Antibiotics

An overview

Presented by

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Important

The information in this presentation has been gathered from medical texts, pharmaceutical companies' web sites, and drug package inserts.

It should not be considered a substitute for medical advice. Your doctor and pharmacist are the experts on these subjects.

Antibiotic Myths

Myth #1

Antibiotics are dangerous

Fact:

They are safer than most drugs

Myth #2

Antibiotics are powerful drugs

Fact:

Compared to most drugs, antibiotics are mild, with minimal side-effects (especially those used to treat Lyme disease)

Myth #3

Lyme patients are likely to encourage the development of antibiotic-resistant bacteria.

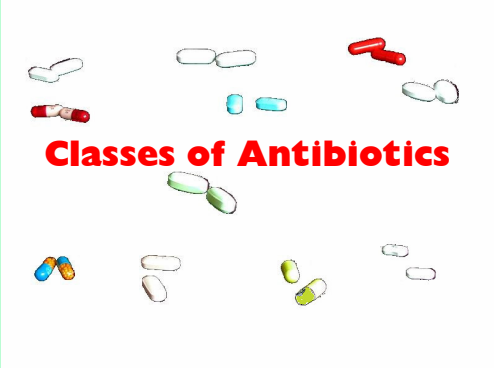
Fact: The way antibiotics are prescribed for Lyme disease makes the possibility of antibiotic resistance very low.

Myth #4

Antibiotics affect your immune system

Fact:

There is no medical evidence that any antibiotics have any negative effect on your immune system



Biochemistry of Antibiotics

- Types or categories
- Mode of action
  - –How they work
  - –Where they work
  - –When they work
- How long do you need them

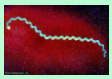
A Little Biology First

Types of harmful organisms

- **Bacteria**
- **Spirochetes** - Lyme (Borrelia burgdorferi)
- Protozoans - Babesia microti, WA1
- Viruses
- Parasites (multi-cellular)

Carriers

- Arachnids (ticks & spiders)
- Insects (flies, mosquitoes…)



Lyme Spirochetes

Borellia burgdorferi (Bb)

- Attacks cells by invading them and disrupting normal operations
- Produce a neurotoxin that interferes with functions of nerves and brain cells

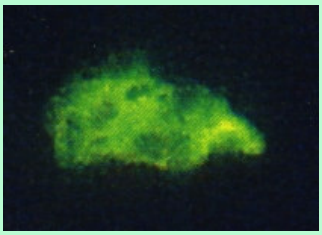
Bb has a double pronged attack on the body in disrupting cellular function and the communication system of the body.

The Spirochete

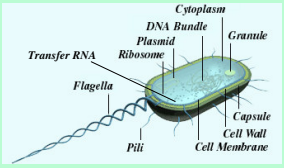
(Borellia burgdorferi - Bb)

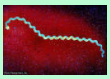
- Spirochete and pleomorphic mass cultured from blood (so-called **cystic or L-form** a no-cell-wall form)

After 12 weeks of oral and 6 weeks of IV antibiotics



Bacteria & Spirochetes





Lyme Spirochetes

Borrelia burgdorferi

Antibiotics attack

1. Cell wall
2. Ribosome (protein factory)
3. Transfer RNA (ribosome instructions)
4. DNA (reproduction)

Rod shaped bacteria

How Antibiotics Work

- Bacteria are most vulnerable when they are reproducing
  - They need to make new cell walls, copies of DNA, proteins and all other components of new cells

1. Antibiotics can interfere with production processes
2. Antibiotics can attack cells directly to kill

Antibiotics Points of Action

Mechanisms: **Prevents making new cell wall components or assembling them properly – Also direct attack to kill.**

- Penicillins (amoxicillin, ampicillin, Bicillin, Augmentin, penicillin-G)
- Cephalosporins (Ceftin, Claforin, Omnicef, Rocephin, Suprax)
  - Work outside cells, fair to poor CSF penetration except Rocephin

Antibiotics Points of Action

Mechanism: **Prevents ribosomes from making new proteins.**

- Macrolides (Biaxin, Dynabac, Zithromax)
  - Very good tissue penetration
  - Often used with Plaquenil (some think kills cyst form)
- Ketolide (new class, e.g. Ketek – attacks at 2 places on ribosome - unique)
- Tetracyclines (tetracycline, doxycycline, Doryx)
  - Fair to good CNS penetration
  - Very effective against ricksettia (anaplasma, ehrlichia, Rocky Mountain Spotted Fever)

