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Original Research Article

Bacteriology and antibiotic sensitivity in gynaecological abdominal surgical site infections

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ABSTRACT

Background: Surgical site infection increases the rate of re hospitalisation, the use of health care, diagnostic, and therapeutic resources, and hospital costs. Severe sequelae may exacerbate primary and devastating infections. About 39-51% of pathogens causing surgical site infections were documented to be resistant to standard prophylactic antibiotics. This study aimed to calculate surgical site infection rate at our hospital. To identify the isolates causing surgical site infections and study anti-microbial susceptibility pattern of isolated organisms.

Methods: This observational study was done among patients who underwent abdominal gynaecological surgeries and who developed surgical site infection in department of obstetrics and gynaecology in Maharajahs institute of medical sciences during May 2022 to April 2024.

Results: Surgical site infection rate at our hospital is 18.29%, there are 30 surgical site infections, 76.7% cases are culture positive, 23.3% cases are sterile, 52.2% cases are gram negative, 47.8% are gram positive. Most common organism isolated is *E. coli* (39%) followed by *Staphylococcus aureus* (26%), *enterococcus* (21.7%), *Pseudomonas* (8.6%), *Klebsiella* (4.3%). Antibiotic susceptibility pattern shows maximum overall sensitivity of organisms to amikacin (65.4%) followed by gentamicin (56%), piperacillin tazobactam (52.17%), amoxycylav (47.8%) followed by rest of drugs.

Conclusions: Practice of routine culture and sensitivity of surgical site infections can prevent grave complications, limit cost of treatment, prevent fast emerging antimicrobial resistance. In our study, complications are limited to need for secondary suturing. The most susceptible drug in our study is amikacin, thus, it can be incorporated as a part of empirical treatment in patients with surgical site infection before the culture sensitivity report is obtained.

Keywords: Amikacin, *E. coli*, Surgical site infection

INTRODUCTION

Surgical site infection is defined as infection related to an operative procedure that occurs at /near surgical incision within 30days of the procedure.¹

The problem gets more complicated in developing countries due to poor infection control, overcrowded hospitals and inappropriate use of antimicrobials.²

Globally surgical site infection rates have been reported from 2.5% to 41.9%.¹

The surgical site infection rate in most gynaecological surgeries is less than 5%; reflective of clean nature of most gynaecological operations.³ The incidence of surgical site infection varies from hospital to hospital and also in different studies that have been reported time to time.⁴

Organisations have developed several accountability measures including timing and selection of prophylactic antibiotics, preoperative glucose control and appropriate hair removal, despite these wound infections are apparent.⁵

There is no doubt that use of appropriate prophylactic antibiotic preoperatively is the best way to prevent infection. The antibiotic should be effective against the relevant bacteria according to site of operative field. Thus conducting regular and high quality SSI surveillance is crucial in the preparation of hospital antibiotic policy.

This study aimed to calculate the incidence surgical site infection at our hospital, to identify the isolates causing surgical site infections and to study anti-microbial susceptibility pattern of isolated organisms.

METHODS

This prospective observational study was conducted at Maharajah's Institute Medical Sciences, Vizianagaram, Andhra Pradesh, India. Patients who underwent gynaecological abdominal surgeries were included. This study conducted for 2 years from April 2022 to March 2024.

Inclusion criteria

Swabs of postoperative patients from surgical site developing infection within 30 days after surgery and patients able to provide consent were included.

Sample size

The convenient sampling method were used for sample size calculation.

Sampling technique

Every consecutive patient who developed surgical site infection satisfying the inclusion criteria.

Sample collection method

The wound swabs from all the cases of SSI were routinely collected aseptically and sent to microbiology department. The samples in laboratory were processed for direct microscopy for culture and sensitivity as per standard guidelines (clinical laboratory standard institute). The samples are inoculated in blood agar, Mac Con-Key agar and brain heart infusion broth in one set of slides initially at 37 degree for 18-24hrs for aerobic culture and another set anaerobic culture. If culture is negative, sub culture is taken from brain heart infusion agar and after 24 hrs if growth is present, final culture report is positive and if growth is negative final culture report is sterile. Antibiotic susceptibility testing is done by modified Kirby Bauer disc diffusion method, drugs studied for each organism are specific for each organism and done as per CLSI guidelines. Zone of clearance of 13 mm diameter is

considered as sensitive for most of drugs. Statistical analysis was done using SPSS version 22, p value <0.05 is taken as significant.

