Original Article

A Study on Community Acquired Pneumonia and Its Antibiotic Resistance Patterns in Children Between 2 Months to 12 Years at A Tertiary Care Centre, Hyderabad, Telangana

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Abstract

Background: The prevalence of community-acquired pneumonia is one of the most frequent causes of morbidity and mortality in children. In low and middle-income countries, the situation is the same. Paediatric pneumonia remains an important problem and threat to the Indian population because of late-onset care-seeking behaviours and risk exposure to environmental determinants, as well as a growing occurrence of antimicrobial resistance. Unconfirmed empirical antibiotic treatment has also promoted new resistance trends, making it hard to treat paediatric community-acquired pneumonia effectively. The current research was conducted to outline the clinical presentation of community-acquired pneumonia in children aged 2 months to 12 years, to define trends in antibiotic resistance among common pathogens, and to identify factors associated with antibiotic resistance in cases of childhood pneumonia. **Material and Methods:** It was a prospective observational study conducted in the Department of Paediatrics at Osmania General Hospital, a tertiary care centre associated with Osmania Medical College, Hyderabad, Telangana, and lasting 24 months. One hundred and fifty children aged 2 months to 12 years were included in the study, with predetermined inclusion and exclusion criteria for a clinical diagnosis of community-acquired pneumonia. A structured pro forma was used to collect demographic information, clinical presentation, socioeconomic status, environmental exposure, nutritional status, previous antibiotic administration, and laboratory results. Microbiological tests were: blood culture and nasogastric aspirate culture with antibiotic susceptibility testing. Descriptive statistics were used to analyse the data, and correlations between selected variables and antibiotic resistance were examined using the chi-square test; p-values < 0.05 were considered statistically significant. **Results:** Most children were aged 5-10 years (38.67%), followed by 1-5 years (36.67%). The study population was composed of 54.00% females. It was the low- and middle-socioeconomic status groups (46.67 percent and 46.67 percent, respectively). The cases where antibiotics had been used previously were 37.33. Sixty-five point three three three percent of children and thirty percent of children had overcrowding and malnutrition respectively. The most frequent clinical characteristics were fever (80.67%), cough (91.33%), and tachypnea (70.00%). The outcome of cultures had not increased in 28.00% of cases, but Haemophilus influenzae (26.67%), Staphylococcus aureus (23.33%), and Streptococcus pneumoniae (22.00%) were the most common. 46.7% were found to be antibiotic-resistant. History of antibiotic use, congestion, malnutrition, and poor outcomes were statistically significantly associated with antibiotic resistance. Most of the children improved (91.33%), with only 6.00% and 2.67% of people getting complications and dying, respectively. **Conclusion:** The research has found a high prevalence of antibiotic resistance in children with community-acquired pneumonia. Previous experiences with antibiotics, overcrowding, and malnutrition played a great role in higher resistance. These results demonstrate the significance of rational antibiotic use, early microbiological testing, and targeted community health interventions in reducing resistance and improving outcomes in paediatric pneumonia in tertiary care units.

Keywords: Pneumonia, community-acquired; children; antibiotic resistance; Paediatric infections; Risk factors; Tertiary care hospital.

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Introduction

Community-acquired pneumonia (CAP) is still among the top causes of morbidity and mortality affecting children below the age of five years worldwide. It has a mortality rate of about 15 percent of all deaths in children below the age of five years, making it take more than 800,000 young lives annually despite being a treatable and preventable disease.[1] Bacterial, viral, and atypical pathogens are the major causes of pneumonia in children, and among the most prevalent are Streptococcus pneumoniae and Haemophilus influenzae type b. Even though the high prevalence of bacterial pneumonia has been significantly reduced in developed countries due to the widespread introduction of vaccines, especially pneumococcal conjugate vaccines, the disease burden remains

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disproportionately high in low- and middle-income countries.[2]

