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ASSESSMENT OF CULTURE AND SENSITIVITY OF MICROORGANISMS WITH VARIOUS ANTIMICROBIAL AGENTS USED IN SURGERY DEPARTMENT IN A TERTIARY CARE HOSPITAL IN INDIA

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ABSTRACT

The human skin and soft tissue infections (SSTIs) caused by microbial pathogens during or after surgical procedures result in significant morbidity, prolonged hospitalization and huge economic burden[1]. The wide spread and inappropriate use of antibiotics were resulted in antibiotic resistance pathogens and leads to prolongation of illness, exacerbation of present disease, ineffective treatment, high risk of morbidity increased patient cost and patient harm[2]. The aim of this study was to assess the culture and sensitivity of microorganisms with various antimicrobials used in surgery department in a tertiary care hospital in India. This prospective observational study was carried out with 181 patients who had undergone various surgeries in the General Surgery department of Muthoot Healthcare Pvt Ltd, Kozhencherry, for a period of 6 months to assess the culture and sensitivity of microorganisms with various antimicrobials. In this study it was found that slough excision has most infection rate of 85.71%, followed by incision and drainage. Most of the cases found to be culture negative (71.11%) and only 28.88% was found to be culture positive. The most commonly isolated organism is S.aureus (8.88%) followed by E.coli (8.14%). On antimicrobial susceptibility testing, Piperacillin / Tazobactam was the most effective drug because it was sensitive to majority of the organism isolated. The second most effective drugs were Ceftriaxone and Cefpirome.

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INTRODUCTION

A plethora of microorganisms with different antimicrobial sensitivity pattern has been identified as the causative agents of wound infections which vary from time to time, hospital to hospital and with the type of surgical procedure.

Wound infections are consequence of a summation of several factors: the inoculum of bacteria introduced into the wound during the procedure, the virulence of the contaminants, the micro environment of each wound and the integrity of the patient's host defense mechanism. Factors intrinsic to the patient, as well as those related to the type and circumstances of surgery affect the incidence of infection. Other factors associated with SSI are duration of pre-hospitalization, age and physical status of the patient, administration of prophylactic antibiotics, duration of surgery, tissue handling and use of drains [3].

The wide spread and inappropriate use of antibiotics were resulted in antibiotic resistance pathogens. These also leads to prolongation of illness, exacerbation of present disease, ineffective treatment, high risk of morbidity increased patient cost and patient harm [2].

Some of the most frequent causative microorganisms are related to wound infections and include *Staphylococcus aureus*, *Streptococcus pyogenes*, *Enterococci*, *Escherichia coli*, *Klebsiella pneumonia*, *Proteus* species and *Pseudomonas aeruginosa*. However, the severity of complication is largely based on the virulence of the infecting pathogen and the site of infection [4].
Widespread use of antibiotics results in the evolution of more resistant strains. An organism can become resistant to a particular antibiotic through repeated exposure. The resistance is a result of genetic alterations or transfer of resistant gene [5].

Active and passive surveillance of wound infections in the hospital will help the surgeons and clinicians to know the antibiotic sensitivity pattern related to the surgical site, which can help reduce postoperative complications [6].

Purpose of antimicrobial sensitivity testing:

a) A laboratory test which determine that how effective antibiotic therapy is against a bacterial infection.
b) AST can control the use of antibiotics in clinical practice.
c) AST testing will assist the clinicians in the choice of drug for the treatment of infection.
d) AST can help the local pattern of antibiotics prescriptions.
e) To reveal the changing trends in the local isolates [7].

The performance of antimicrobial sensitivity testing by the clinical microbiology laboratory is important to confirm sensitivity to chosen empirical antimicrobial agents, or to detect resistance in individual bacterial isolates. Empirical therapy continues to be effective for some bacterial pathogens because resistance mechanisms have not been observed [6].

