The GenerEHlist

Antibiotics, CCFP Topic 5

Objective 1a. In patients requiring antibiotic therapy, make rational choices first-line therapies for common bacterial infections:

Simple Cystitis

Uncomplicated cystitis (applies to the premenopausal woman, first time male due to sexual activity and the pregnant patient with the caveats below):

- *Symptoms/Signs:* dysuria, frequency, urgency, suprapubic discomfort. Not fever or flank/back pain or systemic symptoms.
- *Diagnosed* mainly by symptoms. In symptomatic people urine analysis is sensitive and can be used to help confirm, but testing in asymptomatic people is not specific.
- *Indications for antibiotics:* Symptoms of UTI, though this is beginning to be questioned as a third of patients with symptoms and positive UA will have spontaneous resolution of symptoms within a week.
- *Common pathogens:* E coli and Enterobacteriaceae definitely, others include klebsiella and staph saprophyticus (KEEPS mnemonic)
- *First-line choice:* Nitrofurantoin is still the first line. Alternate is cephalexin, TMP/SMX, cipro. Not amoxicillin due to resistance.

If pregnant avoid quinolones (cipro, levo, moxifloxacin), otherwise treat the same as normal, but repeat urine cultures monthly during pregnancy.

If recurrent within a month and the same organism, treat as a pyelonephritis or renal abscess. If different organism, treat normally for a new UTI as above.

Ref: Hooten, TM et al. **A prospective study of asymptomatic bacteriuria in sexually active young women.** N Engl J Med. 2000 Oct 5;343(14):992-7. **PMID: 11018165**

Gordon, LB et al. **Overtreatment of presumed urinary tract infection in older women presenting to the emergency department.** J Am Geriatr Soc. 2013 May;61(5):788-92. **PMID: 23590846**

Complicated Cystitis/Pyelonephritis

Symptoms/Signs: Can be the same as uncomplicated cystitis plus one of: back/flank pain or CVA tenderness on exam, fever/chills. May have nausea or malaise.

Diagnosed by symptoms, but does not need to have to have symptoms of cystitis. UA can be used to help confirm suspicion.

Indications for antibiotics: Give antibiotics if the diagnosis is made.

Common pathogens: Same as cystitis: E coli, Enterobacteriaceae definitely, others include klebsiella and staph saprophyticus. Get a urine culture/susceptibilities.

First-line choice:

- Out-patient: 1 dose ceftriaxone or gentamycin, then 10 days of amoxi-clav, cefixime or tmp-smx, or cipro for 7 days, though this does not seem to be common in practice. Not nitrofurantoin or fosfomycin.
- In-patient: ceftriaxone or gentamycin for 10 days.

STI: Gonorrhea/Chlamydia

Infection with Chlamydia trachomatis and Neisseria gonorrhoeae are the most common STIs - we'll discuss these here, but be aware that others like syphilis, HPV, hepatitis, HIV should be screened for.

- *Symptoms/Signs:* Patients may be asymptomatic and present after a possible exposure or after a partner tested positive. If they are symptomatic they may have dysuria, urethral or vaginal discharge or itch, lower abdominal or testicular pain or swelling. There could also be rectal pain or discharge, or conjunctivitis.
- *Diagnosis* of both gonorrhea and chlamydia is by first-catch urine or urethral/cervical swab sent for NAAT. Urine microscopy is helpful in post-pubertal males. These tests need to be at least 2 days post-exposure otherwise there's a high risk of false negatives. Health Canada suggests sending for gonococcal culture to help with tracking resistance patterns.
- *Indications for treatment:* Per Health Canada guidelines, it is reasonable to treat for these infections if the tests are positive, or if the clinical signs and symptoms are suggestive of a diagnosis prior to results from the testing, or if a sexual partner was diagnosed. Other special populations requiring treatment are pregnant individuals, victims of sexual assault, and those who may not have adequate follow-up.

First-line choice:

- Gonorrhea:
  - **Ceftriaxone** 250 mg IM in a single dose
  - **PLUS azithromycin** 1 g PO in a single dose
  - OR
  - **Cefixime** 800 mg PO in a single dose
  - **PLUS azithromycin** 1 g PO in a single dose
- Chlamydia:
  - **Doxycycline** 100 mg PO bid for 7 days [A-l]
    OR
  - **Azithromycin** 1 g PO in a single dose if a 7 day course may be difficult for the patient

Public health should be promptly notified of cefixime, ceftriaxone or azithromycin treatment failure of gonococcal infections.