RESULTS

The surgical site infection rate in gynaecological abdominal surgeries (164 surgeries over 2 years) at our centre found to be 18.29%. The mean age of patients with SSI 42.83 years (range 22-69years).

Out of 30 samples sent for culture sensitivity to the microbiology department, 23 samples are culture positive and 7 samples are sterile (Figure 1).

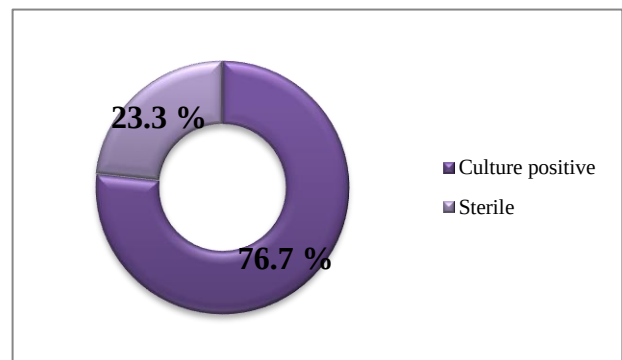


Figure 1: Distribution of culture positive and sterile samples.

Among the 23 culture positive samples yielded, 12 are gram negative and 11 are gram-positive (Figure 2).

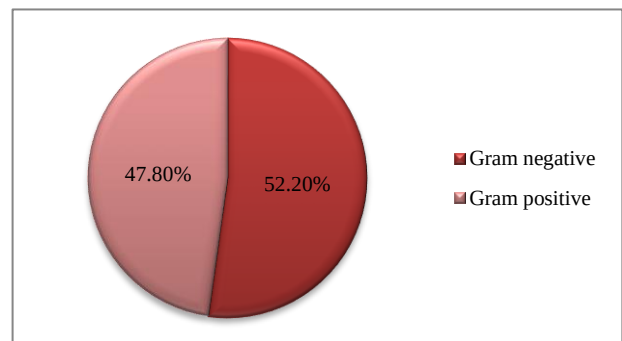


Figure 2: Isolated microbes.

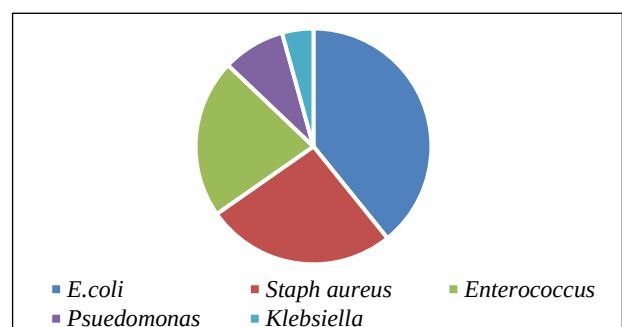


Figure 3: Bacteriological profile of infected sample.

Overall 5 organisms are isolated from 23 culture positive samples (Figure 3).

In our study, antibiotic susceptibility pattern shows maximum overall sensitivity of organisms to amikacin followed by gentamicin, piperacillin tazobactam, amoxycylav followed by rest of drugs (Table 1).

The secondary outcome in our study is regarding antibiotic course. There is no significant difference in surgical site

infection rate in patients given prolonged antibiotic course and short antibiotic course (Table 2).

Table 1: Age distribution.

Age (in years)	Frequency
20-35	2
36-50	23
>50	5

Table 2: Antibiotic susceptibility pattern.

