ID Tips of the Week repository, updated quarterly. For questions, comments, or suggestions, contact SCardwell@peacehealth.org. Prepared by ID/AMS Columbia Network: Andy Root, MD, Mike Conte, DO, Jose Rivera Sarti, MD, and Sophia Cardwell, PharmD, MPH. Recommendations incorporate published research and guidelines, local epidemiology, and diagnostic and therapeutic tools available at PeaceHealth.

Keywords (to aid searching/Ctrl+f):

General ID, bacteremia, UTI, pneumonia, diarrhea, GNRs, oral tx, lab, osteomyelitis, SSTI, DFI, Flu/COVID

7/17/23: **Recommended duration of antibiotic therapy for bacteremia**

With a few notable exceptions, the duration of treatment for bacteremia is not determined by the presence of bacteremia but rather the source or associated infectious syndrome. For example, if the bacteremia is secondary to pyelonephritis then the preferred duration would be 7 days (or 10 depending on which agent is used) because that's how long we treat pyelonephritis.

Exceptions:

- Staph aureus. Staph aureus bacteremia should be treated with at least 14 days of therapy, often 4-6 weeks. ID consult is recommended/expected and associated with improved outcomes.
- Candida (not a bacterium, but we're including it here). Candidemia should also be treated with at least 14 days of therapy. Again, ID consult is recommended/expected and associated with improved outcomes.
- Bacteremia secondary to a source for which a short course (≤5 days) of antibiotic therapy might otherwise be recommended (e.g. CAP or intra-abdominal infection with source control). In this case the duration of therapy should be individualized based on the organism and clinical factors.
- Organisms that commonly cause endocarditis (such as Enterococcus faecalis or viridans streptococci). A short course may be appropriate, but exercise caution here, especially when a focal source is not evident.

Keywords: bacteremia

7/24/2023: **When should surveillance (follow-up) blood cultures be drawn?**

Surveillance blood cultures should be drawn within 1-3 days of starting antibiotic therapy in the following scenarios:

- Staph aureus bacteremia
- Candidemia
- Patients with established or possible endovascular infection including endocarditis, central line infection, cardiac device infection, vascular graft infection, etc (note that sustained bacteremia can be an important diagnostic clue that one of these is present)
- Patients with bacteremia who are not improving as expected on antibiotic therapy

In most other scenarios surveillance blood cultures are unnecessary, low yield, and – if contaminants are detected – could potentially lead to unnecessary antibiotics and/or delay in discharge.

Keywords: bacteremia

7/31/2023: **What is the recommended duration of therapy for UTI?**

Unlike most infections this depends on both a specific characterization of the syndrome AND the antibiotic chosen.

Re: syndrome, a number of classifications are used, but we encourage dividing UTI into 2 distinct categories:

- **Cystitis**: Symptoms include dysuria, frequency, and urgency. This includes both "uncomplicated" and "complicated" cases (the latter often used to indicate abnormal anatomy or particular host factors). Cystitis predominantly occurs in women but can occur in men.
- **Pyelonephritis -OR- UTI with systemic signs/symptoms:** Symptoms include fever/chills and flank pain/tenderness with or without the cystitis symptoms mentioned above.
- *Note that **catheter-associated UTI** can fall into either of these categories.*

Here are recommended durations of therapy:

- **Cystitis**
  - TMP-SMX – 3 days
  - nitrofurantoin – 5 days
  - IV β-lactam – 3 days
  - PO β-lactam – 5 days
  - fluoroquinolones – 3 days
  - PO fosfomycin – single dose
  - IV aminoglycoside – single dose
- **Pyelonephritis -OR- UTI with systemic sign/symptoms**
  - fluoroquinolones – 5-7 days
  - TMP-SMX – 7-10 days
  - IV β-lactam – 7 days
  - IV→PO β-lactam – 7-10 days

Not included above are other syndromes including renal/perinephric abscess, prostatitis, and urethritis.

Keywords: UTI

8/8/2023: **Treatment recommendations for infectious diarrhea**

Rule number 1: infectious diarrhea most often should not be treated with antibiotics

Rule number 2: in the comparatively rare scenario where treatment is indicated, fluoroquinolones are not the drug of choice.

For patients with diarrhea and severe sepsis, treating empirically for sepsis including activity against common GI pathogens (e.g. ceftriaxone +/- metronidazole) is appropriate. Definitive therapy against pathogens of infectious diarrhea can be started with identification and/or sensitivity data.

It's preferable for patients with diarrhea and without sepsis to receive supportive care without antibiotics, due to lack of efficacy, potential harm over and above that of unnecessary antibiotic use, and promotion of antibiotic resistance. Here is a short summary of pathogen-specific recommendations:

	Antibiotics routinely recommended?	Antibiotics specifically harmful?	Antibiotics generally ineffective?	Special considerations antibiotic use	TOC if indicated

Campylobacter	No	No*	Yes	Bloodstream infection; age over 65; pregnant; HIV with AIDS; receiving chemotherapy	Azithromycin[1]; susceptible beta-lactam
Giardia	Yes	No	No	N/A	Metronidazole
E. coli (STEC)	No	Yes[2]	Yes	Do not use	N/A
E. coli (ETEC/EHEC)	No	No*	Yes	N/A	Ceftriaxone
Norovirus	No	No*	Yes	Do not use	N/A
Salmonella	No	Yes[3]		Bloodstream infection; age over 65; immune compromised	Ceftriaxone
Shigella	No			Bloodstream infection; immune compromised; transmission risk high	Azithromycin[1], ceftriaxone[4]

*unnecessary antibiotics are always harmful, but in this case they don't *worsen* the disease, they are just not helping an/or causing their regular toxicities and adverse effects.

1. Caution using macrolides for bloodstream infections, wait for susceptibility or use a likely active beta lactam if need be

2. Antibiotics are recommended against due to their association with potentially fatal cases of hemolytic uremic syndrome, in addition to lack of efficacy.

3. Antibiotics are recommended against due to their association with prolonged bacterial shedding and transmission, in addition to lack of efficacy.

4. If use indicated, recommended to wait for sensitivities before starting antibiotics. Special concern for using fluoroquinolones even if reported susceptible due to undetected resistance

Keywords: diarrhea

8/14/2023: Antipseudomonal agent of choice

Cefepime is the preferred anti-pseudomonal beta lactam here at PeaceHealth. It has reliable activity against *P. aeruginosa,* improved activity against AmpC producing enterobacterales (*E. cloaceae*, *K. aerogenes*, and *C. freundii*) and less nephrotoxicity compared with piperacillin/tazobactam, and a higher threshold for development of resistance compared with meropenem. All three are approximately equivalent for incidence of *C. difficile* infection, although cefepime is likely slightly lower in risk than meropenem or piperacillin/tazobactam. All three are also approximately equivalent in their activity against common pathogens like *E. coli* and *Streptococcus* spp., and no more effective than ceftriaxone – if anti-pseudomonal activity is not required, ceftriaxone is generally preferred over any of the 3.

For patients requiring empiric activity against *P. aeruginosa,* cefepime +/- metronidazole is preferred over piperacillin/tazobactam or meropenem*,* with a few exceptions:

Situation	Alternative

Activity against both *P. aeruginosa* and *Enterococcus* spp.	Piperacillin/tazobactam
Presumed or confirmed ESBL-producing *E. coli*, *Proteus*, *K. pneumoniae*, or *K. oxytoca* spp.	Meropenem
Genuine allergy or intolerance to 3rd or 4th generation cephalosporins	Piperacillin/tazobactam or meropenem

Standard antipseudomonal doses are:

Cefepime 1g IV Q8H or 2g Q12H (2g Q8H is aimed at intermediately susceptible isolates, central nervous system penetration, etc.)

Piperacillin/tazobactam 3.375 g IV q8H via 4 prolonged infusion (4.5 g prolonged infusion is aimed at intermediately susceptible isolates)

Meropenem 1 g IV Q8H (2 g Q8H is aimed at central nervous system penetration)

Keywords: GNR

8/21/2023: **Which antibiotics have excellent oral bioavailability?**

A number of commonly prescribed antibiotics are highly bioavailable, meaning that they have excellent oral absorption and are considered equally effective when administered orally vs. intravenously.

They should be administered orally whenever the patient is able to swallow, has a functional gut, and is not on vasopressors.

Potential benefits of this approach include decreased costs, earlier discharge, and reduced complications associated with IV access.

Highly bioavailable antibiotics:

- fluoroquinolones (levofloxacin, ciprofloxacin, moxifloxacin)
- trimethoprim-sulfamethoxazole
- metronidazole
- azithromycin
- doxycycline
- linezolid
- clindamycin (if you can find a use for it!)
- fluconazole

Keywords: general ID

8/28/2023: **How do I know whether a positive blood culture is a contaminant?**

First, a refresher on the basics …

Number of sets:

Typically 2 sets are obtained. This is preferable to a single set as it increases sensitivity and allows for greater ability to distinguish bacteremia from contamination. Drawing 3 sets (typically over a period of several hours) further increases sensitivity.

Number of bottles:

A blood culture set has 2 bottles, 1 aerobic & 1 anaerobic (most aerobic pathogens can grow in anaerobic bottles). When a blood culture is positive the result will indicate whether the aerobic, anaerobic, or both bottles are positive. If the patient is a difficult draw there may be only a single/pediatric bottle.

