What is PFGE Telling Us...

Are We Listening?

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Objectives

- Present some of the challenges we faced with running PFGE on VRE & MRSA/MSSA isolates
- How do we help without opening the flood gates for PFGE testing?
- Do the results make a difference?
## VRE Results in 3 Days Instead of 7 Days

<table>
<thead>
<tr>
<th>Day 0</th>
<th>Isolate on BAP</th>
<th>Day 0</th>
<th>Isolate on BAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Single colony pick to BHI</td>
<td>Make cell suspension</td>
<td>Make cell suspension</td>
</tr>
<tr>
<td></td>
<td>Incubate 18-24 hrs</td>
<td>Make plugs</td>
<td>Make plugs</td>
</tr>
<tr>
<td>Day 2</td>
<td>Make cell suspension</td>
<td>Lyse for &gt; 2 hrs</td>
<td>Lyse for &gt; 2 hrs</td>
</tr>
<tr>
<td></td>
<td>Centrifuge to remove BHI</td>
<td>Wash &gt;5 times, 15 mins each</td>
<td>Wash &gt;5 times, 15 mins each</td>
</tr>
<tr>
<td></td>
<td>Make plugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 3</td>
<td>Lyse for 24hrs (or over weekend)</td>
<td></td>
<td>Day 1</td>
</tr>
<tr>
<td>Day 4</td>
<td>Wash &gt;8 times, 30 mins each</td>
<td></td>
<td>Load</td>
</tr>
<tr>
<td>Day 5</td>
<td>Restrict 4 hrs at 25C</td>
<td></td>
<td>Day 2</td>
</tr>
<tr>
<td></td>
<td>Load</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A partnership was formed
Case 1: Cluster in ICU?
Case 1: Cluster in ICU?

Identified 3 nosocomial VRE cases within a 2 week period

1 week later:
- 1 additional VRE case
- 1 of 3 initial cases expires

2 weeks from initial alert:
- 1 additional VRE case

Interventions

- Case investigation
- Cluster Alert
- Increased environmental cleaning
- Increase awareness of HH, PPE compliance
- Additional environmental cleaning
- PFGE testing
Case 1: VRE isolates in ICU

Case 1: VRE isolates in ICU

Source | PFGE pattern | PFGE Pattern Interpretation
---|---|---
Urine | ENT00099 | Indistinguishable
Rectal | ENT00099 | Indistinguishable
Case 1: What happened?

A: COLONIZED

Next day

B: 2 WEEKS LATER

2 days later

C: COLONIZED

Patient dies
Case 1: What did they have in common?

Adjacent Rooms

NURSES’ STATION
Cluster or not a cluster?

**Cluster**

- 1 strain between 3 patients
- Combination of nosocomial and present on admission
- Consistent with **healthcare worker transmission**

**Interventions**

- Deep cleaning of rooms decrease bioburden
- Educate: Aggressive hand hygiene
- Concluded cluster after 3 weeks of no new VRE cases
- Returned to regular cleaning schedule
Case 2: Cluster in Surgical Unit?
Case 2: Cluster in Surgical Unit?

Identified 4 nosocomial VRE cases within a 3 week period (above norm: 2-5 per quarter)

1 week later:
1 additional VRE case

- Case investigation
- “Heightened Awareness” Alert (all but 1 discharged)

- Initiated Cluster Alert
- Extra cleaning
- PFGE testing
Case 2: PFGE Results

Source | PFGE pattern | PFGE Pattern Interpretation
--- | --- | ---
Urine | ENT00099 | Indistinguishable
Rectal | ENT00099 | Indistinguishable
Case 2: What Happened In This Room?

Patient A  Day 1: Admit  →  Day 4: Discharged

Patient B  Day 5: Admit  →  Day 6: Discharged

Patient C  Day 6: Admit  →  Day 7: Discharged

Patient D  Day 9: Admit  →  Day 14: Environmental Transmission

Environmental Transmission
Cluster?