Drugs	<i>S. aureus</i> (6) (%)	<i>Enterococcus</i> (5) (%)	<i>E. coli</i> (9) (%)	<i>Klebsiella</i> (1) (%)	<i>Pseudomonas</i> (2) (%)	Overall sensitivity (%)
Amikacin	6 (100)	1 (20)	5 (55.5)	1 (100)	2 (100)	15 (65.4)
Gentamycin	4 (66)	0 (0)	8 (88.8)	1 (100)	0 (0)	13 (56.6)
Piperacillin+tazobactam	0 (0)	0 (0)	9 (100)	1 (100)	2 (100)	12 (52.6)
Amoxycylav	6 (100)	2 (40)	3 (33.3)	0 (0)	0 (0)	11 (47.8)
Vancomycin	6 (100)	3 (60)	0 (0)	0 (0)	0 (0)	9 (39.1)
Ciprofloxacin	4 (66)	1 (20)	3 (33.3)	0 (0)	1 (50)	8 (34.7)
Imipinem	0 (0)	0 (0)	6 (66.6)	1 (100)	1 (50)	8 (34.7)
Linezolid	4 (66.6)	4 (80)	0 (0)	0 (0)	0 (0)	8 (34.7)
Ampicillin sulbactam	0 (0)	3 (50)	3 (33.3)	0 (0)	0 (0)	6 (26)
Teicoplanin	4 (66.6)	2 (40)	0 (0)	0 (0)	0 (0)	6 (26)
Tetracyclin	1 (16.6)	3 (60)	1 (11.1)	0 (0)	0 (0)	5 (21.7)
Cefipime tazobactam	0 (0)	0 (0)	3 (33.3)	0 (0)	2 (100)	5 (21.7)
Polymyxin B	0 (0)	0 (0)	3 (33.3)	0 (0)	1 (50)	4 (17.39)
Levofloxacin	1 (16.6)	2 (40)	1 (11.1)	0 (0)	0 (0)	4 (17.39)
Ceftriaxone	2 (33.3)	1 (20)	0 (0)	1 (100)	0 (0)	4 (17.39)
Tigecyclin	1 (16.6)	3 (60)	0 (0)	0 (0)	0 (0)	4 (17.39)
Doxycycline	1 (16.6)	6 (66.6)	0 (0)	0 (0)	0 (0)	4 (17.39)
Clindamycin	2 (33.3)	2 (40)	0 (0)	0 (0)	0 (0)	4 (17.39)
Cefoxitin	3 (50)	0 (0)	0 (0)	0 (0)	0 (0)	3 (13)
Meropenem	0 (0)	0 (0)	1 (11.1)	0 (0)	2 (100)	3 (13)
Colistin	0 (0)	0 (0)	2 (22.2)	0 (0)	1 (50)	3 (13)
Ofloxacin	0 (0)	3 (60)	0 (0)	0 (0)	0 (0)	3 (13)
Cefotaxime	1 (16.6)	0 (0)	1 (11.1)	1 (100)	0 (0)	3 (13)
Ceftazidime	0 (0)	0 (0)	1 (11.1)	1 (100)	0 (0)	2 (8.69)
Levofloxacin	1 (16.6)	0 (0)	1 (11.1)	0 (0)	0 (0)	2 (8.69)
Cefuroxime	2 (33.3)	0 (0)	0 (0)	0 (0)	0 (0)	2 (8.69)
Moxifloxacin	2 (33.3)	0 (0)	0 (0)	0 (0)	0 (0)	2 (8.69)
Fosfomycin	0 (0)	0 (0)	2 (22.2)	0 (0)	0 (0)	2 (8.69)
Cefpirome	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)	1 (4.34)
Cefpodaxime	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (4.34)

Table 3: Comparison of prolonged antibiotic course and short antibiotic course in surgical site infections.

	Prolonged antibiotic course (%)	Short antibiotic course (%)	Chi square	P value
Wounds with culture positive report	14 (82.3)	9 (69.2)	0.7091	0.3997
Wounds with sterile report	3 (17.6)	4 (30.3)		

DISCUSSION

In the present study 30 postoperative wound infection patients were isolated from where wound swabs were taken to evaluate the bacteriological profile and antibiotic susceptibility pattern.

