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ROLES OF INFECTION CONTROL USUALLY IN A NEONATAL INTENSIVE CARE UNIT (NICU) SETTING

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Abstract
The Centers for Disease Control and Prevention, together with numerous other professional health care organizations, have declared the prevention of nosocomial infections to be a top priority. Because of their undeveloped immune systems, premature newborns are more susceptible to infection from invasive treatments such as the implantation and continued use of central venous lines, mechanical ventilation, and parenteral nourishment. Reducing the chance of infections of newborns in the NICU is the main objective. Because of their underdeveloped immune systems, newborns in the NICU are more prone to infections. The goal of healthcare providers' stringent measures is to lessen the spread of germs.

Key words: infection, control, neonatal, care.

Introduction

Significant negative effects on health and the economy are caused by health care-associated infections (HCAIs), which include higher rates of morbidity and mortality, longer hospital admissions, and higher medical expenses in neonatal intensive care units (NICUs). Depending on environmental, cultural, and clinical practice variations, the prevalence of infections varies greatly amongst NICUs. It has an incidence of about 30%, and there is evidence that these infections are a major cause of newborn morbidity and mortality in developing nations. It is thought to be the reason for almost half of newborn fatalities. Sepsis rates in many NICUs in Egypt were reported to be as high as 70% [1]. Numerous variables contribute to the risk of healthcare-associated infections (HCAIs) in the neonatal intensive care unit (NICU), including the knowledge and attitudes of healthcare providers towards infection control, environmental factors such cleanliness and sterilization of medical equipment, and antibiotic resistance. Institutional factors also contribute to this kind of spread, primarily the lack of funding for infection control programs. Another cause is the overuse of invasive procedures like tracheal incubation and central venous catheterization. Another significant factor is the duration of hospital stay; the longer the stay, the higher the frequency of HCAIs [1].

Newborns referred to neonatal intensive care units (NICUs) regularly have healthcare-acquired infections (HAIs), which have rates ranging from 8 to 30% and are usually connected to severe morbidity and death. Risk factors for this illness include low birth weight, parenteral nutrition, an indwelling central catheter, a history of antibiotic exposure, and invasive procedures. Coagulasenegative staphylococci are the germs that cause HAIs in NICUs the most frequently (CoNS). Among them, Staphylococcus capitis clone NRCS-A has been identified as an increasing cause of healthcare-associated infections (HAIs) and has been isolated internationally, particularly in NICUs. By using multimodal infection prevention and control measures, a significant percentage of HAIs can be avoided. Hand hygiene, common sense safety measures, and environmental cleansing are some of these tactics [2].

Environmental surfaces are one of the primary sources of contamination and transmission. The transmission of S. capitis NRCS-A between hospitalized newborns and its persistence after introduction in a NICU may be significantly influenced by such environmental colonization. Certain Staphylococcus bacteria, like S. capitis, fared extremely well on inert surfaces, according to a prior study. This clone's high degree of resistance to detergent molecules may also contribute to its ability to remain in medical settings and to the recurrence of small outbreaks in some NICUs [2].

Healthcare facilities must have surveillance mechanisms in place as well as an interprofessional team with management and leadership backing to prevent HAIs. The National Department of Health (DoH) of South Africa (DoH 2020) published the National Infection Prevention and Control Strategic Framework, which states that an infection prevention and control (IPC) committee should be the structure of the interprofessional team in charge of managing and preventing HAIs. Even with the declaration of an interprofessional approach, non-pharmacological IPC interventions clearly ignore the influence of non-medical personnel by concentrating largely on medical professionals. All healthcare personnel in healthcare institutions, as well as everyone providing services there, should be required to abide by the IPC. These non-medical personnel include the neonate's significant others, security guards, cleaners and launderettes, and technicians and maintenance personnel [3].

Bloodstream infections (BSI) cause significant morbidity and death in infants referred to neonatal intensive care units (NICUs). Infants diagnosed with brain stem injury (BSI) are more likely to experience chronic lung illness, cerebral palsy, and visual and hearing impairment. Since the use of a central venous catheter may be linked to up to 69% of bloodstream infections (BSI) that develop after 7 days of life, interventions aiming at reducing catheter-related infections may be helpful in lowering the overall incidence of BSI. Premature neonates are particularly susceptible because of their immature host defense system, prolonged usage of invasive life-sustaining devices, and parenteral nutrition [4].

