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“Prevalence of Nosocomial Infection at NICU in a Tertiary Care Hospital, Islamabad”

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Declaration

I declare, this research work is an endeavor to learn and apply research knowledge in order to prevent the replication of other's material; undoubtedly, it was made convinced that no material was used without acknowledgement.

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(Signature of candidate)

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Date

Acknowledgement

"In the name of Allah Almighty, the Most Beneficence and Most Merciful" All the praises and thanks are to Allah, the Lord of the Alameen.

After that I am thankful to my parents and my family members for their unshakable determination to support me economically, physically, psychologically and intellectually during this tenure.

I am also thankful to my colleagues for being a rich source of enthusiasm during my study.

Finally, I would like to thank my father and elder brother for being there to support me along the way.

Thank you all

List of acronyms

BSI	Neonatal Bloodstream Infections
CDC	Centers for Disease Control
CVC	Central Venous Catheter
HCW	Health care worker
ICU	Intensive Care Unit
MRSA	Methicillin-Resistant Sataphylococcus Aureus
NICU	Neonatal Intensive Care Unit
SPSS	Statistical Package for the Social Sciences
US	United States
VRE	Vancomycin-Resistant Enterococcus
WHO	World Health Organization

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Abstract

Nosocomial infection is the most common cause of mortality and morbidity in neonatal intensive care units (NICUs) and is comparatively high as compare to adults. This study focuses to find out the prevalence of nosocomial infections at NICUs of a tertiary care hospital, and the contributing bugs were identified in order to provide possible solutions to control the infections. **Study Objective:** To identify the current prevalence rate of nosocomial infection at NICU and to find out the causative bugs responsible for nosocomial infection. **Methods:** A descriptive-retrospective study design was used to find out the prevalence rate of nosocomial infection at NICU of a private tertiary care hospital, Islamabad (those remained as in-patients 48 hours after admission) in duration of six months. In total of 400 NICU admissions 33 were infected and 25 were due to nosocomial infection. All the neonates those admitted at NICU and get an infection after the first 48 hours of hospital admissions and evidence is found in clinical, laboratorial and microbiological diagnostic test. Study was approved by IRB of a private tertiary care hospital, Islamabad. Written permission consent form was taken from the NICU consultant, nursing manager and head nurse to get access to data. **Results:** The study findings indicated that most common pathogen was assess Klebsella 14 (56%) while Acenotubactor (12%) and MRSE were (12%), in source of infection blood is the most common source of infection 12 (48%) and most of the deliveries occurs in pregnancy weeks between 28-33 weeks 11 (44%) which show prematurity.

Conclusion: Researcher concluded that prevalence of neonatal nosocomial infection at NICU is the major health challenge and need to control nosocomial infection in future through proper management.

Introduction:

Nosocomial infection is defined as an infection in which the clinical, laboratory findings and microbiological diagnostic confirmation is found after the first 48 hours of hospital admission (Imran Gattoo, 2015). According to World Health Organization (WHO), at any time, 1,400,000 people suffer from complications related to hospital acquired infections/nosocomial infection. The rate of preventable nosocomial infection is high in developing countries as compare to developed countries and that is estimated 40%. It is because of limited resources and lack of training among health care professionals (WHO, 2014). Nosocomial infection is a major threat for hospitalized patients especially in intensive care unit (ICU), because of prolong stay in the hospital and due to expensive treatment (Sohn et al., 2001). Nosocomial infection creates difficulties for the treatment of patients due to high rate of mortality and morbidity especially in neonatal intensive care units (NICUs) (Digiovine et al., 1999 and Nagata, 2002).

Nosocomial infections may involve any part of the body or some time multiple parts may involve but there are some common parts of the body those prone to infection like; urinary tract, lower respiratory tract, blood and surgical wounds as compare to the other organs of the body. In case of neonates there are many factors responsible for causing infection like prematurity, low birth weight, prolong hospitalization, excessive use of broad-spectrum antibiotics, use of multiple invasive procedures such as intubation, ventricular shunt, intra-vascular catheter, and parenteral nutrition with fat emulsions facilitate the development of such infections, and increase their incidence (Zaidi et al., 2005).