Antibiotics Points of Action

Mechanism: **Prevents messenger RNA from giving the proper instructions to the ribosome and inhibits protein synthesis**

- Rifampin – good tissue and fluids penetration – including CSF

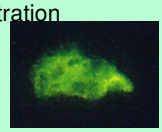
Antibiotics Points of Action

Mechanism: **Interferes with replication of DNA required for bacteria to divide.**

- Fluoroquinolones (Ciprofloxacin = "cipro"& Levaquin)
  - Good tissue and fluid penetration
  - Effective against Bartonella

Antibiotics Points of Action

- Other: Nitroimidazoles (flagyl, tinidazole, Tindamax)
- Effective against anaerobic bacteria and amoebic infections
- Effective against non-cell-wall forms (L-forms or cyst form) of Borrelia
  - Excellent CNS and fluids penetration
  - Good cellular penetration
  - Inhibits protein formation



Combinations of Antibiotics

- Attack spirochetes from different "angles"
- Look for synergistic effects ("1+1=3")
- Address multiple infections simultaneously
- Reduce likelihood of developing resistance

Bacteriostatic vs. Bactericidal

- Antibiotics that inhibit protein synthesis **generally** prevent bacterial growth, but don't kill them outright = **Bacteriostatic** (Ketek is an exception)
- Antibiotics that attack the cell wall or L-forms tend to kill bacteria = **Bactericidal**

Bacteriostatic vs. Bactericidal

- **Old** Rule: Don't mix bacteriostatic with bactericidal antibiotics
- Does not seem to apply to tick-borne infections
- LLMDs often mix types to attack stubborn cases

How Long to Treat?

- LLMDs often say to treat for 2-4 months after symptoms resolve
- Why is this so?
  - Bb thought to have a 4 week life cycle, need to treat for 2 or more cycles after symptoms resolve to catch "slowpokes" or different groups
  - Bb can become dormant, so try to make sure all active Bb are suppressed

Administration

- **Oral** – if short half-life requires several doses daily – hard to do (e.g. amoxicillin)
- **IM** – often longer lasting per dose, bypasses stomach to avoid gastric upset
- **IV** – can get highest consistent levels in the blood even with shorter half-lives, bypasses stomach (may have other side effects, e.g. Rocephin can clog bile ducts)

Antibiotic Resistance

Occurs when bacteria evolve to become resistant to being killed by a particular antibiotic

Resistance can occur when:

- The antibiotic dose is too low
- The antibiotic is not taken for a long enough period to kill most of the bacteria

Resistance cont.

- Antibiotic resistance is often caused by inappropriately using antibiotics for non-bacterial infections
- Antibiotics do not kill viruses (the cause of most cases of colds and flu)

80% of patients do not take their medications as prescribed

- They stop too soon (as soon as they start feeling better)
- They miss doses

Most antibiotic use in the U.S. is for farm animals (and some crops)

- 50-97% of antibiotics, depending on source of data

Side-effects of Antibiotics

- **Gastro-intestinal**
  use pro-biotics (acidophilus)
- **Sun sensitivity**
  tetracyclines
- **Teeth and bone development**
  tetracyclines (children only)
- **Liver damage**
  use milk thistle (silymarin)

- **Gallstones**
  Rocephin
- **Neurological effects**
  e.g. tinnitus (stops when drug is stopped)
- **Tendon rupture**
  Fluoroquinolones (over 60/steroid use)

Antibiotic Allergies

- Many people who have a bad reaction to an antibiotic may actually be experiencing a Herxheimer reaction
- About 1% of the population is allergic to penicillin
- Patients with a penicillin allergy can usually be desensitized …
- Or a different antibiotic may be used

Herxheimer reaction

- First noted in syphilis treatment
- Rapid, severe increase in symptoms immediately after starting antibiotic treatment
- Thought to be a result of sudden kill-off of bacteria (releases toxins)
- Similar reaction in Lyme disease

Future antibiotic development

- Unlikely until the true number of people infected is recognized
- Too expensive to develop for a small market
- It is possible that an effective drug will be found that was developed for some other disease or condition

Further reading

- The Antibiotic Paradox
  Stuart B. Levy, M.D., Perseus Publishing
- Handbook of Antibiotics
  Richard E. Reese, et al, Lippincott, Williams & Wilkins
- Physicians Desk Reference
- Web search
  go to drug company's web site first
  be careful of misleading information

Web Sites

- www.Medscape.com/druginfo
  - **Best site for drug info**
- www.Rxlist.com
  - **Commercial site with reliable information, and may complement Medscape**