OPEN ACCESS
Saudi Journal of Pathology and Microbiology
Abbreviated Key Title: Saudi J Pathol Microbiol
ISSN 2518-3362 (Print) |ISSN 2518-3370 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Study of Frequency, Epidemiology of Nosocomial Infections in Healthcare Centres.

Neelam Saba[1], Wahied Khawar Balwan[2*]

[1]Assistant Professor, Department of Zoology, Govt. Degree College Doda, Jammu & Kashmir, India
[2]Senior Assistant Professor & Head, Department of Zoology, Govt. Degree College Kilhotran, Jammu & Kashmir, India

DOI: 10.36348/sjpm.2023.v08i07.001 | **Received:** 19.05.2023 | **Accepted:** 26.06.2023 | **Published:** 06.07.2023

***Corresponding author:** Wahied Khawar Balwan
Senior Assistant Professor & Head, Department of Zoology, Govt. Degree College Kilhotran, Jammu & Kashmir, India

Abstract

Infections are frequent complications of hospitalization. Nosocomial infections or healthcare associated infections or hospital acquired infections are endogenous or exogenous infections which a patient acquires either during hospitalization or soon after discharge from the hospital. Hospitals and hospital-like settings tend to gather many sick under one roof and hence, serve as a reservoir of numerous infectious agents. These overcrowded healthcare settings with inability to maintain hygienic conditions are threat not only to the patients but also to the healthcare workers. Increasing population of immune-compromised patients including the aged-ones, unsafe medical care, surgical procedure, injections, transplants are some of the major causes of spread of nosocomial infections. Nosocomial infections have severe adverse effects. It leads to emotional stress, functional disability and even death in certain cases. Mortality caused by nosocomial infections in India is more than any other form of accidental death. It also prolongs the hospital stays and adds to the economic burden of managing the underlying disease. The active cooperation of the Healthcare workers for better implementation of the existing preventive and control measures along with the technical advances will contribute much to fight against the nosocomial infections.

Keywords: Nosocomial infections, Endogenous, Exogenous, Healthcare.

INTRODUCTION

If a patient either during hospitalization or after discharge from the hospital develops an endogenous or exogenous infection which was neither present nor incubating at the time of admission to the hospital. Such an infection is known as nosocomial infection (NI) or hospital acquired infection (HAI) [1]. Hospitals and other health care delivery units are the potential source of infection to the admitted patient(s). As per National Nosocomial Infections Surveillance system, a nosocomial infection is defined as a localized or systemic condition that results from adverse reaction to the presence of an infectious agent(s) or its toxin(s) that was not present or incubating at the time of admission to the hospital [14]. The overcrowding of the healthcare settings with the patients and the inability to maintain hygienic conditions contributes much to the spread of nosocomial infections. Prevalence of such conditions has made healthcare settings an epicenter of the infectious agents. As a result, patients undergoing a treatment of any particular ailment develop a secondary infection which at times is more serious than the existing ailment. Increasing population of immunocompromised patients including the aged-ones, aggressive medical interventions including antimicrobial treatments and surgical procedures, rising population of antimicrobial resistant strains due to selective pressures and changing environmental conditions are the major factors contributing to the spread of nosocomial infections. Nosocomial infections can be caused by the endogenous microflora of one's own body, can be acquired from contact with the hospital staff or from the other patients in the hospital. Shorter stay of the patients in the healthcare units prevents the early detection of this infection. Also, it becomes difficult to diagnose whether the infection source was endogenous or exogenous. The average postoperative stay nowadays is 5 days which is shorter than the 5 to 7 days incubation period for S. aureus surgical wound infections [3]. The symptoms of the infection become visible only after the patients are discharged [1].

FREQUENCY OF NOSOCOMIAL INFECTIONS

There has been a global increase in nosocomial infections in the healthcare settings and these infections have contributed much in increasing the morbidity and mortality rates [1]. Also they prolong the hospital stays and add to the economic burden of managing the underlying disease. It is estimated that 5-10 per cent of all the hospitalized patients develop hospital acquired infections, i.e., of every 100 hospitalized patients at any given time, 5-7 in developed and 10 in developing countries will acquire at least one nosocomial infections [6].