Timing of positivity:

Most clinically relevant cultures turn positive within 24-48 hours. Some organisms are fastidious (e.g. anaerobes) and may take longer to grow.

Gram stain:

When growth of bacteria is detected a gram stain is reported.

DNA identification panel:

This is a rapid PCR with a number of targets for various species of bacteria & fungi (it is not exhaustive so a positive culture could have a negative DNA ID panel). Like a gram stain, it is performed after growth is detected and is resulted quickly.

Back to the original question …

The following features, particularly in combination, suggest that a positive result is potentially/likely a contaminant:

- Isolation of coagulase-negative staphylococci (other than *lugdunensis*), diphtheroids, *Bacillus* spp, *Micrococcus* spp, *Cutibacterium acnes*
    - Other streptococci & *Enterococcus* spp can also be occasional contaminants but exercise caution
- Only 1-2 (out of 4) bottles are positive
- Growth occurs late (after 48 hrs of incubation)
- Pre-test likelihood of bacteremia with the isolated organism is low

A few other points:

- *Staph aureus*, gram negative rods, beta-hemolytic streptococci (groups A, B, and C/G), *Strep pneumoniae*, & *Candida* are virtually never considered contaminants
- Clinical context is very important – for example, growth of *Staph epidermidis* in a patient presenting with a possible catheter infection or prosthetic valve endocarditis is very different than in a patient presenting with pneumonia
- When in doubt as to whether a positive result may be a contaminant, repeating cultures (ideally before antibiotics are administered) can be extraordinarily helpful

Keywords: bacteremia

9/5/23: **How to handle positive blood cultures – part 1**

In keeping with the blood culture theme, here is a breakdown on how to handle positive blood cultures with staphylococci. These are general guidelines and exceptions exist – when in doubt please call ID.

DNA ID Panel Result	Organism	Significance	Initial Management	Preferred Antibiotic
***Staphylococcus* spp detected** *S. aureus* not detected *S. epidermidis* not detected *S. lugdunensis* not detected mecA/C & MREJ detected or not	coagulase negative staph (unspecified species)	Usually a contaminant Consider • Number of bottles positive • Clinical context	Likely contaminant? ➢ Do nothing Possibly/probably real? ➢ Repeat cultures FIRST ➢ Consider starting antibiotics though can often wait for results of follow-up cultures to confirm infection	vancomycin (if indicated) Change to cefazolin OR nafcillin if susceptible
***Staphylococcus* spp detected** *S. aureus* not detected ***S. epidermidis* detected** *S. lugdunensis* not detected mecA/C & MREJ detected or not	*Staph epidermidis*			
***Staphylococcus* spp detected** *S. aureus* not detected *S. epidermidis* not detected ***S. lugdunensis* detected** mecA/C & MREJ not detected	*Staph lugdunensis* (methicillin susceptible)	Can be a contaminant but often a pathogen and can behave similarly to Staph aureus Consider • Number of bottles positive • Clinical context	Likely contaminant? ➢ Consider drawing repeat blood cultures Possibly/probably real? ➢ Repeat blood cultures ➢ Consider starting antibiotics ➢ Consider ID consult	cefazolin 2g IV q8 - OR - nafcillin 2g IV q4 (if indicated)
***Staphylococcus* spp detected** *S. aureus* not detected *S. epidermidis* not detected	*Staph lugdunensis* (possibly methicillin resistant)			vancomycin (if indicated) Change to cefazolin OR nafcillin if susceptible

***S. lugdunensis* detected** mecA/C & MREJ detected				
***Staphylococcus* spp detected** ***S. aureus* detected** *S. epidermidis* not detected *S. lugdunensis* not detected mecA/C & MREJ not detected	MSSA	Always a pathogen	➢ Start antibiotics ➢ Evaluate for source and pursue source control ➢ Echocardiogram ➢ Draw surveillance cultures in 1-2 days ➢ Consult ID	cefazolin 2g IV q8 - OR - nafcillin 2g IV q4
***Staphylococcus* spp detected** ***S. aureus* detected** *S. epidermidis* not detected *S. lugdunensis* not detected mecA/C & MREJ detected	MRSA			vancomycin If allergy/contraindication, daptomycin

Keywords: bacteremia

9/11/23: **How to handle positive blood cultures – part 2**

Last week it was staph, this week it's strep.

Again, these are general guidelines and exceptions exist – when in doubt please call ID.

DNA ID Panel Result	Organism	Significance	Management/Antibiotics
***Streptococcus* spp detected** *S. agalactiae* not detected *S. pneumoniae* not detected	Unspecified streptococcus Likely *S. dysgalactiae* (group C or G) OR viridans strep	*S. dysgalactiae* is virtually always a pathogen viridans streptococci are usually pathogens but occasionally contaminants, consider	• If contaminant suspected → repeat cultures FIRST, consider starting antibiotics • Antibiotic choice depends upon clinical context and syndrome • Consider using ceftriaxone while awaiting species ID

S. pyogenes not detected		• Number of bottles positive • Clinical context	• *S. dysgalactiae* is uniformly susceptible to penicillin and other beta-lactams
***Streptococcus* spp detected** *S. agalactiae* not detected *S. pneumoniae* not detected ***S. pyogenes* detected**	*S. pyogenes* (group A strep)	Always a pathogen	• Start (or change to) active antibiotics • Uniformly susceptible to penicillin and other beta-lactams • cefazolin, penicillin, or ampicillin are preferred • *group A Strep only*: clindamycin should be added for shock but not used as monotherapy
***Streptococcus* spp detected** ***S. agalactiae* detected** *S. pneumoniae* not detected *S. pyogenes* not detected	***S. agalactiae*** (group B strep)		
***Streptococcus* spp detected** *S. agalactiae* not detected ***S. pneumoniae* detected** *S. pyogenes* not detected	***S. pneumoniae*** (pneumococcus)		• Start (or change to) active antibiotics • ceftriaxone 1g IV q24 preferred • If meningitis, ceftriaxone 2g IV q12 PLUS vancomycin

Keywords: bacteremia

9/19/2023: **Preferred empiric antibiotic therapy for diabetic foot infection**

Remember:

- Most patients do NOT need empiric (up front) MRSA or *Pseudomonas* coverage
- Excessively broad coverage is often harmful, not just risk-neutral
- Do NOT obtain or feel compelled to act upon results of superficial/swab cultures
- Final antibiotic selection should be based on deep/tissue/surgical cultures
- Chronic infections may exhibit necrosis/gangrene on exam and gas on x-ray but these are distinct from *necrotizing infection* or *gas gangrene* which are acute and often rapidly progressive and accompanied by severe sepsis or shock

Scenario	Preferred empiric therapy	Comments
Absence of ischemia, necrosis, devitalized tissue, or sepsis	cefazolin 2g IV q8	Main pathogens are MSSA, streptococci, and coag-neg staph
Presence of ischemia, necrosis, devitalized tissue, and/or sepsis	ampicillin-sulbactam 3g IV q6 - OR - ceftriaxone 1g IV q24 +/- metronidazole 500mg PO/IV q8	Pathogens include above organisms plus enteric gram-negatives, anaerobes, & enterococci
Increased risk for *Pseudomonas*	cefepime 2g IV q12 +/- metronidazole 500mg PO/IV - OR - piperacillin-tazobactam 3.375g IV q8	Indications for *Pseudomonas* activity: • Necrotizing infection • Recent positive culture from relevant site
Increased risk for MRSA	Above - PLUS - vancomycin IV per pharmacy	Indications for MRSA activity: • Requiring vasopressors • Necrotizing infection • Recent positive culture from relevant site

Keywords: DFI

9/25/23: **Interpretation of C diff test results**

C. difficile testing at PeaceHealth employs a strategy of initial NAAT (DNA) testing. If negative, no further testing is done. If positive, this reflexes to toxin EIA testing. NAAT testing is highly sensitive though lacks specificity (positive result indicates presence of toxigenic strain but not toxin itself). Toxin EIA testing is highly specific to infection but only about 75% sensitive, so false negatives can occur.

Reminder that C diff testing should only be ordered when ALL of the following criteria are met

- Acute onset diarrhea
- 3+ liquid/loose stools within 24 hours
- No evident alternative explanation (another illness, medication, laxatives, etc)

Here's a breakdown of how to interpret results:

RESULT	INTERPRETATION	ACTION
C diff DNA negative	C diff infection ruled out	➢ Do not treat for C diff infection ➢ Do not repeat testing
C diff DNA positive Toxin EIA negative	C diff infection is possible (vs. colonization)	➢ If clinical suspicion low → favor observation

		➢ If clinical suspicion high → consider treatment for C diff infection ➢ If treatment does not lead to clinical improvement, reconsider diagnosis
C diff DNA positive Toxin EIA positive	C diff infection confirmed	➢ Treat for C diff infection

Keywords: diarrhea

10/5/23: **FAQ on pneumonia, Part 1**

Guidance re: pneumonia therapy is generally broken down into **CAP** (community acquired pneumonia) and **HAP** (hospital acquired pneumonia). There are other syndromes that might require modified approaches, including necrotizing pneumonia, empyema, lung abscess, and aspiration pneumonitis.

