Meticillin-Resistant
*Staphylococcus Aureus* (MRSA)

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MRSA vs MSSA

- *Staphylococcus Aureus* – Common cause of infections in humans

- Locally 4/5 Staph aureus bacteraemia are due to meticillin (flucloxacillin) sensitive *staph aureus* (*MSSA*)

- 1:5 due to Meticillin Resistant Staph Aureus (*MRSA*)
MRSA reporting to DoH

- 2004 – Mandatory reporting of all bacteraemia

**Number of MRSA bacteraemia cases (CAI and HAI)**

- Total number of cases
- Number of MRSA bacteraemia cases (CAI and HAI)

**Graphs:**
- Total (CAI + HAI)
- HAI
- Trajectory (CAI + HAI)
- HAI trajectory
MRSA bacteraemias sources (Jan 2009 – Dec 2012)

Source

- HAI
- CAI

- Urinary catheter - UTI
- Diabetic foot infection
- Chronic ulcers infection
- Soft tissue infection
- SSI
- Dialysis line infection
- PVC infection
- Others
- Contaminants

Number of MRSA bacteraemia

3/15/2012
MRSA

- What does it mean to healthcare professionals?

Antibiotic resistant
Antibiotic resistance in traditional MRSA

- Meticillin and Oxacillin represent: Flucloxacillin
- MRSA: Resistant to Beta-lactam antibiotics and Beta-lactam/beta-lactamase inhibitor combinations
- MRSA also resistant to other antibiotics
Sensitivity pattern of traditional MRSA

**METHICILLIN RESISTANT Staph. Aureus (MRSA)**

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxycillin</td>
<td>R</td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>R</td>
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<tr>
<td>Nitrofurantoin</td>
<td>S/R</td>
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<tr>
<td><strong>Flucloxacillin</strong></td>
<td>R</td>
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<tr>
<td>Penicillin</td>
<td>R</td>
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<tr>
<td>Erythromycin</td>
<td>R</td>
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<tr>
<td><strong>Vancomycin</strong></td>
<td>S</td>
</tr>
<tr>
<td>Fusidic acid</td>
<td>S/R</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>S/R</td>
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<tr>
<td><strong>Teicoplanin</strong></td>
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<tr>
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<td>S/R</td>
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<tr>
<td>Tetracycline</td>
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<tr>
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<td>R</td>
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<td>R</td>
</tr>
<tr>
<td>Mupirocin</td>
<td>S/r</td>
</tr>
<tr>
<td>Co-amoxiclav</td>
<td>R</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>S/R</td>
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</tbody>
</table>

Cephalosporins: Resistant

Carbapenems: Resistant

S = Sensitive
R = Resistant
MRSA

- Mostly hospital associated (not anymore)
- Resistant organisms
- Transmissible
- Infections Vs Colonisation
- Transmission controllable
- Infections treatable
Rationale for topic

• Increased screening
• More care in the community
• DoH target of Zero
• CA-MRSA/PVL producing MRSA
Themes

- MRSA process
- Local susceptibility patterns
- Decolonisation process
- Panton-valentine Leukocidin (PVL) producing MRSA
MRSA Process: Identifying MRSA Positive patients

• General samples – MCS

• MRSA Screening
  – Nose (N) and groin (G) – Basic
  – N + G + Wounds (W) – Anyone with wound
  – N + G + CSU – anyone with catheter
  – N + G + Throat
MRSA screening

• Pre-2009 – Risk based screening (DoH and Local)

• March 2009 – Elective admission screening (DoH)

• December 2010 – Emergency admission screening (DoH)

• All MRSA positive in-patients decolonised


‘Those screened but discharged before the result is known should be contacted and offered suppression therapy where appropriate……’
Decolonisation protocol

• Nose: Mupirocin (Bactroban) nasal ointment TDS for 5 days +
• Skin and hair: 4% Chlorhexidine gluconate (Hibiscrub) body wash daily
• Oral antibiotics for decolonisation not routinely given


• 80% short-term suppression, 50-60% effective for long term clearance.
MRSA screening: What is the impact?  

