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Comparative assessment of different antibiotic treatment in children with community acquired pneumonia: A prospective study

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Abstract

Background and Aim: Pneumonia is the leading single cause of mortality in children aged less than five years, with an estimated incidence of 0.29 and 0.05 episodes per child-year in low-income and high-income countries, respectively. Present study was performed with an aim to access the clinical course and outcome of children hospitalized with CAP and compare the efficacy of intravenous amoxiclav with ceftriaxone.

Material and Methods: Present prospective study was performed in 120 Paediatric patients at Tertiary Care Institute of India for the period of one year. Patients aged below 5 years were included in this study. Outcome variables included duration of fever, number of days of oxygen treatment, duration of total IV antibiotic therapy, treatment failure, and duration of hospital stay. All the patients were divided broadly into two study groups with 60 patients in each group. Group 1 included patients who received intravenous amoxiclav, Group 2 included patients who received intravenous ceftriaxone.

Results: There was significant variation in initial therapy choice across hospitals; the rate of narrow-spectrum use ranged from 17.6% to 91.4%. There was no significant difference in duration of oxygen, duration of fever, or readmission rate within 7 days. However, hospital stay was found to be longer in Group 2 as compared to Group 1.

Conclusion: Amoxclav and ceftriaxone are equally effective in children suffering from CAP. Amoxclav can be easily used in uncomplicated case of CAP. No complications were observed in present study and readmission rate was found almost negligible.

Keywords: Children, fever, hospital stay, pneumonia

Introduction

Community acquired pneumonia (CAP) is a common illness in the pediatric population with an annual incidence of 34–40 cases per 1000 in children younger than 5 years of age and 7 cases per 1000 in adolescents in Europe and North America^[1, 2]. It is the leading cause of pediatric hospitalization in the United States, with more than 160,000 hospital admissions annually^[3]. Approximately three quarters of these hospitalizations occur at general community hospitals, while the remainder occurs at children's hospitals^[4].

While a myriad of microorganisms may cause CAP, in reality a relatively small number of pathogens predominate, in particular the bacteria, of which *Streptococcus pneumoniae* (pneumococcus) is by far the most common^[5].

Pneumonia is the leading single cause of mortality in children aged less than five years, with an estimated incidence of 0.29 and 0.05 episodes per child-year in low-income and high-income countries, respectively^[6]. A number of guidelines have been published worldwide, describing the optimal treatment of patients with CAP, with the aim of improving patient outcomes^[7].

Susanna Esposito *et al.*, stated that antibiotic guidelines faced by many challenges which might reduce its reliability such as absence of standard protocol to establish the diagnosis, difficulty to determine the exact aetiology in paediatric community acquired pneumonia, paucity of information regarding pharmacodynamics and pharmacokinetic, the emerging resistance to antibiotics used for community acquired pneumonia and finally the application of some vaccine against respiratory pathogen^[8, 9]. The explanation for the problem facing antibiotics guideline renders immediate therapy empirically an urgent decision^[10, 11]. The diagnosis of Community Acquired Pneumonia (CAP) is usually depending on combination of clinical, radiological and laboratory features^[12].

Streptococcus pneumoniae encountered in 27-44%, mixed infection of *Streptococcus pneumoniae* and other infection occurred in 9-30%, respiratory viruses in 20-45% of the cases, Hemophilus influenzae is rare after vaccination and the remaining percentage due other agents. Whereas some studies suggest that penicillins are as effective as broad-spectrum antibiotics for empiric treatment of CAP due to *S. pneumoniae* [13]. Some authors have suggested that second-generation cephalosporin (ceftriaxone) or a third-generation cephalosporin (cefotaxime or ceftriaxone) is somewhat more effective than either ampicillin or penicillin [14, 15].

Present study was performed with an aim to access the clinical course and outcome of children hospitalized with CAP and compare the efficacy of intravenous amoxiclav with ceftriaxone.

Material and Methods

Present prospective study was performed in 120 Paediatric patients at Tertiary Care Institute of India for the period of one year. Patients aged below 5 years were included in this study. Both males as well as females were selected for the study. Patients' guardians/parents were informed and explained about the purpose and procedure of the study. Ethical committee clearance was obtained prior to the study. A written informed content was obtained from the patient.

Inclusion criteria were: Patients with CAP and Patients less than 5 years of age

Exclusion criteria were: Exposure to any investigational drug or procedure within 1 month prior to study entry or enrolled in a concurrent study that may confound results of this study.

