Screening for multiple antibiotic resistant Gram negative bacteria (MR-GNB) in NICU

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Do we have a problem?

- MR-GNB prevalence is rising both in community and in hospital setting
  - In Birmingham area, prevalence of CTX-M ESBL carriage in stool was 11.3%

- ESBL carriage in pregnant women is rising
  - Antenatal urine positive for ESBL: 3 in 2007, 3 in 2008, 8 in 2009, 12 in 2010 and 14 in 2011

High community faecal carriage rate of CTX-M ESBL producing E. coli in a specific population group in Birmingham, UK. J Antimicrob Chemother May 2012.

Strategies to manage resistant Gram negative organisms in neonates Arch Dis Child Fetal Neonatal Ed Dec 2011
Neonatal Gram negative bacteraemia - resistance rates

- Gentamicin - common antibiotic used on NICU
- neonIN Database
- Data from participating 24 UK and 7 other European neonatal units
- 1/1/12 to 1/1/13 (12 months)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Total bacteraemia</th>
<th>Resistant to Gentamicin</th>
<th>Resistant to cefotaxime</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>34</td>
<td>4/14 (22%)</td>
<td>2/3 (66%)</td>
</tr>
<tr>
<td>K. penumoniae</td>
<td>20</td>
<td>5/9 (55%)</td>
<td>½ (50%)</td>
</tr>
</tbody>
</table>
• Inter-hospital transfer is common now
  – Reconfiguration of neonatal services means more movement of babies between hospitals
  – No uniform screening strategy for resistant organisms
  – Unaware if the other PICU is going through any infection control issue
• Water as potential source of *P. aeruginosa* (especially in NICU)
  – Irish incident in 2012
  – higher risk in neonatal units
  – Vulnerable babies, antibiotic exposure and invasive devices- ? Increased risk
Mortality of some of the GNBs on NICU

– *Serratia* sp: 14% to 60%
– *P. aeruginosa* bacteraemia: >50%

Ref:
Late onset neonatal Gram-negative bacillary infection in Australia and New Zealand *Paed Infect Dis J Jan 2006*
Molecular Epidemiology of *Serratia marcescens* Outbreaks in Two Neonatal Intensive Care Units. *Inf Cont Hosp Epi Sept 2004*
Consecutive serratia marcescences outbreaks in a neonatal intensive care unit *Am J Infect Control Sept 2012*
• So yes, we have a problem.
Important GNBs on NICU

• GNB of interest (GNBi)
  – ESBL producing *enterobacteriaceae*
  – Gentamicin resistant *enterobacteriaceae*
  – *Pseudomonas aeruginosa*
  – *Serratia* sp.
  – ? Metallo-beta lactamases
• GI colonisation can take place in as little as 24 hrs of birth
• Colonisation can last for months
  – Study in Norway following an outbreak of CTX-M K. pneumoniae ESBL: median carriage time 12.5 months in neonates and 2.5 months in parents

Reference: Long-term faecal carriage in infants and intra-household transmission of...*Antimicrob Chemother* May 2013
Can screening predict the organism causing bacteraemia?

• Hypothesis: GNB colonizing the GI tract of infants are the source of subsequent blood stream infection
• US study of <1500g babies
  – 95% (18 of 19) of paired bloodstream infection or antecedent rectal cultures were genotypically concordant meaning GI tract is the reservoir for most cases of Gram-negative sepsis

Reference: The gastrointestinal tract serves as the reservoir for Gram-negative pathogens in very low birth weight infants *Pediatr Infect Dis J 2007 Dec 2007*
How to screen for GNBi

• Rectal swabs/ stool and/or ETS or OPS: on admission and at regular interval
• Non-selective medium- any coliform/ non-fermenter looking colonies- carry out gentamicin and cefpodoxime sensitivity and identification
• CHROMagar, ChromID, Brilliance for ESBL producing organisms
• Pseudomonas selective agars
• Device strategy based on your local resources and requirement or agree a region specific strategy
Local experience

• GNBi screening program in place for last 3 years now in our neonatal unit
• Screen all babies on admission and then on every Monday
• Rectal swabs only
What do we do with results

- Inform the neonatal unit staff and clinician
- Isolate colonised babies where possible
- Alert sticker in notes
- Review antibiotic therapy for colonised babies
- Promote hand hygiene
In case of increase incidence of GNBi

• ‘Outbreak prevention’ or incident meeting
• Review isolation/ consider cohort isolation
• Additional cleaning
• Promote hand hygiene
• Consider interim changes in antibiotic policy
• Consider restricting number of visitors
• Consider environmental sampling
Benefits?

• No major outbreak with any GNBI since introduction of screening
• Never had to close the unit
• NICU staff educated and alert
Conclusion

- MR-GNB (GNBi) : clear and present danger on NICU, problem is worsening
- Inactivity is not an option
- Screening strategy has its flaws...
- But it is an intervention which can be relatively easily introduced at a low cost
- Opportunity to contain the problem before it becomes norm
Every NICU must screen for GNBi

Thank you