Comparison of efficacy of Amoxicillin versus Ceftriaxone in children with pneumonia

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ABSTRACT

BACKGROUND: Pneumonia is the leading cause of death in children worldwide. Pneumonia can be caused by viruses, bacteria or fungi[2]. Pneumonia can be prevented by immunization, adequate nutrition and by addressing environmental factors. Pneumonia can be treated with antibiotics, but around 30% of children with pneumonia receive the antibiotics they need[1]

OBJECTIVE: To compare the efficacy of injectable Amoxicillin vs Injection Ceftriaxone in children with pneumonia.

MATERIAL & METHODS: This study was conducted at a tertiary care hospital, Peshawar. Study design was randomized control study in which the sample size was calculated on the bases of previous studies estimated efficacy of 89.9%[8] of amoxycillin and 76.6% for injection Ceftriaxone, using standard error of proportion at 95% confidence intervals, with a margin of error of 80%, a sample size of 70 cases was selected for each group. More over non-probability consecutive sampling technique was used for sample collection. Patients were divided in two groups. Patients received Amoxicillin therapy was in Group A and patients received injection Ceftriaxone were in Group B. Patients were randomly and consecutively assigned to either group using lottery method.

RESULTS: Our results show that mean age in Group A was 2 years ± 2.23 and mean age in Group B was 2 years ± 2.47. In Group A 63% children were male and 37% children were female. Where as in Group B 65% children were male and 35% children were female. More over intravenous Amoxicillin (Group A) was effective in 78% children while intravenous Ceftriaxone was effective in 84% children.

CONCLUSION: Injection Ceftriaxone was more effective than injectable Amoxicillin in term of improvement of fever and respiratory rate in the treatment of pneumonia.

Key words: *efficacy, Amoxicillin, Ceftriaxone, pneumonia*

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INTRODUCTION:

Bacterial pneumonia is the leading cause of morbidity and mortality in children in the developing world. Pneumonia kills an estimated 1.4 million children under the age of five years every year which is more than AIDS, malaria and tuberculosis combined.[1] Pneumonia can be caused by viruses, bacteria or fungi.[2] Pneumonia can be prevented by immunization, adequate nutrition and by addressing environmental factors. It can be treated with antibiotics, but only 30% of children with pneumonia receive the antibiotics they need.[3]

Pneumonia can be generally defined as inflammation of the lung parenchyma, in which consolidation of the affected part and a filling of the alveolar air spaces with exudate, inflammatory cells, and fibrin is characteristic.[4] For children who have cough or difficulty breathing, the WHO ARI case management guidelines require only an assessment of the respiratory rate and the presence of visible and audible signs of respiratory distress. The presence of rapid breathing (=60 breaths per minute for children <2 months of age and =50 breaths per minute for children =2 months of age) confers a diagnosis of pneumonia.[5]

Historical review of the 1918-19 influenza pandemic suggests that the majority of deaths were not a direct effect of the influenza virus, but they were from bacterial co-infection.[6]Because of the high incidence and severity of disease associated with bacterial pneumonia in developing nations, use of empiric antibiotic therapy has been estimated to reduce mortality rates in the developing world by 27%.[7]

Despite significant disease burden and healthcare costs, little research has been carried out to determine the effectiveness of antibiotic regimens for CAP among hospitalized children, particularly in general community hospitals where the majority of children receive their care. Amoxicillin and ceftriaxone, the most common first-line antibiotic for inpatient management, provides broad antimicrobial coverage.[8] Various studies have linked third generation cephalosporins with an increased prevalence of extended-spectrum beta-lactamase (ESBL)- producing bacteria, and

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increased mortality, longer inpatient time, and higher hospital costs.[9-12]

This study will help us in setting a protocol for the treatment of Pneumonia in children in our local population.

MATERIALS AND METHODS:

Setting: Pediatrics B unit, Khyber Teaching Hospital, Peshawar
Study Design: Randomized Control Study
Sample Size: 70 cases were selected for each group.
Sampling Technique: Non-probability consecutive sampling. Patients were divided in two groups. Patients who received Amoxicillin therapy were in Group A and patients who received Ceftriaxone therapy were in Group B. Patients were randomly and consecutively assigned to either group using lottery method.

Inclusion Criteria:
Children of age 2 months to 60 months presented with pneumonia.

Exclusion Criteria:
Children with bronchiolitis.
Children with recurrent cough and wheeze.
Children with CHD and its complications.
Children with complications of Pneumonia like pyothorax, pneumothorax and hydrothorax.

Data Collection Procedure:
After approval from hospital ethical committee, all children who fulfilled inclusion criteria were admitted in paediatrics department through OPD and casualty. Informed written consent was taken from parents/guardians. Detailed history and relevant examination were performed to look for signs of Pneumonia. Other diseases like asthma, bronchiolitis, pneumothorax, hydrothorax and congenital heart diseases was ruled out on the bases of history taking, clinical examination and chest X-rays. Chest x-rays, complete blood counts, serum calcium and alkaline phosphatase was done in all cases. Z-scoring of all the patients was done to assess the degree of severity of malnutrition. Group A received intravenous amoxicillin (100mg/kg/day in three divided doses). Patients in Group B received intravenous ceftriaxone (50 mg/kg in two divided doses). Time was noted from initiation of treatment and patient was monitored 12 hourly for respiratory rate and fever for 48 hours. All the above mentioned information was recorded in proforma. Efficacy of treatment was determined on the basis of absence of fever and respiratory rate; with age less than 2 months 59/minute, with age 2 months to 1 year 49/minute and with age 1 year to 5 year 39/minute.

