Utility of blood cultures in the management of adults with community acquired pneumonia discharged from the emergency department

S G Campbell, T J Marrie, R Anstey, S Ackroyd-Stolarz, G Dickinson

Study Objective: To assess the clinical value of blood cultures (BCs) in the management of adult patients discharged from the emergency department (ED) with a diagnosis of community acquired pneumonia (CAP).

Methods: The courses of antibiotic regimens and outcomes of patients with positive BC results were examined to assess their influence on BCs.

Results: BCs were obtained from 289 outpatients. Six clinically significant organisms were identified (a yield of 2.1%). Outpatients with CAP who had blood cultures performed had a 0.69% (2 of 289) chance of having a change of treatment directed by the results of the culture.

Conclusion: BCs have little utility in the ambulatory management of CAP.

Despite the fact that contemporary guidelines for the management of community acquired pneumonia (CAP) recommend ordering blood cultures (BCs) only in admitted patients, BCs are commonly ordered as part of the laboratory investigation of patients with CAP who are subsequently discharged from emergency departments (EDs). The utility of routine BC has been questioned. We sought to evaluate the contribution of BC to patient management and outcome in a large number of Canadian outpatients treated for CAP.

METHODS

Study design

The “capitaL study” was a multicentre, controlled clinical trial with cluster randomisation to determine if the use of a clinical pathway in the ED improved the efficacy of treatment for CAP without compromising patient wellbeing. We used the data from the capitaL study to conduct a sub-study to determine whether the use of BC contributed to management or outcome in adult patients with CAP discharged from the ED.

Study setting and population

Eligible patients were adults discharged from the EDs of participating Canadian hospitals between 1 January and 31 July 1998 after presenting with at least two signs or symptoms of CAP (for example, temperature ≥38°C, productive cough, chest pain, shortness of breath, crackles on auscultation) and whose chest radiograph was compatible with acute pneumonia. Exclusion criteria included pregnant or nursing women, alcohol addiction, chronic renal failure, or immune deficiency. The study protocol was approved by the research review board of each participating hospital.

Study protocol

Participating hospitals were assigned either to implement a clinical pathway (n = 9), which consisted of a prediction rule to guide the decision regarding the site of treatment, levofloxacin therapy, and practice guidelines, which included BCs being drawn from every patient or continuing conventional management of CAP (n = 10). In the “intervention” arm, ambulatory therapy was recommended for patients with a Pneumonia Severity Index (PSI), of less than 90, as described by Fine et al. We defined the clinical value of BC as the probability of changing clinical management based on BC results.

Study outcomes

Outcome measures

The data from patients with positive BC were analysed by two investigators (SC and RA) to assess whether the results may have changed the course of treatment for the patient. For the purposes of the study, “utility” of BC was defined as attribution of change in the course of treatment to the BC result. Any changes in treatment made within 24 hours (before which BC results were rarely available) were attributed to the BC. “Patient outcome: was defined as hospital admission or death within 42 days of discharge.

RESULTS

There were 1743 patients enrolled in the capitaL Study. Of these, 1022 were admitted to hospital, and 721 discharged. Blood cultures were drawn from 289 outpatients (40.1%), 233 of 333 (70.0%) in the intervention arm and 56 of 388 (14.4%) in the conventional arm, with a yield of six pathogens. Table 1 shows the courses of treatment of the six patients with positive results. Three patients recovered uneventfully without any change in treatment. One patient, BC positive for Streptococcus pneumoniae with a PSI score of 96, was admitted later the same day of his initial ED discharge. His initial empirical regimen was continued. Two patients had changes in their course of treatment attributed to BC results. One patient BC positive for Staphylococcus aureus was switched to ceftriaxone. The other patient was switched from a fluoroquinolone to an antipseudomonal antibiotic after BC positive for Pseudomonas aeruginosa. Both of these patients had severe CAP.

Abbreviations: CAP, community acquired pneumonia; BC, blood culture; ED, emergency department

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S pneumoniae, initially discharged from the ED receiving treatment with trimethoprim-sulfamethoxazole, was admitted the following day and treated with ceftriaxone and erythromycin. The other patient, BC positive for Escherichia coli, was admitted two days later and treatment was changed to gentamicin followed by oral trimethoprim-sulfamethoxazole on discharge from hospital, one day after admission.

At 42 day follow up, all patients with positive BC were alive and had had no subsequent readmissions. There were no deaths or other readmissions in any other outpatients.

Patients discharged from the ED with CAP who had BC performed had a 0.69% (2 of 289) chance of having a change in treatment directed by the results of the BC. Patients in whom BC did yield positive results had only a 33.3% (2 of 6) chance of having a change in treatment determined by the result.

**DISCUSSION**

The issue of blood cultures in outpatient CAP management has been neglected in the literature. Stuurman and colleagues, in a retrospective study of all patients (not only CAP) discharged from an ED after BC, found similar results to ours; in 1.8% of cases (24 of 1350), positive results were found, and 0.52% (7 of 1350) of patients had results that potentially influenced the outpatient management of CAP and should not be used.

