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Prevalence of Hospital Acquired Infections and Antibiotic usage in ICU and Wards.

Zarine Khety*, Sameer Dawoodi, and Sachin Jain.

131 Kailash Cooperative Housing Society, SV road, Khar west, Mumbai -400052, India.

ABSTRACT

To study the prevalence of hospital acquired infections and rationalize the use of antibiotics in a multidisciplinary hospital. A prospective observational study was conducted for a period of six months from October 2012 to March 2013. A total of 37 patients were studied during the period. Inclusion and exclusion criteria were determined. Patients who were admitted with infections, immuno-compromised patients, patients with septicemia were excluded from the observation. The various sites at which infections were commonly found were surgical site due to incisional wounds post operatively (32.7%), respiratory site nosocomial infections (29.31%), Urinary tract infections (10.34%), Pneumonia (VAP-8.62%), Blood Stream Infections (15.57), other nosocomial infections (3.44%). Pseudomonas infections were the maximum followed by Klebsiella and Acinetobacter orgamisms. Risk factors causing HAIs' are many. Implementation of the right guidelines for infection control practices, using antibiotics based on culture sensitivity reports and avoiding random use, following operational procedures in a guided manner, improving hand hygiene techniques are important for any healthcare setup .

Keywords: HAI (Hospital acquired infections), Site, Gender, Microorganisms

Corresponding author

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INTRODUCTION

Patient care is provided in facilities which range from highly equipped clinics and technologically advanced university hospitals to front-line units with only basic facilities [1]. Despite progress in public health and hospital care, infections continue to develop in hospitalized patients, and may also affect hospital staff. Many factors promote infections among hospitalized patients: decreased immunity among patients; the increasing variety of medical procedures and invasive techniques creating potential routes of infection; and the transmission of drug-resistant bacteria among crowded hospital populations, where poor infection control practices may facilitate transmission. According to the CDC, the most common pathogens that cause nosocomial infections are Staphylococcus aureus, Pseudomonas aeruginosa, and E. coli. Some of the common nosocomial infections are urinary tract infections, respiratory pneumonia, surgical site wound infections, bacteremia, gastrointestinal and skin infections.

Nosocomial infections are not just limited to bacteria; certain fungi such as Candida albicans and Aspergillus, as well as, viruses such as Respiratory Syncytia Virus and Influenza have also been implicated in a number of hospital acquired infections [2].

The aim of this study was,

To study pattern of Hospital Acquired Infection and the role of micro-organism causing the same in a multidisciplinary hospital.

Rationalize usage of antibiotics, to treat hospital acquired infections.

Impact of Hospital acquired infections on length of stay.

MATERIALS AND METHODS

Study title

In order to commence the work on the project finalized “Prevalence of Hospital Acquired Infections and Antibiotics usage in ICU and Wards” the following method was adopted.

Study site

The study was carried out at a Multidisciplinary hospital, in Mumbai. The hospital has a 37 bedded Intensive Care Unit (ICU), which is well equipped with the most modern and specialised equipment. The nurse to patient ratio in ICU is 1:1. The hospital has 9 operation theatres (OT), 20 consulting rooms, and 24 hours Pharmacy, Blood Bank, and Ambulance facilities. The hospital is divided into various sections such as Audiology, Cardiology, Dermatology, Diabetology, Endocrinology, ENT, Gastroenterology, Gynaecology and Obstetrics,

General Surgery, Haematology, Nephrology, Neurology, Oncology, Ophthalmology, Paediatrics and Neonatology, Rheumatology and Urology.

Study design

A prospective observational study was conducted for a period of six months from October-2012 to March -2013.

Study population

A total of 37 patients were studied during the period October-2009 to March-2010.

Study selection

The inclusion and exclusion criteria for the study was as follows,

Inclusion Criteria

All patients above 18 years of age who are admitted in intensive care unit (ICU) and wards(General ward, Economy wards, Deluxe wards).

Patients admitted for more than 48 hours in hospital that showed evidence of culture positivity are included.

Exclusion Criteria

Serious Patients (e.g. Cancer patients)
Evidence of systemic infection (e.g. Septicemia).
Patient transferred from other hospitals, though they were given antibiotic therapy.

Study Methodology

Permission for the study was taken from Hospital Authority. Patients observed in this data were based on inclusion and exclusion criteria. Data were collected in Patient data collection form. Data from Microbiology department regarding culture and specimen positive were noted (MIC not done). Antibiotics prescribed (Name, Dose, and Duration) to the patients, length of stay in the hospital were noted and data analysed.