Many of you may also be familiar with the designation HCAP (healthcare-associated pneumonia), which was included in prior versions of guidelines and applied to some patients who were thought to be at elevated risk for pneumonia due to resistant organisms (including MRSA and *Pseudomonas*). This designation has been abandoned as years of data demonstrated that this approach was both ineffective and harmful. Anyone who develops pneumonia while not admitted to a hospital is considered to have CAP.

What is the preferred empiric therapy for CAP?

ceftriaxone 1g IV q24

+/- azithromycin 500mg PO/IV q24

What are alternatives in the setting of allergy/intolerance/contraindication?

For ceftriaxone: ampicillin-sulbactam 3g IV q6

For azithromycin: doxycycline 100mg PO/IV q12

What about levofloxacin?

Quinolones have a much less favorable safety profile as compared to beta-lactams. Levofloxacin should only be used when a patient truly cannot tolerate the above agents OR in the rare instance that anti-Pseudomonal therapy is warranted (we'll address this in an upcoming tip).

What is the recommended duration of therapy for CAP?

5 days

When should therapy potentially be extended beyond 5 days?

- Lack of clinical improvement after 72 hrs (e.g. still febrile)
- Parapneumonic effusion (maybe)
- Empyema
- Lung abscess
- Necrotizing pneumonia

What should be used for stepdown oral therapy? (assumes that a specific culprit organism was not identified)

- amoxicillin 500mg PO TID (preferred)
- amoxicillin-clavulanate 875mg PO BID
- cefpodoxime 200mg PO BID (non-preferred; reserve for penicillin allergy)
- doxycycline 100mg PO BID

Keywords: pneumonia

10/11/23: **FAQ on pneumonia, Part 2**

MRSA & *Pseudomonas* (and other resistant gram negatives) are rare pathogens in community acquired pneumonia (CAP). Additionally, use of drugs active against MRSA & *Pseudomonas* is associated with risk of drug resistance, AKI, *C. difficile* infection, secondary infection, prolonged length of stay, and death. These drugs should only be used when there is reasonable likelihood of benefit.

So …

Which patients with CAP should receive empiric MRSA coverage?

- Prior isolation of MRSA from respiratory culture (not including MRSA nasal screen)
- Necrotizing or cavitary pneumonia
- Empyema, if severely ill (e.g. ICU)

Which patients with CAP should receive empiric *Pseudomonas* coverage?

- Prior isolation of *Pseudomonas* from respiratory culture
- Underlying structural lung disease, if severely ill (e.g. ICU)

In all cases, therapy should be tailored to results of microbiologic results (sputum gram stain & culture, respiratory virus testing, etc). If no resistant organisms are found, revert to standard therapy (e.g. ceftriaxone alone).

MRSA nasal screening should only be utilized in patients who are *appropriately* started on empiric MRSA therapy based on the criteria above. In those cases a negative result should lead to de-escalation of therapy. While MRSA nasal screening has good negative predictive value in the proper setting, there is no setting where positive predictive value has been demonstrated.

Keywords: pneumonia

10/17/2023: **FAQ on pneumonia, Part 3**

What is the preferred empiric therapy for hospital acquired pneumonia (HAP) & ventilator associated pneumonia (VAP)?

cefepime 2g IV q12 for HAP or q8 for VAP

+/- vancomycin IV per pharmacy

What are alternatives in the setting of allergy/intolerance/contraindication?

For cefepime: piperacillin-tazobactam 3.375g IV q6

For vancomycin: linezolid 600mg PO/IV q12

When is it most important to include empiric MRSA coverage (with vancomycin or linezolid)?

- Prior isolation of MRSA from respiratory culture
- Necrotizing or cavitary pneumonia
- Empyema

Keywords: pneumonia

What is the recommended duration of therapy for HAP/VAP?

7 days

When should we double-cover for resistant gram negatives?

Almost never. Fortunately our local rates of resistance are low enough that double coverage is only indicated in the rare severely ill patient with a history of highly-resistant *Pseudomonas* or other gram negatives. ID or ID pharmacy guidance should be requested in these scenarios.

Keywords: pneumonia

10/23/23: **The MRSA nares PCR**

The MRSA nares PCR has poor positive predictive value and should not be used to start or maintain therapy that is not otherwise indicated. It has good negative predictive value for pneumonia in low-prevalence settings, meaning its utility is in *stopping* recommended empirical therapy.

Predictive values are closely related to disease prevalence, so no test will have good positive predictive value in a low-prevalence setting. MRSA pneumonia rates range from <1 to 10%, depending on the study. Assuming the highest, a 10% population rate of MRSA pneumonia, positive and negative predictive values of the MRSA nasal PCR are:

	PPV	NPV
All pneumonia	44.8%	96.5%
VAP	35.7%	94.8%

When ordering a test with good negative predictive value in a low prevalence setting, it's important to consider whether the test is needed at all/what other tools are available to answer the question the test is purporting to answer. To illustrate: a pregnancy test for a male has excellent negative predictive value, but a positive result doesn't indicate you need to start prenatal vitamins, and you have other ways of knowing the patient is not pregnant.

So when should you use the MRSA PCR?

If you have a patient with pneumonia for whom empiric vancomycin is recommended (prior isolation of MRSA from a respiratory culture [not prior nasal PCR], necrotizing or cavitary pneumonia, empyema), the MRSA PCR has sufficient (>90%) negative predictive value to stop vancomycin.

When should you NOT use the MRSA PCR?

- To continue vancomycin that was started for a patient without relevant risk factors for MRSA. Stopping vancomycin regardless of the nasal PCR is appropriate in this setting.
- To aid in your decision to start MRSA therapy for any indication
- To aid in your decision to start or stop MRSA therapy for non-pulmonary infections

The decision to include anti-MRSA treatment should be made based on clinical status and relevant risk factors, for which there are clearly defined and evidence-based recommendations, regardless of the MRSA nasal PCR.

Keywords: lab, general ID, pneumonia, SSTI

10/21/23: Here are some SCARY <spooky ghost sound!> stats about antibiotic (mis)use and resistance:

- 33-50% of all antibiotic prescriptions are unnecessary or inappropriate (this includes inpatient and has remained stable for more than a decade)
- Inappropriate prescribing is the leading factor driving antibiotic resistance (overly broad therapy, unnecessary combo therapy, excessive duration, wrong dose)
- ~1 in 5 infections in wealthy countries are caused by resistant bacteria
- Antibiotic resistance killed nearly 5 million people in 2019 (the last year this analysis was done)
- In the US, 2.8 million antibiotic resistant infections occur annually, killing more than 35,000 people (data from 2012, current numbers likely substantially higher) and costing nearly $5 billion

On a positive note: since inappropriate prescribing is the main driver of these problems, using antibiotics wisely (right drug at the right dose for the right duration and only when necessary) goes a long way towards solving them.

Credit to our ID pharmacist, Sophia Cardwell, for the stats.

Keywords: general ID

11/9/2023: Aspiration pneumonitis v. pneumonia:

- Approximately 25% of patients with aspiration pneumonitis will progress to pneumonia, regardless of administration of prophylactic (within the first 2 days of aspiration) antibiotics
- For aspiration pneumonitis, observing patients off antibiotics is (and should be) the standard of care, as antibiotics do not affect progression to pneumonia
- Patients with aspiration pneumonitis who are given prophylactic antibiotics are more likely to require escalation of antibiotics should pneumonia develop, due to selection of resistant pathogens

Aspiration		Aspiration pneumonitis		Aspiration pneumonia		Pulmonary abscess
Aspiration events (inhalation of gastric or oropharyngeal contents) are common, and not infectious.	→ Based on volume, pH, etc.	An acute inflammatory response in the first 48 hours after aspiration event. May have ↑WBC, fever, SOB. Not infectious.	→ ~25% develop pneumonia, whether you give antibiotics or not	Pneumonia (standard dx criteria) 2-7 days post aspiration. Infectious. Treat as CAP (e.g. no metronidazole)	→ Takes weeks to months	Chronic, rather than acute, may need to include metronidazole, may require surgery and prolonged treatment.
Observe off antibiotics – giving prophylactic antibiotics here does not				Ceftriaxone monotherapy is sufficient – pathogens are oral anaerobes, not		

change the rate of progression to pneumonia, and causes specific harm.	*Bacteroides* spp. May add metronidazole for abscesses with *Fusobacterium* spp.
Not an infection	Infection

Keywords: pneumonia

11/9/23: **Gram negative resistance: AmpC beta-lactamase**

Cefepime is the preferred agent for treatment of serious infection with ***Citrobacter freundii, Enterobacter cloacae,*** & ***Klebsiella aerogenes***.

With the exception of cystitis and non-severe soft tissue infection, ceftriaxone, piperacillin/tazobactam, and oral cephalosporins & penicillins should be avoided regardless of susceptibility testing results. With susceptibility ciprofloxacin, levofloxacin, trimethoprim/sulfamethoxazole, and if cystitis, nitrofurantoin can be considered as alternatives to cefepime or if transitioning to oral therapy.

Background/explanation:

Citrobacter freundii, Enterobacter cloacae, and *Klebsiella aerogenes* all reliably carry genes for inducible resistance on treatment with 3rd generation cephalosporins and piperacillin/tazobactam via production of the AmpC beta lactamase. Current technology is unable to detect the AmpC beta lactamase prior to emergence of resistance, making susceptibility data from initial cultures misleading. Susceptibility reports for systemic infections to piperacillin/tazobactam and ceftriaxone should NOT be used to make treatment decisions. Cefepime is reliably active against AmpC producing enterobacterales, and an MIC of ≤2 affirms susceptibility to cefepime.

