Wound Culture Interpretation:  
*Not as difficult as you may think*

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Objectives

Discuss methods to assess specimen quality using the direct gram stain.

Understand how to utilize Gram stain results to aid in the work-up of bacteriology wound cultures.

Review a new CAP requirement for utilizing the Gram stain.

Design and implement clinically relevant, timely approaches for cost-effective wound culture work-up.
Still striving…

The major goal of the clinical microbiology laboratory is to provide information of maximal clinical usefulness as rapidly as is consistent with acceptable accuracy and minimal cost.

Jay P. Sanford, MD (1974)
Utility of the Gram Stain

- Rapid, inexpensive, informational

- Evaluation of specimen quality
  - Identify superficially contaminated specimens
  - Enhance discrimination between samples with potential pathogens vs. colonizing flora

- Presumptive organism ID
  - Guide rational selection of preliminary antibiotic therapy
  - Guides interpretation of culture results
Utility of the Gram Stain

  - There was selection of appropriate monotherapy 94% of the time when guided by bacterial morphotypes from the gram stain.
Enteric-like Gram negative bacilli
Gram negative coccobacilli suggestive of *Haemophilus*
Non-enteric Gram negative bacilli
Gram negative diplococci suggestive of *Moraxella*
Gram positive cocci suggestive of Pneumococcus
Gram positive cocci suggestive of *Staphylococcus*
Gram positive cocci suggestive of *Streptococcus*
Gram positive bacilli suggestive of *Bacillus/Clostridium*

Gram positive bacilli suggestive of *Diphtheroids*
Yeast
Work up of Wound Cultures:

- Culture work up
  - 2 Systematic approaches
Work up of Wound Cultures

- Resident flora
- Colonizing organisms
- Pathogens
Work up of Wound Cultures:
Clinical Relevance

- There are no clear guidelines for working up bacterial cultures.
  - literature
  - colleagues

- There seems to be a need for some consistency when performing culture work up.
  - uniformity in work up and reporting of bacterial isolates
**NEW** 07/11/2011

MIC.21530 Direct Gram Stains
The laboratory has protocols in place to use gram stain results to provide a preliminary identification of organisms, evaluate specimen quality when appropriate, and to guide work-up of cultures.

**NOTE:** The laboratory should have guidelines for the interpretation of the gram stain reaction of the organism, morphology of the organism, and the quantification of organisms and cells. The protocol should address correlation of direct gram stain results with final culture results.
Poor Quality
Specimen Quality

Premise:

- PMN are an indication of infection or inflammation
- SEC indicate superficial contamination = If a specimen contains a large amount of SEC, superficial contamination is likely
  - the specimen should “ideally” be recollected (resp)
  - alternatively, bacteria isolated from such specimens should be minimally worked up (wounds)
- Extensive testing on heavily mixed cultures should not routinely be performed.
Work up of Wound Cultures:

Two approaches*

- Q-Score System
- Q/234 System

* 2004: ASM Cumitech 7B: Lower Respiratory Tract Infections (can also be used for wounds)
Work up of Wound Cultures: Q-Score System (RC Bartlett, 1974)

“Q-SCORE” = # of potential pathogens (PP) to work up

**Key:**
- 0 = no cells
- 1 = 1-9/lpf
- 2 = 10-24/lpf
- 3 = ≥25/lpf

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**Neutrophils**

- (+) Q0 = no cult
- (+) Q1 = 1PP
- (+) Q2 = 2PP
- (+) Q3 = 3PP
Work up of Wound Cultures: Q-Score System

“Q-Score” system

Up to 3 organisms can be considered potential pathogens (PP) and be worked up (ID/AST) if from a good quality specimen (Q3).

The lower quality of the specimen (e.g., the more SEC present) the fewer the organisms worked up (Q2, Q1).
Work up of Wound Cultures: Q-Score System

“Q-Score” system

# PP in culture ≤ Q-score: work up PP with ID/AST
(2PP) (Q3)

# PP in culture > Q-score: Look to Gram stain
(3PP) (Q2)

- Work up PP that were seen in Gram stain with ID/AST
- If all PP in the culture are seen in Gram stain
  = do not work up; morphological identify (MID) them
Work up of Wound Cultures: Q/234 System

Gram stain Quality Check: PMN & SEC
Reject any sputum for culture according to normal protocol.

Culture work up is based on number of PP present:
- 2PP = Work up (< 2 PP)
- 4PP = MID
- 3PP = Look to Gram stain*

*Work up to 2 PP if they are seen in the GS.
If all 3 PP are seen in the GS, MID all 3.

NOTE: If mixed flora > PPs = MID PPs.
Example 1: wound

- GS: mod. PMN (+2), few SEC (-1), my gpc/clusters (staph), my gpc/chains (strep)
- CULT: my *S.aureus*, mod. β-strep, mod. coag - staph, few diphtheroids

- WORK UP:
  - Q-Score (Q1= 1PP):
  - Q/2-3-4 (2 PP):
Example 1: wound

- GS: mod. PMN (+2), few SEC (-1), my gpc/clusters (staph), my gpc/chains (strep)
- CULT: my *S.aureus*, mod. β-strep, mod. coag - staph, few diphtheroids

- WORK UP:
  - Q-Score (Q1= 1PP): > MID SAU, β-Strep, & report mixed flora
  - Q/2-3-4 (2 PP):
Example 1: wound

- **GS:** mod. PMN (+2), few SEC (-1), my gpc/clusters (staph), my gpc/chains (strep)

