Original Article

Healthcare Associated Infections in Different Departments of a Tertiary Care Hospital in Bangladesh

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Abstract

Background: *Healthcare-associated infections (HAIs), which occur when a patient is receiving care in a hospital or other healthcare facility, are the most frequent adverse events in healthcare worldwide. This study aimed to find the causative bacterial agents of HAI from different clinical samples in different departments.* ***Materials & Methods:*** *This was a cross-sectional descriptive study conducted in the department of Microbiology & Virology, Sylhet MAG Osmani Medical College, in collaboration with in-patient departments of Sylhet MAG Osmani Medical College hospital from January 2019 to December 2019 with ethical clearance from respective IERB. A total of 123 patients of different age, gender was enrolled in this study. Samples were collected from postoperative wounds, post catheterized urinary tract infections, diabetic wounds and intravenous cannula from Surgery, Medicine and Obstetrics & Gynecology ward. Standard laboratory procedures were applied to isolate and identify the bacteria.* ***Results:*** *Among 123 patients 46 (37.4%) were affected by hospital acquired infections. Higher prevalence (n=28, 60.87%) of HAI was found in the Surgery ward and the lower prevalence (n=9, 19.56%) was found in Medicine and Obstetrics & Gynecology ward. The difference in the frequency of growth and no growth in samples collected from these departments was almost the same. The most common type of infection was surgical wound infection (43.48%). Staphylococcus aureus (28.26%), Pseudomonas aeruginosa (17.39%) and E. coli (13.04%) were the primary causes of healthcare-associated infections.* ***Conclusion:*** *Irrespective of all circumstances, HAI is a burden now-a-days for healthcare professionals. So proper knowledge about the rate of its occurrence and the reasons should be found to control its burden. Through monitoring and proper implementation of the Infection Prevention & Control Programme (IPC) of WHO can help us to control this situation.*

Keywords: Healthcare associated infection, Nosocomial infection, Sites of infection.
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Introduction

Healthcare associated infections (HAIs) affect patients in a hospital or other healthcare facility and are not present or incubated at the time of admission. They also include infections acquired by patients in the hospital or facility but appearing after discharge, and occupational infections among staff[1]. It is also known as hospital acquired infection or nosocomial infection[2]. These infections include catheter-associated urinary tract infections, central line-associated bloodstream infections, surgical site infections, ventilator-associated pneumonia, hospital-acquired pneumonia, and Clostridium difficile induced gastrointestinal infections[3].

HAIs pathogens can be transmitted from person to person, environment or contaminated water and food, through infected individuals, contaminated healthcare personnel's skin or contact via shared items and surfaces[4]. Multi-drug-resistant organisms include methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococci*, *Pseudomonas aeruginosa* and *Klebsiella pneumonia*, whereas *Clostridium difficile* shows natural resistance[5]. The present article emphasizes some common hospital-acquired infections in different departments of a tertiary level hospital and their causative agents.

Materials and Methods

This was a descriptive observational study conducted in the department of Microbiology, Sylhet MAG Osmani Medical College in collaboration with the inpatient departments of Sylhet MAG Osmani Medical College Hospital during the period from January to December 2019. Ethical approval was taken from the Institutional Ethical Review Board (IERB) of Sylhet MAG Osmani Medical College (Ref. No.: SOMC/2019/68). A total of 123 samples of different ages and

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genders according to inclusion and exclusion criteria were selected by purposive sampling.

Study population and sample collection: The clinical specimens for this study were collected from the selective patients admitted in hospital. Four categories of hospital admitted patients of different ages and gender were included in this study, namely: i) patients with postoperative infections, ii) patients with post catheterized urinary tract infections (UTI), iii) newly admitted diabetic patients with wound and iv) newly admitted patients with intravenous cannula.

Microbiological methods: The organisms were isolated from the specimen by inoculation and culture on blood agar and MacConkey agar media. Identification of the organisms was done by colony morphology, Gram staining and standard biochemical tests. Samples which showed significant colony count were taken into consideration.

Data management and analysis: The collected data was checked, verified and edited daily. The data was coded and entered the computer by using the SPSS data entry program. Statistical significance was tested with appropriate tests.

Results

A total of 123 samples of different age and gender according to inclusion and exclusion criteria were selected from different departments. The age of the patients ranged from 14-72 years with the mean age 40.79 ± 16.81 years. Majority of the patients were female 74 (60.2%) with a male to female ratio of 0.6:1. Among them 35 (28.5%) were surgical site wound swab, 31 (25.2%) were catheterized urine samples, 31(25.2%) were intravenous cannula swab and 26 (21.1%) were diabetic wound swab. In a total of 123 cases, 46 acquired healthcare-associated infections. Figure-1 exhibits a pie chart showing distribution of patients with growth positive according to department where maximum 28 (60.87%) patients were admitted in Surgery ward, followed by 9 (19.56%) cases were found in each of Obstetrics & Gynecology and Medicine ward. The Surgery department had the highest number of infections, with surgical site infections accounting for 13 cases (46.43%) and diabetic wound infections accounting for 14 cases (50%). The Obstetrics and Gynecology department reported 7 surgical site infections (77.77%) and 2 urinary tract infections (28.57%). Meanwhile, the Medicine department had the highest rate of UTIs with 7 cases (77.77%) and reported 2 intravenous cannula infections (28.57%). In total, there were 20 cases of surgical site infections (43.48%), 14 cases of diabetic wound infections (30.43%), 10 cases of urinary tract infections (21.74%), and 2 cases of intravenous cannula infections (4.35%). (Table-I)

