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Original Article

Clinico-pathological Evaluation of Infection Pattern in Surgical Wards

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ABSTRACT

Background: *Infection in surgical patients is an ongoing process. Through the whole world, nosocomial infections are considered as hindrance in medical and surgical practice. In the present study, we have attempted to explore different clinical and microbiological aspect of infection in surgical patient.* ***Objective:*** *To find out the bacterial aetiology and the rate of post operative wound infections in relation with total number of infections.* ***Method:*** *This Descriptive cross-sectional observational study conducted among the Male and female wards and cabins under surgery unit.1 of Rangpur medical college hospital. Laboratory works were done in microbiology department of Rangpur medical college.* ***Results:*** *As per age and sex distribution, male were predominating with male to female ratio of 1.8:1,where majority cases(37%) were in the age group of 15-30 years; categorically, patient were divided into different groups (a) a group of 47 patients developed post operative wound infection, (b)another group of 42 patient admitted with prior infection, in all categories majority patient were in male general ward.Most of the infections either prior(47.2%) or post-operative(52.8%)were local wound infections. Highest rate of post operative and prior infections was found in male general ward (30.33%) and 26.96% accordingly. Pre-morbidity statuses of our patients were recorded. Out of 3 patients with diabetes mellitus, 2 developed wound infections and out of 5 cases of malignancy only 2 developed wound infections. Clinically suspected cases of infection ewre evaluated by culture and sensitivity test. A total of 89 sample comprising as 59 wound swab, 24 pus, 4urine and 2 blood. Growth of organisms were noted in 43 samples of which pseudomonas ssp. was highest (16) followed by esch.coli (15) and staph.aureus (08).Pseudomonas ssp. Isolated from patients was highly sensitive to cetazidime and atreonam (>93%).Resistance to ciprofloxacine, pefloxacine,gentamicine and ceftriaxoneewre 31.2%, 28.6%, 50.0% and 12.5% respectively. In 37.5%strains, ceftriaxone showed intermediate sensitive pattern. Esch.coli isolated from patients were 100% resistant to amoxicillin followed by 71.4% to doxycycline and 64.3% to cotrimoxazole. Over 57% strain were resistant to gentamicin and*

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cephalexin. Ciprofloxacin was sensitive in 71.4% and ceftriaxone in 65.3%. Here also 24.3% strain showed intermediate sensitive pattern against ceftriaxone. Staph.aureus strains were highly sensitive to cloxacillin, erythromycin, cephradine, ciprofloxacin, doxycycline, and gentamicin. But penicillin and cotrimoxazole were highly resistant. ***Conclusion:*** *After analyzing the data of the current study, it was concluded that, despite having practically all of the risk factors for nosocomial infection, the rate can be reduced if sufficient attention is given before, after, and during the surgery. Pseudomonas aeruginosa, Escherichia coli, and Staphylococcus aureus remain nosocomial pathogens. Most nosocomial bacteria are still very sensitive to third-generation cephalosporins, such as ceftriaxone and ceftazidime, as well as azteonam. Antibiotics should not be used at random in surgical patients due to the emergence of a significant number of intermediate sensitive strains that run back to the side of resistance.*

Keywords: *Nosocomial infections, post-operative infection, pre-operative infection, bacterial aetiology.*

