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A study of antimicrobial utilisation for lower respiratory tract infections (LRTIs) in paediatric inpatient at tertiary care hospital of north-eastern part of India

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Abstract

Aim: The study was conducted to evaluate antimicrobial utilization in paediatric ward for LRTIs patients.
Materials and methods: A retrospective, observational study was undertaken in a paediatric inpatient of JNIMS. Case sheets of 627 patients of either sex age group 1 month to 12 years clinically diagnosed with LRTIs were studied over the 18 months period. Age, sex, antimicrobial agents (AMAs) received, different LRTIs and types of AMAs used, duration of AMAs treatment, duration of hospital stay, micro-organisms isolated and disease outcome were evaluated. Data collected were typed into Microsoft excel 2019 and transferred into SPSS25 for descriptive statistical analysis.
Results: Mean age was 32.9 months. Out of 827 prescriptions, cephalosporins {521(58.08%)} were the most frequently prescribed followed by aminoglycosides {180(20.07%)}. Out of cephalosporins, ceftriaxone (234) was the most commonly used. The drugs were prescribed mostly in generic name {644(71.79%)}.The AMAs treatment range from 1 to36 days. The maximum number of antimicrobials used in a single patient was 6. The average AMAs used per patient was 1.45. Route of administration was mostly intravenous. Average hospital stay duration was 5.24 days. Male patients {418(66.67%) were more than females {209(33.33%)}. *Staphylococcus aureus* (29) was the most common micro-organisms isolated. 620(98.88%) patients recovered while 7 (1.12%) died.
Conclusions: This study has given an insight into timely, appropriate and adequate use of antimicrobial agents in LRTIs to improve disease outcome. There is less morbidity and mortality seen. There is rational use of AMAs in this hospital as seen by this study.
Keywords: Antimicrobials, LRTIs, drug utilization, paediatrics.

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1. Background

Lower respiratory tract infection (LRTI) is infection below the level of the larynx and may be taken to include bronchiolitis, bronchitis and pneumonia [1]. Pertusis is also included. LRTIs are the most common reasons for consultation and hospitalization in paediatrics [2]. Patients have a wide spectrum of symptoms which range from minor self-limiting illnesses to potentially life threatening infections [2,3].

LRTIs contribute to most of the deaths among all infectious diseases in children worldwide. They occur frequently and are associated with considerable morbidity and mortality in paediatric age group [4].

Pneumonia continues to be one of the most often causes of request for medical assistance, use of antibacterial agents and hospitalizations among children all over the world, although there has been a progressive decrease in its incidence over time[5]. It accounts for 15% of all deaths of children <5 years of age and is the single largest infectious cause of death in children worldwide [6].

Nearly, 1 in 500 children under the age of 5 years is hospitalised each year with CAP [7]. CAP refers to pneumonia acquired in the community.

Pneumonia affects children and families everywhere, but is most prevalent in South Asia and sub-Saharan Africa [8].

There are signs of progress in the 75 countries included in 'Countdown to 2015'[9].The number of deaths from pneumonia in children under 5 has declined from 21% in 2000 to 16% in 2015[10].

The most commonly seen LRTIs are pneumonia and bronchiolitis.

In India, antimicrobials may account for 50% of total value of drugs sold, but the prevalence of antimicrobial use has varied across surveys[11]. Over 80% of antibiotics prescribed are for lower respiratory tract infections[12].

There seems to be increasing concern about antimicrobials prescription in the community [13].

Recently, the studies on drug utilization have become a potential tool to be used in the evaluation of health systems [14].

World Health Organization (WHO) defined drug utilization research as 'studies on the marketing, distribution, prescription and the use of drugs in a society, with special emphasis on the resulting medical, social and economic consequences [15,16].

LRTIs being one of the most common causes of death in children, there are very few research publications about the importance of utilization of antimicrobials in India especially in the north-eastern region. Therefore, this study was conducted to highlight the importance of antimicrobials for LRTIs.

"Antimicrobials" in this study refer to drugs which can kill bacteria, fungi, protozoa and viruses whereas antibiotics refer to drugs that can kill only bacteria.

Aim:

The present study was conducted to highlight the utilization of antimicrobials in LRTIs in paediatric inpatient department.