Blood cultures rarely contribute to the outpatient management of CAP from 19 different Canadian hospitals. This study evaluated the utility of BCs in the outpatient management of CAP and should not be used.

The advantage of using data from the capital Study was that, by the protocol directing BC in all patients in the intervention arm, we were able to follow up BCs in a large number of outpatients, while the conventional arm would show how many BCs are drawn on this population in current practice.

In the conventional arm, 14.4% of patients had BCs drawn, demonstrating that BCs are used sporadically, although not insignificantly, in outpatient CAP management. The combined 40% rate of BC probably represents selection bias in that sicker patients are more likely to have BCs drawn. Considering that outcomes in all outpatients were favourable, we can assume it to be unlikely that BC would have significantly served any of the patients in whom BCs were not drawn.

In our study, one patient, BC positive for E coli and initially treated with levofloxacin, was subsequently admitted two days later and treated with gentamicin, followed by oral trimethoprim-sulfamethoxazole on discharge from hospital the next day. The investigators considered it probable that the BC result steered the change in treatment to that with a narrower spectrum of coverage. Although the decision to admit the patient may have been made on clinical grounds, the fact that the patient was discharged one day after his admission suggests that this decision was made as a result of the identification of E coli bacteraemia. The investigators felt that this reason for admission, after two days of treatment on a drug with high oral bioavailability and good E coli coverage, would have been inappropriate and argue that not receiving the result would have saved the hospital money and the patient inconvenience.

In the case of the patient BC positive for S pneumoniae, although the investigators attributed the admission the following day to the BC result, the antimicrobial regimen was changed to one with a broader spectrum of coverage than the identification of S pneumoniae would have suggested (ceftriaxone and erythromycin), suggesting that the “step up” in treatment was independent of the BC result.

**Limitations**

Our study does have several limitations. Firstly, it is possible that patients excluded from the study may have been candidates for outpatient therapy, so our findings may not apply to all outpatients with CAP.

The fact that 70% of patients in the intervention arm had BCs suggests poor compliance with the study protocol but, considering the universally favourable outcomes, probably represents selection bias in favour of our conclusions in that these are likely to represent the sickest patients.

Our assessments of the effect of BC on clinical decision making were made using the standard submission form and not the original patient record. To be certain that the influence of BC was not underestimated, any change in antimicrobial class after 24 hours was deemed to have been as a result of the BC, even in cases where the investigators believed that the change was an inappropriate reaction to the BC result.

**Conclusion**

This study evaluated the utility of BCs in the outpatient management of CAP from 19 different Canadian hospitals. Blood cultures rarely contribute to the outpatient management of CAP and should not be used.

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Presented at the 9th International Conference of Emergency Medicine, Edinburgh, Scotland, 17–21 June 2002.

Funding: this research was supported by grant 9807PTP 79121 UI D from the Medical Research Council of Canada and the Pharmaceutical Manufacturers’ Association of Canada Awards Program/Industry Partnership (Janssen Ortho Inc was the industry partner).

Conflicts of interest: none declared.

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**Table 1  Course of patients with positive BC (n = 6)**

<table>
<thead>
<tr>
<th>Organism</th>
<th>Age</th>
<th>PSI score</th>
<th>First antibiotic</th>
<th>Second antibiotic</th>
<th>Change in relation to BC</th>
<th>Subsequent admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>S pneumoniae</td>
<td>54</td>
<td>89</td>
<td>Levofloxacin</td>
<td>–</td>
<td>None</td>
<td>–</td>
</tr>
<tr>
<td>S pneumoniae</td>
<td>44</td>
<td>44</td>
<td>Cefuroxime+Levofloxacin</td>
<td>–</td>
<td>None</td>
<td>–</td>
</tr>
<tr>
<td>S pneumoniae</td>
<td>30</td>
<td>40</td>
<td>TMP/SMX</td>
<td>Ceftriaxone/erythromycin</td>
<td>Possible</td>
<td>1 day later</td>
</tr>
<tr>
<td>S pneumoniae*</td>
<td>66</td>
<td>96</td>
<td>Azithromycin+Cefuroxime</td>
<td>–</td>
<td>None</td>
<td>Same day</td>
</tr>
<tr>
<td>E coli</td>
<td>76</td>
<td>66</td>
<td>Levofloxacin</td>
<td>Gentamicin–TMP/SMX</td>
<td>Yes</td>
<td>2 days later</td>
</tr>
<tr>
<td>E coli</td>
<td>80</td>
<td>90</td>
<td>Levofloxacin</td>
<td>–</td>
<td>None</td>
<td>–</td>
</tr>
</tbody>
</table>

PSI, Pneumonia Severity Index; TMP/SMX, trimethoprim-sulfamethoxazole. *The one positive result found in the conventional arm.
REFERENCES
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doi: 10.1136/emj.20.6.521