Mupirocin resistance in staphylococci from blood in the UK and Ireland 2006-2007

Rosy Reynolds, Russell Hope on behalf of the BSAC Working Party on Resistance Surveillance

O40, 19th ECCMID, Helsinki, 16 - 19 May 2009
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BSAC Bacteraemia Resistance Surveillance

- 25 laboratories / year (30 in total)
- 10 S. aureus, 10 CoNS per laboratory per year
- Central testing - HPA Centre for Infections, London
- BSAC agar dilution MICs
- Multiplex PCR for *mecA*, *mupA*
- Data on website: www.bsacsurv.org
ACKNOWLEDGEMENTS

British Society for Antimicrobial Chemotherapy (BSAC)
Bacteraemia Resistance Surveillance Programme 2006-2007

HPA Centre for Infections, Colindale

- Russell Hope
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- Marina Warner
- Geraldine Brick
- Dorothy James

Sponsors

- Astellas
- AstraZeneca
- MSD
- Johnson & Johnson
- Novartis (Chiron)
- Pfizer
- Theravance
- Wyeth

Collecting Laboratories
England - MRSA screening and decolonisation

“From April 2009, all elective admissions must be screened for MRSA in line with Department of Health guidance. This should be extended to cover emergency admissions as soon as possible and definitely no later than 2011.”

Operational Guidance 2, Department of Health, December 2008 and 2009/10 Operating Framework

“We expect all patients who test positive for MRSA on screening prior to admission to be effectively decolonised, as indicated in previous guidance.”

Operational Guidance 2, Department of Health, December 2008
Mandatory screening for MRSA

**ALL** elective NHS patients in England except:
- day case ophthalmology, dental & endoscopy;
- minor dermatology e.g. warts;
- children & maternity/obstetrics (except high risk groups and elective caesarean).

*from Operational Guidance 2, DoH, December 2008*

Monthly reporting to Department of Health:
- number of admissions and attendances of elective patients who should be screened;
- number of tests done on these patients.

*from Operational Guidance 1, DoH, July 2008*
## Isolate numbers and tests

<table>
<thead>
<tr>
<th>Year</th>
<th>CoNS</th>
<th>S. aureus</th>
<th>oxacillin MIC</th>
<th>mecA</th>
<th>mupA</th>
<th>mupirocin MIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>209</td>
<td>238</td>
<td></td>
<td>✓✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>200</td>
<td>245</td>
<td></td>
<td>✓✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>212</td>
<td>235</td>
<td></td>
<td>✓✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>187</td>
<td>244</td>
<td></td>
<td>✓✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>203</td>
<td>244</td>
<td></td>
<td>✓✓</td>
<td>-✓</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>203</td>
<td>242</td>
<td></td>
<td>✓✓</td>
<td>✓✓</td>
<td>✓✓</td>
</tr>
<tr>
<td>2007</td>
<td>181</td>
<td>245</td>
<td></td>
<td>✓✓</td>
<td>✓✓</td>
<td>✓✓</td>
</tr>
</tbody>
</table>

BSAC Bacteraemia Resistance Surveillance Programme
Prevalence of *mecA* and *mupA*

<table>
<thead>
<tr>
<th></th>
<th><em>S. aureus</em></th>
<th>CoNS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>487</td>
<td>384</td>
</tr>
<tr>
<td>% <em>mecA</em> +</td>
<td>39%</td>
<td>78%</td>
</tr>
<tr>
<td>% <em>mupA</em> +</td>
<td>2%</td>
<td>20%</td>
</tr>
</tbody>
</table>

BSAC Bacteraemia Resistance Surveillance Programme 2006-07
**mupA is geographically widespread**

<table>
<thead>
<tr>
<th><strong>487 S. aureus</strong></th>
<th>10 mupA-positive, from</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/26 centres</td>
<td>3/5 countries</td>
</tr>
<tr>
<td>70% hospital &gt;48 hours</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>384 CoNS</strong></th>
<th>77 mupA-positive, from</th>
</tr>
</thead>
<tbody>
<tr>
<td>24/26 centres</td>
<td>5/5 countries</td>
</tr>
<tr>
<td>73% hospital &gt;48 hours</td>
<td></td>
</tr>
</tbody>
</table>

BSAC Bacteraemia Resistance Surveillance Programme 2006-07
Association of \textit{mecA} and \textit{mupA}

\begin{figure}
\centering
\begin{tikzpicture}
\begin{axis}[
    ybar, bar width=12pt, bar shift=0pt, ymajorgrids, title={Association of \textit{mecA} and \textit{mupA}},
    ylabel={\% \textit{mupA}-positive},
    xtick=data, x tick label style={/pgf/number format/1000 sep={}},
    xticklabels={mecA - 297, mecA + 190, mecA - 85, mecA + 299},
    xticklabel style={align=center},
    xticklabels style={font=\textit},
    ytick={0,5,10,15,20,25},
    legend style={at={(0.5,0.85)},anchor=north,legend columns=-1},
]
\addplot[fill=black!20] coordinates{(1,0.3) (2,4.7) (3,5.9) (4,24.1)};
\addplot[fill=black!40] coordinates{(1,0) (2,0) (3,0) (4,0)};
\addplot[fill=black!60] coordinates{(1,0) (2,0) (3,0) (4,0)};
\addplot[fill=black!80] coordinates{(1,0) (2,0) (3,0) (4,0)};
\addplot[fill=black!100] coordinates{(1,0) (2,0) (3,0) (4,0)};
\legend{S. aureus, meA -, meA +, coagulase-negative, meA -, meA +}
\end{axis}
\end{tikzpicture}
\end{figure}

\textit{mecA} as a predictor of \textit{mupA}:

\begin{itemize}
\item \textit{S. aureus}: OR = 19, \( p = 0.007 \)
\item CoNS: OR = 5, \( p = 0.001 \)
\end{itemize}
mupA and phenotypic mupirocin resistance 1

Mupirocin MIC for 245 S. aureus

BSAC Bacteraemia Resistance Surveillance Programme - 2007 only
mupA and phenotypic mupirocin resistance 2

**Mupirocin MIC for 181 CoNS**

- Blue: mupA -
- Red: mupA +

- ≤4 mg/L susceptible
- 8-256 mg/L low-level R
- >256 mg/L high-level R

BSAC Bacteraemia Resistance Surveillance Programme - 2007 only
An unusual mechanism?

One coagulase-negative isolate under investigation:

- Highly resistant: MIC >1024 mg/L;
- *mupA* negative by at least two tests with different primers;
- Hospital inpatient >48 hours, line-associated.

Four others resolved on re-testing:

- 1 mupirocin-susceptible
- 3 *mupA*-positive when tested with different primers.
Conclusions

*mupA*, encoding high-level mupirocin resistance, is:
- currently rare in *S. aureus* from bacteraemia (2%);
- widespread in coagulase-negative staphylococci (20%);
- more common in *mecA*-positive (methicillin-resistant) isolates.

*mupA*-encoded mupirocin resistance could:
- spread from coagulase-negative staphylococci to *S. aureus*;
- rapidly become more prevalent under increased selective pressure.