Pneumonia remains one of the greatest health issues facing the population in India. The World Health Organisation reported that almost one-fifth of all deaths linked to childhood pneumonia occur in India, and better treatment, preventive, and diagnostic measures should be adopted immediately. The results of a 1997 National Family Health Survey showed that a small percentage of children with acute respiratory infection symptoms access medical care on time.[3] Poor awareness, limited access to healthcare facilities, and the use of unqualified healthcare providers, among other factors, contribute significantly to delayed diagnosis and treatment. Furthermore, congestion, air contamination, malnutrition, and inadequate immunisation coverage are common in most areas of the country and are significant risk factors for both the number of children and the severity of pneumonia.[4]

The increasing burden of antimicrobial resistance is an emerging concern in the management of paediatric community-acquired pneumonia. Empirical antibiotic treatment, which in most cases is not microbiologically verified, has helped increase resistance in many common pathogens.[5] Past reports of tertiary care units in India have shown significantly low positivity of culture among children who are given antibiotics before hospitalisation. This situation complicates clinical decisions and makes it difficult to treat the disease, which reduces the duration of illness, complications, and health spending.[6]

There is limited surveillance data on antibiotic resistance on paediatric community-acquired infections especially in developing countries. Very little systematic research on the causative organisms of paediatric CAP has been conducted in India. When no region-specific resistance information is available, clinicians are often forced to choose an empirical antibiotic regimen; this can be suboptimal and may increase the rate of resistance emergence.[7,8]

Besides microbiological determinants, socio-environmental factors, including poor living conditions, indoor air pollution, malnutrition, and overcrowding, are essential in affecting the occurrence and outcome of childhood pneumonia.[9] Nonetheless, the aspects are commonly under-researched in clinical trials, especially in practice with limited resources. To develop effective preventive and treatment approaches that go beyond pharmacological control, a thorough understanding of these determinants is necessary.[10]

The current research was conducted with a twofold objective: to examine the clinical characteristics of pneumonia in children across communities and to assess the distribution of antibiotic resistance in the causative pathogens in the environment of a tertiary care unit. This study shall seek to provide an overall picture of the local context of paediatric CAP by examining demographics, environmental exposures, clinical manifestations, microbiological evidence, and resistance patterns. The results are supposed to provide useful evidence to inform rational antibiotic use, antimicrobial stewardship programs, and secondary research to support public health efforts to reduce morbidity and mortality rates from childhood pneumonia.

Aim of the Study

To study community-acquired pneumonia in children aged between 2 months and 12 years.

Objectives of the Study

1. To describe the clinical profile of paediatric community-acquired pneumonia.
2. To determine the antibiotic resistance among common causative agents of paediatric pneumonia.
3. To identify factors associated with antibiotic resistance among paediatric pneumonia patients.

Materials and Methods

Study Design: This study was designed as a prospective observational study.

Study Setting: The study was conducted in the Department of Paediatrics at Osmania General Hospital, a tertiary care centre affiliated with Osmania Medical College, Hyderabad, Telangana.

Study Duration: The study was conducted over 24 months.

Study Population: The study population consisted of children aged between 2 months and 12 years who were admitted to the hospital with a clinical diagnosis of community-acquired pneumonia.

Inclusion Criteria: Children aged between 2 months, and 12 years admitted with a diagnosis of community-acquired pneumonia were included in the study.

Exclusion Criteria: Children younger than 2 months or older than 12 years were excluded. Children who had been previously admitted elsewhere and already initiated on antibiotics were excluded. Cases diagnosed with viral pneumonia, fungal pneumonia, tuberculosis, aspiration pneumonia, or hospital-acquired pneumonia were also excluded. Children who had pulmonary malformations, cystic fibrosis, congenital heart disease, immunodeficiency disorders, or malnutrition were also not included in the study.

Sample Size: Based on the estimated prevalence, 150 children were enrolled in the study.

Sampling Technique: Children who met the inclusion criteria were sampled consecutively. All eligible children who attended paediatric emergency or inpatient services during the period were included with informed consent from parents or guardians. Recruitment continued until the target sample size of 150 was reached. There was no randomisation or matching because the study was descriptive and observational.

