



Antibiotic Spectrum

What covers what · cover the likely organism, then de-escalate on cultures

De-escalate
at 48–72 h

KEY:

✓

covers ·

~

partial ·

–

none.

Gram+

= strep, staph, enterococci ·

Gram–

= Enterobacterales ·

Pseud

= Pseudomonas ·

Anaer

= anaerobes ·

Atyp

= Legionella, Mycoplasma.

SPECTRUM OF ACTIVITY

Antibiotic	Gram+	MRSA	Gram–	Pseud	Anaer	Atyp	Key organisms and use
Amoxicillin / ampicillin	✓	–	~	–	~	–	Streptococci, enterococcus , Listeria ; limited Gram-negative
Amox-clavulanate	✓	–	✓	–	✓	–	Adds beta-lactamase Gram-negatives and anaerobes; no Pseudomonas . IV equivalent is ampicillin-sulbactam
Nafcillin / oxacillin	✓	–	–	–	–	–	MSSA and streptococci only . Antistaphylococcal penicillins (or cefazolin), the drugs of choice for MSSA bacteremia , beating vancomycin
Piperacillin-tazobactam	✓	–	✓	✓	✓	–	Broad, including Pseudomonas and anaerobes. No MRSA
Ceftriaxone	✓	–	✓	–	–	–	Streptococci, Enterobacterales. No Pseudomonas, no enterococcus
Ceftazidime	~	–	✓	✓	–	–	Gram-negative plus Pseudomonas; weak Gram-positive
Cefepime	✓	–	✓	✓	–	–	Broad incl Pseudomonas. No MRSA or anaerobes . Neurotoxic in renal impairment
Meropenem	✓	–	✓	✓	✓	–	Very broad, incl ESBL , Pseudomonas, anaerobes
Ertapenem	✓	–	✓	–	✓	–	Broad incl ESBL and anaerobes. The carbapenem with no Pseudomonas
Vancomycin	✓	✓	–	–	–	–	Gram-positive incl MRSA. Oral form only for C. difficile (not absorbed)
Linezolid	✓	✓	–	–	–	–	MRSA and VRE ; good lung penetration. Cytopenias, serotonin syndrome
Daptomycin	✓	✓	–	–	–	–	MRSA and VRE. Never for pneumonia (surfactant inactivates it). Monitor CK
Metronidazole	–	–	–	–	✓	–	Anaerobes only, plus C. difficile and protozoa
Clindamycin	✓	~	–	–	✓	–	Gram-positive and anaerobes; suppresses toxin in toxic shock
Ciprofloxacin	~	–	✓	✓	–	✓	Gram-negative, Pseudomonas, atypicals; weak Gram-positive
Levofloxacin	✓	–	✓	~	–	✓	Respiratory fluoroquinolone : adds pneumococcal cover
Azithromycin	~	–	–	–	–	✓	Atypicals (Legionella, Mycoplasma) and some Gram-positives
Gentamicin	–	–	✓	✓	–	–	Gram-negative and Pseudomonas; synergy in enterococcal endocarditis . No anaerobes , inactive in abscess
Aztreonam	–	–	✓	✓	–	–	Gram-negative incl Pseudomonas. Safe in severe penicillin allergy
Colistin	–	–	✓	✓	–	–	MDR Gram-negative last resort (CRE, Acinetobacter); nephrotoxic

THE RULES WORTH MEMORIZING

- Only vancomycin, linezolid and daptomycin reliably cover MRSA, and daptomycin never treats pneumonia.
- Ertapenem is the carbapenem without Pseudomonas cover; ceftriaxone misses Pseudomonas and enterococcus.
- Cefepime and ceftriaxone have no anaerobic cover, so add metronidazole for an intra-abdominal source.
- For MSSA bacteremia, nafcillin, oxacillin or cefazolin beat vancomycin, so narrowing is an upgrade, not a compromise.
- Review every antibiotic at 48 to 72 h, narrow it, switch to oral, and set a stop date when you prescribe.
- Source control beats spectrum. Nothing sterilizes an undrained collection or an infected line.

References: IDSA clinical practice guidelines by syndrome · Sanford Guide to Antimicrobial Therapy · CDC core elements of hospital antibiotic stewardship · trials comparing antistaphylococcal beta-lactams with vancomycin in MSSA bacteremia.

Educational aid; verify doses and local resistance patterns against your antibiogram and local protocol.





Community-Acquired Pneumonia

Outpatient to ICU · ATS/IDSA 2019, with the 2025 ATS update on steroids and duration

SEVERITY

decides everything

WHAT CHANGED IN THE 2025 ATS UPDATE

Steroids: now a **conditional recommendation FOR** systemic steroids in **severe** CAP (2019 suggested against), and a **strong recommendation AGAINST** them in nonsevere CAP. **Duration:** in the clinically stable patient, **shorter is now preferred, under 5 days with a 3-day minimum**, for outpatients and nonsevere inpatients; **severe CAP still gets 5 days or more** (strong). **Viral detection:** a healthy outpatient with a virus and no comorbidity **does not need antibiotics**. **Lung ultrasound** is an acceptable alternative to chest radiography. Empiric regimens, severity criteria and workup are unchanged from 2019.

DECIDE WHERE THEY GO *site of care is the first and highest-stakes decision*

ADMIT OR NOT: USE PSI

The **Pneumonia Severity Index** is preferred over CURB-65, being better validated for identifying patients safe for outpatient care. **PSI I–III go home** unless a comorbidity is unstable or they cannot take oral therapy; **PSI IV–V are admitted**. Never let the score override a patient who looks unwell or has no social support.

ICU OR NOT: THE ATS/IDSA CRITERIA

Severe CAP = 1 major (mechanical ventilation, or septic shock on vasopressors) or 3 or more minor: RR ≥ 30 · P/F ≤ 250 · multilobar · confusion · uremia (BUN ≥ 20) · leukopenia ($< 4,000$) · thrombocytopenia ($< 100,000$) · hypothermia ($< 36^{\circ}\text{C}$) · hypotension needing aggressive fluids. **This label drives the antibiotic, the steroid and the duration.**

EMPIRIC ANTIBIOTICS BY SETTING *2019 regimens, unchanged in 2025*

Setting	Regimen	Why, and what to watch
Outpatient <i>no comorbidities</i>	Amoxicillin 1 g PO TID, or doxycycline 100 mg PO BID. A macrolide alone only where pneumococcal resistance is under 25%.	Macrolide monotherapy was demoted in 2019 because US pneumococcal resistance now exceeds 25% in most regions. Check your antibiogram before reaching for azithromycin.
Outpatient <i>with comorbidities</i>	Amoxicillin-clavulanate (or cefpodoxime / cefuroxime) plus a macrolide or doxycycline, or a respiratory fluoroquinolone alone (levofloxacin 750 mg, moxifloxacin 400 mg).	Comorbidity means heart, lung, liver or renal disease, diabetes, alcohol use, malignancy or asplenia. Keep fluoroquinolones as the fallback given tendon, aortic and <i>C. difficile</i> harms.
Inpatient <i>nonsevere</i>	Beta-lactam + macrolide (ceftriaxone 1–2 g q24h, cefotaxime, ampicillin-sulbactam or ceftazoline, plus azithromycin 500 mg q24h), or respiratory fluoroquinolone monotherapy.	Doxycycline is the alternative to the macrolide if it is contraindicated. Do not add anaerobic cover for suspected aspiration unless there is a lung abscess or empyema .
Inpatient <i>severe</i>	Beta-lactam + macrolide, or beta-lactam + respiratory fluoroquinolone. Monotherapy is not a guideline option here, unlike nonsevere CAP.	Add MRSA or Pseudomonas cover only for real risk (see below). Give the first dose in the ED: delay to effective therapy drives mortality more than the choice between the two regimens.

WHEN TO COVER MRSA OR PSEUDOMONAS *HCAP is gone: cover on risk, not on contact with healthcare*

Indication	Nonsevere CAP	Severe CAP
Prior respiratory isolation of MRSA or Pseudomonas <i>the one consistent predictor</i>	Cover empirically at both severities, and send cultures so you have something to de-escalate on.	
Hospitalized AND given parenteral antibiotics in the last 90 days, plus locally validated risk factors	Send cultures but withhold coverage. Escalate only if a culture turns positive.	Send cultures and cover empirically while you wait: the cost of being wrong for 48 h is far higher here.
Neither of the above	Do not cover. Nursing home residence, dialysis or wound care alone are not indications : that is the HCAP thinking 2019 discarded.	

AGENTS, AND HOW TO GET OFF THEM

MRSA: vancomycin or linezolid 600 mg q12h; local risk factors classically include post-influenza, necrotizing or cavitory disease, empyema and dialysis. **Pseudomonas:** piperacillin-tazobactam, cefepime or meropenem; classically bronchiectasis or other structural lung disease. **De-escalate at 48 h** if cultures are negative and the patient is improving, and remember a **negative MRSA nasal PCR** has a high negative predictive value and is the fastest way off vancomycin.

