Positive Blood Cultures

Tim Ryan, DOI Div. G Chmpn

Outline

- Who, what, when, where, why, how?
- Interpretation of results
- Considerations for certain organisms
  - S. Aureus, Candida, GNR

Don’t Bury the Lede

- A report of positive blood cultures is important and should demand your full attention and appropriate action

- Some microbes are always pathogens, some are almost always contaminants

- Obtaining cultures properly is essential to making these calls (minimize false negatives and false positives).

Blood Cultures

- Even in sepsis, the amount of bacteria in the blood is low, and is often intermittent.

- Yield is most affected by:
  - Technique
  - Volume in tube
  - Number of cultures
  - Drawn before antibiotics administered

Drawing Blood Cultures

- Avoid pulling from lines
- Norberg et al. JAMA 2003, 9.1% (new ED IV) vs. 2.8% (dedicated procedure) false positive rate
- Indwelling line hubs colonized with skin flora
  - CoNS, diptheroids, micrococcus, viridans strep.
- If you must, get a peripheral set concurrently

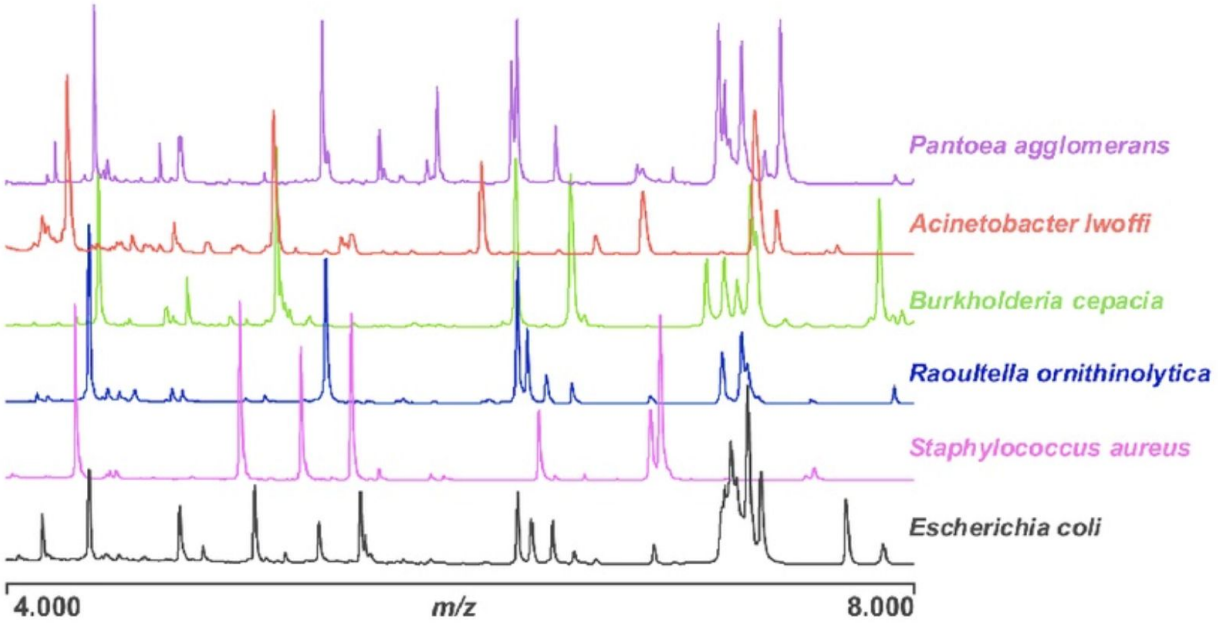
- How many? Cumulative yield true pathogens per set
  - 1 (73-80%), 2 (80-95%), 3 (95-99%), 4 (99-100%)
  - Lee et al. JCM 2007

Drawing Blood Cultures

- How much?
  - 2 sets: 10 cc x 2 bottles per set = 40 cc
  - Mermel et al. Annals Int Med (1993) 92% vs. 63% positive high vs. low volume.
- When?
  - Immediately, before antibiotics.
  - No change in attaining over an interval, waiting for temperature spike
- How long?
  - Incubated 5 days
  - Most clinically significant BSI result <48h
  - Fungemia, fastidious HACEKs even result by 5 days
  - If >72h consider contaminant (exceptions: HACEK, prior abx, Brucella)