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INTRODUCTION

Infection is a prevalent concern in surgical practice. It increases morbidity, anxiety, length of stay in the hospital, and, of course, patient expenditure [1]. A surgeon's embarrassment is understandable when dealing with a post-operative infection. Despite the fact that we are in the era of better medicines, post-operative wound infection remains a common surgical complication. Developed countries are not immune to these issues, despite tremendous gains in modern operational technology [2]. For example, the Centers for Disease Control in the United States estimates that over 500,000 surgical wound infections will occur each year, costing over $500 million per year. In a Turkish study, yalchin et al found a 4.85 percent rate of surgical wound infection. According to Perl and Roy, post-operative wound infection should account for 1 to 9% of surgical procedures in the United States. Surgical wound infection ranked third among nosocromial infections, after urinary tract infection and pneumonia, according to the World Health Organization's guidelines. Western et al. found that in impoverished nations, nosocomial infection could be as high as 26 to 65 percent, with surgical site infection accounting for the majority of cases. Hussain et al observed nosocomial infection in 38 percent of surgical patients in a research at Dhaka Medical College Hospital, with over 36 percent of those having post-operative surgical wound infections and over 23 percent having UTI. In the post-operative stage, 15.9% of patients were found to be infected. In a research from Nigeria, Lawal et al9 found a 15.1 percent total wound infection rate, with 60 percent of filthy wounds becoming infected. Although infection occurs as a result of the procedure due to the related risk, many patients are admitted to the surgical ward having a preexisting infection. Both scenarios have a negative link with operation success while the patients stay in the hospital. Bacterial agents are spread by infected patients in surgery wards. Microbes from the environment, instruments, dressing materials, and wards personnel harboring pathogenic bacteria as a commensal flora are all significantly more important sources. Furthermore, patients' indigenous bacterial flora may infect them [3]. The following types of risk factors for acquiring infection include host variables, surgical factors, environmental factors, and the biology of the bacteria. Age, length of hospital stay, and concomitant infection in other areas of the body are all

host characteristics that enhance the chance of infection. The nature and extensibility of the procedure, the position and depth of the wound, the logistics employed and continuing during and after the operation, and the surgeon's technical talents are all noteworthy surgical considerations. Virulence and the quantity of bacteria are crucial microbiological variables. Avirulent bacteria's minute innoculam can be combated by local tissue defense. Small inoculums of avirulent bacteria can result in an overpowering infection if the host damage is substantial and premorbidity in the form of diabetes or another immunosuppressive stage remains. On the other hand, drug-resistant pathogenic bacteria may be the sole cause of an overt and fulminant infection [1]. Infection control in operating rooms and surgery wards is critical. Many investigations have shown that dangerous microorganisms can be transmitted through the air in the operating room. Overcrowding of visitors in front of the operating room and within the wards causes bacteria to spread through droplets caused by people with intranasal and facial pathogens talking, sneezing, and coughing. Those microorganisms are conveyed to the operated patients after settling on the wall, floor, beds, ot, tables, trolleys, linens, and other surfaces [4]. Microbial agents are transmitted in the same way by the surgical team. Unclean logistics and a dirty floor are both risk factors for wound infection [5]. Staphylococcus aureus was the most common pathogen, followed by E. coli, pseudomonas ssp., enterobacter faec. alis, klebstiella pneumonias, streptococcus pyogens, acinetobacter ssp, and enterobacter ssp. The most significant drawback of the bacteria was their antibiotic resistance. The prevalence of nosocomial infection in surgical wards at Rangpur Medical College Hospital was a major source of concern for local surgeons. From a laboratory standpoint, the susceptibility pattern of bacterial isolates astounds us. There was no effective infection control policy in place at the time. As a result, infection management became a top focus. With this in mind, the current study was carried out as a pilot to determine the actual condition of infection in surgical patients, their epidemiological association, and the antibiogram of the causative bacteria. This will help to promote awareness among concerned clinicians and administrative personnel about the importance of taking the necessary steps to develop an infection control policy using local resources. The antibiogram pattern of the organisms were analtsed with commonly used antibiotics. Resistence to pseudomonas ssp to ciprofloxacin, ceftazidime and gentamicin were 31.2%, 6.3% and 50% respectively. In spain, Bouza [14] found that the resistance.

OBJECTIVE

To find out the bacterial aetiology and the rate of post operative wound infections in relation with total number of infections.

METHOD

Study design: Cross sectional study design.

Study place: Male and female wards and cabins under surgery unit.1 of rangpur medical college hospital. Laboratory works were done in microbiology department of Rangpur medical college.

Study period: From october2007 to march 2008.

Study subjects: All patient admitted from 01.10.2007 to 31.03.2008**.**

Data collection: Relevant information's from each subject on clinical ground and microbiological findings were recorded on predestined structured data sheet.