2. Materials and methods

A retrospective, observational study was carried out by collecting case sheets from August 2018 to January 2020 i.e. a period of 18 months from paediatric inpatient department of JNIMS, Porompat. It is the only state owned tertiary teaching hospital situated in Imphal East.

Patients of either sex of age groups 1month-12 years, clinically diagnosed as LRTIs were taken for this study. There were 634 cases during the 18 months study period excluding tuberculosis patients. 7 were LAMA (leaving against medical advice) so they were also excluded. So, 627 cases were taken for this study.

Age, sex, duration of hospital stay, antimicrobial agents (AMAs) received, different LRTIs and types of AMAs used, micro-organisms isolated and disease outcome were studied.

The data collected were entered in Microsoft excel 2019 which were later transferred into SPSS25.

Ethical approval for this study was obtained from the Institutional Ethics Committee, JNIMS.

3. Results

The study evaluated the utilization of antimicrobials in patients treated for clinically diagnosed LRTIs in paediatric inpatient. Out of 627 patients, males are 418(66.67%) and females are 209(33.33%){Figure 1}.

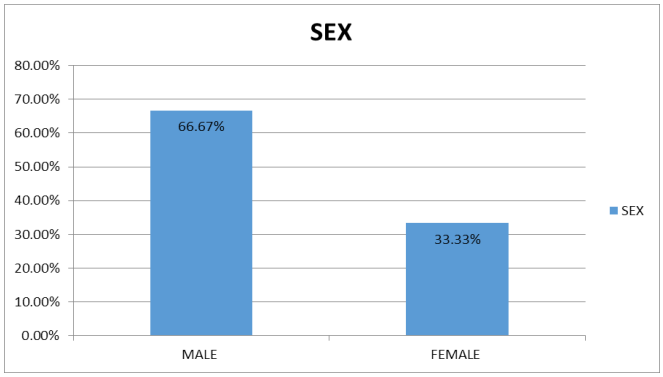

Fig 1: Percentage of males and females.

Mean age is 32.9 months. Total of 897 antimicrobials were prescribed in 627 patients, given intravenous in 499 (79.59%) patients, oral in 71(11.32%) and combination (both intravenous and oral) = 50(7.97%) and no antimicrobials but only supportive care in 7(1.12%){Figure 2}.

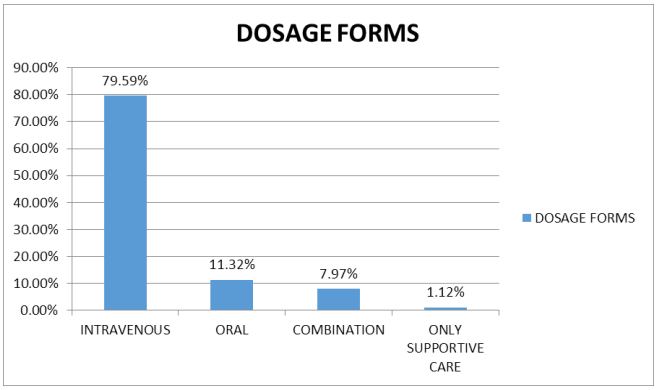

Fig 2: Dosage forms of drugs

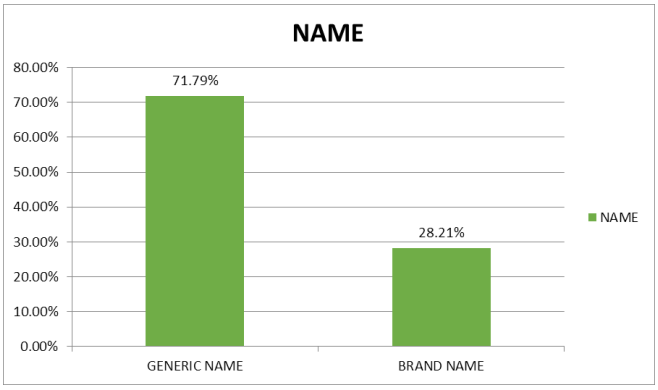

Fig 3: Percentage of name of antimicrobials.

