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RESEARCH ARTICLE

Routine blood cultures in the management of community acquired pneumonia; is it necessary?

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ABSTRACT

INTRODUCTION: The role of blood cultures (BCs) in the management of community acquired pneumonia (CAP) has generated a lot of controversy among clinicians in recent times. The main objectives of this audit were to determine if BC results impact the choice of antibiotics, and hospital outcomes in CAP.

MATERIALS AND METHODS: This was a retrospective study of adults with CAP treated in the ED of Goulbourn Valley Base Hospital, Shepparton in Australia from November 2010 to November 2011.

RESULTS: Two hundred and twenty five patients were treated for CAP during the period in review with a mean age of 67.09±19.82 yrs and male:female of 1.5:1. 277 sets of BCs were performed and only 2.2% of the cases had true positive BCs .87% of the total cost of performing these BCs was spent on those with negative cultres.15.1% of the cases had their antibiotics changed during their hospitalization but the results of the BCs had no impact on the antibiotic change. Even though not statistically significant true positive BCs was associated with prolong length of hospital stay (7.6 ± 9.39 days vs 4.89 ± 3.24 days, p=0.44), and duration of IV antibiotic use (4.8±3.27 days vs 3.58±1.97 days, p=0.39). But the case fatality rate was much lower in those with positive BCs, (0 vs 5.7%,p< 0.05). Tachycardia (>120.4±12.46 bpm), neutrophilia (15.0± 8.16 /ul), and high CRP (326.4±146.32 ug/l) were predictors of true positive BCs.

CONCLUSIONS: Routine BCs in the management of CAP is not cost-effective with large portion of the cost spent on cultures that returned negative result .Therefore it use show be limited to those likely to return positive cultures.

KEY WORDS: Community acquired pneumonia, Routine blood culture

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INTRODUCTION

Routine blood cultures (BCs) is recommended in most treatment guidelines for community acquire pneumonia (CAP).[1,2] However several studies have shown that the yield of blood cultures in patients with CAP is very low and even when positive cultures where obtained the results had no impact on the change of antibiotic(s).[3-6] Positive BC has also been found not to have significant impact on hospital outcome parameters therefore most clinicians and investigators now think it is of very little clinical value and is not cost effective.[5,6,7]

This audit is therefore undertaken primarily to determine if the BC results has impact on the changes of antibiotic regime, length of hospital stay (LOHS),and duration of IV antibiotics use in patients with CAP, and secondarily to determine the yield of BCs and clinical predictors of positive yield.

MATERIALS AND METHODS

This is a retrospective audit of the clinical records of adults 18 years and above treated for CAP between November 2010-November 2011 at the emergency department (ED) of Goulbourn Valley base Hospital, Shepparton, Victoria Australia. The patient records were reviewed on the computer chart view programme and the laboratory and imaging results were reviewed on the Labtrack and IMPAX computer programmes respectively. Categorical data are presented in proportion and were compared with McNemar Chi square while continuous data were presented in mean and standard deviation and compared using Student's T test.

RESULTS

225 patients were treated for CAP in the one year period with the age range of 18-92 yrs (mean±SD of 67.09±19.82 yrs), and male:female ratio of 1.5:1. Patients with negative BCs (67.3±19.58) were older than those with positive cultures (63.0±19.27) with P=0.32.

Blood Cultures Yield

A total of 277 sets of BCs were performed with an average of 2.2 BC sets/case in those with positive cultures and 1.03 BC sets/case in those with negative BCs. Only 5(2.2%) of the 225 patients had true positive BCs, while 10(4.4%) had false positive BCs, and 93.4% had negative BCs. The detail of the BCs isolates is shown in table 1, with *Streptococcus pneumoniae* been the most common isolate in true cultures and coagulase negative *staphylococci* most common in false positive cultures. 40% of those with positive BCs and 13.25% with negative cultures had prior antibiotic exposure before the BCs were obtained.

Predictors of positive BCs

Tachycardia (>120.4±12.46 bpm), neutrophilia (15.0±8.16 /ul), and high CRP (326.4±146.32 ug/l) were significantly higher in those with true positive BCs. The details of the clinical characteristics in relation to the BC results are shown in table 2.

Costing of blood cultures

The 277 sets of BCs cost $ 9237.95($ 33.35/set of BCs), and 87% of these total cost was spent on those with negative cultures ($ 8037.35 vs $ 1200.60).

Impact of BC results on hospital outcome parameters

All the patients had empirical antibiotics of which 60% received a combination of ceftriaxone and roxithromycin and 28.9% received *ceftriaxone* and azithromycin. The detail of the empirical antibiotics used to treat patients with CAP in our ED is shown in figure 1. 34(15.1%) of the patients had a change in antibiotic regime during the course of their hospitalization. There was no recorded evidence in all the cases to suggest that changes in antibiotic regime were necessitated by the culture results, as the changes were either effected before the culture results were obtain or the new antibiotics chosen were not part of the sensitivity panel. The length of hospital stay(LOHS) was higher in those with true positive BCs than in those with negative BCs (7.6±9.39 days vs 4.89±3.24 days ,p=0.44), and similarly the duration of intravenous antibiotic(s) administration was longer in those with positive BCs than in those with negative cultures(4.8±3.27 days vs 3.58±1.97 days, p=0.39). But there was no difference in the duration of pyrexia after starting empirical antibiotic(s)(1.0±1.41 days vs 1.05±1.61 days, p=0.26),and true positive BCs was associated with very low absolute risk reduction (ARR) of 0.05(5%),and relative risk reduction of 1.0 with a number needed to treat (NNTT) of 19.33. However the case fatality rate was much lower in those with positive BCs than in those with negative cultures(0 vs 5.7%,p< 0.05),the detail is shown in table 2.

