Hospital Acquired Infection in a Tertiary Military Hospital in Dhaka, Bangladesh

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Abstract: This descriptive cross sectional study was conducted among the surgical patients of all age and sex at Combined Military Hospital, Dhaka, Bangladesh. The data were collected from 5 April 2015 to 12 April 2015 with a view to find out the prevalence of hospital acquired infection (HAI), its risk factors and pattern of organisms responsible. A total of 360 respondents happened to be available in different surgical wards during data collection period and 30 respondents developed HAI, thus a prevalence rate of 8.33% was yielded. The mean age of the respondents was 36.89 years with standard deviation ± 14.54 years. Among the HAI cases, 53.33% were surgical site infections and 50% were caused by Escherichia Coli. The study found that frequency of HAI depended on patients' performance status: among 40% who required assistance for most activities, who had visitors more than 3 per day (81.3%), who had underlying illness like diabetes mellitus (25%), who had invasive devices (9.5%), who were admitted in ICU (12.9%), who received immunosuppressive therapy (23.5%), who had immunosuppressive conditions (28.1%), who had emergency operation (34.8%), and who had undergone general surgery (19.0%). Findings suggest that association between HAI and number of visitors, admission in ICU, immunosuppressive conditions, use of immunosuppressive therapy, use of invasive devices, and different functional state of patients were statistically significant (p<0.05). Findings of this study suggest that measures need to be taken at increasing awareness of hospital staffs, formulation of policy on use and duration of use of invasive devices, establishing a surveillance system and controlling visitors for effective control of HAI. The researcher suggests further detail study with large sample involving multiple hospitals to get more accurate picture on HAI.

Keywords: Hospital Acquired Infection, Tertiary Military Hospital, Bangladesh

1. Introduction

Despite immense progress in public health and hospital care, infections continue to develop in hospitalized patients without any concession. The effect of hospital acquired infections (HAI) is among the major causes of death and increased morbidity in both developed and developing countries resulting in significant burden both for patients and hospital administration. The World Health Organization (WHO) carried out a study in 2002 in 55 hospitals of 14 countries and found an average of 8.7% of hospital patients with HAI. The situation is worst in Eastern Mediterranean and South East Asian region and accounted for figures of 11.8% and 10.0% respectively. [1] In India, 10-30% of

patients admitted in hospitals acquired HAI, according to a Hospital Infection Survey. The involvement of high cost as an outcome of antibiotic intake, prolonged hospital stay and loss of work effect the health and weaken the economy too. In a few situations, HAI lead to septicaemia having a mortality rate of 80%. [2]

In Bangladesh, a few studies have been conducted in this field. A study in 1990, found the rate of HAI in Dhaka Medical College Hospital as 30%. [3] In 2003, the rate of infection in the same hospital was found to be 11.34%. [3] The study revealed that 38.2% patients with HAI had to bear the burden of extra medical expenditure (1001-2000/- taka)

because of longer hospital stay. A study in CMH Dhaka in 1999, found that HAI rate was 2.04% for which the author recommended further evaluation. [4]

Another study found that the for HAI, average length of hospital stay increased for additional 26 days for patients who developed blood stream infection of pneumonia, additional 12.4 days for UTI, additional 7.8 days for surgical site infection. [5] The primary cost is that patient with HAI needs prolong hospital stay, during which time occupies scarce hospital bed, requires additional diagnostic and therapeutic interventions. Estimated cost of these infections in 2002 prices suggests $ 6.7 billion in each year in USA and $ 1.7 billion in UK. It also found that in USA, average treatment cost for a patient with HAI was more than $29,000, compared to $8,300 for an average patient without HAI. [6] The Institute of Medicine, USA reports that hospital-acquired infection is responsible for 44,000-98,000 deaths per year at a cost of $17-29 billion in USA. [7]

Justification of the study

Bangladesh is one of the least developed countries suffering from the curse of population explosion with a growth rate of 1.2%.[8] A densely populated country with average household size of 4.5 people, [9] with economic status which is far below subsistence level. In our country, hospital-bed: population ratio is only 0.58:1000. [10] Hospital acquired infections take up scarce health care resources by increasing mortality and morbidity, by prolonging patients' hospital stay. Effective infection control strategies can release these resources gone waste, for alternative healthcare uses. The present study is an attempt within constraints of money and time to provide with information related to hospital acquired infection in CMH Dhaka. The findings, discussions and recommendations of this study may provide an insight to effective planning for prevention and control of HAI.