So 620 patients received antimicrobial agents, the prevalence of antimicrobials used is 98.88%. Since there is solid evidence that early administration of antibiotics improves disease outcomes [17], all the antimicrobials prescribed were administered within 24 hrs of admission.

Out of the total 897 antimicrobials used, the number of drugs given in generic names were 644(71.79%) and in brand names were 253(28.21%){Figure 3}.

Different LRTIs seen were very severe (VS) pneumonia = 43(6.86%), severe (S) pneumonia = 134(21.37%), pneumonia = 368(58.7%), bronchiolitis = 56(8.93%), bronchitis = 12(1.91%), pertussis = 14(2.23%) along with antimicrobials used in each {Figure 4, Table 1}.

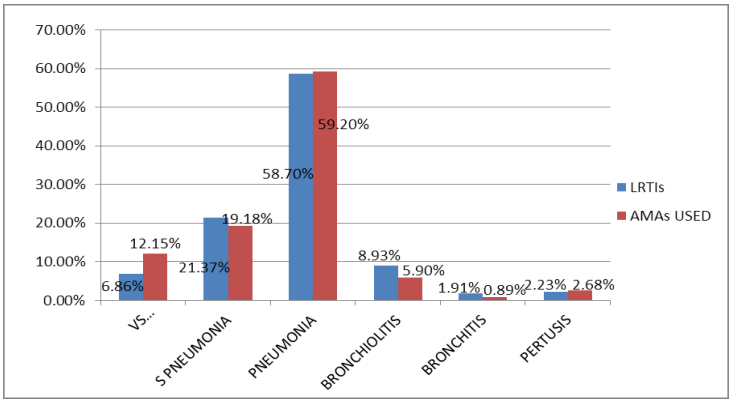

Fig 4: Percentage of different LRTIs and antimicrobial agents used

Table 1: Different LRTIs and AMAs prescribed.

Diseases	AMAs Prescribed in numbers	Common AMAs Prescribed	Class of AMAs	Most commonly seen micro-organisms
1.Very severe pneumonia	109	Ceftriaxone+Vancomycin	Cephalosporins+aminoglycosides	*Klebsiella pneumoniae*
2. Severe pneumonia	172	Ceftriaxone+Amikacin	Cephalosporins+aminoglycosides	*Streptococcus pneumoniae*
3. Pneumonia	531	Amoxicillin+Clavulanate	Beta lactams	*Staphylococcus aureus*
4. Bronchitis	8	Cefixime	Cephalosporins	
5. Bronchiolitis	53	Ceftriaxone	Cephalosporins	
6. Pertusis	24	Erythromycin	Macrolides	*Bordetella pertussis*

The highest number of antimicrobial prescription were from the cephalosporins {521(58.08%)} same findings as Gupta *et al* [18] while macrolides {13(1.45%)} and tetracyclines {7(0.78%)} were used sparingly. The cephalosporins included ceftriaxone (234), cefotaxime (50), cefpodoxime (46), cefoperazone (40), cefipime (38), cefixime (41), cefuroxime (37), and ceftazidime (35).

Among the cephalosporin used, the highest prescribed was ceftriaxone[19] whereas cefuroxime and ceftazidime were used the least. Amikacin (116), moxiclav (52) and vancomycin (37) were prescribed more frequently, whereas pipzo (7) and zostum (6) were used sparingly. Overall the highest number were prescribed from cephalosporins followed by aminoglycosides {180(20.07%)} and other beta lactams.

Percentage of different antimicrobials used is seen in figure 5.

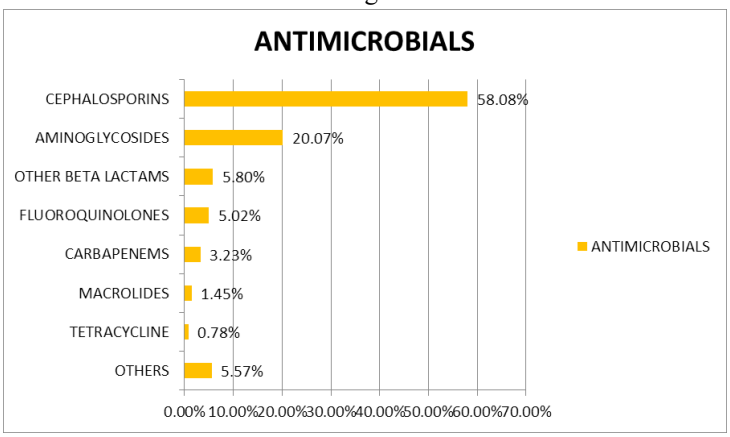

Fig 5: Percentage of antimicrobials used.

