

Current Nosocomial Infections-An Update

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Abstract

Health care-associated infections are infections that occur while receiving health care, developed in a hospital or other health care facility that first appear 48 hours or more after hospital admission, or within 30 days after having received health care. Multiple studies indicate that during hospital stay patients get exposed to several hospitals associated infections such as pneumonias and catheter associated urinary tract infections. Simple infection control procedures, good sterilization techniques, use of combination antibiotics can prevent or minimize hospital associated infections. Recently Covid 19 pandemic caused a havoc in hospitals and became the most common infection that was spread among health care staff as well as patients leading to many hospitals suspending their surgical procedures and maternity care.

Keywords: Nosocomial infections; Ventilator associated pneumonias; Urinary tract infections; SARS-CoV-2.

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Introduction

Health care-associated infections commonly known as hospital infection or nosocomial infection is a kind of infection which is not present at the time of admission to a hospital or health care facility but occurs during the course of stay in the hospital.¹ They are not linked to the original illness for which the patient has been admitted to the hospital. Health care associated infections are wide spread especially in low and middle income countries affecting vast majority of patients. Main cause of hospital associated infections is antibiotic resistant

microbes and ineffective infection prevention set up.² Hospitals house large number of patients who are sick with weakened immune systems, poor sanitation and sterilization protocols all contribute to alarming rise in nosocomial infections. In the developed world too such as United States and Europe health care associated infections from all kinds of microbes contribute to several thousand deaths each year. Health care associated infections result in prolonged hospital stay for patients hence increased burden on hospitals as well as increased mortality rates.³ There is now an ever increasing demand for an organized and uniform effective infection prevention control programs which can reduce hospital associated infections.

The commonest healthcare-associated infections include hospital associated and ventilator associated pneumonia, Urinary tract infections and hospital associated gastroenteritis. In 2019 novel Corona virus pandemic emerged as a global health challenge and took a centre stage of hospital acquired infections. International hospitals and health care systems suffered huge losses and struggled to cope. The poor and middle developed countries the impact was greater and surgical procedures, cancer and maternity care suffered a setback leading to rise in mortality cases.⁴

Types of Health Care Associated Infections

Hospital associated and ventilator associated pneumonia

Hospital-acquired and ventilator associated infections remain a major health concern and have been associated with a higher mortality than any other nosocomial infection. An onset of pneumonia at least 48 hours after hospital admission is referred to as hospital-acquired pneumonia. Hospital-acquired and ventilator associated infections are attributed to lengthy hospital stay and greater hospital expenditures as compared with patients without hospital-acquired and ventilator associated infections.⁵ The incidence of hospital acquired pneumonia is highest in intensive care unit where it is a major cause of morbidity and mortality. Evidence suggests that 25% of patients admitted in ICU who receive mechanical ventilation develop pneumonia which is reasonably greater than in non ICU patients.⁶ Because of its severity, and the fact that the mechanically ventilated population is much more likely to have significant underlying disease and receive more intensive therapy, many physicians have referred to hospital associated pneumonia occurring in mechanically ventilated patients as ventilator-associated pneumonia

A number of patient-related factors have been identified. These factors generally reflect preexisting conditions which impair host defenses and include age over 70 years; the severity of the underlying illness; malnutrition; coma or other causes of impaired consciousness; prolonged hospitalization; and certain comorbid conditions, including diabetes mellitus and chronic obstructive lung diseases.⁷ The presence of these factors can substantially increase the risk for hospital acquired pneumonia. For example, advanced age is associated with a two- to threefold increased risk of hospital acquired pneumonia probably because the elderly are more likely to have comorbid conditions or weakened immune systems, reside in long-term care facilities, and have an increased risk of aspiration. Chronic obstructive pulmonary disease (COPD) increases the risk for hospital acquired pneumonia up to fourfold, probably because of impairments of mucociliary clearance.⁸

The common pathogens causing these infections include gram negative bacilli (e.g. *Pseudomonas aeruginosa*, *E coli*, *Klebsiella pneumoniae*, *Enterobacter spp*, *Acinetobacter spp*) and gram-positive cocci (e.g., *Staphylococcus aureus*, which includes methicillin-resistant *S. aureus*, *Streptococcus spp*). Differences in host factors and in the hospital microbial flora of the hospital affect

the patterns of the causative pathogens.⁹ Hospital associated pneumonias occur if microbial organism reaches lower airways and attacks the host lungs. The patients who are at extreme risk include those with weakened immune systems, elderly as well as some times patients are affected with a highly virulent strain.¹⁰ To determine optimal anti microbial therapy it is essential to determine the causative microbes. Determining the exact cause of infections can improve patient outcomes¹¹ although in medical setting it is often confusing as several organisms are isolated hampering the optimal anti microbial therapy.¹²

