Xournals

Academic Journal of Microbiological Studies

ISSN UA | Volume 01 | Issue 01 | June-2018

A Study on Nosocomial Infections

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Available online at: www.xournals.com

Received 8th January 2018 | Revised 16th February 2018 | Accepted 19th March 2018

Abstract:

In current scenario, Nosocomial infections are caused by different factors such as inappropriate hygiene. Patients in hospital can easily get infections of diseases like methicillin resistant staphylococcus aureus (MRSA) from hospital staff who do not practice basic hygienic measures. Nosocomial infection may also be result of contaminated use of injections, inappropriately bandaged incisions during surgeries, contaminated surgical equipment's, catheters, organ transplant and etc. However, frequency of these type of cases have become less in number today due to advanced technology but still it's the primary role of hospital staff to cure their patients from any suspected nosocomial infection. Here in this paper an effort has been done to understand the nosocomial infection and preventive measure taken to reduce the risk given by World Health Organization.

Keywords: *Nosocomial Infections, World Health Organization, Preventive Measures*

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Introduction

World Health Organization reported that around 109 people are hospitalized yearly for different reasons and 10 million people are infected with nosocomial infection. "Nosocomial" comes from Greek word *nosokomos*, means nosos=disease and komien= to care for (Mourud, 2010). Nosocomial Infection or Hospital Acquired Infection or Health Care-associated Infections can be defined as "*An infection acquired in the hospital by a patient who was admitted for a reason other than that infection. An infection occurring in a patient in a hospital or other healthcare facility in whom the infection was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among the staff of the facility"* (http://apps.who.int). Center for Disease Control (CDC) has also defined nosocomial infection as a localized condition resulting from an adverse reaction to the presence of an infectious agent(s), without leaving any proof of evidence that the infection was incubating during the time of admission to the hospital. Nosocomial infections are developed within 48-72 h of admission in the hospital and extend the stay in hospital, increase the cost of treatment with high mortality and morbidity. As per the survey, it was found that the patients in intensive care unit (ICU) are more prone to acquire the nosocomial infection in comparison to other ward patients (Özer, *et al*., 2015; Patel, *et al*., 2013).

Nosocomial infections are basically adverse events in the healthcare facility. Different infection control programs are based on the surveillance to identify trends in the incidence of nosocomial infection, environmental factors, and practical risks affecting their incidence. Surveillance is basically defined as *"the ongoing, systematic collection, analysis and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know"*(Nadova, and Viera, 2016).

Microorganisms such as a virus, bacteria, fungus etc. cause nosocomial infections. Different factors which are responsible for nosocomial infections are high density of pathogens and population in hospital, immunity of patients, poor hygiene, inadequate cleaning, increased number of medical procedures, etc. (Fang, 2012).

Robert A Weinstein, in his research paper, represents a complete research addressing to the changes in the medical fraternity which have affected nosocomial infections in either of the way. Further, in his study, he also showed the noteworthy impact of progression in technology in medical and healthcare in relation to nosocomial infections. Jessica Lietz concluded in her research article by giving the general overview about the nosocomial infections focusing more on the general arguments. National Center for Infectious Diseases carried out a comprehensive research on the nosocomial infections in the United States discussing the key components of the infections, further comparing the rate of infections in the urban and rural setting. Toni Rizzo highlights on the common types of infections in hospital in his research i.e. respiratory procedures, intravenous (IV) procedures, surgery and wound and urinary bladder catheterization. Emmanuelle Girou and Francois Stephan studied on the ICU patients as they are at a high risk of acquiring nosocomial infections. In conclusion to these articles, especially hand washing and immunization have resulted in controlling the infectious diseases and further to significantly control the infection, people are supposed to join forces and work together with medical personnel for implementing the existing infection control technologies (https://www.ukessays.com).

Types of Nosocomial Infections

Approximately 80% of all nosocomial infections occur at following four frequent sites:

a) Central Line-Associated Bloodstream Infections (CLABSI)

Prolonged used of Catheters in central line can cause serious bloodstream infections. According to the survey, Central Line-Associated Bloodstream Infections are the most deadly nosocomial infections with the death occurrence rate of 12%–25%. In United State hospitals, the decrease of 46% in CLABSI was seen from 2008 to 2013 but still, 30,100 CLABSI occur in ICU and acute facilities wards every year. In this, coagulase-negative staphylococci are the most common type of pathogens, accounting for 27.9%.

b) Catheter-Associated Urinary Tract Infections (CAUTI)

Catheter-associated urinary tract infections are mainly caused by endogenous native microflora of the

patients and is the most frequently diagnosed, approximately 36% of the 2 million infections that occur yearly. In 2011, acute care hospitals stats shows that UTIs account for more than 12% of reported infections. It can further develop to serious complications in all patients, for instance, epididymitis and prostatitis in males, and pyelonephritis etc. *E. coli* (25.8%), enterococcus (15.9%), and *P. aeruginosa* (12%) are the most common type of nosocomial pathogens.