WORKUP: TEST THE SICK, NOT EVERYONE

Blood and sputum cultures for **severe CAP**, anyone treated empirically for MRSA or Pseudomonas, prior isolation of either, or hospitalization with parenteral antibiotics in the last 90 days; not routine otherwise, since yield is low and false positives drive unnecessary therapy. **Pneumococcal and Legionella urinary antigen** in severe CAP, plus Legionella on epidemiologic grounds (outbreak, travel): they stay positive after antibiotics start, so they are the tests most likely to let you **narrow**. **Respiratory viral PCR** whenever influenza or SARS-CoV-2 is circulating. **Never use procalcitonin to withhold initial antibiotics**; its role is to support stopping. **Routine follow-up imaging is not recommended** if symptoms resolve in 5 to 7 days.

STERIODS AND DURATION *both changed in 2025, and both hinge on the severity label*

STERIODS: SEVERE ONLY

Severe CAP: hydrocortisone 200 mg/day IV, started early, for 4 to 7 days. CAPE COD, 2023 found **28-day mortality 6.2% versus 11.9%**, with less intubation and vasopressor use, at the cost of **more hyperglycemia**. **Nonsevere CAP: do not give steroids** (strong), and **avoid in influenza**, where they are associated with worse outcomes.

DURATION: STOP EARLIER THAN YOU THINK

Outpatients and nonsevere inpatients who are clinically stable: under 5 days, with a 3-day minimum. Severe CAP: 5 days or more (strong). **Stability first, then count:** afebrile, HR ≤ 100 , RR ≤ 24 , SBP ≥ 90 , SpO₂ $\geq 90\%$, taking oral intake, normal mental status. **Do not extend therapy for a persistent infiltrate or a lingering cough**, both of which lag the infection by weeks.

NOT IMPROVING AT 48 TO 72 HOURS: WORK THE FOUR BUCKETS BEFORE ESCALATING BLINDLY

Wrong bug: MRSA, Pseudomonas or another resistant organism, so recheck cultures and antigens before broadening on instinct. **Complication:** empyema, abscess or cavitation, so get a CT and **drain it**, because no antibiotic fixes an undrained empyema. **Missed pathogen:** Legionella, viral, TB, PJP or fungal, so revisit exposures, travel and immune status. **Not pneumonia:** heart failure, PE, ARDS, vasculitis, malignancy or organizing pneumonia mimicking infection.

PEARLS & PITFALLS

- Score the severity explicitly. It decides the regimen, the steroid, and the duration, so it is not a formality.
- Time to effective antibiotics beats the choice between concordant regimens.
- Do not treat the chest film. Infiltrates lag the cure by weeks.
- Steroids help severe CAP and harm nonsevere CAP.

References: Metlay et al, ATS/IDSA guideline on diagnosis and treatment of adults with community-acquired pneumonia, AJRCCM 2019 · ATS clinical practice guideline update on CAP, AJRCCM 2025 (imaging, empiric therapy with viral detection, duration, corticosteroids) · Dequin et al, CAPE COD, NEJM 2023.

Educational aid; verify against local antibiogram, renal function, allergies and patient factors.

roundsrx.com

roundsrx Infographic Series · #23





Urosepsis & CAUTI

Sepsis from the urinary tract · relieve the obstruction or antibiotics will fail

Obstructed
= drain it now

OBSTRUCTED PLUS INFECTED IS A UROLOGIC EMERGENCY

An infected, obstructed kidney needs decompression within hours, by ureteral stent or percutaneous nephrostomy. Antibiotics alone reliably fail an obstructed system, because the drug cannot reach urine trapped above the obstruction and the rising pressure forces organisms into the bloodstream. A septic patient with hydronephrosis on imaging goes to urology or interventional radiology, not to the ward for observation. The same applies to a renal or perinephric abscess and to pyonephrosis.

THE PATHWAY *resuscitate, culture, cover, and above all decompress*

RESUSCITATE AND CULTURE

Sepsis bundle in the first hour: lactate, urine and blood cultures before antibiotics, balanced crystalloid, and norepinephrine to a MAP of 65 if needed. In a catheterized patient, take the urine from a freshly placed catheter, since a sample drawn from an old one grows biofilm organisms rather than the pathogen.

IMAGE FOR OBSTRUCTION

CT is the test of choice, and ultrasound is a reasonable rapid screen for hydronephrosis at the bedside. Anyone with sepsis and a urinary source needs imaging, because obstruction is the finding that changes management from medical to procedural.

DEAL WITH THE CATHETER

Remove the catheter if it is no longer needed, and replace it if it is. A catheter in place beyond about 2 weeks is coated in biofilm that antibiotics cannot penetrate, so leaving it means treating around a permanent reservoir. Replacing it before starting therapy improves outcomes.

EMPIRIC ANTIBIOTICS *Gram-negative cover, escalated only for defined resistance risk*

Setting	Regimen	Why
Standard	Ceftriaxone 2 g q24h, or piperacillin-tazobactam 4.5 g q6–8h if Pseudomonas is plausible	Covers E. coli and Klebsiella, which account for most community urosepsis.
ESBL risk	Meropenem 1 g q8h, or ertapenem 1 g q24h if Pseudomonas cover is not needed	Predicted by a prior ESBL isolate, recent antibiotics or hospitalization, long-term care residence, and recent travel to a high-prevalence region. ESBL is common in urinary isolates, and prior cultures predict it better than severity does.
Gram-positive risk	Add vancomycin	For stones, recent instrumentation, indwelling hardware, or healthcare-associated infection, where Enterococcus and staphylococci become plausible.
Likely organisms	E. coli predominates, then Klebsiella, Proteus (think stones, since it splits urea and forms struvite calculi), Pseudomonas and Enterococcus in catheterized and healthcare-associated patients, and Candida in the chronically catheterized, where it is usually colonization.	

DURATION, DE-ESCALATION AND WHEN NOT TO TREAT

HOW LONG

7 days for a prompt clinical response, extending to 10 to 14 days if the response is slow, the patient is bacteremic, or the source was not promptly controlled. Narrow to the urine and blood culture sensitivities as soon as they return, and switch to oral once the patient is improving and absorbing.

DO NOT TREAT ASYMPTOMATIC BACTERIURIA

A positive urine culture without symptoms is not an infection, and treating it causes resistance, C. difficile and drug harm without benefit. This is the commonest antibiotic error on the wards, and it is especially tempting in the confused elderly patient, where the answer is to look for another cause of the delirium. The only routine exceptions are pregnancy and before a urologic procedure that will breach the mucosa.

WHAT COUNTS AS CAUTI

A catheter in place for at least 48 h, plus symptoms or signs attributable to the urinary tract, plus significant bacteriuria. Pyuria alone does not make the diagnosis in a catheterized patient, since nearly all of them have it. Fever with no other source is usually the presenting sign.

NOT IMPROVING? *look for an undrained space or an unreplaced catheter before changing the antibiotic*

Cause	What to do
Undrained obstruction	Re-image and decompress urgently with a stent or nephrostomy. This is the reason most urosepsis fails to respond, and it is procedural rather than pharmacologic.
Renal or perinephric abscess	CT, then percutaneous drainage. Suspect it when fever persists beyond 72 h of appropriate therapy.
Emphysematous pyelonephritis	Gas within the renal parenchyma on CT, overwhelmingly in poorly controlled diabetes. Needs urgent drainage and glycemic control; nephrectomy in severe or refractory disease.
Resistant organism	Escalate to a carbapenem for ESBL, and check whether the isolate is in fact resistant rather than assuming.
The catheter was never changed	Remove or replace it. Biofilm on an old catheter continuously reseeds the urine, and no antibiotic will clear it in situ.

PREVENTING CAUTI *the only intervention that reliably works is not having a catheter*

INSERT FEWER

Risk accumulates at roughly 3 to 7% per catheter-day, so duration is the dominant risk factor. Incontinence and convenience are not indications. Legitimate ones are retention or obstruction, accurate output measurement in critical illness, selected perioperative use, and comfort in end-of-life care. Consider external or intermittent catheterization instead.

REMOVE THEM SOONER

Review the need every single day and remove by default, which is more effective than any insertion-technique intervention. Nurse-driven removal protocols and automatic stop orders outperform relying on the team to remember.

AND WHILE IT IS IN

Sterile insertion, a closed drainage system that is never disconnected, and the bag kept below the bladder without touching the floor. Do not irrigate, and do not use antimicrobial prophylaxis or catheter changes to prevent infection: neither works, and both select resistance.

PEARLS & PITFALLS

- Obstruction plus infection is an emergency. Decompress; antibiotics alone will fail.
- Replace the catheter before you treat, and take the culture from the new one.
- Do not treat asymptomatic bacteriuria, except in pregnancy or before a urologic procedure.
- The best CAUTI treatment is prevention: insert fewer catheters, and remove them daily by default.





Cellulitis & Skin Infection

Purulent or not · That single question picks the antibiotic

BILATERAL IS RARELY IT
think stasis dermatitis

SPLIT IT FIRST *purulence determines whether you need MRSA cover*

NON-PURULENT

Diffuse spreading erythema, warmth, tenderness and edema with **no abscess or drainable pus**. Predominantly **beta-hemolytic streptococci**. **Routine MRSA coverage is not required** — a first-generation cephalosporin such as **cefazolin** or **cephalexin** is appropriate.

