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Original Research Article

Analysis of cost-effectiveness of antimicrobial agents prescribed in tertiary care rural setup of central India

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ABSTRACT

Background: Antimicrobial agents are most commonly prescribed drug and share major cost of the treatment. In india, health insurance doesn't cover all people leading to out-of-pocket expenditure.
Objective: To study the cost-effectiveness of Antimicrobial agents and to recommend the proper therapeutic strategy for the use antimicrobial agents.
Materials and Methods : The present cross sectioned study was carried out in by collecting data from admitted patient's case paper, tabulated in seven groups of disease and four groups of antimicrobial agents, scrutinized for its pharmacoeconomics. Statistical analysis done by using Fisher's Z- test.
Conclusion: Antimicrobials should be preferably prescribed after culture sensitivity test so as to avoid wastage of money spent on empirically prescribed non-sensitive antimicrobials. In the current study Staphylococci, E.coli then Klebsiella are found to be most commonly found organism in the samples, which can help as a guideline for prescribing antimicrobial therapy.

1. Introduction

Antimicrobials are among the most commonly prescribed drugs accounting for 28% to 42% of total drug prescriptions and also among the drugs consuming a major cost share of treatment both for public hospital and individual patients. Cost of the total therapy prescribed to a patient depends largely on physician's patterns of prescribing antimicrobial agents as it forms a major part of prescription.[1,2] Medicines are manufactured by various pharmaceutical companies and most of them are sold under different brand names. There is always a competition amongst these companies which leads to marked variation in the price. Various studies have shown that therapeutic failure and adherence are influenced by the drug prices.[3–5]

Pharmacoeconomics provide a guide for decision makers on resource allocation and in planning process[6] Excessive and inappropriate use of antimicrobial has become a global problem,[7] resulting not only in substantial economic burden on healthcare system but also in contributing to the selective pressure favoring the emergence of antibiotic-resistant microorganisms.[8] Antimicrobial agents which one uses for prophylactic, empiric and therapeutic purposes, depends upon the local epidemiology of infectious diseases, microbiology and resistance pattern as well as local clinical experience.[9] Rejecting certain types of clinical specimens such as sputum with excessive epithelial cells will also avoid misleading clinicians and may decrease unnecessary use of antimicrobials, which would save the institution's money.[10] Best choice of antimicrobial agents must be based on experience and knowledge of current antibiotic susceptibility of the more likely causes of the infection.[11] There should be restriction on antibiotic use which are more

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expensive and organisms are resistant to them. Such type of strategy is very effective in controlling antibiotic resistance and expenditure on antibiotic use.

The present work is undertaken with a view to study the cost-effectiveness of antimicrobial agents and to make recommendations for the proper therapeutic strategy of antimicrobial agents for further use in hospital.

It also aims for cutting the cost of treatment without compromising the quality so that more poor patients can be therapeutically benefited without additional financial burden on the Teaching Hospital.

1.1. Objective of present study was

1. To analyze the cost-effectiveness of prescribed antimicrobial agents
2. To recommend the proper therapeutic strategy of antimicrobial agents.

2. Material and Methods

The present cross-sectional study was carried out by collecting data from admitted patient's case paper in standardized, uniform and meaningful manner to obtain information about pharmacoeconomic, quantitative and qualitative aspects of prescribing pattern of antibiotics. The data of the patients regarding their diagnosis and treatment is subjected to pharmacoeconomic analysis to study the cost-effectiveness of antimicrobial agents. The antimicrobial agents given to the patients in our study are classified into four main groups.

Table 1: Groups and antimicrobial agents

Groups	Antimicrobial agent
1. Aminoglycosides	Amikacin Gentamicin
2. Cephalosporins	Cefotaxime Cephalexine
3. Penicillins	Amoxycillin Ampicillin
4. Quinolones	Ciprofloxacin Norfloxacin Ofloxacin

Data was collected from case paper records of 300 patients admitted in different disciplines-Medicine, Pediatrics, Obstetrics & Gyanecology, Orthopedics, Ophthalmology and ENT. For this study we collected the data from Medical Record (M.R.) section for the period of 18 months. Selected seven broad groups of diseases, considered following diagnosis.

For these seven groups of diseases, we analyzed the following parameters.

