DOI: https://doi.org/10.53350/pjmhs22161227

ORIGINAL ARTICLE

Updated Microflora in Surgical Site Infections at Surgical Floor

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ABSTRACT
Background: Mostly bacterial infections are treatable with oral and injectable antibiotics, but surgical site infections (SSI's) are an important root cause of post-surgical mortality and morbidity. We have undertaken this study in our department to find out the bacterial micro flora isolated from surgical site infections of clean and clean contaminated wounds and their antimicrobial susceptibility at Surgical Unit I, JHL.
Methods: It was a descriptive case series study carried out at Surgical Unit I, Department of Surgery Jinnah Hospital Lahore/Allama Iqbal Medical College. Total 60 cases were selected who developed surgical site wound infections within 30 days postoperatively. Patients with clean and clean contaminated wounds were included and those with dirty and contaminated wounds were excluded. Patient having diabetes, chronic liver disease, on immunosuppressant drugs were also not included. Wound swabs were taken from surgical site infected patients for microbiological analysis and drug sensitivity. Swabs were transported to the microbiology laboratory of JHL. Their culture and sensitivity report was recorded in a predesigned proforma.
Results: A total 60 patients were included who developed SSI post-operatively within 30 days. The age range of patients was 18–70 years, with mean age of the patients 38.5 year. There were 38(63.33%) female and 22(36.66%) male patients. There were 28(46.66%) elective operations and 32 (53.33%) emergency operations. Our study patients who developed SSI postoperaticely were discharged from the hospital and were managed on OPD basis, while no patient died due to SSI. Amongst the positive growth cultures, the most common pathogenic micro flora isolated was Eschericia Coli with an overall incidence of 18(30%) followed by Staphylococcus aureus in 14(23.33%) cases. Meropenem was 100% effective against all E. coli isolates and all MRSA positive 8(13.33%) cases showed sensitivity to vancomycin.
Conclusion: In our study patients who had SSI, Escherichia coli was the most common bacterial pathogen isolated from wounds and high resistance to antibiotics was observed amongst various microbial flora thereby regular antimicrobial susceptibility tests and antibiograms should be carried out in SSIs.
Keywords: Surgical Site Infections (SSIs), clean-contaminated, anti-microbial susceptibility, cultures.

INTRODUCTION
We define Surgical site infections (SSIs) as those infections that occur within a period of 30 days after surgery and affects either the operation incision site or deeper tissues beneath the incision.[1] SSI is one of the most commonly encountered health care associated infections in third world countries. The SSIs are frequently associated with increased grieve of the patients, lengthens the duration of hospital stay, and also increases the hospitalization financial cost.[2]

Current studies have demonstrated that the incidence of SSIs after gastrointestinal surgeries ranges from 1.2 to 5.2%.[3] SSI prevalence is much higher in patients who underwent emergency abdominal surgeries as compared to elective cases.[4]

The responsible bacterial pathogens originate from the patient's own endogenous flora in many SSIs.[4] Causative pathogenic micro flora mostly depends on the surgery performed and Escherichia coli, Staphylococcus aureus, coagulase-negative staphylococci and enterobacter spp. are most isolated pathogens.[4]

The aim of our study was to establish the etiological bacterial pathogens associated with SSIs and their antimicrobial sensitivity and resistance pattern in patients after surgery at Jinnah hospital Lahore, Surgical Unit 1.

METHODS
It was a descriptive case series study which included 60 patients, who had developed postoperative SSI in the Surgical Unit 1 of Jinnah Hospital Lahore between September 2020 and August, 2021. Hospital ethical committee approved our study protocol and before collecting the data, all the 60 participants had given written informed consent. The selected patients were those who underwent operative surgery either as emergency or elective case and had got wound infected within the period of 30 days of procedure and were or above 16 year of age. We have enrolled patients with clean and clean contaminated wounds as per operational definition. Patients with contaminated and dirty wounds were excluded and those with co-morbidities like diabetes, uncontrolled hypertension were also excluded. Wound exudate swabs and pus aspirate were taken from the surgical infected wound sites post-operatively and conventional laboratory techniques for collection of specimen were strictly followed. The perioperative wound site was generously cleaned with ethyl alcohol (70%) swabs and wound base debris was removed by irrigation with Normal saline wash initially before taking the samples with two sterile swabs. Samples were then sent to the microbiology lab immediately for micro flora identification, in order to prevent the growth of other microbial species as that may obscure the real wound site pathogens.