Without identifying the causative agents, risk factors and current status of these infections, the prevention and control of infections at NICU is not possible. The status of

these infections varies in different regions of the World and the every hospital status is also differing with regard of the causative bugs of infection at NICU (Kadivar et al., 2002).

The complications of nosocomial infection is very sever and lethal. The morbidity and mortality from nosocomial infections is very massive. In the US, more than 2,000,000 nosocomial infections (in infants and adults) occur each year, and 50% to 60% are caused by drug resistant organisms. It has been estimated that 9,600 to 20,000 patients die each year in the US from catheter-related bloodstream infections (Richard A. Polin, 2003). Nosocomial infections put on huge financial burden on the NICU budget, prolong the hospital stay for several weeks, and are responsible for almost 50% of the deaths that occur beyond 2 weeks of age (Imran Gattoo, 2015). Although the epidemiology of neonatal nosocomial infections is complex, but its frequency rate can be reduce by using different strategies by following different theories (Richard AP, 2003). According to the World Health Organization (WHO), 1 million deaths occur per year due to neonatal bloodstream infections (BSI) and 42% of these occur at the first week of life (Lawn JE, et. al, 2005). Mortality after Gram-negative sepsis (26.2%) and Candida sepsis (27.6%) is similar and significantly higher than with Gram-positive sepsis (8.7%) (Makhoul IR, et al. 2002). The incidence of neonatal BSI is estimated about 1-10/1000 live-births in developed countries, but situation in Pakistan is change and BSI is three times more common (Mahmood A, et, al, 2008).

There is not a single cause of nosocomial infection, but there are many factors responsible for causing infection like, host related (premature and very low-birth-weight infants are more vulnerable for getting nosocomial infection). Some clinical practices can also be related with an increased risk of getting nosocomial infection. Empirical or prior use of antibiotic and history of treatment with dexamethasone increases the risk by as much as 60% (Stoll BJ, et al. 1999). Environmental factors has also a huge role in the nosocomial infection, about 85% of all NICU surfaces will grow nosocomial pathogens, with over half

contaminated by two or more pathogenic organisms (Chandrashekar MR, et al. 1997). Intra-venous cannulation and central venous catheter are also a cause for developing nosocomial infections.

A study done on the nosocomial infection and results of that showed that the incidence of nosocomial infections in our NICU was 9.74% (Imran Gattoo, 2015). Another study done on the nosocomial infection at NICU, the aim was to identify infection and implemented the best standard practices for decreasing infection rate at NICU and established a decrease in the rate of nosocomial infection from 7.4 to 4.0 per 1000 patients (Cardo D, et al. 2004). Similar study done at the NICU of Al-Azhar University Hospital, Cairo (Egypt) from June 2012 to January 2013 (prospective cohort study), and the results of that study showed that the nosocomial infection rate at NICUs was 20% (Khaled Kasim, 2014).

Based on recommendations from World Health Organization (WHO) and the Centers for Disease Control (CDC), hand hygiene is the most important and easy way for the control of nosocomial infections (Park HY et al., 2014). By taking some standard precautions for nosocomial infection at NICU, the rate of getting nosocomial infection can be decrease. (Memon, 2007). But before the interventions we need to know about the exact prevalence rate of nosocomial infection at NICUs and the common bugs responsible for it.

Material and Methods:

The current study was performed at the Neonatal Intensive Care Unit (NICU) at a private sector tertiary care hospital, Islamabad. The nosocomial infection retrospective data assessed from April 2016 to September 2016 (duration of six) was taken from the NICU patient's available record. All the patients those admitted at NICU and get an infection in which the clinical, laboratorial and microbiological diagnostic evidence is found after the first 48 hours of hospital admissions were included. For the diagnosis of nosocomial infection, the

unit followed criteria of the Centers for Disease Control and Prevention (CDC). A permission consent taken form for the use of NICU nosocomial infection data the from the NICU consultant, nursing manager and head nurse singed that to get access to data. The confidentiality of the data will be ensured and will only be used for the academic and research purposes.