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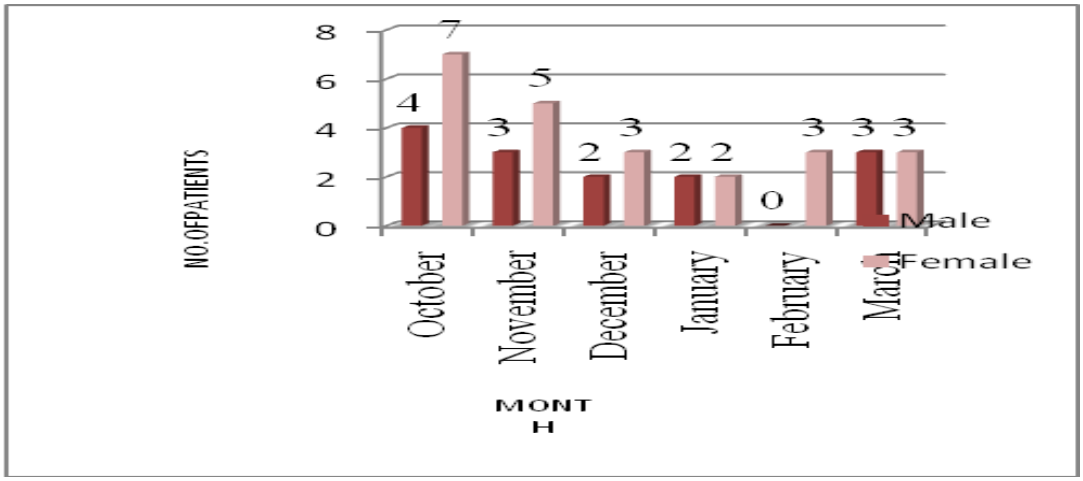
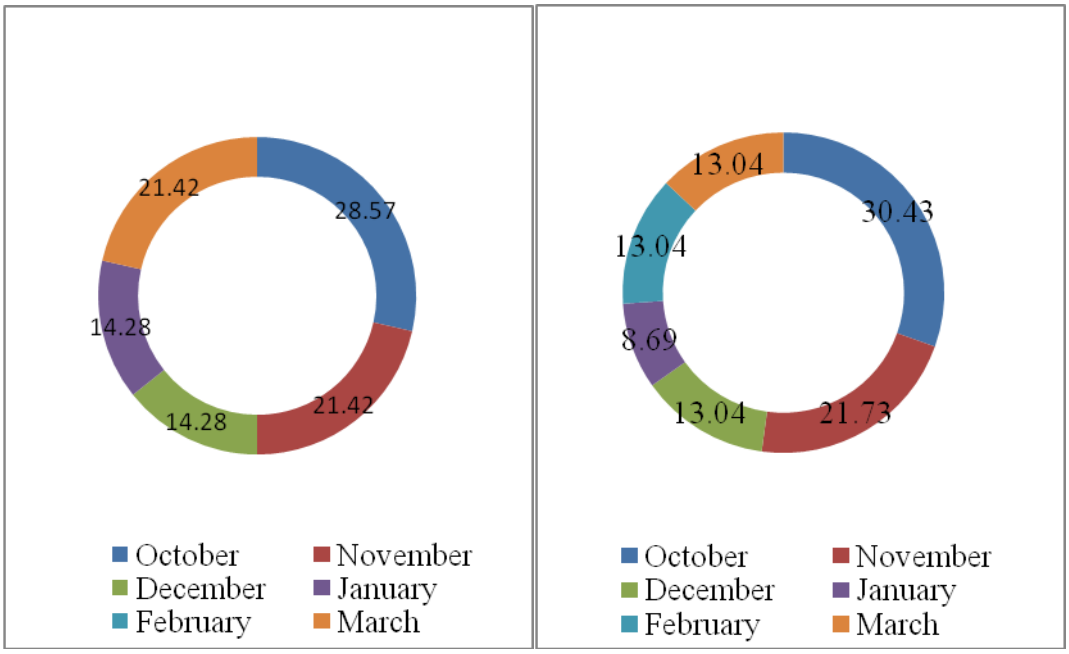
RESULTS AND DISCUSSIONS

Figure 1: Monthly Ratio of Male: Female



A total of 37 patients were observed who were infected with hospital acquired infections from October-2009 to March -2010. 11 patients were infected in the month of October of which 4 were male and 7 were female, 8 patients were infected in the month of November of which 3 were male and 5 were female, 5 patients were infected in the month of December of which 2 were male and 3 female, 4 patients in the month of January of which 2 were male and 2 female, 3 patients in the month of February of which all 3 were female, 6 patients in the month of March of which 3 were male and 3 female.

Figure 2: Percentage Ratio of Male: Female



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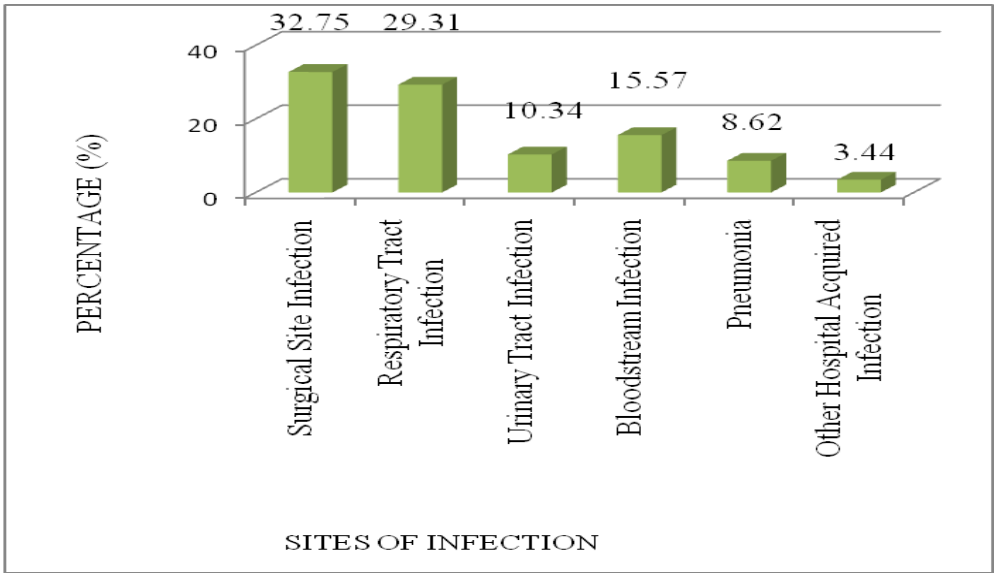
Of the 37 patients of hospital acquired infections male patients were 14 (37.83%), female patients were 23 (62.16%). Of the 14 male patients, 4 (28.57%) were infected in October, 3 (21.42%) in November, 2 (14.28%) were infected in December, 2 (14.28%) were infected in January, 3 (21.42%) were infected in March. Of the 23 female patients, 7 (30.43%) were infected in October, 5 (21.73%) in November, 3 (13.04%) were infected in December, 2 (8.69%) were infected in January, 3 (13.04%) were infected in February, 3 (13.04%) were infected in March.

Table 1: Percentage of No. of Sites Infected

Number Of Sites Infected	Percentage Of Patient
1	56.75%
2	27.02%
3	16.21%

Of the 37 patients infected with hospital acquired infections, the no. of patients in which only one site was infected were 21(56.75%), the patients in whom two sites infected were 10 (27.02%), and patients in whom three sites infected were 6 (16.21%) patients.

Figure 3: Percentage Distribution of Hospital Acquired Infection Sites



Six different sites were found to be infected with hospital acquired infections, of which surgical site infection was highest, the number of patients found to be infected were 19 (32.75%), followed by Respiratory tract infection with 18 (29.31%) patients, Bloodstream infections with 9 (15.57%) patients, Urinary tract infections with 6 (10.34%) patients, Pneumonia with 5 (8.62%) patients and other hospital acquired infection (skin) with 1 (3.44%) patients.