1. No of agents used in empirically prescribed therapy
2. Cost of total empirically prescribed antimicrobial agents (based on local epidemiological data, potential pathogen and antimicrobial susceptibility).
3. Cost of empirically prescribed therapy changed with or without culture sensitivity (c/s) test and cost of waste empirically prescribed therapy.
4. Sensitivity and Resistance pattern of Antimicrobial agents prescribed empirically
5. Common organisms found in c/s test.
6. Cost of Empirically prescribed and changed antimicrobial therapy

Table 2: Disease group and different diagnosis

Groups of Diseases	Different Diagnosis
1 Lung infections	Lower respiratory tract infections, Bronchopneumonia, Pleural effusion.
2.Gastrointestinal tract infections	Acute gastroenteritis, Acute amoebic dysentery, Infective diarrhoea, Colitis
3.Skin and Soft tissue infections	Tubercular ulcer, Cellulitis, Abscess, Burn, Wound infections.
4.Upper respiratory tract infections	Pharyngitis, Tonsillitis, Bronchitis, Upper respiratory tract infections (URTI).
5.Urogenital tract infections	Cervicitis, Orchitis, Urinary tract infections (UTI), Vaginitis, Urethral stricture, Prostitis,
6.Enteric fever	Typhoid, Enteric fever
7.Postoperative infections	Peritonitis, Fractures, Appendicitis, LVH, RVH, BPH, LSCS, Intestinal obstruction, MTP with TL, Fibroid, Gangrene.

In present study, statistical analysis done by using Student's paired t-test and Fisher's Z-test. The statistical significance is evaluated by calculating the t and Z values. The cost of the whole antimicrobial therapy was calculated taking into account the frequency and duration of antimicrobial administration. Brand cost of medicine from: Current Index of Medical Specialities [12] and Indian Drug Review. [13]

2.1. Observations

The data of 300 patients regarding their diagnosis and treatment, was collected from admitted patients in Medicine, Pediatrics, Obstetrics and Gynecology, Surgery, Orthopedics, Ophthalmology and ENT, is tabulated and analyzed as follows:

3. Discussion

Antibiotics are drugs which are very commonly prescribed for the treatment and prophylaxis of various infectious diseases. Pharmacoeconomic analysis has been proved to be of great value in Today's world, where cost-effectiveness of antimicrobial therapy is a burning point. A prescription by a doctor may be taken as summary of physician's attitude to the disease and role of drug in the treatment. It also provides an insight into the nature of the health care delivery system. [14] The current study shows frequent use of Cefotaxime (98.91%), Gentamicin(65.26%) and

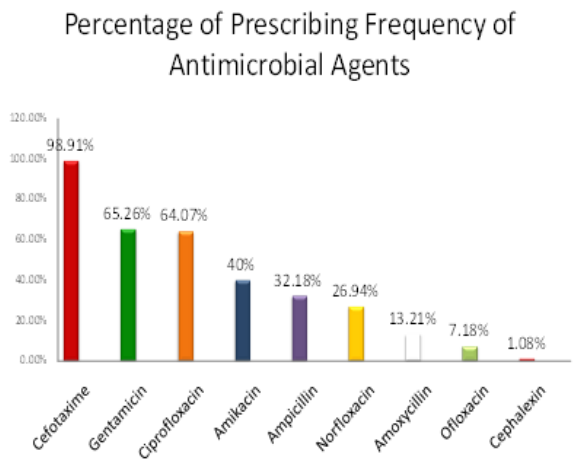

Fig. 1: Shows maximum frequency of prescribing cefotaxime (98.91%), Gentamicin (65.26%) and Ciprofloxacin (64.07%).

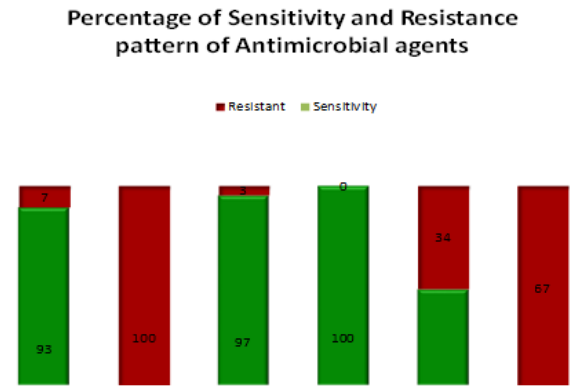

Fig. 2: Organisms show maximum sensitivity to Cephalexin (100%), Cefotaxime (97%) and Amikacin (93%). and totally resistant to Gentamicin (100%) and 67% to Ampicillin.