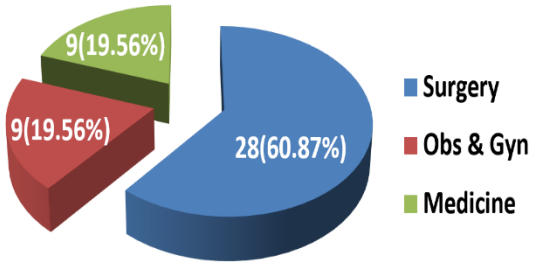

Figure-1: Pie diagram showing distribution of culture-positive patients according to department (n=46)

In this study, the highest number of healthcare-associated infections (HAI) regardless of their source and site were caused by *Staphylococcus aureus* (28.26%), followed by *Pseudomonas aeruginosa* (17.39%), *E. coli* (13.04%), *Serratia* spp. (6.52%), *Aeromonas* spp. (6.52%), *Klebsiella* spp. (4.34%), *Proteus* spp. (4.34%), *Acinetobacter* spp. (6.52%), *Citrobacter* spp. (4.34%), Coagulase negative *Staphylococcus* (2.17%), *Enterobacter* spp. (2.17%), *Morganella morganii* (2.17%), and budding yeast (2.17%) (Table-II). The difference in frequency of growth, no growth in sample collected from Medicine, Surgery and Obstetrics & Gynecology were almost same (Table-III).

Table-I: Types of infection in different departments (n=46)

Department	Site of infection				Total
	Surgical Site Infection	Urinary Tract Infection	Intravenous Cannula Infection	Diabetic wound infection	
Surgery	13 (46.43%)	01 (3.57%)	0 (0%)	14 (50%)	28
Obstetrics & Gynecology	07 (77.77%)	02 (28.57%)	0 (0%)	0 (0%)	09
Medicine	0 (0%)	07 (77.77%)	02 (28.57%)	0 (0%)	09
Total	**20 (43.48%)**	**10 (21.74%)**	**02 (4.35%)**	**14 (30.43%)**	**46**

Table-II: Isolated organism from different departments (n=46)

Infective organism	Department			
	Surgery	Obstetrics & Gynecology	Medicine	Total
Staphylococcus aureus	6 (21.43%)	4 (44.44%)	3 (33.33%)	13 (28.26%)
Pseudomonas aeruginosa	7 (25%)	1 (11.11%)	0 (0%)	8 (17.39%)
Serratia marcescens	3 (10.71%)	0 (0%)	0 (0%)	3 (6.52%)
Escherichia coli	2 (7.14%)	2 (22.22%)	2 (22.22%)	6 (13.04%)
Acinetobacter spp.	2 (7.14%)	1 (11.11%)	0 (0%)	3 (6.52%)
Proteus spp.	2 (7.14%)	0 (0%)	0 (0%)	2 (4.34%)
Aeromonas spp.	2 (7.14%)	1 (11.11%)	0 (0%)	3 (6.52%)
Citrobacter spp.	2 (7.14%)	0 (0%)	0 (0%)	2 (4.34%)
Klebsiella spp.	1 (3.57%)	0 (0%)	1 (11.11%)	2 (4.34%)
Enterobacter spp.	0 (0%)	0 (0%)	1 (11.11%)	1 (2.17%)
Morganella morganii	0 (0%)	0 (0%)	1 (11.11%)	1 (2.17%)
CoNS	1 (3.57%)	0 (0%)	0 (0%)	1 (2.17%)
Budding yeast	0 (0%)	0 (0%)	1 (11.11%)	1 (2.17%)
Total	**28 (60.88%)**	**09 (19.56%)**	**09 (19.56%)**	**46 (100%)**

Table-III: Healthcare associated infection in different departments (n=123)

Department	Growth n (%)	No growth n (%)	Total	p-value
Surgery	28 (45.90%)	33 (54.09%)	61	χ^2=3.76 p=0.153
Obstetrics & Gynecology	9 (28.13%)	23 (71.87%)	32	
Medicine	9 (30%)	21 (70%)	30	
Total	**46 (37.39%)**	**77 (62.61%)**	**123 (100%)**	

Discussion

Healthcare associated infections (HAIs) are one of the major public health problems around the world. In different situations and perspectives, the pattern of HAI is different. In the present study an attempt was made to explore the pattern of the organisms responsible for HAI and their antimicrobial susceptibility pattern in the department of Microbiology and Virology, Sylhet MAG Osmani medical college in collaboration with inpatient departments of Sylhet MAG Osmani medical college hospital. A total of 123 participants were included of different age and gender. The minimum age of participant was 14 years, and the maximum age was 72 years. There were 74 (60.2%) female participants and 49 (39.8%) male participants with a male-to-female ratio of 0.6:1. Amongst 123 participants, 61 (49.6%) were admitted in Surgery ward, 30 (24.4%) were admitted in Medicine ward and 32 (26%) were admitted in Obstetrics & Gynecology ward. Four different types of samples were collected including surgical site wound swab, catheterized urine, intravenous cannula and diabetic wound swab.

