ORIGINAL ARTICLE

How do blood cultures sent from a paediatric accident and emergency department influence subsequent clinical management?

P Leonard, T F Beattie

See end of article for authors' affiliations

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Correspondence to:
Dr P Leonard, Accident and
Emergency Department,
Royal Hospital for Sick
Children, Sciennes Road,
Edinburgh EH9 1LF,
Scotland;
paul_leonard@blueyonder.
co.uk

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Objectives: To determine the clinical impact of positive results from blood cultures sent from a busy paediatric accident and emergency department.

Methods: All children who attended the department over a seven month period and had blood culture investigations were identified. Case notes of patients who had any growth on blood culture were reviewed to determine whether the organism was felt to be pathogenic and how the result affected clinical management.

Results: 1159 children had blood cultures sent, 26 of these grew an organism that was felt to be pathogenic. However, only five significantly influenced clinical management.

Conclusions: Blood cultures sent from an accident and emergency department rarely influence clinical management. A more focused approach to bacteriological investigation is recommended.

Paediatric textbooks recommend paired aerobic and anaerobic blood culture investigations as part of a sepsis screen used to investigate children who present with fever, appear unwell, and have no clear focus of infection on clinical examination.¹ The prevalence and consequences of occult bacteraemia in such children have been well described.^{2–6} Perhaps because of this, and because the initial assessment of unwell children presenting to an accident and emergency (A&E) department is often undertaken by comparatively junior staff, it has become routine practice in many hospitals to perform paired aerobic and anaerobic blood culture investigations in almost all children presenting with a fever.

We became aware that a large number of negative or contaminated blood culture results were being returned to our paediatric A&E department. An Ovid Medline search, (exp [child or neonate or infant].mp AND exp blood culture.mp) identified a number of studies detailing blood culture findings in specific diseases or patient groups but no studies relating to the impact of all blood cultures taken from children presenting to an A&E department regardless of presenting features, diagnosis, or management. We hypothesised that “routine” blood cultures often did not yield clinically helpful results and decided to investigate this further by identifying how many blood cultures were sent from our department, how many of these investigations identified a pathogenic organism and of those that did, how many affected the subsequent clinical management.

METHODS

All children, including self referrals and GP referrals to medicine and surgery, who attended a busy paediatric A&E department over a seven month period and had blood culture investigations were identified. This was done by interrogating the database at the local microbiology department for all samples received from the hospital and correlating that with the computerised attendance list for the department. Case notes of patients who had any growth on blood culture were reviewed to determine whether the organism was felt to be pathogenic and how the result affected clinical management.

Statistical analysis was performed using Fisher's exact test.

RESULTS

Altogether 15 938 children attended the department as new patients during the study period. Of these 1159 (7.3%), aged between 2 days and 15 years, had blood cultures sent, 111 grew an organism, 26 (2.2%) of which were felt to be pathogenic rather than a contaminant.

Pathogenic organisms were more likely to be identified in blood cultures taken from children aged less than 12 months. This relation was less marked if considering all children aged less than 2 years and did not achieve statistical significance in children aged less than 3 years (table 1).

It can be seen from table 2 that in 16 patients the blood culture result did not affect the management of the patient, either because empirical treatment had been started based on a clinical diagnosis or because culture of other specimens had already identified the organism. In five patients minor changes to the management of the patient were made (for example, narrowing antibiotic range), but these were unlikely to have a significant effect on outcome. Of the five patients who had positive blood cultures that significantly changed their management, four had been felt to be well enough for discharge clinically before the blood culture result and were recalled from home to have additional antibiotic therapy.

The cost of these investigations, including microbiologist time involved in follow up and notification, etc, was estimated as £4800 for the seven month study period by our local laboratory.

DISCUSSION

Blood culture investigations performed in a paediatric A&E department are costly and only yield a positive result that

Table 1 Table showing significance of age as a predictor of a pathogenic isolate from blood cultures

	p Value	Odds ratio	95% CI for odds ratio
Under 12 months	0.025	2.56	1.18 to 5.59
Under 24 months	0.045	2.48	1.07 to 5.75
Under 36 months	0.069	2.41	0.96 to 6.039

Table 2 Table showing patients whose blood cultures grew pathogenic organisms and the influence the result had on their treatment

