Isolation of Aerobic Bacteria from Surgical Site Infection and their Antibiotic Susceptibility Pattern

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Abstract

Background: Surgical site infection is one of the commonest complications after surgical intervention. Source of wound infections may be exogenous or endogenous. Wound swabs culture is the most frequently used method for confirming the diagnosis of surgical site infection. A regular bacteriological review is necessary to identify the causative agents and their antibiotic susceptibility pattern. **Objective:** The purpose of the present study was to find out the aerobic bacteria from wound swabs culture and their antibiotic susceptibility pattern. **Methodology:** A total of 175 wound swabs sample were collected aseptically from surgical site infection during the study period. Standard bacteriological methods were used for isolation and identification of organisms and their susceptibility pattern. **Results:** A total of 175 wound swab samples were collected from surgery departments. Out of 175 samples 102 (58.28%) were positive by culture. Among the isolated organisms the gram negative bacilli were predominant 67 (65.68%) than the gram positive cocci 35 (34.32%).The most common isolated bacteria were *Escherichia.coli* 30(29.41%) followed by *Staphylococcus aureus* 28 (27.45%) *Pseudomonous areuginosa* 20(29.85%), *Acinetobacter spp* 08(11.94%), Coaggulase negative *Staphylococcus* (CONS) 07(6.86%) *Klebsiella pneumoniae* 05(4.90%), *Proteus spp* 03(4.45%), and *Citobacter spp* 01(1.49%). Among the total 175 samples 114(65.14%) were collected from male patients and 61(34.86%) were from female patients. All the isolated gram negative bacilli showed resistant to all antibiotics and all isolated gram positive cocci were resistant to all antibiotics except Linezolid. Among the isolated *Staphylococcus aureus* 8 (24.85%) were MRSA and one (3.57%) were VRSA. The most effective antibiotics were Amikacin, Meropenem, Imipenem and Tazobactam in this study. **Conclusion:** Surgical site infections remain the commonest post operative complications after surgery and one of the commonest encountered hospital acquired infections. Therefore, periodic review needs be done to find out the causative agents and their antibiotic susceptibility pattern for better treatment and management. [Bangladesh Journal of Infectious Disease 2015;2(2):28-32]

Keywords: Wound swab; Aerobic bacteria; Antibiotic susceptibility pattern; Surgical Site Infections

Introduction

Surgical site infections are global problem in the field of surgery associated with long hospital stay, higher treatment expenditure and increase the morbidity and mortality rate[1]. Surgical site infections (SSIs) are defined as an infection that occurs within 30 days after surgery[2]. SSIs are the second most commonly encounter type of nosocomial infection in United States[3]. The centers for diseases control and prevention (CDC) that SSIs are associated with a mortality rate 3.0%[4]. Surgical site infection risk depends upon a number of patients factors including pre existing medical conditions, amount and type of resistant skin bacteria, preoperative, intra operative and post-operative care[5].

Wound infections are caused by deposition and multiplication of microorganisms in the surgical site of a susceptible host. In fact most infection of post operative wound are hospital acquired and varies from one hospital to others[6-8]. Lack of standardized criteria for diagnosis of SSIs present a challenge to monitor the global epidemiology of surgical site infection[1]. In addition to this, emerging of high antimicrobial resistance among bacterial pathogens has made the management and treatment of post-operative wound infection difficult[6]. Moreover, rapidly emerging nosocomial pathogens and the problem of multidrug resistance necessitates periodic review of isolation pattern and their sensitivity[9]. Many studies in different part of the world found 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[10-11].

Study in India and Bangladesh showed that the most frequently isolated bacteria were *Escherishia coli, Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, Proteus* species, *Acinetobacter* species and *Citrobacter* species[12-13]. This study was carried out to determine and distribution of common aerobic bacteria and their antimicrobial susceptibility patterns in patients with clinical diagnosis of post operative wound infection.

Methodology

This cross sectional study was conducted in a private hospital in Dhaka City named Green Life Hospital from January 2014 to May 2015 for a period of one and half year. Green Life Hospital is a private hospital in Dhaka city which has 300 bed capacities. Samples were collected from all age group who undergo surgery and developed SSIs as diagnosed clinically by physicians within 30 days after surgery. Wound swabs were collected under all aseptic precaution and were kept in a sterile test tube and then were sent to the microbiology laboratory immediately. All the specimens were inoculated in 5% Blood agar, Chocolate agar and MacConkey's agar media. All plates were incubated overnight aerobically at 37^0C for 24 hours. The bacterial pathogens were identified by colony morphology, Gram staining, biochemical tests according to standard microbiological technique. Antimicrobial susceptibility was performed on Mueller-Hinton agar media by standard disc diffusion method recommended by National Committee for clinical laboratory Standard (NCCLS). The antibiotics were tested for gram positive and gram negative bacteria by Kirby Bauer method. Data analysis was carried out by using SPSS.

