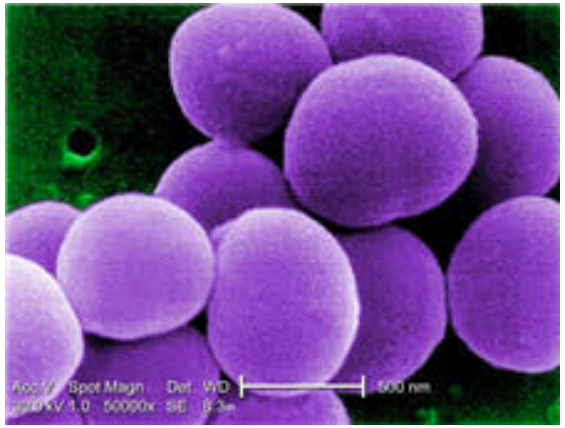
Staph aureus Bacteremia



Erica Stohs, MD, MPH

Aug. 4, 2020

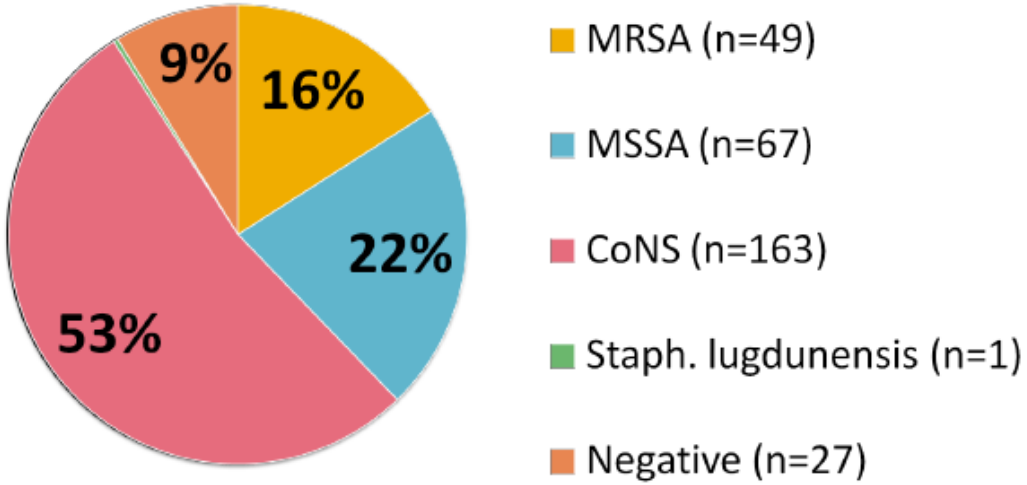
My Journey

My Journey

Rapid Identification of Methicillin-Sensitive *Staphylococcus aureus* from Positive Blood Cultures using the Verigene System: A System-wide Impact on Patient Treatment and Physician Compliance

B.A. Koeneman[1], J.M. Silverberg[2], A. Khalsa[1], H. Fisher[1], K.M. McCabe[3], M.A. Saubolle[1,4], **A.B. Mochon[1,5]**

Breakdown of GPC CL identified by the Verigene BC-GP test from June to December 2012



Stewardship Team:

- GPC ID in ~4.5h
- Lab→PharmD notification of MSSA
- PharmD→Physician
- Vanco→Cef/Naf within 14.5 h (v 45.5h)
- Switch to appropriate therapy: 35%→86%

Clinical Outcomes After Implementation of Rapid Molecular Detection of Blood Culture Contaminants

Outcomes (mean)	Traditional Lab Technique (n=114)	Rapid Molecular Testing (n=72)
Time from GPC-CONS*	**29.6 hours**	**4.4 hours**
Vancomycin duration*	**49.5 hours**	**27.3 hours**
Number vanco troughs	0.39	0.39
Hospital LOS *	**5.9 days**	**4.5 days**

*Statistically significant with p-value <0.05

<u>Cost Savings:</u>
Extrapolated over 1 year @ these 4 hospitals

- Med-surg bed $2000/day
- **$1.3 million/yr**

Additional Stewardship Benefits Postulated:

- ↓ Adverse drug events
- Fewer drug resistant organisms

Objectives

1. Understand the seriousness of staphylococcus aureus bacteremia (SAB) and describe the risk of metastatic infection and endocarditis in patients who have SAB.

