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Original Research Article

Pharmacoeconomical Analysis of Commonly Prescribed Antimicrobial Agents in Patients with Community Acquired Pneumonia (CAP) in a Tertiary Care Center. A Retrospective Institutional Based Observational Study

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ABSTRACT

Objective: Pharmacoeconomical analysis of the commonly prescribed antimicrobial agents in patients with Community-acquired pneumonia (CAP) in a tertiary care center.
Material and Methods: It was a retrospective observational study carried out on 69 indoor patients of CAP in IGMC, Shimla. The details of prescribed drugs were taken from the patients' files procured from the medical record department of the institution. A comparison was made between the expenditure occurred on using prescribed (Branded) drugs with that of generic drugs. Statistical analysis of the data was done by using SPSS 16.0.
Results: The age distribution pattern of the studied patients was 61-70 years (37.5%) followed by 51-60 years (26.08%) and the mean duration of hospital stay was 7.53 days. The most frequently prescribed drugs were Amoxicillin with Clavulanic acid (59.42%), Piperacillin with Tazobactam (55.07%), Azithromycin (46.37%) and Oseltamivir (34.78%). The mean difference between per day cost of generic drugs and branded drugs was (M [I-Q]) [506.04(13.5-2595.0)] and [2269.5 (78.06-12571.0)] respectively.
Conclusion: After statistical analysis, it was concluded that the use of generic drugs in the treatment of CAP is more cost-effective as compared to the use of Branded drugs. Hence, we should emphasize on the use of generic drugs (as these drugs are more pocket-friendly) keeping in view the financial status of most of the people of our country. Simultaneously, we should keep a close check on the quality of the generic drugs so that the health benefits of the patients are not jeopardized.
Keywords: Community-Acquired Pneumonia, Pharmaco-Economical, Analysis, Branded drugs, Generic Drugs

INTRODUCTION

Community acquired pneumonia [CAP] remains the single most common cause of death from infectious diseases in the elderly population.[1] Adults aged over 65 years are a rapidly expanding cohort with growth rates more than twice that of younger populations. With an expected 20% of the world's population reaching elderly status by 2050, the burden of CAP will be even more significant in the coming years.[2] The annual incidence of CAP in elderly patients is estimated to be 25–44 cases per 1000 persons.[3] The most recent data revealed mortality rates ranging from 10 to 30% in those aged 65 years or older.[3]

Mild to moderate condition of CAP can be manageable at the community level with the use of empirical antimicrobial agents (AMAs), while severe CAP with

older age and co-morbidities need hospitalization. This kind of scenario, the choice of AMAs is very important to ensure proper coverage of potentially drug-resistant strain. [4] The annual cost of CAP therapy in the United States was 12.2 billion US$, and it will increase with the age of the patients. In the USA alone, only CAP is responsible for >90% of total hospital cost with approx. US$4 million/100 000 population. [5] In France, among 4, 00,000 annual cases of CAP >80 thousand need hospitalization, [6] while in Germany, approximately 500 million euro spent on the management of CAP. [7]

CAP is a very common cause of hospital admissions among the poor Indian population and is a cause of major financial burden in the treatment. There is a major difference between the cost of branded and generic drugs. Considering the quality of both types of drugs at par, cost analysis between these two types of drugs is required for clear-cut guidelines in prescription. We aim to analyses the cost of the commonly prescribed antimicrobial agents [AMAs] in patients with Community-acquired pneumonia [CAP] in a tertiary care center.

MATERIAL AND METHODS

This is a retrospective cross-sectional study conducted in I.G. Medical College, Shimla. The study included 69 indoor patients diagnosed as suffering from Community-acquired pneumonia. The details of prescribed drugs were taken from the patients files procured from the medical records department of the institution.

