Original Article

Frequency And Susceptibility Pattern Of Microorganisms Found In Surgical Site Infection

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Abstract

Background

Surgical site wound infection is one of the serious concern in developing countries. Multiple studies have been done to find out the most commonly infecting bacteria and the susceptibility pattern, as it varies geographically, the type of surgery performed, the surgeon's hand and hospital to hospital based on the status of sterilization. Current study aimed to find out the frequency and susceptibility pattern of microorganisms found in surgical site infection.

Methods:

A descriptive cross-sectional study was conducted at the surgical department of Abbasi Shaheed hospital Karachi. The infected organism was identified by using culture test after that slide agglutination method was used to confirm it. Kirby Bauer disc diffusion technique was used to assess antibiotic sensitivity. The sensitivity of antibiotics tested were ampicillin, amoxicillin, augmentin, ceftriaxone, cefotaxime, ceftazidime, cefixime, cefepime, cefuroxime, amikacin, gentamycin, ciprofloxacin, ofloxacin, levofloxacin, moxifloxacin, piperacillin in combination with tazobactam, meropenem and vancomycin. The results were analyzed by using Statistical Package for Social Science version 20.

Results:

The mean age of the study participants was 29.42 ± 9.2 years. Among all surgeries the infection rate was 13.9% while majority of cases were infected with E. coli (58.9%) after that staphylococcus aureus (14.7%) was found on second number. Antibiotic susceptibility pattern showed that the meropenem and piprecillin in combination with tazobactam were highly sensitive against E. coli and S. aureus with sensitivity of 97%, 94.1% and 89.2%, 75% respectively while vancomycin was highly sensitive against streptococci and S. aureus with sensitivity of 100% and 87.5% respectively.

Conclusion:

It can be concluded that postoperative wound infection is very common cause of morbidity in developing countries and E. coli was the most commonly involved organism. Antibiotic susceptibility pattern found the meropenem, piprecillin in combination with tazobactam and vancomycin as highly sensitive drugs.

Keywords: postoperative wound infection, Antibiotic susceptibility pattern, E.coli

Introduction

The first line of defense against infection is provided by the skin. If there is trauma or in operative conditions, it is breached, can lead to serious infection. Although currently the protocol is to provide preoperative prophylactic dose of antibiotics and other advancement in the surgical techniques, but still the incidence rate of surgical site infection varies in between 2% to 20% (1, 2). The surgical site infection not only increases the morbidity rate but also increases the duration of hospital stay resulting in increased treatment expenses (3). In United States about 40 million people undergoes into various surgical procedures in inpatient while 31 million outpatient surgeries have been done per year and only 2% cases are reported with surgical site infection (4).

Surgical site wound infection may be acquired exogenously like during operation or post-operative duration or may acquire endogenously. Acute infections that usually appear within 5-7 days post-operatively develop serious morbidity (5). Majority of wound infections only involved the skin or sometimes underlying subcutaneous tissue but if it is left untreated or improperly treated can lead to serious complications. The patient who has developed wound infection usually present with pain at the wound site, pus discharge from the wound and continuous fever. On examination there is warm wound site along with erythema and tenderness (6). There are multiple predisposing factors leading to surgical site wound infection including older age group, malnutrition, preexisted infection, comorbidities, lack of surgical expertise, prolonged surgical duration and lack of sterilization of surgical instruments (7). Besides that, the virulence of microorganisms and the type of surgical technique are also the most important determinants of surgical site wound infection (8).

Multiple studies have been done to find out the most commonly infecting bacteria and the susceptibility pattern, as it varies geographically, the type of surgery performed, the surgeon's hand and hospital to hospital based on the status of sterilization (7). Looking over developing countries like Pakistan, the antibiotics are routinely prescribed post-operatively just to provide a prophylactic support. But this practice is increasing the resistance rate against microorganism, leaving behind a very few options to cure serious infections. Because of unnecessary prescribing medicines, there is a wide variation in the infecting organisms. Currently the gram negative bacteria is the most commonly occurring organism in wound infection leading to serious morbidity (3). This problem is becoming worse day by day because of lack of infection control protocols and over-crowd in hospitals. Therefore, it is very important to recognize infection as soon as possible and prescribing appropriate antibiotics just to avoid serious complications and decreasing the morbidity rate. Infection management always need culture and sensitivity testing so that appropriate antibiotic can be given timely. Current study aimed to find out the frequency and susceptibility pattern of microorganisms found in surgical site infection.

