Intro to Carpenter

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Med-Peds PGY-4

7/16/18

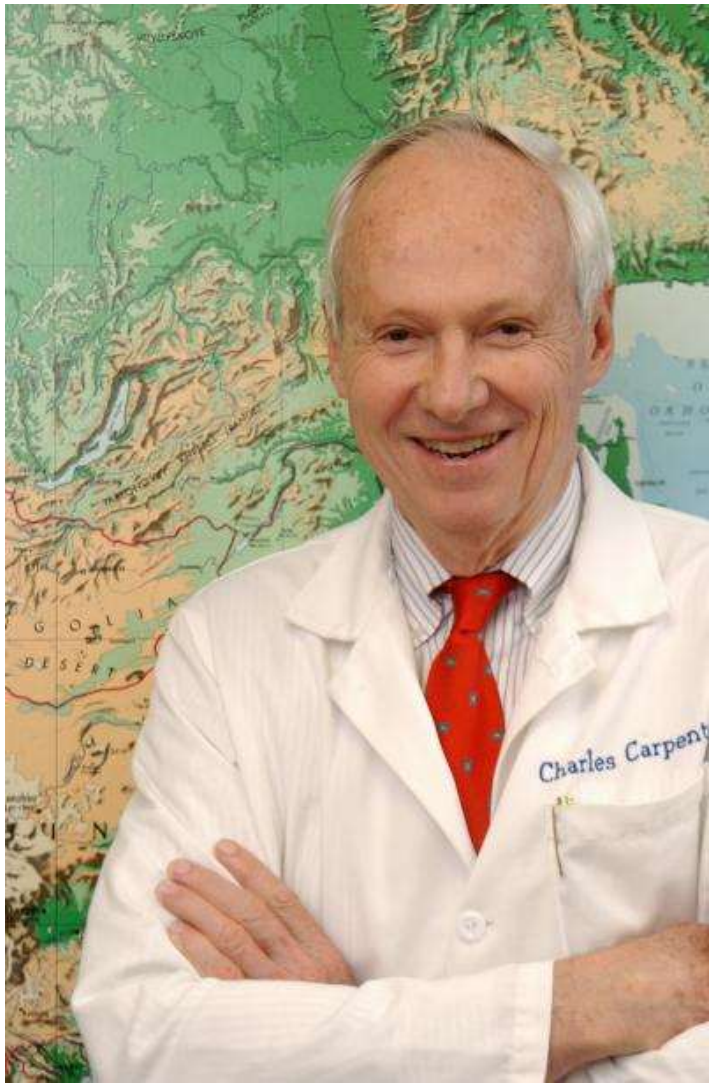
Dr. Charles Carpenter

- After completing his residency at Johns Hopkins Hospital, he began his career in international health in Kolkata, India, during a Cholera epidemic and became the director of the division of allergy and infectious diseases at Hopkins.

- He moved to Ohio in 1973, where he served as the department of medicine chair until 1986, and was a leading figure in the department of ID here, continuing his passion for international health.

- He is currently chair of the department of medicine at Brown.

*All credit to Nate Summers on this slide



The Setting and Cast

- Patients:
  - Complicated infectious reasons for admit (epidural abscess, fungal, FUO)
  - HIV patients who do not have a serious other primary pathology (ESRD, ADHF)
- Attendings:
  - ID or some are Pulm-Crit care trained but all very focused on ID
- Fellow:
  - Sometimes!
- Lerner Tower 8
  - Nurses are used to ID concerns and protocols
  - Care Coordinator and Social Work are used to the nature of ID, PICC lines, etc

Learning Objectives for this talk

- How to structure thinking about Infectious Diseases
  - Note: NOT a review of all ID content—other lectures will cover ABX, etc
- Apply that structure to a few cases
- Understand the setting and resources at UH, esp specific to Carpenter
- Learn new tools to help you accelerate your learning and practice

Let’s warm up with a case

- 40yo woman being admitted for rapidly-spreading erythema on arm
- ED report states “bug bites several days ago, now 2d feeling feverish and the redness has spread far up her arm”

How to think about an ID case

Important Factors

- Host Factors
  - Immune status: HIV, DM, ESRD?
  - Hardware (lines, devices)
- Syndrome
  - Source of infection
  - Results of infection
- Common Bugs
  - What bugs do you expect?
  - Any reason for resistance?
- Drugs / Management
  - ABX or procedure to accomplish
  - With timing / duration

How to Gain Information

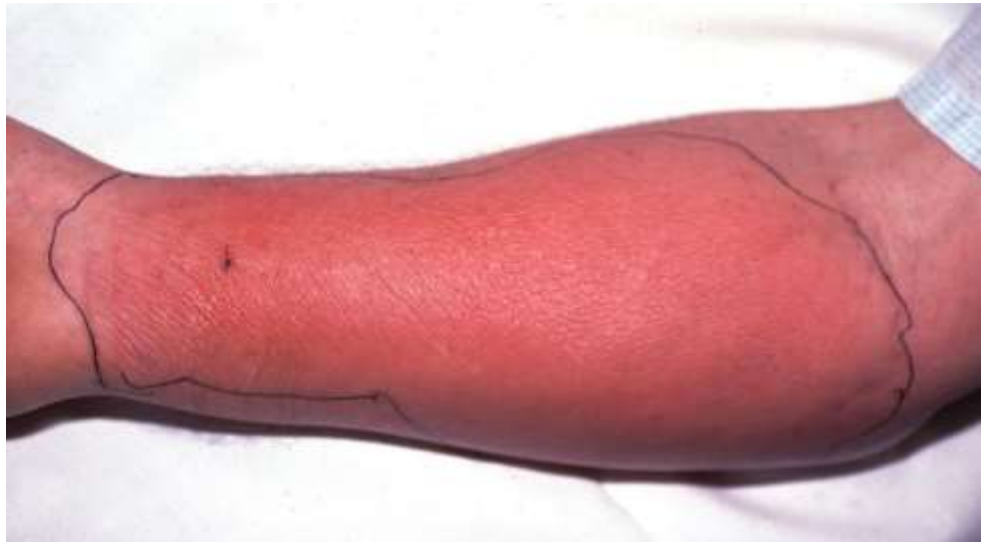
- History and Physical
  - Direction, usually most of a Dx
- Social History is key
  - Pets, travel, job, TB risk factors, Drug history (beyond IVDU)
- Recent Abx
  - What, when, duration, adherence
- Cultures—prep for success
- Prior infections
  - What does the patient know?
  - What does the EMR know?