Age	Organism	Importance of BC result
11 days	<i>Escherichia coli</i>	Treated empirically, organism identified in CSF first
13 days	<i>Staphylococcus aureus</i>	Organism already identified on skin swab
2 months	<i>Streptococcus agalactiae</i> (GrpB)	Treated empirically, blood culture did not change treatment
2 months	<i>Neisseria meningitidis</i>	Treated empirically, organisms seen and grown from CSF
2 months	<i>Streptococcus mitis</i>	Appropriate antibiotic started on chest radiograph appearance, continued after culture result
2 months	<i>Streptococcus agalactiae</i>	Organism already identified in CSF
5 months	<i>Streptococcus pneumoniae</i>	Started empirically on appropriate antibiotic from clinical diagnosis
5 months	<i>Streptococcus pyogenes</i> Group A	Started empirically on broad spectrum antibiotic, spectrum narrowed on basis of blood culture
8 months	<i>Neisseria meningitidis</i>	Treated empirically on clinical diagnosis, PCR positive also
9 months	<i>Neisseria meningitidis</i>	Recalled from home, remained well but IV therapy started on basis of culture result.
10 months	<i>Streptococcus mitis</i>	Treated empirically, blood culture did not change therapy
10 months	<i>Streptococcus pneumoniae</i>	Organism already identified from CSF
10 months	<i>Streptococcus pneumoniae</i>	Empirically on appropriate antibiotic, but additional agent added based on culture result
13 months	<i>Streptococcus</i> group G	Treated empirically, blood culture confirmed need for continued antibiotics
15 months	<i>Streptococcus pneumoniae</i>	Not on antibiotics until result received, other cultures negative
15 months	<i>Streptococcus pyogenes</i> Group A	Treated empirically, organism already grown from swab
18 months	<i>Moraxella catarrhalis</i>	Already on appropriate antibiotic due to radiological diagnosis, initially thought to be meningococcus on microscopy
18 months	<i>Streptococcus pneumoniae</i>	Started on appropriate antibiotic empirically. No change to treatment made after result received
2 years	<i>Streptococcus pneumoniae</i>	Already being treated with appropriate antibiotic empirically
2 years	<i>Streptococcus pneumoniae</i>	Blood culture result prompted antibiotic therapy
4 years	<i>Staphylococcus aureus</i>	Recalled due to positive result and antibiotic therapy started.
5 years	<i>Streptococcus pneumoniae</i>	Started empirically on broad spectrum antibiotic, spectrum narrowed on basis of blood culture result
5 years	<i>Neisseria meningitidis</i>	Treated empirically, blood culture grew slowly and positive at end of treatment only
7 years	<i>Haemophilus influenzae</i>	Result returned after discharge, clinically well but oral antibiotic given as a precaution
8 years	<i>Streptococcus pyogenes</i> Group A	Recalled due to positive result, on appropriate oral therapy already, changed to intravenous for 48 hours
13 years	<i>Staphylococcus aureus</i>	Empirically on appropriate antibiotic, but additional agent added based on culture result

changes clinical management in less than 0.5% of patients. This is similar to yields reported in adult emergency department⁷ and perioperative⁸ patients. A previous small study showed no difference in the outcome of children with a febrile illness who did not have a blood culture taken,⁹ however an earlier study identified a small but significant number of children with complications of bacteraemia that would not have been detected without blood culture analysis.¹⁰ We did not undertake to investigate the effects of positive cultures felt to be attributable to non-pathogenic organisms/contaminants but previous studies have shown that these have a considerable financial impact.

Increasing availability and accuracy of polymerase chain reaction testing for bacterial DNA^{11,12} and assays for specific bacterial antigens permit rapid identification of common causative organisms (for example, meningococcus, pneumococcus, and haemophilus) although offer no means of determining antibiotic sensitivity.

It is clearly important to isolate pathogenic organisms both to permit epidemiological study and to determine the range of antibiotic sensitivity, particularly with increasing antibiotic resistance. However, in many patients with positive blood cultures the causative organism had already been identified from other bacteriological investigations by the time the blood culture result was available. This suggests that where a specific bacterial disease is suspected a focused approach to bacteriological investigation should be used (for example, sending cerebrospinal fluid in suspected meningitis, urine in suspected urinary tract infection) rather than relying on blood cultures.

CONCLUSION

Blood cultures have a very low yield and often do not influence the clinical management of the paediatric emergency department patient. They should be reserved for use in the investigation of younger children, particularly those aged less than 12 months, who have no focal signs of infection to explain their fever and appear clinically unwell.³

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Contributors

Both authors conceived of the original idea for the paper. PL collected the data and performed the analysis. Both authors contributed to the final version of the paper.

Authors' affiliations

P Leonard, T F Beattie, Department Of Accident and Emergency Medicine, The Royal Hospital for Sick Children, Edinburgh, Scotland

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