2. Describe the appropriate clinical evaluation in a patient with SAB according to the IDSA guidelines.

3. Compare/define uncomplicated bacteremia and complicated bacteremia and know the appropriate duration of intravenous antibiotic therapy for both.

4. Know the preferred therapy for methicillin-sensitive staphylococcus aureus (MSSA) bacteremia and the options for therapy for methicillin-resistant staphylococcus aureus (MRSA) bacteremia.

Case 1

- 44 yo F with DM1 and obesity s/p gastric bypass who was admitted in DKA. She also has an eczematous rash that has become extremely itchy.
- Denies fevers, chills.
- No murmur on exam.
- One of 2 blood cultures drawn on admission turns positive at 12h for GPCs in clusters.
- Denies IVDU. No indwelling devices or hardware.

Direct blood pathogen identification panel [511708817]
(Abnormal)
Blood

Final result

Component	Value
mecA	Not Detected
Enterococcus genus	Not Detected
Listeria monocytogenes	Not Detected
Staphylococcus genus	DETECTED
Staphylococcus aureus	DETECTED !
Streptococcus genus	Not Detected
Streptococcus agalactiae	Not Detected
Streptococcus pneumoniae	Not Detected
Streptococcus pyogenes	Not Detected
Acinetobacter baumannii	Not Detected
Enterobacteriaceae family	Not Detected
Enterobacter cloacae complex	Not Detected
Escherichia coli	Not Detected
Klebsiella oxytoca	Not Detected
Klebsiella pneumoniae	Not Detected
Proteus	Not Detected
Serratia marcescens	Not Detected
Haemophilus influenzae	Not Detected
Neisseria meningitidis	Not Detected
Pseudomonas aeruginosa	Not Detected
Candida albicans	Not Detected
Candida glabrata	Not Detected
Candida krusei	Not Detected
Candida parapsilosis	Not Detected
Candida tropicalis	Not Detected

How do you tell if this is MSSA or MRSA?

What do you start?

A) Vancomycin
B) Nafcillin / oxacillin
C) Cefazolin
D) Don’t treat. It’s a contaminant.

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Acinetobacter baumannii	Not Detected
Enterobacteriaceae family	Not Detected
Enterobacter cloacae complex	Not Detected
Escherichia coli	Not Detected
Klebsiella oxytoca	Not Detected
Klebsiella pneumoniae	Not Detected
Proteus	Not Detected
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How do you tell if this is MSSA or MRSA?

What do you start?

A) Vancomycin
B) Nafcillin / oxacillin
C) Cefazolin
D) Don't treat. It's a contaminant.

Nope, never considered a contaminant!

Antibiotic Options for MSSA:

Nafcillin / Oxacillin 2g IV q4h

Cefazolin 2g IV q8h

Cefazolin:

- ✓ Less frequent dosing, easier for PIVs
- ✓ Better side effect profile

  [Naf/ox = ↑ AKI (AIN), hypoK, ↑ LFTs]
- ✓ Patient & home health preferred
- ✓ Acceptable for IE
- X Not ideal for CNS infections
- X Drug shortage last year

(Abnormal)
Blood, Peripheral Draw

Culture Result

Gram Stain result:
Gram Positive Cocci in Clusters
in Aerobic and Anaerobic Bottle.
!
Time to detection:
12 hours and 17 minutes
[redacted]
Call subsequent positives.
See Direct Blood Pathogen Identification Panel for rapid identification panel.
Staphylococcus aureus !

Susceptibility and relative inpatient cost

	Staphylococcus aureus MIC	
$ Clindamycin	<=0.25	Susceptible
$$$ Daptomycin	<=0.25	Susceptible
$ Erythromycin	<=0.25	Susceptible
$$ Gentamicin	<=1	Susceptible
$ Levofloxacin	<=0.5	Susceptible[1]
$$ Linezolid	2	Susceptible
$$$ Oxacillin	<=0.25	Susceptible[2]
$$ Penicillin	8	Resistant
$ Rifampin	<=1	Susceptible[3]
$ Tetracycline	<=2	Susceptible
$ Trimethoprim-Sulfa.	<=0.5/9.5	Susceptible
$$ Vancomycin	0.5	Susceptible

[1] Staphylococcus spp. may develop resistance during therapy with fluoroquinolones.

