Antibiotics in the PICU

We have a problem with resistant Gram-negative bacteria in PICU, the extended-spectrum beta-lactamase producing Klebsiella and Enterobacter spp. These have emerged in the last few years, and lead to the increased use of meropenem and other high-grade antibiotics. So far we don’t have any NDM-1 isolates, which are resistant to carbapenems, but if we do not restrict the use of meropenem we will see these infections, for which there is no effective antibiotics treatment.

The use of vancomycin is also concerning. It provides selection pressure for vancomycin-resistant enterococcus (VRE), which is deadly in the PICU.

There are many steps to prevention and control of nosocomial infections in the PICU. One is antibiotic stewardship.

In deciding which antibiotics to give we need to consider five things:

1. **Probability of bacterial infection**
   - Fever or temperature instability, increasing IT ratio or pro-calcitonin

2. **Is infection likely to be community or hospital / PICU-acquired**

3. **Are there are signs of severe sepsis?**
   - Signs of severe sepsis: increased inotropic requirement with no other likely cause, worsening hypoxaemia associated with new CXR infiltrates.

4. **Likely pathogens**

5. **Likely antimicrobial susceptibility**

In choosing antibiotics for community-acquired infection in the ICU refer to the RCH Clinical Practice Guidelines

**First line treatment of PICU acquired sepsis should be flucloxacillin and gentamicin** (or benzylpenicillin, gentamicin and metronidazole for GI tract sepsis)

MRSA is uncommon in PICU. Although flucloxacillin won’t cover the majority of coagulase-negative Staphs, many of these isolates are contaminants, or the infection indolent, so changing-up to vancomycin if an MRSE is isolated will not result in adverse clinical outcomes

**Indications for vancomycin**

Signs of serious sepsis PLUS
- Known methicillin-resistant *Staph aureus* colonisation
- High risk of methicillin resistant coagulase negative *Staph aureus* infection: such as a VP shunt or previous MRSE sepsis with CVC
- A central line alone is NOT an absolute indication to use vancomycin rather than flucloxacillin as first-line treatment for PICU acquired sepsis

**Indications for meropenen or amikacin**

Signs of serious sepsis PLUS
- Known colonisation or infection with Klebsiella spp or Enterobacter spp
- Recent treatment with 3rd or higher gen cephalosporins, quinolones, pip/tazo, Timentin, carbapenems
- Approval is required by the RCH Drug Usage Committee (DUC)

**STOPPING ANTIBIOTICS or SCALING DOWN ANTIBIOTICS**

Before antibiotics are started cultures (blood, urine +/- BAL) should be taken. Antibiotics should be ceased after 48-72 hours if cultures are negative.

If it is not appropriate to cease antibiotics (because of a high probability of bacterial infection or signs of severe sepsis) antibiotic therapy can be scaled down when 48 hour cultures are negative. Appropriate antibiotics to scale down depend on the clinical context, but include benzypenicillin and gentamicin for culture-negative severe pneumonia or sepsis in the PICU. When scaling down antibiotics, the RCH Clinical Practice Guidelines can be followed for the treatment of focal infections.
Is there a high likelihood of gentamicin-resistant Gram-negative sepsis?

Known colonisation or infection with Klebsiella spp or Enterobacter spp?

Recent treatment with 3rd or higher gen cephalosporins, quinolones, pip/tazo, timentin, carbapenems

Yes

PICU Consultant and DUC approval required:
Meropenem +/- Vancomycin +/- Amikacin

No

Is there an indication for vancomycin?

Known methicillin-resistant Staph aureus colonisation

A central line alone is NOT an absolute indication to use vancomycin over flucloxacillin as first-line treatment for PICU acquired sepsis

High risk of methicillin-resistant coagulase negative Staph aureus infection: such as a VP shunt or previous MRSE sepsis with CVC

Yes

PICU Consultant approval required:
Vancomycin and gentamicin

No

Is there signs of severe sepsis?

Hypotension or increased vasoactive drug requirement with no other likely cause, worsening hypoxaemia associated with new CXR infiltrates

No

Flucloxacillin and gentamicin

or benzylpenicillin, gentamicin & metronidazole if GI sepsis

Yes

If cultures negative after 48 hours cease antibiotics

Are there signs of a bacterial infection?
Fever or temperature instability, high (>0.2) or increasing IT ratio, increasing pro-calcitonin

Is it likely to be a PICU- or hospital-acquired infection?
PICU stay >7 days?

If NO, follow RCH Clinical Practice guidelines

Yes

Are there signs of a bacterial infection?
Fever or temperature instability, high (>0.2) or increasing IT ratio, increasing pro-calcitonin

If cultures negative after 48 hours cease antibiotics

PICU Antibiotic Protocol 2011