The Safest Dental Visit

Antibiotic Stewardship and Our Responsibility

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Objectives

1. Discuss untoward effects of antibiotic use
2. Define antibiotic stewardship
3. Describe 6 goals of antibiotic stewardship programs
4. Describe a rationale for antibiotic selection
5. Describe directed and empiric antibiotic therapy
6. Describe and give examples of 4 tenets of appropriate antibiotic use

Introduction

• The modern age of antibiotic therapeutics was launched in the 1930s with sulfonamides and the 1940s with penicillin
• Since then, many antibiotic drugs have been developed, most aimed at the treatment of bacterial infections
• These drugs have played an important role in the dramatic decrease in morbidity and mortality due to infectious diseases
• While the absolute number of antibiotic drugs is large, there are few unique antibiotic targets
Terminology
• Antibiotics
• Antimicrobials
• Disinfectants
• Sanitizers

Untoward Effects of Antibiotics
• Antibiotic resistance
• Adverse drug events (ADEs)
  – Hypersensitivity/allergy
  – Drug side effects
  – *Clostridium difficile* infection
  – Antibiotic associated diarrhea/colitis
• Increased health-care costs

Ohl CA, Luther VP. J. Hosp. Med. 2011;6:S4

New CDC estimates

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**MDRO's are Epidemiologically Important Pathogens**

Options for treatment are limited

MDRO’s are associated with:

- Increased lengths of stay
- Increased costs
- Increased morbidity and mortality

Can be transmitted in healthcare facilities

Source: Centers for Disease Control and Prevention Guideline for Control of Multidrug-Resistant Organisms in Healthcare Settings, 2006.

**Evolution of Drug Resistance in S. aureus**

- **Penicillin**
  - S. aureus
  - [1950s]
  - Penicillin-resistant S. aureus

- **Methicillin**
  - [1970s]
  - Methicillin-resistant S. aureus (MRSA)

- **Vancomycin**
  - [1990s]
  - Vancomycin-intermediate-resistant S. aureus (VISA)

- **Vancomycin-resistant enterococci (VRE)**
  - [1997]
  - Vancomycin-resistant S. aureus


**Examples of How Antibiotic Resistance Spreads**

- Animals get antibiotics and bacteria in their guts.
- Drug-resistant bacteria can result in less effective antibiotics or cause infections that spread to humans.
- George gets antibiotics and bacterial bacteria in his gut.
- George eats at a restaurant where resistant bacteria are present.
- George gets food at a restaurant where resistant bacteria are present.
- George gets food at a restaurant where resistant bacteria are present.
- Resistance genes travel directly to other pathogens or indirectly on certain kinds of healthcare providers.
- Drug-resistant bacteria in the animal farm can travel to the human gut.
- Patterns, patterns, patterns.
- Resistance genes are spread in other parts of the animal farm within the healthcare facility.

Simply using antibiotics creates resistance. These drugs should only be used to treat infections.
Resistance in action

SUPER BUGS?

- **MRSA** (Methicillin Resistant *Staph aureus*)
- **CRE** (Carbapenem-Resistant Enterobacteriaceae)
- **ACINETOBACTER sp.**
- **CDIFF** (*Clostridium difficile*)
- **NOROVIRUS**
- **CURRENT ORGANISMS OF CONCERN ??**

ESBL and CRE

**ESBL**: Extended-Spectrum Beta Lactamase-Producing gram-negative bacteria

**CRE**: Carbapenem Resistant Enterobacteriaceae

**Cause variety of infections:**
- Pneumonia
- Bloodstream Infections
- Wound infections
- Resistant to many antibiotics and difficult to treat

Source: APIC Text, Association for Professionals In Infection Control and Epidemiology, 2009.
Why the hype on CRE?