[2] Susceptibility to Oxacillin can be used to predict susceptibility to Cefazolin.

[3] Rifampin should not be used alone for antimicrobial therapy.

Back to Our Case:
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-One of 2 blood cultures drawn on admission turns positive at 12h for GPCs in clusters → Biofire=MSSA.
-Denies IVDU. No indwelling devices or hardware.

QUESTION: You have this patient on appropriate antibiotics. You have ordered DAILY blood cultures for her. What additional management is needed?

(There may be more than one answer)

A) CT chest
B) CT abdomen
C) Echo
D) Careful skin examination daily
E) ID Consult

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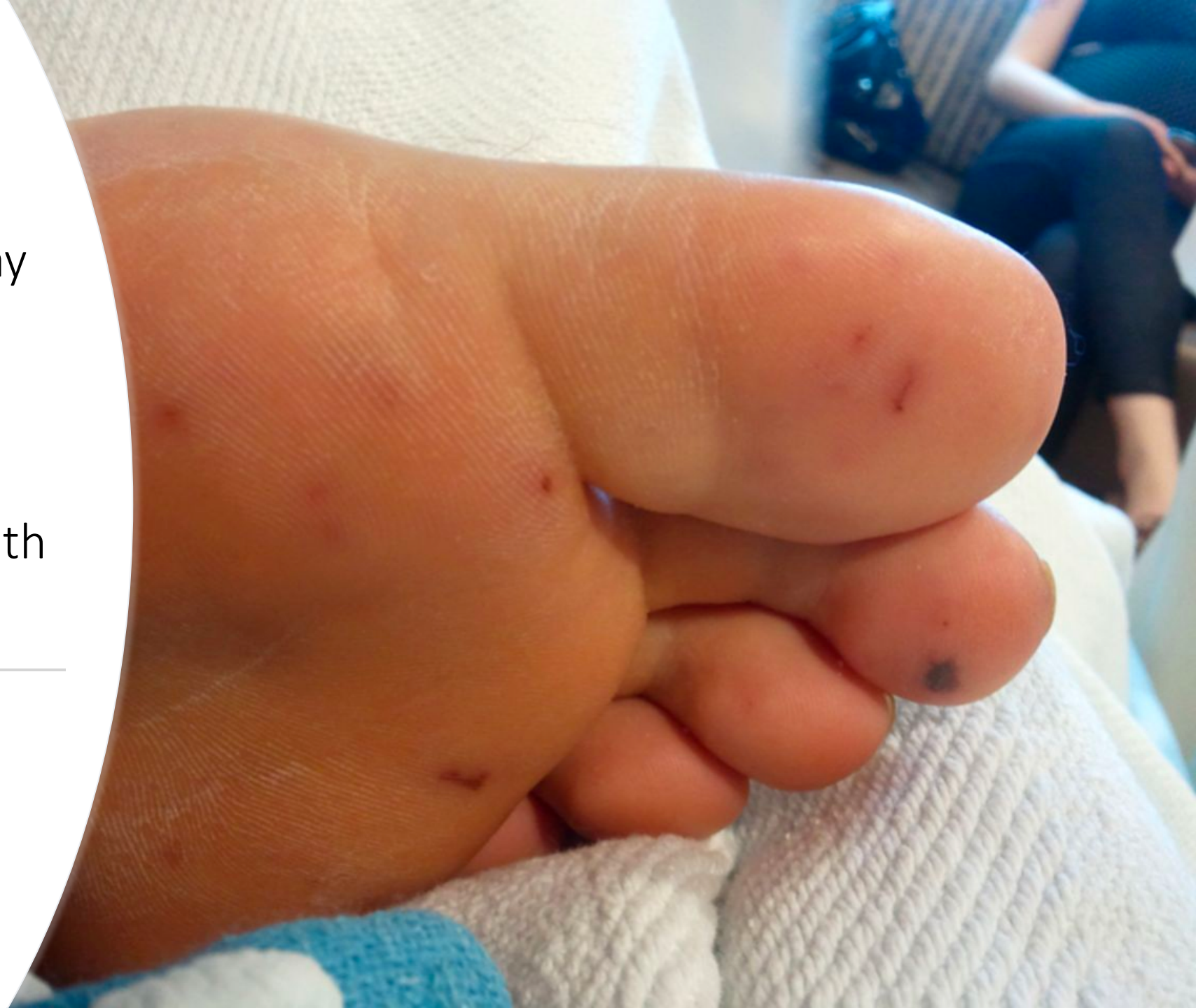
Vascular Phenomena:
Systemic emboli, Janeway lesions (non-tender), splinter hemorrhages