2. Materials and Methods

This observational, descriptive cross-sectional study was conducted among all admitted patients of surgical units (General surgery, Neurosurgery, Urology, Orthopedics, Gynaecology and Obstetrics wards, surgical intensive care units, Post-operative wards) of CMH Dhaka irrespective of their age and sex and those who were willing to participate in the study. During the period of 5 April 2015 to 12 April 2015, a total 360 patients who fulfilled the inclusion criteria and were not admitted 48 hours before data collection were included. This study attempted to find the prevalence rate of Hospital Acquired Infection in CMH Dhaka, along with analysis of personal factors, socio-demographic factors, and hospital related factors in relation to HAI. Research instrument which contained mainly structured questionnaires was developed and pre-tested among ten subjects of surgical ward of CMH Savar for clarity, accuracy and face-validity. Operationally, HAI was defined as infection that occurred in a patient while in the hospital, in which infection was not present or incubating at time of

admission. The infection has been considered as hospital-acquired, when it first appeared more than 48 hours after admission. History sheets were thoroughly checked for evidence of infection during admission into hospital; if found were excluded from the study. Those who were found to be having symptoms and signs of infections, appropriate samples were collected for culture and diagnosis was confirmed. Those already admitted in hospital before the date of data collection, diagnosis of HAI was confirmed basing on history, judgments of surgeons and by culture report. Data were processed in SPSS version 16. Descriptive and inferential statistics of the data were performed and pattern of organisms identified from culture were analyzed. Ethical approval was obtained from Director General Medical Services (DGMS), Bangladesh Armed Forces.

3. Results

A total 360 (n=360) respondents were studied who happened to be available for admission in surgical wards of Combined Military Hospital (CMH), Dhaka during 05 April 2015 to 12 April 2015. The mean age of the respondents was 36.89 years with standard deviation $\pm$ 14.53 years (Table-1).

Table 1. Age distribution of the respondents (n=360).

Age (In years)	Frequency (n=360)	Percentage
15-19	18	5.0
20-29	103	28.6
30-39	119	33.1
40-49	35	9.7
50-59	48	13.3
≥ 60	37	10.3
Total	360	100.0

Mean ± SD = 36.89 ± 14.53 years

Among the total respondents (n=360), 30 (8.33%) developed HAI. Among them, 53.3% were surgical site infection (SSI), 33.33% urinary tract infection (UTI), 6.67% soft tissue infection (STI), 3.3% respiratory tract infection (RTI), and 3.3% developed blood stream infection (BSI) (Figure-1).
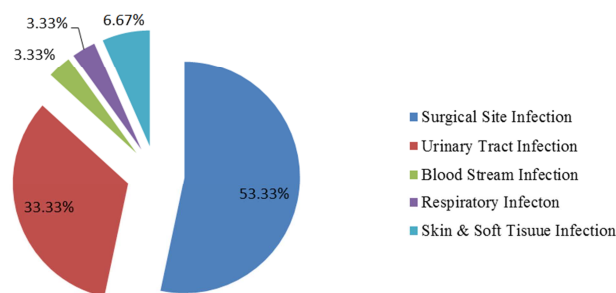
TYPES OF HAI IN RELATION TO SITE

Figure 1. Types of HAI, in relation to site (n=30).

Distribution of HAI by various surgical wards shows, highest in ICU (12.9%), and in chronogical order, in general

surgery ward (11.1%), orthopaedic ward (9.7%), post-operative ward (6.5%) and obstetric & gynaecology ward (5.6%) (Table-2)

Table 2. Distribution of HAI among various surgical wards (n=360).

Surgical ward	Hospital acquired infection		Total
	Present	Absent	
Urology	3 (6.7%)	42 (93.3%)	45 (100%)
ICU	4 (12.9)	27 (87.1)	31 (100)
Post operative	2 (6.5)	29 (93.5)	31 (100)
General surgery	6 (11.1)	48 (88.9)	54 (100)
Nerosurgery	0 (00)	7 (100)	7 (100)
Gynaecology & Obstetrics	5 (5.6)	84 (94.4)	89 (100)
Orthopaedics	10 (9.7)	93 (90.3)	103 (100)
Total	30 (8.33)	330 (91.67)	360 (100)

Figure in parenthesis indicates row percentage

By functional state, respondents who required assistance, 40% of them had infection, those who required some assistance 6.8% of them had infection and those who could perform activities at own, 4.9% of them developed infections. Association between different functional state and HAI was found statistically significant (p < 0.001) (Table-3).

Table 3. HAI among different level of physical activities (n=360).

