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Review Article :Nosocomial infections: types and prevalence

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ABSTRACT

One of the most problematic health issues nowadays is the prevalence of nosocomial diseases which is one of the most important health problems in the world and till now there are no series solutions. There are several types of nosocomial infection such as; Infections of the bloodstream caused by a central line (CLABSI), Infections of the Urinary Tract Caused by Catheters (CAUTI), Infections at the Site of Surgery (SSI), and Pneumonia linked with Ventilators (VAP).

All these types caused by one or more type of biological agent such as bacteria, viruses and fungi. Uncontrolled use of drugs and disregard for health preventative techniques will result in significant health troubles, such as an increase in antibiotic resistance, which the medical community views as a major concern. The most urgent problem facing the medical profession at the moment is the existence of bacteria with genetic traits that allow them to resist antibiotics. It is now necessary to utilize extra antibiotics or a combination of antibiotics to treat many straightforward illnesses that could previously be treated with simple antibiotics.

To lessen the harmful repercussions that might arise in the future from failing to pay attention to this problem, several efforts and activities must be done to restrict the spread of nosocomial diseases. Also, should awareness the people to avoid using antibiotics unless absolutely essential. On the other hand, it would be advisable to pass legislation requiring a prescription from a licensed medical expert before any prescriptions may be filled at a pharmacy or drug store.

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1. Nosocomial Infections

The most prevalent consequences in hospitals are nosocomial infections, which increase morbidity and mortality [1,2]. Any disease acquired by people receiving medical care is referred to as "nosocomial." Infections can be contracted in medical settings like hospitals, nursing homes, and outpatient clinics [3].

The most common types of nosocomial infections include chest disease, secondary surgical wound infections, gastrointestinal tract and genitourinary diseases. The main causes of nosocomial infections are contamination of the surfaces and or the staffs, stopped of infection control practices and procedures and not paying attention to the sterilization of the surrounding environment [4].

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The patients acquired infection in the hospital but the symptoms after leaving the hospital, as well as occupational infections among employees [5].

Every year, health-care-associated infections impact hundreds of thousands of people worldwide, resulting in considerable mortality and financial losses for health-care systems. The most important aspect of healthcare is urinary tract infections. In low- resource setting infection in the surgical site is the most common illness, which affects up to one-third of surgical patients, nine times more than in developed countries. Longer hospital stays, greater antimicrobial resistance, long-term incapacity, socioeconomic disruption, and increased mortality rates are all linked to rising disease rates [5]. Because of poorly developed monitoring systems and lack of control mechanisms, data on the burden of nosocomial infections is scarce. Many patients, for example, are susceptible to respiratory infections while receiving treatment for other conditions, making it

difficult to diagnose nosocomial infections in basic care [5].

No organization or country can claim to have solved this endemic problem, despite the fact that these infections are only found when they become epidemics. [6]. In this article, a quick overview of global distribution of this disease, as well as types of nosocomial infections, agents, prophylaxis, developing causes of antibiotic resistance, and antibiotic resistance strategy for control, are reviewed [7].

2. Nosocomial Infections Types

There are several types of nosocomial infections like infection in blood stream, infection in surgical site, pneumonia caused by using a ventilator, and urinary tract infections caused by catheters. The following is a list of these:

2.1. Infections of the bloodstream caused by a central line (CLABSI)

CLABSIs are serious nosocomial infections that have a 12–25% fatality rate [8]. Catheters are used to deliver fluid and medications through a central line, However, prolonged use can cause serious bloodstream infections, jeopardizing health and driving up healthcare expenses [9].

2.2. Infections of the Urinary Tract Caused by Catheters [CAUTI]

CAUTI one of the most common types of hospital infections around the globe [10]. More than 12% of illnesses are caused by urinary tract infections (UTIs), according to severe care hospital statistics from 2011. CAUTIs are caused by the patients' own natural microbiota [11].

2.3. Infections at the Site of Surgery (SSI)

SSIs are nosocomial infections that are reduced in 2%–5% of patients who undergo surgery. This is the second most prevalent kind of nosocomial infection, *Staphylococcus aureus* almost responsible of this kind of infection and may cause death [12].

2.4. Pneumonia linked with Ventilators (VAP)

This type of nosocomial pneumonia that affects 9 to 27 percent of ventilator-assisted patients. It usually happens 48 hours following tracheal cultivation [13]. Ventilation is linked to 86 percent of nosocomial pneumonia cases [14]. VAP is characterized by elevated fever, bronchial noises and leucopenia [15].