Cellulitis

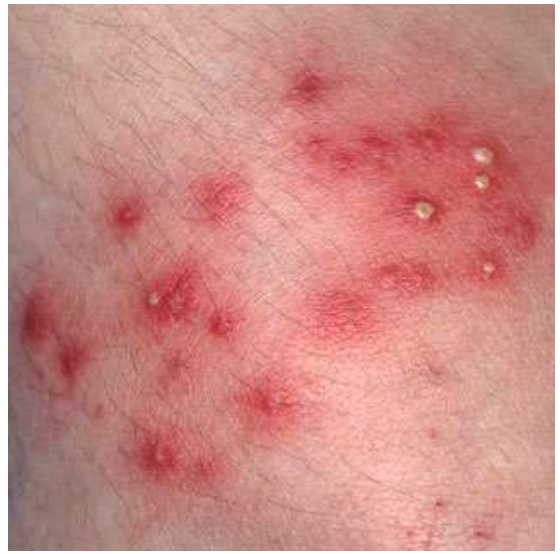
- Host:
  - Why do they have it? (prone to skin disease, injury, IVDU, DM etc)
- Source
  - Is it True Cellulitis? (vs venous stasis, allergy, CHF, edema, burn?)
- Environment
  - Where is the patient coming from? (Home, SNF, LTAC, Hospital, Travel, Homeless?)
- Resistance
  - MRSA risk factors?, Pseudomonas?
- Weird:
  - Animal Bite, hiking, woods, tick born illness, IVDU, etc
- Bugs:
  - Staph, Strep

Diagnostic Clues…

- Strep
  - More rapid onset
  - Rapid response to beta-lactams
  - No purulence



- Staph
  - Often purulent
  - May form abscesses
  - Often multiple



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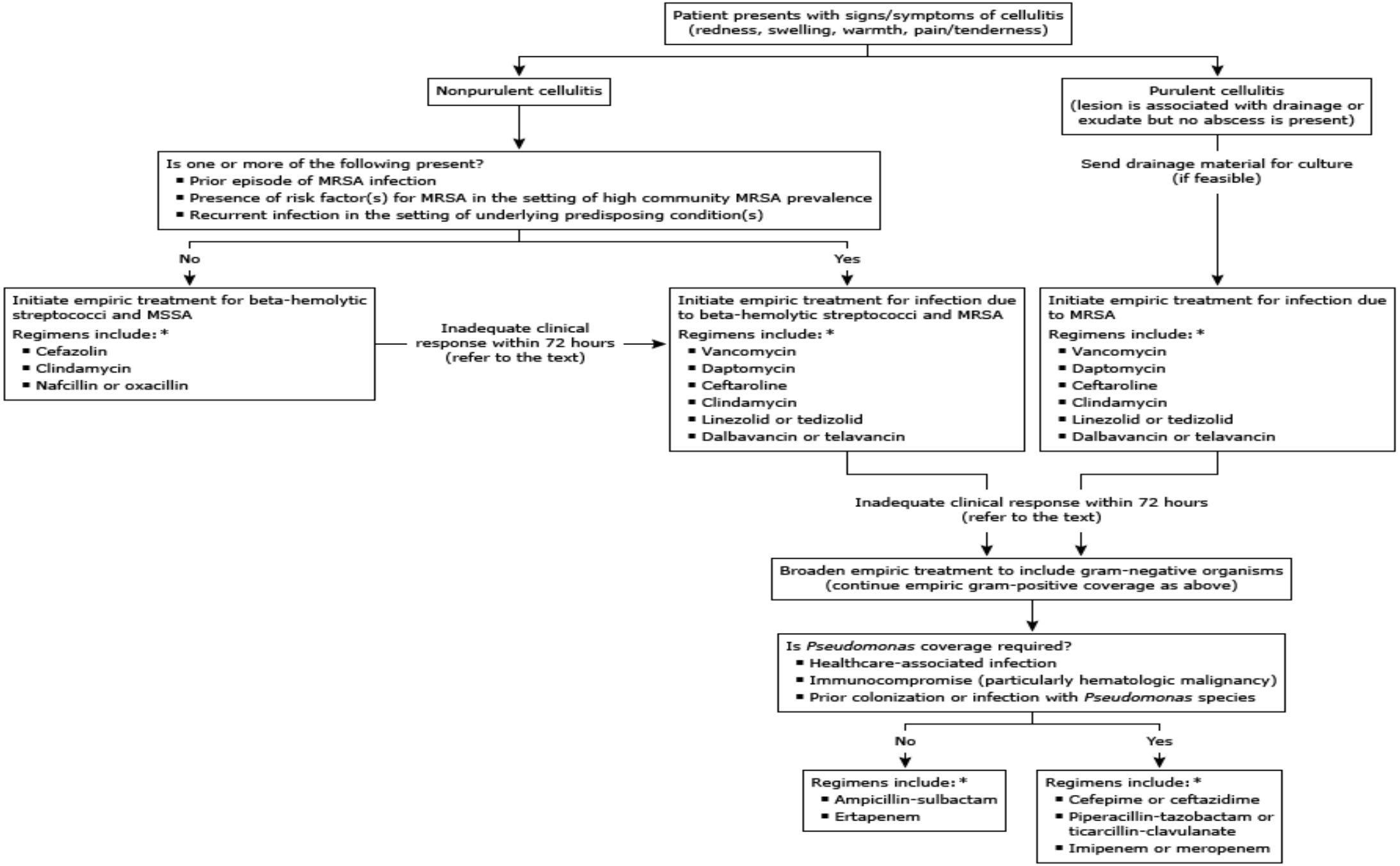

Patient presents with signs/symptoms of cellulitis (redness, swelling, warmth, pain/tenderness)
Nonpurulent cellulitis
Purulent cellulitis (lesion is associated with drainage or exudate but no abscess is present)
Send drainage material for culture (if feasible)
Is one or more of the following present?
Prior episode of MRSA infection
Presence of risk factor(s) for MRSA in the setting of high community MRSA prevalence
Recurrent infection in the setting of underlying predisposing condition(s)
No
Yes
Initiate empiric treatment for beta-hemolytic streptococci and MSSA
Regimens include:*
Cefazolin
Clindamycin
Nafcillin or oxacillin
Inadequate clinical response within 72 hours (refer to the text)
Initiate empiric treatment for infection due to beta-hemolytic streptococci and MRSA
Regimens include:*
Vancomycin
Daptomycin
Ceftaroline
Clindamycin
Linezolid or tedizolid
Dalbavancin or telavancin
Initiate empiric treatment for infection due to MRSA
Regimens include:*
Vancomycin
Daptomycin
Ceftaroline
Clindamycin
Linezolid or tedizolid
Dalbavancin or telavancin
Inadequate clinical response within 72 hours (refer to the text)
Broaden empiric treatment to include gram-negative organisms (continue empiric gram-positive coverage as above)
Is Pseudomonas coverage required?
Healthcare-associated infection
Immunocompromise (particularly hematologic malignancy)
Prior colonization or infection with Pseudomonas species
No
Yes
Regimens include:*
Ampicillin-sulbactam
Ertapenem
Regimens include:*
Cefepime or ceftazidime
Piperacillin-tazobactam or ticarcillin-clavulanate
Imipenem or meropenem

Next Case…

- 55yo patient w/ rapidly-spreading erythema on arm
  - ...and extensive Hx of IV drug use, with 3d shaking chills
  - Exam demonstrates significant new systolic murmur
  - One culture drawn in ED just before ABX
    - What's the best kind of culture?

