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A tertiary care center's cost-effective examination of different antibiotic regimen used to treat pneumonia

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Abstract

Objective: To evaluate the cost-effectiveness of different antibiotics in treating adult patients with community-acquired pneumonia (CAP). Methodology: This retrospective study analyzed 100 case sheets of CAP patients admitted to the Medical Centre between January 2024 and December 2024. The case sheets contained details on various antibiotics administered both orally and intravenously. The most commonly used antibiotics included azithromycin, ampicillin-sulbactam, levofloxacin, cefuroxime, and amoxicillin-clavulanate. Intravenous antibiotics showed a more significant improvement in patient outcomes compared to oral antibiotics. To assess cost-effectiveness, we conducted a pharmacoeconomic analysis and applied a cost-effectiveness evaluation of these antibiotics. The cost-effectiveness coefficient was determined by dividing the monthly number of asymptomatic days by the cost of antibiotics.Results: The cost-effectiveness coefficient ratio indicated that continuous intravenous antibiotic therapy is significantly more expensive than switch therapy.Conclusion: When clinically appropriate, transitioning from intravenous to oral antibiotics at the right time can reduce unnecessary healthcare costs while maintaining effective treatment outcomes.

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INTRODUCTION

In India, one of the significant causes of illness and mortality is community-acquired pneumonia (CAP). The prevalence of pneumonia in India is not well-documented due to inadequate field surveys. WHO estimates that there were 89.5 LRTI-related deaths per 100,000 people in India in 2004. According to the Invasive Bacterial Infection Surveillance (IBIS) Study, the case fatality rate for CAP was 30% [1]. From a pharmacoeconomic

perspective, these factors encourage the use of pharmaceuticals to treat pneumonia. In individuals with CAP, antibiotics (AB) are typically administered empirically [2]. In patients with a simple clinical history of pneumonia, oral antibiotics are usually recommended as a first line of treatment. Although intravenous (i.v.) antibiotics are only used for individuals who are at risk for coexisting conditions, they have the drawback of increasing the risk of consequences like sepsis, thrombophlebitis, or skin abscesses. Therefore, oral delivery is the most appropriate treatment [3]. Therefore, as soon as the overall clinical condition improves, it is suitable for patients who can convert from intravenous to oral administration (also known as switch therapy) [4]. In addition to improving patient compliance, switching treatment has significant pharmacoeconomic ramifications. The length of hospital stay and the expense of oral administration are reduced. Due to the expenses invested in the production of intravenous medicine and the related costs of intravenous application (infusion set, medical personnel, etc.), the price of intravenous application is expensive. Our study aims to determine the beneficial pharmacoeconomic effects of promptly switching from intravenous to oral antibiotic therapy [5].

METHODS

Characteristic of the group: From January to December of 2024, 890 individuals were admitted to hospitals. Out of these patients, we have chosen 100 who have community-acquired pneumonia and whose initial intravenous antibiotics were successful or whose therapy was switched from intravenous to oral antibiotics based on improvement [6]. A comparison was made between the cost-effectiveness of the 57 patients who got switch therapy and the 43 patients who received solely intravenous antibiotics during their treatment. Every information we used came from the Medical Record Department's documentation [7].

Cost-effectiveness analysis:

The following approach was used to conduct cost-effective analysis. First, we determined the direct costs of the medicines used to treat CAP. The pharmacy provided this information. The cost-effectiveness coefficient, which was determined by dividing the price of antibiotics by the number of days in a month that a patient is asymptomatic, was then determined [8],[9]. By subtracting the number of days that the patient's documentation included pneumonia symptoms from the total number of 30 (days in a month), the number of asymptomatic days in a month was determined [10].

Statistical analysis:

The statistical package for the social sciences (SPSS) software version 20 was used for the statistical analysis, and the independent sample test, chi-square test, and paired samples test were used to examine the results. Statistical significance was defined as a p-value of less than 0.05 [11]. Age, sex, and other demographic information are categorical variables, and the baseline characteristics of the patients were compiled by treatment groups using descriptive statistics to determine whether there were any differences. For categorical data, the mean and standard deviation were supplied. The non-parametric Mann-Whitney test was employed to compare two continuous variables [12].

RESULTS AND DISCUSSION

Table 1 lists the study participants' baseline attributes, including age, gender, mean duration of disease (in months), and history of alcohol and tobacco use. The patients' daily dosage requirements and the daily cost of each antibiotic regimen are shown in **Table 4**, and **Table 5** lists the number of patients who received continuous intravenous antibiotic administration as well as those who received switch therapy, which involves initially receiving an intravenous antibiotic that is subsequently switched to an oral antibiotic based on the clinical improvement of symptoms, throughout treatment.

By adding up all of the patients' expenses for each group's various antibiotic regimens, it also displays the effective cost of treatment for each therapy. Every group exhibits statistical significance with a p-value <0.001 according to the Mann-Whitney test. However, the length of hospitalization in the trial did not reach any statistical significance.