On the basis of monthly reports (more than 270 institutions report) of hospital acquired infections from a non-random sample of US hospitals which was received by CDC's National nosocomial infections surveillance (NNIS) system, it was concluded that the rate of nosocomial infections increased by 36% from 7.2 in 1975 to 9.8 in 1995 due to progressively shorter inpatient stays [1]. The estimated nosocomial rate in USA was 4.5% in 2002, corresponding to 9.3 infections per 1000 patient-days. The rate of nosocomial infections is as low as 1 per cent in developed countries like Europe and America whereas in parts of Asia, Latin America and Sub-Saharan Africa the rate of nosocomial infections is more than 40 per cent [9]. In India, Nosocomial infection rate is at over 25 per cent which means nosocomial infection develops in 1 patient in every 4 patients admitted to the hospital. Tikhomirov, 1987 highlighted the severity of nosocomial infections by concluding that over 1.4 million patients all over the world will have nosocomial or hospital acquired infections at any particular time [11].

According to a study conducted in a tertiary teaching hospital in Goa [12], out of 498 patients followed, 103 people developed 169 nosocomial infections. 26.63% suffered from Urinary tract infection, which was found to be the most common nosocomial infection, followed by surgical site infection (23.67%), wound infection (23%) and nosocomial pneumonia (18.34%). Nosocomial phlebitis and septicemia, respectively, accounted for 4.73% and 3.55% of the total Nosocomial Infections [8].

Nosocomial infections are often associated with some or the other invasive support measures like central intravenous lines (CVL), urinary tract catheters and mechanical ventilators. Records have shown that ninety one percent of blood infections were in patients with central intravenous lines (CVL), ninety five percent of pneumonia cases developed in patients undergoing mechanical ventilation, and seventy seven percent of urinary tract infections were in patients with urinary tract catheters [4].

Reintubation, genetic syndromes, immunodeficiency, and immunosuppression in paediatric patients are some of the factors that contribute to the development of ventilator-associated pneumonia (VAP) [4]. In paediatric patients, the risk factors contributing to development of nosocomial urinary tract infections include bladder catheterization, prior antibiotic therapy and cerebral palsy [4]. Catheter hub colonization, exit site colonization, catheter insertion after one week of life, disruption of catheter dressing and extremely low birth weight (less than 1000 g) at the time of catheter insertion increases the risk of catheter-associated bloodstream infections in new-born child [4].

EPIDEMIOLOGY OF NOSOCOMIAL INFECTIONS

Nosocomial infections are most commonly caused by viral, bacterial, and fungal pathogens. While majority (nearly 60%) of nosocomial infections are caused by aerobic gram-negative bacilli, only 30 percent of nosocomial infections are caused by gram positive bacteria and anaerobes account for only 3 percent of nosocomial infections. The remaining 7 percent of the nosocomial infections are caused by either fungi or viruses. The pandemic of 1940s to 1950s, when *Staphylococcus aureus* was prime causative agent of most of the hospital acquired infections was the peak point of gram-positive cocci infections. It is the time when the penicillin resistant *Staphylococci* emerged as the major nosocomial infection agents. Thereafter came the period of 1970s, where gram-negative bacilli, particularly *Pseudomonas aeruginosa* and *Enterobacteriaceae* were the chief causative agent of all the nosocomial infections [3, 6].

The source of the microorganisms causing nosocomial infection can be both endogenous and exogenous. Endogenous flora refers to the microflora of the patients own body whereas exogenous microflora can come from invasive devices [1]. Although the microorganisms causing the nosocomial infections are continuously evolving but the predominant sites of nosocomial infections have not change. The anatomic site of infection specifies the microorganism causing nosocomial infection [2]. In NNIS data analysis (2003), it was found that gram negative bacilli were associated with majority of ICU infections along with 71 percent of the total urinary tract infections, 65 percent of the pneumonia and 24 percent of the blood stream infections [2].

A study was conducted in 12 intensive care units (in seven hospitals) of seven Indian cities by the International Nosocomial Infection Control Consortium, which observed 10,835 patients hospitalized for a total of 52,518 days for nosocomial infection. The observed patients acquired 476 infections in the hospital of which 46 percent were

Enterobacteriaceae, 27 per cent *Pseudomonas* and 3 percent of *Staphylococcus aureus* and 8 percent *Candida spp*. [8].

