Audit of Paediatric Blood Cultures

Dr R Weerasinghe
Foundation Year 1 Doctor

Dr Matthew Laundy (FRCPath MRCPCH)
Consultant Microbiologist

Heatherwood and Wexham Park Hospitals NHS Foundation Trust
Importance of Blood Cultures

- Sepsis is the ninth leading cause of mortality in children 1 – 4 years of age.
- Blood cultures are the standard test to detect bacteraemia in children.
- Blood culture results are used to decide on antibiotic therapy.
- NICE guidelines advise that blood cultures should be used when investigating the feverish child.
How Paediatric Blood Cultures are Used in Practice

- Signs of sepsis in young children and neonates are often very subtle.
- Difficult to distinguish sepsis from other causes.
- Young children have difficulty in localising infection.
- WBC, CRP temperature may not be a good guide.
- Standard practice to give antibiotics, wait 48 hours and stop antibiotics if blood cultures negative and the child has clinically improved.
Aim of audit:

The correct volume of blood must be inoculated into blood culture bottles for the investigation to be valid.

- To determine if the correct volume of blood is being used for blood cultures.

- To improve the understanding of the significance or insignificance of blood culture results.
Objectives

- To assess volume of blood being inoculated into paediatric blood culture bottles and compare this with manufacturer guidelines.

- To assess if volume of blood being inoculated into paediatric blood culture bottles is sufficient to make the test valid.
Method

- Blood culture bottles were weighed and the mass recorded before they were distributed to the wards.
- An average mass of the caps was taken.
- Over a 10 week period 3 February to 9th April 2010 all paediatric blood cultures were weighed on arrival to the microbiology lab and mass recorded.
- The DOB and date the blood culture were taken were also recorded.
- The volume of blood used for the test was calculated. SG of blood is $\approx 1$: Volume $\approx$ mass
- The age of the child was calculated.
Standards/Guidelines/Evidence Base:

- **Manufacturer’s guidelines:**
- **BACTEC® System** (CBD New Jersey) system.
- For paediatric blood cultures they state that 1 - 3 mls of blood should be taken per bottle.

- **Research:** performed a study in which they classed volumes $\geq 0.5$ mls for neonates $\leq 1$ month as adequate and $\geq 4.0$ mls for children $> 3$ years of age. (Connell et al *Pediatrics* 2007:19)
Criteria used:

- Adequate volume 1 – 3 mls (Manufacturer guidelines)
- Adequate volume $\geq 0.5$ mls for newborns < 3 months (Connell et al.)
Results

Number of Bottles: 128

Average volume blood taken for the two different age groups:

<table>
<thead>
<tr>
<th></th>
<th>&lt; 3 months</th>
<th>&gt; 3 months</th>
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<tbody>
<tr>
<td>Mean</td>
<td>0.42 mls</td>
<td>1.22 mls</td>
</tr>
<tr>
<td>Mode</td>
<td>0.27 mls</td>
<td>0.41 mls</td>
</tr>
<tr>
<td>Median</td>
<td>0.36 mls (0.07 – 1.16 mls)</td>
<td>0.85 (0.18 – 5.53 mls)</td>
</tr>
</tbody>
</table>
Results 2

Percentage of blood cultures that met the criteria:

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<tr>
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<th>&lt; 3 months</th>
<th>&gt; 3 months</th>
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<tbody>
<tr>
<td>% 1 – 3 mls</td>
<td>4.6 %</td>
<td>29.0 %</td>
</tr>
<tr>
<td>% &gt; 0.5 mls</td>
<td>29.3 %</td>
<td>NA</td>
</tr>
</tbody>
</table>
Graph: Results neonates < 3 months age

Age (days) vs. Blood Volume (mls)
Graph results children > 3 months age

Age (yrs) vs. Bloods Volume (mls)
Results: Spearman’s rank correlation coefficient

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<tr>
<th>&lt; 3 months</th>
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<tr>
<td>0.28 (n=65)</td>
<td>0.24 (n=62)</td>
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Discussion

- The optimum volume of blood for paediatric cultures in unknown.
- For adults the more blood taken the more sensitive the test – 30 mls yields 61% more results than does 10 mls (Ilstrup DM et al *Diagn Microbiol Infect Dis* 1983:1)
- Smaller volumes can only be taken from neonates due to several factors including; lower circulating volume, technically difficult.
Discussion

- Do children have a higher density bacteraemia? There is evidence that this is not the case:
  - In neonatal *E. coli* sepsis 23% had 4 colony forming units/ml or less and 54% had less than 50 CFU/ml. (Dietzman et al. *J. Pediatr* 1974:85)
  - 60.3% of children had low-level bacteraemia with ≤ 10 CFU/ml on top of which 23.1% had extremely low levels with ≤ 1.0 CFU/ml. (Kellogg et al. *J Clin Microbiol* 2000:38)

- Is 0.5 ml sufficient?
  - In one study it was found that 0.5ml was not sufficient to detect common neonatal pathogens. Sampling 1 -2 ml significantly improved the yield. (Schelonka et al *J Pediatr* 1996:129(2))
Conclusion

- For the majority of paediatric blood cultures at Wexham Park Hospital not enough blood is sampled.
- Therefore a negative result does not exclude bacteraemia.
- There is only a very weak relationship between age and blood volume taken indicating that low weight of a child is not the cause for an inadequate volume of blood being sampled.
- Interventions should include:
  - increasing awareness of what is an adequate blood volume
  - increasing knowledge of how to interpret results if insufficient blood sampled
  - reaudit
Intervention so far

- Presentation to paediatric staff – juniors and seniors
- Insertion in the paediatric guidelines.
- Now for reaudit.....
Thank You
Acknowledgements

- Dr Rachel Weerasinghe
- Biomedical staff of the Microbiology Department of Wexham Park Hospital.