Endocarditis

- Host:
  - Why do they have it?
    - IVDU, underlying infection, heart valve disease, prosthetic valve?
- Source
  - Where is the infection coming from
    - Skin, GI, abscess, GU etc
- Environment
  - Any reason to expect Resistance, e.g.MRSA, VRE?
- Bugs:
  - *Staph. aureus, Strep pyogenes, Strep viridans*, *Enterococcus*, *Staph Epidermidis,* HACEK

Side Note: Staph

- Always take Staphylococcal bacteremia seriously
  - Repeat blood cultures x2 before starting empiric treatment
  - *Staph aureus* is sticky and loves to hide in places. Examine the Pt for metastatic spread (spine, sternoclavicular joints, etc.)
    - Image if concerning physical exam findings
  - IDSA guidelines recommend at least 2 weeks of IV therapy for *Staph* bacteremia
  - Will Require ID Consult!!!! (They may self consult if they hear of it)

A quick note on cultures…

- The time of peak fever does not elevate yield of blood culture
- Amount of blood, timing regarding ABX, proper technique do
- Fever CAN indicate illness, though… on that note, is fever bad?
  - (Not always—it's a signal!)
  - Consider the use of antipyretics—needed? Rarely. And may mask fevers.
  - Do we need daily cultures? (Not always.) How about repeat cultures after a big positive that seems real? (Yes!)

Riedel S, et al. *Timing of specimen collection for blood cultures from febrile patients with bacteremia*. J Clin Microbiol. 2008;46(4):1381. Epub 2008 Feb 27.

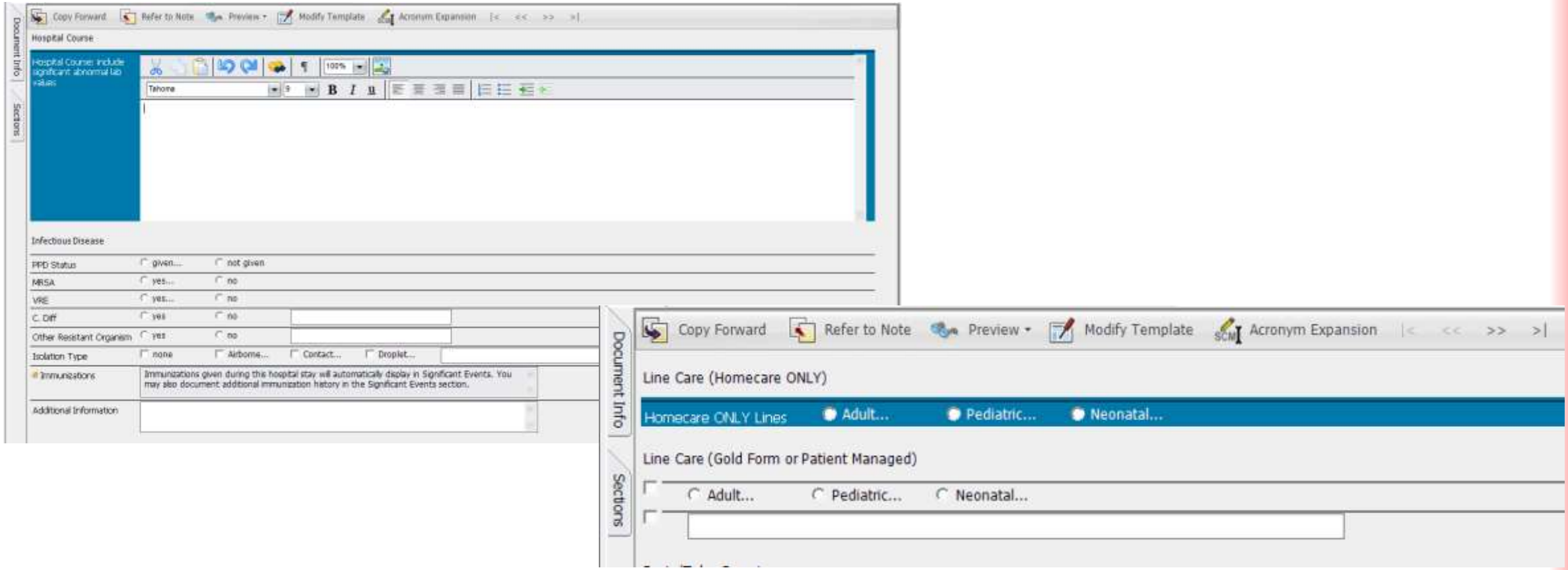
Discharge Planning is in the Details!

- Discharge w/ PICC line… how?
  - When can we place a PICC?
  - ”They report cultures at 11am—we won’t know if it’s clear until then”

- Discharge Profile 2
  - Hospital Course needs to be current
  - Gold Form / Home Care have different needs

Discharge Planning is in the Details!

