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Full Length Research Paper

Prevalence of Hospital Acquired Infections in a tertiary care hospital in India

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Abstract

Hospital Acquired Infections (HAI), are a cause of prolonged hospital stay, are inconvenient for the patient, constitute an economic burden on health care and increase the mortality of hospitalised patients. The aim of this point prevalence study was to estimate the burden of various hospital acquired infections in our hospital and the major related risk factors for acquiring HAIs. This study helps to provide a standardised tool for hospitals to identify target areas for quality improvement. The HAI was defined according to Centres for Disease Control and Prevention standards. An overall HAI prevalence was 8.78% with highest in ICUs (33.3%) followed by paediatric wards (12.5%) and surgical wards (10.3%). Surgical procedures, mechanical ventilation, urinary catheters, or intravascular devices were independent risk factors for HAI. The most common HAI category was urinary tract infection followed by respiratory tract infections, and surgical site infection. The most frequently administered antibiotics were amoxicillin clavulanic acid, ceftazidime, ciprofloxacin, metronidazole and piperacillin-tazobactam. Most common organisms isolated were Pseudomonas aeruginosa, Acinetobacter baumanii and Staphylococcus aureus. This study provides baseline information of HAIs and associated risk factors for future surveillance. Efforts are needed to strengthen Infection control programs, appropriate national strategies for prevention of HAIs, antibiotic stewardship and repeated prevalence studies in our institution in order to decrease the prevalence of HAI.

Keywords: Hospital-acquired infection, Point prevalence study, Surveillance.

INTRODUCTION

Hospital-acquired infections (HAI) are a significant cause of increased morbidity and mortality in hospitalized patients. In addition, HAI are a cause of prolonged hospital stay, are inconvenient for the patient, and constitute an economic burden on health care .It is estimated that 80% of all hospital deaths are directly or indirectly related to HAIs (Hughes et al., 2005). Studies have shown that HAI prevalence varies from 3.8% to 18.6% depending on the population surveyed and the definitions used (Jensen, 2008). Although eradication of HAI is impossible, a well-conducted surveillance and prevention program may significantly reduce HAI and associated costs. Although continuous prospective surveillance for HAIs is the gold standard, this approach requires comprehensive resources. Unfortunately, prospective surveillance is costly; therefore, point prevalence surveys are preferred for determining the magnitude of HAIs in countries with limited resources. Such studies are inexpensive and do not require extensive resources. It is a relatively rapid method to provide a snapshot of the burden of disease and contributory factors, which can then be used to focus interventional programmes to reduce the burden of disease (Humphreys and Syth, 2006; Reilly et al., 2007). Therefore, the aim of this point prevalence study conducted in our hospital was to estimate the burden of various hospital acquired infections in our hospital and the major related risk factors for acquiring HAIs. This study helps to provide a standardised tool for hospitals to identify target areas for quality improvement.

MATERIALS AND METHODS

The point prevalence study was conducted in a tertiary

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care hospital on 20th November 2013.

All admitted patients who had been in the hospital for at least 48 hours were included in the study. Patients admitted at the time of the survey were excluded. Sister in-charge of all the wards was trained by infection control officer regarding definitions of various HAI and filling of the data collection form. The data included the patient's age, gender, admission date, ward type (surgery, medicine, and intensive care unit), duration of hospital stay etc. The HAI was defined according to Centres for Disease Control and Prevention standards (Horan et al., 2008): an infection was defined as HAI when it originates in the hospital environment, was not present or incubating on admission, and which appeared 48 hours or more after admission. The HAI was classified as urinary tract, surgical wound, pneumonia, bloodstream, and others (skin and soft-tissue infections, intra-vascular and gastrointestinal system infections). All surgical procedures during 30 days, and implants during 12 months prior to the survey were registered. Exposures to invasive devices (urinary catheter, central intravascular catheter, peripheral intravascular catheter, and mechanical ventilation) on the day of, or during the 7 days before the survey were noted. The HAI occurrence, HAI site, micro-organisms responsible for HAI, antimicrobial susceptibility patterns when available, and antibiotic therapy were identified. Data were collected from clinical records, temperature charts, radiographs, laboratory reports, and information provided by ward personnel. For privacy protection, every patient in the survey was given a code and his/her data were registered in database only under this code. The results were processed, analyzed and statistically evaluated in Microsoft Excel.