In 2001, a six month study conducted in the intensive care units of AIIMS Delhi found that 140 of 1,253 patients (11%) had 152 hospital acquired infections, 21 percent of the infections were caused by *Pseudomonas aeruginosa*, 23 percent *Staphylococcus aureus*, 16 percent *Klebsiella*, 15 percent *Acinetobacter baumannii* and 8 percent infection were *Escherichia coli* borne. The majority of the total isolates (71%) were gramnegative bacteria. Another similar study conducted on burn patients at Post Graduate Institute of Medical Education and Research (PGIMER) in Chandigarh revealed that up to 59 burn patients out of 71 (83%) had hospital acquired infections. When the pathogens were isolated from wounds and blood, 35 percent of the pathogens were *Staphylococcus aureus*, 24 percent P. aeruginosa, and 16 percent were *Betahaemolytic Streptococci* [8].

A survey done on 110,709 pediatric ICU patients reported nosocomial infection in 6,290 patients. Nosocomial infections of bloodstream, pneumonia and urinary tract were the three major types of nosocomial infection that were recorded. Each of these infections is associated with use of invasive devices. Twenty eight percent of the infections were bloodstream infections caused by primarily by coagulase negative *Staphylococcus* (38%), *Enterococcus* (11%), and *Staphylococcus aureus* (9%). Twenty one percent of the patients developed pneumonia. *Pseudomonas aeruginosa* (22%), *Staphylococcus aureus* (17%), and *Haemophilus influenza* (13%) were the three major causative agents of hospital acquired pneumonia. Fifteen percent of the patients developed urinary tract infection which was caused by gram-negative enteric organisms for about fifty percent of all urinary tract infections. There were three main pathogens which were found associated with the urinary tract nosocomial infections and these were *Escherichia coli*, *Candida albicans* (14%), and *Pseudomonas aeruginosa* (13%) [1] (Table-1).

Table 1: Types of Nosocomial Infections [2]

Types of Nosocomial Infections	**Associated Nosocomial Microorganisms**	**Treatment Related Factors contributing to Infection**
Gastrointestinal Tract Infections	*Clostridium difficile*, *Rotavirus*	1. Antibiotic use 2. Nasogastric intubation
Urinary Tract Infection	*Escherichia coli*, *Proteus mirabilis*, *Klebsiella spp*., *Pseudomonas aeruginosa*, *Enterobacter*, *Enterococci* and *Candida spp*.	1. Use of catheter to measure output. 2. Disconnection of catheter from drainage tube. 3. Duration of catheterization; insertion of catheter late in hospital stay. 4. Retrograde flow of urine from drainage bag.
Ventilator Associated Pneumonia	*Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Haemophilus influenza*	1. Supine head position. 2. Aspiration of gastric contents. 3. Nasogastric tube. 4. Use of paralytic agents. 5. Duration of mechanical ventilation.
Surgical Site Infection	*Staphylococcus aureus*, *Coagulase negative Staphylococcus*, *Enterococcus spp*., *Enterobacter spp*., *Pseudomonas aeruginosa* and *Escherichia coli*	1. Foreign material (including drains and sutures). 2. Skin antisepsis. 3. Duration of operation. 4. Intraoperative contamination. 5. Duration of preoperative hospital stay. 6. Hypothermia during operation. 7. Duration of surgical scrub. 8. Antimicrobial prophylaxis. 9. Preoperative preparation (wash/shave). 10. Surgical technique. 11. Reintubation.
Intravascular Device Related Bloodstream Infections	*Coagulase negative Staphylococcus*, *Enterococcus spp*., *Staphylococcus aureus and Candida albicans*	1. Heavy colonization on skin at site of insertion. 2. Location in internal jugular or femoral vein. 3. Length of time in place. 4. Contamination of catheter hub. 5. Type of infusate. 6. Total parental nutrition. 7. Location of insertion.

In a study carried out by Maqbool *et al.*, [13] in Kashmir region of Jammu & Kashmir, of the 300 neonates studied, 160 were males and 140 were females, among whom 12 were extreme premature (<28

weeks of gestation), and 30 were very low birth weight (<1500 grams). The incidence of NI rate in our NICU was 37.33% with prematurity and low birth weight as major risk factors ($p<0.05$). Sites of infection were primary blood stream infections in 70(62.52%), pneumonia in 20(17.85%), meningitis in 10(8.92%), and others 12(10.71%). Among the studied neonates we found, *Klebsiella* in 45(40%), *Staphylococcus aureus* in 34(30%), *E. Coli* in 11(9.8%), *Acitinobacter* in 7(6.25%), *Pseudomonas* in 3(2.67%) and others 12(10.71%).