- Discharge w/ PICC line… Discharge Profile 2



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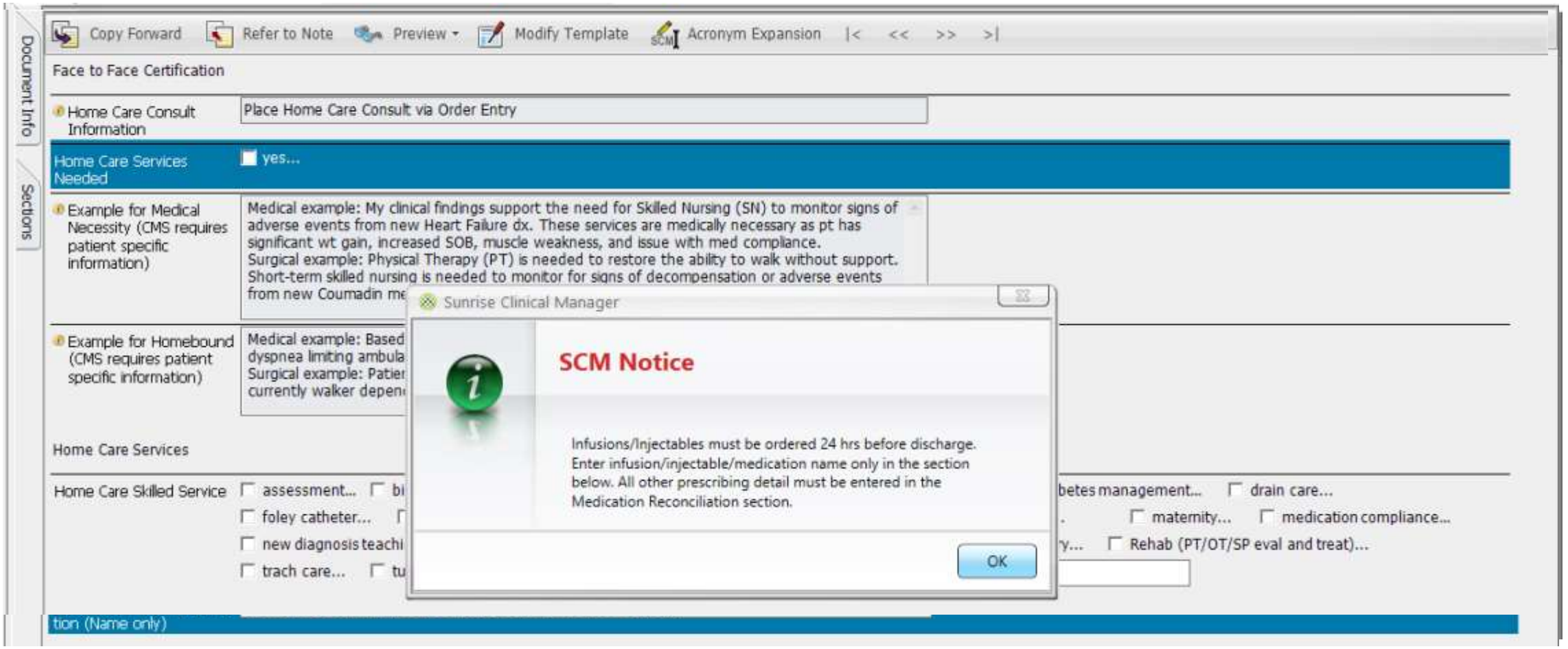

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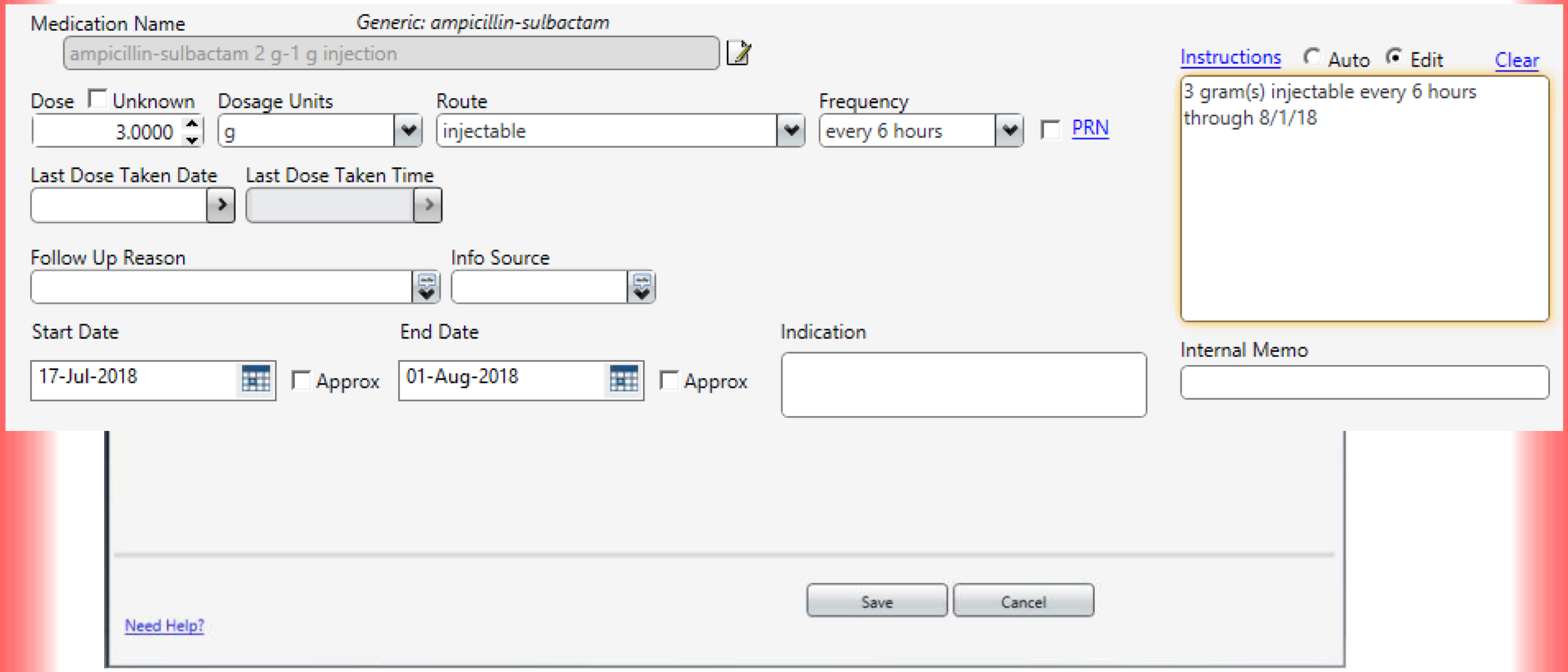


Next Case…

- 60yo pt w/ IDDM-2 presents after coming back from vacation w/ drainage from his foot
- What more do you want to know?
- What do you think is going on, and how thorough can you be?
  - Yes, right now.

The factors, applied to that case

- Host?
  - Diabetic, uncontrolled, Hx of foot ulcers
- Syndrome?
  - Purulent cellulitis? Osteomyelitis? Necrotizing Fasciitis? Go assess!
- Bug?
  - Staph/Strep? Pseudomonas? Venturing into Anaerobes—Clostridium *et al*?
- Drug?
  - Broad coverage at first—usually Vanc/Zosyn here
  - Total duration of treatment?
  - How do we get therapeutic and keep them that way for entire course?

How to Differentiate

- Clinical Exam is Crucial
  - Demarcated borders and shallow?
  - Depth hard to measure?
  - Wound is directly overlying / can probe to bone?
  - Crepitus, subcutaneous emphysema?
- Break the tie: Imaging can help!
  - What if you suspect Osteo?

How to Differentiate

- Break the tie: Imaging can help!
  - What if you suspect Osteo?
  - Select a study… what resources exist?
  - ACR Appropriateness Criteria!