Immunologic:
Osler nodes (painful), Roth spots



SAB: Complicated or Not?

Uncomplicated SAB if EACH of the following is present:

- ✓ Exclude endocarditis
- ✓ No implanted prostheses
- ✓ Follow up blood cultures clear within 2-4 days after the initial set
- ✓ Defervescence within 72h of initiating effective therapy
- ✓ No evidence of metastatic sites of infection

Two weeks of antibiotic therapy is acceptable ONLY if these criteria are met.

ID Consults = Standard of care for SAB

- Reduced patient mortality!
- Decreased SAB relapse

Why?

- More frequent follow up blood cultures
- Obtain echos
- More frequent source control
- More appropriate anti-Staph coverage (i.e. targeted tx for MSSA)
- Longer abx courses

Case 2

61 yo M with h/o colon cancer s/p resection 2013, L4-5 laminectomy s/p revision in 11/2019, 3vCABG + aortic valve replacement in 2/2020, chronic non-healing sternal wound s/p debridements x3 (last in 6/2020) transferred with MRSA bacteremia x3 days.

He's in the ICU ventilated & on pressors. Pain elicited with palpation of lumbar spine. Has bruising of various stages, petechiae at PIV sites & conjunctival hemorrhage.

He's on vancomycin. Initial trough is 9 mcg/mL

TTE: no vegetations, poor windows

Question: Does this patient need a TEE? And why?

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He's in the ICU ventilated & on pressors. **Pain elicited with palpation of lumbar spine**. Has bruising of various stages, petechiae at PIV sites & **conjunctival hemorrhage**.

He's on vancomycin. Initial trough is 9 mcg/mL

TTE: no vegetations, **poor windows**

Question: Does this patient need a TEE? And why?

When do you need a TEE?

- Suggestion of IE on exam or imaging
- Any cardiac devices or prostheses
- Valvular disease
- IVDU
- Positive blood cultures >72 after tx
- Abnormal TTE, poor windows

Essentially, if the patient does NOT meet criteria for simple bacteremia, need a TEE.