Data from in-patient hospitalization, symptoms on presentation, physical examination at presentation, laboratory and microbiologic indices, and treatment will be reviewed. Outcome variables included duration of fever, number of days of oxygen treatment, duration of total IV antibiotic therapy, treatment failure (defined as change of antibiotic therapy), and duration of hospital stay. All the patients were divided broadly into two study groups with 60 patients in each group.

- Group 1 included patients who received intravenous amoxiclav,
- Group 2 included patients who received intravenous ceftriaxone.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages, means and standard deviations. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

No difference was found between two groups in respect to gender, age, asthma, reactive airway disease, or viral lower respiratory tract infection. In present study subjects from, Group 1 i.e. amoxiclav group 27/60 had fever, 15/60 were suffering from Tachypnea, 3/60 suffered from tachycardia and abnormal WBC was found in 25/60 patients.

Whereas in Group 2, 34/60 patients were suffering, 19/60, 5/60 had tachycardia and 20/60 had abnormal WBC. In present study abnormal WBC was found to be more in first

group (Table 1).

In current study we found that there was significant variation in initial therapy choice across hospitals; the rate of narrow-spectrum use ranged from 17.6% to 91.4% ($P \leq 0.05$). Based on results of present study there was no significant difference in duration of oxygen, duration of fever, or readmission rate within 7 days. However, hospital stay was found to be longer in Group 2 as compared to Group 1 (Table 2).

Table 1: Clinical characteristics of patients

Variable	Group 1 N=60	Group 1 %	Group 2 N= 60	Group 2 %
Fever	27	45	34	56.6
Tachypnea	15	25	19	31.6
Tachycardia	3	5	5	8.3
Abnormal WBC	25	41.6	20	33.3

Table 2: Variable outcomes among study participants

Variable	Group 1	Group 2
Fever (Duration)	5.9 (4-8)	8.4 (7-12)
Tachypnea	14.9	0.154
Tachycardia	4.5 (15-23)	5.5 (17-29)
Abnormal WBC	7.1 (6-10)	7.2 (6-12)

Discussion

National clinical practice guidelines for pneumonia management among hospitalized children recommend empiric combination therapy with a macrolide and beta-lactam antibiotic for patients in whom infection with *M. pneumoniae* is a significant consideration.¹¹ Although commonly prescribed, our study suggests that combination therapy does not have a treatment advantage among preschool children with respect to LOS, transfer to the intensive care unit, or rate of hospital readmission. However, in this age group, combination therapy was associated with a significantly increased cost, reflecting increased resource utilization in this group. Among children and adolescents 5–17 years of age, combination therapy was associated with a shorter LOS with no significant difference in total hospital costs or rates of ICU transfer, mortality or readmission.

Interestingly, while it is well described that pneumococcal infections commonly complicate both seasonal and pandemic influenza infections, more recently it was documented that the pneumococcus was a common bacterial co infection in patients with influenza A H1N1 infection who were admitted to hospital with CAP [16]. There is considerable concern about the emerging resistance among the usual CAP pathogens to the most commonly used antimicrobial agents.

Ambroggio *et al.* explored the comparative effectiveness of empiric beta-lactam therapy and beta-lactam-macrolide combination therapy for pneumonia among patients admitted to freestanding children's hospitals and found that combination therapy was associated with a shorter LOS among school-aged children with no benefit to preschool children [17].

In present study we compared amoxiclav therapy to ceftriaxone therapy for children hospitalized with CAP. In this study, we found that both antibiotics in all measured outcomes including like duration of oxygen, duration of fever, daily standardized pharmacy and readmission rates within 7 days were equal.

Results of the present study are in support of Gotfried MH who recommended the empiric use of amoxclav in CAP of hospitalized pediatric patients^[18]. Balgos AA *et al.* in their study concluded that amoxicillin/clavulanate 875/125 mg twice daily is as effective as amoxicillin/clavulanate 500/125 mg three times daily for the treatment of community-acquired lower respiratory tract infections and could improve patient compliance^[19].

Although the strength of this study is being prospective conducted in teaching tertiary hospital but factors like the small numbers, difficulty in making precise diagnosis of pneumonia, absence of accurate decision regarding failure to response after 72 hours might be the limitations of the study in addition to the confounders.

Conclusion

Amoxclav and ceftriaxone are equally effective in children suffering from CAP. Amoxclav can be easily used in uncomplicated case of CAP. No complications were observed in present study and readmission rate was found almost negligible.

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