MATERIALS AND METHODS

This is a prospective observational study conducted for a period of 6 months in the General Surgery department of Muthoot Healthcare Hospital Pvt Ltd, Kozhencherry, Kerala, India after obtaining the approval from the Institutional Ethics Committee of the hospital. A sample size of 181 patients of either sex who were undergoing the following surgeries, that is Laparoscopic appendectomy, laparoscopic and open hernioplasty, thyroidectomy, lipoma excision, breast lump excision, circumcision, laparoscopic and open cholecystectomy, video assisted anal fistula treatment, infected sebaceous cyst incision and drainage, slough excision-bedsore, stapler hemorrhoidectomy and fistulectomy were included in the study. Patients who were immune compromised, with uncontrolled diabetes mellitus were excluded from the study. All subjects were provided with a brief introduction regarding the study and the confidentiality of the data. A written Informed Consent printed in their understandable language was obtained from the patient or care-giver, if the subject was unable to give the same. Relevant information was collected according to the approved pre-designed data collection form. Data of each subject was individually screened to assess the culture and sensitivity of microorganisms with various antimicrobials and identified the most effective antimicrobial agent against the organism isolated. Data was then statistically analyzed in Microsoft excel -2010 version and results were analyzed as tabular form and percentages. Paired T-test was used for analysis of data.

RESULTS

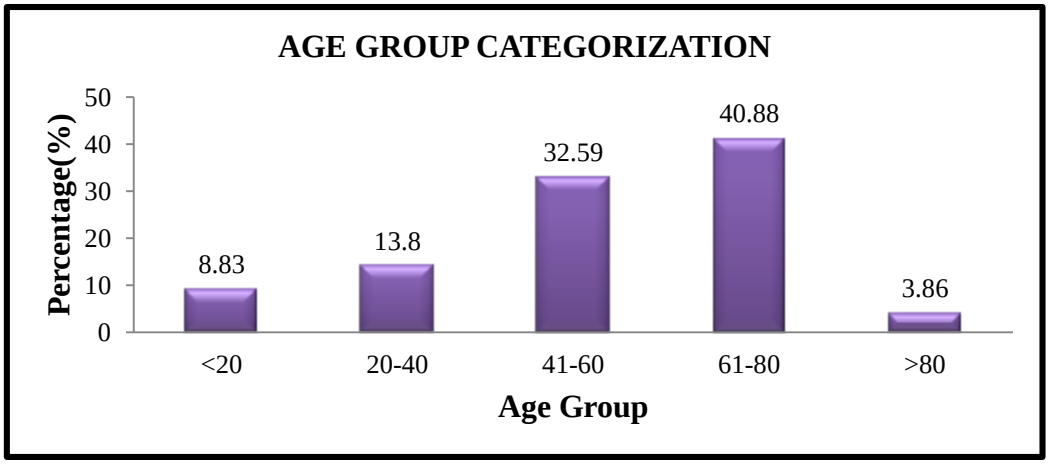

FIGURE 1: DISTRIBUTION OF PATIENTS BASED ON AGE GROUP.

8.83% of the surgeries performed were in the age group of less than 20 years, followed by 13.8% in the age group of 20-40 years, 32.59% in the age group of 41-60 years, 40.88% in the age group of 61-80 years and 3.86% in the age group above 80 years.

