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Over view of healthcare associated infections in Indian and global scenario: A literature review

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Abstract: Hospital Acquired Infectionsare known as Health care associated infections / Nosocomial infections. These are the type infections that patient develops during their course of receiving Healthcare treatment for other conditions, which are not present during the time of admission. Hospital acquired infections occurs usually after 48hrs of admission or within 30days of discharge/surgery done or within 2 years of implants placed. Common hospital acquired infections include Surgical site infections, Blood stream infections, Ventilator-associated pneumonia, Urinary tract infections. It is indeed a great challenge for clinicians to deal with Health-care-associated infections as these infections many times causes life threating to patients, causes morbidity , mortality and long term disability. Hence the burden of Health care expenditure and control on cost is the main area to be focused. Developed countries have less rate of HAI when compared to developing countries due to the variation of money spent in each country as health budget in their GDP. According to world health statistics the total GDP on health spent in India is only 1.62% of total health budget. Money spent on health care is more in United States which accounts from 8.8 to 15.2% of GDP. According to the national health policy draft 2015 the public expenditure on health is rising from one percent of GDP to 2.5 %. In the light of this fact, still the healthcare outcomes are not improved. In the socio-economic and epidemiological point of view, the study of HAI (Hospital acquired infections) is important as they increase the economic burden to the patient due to increase in hospital stay to care givers , burden to the Hospital administrators, patients and clinicians. Proper Protective measures like Personnel Protective Equipment, Hand hygiene, proper sterilization of equipment's and instruments helps to reduce the number of HAI.

Keywords: Hospital acquired infections, Cost control, Length of stay, Epidemiology.

Introduction

Hospital acquired infections are those Infections which are not occurring at the time of admission, usually seen after 48 hours of admission / 30 days of surgery / 2 years of implants placed. These infections sometimes appears in the hospital or seen even after discharge and HAI are also occupational infections among staff who are directly involved in treating the patients [1].

These health care associated infections causes Morbidity, Illness to the patient, Mortality, Longer stay in hospital, Longer recovery time, More expenditure to the patients, Anti-microbial resistance, Emotional consequences and Medical consequences.

Health care Associated Infections occur in any type of health care settings such as;

- Acute heath care hospitals which includes Primary health cares at the rural areas, District health care centers at the district level, Super specialty centers at the teaching hospitals, Quaternary care centers at the capital centers.
- Poly clinics.
- Dialysis centers.
- Outpatient clinics/ Departments.
- Nursing Homes.
- Physical medicine and Rehabilitation centers.

Hospital acquired infections are caused by various disease causing pathogenic microorganisms which include Acinetobacter, Vancomycin - resistant Enterococci, Clostridium difficile, Methicillin-resistant Staphylococcus aureus, klebshella, Staphylococcus aureus, Gram-negative

bacteria, Influenza. These infections are caused by improper aseptic infection control practices, non-sterile environment and unclean surfaces and even through ill employees/ staff [2]. The health care associated infections are preventable but still no country had claimed to solve the issue yet [3]. The numbers of people who are sick and die are high, unacceptably due to HAI due to various underlying factors and co- morbidities.

There is a need for the elimination health care associated infections by implementation of various strategies which will help to reduce these [4]. Health care associated infections burden patient, patient attenders, hospital management, public/community due to the factors like illness to the patient, a longer length of stay at the hospital, taking ling time to recover, costs associated with both length of stay and recovery time, blocking of the beds leading to greater economic burden [5]. Paediatric patients, Immune compromised patients like who are treated with chemotherapy or steroids, very old people like frail and elderly, very young people like premature babies, patients with medical conditions like diabetes are the one who are more prone to hospital acquired infections [5]. HAI diseases are mainly caused by gram negative , gram positive, and other disease causing pathogenic micro-organisms like fungi, bacterial , protozoa's and viruses [6]. As per "National Nosocomial Infections Surveillance" (NNIS) System" most common HAI includes Ventilator associated pneumonia, Urinary tract infection, Surgical site infection and bloodstream infection [6].

