

Original Research

Efficacy of Oral vs. Intravenous Antibiotics in Treating Pediatric Pneumonia: A Comparative Study

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ABSTRACT:

Aim: The objective of this study was to compare the efficacy of oral versus intravenous (IV) antibiotics in treating pediatric community-acquired pneumonia (CAP) and to evaluate differences in clinical resolution, length of hospital stay, adverse drug reactions, and parental satisfaction. **Material and Methods:** This randomized comparative study was conducted on 100 pediatric patients diagnosed with CAP at a tertiary care hospital. Patients were assigned to either the oral antibiotic group (n=50) or the IV antibiotic group (n=50). Inclusion criteria included children aged 6 months to 12 years with clinical and radiographic evidence of pneumonia, while exclusion criteria comprised chronic illnesses, immunodeficiency, or prior antibiotic use within 48 hours. The oral group received amoxicillin-clavulanate or azithromycin, while the IV group received ceftriaxone or ampicillin, transitioning to oral therapy upon clinical improvement. Outcomes assessed included clinical resolution within 7 days, length of hospital stay, recurrence within 30 days, and adverse drug reactions. Statistical analysis was performed using SPSS software, with significance set at $p < 0.05$. **Results:** Both groups exhibited high clinical resolution rates, with 90% in the oral group and 94% in the IV group ($p = 0.52$). The mean length of hospital stay was significantly shorter in the oral group (3.2 ± 1.1 days) compared to the IV group (4.8 ± 1.5 days, $p < 0.001$). Adverse drug reactions were infrequent, though injection site reactions were notably higher in the IV group (12% vs. 0%, $p < 0.001$). A small proportion of patients (6%) in the oral group required a switch to IV therapy due to insufficient improvement. Parental satisfaction was significantly higher in the oral group (8.7 ± 1.5 vs. 7.2 ± 1.8 , $p < 0.001$), likely due to the convenience of oral administration. **Conclusion:** This study confirms that oral antibiotics are as effective as IV antibiotics for treating pediatric CAP in stable patients. Oral therapy offers advantages such as shorter hospital stays, fewer injection-related complications, and higher parental satisfaction. While IV therapy remains necessary for severe cases, oral antibiotics serve as a safe, effective, and cost-efficient alternative for mild to moderate pneumonia.

Keywords: Pediatric pneumonia, oral antibiotics, intravenous antibiotics, clinical outcomes, treatment efficacy.

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INTRODUCTION

Pneumonia is one of the leading causes of morbidity and mortality in children worldwide, particularly in developing countries where access to healthcare and advanced medical interventions is limited. Pediatric pneumonia is a significant public health concern, and timely, effective treatment is essential to prevent complications and reduce mortality. The management of community-acquired pneumonia (CAP) in children has evolved over the years, with antibiotics playing a crucial role in treatment. While both oral and intravenous (IV) antibiotics are commonly used, the choice of administration route remains a subject of

debate among healthcare professionals.¹The decision to use oral or IV antibiotics in pediatric pneumonia treatment is influenced by several factors, including disease severity, patient age, ability to tolerate oral medications, and healthcare setting. Traditionally, IV antibiotics have been preferred for children with moderate to severe pneumonia requiring hospitalization. This preference is based on the assumption that IV administration ensures better bioavailability, faster action, and higher serum drug levels compared to oral antibiotics. However, recent studies suggest that oral antibiotics may be equally effective in many cases, especially in children with

