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Original Research Article

A Cross Sectional Prospective Study on Antimicrobial Drug Utilization in the Department of Surgery at a Tertiary Care Teaching Hospital

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Conflict of interest: Nil

Abstract

Objectives

1) To assess the utilization of antimicrobials in surgery department.
2) To assess the Pharmacoeconomic status of the antimicrobials utilized in Surgery Department.

Materials and Method: This research employed a Cross-sectional, prospective, observational study. This study was conducted at Department of Surgery at JSS Tertiary Care Teaching Hospital. Study will be carried out for period of 6 months The Samples of the study were Simple random technique The method of data collection will be cross-sectional, prospective, data's will be directly collected from patient prescription by observation for a period of 1 year.

Results: In 200 case sheets, Various antibiotics are prescribed for variousindications in surgery department. Drug utilization studies have the potential to make objective evaluation and analysis of health professionals work and provide them with feedback to stimulate thinking about their practice and looking for the ways to improve their own performance. The most commonly admitted indication was GI and liver related problem with 20%, and most commonly prescribed antibiotic was Cefaperazone+Sulbactam with 30%, and the most used FDC is Cefaperazone+Sulbactam with 57%, Most of the prescription follows monotherapy with 92%. The cost minimizing analysis has been done for various drugs in this study.

Analysis: The data of two pharmaceutical drug price list was collected, The Mann Whitney U test revealed that the drug price were difference between hospital (MD-294, N=11) compared to alternative companies (MD-215, N=11) which was not statistically significant [U=51, Z= 0.624, P=0.5333].

Conclusion: Preference to Cefaperazone+sulbactam was on the higher side. Prescribing drugs by brand name was high and generic name was low. Hence, prescribing drugs by generic name and drugs from Essential drug list has to be encouraged.

Keywords: Antimicrobial, Resistance, Pharmacoeconomic, Cost minimizing analysis.

Introduction

The World Health Organization (WHO) defines drug usage research as "the vend, distribution, prescription, and use of medications in society, with an emphasis on medical, social, and finance implications." The major purpose of drug usage in the community is to make drug use more reasonable[1]. To maximize therapeutic benefit while minimizing the development of resistance, drug usage patterns must be reviewed on a regular basis[2]. Utilization studies aid in estimating the amount of antimicrobials to be acquired in a given year and the budget required to do so. Prescription monitoring and drug utilization studies could aid in identifying connected issues and providing feedback to prescribers in order to raise awareness about drug rationalization[3]. The World Health Organization (WHO) and the International Network for the Rational Usage of Drugs (INRUD) have collaborated to develop common medication use indicators [4]. Irrational medicine and dosage form use can have negative consequences for patients as well as cost them money. To avoid such issues, every member of the health-care system should utilise medications responsibly. Accurate diagnosis, proper dosing, right dispensing, appropriate packaging, and patient adherence are all important criteria for rational use[5].

Antibacterial resistance has been found and documented with almost all the newly discovered antimicrobial compounds till date. Antimicrobial resistance makes it difficult, expensive, and often impossible to treat patients. Irrational drug usage, self-medication, and drug misuse enhance the selection and dissemination of resistant bacteria in the presence of antimicrobials. The Ministry of Health recently created a 'National programme for AMR Containment' that will run from 2012 to 2017, with one of the primary activities being AMR (Antimicrobial Resistance) surveillance, which will be carried out by a network of ten laboratories across the country. Currently, the national AMR containment programme is gathering AMR data for common bacterial diseases from numerous surveillance network sites across the country, as well as a pharmacoeconomics study to determine the cost and benefits of differential therapeutic options [6].

Inappropriate medicine and dosage form use can put patients' health at risk while also putting a financial strain on the system. To avoid such issues, every member of the health-care system should conduct themselves in a sensible manner. Antibiotics are commonly used to treat a variety of diseases. Evidence has suggested that resistance to a distinct class of antibiotics is becoming more common[7]. indiscriminate use of newly developed expensive and broad-spectrum antibiotics to combat developing microbial resistance, which contributes to an increase in antimicrobial resistance and health-care costs. Many new drugs have recently been developed to combat antibiotic resistance in the elderly [8].

Therefore, studies pertaining to utilization of drugs and their prescribing patterns form a platform to review proper usage and utilization of antimicrobial classes. Therapeutic benefit with minimal number of drugs and cost is an important factor in a developing country like India. Hence, such studies should be undertaken on a periodic basis to help revise the appropriate treatment strategy along with reducing the Patient's financial burden.

Objectives

3) To assess the utilization of antimicrobials in surgery department.

4) To assess the Pharmacoeconomic status of the antimicrobials utilized in Surgery Department.

Materials and Methods

Source of Material:

The research was carried out at JSS Medical College and Hospital,Mysore, a tertiary care teaching hospital, in the Surgery ICU department.

Type of Study:

A Hospital based, observational, Cross-sectional study was conducted on 200 patients in surgery ICU department, JSS Medical College from June 2021- December 2021 for a period of one year.

Methods of collection of data:

Inclusion and Exclusion criteria of patients

Inclusion criteria:

Patients age range between 18-60 years.

Admitted to surgery ICU and Ward.

Who were disposed to participate were included in this study.

Exclusion criteria:

Patients who are prescribed with antimicrobials on OPD basis.

Patients who are prescribed with only drugs other than antimicrobials.

Patient age group below 18 and above 60 years of age.

Methodology:

Clinical data, treatment data, and numerous other relevant and necessary data were obtained from the patient after getting their consent.

1. Patient's prescription to observe the chief complaint, history of present illness, past medication history.
2. After collecting all required data from patient, it will be analyzed for utilization antimicrobial and pharmacoeconomic of a drug.

Study procedure:

All admitted surgery ward patients will be examined to determine the patient's diagnosis as well as any associated co morbidities. Prior to the study, an ethical clearance from the JSS Medical College & Hospital, Mysore's institutional Ethical Committee would be sought. By reviewing the patient's prescription, a suitable data collection form was designed to collect all relevant and necessary data such as the patient's demographic details, clinical data such as diagnosis, therapeutic data such as name of the drug, dose, route, frequency, DOT (Duration of Therapy), cost of the drug, and other relevant details.

Statistical Analysis

All of the data was evaluated in order to determine the drug usage pattern in surgery patients and to estimate the Pharmacoeconomics of each drug. Using Microsoft Excel and SPSS version 22.0, the data was submitted to appropriate descriptive statistical analysis.

Results

Socio-demographic profile:

In the present study comprising of 200 patients, 140 in males, 60 in females with different age group, in the age between (20-40 years), 131 (65.5%), were of age group (40-60 years), 69 (34.5%) The mean age of the study participant was found to be 35.23 with a standard deviation of ±10.65, as shown in the Figure 1,2.

