Implementation of Hospital Infection Control Committee: A Big Step Forward Towards Improved Patient Care

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INTRODUCTION

Hospital infections or nosocomial infections (Greek: Nosus means disease, and Komeion means taking care of) are all those infectionsacquired by hospitalized patients, other than the cause for which they werehospitalized, and undergoing treatment. Infections which occur after 48 hours of admission, or acquired within three days after being discharged, and within a month after undergoing a surgical procedure are called as hospital infections. These infections are also called as hospital acquired infections or health-care associated infections (HAI). HAI's contribute to severe morbidity and mortality among hospitalized patients. Microorganisms including the bacteria, fungi, viruses, and in some instances, parasites might be responsible for HAI's. HAI's usually present as blood stream infections (BSI), urinary tract infections (UTI), gastrointestinal infections, surgical site infections (SSI), ventilator associated pneumonia (VAP), and meningitis. Acquisition of HAI's depends on the condition of the patient, as evident from the fact that patients admitted to the intensive care units (ICU), paediatric or neonatal intensive care units (NICU), patients admitted with severe trauma, old age patients, patients who underwent major surgical procedures, catheterized patients, and immunocompromised patients are at increased risk of developing nosocomial infections. Majority of HAI's are caused by bacteria which include *Pseudomonas* spp, *Acinetobacter* spp, *Staphylococcus aureus*, methicillin resistant *Staphylococcus aureus* (MRSA), Coagulase negative *Staphylococci, Enterococci*(vancomycin resistant *Enterococci*), *Escherichia coli, Klebsiella* spp, *Citrobacter* spp, and others. Among these bacteria which cause HAI's, most bacteria are multi-drug resistant, which can produce extended spectrum beta-lactamases (ESBL), carbapenemases, and other mechanisms of resistance towards commonly used antimicrobial agents. HAI's result in prolonged hospital stays, increased use of antibiotics, and increased treatment costs.

Predisposing factors for HAI's

Geriatric age patients (>70 years), patients admitted to the ICU's, patients on ventilator, comatose patients, patients suffering from shock, and disseminated intravascular coagulation, patients with a previous history of repeated antimicrobial therapy, acute renal failure patients, individuals on steroids, and patients with prolonged catheterization are at a greater risk of acquiring HAI's. Other associated conditions which can predispose to HAI's include pre-term neonates, patients suffering from genetic disorders, and haematological abnormalities, patients with immunodeficiency diseases and transplant patients.

A recent research study from a university teaching hospital had revealed that urinary catheterization and the presence of invasive respiratory devices had increased chances of acquiring HAI's[1]. A study from Ethiopia by Yallew WW et al, had noted that the patients kept in wards with medical waste containers had 82% less chance of developing HAI's and immunocompromised patients are at greater (2.34 times) risk of acquiring HAI's. This study had also observed that patients who received antibiotics, catheterized patients and patients who underwent surgeries have an 8.63, 6.91, and 2.3 times increased chances of developing HAI's respectively[2]. Prior history of hospitalization, and patients with underlying illnesses are associated with high rates of HAI's as noted from a recent study in Ethiopia[3].

Exposure to central air-conditioner was associated with HAI's as reported from India by Nair V et al. The same study had observed that duration of stay in hospital was directly linked to the probability of acquiring HAI's[4]. Another Indian study had observed that among the HAI's 50% were attributed to the extensive use of antibiotics, and 27% were seen among patients having indwelling devices[5].

A study from Iran by Askarian M et al, who followed up patients admitted to various university teaching hospitals, had noted that male patients had an increased chance of developing HAI's as compared to female counterparts[6]. Male predominance (5%), patients aged over 85 years (19%), admission into ICU's (35%), indwelling catheters (23%), and supportive ventilation (16%) were noted to be risk factors for HAI's in a Chinese hospital [7].

Prevalence of HAI's

Screening for the prevalence of HAI's should be regularly done to implement mechanisms to improve the patient care and reduce the resultant morbidity and mortality. HAI's and their prevalence vary significantly with the geographical locations, and the implementation of effective infection control measures. In a recent report from Ethiopia, a 15% prevalence of HAI's was noted with *Klebsiella* spp (23%), and *Staphylococcus aureus*(20%) accounting for most infections[8].