Taj *et al.*, [19] in their study on nosocomial infections in Jammu and Kashmir reported that a total of 10 types of microorganisms were isolated namely *Escherichia coli*, *Enterococcus*, *Enterobacter spp*., *Proteus spp*., *Staphylococcus aureus*, *Citrobacter spp*., and *Candida* spp.) from six types of samples among which maximum number of microorganisms were isolated from swab which was followed by blood and urine, while minimum number of microorganisms were isolated from ETT. Further, among ten microorganisms isolated, the highest percentage was recorded for *Pseudomonas* spp., which was followed by *Klebsiella* spp. and *E. coli*, while the lowest percentage was recorded for *Proteus* spp. There was a predominance of Gram-negative bacilli than Gram-positive bacilli.

NOSOCOMIAL INFECTIONS AS OPPORTUNISTIC INFECTION

Opportunistic infections are those infections which infect the person with weak immune system or immunocompromised patients. These are secondary infections which attack the body when its immune system is already busy fighting other chronic illness or when the immune system is compromised due to malnutrition, fatigue, HIV infection, chemotherapy, skin damage, antibiotic treatment or some immunosuppressing agents like corticoids, etc. and hence is vulnerable to attack by infectious agents. In last twenty years, the infections of opportunistic fungi have emerged as a cause of death and poor health in many patients. Earlier, majority of the opportunistic fungal mycoses was caused by *Aspergillus spp.* and *Candida spp.* But during the past decade, infections by some of the uncommon opportunistic fungal microorganisms have also been reported which includes *Trichosporon* (yeast), *Fusarium spp*. (filamentous fungi), *Penicillium mameffei* (endemic dimorphic fungi), *Zygomycetes* and a variety of *Dematiaceous moulds* [5].

CAUSES OF SPREAD OF NOSOCOMIAL INFECTIONS

Unsafe medical care is the prime cause of spread of nosocomial infections, specially, in underdeveloped and developing countries [1]. Recently, strong evidences suggesting the unsafe healthcare facilities to be an important factor in transmitting HIV have been found [7]. The reason for the widespread of nosocomial infections are as follows:

- Crowding of patients in a hospital or healthcare setting increase the chances of spreading an infection [7].
- The risk of nosocomial infection increases with age and illness as they decrease the immune strength [7].
- An invasive treatment may pave a way for the entry of the infectious agents inside the body [7]. The increasing use of invasive devices like mechanical ventilators, urinary catheters and central intravenous lines is the key factor contributing to the spread of nosocomial infections specially if used without proper training or laboratory support [1].
- Rapidly increasing antibiotic resistance among the microorganisms has increased the difficulty of healthcare workers to combat the deadly infection. Up to 60 per cent of hospital infections are caused by drug-resistant microbes and in 35 to 40 per cent of the infections the microorganism is resistant to the best drug commonly used to treat that infection. The excessive use of broad spectrum antibiotics has led to the development of antibiotic resistance among the microorganisms [1]. Vancomycin-resistant *Enterococci* (VRE) and methicillin resistant *Staphylococcus aureus* (MRSA) are the major gram-positive nosocomial micro-organisms and *Pseudomonas aeruginosa*, *Klebsiella*, and *Enterobacter* that harbour chromosomal or plasmid-mediated beta- lactamase enzymes are major gram-negative antimicrobial resistant pathogens of concern [3]. The development of resistance to antibiotic acyclovir and ganciclovir in Herpes virus is major threat to immunocompromised patients, particularly HIV-infected patients [3]. The WHO report on infectious diseases states that due to emerging co-infection with HIV, the cases of visceral leishmaniasis are increasing at an alarming rate in countries like India and Sudan and in certain parts of India, over 60 per cent of visceral leishmaniasis cases no longer respond to the first- line drug [1, 16]. *Candida spp.* with intrinsic resistance to azole antifungal agents (For Example, *Candida krusei*) and to amphotericin B (For Example, *Candida lusitaniae*) has emerged as grave concern in oncology units [3].
- The frequent use of unnecessary injections (For Example, routine injections of vitamins like vitamin B_{12} or an antibiotic such as Carbapenems) should be avoided. In the developing countries more than 50 per cent of the needles, syringes or both are reused i.e. are unsafe [10]. As a consequence nearly 80,000 to 1,60,000 new HIV infections occur annually in Sub-Saharan Africa.