After receiving the specimens at the microbiology lab, the collected aspirate or specimen swabs were inoculated onto the MacConkey agar, chocolate agar plates, blood agar and Sheep Blood agar by sliding the swabs over the agar plates and finally incubated at a temperature of 37 °C for 24–48 hour. The bacterial micro flora were then identified using conventional microbiological guidelines. The microbial susceptibility and resistance was then evaluated using the standardized disc diffusion techniques. Laboratory data results including pathogen culture results, recognition of the micro flora isolates and antimicrobial susceptibility and resistance were completely recorded on a predesigned proforma data sheets. All statistical data were analyzed using the Statistical Package Social Sciences for Windows version 20.

RESULTS
In our study 60 cases were enrolled who developed SSI from clean and clean contaminated wounds post-operatively. The patients mean age was 38.5 year, with a range of 18–70 years. 21(35%) patients were between the ages of 15–40 years, 25(41.66%) patients between 41-60 years and 14(23.33%) above 61 years. There were 38(63.33%) female and 22(36.66%) male patients.

There were 28(46.66%) elective operations and 32 (53.33%) emergency operations. All 60 patients who had postoperative SSI were discharged and were managed on OPD basis, while no patient died due to SSI. Out of total 60 infected cases, 54(90%) cases had superficial infection and only 6(10%) cases had deep bacterial infections.

The duration of the surgery also had an effect on the occurrence of SSI. Surgical procedures that lasted for more than 2 hours were more frequently associated with SSIs than operations of less than 2 hours. In our study 38(63.33%) cases lasted more than 2 hours and 22(36.66%) cases lasted less than 2 hours. Wound swab specimens from all enrolled 60 patients with SSIs were tested and cultured for antibiotic sensitivity and resistance. All specimens showed positive microbial growth. The most common micro flora pathogen isolated from positive specimen cultures was E.Coli having incidence of 18(30%) isolates, Staphylococcus aureus 14(23.33%) cases, Acenatobacter 8(13.33%), Pseudomonas 7(11.66%) Klebsiella ssp 5(8.33%), *Proteus ssp.* 3(5%), enterobacter 3(5%). Oxidase-negative protease 2 (3.33%) isolates (Figure A). Amongst 14 cases with staphylococcus aureus growth, 8(13.33%) cases were MRSA. The isolation rate of Gram negative micro flora was greater (75%) than Gram positive micro flora (14.5%) in this study.

The antibiotic sensitivity and resistance report of bacterial growth is given below in Table 1. Meropenem showed 100% sensitivity against all isolates of E.Coli, which was the predominant micro flora in our study. All MRSA positive 8(13.33%) cases showed sensitivity to vancomycin. In our study, ceftriaxone resistance was documented in 69.98% isolates.

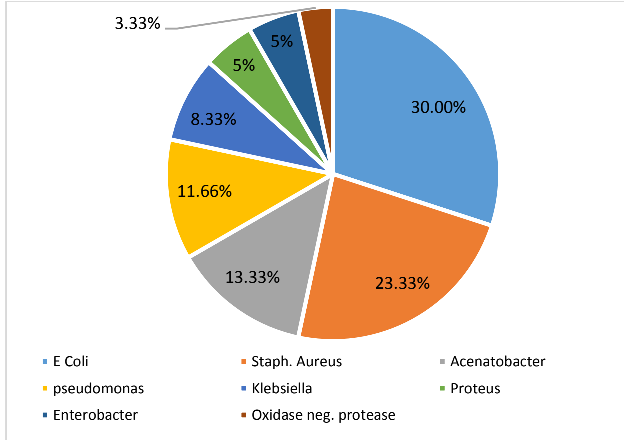

Figure A: Types of Micro flora and their Percentages in Patients with Postoperative Surgical Site Infections (SSIs)

Table 1: Sensitivity patterns of the different pathogens to antibiotics.