PURULENT

Abscess, furuncle, carbuncle, or purulent drainage. Predominantly **Staphylococcus aureus including MRSA**. **Incision and drainage is the treatment** — antibiotics are an adjunct, added for systemic features, extensive surrounding cellulitis, immunosuppression, or failure of drainage alone.

SEND WHAT IS USEFUL

Culture the pus from any drained abscess. **Blood cultures are low yield** in uncomplicated cellulitis — reserve them for systemic toxicity, immunosuppression, or unusual exposures. **Skin swabs of intact cellulitis are not useful**.

IS IT ACTUALLY CELLULITIS? *a large share of admitted "cellulitis" is something else*

Mimic	How to tell
Stasis dermatitis by far the commonest	Bilateral , chronic, itchy rather than painful, with hemosiderin staining and edema, and no fever or leukocytosis . True cellulitis is almost always unilateral — bilateral lower limb erythema should make you doubt the diagnosis before reaching for antibiotics.
Deep vein thrombosis	Swelling and tenderness with less well-demarcated erythema. Consider it in every unilateral swollen leg — the two can coexist.
Gout or septic arthritis	Erythema centered on a joint with pain on passive movement. Examine the joint rather than only the skin.
Contact or drug reaction	Itch dominates, sharply demarcated to the area of contact, often bilateral or symmetrical.
Necrotizing infection	The one you cannot miss — see below. Any of its red flags overrides all of the above.

EXCLUDE NECROTIZING INFECTION *a surgical emergency, and it can look like cellulitis early*

RED FLAGS

Pain out of proportion to the visible findings · **rapid progression** over hours, often with a marked pen line advance · systemic toxicity and hemodynamic instability · **skin necrosis, bullae, or dusky discoloration** · **crepitus** · **anesthesia** over the affected skin · failure to respond to appropriate antibiotics.

WHAT TO DO

Urgent surgical review — **do not wait for imaging**. Surgical exploration is both diagnostic and therapeutic, and **delay to debridement is the strongest predictor of death**. Start **broad-spectrum antibiotics with clindamycin** for its antitoxin effect, and resuscitate. Scoring systems such as LRINEC may support suspicion but **must never be used to rule it out**.

TREAT AND PREVENT RECURRENCE *the parts that shorten stay and stop readmission*

Element	Detail
Duration	5 days is sufficient for uncomplicated cellulitis that is improving. Extend only if the response is inadequate. Longer courses do not improve outcomes and drive resistance and C. difficile.
Elevation	Limb elevation is genuinely therapeutic and consistently under-prescribed — it speeds resolution of edema and erythema. Write it in the plan.
Treat the portal of entry	Tinea pedis and toe-web maceration are a common and treatable source — examine between the toes and treat the fungus. Also address eczema, ulcers and trauma.
Manage edema	Lymphedema and chronic venous insufficiency are the strongest risk factors for recurrence . Compression and skin care after the acute episode prevent repeat admissions.
Expect early worsening	Erythema can appear to advance in the first 24–48 hours despite effective treatment, from inflammation as organisms lyse. Do not escalate antibiotics on this alone if the patient is systemically improving.
Recurrent disease	After repeated episodes, consider prophylactic penicillin alongside edema and skin management.

WHO NEEDS ADMISSION, AND SPECIAL EXPOSURES *most cellulitis is an outpatient illness*

Consideration	Detail
Admit for	Systemic toxicity or sepsis · rapid progression · failure of appropriate oral therapy · immunosuppression or neutropenia · inability to take or tolerate orals · significant comorbidity or frailty · suspicion of a deeper infection. Otherwise treat orally at home with a marked border and clear return advice.
Water exposure	Fresh water → Aeromonas . Salt water or shellfish , especially with liver disease → Vibrio vulnificus , which causes fulminant infection with hemorrhagic bullae. Both need added gram-negative cover , typically a tetracycline plus a cephalosporin.
Animal or human bites	Pasteurella from cat and dog bites, Eikenella from human bites. Amoxicillin-clavulanate is the agent of choice. Assess for tendon, joint and bone involvement , and update tetanus and rabies risk.
Neutropenia or immunosuppression	Signs are blunted, so erythema may be minimal despite serious infection . Broaden cover, include Pseudomonas , and consider fungal causes. Have a much lower threshold for imaging and surgical review.

PEARLS & PITFALLS

- **Doses by phenotype: non-purulent** (streptococcal) — cephalexin **500 mg PO four times daily**, or cefazolin **1-2 g IV q8h**. **Purulent** (cover MRSA) — TMP-SMX **1 DS tablet twice daily** or doxycycline **100 mg twice daily**, or vancomycin **15-20 mg/kg IV** if unwell. **5 to 7 days is enough** in uncomplicated disease that is improving.
- **Bilateral lower limb "cellulitis"** is usually **stasis dermatitis**. Reconsider before committing to intravenous antibiotics and an admission.
- **Pain out of proportion means surgical review now**. Necrotizing infection is a clinical diagnosis and imaging delays kill.
- **Drainage is the treatment for an abscess**. Antibiotics without drainage will not resolve it.
- **Non-purulent cellulitis does not need routine MRSA cover** — it is mostly streptococcal.
- **Look between the toes**. Treating tinea pedis prevents the next episode more reliably than a longer antibiotic course.
- **Five days is enough** when improving, and elevation does more than most people credit.

References: IDSA Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections · studies of cellulitis misdiagnosis and pseudocellulitis · trials of short-course therapy in uncomplicated cellulitis.

Educational aid; verify doses against local protocol, renal function and patient factors.





Intra-Abdominal Sepsis

Secondary peritonitis · source control first, antibiotics second

6–12 h

to source control

SOURCE CONTROL IS THE TREATMENT

Drainage, resection or diversion within 6 to 12 h of recognizing an uncontrolled source. Antibiotics do not substitute for it, because they cannot penetrate an undrained collection or stop ongoing contamination from a perforated viscus, and every hour of delay adds mortality. **The order of operations is: resuscitate, image, give antibiotics, control the source,** with the antibiotics given on the way to the CT scanner or the operating room rather than after.

THE PATHWAY *run these in parallel, not in sequence*

RESUSCITATE

Sepsis bundle within the first hour: cultures before antibiotics where it does not delay them, **lactate**, balanced crystalloid for hypotension or lactate above 4, and **norepinephrine** to a MAP of 65 if fluid is not enough. Repeat the lactate to confirm clearance.

IMAGE AND CULTURE

CT abdomen and pelvis with IV contrast is the test, and it also plans the intervention. **Blood cultures plus operative or drain cultures**, since the operative sample is what lets you de-escalate later. **Do not send a swab of pus when you can send the fluid.**

DECIDE THE INTERVENTION

Percutaneous drainage for a discrete, accessible collection, which is less morbid and often definitive. **Surgery** for diffuse peritonitis, perforation, ischemic bowel or a failed drain. **A drain that does not resolve the sepsis within 48 h has failed**, and the answer is re-imaging, not patience.

EMPIRIC ANTIBIOTICS *cover Enterobacterales and anaerobes in everyone; add cover only for defined risk*

Setting	Regimen	Add
Community-acquired	Piperacillin-tazobactam 4.5 g q6–8h, or ceftriaxone 2 g q24h plus metronidazole 500 mg q8h, or ertapenem 1 g q24h	Nothing further in most cases. Routine enterococcal and antifungal cover is not indicated and drives resistance.
Healthcare-associated or severe	Meropenem 1 g q8h, or piperacillin-tazobactam where local resistance is low	Enterococcal cover (vancomycin or ampicillin) for post-operative, immunosuppressed, or valve-prosthesis patients
Antifungal	Echinocandin (caspofungin 70 mg then 50 mg daily)	Only for upper GI perforation, recurrent or post-operative peritonitis, or immunosuppression , where Candida is a genuine pathogen rather than a colonizer
Likely organisms	E. coli, Klebsiella, Enterobacter , and Pseudomonas in healthcare-associated disease · anaerobes , above all Bacteroides fragilis , which must always be covered · Enterococcus, streptococci and Candida in complicated, post-operative or upper GI sources.	

HOW LONG *the answer is shorter than most people give, provided the source is actually controlled*

FOUR DAYS AFTER ADEQUATE SOURCE CONTROL

STOP-IT, NEJM 2015 (n = 518) compared a **fixed 4-day course** against continuing until 2 days after fever, leukocytosis and ileus resolved (median 8 days). **The composite of surgical site infection, recurrent intra-abdominal infection and death was identical, 21.8% vs 22.3%. Longer courses add toxicity, C. difficile and resistance without adding benefit.**

THE CONDITION THAT MATTERS

Four days applies only if the source is adequately controlled. If it is not, no duration of antibiotics will substitute: **continue therapy and re-intervene.** The clock starts at the moment of definitive source control, not at admission or at the first dose.

DE-ESCALATE ON CULTURES

Narrow to the operative culture results at 48 to 72 h, and stop the empiric enterococcal or antifungal cover if nothing grew. **Track lactate clearance, fever, white cell count, organ support, and the volume and character of drain output** as the response markers.