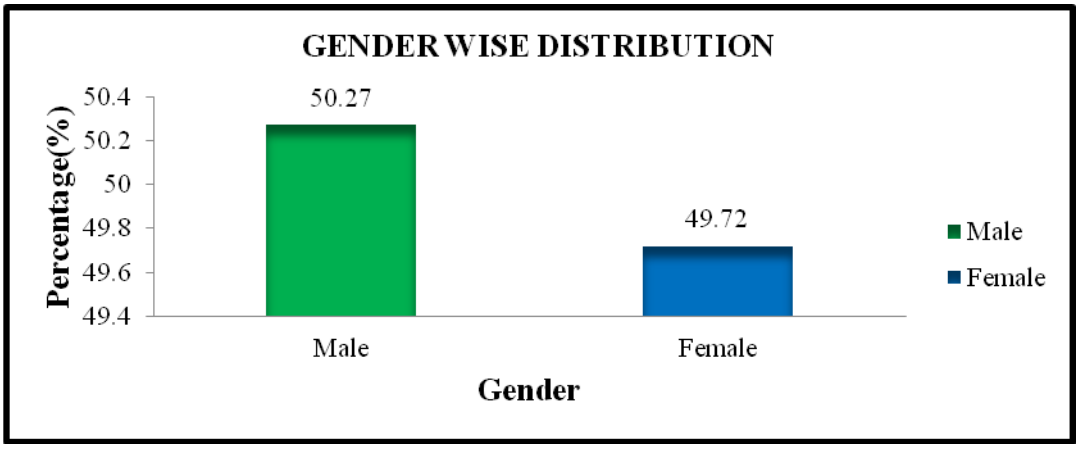

FIGURE 2: DISTRIBUTION OF PATIENTS BASED ON GENDER.

The study result shows that 50.27% of the patients were male and 49.72% were female.

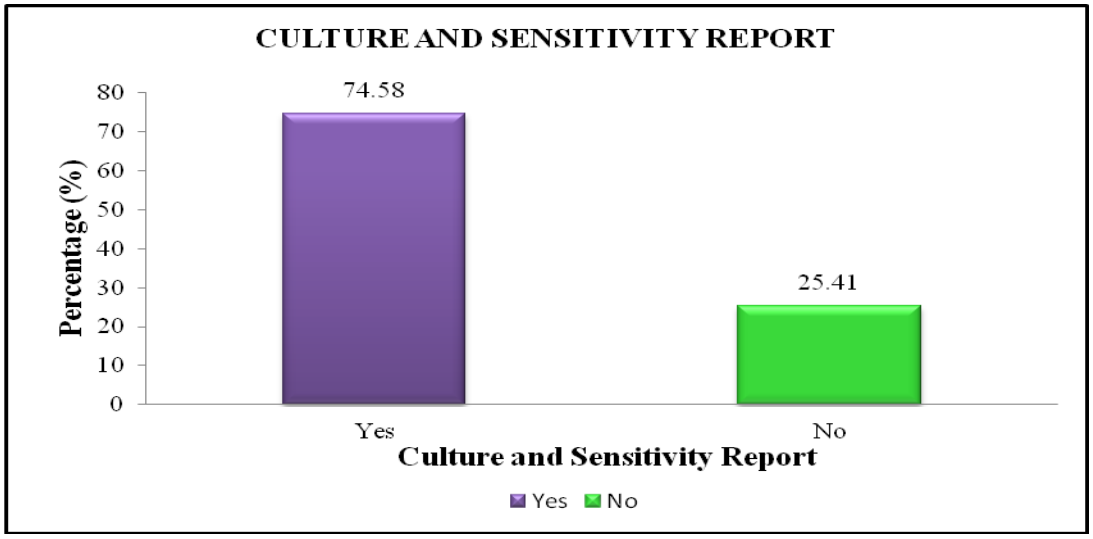

FIGURE 3: ASSESSMENT OF CULTURE AND SENSITIVITY PERFORMED.

Here the study population was analysed for culture and sensitivity reports, and was found that, 74.58% of the patients were tested for culture and sensitivity, whereas 25.41 % hadn't performed culture and sensitivity test.