Functional state	Hospital acquired infection		Total
	Present	Absent	
Can perform activities at own	7 (4.9%)	136 (95.1%)	143 (100%)
Require assistance for some activities	13 (6.8)	179 (93.3)	192 (100)
Require assistance for most activities	10 (40)	15 (60)	25 (100)
Total	30 (8.33)	330 (91.67)	360 (100)

$\chi 2=35.645$, df=2, p=0.000

Figure in parenthesis indicate row percentage

Prevalence rate of HAI was determined by following formula: Prevalence rate (p) =
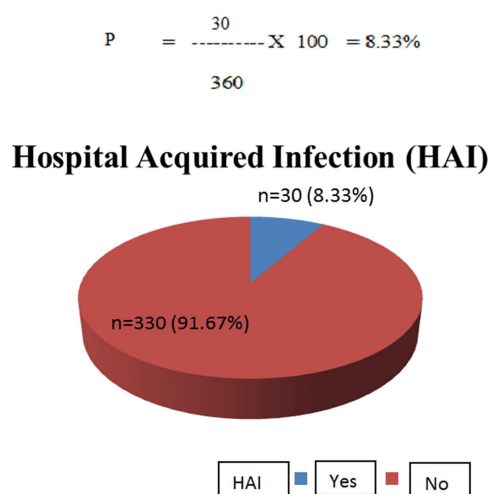
$$\text{Prevalence rate (p)} = \frac{\text{Number of people with HAI at the time of data collection}}{\text{Number of people in the population at risk at the time data collection}} \times 100$$

$$P = \frac{30}{360} \times 100 = 8.33\%$$

Hospital Acquired Infection (HAI)

n=30 (8.33%)

n=330 (91.67%)

HAI   Yes   No

Figure 2. Prevalence of Hospital-acquired infection 8.33%.

It was evident that those who had more than 3 visitors per day, they constituted 81.3% of HAI cases, whereas 18.8% developed HAI, who had 3 visitors per day, and those who had 1 and 2 visitors per day, constituted each 1.6% of the HAI cases. About 3% of HAI cases had no visitors. Association between visitors and HAI was found statistically significant (p < 0.001) (Table-4)

Table 4. HAI cases in relation to number of visitors (n=360).

Average visitors per patient per day	Hospital acquired infection		Total
	Present	Absent	
1	2 (1.6%)	122 (98.4%)	124 (100%)
2	2 (1.6)	121 (98.4)	123 (100)
3	12 (18.8)	52 (81.3)	64 (100)
3	13 (81.3)	3 (18.8)	16 (100)
No visitor	1 (3)	32 (97)	33 (100)
Total	30 (8.33)	330 (91.67)	360 (100)

$\chi 2=136.245$, df=4, p=0.000

Figure in parenthesis indicate row percentage

Table-5 depicts that 27 (9.5%) of the respondents who applied invasive devices developed HAI, whereas 3 (4.0%) of the respondents who did not use any device, developed infections. Association between invasive device and HAI was found statistically significant (p < 0.05)

Table 5. HAI in relation to use of invasive devices (n=360).

Use of invasive devices	Hospital acquired infection		Total
	Present	Absent	
Yes	27 (9.5%)	258 (90.5%)	285 (100%)
No	3 (4.0)	72 (96.0)	75 (100.0)
Total	30 (8.33)	330 (91.67)	360 (100.0)

$\chi 2=329$, df=1, p=0.042

Figure in parenthesis indicate row percentage

The study found that 22.7% of the respondents among 66 who were admitted in ICU developed infections, whereas 5.1% of the respondents who were not-admitted in ICU developed infections. Association between HAI and admission in ICU was found statistically significant (p < 0.001) (Table-6)

Table 6. Distribution HAI, depending on admission in ICU.

Admission in ICU	Hospital acquired infection		Total
	Present	Absent	
Yes	15 (22.7%)	51 (77.3%)	66 (100%)
No	15 (5.1)	279 (94.9)	294 (100.0)
Total	30 (8.33)	330 (91.67)	360 (100.0)

$\chi 2=21.919$, df=1, p=0.000

Figure in parenthesis indicate row percentage

Out of 30 HAI cases, 50% were caused by E Coli, 27% were by Ps aeroginosa, 7% were by Staph aureus, 7% organisms could not be grown in couture in spite of having the features of infections (Which may be due to antibiotic effects), 3% each by Proteus, Candida albicans and mixed infection which included E Coli and Ps Aeroginosa (Figure-3).
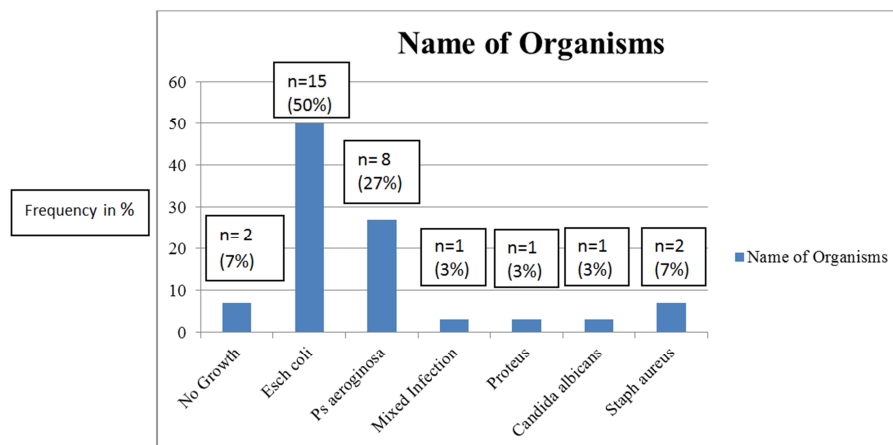
Figure 3. Organisms causing HAI (n=30).