A study from Singapore by Cai Y et al, had reported an alarmingly high rate of culture positive HAI's (46%), with clinically diagnosed sepsis, pneumonia, were the most common conditions. *Staphylococcus aureus, Pseudomonas aeruginosa,* and *Acinetobacter* spp, were the predominant bacterial species causing HAI's. The same study had also observed that a high percentage of *Acinetobacter* spp (72%), and *Pseudomonas* spp were carbapenem resistant strains and amoxycillin/clavulanic acid was the most frequently prescribed antibiotic [9].

A study from Italy by Antonioli P et al, who estimated the prevalence of HAI's and antimicrobials used in a university teaching hospital, observed that there was a 9.6% prevalence of HAI's. This study had also noted that HAI's were more prevalent in intensive care units (ICU's), and urinary tract infections (UTI's) were most frequent, with *Escherichia coli* being the most common microbe associated with UTI's[1].

A study from Saudi Arabia by Balkhy HH et al from a tertiary care centre, who assessed point prevalence of HAI's and community acquired infections (CAI's), had noted an 8% prevalence of HAI's. Most frequent HAI's reported included the line related BSI (31%), followed by ventilator associated pneumonia (VAP) (29%) and catheter related UTI's (24.4%). Most HAI's were reported from the ICU's followed by medical and surgical wards, and the most common presentation was pneumonia [35%]. The organisms frequently associated with HAI's included the Pseudomonas spp [21%], and Enterococcus spp [17%] [10].

A 4% prevalence of HAI's was noted among Chinese population who attended the China-Japan friendship hospital. Respiratory tract infections (65%) accounted for most HAI's followed by UTI's (13%), and BSI's (5%). This study revealed that a high percentage of HAI's were associated with Gram-negative bacteria (67%), followed by gram-positive bacteria and fungi. Among bacterial causes *Pseudomonas* spp, *Acinetobacter* spp, and *Klebsiella* spp accounted for most HAI's[7].

A study from India recently had reported a 3.76% prevalence of HAI's, with most being reported from the surgical ICU's (25%), followed by the medical ICU's (20%), burns wards (20%) and paediatrics wards (13%)[4]. Kumar A et al, from North India in their study reported a 7% prevalence of HAI's among patients attending a tertiary care centre [5].

Another study from North India by Kumar S et al, who followed up 3755 patient days, had noted that there was a 20% prevalence of HAI's. The same study had reported that among patients with indwelling catheters, *Klebsiella pneumoniae* (29%) was the most common bacteria accounting for HAI's followed by *Enterococcus* spp (24%). *Acinetobacter* spp, *Enterococcus* spp, and *Candida* spp, were most commonly associated with VAP, UTI's, and BSI's respectively. Most gram-negative isolates were found to be resistant to carbapenem group of antibiotics and sensitive to colistin[11].

Report from the international nosocomial infection control consortium (INICC), Iran showed that among the bacteria causing device associated HAI's (DA-HAI's), *Pseudomonas* spp, *Acinetobacter* spp, *Klebsiella* spp, *Staphylococcus aureus*, and *Enterococcus* spp were most common. Among the gram-negative bacterial isolates more than 70% were resistant to imipenem (carbapenemase producers) and 68% isolates were multi-drug resistant[12].

Diagnosis and management of HAI's

Clinical and laboratory diagnosis of HAI's should be done carefully. Patients condition, the process of collection of the clinical samples, and the time of collection of specimens (preferably prior antibiotic therapy) could influence the laboratory results. Specimens from immunocompromised patients need to be processed appropriately, taking into consideration rare microbial species responsible for infections (Nocardiosis, atypical Mycobacteria, legionellosis)[13,14].

A recent report highlighted the significance of water from continuous positive airway pressure (CPAP) equipment in transmitting *legionellosis*[15].

It is important to have a definitive criterion for the laboratory diagnosis of serious infections, especially among the neonates as evidenced by a recent study from turkey. This study has confirmed that a combination of bio-markers that included the C-reactive protein, white blood cell counts, and the absolute neutrophil count can diagnose urinary tract infection, gastroenteritis, blood stream infection, pneumonia and meningitis[16].

In developing countries like India, where there is a limitation of finance and infrastructure, implementation of strategic mechanisms to diagnose HAI's assume significance. In a report by Saptharishi LG et al., who worked on neonates admitted to the paediatric intensive care units (PICU), it was observed that a scoring system based on certain factors can be used to assess the risk of developing HAI's. It could limit

over diagnosis and unnecessary antimicrobial therapy[17]. In a study from Finland, done by Sarvikivi E et al, among neonatal intensive care unit (NICU) patients, the most common HAI's were BSI's, conjunctivitis and pneumonia. This study had also noted that only 24% of the HAI's were microbiologically confirmed. This signifies the importance of clinical diagnosis [18].