More info here: https://www.peacehealth.org/sites/default/files/2023-03/PeaceHealth-AmpC.pdf

Keywords: GNR

11/28/23: **Gram negative resistance: extended-spectrum beta-lactamase (ESBL)**

ESBL-producing *E. coli*, *Klebsiella pneumoniae/oxytoca*, or *Proteus* can be identified by resistance to ceftriaxone or ceftazidime OR by detection of CTX-M gene in blood isolates.

Serious or systemic infection

- **Meropenem is preferred**
- Oral stepdown therapy with SMX-TMP, ciprofloxacin, or levofloxacin may be considered (if susceptible)

Uncomplicated cystitis

- **Nitrofurantoin or SMX-TMP are preferred**
- Alternatives
    - Single dose aminoglycoside
    - Ciprofloxacin or levofloxacin for 1-3 days
    - Single dose fosfomycin (*E. coli* only)
    - Meropenem (if the only susceptible agent)
- Patients initially started on cefepime or piperacillin/tazobactam who are clinically improving may complete treatment without change or extension
- Doxycycline & amoxicillin/clavulanate should NOT be used (regardless of susceptibility results)

ID consult is encouraged for bacteremia and other serious systemic infections.

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Keyword: GNR

12/28/23: **Influenza & oseltamivir**

For inpatients with influenza, antiviral treatment with oseltamivir should be started as early as possible.

This recommendation applies regardless of timing of symptom onset. There is good evidence supporting oseltamivir for any hospitalized patient with influenza to reduce death and duration of hospitalization, especially when started within 48 hours from admission. Withholding oseltamivir for inpatients based on symptom duration is NOT recommended and may be harmful. Even if delayed until hospital day 3 or later, it is still officially recommended wherever possible.

1/2/24: **Influenza & bacterial pneumonia**

How common does secondary bacterial pneumonia complicate influenza?

Uncommonly! About 1-3% of cases (in a non-pandemic year), skewing a bit higher in hospitalized patients.

When should I suspect secondary bacterial pneumonia?

- Biphasic illness, e.g. relapsed fever after prior improvement
- Persistent fever after 3-5 days
- Purulent sputum production
- Lobar consolidation

What are the most common pathogens?

- *Strep pneumoniae*
- *Staph aureus* (MSSA & MRSA)

How should I evaluate patients with suspected secondary bacterial pneumonia?

- Repeat chest imaging
- Sputum gram stain & culture (tracheal aspirate or BAL if intubated)
- Nasal MRSA PCR if starting vancomycin

What empiric antibiotics should be used if I suspect secondary bacterial pneumonia?

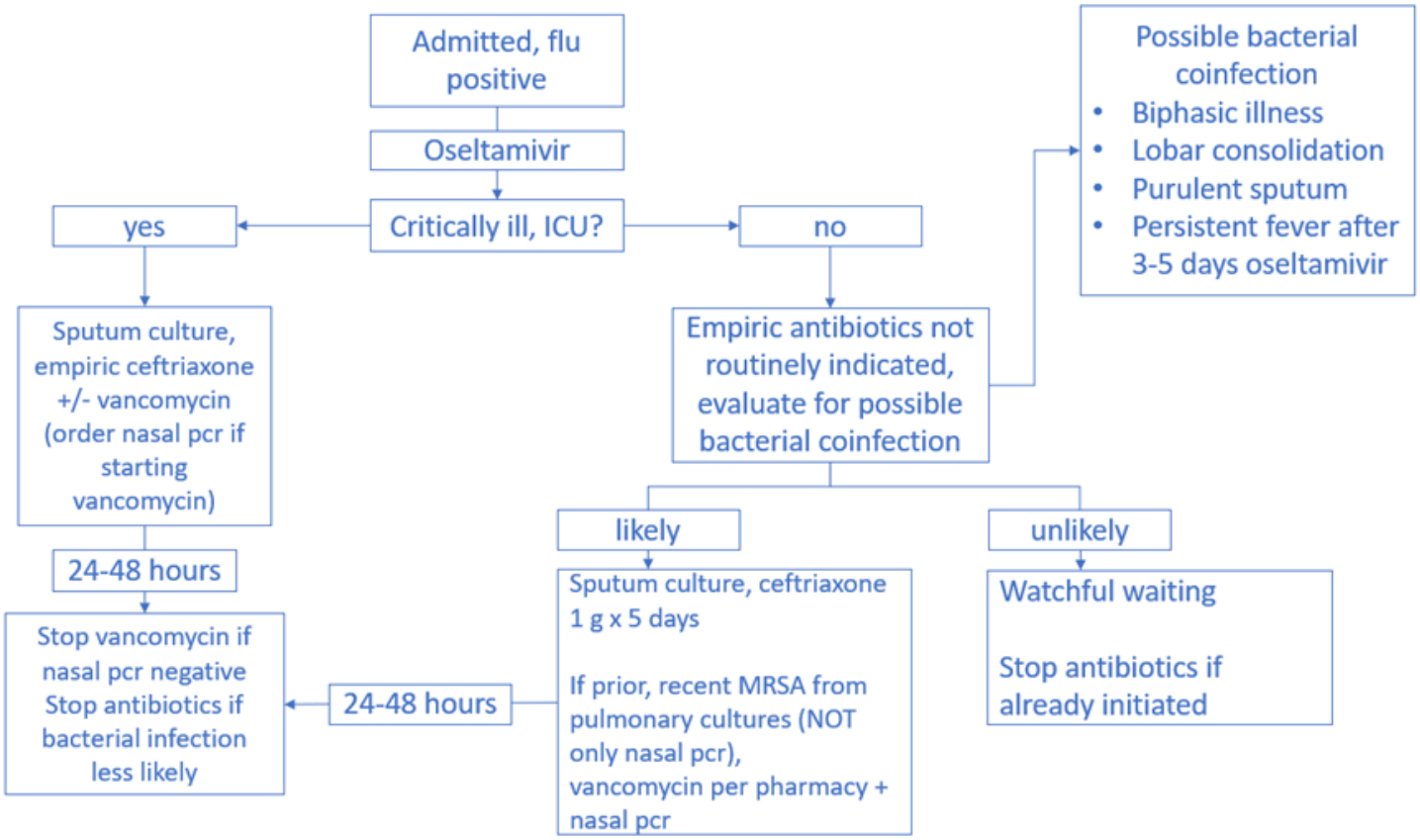
- ceftriaxone 1g IV q24
- +/- vancomycin IV per pharmacy ***IF*** critically ill or MRSA recently isolated from respiratory culture (not just nasal PCR)

What should I NOT do in this scenario?

- Routinely start antibiotics in patients with influenza
- Prescribe atypical agents (e.g. azithromycin)
- Prescribe anti-Pseudomonal agents (e.g. cefepime)

Keywords: Flu/COVID, pneumonia

Prefer a flow-chart? Here you go!



1/26/24: **Antibiotic management of hematogenous osteomyelitis**

Hematogenous osteomyelitis (most commonly vertebral osteomyelitis-diskitis with/without epidural abscess) is a distinct syndrome from contiguous osteomyelitis (e.g. diabetic foot infection). Hematogenous ostemyelitis is most commonly mono-microbial, and *Staphylococcus* spp. (MSSA, MRSA, CoNS) are the most frequently identified pathogens with gram negative organisms are less common. It's essential that the culprit pathogen be isolated in order to ensure successful management. Accordingly, antibiotics should NOT be started reflexively.

Here is a recommended approach to initial management:

Stable patients →

- HOLD ANTIBIOTICS until cultures can be obtained surgically or percutaneously (in addition to blood cultures)
- Once cultures obtained, start vancomycin IV per pharmacy +/- ceftriaxone 1-2g IV q24

Stable patients with positive blood cultures →

- Assuming that a contaminant is not suspected, start antibiotics targeting the isolated organism

Patients with hemodynamic instability OR neurologic deficits →

- Start vancomycin IV per pharmacy +/- ceftriaxone 1-2g IV q24

ID consult is strongly encouraged for these cases.

SC 12_2024

Keywords: osteomyelitis

2/7/2024: **Antibiotic management of contiguous osteomyelitis**

As mentioned with our last tip, this is a distinct syndrome from hematogenous osteomyelitis.