It was found that 414 prescription contained single antimicrobial agent, 156 contained two antimicrobials, 38 contained three antimicrobials, 6 contained four AMAs, 3 contained five and six AMAs. In three instances, total of 6 AMAs were prescribed during the hospital stayed.

Table 2 shows variables like total number of antimicrobials used, number of antimicrobials per patient, duration of antimicrobial treatment in days, duration of hospital stay in days and percentage of antimicrobials used along with their data.

Table 2: AMAs and duration of hospital stay

VARIABLES	DATA
1.Total number of antimicrobials used	897 in 620 cases
2.Number of antimicrobials per patient: Range Mean Median	 1-6 1.45±0.764 (mean±SD) 1
3.Duration of antimicrobial treatment (days): Range Mean Median	 1-36 5.06±3.233(mean±SD) 5
4.Duration of hospital stay (days): Range Mean Median	 1-38 5.24±3.533(mean±SD) 5
5. Percentage of antimicrobials: Intravenous Oral Combination(iv +oral)	 79.59% 11.32% 7.97%

The numbers of micro-organisms isolated were 150 in total among 627 patients. Fewer micro-organisms were seen in comparison to the number of cases which could be due to the early administration of AMAs (all within 24 hours of admission). Among them, *Staphylococcus aureus* (29) was the most common. Others included *Klebsiella pneumoniae* (27), *Pseudomonas aeruginosa* (23), *Acinebacter baumannii* (18), *Streptococcus pneumoniae* (17), *Candida albicans* (10), Coagulase negative Staphylococcus/CONS (9), *Escherichia coli* (7), Methicillin-resistant *Staphylococcus aureus*/MRSA (5), *Bordetella pertussis* (5){Figure 6}.

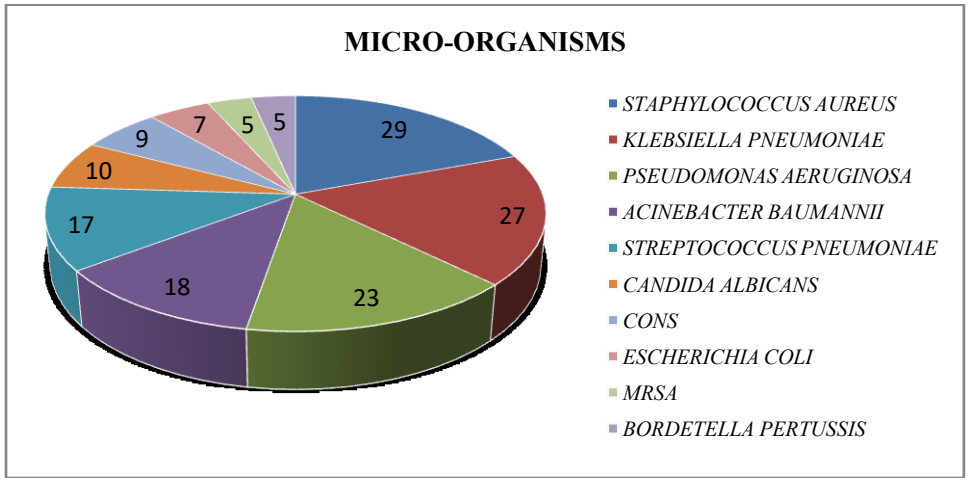

Fig 6: Numbers of micro-organisms isolated (n=150).

Out of 627 patients, the recovered cases were 620 (98.88%) patients and the mortality cases were 7(1.12%) patients {Figure 7}. From these data we can know that timely, appropriate and adequate administration of antimicrobials play a crucial role in the outcome of mortality.