DISCUSSION

Only 2.2% of the patients with CAP in this audit had

Table 1. Isolates from the blood cultures

Cultures positives	n (%)
True positive isolates	5/225 (2.2)
Stretococcus pneumoniae	3(60)
Staphylococcus aureus	1(3)
Escerichia coli	1(20)
Contaminated cultures	10/225 (4.4)
Staphylococcus epidermidis	4(40)
Staphylococcus hominis	3(30)
Staphylocossus capitis	2(20)
Staphylococcus saprophyticus	1(10)
Siphonobacter spp.	1(10)

Numerator, true positive/contaminated cultures; denominator, total culture positive

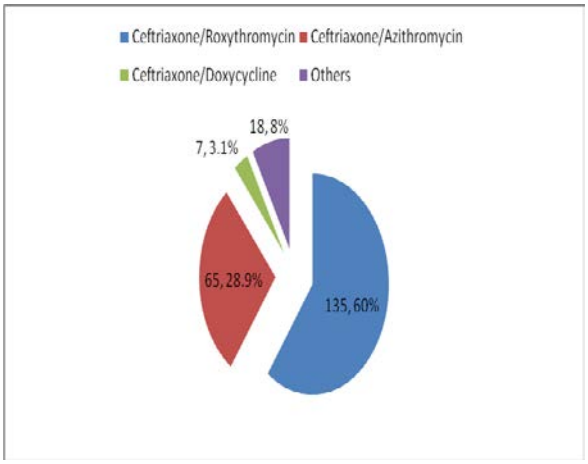

Figure 1. Common empirical antibiotics used to treat patients with CAP in ED

Table 2. Patient characteristics predicting outcome of blood cultures

Patient characteristics	True positive cultures	Negative cultures	p-value
Age	63.0±19.3	67.3±9.6	0.32
Body temperature	38.0±16.0	37.8±1.3	0.29
Systolic blood pressure	142.8±20.9	130.2±23.7	0.09
Heart rate	120.4±12.5	103.7±22.1	0.002
Oxygen saturation	96.6±3.1	96.7±7.0	0.24
Neutrophil count	15.0±8.2	10.3±4.9	0.0001
CRP	326.4.0±146.3	148.4±125.4	0.004

true positive BCs which is much lower than the yield reported in some other studies,[7-9] despite having higher numbers of BCs sets/case. Cham et-al,[7] in Singapore reported a true positivity rate of 5.3% in adults patients with CAP(mean of 1.9 BCs sets/case vs our 2.2 BCs sets/case). Similarly Ramanujam and Rathler,[8] and Corbo et-al,[9] in the USA reported true BCs positivity rate of 4.5% and 9% respectively in their study of patients with CAP. Contrary to the findings in other studies,[3-10] prior antibiotic(s) use was not a reason for the low yield of the BCs in this audit and apart from the number of BCs sets /case no obvious reasons are found to explain the low true positivity and high false positivity rates. Therefore strategies to improve the yield of BCs in patients with CAP might involve increasing the amount of blood inoculated into the broth, increasing the number of BCs per case and improving on the aseptic techniques to cut down on the contamination rate. This may be complemented in those in whom it is likely to yield a true positive result using clinical parameters such as tachycardia, neutrophilia and high CRP which were predictors of true positive BCs in this and other studies.[6,10,11] These clinical parameters can subsequently be employed to develop a simple predictive score that can be use readily in the ED to decide which patient with CAP should have BCs.

Empirical antibiotic(s) was started in all the patients treated in our ED like in most other studies,[7,12] as BCs results are usually not available for 48-72 hrs. In all the patients (15%) that had their antibiotic(s) changed during the course of hospitalization the culture results had no influence on the choice of new antibiotic(s) as clinicians didn't necessarily depending on the culture results before antibiotics were changed. This practice is similar to that observed in earlier studies,[3,5,6,7,11] and is a major reason why most clinician now belief that

routine BCs are no more necessary.

In addition to positive BCs not influencing the change in antibiotic regime it has negative impact on most measures of hospital outcomes in CAP. Even though the differences were not statistically significant in this audit true positive BCs was associated with prolong hospital stay and duration of intravenous antibiotics use. This with the low ARR and the fact that 87% of the total cost of BCs is spent on cultures that yield negative results suggest that BCs in this study like in other studies,[4,6,7,13-16] was not cost-effective.

And even though true positive BCs were associated with better survival and the number of cultures needed to save one patient is about 20 the number with true positive BCs was too small to make an appreciable impact on the cost of caring for patients with CAP. This benefit is outweighed by the enormous increase cost of care incurred from the longer hospital stay and duration of IV antibiotic use. Therefore further supporting the view that BCs is not cost effective in the management of patients with CAP.

CONCLUSION

Even though some clinicians still belief that BCs are needed in the management of patients with CAP. The fact that culture results are not available for 48-72 hrs coupled with the fact that it has no impact on the change of antibiotic(s) regime, and it lack of cost effectiveness underscores the need to limit the use of BCs to only those in whom it is more likely to be truly positive. The finding from this audit strongly support the need for the development of clinical predictive score to aid in this decision making as to who among patients with CAP should get BCs.

CONFLICT OF INTEREST: None to declare.

FINANCIAL INTEREST: None to declare.

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