Study Procedure: Once the patient had been admitted, a comprehensive clinical history, including age, sex, presenting complaint, symptom duration, previous treatment history, and socioeconomic status, was obtained. A detailed physical examination was conducted, with a focus on respiratory status, nutritional status, and comorbidities. The research involved a complete blood count, renal and liver function tests, an admitted chest radiograph, blood culture, urine culture, and nasogastric aspirate culture and antibiotic sensitivity testing. The anthropometric measurements were used to evaluate nutritional status. It was expressed in terms of treatment response, hospital stay duration, complications, and outcomes. The patterns of antibiotic susceptibility were also examined to determine the resistance patterns of the isolated organisms. All the data were keyed into a structured case pro forma.

Data Collection: The case sheet was a standardised data collection tool that included demographic data, clinical presentation history, environmental and social exposures, any history of prior antibiotic use, and laboratory results. Data were collected during interviews with caregivers and during clinical examinations performed by the attending pediatricians. Diagnostic tests were performed according to hospital-standard laboratory procedures.

Study Tools: The research employed a pre-designed case sheet, chest radiography, nasogastric aspirate microbiological examination, blood and urine cultures, and haematological and biochemical tests, including complete blood count, renal function tests, and liver function tests.

Independent and Outcome Variables

Independent Variables: Age, sex, socioeconomic status, duration of symptoms, nutritional status, environmental exposure, and prior antibiotic use.

Outcome Variables: Clinical outcome, length of stay, culture positive, and trends of antibiotic resistance, complications, and outcome.

Ethical Considerations: The study was initiated under the Institutional Ethics Committee, which permitted the researcher. All participants had their informed consent, in the form of written consent, obtained from a parent or guardian. Patient confidentiality would be preserved, and participation would involve choice, with withdrawal possible at any time without interfering with normal treatment.

Statistical Analysis: The statistical software was used in Microsoft Excel to input and analyse data. Demographic and clinical variables were summarised using descriptive factors of mean, standard deviation, frequency, and percentage. The chi-square test was used to assess associations between categorical variables and antibiotic resistance. A p-value below 0.05 was considered significant.

Results

The study covered 150 children aged 2 months to 12 years with community-acquired pneumonia. These findings have been summarised as shown below based on demographic traits, environmental and clinical factors, microbiological results, patterns of antibiotic resistance, and results.

Table 1: Distribution of Age

Age group	Frequency (n)	Percentage (%)
Up to 1 year	10	6.67
1–5 years	55	36.67
5–10 years	58	38.67
>10 years	27	18.00

The age distribution showed that the majority of children belonged to the 5–10-year age group (38.67%), followed by 1–5 years (36.67%). Children above 10 years constituted 18.00%, while those up to 1 year formed the smallest group (6.67%).

Table 2: Distribution of Gender

Gender	Frequency (n)	Percentage (%)
Female	81	54.00
Male	69	46.00

Female children constituted a slightly higher proportion (54.00%) compared to males (46.00%).

Table 3: Distribution of Socioeconomic Status

Socioeconomic status	Frequency (n)	Percentage (%)
High	10	6.67
Low	70	46.67
Middle	70	46.67

Both low and middle socioeconomic groups accounted for 46.67% each, while only 6.67% of children belonged to the high socioeconomic group.

Table 4: Distribution of Previous Antibiotic Use

Previous antibiotic use	Frequency (n)	Percentage (%)
No	94	62.67
Yes	56	37.33

A history of prior antibiotic use was present in 37.33% of children, while 62.67% had not received antibiotics before admission.

Table 5: Distribution of Air Pollution Exposure

Air pollution exposure	Frequency (n)	Percentage (%)
No	82	54.67
Yes	68	45.33

Exposure to air pollution was reported in 45.33% of cases, whereas 54.67% had no reported exposure.

Table 6: Distribution of Overcrowding

Overcrowding	Frequency (n)	Percentage (%)
No	52	34.67
Yes	98	65.33

Overcrowding was observed in 65.33% of the households of affected children.

Table 7: Distribution of Malnutrition

Malnutrition	Frequency (n)	Percentage (%)
No	105	70.00
Yes	45	30.00

Malnutrition was present in 30.00% of children, while 70.00% had normal nutritional status.