Table 6 displays the analysis of our study's most crucial metric, the cost-effective coefficient of each drug. We discovered that switch therapy is less expensive than continuous intravenous antibiotic

delivery. Antibiotics must be administered promptly to treat pneumonia.

Antibiotics are typically administered empirically based on the patient's symptoms during hospitalization. With a population of over a billion, India requires cost-effective healthcare system improvements to give its citizens improved access to treatment options.

Table 1 Patient characteristics

Characteristics	SwT n = 57	I.V n =43
No of Patients	57	43
Mean	53.10	53.50
Standard Deviation	8.385	8.819

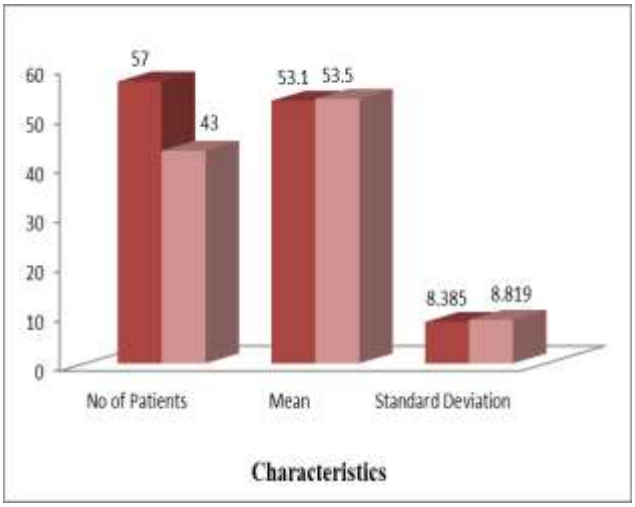

Figure 1 Patient characteristics

Table 2 Based on Gender

Gender	SwT n = 57	I.V n =43
Male	11 (41%)	10 (43%)
Female	16 (59%)	13 (57%)

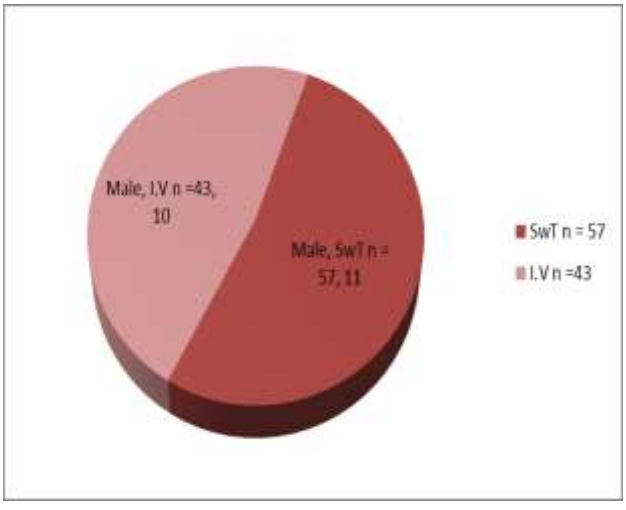

Figure 2 Based on Gender

Table 3 Based on Age Criteria

Age Criteria	SwT n = 57	I.V n =43
< 40 years	8 (7%)	8 (17%)
41- 60 years	28 (74%)	16 (57%)
> 60 years	9 (19%)	12 (26%)
Mean Duration of Disease (months)	9 ±7.2	9±6.7
Smokers	7 (19%)	8 (17%)
Alcohol Use	6 (11%)	6 (13%)

intravenous (i.v.) SwT-switch treatment. The data in the tables above are presented as mean + SD, except for categorical variables, shown as absolute values with percentages in brackets. The two groups' baseline parameters do not differ statistically significantly.

Table 4 Cost and daily dosage of the antibiotics used in the study

Antibiotics	Daily Dosage (mg)
i.v. Amoxicillin-clavulanate	2400
i.v. Levofloxacin	500
i.v. Cefuroxime	1500
i.v. Ampicillin-salbactam	4500
i.v. Azithromycin	500
Tab Amoxicillin-clavulanate	1875
Tab Levofloxacin	500
Tab Cefuroxime	1000
Tab Ampicillin-salbactam	1500
Tab Azithromycin	500

i.v. – intravenous, Tab – tablet, Price/DD – Price per daily dosage

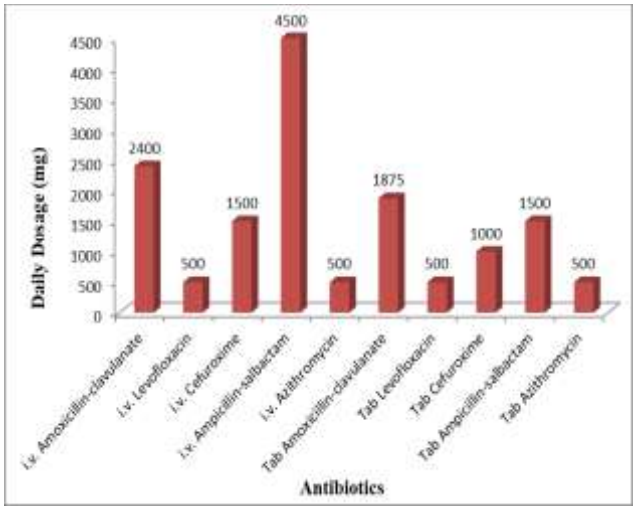

Figure 3 Cost and daily dosage of the antibiotics

Table 5 Number of patients treated with antibiotics, average length of hospital stay, and effective cost