American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Suspected Osteomyelitis of the Foot in Patients with Diabetes Mellitus**

Variant 2: **Soft-tissue swelling with neuropathic arthropathy without ulcer.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot	9	Initial study. Radiographs and MRI are complementary, and both are indicated. The results of initial x-ray examination do not preclude the necessity for additional studies.	☢
MRI foot without and with IV contrast	9	Radiographs and MRI are complementary, and both are indicated. MRI is useful preoperatively to identify the extent of involvement and to map devitalized areas.	O
MRI foot without IV contrast	9	Radiographs and MRI are complementary, and both are indicated.	O
CT foot without IV contrast	5	For neuropathy or if MRI contraindicated.	☢
Labeled leukocyte scan foot (In-111 or Tc-99m)	3	May be appropriate in certain circumstances such as if MRI is contraindicated or unavailable.	☢☢☢☢
Labeled leukocyte scan (In-111 or Tc-99m) and Tc-99m sulfur colloid marrow scan foot	3	May be appropriate in selected clinical circumstances.	☢☢☢☢
CT foot without and with IV contrast	1		☢
CT foot with IV contrast	1		☢
Tc-99m 3-phase bone scan foot	1		☢☢☢
Tc-99m 3-phase bone scan and labeled leukocyte scan (In-111 or Tc-99m) foot	1		☢☢☢☢
Tc-99m 3-phase bone scan and labeled leukocyte scan (In-111 or Tc-99m) and Tc-99m sulfur colloid marrow scan foot	1		☢☢☢☢
US foot	1		O
FDG-PET/CT foot	1		☢☢☢☢

Rating Scale: **1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate** ***Relative Radiation Level**

Next Case…

- 78yo w/ mild dementia presenting with severe fatigue, chronic cough
  - Not a very good historian, but no complaints other than fatigue and cough
  - Appears dehydrated on examination
  - UA ordered—mod LE, no nitrites, WBC 18, RBC 8, Squamous 1+, Mucus 1+
  - Culture is…
    - Wait, what culture? (Neither blood nor urine sent… we could add on; do you WANT to?)
- Should we treat?

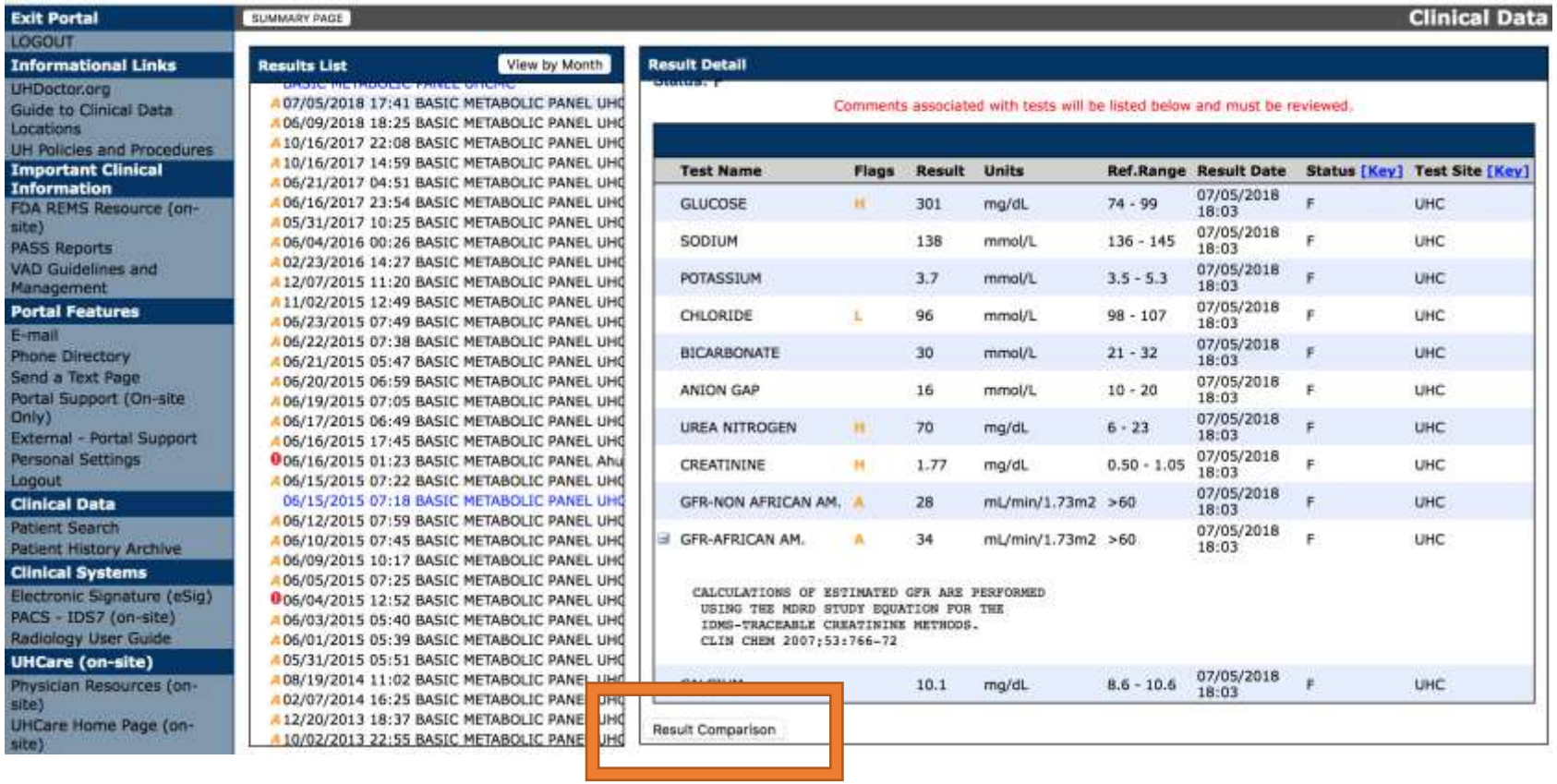
- Someone from the ED mentions they thought they saw history of resistant pathogens… so they started treatment

Pyelonephritis / UTI

- Host:
  - Concerning findings
    - Male/Female, Age, Comorbidities
- Source
  - How did they get it?
    - Recent Urologic procedure, catheterization, “spontaneous”, Sexual
    - Is it really a “UTI”: PID, STD, GI infection/abscess, Seeding from elsewhere
- Environment
  - Where is the patient coming from? Home, SNF, able to care for self, can tolerate PO?
- Resistance
  - Hx of resistant organisms? MDR, XDR
  - Other common issues: ESBL, MRSA, Pseudomonas
- Weird:
  - Fungal
- Bugs:
  - Ecoli, enterococcus, staph, other GI/GU flora