Clinical observation: every patient was clinically evaluated under strict supervision of the unit head for the whole period of hospital stay. Patient admitted with prior infection undergone

microbiological testing. Uninfected patients were checked on everyday basis to notice any sign of infection. No operation was carried out until cure of any supervening infection in elective cases. Surgical emergency cases were operated and followed up for post operative infection.

Sampling techniques for culture: Different samples comprising of wound swab, pus, discharge, urine and blood according to site of infection were collected with all aseptic precaution and sent to microbiology laboratory for culture.

Culture and antimicrobial susceptibility test:

Aerobic culture was done for every sample using appropriate media following slandered methods. no sample was discarded 72hours before declaring no growth. Bacterial isolates were identified according to morphological, colonial and biochemical caracteristics8, 9. Anti microbial susceptibility test was performed by dick diffusion methods according to procedures described in NCCLS guidelines. For grading of results breakpoint zone of inhibition was considered and expressed as sensitive(S), intermediate (I), and resistant(R).

Data management & analysis plan

The statistical analysis of the data was carried out by using the software program SPSS version 20. Data were be checked, edited and appropriately coded before analysis. For summarizing data, statistics such as mean, median and mode and percentage will be calculated. The data were presented in tables.

RESULTS

Age and sex distribution of cases were shown in table.I. Out of 89 cases 57 were male and 32 were female giving a male female ratio of 1.8:1. Majority of cases (33) were in the age group of 15 to 30 years followed by the age group of 40 to 60years (21). Least number of cases (07) were in the age group of above 60 years. Male were predominating in almost all the age groups.

Table-I: Age and sex distribution of cases

Age group in years	**Male**	**Female**
Up to 15 (n=11)	07(63.6%)	04(36.4%)
15 to 30 (n=33)	23(69.7%)	10(30.3%)
30 to 40 (n=17)	11(64.7%)	06(35.3%)
40 to 60(n=21)	11(52.4%)	10(47.6%)
Above 60(n=07)	05(71.4%)	02(28.6%)
Total=89	**57(64.0%)**	**32(36.0%)**

Table II showed the distribution of cases according to the category of post operative wound infection or prior infection and bed status. Forty-seven patients developed infection in hospital. Those patients admitted with prior infection numbered 42. In both groups the majority of patients were in male general ward.

Table II: Category wise distribution of cases

Category	mgw	fgw	mpw	fpw	mc	fc
Infection acquired in hospital(n=47)	27	15	02	02	00	01
Admitted with	24	12	02	02	02	00

prior infection(n=42)						
Total=89	51	27	04	04	02	01

Mgw=male general ward, fgw=female general ward, mpw=male paying ward, fpw=female paying ward, mc=male cabin, fc=female cabin

Among 89 cases 52.8% developed infection during their hospital stay. Prior infections at the time of admission were recorded in 47.2% cases (Table III).

Table-III: Category wise rate of infection

Category	Frequency	Percentage
Infection acquired in hospital	47	52.8%
Cases with prior infection	42	47.2%

Out of 42 patients having prior infection during admission,35 cases had local wound or localized superficial or deep infection and 06 had systemic infection. Both systemic and local infections were in 01 case. None of 47 post operative cases had any isolated systemic infection, but 02 cases were developed local as well as systemic infections. Majority cases (45) were having local wound infections (Table IV).

Table-IV: Pattern of infections

Category	Systemic infection	Local infection	Both local and systemic infections
Prior infection(n=42)	06(14.3%)	35(83.3%)	01(2.4%)
Postoperative infection(n=47)	00	45(95.7%)	02(4.3)

Sample wise distributions of bacterial isolates were shown in table V. In wound swabs esch.coli were highest (13) followed by pseudomonas ssp.(11) but in pus pseudomonas ssp. Is highest followed by Staph. aureus (3).

Table V: Sample wise distribution of bacterial isolates

Sample	*pseudomonas*	*Esch.coli*	*Staph.aureus*	Others
Wound swab(n=59)	11	13	05	03*
Pus(n=24)	04	01	03	00
Urine(n=4)	01	01	00	01
Blood(n=2)	00	00	00	00
Total=89	16	15	08	04

*klebsiella ssp=02,streptococcus beta haemolyticus=01

We recorded pre morbidity status in our patients that was being shown in table VI. out of 03 cases of diabetes mellitus wound infections were found in 02 cases. Corresponding values for malignancy and tuberculosis were 02/05 and 01/02.