The Centers for Disease Control and Prevention, together with numerous other professional health care organizations, have declared the prevention of nosocomial infections to be a top priority. Because of their undeveloped immune systems, premature newborns are more susceptible to infection from invasive treatments such as the implantation and continued use of central venous lines, mechanical ventilation, and parenteral nourishment. According to a point prevalence analysis, 50% of nosocomial infections in NICU patients (11% of patients overall) were bloodstream infections. Because BSI are linked to higher mortality and frequently present with systemic symptoms, they are especially significant. Furthermore, intraventricular hemorrhage, periventricular leukomalacia, chronic lung disease, cerebral palsy, and other neurodevelopmental abnormalities are among the conditions that premature newborns with BSI are more likely to have [4].

Aim

Reducing the chance of infections of newborns in the NICU is the main objective. Because of their underdeveloped immune systems, newborns in the NICU are more prone to infections. The goal of healthcare providers' stringent measures is to lessen the spread of germs.

Literature review

Healthcare-associated infections (HAIs) are still a major global health concern, posing a financial burden on families, individuals, and medical facilities on a direct and indirect basis. Maintaining patient safety can be difficult in neonatal intensive care units (NICUs), where neonates receive sophisticated medical therapy in a highly technology setting. Over 25% of reported neonatal fatalities in hospitals are attributed to healthcare-associated infections (HAIs). [5].

Mothers of babies admitted to the NICU are significant stakeholders, and their participation is essential to raising the standard of care. Moms are significant stakeholders in the care process, whose roles and concerns must be taken into account, even though they are not the only ones in charge of their children's upbringing. This is because moms are frequently present in the therapeutic setting. Recognizing and taking into account the underlying social relations of power is also necessary for this. There has been a perception that patients are under the control of doctors during medical visits. The fundamental element at the center of addressing quality of treatment is the uneven power connections between healthcare practitioners (HPs) and customers (including patients, carers, and moms) [5].

Figure (1) neonatal intensive care units (NICUs) [15].

The NICU is designed for sick newborns who need specialized care. It employs medical professionals who have received the necessary training in neonatal care, together with equipment designed especially for babies. Typically, babies who require admission to the facility are admitted during the first twenty-four hours of their lives. NICU admissions are usually made for premature babies, low birth weight or extremely low birth weight babies, congenital issues, and problems like meconium aspiration or respiratory infections [15].

Hospitalized newborns are more susceptible to health care-associated infections (HAIs), which are linked to higher rates of survival among survivors as well as longer hospital stays, higher expenses, and greater mortality.1-3 Neonatal central line-associated bloodstream infections (CLABSIs) were much less common in the US between 2007 and 2012, though rates have since stabilised.4,5 Worldwide estimates indicate that hospitalized neonates in low- and middle-income countries (LMICs) have a noticeably greater incidence of HAI.6, 7 It is therefore crucial to implement infection prevention and control (IPC) methods in neonatal care settings, particularly in the neonatal intensive care unit (NICU), that take into account the needs of both patients and their surroundings [6].

Central Line–Associated Bloodstream Infections

Central venous catheters (CVCs) are frequently needed for the implantation of medication delivery, fluid administration, parenteral nutrition, and central venous monitoring in newborns admitted to neonatal intensive care units (NICUs). Even though CVCs have many benefits, there is a chance that they may also increase the risk of infections and other issues. A laboratoryconfirmed bloodstream

infection that does not stem from an illness at another location and appears 48 hours after the implantation of a central line or within 48 hours after its removal is known as a central line–associated bloodstream infection (CLABSI) [7].

Significant morbidity and mortality, elevated medical expenses, and extended hospital stays are all linked to CLABSIs. Gram-positive bacteria are responsible for the majority of newborn CLABSIs in the US. Almost half of NICU CLABSI episodes are caused by coagulase-negative staphylococci and Staphylococcus aureus.10 Escherichia coli and Klebsiella species are the most common gram-negative bacteria that cause illnesses. In particular, Candida albicans is still a significant fungal etiology in extremely premature infants. Patient characteristics such as low birth weight, critical illness, mucosal barrier damage, and preterm increase the incidence of CLABSI [6].

The use of "bundles" in the insertion and maintenance of central lines has been shown to reduce CLABSI. A collection of evidence-based treatments that, when correctly and consistently followed, have been demonstrated to improve patient outcomes is referred to as a "bundle." Payne et al. did a meta-analysis of 24 trials and found that the use of a "care bundle" in the NICU resulted in a mean reduction rate of 60% in CLABSIs. For this susceptible group to have a higher chance of survival and less neurodevelopmental impairment, lower infection rates in the NICU are essential [7].

