A Review of Pathogenic Organisms that might contribute to Nosocomial Infection

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ABSTRACT:-
Patients receiving medical care may get nosocomial infections or infections related to healthcare. Both wealthy and poor nations around the world are affected by these illnesses. In industrialized countries, nosocomial infections account for 7% of cases, while they account for 10% in poor nations. These infections cause a prolonged stay, incapacity, and financial hardship because they happen while you're in the hospital. Infections that are frequently encountered include pneumonia brought on by a ventilator, urinary tract infections brought on by catheters, and infections at surgical sites. Bacteria, viruses, and fungal parasites are some examples of nosocomial pathogens. According to WHO estimates, these illnesses affect about 15% of all hospitalized patients. During their stay in the hospital, patients are exposed to pathogens from a variety of sources, including the environment, medical personnel, and other sick people. To prevent these illnesses, transmission should be limited. Hospital waste is a possible source of germs, with 20–25 percent of it being classified as hazardous.Nosocomial infections can be prevented by implementing infection control procedures, monitoring antibiotic use and resistance, and establishing antibiotic control policies. Effective surveillance systems can contribute both domestically and internationally. All parties must make an effort to stop and manage nosocomial infections.

***Keywords*: nosocomial infection, types, persist an inanimate surface**

I. INTRODUCTION

Nosocomial infections (NIs) have become more common as a result of the operating room's (OT) microbial contamination [1-4,5]. It has a significant clinical impact on the patient and the compassionate surgical team [2,4,6]. With multi-drug resistant strains like methicillin-resistant Staphylococcus aureus (MRSA) [5], about 10% of all infections can have major repercussions in terms of increased patient mortality, morbidity, duration of hospital stay, and overall expenses among patients in for post-operative surgery. Antimicrobial resistance causes an increase in disease, fatalities, and medical expenses. Hospital infection control issues are getting worse due to the rise of multidrug-resistant bacteria, which are more common in underdeveloped nations and are linked to high rates of NIs and antibiotic resistance [8]. Unfiltered air, ventilation systems, antiseptic solutions, drainage of wounds, patient transportation, and collection bags, the surgical team, the volume of indoor traffic, theatre gowns, footwear, gloves, and hands, the use of inadequately sterilized equipment, the contaminated environment, and grossly contaminated surfaces have all been reported as reservoirs for OT contamination [2,4]. Depending on the number of pathogens involved, the effect of various sources on the level of microbial contamination varies. The main microorganisms connected to infection of implantable biomedical devices include Staphylococcus aureus and coagulase-negative staphylococci (CoNS), for instance [9].
By properly implementing infection control procedures, microbial contamination of the OT can be avoided. For instance, a 13-fold decrease in airborne bacteria in the OT would result in a 50% reduction in wound contamination [2]. This mostly depends on better OT cleaning, appropriate disinfection, and routine fumigation [2,4,5]. Information on the microbiological contamination of OT in Ethiopia is hard to come by. to analyze the extent of microbial contamination and determine the antibiotic resistance of the bacterial isolates from the major OT at Ayder Referral Hospital, Northern Ethiopia, this study was carried out.
The intraoperative setting increases the risk of hospital-acquired infections for Many reasons. [23-29] This shows that anesthetic practice in general, may also be connected to the emergence of hospital-acquired infections, especially in light of research showing that general anesthesia is linked to immunological suppression.[30,31] There is more pressure to create preventative measures now that this issue is becoming more widely known in the community and those pay-for-performance policies will soon be implemented. This approach might be aided by a deeper comprehension of the fundamental mechanisms governing the bacterial transmission and the rise in resistance. The anesthetic work area's medical equipment and aerosolized particles are both parts of the intraoperative environment.There is no concrete evidence connecting these parameters with the direct transmission of bacterial organisms to patients, even though this is potentially connected to the emergence of nosocomial illnesses. [23, 26,28,32]

II .NOSOCOMIAL INFECTION TYPES

The most common types of infections include pneumonia linked to ventilators, urinary tract infections linked to catheters, bloodstream infections linked to central lines, and surgical site infections. Below is a description of these:

Central line-associated bloodstream infections (CLABSI)

It has a fatality incidence rate of between 12 and 25 percent [8]. They are fatal nosocomial infections. to provide fluid and medications, catheters are put in central lines. However, extended use of these devices can result in significant bloodstream infections, which affect health and raise healthcare costs [9]. Despite a 46 percent drop in CLABSI from 2008 to 2013 in US hospitals, an estimated 30,100 CLABSI cases are still reported in ICU and acute facility wards every year.