E.Coli	Sensitivity	Gentamicin, Ceftriaxone, Imipenem, Meropenem, Amikacin
	Resistance	C0-Amoxiclav, Tazobactum, Ciprofloxacin,
Staph. Aureus	Sensitivity	Tigecyclin, Co-Amoxiclav, Amikacin, Gentamicin, Vancomycin, Teicoplanin, Fusidic Acid, Linezolid, Trimethoprim, Sulphamethoxazole
		MRSA: Piperacillin, Tazobactum, Amikacin, Erythromycin, Clindamycin, Vancomycin, Linezolid, Fusidic Acid
	Resistance	Ampicillin, Amoxicillin, Methicillin, Co- Amoxiclav, All Cephalosporins, Ciprofloxacin, Co-Trimoxazole
Acenatobacter	Sensitivity	Gentamicin, Tobramycin, Polymyxin, Amikacin, Imipenem, Aztreonam
	Resistance	Ceftazidime, Ciprofloxacin, Meropenum, Amoxiclav, Ampicillin, Aztreonam, Piperacillin, Ceftriaxone, Cefixime, Meropenem, Colisten
Pseudomonas	Sensitivity	Meropenem, Polymyxin, Amikacin, Cotrimoxazole
	Resistance	Ampicillin, Piperacillin, Gentamicin, Ciprofloxacin, Imipenum, Meronem, Aztreonam, Doxycycline, Ceftriaxone
Klebsiella	Sensitivity	Polymyxin
	Resistance	Ampicillin, Amoxicillin, Piperacillin, Ceftriaxone, Ciprofloxacin
Proteus	Sensitivity	Imipenem, Meropenem
	Resistance	Amoxiclav, Tazobactum, Ceftriaxone, Amikacin, Gentamicin, Ciprofloxacin, Doxycycline, Co-trimoxazole, Chloramphenicol
Enterobacter	Sensitivity	Amikacin, Imipenem, Gentamicin, Trimethoprim sulphamethoxazole, Ciprofloxacin
	Resistance	Amoxicillin, Ampicillin, Aztreonam, Piperacillin, Ceftriaxone, Cefixime, Meropenem, Colisten
Oxidase negative protease	Sensitivity	Aztreonam, Ceftazidime, Cefixime, Amikacin, Gentamicin, Meropenem
	Resistance	Ampicillin, Co-Amoxiclav, Cotrimoxazole, Ciprofloxacin, Ceftriaxone

DISCUSSION

Breaches in the continuity of the skin and mucosa that allow bacterial pathogens to gain entry into a sterile surgical incision wound, can lead to wide range of wound contaminations known as surgical site infections (SSIs).[5] Such infections are linked with an increased healthcare system economic burden due to prolong hospitalization and readmission chances.[6]

In our study on 60 cases who had SSI on clean and clean contaminated wounds, we have attempted to assess the causative micro flora associated with surgical site wound infections and their drug sensitivity and resistance pattern at a tertiary institute Jinnah Hospital Lahore.

In our study there were 28(46.66%) elective surgeries and 32 (53.33%) emergency surgeries. Most of the surgical operations performed were appendicectomies and cholecystectomies in which there was no spillage from the intestinal tract and their surgical wounds were either clean or clean contaminated.