Data Analysis Procedure:
All the data was entered and analyzed in SPSS version 18. Frequency and percentages were calculated for categorical variables like gender and effectiveness. Mean and standard deviation was calculated for continuous variables like age and duration of recovery. Independent sample T-Test was used to compare mean hospital stay in both groups. Chi-square test was applied to compare the efficacy of both line of treatment. P values < 0.05 were considered as significant. Efficacy was stratified among age and sex by applying chi-square test to see effect modifiers. All these results were presented as tables and graphs.

RESULTS:

Study was conducted at the Department of Pediatric, Khyber Teaching Hospital, Peshawar in which a total of 140 children (70 in each group) were included. Age distribution among two groups was analyzed as in Group A 28 (34%) children were in age range < 1 year, 34 (44%) children were in age range 1-3 years and 8 (22%) children were in age range 4-5 years. Mean age was 14.4 months with SD 16.6 where as in Group B 30 (36%) children were in age range < 1 year, 39(45%) children were in age range 1-3 years and 11(19%) children were in age range 4-5 years. (Table No 1)

In Group A 44 (63%) children were male and 26(37%) children were female. In Group B 46 (65%) children were male and 24 (35%) children were female with a P-value of 0.86 which is not significant. (Chart No. 01 and 02) Status of fever among two groups was analyzed as at the end of 1st day all the 70 patients in both the groups had fever but at the end of 2nd day follow up 56 (80%) children had improved and had no fever in Group A and 59 (84%) children had improved and had no fever in Group B with a P value of 0.66 which is not significant. (Table No. 02)

Results of respiratory rate among two groups showed that at 1st day all the 70 patients in both groups had respiratory rate more than normal but at the end of 2nd day follow up 53 (76%) children had improved with a mean respiratory rate of

46/minute in Group A and 56 (80%) children had improved in Group B with a mean respiratory rate of 44/minute with a P-value of 0.46 at the end of 48 hours of treatment which is not significant. (Table No. 03)

The mean hospital stay was 3.7 days in Amoxicillin group as compared to 4.1 days in Ceftriaxone group with a P value of .001 which is significant. (Table No. 04) Efficacy in term of improvement in fever and respiratory rate after 24 hours follow up was analyzed as intravenous Amoxicillin (Group A) was effective in 55(78.6%) children while intravenous Ceftriaxonewas effective in 59(83.4%) children with a P value of 0.5 which is not significant. (Table No. 05) So it means that injection amoxicillin and injection ceftriaxone was equally effective in the treatment of pneumonia in terms of improvement in fever and respiratory rate with no significant difference in efficacy. The significant difference was noted in hospital stay which favors the use of injectable amoxicillin in the treatment of pneumonia.

DISCUSSION:

In our randomized prospective clinical study of children under 5 years old diagnosed with pneumonia which compared amoxicillin and ceftriaxone antibiotic treatment schemes. In our study amoxicillin group had shorter hospital stay as compared to ceftriaxone group. However, fever and respiratory rate statistics were similar in both groups.

In Group A 63% children were male and 37% children were female. Where as in Group B 64.3% children were male and 35.7% children were female. More over intravenous Amoxicillin was effective in 78.6% children while intravenous Ceftriaxone was effective in 81.4% children with a P value of 0.51 which is not significant. Similar results were found in another study done by Pukander JS et al in which intravenous Ceftriaxone was compared with intravenous Amoxicillin. In intravenous Ceftriaxone Group 70% children were male and 30% children were female. Where as in intravenous Amoxicillin Group 75% children were male and 25% children were female. In this study intravenous Ceftriaxone was effective in 87% children while intravenous Amoxicillin was effective in 80% children.[13] In one study done by Blatter MM in intravenous Ceftriaxone was effective in 90% children while intravenous Amoxicillin was effective in 78% children.[14] Korbila IP had shown that in intravenous Ceftriaxone was effective in 87% children while intravenous Amoxicillin was effective in 74% children.[15]

Two previous randomized trials compared other antibiotic schemes for children with pneumonia in developing countries. In India, a prospective multicenter study of 3-month- to 12-year-old children with severe lower respiratory tract infection comparing amoxicillin/clavulanate treatment with cefotaxime/sulbactam found no statistical differences between groups for improvements in coughing, tachypnea, and fever.[16] In another Indian study that compared crystalline penicillin plus gentamicin with amoxicillin plus clavulanic acid in children 259 months old with severe or very severe CAP, in which patients received IV antibiotics for at least three days and were changed to OR amoxicillin/clavulanate after clinical stabilization.[17] The authors concluded the two antibiotic schemes were equally effective as no difference was found between treatment groups for time on IV antibiotics, improvement in tachypnea, or improvement in oral eating ability.

According to WHO, oral/injectable Amoxicillin is the drug of choice in cases of pneumonia. Studies have shown that oral amoxicillin and injectable penicillin are equally effective at 48 h and beyond. The 48-h treatment failure rate was similar to that of 10.1% with amoxicillin for the treatment of pneumonia of with a success rate of 89.9%.[18] Studies have shown that injectable ceftriaxone is having a good efficacy in the treatment of Pneumonia. It has been shown that injection ceftriaxone has an efficacy of 76.6% in Pneumonia treatment.[19]

Our study showed that injectable Amoxicillin and injection Ceftriaxone was equally effective in the treatment of Pneumonia regarding the improvement in fever and respiratory rate with no significant difference in efficacy which favors the null hypothesis. The only significant difference was noted in hospital stay which favors the use of injectable Amoxicillin in the treatment of Pneumonia.

CONCLUSION:

Our study concluded that injection Ceftriaxone and injectable Amoxicillin are equally effective in term of improvement of fever and respiratory rate in the treatment of pneumonia which favors the null hypothesis.

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