3. Agents associated with nosocomial infection

There are many types of pathogens that cause nosocomial infections including fungi, viruses and bacteria. Bacterial infection differs depending on demographic of patients, health-care services, also environmental differences in hospital environments [16]. Bacteria cause 90 percent of infections, while protozoans, fungi, viruses, and Mycobacteria cause 10% of infection [17].

3.1. Bacteria

In hospitalized patients, bacteria are the most frequent pathogens that can cause nosocomial infections especially in immune compromised patients where the normal become a source of illness. *Pseudomonas aeruginosa, Staphylococcus aureus, Bacillus cereus, Legionella spp., Streptococcus spp., Acinetobacter spp*, coagulase negative staphylococci also members of the Enterobacteriaceae family such as *Klebsiella pneumoniae*, *Proteus mirablis*, *Serrati marcescens* and *Escherichia coli* are the most common enterococci [18].

Intensive care unit infections are caused by pathogenic bacterium *Acinetobacter*. It is prevalent in water and soil, and it is responsible for eighty percent of all infection documented [19].

Due to the replacement of beneficial bacteria with pathogenic bacteria, *Clostridium difficile* induces inflammation in colon, which results from antibiotic-associated colitis and diarrhea. Health-care workers who do not adequately wash their hands spread *C. difficile* from an infected patient to others [20].

Direct contact, open sores, and contaminated hands are all ways for methicillin-resistant S. aureus (MRSA) to spread. By traveling from organs or the bloodstream, it causes sepsis, pneumonia, and SSI. Antibiotics classified as Beta-lactams are very resistant to it [21]. On the other hand, If Enterobacteriaceae [carbapenem-resistant] travels from the gut to other body areas, it can cause infections. Also *Klebsiella* species and *Escherichia coli* belong to the Enterobacteriaceae family, these species defending against them is more difficult due to their high

carbapenem resistance [21]. While *Bacteroides fragilis* is a bacteria that can be found in nature and can be found in the gut and colon when mixed with other bacteria and causes illnesses [20].

The overuse and misuse antibiotics with a broad spectrum, particularly in healthcare places, is increasing nosocomial infections. Drug-resistant bacteria include penicillin-resistant pneumococci, multidrug-resistant TB, methicillin-resistant *S. aureus* (MRSA), and vancomycin-resistant *S. aureus.* Streptococci, as well as coagulase-positive and coagulase-negative staphylococci, were increased in recent years, raising the frequency of *Klebsiella*. Pneumonia and *E. coli* infections decreased from seven to five percent and 23 to 16 percent, respectively [22]. The bacterial distribution in nosocomial infections changes over time. In the 1960s, *Proteus spp*., *Klebsiella spp*., and *Escherichia spp.* were caused nosocomial infections, but *Acinetobacter spp*. with *P. aeruginosa* caused clinical difficulties from 1975 to 1980 [23].

3.2. Viruses

Viruses, as well as bacteria, are the main cause of hospital infection. Based on conventional monitoring viruses cause 5% of all nosocomial infections in hospitals [24]. Viruses can spread via hand-to-mouth, respiratory, and fecal-oral routes [25]. an example of viral infection is hepatitis disease, which is a viral infection that causes a chronic condition. Hepatitis viruses are contagious through healthcare transfers among patients and personnel. Hepatitis C and B are usually spread via incorrect injection procedures. [21]. Other viruses include HIV, Influenza, Herpes- simplex virus and Rotavirus [25].

3.3. Fungi

In immunocompromised patients, fungal parasites considered as opportunistic pathogens and cause nosocomial infections. Through environmental contamination, *Aspergillus spp.* can cause illnesses. Patients may have infection during hospitalization by *Candida albicans* and *Cryptococcus neoformans* [25]. Breathing fungal spores from contaminated air during the building or renovation of a health care facility causes Candida infections, while inhaling fungal spores from polluted air causes Aspergillus infections [26].

4. Nosocomial infection prevention

In order to restrict the spread of nosocomial infections, which are a primary cause of illness and death in hospitals, they must be avoided from the outset [27].

4.1. Transmission to the environment

Optimum setting for harmful microorganisms to thrive is an unclean environment. Contaminated water, food and air can be conveyed to people receive healthcare. Doing cleaning and the usage of cleaning chemicals to windows, toilets walls, beds, floors, baths, windows and other medical devices must adhere to strict hygiene guidelines [28, 29]

With adequate ventilation and fresh filtered air, airborne bacterial contamination can be minimized. In general wards, operating rooms, and intensive care units (ICUs), filters and ventilation systems must be tested and documented on a regular basis [30]

Infections connected to water are caused by healthcare institutions that do not adhere to the necessary requirements. Microbiological monitoring methods should be used for water analysis and infected individuals should be given separate baths [31, 32]. Foodborne illnesses can be spread by improper food handling. The place should be sanitized. In addition, the quality of the meal should meet industry requirements [33, 34].