- Not a cluster, true transmission
- 1 strain between 2 pts
- Never in same unit at the same time
- Never in hospital at the same time BUT, was in same room 5 days apart
- Consistent with Environmental contamination

Interventions

- Deep cleaning of common room
- Educate staff and housekeepers regarding quality cleaning
- No new VRE cases
What’s Left Behind? 
Room Contamination After a Terminal Discharge Cleaning Procedure

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>% Contaminated After Discharge Cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA ¹</td>
<td>74% of surface cultures</td>
</tr>
<tr>
<td>MRSA ²</td>
<td>46% of rooms</td>
</tr>
<tr>
<td>MRSA ³</td>
<td>24% of rooms</td>
</tr>
<tr>
<td>VRE ³</td>
<td>22% of rooms</td>
</tr>
<tr>
<td>VRE ⁴</td>
<td>16% of rooms</td>
</tr>
</tbody>
</table>

¹ French GL et al. J Hosp Infect 2004;57:31-7
Case 3: Cluster of MRSA & MSSA in a Neonatal ICU?
Case 3: A potential cluster MRSA & MSSA in a Neonatal ICU

Month 1

1A
+MRSA
✓ Wound
✓ Nares screen

2
+MSSA
✓ Eye drainage

Month 2

3
+MSSA
✓ Blood

4A
+MSSA
✓ Blood
✓ Eye drainage
✓ Nares screen

!!!
Unexpectedly expires
Case 3: Additional Cases

- **Month 1**:
  - **1A**: +MRSA
    - ✓ Wound
    - ✓ Nares screen
  - **2**: +MSSA
    - ✓ Eye drainage

- **Month 2**: 3
  - **3**: +MSSA
    - ✓ Blood
  - **4A**: +MSSA
    - ✓ Blood
    - ✓ Eye drainage
    - !!! Unexpectedly expires

- **Month 3**: 1B, 1C
  - **1B**: +MRSA
    - ✓ Blood
    - ✓ Nares screen
  - **1C**: +MRSA
    - ✓ Blood
    - ✓ Arm pustule

- **Initiate MRSA/MSSA screening of all babies in the unit including previous positive babies.**
Case 3: Situation above the endemic norm

- **Endemic norm:**
  - Cases few and far apart
  - No more than 2 per year

- Unexpected MSSA related death

Cluster Alert
Case 3: Screening Results

- No additional +MRSA patients
- 7 additional +MSSA colonization
  - Up to 30% of population is colonized with any *S. aureus*
- In total:
  - 3 sets of triplets
  - 3 sets of twins
  - 1 singleton

PFGE TESTING
Case 3: PFGE Results

Key | Patient | MRSA or MSSA
---|---------|--------------
13-194-0037 | Twin C | MSSA
13-194-0039 | Baby A | MSSA
13-194-0032 | Twin A | MSSA
13-194-0034 | Twin A | MSSA
13-191-0233 | Triplet B | MSSA
13-191-0234 | Triplet B | MSSA
13-194-0033 | Triplet B | MSSA
13-137-0180 | Triplet A | MRSA
13-184-0203 | Triplet A | MRSA
13-193-0158 | Triplet A | MRSA
13-194-0038 | Twin C | MSSA
13-194-0035 | Twin B | MSSA
13-194-0036 | Twin B | MSSA
Case 3: PFGE Results

6 patients

1A +MRSA +MSSA +MSSA
2 +MSSA
3 +MSSA
4A +MSSA
1B +MRSA
1C +MRSA

7 patients

6A +MSSA
6B +MSSA
7A +MSSA
7B +MSSA
4B +MSSA
6C +MSSA
9 +MSSA

TOTAL 13 patients
Case 3: Interpretation of PFGE

- Each set of twins (except 1) shared the same fingerprint
- None of the fingerprints are common between families
- Cluster? NOT a cluster
- Source Unknown:
  - Chicken or the egg?
    - Was it a staff, parent, or visitor?
    - Parents’ active role in babies activities.

**Interventions**

- Staff: be more conscientious about activities between sets of twins
- Need to emphasize environmental and hand hygiene activities to keep bioburden low
- Educate parents
- Decolonization of known cases
PFGE did make a difference for detection and defining nosocomial clustering in this hospital setting
“The [PFGE] results make serious impact on residents, interns, and attendings alike – as we struggle to improve HH/PPE [Hand Hygiene/Personal Protective Equipment] compliance among MDs, it is this level of epidemiologic inquiry that actually results in a shift in thinking for our MDs (in my opinion)”

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