The surgical site infection rate (SSI) in the current study is 18.29%, which is in contrast to other studies which reported SSI rate of 10.5% according to Nephade et al study and SSI rate of 7% in major abdominal surgeries according to Paremawaran et al study.^{6,7} The study by Islam et al was relatively in concordance with SSI rate of 13%.⁸ Panda et al study has SSI rate of 12%.⁹

In this study out of the total samples, 76.7% samples are culture positive and 23.3% samples are culture negative that is sterile without any growth. This is ascertained by Mallik et al study with 84.2% culture positive samples and 15.8% sterile samples.¹⁰ This also correlates with study by Fiaz et al with 70.2% culture positive samples and 29.8% sterile samples.⁵

In the present study, 47.8 % samples yielded gram positive cocci and 52.2% samples yielded gram negative cocci which is correlated with Malakar et al study with gram positive microbe yield of 45% and gram negative microbe yield of 55%.¹⁰

In our study, predominant microbe in the bacteriological profile of infected samples is *E. coli* (39.1%) followed by *S. aureus* (26%), *Enterococcus* (21.7%), *Pseudomonas* (8.6%), *Klebsiella* (4.3%). Study by Fiaz et al study shows similarity in accordance with the predominant microbe which is *E. coli*.⁵ Whereas studies by Malakar et al and Mallik et al are in contrast to our current study, with predominant microbe being *S. aureus*.^{9,11}

In our study, antibiotic susceptibility pattern shows maximum overall sensitivity of organisms to amikacin followed by gentamicin, piperacillin tazobactam, amoxycylav followed by rest of drugs. Overall sensitivity to amikacin was 65.4%. Out of which *S. aureus*, *Klebsiella* and *Pseudomonas* shows 100% sensitivity, *E. coli* shows 55% sensitivity and *Enterococci* shows 20% sensitivity. Overall sensitivity to gentamicin is 56.65%, out of which, *Klebsiella* shows 100% sensitivity, *E. coli* shows 88.8% sensitivity, *S. aureus* shows 66% sensitivity, *Enterococcus* and *Pseudomonas* has 0% sensitivity. Overall sensitivity to piperacillin tazobactam is 52.17%, out of which *E. coli*, *Klebsiella*, *Pseudomonas* shows 100% sensitivity, *S. aureus* and *Enterococcus* has 0% sensitivity. Overall sensitivity to amoxycylav is 47.8%, out of which *S. aureus* shows 100% sensitivity, *Enterococcus* shows 40% sensitivity, *E. coli* shows 33.3%, *Klebsiella* and *Pseudomonas* shows 0% sensitivity. Rest of the drugs showed overall sensitivity of 39% and below ceftriaxone which is a part of antibiotic prophylaxis followed at our institute came to be sensitive in 17.39% (4/23) of culture positive samples. The most susceptible drug in our study

is amikacin, thus can be included as a part of empirical treatment in patients with surgical site infection before the culture sensitivity report is obtained.

Study by Fiaz et al shows overall maximum antibiotic sensitivity to imepenem followed by cefoperazone, vancomycin, amikacin, ciprofloxacin.⁵ Another study by Malakar et al shows overall maximum antibiotic sensitivity to amoxycylav+clavulinic acid followed by amikacin, cefoperazone+sulbactam, piperacillin tazobactam, imipenem. The above studies have contrasting antibiotic susceptibility pattern compared to our study.¹¹

Our secondary outcome shows that there is no significant difference between surgical site infection rates with long course antibiotic and short course antibiotic that means there is no added benefit with prolonged antibiotic therapy.

This study has few limitations. Minimal inhibitory concentration of drugs is not tested, thus infections attributed to inappropriate dosage administration cannot be analyzed further. Sample size is small.

CONCLUSION

Surgical site infection is a nightmare to every surgeon and meticulous operative technique, maintenance of proper asepsis, decontamination of operation theatres and timely administration of appropriate preoperative antibiotics are necessary to prevent this. But when it cannot be prevented, it must be treated effectively and for that we need to start the appropriate and most effective antibiotic. The Surgical site infection rate in our study is 18.29%. The most common microbe isolated in the current study was *E. coli*. Amikacin has overall maximum antibiotic susceptibility in surgical site infection at our institute. The short course antibiotic therapy or prophylactic antibiotic course should be followed rather than long course antibiotic therapy as there is tangible gain in monetary terms and manpower of health care and intangible gain in prevention fast emerging antibiotic resistance. This study helped us to get an insight into local microbial aetiology in gynaecological surgeries as well as their susceptibility pattern to antibiotics.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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