Hospital associated infections are derived from either an endogenous or exogenous source.¹³ Endogenous infections are the most common cause of infections and can occur with hospital acquired pathogens that attack the host.¹⁴ Exogenous infection with nosocomial pathogens acquired from the hospital environment is less common and generally occurs late in the ICU admission.¹⁴ Precise data concerning the etiology of Hospital acquired and ventilator associated pneumonia are limited and the main reason for that is the lack of proper microbial diagnosis. Effective microbiological studies and identification of the causative pneumonia causing pathogen and development of effective therapy can reduce hospital associated pneumonias.

Urinary tract infection

A urinary tract infection (UTI) is an infection involving any part of the urinary system, including urethra, bladder, ureters, and kidney. UTIs are the most common type of healthcare-associated infections reported in hospitals. UTIs are a huge burden on hospital resources as well as on patients extending their hospital stay and increasing the costs manifold. According to one study account for 40% of total hospital acquired infections.² Centre for disease control and prevention (CDC) reports that among the UTIs occurring in the hospital more than 75% are due to urinary catheter and every time about 15-25% of hospitalized patients receive urinary catheters during their hospital stay. In addition to catheters increasing age, diabetes, obstructions, stone also predispose a patient to UTIs.¹⁵ In one study conducted in Norway they reported the urinary tract infection to be the commonest nosocomial infection followed by respiratory tract infections.¹⁶

UTIs are the main cause of morbidity and mortality in hospital admitted patients in general, and in post-operative surgical patients in particular.

Treatment is mostly complicated due to resistant bacteria not treated well with latest antibiotics.¹⁷ Nowadays efforts need to be taken to prevent complicated UTIs to reduce their occurrence worldwide. Numerous studies have published data regarding hospital acquired urinary tract infections.¹⁸ Most of the Nosocomial UTIs originate at the moist place and the causative bacteria are more complicated than those causing simple UTIs

It is imperative that every hospital or health care facility should have proper procedure and protocols in place to minimize hospital associated UTIs. Since UTIs are the commonest nosocomial infections occurring mostly due to use of urinary catheters, discontinuation of catheters in patients as soon as it's possible would be of help in reducing these resistant UTIs. Patients with resistant bacterial infection need their urine samples to be sent to microbiology laboratory to identify causative bacteria and effective combination of antibiotics be administered to treat the infection. Impregnation of catheters with antibiotics can also reduce infections.

Gastroenteritis

Gastroenteritis refers to inflammation of intestinal tract. It includes a combination of symptoms such as diarrhea, abdominal pain and vomiting although all need not be present to make a diagnosis. Nosocomial or hospital acquired gastroenteritis has become a cause of attention in past decade due to its increasing prevalence. However unlike other hospital acquired infections there is no proper method to detect exact cases of hospital acquired gastroenteritis. Therefore our understanding of accurate incidence and its effect on hospitals is limited. In one study conducted in three hospital systems in England from 2002-2003 a total of 2,154 patients (2.21 cases/1,000-hospital-days) and 1,360 healthcare staff (0.47 cases/1,000-hospital-days) were affected in 227 unit outbreaks and in about 63% causative agent was norovirus.¹⁹ Gastroenteritis outbreak often leads to ward closure and disruption of hospital activity with attacks on both patients as well as staff.²⁰ Gastroenteritis outbreaks most commonly affect elderly and children. Several studies have demonstrated that stringent infection control measures and contact tracing can rapidly cease the norovirus outbreak and prevent a second wave of infection. Children with unexplained vomiting and those with contact history of gastroenteritis should be properly, isolated, and investigated for possible infective causes, including norovirus-induced gastroenteritis.²¹

Nosocomial COVID-19 infection- a challenging situation.