Positive Blood Culture

- First ID is gram stain: G+ cocci, G- cocci, G+ rods, G- rods, budding yeast
- MALDI-TOF ID species
-



The Clinical and Prognostic Importance of Positive Blood Cultures in Adults

Brian C. Pien, MD,[a,b] Punidha Sundaram, MD,[c] Natalia Raoof, MD,[c] Sylvia F. Costa, MD,[a,d] Stanley Mirrett, MS,[a] Christopher W. Woods, MD,[b,d,e] L. Barth Reller, MD,[a,d,e] Melvin P. Weinstein, MD[c,f]

[a]Clinical Microbiology Laboratory, Duke University Medical Center, Durham, NC; [b]Durham Veterans Affairs Medical Center, NC; [c]Department of Medicine, Robert Wood Johnson Medical School, New Brunswick, NJ; [d]Department of Medicine and [e]Department of Pathology, Duke University School of Medicine, Durham, NC; [f]Department of Pathology, Robert Wood Johnson Medical School, New Brunswick, NJ.

Retrospective assessment of hospitalized adults with positive blood cultures at 3 academic centers.

Assessed: Number of positive cultures, plausible source, clinical correlation

- 2269 isolates: 51% true BSI, 41% contaminant, 8% unknown

Pien et al. 2010 - Gram Positives

	Total	True BSI		Contaminant		Unknown Significance	
Microorganism	n	n	%	n	%	n	%
Coagulase-negative staphylococci	1005	105	10	828	82	72	7
Staphylococcus aureus	339	315	93	4	1	20	6
Enterococcus spp.	203	128	63	23	11	52	26
Viridans group streptococci	98	29	30	54	55	15	15
Streptococcus pneumoniae	26	26	100	0	0	0	0
Beta-hemolytic streptococci	32	31	97	0	0	1	3
Corynebacterium spp.	86	7	8	76	88	3	3
Bacillus spp.	33	0	0	33	100	0	0
Micrococcus spp.	14	0	0	14	100	0	0
Lactobacillus spp.	10	4	40	6	60	0	0
Other Gram-positives	13	3	23	9	69	1	8

Pien et al. 2010 - Gram Negatives

	Total	True BSI		Contaminant		Unknown Significance	
Microorganism	**n**	**n**	**%**	**n**	**%**	**n**	**%**
Escherichia coli	175	170	97	1	1	4	2
Klebsiella pneumoniae	118	112	95	1	1	5	4
Enterobacter cloacae	46	43	93	0	0	3	7
Serratia marcescens	42	39	93	0	0	3	7
Proteus mirabilis	25	25	100	0	0	0	0
Other Enterobacteriaceae	62	62	100	0	0	0	0
Pseudomonas aeruginosa	52	50	96	2	4	0	0
Stenotrophomonas maltophilia	11	8	73	0	0	3	27
Acinetobacter baumanii	15	10	67	0	0	5	33
Other Gram-negatives	22	12	55	5	23	5	23

True BSI?

Always:

- Staphylococcus Aureus, Streptococcus pneumoniae, Group A/B Streptococci, Enterobacteriaceae, Haemophilus Influenza, Pseudomonas Aeruginosa, Bacteroidaceae, Candida species

Probable:

- Enterococci, Viridans Group Strep

Rarely:

- Propionibacterium acnes, Cornyebacterium sp., Bacillus sp., Micrococcus sp., Coagulase negative staphylococci (except Lugdunensis)

75% of true BSI p/w 2/2 positive, 25% of true BSI p/w 1/2 positive

True BSI Take Home

Some microbes are always pathogens.

Some microbes are never contaminants.

Same microbe in >1 culture - treat as real. Single positives can be pathogens so consider all positives carefully.

Beware prosthetics and hardware (positive more likely to be true).

Calling a contaminant?

Hard contaminant requirements: Only 1 positive. Known contaminant species.