RESULTS

Of 660 patients included in the survey, there were 372 (56.4%) males and 288 (43.6%) females. 257 patients were from medical wards (medicine, psychiatry), 242 from surgical wards (surgery, orthopaedics, neuro-surgery, ophthalmology, burns and plastic surgery and ENT), 80 from paediatric wards (paediatric and neonatal), 42 from obstetrics and gynaecology and 39 from ICUs (Medical ICU, Trauma ICU, Paediatric and neonatal ICU). Of 660 evaluated patients, 58 patients acquired 77 hospital acquired infections. Hence the proportion of admitted patients with HAI was found to be 8.78%. 46 patients had single HAI while 12 patients had multiple HAIs. The prevalence of HAI was highest in ICUs (33.3%) followed by paediatric wards (12.5%) and surgical wards (10.3%) as shown in table 1. Surgical procedures, mechanical ventilation, urinary catheters, or intravascular devices were independent risk factors for HAI. Out of 660 patients included in the study, 576 (87.2%) patients had peripheral intravenous catheters (PVC), 110 (16.6%) underwent surgery, 88 (13.3%) had indwelling urinary catheters (UC), 54 (8.1%) had central venous catheters (CVC) and 35 (5.3%) were on mechanical ventilator. While the overall HAI prevalence was 8.78 %, if a patient had a device *in situ* the HAI prevalence was significantly higher (13.3%). The presence of specific devices was associated with higher HAI prevalence: CVC (22.2%), PVC (12.6%), urinary catheter (19.3%) and intubation (25.7%). Also prevalence of HAI was higher for patients undergoing surgery than for those who did not have surgery (13.6% versus 7.2%) (Table 2). Table 3 is showing the prevalence of various HAIs in our hospital. The most common HAI category was urinary tract infection (UTI-31.1%) followed by respiratory tract infections (RTI-24.3%), surgical site infection (SSI- 20.3%) and blood stream infection (BSI- 18.2%) as shown in table 3. At least one antibiotic was taken by 572 patients, which represents prevalence of 86.6%. The most frequently administered antibiotics were amoxicillin clavulanic acid, ceftazidime, ciprofloxacin, metronidazole and piperacillin-tazobactam. Microbiological culture results were available for 44 HAI (57.1%). Common organisms isolated were *Pseudomonas aeruginosa, Acinetobacter baumanii, Staphylococcus aureus, Escherichia coli* and *Klebsiella pneumoniae.*

DISCUSSION

In this study we documented an overall HAI prevalence of 8.78%, which is in accordance with other studies particularly from developing countries (13.9%–17.9%) (Jroundi et al., 2007; Allegranzi et al., 2011), but is higher when compared with point prevalence studies from developed countries (5.7%–6.8%) (Sartor et al., 2005). Disease, death, and economic costs associated with HAI are increasing especially in the last few decades. There are certain risk factors associated with high rate of HAIs like length of stay in the hospital, underlying immunocompromised conditions, age of the patient, any surgical procedure during hospital stay and presence of invasive medical devices *in situ* (e.g., vascular catheters, urethral catheters, intubation of the respiratory tract). The prevalence of HAI was highest in ICUs (33.3%) followed by paediatric wards (12.5%) and surgical wards (10.3%). This may be due to the high frequency of invasive procedures, high frequency of serious illness, and use of large therapeutic agents (Metintas et al., 2004). In our study, the presence of specific device was associated with higher HAI prevalence: CVC (22.2%), PVC (12.6%), urinary catheter (19.3%) and intubation (25.7%). The device associated infections identified within this survey further emphasise the importance of improving practices around insertion and maintenance of medical devices. Also prevalence of HAI was higher for patients undergoing surgery than for those who did not have surgery (13.6% versus 7.2%).

Table 1. Prevalence of HAI in various wards

S.No.	Wards	No. of admitted patients	No. of HAI patients	%age of HAI
1	Medical wards	257	8	3.1%
2.	Surgical wards	242	25	10.3%
3.	Paediatric wards	80	10	12.5%
4.	Obstetrics & gynaecology	42	2	4.7%
5.	ICUs	39	13	33.3%

Table 2. Distribution of HAI by intrinsic risk factors

S.No.	Risk factors	No. of patients	Presence of HAI	HAI prevalence percentage
1	Invasive device *in situ*	578	77	13.3%
2	PVC	576	73	12.6%
3	CVC	54	12	22.2%
4	Urinary catheter	88	17	19.3%
5	Intubation	35	9	25.7%
6	Without any invasive device	82	0	Nil
7	Any surgery done	110	15	13.6%
8	No surgery	550	40	7.2%