Wait seven days after starting medications before having sex. (May resume day 8)

https://www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/canadian-guidelines/sexually-transmitted-infections/canadian-guidelines-sexually-transmitted-infections-30.html

https://www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/canadian-guidelines/sexually-transmitted-infections/canadian-guidelines-sexually-transmitted-infections-34.html

Government of Manitoba Guidelines for Gonorrhea

Cellulitis and Erysipelas (non-purulent skin infections)

Symptoms/Signs: Must have redness, warmth, swelling, pain and unilateral involvement. The redness will not disappear with elevation of the area.

Diagnosed by symptoms and appearance on exam. Blood cultures only indicated if systemic symptoms/abnormality in vitals. Do NOT take a superficial swab. Compare with erysipelas which has a much sharper demarcation with a raised edge and induration.

Indications for antibiotics: If cellulitis is suspected, always treat it.

Common pathogens: Strep more than Staph

First-line choice for cellulitis: Cephalexin 5-10 days, or cefazolin IV.

Erysipelas: treat for Group A Strep with penicillin V or amoxicillin

Abscess (purulent skin infection)

Symptoms/Signs: locally painful, possibly fluctuant area

Diagnosed by appearance/presentation. Can use ultrasound to help visualize these. Cultures of the purulent drainage can be sent to help identify the specific organism if failed treatment with I and D or other complicating factors.

Indications for antibiotics:

- A single abscess <2 cm, without systemic symptoms or surrounding cellulitis, in the otherwise healthy, immunocompetent patient **can be drained and will often heal without antibiotics**. The most recent meta-analyses are conflicting on whether prescribing antibiotics in these simple cases actually reduces treatment failure, recurrence etc. Given the risk of GI side effects from antibiotics, be careful here.
- Any other abscesses get antibiotics. Systemic symptoms like fever, multiple or large abscess >2cm, surrounding cellulitis, immunocompromised or major comorbidities, risk

of endocarditis, indwelling medical device, risk of community transmission like with Staph aureus.

Common pathogens: Group A Strep, Staph aureus, Group B,C,G Strep

First-line choice:

- Mild clinical picture - cephalexin x 5 days
- More severe picture - cefazolin IV x 5+ days, and TMP/SMX

https://www.uptodate.com/contents/cellulitis-and-skin-abscess-in-adults-treatment

https://pubmed.ncbi.nlm.nih.gov/29437689

https://pubmed.ncbi.nlm.nih.gov/23686731/

Impetigo

Symptoms/Signs:

- Non-bullous: over 1 week the lesions go from papules to vesicles with surrounding erythema, then pustules breaking to form honey crusted lesions
- Bullous: mostly younger children, where vesicles enlarge to form flaccid bullae, clear yellow to darker and turbid.
- Ecthyma: deeper, punch lesions into the dermis with surrounding erythema and yellow crust.

Diagnosed by appearance and distribution. Non-bullous is mostly face and extremities. Bullous is typically over the thorax. If the presentation is classic, no need for cultures, but if there's any question then get that swab.

Indications for antibiotics: Always treat.

Common pathogens:

- **Bullous:** Staph aureus
- **Non-bullous, honey crust lesions:** Group A Strep

First-line choice:

- Limited area of bullous or non-bullous → mupirocin 2% TID topically
- Unresponsive to topical or more extensive or ecthyma → Cloxacillin of cephalexin, both 500mg PO QID
- Either route treat until resolved, max 7 days

If you suspect MRSA options include TMP-SMZ, clinda or doxy.

Use contact precautions for these patients.

If an adult presents with bullous impetigo test for HIV

https://www.uptodate.com/contents/impetigo

http://www.bugsanddrugs.org/618552C9-FFFC-4A00-833B-89C66EA37F30

Bacterial Community Acquired Pneumonia

Mild CAP, CURB-65 score of 0 or 1, that can be treated as an outpatient. All others, admit and treat with broad spectrum antibiotics.