Centre for disease control and prevention (CDC) is the major operating body in Health and human services [7]. According to CDC's annual report of National and State Healthcare-Associated Infections Progress Report there was 50% decrease in central line catheter associated blood stream infections. Urinary tract infections associated with Catheters reduced in between the year 2009-2014, there was 17% decrease in abdominal hysterectomy surgical site infections and 2% decrease in colon surgical site infections in between the year 2008 and 2014. In 2011 it was estimated that about 7,22,000 patients were hospitalized with hospital acquired infections and nearly 75,000 patients died due to hospitalization [8]. A study conducted In US showed there was 36% increase in Hospital acquired infections and among them it's been estimated that around 90000 people die each year [9]. It has been reported that hospital acquired infections are the 5th leading causes of death in USA [10].

According to European surveys it is been found that about five to ten percent of patients will get admitted to acute care wards. The reason for acute patient admissions includes immune-compromised status, patients with some disease and those who undergone one or the other procedures, bleeding at the operated site, complications at the medical centres and transferred the patient for higher follow up to a bigger centre . Study was conducted in multi centred tertiary care hospital located in Europe and the data related to Heath care associated infections revealed that about 2.8% of deaths are after 48hours of admission. HAI were frequents and are mostly because of patient transfers from one medical centres to other centre for higher care.

Research was conducted by Malhotra S Sharma and his co-authors to find the prevalence of HAI in various ward category and intensive care units and the rate of various hospital acquired infections. The results showed that the prevalence of HAI was highest in ICUs -33.3%, paediatric wards contributes to -12.5%, surgical wards had infection rate of -10.3%, an overall HAI prevalence - 8.78%. Prevalence of various types of Hospital acquired infection includes UTI- 29.9 %, Respiratory tract infections - 23.3%, SSI - 19.5%, BSI- 18.2%, Burn Wound Infection -7.8%, Others - 1.3% [11].

The rate of HAI was more common in ICU due to various invasive procedures and lifesaving treatments which are done in ICU units and the rate of infection in ICU is more when compared to ward admitted patients. Study conducted by Mythri H and Kashinath K in a selected district hospital among the patients who got admitted in Medical Intensive Care Unit. Results showed the rate of HAI in MICU was 17.7% of patients were acquired with Infections Rate of each category of HAI includes UTI (34.8%) being the most common which is followed by pneumonia (21.7%), surgical site infection (17.4%) and blood stream infections (13%) [12].

Evaluation of term Hospital Acquired Infection

Earlier to 1800 there was only Typus condition which was recognized as a hospital acquired infection. 1830 Sir. James Simpson from England coined the term Hospitalism for hospital acquired infections. Ingaz Semmelweis was a surgeon who came up a concept of hand washing to reduce infection in 1848. The above concept was rejected after 40 years later Joseph Lister put forth the same with a practical application. He showed that 47% of infection occurred in limb amputation patients before washing hands and carbolic acid aseptic measures. Only 15% were infected after the concept of hand hygiene introduction.

Florance nightingale demonstrated the hand hygiene importance in 1854 to treat the solders at military hospital. She could prevent the infection by 40% including death rate reduction from 40% to 2% which actually meets the today standards. 1870's limb amputation was the simple surgery done which acquired with bacterial infections. The theory behind the infection was poor ventilation and stagnant air was responsible for the spread of hospital acquired infections. During 20th century the hospital acquired infections are climbing high because of disease resistance towards the medications, especially antibiotics [13], anti- microbial resistance.

Methods

Critical review of various types of health care associated infections done. The literature search followed with the similar title written by many authors. Literature was searched for recent updates, conference proceedings, various health reports from Centre for disease control (CDC) and World Health Organization (WHO). The terms used were identified from the latest systematic review of literature

Clinical significance of HAI

The diseases causing micro-organisms usually leads to hospital acquired infections. HAI disease is usually associated with the preponderance of foreign body associated infections and also from the presence of indwelling catheters.