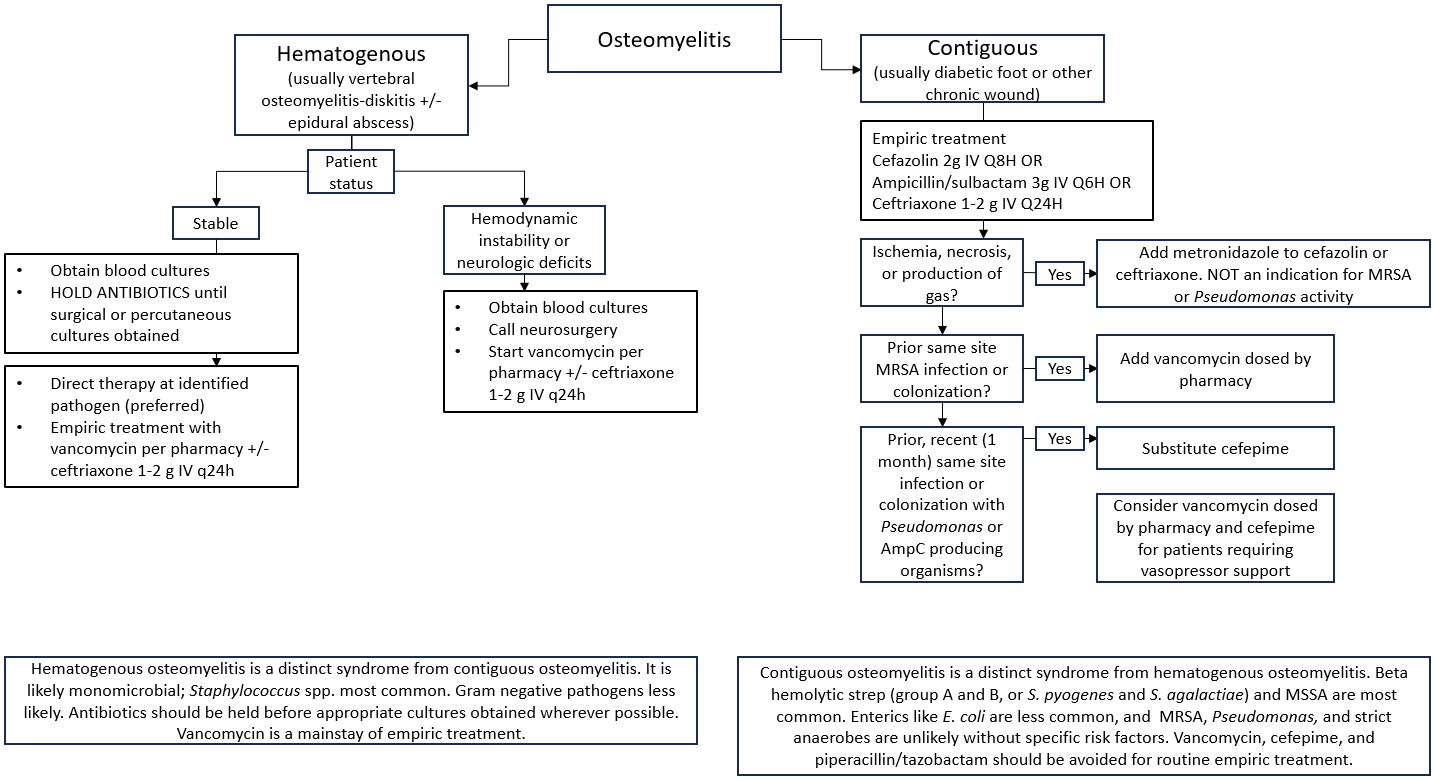
We most commonly see contiguous osteomyelitis in the setting of diabetic foot infection, though the same general principles apply to other scenarios.

- Bone cultures (e.g. with surgical debridement) are STRONGLY preferred over soft tissue or superficial cultures (as the latter will often pick up irrelevant superficial colonizers)
- Streptococci (group A/*pyogenes* and B/*agalactiae*) and MSSA are the most common pathogens
    - Enteric pathogens like *E. coli* are less common
    - MRSA, *Pseudomonas*, & anaerobes are unlikely in absence of specific risk factors
- **Most patients DO NOT require MRSA or *Pseudomonas* coverage up front**
    - Antibiotics targeting these organisms are no more effective for the most common pathogens
    - Starting these antibiotics unnecessarily is more likely to be harmful than beneficial
    - You have plenty of time to start these later if indicated based on cultures

Scenario	**Preferred empiric therapy**
Absence of ischemia, necrosis, gas, devitalized tissue, or sepsis	cefazolin 2g IV q8
Presence of ischemia, necrosis, devitalized tissue, gas, and/or sepsis	ampicillin-sulbactam 3g IV q6 - OR - ceftriaxone 1g IV q24 +/- metronidazole 500mg PO/IV q8
Increased risk for *Pseudomonas* or other resistant gram negatives • Recent (~1 month) same site culture with these organisms • Critically ill patients (e.g. requiring pressors)	cefepime 2g IV q12 +/- metronidazole 500mg PO/IV - OR - piperacillin-tazobactam 3.375g IV q8
Increased risk for MRSA • Recent (~1 month) same site culture with MRSA • Critically ill patients (e.g. requiring pressors)	Above - PLUS - vancomycin IV per pharmacy

Keywords: osteomyelitis, DFI

2/16/24: **Differential antibiotic management of hematogenous v. contiguous osteomyelitis**



Keywords: osteomyelitis, DFI

2/26/24: **Management of sacral decubitus ulcers**

(Sticking with the recent theme of osteomyelitis …)

The mainstay of therapy for sacral decubitus ulcers is local wound care and off-loading.

If there is evidence of local soft tissue infection, empiric antibiotics targeting skin & enteric flora are appropriate. Reasonable options include ampicillin-sulbactam OR ceftriaxone +/- metronidazole. Anti-MRSA & anti-pseudomonal agents should be avoided for routine empiric therapy.

Imaging studies, including MRI, often over-estimate the presence of osteomyelitis and cannot reliably distinguish osteomyelitis from bone remodeling.

There is no evidence of benefit of antibiotic therapy for sacral osteomyelitis associated with sacral decubitus ulcers unless concomitant surgical debridement and wound coverage is performed. In that scenario, a course of culture-directed antibiotic therapy is appropriate following closure.

Unfortunately, to our knowledge, there are no surgeons in SW Washington that perform these surgeries. As such, patients are generally referred to an academic center and can be maintained with wound care, off-loading, nutritional optimization and – when appropriate – a short course of antibiotics for soft tissue infection until evaluated by a surgeon.

Keywords: osteomyelitis

3/15/24**: How to use this year's antibiogram, gram negative edition!** See here https://www.peacehealth.org/pages/providers-and-medical-professionals/resources/infectious-diseases or instructions for Epic link in any micro result below (using SW rather than SJ given it has more unique isolates):

Species identification on blood pcr/preliminary culture should be used with the antibiogram to focus antibiotics for responding patients

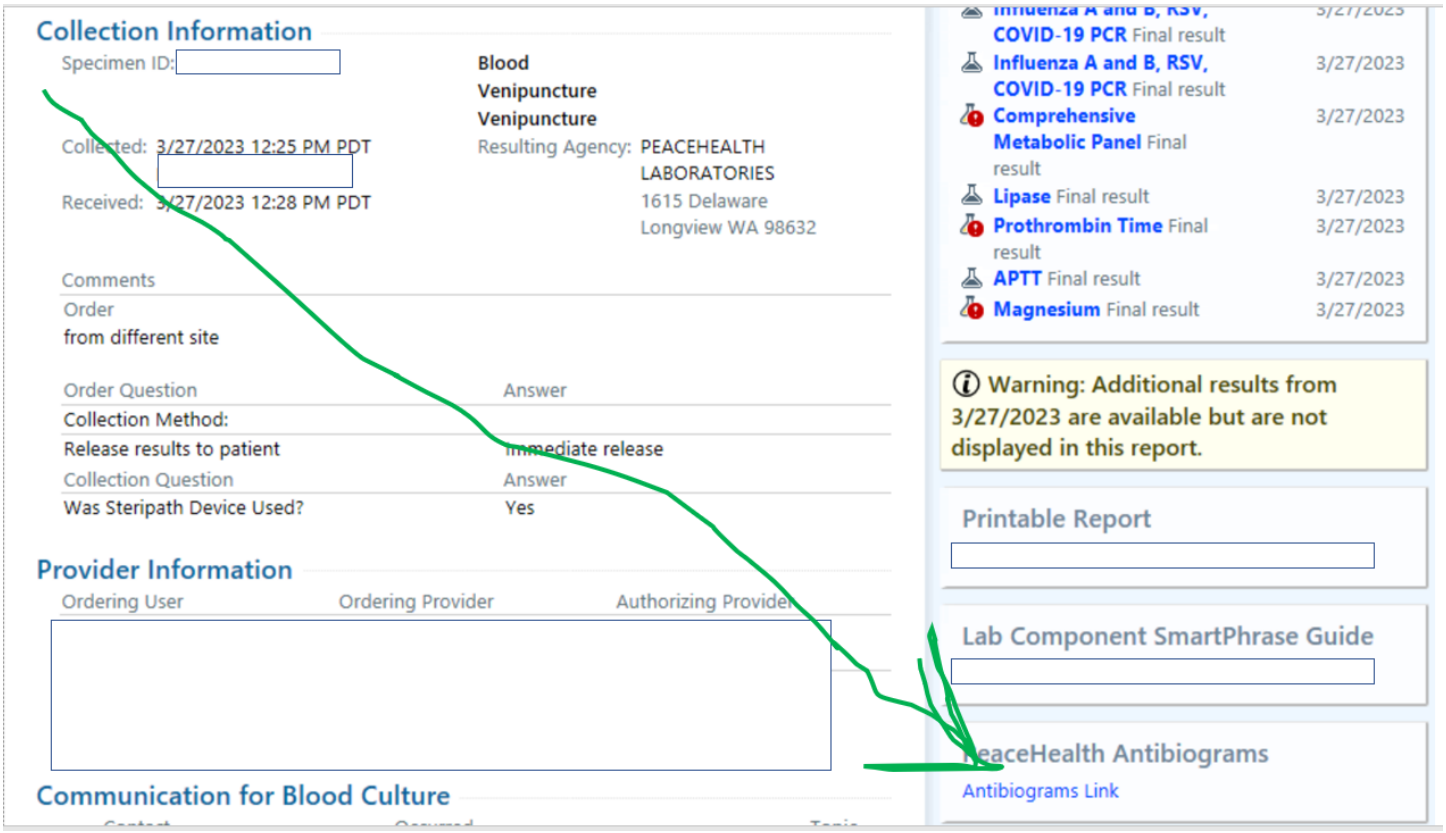
1. If GNRs identified, stop vancomycin wherever possible
2. If cefepime, piperacillin/tazobactam, or meropenem is ordered, change to ceftriaxone for *E. coli, C. koseri, K. oxytoca, K. pneumoniae* with no CTX-M gene identified
    a. CTX-M is an accurate predictor of ceftriaxone non-susceptibility, if positive, meropenem should be used, if negative, ceftriaxone is appropriate
3. If ceftriaxone or piperacillin/tazobactam is ordered, change to cefepime for AmpC producers *C. freundii, E. cloacae, K. aerogenes*