The infections can be passed from one person to another in the healthcare field. Healthcare professionals are responsible for infection control. Employees should exercise personal hygiene because it is crucial for everyone. Hand disinfection using the right hand disinfectants is required when in contact with patients who have been infected. Safe injection techniques and sterile equipment must be employed. Head covers, masks and gloves, or appropriate gear are important for the delivery of healthcare [35, 36].

4.2. Management of waste in hospitals

Hospital waste can operate as a germ reservoir which require demanding treatment. Healthcare facilities create 10–25 percent of their garbage as hazardous waste [16]. Infectious healthcare waste should be kept in a secure location. Garbage from surgeries, blood and

sputum-contaminated waste, and waste from diagnostic laboratories must all be separately disposed. Also, the hazards of trash and how to properly dispose of it should be taught to healthcare staff [16, 37, 38].

5. Infection control in hospitals

Despite significant efforts to avoid nosocomial infections, more work is needed to keep them under control. One out of every 25 hospital patients can get a nosocomial infection in a single day [39].

Programs to combat infection

Control programs for these infections should be devised by healthcare institutes. In order to do their part in infection prevention, the administration, personnel, and individuals who visiting the hospital must consider such initiatives [16, 38].

6. Antimicrobial resistance and use

Antimicrobial medications used to treat germs but in recent decades resistance to antibiotics occurs when bacteria develop mechanism of antibiotic resistance; where the antibiotics fail to kill bacteria and they undergo in growth continues.

6.1. Antimicrobial usage that is appropriate

The Centers for Disease Control and Prevention CDC reports that office-based physicians prescribe around 100 million antibiotic courses each year, with about half of those being unnecessary [40]. Antibiotics should be chosen based on the tolerance of the patient as well as the microorganisms involved and disease nature. Therapy with antibiotics tries to use an antibiotic which is specific and active against the most likely pathogen while causing as little resistance and side effects as possible [16].

6.2. Antibiotic resistance

In the Southeast Asian region, one kid dies every five minutes due to antibiotic resistance. Drugs which once used to treat deadly diseases are increasingly losing its effectiveness because an increase in bacterial resistance against drugs [42].

Antibiotic self-treatment, inappropriate dosage, long-term use, a shortage of medical attention staffing requirements and mistreatment during husbandry of animals are the main causes of antibiotic resistance [43]. This resistance decreases efficient control of germs that cause urinary tract infections blood stream infections and pneumonia. MRSA or multidrug-resistant Gram-negative bacteria are examples of highly resistant bacteria which produce a high risk of nosocomial infections [43].

6.3. Antibiotic management

Overuse and misuse of antibiotics are driving the global pandemic of antibiotic resistance, posing a threat to disease prevention and treatment. Excellent hygiene, clean water, and vaccination, according to the WHO's global report on antibiotic resistance, can help reduce the need for antibiotics. In order to control the spread of antibiotic resistance, healthcare institutions must create new diagnostics and other technologies. On other hand policymakers should encourage collaboration and information sharing among all stakeholders, and when an antibiotic is truly needed, pharmacists should play a crucial role in prescribing it [44].

7. Antibiotic resistance: molecular mechanisms

Antibiotic resistance define as the ability of a microbe to tolerate antibiotics effects. Where the germs do not destroyed and their growth continuous [45]. Resistance to antibiotics is linked to the bacteria under investigation as well as their previous antibiotic exposure. Antibiotic resistance has been thoroughly researched at the molecular level [46, 47]

Bacteria may have gained resistance to antibiotics, which can be acquired by obtaining antibiotic resistance gene from another bacterium via movable transposons or plasmid [by horizontal gene transfer process or change the chromosomes] [48]. On the other hand resistance to antibiotics can developed through 4 various paths (i.e., transduction, conjugation, mutation and transformation) also expressed in various mechanisms i.e., protein synthesis, cell wall synthesis, RNA polymerase and DNA gyrase, membrane structure and folate mechanism [48].

8. Antibiotic resistance is a major worldwide issue.

Antibiotic-resistant bacteria such as *Enterococcus faecium, S. aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa,*

and the so-called "ESKAPE" bacteria, *Enterobacter spp*., have been identified as the cause of substantial illness and mortality [49]. Multidrug-resistant (MDR) bacteria are divided into three categories by the centers for disease control and prevention (CDC) in the United States of America (i.e., levels of danger that are urgent, serious, and worrisome) [38]. MRSA, vancomycin resistant *S. aureus* (VRSA), multidrug-resistant *Acinetobacter*, extended spectrum -lactamase producing enterobacteriaceae (ESBLs), and multidrug-resistant *Pseudomonas aeruginosa* are among the MDR pathogens that have been found in infections caused by orthopaedic implants [50].