Hospital acquired infections are controllable and preventable following simple hand hygiene techniques. In India, most of the hospitals do not follow infection control policies which are the leading cause for rapid spread of the health care associated infections. Several recommendations are put up set up reduce the health care associated infections. These recommendations include control plan for treatment, standard protocols, policies, standard operating procedures, committees and teams [14].

Quality of literature

Our literature search identified 45 papers to establish the various reasons for health care associated infections, burden of HAI, Amount spent on health care, various micro-organisms causing HAI. Hospital-acquired infections causes many times functional disability, emotional stress of the patient and relatives. Quality of life is reduced by Hospital acquired infections and their prolonged treatment. The prolonged stay at the hospital adds cost to the patient. The economic costs are abided with the hospital acquired infections. The costs are added to the patients are both direct cost and indirect cost. Directly due to prolonged stay where as indirectly affects the lost work. The drug usage at hospital during the course of treatment, laboratory charges, and diagnostic procedure costs are also added. Hospital-acquired infections are widespread hence they are important contributors to morbidity and mortality.

On review of studies, there were notifiable features related to health care associated infections, most of the review literature is from over the past few years and recent clinical data available. The data taken were analyzed and interpreted.

Vaman Kulkarni [15] aims at checking the medical students concern about the hospital acquired infection prevention practices. Sample was assumed only the medical students in a medical College in Mangalore. The study method was cross sectional conducted among 268 medical students of Kasturba medical college. Semi structured questionnaires were prepared to know the knowledge about hand hygiene, needle stick injuries standard precautions. The analysis of information is done using SPSS software. The

association between the variables are tested using Fisher's exact test. Knowledge levels were low in concern with hand hygiene (40%) and infections due to needle prick injuries (56%). The knowledge about the indications using hand hygiene and standard practices found the highest. The gaps identified include only knowledge levels were taken into consideration instead of actual disease/ hospital infections part of it. The better focus could be made on assessing the knowledge on hospital acquired infections like SSI, BBI etc.

Decoster [16] aims at determination of Number of deaths occurring because of Nosocomial infections in 14 France hospitals. The study aimed at evaluation of mortality reviews to prevent the nosocomial infection associated deaths. The methods of the study included 13537 deaths which are consecutive and occurred from 2008-2013. The expert team consisted of doctors, physicians and nurses who could determine that nosocomial infectious should be attributed. The team evaluated the medical records of 2355 patients records, 182 patients died at least with one nosocomial infection. Among 182 deaths, 35 deaths were preventable and 10 more deaths were unexpected. The results were correlated to national level and found that 3500 deaths occur in France annually. Among those 1300 were nosocomial infections and 800 deaths could be preventable.

Lilani S [17] aims at rate of surgical site infections and frequency of pathogens which cause surgical site infections in general surgery units. The duration of study was from May 2001 to July 2002. The sample size was 190 patients. The bacteriology and clinically wounds were studied and found that 8.95% of infection rate. The rate of SSI is high and is mainly caused due to the presence of micro- organisms. C. King [18] conducted study to know the rate of catheter associated Urinary Track Infection based on the risk factors in patients. The study methods include literature review, calculation of Population-attributable risk percentages. Results showed that approximately 30% of the risk factors were independent predictors of hospital acquired infection. If catheterization was not performed nearly 79.3% of UTI could have been prevented. 65% were coded with administrative data.

Study conducted in cardiology department to know the rate of Hospital acquired infection associated after cardiac surgery. Prospective collection of data done from multi-centre and observation of all cardio-thoracic patients. Average length of stay and cost associated with it due to infections are determined using linear models among 4320 patients. Results showed that 2.80% of patients experienced HAI due to prolonged hospitalization. The most common HAIs were pneumonia - 48% sepsis contributed to 20%, and Clostridium difficile colitis contributed to 18%. The Length of stay was 14 days. 849 patients readmitted, the cost of readmission was almost 3 times more when compared with non HAIs patients, 8.7% of the patients attributed to major types HAIs. Increased LOS, Hospital cost and readmissions were mainly due to the commonly occurring hospital acquired infections.