- High mortality rate
- Transfer antibiotic resistance
- Easily spread by contact

ESBL
- Gram negative organisms that produce an enzyme called beta-lactamase that causes resistance to these antibiotics:
  - Penicillins
  - Cephalosporins (1st, 2nd, 3rd & 4th generation) (Keflex, cefepine)
  - Monobactams (Azactam)
  - One or more Carbapenem
- Can usually be treated with one of the Carbapenems:
  - Meropenem, Imipenem, Ertapenem, Doripenem
- Commonly isolated from:
  - abscesses, blood, catheter tips, lungs, sputum, peritoneal fluid
- Risk Factors include:
  - Recent surgery or instrumentation, admission to ICU, recent Abx therapy (esp. Beta lactams), prolonged hospital stay

Source: APIC Text, Association for Professionals In Infection Control and Epidemiology, 2009.

CRE
- Gram negative organisms that produce one type of beta-lactamase enzyme called carbapenemase.
- Occurs typically in the Enterobacteriaceae family of bacteria
- Confers resistance to all currently available antibiotics, including Carbapenems
- Carbapenem Resistant Enterobacteriaceae
- Most common CRE is:
  - Klebsiella pneumoniae - KPC

Source: CDC MMWR, Vol. 58 No. 12 3/20/09

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**Clostridium difficile Infection (CDI)**
A potentially deadly colitis
- Antibiotics are the single most important risk factor for CDI
- Incidence and mortality increasing
- A more virulent NAP1/BI strain also seen with increasing frequency

Redelings, et al. EID, 2007;13:1417
CDC. Get Smart for health care. Access at www.cdc.gov/GetSmart/healthcare

**Correlations with CDAD**
- Antibiotic exposure is the single most important risk factor for the development of Clostridium difficile associated disease (CDAD).
  - Up to 85% of patients with CDAD have antibiotic exposure in the 28 days before infection

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**Antibiotic Stewardship**
- Definition: A system of informatics, data collection, personnel, and policy/procedures which promotes the optimal selection, dosing, and duration of therapy for antimicrobial agents throughout the course of their use
  - Limit inappropriate and excessive antibiotic use
  - Improve and optimize therapy and clinical outcomes for the individual infected patient

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Antibiotic Stewardship

- Is pertinent to inpatient, outpatient, and long-term care settings
- Is practiced at the
  - Level of the patient
  - Level of a health-care facility or system, or network
- Should be a core function of the medical staff (i.e. doctors and other healthcare providers)
- Utilizes the expertise and experience of clinical pharmacists, microbiologists, infection control practitioners and information technologists

Six Goals of Antibiotic Stewardship Programs

1. Reduce antibiotic consumption and inappropriate use
2. Reduce *Clostridium difficile* infections
3. Improve patient outcomes
4. Increase adherence/utilization of treatment guidelines
5. Reduce adverse drug events
6. Decrease or limit antibiotic resistance
   - Hardest to show
   - Best data for health-care associated gram negative organisms

Nine Factors to Consider When Selecting an Antibiotic

1. Spectrum of coverage
2. Patterns of resistance
3. Evidence or track record for the specified infection
4. Achievable serum, tissue, or body fluid concentration (e.g. cerebrospinal fluid, urine)
5. Allergy
6. Toxicity
7. Formulation (IV vs. PO); if PO assess bioavailability
8. Adherence/convenience (e.g. 2x/day vs. 6x/day)
9. Cost
**Principles of Antibiotic Therapy**

**Empiric Therapy (85%)**
- Infection not well defined ("best guess")
- Broad spectrum
- Multiple drugs
- Evidence usually only 2 randomized controlled trials
- More adverse reactions
- More expensive

**Directed Therapy (15%)**
- Infection well defined
- Narrow spectrum
- One, seldom two drugs
- Evidence usually stronger
- Less adverse reactions
- Less expensive

**Why So Much Empiric Therapy?**
- Need for prompt therapy with certain infections
  - Life or limb threatening infection
  - Mortality increases with delay in these cases
- Cultures difficult to do to provide microbiologic definition (i.e. pneumonia, sinusitis, cellulitis)
- Negative cultures
- Provider Beliefs
  - Fear of error or missing something
  - Not believing culture data available
  - "Patient is really sick, they should have 'more' antibiotics"
  - Myth of "double coverage" for gram-negatives e.g. pseudomonas
  - "They got better on drug X, Y, and Z so I will just continue those"

