

A Clinical Study of Evaluation of Blood Cultures in Paediatric Patients of Community Acquired Pneumonia at a Tertiary Care Teaching Hospital

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ABSTRACT

Background: Community acquired pneumonia is a common cause of hospitalization amongst children. There are varied treatment modalities available for its cure. According to the infectious disease society of America, strict norms have been put forward for the management of community acquired pneumonia. These include collection of blood cultures in all the patients requiring hospitalization. Various studies have shown that diagnostic tests lead to an increase in hospital revisit rate but no significant change in the clinical management. Our present study is aimed at assessing the blood cultures in paediatric patients with community acquired pneumonia and find its association with paediatric positive disease detection.

Materials and Methods: The retrospective study was conducted in the Department of Microbiology, RKDF Medical College Hospital & Research Centre, Jatkhedi, Bhopal, Madhya Pradesh (India) during a period of two years. The data was obtained from the medical records of the hospital and it was anonymized before tabulating and analysis. Patients aged between 4 months to 17 years without any co morbidities were included in this study. Information was collected regarding the demographic data, diagnostic tests, antimicrobial therapy and therapeutic procedures performed. Information regarding child's vaccination was also taken into consideration. Vaccination against pneumococcus, hemophilus influenza type b was given prime importance. Statistical analysis was performed using Chi square test or fisher's test. Continuous variables were assessed using linear regression. SPSS software was used for analysis.

Results: Blood cultures of 280 patients were obtained. About 7 children (2.5%) had positive blood culture, 5 for streptococcus

pneumonia and 2 for non typable strain of haemophilus influenza. Around 38.5% in blood culture group received antibiotics before admission to hospital and 36.4% children in whom blood culture was not obtained received antibiotics. There were 88.5% children who met the SIRS criteria at the time of presentation in the blood culture group. The factors associated with increased odd's ratio include patients receiving antibiotics (1.47, 95% CI 0.87-1.99), patients receiving iv hydration (3.66, 95% CI 3.11-3.96), patient's who met SIRS criteria at the time of presentation (1.67, 95% CI 0.93-2.89) and patients who were admitted from ED (1.76, 95% CI 1.03-2.21).

Conclusion: Blood culture obtainment amongst hospitalised children rarely lead to identification of causative organism due to high incidence of false positive cultures. According to our study there is a need of refining the association between blood culture and community acquired pneumonia.


Keywords: Antibiotics, Community, Haemophilus, Pneumonia.

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INTRODUCTION

The common cause of hospitalization amongst children is community acquired pneumonia. It substantially increases the healthcare cost both for the patients and for the medical authorities. There has been an extensive variation in the treatment of community acquired pneumonia.^{1,2} According to the infectious disease society of America, strict norms have been put forward for the management of community acquired pneumonia. These include collection of blood cultures in all the patients requiring hospitalization.³ However it has been seen that this criterion of obtaining blood cultures is not often followed.⁴ The blood cultures

do not identify the microorganisms and therefore there are no alterations in the antimicrobial management. Due to this blood cultures are considered of limited utility.⁵⁻⁷ There is a high prevalence of bacteraemia amongst children who are hospitalized with community acquired pneumonia. However the overall prevalence is reported to be only 7%.⁸ All this poses an increased potential of false positive results in blood cultures. This lead to a significant increase in treatment costs as hospital stay was prolonged by 4.5 days.⁹ Various studies have shown that diagnostic tests lead to an increase in hospital revisit rate but no

significant change in the clinical management.¹⁰ There have been various studies which demonstrate that the incidence of positive cultures is low and there is less sensitivity in detecting bacterial pneumonia.^{11,12} Our present study is aimed at assessing the blood cultures in paediatric patients with community acquired pneumonia and find its association with paediatric positive disease detection.