mild to moderate pneumonia who do not exhibit complications such as respiratory distress, hypoxia, or sepsis.² One of the primary considerations in determining the efficacy of oral versus IV antibiotics is the severity of pneumonia. Mild to moderate cases of pneumonia, characterized by symptoms such as cough, fever, and mild respiratory distress, can often be managed with oral antibiotics, provided the patient has no difficulty swallowing and does not exhibit signs of gastrointestinal dysfunction that may impair drug absorption. Conversely, severe cases of pneumonia, including those with high fever, significant respiratory distress, hypoxia, or sepsis, often require IV antibiotics due to concerns about rapid disease progression and the need for immediate therapeutic action. Another critical factor in antibiotic selection is the pharmacokinetics and bioavailability of the drug. Certain antibiotics, such as amoxicillin and azithromycin, have high oral bioavailability, meaning they achieve therapeutic levels in the bloodstream even when administered orally. These antibiotics have been widely used in outpatient settings to treat pediatric pneumonia with good clinical outcomes. In contrast, other antibiotics, such as ceftriaxone and ampicillin, are commonly administered intravenously in hospitalized children due to their pharmacokinetic properties and superior effectiveness in severe infections.³ The duration of hospital stay is another aspect influencing treatment decisions. Oral antibiotic therapy has been associated with shorter hospital stays, reducing the burden on healthcare facilities and minimizing hospitalization costs. Children receiving IV antibiotics typically require longer hospital admissions for close monitoring and completion of the IV course. Additionally, IV administration necessitates the placement of a venous catheter, which can increase the risk of complications such as phlebitis, catheter-related infections, and discomfort for pediatric patients. This makes oral antibiotics a preferable option when clinically appropriate. Parental and caregiver perspectives also play a crucial role in antibiotic selection. Hospitalization for IV antibiotics can be distressing for both children and their families, leading to increased emotional and financial stress. Oral antibiotic therapy, which can be administered at home, allows for greater comfort and convenience, improving adherence to treatment and overall patient satisfaction. Furthermore, the ease of administering oral antibiotics reduces the need for repeated hospital visits, which is especially beneficial in resource-limited settings where access to healthcare is a challenge.⁴ Despite these advantages, there are concerns about the appropriateness of oral antibiotics in certain cases. Some children may have difficulty absorbing oral medications due to underlying gastrointestinal conditions, vomiting, or severe illness. In such situations, IV antibiotics provide a reliable alternative, ensuring that the child receives the necessary medication without concerns about

absorption or compliance. Additionally, bacterial resistance patterns must be considered, as certain pathogens causing pneumonia may be more susceptible to IV antibiotics, especially in cases of complicated pneumonia or treatment failure.⁵ The debate over the efficacy of oral versus IV antibiotics has prompted numerous studies to compare their effectiveness in treating pediatric pneumonia. Research suggests that in many cases, oral antibiotics are as effective as IV therapy, particularly for uncomplicated pneumonia. Clinical outcomes, including symptom resolution, recurrence rates, and adverse effects, have been found to be comparable between the two routes of administration. However, the decision to use oral or IV antibiotics should be individualized, taking into account patient characteristics, disease severity, and potential complications. With growing concerns about antibiotic resistance, the choice of antibiotic administration also has implications for antimicrobial stewardship. Overuse of IV antibiotics, particularly in cases where oral therapy would suffice, contributes to increased antibiotic resistance and unnecessary healthcare costs. Encouraging the appropriate use of oral antibiotics in mild to moderate cases of pneumonia can help mitigate these risks while ensuring effective treatment.⁶ The selection of oral versus IV antibiotics for pediatric pneumonia treatment is a complex decision influenced by disease severity, pharmacokinetics, hospital stay duration, parental preference, and healthcare resources. While IV antibiotics remain the standard of care for severe pneumonia, oral antibiotics have proven to be a viable and effective alternative in many cases. Understanding the benefits and limitations of each approach is crucial in optimizing treatment outcomes for children with pneumonia while promoting cost-effective and patient-friendly healthcare practices. Future research and updated clinical guidelines will continue to refine the best practices for antibiotic use in pediatric pneumonia, ensuring optimal management strategies that balance efficacy, safety, and healthcare resource utilization.

MATERIAL AND METHODS

The study was conducted on a cohort of 100 pediatric patients diagnosed with community-acquired pneumonia (CAP) at tertiary care hospital. Patients were randomly assigned into two treatment groups: the oral antibiotic group (n=50) and the intravenous (IV) antibiotic group (n=50). Inclusion criteria encompassed children aged 6 months to 12 years with clinical and radiographic evidence of pneumonia, while exclusion criteria included patients with underlying chronic illnesses, immunodeficiency, or prior antibiotic use within 48 hours of admission. Oral antibiotics, including amoxicillin-clavulanate or azithromycin, were administered based on weight-adjusted dosing guidelines, whereas the IV group received ceftriaxone or ampicillin according to

standard pediatric dosing protocols. Patients in the IV group were transitioned to oral therapy upon clinical improvement. Baseline demographic data, clinical symptoms, duration of fever, length of hospital stay, and treatment outcomes were recorded. The primary outcome measure was clinical resolution within 7 days, while secondary outcomes included hospital length of stay, recurrence within 30 days, and adverse drug reactions. Statistical analysis was performed using SPSS software, with a significance level set at $p < 0.05$. Ethical approval was obtained from the institutional review board, and informed consent was secured from the parents or guardians of all participants.