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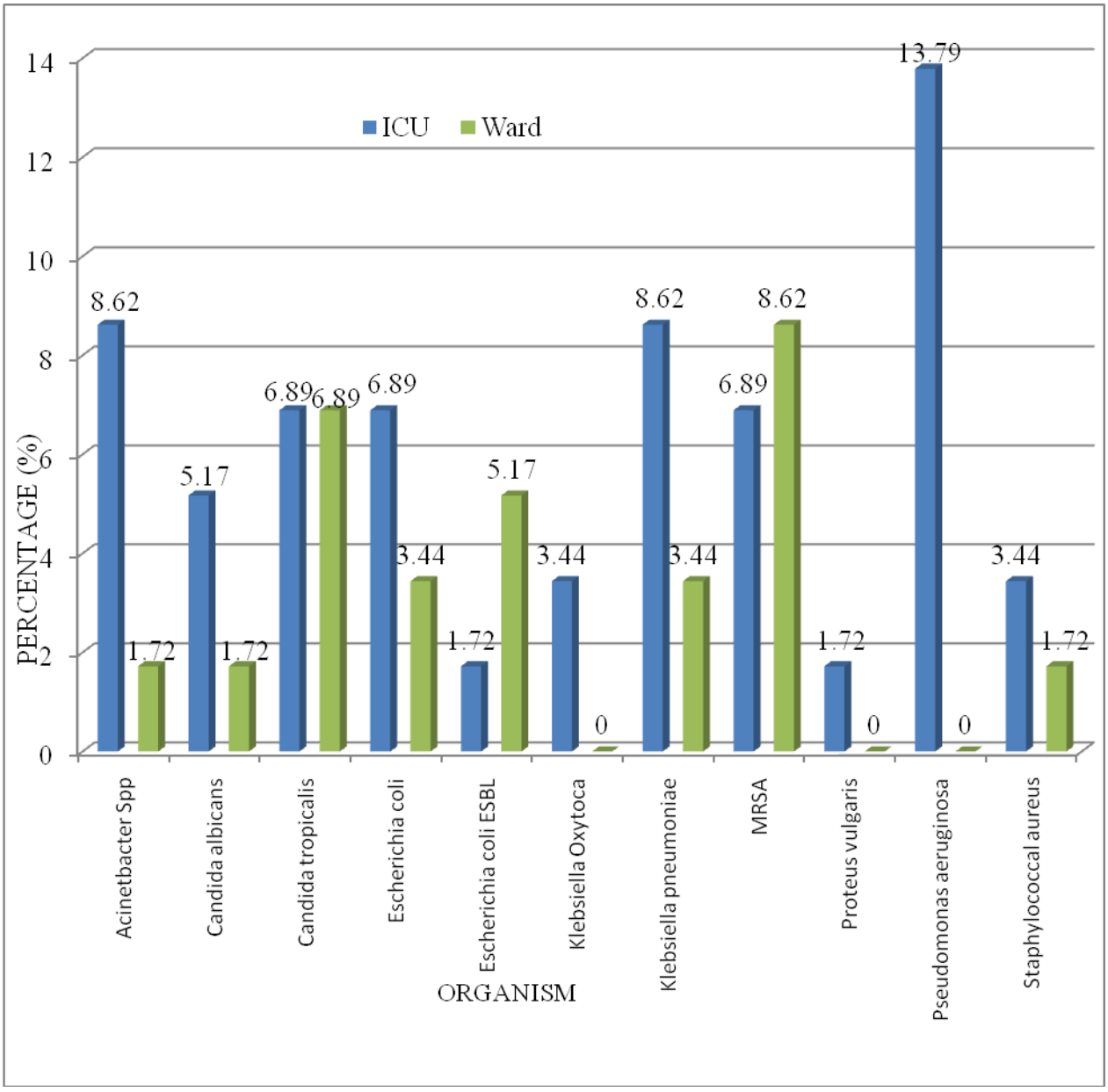
Figure 4: Percentage Distribution of Organism



A total of 11 different microorganisms were found to be the causative organisms responsible for hospital acquired infections. In ICU, *Acinetobacter spp.* caused infection to 5 (8.62%) patients, *Candida albicans* to 3 (5.17%) patients, *Candida tropicalis* to 4 (6.89%) patients, *Escherichiacoli* to 4 (6.89%) patients, *Escherichia coli ESBL* to 1 (1.72%) patient, *Klebsiellaoxytoca* to 2 (3.44%) patients, *Klebsiellapneumoniae* to5 (8.62%) patients, *MRSA* to 4 (6.89%) patients, *Proteus vulgaris* to 1 (1.72%) patient, *Pseudomonas aeruginosa* to 8 (13.79%) patients, *Staphylococcal aureus* to 2 (3.44%) patients. In Wards, 8 organism were found to be the causative organism for hospital acquired infections, *Acinetobacter spp.* caused infection to 1 (1.72%) patient, *Candida albicans* to 1 (1.72%) patient, *Candida tropicalis* to 4 (6.89%)