Antibiotic resistance affects the treatment of infections directly. Patients with infections caused by MDR bacteria have a greater chance of having poor clinical outcomes and dying, as well as consuming more health-care resources than patients with antibiotic-susceptible bacterial infections [51].

9. Final thoughts

Nosocomial infections are still unmanageable in the age of drugs. Controlling organisms that cause nosocomial infections is critical because they result in significant financial and productivity losses. Infection control measures can be used to prevent the spread of certain illnesses in hospital settings through healthcare personnel.

Misuse and overuse of antibiotics contribute to the emergence of antibiotic-resistant bacteria that are hard to cure. Infection control programs must be developed by hospitals so that it is possible to compare and manage infection rates. In light of CDC standards, a well-managed surveillance approach is critical. In order to halt the spread of nosocomial infections in hospitals, it is equally critical that best practices be communicated throughout institutions.

Antimicrobial resistance in emerging diseases can be easily decreased by following delivery of safe and healthy care techniques specified by committees in charge of infection control, preventing the spread of these illnesses by using proper antimicrobial usage process. WHO-guided surveillance can assist healthcare institutions in developing infection control plans.

Raising public knowledge about these endemic diseases, as well as training hospital personnel in biosafety, good waste management, and healthcare reforms, can all help to prevent nosocomial infections. In addition, all hospitals should have an integrated infection control program that is closely monitored.

This strategy should include aspects that attempt to reduce infection rates. These strategies have shown to be quite effective. They offer information, training, and feedback.

It also supply documentation and data that can be compared among hospitals and within them. The primary components of any program vary every hospital, but they generally include: reducing organism transmission through commitment to fundamental precautions (use gloves ,hand cleanliness, and perform sterilization procedures), isolation methods, and correct waste processing. Other considerations include minimizing intrusive procedures and identifying and controlling epidemics.

10. Conclusion

One of the major health issues that has to be managed and decreased is the issue of the incidence and spread of nosocomial infections. There are many causes and reasons for this phenomenon, but one of the most crucial things to concentrate on is keeping healthcare facilities clean, properly disposing of waste in hospitals, raising awareness of the overuse of antibiotics, and never prescribing any treatment without first consulting a doctor.

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مراجعة :عدوى المستشفيات: الأنواع والانتشار

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الخلاصة:

من أكثر المشاكل الصحية إشكالية في الوقت الحاضر انتشار أمراض المستشفيات التي تعد من أهم المشاكل الصحية في العالم وحتى الآن لا توجد حلول جادة. هناك عدة أنواع من عدوى المستشفيات مثل؛ التهابات مجرى الدم الناجمة عن الخط المركزي **(CLABSI)**، والتهابات المسالك البولية التي تسببها القسطرة **[CAUTI]**، والتهابات في موقع الجراحة **(SSI)**، والالتهاب الرئوي المرتبط بأجهزة التنفس الصناعي **(VAP)**.

كل هذه الأنواع ناتجة عن نوع واحد أو أكثر من العوامل البيولوجية مثل البكتيريا والفيروسات والفطريات. سيؤدي الاستخدام غير المنضبط للأدوية وتجاهل الأساليب الوقائية الصحية إلى مشاكل صحية كبيرة، مثل زيادة مقاومة المضادات الحيوية، والتي يعتبرها المجتمع الطبي مصدر قلق كبير. المشكلة الأكثر إلحاحًا التي تواجه مهنة الطب في الوقت الحالي هي وجود بكتيريا ذات سمات وراثية تسمح لها بمقاومة المضادات الحيوية. من الضروري الآن استخدام المزيد من المضادات الحيوية أو مجموعة من المضادات الحيوية لعلاج العديد من الأمراض المباشرة التي كان من الممكن علاجها سابقًا بالمضادات الحيوية البسيطة. لتقليل الآثار الضارة التي قد تنشأ في المستقبل من عدم الاهتمام بهذه المشكلة، يجب بذل العديد من الجهود والأنشطة للحد من انتشار أمراض المستشفيات. أيضا، يجب توعية الناس لتجنب استخدام المضادات الحيوية إلا في حالة الضرورة القصوى. من ناحية أخرى، من المستحسن تمرير تشريع يتطلب وصفة طبية من خبير طبي مرخص قبل ملء أي وصفات في الصيدلية أو متجر الأدوية.