Soft contaminant requirements: Long time to positive. Clinically not correlating (patient non-infectious).


6'6"
6'0"
5'6"
5'0"
4'6"
4'0"
3'6"
3'0"

Staphylococcus Aureus

Case: 62F with DM, HTN p/w leg furnacle with surrounding cellulitis. HD stable, temperature 100.3. I&D in ED, blood cultures attained, sent home on PO clindamycin. Next day blood cultures 2/2 +MRSA, both clindamycin susceptible.

Next step:

A) Call patient, reassure, continue current abx.
B) Call patient, advise to come back to hospital for admission.
C) Call patient, change antibiotic to home IV vancomycin for 2 weeks.

Staphylococcus Aureus

- S. Aureus is a terrible organism that causes frequent metastatic disease.
  - IE, septic arthritis, vertebral OM, epidural/psoas/deep tissue abscess, meningitis
- Requires 4-6 weeks IV treatment.
- All patients need echocardiogram (ideally TEE)
- Anti-staph beta-lactams much better than vancomycin at killing.
- If hardware is involved, it must come out.
- If pus is involved, it must be drained.

Staphylococcus Aureus

Technically, there is a “uncomplicated” group of S. Aureus infections that are candidates for 14 days IV anti-staphylococcal therapy.

They must meet the ALL of the following criteria:

- Fever resolved within 72h
- Negative surveillance cultures drawn 48-96h from first positive set
- Negative echocardiogram
- No evidence of focal infection
- No immunocompromised state including DM.

Staphylococcus Aureus Treatment Failure

Considered if persistent fevers, bacteremia.

Median time to clearance: MSSA - 4 days, MRSA - 7 days.

Some recommend change to daptomycin (except pneumonia) plus another agent.

Alternatively and a likely better recommendation: Ensure adequate vancomycin level, proper source control/hardware removal.

IM/ID should be involved in these cases.

Candidemia

Always a pathogen warranting immediate antifungal coverage.

Risk factors: really sick (acutely or chronically), immunocompromised.

Entry tracts: GI (recent thoracic/mediastinal involving esophagus/abdominal surgery), plastic, localized focus.

Candidemia

- Treatment:
  - Echinocandins (Caspofungin, micafungin)
  - Amphotericin B
  - Azoles
- Azoles not suitable for very ill.
- C. Krusei, C. Glabrata have inherent resistance (in some areas represent >30% of all infections).
- Need ophtho consult, IM/ID here too.
- Plastic out, TPN stopped, daily blood cultures until clearance then 2 weeks IV.

Gram Negative Rods on Blood Culture

1. Severe sepsis or shock
2. Immunocompromised
3. Healthcare or pseudomonas risk factor

Empiric anti-pseudomonal, second agent if high-resistance and critically ill (US).

Single agents: ceftazidime(+avibactam), pipercillin-tazobactam, mero-/erta-/imi-penem

Second agents: Ciprofloxacin, levofloxacin, gentamycin, tobramycin

Duration Therapy for GNR BSI

Depends on initial source and clinical response.

Most cases 7-14 days.

Initial route IV, once afebrile 48h can switch to PO with good susceptibility and high bioavailability (think FQ).

A Couple More Things to Consider

- Surveillance
- Duration

Surveillance Cultures - When to get?

- 1-2 days after starting antibiotics.
- Critical for S. Aureus, Candida sp.
- If fever, leukocytosis 72h after antibiosis.
- Known or suspected IE, joint, CNS, abscess as source.
- Unknown source BSI.
- Hardware indwelling (prosthesis, central lines, pacemakers).
- MDR organisms.
- EVERYONE except quickly resolving sepsis from simple G- urinary source

Treatment Duration

- Whatever bug + recommended duration, date of initiation is the first day of proven clearance.
- Day 1 = Date drawn of first negative finalized culture.

IM/ID BSI final recommendations should include:

Organism, source of infection, antibiotic history for current infection, date of first negative culture, antibiotic route, antibiotic end date, antibiotic dose.

Questions?

Please call IM on call if there are ever any questions regarding next steps in BSI management.