c) Surgical Site Infections (SSI)

Surgical site infections are the second most common type of nosocomial infections (approximately 17%) caused by Staphylococcus aureus which will ultimately result in death or hospitalization. It has been classified by level of contamination present at the time of surgery i.e. clean (class I), clean-contaminated (class II), contaminated (class III), and dirty (class IV) procedures since 1964. Pathogens which causes surgical site infections arise from endogenous microflora of the patient.

d) Ventilator-Associated Pneumonia (VAP)

Ventilator-associated pneumonia usually occur within 48 h after the tracheal incubation and found in 9–27% of patients on mechanically assisted ventilator. Common symptoms of ventilator-associated pneumonia are fever, leucopenia, and bronchial sounds etc. *P. aeruginosa* (16.9%), *S. aureus* (16.1%), and *Enterobacter sp.* (10.5%) are most common pathogen causing nosocomial pneumonia. (Root, *et al.* 63; Khan, *et al.*, 2017; Mohammed, *et al.* 2014).

Above all Gastroenteritis, Meningitis, and Respiratory infections and g. Puerperal fever are few of the infections classified by National Healthcare Safety Network with Center for Disease Control (CDC), who has also classified nosocomial infection sites into 13 types, with 50 infection sites (Sharma and Shabir, 2017). According to the World Health Organisation, surgical site infections, urinary tract infections and lower respiratory tract infections are the most common type nosocomial infections. Figure 1 shows common nosocomial infections distribution as per the French national prevalence survey. Nosocomial infections might vary from country to country also, for instance, in Europe, most common healthcare acquired infections are urinary infections, followed by respiratory tract infections, surgical site infections and others whereas in UK, gastro-intestinal infections as the second most common infection as HAI further followed by the surgical wound infections (Fang, 2012).

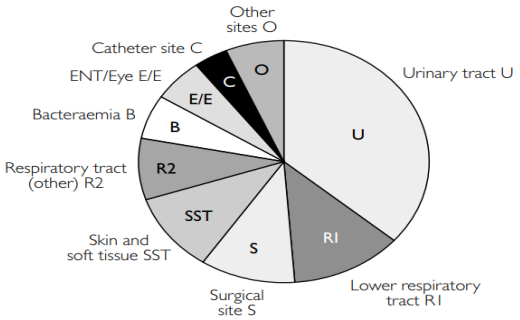

Figure 1: Sites of the most common Nosocomial Infections (Source: http://apps.who.int)

Nosocomial Pathogens

The infecting pathogens differ between different patient, different medical amenities, different health care settings, and different countries according to the World Health Organization 2002 guidelines. Nosocomial infections are mainly caused by common pathogens found in general population. Following are the organisms which can cause nosocomial infections:

a) Bacteria
b) Viruses
c) Fungi
d) Parasites

In all pathogens bacteria are responsible for about 90% nosocomial infections, where protozoans, fungi, viruses and mycobacteria are less contributing in comparison to bacterial infections. Bacteria are the most common nosocomial pathogens and their reservoir can be endogenous or exogenous, in which endogenous bacteria are from patient's own flora whereas exogenous are from another patient, hospital staff. Further, difference in bacteria can be made among commensal bacteria (opportunistic) and pathogenic bacteria, in which commensal bacteria are part of normal flora of healthy women whereas pathogenic bacteria have greater virulence, and cause infections irrespective of host status. Intravascular line infection and Urinary infection are caused by cutaneous coagulase-negative staphylococci and Escherichia coli respectively are the best example of commensal bacteria. Anaerobic Gram-positive rods (e.g. Clostridium) cause gangrene is example of pathogenic bacteria.

Other than bacteria, viruses are also common pathogen causing nosocomial infection and are generally transmitted by parenteral route i.e. transfusion, injections, dialysis or endoscopy or by faecal-oral route. Hepatitis A, B and C, RSV, Rotavirus, Enterovirus, CMV, HIV, etc. are different type of viruses causing nosocomial infections.

Fungi and parasites pathogens causes nosocomial infections during extended antibiotic therapy. In this fungal infections have become common cause of nosocomial infection. Giardia lamblia is an example of a parasite that can be easily spread among adults or children. Candidiasis is the most common type of nosocomial fungal infection.

Centre of Disease Control and Prevention (CDC) tried to calculate the frequency of sites affected by nosocomial infection and in their study they found that 32% of all nosocomial infections are urinary tract infections, 22% are surgical site infections, 15% are pneumonia, and 14% are bloodstream infections. Conclusively they said that 25% of all these infections can be prevented, if hospital people start taking proper precautions. Below table 1 shows the site of infection and common pathogens causing nosocomial infection (http://apps.who.int; Khan, *et al*. 2017; Mourud, 2010).