A note on piperacillin/tazobactam: it should not routinely be used for empiric therapy in our population. It is not reliably active against AmpC producers, which are more common than *P. aeruginosa.* It is no better than ceftriaxone for *E. coli* and other non AmpC producing enterobacterales; ceftriaxone resistance precludes the use of piperacillin/tazobactam for these, regardless of final susceptibility. It is less reliable for *P. aeruginosa* than cefepime, and it has a much higher risk of nephrotoxicity than any cephalosporin.

Further definitive treatment with susceptibility data (narrow spectrum, PO, stop date) should still happen 😊

GRAM NEGATIVE ORGANISM PERCENT *SUSCEPTIBLE*	# Isolates Tested	Beta-lactams										Fluoro-quinolones		Aminoglycosides			Miscellaneous		
		Penicillins			Cephalosporins					Carbapenems									
		Ampicillin	Amoxicillin/clavulanic acid	Piperacillin/tazobactam	Cefazolin - *urine isolates only*	Cefoxitin	Ceftriaxone	Ceftazidime	Cefepime	Ertapenem	Meropenem	Ciprofloxacin	Levofloxacin	Amikacin	Gentamicin	Tobramycin	Nitrofurantoin - *urine only*	Tetracycline	Trimethoprim/sulfamethoxazole
Citrobacter freundii	63	R	R	-	-	R	-	-	100	98	100	97	95	100	97	98	94	98	97
Citrobacter koseri	30	R	100	100	-	87	100	100	100	100	100	100	97	100	100	100	-	97	100
Enterobacter cloacae	138	R	R	-	-	R	-	-	96	95	100	94	93	100	99	98	52	87	93
Escherichia coli	1529	61	88	98	88	94	92	97	98	100	100	84	79	100	94	95	98	81	81
Klebsiella aerogenes	51	R	R	-	-	R	-	-	100	98	100	96	98	100	100	98	17	94	98
Klebsiella oxytoca	75	R	92	97	-	97	91	96	100	100	100	96	95	99	95	95	82	90	93
Klebsiella pneumoniae	333	R	92	97	87	97	89	93	97	99	99	88	88	100	95	92	35	84	89
Morganella morganii	35	R	R	97	-	51	89	74	97	100	100	71	71	100	91	100	-	50	74
Proteus mirabilis	201	74	85	100	93	91	95	99	100	100	100	82	82	100	94	96	R	R	79
Pseudomonas aeruginosa	295	R	R	89	-	-	R	91	91	R	99	91	84	99	-	100	-	-	R
Serratia marcescens	45	R	R	98	-	R	93	100	100	100	100	93	91	100	98	87	R	41	100
Stenotrophomonas maltophilia	56	R	R	R	-	-	R	-	-	R	R	-	95	R	R	R	-	-	100

NOTE: Third generation cephalosporins and piperacillin/tazobactam are unreliable for systemic infections with AmpC producing organisms (E. cloacae, K. aerogenes, or C. freundii), regardless of susceptibility data, due to the development of induced resistance on treatment.



Keywords: general ID, lab

3/25/24: **How to use this year's antibiogram, gram positive edition!** See here https://www.peacehealth.org/pages/providers-and-medical-professionals/resources/infectious-diseases or instructions for Epic link in any micro result below (using SW rather than SJ given it has more unique isolates):

Species identification on blood pcr/preliminary culture should be used with the antibiogram to focus antibiotics for responding patients

1. If common pathogens other than MRSA identified, stop vancomycin wherever possible (GNRs, MSSA, strep, most coagulase negative staph and enterococcus)
2. If MSSA identified, change to cefazolin or nafcillin wherever possible, there is a mortality/morbidity benefit for these agents for MSSA compared with vancomycin or ceftriaxone
3. If beta hemolytic strep identified (*S. pyogenes, S. agalactiae, S. dysgalactiae*), change to cefazolin – these organisms are uniformly susceptible
    a. Clindamycin is more harmful than beneficial except for infection with *S. pyogenes* in patients requiring vasopressors
4. If *Enterococcus faecalis* identified, change to an ampicillin containing regimen wherever possible; cephalosporins do not have enterococcal activity

A note on vancomycin: it is inferior to beta lactams for treatment of common pathogens other than MRSA/MRSE (MSSA, strep, and enterococcus), from both an efficacy and safety standpoint. It's used for MRSA largely because the alternatives are even worse than vancomycin, but it is neither safe nor particularly effective when used for treating infections where beta lactam antibiotics are active. Because of its unfavorable safety profile, vancomycin should only be

used empirically for infectious disease states where MRSA (or more rarely coagulase negative staphylococcus) are likely pathogens, unless there is a genuine contraindication to preferred therapy.

Further definitive treatment with susceptibility data (narrow spectrum, PO, stop date) should still happen 😊

GRAM POSITIVE ORGANISM PERCENT *SUSCEPTIBLE*	# Isolates Tested	Beta lactams: Penicillins/Cephalosporins					Fluoro-quinolones		Amino-glycosides		Miscellaneous								
		Penicillin	Oxacillin	Ampicillin	Cefazolin	Ceftriaxone	Ciprofloxacin	Levofloxacin	Gentamicin Synergy	Streptomycin Synergy	Clindamycin	Daptomycin	Erythromycin	Minocycline	Nitrofurantoin - *urine only*	Rifampin	Tetracycline	Trimethoprim/sulfamethoxazole	Vancomycin
Enterococcus faecalis	300	-	-	100	-	-	-	-	83	96	-	-	-	-	99	-	-	-	100
Enterococcus faecium	34	-	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64
Staphylococcus aureus, MRSA	318	-	0	-	0	-	-	-	-	-	79	100	-	100	-	100	74	99	100
Staphylococcus aureus, MSSA	696	-	100	-	100	-	-	-	-	-	87	-	-	100	-	-	92	100	-
Staphylococcus epidermidis	89	-	42	-	42	-	-	-	-	-	62	-	-	100	-	-	74	63	100
Staphylococcus lugdunensis	47	-	89	-	89	-	-	-	-	-	84	-	-	100	-	-	100	98	100
Streptococcus agalactiae (Group B)	89	100	-	-	100	100	-	-	-	-	65	-	49	-	-	-	-	-	100
Streptococcus anginosus	92	98	-	-	-	99	-	-	-	-	-	-	-	-	-	-	-	-	100
Streptococcus constellatus	43	91	-	-	-	93	-	-	-	-	-	-	-	-	-	-	-	-	100
Streptococcus intermedius	38	100	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	100
Streptococcus mitis/oralis	57	75	-	-	-	100	-	98	-	-	-	-	-	-	-	-	88	-	100
Streptococcus pneumoniae	70	100*	-	-	-	99*	-	100	-	-	-	-	74	-	-	-	81	-	-
Streptococcus pyogenes (Group A)	117	100	-	-	100	100	-	-	-	-	71	-	71	-	-	-	-	-	100

Keywords: general ID, lab, bacteremia

4/8/24: **Ceftriaxone remains our antibiotic of choice for empiric treatment of most ***community acquired*** infections.**

This includes (but is not limited to) community-acquired pneumonia, pyelonephritis, intra-abdominal infection, and diabetic foot infection.

Local rates of resistant organisms (e.g. MRSA, *Pseudomonas*, other resistant gram negatives) remain low and predictable based on history and site of infection. They are unlikely pathogens in the above scenarios.

Anti-pseudomonal agents (including cefepime, piperacillin-tazobactam, quinolones) and vancomycin are *more toxic*, *less effective* against more likely pathogens, or *both*.

Keywords: general ID

5/15/2024: Individual species of coagulase negative staphylococci (CoNS) are now being reported in microbiology results.

SC 12_2024

This is a change from our previous process of identifying them only as 'Coagulase negative *Staphylococcus* species, not *Staphylococcus lugdunensis'*.