Case 1:  

• 44 yo  

• Day 1 – Admitted. 3/7 h/o R sided abd pain  
  Amoxicillin + MTZ + Gentamicin  

• Day 2 – MRSA screening swabs collected  
  Laparascopy…. open cholecystectomy
Case 1

- Day 5 – MRSA screen result: MRSA POSITIVE
- *Should patient continue on Tazocin and MTZ?*
Case 1

• Day 5 – MRSA screen result: MRSA POSITIVE
• Tazocin and MTZ continued – improved.
• Day 13 – Discharged on oral Co-amoxiclav
• Comments on choice of antibiotics?

• What choice of antibiotics if he presents later with wound infection
MRSA screening – Impact: Case 2

- 74 yo, Diabetic, PVD, Chronic foot ulcers
- 2009 – Attended 3 different hospitals
- July 2010 – Seen in A&E, L foot ulcer swab: MRSA POSITIVE***
- Nov 2010 – Admitted Foot infection, Treated with Teicoplanin, Discharged
- Patient failed to attend podiatric clinic
- Jan 2011 – Foot infection in community, given Flucloxacillin
- April 2011 – Admitted with severe infection of foot with osteomyelitis
Case 2

- MRSA screening swabs (Nose and groin): Negative
- Wound swab – MRSA POSITIVE
- Blood culture – MRSA POSITIVE
- IV antibiotics and surgery
Guidelines (2008) for the prophylaxis and treatment of methicillin-resistant *Staphylococcus aureus* (MRSA) infections in the United Kingdom


**SSI:** Doxycycline, Cotrimoxazole, Clindamycin (C.difficile risk)

**UTI:** Nitrofurantoin, Trimethoprim, Cotrimoxazole
Local Susceptibility results

Proportion common MRSA isolates sensitive to different antibiotics

Fusidic acid and rifampicin should never been given as mono-anti-staphylococcal systemic therapy. Use them in combination with others listed.
24 Years old, extensive history of travel, sports-related knee injury, infected knee. This

Staph aureus sensitivity pattern at start of treatment and afterwards

<table>
<thead>
<tr>
<th></th>
<th>August 2010</th>
<th>Dec 2011</th>
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</thead>
<tbody>
<tr>
<td>Flucloxacillin</td>
<td>R</td>
<td>R</td>
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<tr>
<td>Erythromycin</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Fusidic acid</td>
<td>S</td>
<td>S</td>
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<tr>
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Staph aureus sensitivity pattern at start of treatment and afterwards

MRSA was found to produce the Panton-Valentine Leukocidin (PVL-toxin). It was a Community associated MRSA (CA-MRSA)
PVL producing Staph aureus

- Toxin destroys WBC
- <2% of MSSA and MRSA carry gene
- Croydon University data 2011
PVL-Producing Staph aureus

• Mainly found in community, so if MRSA = CA-MRSA
• Outbreaks in community
• USA CA-MRSA epidemic strain: USA300

\textit{USA300 strain} = \textit{UK MLST complex 8/spa type 008}
CA-MRSA

• Hospital outbreaks with CA-MRSA reported

Outbreak of a South West Pacific clone Panton–Valentine leucocidin-positive meticillin-resistant *Staphylococcus aureus* infection in a UK neonatal intensive care unit

Journal of Hospital Infection. April 2012 issue
PVL producing CA-MRSA + MSSA

• Infections:
  - Skin and soft tissue infections (often recurrent)
    - Cellulitis, Boils, boils, necrosis
  - Invasive disease
    - Pneumonia (necrotising)
    - Bone and joint infections
    - Necrotising fasciitis
Risk factors for CA-MRSA

• CDC summarised as 5 Cs
  - Crowding (prisons etc)
  - Close contact (sports etc)
  - Contaminated items
  - Cuts ...
  - Cleanliness
PVL-producing CA-MRSA + MSSA

- Typical patient: Young, healthy, fit, athletic
- History: No significant medical history
- Infection: Spontaneous, cellulitis, **boils - recurrent**
- Spread: Community, family, sports teams

- Virulence: PVL etc
- Antibiotic susceptibility
Community associated MRSA (CA-MRSA)