- *Symptoms/Signs:* Cough, tachypnea and subjective fever are sensitive for pneumonia. Subjective fever/chills or dyspnea, or objectively febrile, tachypneic or tachycardic have good positive predictive value compared with influenza-like illness.
- *Diagnosis* is by chest x-ray as typical symptoms aren't particularly specific. Bloodwork can help confirm the presence of infection such as an elevated white cell count with left shift, and elevated CRP. Chest x-ray may be falsely negative in immunocompromised patients and a CT chest is thus indicated.
- *Indications for antibiotics:* If the diagnosis is made for a pneumonia in the context of appropriate symptoms, treatment should be initiated.
- *Common pathogens:* S. pneumoniae, Mycoplasma pneumoniae, Chlamydophila pneumoniae, Haemophilus influenzae.
- *First-line choice:*
    - Otherwise healthy individuals: Amoxicillin 1g PO TID x 5 days, as monotherapy, is suggested by Bugs and Drugs. UTD suggests amoxicillin plus azithromycin. Spectrum suggests doxycycline as monotherapy x 7 days.
    - Those who smoke, have comorbidities or recent antibiotic use: UTD and Bugs and Drugs suggest amoxi-clav plus azithro.

Clinical Characteristic	Characteristic in Subjects with Community-acquired Pneumonia (CAP), n = 100 (Sensitivity; 95% CI)	Characteristic in Subjects with Influenzalike Illness (ILI), n = 100 (1 – Specificity; 95% CI)	Positive Likelihood Ratio (95% CI)
Historical finding			
Fever	79/91 (0.87; 0.78, 0.93)	45/89 (0.51; 0.38, 0.61)	1.72 (1.38, 2.14)
Chills	58/70 (0.83; 0.72, 0.91)	33/66 (0.50; 0.37, 0.63)	1.66 (1.27, 2.16)
Chest pain	51/90 (0.57; 0.46, 0.67)	39/69 (0.57; 0.44, 0.68)	1.00 (0.76, 1.32)
Dyspnea	54/90 (0.60; 0.49, 0.70)	33/81 (0.41; 0.30, 0.52)	1.47 (1.08, 2.01)
Cough	85/95 (0.89; 0.81, 0.95)	98/100 (0.98; 0.93, 1.0)	0.91 (0.85, 0.98)
Nausea	23/79 (0.29; 0.19, 0.40)	13/63 (0.21; 0.11, 0.33)	1.41 (0.78, 2.56)
Vomiting	14/81 (0.17; 0.10, 0.27)	5/61 (0.08; 0.03, 0.18)	2.11 (0.80, 5.54)
Physical examination finding			
Temperature > 100.4°F	32/99 (0.32; 0.23, 0.42)	7/95 (0.07; 0.03, 0.15)	4.39 (2.04, 9.45)
Tachycardia > 110 beats/min	33/98 (0.34; 0.24, 0.44)	9/96 (0.09; 0.04, 0.17)	3.59 (1.82, 7.10)
Tachypnea ≥ 18 breaths/min	88/98 (0.90; 0.82, 0.95)	68/95 (0.72; 0.61, 0.80)	1.25 (1.09, 1.48)
Systolic BP < 130 mm Hg	32/98 (0.33; 0.24, 0.43)	36/95 (0.38; 0.28, 0.48)	0.86 (0.59, 1.26)
Diastolic BP < 75 mm Hg	36/99 (0.36; 0.27, 0.47)	25/96 (0.27; 0.19, 0.37)	1.40 (0.91, 2.14)
Pulse oximetry < 96%	32/96 (0.33; 0.24, 0.44)	13/92 (0.14; 0.08, 0.23)	2.36 (1.32, 4.20)

BP = blood pressure.

http://www.bugsanddrugs.org/9A7AF542-8186-437A-9EDB-6B31E7EAE646

www.uptodate.com/contents/overview-of-community-acquired-pneumonia-in-adults

https://onlinelibrary.wiley.com/doi/full/10.1111/j.1553-2712.2007.00011.x

Sinusitis

Symptoms/Signs: nasal discharge, facial pain, fever; potentially other viral symptoms initially.

Only about 1-5% of URTI with sinusitis-like symptoms are bacterial in nature, the vast majority are viral. Diagnosis of a bacterial sinusitis is likely if

1. high fever >39 degrees C with purulent discharge or facial pain for >3 consecutive days at onset, OR
2. URTI symptoms lasting >10 days or worsening around day 5, with nasal congestion or discharge and unilateral facial pain, with or without fever, swelling, toothache.