For example, what would have previously been reported as:

Isolated from the anaerobic bottle Coagulase negative Staphylococcus species, not Staphylococcus lugdunensis !! (Critical)

May now appear as:

Isolated from the anaerobic bottle Staphylococcus hominis !! (Critical)

Here's what you should know/remember about CoNS:

- They make up ~25% of all blood isolates; species include *Staph epidermidis, lugdunensis, haemolyticus, simulans, auricularis, capitis, hominis*
- They usually represent blood culture contamination
- *Staph lugdunensis* is the one exception – while it can also be a contaminant, it is more likely to cause disease and behaves similarly to Staph aureus
- Presence or absence of the MecA gene is irrelevant with respect to significance of a positive culture

If you think a patient may have a "real" CoNS bacteremia, the best course of action is to collect more blood cultures before starting antibiotics.

A true bacteremia is more likely present with one or more of the following:

- Multiple (typically > 2) bottles positive with the same organism (species and susceptibility pattern)
- Risk factors, especially a central line or other endovascular device/hardware
- Fever and other signs/symptoms of infection without a more likely explanation

Keywords: bacteremia, lab

6/13/2024

Management of diabetic foot infection, Part 1

Management of diabetic foot infection includes a decision regarding empiric (up-front) antibiotics as well as evaluation to determine pathogens involved, depth of infection, concurrent vascular disease and need for revascularization, and surgical debridement (or amputation). Subsequent management decisions include interpretation of culture results, adjustment of antibiotic therapy, and decision re: intensity (e.g. IV vs PO) and duration of antibiotic therapy.

For empiric antibiotic therapy, remember:

- Most patients do NOT benefit from empiric (up front) MRSA or *Pseudomonas* coverage
- The presence or absence of osteomyelitis should not alter antibiotic selection (for example, osteomyelitis does not necessitate broader therapy)
- Excessively broad coverage is *harmful*
- Do NOT obtain or feel compelled to act upon results of superficial/swab cultures

- Chronic infections may exhibit necrosis/gangrene on exam and gas on x-ray - these changes are distinct from *necrotizing infection* or *gas gangrene* which are acute and often rapidly progressive and accompanied by severe sepsis or shock

Scenario	Preferred empiric therapy	Comments
Absence of ischemia, necrosis, devitalized tissue, or sepsis	cefazolin 2g IV q8	Likely pathogens are MSSA, streptococci, and coagulase-neg staph
Presence of ischemia, necrosis, devitalized tissue, and/or sepsis	ampicillin-sulbactam 3g IV q6 - OR - ceftriaxone 1g IV q24 +/- metronidazole 500mg PO/IV q8	Pathogens include above organisms plus enteric gram-negatives, anaerobes, & enterococci
Increased risk for *Pseudomonas*	cefepime 2g IV q12 +/- metronidazole 500mg PO/IV - OR - piperacillin-tazobactam 3.375g IV q8	Indications for *Pseudomonas* activity: • Necrotizing infection • Recent positive culture from relevant site
Increased risk for MRSA	Above - PLUS - vancomycin IV per pharmacy	Indications for MRSA activity: • Requiring vasopressors • Necrotizing infection • Recent positive culture from relevant site

Keywords: DFI

7/3/2024

Management of diabetic foot infection, Part 2

Aside from selection of empiric (up-front) antibiotic therapy there are a number of other management considerations and principals to follow.

Initiation of antibiotic therapy

- For patients with osteomyelitis who are stable (afebrile, without significant cellulitis, abscess, or septic arthritis) it is best to hold antibiotics until deep/bone cultures are obtained (e.g. surgically)
- For all other patients, it is reasonable/appropriate to start antibiotics while also obtaining cultures as quickly as possible so as to maximize yield
- Remember that most patients should NOT receive empiric anti-MRSA or anti-Pseudomonas therapy (see table below)

Cultures

- Do NOT obtain specimens for culture by swabbing a superficial wound (studies show superficial wound swabs do not correlate with deeper/tissue/bone samples)

- Cleanse and debride wounds before obtaining any specimen for culture
- For suspected osteomyelitis of the foot, collect a sample of bone (percutaneously or surgically) for culture and histopathology

Additional evaluation & management

- Most patients, including any with evidence of ischemia, necrosis, devitalized tissue, and/or sepsis, should be evaluated by podiatry/orthopedics
- Consider vascular studies +/- vascular surgery evaluation
- Consider wound care team and diabetes educator evaluations

Keywords: DFI

7/17/2024

Management of diabetic foot infection, Part 3

Determining definitive antibiotic therapy

- Final antibiotic selection can be made based on clinical improvement, relevant culture results, and upon completion of any surgical procedures
- If started initially, drugs targeting MRSA, *Pseudomonas*, or other resistant gram negatives should be discontinued if these organisms are not isolated from relevant cultures
- Patients without osteomyelitis can be treated with oral antibiotics (unless cultures dictate otherwise, e.g. quinolone-resistant *Pseudomonas*)
- Patients with osteomyelitis may require IV antibiotics for the duration of treatment and should typically be managed with ID assistance

Scenario	Typical Duration of Therapy
Curative amputation without residual soft tissue infection	24-48 hours post-op
Soft tissue infection	10-14 days
Residual osteomyelitis following debridement/amputation	3-6 weeks
Osteomyelitis managed non-operatively	6 weeks

Keywords: DFI

8/2/2024

Hi everyone,

Along the recent tip of the week theme of Diabetic Foot Infections, wanted to make you aware of the recent ID related State of the Art Reviews (StAR) being written and published in the Clinical Infectious Disease (CID) journal.

There is a great review on Diabetic Foot Infections here:
Evaluation and Management of Diabetes-related Foot Infections | Clinical Infectious Diseases | Oxford Academic (oup.com)

Other topics published thus far include Staph aureus bacteremia, Enterococcal bacteremia, Prosthetic Joint Infection, Neurosyphilis, and Encephalitis. The homepage can be found here:
State-of-the-Art Reviews | Clinical Infectious Diseases | Oxford Academic (oup.com)

These are intended for ID, Non-ID providers, and trainees alike. Maybe the easiest way to digest this is likely in its Podcast form, via the highly regarded Febrile podcast (should be a free podcast in all app stores):
febrile – A Cultured Podcast About All Things Infectious Disease (febrilepodcast.com)
Keywords: DFI, general ID

SC 12_2024

8/19/2024

Hello,

DFI guide 12_2024.pdf

For this week, please find the attached document for Diabetic Foot Infection management I created with the help of the ID team and input from Dr. Fish with podiatry.

This hopes to serve as a guideline to streamline management of patients with foot infection and concern for osteomyelitis. There is an algorithm at the end for quick reference.

Keywords: DFI, osteomyelitis

8/29/2024

Metronidazole dosing

Key points:

- **Dosage interval of metronidazole at PeaceHealth has changed from Q8 to Q12 for most infections (and for both PO & IV routes)**
- **Pharmacy will adjust dosing as appropriate based on an interchange policy**
- **Please note your patient's current dosage interval if continuing metronidazole on discharge**
- **While the above dosing is different from commonly used references (e.g. UpToDate, Lexicomp, Sanford) it is supported by PK data and several clinical studies and is employed at other reputable institutions**

Background:

In response to a nationwide shortage of IV metronidazole, a review of alternatives yielded good information about Q12H dosing, which is different from recommendations from tertiary databases and national guidelines. In light of this review, the dosage interval of metronidazole at PH has recently changed from a standard of Q8H for most infections to Q12H.

This change is supported by the pharmacokinetics of metronidazole (oral and IV) and several clinical studies (here, here, and here) examining outcomes with Q8 versus Q12 hour dosing. Metronidazole has an approximately 8-12 hour half-life, achieves 98-100% oral bioavailability, and plasma levels are unaffected by infection, acute or chronic renal disease, renal replacement, etc. It also has a low volume of distribution (0.5-1L), meaning it does *not* require weight based dose adjustments (please ask a pharmacist colleague for more about volume of distribution 😊). 500 mg Q12H dosing provides serum levels well in excess of susceptible MICs for *Bacteroides fragilis* and other *Bacteroides spp.*, which are the primary anaerobic pathogens is it used for in our institutions.

Based on these data, a few institutions have examined clinical outcomes comparing Q8 versus Q12 hour dosing. The first, above Soule at al. at Novant Health, compared outcomes for primarily intra-abdominal infections, and found no difference in duration of treatment, length of stay, escalation of treatment, or death. Cure rates were ~80% in both groups. The second, above by Shah et al. at Yale New Haven, compared outcomes specifically for anaerobic bacteremia, of which the majority were *Bacteroides spp.*, and found no difference in escalation of treatment, length of stay, or death. Lastly, Béïque et al. compared outcomes for diverticulitis/appendicitis and found no difference in outcomes. These excluded parasitic or amoebic infections, *C. difficile*, and CNS infections. Studies suggesting superiority of Q8 over Q12 hour dosing are not available.

SC 12_2024

It's important to note that the cure rates in the first paper (80%) are similar to pooled cure rates for intra-abdominal infections with sepsis overall. That's not to suggest that patients on Q12H metronidazole have no risk of escalation of treatment, but that both pharmacokinetic data and clinical evidence demonstrate that escalation of treatment is most likely related to factors *other* than metronidazole dosing.