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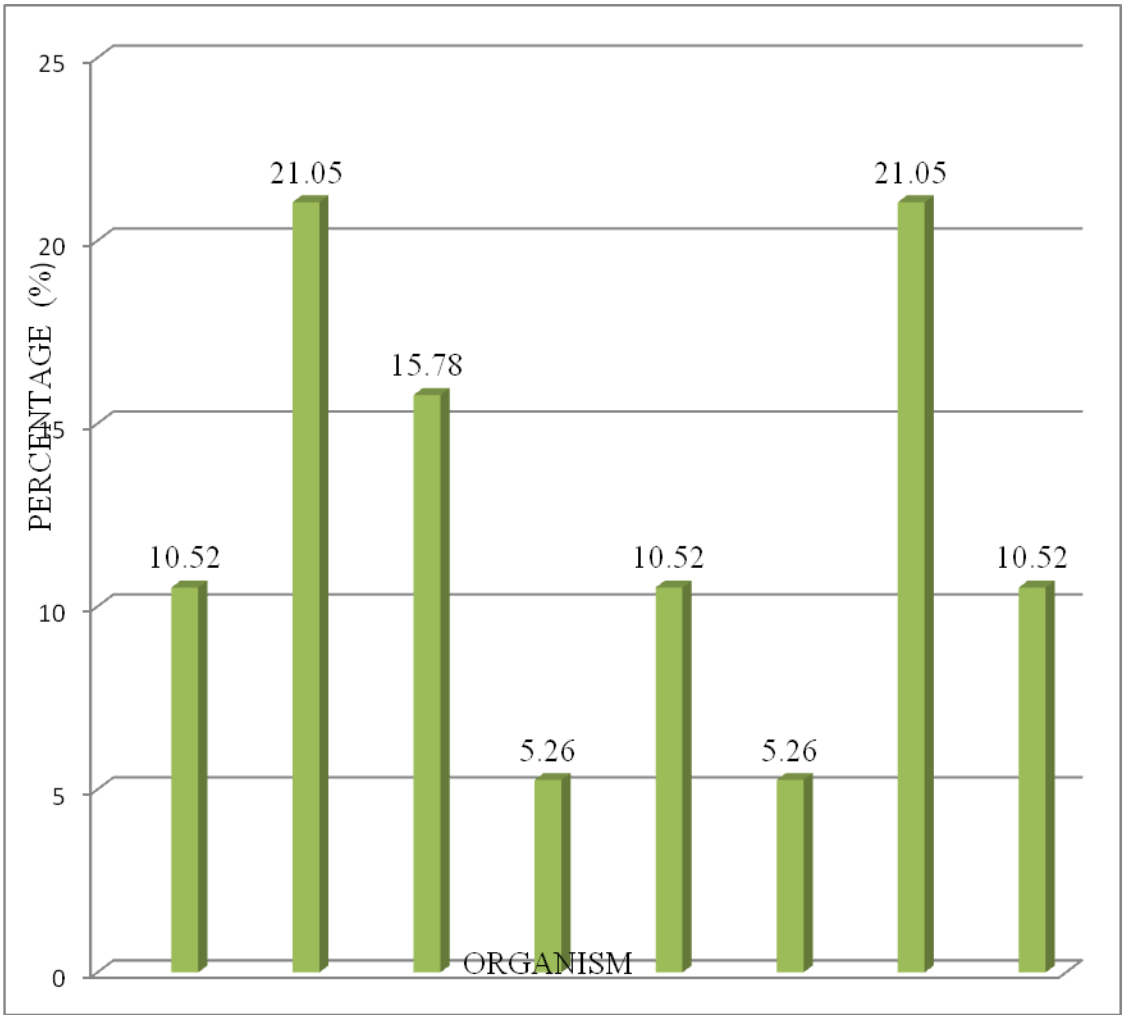
patients, *Escherichiacoli* to 2 (3.44%) patients, *Escherichia coli ESBL* to 3 (5.17%) patients, *Klebsiellapneumoniae* to 2 (3.44%) patients, *MRSA* to 5 (8.62%) patients, *Staphylococcal aureus* to 1 (1.72%) patient.

Figure 5: Percentage Distribution Of Organism At Surgical Site



In surgical site infections a total of 19 patients were found to be infected with 8 different microorganisms. *Acinetobacter spp.* caused infection to 2 (10.52%) patients, *Escherichiacoli* to 4 (21.05%) patients, *Escherichia coli ESBL* to 3 (15.78%) patients, *Klebsiellapneumoniae* to 1 (5.26%) patient, *MRSA* to 2 (10.52%) patients, *Proteus vulgaris* to 1 (5.26%) patient, *Pseudomonas aeruginosa* to 4 (21.05%) patients, *Staphylococcal aureus* to 2 (10.52%) patients.

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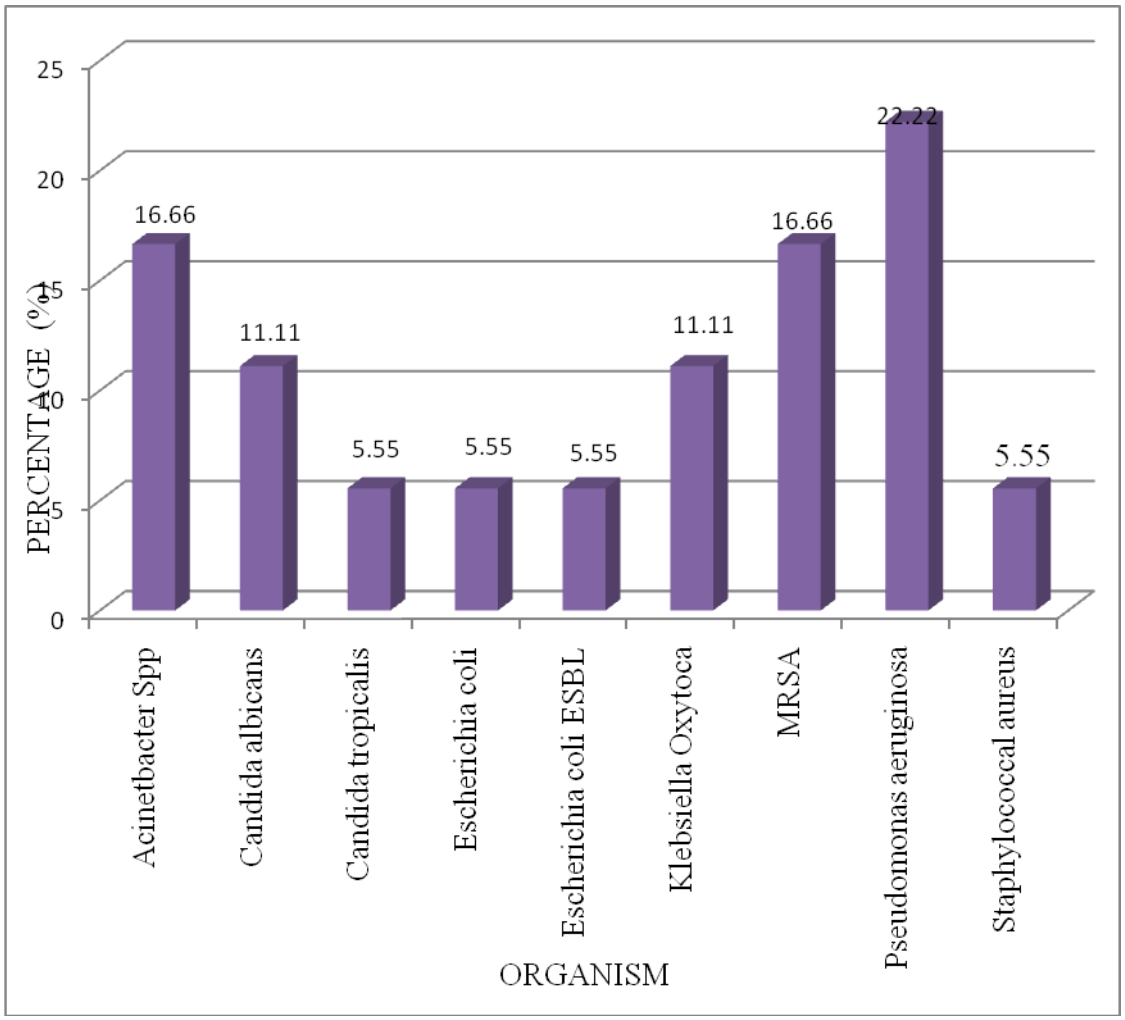
Figure 6: Percentage Distribution Of Organism At Respiratory Tract