Table 1: Gender

Gender	Quantity	Percentage
Male	140	70%
Female	60	30%

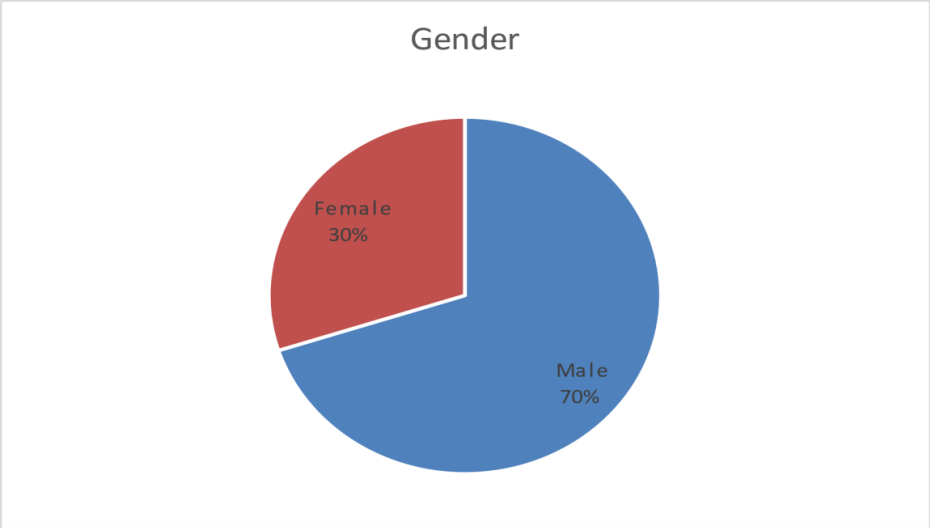


Figure 1: Gender

Table 2: Age group

Age group	Quantity	Percentage
20-40	131	65.5%
40-60	69	34.5%

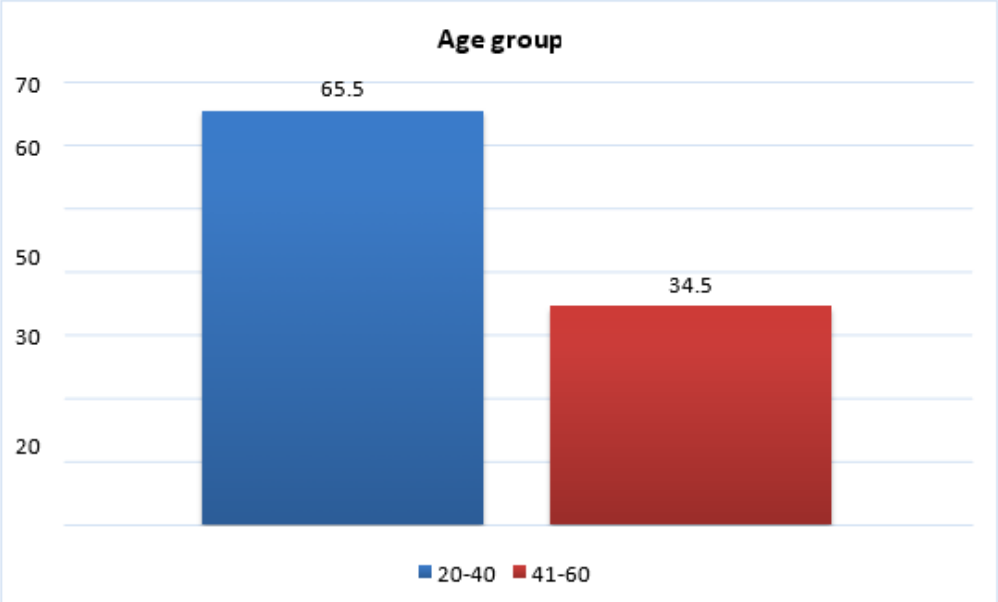


Figure 2: Age group

Among 200 patients Infection in GI and Liver related conditions were admitted most percentage 20%, and followed by Pancreatitis 12.50%, and the least one is otitis media 2%, and it has been shown in the, Figure 3.

Table 3: Distribution of cases according to various indications

Sl.no	Indications	Quantity (N)	% Of variousincidence
1	Acute appendicitis	21	10.5%
2	Cholecystitis	14	7%
3	Pancreatitis	25	12.50%
4	Hypospadias	7	3.50%
5	Otitis media	4	2%
6	DM and DKA	8	4%
7	Infections in GI and Liver	39	20%
8	Kidney disease	15	7.50%
9	Testis related	5	2.50%
10	Pneumonia	6	3%
11	Hernia	13	6.50%
12	Peritonitis	11	5.50%
13	Head injury	19	9.50%
14	Others	13	6.50%
	Total	200	

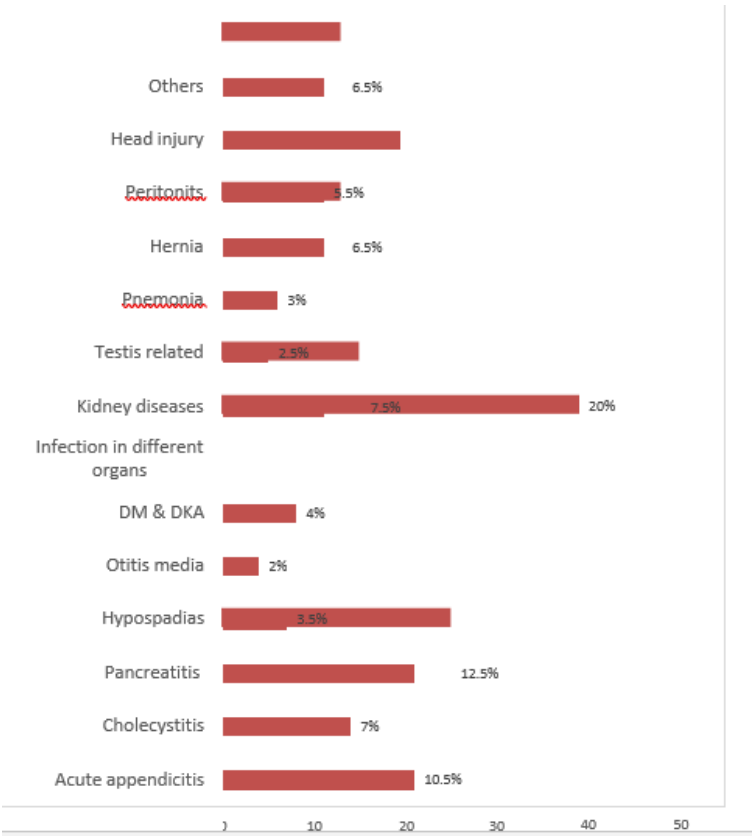


Figure 3: Distribution of cases based on various indications

In this study the most prescribed antibiotic was Cefaperazone + Sulbactam with 30% and followed by ceftriaxone 13.5%, and the least prescribed was Meropenam + Sulbactam with 0.5%, has shown in the, Figure-4.