NOT IMPROVING? *after 48 to 72 h without response, assume a source problem before a drug problem*

Cause	What to do
Undrained collection <i>the commonest reason</i>	Re-image with CT. Collections mature, loculate and reaccumulate, and a drain can dislodge or block. Re-drain or re-operate rather than escalating antibiotics against a mechanical problem.
Anastomotic leak	Suspect in any post-operative patient with rising inflammatory markers, ileus or feculent drain output. Back to the operating room.
Resistant organisms	ESBL-producing Enterobacterales need a carbapenem. Review prior cultures and recent antibiotic exposure, which predict resistance better than severity does.
Missed Enterococcus or Candida	Broaden in healthcare-associated, post-operative, upper GI or immunosuppressed sources, where these are genuine pathogens.
Abdominal compartment syndrome	Measure bladder pressure in the distended, oliguric, difficult-to-ventilate patient. Sustained pressure above 20 mmHg with new organ dysfunction needs decompression.

SOURCE-CONTROL OPTIONS *choose the least invasive option that will actually control the source*

Option	Best for	The trade-off
Percutaneous drainage	A discrete, accessible, unilocular collection: diverticular or appendiceal abscess, post-operative collection	Far less morbid than laparotomy and often definitive. Fails with multiloculated or thick, particulate collections, and cannot address ongoing contamination from a perforation.
Resection or repair	Perforated viscus, ischemic bowel, diffuse peritonitis	Definitive, but a primary anastomosis in a contaminated, hypoperfused field carries a real leak rate, which is why diversion is often chosen instead.
Diversion	When an anastomosis would be unsafe	Trades a stoma for a leak. The right decision in an unstable or malnourished patient, and reversible later.
Damage control	The physiologically exhausted patient: acidotic, coagulopathic, hypothermic	Control contamination, pack, leave the abdomen open, and return in 24 to 48 h once resuscitated. Definitive repair in an unstable patient is how they die on the table. The cost is an open abdomen with its fistula and hernia risk.

PEARLS & PITFALLS

- **Antibiotics never substitute for source control.** If sepsis persists, re-image before you escalate the drug.
- **Always cover anaerobes.** B. fragilis is the organism that defines this infection.
- **Four days after adequate source control is enough.** Longer courses add harm, not cure.
- **Send fluid or tissue, not a swab.** The operative culture is what lets you de-escalate safely.

References: Sawyer et al, STOP-IT, NEJM 2015 · Surgical Infection Society and IDSA guidelines on complicated intra-abdominal infection · World Society of Emergency

Surgery guidelines on intra-abdominal infections · Surviving Sepsis Campaign guidelines.

Educational aid; verify doses against local protocol, renal function, and patient factors.

roundsrx.com

roundsrx Infographic Series · #24





Clostridioides difficile

CDI · Test only if it fits, fidaxomicin first, soap and water always

FIDAXOMICIN PREFERRED

IDSA/SHEA 2021

TEST THE RIGHT PATIENT *over-testing creates over-treatment*

ONLY TEST IF

≥ 3 **unformed stools in 24 hours** with no other explanation. **Do not test formed stool**, do not test asymptomatic patients, and **do not screen for colonization** — a positive result in a patient without diarrhea is colonization, and treating it causes harm without benefit.

WHICH ASSAY

A **two-step algorithm** is preferred: a sensitive screen (**NAAT or GDH**) followed by a **toxin** immunoassay. NAAT alone detects the **gene**, not toxin production, so it cannot separate infection from carriage.

DO NOT REPEAT

No test of cure and no repeat testing within the same episode — the assay stays positive for weeks after clinical resolution. Repeat testing generates false alarms and unnecessary courses.

TREAT BY SEVERITY *2021 IDSA/SHEA focused update*

Episode	Regimen	Notes
Initial non-severe or severe	Fidaxomicin 200 mg PO BID × 10 days alternative: vancomycin 125 mg PO QID × 10 days	Fidaxomicin is now preferred over vancomycin. Cure rates and mortality are similar, but fidaxomicin gives a better sustained response at 4 weeks through fewer recurrences — it spares the gut microbiome.
First recurrence	Fidaxomicin , or a vancomycin tapered and pulsed regimen	If vancomycin was used first line, fidaxomicin or a taper/pulse is preferred to a second identical course.
Preventing further recurrence	Fidaxomicin , then consider a live biotherapeutic, Rebyota (rectal) or Vowst (oral), once the antibiotic course is complete	Bezlotoxumab is no longer available in the US: it cut recurrence from about 27% to 17% in MODIFY I/II, but Merck discontinued it in January 2025.
Multiply recurrent	Faecal microbiota transplantation after an appropriate antibiotic course	Highly effective for restoring colonization resistance once two or more recurrences have occurred.
Fulminant shock, ileus, megacolon	Vancomycin 500 mg PO/NG QID + IV metronidazole 500 mg q8h ; add rectal vancomycin if ileus	Surgical consultation immediately. Rising lactate and WCC signal the need for colectomy or diverting loop ileostomy. Oral drug cannot reach the colon in ileus, hence the IV and rectal routes.

EVERYTHING ELSE THAT MATTERS *the parts that are not the antibiotic*

- 1 **Stop the inciting antibiotic** wherever possible, or narrow it. Continuing broad-spectrum therapy alongside CDI treatment is the commonest reason for failure and recurrence.
- 2 **Stop proton pump inhibitors** unless there is a clear indication, and **avoid antimotility agents** such as loperamide in severe or fulminant disease, where they risk ileus and toxic megacolon.
- 3 **Contact precautions** in a single room, and **wash hands with soap and water** — **alcohol gel does not kill spores**. Use a **sporicidal (chlorine-based) agent** for environmental cleaning and dedicated equipment.
- 4 **Assess severity objectively:** WCC > 15,000 or creatinine > 1.5 mg/dL marks severe disease. Add **lactate, albumin, and imaging** if you suspect fulminant disease or megacolon.
- 5 **Flag it for future admissions.** Document the episode clearly, since prior CDI changes both antibiotic stewardship decisions and the treatment choice if it recurs.

RISK FACTORS *who is vulnerable, and what you can modify*

MODIFIABLE

Antibiotic exposure is the dominant risk, especially clindamycin, fluoroquinolones, cephalosporins, and carbapenems. Also **proton pump inhibitors**, prolonged hospitalization, and enteral feeding. **Antibiotic stewardship is the single most effective prevention.**

NON-MODIFIABLE

Age ≥ 65, previous CDI, immunosuppression and chemotherapy, inflammatory bowel disease, chronic kidney disease, and recent abdominal surgery. In IBD, distinguishing a flare from CDI is difficult — **test for both**.

SEVERITY DEFINITIONS & SPECIAL POPULATIONS *classify before you prescribe*

Category	Definition or consideration
Non-severe	WCC ≤ 15,000 cells/μL and serum creatinine < 1.5 mg/dL.
Severe	WCC > 15,000 cells/μL or serum creatinine ≥ 1.5 mg/dL. Same oral agents as non-severe under the current guidance — severity no longer changes the first-line drug, only your vigilance.
Fulminant	Hypotension or shock, ileus, or megacolon. This is the category that changes the regimen and needs surgery on the phone.
Inflammatory bowel disease	Test for CDI in every IBD flare — the presentations are indistinguishable and CDI worsens outcomes. Treat the infection before escalating immunosuppression.
Pregnancy & lactation	Oral vancomycin is generally preferred, given minimal systemic absorption and more experience in pregnancy.

WHEN TO WORRY ABOUT THE COLON *the surgical conversation*

WARNING SIGNS

Rising **lactate**, **WCC above ~25,000**, falling **albumin**, worsening pain with peritonism, abdominal distension, or **diarrhea that suddenly stops** (ominous — suggests ileus, not recovery). **Get a CT abdomen** to look for colonic dilatation and wall thickening.

WHAT SURGERY OFFERS

Subtotal colectomy or a **diverting loop ileostomy with colonic lavage**. Outcomes are far better when surgery is considered **before** multi-organ failure sets in, so involve them at the point of fulminant classification rather than after a failed medical trial.

PEARLS & PITFALLS

- A **positive NAAT** in a patient without diarrhea is **colonization**. Treating it does not help and drives resistance and unnecessary courses.
- **Alcohol hand gel does not kill C. difficile spores.** Soap and water, every time.
- **No test of cure.** The assay remains positive long after the patient is well.
- In **ileus**, **oral vancomycin cannot reach the colon** — add IV metronidazole and consider the rectal route.
- **Metronidazole alone is no longer recommended** for initial treatment; it is an IV adjunct in fulminant disease only.





HAP & VAP

Hospital- and ventilator-associated pneumonia · cover broadly, then narrow hard

7 days
for almost everyone

DEFINE AND DIAGNOSE *an overcalled diagnosis, and the commonest reason ICU patients get unnecessary antibiotics*

THE DEFINITIONS

HAP: pneumonia beginning 48 h or more after admission. **VAP:** 48 h or more after intubation. **HCAP** has been retired, because it over-predicted resistant organisms and drove broad therapy in patients who did not need it. Risk is now judged on **the individual patient and your local antibiogram**, not on where they came from.

THE CRITERIA

A new or progressive infiltrate plus at least two of: fever, leukocytosis or leukopenia, purulent secretions, or worsening oxygenation. **Send a lower respiratory culture before antibiotics**, since it is what lets you de-escalate later. **Do not use the CPIS** to make the diagnosis; it performs poorly.

