Persuasion

- Organism Typing for Success

L.E. Nicolle
University of Manitoba
Winnipeg, MB  CANADA
An Outbreak of Group A Streptococcal Bacteremia in an Intensive Care Unit

L.E. Nicolle, MD; K. Hume; H. Sims; T. Rosenal; D. Sandham
Infect Control 1986, 7: 177 - 180
Outbreak: ICU patients

Case 1: GAS wound and blood
54 yr old male admitted cellulitis with septic shock
survived

Case 2: 69 yr old female COPD
improved & extubated
new pneumonia & reintubated 48 hr
GAS sputum and blood
died

Case 3: 74 yr old female
AMI; hospital acquired pneumonia 5 days
GAS sputum & blood
died
Outbreak of GAS Bacteremia in ICU

Infect Control 1986; 177

Figure. Clinical and microbiologic observations during an outbreak of group A streptococcal bacteremia in an Intensive Care Unit.
Attack Rates

- admitted ICU and survived ≥ 24 hr: 9.5%
- not receiving antibiotics effective GAS: 20%
  - not on respirator 0/7
  - on respirator 2/2
Outbreak of GAS Bacteremia in ICU

Infect Control 1986; 177

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**TABLE**

**ASSESSMENT OF POTENTIAL RISK FACTORS BETWEEN INFECTED AND NON-INFECTED PATIENTS**

<table>
<thead>
<tr>
<th>Patients Not Receiving Antibiotics</th>
<th>Not Infected (N=8)</th>
<th>Infected (N=2)</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number female</td>
<td>4</td>
<td>2</td>
<td>.33</td>
</tr>
<tr>
<td>Age (yr): median, range</td>
<td>52 (10-77)</td>
<td>72 (69-74)</td>
<td></td>
</tr>
<tr>
<td>Duration ICU stay (days)</td>
<td>2 (1-3)</td>
<td>2†</td>
<td></td>
</tr>
<tr>
<td>Invasive devices:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vascular lines (excluding peripheral IV)</td>
<td>4</td>
<td>1</td>
<td>.78</td>
</tr>
<tr>
<td>Foley catheter</td>
<td>3</td>
<td>2</td>
<td>.22</td>
</tr>
<tr>
<td>Nasogastric tube</td>
<td>2</td>
<td>1</td>
<td>.53</td>
</tr>
<tr>
<td>Intubation/respirator</td>
<td>1*</td>
<td>2</td>
<td>.06</td>
</tr>
<tr>
<td>Surgical procedures</td>
<td>3</td>
<td>1</td>
<td>.67</td>
</tr>
</tbody>
</table>

*Fisher's Exact Test.
†Duration prior to onset of illness.

* died < 36 hr
GAS Bacteremia: Investigation

- Previous 24 months:
  - 3 of 4 community-acquired
  - Intervals 2 – 7 months
- Outbreak: 3 isolates:
  - MNT; T5/27/44; serum opacity reactive
  - Next month; hospital-acquired bacteremia M30, T9
Outbreak of GAS Bacteremia in ICU

Figure. Clinical and microbiologic observations during an outbreak of group A streptococcal bacteremia in an Intensive Care Unit.
Outbreak of GAS Bacteremia in the ICU

- notified unit*
- reviewed procedures
- staff cultures
  - with pharyngitis/skin lesions (none)
  - throat/nasal cultures 89 staff-negative
- penicillin to all patients without antibiotics (none)
An Outbreak of *Staphylococcus aureus* Sternal Wound Infections in Patients Undergoing Coronary Artery Bypass Surgery

AJIC 1991; 92 - 97

J. McLeod, RN, CIC; L. Nicolle, MD; S. Parker, MD; A. Maniar, PhD; M. McGill, RN; A. Yassi, MD.

Sternal wound infections: *S. aureus*

Jan 1 – May 2, 1988 (4 mo): – 0
May 5 – June 2, 1988 (< 1 mo): – 5 (33%)
An Outbreak of *Staphylococcus aureus* Sternal Wound Infections in Patients Undergoing Coronary Artery Bypass Surgery

Table 1. Predisposing factors for sternal wound infections after CABG procedures. Asterisk, by t test; double asterisk, by Fisher's Exact Test.