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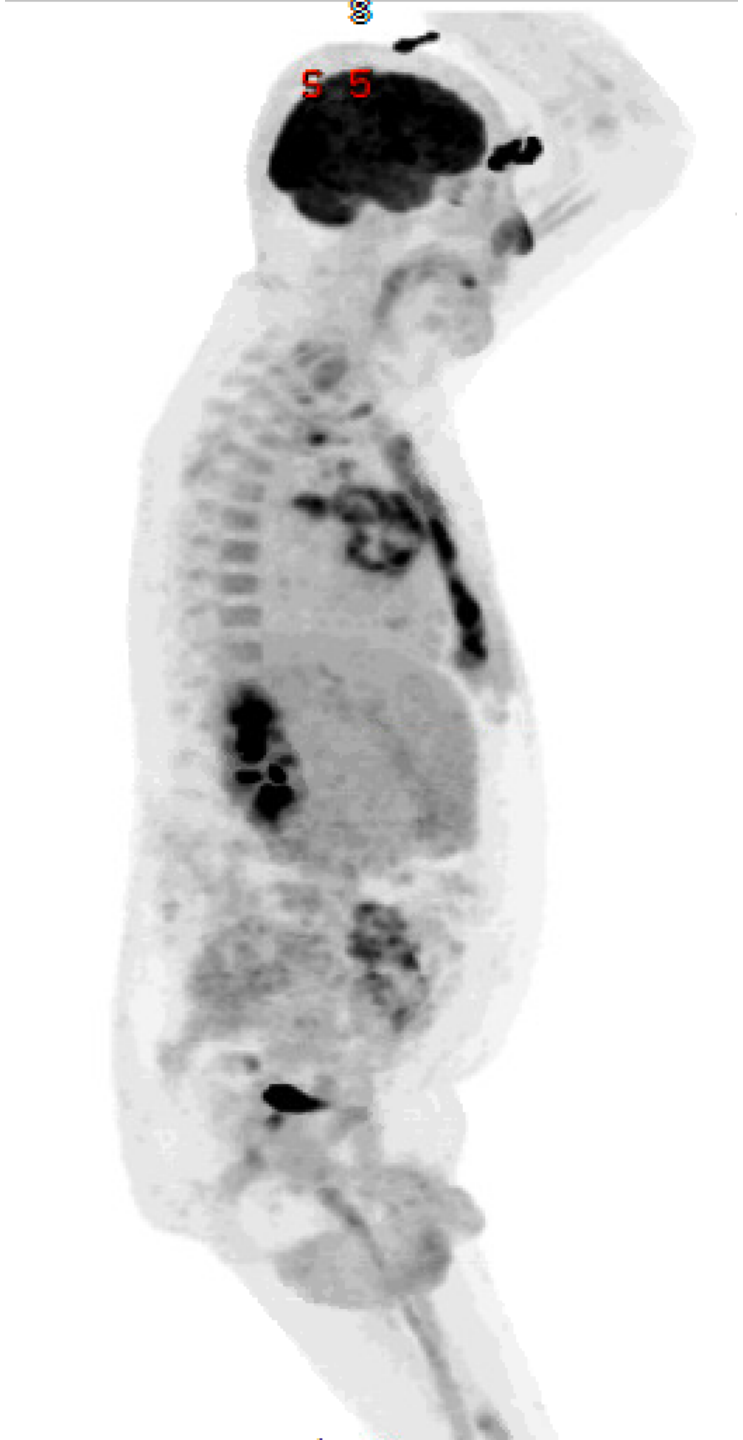