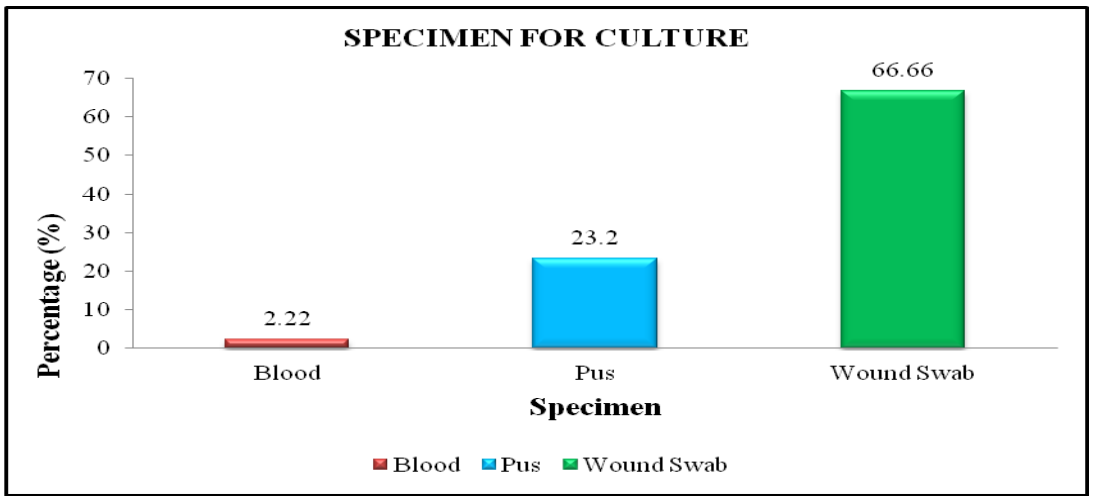

FIGURE 4: DISTRIBUTION OF SPECIMEN FOR CULTURE.

In this study, the mostly used sample specimen for culture sensitivity was Wound Swab 66.66% followed by Pus 23.2% and then Blood 2.22%

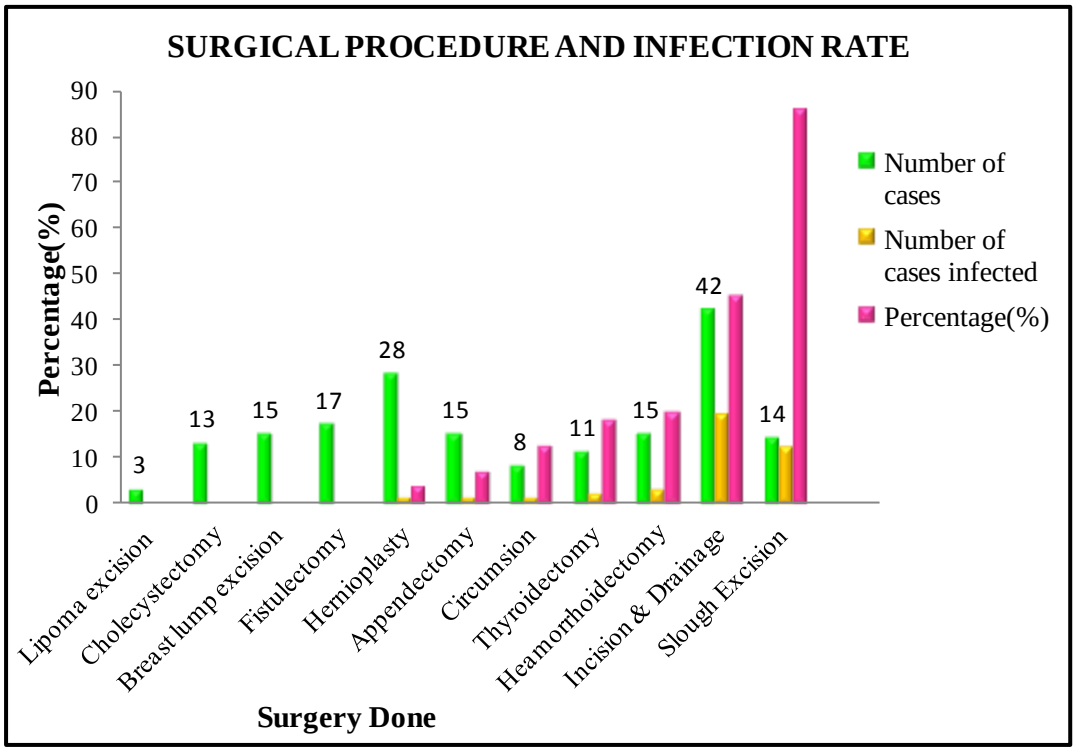

FIGURE 5: ASSESSMENT OF SURGICAL PROCEDURE AND INFECTION RATE.