<table>
<thead>
<tr>
<th>Age (mean years ± SD)</th>
<th>Controls (n=12)</th>
<th>Cases (n=5)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>61±17</td>
<td>65±7</td>
<td>0.30*</td>
</tr>
</tbody>
</table>

| Sex (M/F)             | 11/1            | 3/2         | 0.20**  |

<table>
<thead>
<tr>
<th>Operative time (mean minutes±SD)</th>
<th>Controls (n=12)</th>
<th>Cases (n=5)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>244±53</td>
<td>298±53</td>
<td>0.04*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean time between administration of preoperative antimicrobials to incision time (mean minutes±SD)</th>
<th>Controls (n=12)</th>
<th>Cases (n=5)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>154±62</td>
<td>220±93</td>
<td>0.06*</td>
</tr>
</tbody>
</table>

- same surgeon and staff
  - ? staff carrier

“usual suspects”
An Outbreak of *Staphylococcus aureus* Sternal Wound Infections in Patients Undergoing Coronary Artery Bypass Surgery

2 patients/one scrub nurse/one anesthetist  phage 96
1 patient/one nurse  phase 29
• no single strain
• no clear staff implicated
• ? other factors
An Outbreak of *Staphylococcus aureus* Sternal Wound Infections in Patients Undergoing Coronary Artery Bypass Surgery

Meteorologic summary: Winnipeg: Environment Canada, 1988

HVAC standards: temperature 21 - 24°C
humidity 45% - 60%

Discussion with staff:
- HVAC no longer meets standards
- afternoon temperatures: 30°C some theatres
- window air conditioners functioning poorly

* infections
An Outbreak of *Staphylococcus aureus* Sternal Wound Infections in Patients Undergoing Coronary Artery Bypass Surgery

AJIC 1991; 92

Interventions:

- timing of antimicrobial prophylaxis
- additional air conditioning units
- monitoring temperature and humidity in OR’s*
- continued surveillance
Transmission of Hepatitis C in a Pharmacologic Study

ICHE 2001; 22:697-700

R. Saginur, MD; J. Nixon, MD; B. Devries, RN, BScN, CIC; N. Bruce, RN, BScN, CIC; C. Carruthers, MD; L. Scully, MD; R. Berger, ART (CSMLS); J. Leech, MD; L. Nicolle, MD; A. Mackenzie, MD

5 respiratory therapists HCV positive
Transmission of Hepatitis C in a Pharmacologic Study

ICHE 2001; 22:697-700

HCV testing on stored specimens for study

V: acute symptoms: 1992
W: minimal ↑
LF: 1992

FIGURE. Relation between seroconversion and participation in pharmacologic studies.
Transmission of Hepatitis C in a Pharmacologic Study
ICHE 2001; 22:697-700

Outbreak Investigation

- pharmacologic studies
- respiratory therapists were volunteers
- index case: dermatitis
- intravenous cannula
  - same syringe to flush
- Genotyping: HCV

Genotype 1a; 96% homology in hypervariable segment of E1 region
Transmission of Hepatitis C in a Pharmacologic Study

Patient Follow-up

Patient follow-up: rationale

- index routinely performed outpatient arterial puncture
- index had dermatitis
- previous reports staff-to-patient HBV with arterial puncture
Transmission of Hepatitis C in a Pharmacologic Study
Patient Follow-up

Patient follow-up: results

• 498 patients arterial puncture by X
  • 107 had died; 100 not traced
  • 215/291 tested
  • 2 HCV positive 2/215 (~1%)
    • unrelated type 1b
    • 46% hypervariable segment homology with outbreak strain; patient with multiple transfusions prior to 1985
Klebsiella pneumoniae Infection on a Rehabilitation Unit: Comparison of Epidemiologic Typing Methods

ICHE 1993; 14:203-210

W. Thompson, MD; L. Romance, RN; H. Bialkowska-Hobrazanska, PhD; R.P. Rennie, MD; F. Ashton, PhD; L.E. Nicolle, MD
*K. pneumoniae* Infection on a Rehabilitation Unit: Comparison of Epidemiologic Typing Methods