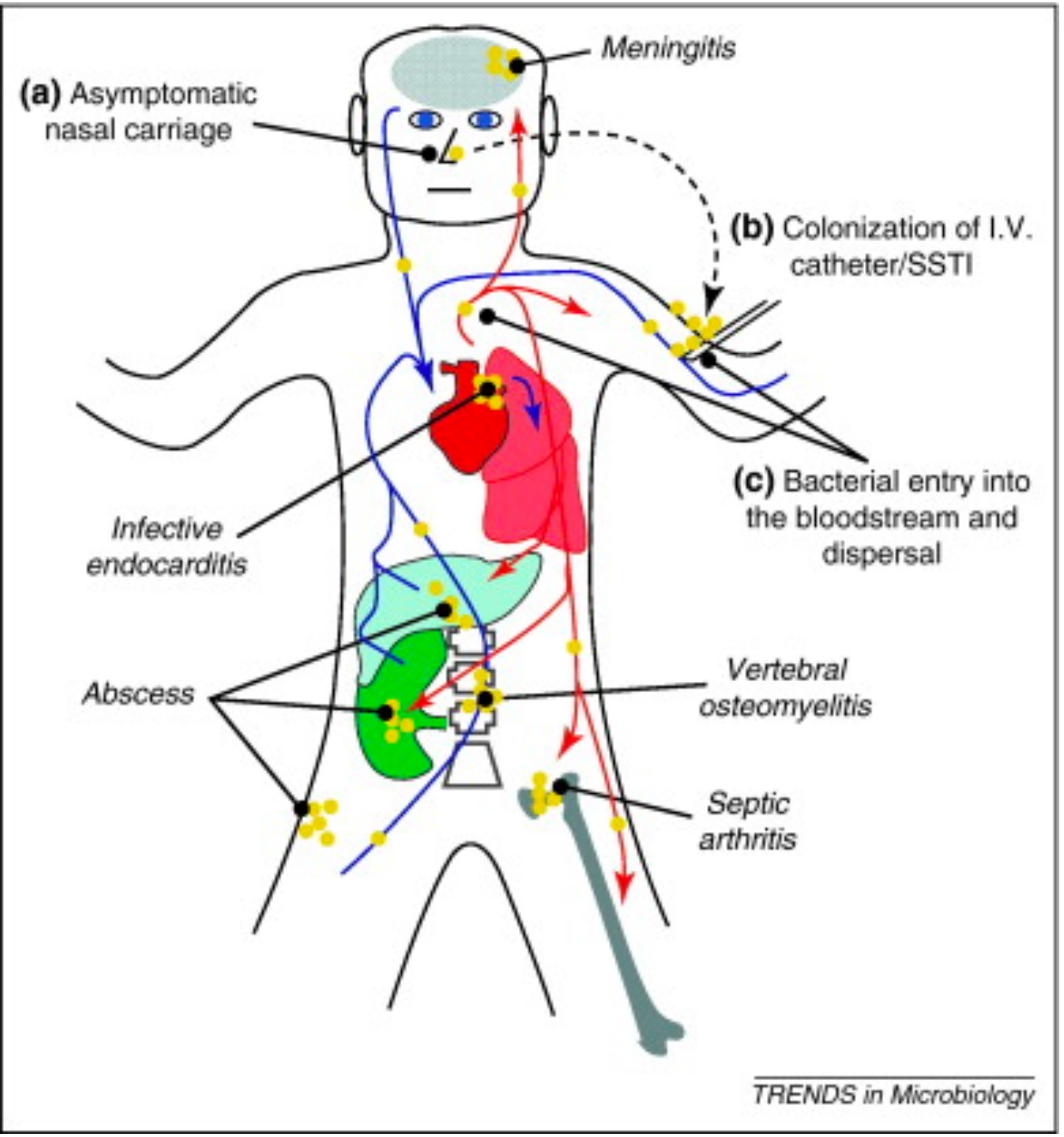
Question: What other imaging would you like?