In respiratory tract infections a total of 18 patients were found to be infected with 9 different microorganisms. *Acinetobacter spp.* caused infection to 3 (16.66%) patients, *Candida albicans* to 2 (11.11%) patients, *Candida tropicalis* to 1 (5.55%) patient, *Escherichiacoli* to 1 (5.55%) patient, *Escherichia coli ESBL* to 1 (5.55%) patient, *Klebsiellaoxytoca* to 2 (11.11%) patients, *MRSA* to 3 (16.66%) patients, *Pseudomonas aeruginosa* to 4 (22.22%) patients, *Staphylococcal aureus* to 1 (5.55%) patient.

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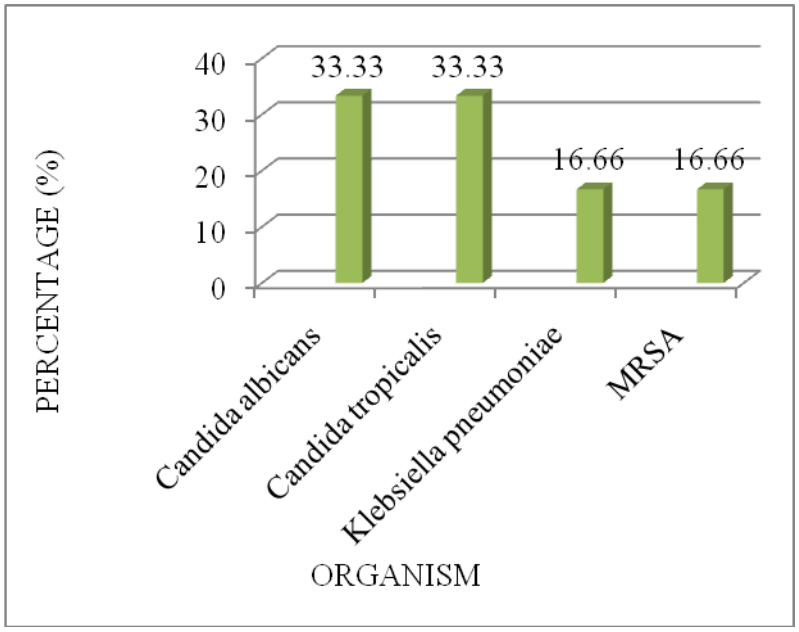
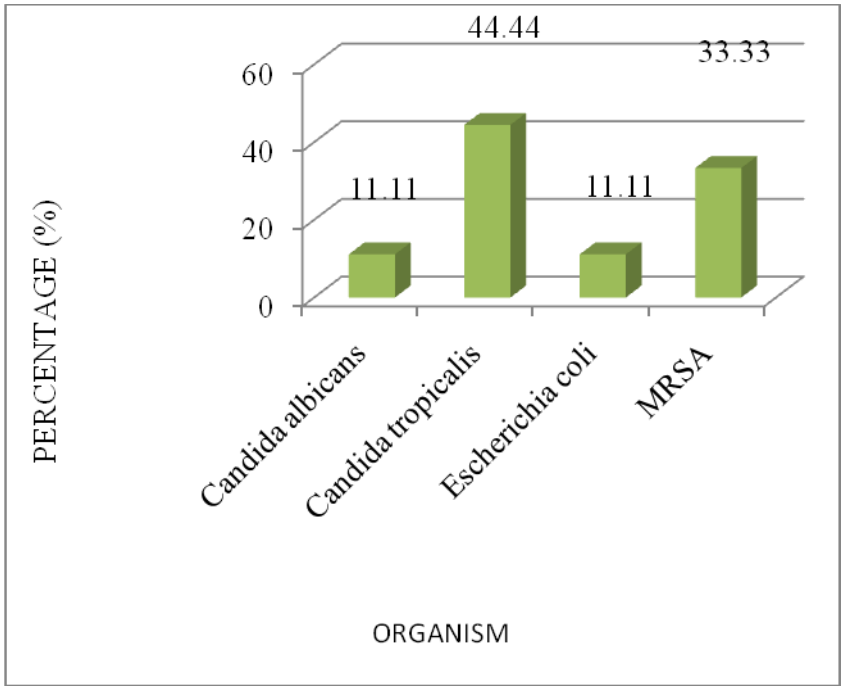
Figure 7: Percentage Distribution Of Organism At Urinary Tract



In urinary tract infections a total of 6 patients were found to be infected with 4 different microorganisms. *Candida albicans* caused infection to 2 (33.33%) patients, *Candida tropicalis* to 2 (33.33%) patients, *Klebsiellapneumoniae* to 1 (16.66%) patient, *MRSA* to 1 (16.66%) patient.