**To Increase use of Directed Therapy for Outpatients:**
- Define the infection 3 ways
  - Anatomically, microbiologically, pathophysiologically
- Obtain cultures before starting antibiotics
  - Often difficult in outpatients (acute otitis media, sinusitis, community-acquired pneumonia)
- Narrow therapy often with good supporting evidence
  - Amoxicillin or amoxicillin/clavulinate for AOM, sinusitis and CAP
  - Penicillin for Group A Streptococcal pharyngitis
  - 1st generation cephalosporin or clindamycin for simple cellulitis
  - Trimethoprim/sulfamethoxazole or cipro/levofloxacin for cystitis
Tenet 1: Treat Bacterial Infection, not Colonization

- Many patients become colonized with potentially pathogenic bacteria but are not infected
  - Asymptomatic bacteriuria or foley catheter colonization
  - Tracheostomy colonization in chronic respiratory failure
  - Chronic wounds and decubiti
  - Lower extremity stasis ulcers
  - Chronic bronchitis
- Can be difficult to differentiate
  - Presence of WBCs not always indicative of infection
  - Fever may be due to another reason, not the positive culture

Tenets of Proper Stewardship

Tenet 1: Treat Bacterial Infection, not Colonization
Tenet 2: Do not Treat Sterile Inflammation or Abnormal Imaging Without Infection
Tenet 3: Do not Treat Viral Infections with Antibiotics
Tenet 4: Limit Duration of Antibiotic Therapy to the Appropriate Length
Other Tenets of Antibiotic Stewardship

• Limit duration of surgical prophylaxis to <24 hours perioperatively
• Use rapid diagnostics if available (e.g. respiratory viral PCR)
• Solicit expert opinion if needed
• Prevent infection
  – Use good hand hygiene and infection control practices
  – Remove catheters

Improvement is Possible-Example

Antibiotic Rx for Hospitals
Proceed with Caution

If
prescriptions of high-risk
antibiotics in hospitals
are reduced by 30%

H

Then
it could lead to 26%
from cases of deadly
diabetic infections.


Protect patients from antibiotic-resistant infections.

Source: US Centers for Disease Control and Prevention
Holistic View of Antibiotic Use

Antibiotics are the only drug where use in one patient can impact the effectiveness in another.

If everyone does not use antibiotics well, we will all suffer the consequences.

Antibiotics are a shared resource, and becoming a scarce resource.

Using antibiotics properly is analogous to developing and maintaining good roads.

CDC Core Elements of Antibiotic Stewardship Programs

- Leadership Commitment
- Accountability
- Drug Expertise
- Action
- Tracking
- Reporting
- Education

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History of antibiotic discovery and concomitant development of antibiotic resistance.

Microbiology and Molecular Biology Reviews

www.OSAP.org  For more information visit www.osap.org or email office@osap.org
Monitoring and Compliance

- **Develop Measures**
  - Observation of adherence to protocols and practice, contact precautions, hand hygiene
  - New Infections
  - Organism prevalence
  - Microbiological Antibiotics Resistance Trends
- **Collect Data**
- **Analyze Data**
- **Present Findings**
- **Develop strategies for improvement**


SUPER BUGS...

“Survival of the fittest”
Realize they are here to stay

- In the environment
- In all healthcare facilities
- In or on ourselves

Practice Prevention Methods

Team Collaboration toward changes and success

- **Utilize a TEAM APPROACH**
- **Define your GOAL**
- **Work toward your END RESULT**
- **Celebrate your SUCCESS**


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Conclusion

• The therapeutic benefit of antibiotics should be balanced with their unintended adverse consequences
• Inappropriate antibiotic use is associated with increased antibiotic resistance, adverse drug effects and *Clostridium difficile* infection
• Antibiotic stewardship is important for preserving existing antibiotics and improving patient outcomes
• Antibiotic prescribing should be prudent, thoughtful and rational

References


• 10 Things You can Do to be a Safe Patient, electronically accessible from: http://www.cdc.gov/features/patientsafety/.

Question and Answer

• To Contact Dr. Garrett:
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