Table 1: Site of Infection and Common Pathogens

Site of Infection	**Common Pathogens**
Blood Stream	*Coagulase-negative staphylococci* (CNS) *S. aureus* *P. aeruginosa* *Candida* sp
Pneumonia	CNS *S. aureus* *P. aeruginosa* Respiratory syncytial virus
Skin/Soft Tissue/Surgical Site	CNS *S. aureus*
Gastrointestinal Tract	Rotavirus
Conjunctivitis/Occular	CNS *P. aeruginosa*
Urinary Tract	Gram-negative bacilli *Enterococci*
Endocarditis	CNS *S. aureus*
Central Nervous System	CNS *S. aureus*
Osteoarthritis	*S. aureus* Group B Streptococci

(Source: Mohammed, *et al.* 2014)

Mode of Transmission

Nosocomial pathogens are transmitted in hospital by numerous route and many a time same pathogens may be transmitted by more than one route also. Contact, airborne, droplet route, common vehicle and vector borne are main route of transmission (Nazir and Kadri, 2014).

Prevention of Nosocomial Infections

Every individual in hospitals are individually responsible for prevention of nosocomial infections. Every individual hospital staff must work cooperatively to reduce the risk of nosocomial infection for patents and staff. There are different national or regional and hospitals programs to control the nosocomial infection.

National or Regional Programmes

These programs are developed by responsible authority to support the hospitals in reducing the risk and these programs must:

- Develop a national system to monitor infections.
- Develop and continually update guidelines.
- Provide facility to access materials and products required for hygiene and safety.
- Provide training programmes for health care professionals.
- Set a national objectives

Hospital Programmes

The major preventive effort should be focused in hospitals and other health care facilities (2). Risk prevention for patients and staff is a concern of everyone in the facility, and must be supported at the level of senior administration. A yearly work plan to assess and promote good health care, appropriate isolation, sterilization, and other practices, staff training, and epidemiological surveillance should be developed. Hospitals must provide sufficient resources to support this programme. Infection Control Committee, Infection Control Professionals, Infection Control Manual and Infection Control Responsibility (discussed in table 2) individually have their responsibility to reduce the risk of nosocomial infection.

Table 2: Infection Control Responsibility

Role	Responsibility
Role of Hospital Management	• Establish an Infection Control Committee. • Monitor infections and apply the most suitable methods for preventing infection. • Education and training of all hospital staff. • Occasionally reviewing the status of nosocomial infections.
Role of the Physician	• Protect their own patients from other infections • Obtain proper microbiological specimens when an infection is present. • Inform cases of nosocomial infection to the team and infected patients • Guide patients, visitors and hospital staff how to prevent from nosocomial infection.
Role of the Microbiologist	• Handle patient and staff specimens for microbiological diagnosis • Develop proper guidelines for collection, transport, and handling of microbiological specimens • Make sure that laboratory practices standards procedure • Inform Infection Control Committee about the results.
Role of the Hospital Pharmacist	• Supply anti-infectious drugs and maintaining records. • Obtain and store vaccines and making them available. • Maintain a records of antibiotics distributed to the medical departments • Take part in developing guidelines for antiseptics, disinfectants, and products used for washing and disinfecting the hands
Role of the Nursing Staff	• Take part in the Infection Control Committee • Promote the development and improvement of nursing techniques, with approval by the Infection Control Committee • Develop training programmes for members of the nursing staff • Maintain a safe and adequate supply of ward equipment, drugs and patient care supplies. • Identify nosocomial infections
Role of the Central Sterilization Service	• To clean, decontaminate, test, prepare for use, sterilize, and store aseptically all sterile hospital equipment.
Role of the Food Service	• To maintain the high level safety follow the proper criteria for the purchase of foodstuffs, equipment use, and cleaning procedures. • Clean all equipment used, working and storage areas. • Give proper instructions for handwashing, clothing, staff responsibilities and daily disinfection duties
Role of the Laundry Service	• Select fabrics for use in different hospital areas • Develop policies for the collection and transport of dirty linen • Develop a standard criteria for selection of site of laundry services.
Role of the Housekeeping Service	• Responsible for the regular and routine cleaning of all surfaces and maintaining a high level of hygiene in the facility.
Role of the Infection Control Team	• Responsible for oversight and coordination of all infection control activities to ensure an effective programme.

(Source: http://apps.who.int)

Conclusion

After the detailed study about the nosocomial infection, it was found that the nosocomial infection is increasing day by day and caused just because of the inappropriate hygiene. With this increase burden of nosocomial infection it is becoming difficult for infection control committees to control the infection. However, World Health Organization gave a standard and systematic procedure which should be followed by

every hospital staff to control the nosocomial infection. Every individual of hospital is equally responsible in reducing the risk by practicing healthy ways designed by infection control committees. With this all the hospital staff must be given proper training for controlling the infection if suspected.

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