Figure 8: Percentage Distribution Of Organism At Bloodstream Infection



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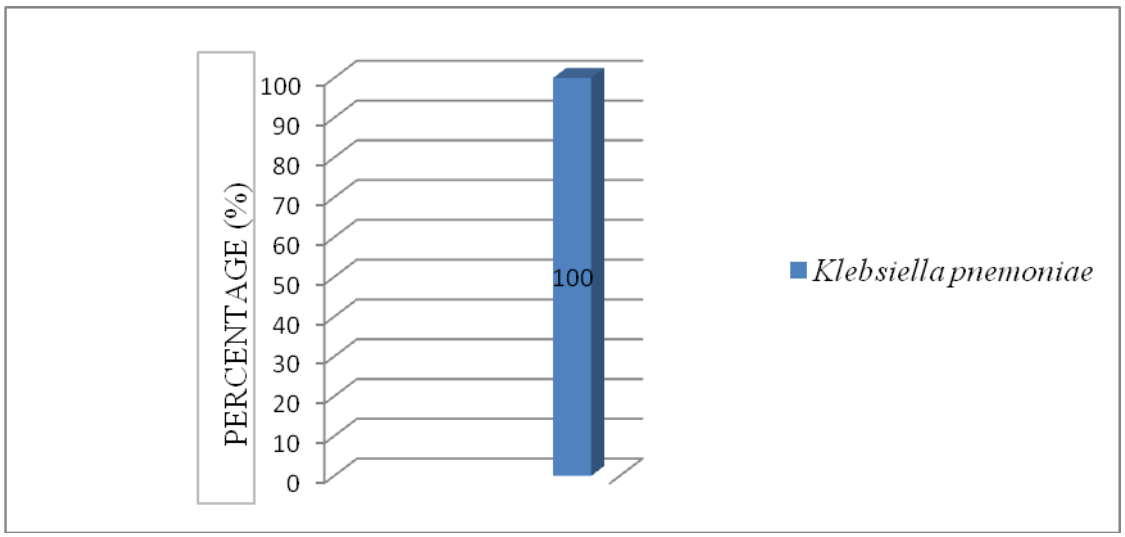
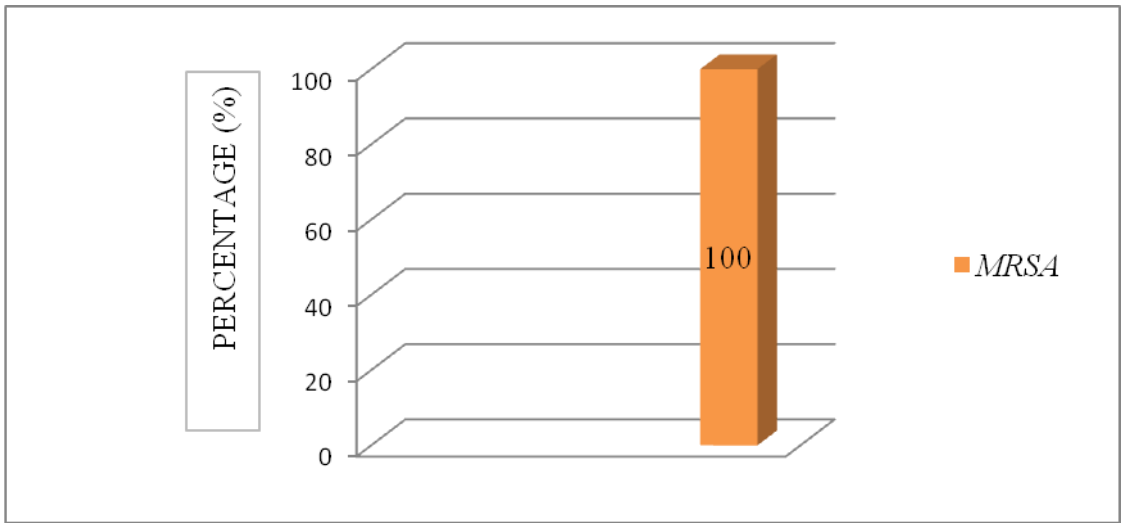
In bloodstream infections a total of 9 patients were found to be infected with 4 different microorganisms. *Candida albicans*caused infection to 1 (11.11%) patient, *Candida tropicalis* to 4 (44.44%) patients, *Escherichiacoli* to 1 (11.11%) patient, *MRSA* to 1 (11.11%) patient.

Figure 9: Percentage Distribution Of Organism Of Pneumonia



In Pneumonia infections a total of 5 patients were found to be infected, the only causative organism found to be responsible was *Klebsiellapneumoniae*.

Figure 10: Percentage Distribution Of Organism Of Other Hospital Acquired Infection



In other hospital acquired infections (Skin) 1 patient was found to be infected, the causative organism was *MRSA.*

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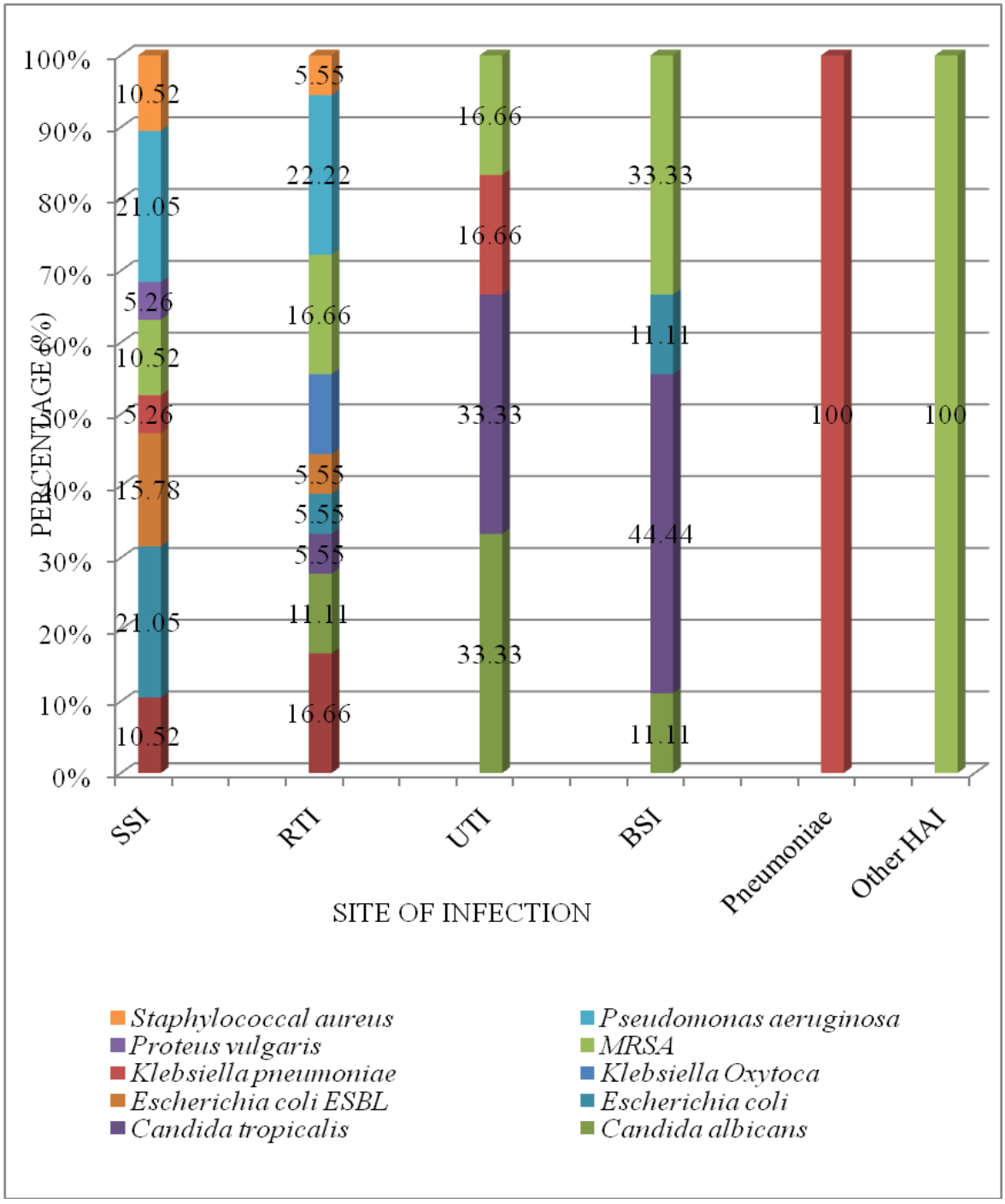
Figure 11: Percentage Comparison Of Organism At Different Sites