Antibiotics(AB)	No. of patients		Effective cost		P	Duration of hospital stay		P
	SwT	I.V.	SwT	I.V.		SwT	I.V.	
Amoxicillin-clavulanate	6	7	1010	3440	<0.001	22	24	NS
Levofloxacin	3	2	158	390	<0.001	24	23	NS
Cefuroxime	5	6	340	1900	<0.001	25	25	NS
Ampicillin-salbactam	7	3	460	1320	<0.002	23	24	NS
Azithromycin	3	2	146	600	<0.001	25	25	NS

Table 6 Economical Co-efficient Test

Antibiotics(AB)	Economical Co-efficient Test		P
	SwT	I.V.	
Amoxicillin-clavulanate	43.1	138.6	0.001
Levofloxacin	7.3	16.6	0.001
Cefuroxime	14.1	74.1	0.001
Ampicillin-salbactam	20.2	53.8	0.002
Azithromycin	6.6	24.1	0.01

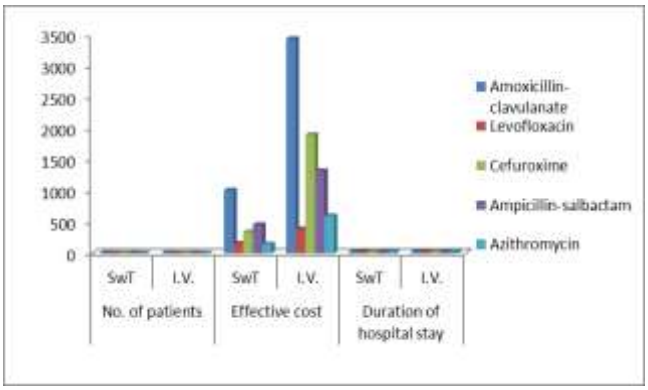

Figure 4 Patients treated with antibiotics, average length of hospital stay, and effective cost

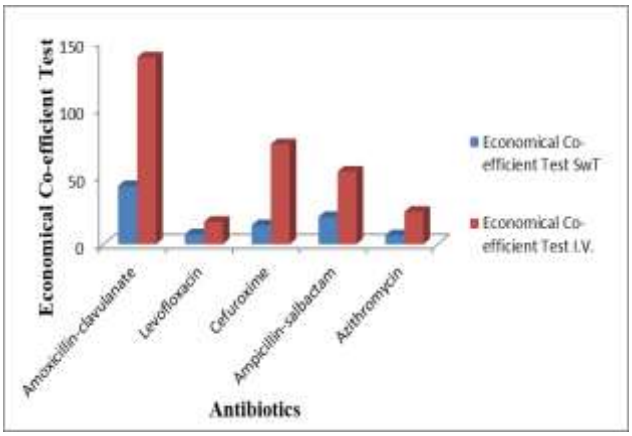

Figure 5 Economical Co-efficient Test

Our study aims to determine the most economical way to provide antibiotics in a tertiary care hospital. For our pharmacoeconomic analysis, we decided to use the cost-effective analysis. This approach contrasts the cost of treatment with outcomes that are stated in natural units. (for instance, the number of years gained, days without symptoms, etc.).

The cost-effective coefficient is the most crucial metric to examine in this case. Until the patient finished treatment, we determined the direct cost of antibiotics per day dosage. Additional costs, such as hospital bed charges, staff salaries, diagnostic testing, and additional treatment options during hospitalization, were not factored in. Most patients' hospitalization length exceeded the time needed to treat their pneumonia with antibiotics. Our investigation observed no difference in treatment efficacy between switch therapy and continuous intravenous antibiotic delivery.

Switch treatment is appropriate for patients who can take the medication orally and who do not have high prognosis risk factors. This drastically reduces the costs.

CONCLUSION:

An effective strategy to prevent unwanted costs is promptly transitioning a suitable patient from intravenous to oral antibiotics. Additionally, it provides the benefit of improved patient compliance.

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Author Contribution

All authors made substantial contributions to the conception, design, acquisition, analysis, or interpretation of data for the work. They were involved in drafting the manuscript or revising it critically for important intellectual content. All authors gave final approval of the version to be published and agreed to be accountable for all aspects of the work, ensuring its accuracy and integrity.

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