- The overall clinical impression, cacosmia, and pain in the teeth are the best predictors of acute bacterial rhinosinusitis (LR 3.8, 4.3, 2.0 respectively)
- In kids, cough, lethargy and irritability are also common with a bacterial infection.
- Ensure there is no involvement of surrounding tissues or structures as this could suggest an alternate infection or process.

Indications for antibiotics: (as above) This is either the significant symptoms right in those first 3-4 days, or the worsening after 5-7 days and overall symptoms persistent for 10 days. Some sources suggest having the patient return in 5-7 days for a follow-up and prescription of antibiotics at that time since a good number of these will resolve spontaneously.

Common pathogens: Strep pneumo, H. flu, M. catarrhalis. Cultures not needed or useful.

First-line choice: High dose amoxicillin is still the first line treatment in Canada - 500-1g PO TID x 5-7 days. Nasal saline rinses can also be helpful.

If the patient has black necrotic discharge and diabetes or immunosuppression think about mucormycosis, and get urgent ENT/ID consult. This is one of those rare but serious fungal infections.

http://www.bugsanddrugs.org/0F0EF8A2-452D-4ECF-96FC-5A4352C18B26

https://pubmed.ncbi.nlm.nih.gov/30858261

https://pubmed.ncbi.nlm.nih.gov/24137025/

Acute Otitis Media

Symptoms/Signs: typically ongoing unilateral otalgia and decreased or muffled hearing, fever

This is most common in children, less so in adults.

Diagnosis: bulging tympanic membrane, especially if yellow or hemorrhagic is highly sensitivity for AOM. Perforation of the tympanic membrane with purulent discharge similarly indicates a bacterial cause.

The triad of bulging tympanic membrane, impaired tympanic mobility, and redness or cloudiness of the tympanic membrane predicted AOM approximately 90% of the time in children, and bulging tympanic membrane more predictive than a red tympanic membrane.

Indications for antibiotics: Canadian Pediatric Society states "Immediate antibiotic treatment is recommended for children who are highly febrile (≥39°C), moderately to severely systemically ill or who have very severe otalgia, or have already been significantly ill for 48 h. For all other cases, parents can be provided with a prescription for antibiotics to fill if the child does not improve in 48 h or the child can be reassessed if this occurs" All adults with AOM should be treated as data does not exist regarding observation alone.

Common pathogens: varies a little by age, but generally Strep pneumo, H flu, Moraxella catarhalis

First-line choice: Amoxicillin remains the clear drug of choice. High dose is 90mg/kg/d divided BID. CPS says ten days of therapy is appropriate for children <2 years of age, and older children can be treated for five days, but Bugs and Drugs says 5 days for older than 6 months. Failure of amoxicillin warrants amoxi-clav 45mg/kg/d divided.

https://www.cps.ca/en/documents/position/acute-otitis-media

http://www.bugsanddrugs.org/C3FC31A5-E2D3-49B6-94F4-74641BF6A5F6

Acute Conjunctivitis

Symptoms/Signs: redness and purulent discharge in one or both eyes. Mild discomfort may be present, but pain is not likely without corneal involvement.

Differentiate bacterial from viral conjunctivitis via the quality of the discharge. Bacterial infection produces a white, milky purulent discharge that if wiped away will quickly reappear. A viral conjunctivitis produces a clear watery or stringy discharge that will not reappear if wiped away. Both will have redness and a "stuck-shut in the morning" story.

Indications for antibiotics: Many cases will resolve spontaneously, but if given early in the illness antibiotics can reduce the length of infection and facilitate return to work or school, or reduce spread. Contact lens wearers always require antibiotics.

Common pathogens: Staph aureus, *Strep pneumo*, *H flu*, and *Moraxella catarrhalis*

First-line choice: Any of bacitracin-polymixin vs tobramycin vs erythromycin

Both bacterial and viral conjunctivitis are contagious!

Hyper-Acute Conjunctivitis

Symptoms/Signs: Develops within 12 hours, with symptoms of **copious** purulent discharge, redness, and pain. Conjunctival edema, lid swelling and tender preauricular lymphadenopathy are common.

Common Pathogens: **THIS IS A SIGHT THREATENING INFECTION** with either N. gonorrhoeae or N. meningitidis. A swab of the purulent discharge should be sent for gram stain and PCR NAAT.

First-line choice: Promptly treat with Ceftriaxone 2g IV and either 1 dose of azithromycin, or 7 days of doxycycline.