Result

A total of 175 wound swabs were collected under all aseptic precaution. Out of a total 175 samples, 102(58.28%) were positive by culture.

Table 1: Sex Distribution among the Study Population (n=175)

Sex	Frequency	Percentage
Male	114	65.14
Female	61	34.86
Total	**175**	**100.0**

A total 102 strains were isolated, out of which 67(65.68%) were Gram negative bacilli and 35(34.32%) were Gram positive cocci. Among the total 175 samples 114(65.14%) were collected from male patients and 61(34.85%) were collected from female patients (Table 1).

Table 2: Age Distribution among the Study Population (n=175)

Age group	Frequency	Percentage
0-15	21	12.0
15-40	63	36.0
40-60	64	36.5
>60	27	15.4
Total	**175**	**100.0**

Overall infection rate was highest in the age range 15 to 60 years and lowest in the age range 0 to 15 years (Table 2).

Table 3: Distribution of Organism Isolated from Post-Surgical Wound Infection (n=102)

Bacteria	Frequency	Percentage
Staph. aureus	28	27.4
• MRSA	08	
Stap epidermidis	07	6.86
Escherichia coli	30	29.41
P. aeroginosa	20	19.60
Acinetobacter spp	08	7.83
Kleb. pneumonia	05	4.90
Proteus spp	03	2.93
Citobacter spp	01	0.97
Total	**102**	**100.0**

Among the Gram negative bacilli the most common bacilli were *Escherichia coli* which was 30(44.77%) isolates followed by *Pseudomonas aeruginosa*, *Acinetobacter* species, *Klebsiella pneumoniae*, *Proteus* species and *Citrobacter* species 20(29.85%) isolates, 8(11.94%) isolates, 5(4.90%) isolates, 3(4.45%) isolates and 1(1.49%) isolates respectively. Out of 35(34.32%) isolated Gram positive cocci the commonest were *Staphylococcus aureus* which was 28(80.0%) isolates followed by coagulase negative *Staphylococcus* (CONS) which was 7(20%) isolates (Table 3). Samples were collected from orthopedic surgery in 44(25.14%) cases , vascular surgery in 43(24.57%) cases, general surgery in 42(24%) cases, thoracic surgery in 23(13.14%) cases, neurosurgery in 11 (6.28%) cases, Gynaecology & Obstetrics in 5(2.85%) cases, ENT in 4(2.28%) cases and 3(1.17%) from paediatric surgery.

Table 4: Antibiotic Resistance Pattern of Gram Negative Bacteria (n=67)

Antibiotic	*E. coli* (n=30)	*Pseudomonas spp* (n=20)	*Acinetobacter spp* (n=11)	*Klebsiella spp* (n= 05)	*Proteus spp* (n=03)	*Citrobacter spp* (n=01)
Amoxicillin	10(33.4)	20(100)	11(100)	04(90)	02(66.66)	01(100)
Amikacin	04(13.8)	09(49)	10(90)	02(40)	02(66.66)	0(0)
Ceftazidime	08(26.7)	12(60)	11(100)	05(100)	03(100)	0(0)
Ceftriaxone	18(60)	18(90)	11(100)	05(100)	03(100)	0(0)
Cefuroxime	20(66.7)	18(90)	11(100)	04(90)	03(100)	1(100)
Ciprofloxacin	18(60)	15(75)	11(100)	04(90)	03(100)	0(0)
Gentamicin	11(36.7)	18(90)	10(90)	04(90)	03(100)	0(0)
Levofloxacin	16(53.4)	05(25)	10(90)	02(40)	03(100)	0(0)
Imipenem	01(3.6)	05(25)	10(90)	0(0)	01(33.33)	0(0)
Meropenem	01(3.6)	05(25)	10(90)	0(0)	01(33.33)	0(0)
Piperpicilin	04(13.4)	04(20)	11(100)	04(90)	02(66.66)	0(0)
Tazobactum	0 (0)	02(10)	11(100)	01(10)	0(0)	0(0)

The susceptibility patterns of antibiotic of isolated bacteria are showed in the Table 4 & 5.

