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Original Research Article.

Post-Operative Surgical Site Infection Following Open and Laparoscopic Surgery at Tertiary Care Hospitals in Dhaka City

Sk. Shehab Hasan[1*], KM Shahidul Islam[2], Rafia Afreen Jalil[3]

[1]MBBS, MD (Microbiology), Junior Consultant, Department of Microbiology & Clinical Pathology, National Heart Foundation Hospital & Research Institute, Dhaka, Bangladesh.
[2]MBBS, MPhil, FCPS, Professor & Ex Head, Department of Microbiology, BIRDEM General Hospital, Dhaka, Bangladesh.
[3]MBBS, MD (Microbiology), Assistant Professor, Department of Microbiology, Green Life Medical College, Dhaka, Bangladesh.

ABSTRACT

Background: Surgical site infection (SSI) is a worldwide problem that has far reaching implications on patient morbidity and mortality as well as significant financial implications. SSIs are the second most common nosocomial (hospital-acquired) infection after urinary tract infection even with modern facilities, standard protocols of preoperative preparation and antibiotic prophylaxis. Increasing antibiotic resistance of pathogens associated with SSI also becomes a major therapeutic challenge for the physicians.

Methods: A cross sectional hospital based observational study was conducted in the department of Microbiology, BIRDEM General Hospital from period of September, 2018 to August, 2019. A total of 187 study participants clinically suspected as a case of SSI were investigated during the study period from two tertiary care hospitals of Dhaka city. Out of 187, 84 samples were collected from patients of laparoscopic surgery and 103 samples from open surgery. Among 103 samples from open surgery 50 were collected from general surgery ward and 53 from obstetrics & gynecology ward. Samples were collected using sterile cotton swabs from clinically diagnosed patients having SSIs and were processed as per standard microbiological techniques. Antimicrobial susceptibility testing was done using modified Kirby-Bauer disc diffusion method.

Results: Among different surgical specialties, 82.1% culture positive cases were found from laparoscopic surgery, 82% & 73.5% from general surgery and obstetrical-gynecological surgery respectively. In BIRDEM General Hospital 81.7% (103/126) isolates were gram negative and 18.3% (23/126) were gram positive bacteria. In DMCH 85.6% (113/132) were gram negative and 14.3% (19/132) were gram positive bacteria. *Acinetobacter baumannii* and *E.coli* were the predominant gram negative and *Staphylococcus aureas* was the predominant gram positive bacteria among the total isolates. Among the gram-negative isolates in this study, *Acinetobacter baumannii and Citrobacter* sp. showed higher resistance (96.1%-100%) to 3rd generation cephalosporine. Isolated *Acinetobacter baumannii* were highly resistant to all antimicrobials except colistin.

Conclusion: Higher rate of culture positivity among clinically suspected cases of SSI was observed in two tertiary care hospitals in Dhaka city. Similar pattern of pathogens was observed causing SSI in both laparoscopic and open surgery. The antimicrobial resistance pattern of isolated bacteria to different antibiotics was almost similar in two hospitals.

Key words: Microbial Aetiology, Phenotypic, Genotypic, Acinetobacter.

***Correspondence to:**

Dr. Sk. Shehab Hasan, MBBS, MD (Microbiology),
Junior Consultant,
Department of Microbiology & Clinical Pathology,
National Heart Foundation Hospital & Research Institute,
Dhaka, Bangladesh.

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INTRODUCTION

Surgical site infection (SSI) are the second most common nosocomial (hospital-acquired) infection after urinary tract infection even with modern facilities, standard protocols of preoperative preparation and antibiotic prophylaxis.[1] Despite considerable research on best practices and strides in refining surgical techniques, technological advances and environmental improvements in the operating room and the use of prophylactic preoperative antibiotics, infection at the surgical site remains the common adverse event occurring to hospitalized patients and a major source of morbidity following surgical procedures.[2,3]