ICHE 1993; 14:203-210

- *K. pneumoniae*: endemic/outbreak HA infections
- some previous reports: *K. pneumoniae* increased in rehabilitation (spinal cord) populations
- no simple, reliable, accessible epidemiologic typing (at this time)
*Klebsiella pneumoniae* Infection on a Rehabilitation Unit: Comparison of Epidemiologic Typing Methods

ICHE 1993; 14:203-210

Nosocomial urinary *K. pneumoniae*

Attack rate urine or wound: 1988: 19%
1989: 28%
**K. Pneumoniae on Rehabilitation Unit**

ICHE 1993; 203

- routine twice weekly urine culture for IC and indwelling

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### TABLE 1

**Characteristics of Three Patient Groups Admitted to Rehabilitation Wards in 1989**

<table>
<thead>
<tr>
<th></th>
<th>Nosocomial Infection</th>
<th>K pneumoniae Other Than K pneumoniae</th>
<th>No Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N=31)</td>
<td>(N=21)</td>
<td>(N=60)</td>
</tr>
<tr>
<td>Sex (F/M)</td>
<td>8/23</td>
<td>4/17</td>
<td>19/41</td>
</tr>
<tr>
<td>Age*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;40 years</td>
<td>15</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>40-60 years</td>
<td>8</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>&gt;60 years</td>
<td>8</td>
<td>4</td>
<td>23</td>
</tr>
<tr>
<td>Duration admission (days)†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>233 ± 285</td>
<td>78 ± 285</td>
<td>62 ± 81</td>
</tr>
<tr>
<td>Median</td>
<td>155</td>
<td>42.5</td>
<td>44</td>
</tr>
<tr>
<td>Service‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal injury</td>
<td>25</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>Amputee</td>
<td>2</td>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Level of injury</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervical, T1-6</td>
<td>17</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>T7-12, lumbar</td>
<td>8</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Urinary voiding§</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continent</td>
<td>3</td>
<td>5</td>
<td>46</td>
</tr>
<tr>
<td>IC † (staff)</td>
<td>9</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>IC (self)</td>
<td>11</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Condom</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Foley</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

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*χ² = 8.315 (df = 4), p = .08 for all 3 groups; χ² = 4.963 (df = 2), p = .08 for infected groups only (χ² = 7.852, df = 2, p = .02 only.

† p<.001, analysis of variance.

‡ χ² = 27.38 (df = 3), <.001 for all 3 groups; χ² = 3.11 (df = 2), p = .21 for infected groups only.

§ χ² = 48.50 (df = 8), p<.001 for all 3 groups; χ² = 4.27 (df = 2), p = .12 for infected groups only.

‖ Intermittent catheterization.
Investigation

- Environmental cultures:
  - 3 infected patient rooms: sink drains, sink taps, soap dish
    - no *K. pneumoniae* isolated
  - utility room
    - counter top, sink, hopper where urines collected
    - no *K. pneumoniae* isolated
  - common graduate for emptying leg bags by patients in utility room
    - *K. pneumoniae* isolated
Klebsiella pneumoniae Infection on a Rehabilitation Unit: Comparison of Epidemiologic Typing Methods

ICHE 1993; 14:203-210

K. Pneumoniae typing: capsular serotyping, electrophoresis (metabolic enzymes), plasmid profile, chromosomal typing, ribotyping

- multiple strains isolated/several patients >1 strain
- one major strain: 23/36 same strain
- graduate cylinder same strain
- Aug – Nov 1989: 15 isolates
  - 8, all HA, were same strain
  - 5/7 other strains present at admission
Klebsiella pneumoniae Infection on a Rehabilitation Unit: Comparison of Epidemiologic Typing Methods

ICHE 1993; 14:203-210

Nosocomial urinary *K. pneumoniae*
Persuasion

Evidence essential:
- high quality,
- local

Other professionals may try to discredit evidence:
- be convinced yourself
- acknowledge limitations

Organism typing for precision and clarity is often compelling evidence