WHAT ELSE LOOKS LIKE THIS

Atelectasis, pulmonary edema, ARDS, aspiration pneumonitis without infection, pulmonary embolism, and drug reaction all produce infiltrates with fever and a rising white count. **A positive tracheal aspirate in a ventilated patient usually reflects colonization**, so treat the patient rather than the culture.

EMPIRIC THERAPY *one antipseudomonal beta-lactam for everyone, and additional agents only for defined risk*

Component	Agent and dose	When to add it
Antipseudomonal beta-lactam	Piperacillin-tazobactam 4.5 g q6h, or cefepime 2 g q8h, or meropenem 1 g q8h	Always. A single agent is sufficient in a patient without resistance risk factors.
MRSA cover	Vancomycin (25 to 30 mg/kg load, then AUC 400 to 600) or linezolid 600 mg q12h	IV antibiotics within 90 days, a unit MRSA rate above 20% or unknown, or high risk of death. Linezolid penetrates lung tissue better and avoids nephrotoxicity when combined with piperacillin-tazobactam.
Second antipseudomonal	Aminoglycoside (gentamicin 5 to 7 mg/kg) or an antipseudomonal fluoroquinolone	Septic shock, structural lung disease (bronchiectasis, cystic fibrosis), or known resistance risk. The purpose is to broaden the chance of hitting the organism empirically, not to achieve synergy , so stop the second agent once susceptibilities return .
Consider separately	TMP-SMX or minocycline	Stenotrophomonas maltophilia , which is intrinsically carbapenem-resistant and typically emerges in a patient already on broad therapy. Suspect it when a patient deteriorates on meropenem.

REVIEW, NARROW AND STOP *the part that determines whether you help or harm the next patient in that bed*

- Track the response objectively.** Fever, white cell count, **oxygenation (P/F ratio)**, and secretion volume. **Improvement is often steady but slow**, so **do not reflexively broaden** a patient who is simply improving unhurriedly. A procalditonin trend can support a decision to stop, though not to start.
- De-escalate at 48 to 72 h on the culture.** Narrow to the single narrowest effective agent, **stop the MRSA cover if no MRSA grew**, and **stop the second antipseudomonal**. Most patients should be on one drug by day 3.
- Stop at 7 days.** Seven days is enough for almost all HAP and VAP, including *Pseudomonas*, with no increase in mortality or relapse compared with 14. **Longer courses drive resistance, C. difficile and candidemia.** Extend only for **empyema, abscess, or an extrapulmonary focus such as endocarditis**.

NOT IMPROVING BY DAY 3? *work through these four before broadening the antibiotic*

Possibility	What to do
Wrong organism	Resistant Gram-negative, MRSA, <i>Stenotrophomonas</i> , or a fungus. Recheck the cultures you already sent before empirically broadening, since the answer is often already back.
A complication	Empyema, lung abscess or cavitation. Get a CT chest, and drain what is drainable. An undrained empyema will not respond to any antibiotic.
Wrong diagnosis	ARDS, aspiration pneumonitis, pulmonary embolism, pulmonary edema or malignancy. Revisit the original imaging with fresh eyes.
Undrained source elsewhere	An infected line, sinusitis in an intubated patient, or an abdominal collection . Fever on appropriate therapy is a prompt to re-examine, not to escalate.

PREVENT THE NEXT ONE *the VAP bundle, which works better than any antibiotic*

THE BUNDLE

Head of bed elevated 30 to 45 degrees, daily sedation interruption paired with a spontaneous breathing trial, oral care with chlorhexidine, subglottic secretion drainage, and VTE and ulcer prophylaxis where indicated.

THE ACTIVE INGREDIENT

Most of the benefit comes from extubating sooner. Every element that lightens sedation and shortens ventilation reduces VAP, because **the endotracheal tube itself is the risk factor**. Avoid intubation entirely with NIV or high-flow where appropriate.

ASPIRATION: PNEUMONITIS OR PNEUMONIA? *the distinction that decides whether antibiotics are needed at all*

Feature	Aspiration pneumonitis (Mendelson)	Aspiration pneumonia
Mechanism	Chemical injury from gastric acid, sterile at the outset	Bacterial infection from aspirated oropharyngeal flora
Onset	Within hours of a witnessed event, often dramatic	Over days, in a patient with impaired swallow or consciousness
Course	Frequently improves within 24 to 48 h without antibiotics	Progresses without treatment
Treatment	Supportive: suction, oxygen, observe. Do not start antibiotics reflexively, and do not give steroids	Antibiotics , guided by whether it began in the community or in hospital
Anaerobic cover	Routine anaerobic cover is no longer recommended for most aspiration pneumonia. Reserve it for necrotizing pneumonia, lung abscess or empyema , since standard regimens already cover the relevant organisms and added anaerobic cover increases <i>C. difficile</i> risk.	

PEARLS & PITFALLS

- A positive tracheal aspirate is usually colonization.** Treat the patient, not the culture.
- Send the respiratory culture before the first dose**, or you lose the ability to de-escalate.
- Seven days, including for Pseudomonas.** Fourteen is legacy practice.
- Deterioration on meropenem suggests Stenotrophomonas or a fungus**, not a need for more of the same.

References: IDSA / ATS clinical practice guidelines for the management of adults with hospital-acquired and ventilator-associated pneumonia · trials of short-course versus prolonged therapy in ventilator-associated pneumonia · SHEA / IDSA strategies to prevent ventilator-associated pneumonia and events.

Educational aid; verify doses against local protocol, renal function, and your local antibiogram.





Antibiotic Safety

Allergy alternatives · adverse effects · what to monitor and when

Check first
then prescribe

MOST REPORTED PENICILLIN ALLERGY IS NOT ALLERGY

Around 1 in 10 patients report a penicillin allergy, yet the large majority are not truly allergic on testing: many recall a childhood rash, a viral exanthem, or a GI upset. **The label itself causes harm**, driving broader, more toxic and less effective therapy, with more C. difficile, more resistance and worse outcomes. **Take a real history before accepting it:** what happened, how long after the dose, how long ago, and did it need treatment. **A vague 30-year-old rash is not a reason to withhold a beta-lactam in sepsis.**

PENICILLIN ALLERGY *separate the true IgE reaction from everything else, then choose*

Category	What it means for prescribing
Severe / true IgE	Anaphylaxis, urticaria, angioedema, wheeze, or hypotension within an hour of a dose. Also severe delayed reactions: SJS/TEN, DRESS, interstitial nephritis. Avoid all beta-lactams in the severe delayed group , and use the alternatives below.
Non-severe	An isolated non-urticarial rash or GI upset. A cephalosporin or carbapenem is usually safe, and in many settings a direct oral challenge or referral for testing is appropriate.
Cross-reactivity, in numbers	Cephalosporins about 1 to 2%, and it is side-chain dependent rather than class-wide. Carbapenems under 1%. Aztreonam has essentially none , because it is monocyclic and shares no side chain, except with ceftazidime , which shares one. That single exception is the detail most often missed.

IF THE ALLERGY IS GENUINELY SEVERE, COVER BY TARGET

Gram-negative and Pseudomonas: aztreonam, ciprofloxacin, an aminoglycoside.

Gram-positive and MRSA: vancomycin, linezolid, daptomycin, clindamycin.

Anaerobes: metronidazole, clindamycin. **Atypicals:** a macrolide or doxycycline. **Build the regimen from the organisms you need to cover**, rather than reaching for one very broad agent.

AND DOCUMENT WHAT ACTUALLY HAPPENED

Record the reaction, not just the word "allergy": the drug, the timing, the manifestation and the year. **An undocumented label is inherited by every future admission** and never questioned. Refer for formal testing or de-labeling where available, since that is the intervention that fixes it permanently.

ADVERSE EFFECTS AND MONITORING *the ones that actually change prescribing*

Drug	Caution	Key adverse effects	Monitor
Vancomycin	Renal impairment; combined with piperacillin-tazobactam	Nephrotoxicity, infusion reaction (rate-related, not allergy), ototoxicity	AUC 400 to 600 , renal function
Aminoglycosides	Renal impairment, myasthenia, pregnancy	Nephrotoxicity, irreversible ototoxicity , neuromuscular blockade	Levels, renal function daily
Linezolid	SSRIs and MAOIs ; courses beyond 14 days	Thrombocytopenia , serotonin syndrome, peripheral and optic neuropathy	Platelets weekly
Piperacillin-tazobactam	With vancomycin (additive AKI)	Acute kidney injury, hypokalemia	Renal function, potassium
Carbapenems	Renal impairment; valproate	Seizures at high dose or in renal failure; C. difficile	Renal dose adjustment. Carbapenems drop valproate levels sharply and unpredictably , so this pairing risks breakthrough seizures
Ceftriaxone	Neonates, and co-administered calcium	Biliary sludge and pseudolithiasis, cytopenias, C. difficile	LFTs if prolonged
Fluoroquinolones	Elderly, steroids, aortic disease, epilepsy	Tendinopathy and rupture, aortic aneurysm and dissection, QT prolongation, delirium, dysglycemia , C. difficile	ECG if QT risk; review the indication
Metronidazole	Alcohol; prolonged courses	Disulfiram-like reaction, peripheral neuropathy, metallic taste	Course duration
TMP-SMX	Renal impairment, ACE inhibitors, ARBs	Hyperkalemia , rising creatinine (partly secretion, not injury), marrow suppression, SJS	Potassium and renal function

THE INTERACTIONS AND HABITS WORTH KNOWING

THE PAIRINGS TO AVOID

Vancomycin plus piperacillin-tazobactam raises AKI risk beyond either alone; consider cefepime or meropenem instead when both Gram-positive and Pseudomonas cover are needed. **Linezolid plus a serotonergic drug. Carbapenem plus valproate. Any QT-prolonging combination**, since fluoroquinolones, macrolides and azoles stack.