Here the study population was analysed, based on the surgical procedure undergone, slough excision was found to have most infection rate of 85.71%, followed by incision and drainage having infection rate of 45.23%, hemorrhoidectomy 20%, thyroidectomy 18.18%, circumcision 12.5%, appendectomy 6.66% and hernioplasty 3.57%. (Figure 21).

FIGURE 6: DISTRIBUTION OF CULTURE GROWTH.

Here, out of 135 samples 71.11% were found to be culture negative and 28.88% were found to be culture positive.

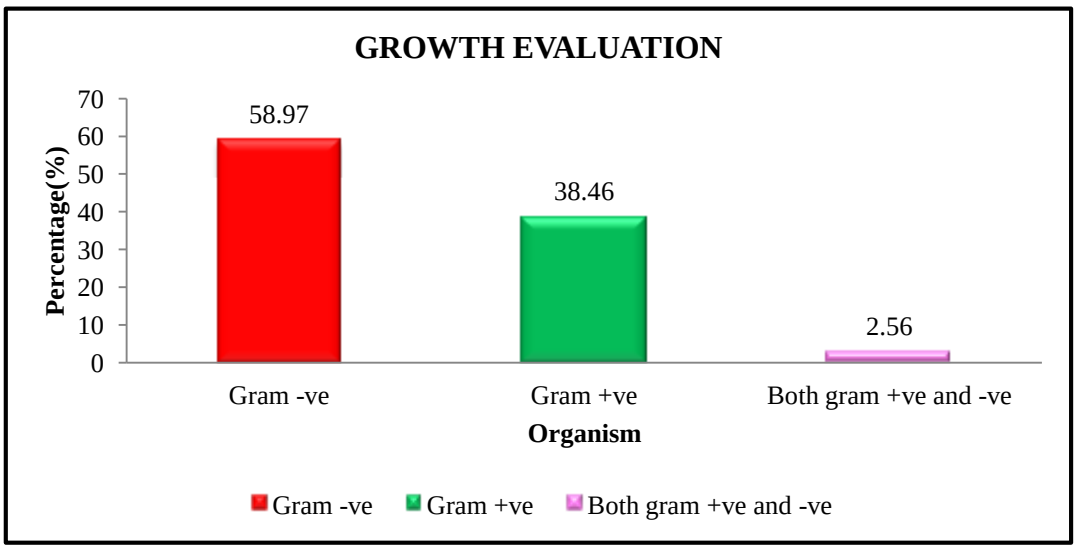

FIGURE 7: GROWTH EVALUATION.

In this study, among the isolated organisms 58.97% was found to be Gram –ve and 38.46% was found to be Gram +ve organism. Only 2.56% was mixed culture including both Gram –ve and Gram +ve organisms.

