Vancomycin-Resistant Enterococci: Thailand Experience

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Enterococci

- Normal flora of animal and human GI-tract
  Human: *E. faecalis*, *E. feacium*
  Animal: *E. feacium*

- Public health concern – nosocomial infections

- Acquire high-level resistance to antimicrobial agents incl vancomycin, the last line antibiotic for resistant infections
Vancomycin-resistant enterococci (VRE)

- Several combinations of *Enterococcus* strains
- Develop resistance to antibiotic vancomycin
- Obtain DNA in form of plasmids or transposons - encode genes that confer vancomycin resistance
Vancomycin-resistant enterococci (VRE)

- High level vancomycin resistance: *E. faecalis* and *E. fecium* clinical isolates
- Sources: hospitals, food animals, environment, waste water
- Associated with use of avoparcin mixed feed
- VRE in feces of exposed animals and meat products
- VRE of identical clones in humans contact with animals (farm workers, butchers)
Vancomycin-resistant enterococci (VRE)

- Avoparcin & vancomycin are glycopeptide antibiotics with similar chemical structure
- Emergence and dissemination of VRE in food animals and food supply
- Ban the use of avoparcin in animal feed
- Decrease VRE colonization rate in healthy humans
VRE – Thailand Experience

• July 1998: Outbreaks of VRE in Japanese hospitalized patients
• Japanese outbreaks connect with imported chicken meat
• Japanese research:
  - No VRE isolated from domestic chicken meat
  - High frequency of VRE isolated from imported meat

  Thailand 20%, high-level vancomycin resistance and relatively low-level teicoplanin resistance

  France 30-50%, high-level vancomycin and teicoplanin resistance
VRE - Thailand Experience

- VRE strains isolated from 3 patients at 2 hospitals had same characteristics as VRE strains isolated from Thai chicken meat
- News from Japanese media caused a tremendous scare to Japanese consumers
- Thai chicken meat was refused and importation was suspended
- Thai poultry industry was severely disrupted
Thai Govt banned the use and import of avoparcin mixed feed on 15 July 1998

DLD has established measures for VRE control and surveillance for the whole poultry meat production chain

Japan resumed import of Thai chicken meat
VRE Control & Surveillance

- Whole poultry meat production chain
- Samplings for VRE tests
  - Breeder farms: feces, drinking water, feed, cleansing water – birds’ age at laying
  - Hatcheries: meconium of DOC, swabs of hatching tray after cleaning and disinfection
  - Broiler farms: feces, drinking water, feed, cleansing water – birds’ age over 30 days
  - Poultry slaughterhouses: cloacal swabs, carcass swabs after evisceration but before washing, fresh poultry meat
  - Poultry meat product processing plants: poultry meat products
VRE Control & Surveillance

- VRE tests by the VPH Lab of the DLD
- Determine MIC of enterococci to vancomycin and teicoplanin using Agar Dilution Technique following the NCCLS
- VRE +ve: completely clean and disinfect establishment
# VRE Control & Surveillance

## Results of VRE contamination in poultry meat production chain, 2001-2004

<table>
<thead>
<tr>
<th>Source</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breeder farms</td>
<td>6.5%</td>
<td>1.5%</td>
<td>0.3%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Hatcheries</td>
<td>6.8%</td>
<td>3.4%</td>
<td>0</td>
<td>1.6%</td>
</tr>
<tr>
<td>Broiler farms</td>
<td>5.9%</td>
<td>2.8%</td>
<td>1.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Feed</td>
<td>2.7%</td>
<td>0.8%</td>
<td>0.3%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Cleansing water</td>
<td>1.9%</td>
<td>0.2%</td>
<td>0.1%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Clocal swabs at slaughterhouses</td>
<td>10.6%</td>
<td>3.3%</td>
<td>2.6%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Poultry meat</td>
<td>6.5%</td>
<td>1.0%</td>
<td>0.3%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Poultry meat products</td>
<td>0</td>
<td>0.4%</td>
<td>0.2%</td>
<td>0.6%</td>
</tr>
</tbody>
</table>
Results of VRE contamination in poultry meat production chain, 2005-2012

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of tested samples</th>
<th>No. of VRE +ve samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>7,012</td>
<td>48 (0.7%)</td>
</tr>
<tr>
<td>2006</td>
<td>6,227</td>
<td>17 (0.3%)</td>
</tr>
<tr>
<td>2007</td>
<td>3,196</td>
<td>0</td>
</tr>
<tr>
<td>2008</td>
<td>3,426</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>3,789</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>3,919</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>3,033</td>
<td>3 (0.1%)</td>
</tr>
<tr>
<td>2012</td>
<td>1,898</td>
<td>0</td>
</tr>
<tr>
<td>(Jan-Sep)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VRE Control & Surveillance

- VRE decreased remarkably after the prohibition of avoparcin use in feed

- VRE isolates from poultry meat production chain: *E. faecalis*, *E. faecium*, *E. gallinarum*, *E. durans*

- Predominant VRE (MIC $\geq 64 \mu g/ml$): *E. faecalis*, *E. faecium* (particularly in samples related to live birds)

- No VRE has been detected since 2007, except in 2011 - 3 chicken meat samples were positive for *E. durans* (MIC $\geq 64 \mu g/ml$)
Prevalence of VRE in Thai poultry industry is currently very low

Potential risk of VRE resistant genes transfer from food animals to humans, from enterococci to other Gram-positive bacteria i.e. *Staphylococcus aureus*

Continuation of VRE surveillance in the whole poultry meat production chain

To ensure the safety of Thai poultry meat supplying to domestic and export markets
Prevalence of VRE in Thailand

- Study of Chalermchaikit et al. during Aug 2005-July 2006
- Prevalence of VRE in environment, animal feeds and raw meats in Thailand
- Samples: ark shell, chicken meat, pork, beef, pet food, chicken feed, pig feed
- VRE tests – MIC $\geq 8 \, \mu g/ml$
Prevalence of VRE in Thailand

• VRE contaminated samples

  - Ark shells 6.6%: *E. faecium* (60%), *E. faecalis* (20%), *E. gallinarum* (12%), *E. casseliflavus* (8%)

  - Chicken meat 5%: *E. gallinarum* (60%), *E. faecalis* (40%)

  - Pork 3%: *E. gallinarum* (66.7%), *E. faecium* (33.3%)

  - Beef 13%: *E. gallinarum* (53.8%), *E. faecalis* (38.5%), *E. faecium* (7.7%)

  - Dog feed 0.93%: *E. gallinarum*

  - Chicken feed 0.89%: *E. gallinarum*

• None of VRE was found in cat feed and pig feed samples
Pattern of glycopeptide (vancomycin & teicoplanin) resistance of most VRE isolates: either vanB or vanC resistant genes, only one isolate from chicken meat indicated vanA genes

- vanA - high resistance to both vancomycin & teicoplanin
- vanB - moderate resistance to vancomycin, sensitive to teicoplanin
- vanC - partly resistance to vancomycin, sensitive to teicoplanin
Prevalence of VRE in Thailand

- Preliminary conclusion: VRE is not a public health threat in Thailand

- VRE in ark shell: contamination of VRE in environment from communities, hospitals, pets and/or animal farms

- Prudent use of antimicrobials in humans and animal industries & routine surveillance of antimicrobial-resistant pathogenic bacteria must be continued