In our study high prevalence of Escherichia coli isolates (30%) were found, and post-operative contaminations and outbreaks could be the possible etiological factor and natural habitat of E.Coli is intestinal tract. Emergency surgeries have high incidence rate of surgical site wound infections due to deficient preoperative preparation and inadequate control of associated comorbid conditions like diabetes, sepsis and hypertension.[7]

In our study followed by E.Coli (30%), the Staphylococcus aureus is the second most predominant micro flora causing surgical site wound infection in clean and clean contaminated wound (23.33%) cases post-operatively, which can be described by its existence as normal cutaneous micro flora and it may set foot into deep surgical sites intraoperatively. In a study by Lubega *et al*.[8] and Mardanpour K *et al*.[9], S. aureus, was the predominant micro flora of surgical site wounds post-operatively, which is in contrast to our study where E.Coli was the main micro flora pathogen.

Similar to our case, S.M. Patel *et al.*[10] demonstrated in his study that Escherichia coli in 35.7% cases was the most common bacterial pathogen isolated from SSI followed by Staphylococcus aureus in 21.4% cases, Klebsiella spp. in 14.3% and Pseudomonas aeruginosa in 14.3% isolates. In our study the most common pathogen isolated in SSI was E.Coli with an incidence of 30% patient, *Staphylococcus aureus* 23.3% cases, Acenatobacter 13.33%, Pseudomonas 11.66%, *Klebsiella ssp.* with an incidence of 8.33%, *Proteus ssp.* 5%, enterobacter 5% and Oxidase-negative protease 3.33%.

In a study conducted in India and Chennai, Escherichia coli was described as the main bacterial flora isolated in 41.17% cases, followed by Staph. Aureus in 13.72%, Klebsiella in 9.80%, Pseudomonas aeruginosa in 7.84%.[11,12] The possible reason could be poor gut preparation preoperatively in emergency laparotomies leading to fecal contamination or due to post-operative contamination.

In our paper, multiple drug resistance to mostly prescribed antibiotics like third generation cephalosporin was found. In a study conducted at Tikur Anbessa specialized Hospital, about 95% of the bacterial flora showed defiance to two or more drugs while 82.3% have shown defiance to three or more antibiotics.[13] Another study from Mekelle (Ethiopia) revealed a multiple drug resistance to mostly prescribed antimicrobials.[14] Our research findings were accordant with many other international papers [13,14,15,] and the reason for drug resistance being injudicious use of antibiotics for various diseases in our settings.

In our research paper, ceftriaxone defiance was documented in 69.98% isolates which in comparison to study conducted by Misha *et al.*[16] observed ceftriaxone overall resistance in 78.79% isolates. In our study and study by Misha *et al.* proteus and pseudomonas spp. isolates had shown 100% resistance to ceftriaxone. In our hospital, this higher resistance of isolates to ceftriaxone might be due to its indiscriminate and injudicious use as first choice prophylactic antimicrobial drug to most of the patients who undergo surgical procedures. However Meropenem has shown 100% sensitivity against Escherichia coli, the major pathogenic micro flora causing SSI in our research and vancomycin was 100% sensitive against all cases (13.33%) of MRSA which is comparable to their study. In their analysis[16], *Proteus* spp. demonstrated resistance to ceftriaxone (100%), Cefepime (100%), Cefuroxime (100%), ciprofloxacin (67%), chloramphenicol (67%), ampicillin (67%), and cotrimoxazole (67%) which is almost comparable to our study in which proteus isolates were resistant to Amoxiclav, tazobactum, ceftriaxone, amikacin, gentacin, ciprofloxacin, doxycycline, cotrimoxazole and chloramphenicol.

The global rise in antibiotic resistance emphasizes the need for formulation of strategies to empower the rational use of antibiotics in our hospitals and increase research for development of new antimicrobial drugs and vaccines. There is a crucial need to understand the prescribing pattern of antimicrobials in order to tackle irrational prescription.

Major limitations of our study was that most of the comparative SSI data presented from other international papers were not stratified into clean or clean contaminated surgical field data.

CONCLUSION

In order to decrease the incidence of SSIs in our hospital, there is a dire need to adopt aseptic operative techniques, adequate gut preparation preoperatively, reduce the duration of surgery without compromising on safety of patient, application of topical antimicrobials to the surgical wound before closing the incision site, regular intensive drain care post-operatively and judicious administration of prophylactic intravenous antimicrobials.

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