Table 8: Distribution of Fever

Fever	Frequency (n)	Percentage (%)
No	29	19.33
Yes	121	80.67

Fever was present in 80.67% of children at the time of presentation.

Table 9: Distribution of Cough

Cough	Frequency (n)	Percentage (%)
No	13	8.67
Yes	137	91.33

Cough was reported in 91.33% of children.

Table 10: Distribution of Tachypnea

Tachypnea	Frequency (n)	Percentage (%)
No	45	30.00
Yes	105	70.00

Tachypnea was observed in 70.00% of cases.

Table 11: Distribution of Chest Indrawing

Chest indrawing	Frequency (n)	Percentage (%)
No	79	52.67
Yes	71	47.33

Chest indrawing was observed in 47.33% of children, while 52.67% did not exhibit this sign.

Table 12: Distribution of Crepitations

Crepitations	Frequency (n)	Percentage (%)
No	60	40.00
Yes	90	60.00

Crepitations on auscultation were present in 60.00% of cases.

Table 13: Distribution of Hospital Stay

Hospital stay	Frequency (n)	Percentage (%)
Up to 1 week	73	48.67
>1 week	77	51.33

More than half of the children (51.33%) required hospitalization for more than one week.

Table 14: Distribution of Antibiotic Given

Antibiotic given	Frequency (n)	Percentage (%)
Amoxicillin	38	25.33
Azithromycin	33	22.00
Ceftriaxone	40	26.67
Clindamycin	39	26.00

Ceftriaxone was the most commonly administered antibiotic (26.67%), followed by clindamycin (26.00%), amoxicillin (25.33%), and azithromycin (22.00%).

Table 15: Distribution of Culture Organism

Culture organism	Frequency (n)	Percentage (%)
H. influenzae	40	26.67
No growth	42	28.00
Staph. aureus	35	23.33
Strep. pneumoniae	33	22.00

Culture results showed no growth in 28.00% of cases. Among positive cultures, H. influenzae, Staphylococcus aureus, and Streptococcus pneumoniae were the most commonly isolated organisms.

Table 16: Distribution of Resistance Detected

Resistance detected	Frequency (n)	Percentage (%)
No	80	53.33
Yes	70	46.67

Antibiotic resistance was detected in 46.67% of the children.

Table 17: Distribution of Outcome

Outcome	Frequency (n)	Percentage (%)
Complications	9	6.00
Death	4	2.67
Recovered	137	91.33

The majority of children recovered (91.33%), while 6.00% developed complications and 2.67% died.

Table 18: Comparison of Age and Antibiotic Resistance

Age group	No n (%)	Yes n (%)	P value
Up to 1 year	5 (50.00%)	5 (50.00%)	
1–5 years	26 (47.27%)	29 (52.73%)	0.585
5–10 years	32 (55.17%)	26 (44.83%)	
>10 years	17 (62.96%)	10 (37.04%)	

The highest proportion of resistance was observed in the 1–5-year age group (52.73%), with no statistically significant association.

Table 19: Comparison of Gender and Antibiotic Resistance

Gender	No n (%)	Yes n (%)	P value
Female	41 (50.62%)	40 (49.38%)	0.470
Male	39 (56.52%)	30 (43.48%)	

There was no statistically significant association between gender and antibiotic resistance.

Table 20: Comparison of Previous Antibiotic Use and Resistance

Previous antibiotic use	No n (%)	Yes n (%)	P value
No	58 (61.70%)	36 (38.30%)	0.008
Yes	22 (39.29%)	34 (60.71%)	

A statistically significant association was observed between prior antibiotic use and resistance.

Table 21: Comparison of Air Pollution Exposure and Resistance

Air pollution exposure	No n (%)	Yes n (%)	P value
No	47 (57.32%)	35 (42.68%)	0.283
Yes	33 (48.53%)	35 (51.47%)	

No statistically significant association was found between air pollution exposure and resistance.