Table 4: Distribution of Antimicrobial drug utilization among IP patients

Sl.no	Medications	Quantity (N)	Percentage
1	Amikacin	10	5%
2	Ampicillin+Sulbactam	12	6%
3	Ceftazidime+Tazobactam	11	5.5%
4	Cefaperazone+Sulbactam	60	30%
5	Ceftriaxone	27	13.5%
6	Cefuroxime+Sulbactam	15	7.5%
7	Metronidazole	15	7.5%
8	Cefaperazone+Sulbactam, Meropenam	10	5%
9	Cefaperazone+Tazobactam	4	2%
10	Pipracillin+Tazobactam	10	5%
11	Meropenem	4	2%
12	Ceftriaxone+Sulbactam	6	3%
13	Linezolid	5	2.5%
14	Meropenam+Sulbactam	1	0.5%
15	Linezolid, Cefaperazone + Sulbactam	2	1%
16	Ceftriaxone, Metronidazole, meropenem	3	1.5%
17	Ceftriaxone+Sulbactam, Meropenem	2	1%
18	Imipenem	3	1.5%

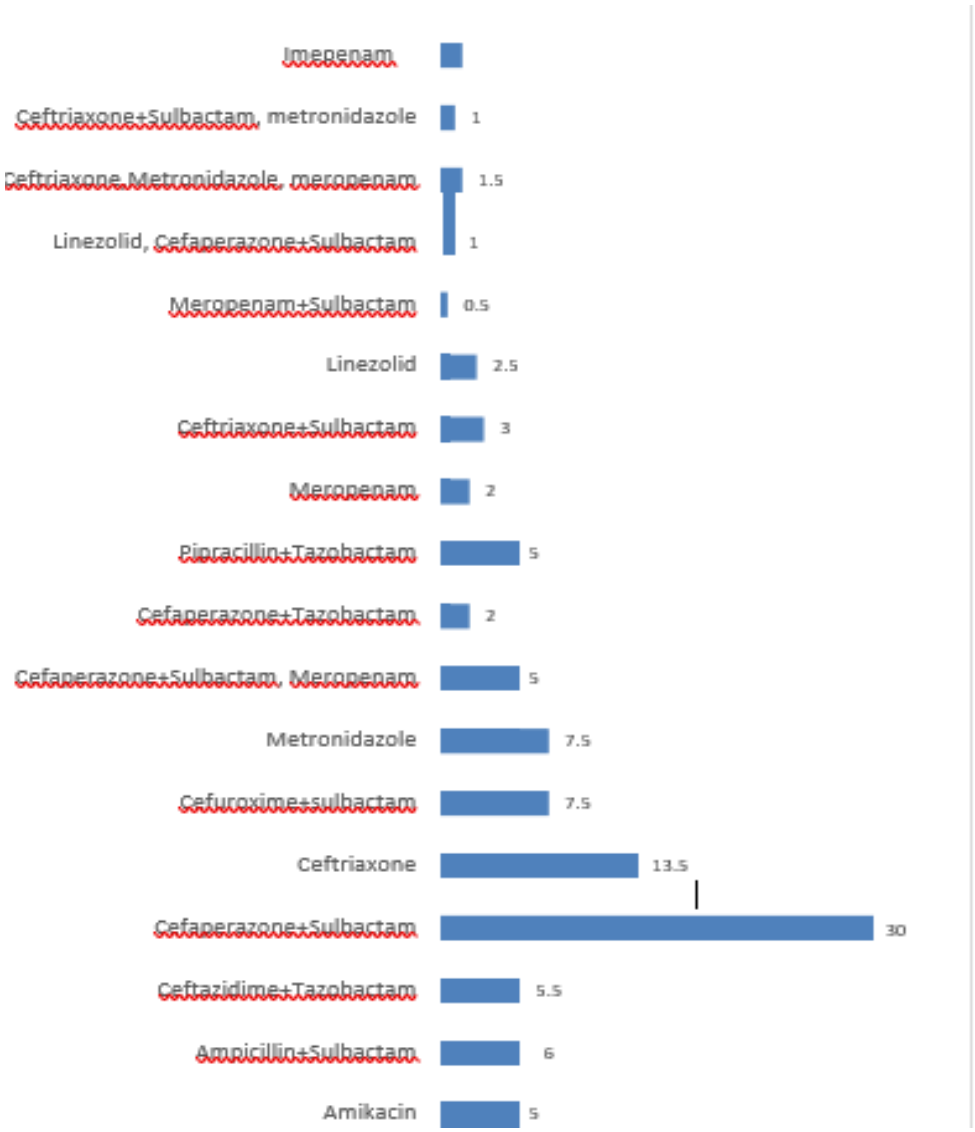


Figure 4: Distribution of individual antimicrobial drugs

Among this drug utilization, monotherapy was prescribed with most percentage92%. And poly therapy 8%, has been shown in the Figure-5.

Table 5: Distribution based on Monotherapy and polytherapy:-

	Frequency	Percentage
Monotherapy	184	92%
Polytherapy	16	8%
Two drug combination	13	6.50%
Three drug combination	03	1.50%

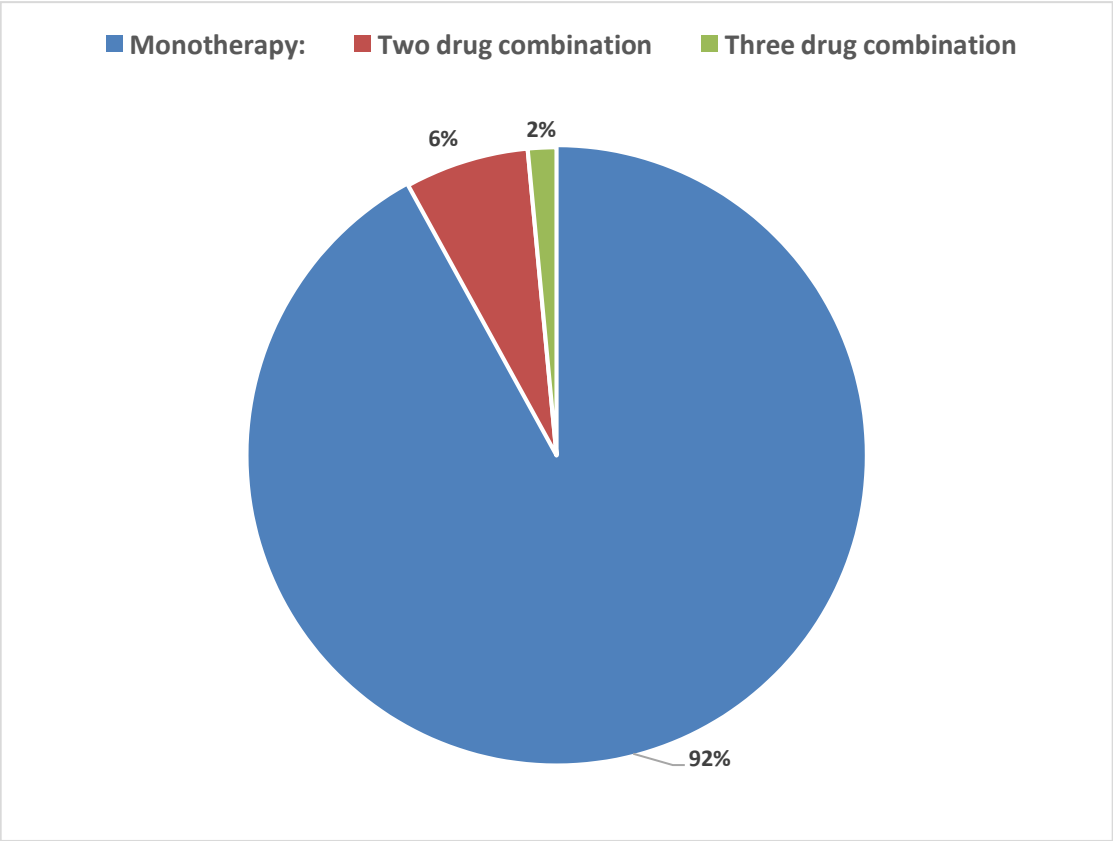


Figure 5: Distribution of cases based on monotherapy and polytherapy

Among all the antibiotics, Cefaperazone+sulbactam has been the most common FDC with 57%, followed by Pipracillin+Tazobactam 9.43% has been shown in the Figure-6.