4. Discussion

Present study aimed at describing the state of hospital acquired infection in Combined Military Hospital, Dhaka. In doing so, it tended to fill a major gap in current knowledge of extent of HAI and related factors.

Present study found total 30 cases of HAI among 360 populations at risk, making a prevalence rate of 8.33%, which did not conform to findings of Sridhar MR et al, [11] which found prevalence rate of HAI among South East Asian countries in 2004 as 10%. Same was applicable to the findings of Khan HM et al, [3] where rate of HAI in 2003 at Dhaka Medical College Hospital was 11.34% and the findings of Hossain T et al, [12] where infection rate of Dhaka Medical College Hospital in 1991 was 30%. The difference with this study, may be due to that fact that in any Military Hospitals, usually strict compliance to aseptic precautions are maintained, which to certain extent may bring down the rate of HAI in comparison to national average or other public hospitals. The result concorded with the findings of Emmersom et al, [13] where HAI rate in UK in 1996 was 8.0% (Range- 2-29%). Haley RW et al, [14] conducted a study in USA in 1985, and HAI prevalence rate was 5.7%.

This study found site-wise HAIs as follows: 53.3% were Surgical Site Infections (SSI), 33.3% Urinary Tract Infection (UTI), 6.57% Skin & Soft Tissue Infection (SSTI), 3.3% Blood Stream Infection (BSI), 3.3% were Respiratory Tract Infection (RTI). Present study did not conform to the findings of Hussain T et al, [12] where among the HAI cases, 36.1% were SSI, 23.6% were UTI, 15.2% were RTI, and 12.6% were Gastro Intestinal Tract Infection. This study almost conformed to the findings of Hussain M et al, [15] where HAI as per site was as follows: 50.1% SSI, 34.9% UTI, 7.93% SSTI, 3.1% BSI and 3.9% RTI.

This study found that those respondents who had more than 3 visitors per day, 81.3% of them had developed HAI, those who had 3 visitors, 18.8% of them had developed HAI. This finding did not conform to the result of Hussain T et al.

[12] This study result found strong association between number of visitors per patients and development of HAI, and found having high statistical significance ($\chi2= 136.245$, df= 4, p <0.001), which almost conformed to the findings of Khan HM et al, [3] where number of visitors per day per patient was associated with developing HAI (t=13.526, df=51.583, p <0.001).

This study found that 285 (79.2%) of the respondents had the application of invasive devices as part of treatment procedure and among them 27 (9.5%) developed HAI. It found that there was association between use of invasive devices and development of HAI (($\chi2= 2.329$, df= 1, p <0.05) which corroborate with the findings of Coello R, [16] and Klevs I et al. [17]

This study found that those who needed assistance for most activities, 40% of them had developed HAI, whereas those who could perform activities at-own, only 4.9% of them had developed HAI. This study was in accord with the finding of Sramova H. [18] This study also found that there was strong association between different functional abilities and development of HAI ($\chi2= 35.645$, df= 2, p <0.001), which also conforms with the findings of Vivian GL et al. [19]

This study found that among all the cases of HAI, 50% were by Esch coli, 27% by Ps aeroginosa, 7% by Staph aureus, no growth could be yielded in 7% cases (Might be due to antibiotic effects), 3% each by Proteus, Candida albicans and Mixed infection (Combined Esch coli and Ps aeroginosa). This finding conforms to the finding of Oncul O et al. [20]

5. Limitations

The study was conducted in selective surgical units, where other departments of surgery were not included (eg Eye, ENT etc), because of time constraints. Also this study is not truly representative of the population of the country, which only included the personnel serving or retired from Bangladesh Armed Forces and their families. In addition, many important

variables related to HAI were not considered (eg, hand washing, over-crowding, general cleanliness, food hygiene, appropriate device handling, house-keeping services, hospital days, antibiotic policy etc), as these did not fall within the purview of this study.

6. Conclusion

This study tended to detail an account of morbidity due to hospital-acquired infection in Combined Military Hospital, Dhaka. The prevalence of HAI was found to be 8.33%, which can be safely inferred from the study that hospital-acquired infection rate is relatively low in relation to the WHO study finding for South East Asian region (10%); but is much higher than CDC recommendation where infection rate is assigned to be less than 3%. To attain further decrease of HAI needs appropriate house-keeping, visitors' control, training and education of both hospital staffs, patients and their attendants and finally, raising awareness at all level.

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