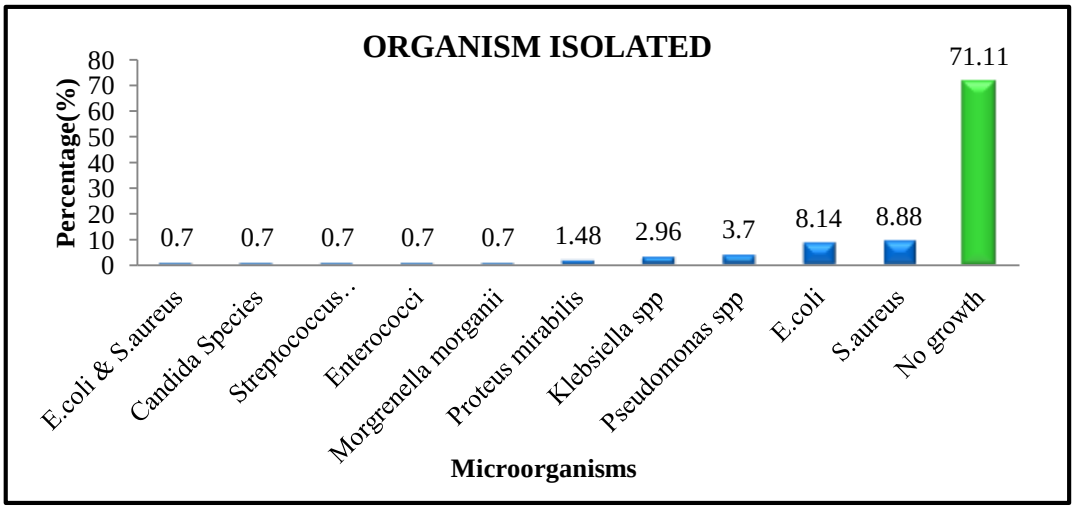

FIGURE 8: DISTRIBUTION OF ORGANISM ISOLATED.

This study shows different strains of organisms that were isolated from the patient's culture test. Majority of the patients in the study population that is 71.11% had no growth when culture and sensitivity test was performed. Among the isolated organisms 8.88% were S.aureus, 8.14% were E-Coli, 3.7% P. aeurogenosa, 2.96% Klebsiella spp, 1.48% Proteus mirabilus, 0.7% Streptococcus pneumoniae, 0.7 % Candida species, 0.7% Morgrenella morganii and 0.7% Eneterococci.

TABLE 1: ANTIBIOTIC SENSITIVITY PATTERN.

Organism	Prcentage (%) Of Patients Infected	Piperacillin/Tazobactam	Cefoperazone/Sulbatcam	Ceftriaxone	Cefpirome	Linezolid	Chloramphenicol	Ciprofloxacin	Ofloxacin	Cefazolin	Meropenem
Candida spp	0.70	0	0	0	0	1	0	0	0	0	0
E.coli	8.14	8	5	4	2	2	3	0	0	1	0
Enterococci	0.70	1	0	0	0	1	0	0	0	0	0
Klebsiella spp	2.96	1	2	1	2	0	0	1	1	2	0
Morgenella morganii	0.70	1	0	1	1	0	0	1	1	0	0
Proteus mirabilis	1.48	0	0	0	2	0	2	0	0	0	0
Pseudomonas aeurogenosa	3.70	4	3	1	2	0	0	1	1	0	1
S.aureus	8.88	6	2	5	5	6	0	1	0	1	0
Streptococcus pneumoniae	0.70	1	0	1	0	0	0	0	0	1	0

Antibiotic susceptibility testing showed that most strains (8cases) of *E.coli* are sensitive to Piperacillin/ Tazobactam followed by Cefoperazone /Sulbactam (5 cases). *Candida spp* is found to be sensitive to linezolid where as *enterococci* are sensitive to both Piperacillin/ Tazobactam and linezolid. Proteus mirabilis is sensitive to Cefpirome and chloramphenicol. Pseudomonas aeurogenosaand S.aureus were found to be more sensitive to Piperacillin/ Tazobactam. Streptococcus pneumonia shows sensitivity to Piperacillin/ Tazobactam, Ceftriaxone and Cefazolin only.

DISCUSSION

Monitoring the use of AMS and review of sensitivity patterns are imperative. Audit of AM sensitivity patterns in surgery department is crucial and far more important for giving effective treatment and decreasing the spread of resistance [8]. In the present study, an attempt has been made to know the various pathogens associated with surgical site infections.

In our study the culture and sensitivity test was performed in 74.58% of cases and in 25.41% it was not done. According to the study conducted by Sheth KV *et al.*, 59.4% cases the antibiotic sensitivity test was performed and in 40.6% it was not done [9]. Antimicrobials prescribed empirically and prophylactically without performing culture sensitivity pattern may increases the chances of antimicrobial resistance. Hence the importance of performing culture sensitivity for patients should be emphasized.

Out of 135 collected specimens for culture and sensitivity test, 90 (66.66%) samples were wound swab and 42 (23.20%) were pus. In a study carried out by Kumari, most of the samples were wound swabs followed by aspirated pus [10] which is similar to our result.