Table 6: Fixed dose combinations

Fixed Drug Combinations	Number	%
Ampicillin+Sulbactam	12	11.32%
Ceftazidime+Tazobactam	11	10.00%
Cefaperazone+Sulbactam	60	57%
Cefaperazone+Tazobactam	4	3.77%
Pipracillin+Tazobactam	10	9.43%
Ceftriaxone+Sulbactam	8	7.54%
Meropenem+Sulbactam	1	0.94%

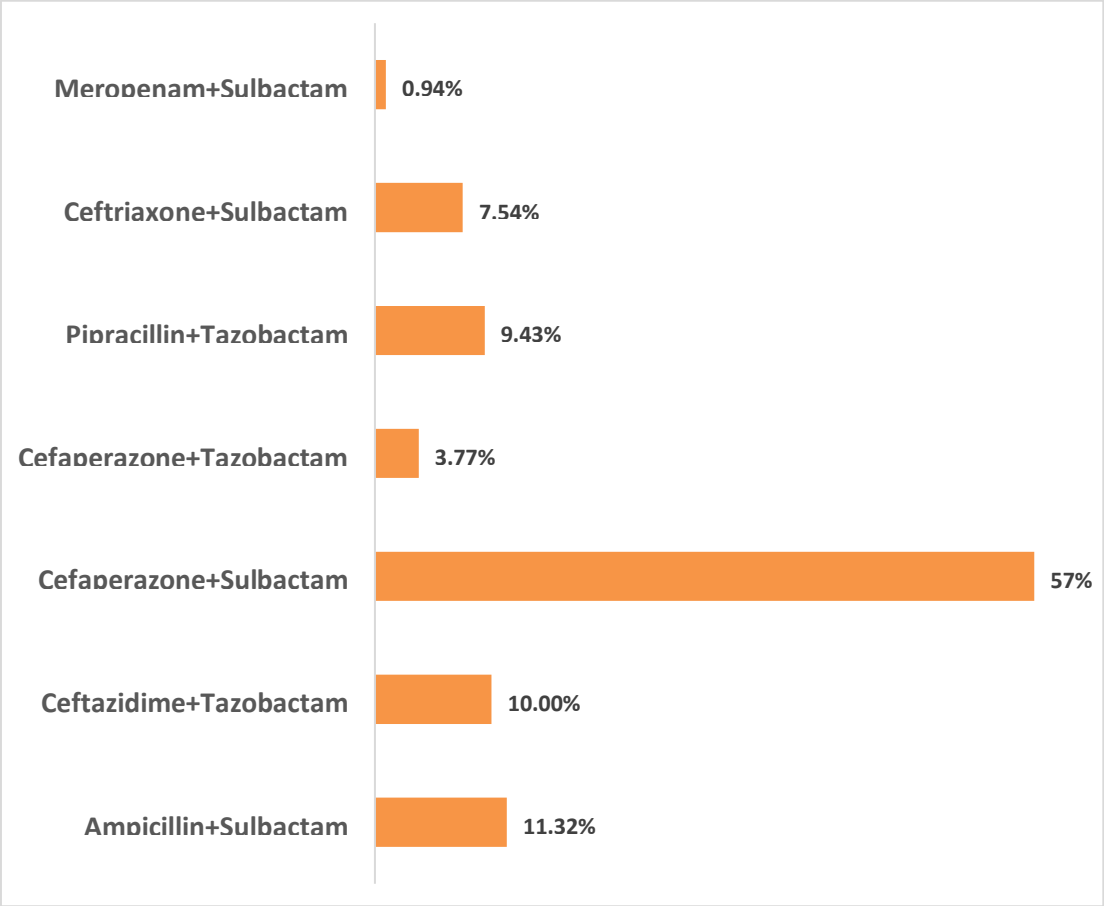


Figure 6: Distribution of Fixed drug combinations

In this study the comparison of cost between hospital drug companies and Alternative drug companies, the most cost difference seen in drug with Imipenem Rs.350, and followed by Cefotaxime Rs.150, shown in the Figure-7

Table 7: Cost minimizing analysis

Sl.no	Drugs	In hospital (Price) "A"	Alternate company (Price) "B"	Cost benefit(Rs)
1	Cefaperazone+Sulbactam	499	434	65
2	Ceftazidime+Tazobactam	314	259	55
3	Amikacin	91	85	6
4	Cefotaxime	1500	1350	150
5	imipenem	1480	1130	350
6	Ampicillin	55	43	12
7	Pipracillin+Tazobactam	230	199	31
8	Meropenem	990	950	40
9	Linezolid	294	215	79
10	Ceftriaxone	51	45	6
11	Metronidazole	22	12	10

