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Original Research Article

Antibiotic susceptibility among under-fives with severe pneumonia: a prospective study

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ABSTRACT

Background: In underdeveloped countries, lower respiratory tract infection (LRTI) remains the leading cause of under-five mortality. Judicious use of antibiotics prevents the emergence of multidrug resistant organisms, but appropriate selection is vital in the child requiring intensive care.
Methods: The study in conducted prospectively in the paediatric wards and intensive care unit, Rajah Muthiah Medical College and Hospital, Chidambaram. Fifty children were enrolled in the study using simple random sampling. Data regarding the demographic details, mean duration of stay, antibiotics given, immunisation status, intensive care unit admission and complications were collected. Statistical analysis is done using the Microsoft excel 2010.
Results: The complications (n=3) is more among the female children (n=2) belonging to the age group one to two years (n=2) with mean duration of stay of more than seven days (n=2) and non-immunized for age children (n=3).
Conclusions: The gram positive and atypical pneumonia in Chidambaram is found to be sensitive to aminopenicillin with penicillinase resistant penicillin and macrolide respectively.

Keywords: Antibiotic resistance, Bacterial infections, Lower respiratory tract infection, Under-five

INTRODUCTION

In underdeveloped countries, lower respiratory tract infection (LRTI) remains the leading cause of under-five mortality.[1] Co-existing malnutrition, admission at late stage, multi-drug resistant pathogens, immunodeficiency plays detrimental effect on the outcome following LRTI.[2] With newer antibiotics, the under-five mortality rate has reduced in the recent year than the pre-antibiotic era but the LRTI remains the leading cause of under-five mortality.[3] The main factor driving the LRTI to be the leading cause of under-five mortality is multi-drug resistance in western countries and malnutrition in under-developed countries.[4] Gram positive organism viz. Streptococcus pneumoniae is the most common cause of LRTI in this age group.[5] LRTI presents with fever, cough and breathlessness but chest retractions, cyanosis and tachypnoea signify severe infection.[6] The outcome is poor among the latter group even with intensive care and higher antibiotics.[7]

Early diagnosis and referral at the primary healthcare facilities is known to improve the prognosis.[8] Judicious use of antibiotics prevents the emergence of multidrug resistant organisms, but appropriate selection is vital in the child requiring intensive care.[9]

Death toll in pneumonia can be reduced by effective care during initial presentation and quick referral to the higher centres.[10] Reassessment of antibiotic selection when the LRTI is not subsiding has crucial impact on the outcome without any sequel.[11]

METHODS

The study in conducted prospectively in the paediatric wards and intensive care unit, Rajah Muthiah Medical College and Hospital, Chidambaram from September 2017 to August 2018. Fifty children were enrolled in the study using simple random sampling after obtaining informed consent from the parents. Children aged six months not more than five years with clinical or radiological signs of severe pneumonia according to the IMNCI guidelines viz, fast breathing, chest in drawing along with any one danger signs (persistent vomiting, lethargy or unconsciousness, not able to drink, stridor in a calm child and convulsions) without protein energy malnutrition (PEM) and other chronic diseases were included in the study. To rule out PEM, WHO growth charts are used. Children with non-bacterial pulmonary infections like bronchiolitis, Aspergillus pneumonia and pre-existing lung conditions like asthma, cystic fibrosis were excluded from the study. Data regarding the demographic details, mean duration of stay, antibiotics given, immunization status, intensive care unit admission and complications were collected. Statistical analysis is done using the Microsoft excel 2010.

RESULTS

Among the 50 children, 34 patients were admitted in the wards and 16 in the paediatric intensive care unit. In the latter group 2 patients required intubation and one patient with lung abscess referred to higher centre for video assisted thoracoscopic surgery. The two patients required ventilation presented in the late stages with tachypnoea and chest retractions. The complications (n=3) is more among the female children (n=2) belonging to the age group one to two years (n=2) with mean duration of stay of more than seven days (n=2) and non-immunized for age children (n=3). Antibiotics used belong to modified pencillins, higher penicillin, second and third generation cephalosorins, sulphonamides, macrolides, glycopeptide and nitroimidazole. The day on which antibiotic modified is 2.54±0.289.

