



Proper Use of Antibiotics

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Resistance to antibiotics continues to rise. Over the past decade antibiotic resistance has emerged for common pathogens like *Streptococcus pneumoniae* and *Campylobacter jejuni*. Several factors contribute to antibiotic resistance, including antibiotic overuse and inappropriate use of broad-spectrum antibiotics.

Restricting the use of antibiotics has been shown to decrease the incidence and the spread of antibiotic resistance. By using available evidence to determine etiologies of symptoms and choosing antibiotics based on the most likely pathogens involved, we may be able to narrow our inappropriate antibiotic use.

Based on our population needs and practice setting, we are often faced with treating patients empirically. Although this practice increases the

tendency to use broader spectrum antibiotics, we can still do our part to restrict unnecessary antibiotic use. The following common diseases are reviewed to illustrate methods for antibiotic choice.

Upper Respiratory Tract Infections (URI)

The common cold is one of the leading reasons patients seek medical attention. An average adult has 2-3 colds a year, and the average child has 6-10 colds a year. The typical symptoms of a common cold

*This man had methicillin-resistant Staphylococcus aureus bacteremia from a scalp laceration. He required several weeks of IV antibiotics at McInnis House after discharge from the hospital.
Photo by James O'Connell MD*

include nasal obstruction, rhinorrhea (runny nose), and sneezing. Most colds are caused by viruses and require no antibiotic therapy. Some common viral pathogens include rhinovirus, coronavirus, respiratory syncytial virus (RSV), and adenovirus.

Antibiotics are not indicated for the treatment of uncomplicated upper respiratory tract infections. The most effective treatment for the common cold is symptomatic treatment. Many scientific studies emphasize this fact. In one study looking at over 2200 patients, no significant benefit was found to antibiotic use in patients with the common cold. Additionally, the use of antibiotics was associated with a three-fold increase in adverse effects. Although solid evidence exists against the use of antibiotics in this situation, almost 50% of patients receive antibiotics for the common cold in national surveys.

Since the common cold is a clinical diagnosis, caregivers need to be vigilant and recognize symptoms that may be associated with other respiratory conditions that require antibiotic treatment or closer monitoring. Some of these symptoms include shortness of breath, fever greater than 102°F (38.9°C), persistent symptoms >7 days, difficulty controlling salivation, and severe headache.

Sinusitis (Rhinosinusitis)

Only a very small percentage of colds (0.5-2%) are complicated by acute sinusitis. The exact factors that lead a cold to develop into sinusitis are unknown. However, thick secretions accumulating in the sinuses and increased dispersion of nasal bacteria and viruses into the sinuses from nose blowing may be factors. Some important predisposing conditions include poor dental hygiene, history of swimming or diving, or persistent nasal obstruction.

The most common causes of sinusitis are viruses, including rhinovirus, as well as parainfluenza and influenza viruses. The most common bacterial causes of sinusitis include the normal nasopharyngeal occupants *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*. The differentiation of viral from bacterial sinusitis is a challenge to clinicians.

Studies have shown that the following symptoms are more likely to be associated with a bacterial etiology: maxillary toothache, transillumination, lack of response to decongestants or antihistamines, and purulent discharge seen on exam or reported by the patient. Other useful indicators include symptoms for >7 days and facial pain or swelling.

Effective methods to diagnose bacterial sinusitis include sinus aspiration or CT, although these are neither practical nor necessary to make the diagnosis of uncomplicated sinusitis.

Viral sinusitis should be treated symptomatically. Studies have shown that in immunocompetent patients, mild bacterial sinusitis is also self-limited. Patients with moderate to severe bacterial sinusitis should receive antibiotic treatment. Some controversy exists over appropriate treatment for bacterial sinusitis, but all agree that the most narrow spectrum agent effective against the likely pathogens should be used. First line agents include amoxicillin (Amoxil™), doxycycline (Vibramycin™), or trimethoprim-sulfamethoxazole (Septra™, Bactrim™).

Pneumonia

Pneumonia is the 6th leading cause of death in the USA. The most common bacterial cause of community-acquired pneumonia is *Streptococcus pneumoniae*. The emergence of antibiotic resistance among *S. pneumoniae* has further complicated treatment.

It is important to differentiate pneumonia from other causes of acute respiratory symptoms. Pneumonia can present with a variety of clinical findings including fever, cough, dyspnea, myalgias, tachycardia, and crackles on lung exam. Studies have shown that no individual clinical finding or group of findings can definitely make the diagnosis of pneumonia. There is some suggestion that a normal lung exam and normal vital signs make pneumonia a less likely diagnosis. The chest x-ray (CXR) is the standard for diagnosing pneumonia. A CXR should therefore be obtained whenever pneumonia is suspected in vulnerable individuals, including those with COPD or asthma, chronic diseases such as congestive heart failure (CHF) or diabetes mellitus (DM), and those who are immunocompromised.

