Original Research Article

Epidemiology of hospital-acquired infections in a tertiary care teaching hospital in India: a cross-sectional study of 79401 inpatients

V. Narendranath[1], B. S. Nandakumar[2], K. S. Sarala[1]*

[1]Department of Hospital Administration, Ramaiah Medical College Hospital, Bangalore, Karnataka, India
[2]Department of Community Medicine, Ramaiah Medical College, Bangalore, Karnataka, India

*Correspondence:
Dr. K. S. Sarala,
E-mail: dr.saralaks2014@gmail.com

ABSTRACT

Background: Healthcare-associated infections are those infections that the patients develop during the course of receiving healthcare treatment for other conditions, which are not incubating at the time of admission. Health care associated infections are the major concerns in the developing countries commonly affecting the ill patients. The purpose of the study is to assess the epidemiology of health care associated infections (HAI) in a tertiary care teaching hospital.
Methods: Cross sectional retrospective data was collected for all inpatients from January 2013 to December 2015 covering 79401 inpatients. Data was collected as per ICD – 10 coding, analyzed using SPSS software ver.16.
Results: Overall Percentage of different types of HAI calculated, UTI- 1318 (1.66%) more among females and 51.7 %, highest rate in general ward. BSI -360 (0.45%) with 54% male patients, 79.7% medical related type of diagnosis, 66.9% cases from ICU. VAP 148 (0.19%), 62.1% male patients, 94.8%- medical related type of diagnosis. SSI – 30 (0.04%) 65.5% male patients , General Ward 86.2% , 65.5% male patients. Mortality analysis reveal maximum number of deaths was due to BSI contributing to 27.22 % as case fatality rate and 60.12 % proportional mortality rate.
Conclusions: Occurrence of hospital acquired infections pose a grave threat to patients as well as health care personnel. Tertiary care centers require a multi-pronged approach to tackle these infections. HAIs lead long term disability, increase in hospital stay, financial burden to the family members. Many a times health care associated infections can be prevented by using standard guidelines, precautions, correct protective measures by health care workers.

Keywords: Economic burden, Epidemiology of HAI, Mortality rates, Nosocomial infections

INTRODUCTION

As per World Health Organization – out of every 100 hospitalized patients at any given time, 7 in developed and 10 in developing countries will acquire at least one health care-associated infections. Most Common types of HAIs includes Surgical Site infections (SSI), Urinary tract infections (UTI), Blood stream infections (BSI) and Ventilator Associated Pneumonia (VAP).[1] Adult inpatients in common specialties who developed hospital acquired infection (HAI) remained in hospital 2.5 times longer, incurred hospital costs almost three times higher. Hospital costs after discharge from hospital than uninfected patients. Increased resistance of microorganisms to antimicrobials, additional costs for health care systems and unnecessary deaths. Health-care-associated infections many times causes life threating to patients all over worldwide.

HAI surveillance plays an important role to evaluate the economic burden of HAI. In low and middle income country monitoring of HAI has become difficult task at the national level because of underreporting thus, Ministry of Health & Family Welfare (MOHFW) is unable to report the burden.

Systematic reviews of the literature have been conducted by several authors regarding HAI, published studies says that both developed and developing countries face a burden of HAI in varying degrees. The authors highlighting the magnitude of the HAI problem.

METHODS

Study was conducted in M.S. Ramaiah hospital, a tertiary care teaching hospital with 12 –general specialty and 13 – super specialty departments with 800 bed strength. The hospital offers clinical services like out patient services, in-patient services, multidisciplinary intensive care, paediatric ICU, neonatal ICU services, accident and emergency services -24/7, 13 major operation theatres. Non clinical/supportive services includes NABL accredited laboratory radiology, maintenance department, biomedical engineering department, medical records department, laundry, CSSD dietary services, rehab and physical medicine, mortuary.

This study is based on the retrospective data for HAI surveillance data subjected to ICD-10 Coding. The study focused on the data collected from January 2013 – December 2015 from all the inpatients who were admitted for more than 48 hours and categorized as per ICD – 10 coding. Inclusion criterion included patients confirmed with urinary tract infections (UTI), blood stream infections (BSI), ventilator associated pneumonia (VAP) and surgical site infections (SSI). Data collected included the following types of related factors such as demographic details ward category (general ward/ private ward/ICU), admission diagnosis (medical specialty/surgical specialty), microbial profile (*Cocci, Bacilli, Klebsiella, MRSA*) obtained through standard techniques.