Table VI: Premorbidity status of surgical patients

Pre morbidity	Total cases	Wound infection
Diabetes mellitus	03	02(66.7%)
malignancy	05	02(40%)
tuberculosis	02	01(50%)

Table VII showed that Antimicrobial susceptibility of esch.coli and klebsiella ssp, Is isolated from patients were being given in table.9 and10, where 100% strains of both genus were resistant to Amoxycillin and >71% strain of esch.coli and >66% strain of klebsiella ssp. Were sesistant to doxycycline. Over 57% strain of esch.coli. were resistat to gentamicin and cephalexin,where as resistance to cotrimoxazole were higher(64%). For strains of esch.coli, though lowest resistant (10.2)drug was ceftriaxone but >24% strains yielded intermediate sensitive results and highest sensitive (71.4%) drug appeared to be ciprofloxacin. All the strains of klebsiela ssp. Were sensitive to ceftriaxone and ciprofloxacin. the susceptibility of pseudomonas ssp. Isolated from patients. Over 93% strains were sensitive to ceftazidime and aztreonam followed by pefloxacine (57.1%) and ciprofloxacin (56.3%), ceftriaxone appeared intermediate sensitive to 37.5% strains and resistant to 12.5% strains. Gentamicin resistance were found in 50%strains. the susceptibility of staph.aureus isolated from patients. Only 12% strains were sensitive to penicillin whereas 100% strains were sensitive to cloxacillin and 87.5% to erythromycin and ciprofloxacin. Sensitive result of 75% were found against cephradine, gentamycin and doxycycline.

Table VII: Antibiotic susceptibility of bacterial isolates

Antibiotic susceptibility(in percentage) of isch.coli			
Antibiotics	**R**	**I**	**S**
Amoxycillin	100	00	00
Doxycycline	71.4	14.3	14.3
Cotrimoxazole	64.3	00	35.7
Gentamycine	57.1	14.3	28.6
Cephalexin	57.1	14.3	28.6
Ceftriaxon	10.4	24.3	28.6
Ciprofloxcin	21.4	7.1	71.4
Antibiotic susceptibility(in percentage) of klebsiella ssp			
Antibiotics	**R**	**I**	**S**
Amoxycillin	100	00	00
Doxycycline	66.7	33.3	00
Cotrimoxazole	100	00	00
Gentamycine	33.3	00	66.7
Cephalexin	66.7	00	33.3
Ceftriaxon	00	00	100
Ciprofloxcin	00	00	100
Antibiotics susceptibility to pseudomonas ssp. Isolated from patients(in percentage)			
Antibiotics	**R**	**I**	**S**

Gentamicin	50.0	06.3	42.7
Ciprofloxacin	31.2	12.5	56.3
Pefloxacin	28.6	14.3	57.1
Ceftazidime	06.3	00	93.7
Ceftriaxon	12.5	37.5	50.0
Aztreonam	06.3	00	93.7
Antibiotics susceptibility of staph.aureus isolated from patients(in percentage)			
Antibiotics	**R**	**I**	**S**
Penicillin	75.0	12.5	12.5
Cloxacillin	00	00	100
Erythromycin	12.5	00	87.5
Cephradine	12.5	12.5	75.0
Ciprofloxacin	12.5	00	87.5
Doxycyclin	12.5	12.5	75.0
Cotrimoxazole	87.5	00	12.5
Gentamycin	25.0	00	75.0