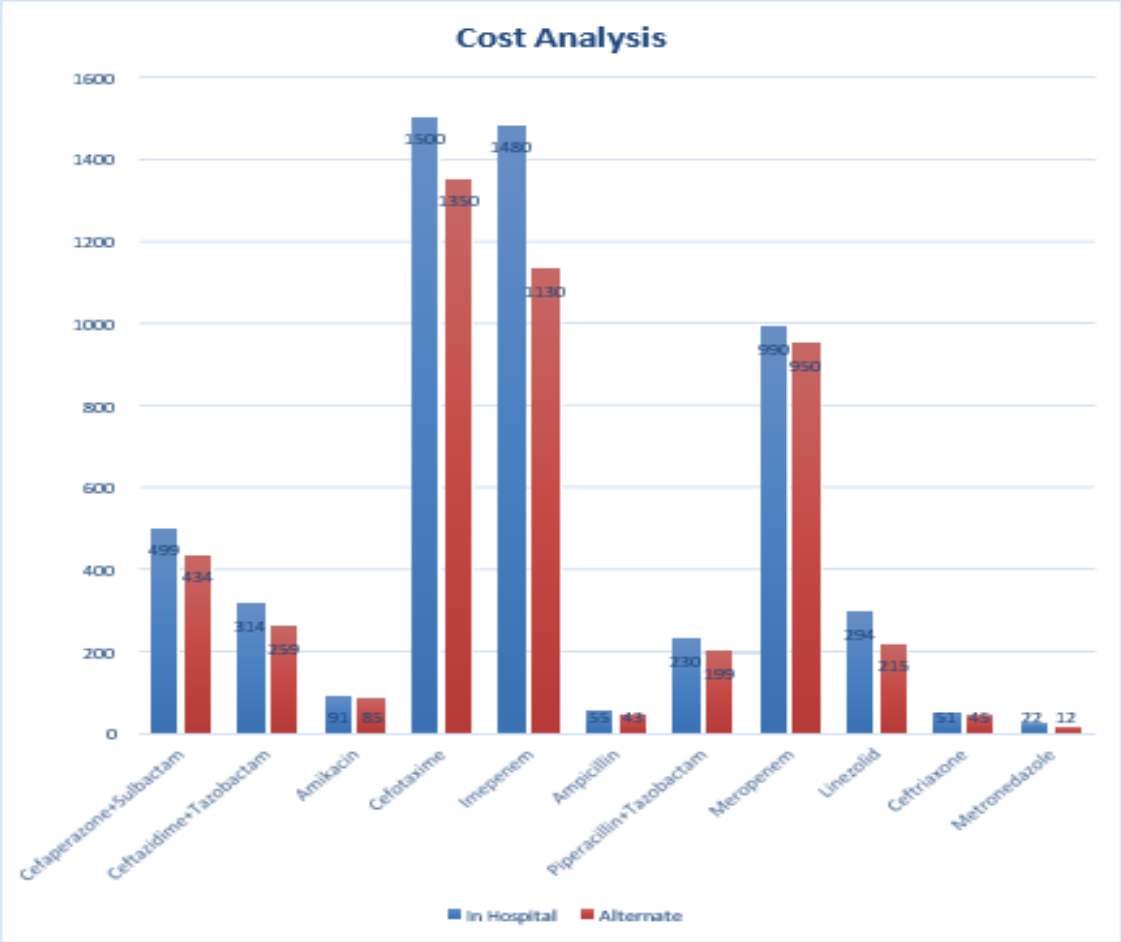
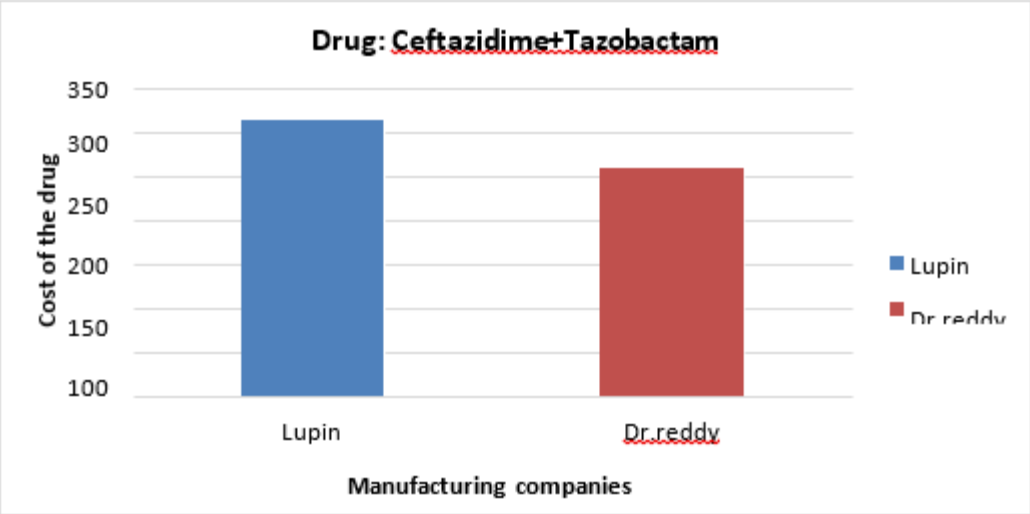


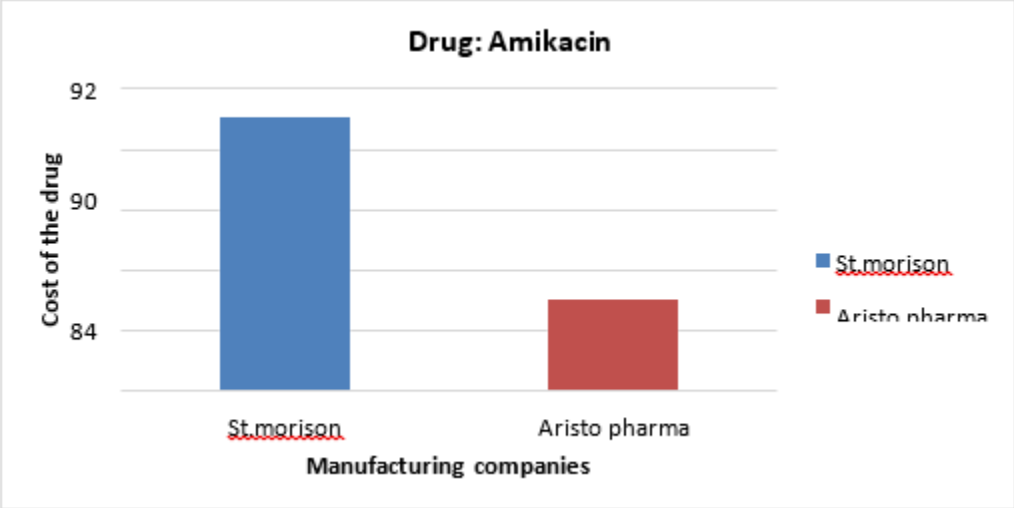
Figure 7: Distribution of Cost effective difference among variouscompanies

The difference between Hospital and alternative companies prices are shown inthe table-8.

Table 8: Distribution of Prices among various companies

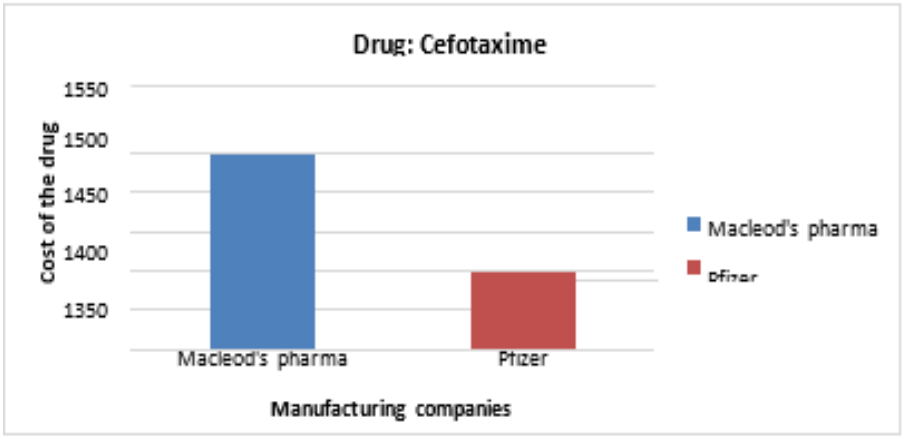
Drug	Lupin (Rs)	's laboratories(Rs)
Ceftazidime+Tazobactam	314	259