Statistical analysis: Retrospective data was collected using descriptive analysis, calculated based on ICD- 10 Coding for the most commonly occurring health care associated infections as mentioned above. Data was collected entered into the Microsoft Excel Spread Sheet. The data was subjected to various data quantity checks and the data was exported to SPSS Software version 16.0 Quantitative analysis for continuous variables was done and summarized by using excel spread sheet presented in the form of tables, frequency of mean was calculated and the diagrams were plotted on continuous graph for the representation of the results. The percentage of each health care associated infections were done.

RESULTS

Study period included records of 3 years, total in-patient admissions was 79401. A total of 47357 devices or procedures were undertaken. Distribution of patients were maximum in general ward and least in ICU.

Overall occurrence of different types of HAI calculated revealed, UTI- 1318 (1.66%) more among females and 51.7%, highest rate in general ward. BSI -360 (0.45%) with 54% male patients, 79.7% medical related type of diagnosis, 66.9% cases from ICU. VAP 148 (0.19%), 62.1% male patients, 94.8%- medical related type of diagnosis. SSI – 30 (0.04%) 65.5% male patients, General Ward 86.2% , 65.5% male patients.
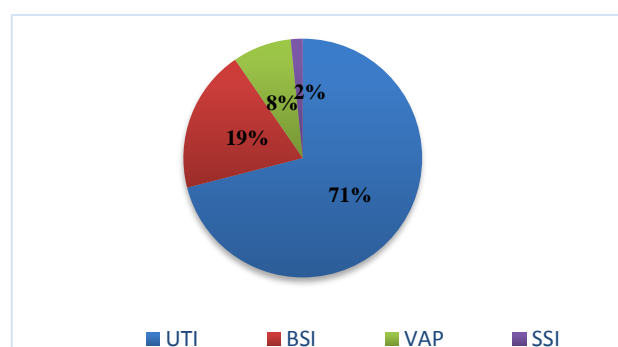

Figure 1: Overall percentage of different types of HAI.

Table 1: Demographic description for different types of HAI.

Variable (N=79401)	UTI	BSI	VAP	SSI
Devices inserted / procedures	12852	3761	2216	28528
Device days	46127	18137	8399	-----------
General ward	1019 (77.2%)	98 (27.3%)	116 (78.7%)	25 (85.5%)
Private ward	253 (19.2%)	21(5.6%)	20 (13.3%)	4 (11.6%)
Intensive care unit (ICU)	46 (3.4%)	241 (66.9%)	12(7.7%)	1(2.7%)
Medical related	931 (70.6%)	288(79.7%)	140(94%)	-----------
Surgical related	387 (29.2%)	71(19.9%)	8(5.0%)	-----------
Female patients	682 (51.7 %)	153 (42.7%)	56 (37.9%)	10 (34.4%)
Male patients	636 (48.3%)	207 (57.3%)	92 (62.0%)	19 (62.7%)

Total number of deaths attributable to UTI, BSI, VAP and SSI were 163. Mortality analysis reveal maximum number of deaths was due to BSI contributing to 27.22% as case fatality rate and 60.12 % proportional mortality rate.

With regards to the microbial profile of the organisms involved in the HAI, bacilli were the most frequent accounting to 590 confirmed cases. Other organisms implicated were *Cocci, Staph aureus, Acinetobacter, Klebsiella* and *Pseudomonas aeruginosa*. Among UTI cases *baccili* contributed to 545 (85%) of infections whereas cocci was the most frequently encountered infections among SSI cases accounting for 12 (54.55%)**.**

Table 2: Co-morbidities and mortality rates for different types of HAI.

Variable	UTI	BSI	VAP	SSI
Confirmed cases	1318 (1.66%)	360 (0.45%)	148 (0.19%)	30 (0.04%)
Co-morbidities (DM, HTN, Others)	325 (24.7%)	221 (61.3%)	29 (19.7%)	20 (68.8%)
Deaths	45	98	20	None
Cause specific death rate	0.06%	0.12%	0.03%	None
Case fatality rate	3.41%	27.22%	13.51%	None
Proportional mortality rate	27.61%	60.12%	12.27%	None

Table 3: Microbial profile of the different types of HAI.

Microbial profile	UTI	BSI	VAP	SSI
Bacilli	545 (85%)	29 (21.3%)	13(56.7%)	3(13.64%)
Other organisms	24 (3.7%)	55 (54.1 %)	5(18.5%)	7 (31.82%)
Cocci	70 (11%)	36 (24.6%)	7(24.6%)	12 (54.55 %)

*Other organism includes - *Aures, Acinetobacter, Klebsiella, Pseudomonas aeruginosa*

Table 4: Preventive guidelines for different types of HAI.