RESULTS

Table 1: Baseline Characteristics of Patients

The baseline characteristics of the study population were comparable between the two treatment groups. The mean age of patients receiving oral antibiotics was 5.2 ± 2.1 years, while that of the IV antibiotics group was 5.1 ± 2.3 years, with no significant difference ($p=0.78$). The gender distribution was also similar, with 56% males in the oral group and 60% in the IV group ($p=0.72$). The proportion of females was slightly higher in the oral group (44%) compared to the IV group (40%), but the difference was not statistically significant ($p=0.65$). The fever duration before hospital admission was almost identical in both groups (3.5 ± 1.2 days vs. 3.6 ± 1.3 days, $p=0.81$), indicating that the severity of illness at presentation was comparable.

Table 2: Clinical Outcomes

The clinical resolution rate within seven days was high in both groups, with 90% of patients in the oral antibiotic group and 94% in the IV antibiotic group achieving full recovery ($p=0.52$). This suggests that both treatment modalities were similarly effective in resolving pneumonia within a short timeframe. However, the length of hospital stay was significantly shorter in the oral antibiotic group (3.2 ± 1.1 days) compared to the IV antibiotic group (4.8 ± 1.5 days, $p < 0.001$). This highlights the advantage of oral therapy in reducing hospital stays, which may lead to lower healthcare costs and reduced burden on hospital resources. Recurrence of pneumonia within 30 days was low in both groups (6% in the oral group vs. 8%

in the IV group), with no statistically significant difference ($p=0.68$), suggesting that both treatment strategies were equally effective in preventing relapse.

Table 3: Adverse Drug Reactions

Adverse drug reactions were relatively infrequent in both groups. Gastrointestinal symptoms such as nausea, vomiting, and diarrhea were reported in 10% of patients in the oral group and 8% in the IV group ($p=0.75$), indicating a similar risk profile for gastrointestinal side effects. Allergic reactions, including rash and pruritus, were slightly more common in the IV group (6%) than in the oral group (4%), though the difference was not significant ($p=0.67$). Notably, injection site reactions were observed in 12% of patients receiving IV antibiotics, whereas no such reactions were reported in the oral group ($p < 0.001$).

Table 4: Antibiotic Switch and Need for Additional Treatment

A small proportion of patients (6%) in the oral antibiotic group required a switch to IV therapy due to insufficient clinical improvement. In contrast, none of the patients in the IV group needed to switch to another treatment modality ($p=0.24$). This suggests that while oral therapy is highly effective, a small subset of patients may still require escalation to IV antibiotics. The need for additional treatment, such as supplementary antibiotics or extended therapy duration, was minimal in both groups (4% in the oral group vs. 2% in the IV group, $p=0.56$), further supporting the overall efficacy of both treatment options.

Table 5: Parental Satisfaction and Compliance

Parental satisfaction was significantly higher in the oral antibiotic group, with a mean satisfaction score of 8.7 ± 1.5 compared to 7.2 ± 1.8 in the IV antibiotic group ($p < 0.001$). This difference likely reflects the convenience and comfort associated with oral administration, as IV therapy requires hospitalization and frequent injections, which can be distressing for children and caregivers. Treatment compliance was also slightly better in the oral antibiotic group (96%) compared to the IV group (90%), though the difference was not statistically significant ($p=0.42$).

Table 1: Baseline Characteristics of Patients

Characteristic	Oral Antibiotics (n=50)	IV Antibiotics (n=50)	p-value
Age (Mean \pm SD, years)	5.2 ± 2.1	5.1 ± 2.3	0.78
Male (%)	28 (56%)	30 (60%)	0.72
Female (%)	22 (44%)	20 (40%)	0.65
Fever Duration before Admission (Mean \pm SD, days)	3.5 ± 1.2	3.6 ± 1.3	0.81

Table 2: Clinical Outcomes

Outcome	Oral Antibiotics (n=50)	IV Antibiotics (n=50)	p-value
Clinical Resolution within 7 Days (%)	45 (90%)	47 (94%)	0.52

Length of Hospital Stay (Mean \pm SD, days)	3.2 \pm 1.1	4.8 \pm 1.5	<0.001
Recurrence within 30 Days (%)	3 (6%)	4 (8%)	0.68

Table 3: Adverse Drug Reactions

Adverse Reaction	Oral Antibiotics (n=50)	IV Antibiotics (n=50)	p-value
Gastrointestinal Symptoms (%)	5 (10%)	4 (8%)	0.75
Allergic Reactions (%)	2 (4%)	3 (6%)	0.67
Injection Site Reactions (%)	0 (0%)	6 (12%)	<0.001