Regarding the administration and manufacturing of drugs, a new "bundle" was developed. Anytime a medicine or infusion is ready to be injected into a central line, nurses must now put on sterile gloves and a mask. We implemented the use of continuous passive disinfection caps saturated with 70% isopropyl alcohol to enhance the disinfection of the hub during drug administration. It was emphasized how crucial it is to let the port dry before attaching the syringe [7].

Catheter-Associated Urinary Tract Infection, Surgical Site Infection, and VentilatorAssociated Event

Due to the limited use of indwelling urine catheters in the NICU, incidence of catheter-associated urinary tract infections (CAUTIs) have been shown to be low. Nonetheless, uniform catheter insertion and maintenance packages need to be prioritized as part of effective infection control protocols. Since surgical site infections (SSIs) are associated with a high rate of morbidity, hospital-wide preventative programs usually involve the NICU. When performing high-risk surgeries prevalent in newborns, like ventriculoperitoneal shunt placement or congenital heart defect repair, SSI surveillance can be carried out locally or as part of a network. Monitoring and preventative initiatives are hampered by the absence of a common criteria for neonatal ventilatorassociated events (VAEs). Some units have chosen to identify VAE using standard guidelines when the 2015 revisions to the pediatric VAE guidelines became available. Standardizing VAE reporting could be achieved by incorporating variations in the proportion of inspired oxygen and mean airway pressure into the surveillance definitions utilized by NICUs [6].

November 1, 2010 was the opening day of the new facility and the closure of the old NICU. The new policy for all of our hospital's intensive care units led to the implementation of three catheterbased bundles in the new NICU: the urinary tract bundle, the ventilator bundle, and the central line bundle. Preventing blood stream infections connected with central lines, pneumonia related to ventilators, and urinary tract infections associated with foley was the main goal of the bundles. [8]**.**

A bundle is a condensed collection of certain care procedures that are all necessary to give a certain patient group safe, effective treatment. It has been shown that using the combination of care practices reduces the incidence of bloodstream infections linked to central lines, urinary tract infections linked to catheters, and pneumonia linked to ventilators in children, with much improved outcomes predicted [8].

Surgical Site Infection in NICU

Preoperative stay in an ICU appears to be linked to the development of Surgical Site Infection (SSI); one study found that SSI was unrelated to gestational age and was most likely related to the severity of the sickness. Prematurity has been linked to SSI, although the evidence for this comes from

research that looked at newborns under the age of 28 days as a whole, not only those who were admitted to NICUs [9].

Surgical site infections (SSI) account for 20 to 31 percent of healthcare-associated infections and are linked to increased rates of morbidity, mortality, hospital stay length, and healthcare costs. The overall rate of surgical site infections (SSI) in adult patients is less than 2%, according to data from the National Healthcare Safety Network and the International Nosocomial Infection Control Consortium. However, the rate is much higher following high-risk procedures like exploratory abdominal surgery. The majority of adult populations have been found to have risk factors for SSI, which include hyperglycemia, past infections, malnutrition, longer operating times, and higher blood loss following surgery. infants brought into tertiary care Surgery is frequently needed in neonatal intensive care units (NICU) to treat complicated congenital defects, especially those relating to the heart or gastrointestinal system, as well as prematurity-related problems including necrotizing enterocolitis or intraventricular hemorrhage. Due to their intrinsic immunodeficiency, undeveloped skin, frequent need for medical equipment, concomitant diseases, and extended hospital stays, infants may be more susceptible to SSI. But there is limited information available regarding the prevalence of and risk factors for SSI in the NICU population [10].

Roles of infection control

Hand hygiene (HH)

When it comes to preventing healthcare-associated infections (HAIs), hand hygiene (HH) is the strategy with the biggest potential impact. It is also the least expensive and has been shown to be effective. Given that the hands of healthcare providers are the most prevalent means of transferring microbes to patients, it is a powerful measure of the quality of care in terms of patient safety. The multimodal method is one of the measures the WHO has implemented to increase HH compliance in health services. It includes five elements: personnel training, HH practice assessment and input on personnel compliance metrics, system modification, the provision of alcoholic beverages at help stations, access to running water, workplace reminders, and the creation of an institutional safety environment with the express consent of managers and leaders [11].

In the hospital setting, patient safety with regard to HH must come first. This is especially true in intensive care units. Professional attention for the act of HH is required in the Neonatal Intensive Care Unit (NICU) due to its high demand for care and status as a place of care for severely sick or potentially dead newborns. Newborns are more vulnerable to healthcare-associated infections (HAIs), which can lower the standard of care given to them, harming their health and increasing hospital costs [11].