SSI may vary from hospital to hospital in different countries or within same country. It was estimated that 234 million major surgical procedures were performed annually worldwide.[4] It has been reported that the incidence of SSI rates ranged from 2.5% to 41.9% all over the world.[5] The prevalence of hospital acquired infection is high in both developed and developing countries with attendant morbidity and mortality.[6,7] In one study it was reported that the most frequently isolated bacteria from surgical wound infections were *Staphylococcus aureus*, coagulase negative *Staphylococcus* (CONS), *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Proteus species*.[8] Laparoscopic port site infections are of two broad varieties based on the timing of presentation. The more common type manifests early within a week or so following the surgical procedure with pain or tenderness, wound discharge and erythema around the port site. They are usually caused by Gram positive or Gram-negative bacteria and respond well to the common antimicrobial agents. Other variety- the delayed type is chronic in nature, commonly caused by atypical Mycobacteria and manifests nearly a month or so after the surgery in the form of nodules, abscess or persistent discharging sinus at the port site.[9] The symptoms of a surgical site infection typically appear 3-7 days later after the procedure. The common clinical features of surgical site infection include spreading erythema, localized pain, pus /discharge from the wound, wound dehiscence, unexplained persistent pyrexia.[10]

OBJECTIVES

General objectives: Bacteriological evaluation of surgical site infection in Surgery & Obstetrics- Gynecology unit of BIRDEM General Hospital and Dhaka Medical College Hospital.

Specific objectives

1. Isolate and identify bacteria causing surgical site infection.
2. Explore antimicrobial resistance pattern of isolated bacteria.

METHODOLOGY

Type of Study: Cross sectional hospital based observational.

Place of Study: Department of Microbiology, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka.

Study Period: 01-year September 2018 to August 2019.

Study Population: Clinically suspected surgical site infection patients with one or more of the following features of infection were included in this study.

Sampling Technique: Purposive

Inclusion Criteria

- All patients who developed
  1. Spreading erythema
  2. Localised pain (This is often different to the typical post-operative pain)
  3. Pus/ discharge from the wound
  4. Wound dehiscence
  5. Unexplained persistent pyrexia.
- Wound deliberately opened by the surgeon for drainage.

The study cases were selected by the surgeon and gynecologist working in the Department of Surgery, Obstetrics and Gynecology.

Exclusion Criteria: Not giving consent to participate in the study.

Data Collection: Detailed history was obtained from the patient or the attendant and a structured questionnaire was filled up for each patient. Data regarding blood glucose (fasting and 2 hours after breakfast) level were collected from the hospital document.

Sample Collection: Wound swab samples were collected from 187 suspected post-surgical infected cases that fulfilled the inclusion criteria. Ninety-four wound swab samples were taken from BIRDEM of which 44 swabs were taken from laparoscopic port site and 50 swabs were taken from open surgical wound site. Ninety-three wound swab samples were collected from DMCH of which 40 swabs were taken from laparoscopic port site and 53 swabs were taken from open surgical wound site. Samples were collected aseptically by sterile swab stick avoiding contamination from external sources. Swabs were collected using two sterile cotton tipped swab sticks one for culture and other for microscopy from clinically deep area of wound site prior to any dressing.

RESULTS

Table 1 shows the frequency of cases with surgical site infection in different types of surgery from 2 tertiary care hospitals. Out of total 187 cases 94 (50.3%) wound swab samples were taken from BIRDEM General Hospital, of which 44 (52.4%) swabs were taken from laparoscopic port site, 22 (44%) swabs were taken from open general surgical wound site and 28 (52.8%) swabs were taken from wound infection of patient undergone obstetrical & gynecological surgery.

Table 2 shows rate of culture positive surgical site infection among clinically suspected patients in two tertiary care hospitals. Out of 187 cases of SSI, 149 (79.6%) were culture positive. Among different surgical specialties, 82.1% culture positive cases were isolated from laparoscopic surgery followed by 82% from open general surgery and 73.5% from obstetrical & gynecological surgery.

Table 3 shows, frequency of bacterial isolates in culture from study samples. Highest microbial infections were done by single organism 36.4% (68/187) followed by double and multiple organism which were 29.9% (56/187) and 13.4% (25/187) respectively. No growth was observed in 38 (20.3%) cases.