MATERIALS AND METHODS

The retrospective study was conducted in the Department of Microbiology, RKDF Medical College Hospital & Research Centre, Jatkhedi, Bhopal, Madhya Pradesh (India) during a period of two years. Ethical committee clearance was obtained from the institute for obtaining information of the patients and a written informed consent was also collected for obtainment of information of patients. Patient's confidentiality was maintained and data was anonymized prior to tabulating and analysis.

The data was obtained from the medical records of the hospital. Patient's aged between 4 months to 17 years, otherwise healthy who were admitted to the inpatient department for community acquired pneumonia and was identified with pneumonia during discharge or at the time of admission were included in the study and patient's admitted directly to the intensive care unit due to any associated medical condition like chronic neuromuscular problem, respiratory, cardiovascular, gastrointestinal, congenital abnormality or malignancy elsewhere in body were excluded. Information was collected regarding the demographic data,

diagnostic tests, antimicrobial therapy and therapeutic procedures performed. Information regarding child's vaccination was also taken into consideration. Vaccination against pneumococcus, hemophilus influenza type b was given prime importance. Patients were considered immunized if there were completed records for review and considered incomplete if there was no record or documentation. Systemic inflammatory response syndrome criteria were met based on the vital signs of the patient. False positive blood culture results were considered if there was growth of an organism which was unlikely a pathogen in healthy children like Bacillus non antracis species and corneycacterium, if there was growth of numerous bacteria that were present in contaminated skin like coagulase negative staphylococcus, or there was a growth of a likely organism in simple blood culture greater than 48 hours.

In this study, Group I patients were defined as treated patients from whom blood culture was drawn and patients in whom blood culture was not performed were categorised as control i.e. Group II. Group I was matched with Group II in 1:1 ratio using random sampling. There was a large sample of matched participants without blood cultures, therefore controls were matched with replacement which resulted in pseudo population. The final sample of this pseudo-population control group was reweighted to restore the original control group sample size.

Statistical analysis was performed using Chi square test or fisher's test. Continuous variables were assessed using linear regression. SPSS software was used for analysis.

Table 1: Characteristics of children hospitalised for pneumonia

VARIABLE	Culture (n=280)	No culture (n=140)	Matched culture Population (n=248)	Matched no culture pseudo-population (n=248)
Age	6.1(3.8)	5.8(3.6)	6.0(3.4)	5.9(3.5)
male gender	154(55%)	73(52.1%)	132(53.2%)	121(48.7%)
Preceding illness (days)	5.5(3.9)	5.4(4.2)	5.2(4.1)	6.3(5.2)
Received antibiotics pre-admit	108(38.5%)	51(36.4%)	92(37.1%)	95(38.3%)
Met SIRS criteria at presentation†	248(88.5%)	118(84.2%)	219(88.3%)	210(84.6%)
Received supplemental oxygen at presentation	144(51.4%)	74(52.8%)	127(51.2%)	124(50%)
Chest X-ray performed	268(95.7%)	135(96.4%)	237(95.5%)	226(91.1%)
Pleural effusion identified	160(57.1%)	89(63.5%)	143(57.6%)	159(64.1%)
Received intravenous hydration	253(90.3%)	123(87.8%)	223(89.9%)	225(90.7%)
Vaccinated for Hib, S. pneumo	270(96.4%)	136(97.1%)	240(96.7%)	244(98.3%)

Table 2: Variables associated with blood cultures

VARIABLE	Unadjusted odd's ratio	Adjusted odd's ratio
Age	0.96(0.99-1.23)	1.02(0.92-1.22)
male gender	0.88(0.81-1.02)	0.98(0.86-1.24)
Preceding illness (days)	1.01(0.92-1.55)	0.96(0.84-1.34)
Received antibiotics pre-admit	1.24(0.94-1.84)	1.47(0.87-1.99)
Met SIRS criteria at presentation†	1.36(0.87-2.76)	1.67(0.93-2.89)
Received supplemental oxygen at presentation	0.92(0.81-1.10)	0.80(0.65-1.04)
Pleural effusion identified	0.80(0.66-1.54)	0.67(0.46-1.24)
Received intravenous hydration	3.45(3.21-3.87)	3.66(3.11-3.96)
Insured	0.35(0.32-0.46)	0.41(0.30-0.52)
Admitted from ED	1.86(1.23-2.88)	1.76(1.03-2.21)