C. DIFFICILE RISK IS A PRESCRIBING FACTOR

Clindamycin, fluoroquinolones, cephalosporins and carbapenems carry the highest risk. Duration matters as much as choice, which is the practical argument for setting a stop date at the time of prescribing rather than reviewing indefinitely.

DOSE FOR THE PATIENT IN FRONT OF YOU

Renal and hepatic function, weight, and the site of infection all change the dose. **Under-dosing in sepsis and obesity is as harmful as the wrong drug**, and beta-lactams in particular are frequently under-dosed in the hyperfiltrating young septic patient.

PEARLS & PITFALLS

- **Check a QTc before combining agents that prolong it.** Fluoroquinolones, macrolides and azoles stack with ondansetron, haloperidol and methadone, and the additive effect is what causes torsades.
- **Linezolid beyond 2 weeks causes cytopenias, and it is a reversible MAO inhibitor:** combined with an SSRI or SNRI it can precipitate serotonin syndrome.
- **Interrogate the allergy label.** Most are not allergy, and the label itself causes measurable harm.
- **Aztreonam is safe in severe penicillin allergy**, with ceftazidime the one side-chain exception.
- **Avoid vancomycin with piperacillin-tazobactam** where an alternative exists; the AKI risk is additive.
- **Set a stop date when you prescribe.** Duration drives C. difficile and resistance as much as choice does.





Catheter-Related BSI

Central-line bloodstream infection · the line is the source, so the line usually comes out

Pull it
for the big four

DIAGNOSE *paired cultures drawn before antibiotics are what make this diagnosis possible*

SUSPECT IT

Sepsis in a patient with a central line in place for at least 48 h and no other source. Local signs at the exit site are helpful when present but are **absent in most cases**, so their absence excludes nothing. **Fever with no explanation in a lined patient is the presentation.**

DRAW PAIRED CULTURES

One set from a peripheral vein and one from each catheter lumen, before antibiotics. The diagnosis is supported when the **same organism grows from both** and the **catheter sample turns positive at least 2 h earlier**, the differential time to positivity, which reflects the higher organism burden at the source.

INTERPRET WITH CARE

A single coagulase-negative staphylococcus from one set is usually contamination, so treating it commits a patient to vancomycin for a skin flora. **Send the catheter tip only if the line comes out**, and never culture a tip routinely from an uninfected line.

REMOVE THE LINE *antibiotics cannot sterilize biofilm on an indwelling catheter*

Situation	What to do, and why
Always remove	S. aureus · Pseudomonas · Candida · severe sepsis or shock · suppurative thrombophlebitis · endocarditis · persistent bacteremia beyond 72 h of appropriate therapy. Do not attempt to treat through the line for any of these: salvage fails, relapse is the rule, and each of these organisms seeds distant sites. Leaving a line in for S. aureus bacteremia is among the most consequential errors on this page.
Salvage may be considered	Only for a long-term, difficult-to-replace catheter (tunneled line or port) infected with a low-virulence organism such as coagulase-negative staphylococcus , in a clinically stable patient. Combine systemic therapy with antibiotic lock therapy to reach the biofilm inside the lumen. Any failure to clear means removal.
Do not rewire	Exchanging a line over a guidewire into an infected site reinfects the new catheter. Where a line is still required, place a new catheter at a new site.

EMPIRIC THERAPY, THEN TAILOR

Component	Agent	When
Gram-positive cover	Vancomycin , 25 to 30 mg/kg load, then dosed to an AUC of 400 to 600	Always. Covers MRSA and coagulase-negative staphylococci, the commonest pathogens. Use daptomycin if the MRSA MIC is elevated or vancomycin fails.
Gram-negative cover	Antipseudomonal beta-lactam: cefepime, piperacillin-tazobactam or meropenem	Severe sepsis or shock, neutropenia, a femoral line, or known colonization. Narrow promptly once cultures return.
Antifungal	Echinocandin (caspofungin 70 mg then 50 mg daily)	Parenteral nutrition, prolonged broad-spectrum antibiotics, femoral line, hematologic malignancy, or known Candida colonization.

DURATION AND FOLLOW-THROUGH *count from the first negative culture, not from the first dose*

BY ORGANISM

Coagulase-negative staph: 5 to 7 days after line removal. **Enterococcus and Gram-negatives:** 7 to 14 days. **S. aureus:** at least **14 days for genuinely uncomplicated** disease, and **4 to 6 weeks** if complicated. **Candida: 14 days from the first negative blood culture.** The clock starts at the first negative culture, so a patient still bacteremic on day 4 has not started counting.

DOCUMENT CLEARANCE AND LOOK FOR SEEDING

Repeat blood cultures every 48 h until negative. Echocardiography for S. aureus and for candidemia, with TEE preferred given the poor sensitivity of TTE. Dilated retinal examination for candidemia to find endophthalmitis. Persistent fever should prompt a search for **metastatic foci in bone, joints, spine and eye.**

IF BACTEREMIA PERSISTS

The line is still in, or there is an undrained focus. Remove the catheter if it has not already gone, then image for **suppurative thrombophlebitis, endocarditis or a metastatic abscess**, and extend therapy to **4 to 6 weeks** when one is found. **Infectious diseases consultation measurably improves outcomes in S. aureus bacteremia.**

DURATION BY ORGANISM *counted from the first negative blood culture, after the line is out*

Organism	Duration	Caveats
Coagulase-negative staph	5 to 7 days	Or as little as 48 h with line removal alone in a stable patient. Confirm it is not a contaminant before committing to therapy at all.
Enterococcus	7 to 14 days	Ampicillin if susceptible; vancomycin or daptomycin if resistant.
Gram-negative bacilli	7 to 14 days	De-escalate on susceptibilities. Pseudomonas mandates line removal.
S. aureus	≥ 14 days, or 4 to 6 weeks	Fourteen days only if all apply: line removed, defervescence and culture clearance within 72 h, no endocarditis on TEE, no prosthetic material, no metastatic focus. Otherwise 4 to 6 weeks.
Candida	14 days	From the first negative culture. Line removal is mandatory, plus a dilated retinal examination before stopping.

PREVENTION *CLABSI is a largely preventable event, and the bundle works*

AT INSERTION

Hand hygiene, full barrier precautions, chlorhexidine skin preparation allowed to dry, and ultrasound guidance. Avoid the femoral site, which carries the highest infection and thrombosis risk. Subclavian has the lowest infection rate, balanced against pneumothorax risk.

AFTER INSERTION

Scrub the hub before every access, use chlorhexidine-impregnated dressings, and review the need for the line every single day. The most effective preventive measure is **prompt removal**, since risk accrues per catheter-day. **Do not give antibiotic prophylaxis or change lines on a schedule:** neither reduces infection.

PEARLS & PITFALLS

- S. aureus, Pseudomonas or Candida means the line comes out.** Treating through them fails.
- Draw paired cultures before antibiotics**, or you lose the ability to prove the line is the source.
- Duration counts from the first negative culture.** A still-positive patient has not started the clock.
- Get a TEE and an eye exam** for S. aureus and candidemia. Occult endocarditis changes the duration entirely.

References: IDSA clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection · IDSA clinical practice guideline for the management of candidiasis · SHEA / IDSA practice recommendations for preventing central line-associated bloodstream infections · guidance on vancomycin AUC-guided dosing.

Educational aid; verify doses against local protocol, renal function, and patient factors.





DIABETIC FOOT INFECTION

Grade it, probe it, perfuse it · antibiotics do not heal an ischemic or undrained foot

PROBE THE BONE
and check the pulses

GRADE THE INFECTION *IWGDF / IDSA classification — grade decides setting and route*

Grade	Features	Setting, route and duration
1 — Uninfected	Ulcer with no purulence and no signs of inflammation	No antibiotics. Offloading, wound care and glycemic control. Treating a colonized ulcer breeds resistance without healing it.
2 — Mild	Skin and subcutaneous tissue only, erythema 0.5–2 cm around the ulcer	Oral, outpatient. Cover staphylococci and streptococci only, e.g. amoxicillin-clavulanate or cephalexin. 1–2 weeks.
3 — Moderate	Erythema > 2 cm , or involvement of deeper structures (abscess, fasciitis, joint, bone), without systemic upset	Usually admit. Broader cover including anaerobes and Gram-negatives. 1–3 weeks for soft tissue.
4 — Severe	Any of the above plus systemic inflammatory response (fever, tachycardia, leukocytosis, hypotension, metabolic derangement)	Admit, IV, urgent surgical review. Broad-spectrum empiric cover; de-escalate on deep tissue culture.