Table 1: Frequency of cases with surgical site infection at two tertiary care hospitals

Types of surgery	BIRDEM	DMCH
Laparoscopic surgery (n = 84)	44 (52.4)	40 (47.6)
Open Surgery		
General Surgery (n = 50)	22 (44.0)	28 (56.0)
Obstetrical & Gynecological Surgery (n = 53)	28 (52.8)	25 (47.2)
Total (N= 187)	**94 (50.27)**	**93 (49.73)**

No. = Number; N = Total no of cases

Table 2: Rate of culture positive surgical site infection among clinically suspected patients in two tertiary care hospitals studied

Types Case	Culture positive case No. (%)
Laparoscopic surgery (n = 84)	69 (82.1)
Open Surgery	
General Surgery (n = 50)	41 (82)
Obstetrical & Gynecological Surgery (n = 53)	39 (73.5)
Total (N= 187)	**149 (79.6)**

Table 3: Frequency of bacterial isolates in culture from study samples

Culture yielded	Number of cases No. (%)	Isolates No. (%)
Single organism	68 (36.4)	68 (26.4)
Double organism	56 (29.9)	112 (43.4)
Multiple organism	25 (13.4)	78 (30.2)
No growth	38 (20.3)	-
Total	**187 (100)**	**258 (100)**

No. = Number

Table 4: Pattern of isolated organisms from post- operative wound infection in BIRDEM General Hospital and Dhaka Medical College Hospital

Isolated Bacteria	BIRDEM No. (%)	DMCH No. (%)	Total
Gram Negative:			
Acinetobacter baumannii	25 (19.8)	27 (20.4)	52 (20.2)
Pseudomonas sp.	23 (18.3)	25 (18.9)	48 (18.6)
Klebsiella sp.	23 (18.3)	21 (15.9)	44 (17.0)
E. coli	25 (19.8)	27(20.4)	52(20.2)
Citrobacter sp.	2 (1.6)	0	2 (0.7)
Proteus sp.	5 (3.9)	7 (5.3)	12 (4.6)
Enterobactor sp.	0	6 (4.5)	6 (2.3)
Gram Positive:			
Staph. aureus	20 (15.9)	14 (10.6)	34 (13.2)
Enterococcus sp.	3 (2.4)	5 (3.7)	8 (3.2)
Total	**126 (100)**	**132 (100)**	**258 (100)**

No. = Number

Table 5: Antimicrobial resistance pattern of Enterobacteriaceae

Antimicrobial drugs	E. coli (N=52)	Klebsiella sp. (N=44)	Proteus sp. (N=12)	Enterobacter (N=6)	Citrobacter sp. (N=2)
No. (%) resistance					
Carbapenem					
Imipenem	1 (1.9)	03 (6.8)	0	0	0
Cephalosporine					
Ceftriaxone	38 (73)	40 (90.9)	09 (75)	04 (66.6)	02 (100)
Ceftazidime	38 (73)	40 (90.9)	09 (75)	04 (66.6)	02(100)
Cefixime	38 (73)	40 (90.9)	09 (75)	04 (66.6)	02 (100)
Cefotaxime	38 (73)	40 (90.9)	09 (75)	04 (66.6)	02 (100)
Beta- lactamase inhibitor combination					
Co-amoxiclav	38 (73)	40 (90.9)	09 (75)	06 (100)	02 (100)
Pipercillin + Tazobactam	0	03 (6.8)	0	0	0
Monobactam					
Aztreonam	38 (73)	40 (90.9)	09 (75)	04 (66.6)	02 (100)
Fluroquinolone					
Ciprofloxacin	40 (76.9)	40 (90.9)	03 (25)	0	02 (100)
Folate pathway inhibitor					
Cotrimoxazole	42(80.7)	35 (79.5)	09 (75)	0	02 (100)
Aminoglycosides					
Amikacin	17 (32.6)	39 (89)	07 (58.3)	0	02 (100)
Netilimicin	17 (32.6)	40 (90.9)	09 (75)	0	02 (100)
Gentamicin	16 (30.6)	38 (86.4)	09 (75)	0	02 (100)
Colistin	0	0	12 (100)	0	0