Keywords: general ID, oral tx

9/13/2024

Management of septic arthritis

(native/non-prosthetic joints)

Diagnosis

- For stable patients, aspirate suspected septic joints *BEFORE* administration of antibiotics

- Evaluate synovial fluid for: GS & culture, cell count with differential, crystals

- Collect blood cultures for febrile patients or in those with suspected concomitant bacteremia (also before antibiotics)

- CRP is of some value (if normal, argues against septic arthritis; if elevated, support diagnosis)

Microbiology

- MSSA is most common

- Strep, gram negatives, MRSA are less common

- *Neisseria gonorrhoeae* is uncommon but worth noting as requires some pre-test suspicion to ensure appropriate testing

Preferred empiric therapy

- Cefazolin or ampicillin/sulbactam are preferred for most patients

- Ceftriaxone is a reasonable alternative if GNRs are suspected

- Consider adding vancomycin for hemodynamic instability, injection drug use, or history of MRSA infection (note: nasal PCR has no predictive value for joint infections)

Management

- Consult orthopedics - source control with surgical debridement is recommended wherever possible

- De-escalate therapy to the narrowest spectrum effective agent ASAP.

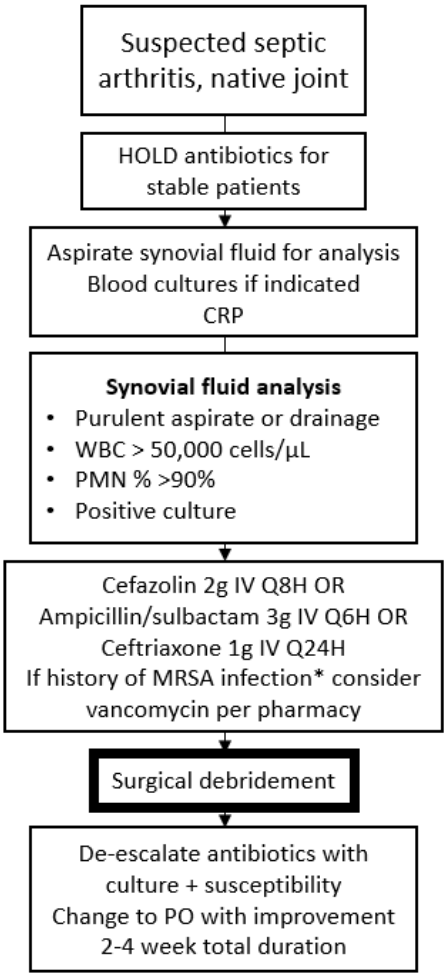
- IV antibiotics can be transitioned to PO in most cases

- Total duration of antibiotics with source control is 2-4 weeks

- ID consult is generally appropriate

Keywords: general ID, osteomyelitis

For those of you who prefer flow charts:



9/19/2024:
Management of *C. difficile* diarrhea (for interpretation of test results, please see the tip from 9/25/23)

Step 1: Stop or de-escalate the inciting antibiotic wherever possible

This is step is extremely important, continuation of broad spectrum antibiotics is directly associated with severe disease and recurrence. Non-infections conditions for which antibiotics are commonly prescribed inpatient include hypoxia or peripheral edema due to volume overload, asymptomatic bacteriuria, aspiration pneumonitis, viral respiratory tract infections, vascular insufficiency, or diverticulosis without diverticulitis. Fluoroquinolones, ceftriaxone, antipseudomonal beta lactams, and clindamycin are the highest-risk antibiotics. Non-fluoroquinolone oral antibiotics, tetracyclines, metronidazole, and cefazolin are lower risk. Probiotics do not mitigate the effects of antibiotics in the setting of *C. difficile* (or any other setting, for that matter).

Step 2: Treat with oral vancomycin at 125 mg four times a day for 10 days

Colonic concentrations of vancomycin 125 mg average 500-1000 µ/g; elevated MICs to vancomycin are rare, and 125 mg dosing yields concentrations 30 to 250 times above even intermediately susceptible MICs. Studies comparing doses ranging from 125 to 500 mg have identified no difference in time to resolution of symptoms, clinical cure, or other outcomes. There is little evidence to support the 500 mg dose, even in critically ill patients, however it is recommended as a last line option to prevent colectomy, despite the lack of data. Systemic concentrations of vancomycin have been measured with the 500 mg dose, especially in patients with renal failure – monitoring is recommended in this

circumstance. Fidaxomicin is equally effective when compared with PO vancomycin at treating CDI, but cost prohibitive ($5977 v. $57 per standard treatment), so it remains non formulary.

Other management considerations

The most important modifiable risk factor for *C. difficile* is exposure to antibiotics. The overwhelming majority of cases are directly preceded by exposure to antibiotics. 30-50% of antibiotics prescribed in the US are unnecessary or ineffective as written, for both the inpatient and outpatient setting. Reducing unnecessary use of antibiotics, in number, duration, by class, or overall has repeatedly demonstrated drastic decreases in *C. difficile* incidence, in a variety of settings, without adverse outcomes on the management of infectious diseases.

There is an emerging body of literature related to chemoprophylaxis in high-risk patients, alternative therapies/doses, and management of recurrence and severe disease. There are no clear recommendations in these populations. Often, these interventions are demonstrated to either have no effect or worsen outcomes, depending on the scenario. ID consultation is recommended for recurrent or severe disease. Your pharmacy colleagues are always available to assist with antibiotic de-escalation. Wherever possible, observing patients with questionable bacterial infection v. non-infectious syndromes *off* of antibiotics is safer than administration of antibiotics, with or without probiotics, chemoprophylaxis, etc.
Keywords: diarrhea

10/10/2024:

Transmission precautions

Below is an incomplete list of common infections for which transmission precautions (above & beyond standard precautions) may be required.

Bear in mind that patients in isolation generally receive less (and therefore less good) care, and for this reason precautions should not be put in place unless they are indicated.

Note that infection/colonization with MRSA is *__not__* an indication for contact precautions (this was a historical practice but now we know better).

For any questions regarding transmission precautions, including if they're indicated or can be discontinued, please call Infection Prevention (IP) at 360-514-2210.

Infection	Precautions
MRSA	None

MRSA *with uncontained drainage*	Contact
Meningococcal, *H. influenzae*, or undetermined bacterial meningitis	Droplet (discontinue after 24 hours antibiotics)
Influenza	Droplet
COVID-19	Special Contact Droplet with Eye
Pulmonary TB (including rule out)	Airborne (without contact)
C. difficile	Contact Enteric
Diarrhea, noninfectious	None
Diarrhea, infectious (confirmed/suspected)	Varies by organism - check with IP
Shingles	None (cover lesions until dry/crusted)
Shingles, immunocompromised or disseminated	Airborne & Contact

Keywords: general ID, lab

10/18/2024

IV to PO conversion

We're going to focus on IV to PO as we continue to address the ongoing shortages of the fluids needed to administer IV meds. See ID facts from 7/17, 7/31, and 8/21 of 2023 for more information of bioavailability and duration of therapy 😊.

Changing antibiotics from IV to PO once patients are stable and tolerating oral medications is a best practice, demonstrated to facilitate earlier hospital discharge and reduce complications including readmission. For highly bioavailable medications, we have good information about switching directly between IV and PO forms of the same drug (your pharmacy colleagues can facilitate this with minimal fuss). Recommendations for IV beta lactams and vancomycin are a little trickier, as the menu of options differs by disease state, but nonetheless a sizeable body of evidence recommends we do this earlier and more often than we think. General tips:

- Amoxicillin, amox/clav, and cephalexin have excellent oral bioavailability when dosed at the upper end of their ranges
    - With susceptibility data, these are good choices for step down therapy for CAP, UTI, gram negative and some gram positive bacteremia
- Fluoroquinolones and SMX-TMP are good choices for gram negative bacteremia with sensitivity data
    - More toxicities are associated with their use compared with beta lactams

- Cefpodoxime has reliable activity against respiratory pathogens and most quinolone and SMX-TMP resistant GNRs
    - Its poorer bioavailability relegates it to when use of other oral options is precluded by allergy, resistance, etc.

Keywords: general ID, oral tx

See attached guide for more detailed recommendations.

Clinical decision support IV PO.pdf

12/11/2024 Ceftriaxone dosing

Ceftriaxone dosed at 1g Q24H is appropriate for most infections.

Below is a breakdown of recommendations, including select disease states for which higher dosing is recommended based on available evidence.

As ceftriaxone is generally safe and well-tolerated, it may be tempting to think *more is better*. But keep in mind that giving double the dose of any drug without need is likely to increase adverse events without corresponding benefit.

Dose	Disease state
1g IV Q24H	Pneumonia, UTI (including pyelonephritis), skin & soft tissue infection, intra-abdominal infection (including SBP*), streptococcal bacteremia, enterobacterales bacteremia
2g IV Q24H	Infective endocarditis, some osteomyelitis/large abscesses if surgical source control is not feasible
2g IV Q12H	Bacterial meningitis, adjunctive therapy for enterococcal infective endocarditis

*citations for the recommendation in UpToDate for 2g for SBP are 2 papers demonstrating no difference between 1 and 2 gram dosing for this indication

1g Q24H of ceftriaxone achieves optimal kinetics (100% time/MIC), and studies comparing 1 v 2-gram dosing (non CSF/IE indications) in critical illness, obesity, hypoalbuminemia, etc. have demonstrated no difference in outcomes. Tertiary references contain mixed messaging, e.g. the pages for bacteremic pyelonephritis and pneumonia recommend 1g, where the pages for pneumococcal bacteremia and enterobacterales bacteremia recommend either ranges or 2 g in UpToDate, but without citation.

Keywords: general ID, bacteremia