Data related to patients' age, gender, isolated microorganism and prescribed antimicrobial agents with respect to their names, dosage and duration were extracted from the prescription for an individual patient. Total of 12 antimicrobial agents was used for the treatment of CAP, which includes Piperacillin-Tazobactam, Amoxicillin- Clavulanic Acid, Azithromycin, Oseltamivir, 3rd Generation Cephalosporins, Meropenem, Faropenem, Fluoroquinolone, Doxycycline, Linezolid, Clindamycin, and Metronidazole. The market rates of the prescribed (branded) drugs were taken from the civil supply medicine shops and that for the generic drugs were taken from the Generic drug stores, both located in the institution campus. A comparison was made between the expenditure occurred on using branded drugs with that of generic drugs.

Statistical Analysis

Data were entered in Statistical Package for Social Sciences (SPSS) version 23 for Chicago Inc. Patients age and pricing of various antimicrobial agents was reported as mean±SD and differences in the mean levels between genders was compared with unpaired student t-test. Chi-square test was used for descriptive analysis. A priori p-value of 0.05 was used throughout the analyses and the results were considered statistically significant at $p<0.05$.

RESULT

In this study, 64% of male patients diagnosed with Community-acquired pneumonia (figure-I). We also observed that the commonest age group to diagnosed CAP was 51- 60 years both male (29.55%) and female (36%) patients ($p>0.7$); table-I. The mean age of male patients was 59±16.4 years as compared to female patients 58.3±211.8 years ($p>0.8$). A total number of 179 antimicrobial agents (In the form of mono and combined therapy) were prescribed over 69 patients suffering from community-acquired pneumonia during their complete stay in the hospital (figure-II).

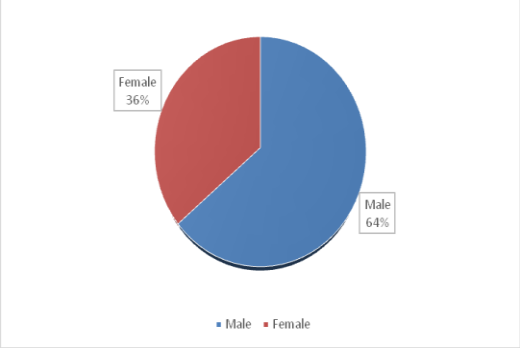

Figure-1: Incidence of newly diagnosed patients of CAP.

Table-I Incidence of Community-Acquired Pneumonia between various age groups.

Age	Male (n-44)	Female (n-25)	2 – tailed significant
11-20 yrs.	02.27%	-	0.7
21-30 yrs.	04.55%	04%	
31-40 yrs.	04.55%	-	
41-50 yrs.	15.91%	16%	
51-60 yrs.	29.55%	36%	
61-70 yrs.	22.73%	36%	
71-80 yrs.	18.18%	08%	
81-90 yrs.	02.27%	-	