	Suggested preventive mechanisms
UTI	- Insertion of catheters only for appropriate indication - trained persons insert and maintain catheters using aseptic technique and sterile equipment (acute care setting) - maintain a closed drainage system with unobstructed urine flow
BSI	- Educate healthcare personnel regarding the indications for intravascular catheter use - Trained persons insert and maintain catheters using aseptic technique and sterile equipment - Assessing the knowledge of all personnel involved in the insertion and maintenance of intravascular catheters - Ratio of staff levels in icus monitoring
VAP	- Hand hygiene-chlorhexidine - HOB – Head Of Bed Elevation – 30-45 DEGREE - Attention to proper ET and TT cuff pressures , Oral hygiene x 4 hrly - Closed endotracheal suctioning system and Daily sedation vacation with spontaneous breathing trial - Enteral feeding instead of TPN and GI prophylaxis - Strict glucose control - Subglottic suctioning before deflating the cuff of ET/TT
SSI	- Optimize health- Control risk. - Bathing prior to surgery - Meticulous Hand Hygiene, Adhere to appropriate scrub and drying times , Head Covering – Wear a cap, face, Shoe covers and Eye Shield - Skin preparation- to remove harmful bacteria - Appropriate surgical techniques- the types of incisions made, the amount of manipulation of the tissue - Required, the amount of time the procedure takes and the technique used to close the incision can increase or reduce the risk of infection. - Avoid flashing of surgical instruments

DISCUSSION

HAIs leads to morbidity and mortality increases with the increase in HAI , the WHO and many health care organizations have come forward setting the standard operating protocols at the national and also international level for reducing the burden of HAI.

Urinary tract infections (UTI)

Our study revealed that UTI was the most common among all the type of HAI. Several studies have reported that UTI as the most common and frequently occurring HAI especially in critical ill patients.

Similar study was conducted by Ahmed al-Bader et.al found that UTI frequency was more commonly seen in in women when compared to men in the female:male ratio was 8:1, many females complain of UTI and they are resistant to many antimicrobials during their course of treatment.[2-4]

Blood stream infections (BSI)

Blood stream infections are the second most commonly occurring HAI in our study. Catheter-related bloodstream infection originates from the insertion of central line catheter which causes severe infection leads to complexity of the disease , difficult to treat , costlier to treat the disease as it causes septicemia.[5] As per Egypt national cancer institute , a study was conducted by them and showed that the BSI were the second most commonly occurring HAI, Among the overall % of BSI , study showed that 61% cases had central line catheter insertion.[6] Study by Ali et al also reported that prolonged hospitalization /longer hospital stay increases the rate of HAI.[7,8]

A study conducted by Hamdan et al reported similar microbial profile of organisms which correlated well with the current study findings.[9]

Ventilator associated pneumonia (VAP)

VAP remains an important complication of patients who get admitted to ICU , and it is also an   important drain on hospital resources for both the patients and the care givers.[8] A study conducted by Rouby et al had similar findings with older patients admitted to ICU, patients with more co-morbidities, patients who are   chronic smokers , patients who are on mechanical ventilators for longer duration succumb to complications for VAP.[9] Study by Fagon et al also showed similar findings , 7.3% infections per 100 patients among them 37.8% female patients , 62.1% male patients had VAP . Mortality rate was 0.52% of infections per 100 infections. VAP patients had a co-morbid conditions which contributed to 33.2%.[11]

Microorganisms such as *Bacilli* (56.7%) , other organism (18.5%), *Cocci* (24.6%), other microorganisms included budding cells, *Aures, Acinetobacter, Klebsiella, Pseudomonas aeruginosa* which contributed to 18.5% were found in the VAP infection. Several studies showed that gram-negative bacilli   is the   common most microorganism responsible for VAP

Surgical site infection (SSI)

Surgical site infections are complications of any surgical /operated procedure and increases the cost of treatment, mortality rate hospital stay. SSIs are predominant in diabetes patients were delayed wound healing is an known phenomena.

Direct mortality attributed to SSI was not reported in this study. Patients who had SSI had 68.6% of co-morbid conditions.

Cocci   were   the   most   commonly   implicated microorganisms   in   the   study.   Similar   study   was conducted by Haley et al reported "*Streptococci species* (11.2%), *Pseudomonas aeruginosa* (6.7%), coagulase-negative *Staphylococci (*10.1%),   *Enterobacteriaceae* (12.4%), *Enterococci species* (7.9%) and *Staphylococcus aureus* (25.8%) as the causes for SSI.[12-14]

CONCLUSION

Hospital acquired infections pose a grave threat to the treatment of patients in tertiary health care settings. These pose a risk not only to the patients but equally affect the health care personnel. They contribute significantly to the cost of hospitalization and mortality rates. Management of HAI in tertiary care settings require a multi-pronged approach as outlined in the above table.

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