Table 22: Comparison of Overcrowding and Resistance

Overcrowding	No n (%)	Yes n (%)	P value
No	32 (61.54%)	20 (38.46%)	0.042
Yes	48 (48.98%)	50 (51.02%)	

Overcrowding showed a statistically significant association with antibiotic resistance.

Table 23: Comparison of Malnutrition and Resistance

Malnutrition	No n (%)	Yes n (%)	P value
No	63 (60.00%)	42 (40.00%)	0.012
Yes	17 (37.78%)	28 (62.22%)	

Malnutrition was significantly associated with higher antibiotic resistance.

Table 24: Comparison of Fever and Resistance

Fever	No n (%)	Yes n (%)	P value
No	13 (44.83%)	16 (55.17%)	0.307
Yes	67 (55.37%)	54 (44.63%)	

No significant association was observed between fever and resistance.

Table 25: Comparison of Hospital Stay and Resistance

Hospital stay	No n (%)	Yes n (%)	P value
Up to 1 week	37 (50.68%)	36 (49.32%)	0.095
>1 week	43 (55.84%)	34 (44.16%)	

Hospital stay duration was not significantly associated with resistance.

Table 26: Comparison of Outcome and Resistance

Outcome	No n (%)	Yes n (%)	P value
Complications	2 (22.22%)	7 (77.78%)	0.047
Death	1 (25.00%)	3 (75.00%)	
Recovered	77 (56.20%)	60 (43.80%)	

A statistically significant association was observed between adverse outcomes and antibiotic resistance.

[Table 1] shows that the highest proportion of children with community-acquired pneumonia was in the 5–10 years age group, with 58 cases (38.67%), followed by the 1–5 years age group, with 55 cases (36.67%). Children aged above 10 years accounted for 27 cases (18.00%), while infants up to 1 year constituted 10 cases (6.67%). [Table 2] demonstrates a slight female predominance, with 81 females (54.00%) affected compared to 69 males (46.00%). [Table 3] indicates that children from low and middle socioeconomic status formed the majority, with 70 cases each (46.67%), whereas only 10 children (6.67%) belonged to the high socioeconomic group. [Table 4] reveals that 56 children (37.33%) had a history of previous antibiotic use, while 94 children (62.67%) had not received antibiotics before hospital admission. [Table 5] shows that exposure to air pollution was reported in 68 children (45.33%), whereas 82 children (54.67%) had no such exposure. [Table 6] highlights that overcrowding was present in a majority of cases, affecting 98 children (65.33%), while 52 children (34.67%) lived in non-overcrowded conditions. [Table 7] indicates that malnutrition was observed in 45 children (30.00%), while 105 children (70.00%) had a normal nutritional status. [Table 8] shows that fever was present in 121 children (80.67%), whereas 29 children (19.33%) did not have fever at presentation. [Table 9] demonstrates that cough was a predominant symptom, reported in 137 children (91.33%), with only 13 children (8.67%) not exhibiting cough. [Table 10] indicates that tachypnea was observed in 105 children (70.00%), while 45 children (30.00%) had normal respiratory rates. [Table 11] shows that chest indrawing was present in 71 children (47.33%), whereas 79 children (52.67%) did not exhibit this clinical sign. [Table 12] demonstrates that crepitations were noted in 90 children (60.00%), while 60 children (40.00%) did not have crepitations on auscultation. [Table 13] indicates that a prolonged hospital stay of more than one week was required in 77 children (51.33%), while 73 children (48.67%) were hospitalised for up to one week. [Table 14] shows that ceftriaxone was administered to 40 children (26.67%), clindamycin to 39 children (26.00%), amoxicillin to 38 children (25.33%), and azithromycin to 33 children (22.00%). [Table 15] demonstrates that culture showed no growth in 42 cases (28.00%). Among positive cultures, Haemophilus influenzae was isolated in 40 cases (26.67%), Staphylococcus aureus in 35 cases (23.33%), and Streptococcus pneumoniae in 33 cases (22.00%). [Table 16] indicates that antibiotic resistance was detected in 70 children (46.67%), while 80 children (53.33%) showed no resistance. [Table 17] shows that the majority of children recovered, accounting for 137 cases (91.33%), while complications occurred in 9 cases (6.00%) and mortality was observed in 4 cases (2.67%). [Table 18] demonstrates that antibiotic resistance was highest in the 1–5 years age group with 29 cases (52.73%), though the association between age and resistance was not statistically significant (p = 0.585). [Table 19] shows comparable resistance among females with 40 cases (49.38%) and males with 30 cases (43.48%), with no statistically significant association (p = 0.470). [Table 20] indicates a significant association between prior antibiotic use and resistance, with resistance observed in 34 children (60.71%) who had previous antibiotic exposure compared to 36 children (38.30%) without prior use (p = 0.008). [Table 21] shows that resistance was present in 35 children (51.47%) exposed to air pollution and in 35 children (42.68%) without exposure, with no statistically significant association (p = 0.283). [Table 22] demonstrates a statistically significant association between overcrowding and resistance, with resistance observed in 50 children (51.02%) from overcrowded households compared to 20 children (38.46%) from non-overcrowded households (p = 0.042). [Table 23] shows that malnourished children had a higher proportion of resistance (28 cases, 62.22%) than well-nourished children (42 cases, 40.00%), and this association was statistically significant (p = 0.012). [Table 24] indicates that resistance was observed in 16 children (55.17%) without fever and 54 children (44.63%) with fever, with no statistically significant association (p = 0.307). [Table 25] shows that resistance was present in 36 children (49.32%) with hospital stay up to one week and 34 children (44.16%) with hospital stay exceeding one week, with no statistically significant association (p = 0.095). [Table 26] demonstrates that resistance was higher among children with complications at 7 cases (77.78%) and deaths at 3 cases (75.00%) compared to recovered children with 60 cases (43.80%), showing a statistically significant association between adverse outcomes and antibiotic resistance (p = 0.047).