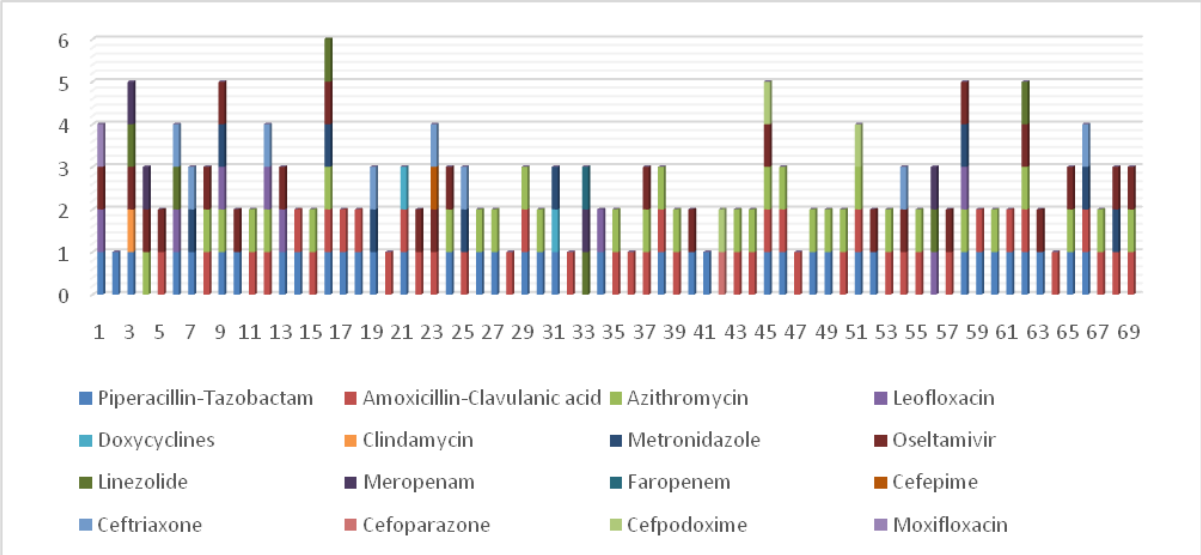

Figure-2 Combination of drugs regimen prescribed in CAP diagnosed patients.

The commonest isolated organism was *Streptococcus pneumonia* accounting 11.36% in male while 20% in female patients, while more than 72% of samples were found to be cultured negative. The most frequently prescribed drugs were amoxicillin with clavulanic acid (59.42%), piperacillin with tazobactam (55.07%), azithromycin (46.37%) and oseltamivir (34.78%) while if compare between both the genders, the frequency of amoxicillin and clavulanic acid combination was 22.61% in male & 23.44% in female patients. The prescribed frequency of 21.74% in male and 20.31% in female patients was observed with piperacillin and tazobactam combination; gender wise comparison of prescription frequency is given in table-II. 85% of the patients belonged to lower socio-economic status (below poverty line). Among 179 antimicrobial agents, 77% of the AMAs used were injectables and 23% were tablets. The mean duration of hospital stay was 7.54±4.10 days. The mortality rate was 7.25% (n-5) and one patient took LAMA (leave against medical advised).

Table-2. Commonest prescribed Antimicrobial agents (AMAs) in CAP diagnosed patients. (in Percentages)

Antimicrobial agents	Male (n-44)	Female (n-25)	2 tailed significant
Piperacillin-Tazobactam	21.74%	20.31%	0.09
Amoxicillin- Clavulanic acid	22.61%	23.44%	
Azithromycin	16.52%	20.31%	
Oseltamivir	13.04%	14.06%	
Cephalosporins	6.09%	6.25%	
Others (Meropenem, Faropenem, Fluoroquinolone, Doxycycline, Linezolid, Clindamycin, and Metronidazole)	20.01%	15.63%	

Table-3. Pharmacoeconomical evaluation of commonest prescribed AMAs in CAP diagnosed patients (in INR).

Antimicrobial agents	Cost of branded drug (± SD)	Cost of generic drug (± SD)	2 tailed significant
Amoxicillin and Clavulanic acid	242.65±88.6	34.73±10.80	0.0003
Piperacillin and Tazobactam	2039.76±670.6	501.04±00	0.0041
Azithromycin	22.75±10.17	4.64±0.79	0.0084

The median difference between per day cost of generic drugs and branded drugs was (M [I-Q]) [506.04(13.5-2595.0)] and [2269.5 (78.06-12571.0)] rupees, respectively. It was found to be statistically very significant ($p<0.0001$). The mean cost of the commonest drug (Amoxicillin-Clavulanic acid) used in CAP was 242.65± 88.6 (as branded drug) rupee as compared to the generic drug (34.73±10.80) rupee ($p<0.0003$) and the cost of 2nd most common drug (Piperacillin-Tazobactam) was 2039.76± 670.6 rupee as compared to 501.04 (as generic drug) rupee ($p<0.004$). The cost of azithromycin as a branded drug was 22.75± 10.17 rupee and as the generic drug was 4.64± 0.79 rupees ($p<0.008$); table-3.