Ophthalmology consultation is **REQUIRED**.

This is reportable, like any other gonococcal infection, and partners should be treated.

Objective 1b. Make rational choices regarding knowledge of local resistance patterns:

This is region specific. Consult local hospital's antibiogram, or an app like "Spectrum"

Objective 1c. Make rational choices with respect to patient's medical and drug history:

Recent antibiotic use? → Consider getting cultures, choosing a different antibiotic or covering for MRSA.

Renal dysfunction? → Dose adjustments are often needed, consult your reference of choice. We like the Spectrum App for this.

Liver cirrhosis? → Dose or regimen adjustments may be needed, best to consult a drug database or a pharmacist.

Table 1.
Summary of Key Pharmacologic and Pharmacokinetic Variables a Select Antibiotic Agents That Undergo Hepatobiliary Elimination

Drug	Hepatic Metabolism (Phase I or II)
Azithromycin	Demethylation (I)
Cefotaxime	Desacetylation (II)
Ceftriaxone	Nonenzymatic (biliary clearance)
Ciprofloxacin	Oxidation (I)
Clarithromycin	Hydroxylation (I), demethylation (I)
Clindamycin	Sulfoxide metabolite (I), demethylation (I)
Doxycycline	Nonenzymatic
Erythromycin	Demethylation (I)
Isoniazid	Acetylation (II)
Linezolid	Oxidation (I)
Metronidazole	Hydroxylation (I), oxidation (I), glucuronidation (II)
Minocycline	Hydroxylation (I), demethylation (I)
Moxifloxacin	Glucuronidation (II), sulfation (II)
Nafcillin	Oxidation (I), other unknown methods
Nitrofurantoin	Unknown
Norfloxacin	Oxidation (I)
Pyrazinamide	Hydrolysis (I)
Quinupristin–dalfopristin	Quinupristin: cysteine–glutathione conjugation (II) Dalfopristin: hydrolysis (I)
Rifabutin	Deacetylation (II), hydroxylation (I)
Rifampin	Deacetylation (II), oxidation (I)
Sulfamethoxazole–trimethoprim	Sulfamethoxazole: acetylation (II) Trimethoprim: hydroxylation (I), oxidation (I)
Tigecycline	Glucuronidation (II), *N*-acetylation (II)

Oral contraceptive pill use? → Meta-analyses have shown that use of rifampin while on an estrogen containing contraceptive reduces the effectiveness of the contraceptive and a secondary

method of control is needed for the full cycle. Other antibiotics have not been shown to decrease effectiveness of OCP's.

Alcohol use? → Avoid metronidazole as it causes N/V.

Methotrexate or allopurinol? → Avoid penicillin.

Warfarin? → interacts with several antibiotics such as cipro, metronidazole, TMP-SMZ, clarithro and erythromycin.

Antifungals, cyclosporin, diuretics or muscle relaxants? → Consider avoiding gentamycin and tobramycin due to renal and hearing injury.

Tetracyclines, macrolides and fluoroquinolones can interact with a number of medications, best use an interaction checker.

https://www.aafp.org/afp/2000/0315/p1745.html

https://pubmed.ncbi.nlm.nih.gov/28694152/

https://pubmed.ncbi.nlm.nih.gov/29130574

https://www.uptodate.com/contents/overview-of-medication-adjustments-for-adult-patients-with-cirrhosis

Objective 1d. Make rational choices regarding patient's context:

Think about can your patient swallow whole pills? Can they make it to the hospital for IV antibiotics, can they be treated at home, or do they need admission? Can they take their own medications 4 times daily, or do they rely on home care? Is cost an issue for them?

Objective 2. In patients with a clinical presentation suggestive of a viral infection, avoid prescribing antibiotics.

Many presentations are not bacterial in nature such as the common cough and cold, thrush, Athlete's foot, and the flu.

Sore throats are also usually not bacterial. Choosing Wisely suggests that antibiotics should only be used in patients with intermediate and high clinical prediction scores for Group A Strep AND confirmatory testing that is positive for GAS.

Asthma and bronchitis also do not need antibiotics.