Add "(O)" to grade 3 or 4 when osteomyelitis is present, because it changes the duration far more than the grade does. **Swab cultures of the ulcer surface are near-useless** — they grow colonizers. **Send deep tissue or bone taken at debridement**, and take blood cultures in moderate or severe disease (positive in around 15%).

THE THREE QUESTIONS *ask all three on the first encounter*

1. IS THE BONE INVOLVED?

Probe-to-bone: a sterile blunt probe reaching bone through the ulcer raises the odds of osteomyelitis substantially (likelihood ratio around 6, and a positive predictive value near 90% in a high-prevalence foot). **ESR above 70 mm/h is roughly 90% specific. Plain films lag by 2–3 weeks; MRI is the standard** at about 90% sensitivity. **Bone biopsy is the definitive answer** when it will change management.

2. IS THERE BLOOD SUPPLY?

Palpate dorsalis pedis and posterior tibial, then measure the ABI. Below 0.9 means peripheral arterial disease; below 0.5 means critical limb ischemia and the wound will not heal on antibiotics alone. **Beware a falsely normal or high ABI above 1.3** from medial arterial calcification, which is common in diabetes — use **toe pressures or TBI** instead. **Refer for revascularization before expecting healing.**

3. IS THERE SOMETHING TO DRAIN?

Abscess, necrotic tissue and dead bone need surgery, not a longer antibiotic course. Urgent debridement for grade 4, deep abscess, gas in the tissues or rapidly spreading infection. **Offloading is treatment, not advice** — total contact casting or equivalent, because a foot that keeps bearing weight will not heal whatever you prescribe.

ANTIBIOTICS AND DURATION *the surgical answer changes the duration*

- 1 Mild, no recent antibiotics:** target **staphylococci and streptococci only.** Amoxicillin-clavulanate 875/125 mg BID, dicloxacillin, or clindamycin if penicillin-allergic. **Do not add Gram-negative or anaerobic cover reflexively** in a mild infection.
- 2 Moderate to severe, or chronic and previously treated:** broaden to cover **Gram-negatives and anaerobes** (amoxicillin-clavulanate, or piperacillin-tazobactam, or a carbapenem where resistance is likely). **Add MRSA cover** (vancomycin or linezolid) for prior MRSA, recent hospitalization, or high local prevalence. **Cover Pseudomonas only with a reason** — macerated wounds, warm climates, prior isolation.
- 3 Soft tissue duration is short:** **1–2 weeks for mild, 1–3 weeks for moderate or severe.** Stop when the infection has resolved, not when the ulcer has closed — **an open but uninfected ulcer does not need antibiotics.**
- 4 Osteomyelitis:** 6 weeks if infected bone remains. If all infected bone is resected with clean margins, treat as a soft tissue infection instead — days to about a week. **The operation, not the antibiotic, is what shortens the course**, so ask the surgeon what was left behind before you set a stop date.

EMPIRIC REGIMENS *then de-escalate on deep tissue culture*

Situation	Regimen	Notes
Mild, no recent antibiotics	Amoxicillin-clavulanate 875/125 mg PO BID, or dicloxacillin 500 mg PO QID	Gram-positive cover is enough. Clindamycin 300–450 mg QID if penicillin-allergic; doxycycline or TMP-SMX if MRSA is a concern.
Moderate	Amoxicillin-clavulanate 1.2 g IV TID, or ceftriaxone 2 g daily + metronidazole 500 mg TID, or ertapenem 1 g daily	Adds Gram-negative and anaerobic cover. Ertapenem does not cover Pseudomonas , which is usually fine here.
Severe, or limb-threatening	Piperacillin-tazobactam 4.5 g IV q6–8h, or meropenem 1 g IV q8h	Broad, including <i>Pseudomonas</i> and anaerobes. Pair with urgent surgical review — the antibiotic is the adjunct here, not the treatment.
Add MRSA cover if	Vancomycin (AUC/MIC 400–600) or linezolid 600 mg BID	Prior MRSA, recent hospitalization, high local prevalence, or failure on a beta-lactam. Linezolid has the better tissue penetration ; watch platelets beyond 14 days.
Add <i>Pseudomonas</i> cover only if	Piperacillin-tazobactam, cefepime, or ciprofloxacin	A reason is required: macerated or water-exposed wounds, warm climate, prior <i>Pseudomonas</i> isolate. Do not cover it reflexively.

LIMB-THREAT RED FLAGS *these change the call from ward to OR*

SURGICAL EMERGENCY

Gas in the tissues, crepitus, rapidly advancing erythema, bullae or skin necrosis, or pain out of proportion. This is necrotizing infection until the operating room proves otherwise — **do not wait for imaging.**

SYSTEMIC COMPROMISE

Fever, tachycardia, hypotension, leukocytosis, or an unexplained rise in glucose or ketones. New glycemic instability is often the earliest signal that a foot infection has become systemic.

VASCULAR EMERGENCY

ABI below 0.5, TBI below 0.4, rest pain, or absent pedal pulses with tissue loss. Critical limb ischemia: **vascular referral takes priority over adjusting antibiotics.**

PEARLS & PITFALLS

- Do not treat an uninfected ulcer.** Grade 1 needs offloading and wound care; antibiotics here select resistance and change nothing.
- Surface swabs grow colonizers.** Deep tissue or bone at debridement is the only culture worth acting on.
- A normal ABI in a diabetic foot can be false.** Medial calcification stiffens the vessels; use toe pressures if the ABI is above 1.3.
- Probe-to-bone is a bedside test worth doing every time.** It shifts the probability of osteomyelitis more than any blood result.
- Antibiotics cannot heal an ischemic foot.** If the ABI is below 0.5, the referral matters more than the prescription.
- Ask what bone was left behind.** Clean resection turns a 6-week course into a few days; residual infected bone does the reverse.





BACTERIAL MENINGITIS

The CNS emergency · antibiotics before the scan, dexamethasone before the antibiotics

DON'T DELAY ABX

not for the CT, not for the LP

RECOGNIZE IT, THEN MOVE *the order of operations decides the outcome*

THE PRESENTATION

Fever, headache, neck stiffness and altered mental status — but the classic triad is complete in fewer than half, so its absence does not exclude meningitis. Also photophobia, seizures, focal deficit and a **purpuric rash** (think meningococcus, and move faster).

CT BEFORE LP ONLY IF

Immunocompromised · known CNS disease · new-onset seizure · papilledema · reduced consciousness · focal neurological deficit. With none of these, **go straight to LP**. The scan is to exclude a mass lesion before you release CSF pressure, not to diagnose meningitis.

THE ORDER

Blood cultures → dexamethasone → antibiotics → CT if indicated → LP. If a CT is needed, the antibiotics go in first and the LP waits. CSF cultures stay positive for hours after the first dose, so treating early costs you very little diagnostically and buys a great deal.

CSF INTERPRETATION *the pattern usually declares itself*

Parameter	Bacterial	Viral	TB / fungal
Opening pressure	Markedly raised (often > 25 cmH ₂ O)	Normal or mildly raised	Raised
White cells	1,000–5,000, neutrophil-predominant	10–500, lymphocytic	10–500, lymphocytic
Glucose (CSF:serum)	Low, ratio < 0.4	Normal	Low, often profoundly so
Protein	> 100 mg/dL, typically 100–500	Mildly raised, 50–100	High, often > 200
Microbiology	Gram stain positive in 60–90%; culture and PCR	HSV and enterovirus PCR	AFB smear (low yield), GeneXpert, culture

Early bacterial meningitis can be lymphocyte-predominant in the first 12–24 hours, and **prior antibiotics blunt every one of these numbers**. Treat the patient in front of you, not a reassuring cell count.

EMPIRIC THERAPY *adult, community-acquired — meningeal doses, not systemic ones*

Drug	Dose	Why this, why this dose
Ceftriaxone	2 g IV q12h	Pneumococcus, meningococcus, <i>H. influenzae</i> . The meningeal dose is 2 g twice daily, not the usual once-daily gram — the blood-brain barrier admits only a fraction of the serum level, so you need higher and more frequent dosing to hold CSF concentrations above the MIC.
Vancomycin	25–30 mg/kg load, then 15–20 mg/kg q8–12h. Target AUC/MIC 400–600	Added for penicillin- and cephalosporin-resistant pneumococcus. Dose by AUC, not by trough: the 2020 ASHP/IDSA/PIDS/SIDP revision moved off trough-only monitoring, because a trough of 15–20 (the 2009 surrogate) drives nephrotoxicity without reliably confirming the AUC . Load every patient — CSF penetration is poor at the best of times.
Ampicillin	2 g IV q4h	Listeria cover , and the reason to add it is simple: cephalosporins do not touch Listeria . Add for age over 50, pregnancy, immunosuppression, chronic steroids or alcohol dependence .
Aciclovir	10 mg/kg IV q8h	Add whenever HSV encephalitis is plausible (behavioral change, seizures, temporal lobe changes). Untreated HSV encephalitis kills around 70% ; treated, closer to 20%. Start empirically and stop later if PCR is negative.
Dexamethasone	0.15 mg/kg IV q6h × 4 days	Give it before, or with, the first antibiotic dose . Antibiotics lyse bacteria and release cell-wall fragments, and the resulting inflammatory burst is what causes the edema and hearing loss — steroid given afterwards has missed the event . Continue only if pneumococcal ; stop it once another organism is confirmed.