Catheter-associated urinary tract infections(CAUTI)

The most prevalent kind of nosocomial infection worldwide is CAUTI [11]. UTIs account for more than 12% of reported infections in acute care hospitals as of 2011 [12]. The patient's endogenous native microbiota is what causes CAUTIs. In contrast to the inefficient drainage from catheters, which keeps some urine in the bladder and stabilizes bacterial residence, catheters implanted within a function as a conduit for bacterial entrance [11]? Male patients may develop orchitis, epididymitis, or prostatitis from CAUTI, whereas female patients may suffer pyelonephritis, cystitis, or meningitis [12].

Surgical site infections (SSI)

which are nosocomial infections that affect 2-5% of patients who undergo surgery, and are a common complication. These are the second most frequent kind of nosocomial infections, primarily brought on by Staphylococcus aureus and associated with a higher risk of death [13]. The microorganisms that cause SSI are produced by the patient's endogenous microflora. Depending on the approach and surveillance criteria utilized, the incidence could reach 20%[14].

Ventilator-associated pneumonia (VAP)

Nosocomial pneumonia, or VAP, affects 9 to 27% of patients using a mechanically assisted ventilator. After tracheal intubation, often happens within 48 hours [15]. Ventilation is linked to 86 percent of nosocomial pneumonia [16]. VAP symptoms include bronchial noises, leucopenia, and fever.

III. NOSOCOMIAL PATHOGENS

Nosocomial infections are caused by bacteria, viruses, and fungus parasites. These bacteria differ based on various patient demographics, healthcare facilities, and even variations in the environment where care is provided.

• Bacteria

The most frequent pathogens that cause nosocomial infections are bacteria. Some are a part of the patient's normal flora and only cause infection when the patient's immune system becomes vulnerable to pathogens. The group of dangerous bacteria called Acinetobacter is what causes infections in intensive care units. It causes 80% of reported illnesses and is ingested through soil and water [18]. A commensal bacteria called Bacteroides fragilis is prevalent in the colon and gastrointestinal tract. When mixed with other bacteria, it can result in illnesses [19]. Due mostly to the replacement of helpful bacteria with pathogenic ones, Clostridium difficile can induce inflammation of the colon, which can result in antibiotic-associated diarrhea and colitis. C.difficile is spread from an infected patient to others by the ll-sanitized hands of medical personnel [19]. When Enterobacteriaceae, which are commonly found in the gut and are carbapenem-resistant, spread to other bodily areas, they can cause infections. Escherichia coli and Klebsiella species belong to the family Enterobacteriaceae. The defense against them becomes more challenging due to their strong resistance to carbapenem [20]. MRSA is a kind of methicillin-resistant S. aureus that spreads through direct contact, open wounds, and dirty hands. Sepsis, pneumonia, and SSI are brought on by it spreading from organs or the bloodstream. It has a high level of resistance to beta-lactam antibiotics [20].

• Viruses

In addition to bacteria, viruses play a significant role in nosocomial illness. According to routine monitoring, viruses are responsible for 5% of all nosocomial infections [21]. They are spread through hand-to-mouth contact, respiratory contact, and fecal-oral contact [22]. The virus-based chronic illness known as hepatitis is.

Hepatitis viruses can be spread during the administration of healthcare to both patients and staff. Unsafe injecting techniques frequently lead to the transmission of hepatitis B and C [20]. Other viruses include rotavirus, herpes simplex, HIV, influenza, and more[22].

• Parasite fungi

In people with impaired immune systems, fungus parasites operate as opportunistic pathogens that cause nosocomial infections. Infections can be brought on by Aspergillus spp. environmental pollution. Additionally, infections during hospital stays are brought on by Cryptococcus neoformans and Candida albicans [22]. While Aspergillus infections are brought on by inhaling fungus spores from contaminated air during hospital construction or renovation, Candida infections are brought on by the patient's own internal flora [23].

IV.NOSOCOMIAL INFECTION PREVENTION

Nosocomial infections must be prevented from the outset to control their spread because they are a substantial cause of sickness and death[22].

• Transmission from the outside

The best habitat for the pathogenic organism to thrive is one that is unhygienic. Food, water, and the air can all become polluted and spread to the people receiving medical care. Policies must be in place to guarantee that cleaning solutions are used on the walls, floors, windows, beds, bathtubs, toilets, and other medical equipment. Airborne bacterial pollution can be eliminated with proper ventilation and fresh, filtered air. It is necessary to maintain and record routine inspections of the filters and ventilation systems in general wards, surgical rooms, and ICUs. Healthcare facilities not meeting the required standards are to blame for infections that are ascribed to water. For water analysis, microbiological monitoring techniques should be applied. Separate baths must be supplied to infected patients. Food-borne infections may result from improper food management. The environment needs to be cleaned, and the food needs to fulfill minimum standards[22].