The choice of antibiotic for presumed pneumonia is determined by whether the person can be treated as an outpatient or requires admission to the hospital. Clinical guidelines called the PORT criteria are very helpful in determining a patient's level of risk and need for hospitalization. (Please see table in the chapter on Pneumonia.)

The most common pathogens should be considered when choosing an antibiotic for the outpatient treatment of uncomplicated CAP, particularly *Streptococcus pneumoniae*, Mycoplasma, and viral etiologies. The most likely pathogens can vary based on patient co-morbidities. For example,

in patients who use alcohol, consider covering anaerobes and Klebsiella. In smokers, consider *Moraxella catarrhalis* and *H. influenzae*. The possibility of *Pneumocystis carinii* pneumonia (PCP) should be considered in immunocompromised patients.

The first line of empiric treatment of uncomplicated CAP in those who do not require hospitalization should be doxycycline (Vibramycin™) or an advanced generation macrolide such as clarithromycin (Biaxin™) or azithromycin (Zithromax™).

Cellulitis

Cellulitis is a common skin condition. The diagnosis is mostly clinical, and the common findings include tenderness, warmth, swelling, or erythema. The most common pathogens include group A beta hemolytic Streptococcus and *Staphylococcus aureus*. Empiric treatment should focus on agents that cover these common pathogens.

Uncomplicated cellulitis can be treated with cephalexin (Keflex™) or dicloxacillin (Dynapen™). Patients with penicillin allergies can be treated with clindamycin (Cleocin™) or erythromycin (Eryc™, E-mycin™). For those persons with a history of intolerance to erythromycin, azithromycin (Zithromax™) or clarithromycin (Biaxin™) can be prescribed. Clindamycin (Cleocin™) should not be given to patients with a history of *Clostridium difficile*. Patients at risk for cellulitis from Gram negative pathogens, such as diabetics, should be treated with an agent that includes gram negative coverage, such as levofloxacin (Levaquin™) or amoxicillin/clavulanate (Augmentin™). Early uncomplicated cellulitis should be initially treated with a narrow spectrum antibiotic, and the more expensive fluoroquinolones, such as levofloxacin (Levaquin™), should be reserved for resistant or severe cases.

Diarrhea

Most cases of acute diarrhea are self-limited, whether the etiology is bacterial or viral. The treatment of acute diarrhea is supportive in most cases. However, antibiotic treatment should be considered in certain situations. Some bacterial causes of diarrhea include *Staphylococcus aureus*, *Yersinia*, *Shigella*, *Salmonella*, and *Escherichia coli*. Empiric antibiotic therapy should be considered in patients with fever, bloody diarrhea, or the presence of occult blood or fecal leukocytes on stool exam. Immunocompromised persons, the frail elderly, and other patients with chronic diseases may be considered for early empiric treatment for acute diarrhea.

Since most cases of acute diarrhea are self-limited, it is not necessary to obtain labs and stool studies. In more complicated cases, stool cultures and/or ova and parasite studies can be sent. The optimal time to utilize these more expensive cultures remains controversial.

Clinicians should remember that most cases of acute diarrhea resolve spontaneously without treatment. Fluoroquinolones are the first line agents in most cases of acute diarrhea. Overuse of the fluoroquinolones has already led to quinolone-resistant strains in many parts of the world. Consider the use of fluoroquinolones when obtaining stool studies is impractical and the patient has prolonged symptoms or cannot be followed or monitored for several days. Patients who are immunocompromised should have further workup done if symptoms persist. Also, consider if patient is at risk for *Clostridium difficile*, which is treated with metronidazole (Flagyl™).

Summary

Antibiotic resistance continues to increase and will continue to limit our drug choices. When providing empiric treatment for infections, two considerations can facilitate appropriate use of antibiotics. First, consider if the signs and symptoms warrant antibiotic use in addition to symptomatic treatment. Second, consider the most common pathogens based on the patient's history and presentation, and choose the drug with the narrowest spectrum that will cover the pathogens involved. We urge all clinicians to be judicious in the use of antibiotics and resist the tendency to rely on broad spectrum and expensive antibiotics that are not necessary. As we all improve our choices of antibiotics, we will be engaging in cost effect practice that leads to fewer side effects and less antibiotic resistance. ■■

Antibiotics Medication List

Generic	Brand Name	Cost
amoxicillin	Amoxil	\$
amoxicillin-clavulanate	Augmentin	\$\$\$
azithromycin	Zithromax	\$\$
cephalexin	Keflex	\$
clarithromycin	Biaxin	\$\$\$
clindamycin	Cleocin	\$\$
doxycycline	Vibramycin	\$
erythromycin	Eryc, E-mycin	\$
levofloxacin	Levaquin	\$\$\$
metronidazole	Flagyl	\$
trimethoprim-sulfamethoxazole	Bactrim, Septra	\$

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