Let’s take a quick aside to review portal

- Patient Portal can help a LOT



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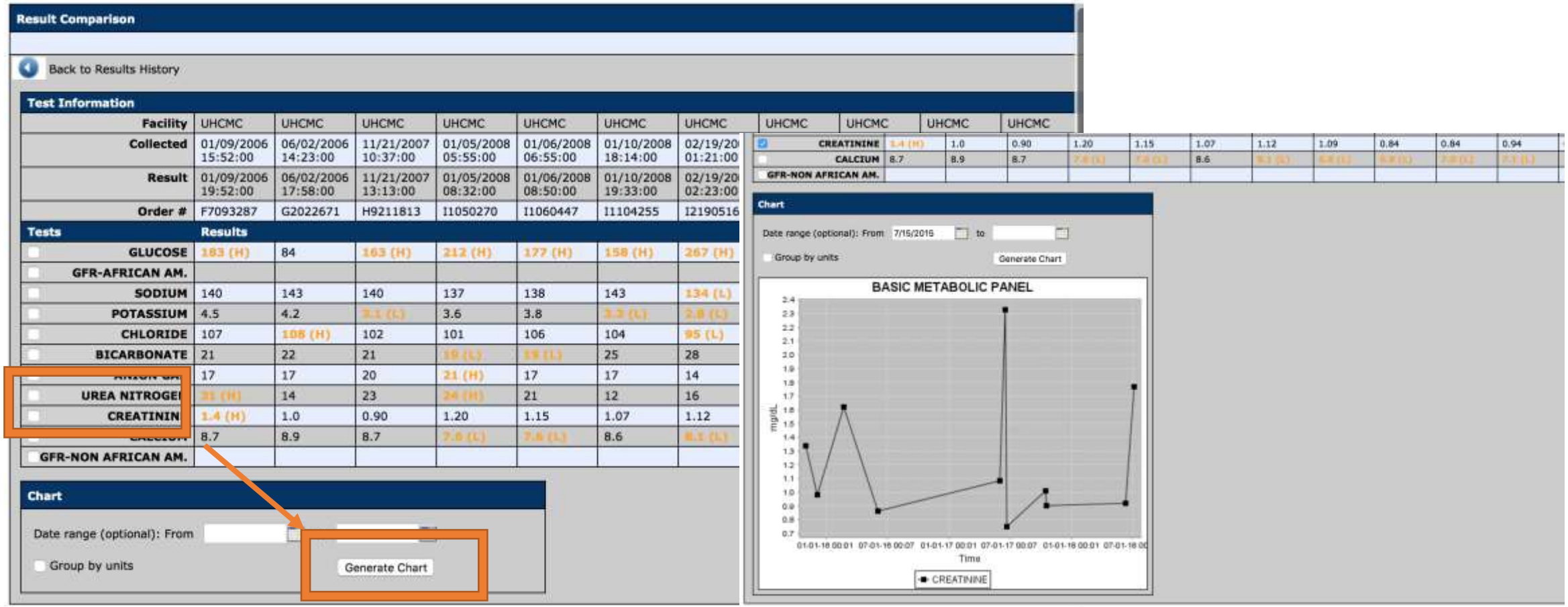

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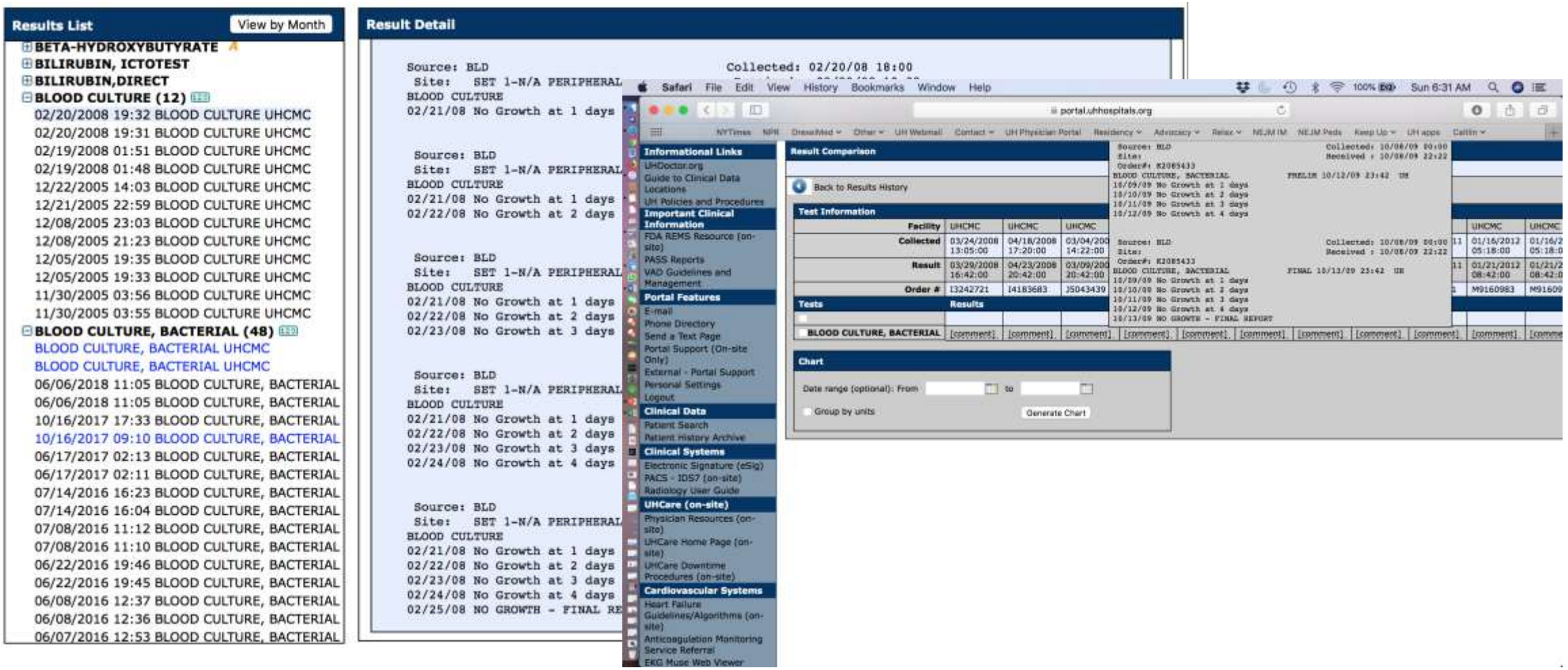


Onward with that case…

- That patient with the “UTI” was given IVF and Cipro, sent back to SNF
- She comes back to ED 14 days later, same sort of condition
  - Dehydrated
  - Profuse diarrhea
- What’s her situation?
  - What’s the most common cause?
- What’s the solution?

IDSA Guidelines are Great!

- C Diff? Gotcha!