Table 3. Prevalence of various hospital acquired infections in our hospital

S. No.	HAI groups	No. of HAI	Percentage of HAI
1.	Urinary tract infection	23	29.9%
2.	Respiratory tract infections	18	23.3%
3.	Surgical site infection	15	19.5%
4.	Bloodstream infection	14	18.2%
5.	Burn wound infection	6	7.8%
6.	Others (skin infection)	1	1.3%
	Total	**77**	

The most common HAI category was UTI followed by RTI, SSI and BSI which are similar to those reported in other studies and should call importance to the strong association between urinary tract infection and urinary catheter (Zarb et al., 2012; ECDC, 2011). High rate of RTI and SSI could be because of the fact that it is a tertiary care hospital and hence complicated cases are referred which requires emergency intubation and surgical procedure. BSI are potentially serious infections, which often require lengthy courses of intravenous antimicrobials, may result in metastatic infection to cardiac valves, bones and joints and are associated with patient morbidity and mortality. BSI associated with intravascular catheter infections are potentially preventable via simple measures, which include; avoiding unnecessary use of catheters, inserting and maintaining catheters with care and removing catheters when they are no longer required (All Wales, 2011).

While the use of antimicrobial agents has revolutionised our ability to treat infections, it is associated inevitably with the risk of development and spread of antimicrobial resistance. In our study, 86.6% of patients were prescribed antimicrobials. Antimicrobial resistance is a cause for concern as HAIs are difficult and more expensive to treat and associated with increased patient morbidity and mortality. Also there is emergence of multidrug resistant organisms in the hospital like methicillin resistant staphylococcus aureus, extended spectrum ß-lactamase, Amp C production and carbapenemase production over the past few decades and there are extremely limited treatment options for these infections and there will be no new antimicrobials available in the foreseeable future. Hence it is important that all hospitals should implement appropriate use of antimicrobials and good prescribing practices. Adaption of such a framework by doctors, specifically for antimicrobial prescribing, may be a useful tool to improve prescribing practices (Scottish Antimicrobial Prescribing Group, 2010).

Data fields on the types of micro-organisms causing HAI were poorly completed, with only 57.1% of the HAI having an associated micro-organism. In general, the most common HAI pathogens (*P. aeruginosa* and *A. baumanii*) identified in our survey were similar to those identified in other published investigations (Hung et al., 2008; Allegranzi et al., 2011). Multidrug resistance

among gram-negative bacteria has rendered therapy of HAIs more difficult or likely to fail and has increased the attributable morbidity and mortality (Hulscher et al., 2010). Thus, for developing countries like India, surveillance of antimicrobial resistance is essential for preventing the emergence and transmission of multidrug-resistant pathogens in healthcare facilities.

Our findings suggest that infection control practices and procedures need to be strengthened further and also training and reinforcement of aseptic techniques in healthcare personnel for performing invasive procedures is required. Hence it is necessary to provide comprehensive educational programs for healthcare workers, addressing basic infection control (IC) issues, such as standard precautions, device utilization, and evidence-based practices and procedures, and to establish more effective institutional IC policies. However, even though the prevalence surveys are a rapid, inexpensive, and easy way to estimate the HAI problems, they are less acceptable and less reliable than prospective surveillance studies because it is a snapshot at one particular point in time and may not represent the prevalence at all other times in the same hospital, or at different times of year, such as seasonal variations. Also, despite standardised training, there may be variations in the interpretation of definitions and the availability of data items necessary for the fulfilment of definitions, between data collecting teams and hospitals (Hopmans et al., 2007). Despite these limitations PPS (point prevalence survey) data are very valuable as they give the best available estimate of the total burden of HAI and antimicrobial use to inform the targeting of appropriate quality improvement plans and interventions.

Our study had some limitations. One-day point prevalence studies tend to overestimate persistent infections and underestimate infections with shorter durations. This study did not cover all risk factors leading to HAIs, such as underlying disease, previous hospitalisations, frequency of days before surgery, admission to the emergency ward and the need to perform invasive procedures under emergency conditions. Also data regarding micro-organisms causing HAIs and their antimicrobial resistance were not complete.

CONCLUSION

This study provides baseline information of HAIs and associated risk factors for future surveillance. Efforts are needed to strengthen Infection control programs, appropriate national strategies for prevention of HAIs, antibiotic stewardship and repeated prevalence studies in our institution in order to decrease the prevalence of HAI. Our results highlight the need for a national HAI database and reporting system using standardized surveillance definitions to monitor HAI trends and patient outcomes.

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