In Surgical site infection, 8 pathogens were responsible for infection, *Pseudomonas aeruginosa* (21.05%), *Escherichia coli* (21.05%) combined contributed to more than 42% of all surgical site infection. In Respiratory tract infection, 9 pathogens were responsible for infection, *Pseudomonas aeruginosa* (22.22%), *Acinetobacter spp*. (16.66%), *MRSA* (16.66%) were the main causative organism. In Urinary tract infections and Bloodstream infections, infections with fungi

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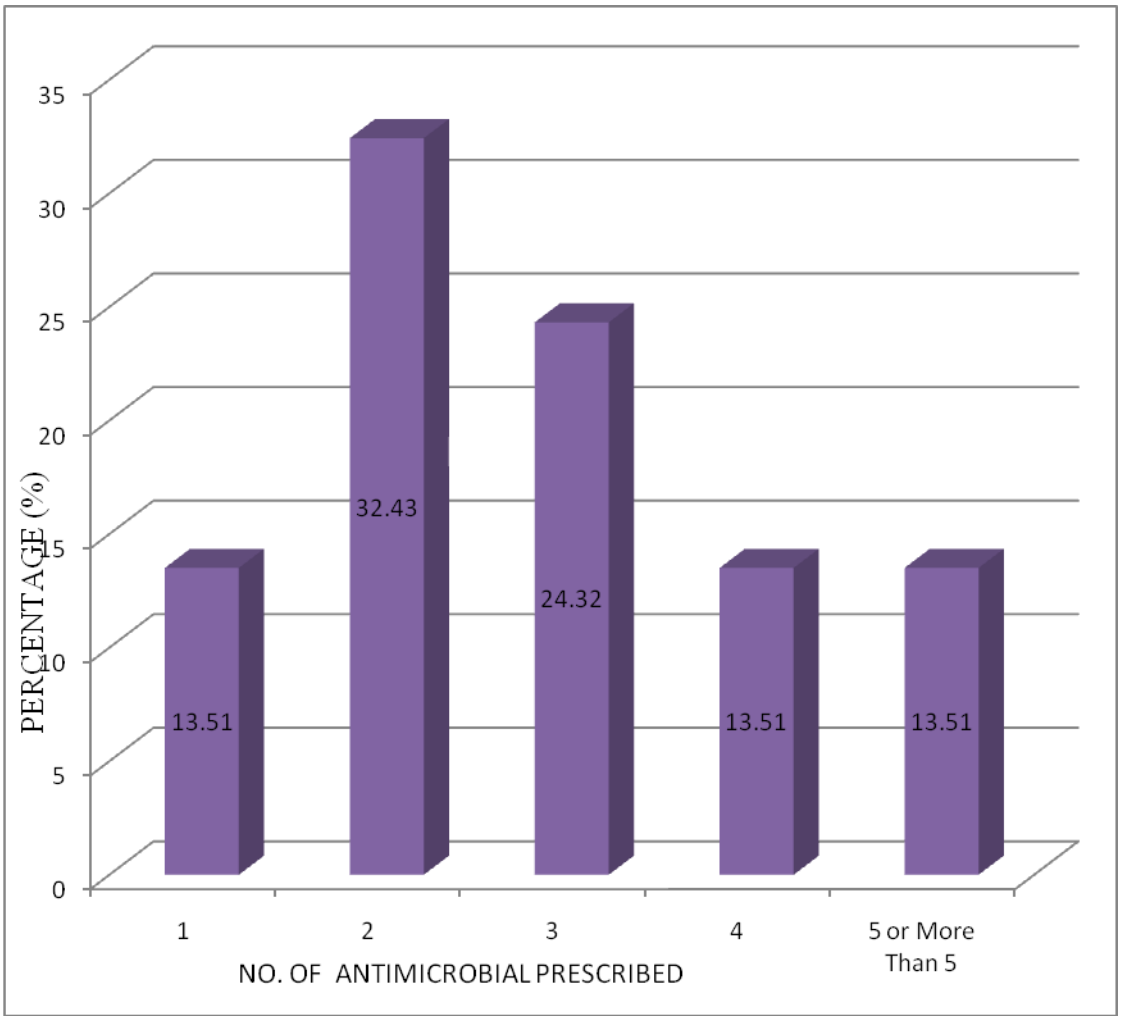
were more prominent. In UTI, *Candida albicans* (33.33%), and *Candida tropicalis* (33.33%) accounted for more than 67% of all urinary tract infection. In BSI, *Candida albicans* (11.11%), and *Candida tropicalis* (44.44%) accounted for more than 55% of all bloodstream infection. In Pneumonia, the only pathogen found to be infecting was *KlebsiellaPneumoniae.* In Other HAI, the pathogen found to be infecting was *MRSA.*

Figure 12: Percentage Of No. Of Antimicrobial Prescribed



The number of patients prescribed with only one antimicrobial agent to treat the hospital acquired infections were 5 (13.51%), the number of patients prescribed with two antimicrobial agents were 12 (32.43%), the number of patients prescribed with three antimicrobial agents were 9 (24.32%), the number of patients prescribed with four antimicrobial agents were 5 (13.51%), and number of patients prescribed with five or more than five antimicrobial agents were 5 (13.51%).