Table 1. Recommendations for the Treatment of *Clostridium difficile* Infection in Adults

Clinical Definition	Supportive Clinical Data	Recommended Treatment[a]	Strength of Recommendation/ Quality of Evidence
Initial episode, non-severe	Leukocytosis with a white blood cell count of ≤15 000 cells/mL and a serum creatinine level <1.5 mg/dL	• VAN 125 mg given 4 times daily for 10 days, OR	Strong/High
		• FDX 200 mg given twice daily for 10 days	Strong/High
		• Alternate if above agents are unavailable: metronidazole, 500 mg 3 times per day by mouth for 10 days	Weak/High
Initial episode, severe[b]	Leukocytosis with a white blood cell count of ≥15 000 cells/mL or a serum creatinine level >1.5 mg/dL	• VAN, 125 mg 4 times per day by mouth for 10 days, OR	Strong/High
		• FDX 200 mg given twice daily for 10 days	Strong/High
Initial episode, fulminant	Hypotension or shock, ileus, megacolon	• VAN, 500 mg 4 times per day by mouth or by nasogastric tube. If ileus, consider adding rectal instillation of VAN. Intravenously administered metronidazole (500 mg every 8 hours) should be administered together with oral or rectal VAN, particularly if ileus is present.	Strong/Moderate (oral VAN); Weak/Low (rectal VAN); Strong/Moderate (intravenous metronidazole)
First recurrence	…	• VAN 125 mg given 4 times daily for 10 days if metronidazole was used for the initial episode, OR	Weak/Low
		• Use a prolonged tapered and pulsed VAN regimen if a standard regimen was used for the initial episode (eg, 125 mg 4 times per day for 10–14 days, 2 times per day for a week, once per day for a week, and then every 2 or 3 days for 2–8 weeks), OR	Weak/Low
		• FDX 200 mg given twice daily for 10 days if VAN was used for the initial episode	Weak/Moderate
Second or subsequent recurrence	…	• VAN in a tapered and pulsed regimen, OR	Weak/Low
		• VAN, 125 mg 4 times per day by mouth for 10 days followed by rifaximin 400 mg 3 times daily for 20 days, OR	Weak/Low
		• FDX 200 mg given twice daily for 10 days, OR	Weak/Low
		• Fecal microbiota transplantation[c]	Strong/Moderate

Abbreviations: FDX, fidaxomicin; VAN, vancomycin.

[a]All randomized trials have compared 10-day treatment courses, but some patients (particularly those treated with metronidazole) may have delayed response to treatment and clinicians should consider extending treatment duration to 14 days in those circumstances.

[b]The criteria proposed for defining severe or fulminant *Clostridium difficile* infection (CDI) are based on expert opinion. These may need to be reviewed in the future upon publication of prospectively validated severity scores for patients with CDI.

[c]The opinion of the panel is that appropriate antibiotic treatments for at least 2 recurrences (ie, 3 CDI episodes) should be tried prior to offering fecal microbiota transplantation.

Clinical Infectious Diseases

IDSA GUIDELINE

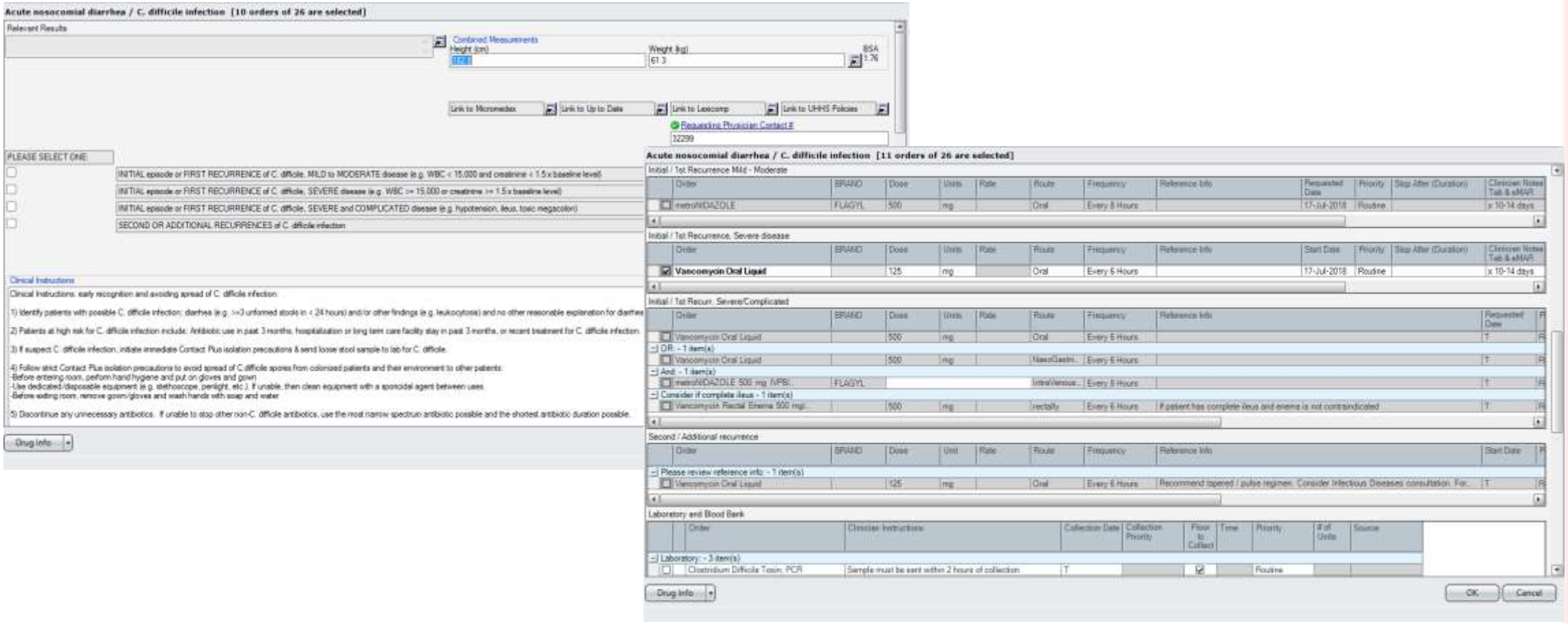
Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults and Children: 2017 Update by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA)

L. Clifford McDonald,[1] Dale N. Gerding,[2] Stuart Johnson,[2,3] Johan S. Bakken,[4] Karen C. Carroll,[5] Susan E. Coffin,[6] Erik R. Dubberke,[7] Kevin W. Garey,[8] Carolyn V. Gould,[1] Ciaran Kelly,[9] Vivian Loo,[10] Julie Shaklee Sammons,[5] Thomas J. Sandora,[11] and Mark H. Wilcox[12]

[1]Centers for Disease Control and Prevention, Atlanta, Georgia; [2]Edward Hines Jr Veterans Administration Hospital, Hines, and [3]Loyola University Medical Center, Maywood, Illinois; [4]St Luke's Hospital, Duluth, Minnesota; [5]Johns Hopkins University School of Medicine, Baltimore, Maryland; [6]Children's Hospital of Philadelphia, Pennsylvania; [7]Washington University School of Medicine, St Louis, Missouri; [8]University of Houston College of Pharmacy, Texas; [9]Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts; [10]McGill University Health Centre, McGill University, Montréal, Québec, Canada; [11]Boston Children's Hospital, Massachusetts; and [12]Leeds Teaching Hospitals NHS Trust, United Kingdom

UH Order Sets are Great! (Usually)

- C Diff? Gotcha!