• Transmission from staff Healthcare

workers may transmit infections. Healthcare practitioners have a responsibility to participate in infection control. Staff members need to practice good personal hygiene, thus they should do so. After having contact with infected patients, it is necessary to properly decontaminate your hands using hand disinfectants. Sterilized tools and safe injection techniques should be applied. The delivery of healthcare requires the use of masks, gloves, head coverings, and/or a proper uniform [22].

V. NOSOCOMIAL PATHoGENS PERSIST ON INANIMATE OBJECTS.

The majority of papers using experimental data explored persistence on dry surfaces utilizing lab-based artificial contamination of a predetermined kind of surface. The majority of research prepared the bacteria in broth, water, or saline. Typically, viruses were created in a cell culture medium [43]. The climatic conditions are stable in terms of temperature and air humidity, which is the key benefit. Additionally, only controlled conditions—which are much simpler to guarantee in a lab—can be used to establish the impact of temperature or relative humidity[44].

Surfaces in hospitals that people touch frequently include nosocomial diseases and could spread those viruses to other patients [45–46]. A pathogen may be transferred to the hand from a contaminated surface to another hand in varying degrees. Escherichia coli, Salmonella spp., Staphylococcus aureus (all 100%) [47], Candida albicans (90%) [48], rhinovirus (61%) [49], HAV (22-33%) [50], and rotavirus (16%) [51,52] were the pathogens most successfully transmitted to hands. Viral transmission from contaminated hands can affect 14 additional patients or 5 other surfaces [53,54]. As evidenced by HAV [50,53], contaminated hands can potentially be the cause of recontaminating the surface. The compliance rate for hand hygiene among healthcare personnel is believed to be around 50% [55].

Persistence of bacteria

Staphylococcus aureus (including MRSA), Streptococcus pyogenes, and other gram-positive bacteria can persist for months on dry surfaces. Between multiresistant and susceptible isolates of Staphylococcus aureus and Enterococcus spp., there was generally no discernible difference in survival [56]. Such a distinction was only suggested in one investigation, but the susceptible strains showed a very short survival as such [57]. Numerous gram-negative bacteria, including Shigella spp., Acinetobacter spp., Escherichia coli, Klebsiella spp., Pseudomonas aeruginosa, Serratia marcescens, and others, can last for weeks or even months on inanimate objects. The majority of isolates from individuals with nosocomial illnesses contain these species [58]. However, several other diseases only last for a few days, like Bordetella pertussis, Haemophilus influenza, Proteus Vulgaris, or Vibrio cholera. Mycobacteria, such as Mycobacterium TB and spore-forming organisms like Clostridium difficile, can also endure on surfaces for long periods. Overall, it has been noted that gram-negative bacteria survive longer than gram-positive bacteria [59,60]. Most bacterial species, including Chlamydia trachomatis [61], Listeria monocytogenes [62], Salmonella typhimurium [62], Pseudomonas aeruginosa [63], Escherichia coli [64], or other important pathogens [65,66], exhibited better persistence in humid environments. At low humidity, only Staphylococcus aureus was observed to survive longer [63]. The majority of bacteria, including Listeria monocytogenes [62], Salmonella typhimurium [62], MRSA [67], corynebacteria [68], Escherichia coli [64,69], Helicobacter pylori [70], and Neisseria gonorrhoeae [24], all exhibited better persistence at low temperatures, such as 4°C or 6°C. There is no consistent outcome, regardless of the test content. While some researchers claim that the type of material has no bearing on persistence [72,73], others have noted that plastic has a longer persistence than steel [74,75], and yet others have observed a survival advantage with steel [76]. Other factors were rarely looked into, hence the results are uneven. Higher inocula [75], the presence of protein [60], serum [60,71], sputum [77], and the absence of dust [57] have all been associated with long persistence.

Persistence of fungi Candida

The most significant nosocomial fungal infection, Candida albicans, can live on surfaces for up to 4 months (Table 2). Other yeasts' persistence was said to be comparable to (Torulopsis glabrata 5 months) or shorter (Candida parapsilosis 14 days). Longer persistence has been attributed to the presence of serum or albumin, a low temperature, and high humidity [78].

viruses' ability to persist The majority of respiratory tract viruses, including corona, coxsackie, influenza, SARS, and rhinovirus, can survive on surfaces for a few days. Astrovirus, HAV, poliovirus, and rotavirus are examples of gastrointestinal system viruses that can persist for up to two months. Blood-borne pathogens like HBV and HIV can survive for longer than a week. CMV and HSV type 1 and 2 and other herpes viruses have been shown to last from a few hours to seven days. There are conflicting descriptions of how humidity affects persistence. High humidity was linked to extended persistence for entero- [79] and rhinovirus [33]. At low humidity, HSV [34] and HAV [35] can survive longer. Conflicting results were observed for adeno- [32,34], rota- [36,37], and poliovirus [34,35]. Most viruses, including Astro- [38], adeno- [34], poliovirus [34], HSV [34], and HAV [35], are more persistent when the temperature is low. Results on the influence of material type are also said to have been inconsistent. Some authors claimed that the type of material had no impact on the persistence of norovirus [42], rotavirus [41], RSV [39], poliovirus [41], adenovirus [39-41], and echovirus [39-41].