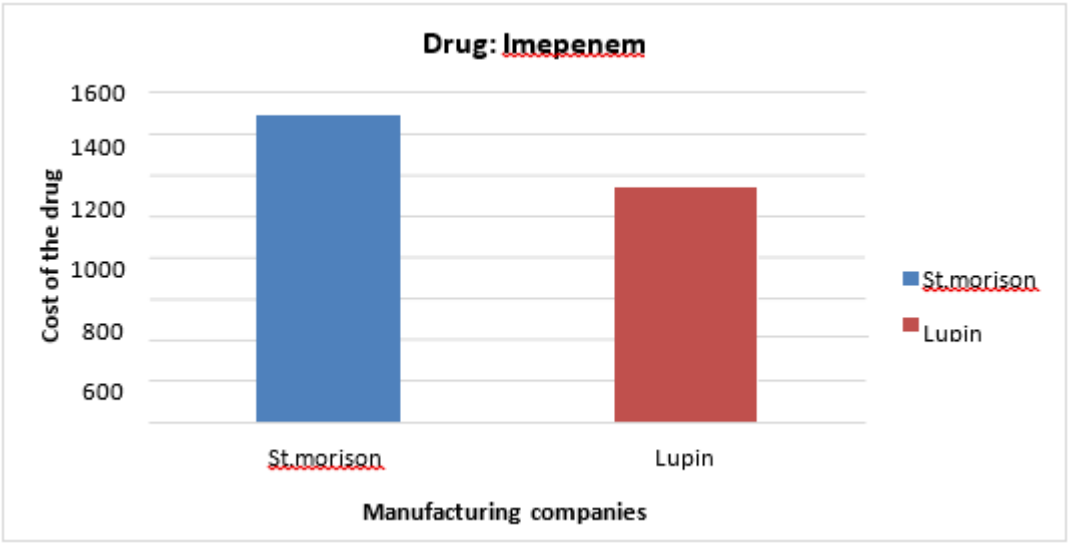


Drug	St.Morison (Rs)	Aristo pharma (Rs)
Amikacin	91	85

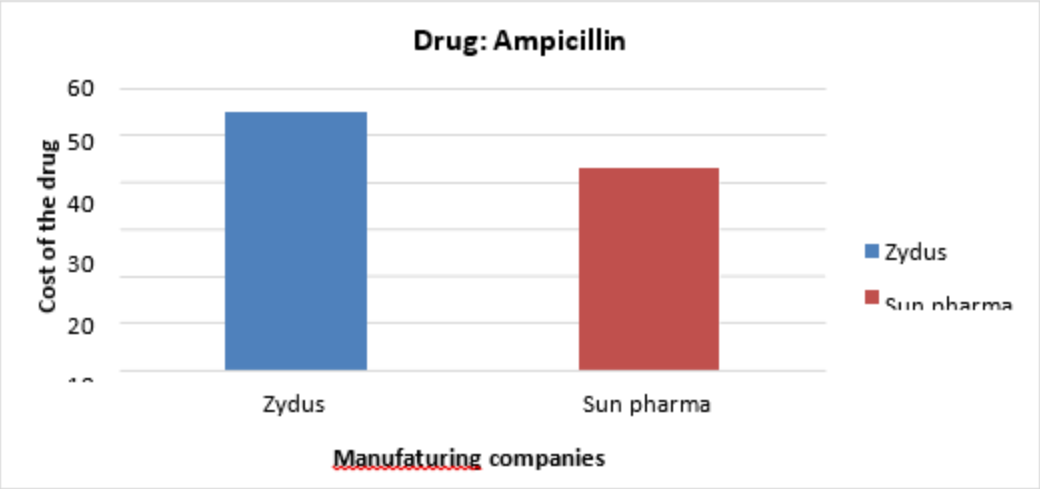
Drug	Macleod's pharma (Rs)	Pfizer (Rs)
Cefotaxime	1500	1350