A couple of variants to finish up:

- 22yo home from college campus, 2d of fever, headaches, now a fall
  - Generally healthy
  - Altered mentation since yesterday after going out with friends despite illness

- 22yo from long-term care campus, 2d fever, headaches, now a fall
  - s/p VP shunt 2 months ago
  - Baseline cognitive impairment but seems more uncomfortable to providers

- 22yo patient w/ HIV presents w/ 2d fever, headaches
  - Well-known to Carpenter attendings, does not take medications
  - No neuro changes, just his standard irritability

- For each variation…
  - What workup? Need a tap? (Yes!)
  - Need imaging (yes, but which kind for which case?),
  - Who could you call for each of these, and what do you say? (For LP help or further workup)
  - What meds do you start for each?

Meningitis

- Host:
  - Immune status, Age, surgical hx, cancer hx
- Source
  - How did they get it?
  - Spontaneous, Seeded from elsewhere, IVDU, Neurologic procedure
    - Is it true infection or could it be cancer?
- Environment
  - Where is the patient coming from?
  - Home, SNF, able to care for self, can tolerate PO
- Resistance
  - Really an issue if associated with Neurologic Procedure, IVDU etc
- Weird:
  - Fungal, MRSA,
- Bugs:
  - *Neisseria meningitidis, Strep. pneumoniae, H. flu*, *Listeria monocytogenes,* enteroviruses, arboviruses, TB, *Cryptococcus neoformans*

HIV patients

- For CHF, we have a system, right?
  - “50yo w/ HFrEF, (LVEF 35% by TTE 11/2017, recovered from 20%, Cardiologist is Dr. Longenecker)
- What do you think is important for HIV patients?
  - Most recent CD4 and Viral Load
  - Nadir, any Hx of Opportunistic Infections, any Prophylaxis
  - HIV physician
  - Resistance: can ask UH SIU (Special Immunology Unit) for their “packet”/chart

HIV patients

- 40yo w/ HIV (CD4 600, VL undetect, nadir CD4 of 128 at Dx 2017, adherent on Stribild, pt of Dr. Hirsch, admitted from clinic w/ CAP)
- 62yo w/ HIV (CD4 89, VL 2k, nadir CD4 of 5 in 1996, actively on 4-agent HAART and TMP-SMX, pt of Dr. Hirsch, last visit 4 mos ago)
- 22yo w/ HIV (CD4 of 8, VL 384k, at nadir, not taking HAART due to pill burden s/p failing three regimens, pt of Dr. Hirsch, recent no-show)

Pneumonia

- Host:
  - Concerning findings
  - Elderly, AMS, dysphagia, DM, ESRD, immunosuppressed
- Source
  - What kind of pneumonia
  - CAP, HCAP, HAP, VAP, Aspiration?
- Environment
  - Where is the patient coming from?
  - Home, SNF, LTAC, Hospitalized, Homeless, HD, air conditioners
- Resistance
  - MRSA risk factors?, Pseudomonas?
- Weird:
  - TB, Fungal, anthrax, viral, legionella
- Bugs:
  - *Strep pneumoniae, H. influenza, M. catarrhalis, Chlamydia pneumoniae, Mycoplasma pneumoniae, Staph aureus, Legionella pneumophilia*

What Kind

- HCAP:
  - Hospitalization for 2+ days w/ in past 90 days
  - HD w/ in 30 days
  - NH or LTAC w/ in 30 days
  - IV therapy (chemo, Abx) w/in 30 days
  - Wound care w/ in 30 days
  - Family member w/ MDR pathogen
- CAP
  - Community Acquired
- HAP
  - Occurs 48 hours or more after admit (and not present/brewing at time of admission)
- VAP
  - 48-72 hours post intubate
- Aspiration
  - Dysphagia key

Think carefully your choice of type has implications in terms of billing, inpatient criteria, severity score, and reimbursement

References / Works Cited

- Dr. UpToDate's page on cellulitis
- ACR on Soft Tissue Infection https://acsearch.acr.org/docs/69340/Narrative/
- IDSA update on C diff, 2017 http://www.idsociety.org/Guidelines/Patient_Care/IDSA_Practice_Guidelines/Infections_By_Organ_System-81567/Gastrointestinal/Clostridium_difficile/
- Riedel S, et al. *Timing of specimen collection for blood cultures from febrile patients with bacteremia*. J Clin Microbiol. 2008;46(4):1381. Epub 2008 Feb 27.

Allergies

- Is it real?
  - “My throat closes up” – YES!
  - “I get swelling” – Maybe? Need to know more
  - “Itchy” – Probably not, find out more
  - “Nausea” - nope

Allergies

- Key things to find out
  - What was the reaction and do we have it documented
  - How serious is the reaction
    - Ie if PCN is only option pt can deal with itching
  - Has patient had this medication/class before
    - Check EMR have they had X or a similar family?
  - Note history of EBV and amoxicillin
    - But difficult to prove this
  - Is it the nature of the med
    - Do you expect the “allergy” as a common effect of the abx
    - Ex: Red man syndrome, GI upset, etc

OK so it’s real

- Allergy to PCN
- Cephalosporin (5-10% Cross reactivity)
- Carbapenem (2-5%)
- Monobactam (0%)

- Think of severity of reaction
  - Itchy: may risk trying cephalosporin
  - SOB: don’t risk it and go to monobactam
- Overall weight risk/benefits and discuss w/pt

No Other Options?

- Are you sure?
  - Lots of old meds not used recently
  - Several “ID controlled” abx you can use
- Call Allergy!
  - Confirm allergy and desensitize if needed

Back up plans

- What are you missing
  - Should you broaden abx
  - Beware gaps in coverage: Ertapenem no PSA
- Re-culture
  - Is there unexpected resistance
- Do you need to switch classes
  - IE PCN to Carbapenem?
- Is really an infection?
  - All that is SIRS is not ID

Tips/Tools

- Choosing an antibiotic with all things equal
  - Think of ease of use for pt
- Up To Date
  - Great for dosing
- Sanford Guide
  - Best 20 bucks you'll ever spend
- Antibiogram: On the Intranet at UH! https://intranet.uhhospitals.org/RedirectToDWP.aspx#
  - Specific resistances at your hospital
- Call your friendly pharm D
  - Help with dosing, other abx suggestions to add
- Call your friendly Microlab
  - May help with resistance panels (they know more than they release)