- Trimethoprim \( S \)
- Flucloxacillin \( R \)
- Penicillin \( R \)
- **Erythromycin** \( S \)
- Vancomycin \( S \)
- Fusidic acid \( S/r \)
- Gentamicin \( S \)
- Teicoplanin \( S \)
- Rifampicin \( S \)
- Tetracycline \( S \)
- **Ciprofloxacin** \( S \)
- Clindamycin \( S \)
- Mupirocin \( S \)
- Cephalosporins \( R \)
- Carbapenems \( R \)

Amoxycillin \( R \)
Trimethoprim \( R \)
Nitrofurantoin \( S \)
Flucloxacillin \( R \)
Penicillin \( R \)
Erythromycin \( R \)
Vancomycin \( S \)
Fusidic acid \( S \)
Gentamicin \( S \)
Teicoplanin \( S \)
Rifampicin \( S \)
Tetracycline \( S \)
Ciprofloxacin \( R \)
Clindamycin \( R \)
Mupirocin \( S \)
Co-amoxiclav \( R \)
Chloramphenicol \( S \)
Cephalosporins \( R \)
Carbapenems \( R \)

S= Sensitive
R = Resistant

Healthcare associated MRSA (HA-MRSA) sensitivity pattern
Susceptibility to antibiotics of PVL producing MRSA compared to common MRSA. Croydon Data for 2011

% Sensitive to the antibiotic

Antibiotic

Fluclox/pen  Ciprofloxacin  Erythromycin  Trimethoprim  Fusidic acid  Tetracycline  Rifampicin  Mupirocin (topical)  Vancomycin  Teicoplanin

Common MRSA  CAI/PVL-pos MRSA
UK national guidelines on PVL-producing Staph aureus

Guidance on the diagnosis and management of PVL-associated Staphylococcus aureus infections (PVL-SA) in England
Report prepared by the PVL sub-group of the Steering Group on Healthcare Associated Infection

http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1218699411960
PVL-producing CA-MRSA + MSSA: Management

- Incision and drainage
- Antibiotic – combination therapy
- Public health involvement
- Contact tracing
- Decolonisation for all with symptoms

  **Timing:** after wound healed

- House hygiene
- Personal hygiene
- Non-equipment/clothing sharing
Case 3

- 26 year old
- May 2011: Boil - neck
- Flucloxacillin given – no response, worsened
- Admitted – MRSA screening (Nose and groin) – Negative
- swab – MRSA POSITIVE
- Treated with IV Teicoplanin
- Improved
Case 3

- Dec 2012 Seen again
- Boil on hand
- I and D
- MRSA POSITIVE
- PVL POSITIVE
Case 3

- No travel history, no sport, no pets
- Partner fine
- So where did it come from......?
- Type: Southwest Pacific clone (MLST 30)

- Extend enquiry especially if recurrent
<table>
<thead>
<tr>
<th>Age of patients (years)</th>
<th>Clone</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>South West Pacific</td>
</tr>
<tr>
<td>48</td>
<td>Bengal Bay</td>
</tr>
<tr>
<td>18</td>
<td>South West Pacific</td>
</tr>
<tr>
<td>45</td>
<td>European</td>
</tr>
<tr>
<td>5</td>
<td>MLST complex 5</td>
</tr>
<tr>
<td>38</td>
<td>MLST complex 22</td>
</tr>
<tr>
<td>70</td>
<td>MLST complex 8 (USA300)</td>
</tr>
<tr>
<td>26</td>
<td>MLST complex 5</td>
</tr>
<tr>
<td>29</td>
<td>MLST complex 5</td>
</tr>
<tr>
<td>34</td>
<td>MLST complex 8 (USA 300)</td>
</tr>
</tbody>
</table>
Summary

• MRSA no longer hospital only problem
• Screen sites according to risk factors
• Tetracyclin/Doxycyline can be used to treat MRSA
• Decolonisation effectiveness short lived
• MRSA positive with wounds remain colonised
• All patients with PVL producing MRSA + MSSA should be decolonised after wound healed
• Timing of decolonisation crucial
• Decolonise Close contacts of PVL patients if symptomatic or risk to vulnerable
MRSA

Should we decolonise everyone found MRSA positive in the community?