Isolation of coagulase negative *Staphylococcus,* which normally is ignored as a contaminant, was reported as a most frequent cause of sepsis (early onset, late onset and very late onset) among neonates, as evidenced from the results of a study by Ozkan H et al, from Turkey[19].

Occurrence of candidemia among neonates is another common HAI which needs to be dealt cautiously taking in to consideration the antibiotic profile of the isolated organisms [20].

Control and Prevention of HAI's

Knowledge among nursing staff regarding the prevalence of HAI's, standard precautions required to control and prevent HAI's, and the importance of hand hygiene in preventing the transmission of infectious agents appear to be instrumental in reducing the incidence of HAI's as noted by a recent report by Brosio F et al from Italy[21].

A study by Musu M et al, who assessed the significance of hand hygiene, and knowledge of standard precautions among health care workers attending the ICU's had noted that there was low level of adherence to hand hygiene practices, and there was a low level of knowledge with respect to the HAI's. The same study had recommended that the nursing staff requires periodic check on the level of knowledge on HAI's, and frequent training to control and prevent HAI's [22].

A recent study by Stahmeyer JT et al, who assessed the factors influencing the compliance of hand hygiene practices in the ICU's had noted that these practices although are significant in reducing HAI's, they were noted to be time consuming [23].

Despite the recent advances in the infection control practices, and the availability of molecular methods for the diagnosis of multi-drug resistant microbial infections, HAI's are still difficult to control and prevent, mostly attributed to the non-compliance to standard and conventional infection control measures by the health care workers[24].

Since ICU's pose an increased threat of colonization and transmission of HAI's, a survey of patients for colonization of MRSA, and VRE on admission and initiation of effective hand hygiene, and chlorhexidine body wash could limit the occurrence of serious HAI's with multi-drug resistant bacteria[25].

Universal gloving, use of gowns, masks, and hand hygiene have been noted to be the most important contact precautions which are instrumental in the controlling and prevention of HAI's[26,27].

In the era of infectious diseases which spread quickly, it is important to have a biocontainment facility, where better care for patients infected with microbes like the Ebola virus can be given with minimum risk of transmission to health-care workers as well as limiting hospital spread[28].

Hospital environment also faces a threat from the potential outbreaks of infectious diseases, which may involve multidrug resistant microorganisms[29].

Hospital infection control committee (HICC)

Implementation of hospital infection control committee (HICC) is important to control the spread of HAI's, reduce antibiotic use, health-care associated expenses, and decreased morbidity and mortality. HICC can be headed by medical administrator and will have members including the microbiology faculty (infection control officer), representatives from clinical departments, the nursing staff, a pharmacist, member from central sterile supplies department (CSSD), and a representative each from the bio-medical, and maintenance department. HICC aims to work in co-ordination by formulating infection control polices, educating the medical and paramedical staff, active surveillance of HAI's, and recommendations towards antibiotic stewardship (judicial use of antibiotics to reduce the occurrence of resistance and health-care related costs) as shown in Table 1.

Table 1: Composition and responsibilities of HICC

Composition of HICC	Responsibilities of HICC
Medical administrator Microbiology faculty (infection control officer) Representatives from clinical departments Nursing staff A pharmacist Member from central sterile supplies department (CSSD) Representative each from the bio-medical, and maintenance department.	Framing infection control guidelines Implementing antibiotic stewardship Conduction of hospital surveillance Monitoring disinfection procedures Frame guidelines to control and prevent hospital infection outbreaks Identification and prevention of infection hazards in hospital settings

CONCLUSION

Debilitated patients, patients with underlying conditions, immunocompromised people and patients undergoing specialized treatment/surgical procedures appear to be at increased risk of acquiring HAI's. Health care workers are required to consistently follow the stringent infection control practices to minimize the occurrence of HAI's. Paramedical personnel including the nursing staff and the laboratory technicians should be adequately sensitized and regularly trained regarding the best practices to control and prevent HAI's. Continuous surveillance of hospital environment, especially the operation theatres ICU's, NICU's, PICU's, surgical wards, and other critical patient management places for the prevalence of microbes including the multi-drug resistant microorganisms could contribute to better patient management. Hospital microbes, their antibiotic susceptibility profiles should be regularly updated, and an antibiotic policy should be framed specifically.

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