Culture Results:
BCx (8/3): pending
Sternal Bone Cx (7/31): few staph aureus
Chest Wall Wound Tissue Culture (7/31): rare MRSA
Mediastinal Tissue Culture (7/31): NGTD
BCx (7/29): MRSA in 2/4
BCx (7/28): MRSA in 2/4
BCx (7/26): MRSA in 1/4

PET/CT:

- Pseudoaneurysm along the ascending thoracic aorta
- Anterior mediastinal abscess, 6.5 x 4.4 cm
- Aortic valve not effected…at this point



Staph aureus Virulence Factors:

- Surface proteins → colonization
- Invasins → bacterial spread
- Pro-thrombotic
- Inhibits phagocytic engulfment, biofilms
- Protein A, catalase → immunologic disguises
- Lysis of host cell membranes
- Exotoxins → TSS, food poisoning
- MecA gene → PBP2a = resistance to beta-lactams

Persistent MRSA Bacteremia

1. Source control
2. Source control
3. Source control

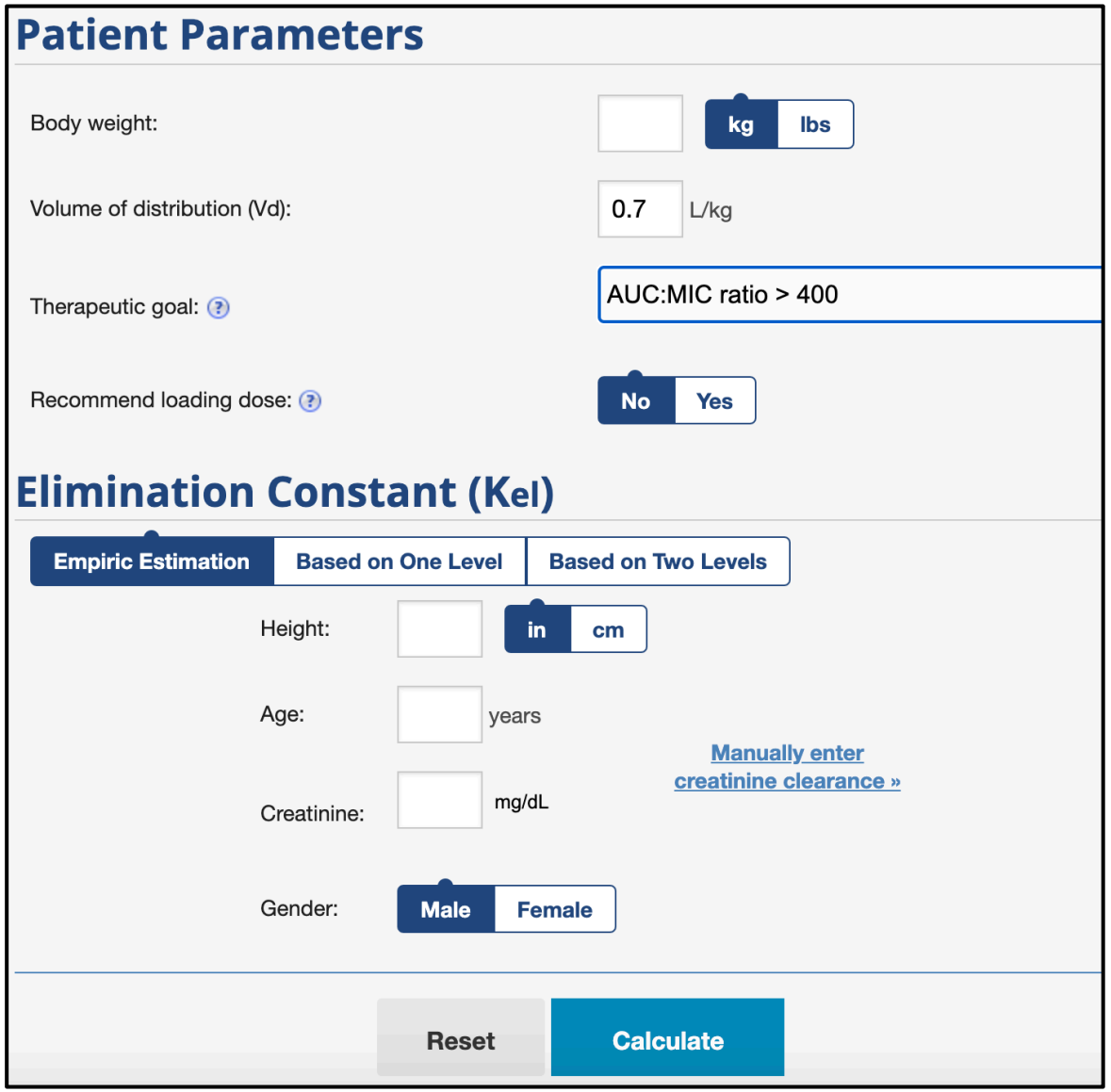
With persistent bacteremia, it’s not a failure of antibiotics, it’s a failure of source control.

Antibiotic Options for MRSA Bacteremia

1. Vancomycin
   - Troughs/AUC, AKI, dosing
2. Daptomycin
   - Daily dosing, costly, no lung covg
3. Ceftaroline
   - Dose frequency, costly, restricted
4. ?Dalbavancin
   - Weekly/no central line, harm reduction

Vancomycin AUC Monitoring better than Trough Goals

Decreased nephrotoxicity



Case 3

- 35 yo M injects drugs presents with fever.
- Track marks noted including one with cellulitis. R elbow is red & swollen.
- CT chest shows findings c/w septic emboli.
- TTE day 1 negative. TEE on day 3 with TV vegetation.
- Undergoes washout of the septic elbow.
- Vancomycin with subtherapeutic levels till on q8h dosing.
- BCx skip days but eventually clear.
- Pt uninsured. Can’t get a PICC.

What will this patient discharge on?

Case 3

What will this patient discharge on?

(There's no right answer here).

-Often patient stays inpatient to complete antibiotic course. (Treat their addiction so they don't leave AMA).