DISCUSSION

In both developed and developing countries, nosocomial infection is a major issue [10]. In developed countries, various strategies have been implemented to combat nosocomial infection. However, in poor countries such as Bangladesh, no priority has been placed on this issue. Nosocomial infections vary depending on the situation and perspective. Due to the resurgence of antibiotic resistance, infection in surgical patients has become a severe issue [1]. It can appear to be a life-threatening task at times. Surgeons are bored and overworked when it comes to infection control [3]. In the current study, we made one preliminary attempt to investigate the situation in our context. The surgery unit-1 of Rangpur Medical College Hospital was chosen for this study because it was the most populous unit in terms of patients and attendants. Overcrowding is usually thought to be a risk factor for a high prevalence of nosocomial infection [10]. In order to confirm the diagnosis and determine antibiotic sensitivity, we collected samples from affected patients for microbiological analysis. The age and sex distribution of the cases in this study revealed that the age group of 15 to 30 years had the highest number of both male and female cases (37 percent). In terms of sex, males also outnumbered females. The findings revealed that the number of surgical disorders is highest in active age of life, particularly in males. Adult patients are predisposed to infection as a result of surgery. Wound infection was also seen in the adult age group in this investigation. Furthermore, the age sex distribution in our study may not reflect the true distribution, but rather an overestimate, as more adult patients are frequently hospitalized. The patients who developed infection in hospital were 47 in number and majority showed post operative wound infection despite of prophylactic antibiotics. 42 patients were having infection at the time of admission. In all categories, majority were admitted in general wards because of higher number of beds and facilities are out of coasts, which is well suited with low socioeconomic condition of general population of Bangladesh. Highest incidence(66.7%) of postoperative infections was noted in cases with diabetes

meletus. Although malignancy was at the top of the list as a pre morbidity status, but postoperative infection developed in only 40% of the cases. This findings disagreed with the general concept of high prevalence of infection in malignancy. The low incidence of infection in our study might be due to carefull precaution taken scincerely through the surgical procedure in malignant cases. More over prophylactic antibiotics and appropriate patient care might have reduced the rate of infection. In this study, out of 89 clinical samples, 43 yielded growth in culture. No growth in rest of 46 samples might be due to the the reason of having anaerobic bacteria or prior administered of antibiotics might had inhibited growth in culture. It was observed that most common infective organism were pseudomonas ssp(16/43). followed by esch.coli.(15/43), staph.aureus(8/43), klebsiella ssp.(2/43) , streptococcus beta haemolyticus (1/43),others(1/43). In an earlier study in bangladesh,Ashraf et al7 found that in wound infection esch.coli (37.5%) was predominating organism followed by staph.aureus(21.7%) and pseudomonas ssp.(15.1%). In another study in Bangladesh, Zaman et al 6 showed that esch.coli was the major pathogen in the postoperative wound infection (60.0%).followed by staph.aureus (20.0%). We isolated only one strain of streptrococcus,which was a dissimilar observation,compered with others11,12. But the above mention study also did not isolate any streptococcus. The reason behind this dissimilarity might be that prophylactic antibiotics are commonly used in almost every postoperative patient and still now streptococcus appeared to be sensitive to almost all antibiotics available commercially. So this had resulted eradication of streptococcus from surgical site giving no growth in culture. Other bacteria, which were resistant to the antibiotics used in prophylaxis,could not be inhibited in culture. In a study in Canada, westwood13 found that majority of the organisms are responsible for nosocomial infection was esch.coli (25.3%) followed by klebsiella ssp.(16.8%) and staph.aureus(12.5%). Similarly many studies in Bangladesh and abroad showed different isolation rate in different clinical samples [4, 6, 7, and 13]. But in diabetic wounds, pseudomonas ssp. Was predominant (91.7%), followed by esch coli.(33.3%). Jinnah et al from Bangladesh reported similarly and their isolation rate of pseudomonas ssp. Was similar (36.9%) as compared to the present study (37.2%) .

CONCLUSION

After analyzing the data of the current study, it was concluded that, despite having practically all of the risk factors for nosocomial infection, the rate can be reduced if sufficient attention is given before, after, and during the surgery. Pseudomonas aeruginosa, Escherichia coli, and Staphylococcus aureus remain nosocomial pathogens. Most nosocomial bacteria are still very sensitive to third-generation cephalosporins, such as ceftriaxone and ceftazidime, as well as azteonam. Antibiotics should not be used at random in surgical patients due to the emergence of a significant number of intermediate sensitive strains that run back to the side of resistance.

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