PATHOGEN-DIRECTED THERAPY & DURATION *narrow once the organism is known*

Organism	Directed therapy	Duration
<i>N. meningitidis</i>	Ceftriaxone (penicillin G if fully susceptible)	7 days . Notify public health; droplet isolation for the first 24 h of effective therapy
<i>S. pneumoniae</i>	Ceftriaxone; keep vancomycin if resistant	10–14 days . The only organism in which dexamethasone is continued
<i>H. influenzae</i>	Ceftriaxone	7–10 days. Notifiable; prophylaxis for contacts
<i>L. monocytogenes</i>	Ampicillin + gentamicin (synergy)	At least 21 days — it survives intracellularly, so short courses relapse
Gram-negative / post-neurosurgical	Meropenem ± an aminoglycoside; remove or exchange any EVD	About 21 days. Source control matters as much as the drug

Contact prophylaxis for meningococcus (household, kissing, or unprotected airway exposure): **ciprofloxacin 500 mg orally once**, rifampin 600 mg twice daily for 2 days, or ceftriaxone 250 mg IM once. **None is needed for pneumococcus**.

WHEN IT ISN'T GOING WELL

NOT IMPROVING AT 48 H

Repeat the LP. Think **resistant pneumococcus**, an **undrained focus** (subdural empyema, brain abscess, mastoiditis or sinusitis), or the **wrong diagnosis** entirely. Re-image before you simply broaden the antibiotics.

COMPLICATIONS TO EXPECT

Early: raised intracranial pressure, seizures, and **SIADH with hyponatremia**. **Late**: brain abscess, **hydrocephalus**, cerebral venous sinus thrombosis, and **sensorineural hearing loss** — arrange audiometry before discharge.

NEUROPROTECTION

Head up 30°, treat seizures (benzodiazepine then levetiracetam), analgesia, **maintain normocapnia**, and **avoid hypotonic fluids**, which worsen cerebral edema. Neurosurgery for hydrocephalus needing CSF diversion.

PEARLS & PITFALLS

- **Antibiotics within the hour**. Never hold them for a CT or an LP — take blood cultures and treat.
- **Dose vancomycin by AUC (400–600), not by trough**. Trough 15–20 is the superseded 2009 surrogate and over-exposes the kidneys.
- **Dexamethasone only works if it is early**. Before or with the first dose; there is no benefit giving it afterwards.
- **Add ampicillin over 50, in pregnancy, or if immunosuppressed**. Cephalosporins do not cover *Listeria*, and this is the classic miss.
- **An incomplete triad does not exclude it**. Fewer than half have all four features; the elderly and immunosuppressed present blandly.
- **Arrange audiometry before discharge**. Hearing loss is the commonest lasting sequela and is easy to overlook in a recovering patient.

References: Tunkel et al. IDSA Practice Guidelines for Bacterial Meningitis, *Clin Infect Dis* 2004 · ESCMID acute bacterial meningitis 2016 · de Gans & van de Beek, *NEJM* 2002 · Rybak et al. Vancomycin therapeutic monitoring, revised ASHP/IDSA/PIDS/SIDP consensus, *Am J Health-Syst Pharm* 2020.

Educational aid; verify doses against local protocol, renal function and patient factors.

roundsrx.com

roundsrx Infographic Series · #22



DEFINE IT AND MOVE *a single temperature is enough — do not wait for a second*

THE DEFINITION

ANC < 500/ μ L, or < 1,000 and expected to fall below 500, plus a **single oral temperature $\geq 38.3^{\circ}\text{C}$ or $\geq 38.0^{\circ}\text{C}$ sustained over an hour**. Fever may be the **only** sign — there is no pus, no infiltrate and no localizing inflammation without neutrophils.

ACT IN THE FIRST HOUR

Cultures then antibiotics within 60 minutes of presentation. Do not wait for the neutrophil count if the clinical suspicion is high in a recently treated patient. **Delay to antibiotics is directly associated with mortality.**

EXAMINE THE HIDDEN SITES

Mouth (mucositis), **perianal area** — but **no rectal examinations or suppositories**, which risk bacteremia — **indwelling line sites**, skin, and perineum. **Avoid instrumentation** in the neutropenic patient.

RISK-STRATIFY *not everyone needs admission*

Tool / group	Detail
MASCC score	≥ 21 is low risk; ≤ 20 is high risk. The MASCC index or Talcott's rules are the recommended tools for identifying candidates for outpatient management.
Low risk — outpatient option	Oral fluoroquinolone plus amoxicillin-clavulanate (or clindamycin if penicillin-allergic) is recommended empirical outpatient therapy — unless fluoroquinolone prophylaxis was already being taken, in which case a quinolone must not be used.
Outpatient prerequisites	Clinically stable, no significant comorbidity, able to tolerate oral intake, reliable transport and a carer , close follow-up, and living within reasonable distance of the hospital. If any of these fail, admit.
High risk	Anticipated prolonged (> 7 days) and profound neutropenia, hemodynamic instability, mucositis interfering with swallowing, gastrointestinal symptoms, new neurological change, line infection, or hepatic or renal impairment. Admit for intravenous therapy.

CHOOSE THE ANTIBIOTIC *monotherapy is standard — and vancomycin is not routine*

- 1 **Monotherapy with an antipseudomonal beta-lactam** is recommended — **cefepime, piperacillin-tazobactam, or a carbapenem** (meropenem or imipenem-cilastatin). Pseudomonal cover is non-negotiable.
- 2 **Do not add vancomycin routinely.** These monotherapy regimens give **excellent coverage of viridans streptococci** and are adequate as sole agents **even with oral mucositis** — which removes the traditional reason people reach for vancomycin.
- 3 **Add vancomycin only for: hemodynamic instability, skin or catheter-site infection,** suspected **MRSA pneumonia,** or **gram-positive organisms on blood culture** pending identification and susceptibilities. **If no gram-positive infection is confirmed, stop it after 48 hours.**
- 4 **Broaden for specific concerns** — add an aminoglycoside or switch to a carbapenem for suspected resistant gram-negatives or septic shock, and cover anaerobes for perianal or intra-abdominal sources. **Consult the local antibiogram,** which should drive empirical choice.
- 5 **Consider antifungal cover for persistent or recurrent fever after 4–7 days** of broad-spectrum antibacterials with anticipated prolonged neutropenia. Send galactomannan or beta-D-glucan and image the chest and sinuses.

DE-ESCALATE AND STOP *the part most people get wrong*

DURATION

If **all cultures are negative and the fever has resolved**, it is appropriate to consider **stopping intravenous antibiotics 72 hours after the last fever**, and to reinstate prophylaxis if applicable — **regardless of the neutrophil count**. Waiting for count recovery before stopping is an outdated practice that prolongs exposure, drives resistance and increases *C. difficile* risk.

IF A SOURCE IS FOUND

Treat for the **duration appropriate to that infection** rather than an arbitrary neutropenic-fever course. **Remove infected lines** for tunnel infection, port-pocket infection, septic thrombophlebitis, persistent bacteremia, or infection with *S. aureus*, *Pseudomonas*, *Candida*, or rapidly growing mycobacteria.

PREVENTION *who should never have got here*

Measure	Detail
G-CSF prophylaxis	Primary prophylaxis when the regimen carries a febrile neutropenia risk of $\geq 20\%$, and considered at 10–20% with additional patient risk factors — age, prior episode, poor performance status, comorbidity. It prevents; it does not treat established fever, where routine use is not recommended.
Antibacterial prophylaxis	A fluoroquinolone in high-risk patients with anticipated prolonged profound neutropenia , typically acute leukemia and stem cell transplant. Not for standard solid-tumor chemotherapy — the resistance and <i>C. difficile</i> cost outweighs benefit.
Antifungal & antiviral	Antifungal prophylaxis for prolonged neutropenia and transplant. Aciclovir for HSV-seropositive patients receiving intensive therapy. Pneumocystis prophylaxis with sustained steroid exposure or specific regimens.
Patient education	Every patient starting chemotherapy needs a thermometer, written instructions, and an alert card with a 24-hour number . They should be told to present immediately with fever and to say they are on chemotherapy at the door — this is what shortens door-to-antibiotic time.

PEARLS & PITFALLS

- **Empiric doses, since the sheet names the agents but the clock is 60 minutes:** cefepime 2 g IV q8h, piperacillin-tazobactam 4.5 g IV q6h, or meropenem 1 g IV q8h. **Vancomycin 15–20 mg/kg q8–12h is not routine:** add it only for a suspected line infection, skin or soft-tissue source, hemodynamic instability, severe mucositis, or known MRSA colonization.
- **Antibiotics within an hour.** Every delay costs survival, and this is the single measured standard for the condition.
- **Do not add vancomycin reflexively** — not even for mucositis. It has defined indications, and stopping it at 48 hours when cultures are negative is part of the protocol.
- **No rectal examinations, suppositories or enemas** in neutropenia — they can seed bacteremia.
- **Fever may be the only sign.** Absence of infiltrate, pus or erythema means nothing without neutrophils.
- **Stop at 72 hours afebrile with negative cultures**, without waiting for count recovery.
- **Give G-CSF for prophylaxis, not as treatment** of established fever, where routine use is not recommended.