This study yielded that 46 (37.4%) patients were affected by hospital acquired pathogens among 123 participants. Frequency of HAI was found to be 33.33% among 130 participants in a study held in India[6]. A similar finding was observed in Ethiopia where the occurrence rate was 35.8% in 215 subjects[7]. A study conducted in Dhaka Medical College Hospital in Bangladesh showed 67.10% patients acquired nosocomial infection out of 152 participants during their hospital stay[8]. Islam, et al.[9], found 67.31% patients acquired nosocomial infection in another study in Dhaka. It was observed in another study that 10.9% of patients acquired HAI among 1055 pediatric patients[10]. After comparing the findings of the present study with the above-mentioned previous studies, it can be concluded that the prevalence of HAI in the tertiary level hospitals

in different cities of our country is declining to some extent. In our country though it is decreasing from the previous rate, it is still higher.

HAIs were acquired equally by males and females in this study. A study in Ethiopia showed a little difference where female patients were more infected (56.6%)[11]. Present study showed the distribution of healthcare associated infection varies in different types of infection. Among them surgical site infections were highest (43.48%) followed by diabetic wound infections (30.43%), urinary tract infections (21.74%) and intravenous cannula infections (4.35%). Research conducted at the Gadarif Teaching Hospital in Sudan shows that out of the 432 operations 109 (25%) wound swabs were collected from patients who had developed post-operative wound infection with purulent discharge and clinically diagnosed as post-operative wound infection[12]. In a study conducted in Bangladesh it was observed that surgical site wound infection (48.7%) more than urinary tract infection (10.5%) and diabetic wound infection (7.9%) among 102 positive cases[7]. Begum, et al.[13], found 21% of patients acquired nosocomial urinary tract infection. Another study revealed 40% diabetic foot infection in 75 participants which was similar with the present study[14]. Surgical site wound infection and diabetic wound infection were predominant, which was statistically significant. Sources of higher incidence in surgical site wound infection are (i) in case of surgery when incision is made invariably it impairs first line of defenses between the environmental microbes and internal host environment, therefore the exposed tissues are at risk of contamination with endogenous patient's flora. Exogenous contamination may also occur from operating room environments, surgical teams and instruments[15]; (ii) Patients who had undergone surgical intervention had higher rate of infection which is significant as the chance of exposure of the body tissue and fluids to the external environments for the operated patients is much higher than the non-surgical patients, so it is usual and logical that they would have the higher chance to be infected by hospital acquired infections[10]; (iii) the high rate of postoperative wound infections can be likely influenced by the lack of strict adherence to infection prevention procedures together with overcrowding of the wards[7]. But the proportion could be minimized by strictly following WHO guidelines for safe surgery and by taking appropriate precautions in different stages of surgery[10].

The most common organism for HAI was *Staphylococcus aureus* (13, 28.26%), second highest was *Pseudomonas aeruginosa* (08, 17.39%), third highest was *Escherichia coli* (06, 13.04%) followed by *Serratia* spp. (03, 6.52%), *Aeromonas* spp. (03, 6.52%), *Klebsiella* spp. (02, 4.34%), *Proteus* spp. (02, 4.34%), *Acinetobacter* spp. (02, 4.34%), *Citrobacter* spp. (02, 4.34%), Coagulase negative *Staphylococcus* (01, 2.17%), *Enterobacter* spp. (01, 2.17%), *Morganella morganii* (01, 2.17%) and budding yeast (01, 2.17%) in this study. A similar result was found in a study where the predominant organism for hospital acquired infection in surgical site was *Staphylococcus aureus*[16]. Another study in Ethiopia showed *Staphylococcus aureus* (55.0%), *E. coli* (5.0%), *Pseudomonas aeruginosa* (3.0%) and Proteus spp. (37%) which is different from our study[17].

In our present study, among the cases of surgery ward, 46.43% were surgical site wound infection (SSI) followed by diabetic wound infection (50%) and urinary tract infection (3.57%). At present SSI was observed in 24.6% of patients in Ethiopia which is different from our study[18]. In this study diabetic wound infection was about 50% which may be the reason for the increased rate of infection in cases of surgery department. It's well established that co-morbidities like diabetes mellitus enhance the chances of increased HAI and treating hyperglycaemia can improve the outcome[19]. Diabetic patients also have compromised immunity for that the chances of any kind of infection gets enhanced[20].

Conclusion

The higher incidence of healthcare associated infection is alarming. It can be said that to get rid of this alarming condition we, the healthcare givers, must be very careful and follow the instructions given by the Infection Prevention & Control Programme (IPC) of WHO that is ongoing all over the country to limit all kinds of infections or it will be difficult to avoid such fatal conditions.

Conflict of Interest

The authors declared that they have no conflicts of interest.

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