Material and Methods

A descriptive cross-sectional study was conducted at the surgical department of Abbasi Shaheed hospital Karachi during July 2021 to June 2022. The sample size was calculated by using OpenEpi calculator and was 580. All the patients above the age of 16 years who underwent surgery and developed postoperative wound infection were included in the study. Those patients were excluded who developed surgery related complication instead of wound infection. After preoperative surgical protocol including detailed clinical examination, laboratory findings, cardiac and anesthetic fitness the patients underwent surgery. Patients were also observed for any sign and symptom of infection. As per protocols prophylactic antibiotic dose was also given before operation and after operation as well. After performing surgery, patients were put on follow-up for assessing wound infection specifically focusing the signs and symptoms like aggravated wound pain, fever (excluding other causes) erythematous wound margins, pus or discharge from the wound.

Those patients, who developed wound infection. The sample from wound was collected and culture and sensitivity done. The sample was taken by the doctor by using swab on stick under aseptic conditions to avoid colonization. The infected organism was identified by using culture test after that slide agglutination method was used to confirm it. Kirby Bauer disc diffusion technique was used to assess antibiotic sensitivity. The sensitivity of antibiotics tested were ampicillin, amoxicillin, augmentin, ceftriaxone, cefotaxime, ceftazidime, cefixime, cefepime, cefuroxime, amikacin,

gentamycin, ciprofloxacin, ofloxacin, levofloxacin, moxifloxacin, piperacillin in combination with tazobactam, meropenem and vancomycin. All the data was noted on preformed proforma consisting of age, gender, history, comorbidities, clinical examination, diagnosis, type of surgical procedure performed, history of wound infection and culture and sensitivity findings.

The results were analyzed by using Statistical Package for Social Science version 20. Mean with standard deviation was used to present the numerical data while frequency and percentage for categorical variables.

Results

The mean age of the study participants was 29.42 ± 9.2 years. Majority of them were males (65.4%) as compared to their counterpart. Majority of cases were of inguinal hernia (27.9%) followed by appendectomy (23.8%), cholecystectomy (15.1%), benign breast swelling (8.4%), laparotomy (7.1%), thyroidectomy (6.7%), mastectomy (6.2%) and lymph node biopsy (4.8%). Among all surgeries the infection rate was 13.9%. Majority infection cases were reported in the laparotomy (36.6%) followed by appendectomy (22.5%) while very few cases (4.1%) of benign breast swelling were reported with infection as reported in Table 1. About 21.4% of patients were having comorbidities including diabetes mellitus (13.2%), hypertension (8.2%), ischemic heart disease (4.5%) and chronic obstructive pulmonary disease (3.2%).

Table 1

Type of Surgery	Number of surgeries (%)	Infection rate (%)
Appendectomy	138 (23.8)	31 (22.5)
Inguinal hernia	162 (27.9)	9 (5.5)
Laparotomy	41 (7.1)	15 (36.6)
Cholecystectomy	87 (15.1)	13 (14.9)
Mastectomy	36 (6.2)	5 (13.8)
Benign breast swelling	49 (8.4)	2 (4.1)
Thyroidectomy	39 (6.7)	3 (7.7)
Lymph node biopsy	28 (4.8)	3 (10.7)
Total	580 (100)	81 (13.9)

Looking over the wound infection, majority of cases were infected with E. coli (58.9%) after that staphylococcus aureus (14.7%) was found on second number while very few of the cases were infected with S. epidermides (2.1%) and klebsiella (3.4%) as mentioned in Figure 1. Antibiotic susceptibility pattern showed that the meropenem and piprecillin in combination with tazobactam were highly sensitive against E. coli and S. aureus with sensitivity of 97%, 94.1% and 89.2%, 75% respectively while vancomycin was highly sensitive against streptococci and S. aureus with sensitivity of 100% and 87.5% respectively. The sensitivity pattern of different antibiotics against the microorganism isolated from wound infection are shown in Table 2.

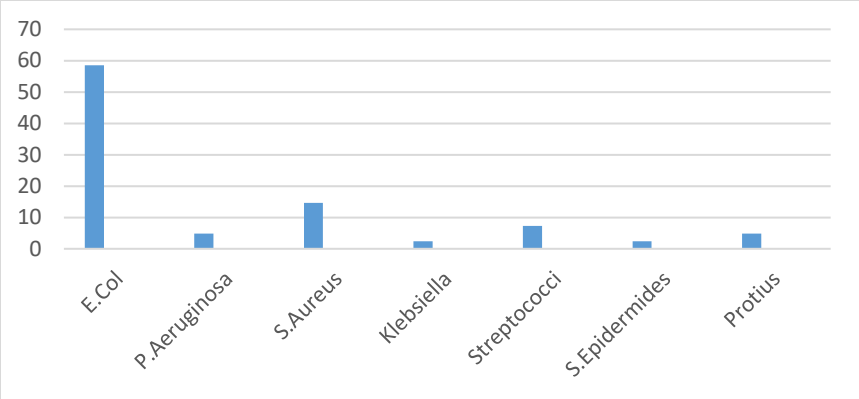

Figure 1 Frequency of microorganisms isolated from the wound infection

Table 3 Susceptibility pattern of of microorganisms isolated from the wound infection