Discussion

Surgical site infection is the most commonly and frequently reported nosocomial infections in the world[14]. SSIs rate has varied from as low of 2.5% to a high of 41.9%[15]. In spite of the progress in the field of surgery, surgical technique and antibiotic prophylaxis, post-operative wound infection remain the commonest post-operative complications and

one of the frequently encountered hospital acquired infection in the world wide[8]. This study gives an insight to the causative pathogens of post operative wound infections and their susceptibility patterns. In this study the isolation rate was (58.28%). Similar isolation rate (55.4%) was reported by Sikka et al[14] in India in 2015. However other studies in Ethiopia found that the isolation rate of bacteria was 71.1%[17] and 75%[18] and in Nepal isolation rate was 80.0%[6]. In this study the isolation rate was lower than the previous study that took place in Ethiopia and Nepal, probably SSIs caused

by anaerobic bacteria or patients were under antibiotics treatment or presence of fastidious organism.

Table 5: Antibiotic Resistance Pattern of Gram Positive Bacteria (n=35)

Antibiotic	*Sta. aureus* (n=28)	CONS (n=07)
Augmentin	12(42.85)	03(42.85)
Amikacin	12(42.85)	02(28.57)
Cefuroxime	25(89.28)	02(28.57)
Ceftriaxone	13(46.42)	01(14.28)
Ceftazidime	17(60.71)	01(14.28)
Ciprofloxacin	22(78.57)	01(14.28)
Co-trimoxazole	12(42.85)	01(14.28)
Clindamycin	26(92.85)	06(85.71)
Gentamicin	17(60.71)	03(42.85)
Levofloxacin	18(64.28)	2(28.57)
Meropenem	12(42.85)	2(28.57)
Imepenem	14(50)	03(42.85)
Oxacillin	8 (24.85)	01(14.28)
Doxacyicillin	10(35.71)	02(28.57)
Vancomycin	01(3.57)	0 (0)
Linozolid	0(0)	0 (0)

*Augmentin= Amoxicillin/ Clavulanic acid

In this study the isolation rate of Gram negative bacilli was higher (65.68%) than the Gram positive cocci (34.32%). Similar observations are also reported from Ethiopia where the Gram negative bacilli were found in 59.3% cases and Gram positive cocci in 40.7% cases[16]. From India the Gram negative bacilli (62.7%) were present predominantly than the gram positive cocci (37.3%); furthermore, *Escherichia coli* was the most prevalent isolate among gram negative bacilli[11]. Another study in Pakistan has been reported that the isolation rate of Gram negative bacilli was higher than the gram positive cocci and the most frequent isolates were *Escherichia coli* 60.7%[17]. In this study the most frequent isolates were *Escherichia coli* (29.7%) followed by *Staphylococcus aureus* (27.4%), *Pseudomonas aeruginosa* (19.6%), *Acinetobacter* species (7.8%), *Klebsiella pneumoniae* (4.9%), *Proteus* species (2.93%), *Citrobacter* species (0.97%). However, Das et al[7] found that the predominant isolated organisms were *Staphylococcus aureus* (24.3%) and followed by *Escherichia coli* (18.9%), *Pseudomonas* species (18.9%), *Enterobacter* species (8.1%) and *Citrobacter* species (8.1%) and also Santos et al[18] found that the *Staph. aureus* was the most frequent (33.9%) followed by *Esch. coli* (20.3%).

High infection rate was found in male (65.14%) patients than in female patients (34.86%) in this study. Similar observation also reported from Nepal that the infection rate was (62.5%) in male patients and (53.1%) in female patients[5]. The reason behind this variation has not yet been established clearly[7].

In this study the isolated gram negative bacilli showed resistant all antibiotics. Among the isolated gram negative bacilli, *Acinetobacter* species showed higher percentage of antibiotics resistance. During the study period it was found that most efficient antibiotics were meropenem, imipenem, amikacin, pipercilli, tazobactum and linozolid and vancomycin and linozolid. *Staphylococcus aureus* showed 8(24.85%) MRSA and 01(3.57%) VRSA in this study. Isolation of MRSA was 2.2% noted by Amatya et al[5]. Isolation of MRSA was higher (40-50.5%) noted[19] and 26 (76.47%) MRSA by Diaz et al[20]. There were some limitations of this study. This study did not isolate strict anaerobe bacteria and fungi, which could have increased the numbers of isolates bacteria reported as negative growth.

Conclusion

It is concluded that post surgical wound infection were associated with gram negative bacilli and gram positive cocci. Results showed that high rate of antibiotics resistance to most of the isolated pathogens. A regular surveillance should be carried out to monitor the susceptibility pattern of isolated pathogens and chose appropriate regimens for the treatment of post surgical wound infection. There is need to develop an antibiotic policy and guideline to prevent or reduce indiscriminate use of antibiotic and preserve their effectiveness for treatment and management of post-surgical wound infection.

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