DISCUSSION

In this study, we tried to demonstrate the burden of the disease like CAP in the northern state of India. As we observed, the incidence was higher among male patients and common age group was 51-60 years and the mean age was around 58 to 59 years observed in both male & female. As cited by Minhas et al. in 2007, the mean age was 67 years (median 71 years; range 20 to 95 years) among 67 CAP diagnosed patients at tertiary care hospital in Toronto, Ontario.[8] we also observed the among 69 patients as combination or as monotherapy approximately 169 AMAs were used. >17.39% of patients (n-12) received 4 or more antimicrobial therapy while one patient had six AMAs (figure-II). Majority of patients with CAP treated with the combination of various AMAs. As demonstrated by Minhas et al. out of 59 patient of CAP 42 received combination drug therapy.[8]

In our study, we observed, that approximately 72% of body fluid samples were cultured negative. The most common isolated organism was *Streptococcus pneumonia*, 11.36% in male and 20% in female patients followed by *Pseudomonas aeruginosa* 1.4% in male and 1.8% in female patients. The commonest organism causing CAP *Streptococcus pneumonia was* also observed by various in many studies.[4,8,9] Amoxicillin with clavulanic acid was the highest prescribed medicine followed by piperacillin with tazobactam then azithromycin. As cited by Minhas et al.[8] Amoxicillin with clavulanic acid was included as first-line and second-line antibiotics for the management of CAP in the USA, France, and Germany. Caballero et al. reported the usage of piperacillin with tazobactam combination in the management of CAP.[9]

85% of the patient's population was below poverty line (<1457 rupees/month) and the majority of AMAs were used as in injectable form (77%). The pricing of injectable AMAs has a higher cost as compared to oral tablets. In our study, we observed that, the average cost of generic AMAs and branded AMAs among 69 patients was (M [I-Q]) [506.04(13.5-2595.0)] and [2269.5 (78.06-12571.0)] rupees/day, respectively. We also observed that there was a significant difference in pricing between commonly prescribed AMAs such as Amoxicillin with clavulanic acid (242.65±88.6 vs 34.73±10.80 rupees), piperacillin with tazobactam (2039.76± 670.6 vs 501.04 rupees) and azithromycin (22.75±10.17 vs 4.64±0.79 rupees) as branded AMAs versus generic AMAs, respectively. As demonstrated by Saha et al. Pneumonia in paediatric population, the direct cost which includes the cost of drug therapy, investigations and hospitalization accounting 57% of the total cost while indirect cost accounting 43% which includes the cost of food, traveling, accommodation, and telephone bills.[10]

The mortality of CAP was higher among the elderly as compared to younger populations. It was observed that, in patients aged >65 or older, the mortality rate was between 10-30%.[11,12] As demonstrated by Kaplan et al. in a matched case-control database of Medicare patients, the death rate of CAP inpatient was 12% and the one-year

mortality rate was >40%.[13] In our study, we observed that, among 69 patients the mortality rate was 7.25%.

CONCLUSION

Branded products were more frequently prescribed than their generic equivalents in CAP patients. Both branded and generic drugs are easily available in the market. It was observed that the use of generic drugs in the treatment of CAP is more cost-effective as compared to the use of branded drugs. I.e. The generic drugs have been found more pocket-friendly than their branded counterparts. The generic products are a low-cost option to the branded equivalents for all AMAs analyzed (Considering the quality of both types of drugs at par).

The affordability of prescribed drugs is a concern for both physicians and patients. So, to maximize the benefit of therapy along with minimizing the economic burden on patients, the prescribing physicians should be aware of the huge difference in expenditure between these two types of drugs. The results of this study can be used as a base to emphasize the use of generic drugs, keeping in view the financial burden of treatment in poor Indian patients. Simultaneously, we should keep a close check on the quality of the generic drugs so that the health benefits of the patients are not jeopardized.

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Conflict of Interest: Nil

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