Not prescribing antibiotics is often challenging if patients are expecting antibiotics. The literature says that we should:

- Explain to patients the probable viral nature of common respiratory infections and that antibiotics have no effect on duration of symptoms of viral infections.
- Explain to patients that antibiotics are potentially harmful including:
    - Increased colonization and infection with resistant pathogens in patients with prior antibiotic therapy
    - Increased antimicrobial resistance in the community
    - Unwanted allergic reactions and adverse effects of antibiotics
    - Cost of unnecessary therapy
- Empathize with patients about the effect of symptoms on their daily activities, provide educational materials, and prescribe therapies for symptoms

"Major determinants of patient satisfaction, regardless of the illness, are based on the patient's perception that the physician spent enough time with him or her, explained the illness coherently, and treated him or her with respect" so slow down, explain why they don't need the antibiotics, treat their concerning symptoms and offer to see them again if they're not improving.

https://www.aafp.org/afp/2001/0915/p999.html

https://www.aafp.org/afp/2005/1101/p1900.html

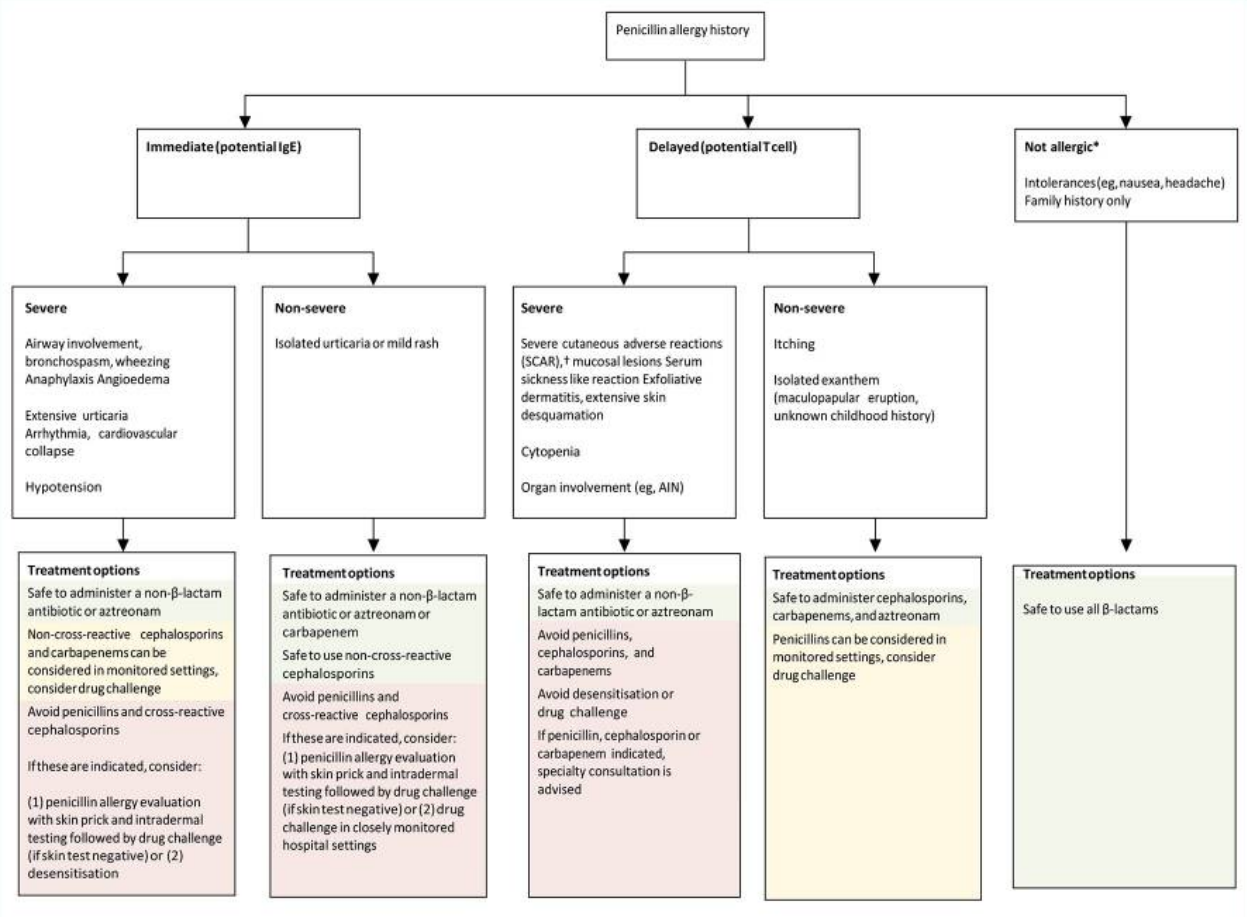
Objective 3. In a patient with a purported antibiotic allergy, rule out other causes (e.g., intolerance to side effects, non-allergic rash) before accepting the diagnosis.