Q. L. Grammatico-Guillon [19] conducted a study to describe economical" outcomes of Adult bone joint infections and also the epidemiology in France". The methods used in the study were selected with 3 parameters like demographic details, medical and economic parameters. The data was collected for the year 2008 using French hospital database and results are analysed. Univariate analysis is carried out to know the patient physical characters and length of stay in the hospital.54.6 cases of total 1,00000 people samples are found to be males who stay, 6% of cases from ICU stay, readmissions in 19% of total cases. Longer duration was found in the patients who are associated with devices. (18.9 days). As per the study High economic burden was associated with health care associated infections and it was due to more frequent and prolonged stay in hospitalizations, complexity of care and high morbidity.

M.M. Gianino [20] develop a cost model to calculate cost of the hospital acquired infections. Research focused mainly on cost-modelling method". The study method is Retrospective record analysis. Cost model analysis showedthat infections protract patients Length of stay. This model permits the determination of costs incurred

exclusively by HAIs. Jacobs [21] study conducted Canadian hospital to develop a "model costs of community and nosocomial paediatric respiratory syncytial virus infections. This model helps in predicting the risk and cost of nosocomial infection in paediatric departments only. The model is developed to capture the costs related to respiratory syncytial virus infection hospitalization. The results found that it adds approximately30.5% to the total cost of patients.

Table-1: Prevalence of HAI worldwide in different countries

Sl. No	Country	HAI %
1	Norway	5.1%
2	Scotland	9.5%
3	Finland	9.1%
4	Switzerland	10.1%
5	Canada	11.6%
6	USA	4.5%
7	UK & Ireland	7.6%
8	France	6.7%
9	Greece	9.3%
10	Korea	3.7%
11	Italy	8.3%
12	Cyprus	7.9%
13	Lithuania	9.2%
14	Albania	19.1%
15	Turkey	13.4%
16	Lebanon	6.8%
17	Morocco	17.8%
18	Tunisia	17.8%
19	Thailand	7.3%
20	Mali	18.7%
21	Malaysia	13.9%
22	Brazil	14.0%
23	Tanzania	14.8%

A summary: First Global Patient Safety Challenge, "Systematic review conducted by WHO 1995-2008 [22].

Conclusion

National Healthcare Safety Network (NHSN) and the American College of Surgeons National Surgical Quality Improvement Program found around 5 lakh people die in USA annually because of surgical site infections among them 40% to 60% of HAI are preventable by adopting precautionary measures. Factors such as Length of stay at hospital, associated risks, co-morbidities and mortality is found to be higher who has HAI.

The preventive measures helps to prepare compliance to improvise the condition and also potential long-term sequence to reduce the rate of HAI. Antibiotic administration before one hour, the start of the procedure is the main start to prevent surgical site infections, excess prophylactic antibiotic use either through poor selection or continuation postoperatively is a major driver of increased multidrug-resistant organism isolates. Adjunctive measures such as surgical safety checklists, minimally invasive surgical techniques, and maintenance of perioperative homeostasis, monitoring of PPE, proper use of disinfectants, protocols adopted in central sterile supply department can help further reduce the burden of HAI [14].

Hospital acquired infections are directly related with the Hospital stay of patient in the hospital, the increased Hospital stay adds to patient care given by the hospital. The cost depends upon the severity of infection, length of stay and total care given by the hospital [23]. HAI is causes prolonged hospital stay and it accounts for a major risk factor and causes serious health issues leading to death [24]. There should be a consistent training, encouragement towards the reduction in hospital acquired infections to reduce the burden of cost on patients, lesser stay in the hospital. Special emphasis should be given to those infectious diseases which occur most commonly like Urinary track infections, blood stream infections, ventilator associated pneumonia, surgical site infection and hospital acquired pneumonia.

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