Discussion

Community-acquired pneumonia has remained a great challenge to the morbidity and mortality of children, especially in developing nations. The article under review assessed the clinical presentation, microbiological trends, and antibiotic resistance in children with community-acquired pneumonia aged 2 months to 12 years admitted to a tertiary care unit.[11]

The largest number of cases was recorded among children between the ages of 5 and 10 years and the 1-5 years age group in the current study. Though pneumonia is also thought to be more prevalent in infants and young children, the fact that older children were more prevalent in the study might reflect greater contact with the external environment, such as school. Younger children were also more likely to survive due to the immunisation program or the unique healthcare-seeking behaviour of this group.[12]

There was a little female dominance in this study. Such an observation is inconsistent with past studies that have shown increased prevalence in males. The identified difference can be explained by regional, cultural, or referral-related factors, but not

necessarily by the biological susceptibility.[13]

Socioeconomic status was an influential factor in the distribution of the disease, and most of the children were from low- and middle-income groups. Traditionally, poor conditions of living, insufficient healthcare practitioners, and more susceptibility to environmental hazards, which are mostly related to lower socioeconomic groups, may also explain the increased cases of pneumonia among these groups.[14]

Previous antibiotic administration had been reported in more than a third of the children and was statistically correlated with antibiotic resistance. The given finding underscores the high prevalence of antibiotic use before hospitalisation and the role of antibiotics in supporting the growth of resistant organisms. Poor exposure to appropriate antibiotics, incomplete dosing, and over-the-counter access are already recognised as contributors to this issue in paediatric populations.[15]

Environmental factors, such as air pollution and overcrowding, were common among the study participants. There was no statistically significant correlation between air pollution exposure and antibiotic resistance, but overcrowding did show a significant correlation. Poor living conditions are conducive to the spread of respiratory diseases and can lead to recurrent infections and repeated exposure to antibiotic treatment, thereby increasing the risk of resistance.[16]

Malnutrition was a fact in a significant percentage of children and was statistically significantly correlated with antibiotic resistance. It is reported that malnourished children have flawed immune functions, which cause further advanced infections, recovery, and exposure to extended or repeat courses of antibiotic therapy, which can result in antibiotic resistance development.[17]