COVID-19 emerged as a huge challenge in 2019. Originated in the Wuhan province of China it soon spread globally causing the WHO to declare it as a pandemic in March 2020. There has been a huge pressure on medical health care professionals who have been on forefront fighting this Covid 19 battle. COVID-19 caused huge mortality rates worldwide. Also reluctance of the public to visit hospitals for diagnosis or treatment due to COVID-19 fear also contributed to excess mortality. The causative virus novel corona virus SARS-CoV-2 causes flu like symptoms and pneumonia like complications. While most people have only flu like symptoms such as fever, fatigue, cough some people go on to develop extreme complications like acute respiratory distress syndrome and death. Despite serious efforts in hospitals, hospital acquired Covid 19 infection has been a huge problem. It has put patients with other medical problems at serious risk. Transmission of COVID-19 infection among admitted patients resulted in increase in mortality cases. COVID-19 burdened the hospitals causing huge losses. Reduction in hospital beds and operating rooms has led to considerable delays in surgical and semi elective surgical procedures.²² The SARS-Cov2 virus is highly contagious. It mainly transmits through person to person contact and has the potential to be viable on surfaces for up to three days. Prior to the current COVID-19 pandemic, nosocomial infections mostly hospital acquired pneumonia and urinary tract infection already caused significant burden on hospitals and health care systems. Hospitals are currently engulfed in Covid 19 storm and have become an important source of viral transmission with even health care facilities in the developed world struggling to prevent nosocomial COVID-19. A case series study conducted in China estimated that 44% of 179 COVID-19 infections were nosocomial in nature.²³ The catastrophic effect of hospital or nosocomial acquired COVID-19 came from a study conducted very recently in South Africa where investigators demonstrated how a single unsuspected case of COVID-19 led to spread of infection among five hospital wards with infection confirmed in 39 patients with half of them dead and eighty staff members.²⁴ Margo et al., carried out a study in General district hospital North west of England and concluded that out of 239 cases testing positive for COVID-19 16.2% were hospital acquired infections and such patients endured longer hospital stays.²⁵ Wang et al described a case study of 138 patients with COVID-19 out of which

12.3% cases had hospital acquired COVID-19 and had been admitted to hospital for other reasons.²⁶ Zhou et al., conducted a meta analysis and review study in China and found that in the early outbreak proportion of nosocomial infection in patients with COVID-19 was upto 44%.²⁷ Wake et al., conducted a study at NHS trust in South London and concluded that out of 662 patients admitted with COVID-19, 45 patients had acquired COVID-19 in hospital. These patients had no evidence of respiratory or influenza-like illness on admission and developed symptoms, with positive SARS-CoV-2 PCR test results, more than 7 days after admission and 40 of these patients had shared a ward with a confirmed COVID-19 case prior to testing positive.²⁸ Nosocomial COVID-19 infections have high mortality rates. In a study conducted by Rickman et al in one of the biggest teaching hospitals of London 15% cases of COVID-19 admitted patients between 2 March and 12 April 2020 were definitely or probably hospital-acquired, through different transmission routes and the fatality percentage was 36%.²⁹ Several studies conducted in hospitals around the world as well as many independent health care professionals strongly suggest the use of simple surgical masks to reduce hospital transmission among patients as well as health care workers. The use of masks has proven to be very effective in hospitals where total physical distancing is not possible. A study conducted by Seidelman et al on 21000 health care workers found that hospital acquired COVID-19 infections were drastically reduced after strictly implementing universal masking policy.³⁰ Use of masks and other protective gear can go a long way in protecting both patients and hospital staff from nosocomial or hospital acquired COVID-19 infection.

Conclusion

Hospital associated infections or nosocomial infections are a reality in health care set up worldwide. Several infections such as pneumonias, urinary tract infections, gastroenteritis affects many admitted patients globally and cause increased hospital stay as a result excessive burden on hospitals, increased costs for patients as well as high mortality. There is an imperative need to improve infection control measures, develop good sterilization techniques especially in developing countries to reduce the nosocomial infections and thus avoid preventable deaths. In 2019 SARS-CoV-2 came as a huge challenge to medical fraternity. Declared as a global pandemic by WHO it spread quickly through out the world killing

millions of people. Hospitals became a huge source of COVID-19 spread with infections spreading rapidly among both patients as well as hospital staff. It affected the functioning of even the best hospitals worsening the surgical and maternity care with even forcing closure of healthcare facilities at some places. Recent studies have demonstrated that good hygiene protocols, distancing measures and masking are effective in preventing COVID-19. Use of surgical masks and other protective gear by both patients and staff can lessen this contagious infection in hospitals.

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