Much more cases of HBV and HCV occur annually because of unsafe injections [9].

- The emergences of new pathogenic agents have further aggravated the existing problems [1, 15].
- Besides the above mentioned causes of nosocomial infection spread, poor infection prevention practices, improper use of limited resources and lack of supervision are major causes of nosocomial infections in developing countries [1].

EFFECTS OF NOSOCOMIAL INFECTIONS

The effects of nosocomial infections can be very severe. They can lead to emotional stress, functional disability and even death in certain cases. Mortality caused by nosocomial infections in India is more than any other form of accidental death. It is one of the five major cause of death of infants in India and the maternal mortality rate is as high as 450 deaths per 1, 00,000 live births with wide regional disparities [1, 7]. Nosocomial infection prolongs the hospital stays and hence increases the expense of the treatment. The worst part is that the nosocomial infections have affected those countries the most which have limited healthcare facility, limited resources and least capability to afford the expensive medication [1].

TYPES OF NOSOCOMIAL INFECTIONS

Surgical site infections, urinary tract infections and lower respiratory (pneumonia) infections are the most frequent types of nosocomial infections occurring in developing countries whereas in developed countries the sequence is somewhat different. The nosocomial infections of urinary tract and respiratory tract are more prevalent in US as compared to the surgical site infections [9]. As much as 80 percent of all the nosocomial infections are urinary tract infections, surgical site infections, pneumonia or bacteraemia. Rest of the 20 percent of the nosocomial infections are gastrointestinal tract, bone, joints, severe burns, eyes and genital tract infections [6].

Gastrointestinal Tract Infections

Rotavirus infection is the major threat to the children especially, younger than three years. It causes acute gastroenteritis in hospitalized children. *Clostridium difficile* is the most important bacterial cause of nosocomial infections in gastrointestinal tract and is often suspected in the patients with diarrhea and recent medical history of antibiotic use (especially, Cephalosporin and Clindamycin) [4].

Urinary Tract Infection

The rate of urinary tract nosocomial infection accounts for 35 percent of all the nosocomial infections but costs the least in terms of economics, mortality and morbidity. Its occurrence is very high in the patients who have an indwelling catheter or have had a kidney transplant. A catheter is associated with nearly 80 per cent of all the hospital acquired urinary tract infections [2].

Ventilator Associated Pneumonia

Ventilator associated pneumonia is defined as the pneumonia that develops within 48 hours of tracheal intubation. It accounts for 15 to 20 percent of all the nosocomial infections but costs highest in terms of economics, mortality and morbidity. Those patients who are critically ill or those who are receiving continuous mechanical ventilation have a high risk of getting infected with ventilator associated pneumonia. Approximately 9 to 27 percent of the intubated patients develop ventilator-associated pneumonia and nearly 25 to 60 percent of these are not able to survive [2].

Surgical Site Infection

Surgical site infections accounts 40 percent of all the hospital acquired infections. They prolong the hospital stay, have expensive treatment and have higher rates of morbidity and mortality [2].

Intravascular Device Related Bloodstream Infections

Intravascular device related bloodstream infections account for approximately 15 percent of all nosocomial infections. Although bloodstream infections such as septicemia and bacteremia can develop from the infection at other types of infections on some other site in the body but nearly half of them are caused by central venous catheters [2].

VICTIMS OF NOSOCOMIAL INFECTION

The susceptibility to nosocomial infections varies from person to person. Aged patients are more susceptible to nosocomial infections because of low nutritional status, decreased immunity and underlying diseased condition. As a result, as much as three times higher infection rates are observed in the patients of intensive care units (I.C.U.) as compared to elsewhere in the hospitals. On the other hand, young with a healthy lifestyle and good health have a stronger immune system and hence, are less susceptible to nosocomial infections. The risk of nosocomial infection can be classified as follows depending upon the age, general health and the type of treatment being carried out on the patient:

1. **Minimal Risk**: It is assigned to those patients with a strong immune system and not undergoing an invasive procedure.
2. **Medium Risk:** It is assigned to older patients and those undergoing an invasive procedure such as surgeries and transplantations or implantation of invasive medical devices such as mechanical ventilators, urinary catheters and central intravenous lines.
3. **High Risk** individuals undergoing surgical invasive procedures such as organ transplantation and the immunocompromised people such as HIV

patients are under high risk of infections. ICU patients, cancer patients and patients with multiple trauma or severe burns are also assigned high risk factor [1, 3].