Table 1: Frequency percentage data table.

Age (years)	Number	Percentage
0.5-1	14	28
>1-3	25	50
>3-5	11	22
Sex		
Male	28	56
Female	22	44
Immunisation status		
Immunized	42	84
Not immunized for age	8	16
Duration of stay		
<7 days	38	76
≥7days	12	24
Complications		
None	47	94
Incubation and ventilation	2	4
Lung abscess	1	2

Table 2: Total quantity of antibiotic given.

Number of antibiotics	Number (%)	Mean duration
Single antibiotic preparation	15 (30)	6±1.2
More than one antibiotic	35 (70)	7±1.7
Total	50 (100)	

Table 3: Course of antibiotic given to the children.

Initial antibiotic given	Number (%)	Antibiotic modified	Number (%)
Modified penicillin with aminoglycoside	6 (12)	Fourth generation cephalosporin, aminoglycoside	3 (6)
		Macrolide	1 (2)
III generation cephalosporin with aminoglycoside	9 (18)	Aminopenicillin with beta lactamase inhibitor	3 (6)
		Macrolide	3 (6)
Modified penicillin with Penicillinase resistant penicillin	8 (16)	None	
Modified penicillin with beta lactamase inhibitor	11 (22)	Aminopenicillin with Penicillinase resistant penicillin	5 (10)
		Macrolide	3 (6)
		Glycopeptide, nitro-imidazole and macrolide	1 (2)
Macrolide	4 (8)	None	
Fourth generation cephalosporin	12 (24)	Aminopenicillin with beta lactamase inhibitor	6 (12)
		Extended spectrum penicillin, Aminopenicillin with beta lactamase inhibitor and macrolide	2 (4)
		Natural penicillin	1 (2)
Total	50 (100)	Not modified total	22 (44)

Modification of the antibiotic is nearly nil on initial treatment with aminopenicillin with Penicillinase resistant penicillin and macrolide antibiotics. Twenty-seven patients continued the same antibiotic throughout the therapy with any modification of antibiotics. Only nine patients had a single antibiotic throughout the therapy.

Table 4: Route of administration of antibiotic given.

Route of administration	Initial antibiotic given	Antibiotic modified	
Oral	4 (8)	Oral	3 (6)
		Parental	1 (2)
Parental	46 (92)	Oral	25 (50)
		Parental	21 (42)

Patients requiring ventilator support needed more one higher antibiotic like glycopeptide and extended spectrum penicillins. No difference is seen when the antibiotic is given either orally and parenterally. Initially 42 (84%) patients showed radiological findings of pneumonia and were found to be cleared after antibiotic therapy in subsequent chest roentgenogram.

DISCUSSION

Knowledge about prevalent bacterial strain and the antibiotic sensitive to it in a locality is essential in treating cases of LRTI. These measures reduce the recovery time of the patient and prevents the emergence of drug resistant strains.[11] Dermis and lower respiratory tract (63.2%) were the most susceptible sites for Staphylococcus aureus bacteraemia. Personal hygiene, early diagnosis and treatment improves the prognosis with reduced sequel.[12] In present study, authors found that aminopenicillin with penicillinase resistant penicillin and macrolide in suspected gram positive and atypical pneumonia improves the condition within the course of antibiotic and didn't require modification in antibiotic with no complications. Also, authors found that initial treatment with oral or parental route has no difference in the outcome and no significant adverse effects were noticed. The antibiotic modified was primary due to nil sensitivity not because of adverse effect to the antibiotics. Three- fourths of antibiotics were given are for LRTI has led to drug-resistant bacterial strains, severe adverse effects, and a more loss of resources. The inappropriate prescription of antibiotics for non-bacterial infections and for self-limiting conditions is a main risk factor for drug resistance. The primary health care physicians are known to prescribe antibiotics in large number. Since the patient present here usually have self- limiting course, it contributes to development of resistance.[13] A newer study in developed country implies that tachypnoea with the presence of an infiltrate on chest X-ray has poor prognosis. History of rapid breathing by the informants was a good equivalent of tachypnoea. Tachypnoea better elicits the severity of LRTI than the crepitations, fever, nasal flaring, pallor, retraction, grunting and cyanosis.[14]

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