The most frequent clinical manifestations studied were fever, cough, tachypnea, chest indrawing, and crepitus, which are consistent with the classical presentations of community-acquired pneumonia. Tachypnea and chest indrawing are both significant markers of disease severity and were reported to occur in a high percentage of children, underscoring the need to identify them early and intervene accordingly.[18]

Over half of the children had a hospital stay of over one week, indicating that the illness was severe in a significant proportion of cases. The duration of hospital stay was, however, not statistically significantly associated with antibiotic resistance, which might indicate that factors that occur pre-hospitalisation are more substantial in the development of resistance.[19]

The most used antibiotics were ceftriaxone, followed closely by clindamycin, amoxicillin, and azithromycin. Such a mode of prescribing indicates the need for broad-spectrum coverage when a child is hospitalised. Still, it is also prone to increasing antibiotic use and its role in augmenting resistance.[20]

Microbiological examination indicated that the most frequently isolated microorganisms were Haemophilus influenzae, Staphylococcus aureus, and Streptococcus pneumoniae. A high percentage of cultures did not grow, which could be attributed to prior antibiotic treatment or constraints in traditional culture methods. These results indicate the difficulties in microbiological diagnosis of child-based pneumonia.

Almost half of the study population was found to be antibiotic-resistant. There were also significant correlations between resistance and previous antibiotic use, overcrowding, malnutrition, and adverse outcomes. The proportion of antibiotic resistance in children who developed complications or died was higher, showing a possibility of resistant infections being correlated with worse clinical outcomes.

Although the burden of resistance was high, overall recovery was high, with over 90 percent of the children recovering. That implies that there can be positive outcomes even with resistance present, provided there is timely hospitalisation and proper management, but resistance prevention remains the key.

Strengths And Limitations

Strengths

The research was conducted as a 24-month prospective observational study to systematically collect data and provide follow-ups in cases of hospitalisation. The relatively large sample size of 150 children, with a broad paediatric age range, provided a well-rounded examination of community-acquired pneumonia in a tertiary care unit. The careful examination of demographic, clinical, environmental, microbiological, and treatment-related variables enabled consideration of numerous factors related to antibiotic resistance. Culture and sensitivity testing enabled the assay of resistance patterns of the common causative organisms.

Limitations

The researchers conducted the study at a single tertiary care centre, which may limit the generalisability of the results to other facilities. A percentage of the children had also been exposed to antibiotics before being admitted to the hospital, and this could have led to that. No etiological agents were studied due to a shortage of diagnostic facilities, and the study was not conducted using molecular diagnostic techniques. There was no post-discharge long-term follow-up to limit the determination of late complications and recurrence.

Conclusion

Community-acquired pneumonia is one of the major causes of hospitalisation among infants and children between the ages of 2 months and 12 years. The researchers demonstrate that antibiotic resistance is a significant problem and that almost 50 percent of cases are complicated by it. Resistance was greatly related to prior antibiotic use, overcrowding, malnutrition, and poor clinical outcomes. The most common organisms that were isolated were Haemophilus influenzae, Staphylococcus aureus, and Streptococcus pneumoniae. The majority of children obtained through proper inpatient treatment, however, despite the resistance. The findings also stress the importance of rational antibiotic use, prompt recognition of risk factors, improved living conditions, adequate nutrition, and enhanced antimicrobial stewardship to reduce the burden of resistant paediatric pneumonia.

Summary

This was a prospective observational study that assessed clinical

profile, microbiological spectrum, and pattern of antibiotic resistance in children hospitalised with community-acquired pneumonia in a tertiary care unit. Most of the cases were found in children in the age range of 1-10, with a slight female dominance. Malnutrition and overcrowding were widespread among the environmental and socioeconomic factors. Antibiotic resistance was found to occur in a considerable proportion of cases and was strongly associated with antibiotic exposure and poor outcomes. The paper has highlighted the ongoing problem of treating pneumonia in children amid the ongoing increase in antimicrobial resistance.

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Conflicts of interest
There are no conflicts of interest.