Patients commonly report allergies to beta-lactam, cephalosporin and sulfonamide antibiotics. However, the incidence of true allergy to these medications is only 10 - 20% of these individuals.

Most patients labelled with a β-lactam allergy are not allergic that is they tolerate penicillin and related drugs. This mislabel occurs for a variety of reasons. First, the original reaction might not have been an allergy; there could be intolerance, a viral exanthem, or a drug-infection interaction. Even if the original reaction were immunological, it might not recur with re-challenge. IgE-mediated reactions to β-lactams can wane over time; approximately 80% of patients who are positive for a penicillin skin test and 60% of those positive for a cephalosporin skin test are no longer sensitive, as measured by skin testing after a period of 10 and 5 years, respectively.

Cross reactivity to cephalosporins in those with true penicillin allergy is essentially the same as the background population rate.Notably there is no cross-reactivity between sulfonamide antibiotics and non-antibiotic sulfonamides.

If a reasonable history of an immediate or delayed reaction is provided, treat the current condition with another antibiotic. Consider referring for allergy testing to confirm if the history is not 100% clear, or the previous reaction was a number of years ago.



https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6563335/

Objective 4. Use a selective approach in ordering cultures before initiating antibiotic therapy (usually not in uncomplicated cellulitis, pneumonia, urinary tract infections, and abscesses; usually for assessing community resistance patterns, in patients with systemic symptoms, and in immunocompromised patients).

Most simple infections seen in the clinic do not need cultures. However, for any systemic illness, you should consider a culture - whether that's a local site of infection, or blood cultures. Instances where a culture is indicated include:

- UTI's if the patient is pregnant, there are other complicating factors such as structural anomalies, stones or a pyelonephritis, or if there have been multiple recent infections.
- Cases of impetigo where the diagnosis is unclear.
- Cases of cellulitis with systemic illness, get blood cultures.
- Abscesses if failed initial therapy get a culture of the purulent drainage, or if systemic illness get blood cultures.

- Pharyngitis - swab to rule out GAS.
- Suspected gonococcal infections to assess community resistance.
- Consider cultures for immunocompromised patients or those who have received antibiotics within the last 3 months .

*based on Objective 1 info.

https://www.albertahealthservices.ca/assets/info/hp/as/if-hp-as-evidence-based-criteria-for-urinary-infection-testing.pdf

Objective 5: In urgent situations (e.g., cases of meningitis, septic shock, febrile neutropenia), do not delay administration of antibiotic therapy (i.e., do not wait for confirmation of the diagnosis).

Serious infections can happen in anyone, but are more likely in those who are immunocompromised due to illness, immune modulating medications or therapies, or are unvaccinated. If you suspect meningitis, sepsis or a febrile neutropenia treat quickly with broad spectrum antibiotics. Don't forget to order cultures prior to antibiotics if this won't delay antibiotic administration.

If you suspect *meningitis* in an otherwise healthy patient aged 3 months - 50yo go for ceftriaxone and vancomycin. If there are co-morbidities or over 50yo, add ampicillin. Under 3 months, ampicillin and cefotaxime, and call peds STAT.

Sepsis is defined as a likely infection + life-threatening organ dysfunction, as defined by 2pt increase in SOFA score or qSOFA>=2
(Recall qSOFA is composed of: 1) altered mental status, 2) RR > 22, 3) SBP <100)

Septic shock is defined as the need vasopressors to maintain MAP > 65 & serum lactate >2 (once hypovolemia corrected)

If a patient presents with septic shock, tailor treatment to the site of infection if possible, otherwise go big with pip-tazo (and vancomycin if suspicion for MRSA). Don't forget to support their airway, breathing and circulation, including pressors while the antibiotics take effect.

Febrile neutropenia is fever with single oral temperature of ≥38.3°C or ≥38.0°C sustained over one-hour, and an absolute neutrophil count <500 cells/microL. If you suspect febrile neutropenia and they are stable choose piptazo monotherapy. If they're unstable piptazo, vanco and gentamicin, then treat like sepsis.