	E.Coli	Pseudomonas	S. Aureus	Klebsiella	Streptococci	S.Epidermidis	Proteus
Ampicilin	37.1%	--	25%	--	33.3%	--	00
Amoxicillin	43.9%	--	35.5%	--	33.3%	100%	50%
Augmentin	67.7%	50%	65.2%	--	66.6%	100%	50%
Ceftriaxone	71.5%	50%	59.9%	100%	66.6%	100%	100%
Cefotaxime	76.4%	50%	50%	100%	66.6%	100%	50%
Ceftazidime	81.7%	50%	76%	100%	100%	100%	100%
Cefixime	44.3%	--	50%	--	68.6%	100%	50%
Cefipime	79.9%	50%	50%	100%	100%	100%	100%
Cefuroxime	81.6%	100%	25%	--	33.3%	100%	100%
Amikacin	89.5%	100%	13.7%	100%	33.3%	--	100%
Gentimycin	62.4%	--	--	100%	--	--	50%
Ciprofloxacin	82.8%	50%	25%	100%	65.5%	100%	50%
Oflaxacin	71.2%	--	13.5%	--	33.3%	--	50%
Levofloxacin	67.8%	--	12.5%	100%	33.3%	--	50%
Moxifloxacin	88.6%	50%	64.5%	100%	66.6%	100%	50%
Piperacilin +Tazobactam	94.1%	50%	75%	100%	100%	100%	50%
Meropenem	97.0%	100%	89.2%	100%	100%	100%	100
Vancomycin	73.2%	--	87.5%	--	100%	100%	--

Discussion

Postoperative wound infection is a very serious issue worldwide as it prolongs the hospital stay and economically burden for the patient beside facing morbidity and increased risk of mortality. Additionally, the multidrug resistance against various microorganisms increasing day by day because of irrational use of antibiotics in the developing countries which further increases the morbidity and mortality (4, 9). There are multiple factors responsible for wound infection including size of inoculum, invading capability of microorganisms, condition of tissue at the wound site and immunity of the patient (10, 11).

Current study also reported that the most common organism responsible for postoperative wound infection was E. coli (58.9%) after that staphylococcus aureus (14.7%) was on second number while very few of the cases were infected with S. epidermides (2.1%) and klebsiella (3.4%). A study conducted in India reported that E.coli was involved in

32% cases of postoperative wound infection and S. aureus in 31.5% cases (12). Zafar et.al conducted a study in Lahore and reported S. aureus as the most common organism involved in wound infection (13). Similarly, a study from Peshawar reported S. aureus in 25% of postoperative wound infection cases, followed by P. aeruginosa in 21% of cases (14).

The antibiotic susceptibility pattern in the current study showed that the meropenem and piprecillin in combination with tazobactam were highly sensitive against E. coli and S. aureus with sensitivity of 97%, 94.1% and 89.2%, 75% respectively while vancomycin was highly sensitive against streptococci and S. aureus with sensitivity of 100% and 87.5% respectively. The current results were favored by Surahio et.al who also found majority of cases were infected with E. coli and meropenem was the most effective antibiotic in cases of wound infection with E. coli (sensitivity 96.5%), S. aureus (87.5% sensitivity) while piperacillin in combination with tazobactam were also highly sensitive against E.coli S. aureus and streptococci with sensitivity pattern of 92.3%, 75% and 100% respectively (10). Power et.al in his study reported that pseudomonas aeruginosa was the most common infecting organism and is sensitive to Amoxicillin calvulinic acid, Cloxacillin, and cefuroxime with sensitivity of 94.9%, 100% and 92.3% respectively (15). Another study conducted in Nigeria found that S. aureus, E.coli, P. aeruginosa and klebsiella were the most commonly infecting organism and were sensitive to aminoglycosides and quinolones (16). In current study vancomycin was 100% sensitive against S. aureus which is supported by a study conducted in Nepal (17) but another study from Ethopia found 66.7% cases of S. aureus were resistant to vancomycin (18).

Conclusion

It can be concluded that postoperative wound infection is very common cause of morbidity in developing countries and E. coli was the most commonly involved organism. Antibiotic susceptibility pattern found the meropenem. piprecillin in combination with tazobactam and vancomycin as highly sensitive antibiotics.

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