PREVENTION AND CONTROL OF NOSOCOMIAL INFECTIONS

In 1840s, Ignaz Semmelweis emphasized on controlling the infection transmissions in hospitals by stating the importance of hand washing by healthcare workers between the patients [3]. Scheckler *et al.,* 1998 had stated that approximately one third of the nosocomial infections are preventable. In 1985, a study on the efficacy of nosocomial infection control conducted by the centers for disease control and prevention's (CDC's) showed that the rate of nosocomial infections reduced by one third by the following four infection control components:

1. An effective hospital epidemiologist.
2. One infection control practitioner for every 250 beds.
3. Active surveillance mechanisms and
4. Ongoing control efforts.

The various measures to prevent nosocomial infections are as follows:

Improved National Surveillance

It is mandatory to develop efficient surveillance systems for surveillance of nosocomial infections that occur in inpatient as well as outpatient facilities where much healthcare is now given [3]. Surveillances target those infections which are difficult to treat and are expensive in terms of mortality, morbidity and economics [2, 17].

Improved Epidemiologic Tools

Aseptic techniques and hand washing are the foremost preventive measures. Weinstein RA in 1991stated that in ICUs, Asepsis is often ignored in the rush of crisis care. Pulsed-field gel electrophoresis has become an important tool in investigating the multi-drug resistant pathogens [3, 15].

Risk Adjustment

Robert A. Weinstein, 1998 has emphasized on the need to risk adjust infection rates so that inter hospital comparisons are valid. The development of non-invasive infection resistant devices and implementation of the existing infection control measures help in preventing and controlling the nosocomial infections [3].

Improved Invasive Devices

Most of our successes in controlling nosocomial infections rely on the development of non-invasive monitoring devices or improved invasive devices or minimally invasive surgical tools [3].

Antibiotic Control

Microorganisms are increasingly becoming resistant to the antibiotics and therefore, depleting the antimicrobials available for their treatment. Judicial use of the available antibiotics and proper implementation of the infection preventive measures can be the effective measures to limit the antimicrobial resistance among the pathogens. Aggressive antibiotic control programs are mandatory to combat nosocomial infections [3]. Combination therapy in antimicrobial use is recommended in most of the surveys [6, 16, 17].

Development in Therapeutics

Physicians should give necessary value to the results of microbiology laboratories. Development of new diagnostic techniques should be encouraged and all the healthcare settings, whether small or large ones should have the required facilities to conduct a range of diagnostic tests. Also, the essential vaccination programs should be efficiently implemented. According to a current schedule, one third of world's unimmunized children are in India and not even half of the all the Indian children are fully immunized. Vaccination against the vaccine preventable diseases would promote the health and reduce the mortality and morbidity rates. It will prevent the spread of epidemics, reduce the expenses on healthcare, save on the use of antibiotics and also prevent the spread of antibiotic resistance among microorganisms [8, 17].

Occupational Safety

Care should be taken when using needles, scalpels and handling sharp instruments after procedures. Also the disposal of these instruments should be carefully done to avoid infection by any blood borne pathogen. Puncture resistant bags must be used for placing sharp articles to be disposed or to be transported to the reprocessing area for sterilization before reuse. The use of mouthpieces and resuscitation bags or other ventilation devices is recommended over mouth-to- mouth resuscitation [2]. Apart from these, personnel education programs, environmental control, patient isolation, hand washing guidelines, wearing gloves, gowns, mask, eye protection and face shields are some of the standard preventive measures [2].