References
1. WHO. Revised WHO classification and treatment of childhood pneumonia at health facilities: evidence summaries. Geneva: World Health Organization; 2014.
2. Morris SK, Moss WJ, Halsey N. Haemophilus influenzae type b conjugate vaccine use and effectiveness. Lancet Infect Dis. 2008;8(7):435–443.
3. Jain S, Williams DJ, Arnold SR, Ampofo K, Bramley AM, Reed C, et al. Community-acquired pneumonia requiring hospitalization among U.S. children. N Engl J Med. 2015;372(9):835–845.
4. McIntosh K. Community-acquired pneumonia in children. N Engl J Med. 2002;346(6):429–437.
5. National Family Health Survey (NFHS-5), India, 2019–21. Mumbai: International Institute for Population Sciences (IIPS); 2021.
6. Dean P, Florin TA. Factors associated with pneumonia severity in children: a systematic review. J Pediatric Infect Dis Soc. 2018;7(4):323–334.
7. Heiskanen-Kosma T, Korppi M, Jokinen C, Kleemola M, Herva E. Risk factors for community-acquired pneumonia in children: a population-based case-control study. Scand J Infect Dis. 1997;29(3):281–285.
8. Gerber JS, Newland JG, Coffin SE, Hall M, Thurm C, Prasad PA, et al. Identifying targets for antimicrobial stewardship in children's hospitals. Infect Control HospEpidemiol. 2013;34(12):1252–1258.
9. Heine D, Cochran C, Moore M, Titus MO, Andrews AL, Wills HE, et al. The prevalence of bacteremia in pediatric patients with community-acquired pneumonia: guidelines to reduce blood cultures. Hosp Pediatr. 2013;3(2):92–96.
10. Kronman MP, Hersh AL, Gerber JS, Newland JG, Wong T, Lee BR, et al. Ambulatory visit rates and antibiotic prescribing for children with pneumonia, 1994–2007. Pediatrics. 2011;127(3):411–418.
11. Ambroggio L, McCulloh RJ, Alverson B, Young PC, Reed J, Shah SS, et al. Beta-lactam versus beta-lactam/macrolide therapy in pediatric outpatient pneumonia. PediatrPulmonol. 2016;51(5):541–548.
12. Florin TA, Ambroggio L. Biomarkers for community-acquired pneumonia in the emergency department. Curr Infect Dis Rep. 2014;16(10):451.
13. Ayukekbong JA, Ntemgwa M, Atabe AN. The threat of antimicrobial resistance in developing countries: causes and control strategies. Antimicrob Resist Infect Control. 2017;6(1):47.
14. Das B, Chaudhuri S, Srivastava R, Nair GB, Ramamurthy T. Fostering research into antimicrobial resistance in India. BMJ. 2017;358:j3535.
15. Harris M, Clark J, Coote N, Fletcher P, Harnden A, McKean M, et al. British Thoracic Society guidelines for the management of community-acquired pneumonia in children. Thorax. 2011;66(Suppl 2):ii1–ii23.
16. Lodha R, Kabra SK, Pandey RM. Antibiotics for community-acquired pneumonia in children. Cochrane Database Syst Rev. 2013;2013(6):CD004874.
17. Awasthi S, Pandey CM, Verma T, Mishra N. Incidence of community-acquired pneumonia in children aged 2–59 months in Uttar Pradesh and Bihar, India. PLoS One. 2019;14(3):e0214086.
18. Yun KW. Community-acquired pneumonia in children: updated perspectives on etiology, diagnosis, and treatment. Clin Exp Pediatr. 2024;67(2):80–89.
19. Pokhrel B, Koirala T, Gautam D, Kumar A, Camara BS, Saw S, et al. Antibiotic use and treatment outcomes among children with community-acquired pneumonia in Nepal. Trop Med Infect Dis. 2021;6(2):55.
20. Chaudhary GS, Kumar S, Kankane A, Gupta S. Microbiological profile in community-acquired pneumonia in children. J Med Sci Clin Res. 2021;9(7):58–63.