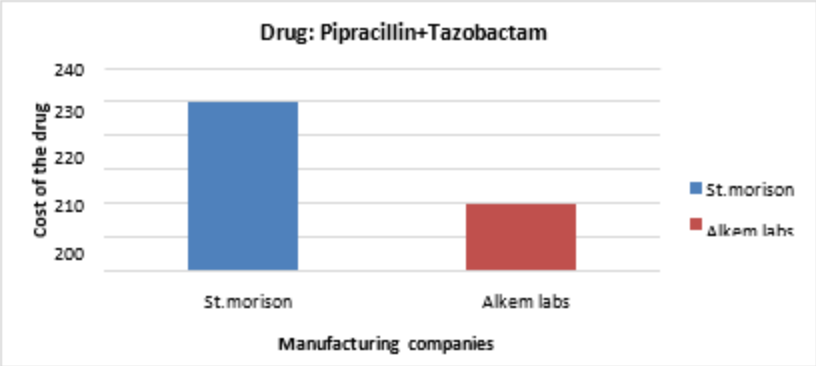


Drug	St.Morison	Lupin (Rs)
Imipenem	1480	1130

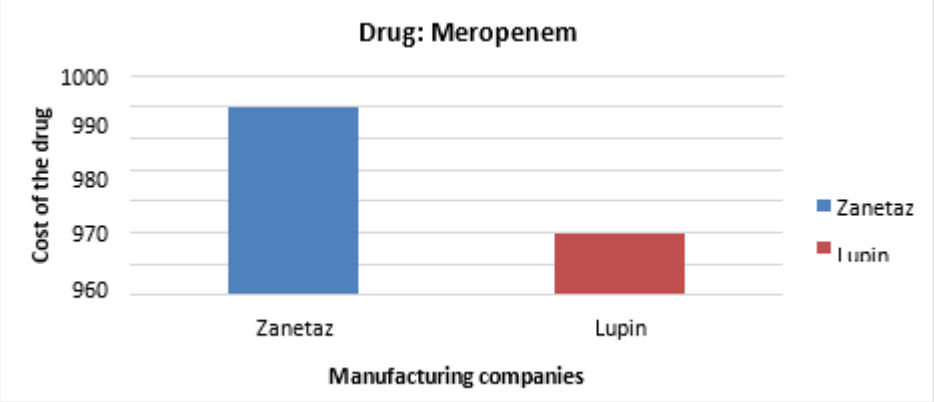


Drug	Zydus	Sunpharma
Ampicillin	55	43



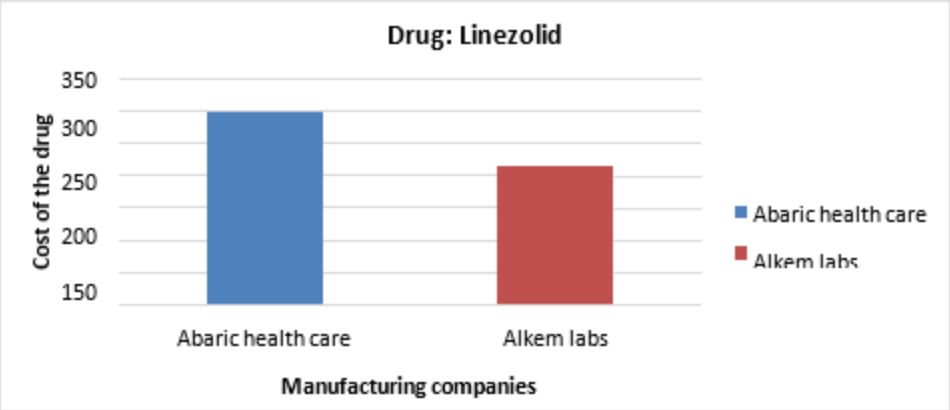


Drug	St.Morison	Alkem labs
Pipracillin+Tazobactam	230	199

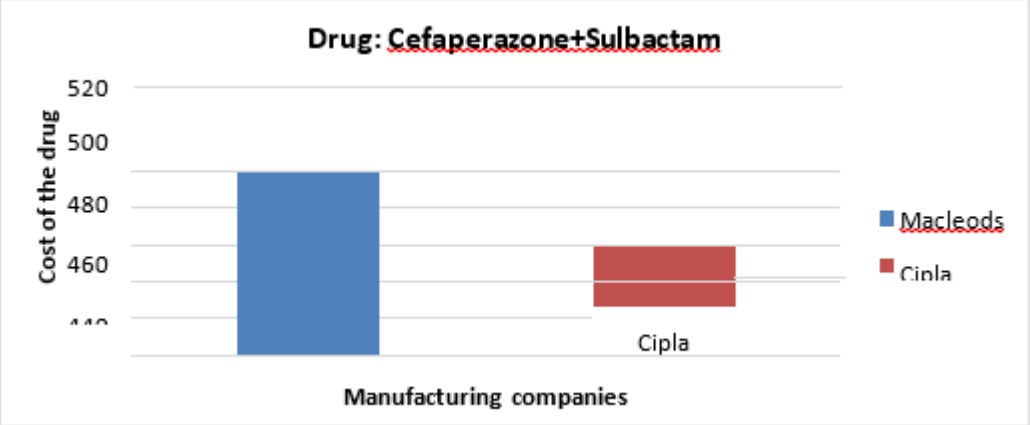


Drug	Zanetaz	Lupin
Meropenem	990	950

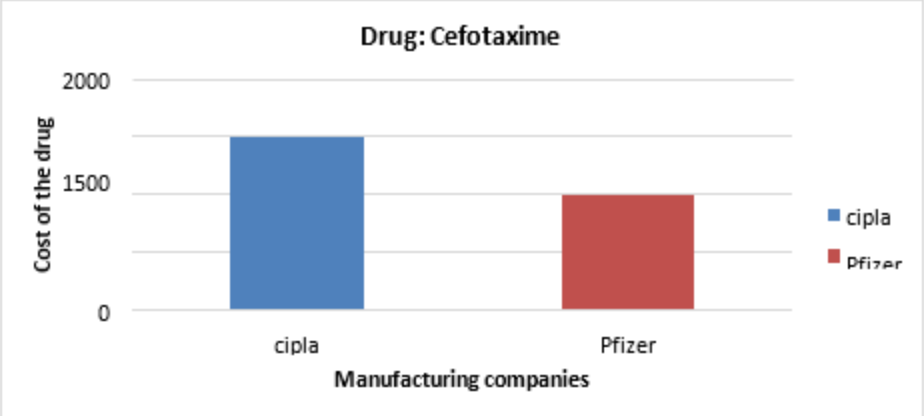
Drug	Abaric health care	Alkem labs
Linezolid	294	215



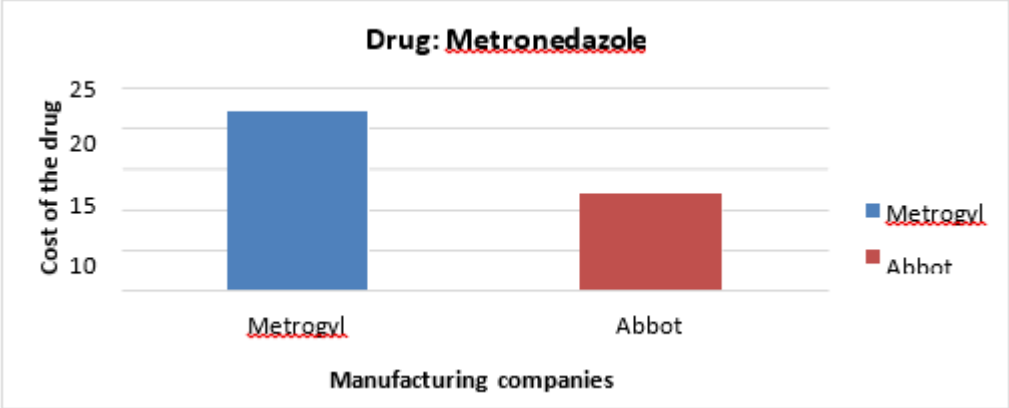
Drug	Macleods	Cipla
Cefaperazone+Sulbctam	499	434



Drug	St.morison	Alkem labs
Ceftriaxone	51	12



Drug	Metrogyl	Abbott
Metronidazole	22	12



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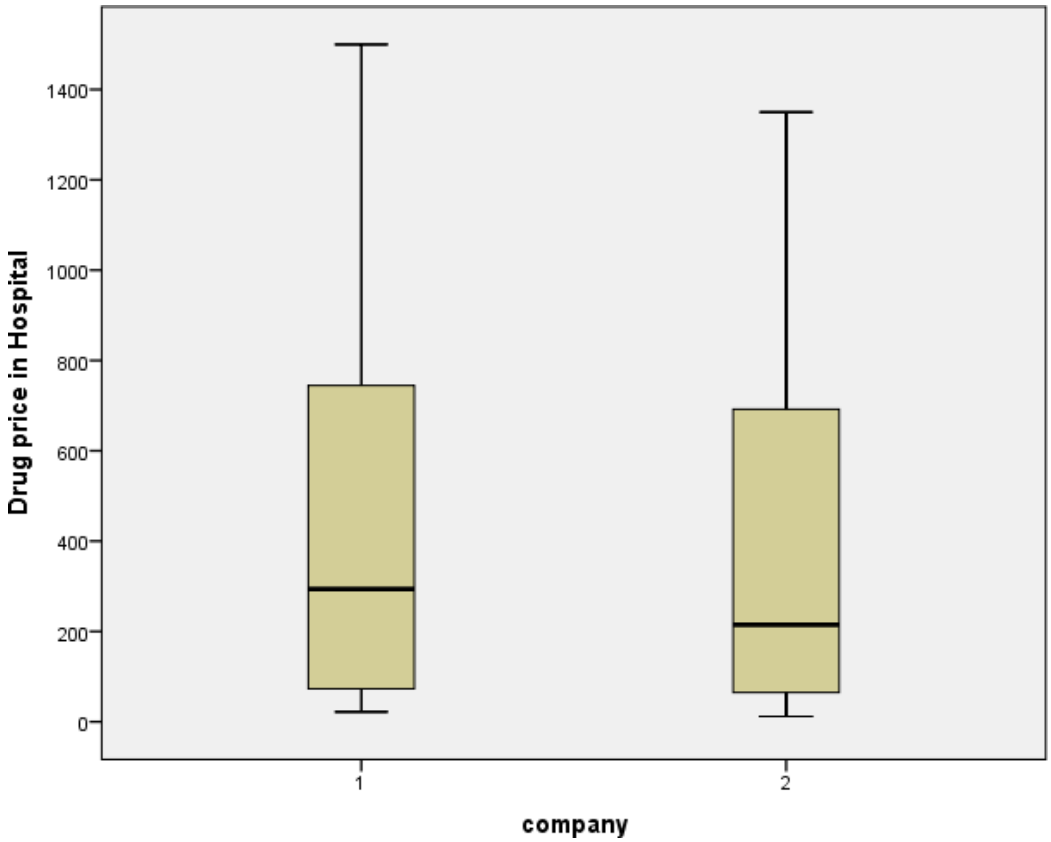

Figure 8: Box-Whisker between two companies drug prices

Discussion

One of the most effective ways to obtain and evaluate doctors' prescribing behavior is to conduct a prescription-based survey. Several studies have been conducted to obtain baseline data on prescribing indicators in day-to-day practice.