CONCLUSION

Healthcare settings are the reservoir of numerous infectious agents because of the presence of many patients with different infectious agents under one roof. These are threat not only to the patients but also to the healthcare workers. A healthy human body has its own ways and means to protect itself against the invading microorganisms. It offers physical and chemical barriers to the infection causing microorganisms. But the surgical procedures pave a way for the easy entry of infectious agents into the body. Therefore, immunization, maintenance of proper hygienic conditions, sterilization of soiled equipment's

and other articles, increased national surveillances and development of non-invasive procedures are some of the measures to prevent the nosocomial infections. The active cooperation of the Healthcare workers for better implementation of the existing preventive and control measures along with the technical advances will contribute much to fight against the nosocomial infections.

CONFLICT OF INTEREST

Authors declare there is no conflict of interest.

REFERENCES

1. World Health Organization (1999). Removing Obstacles to Healthy Development: Report on Infectious Disease, 1-68, Geneva, Switzerland.
2. Lori L. A. (2019). Research results of a survey on writing needs assessments for CME. *AMWA Journal*, *34*(2), 55.
3. Weinstein, R. A. (1998). Nosocomial infection update. *Emerg Infect Disease*, *4*(3), 416-420.
4. Custodio, H. T., & Steele, R. W. (2021). Hospital Acquired Infections: Practice Essentials, Background and Pathophysiology. medscape.com.
5. Groll, A. H., & Walsh, T. J. (2001). Uncommon opportunistic fungi: new nosocomial threats. *Clin Microbiol Infec.*, *7*(Supplement 2), 8-24.
6. Eugenie, B. B., Dominique, D., & Marie-Laure, J. (1993). Nosocomial Infections. *J Antimicrob Chemoth*, *32*(Suppl. A), 39-47.
7. Ducel, G. J., Fabry, J., & Nicolle, L. (2002). Prevention of hospital acquired infections, World Health Organization, A Practical Guide, 2002, 2nd ed., 30-62, WHO Press, Malta.
8. Nirmal, K., Ganguly, N. K., Arora, S. J. C., Mohamed, N. F., Gill, J. P. S., Guru, A. D., Usha, G., Shah, H., Sadhna, J., Joshi, P. C., Manish, K., Anita, K., Ashok, R., Sudarshan, H., Kurien, T., Chand, W., Alice, E., & Ramanan, L. (2011). Rationalizing antibiotic use to limit antibiotic resistance in India. *Indian J Med Res*, *134*(3), 281-294.
9. Saha, J. C. (2010). Nosocomial infections as a preventable burden for health care delivery. *Faridpur Med. Coll. Journal*, *5*(1), 1-2.
10. Simonsen, I., Kane, A., Lloyd, J., Zaffran, M., & Kane, M. (1999). Unsafe injections in the developing world and transmission of blood borne pathogens: A review. *Bulletin of the World Health Organization*, *77*(10), 789–800.
11. Eugene, T. (1987). Nosocomial Infections. *Chemiotherapia*, *6*(3), 148–151.
12. Kamat, U. S., Ferreira, A. M. A., Savio, R., & Motghare, D. D. (2008). Antimicrobial Resistance among Nosocomial isolates in a teaching Hospital in Goa. *Indian J. Community Med*, *33*(2), 89-92.
13. Maqbool, J., Ashraf, M., Aslam, B., & Tak, A. A. (2018). Neonatal nosocomial infections: A Kashmir experience. *Journal of Clinical and Diagnostic Research*, *12*(11), SC01-SC03.
14. Garner, J. S., Jarvis, W. R., Emori, T. G., Horan, T. C., Hughes, J. M. (1988). CDC definitions for nosocomial infections. *American J Infect Control*, *16*, 128-40.
15. Neelam, S., & Wahied, K. B. (2021). Potential Threat of Emerging and Re-emerging Zoonotic Diseases. *Annals of the Romanian Society for Cell Biology*, 25(5), 29-36.
16. Wahied, K. B., & Neelam, S. (2021). Elimination of Lymphatic Filariasis. *East African Scholars J. Parasitol Infect Dis*., 3(2), 31-36.
17. Wahied, K. B., & Neelam, S. (2021). Quantifying the risk of premature death in tuberculosis survivors. *The Journal of Oriental Research Madras*, Vol. XCII-II.
18. Taj, A., Shamim, A., Khandey, S. B., & Ommid, M. (2018). Prevalence of common nosocomial organisms in surgical Intensive Care Unit in North India: A hospital-based study. *Int J Crit llln Inj Sci.*, *8*(2), 78-82.