COST OF EMPIRICALLY PRESCRIBED THERAPY

Type of Therapy	Cost of Empirically Prescribed Therapy (Rs.)
A. Cost of Total Therapy	76752.38
B. Cost of Effective Therapy	41603.47
C. Cost of Waste(ineffective) Therapy	35148.91

Fig. 3: Empirically prescribed therapy shows cost of effective therapy (41603.47) and waste therapy (35148.91).

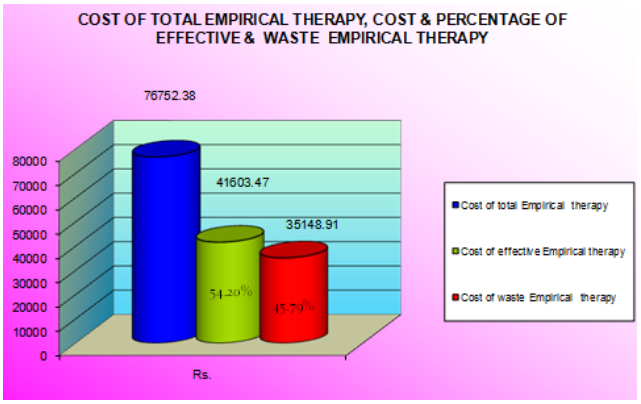

Fig. 4: Showing effective cost empirical therapy (54.2%) and ineffective (waste) cost of empirical therapy (45.7%).

Ciprofloxacin(64.07%) Dawadi Sushma, et al. 2005, has studied six different antimicrobials and reported the most commonly used group as Penicillins (47.36%) followed by Tetracycline (43.15%), Macrolides (4.2%), Quinolones (3.1%) and Cephalosporins (2.1%). E.coli, Kleb. and Staph. organisms found maximally sensitive to Cephalexin(100%) Cefotaxime (97%) and Amikacin (93%) while, totally resistant to Gentamicin.[15] Kollef M.H., et al. 1999, demonstrated a statistically significant association between the initial prescription of inadequate antimicrobial and hospital mortality.[16] The use of such antimicrobials initial to the culture sensitivity test lead to unnecessary increase in the cost of therapy and bacterial resistance. The indiscripancy between the antibiotics sensitivity and usages increases the cost of consumer's therapy, which is very important from Pharmacoeconomic point of view. The result indicates a considerable step to improve the prescribing pattern of antimicrobial agents in order to minimize the cost of therapy. In the study by Michael B.E., et al. 1999, the most common organisms found were Staphylococci (32%), Staphylococcus aureus (16%) and Enterococci (11%). In the current study it is observed that most common organism found in all the samples tested were Staphylococci (38.81%), E.coli (28.94%) then Klebsiella (28.28%).[17] This is important so as to decide the antibiotic therapy. Antimicrobials having maximum sensitivity against these organisms should give preference.

The current study shows empirically prescribed therapy shows cost of effective therapy (41603.47) and waste therapy (35148.91). Total cost of therapy is found more (76752.38) in case of empirically prescribed therapy. The study of prescription in an Indian referral hospital was done to see utilization of antimicrobials, which reveals that most of the expensive antimicrobials have been prescribed without doing culture and sensitivity test.[18] This suggests that antimicrobials should be preferably prescribed after culture sensitivity test so as to avoid wastage of money spent on empirically prescribed non-sensitive antimicrobials. In

the current study Staphylococci, E.coli then Kleb. Are found to be most commonly found organism in the samples, which can helps as a guideline for prescribing antimicrobial therapy. Overall analysis Empirical therapy shows wastage of cost, this suggests that it is better to prescribed antimicrobials on the basis of report obtained after culture sensitivity test, which will definitely lead to minimize or completely avoid the wastage cost and can definitely overcome the problem of cost-effectiveness of antimicrobial therapy.

4. Conclusion

Antimicrobials should be preferably prescribed after culture sensitivity test to avoid wastage of money spent on empirical treatment and to minimize the problem of cost effectiveness of antimicrobial therapy. This will also help reduce the chances of development of resistance to the antimicrobial agents prescribed empirically.

5. Source of Funding

None.

6. Conflict of Interest

None.

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