Figure (2) Hand hygiene is crucial to infection prevention and control [16].

Consequently, it is important to address health professionals' HH compliance in the neonatal risk environment, particularly in relation to the five moments that the World Health Organization recommends. This will improve the standard and safety of care given to neonates admitted to the NICU and lower the chance of cross-infection between patients and carers [11].

Topical antisepsis in the neonate

The perfect antiseptic should not be rendered ineffective by the presence of organic materials, such blood. It should also be able to combat a broad range of microorganisms, work quickly, leave a lasting impression, and have negligible negative effects on the skin and other organ systems. Various topical antiseptics have been used in various mixtures and ratios. According to surveys conducted in the United States, the United Kingdom, Australia, and New Zealand, the most often utilized agents in neonatal units are CHG, alcohols, and povidone-iodine (PI) [12].

Chlorhexidine: Methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant enterococcus (VRE), streptococci, and pseudomonas are among the resistant species that it is successful against. It is considerably less efficient against gram-negative bacteria [12].

Neonates have been treated with antiseptics in a variety of ways, at various quantities, and for a variety of purposes. To find a more effective antiseptic kind and preparation than alternative agents, we conducted a review of the available literature based on their intended application. Numerous measures have been attempted to reduce the number of harmful organisms colonizing the skin of newborns and the resulting sepsis. Studies have examined the use of antibiotics, emollients, umbilical cord cleaning, whole body washing, and vaginal CHG washes during labor in an effort to lower infection rates [12].

Medication and intravenous fluid preparation and administration

To help with timely administration, antibiotics, anti-epileptic medications, and analgesics or sedatives may be kept in storage in the NICU. It is important to prepare injections aseptically and in accordance with guidelines. When at all feasible, multi-dose vials, or MDVs, should be avoided. Unless the manufacturer specifies otherwise, MDV should be used, stored properly, dated when first opened, and disposed of after 28 days. MDV should only have one patient's content if they enter the immediate patient care area. Reusing single dose vials (SDV) is not advised. IV fluid solution bags are meant to be used only for that one patient [13].

Injection safety preparation outside from the direct patient care setting. using aseptic method and thoroughly cleaning vials before adding medication. Avoid reusing syringes or needles. There are no more access needles in the septum. If there are obvious septal holes, discard vials. Healthcare personnel should have access to a puncture-resistant container for the proper disposal of sharps [13].

Cleaning and disinfection of reused medical equipment

The daily routine environmental disinfection was carried out one hour following the morning cleaning. All floors remained treated with a 200 mg/L dilution of household bleach. Disinfectant wet wipes were first utilized for routine cleaning in our city and were later employed for cots and incubators, monitors, Syringe pumps, carts, and other environmental surfaces. A commercial washing machine was used to wash clothes and detachable mops for ten minutes at 90°C [14].

Environmental cleaning

Hand-contact environmental surfaces are frequently contaminated with microorganisms linked to healthcare and can act as vectors for cross-contamination. Meanwhile, the resistance of healthcareassociated infections to several antibiotics restricts the treatment choices for HAIs. Thankfully, a decreased incidence of healthcare-associated infections (HAIs) might be linked to better cleaning of hospital environments. The researchers compiled a list of measures that effectively enhance surface cleaning and disinfection in hospital rooms. Following that, a fresh set of environmental cleaning procedures was put into place. The purpose of this study was to assess the overall effects of moving the ward to a new location and altering environmental cleaning procedures

on lowering MRSA on inanimate surfaces and the frequency of healthcare-associated infections over a fiveyear period [14].

Environmental service workers (ESWs) carried out normal cleaning twice a day during the baseline period. In the past, a bucket method and cotton cloth were employed. In one open bay, the same material was used for community areas, patient-shared objects, and high-touch patient care locations. When the cloth was clearly contaminated or needed to be cleaned for the next cot, it was manually cleaned in the bucket. Only while switching between two distinct bays was the detergent-infused water in the bucket replaced [14].

Routine cleaning was continued twice a day during the intervention period, but microfiber towels with color-coding took the place of cotton cloths. Only one item or one patient zone was covered by a single microfiber cloth. When the cloth became obviously polluted or was utilized across different cots, it was changed out for a new one [14].

Conclusion

The most often cited obstacles include a lack of healthcare personnel, insufficient time to implement infection control guidelines, little opportunities for infection control training, and an excessive workload. If these underlying obstacles and difficulties are not sufficiently addressed, the NICU's current infection control strategy is likely to stay unsuccessful.

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