-Dalbavancin – a great option if authorized

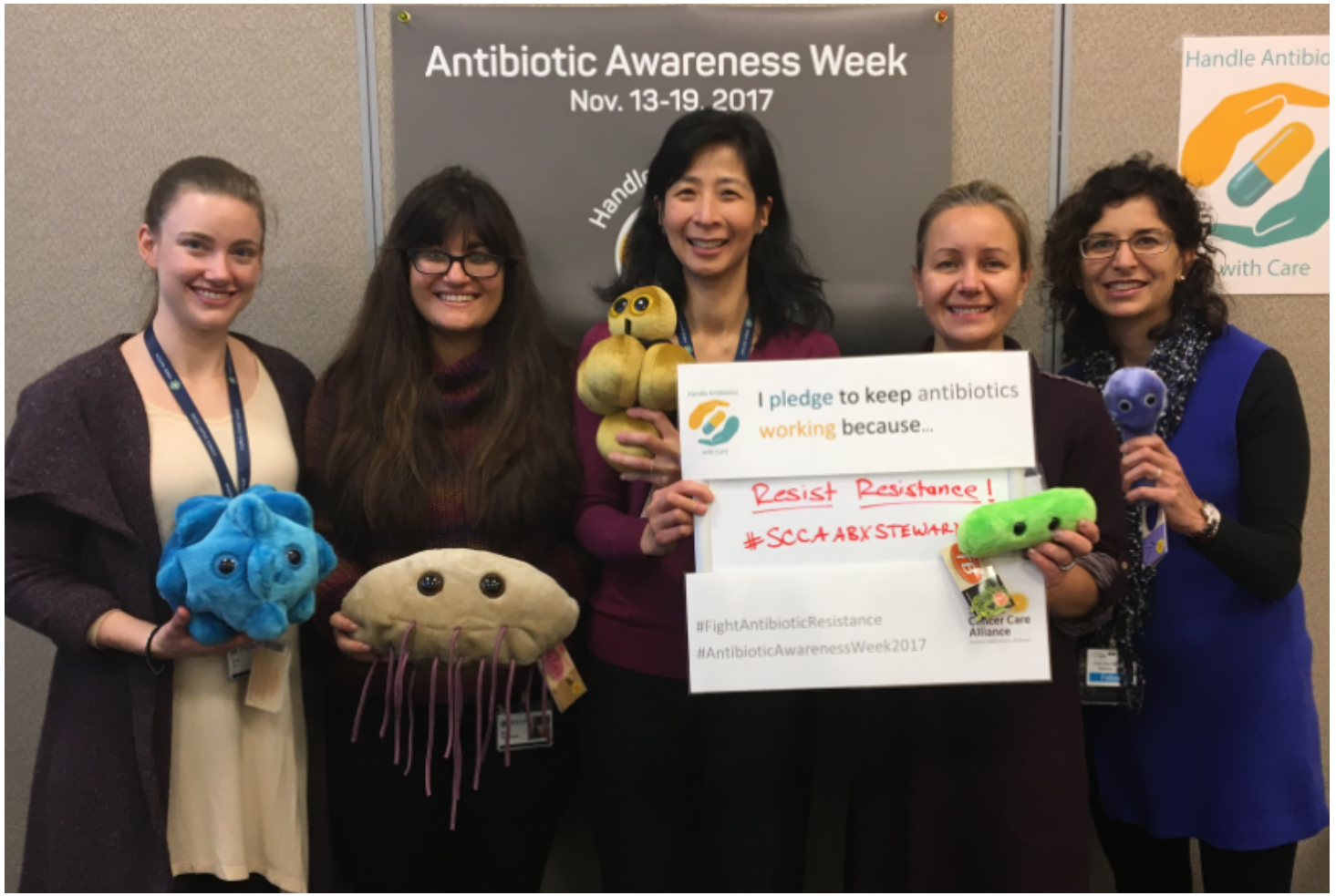
-Daptomycin via PICC with tamper-proof tape

(Hospital eats the cost of all these options)

-Oral anti-MRSA antibiotics if patient leaves AMA (Not ideal, but harm reduction)

SAB Management Take Home Points

- ✓Remove any central lines ASAP
- ✓Consult ID
- ✓Address indwelling hardware/devices
- ✓Repeat BCXs daily until clear min 2 days
- ✓No new lines or devices until cleared >48h
- ✓Target antibiotic to MSSA upon identification
- ✓Duration: 2 weeks is the exception (Most patients are complicated SAB & need 4-6 wks)
- ✓Don’t hesitate to get the TEE!



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