Here the study population was analysed based on the surgical procedure undergone, slough excision was found to have most infection rate of 85.71%, followed by incision and drainage having infection rate of 45.23% since slough excision is a contaminated procedure and more exposed to the external environment. In another study conducted by Mundhada AS and Tenpe S found appendectomy and surgeries involving gastric, small and large bowel found to have large and equal infection rate (50%) [8] which is different from our study.

In our study out of 135 samples, 71.11% was found to be culture negative and only 28.88% was found to be culture positive. Because all the aseptic procedures were carried out in the OT before conduction of the scheduled surgeries. As a result all the exogenous factors contributing to infection among the patients were prevented. In another study, out of 206 specimens most of the cases were culture negative [11] which is similar to our result.

In this study the most commonly isolated organism is S.aureus (8.88%) followed by E.coli (8.14%).This trend is seen in majority of studies related to culture and sensitivity conducted in Indian environment which is much favorable for the growth and colonization of these organisms. The study gives us insight into the bacterial flora isolated in postoperative patients in a tertiary care hospital. However the most commonly isolated organism is gram negative (58.97%) pathogens. In a similar study conducted by Mundhada AS and Tenpe S reveals that Gram-negative organisms were frequently isolated from postoperative wounds however S. aureus was the single predominant pathogen isolated [8] and is similar to our study.

In another study conducted by Bhave PP *et al.*, reveals that the most common gram positive and gram negative isolates were Staphylococcus aureus and E. coli respectively [32] and is similar to our study. Similar result was obtained from study conducted by Goswami *et al.*, out of 183 organisms, gram negative organisms were more prevalent than gram positive bacteria [12].

Among 39 culture positive cases 38 showed the growth of a single organism while only 1case exhibited growth of more than one pathogen. Single growth was higher than multiple growths. Similarly, in a study carried out by Sanjay *et al.*, single growth was higher than multiple growths [13].

The drug choice according to culture and sensitivity is having an important role. Inappropriate antibiotic therapy was defined as the use of an antimicrobial to which the documented pathogen was resistant, or as the failure to provide coverage against an identified pathogen.

In our study antibiotic susceptibility testing showed that most strains (8cases) of *E.coli* is sensitive to Piperacillin/ Tazobactam followed by Cefoperazone /sulbactam (5 cases). *S.aureus* is more sensitive to Piperacillin/ Tazobactam and Linezolid.
On antimicrobial susceptibility testing, Piperacillin/ Tazobactam was the most effective drug because it was sensitive to majority of the organism isolated. The second most effective drugs were Ceftriaxone and Cefpirome. In study conducted by Bastola R *et al.*, found that Amikacin (86.4%) was the most effective drug followed by Cefoperazone-sulbatam [11].

In 2014 Center for Disease Control (CDC) recommended that all acute care hospitals implement ASP. The core elements of hospital ASP were leadership, commitment, accountability, drug expertise, action, tracking, reporting & education. Through this ASP for optimizing antibiotic use implementation of antibiotic policies and interventions were required. Broad interventions include antibiotic "Time out" (all clinicians should perform a review of antibiotics 48 hrs after antibiotics are initiated), prior authorization (availability of expertise in antibiotic use and infectious disease and authorization needs to be completed in a timely manner), prospective audit and feedback [14].

CONCLUSION

The study was conducted prospectively by using a sample size of 181 patients with the aim of assessing the culture and sensitivity with various antimicrobials and to identify the most effective antimicrobial against the organism isolated in patients admitted in the general surgery department for a study period of 6 months. The focus on culture and sensitivity report showed that majority of the study population had undergone culture and sensitivity test, for which slough excision was found to have most infection rate and wound swab was the most commonly used specimen. Gram-negative organisms were frequently isolated from postoperative wounds however S. aureus was the single predominant pathogen isolated. Piperacillin/ Tazobactam were the most effective drug because it was sensitive to majority of the organism isolated. Resistance was maximum with Chloramphenicol and Ofloxacin.

AREAS OF CONFLICT

NIL

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