RESULTS

During the study period, a total of 448 children met the inclusion criteria. But 28 children were excluded from the study because of the presence of complex chronic condition. Table 1 summarizes the demographic data and the characteristics of children hospitalised for pneumonia. Blood cultures of 280 patients were obtained. About 7 children (2.5%) had positive blood culture, 5 for streptococcus pneumonia and 2 for non typable strain of haemophilus influenza. There were 3 patients with pneumococcal bacteremia who were given narrow spectrum antibiotics and rest were given cephalosporins. Around 38.5% in blood culture group received antibiotics before admission to hospital and 36.4% children in whom blood culture was not obtained received antibiotics. There were 88.5% children who met the SIRS criteria at the time of presentation in the blood culture group. Majority of children were vaccinated against Hemophilus influenza and streptococcus pneumonia (96.4% in blood culture group and 97.1% in non-blood culture group). There was no significant difference amongst the factors that were assessed in this study. Thus suggesting that matching procedure was successful. Table 2 describes the association between the selected criteria and the decision of obtainment of blood culture. The factors associated with increased odd's ratio include patients receiving antibiotics (1.47, 95% CI 0.87-1.99), patients receiving iv hydration (3.66, 95% CI 3.11-3.96), patient's who met SIRS criteria at the time of presentation (1.67, 95% CI 0.93-2.89) and patients who were admitted from ED (1.76, 95% CI 1.03-2.21). Patients who were insured had fewer blood cultures obtained than who didn't had insurance (0.41, 95% CI 0.30-0.52).

DISCUSSION

In our present study, several factors are indentified to be associated with the decision of obtaining blood cultures. Studies conducted in the past by Tayima T et al¹³ and Leibowitz et al¹⁴ compared the clinical, laboratory and radiographic criteria for community acquired pneumonia. The most frequently isolated microorganisms from blood cultures of children with community acquired pneumonia were streptococcus pneumonia, haemophilus influenza and staphylococcus aureus. In our study increased odd's ratio for blood culture was found in the following criteria i.e. administration of antibiotics prior to hospital admission, consistence with SIRS criteria and administration of intravenous hydration. According to a study by Neuman MI et al¹⁵ on emergency management of childhood pneumonia in US, found that admission to hospital from ED was associated with increased odd's ratio for blood culture obtainment. This fact was consistent with our study. Blood cultures are recommended by the American Thoracic Society as a part of initial evaluation of patients with community acquired pneumonia.¹⁶ Blood culture obtainment decision occurs in accordance with several other decisions regarding the management of community acquired pneumonia. Other decisions include the route and mode of administration of antimicrobial therapy, other diagnostic tests and the need of hospitalization. According to WHO, presence of cough and tachypnea is the criteria that defines mild to moderate community acquired pneumonia.^{17,18} But this criteria is of limited use as the symptoms are consistent with most of the lower respiratory tract infections. There have been numerous reports on the presence of false positive cultures, which have ranged from 0.7% to 8.1%.¹⁹

Studies conducted by Kurz H et al²⁰ on spectrum of pathogens in children and youth with community acquired pneumonia have reported the presence of contaminants while obtaining blood culture. The present study was associated with certain limitations like the frequency of children with blood culture admitted to ICU were marginally high, which could lead to discrepancy in result. Moreover the timing of blood culture was also not available to us, so we could not delineate the cases in which blood cultures were obtained after development of complication during hospitalization. In our study only hospitalized children were included, ambulatory children in outpatient setting were not included.

CONCLUSION

Blood culture obtainment amongst hospitalised children rarely lead to identification of causative organism due to high incidence of false positive cultures. According to our study there is a need of refining the association between blood culture and community acquired pneumonia. Various newer and more defined diagnostic tests need to be performed to confirm the diagnosis.

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