In this study, kidney related conditions was observed in 7.5%, and Diabetes mellitus and diabetic keto acidosis conditions was observed in 4%, Zhi-Hong Liu et.al, Patients with T2DM are 50% more likely to develop CKD, whereas obesity is linked to a 23% higher risk of CKD. According to a 2016 survey, diabetes-related CKD is now more common in China than glomerulonephritis, which was formerly the leading cause of ESRD. Furthermore, data from an autopsy series in the United States demonstrated a rise in the incidence of obesity-related glomerulopathy (ORG) from 0.2 percent in 1986–1990 to 2.0 percent in 1996–2000. Patients with a BMI of more than30 kg/m2 have a threefold increased chance of getting ESRD than those with a normal body weight, according to another study. Although only a small percentage of people with CKD proceed to ESRD, renal replacement therapy (dialysis or transplantation) is a significant financial and logistical burden for individuals and health-care systems, therefore methods to prevent or reduce the progression of renal disease are needed.

In this study the GI and Liver related infections were admitted in the hospital in a percentage of 20%, hence it was the highest percentage among all indications, O lsik et.al The study involved patients who had general surgical procedures between 2003 and 2009. A total of 4690 patients were involved in the study. The overall SSI rate (192/ 4690) was 4.09 percent.

Colorectal surgery had the highest SSI rate (9.43%), followed by upper GI (8.09%), and hepatobiliary (6.68%).

Procedure type (colorectal, hepatobiliary, and upper GI surgery), prolonged preoperative hospital stay, higher ASA score, emergency surgery, infected wound class, prolonged operating time, presence of surgical drains, and intraoperative were all associated with SSI. The use of blood transfusions was found to be an independent risk factor for SSI.

In this study Cefaperazone+Sulbactam were used 30% among majority kind of surgery, Agarwal AC et.al Cefaperazone and ceftriaxone were viewed as the best anti-microbials against gram negative microorganisms while cefaperazone was similarly successful against S. aureus. A rising check was found against amoxicillin, ampicillin and the aminoglycoside: amikacin.

In this study Cefaperazone+Sulbactam is the most used FDC which is about 57% to cover various micro*o*rganism, Johnson CA et.al Thus Each patient's cefoperazone-sulbactam concentration ratios were obtained. Over cefoperazone/sulbactam ratios ranging from 0.002 to 1,024, these MICs remained substantially unchanged. The cefoperazone MIC for S. aureus was 2 ug/ml, while the MIC for S. epidermidis was 0.5 ug/ml. The MICs for the reference strain of E. coli (ATCC 25922) were 0.12 to 0.25 ug/ml, but the MICs for clinical isolates of E. coli were 4 to 8 jig/ml. The MIC for K. pneumoniae was 0.25 to 0.5 ug/ml, whereas the MIC for both strains of P. aeruginosa was 16 ug/ml.

In this study the pharmacoeconomic studies on cost minimizing analysis the prices of every drug is same quantity of dose but cost wise difference has been noted and it has been compared with alternative company with same quantity of dose amikacin 500 mg i.v in hospital the company which using is Cipla and price is 91rs, but alternative company Pfizer company is 85rs, followed by cefotaxime sodium in hospital the company which using is Macleod's pharma 1500rs, were alternative company is Pfizer 1350rs, and Imipenem in hospital the company which using is St.morison 1480rs, were alternative is Lupin 1130rs, You J et.al Many recent cost assessments of ASP in the literature have used the cost-minimization analysis approach, which compares the costs of alternatives (with and without ASP) with no treatment difference in clinical results. The economic effects of ASP were predominantly focused on changes in medication budget as a result of reduced usage of target antimicrobial agents, whereas clinical quality indicators switched to the safety of ASP interventions, with no significant improvement in mortality or readmission.

This study results are similar to the results of drug utilization studies done in other parts of the world. There is a need to further improve the prescription of drugs from Essential drug list and by generic name as it would lead to rational use of drug.

Conclusion

Antibiotics prescribed in the LTCF should be monitored by the antimicrobial review programme. Depending on the size of the institution and the amount of antibiotics provided, surveillance data should be examined on a frequent basis, such as monthly, quarterly, or semi-annually. The programme should include a list of the exact antibiotics utilised in the LTCF, as well as the number of doses or days of therapy and expenditures. These data ought be integrated with surveillance data on infections caused by resistant microorganisms whenever possible. The infection control committee should analyse this material before sending it to prescribe.

Drug utilization studies have the potential to give objective evaluation and analysis of health professionals' work, as well as

feedback to encourage reflection on their practise and the search for methods to improve it. Rather than being viewed as a danger or another bureaucratic burden, these studies should be viewed as a way to improve job satisfaction and education for health professionals. Antibiotic resistance is a growing issue that has posed a serious threat to the medical community. Antibiotic overuse and misuse has been a major factor to this ever-increasing problem.

Antimicrobial utilisation evaluation should be promoted as part of infection control efforts in LTCFs. The goal of this activity should be to encourage antimicrobial stewardship and, possibly, to reduce the spread of antibiotic-resistant pathogens in the LTCF. Antimicrobial use review is best categorised as part of an infection control programme since improper antimicrobial prescribing practises have an impact on the success or failure of infection control initiatives. The infection control practitioner, the medical director, nursing staff, practising physicians, and the pharmacist must all contribute to this interdisciplinary programme.

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The antimicrobial review programme should create and support programmes that improve antibiotic stewardship. This includes including information about the rationale for using antimicrobials for symptomatic illnesses in the patient's medical records as part of the treatment plan. Antibiotics, particularly broad-spectrum antibiotics, should be avoided whereverfeasible.

The process of prescription auditing is a type of vigilance activity, which is very beneficial for the hospital in terms of reducing the burden because of medication error and increasing the rate of patient recovery. so, the only way to get rid of medication error is a through scrutiny of all the steps involved in medication process like the prescription auditing.

WHO recommends that all the drugs (100%) written on a prescription should be in the generic name. Prescription of medicines in their brand names often result in increased cost of the patient, which may in turn lead to non- compliance to the treatment. The advantages of prescribing drugs by generic name have a dual responsibility of providing patients service as well as medical education in the teaching hospital, especially in tertiary care teaching hospital. This indicated there is need to encourage physicians to prescribe by generic names.

The difference in costs between various interventions is measured in cost-minimization analysis. When comparing the interventions, the assumption is that they are all equally effective, and the cost difference is the only difference. The costs are compared, with the premise that the lower-cost intervention will be chosen.

By this type of study one can create awareness among doctors, as well as regular medication reviews, rationalization of medications and use of less medication in care of elderly patients is very essential.

Limitation of the study: The study was based on surgery ICU and wards (Male and female) only.

Summary

A cross-sectional, prospective study was conducted in 200 surgery wards and ICU patients attending the surgery department patient's relevant data was collected and results were subjected to descriptive analysis.

Results were as follows.

- Infections with GI and Liver related conditions were most attending case with 20%.
- 30% of the patients were treatment on cefeperazone+sulbactam.
- 92% of the patients were treatment on monotherapy.
- Cefaperazone+sulbactam (57%) was the most usually prescribed medication. Followed by Ampicillin+Sulbactam (11.32%) was the most commonly fixed dose combination prescribed.
- Cost of the various drugs are noted and compared with low-cost manufacturer for the benefits of patients.
- The data of two pharmaceutical drug price list was collected, The Mann Whitney U test revealed that the drug price were difference between hospital (MD-294, N=11) compared to alternative companies (MD-215, N=11) which was not statistically significant [U=51, Z= 0.624, P=0.5333].

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