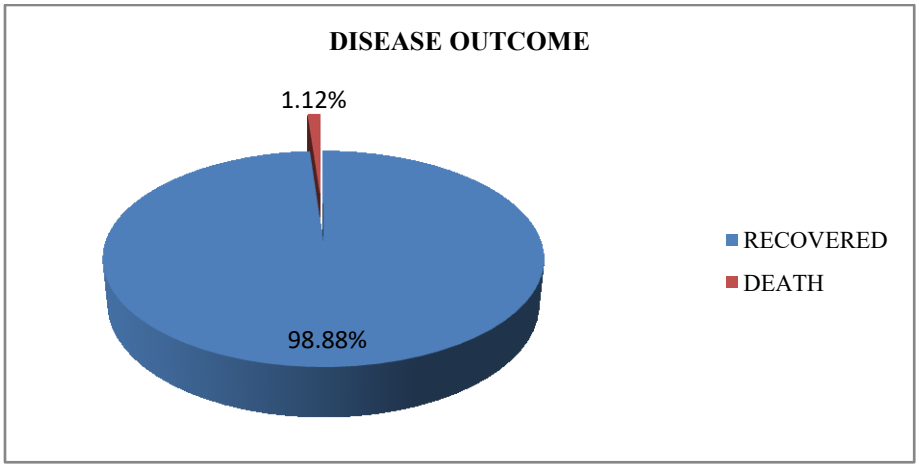

Fig 7: Disease outcome in percentage (n=627).

4. Discussion

Antimicrobials are one of the most commonly used drugs in indoor hospitals particularly tertiary care hospitals that act as referral centres and particularly so in pediatric wards [20]. In a nation-wide point prevalence study in pediatric in-patients across 8 children hospitals in Australia[21], the authors reported that of 1373 patients, 631 (46%) were prescribed at least one antimicrobial agent, 198 (31%) of whom were <1 year old. The prevalence was nearly 80% with the majority of children within 4 years of age [20]. In our study, the prevalence was 98.88% in pediatric age group 1 month to 12 years of age, neonates were excluded. The increasing use of antibiotics in paediatric age group is caused by children having lesser immunity than adults, leaving them more vulnerable to serious infections without prompt intervention, prophylactic treatment for different infections and for doubtful secondary bacterial infections in viral diseases. The lack of proper or definitive diagnosis can also be a reason for increased antibiotic use needing broad spectrum antimicrobials treatment.

This study showed predominance of male patients (66.67%) over female patients (33.33%) which was also seen in the study done by Palikhe[22].

Among LRTIs in this study, the most common reason for hospital admission was pneumonia (58.7%) whereas the least common was bronchitis (1.91%) which was similar to study done by Abramczyk *et al*[23].

Out of 897 antimicrobials used in 620 patients, the most frequently prescribed was cephalosphorins (58.08%) followed by aminoglycosides (20.07%) which was similar to the study done by Senthilselvi *et al*[20], whereas the least prescribed was tetracycline(0.78%). Out of cephalosporin class, ceftriaxone was the most prescribed (44.91%), same in study done by Deshmukh *et al*[19].

Prescribing pattern of AMAs in this study showed that combination of different class AMAs were only prescribed for severe and very severe pneumonia. These combined AMAs were mostly from combination of cephalosporin and aminoglycosides which was also seen in the study done by Ilia *et al*[24].

The most common route of administration of drugs was intravenous (79.59%) which could be due to patients admitted in critically ill condition and the most prescribed AMAs were in a combination of cephalosporins and aminoglycosides which are available in intravenous form.

An average number of drugs prescribed per prescription were 1.45 which is lesser the average number (i.e. 2) recommended by world health organisation (WHO). Patients who receive done antimicrobial were 414; two AMAs were 156; three AMAs were 38; four AMAs were 6; five and six AMAs were 3 each.

The average duration of hospital stay in days was 5.24 days where the maximum duration of hospital stay is 38 days.

5. Conclusions

In our study, we found that antimicrobials if given early, appropriately and adequately helped reduced the morbidity and mortality of the patients. There is rational use of antimicrobials at this hospital. Early consultations and hospitalizations are the most important factors for mortality in children suffering from LRTIs.

Conflict of interest: None.

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