Antibiotics Introduction

Jason Waechter
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Antibiotics is the term used to describe drugs that kill or inhibit the growth of bacteria. A more general term "anti-infective" describes drugs that do the same to any type of organism that could infect humans, including: viruses, parasites, bacteria or other.

Important Considerations:

Learning antibiotics can be overwhelming for the following reasons:

- There are about a million antibiotics
- There are about a billion infectious organisms
- Every year, drug resistance patterns change
- Geographically, drug resistance patterns are different
- Multiple drugs kill multiple bacteria

Therefore, it might be helpful to organize your approach to learning the antibiotics. This introduction will offer some suggestions to assist you.

Suggestions:

- Know which category the individual drugs belong to and learn the category as a whole. For example, Ceftriaxone is a 3rd generation cephalosporin. Therefore, learn about cephalosporins in general and then know the general differences between 1st, 2nd, 3rd and 4th generation cephalosporins. In some circumstances there might be one or two extra important bits of information pertaining to individual drugs that are important to learn.
- Learn the *unique* common side effects of the drug.
    - A lot of drugs cause nausea, rash, diarrhea, GI upset, etc. It is good to know these side effects, but these are common and if a patient is experiencing these symptoms, a drug should always be considered as a potential cause.
- Learn the *dangerous* (and usually rare) side effects of the drug.
    - If a side effect was dangerous *and* common, the drug would not be used. Therefore, the really dangerous side effects are usually rare and therefore easily forgotten about. *Don't forget about them*.
- Antibiotics can usually be classified in terms of the categories of bacteria they kill. These categories include:
    - Gram positives (which are usually cocci but sometimes rods)
    - Gram negatives (which are usually rods but sometimes cocci)
    - Anaerobes
    - Atypicals (like Chlamydia, Rickettsia, etc)
    - Mycobacterial (TB)
- For each drug make a small table to summarize what categories they usually kill.
- You will have to learn bugs and drugs in at least **3 different frameworks**:

    - Drugs → which bugs do they kill?
        - "List the bugs that are sensitive to Penicillin."
    - Bugs → which drugs kill it?
        - "MRSA is usually sensitive (killed by) which drugs?"
    - Infections → which bugs usually cause them
        - "Dental abscesses are most commonly caused by …"
- In order to adequately learn infectious disease, you will need to establish a mental framework which organizes your knowledge in the above methods.

Important Considerations:

- It is *required* that you learn the **mechanism of action** of a drug and also the **mechanism of resistance** by which bacteria commonly develop to enable them to not be killed by the drug. This is important because when selecting an antibiotic, if your first choice did not work, you will have a better understanding of why it did not work and will be better educated to select a different antibiotic which will have a greater probability of killing it second time round. For example, if a beta lactam antibiotic was given and the bug is known to produce beta lactamase, another beta lactam (even if had a greater spectrum of activity and was "stronger") would be a poor choice.
- Make sure that the drug you select can get to the tissue in which the infection is located. Special examples:
    - Gut (intra-intestinal, not intra-peritoneal) infections are often best treated with oral medications that *cannot* be absorbed into the body (since they remain in the gut which is where the infection is). E.g. oral vancomycin for *C. diff*. colitis.
    - CNS infections: some drugs do not penetrate the blood brain barrier. These would be poor choices for treatment of bacterial meningitis
    - Bone
    - Soft tissues (cellulitis)
    - Abscesses: there is no blood flow to an abscess. Therefore, how to antibiotics get to the site of infection? *They can't*. Abscesses have to be physically drained.
- The choice of antibiotic (oral vs. intravenous, broad spectrum vs. narrow spectrum) is usually determined by how sick the patient is and how certain you are about which bacteria is causing the infection. If you are uncertain, choose a broad spectrum drug.
- If you can do cultures, do them *before you start antibiotics* since after you give antibiotics, the drug will be in the patient's system and will inhibit growth of specimens collected from the patient after that point in time.
- If you have positive cultures, then adjust your antibiotics to ensure proper coverage.
- Broad spectrum drugs tend to be more expensive and more "powerful" and should be reserved for situations in which narrow spectrum is not indicated. Development of resistance is a very real risk every time an antibiotic is used. Therefore, always using the powerful drugs will result in bacterial becoming resistant to them. *Then what do you use?*