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Table 2: Breakdown Of Antimicrobial Prescription By Class

CATEGORY	NO. OF PRESCRIPTION	PERCENTAGE OF TOTAL ANTIMICROBIAL PRESCRIPTION
1) Penicillin, Total	24	27.58
a) Ureidopenicillins	14	-
b) β Lactamase Inhibitors	9	-
c) Aminopenicillins	1	-
2) Cephalosporin, Total	15	17.24
a) 2nd Generation	3	-
b) 3rd Generation	5	-
c) 4th generation	7	-
3) Aminoglycoside Antibiotics	7	8.04
4) Fluoroquinolones	12	13.79
5) Azole Antifungal	7	8.04
6) Carbapenams	6	6.89
7) Glycopeptide Antibiotics	6	6.89
8) Nitroimidazole Antiprotozoal	4	4.59
9) Oxazolidinone Antibiotics	3	3.44
10) Polyene Antibiotics	2	2.29
11) Polypeptide Antibiotics	1	1.14

Antimicrobial from the class of Penicillin were the mostly prescribed antibiotics to treat the hospital acquired infections, the total number of prescription of penicillin's was 24 (27.58%) of which Ureidopenicillins (Piperacillin + Tazobactam) were prescribed for 14 patients, β Lactamase inhibitors (Sulbactam + Cefoperazone) were prescribed for 9 patients, and Aminopenicillins (Amoxicillin + Clavulanic acid) were for 1 patient. Cephalosporins were prescribed for 15 (17.24%) patients of which 2nd generation cephalosporin (Cefuroxime) were prescribed for 3 patients, 3rd generation cephalosporin (Ceftriaxone, Cefotaxime, Cefoperazone, Cefexime) were prescribed for 5 patients, and 4th generation cephalosporins (Cefepime, Cefepime + Tazobactam) were prescribed for 7 patients. Aminoglycoside antibiotics (Amikacin, Netilmicin, Tobramycin) were prescribed for 7 (8.04%) patients. Fluoroquinolones (Levofloxacin, Ofloxacin, Pazufloxacin, Ciprofloxacin) were prescribed for 12 (13.79%) patients. Antifungal from class of Azole (Fluconazole) were prescribed for 7 (8.04%) patients. Carbapenam (Meropenam, Imipenam+Cilastatin) were prescribed for 6 (6.89%) patients. Glycopeptide antibiotics (Vancomycin, Teicoplanin) were prescribed for 6 (6.89%) patients. Antiprotozoal from the class of Nitroimidazole (Metronidazole, Tinidazole) were prescribed for 6 (6.89%) patients. Oxazolidinone antibiotics (Linezolid) were prescribed for 3 (3.44%) patients. Polyene antibiotics (Amphotericin-B) were prescribed for 2 (2.29%) patients. Polypetide antibiotics (Colistin) were prescribed for 1 (1.14%) patient.

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Table 3: Average Length Of Stay In Hospital

Sr. No.	Site of Infection	Average length of stay in Hospital (In Days)
1	Surgical Site Infection	22.06
2	Respiratory Tract Infection	24.15
3	Urinary Tract Infection	19.28
4	Bloodstream Infection	25.11
5	Pneumonia	22.00
6	Other Hospital Acquired Infection	26.00

The average length of stay was calculated on basis of number of days the patients was admitted in the hospital from the date of admission to date of discharge. The average length of stay was highest for Bloodstream infection i.e. 25 days, followed by Respiratory tract infections with average LOS of 24 days, for Pneumonia and Surgical site infection the average LOS was 22 days, for Urinary tract infection it was 19 days and for other hospital acquired infection it was 26 days.

CONCLUSION

Having carried out this study, the inferences that we have drawn are as follows-

- Maximum were surgical site infections, caused due to E.coli and Pseudomonas Aeruginosa. Factors like improper use of antibiotics for surgical prophylaxis, improper sterilization techniques, lack of proper dressing techniques could be probable causes. Management of SSI includes the following: Surgical debridement and right Antibiotic therapy. If done properly SSIs could be reduced. Therefore a checklist of International guidelines to be followed pre, per and post operatively could help overcome this.
- Of the 37 patients included in the study, maximum were females. Thus indicating more female susceptibility to hospital acquired infections, the reason not very apparent.
- After surgical site infections, the next most common site of infection was the Respiratory tract, probable sources of infection being invasive procedures like tracheostomy, endotracheal intubation. Lack of adequate and timely fumigation of the ICU/ Wards leading to airborne infections(6) could also be a causative factor, therefore improving on the above may help reduce the burden of HAIs'.
- In the ICU, the maximum burden of nosocomial infections was due to Acinobacter species followed by Candida Albicans. Same was the case with the wards. And since it is documented that source of this infecton is unclean hands and fomites, proper hand washing techniques() by all medical personnel, use of sterile gloves when handling patients, will help to reduce the burden of these infections in a hospital setting tremendously.
- Other points observed were the average length of stay for a specific nosocomial infection, which was maximum for bloodstream infections (24 days) followed by respiratory tract infections (22 days). Management of BSI may include the following: Line removal as appropriate . Antibiotic therapy covering gram-positive and gram-

negative organisms, started empirically and then tailored according to specific susceptibility patterns, Antifungal therapy as appropriate [4].

- Therefore this calls for a more aggressive approach when dealing with the above sites of infection.

- Most heavily prescribed antimicrobial was the class of penicillins followed by 3rd and 4th generation cephalosporins. Thus a gradual process of an antibiotic stewardship programme [7] targeting the right antibiotics for the infections as per site and kinetics of the drugs used would rationalize antibiotic usage and minimize development of drug resistance. Albeit a larger sample size would be beneficial to draw an antibiotic guideline programme for the multidisciplinary tertiary hospital catering to all patients .

ACKNOWLEDGEMENTS

We would like to take this opportunity to thank all our friends and colleagues who have stood by our side at all times during the course of this endeavour, constantly motivating us, giving us a plethora of ideas to chose from when we came across some road blocks, and above all for always believing in us, never losing faith in our ability.

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