RB’s infection?  
A. Azithromycin  
B. Ceftriaxone.  
C. Colistin  
D. Fosfomycin
5. RB’s mental status returns to baseline after 24 hours of treatment. The team is getting ready to send her home and consults you for the duration of treatment. Which of the following is the best recommendation?
   A. 3 days
   B. 5 days
   C. 7 days
   D. 21 days

6. Which of the following patient descriptions are compatible with the definition of a patient who may experience an uncomplicated urinary tract infection?
   A. A previously healthy, 20 year old man
   B. A previously healthy, 20 year old woman
   C. A previously healthy, 70 year old man
   D. A previously healthy, 70 year old woman

7. Bacteria that cause urinary tract infections typically arise from:
   A. Skin flora
   B. Bowel flora
   C. Renal abscesses
   D. Bacteremia

8. Which of the following symptoms is commonly seen in individuals with a urinary tract infection arising from catheterization?
   A. Dysuria
   B. Flank pain
   C. Urinary frequency
   D. Urinary symptoms do not frequently arise in catheterized patients presenting with a urinary tract infection

9. Long term catheterization typically results in a urinary tract infection which is:
   A. Polymicrobial
   B. Caused by a single organism, typically Escherichia coli
   C. Caused by a single organism, typically Staphylococcus aureus
   D. Caused by a single multi-drug resistant (MDR) organism

10. When considering antibiotics for the treatment of urinary tract infections, which of the following characteristics would the ideal regimen have?
    A. Well tolerated
    B. Poorly absorbed.
    C. High concentration in the urine
    D. A and C
    E. All of the above

Please submit your final responses on freeCE.com. Thank you.