Pattern of isolated organisms from post- operative wound infection in two different hospitals of Dhaka city is shown in table 4. From total 258 isolated organisms, 126 (48.9%) and 132 (51.1%) strains were isolated from BIRDEM General Hospital and Dhaka Medical College Hospital respectively. In BIRDEM, out of 126 isolates, 25 *Acinetobacter baumannii* (19.8%), 25 *E.coli* (19.8%), 23 *Pseudomonas* sp. (18.3%), 23 *Klebsiella* sp. (18.3%), 5 *Proteus* sp. (3.9%), 2 *Citrobacter* sp. (1.5%), 20 *Staph. aureus* (15.9%) and 3 *Enterococcus* sp. (2.4%) were isolated. In DMCH out of 132 isolates 27 *Acinetobacter baumannii* (20.4%), 27 (20.8%) *E.coli*, 25 *Pseudomonas* sp. (18.9%), 21 *Klebsiella* sp. (15.9%), 7 *Proteus* sp. (5.3%), 6 *Enterobactor* sp. (4.5%), 14 *Staph. aureus* (10.6%) and 5 *Enterococcus* sp. (3.7%) were isolated.

Antibiotic resistance pattern of isolated Enterobacteriaceae is shown in Table 5. Resistant pattern of *Klebsiella* sp. *and Citrobacter* sp. to third generation cephalosporine, co-amoxiclav, aztreonam and ciprofloxacin were in a range of 90%-100%. Aminoglycosides and co-trimoxazole resistance were in a range of 79%-100%. Resistance pattern of *E. coli to* third generation cephalosporine, aztreonam and co- amoxyclav were 73%. The isolated organism showed less resistance to Imipenem (0%-6.8%). *Proteus* sp. was 100% resistant to colistin.

DISCUSSION

Surgical site infection (SSI) remains a common and widespread problem that contributes to significant morbidity, mortality, prolongs hospital stay and consequently increasing health care cost.[16] These infections are usually caused by exogenous and/ or endogenous microorganisms that enter the operative wound either during the surgery (primary infection) or after the surgery (secondary infection).[17]

Ninety-four (50.3%) wound swab samples were taken from BIRDEM General Hospital, of which 44 (52.4%) swabs were taken from laparoscopic port site, 22 (44%) swabs were taken from open general surgical wound site and 28 (52.8%) swabs were taken from wound infection of patient undergone obstetrical & gynecological surgery. Among 93 (49.7%) wound swab samples taken from Dhaka Medical college Hospital, 40 (47.6%) samples were taken from laparoscopic port site, 28 (56%) samples were taken from open surgical wound site and 25 (47.2%) swabs were taken from patient undergone obstetrics-gynecological surgery.

In this study, 79.6% cases (149/187) were culture positive. This finding was in agreement with the studies by Begum et al. (2015.[18] The high rate of SSI observed in this study can be explained by poor practice of infection control protocol, mainly overcrowded environment in the post-operative room of the hospitals.

In the present study 68 (36.4%) had single bacterial growth and 56 (29.9%) had dual bacterial growth, whereas 25 (13.4%) case yielded more than two organisms. Almost similar higher proportions of mono isolate (50%) followed by double isolates (33%) were also reported in Tanzania.[19] In this study Gram negative bacteria were more prevalent than gram positive bacteria. Out of 258 strains, 216 (83.7%) were gram negative and 42 (16.3%) were gram positive bacteria. Gram negative bacilli (60.74%) dominated but higher prevalence of gram positive cocci (39.26%) was reported in a study by Kaur in 2017 from India.[20] A review article described that hands of health care workers and patients can play a role in transfer of gram negative bacteria to surgical sites.[21] Another possible explanation of the predominance of gram negative bacteria is that asymptomatic colonization of patients, the contaminated environment, or both can serve as reservoirs for these pathogens, which are then transmitted by the hands of health care workers.[22]

CONCLUSIONS

Most of the clinically suspected cases of SSI in laparoscopic surgery, general surgery and obstetrical-gynecological surgery are culture positive and almost similar (82.1%, 82% & 73.5%). Gram negative are the predominant bacteria causing SSI in all the specialties of surgery in both the hospitals. In laparoscopic surgery the rate of isolation of *Pseudomonas* sp. is highest (27.8%) and in open surgery the rate of isolation of *Klebsiella* sp. is highest (18.7%). However, *A. baumannii* & *E. coli* are the predominant gram negative and *Staph. aureus* is the predominant gram-positive bacteria among the total isolates in two hospitals. The rate of culture positive SSI among the clinically suspected cases is more in diabetic than non-diabetic patients. Most of the isolates of this study are multidrug resistant. The information obtained from this study will be helpful in understanding SSI in terms of aetiological agents, their antimicrobial resistance pattern.

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