VI. SURVEILLANCE OF NOSOCOMIAL INFECTION

Although the purpose of infection prevention and control programs is to eradicate nosocomial infections epidemiological surveillance for evidence of performance improvement is still required to reach the aim. Data collection from many sources of information by professional data collectors is one of the most effective monitoring strategies. Information should include administrative data, demographic risk factors, patients' medical histories, diagnostic testing, and data validation. After the data has been extracted, the information should be analyzed. This analysis should contain a description of the determinants, a distribution of infections, and a comparison of incidence rates. Infection control committees, management, and laboratories should communicate feedback and reports following analysis while maintaining the privacy of individuals. For the deployment of interventions to be successful and to continue, surveillance systems must be evaluated for credibility.Finally, it should become mandatory to collect data at regular intervals to maintain the effectiveness of surveillance systems [22]. The figure provides an effective way for an acceptable surveillance approach.

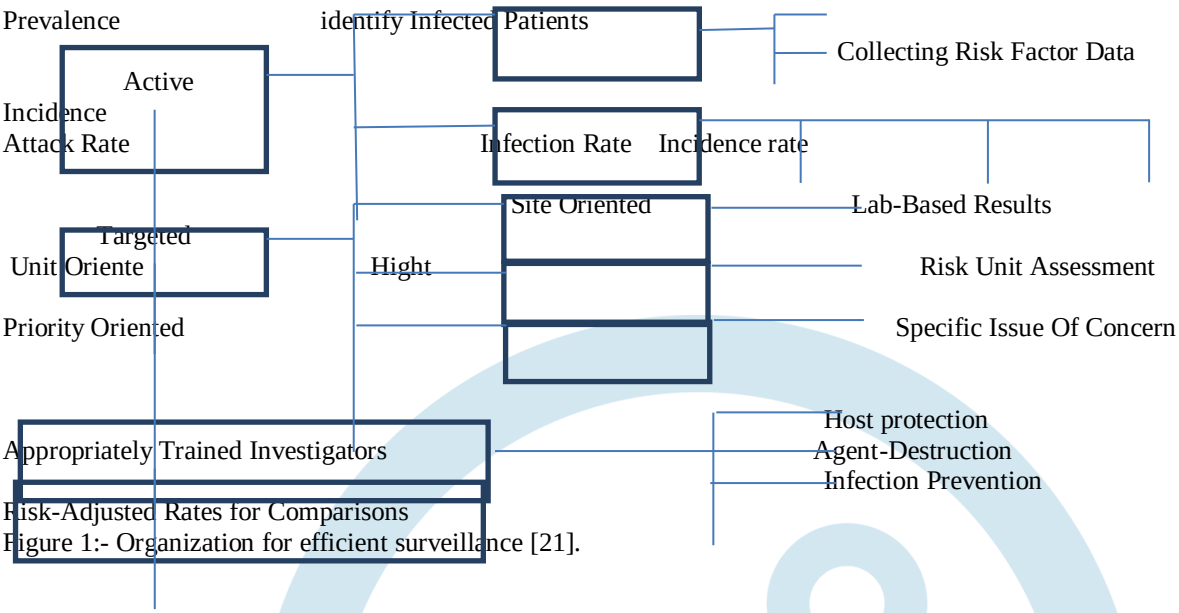

Figure 1:- Organization for efficient surveillance [21].

VII. CONCLUSION

It is now more challenging for infection control committees and healthcare administrations to achieve the goal of eliminating intervals due to rising nosocomial infection rates and antimicrobial resistance. However, it is possible to easily reduce the resistance of emerging pathogens against antibiotics by implementing sound and healthy methods for care delivery that were designed by infection control committees, controlling the transmission of these infections using appropriate methods for antibiotic use. Healthcare institutions can develop infection control plans with the aid of an effective surveillance approach supervised by WHO. Nosocomial infections can be decreased by properly training hospital staff in biosafety, waste management, and healthcare records, as well as by raising public awareness of these endemic infections.

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