Table 4: Antibiotic Switch and Need for Additional Treatment

Parameter	Oral Antibiotics (n=50)	IV Antibiotics (n=50)	p-value
Patients Requiring Switch to IV (%)	3 (6%)	- (0%)	0.24
Patients Requiring Additional Treatment (%)	2 (4%)	1 (2%)	0.56

Table 5: Parental Satisfaction and Compliance

Measure	Oral Antibiotics (n=50)	IV Antibiotics (n=50)	p-value
Parental Satisfaction Score (Mean \pm SD)	8.7 \pm 1.5	7.2 \pm 1.8	<0.001
Compliance with Treatment (%)	48 (96%)	45 (90%)	0.42

DISCUSSION

The findings of this study align with previous research comparing oral and intravenous (IV) antibiotic treatments for pediatric community-acquired pneumonia (CAP). The comparable baseline characteristics between the two groups, such as mean age (5.2 \pm 2.1 years for oral antibiotics vs. 5.1 \pm 2.3 years for IV antibiotics) and gender distribution (56% males in the oral group vs. 60% in the IV group), suggest that the randomization process was effective in minimizing potential confounding factors. Similar demographic distributions were reported by Addo-Yobo et al. (2004), who found no significant differences in baseline characteristics among children treated with oral versus IV antibiotics for severe pneumonia, ensuring a fair comparison of treatment outcomes.⁷ Regarding clinical outcomes, our study observed a high clinical resolution rate within seven days in both treatment groups, with 90% in the oral antibiotic group and 94% in the IV antibiotic group achieving full recovery (p=0.52). These findings are in agreement with a study by Agarwal et al. (2004), which reported that oral amoxicillin was as effective as IV penicillin in children with CAP, with resolution rates exceeding 90% in both groups. This supports the idea that oral antibiotics are a viable first-line treatment for pediatric pneumonia in stable patients.⁸ The significantly shorter length of hospital stay for the oral antibiotic group (3.2 \pm 1.1 days) compared to the IV group (4.8 \pm 1.5 days, p<0.001) in our study highlights the advantage of oral therapy in reducing hospitalization duration. A similar trend was observed in a study by Greenberg et al. (2011), which found that children treated with oral antibiotics had shorter hospital stays and earlier discharge readiness compared to those receiving IV therapy. This reduction in hospital stay has important implications for healthcare costs and resource utilization, making oral antibiotics a cost-effective alternative.⁹ Adverse drug reactions were relatively infrequent in both

groups in our study. Gastrointestinal symptoms were reported in 10% of the oral antibiotic group and 8% of the IV group (p=0.75), while injection site reactions occurred in 12% of patients in the IV group but none in the oral group (p<0.001). Similar results were found in the study by Lodha et al. (2011), which reported that IV antibiotics were associated with a higher risk of local site complications, such as phlebitis, reinforcing the safety profile of oral therapy.¹⁰ A small proportion of patients in the oral antibiotic group (6%) required a switch to IV therapy due to insufficient clinical improvement. This aligns with the findings of a study by Favre-Bulle et al. (1999), which showed that while most children with CAP responded well to oral therapy, approximately 5-7% required escalation to IV treatment. This reinforces the importance of close clinical monitoring when using oral antibiotics, particularly in severe cases.¹¹ Parental satisfaction was significantly higher in the oral antibiotic group in our study, with a mean satisfaction score of 8.7 \pm 1.5 compared to 7.2 \pm 1.8 in the IV group (p<0.001). This finding is consistent with the study by Peltola et al. (2009), which demonstrated that caregivers preferred oral therapy due to its convenience, reduced distress for children, and fewer hospital visits. Additionally, treatment compliance was slightly better in the oral group (96%) compared to the IV group (90%), further supporting the preference for oral administration.¹²

CONCLUSION

This study demonstrates that oral antibiotics are as effective as intravenous antibiotics in treating pediatric community-acquired pneumonia in clinically stable patients. Both treatment groups showed high clinical resolution rates, with no significant difference in recurrence. However, oral antibiotics were associated with shorter hospital stays, fewer injection-related adverse effects, and higher parental satisfaction. While IV therapy remains essential for

severe cases, oral antibiotics offer a convenient, cost-effective alternative for mild to moderate pneumonia.

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