- **CULT:** my *S. aureus*, mod. β-strep, mod. coag - staph, few diphtheroids

- **WORK UP:**
  - **Q-Score (Q1= 1PP):** > MID SAU, β-Strep, & report mixed flora
  - **Q/2-3-4 (2 PP):** > Work up SAU & β-Strep, & report mixed flora
Example 2: wound

- GS: my PMN (+3), no SEC (0), my gnr (enterics), my gncb
- CULT: mod. Kleb sp., mod. *Bacteroides* sp., few *Enterococcus*

- WORK UP:
  - Q-Score (Q3=3PP):
  - Q/2-3-4 (3PP):
Example 2: wound

- GS: my PMN (+3), no SEC (0), my gnr (enterics), my gncb
- CULT: mod. Kleb sp., mod. *Bacteroides* sp., few *Enterococcus*

**WORK UP:**
- Q-Score (Q3=3PP): > Work up Kleb, *Enterococcus* & *Bacteroides* sp.
- Q/2-3-4 (3PP):
Example 2: wound

- GS: my PMN (+3), no SEC (0), my gnr (enterics), my gncb
- CULT: mod. Kleb sp., mod. *Bacteroides* sp., few *Enterococcus*

- WORK UP:
  - Q-Score (Q3=3PP): > Work up Kleb, *Enterococcus* & *Bacteroides* sp.
  - Q/2-3-4 (3PP): > Work up Kleb & *Bacteroides* sp. > MID *Enterococcus*
Premise for “Q” systems

- Based on published prevalence of potential pathogen colonization of the oropharynx;

- The more superficially contaminated the specimen, the higher the # of colonizing organisms present;

- Quality of specimen is important in determining acceptability of specimen and extent of culture work up;

- If organisms seen in smear, greater chance they are associated with an infective process.
Advantages for “Q” systems

1. Offers a consistent approach for interpreting cultures:
   - Based on specimen quality (primarily SECs).
   - Based on organisms seen in Gram stain (if see organism on smear, should be in a significant number in the specimen, \( \geq 10^5 / \text{ml} \)).
   - Limits # of organisms worked up from mixed cultures, so that the reporting of misleading information can be minimized.
Advantages for “Q” systems

2. No Potential Pathogen is ever ignored:

- All PP reported; but may not be fully identified or have full AST performed.

- The pathogens that some believe should “ALWAYS BE WORKED UP”, such as *S. aureus, b-strep, P. aeruginosa* are identified and always indicated on the report.

- Can be modified to include screening for MRSA, VRE, ESBLs, etc.
Advantages for “Q” systems

3. Guidelines:

- The Q-Systems offer “Guidelines” for a systematic culture interpretation approach

- These Guidelines are just that = Guidelines! Exceptions can be made if necessary.

- Any concerned physician can consult with microbiology to have further work performed on any culture if clinically indicated.
Q-References:


Of the 305 wound cultures evaluated over 3 months, 147 (48%) and 84 (28%) would have been interpreted differently with Q-score and Q234 systems, respectively, as compared to their routine wound procedure. Routine procedure = work up to 3 organisms per culture. The majority of these differences were the result of unnecessary culture work-up utilizing their routine procedure.
Matkoski, et. al.

The reagent cost savings as compared to the routine procedure were greatest with Q score:
- Q-score: $4895 per year
- Q234: $1503 per year

The cost savings would increase for both Q-systems if technologist time were factored in as well.
Although the Q-score had a yearly savings of $3,392 over the Q234 system and would have eliminated more culture work-up, it had several issues that would need to be addressed prior to implementation:

- Would require physician approval for not culturing specimens with a Q-score of zero (Q0)

- Would require the training on all shifts to examine the Gram stain and generate a Q-score
  - the Q234 system did not require a different interpretation of direct smears
Matkoski, et. al.
Conclusions:

- Both the Q-score and the Q234 systems showed clinical relevance, cost effectiveness and would allow for standardized approaches to the work up of wound cultures.

- The Q234 system proved to be a more practical procedure to implement in their laboratory.

- The Q234 system does not require a change in Gram stain interpretation or physician approval for specimen rejection.
Matkoski, et. al.  
Conclusions (cont’d):

- All PP are reported from a culture with either ID or MID, allowing for further consultation with the ordering physician if clinically warranted.

- The Q234 system, which is more structured and cost-effective than their current method, was acceptable to the ID physicians.

- Allowed technologists to make more independent & consistent decisions about the significance of organisms in a wound culture.
Gram stain of direct specimens is useful:

- Specimen quality assessment
- Rapid presumptive identification
- Guide culture work up
- Be compliant with new CAP checklist item
“Mind your Ps and Qs”

- Determine your “Ps” (potential pathogens)
- Pick one of the “Qs” (Q systems)
- Report consistent and clinically-relevant wound culture results
Sterile site work up?
Sterile site work up?

Q234 → Q345:
Sterile site work up?

Q345:

- Culture work up is based on number of PP present:
  - 3 PP = work up (< 3 PP)
  - 5 PP = MID
  - 4 PP = Look to Gram stain*

- Work up to 3 PP if they are seen in the GS.
- If all 4 PP are seen in the GS, MID all 4.
Still striving...

The major goal of the clinical microbiology laboratory is to provide information of maximal clinical usefulness as rapidly as is consistent with acceptable accuracy and minimal cost.

— Jay P. Sanford, MD (1974)
thrive