A database was created to analyze the information collected from the patient's files. SPSS (Statistical Package for Social Sciences) 21.0 for Windows were used for statistical analyses of the data. Prevalence was calculated for the total infections and the site of infections.

Results:

After reviewing the last six months data (retrospective data), data collected from record register of NICU and some patients' data was traced from the intra net system record. Retrospective data from April 2016 to September 2016 was collected and out of 400 NICU admissions 33 patients were infectious (25 were nosocomial infection and 08 were community acquired infection cases). The prevalence rate of nosocomial infection was calculated 6.25%. The table 1.1 show the different other characteristic of the data collected at NICU files.

Table 1: <u>Demographic Data of Neonates from NICU Record.</u>

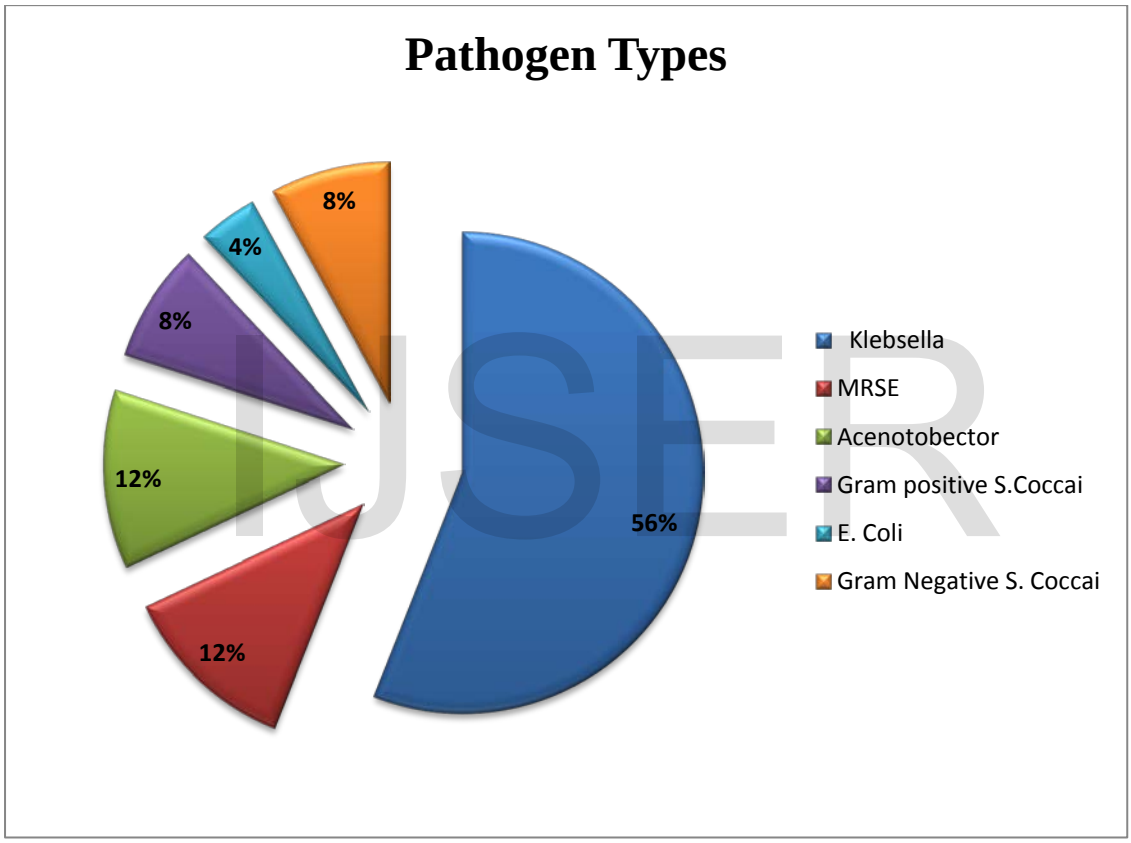
S/no	Description	Frequencies	Percentages (%)
1	**Gender**		
	1. Male	12	48
	2. Female	13	52
2	**Age**		

	1. 1- 7 days 2. 8-14 days 3. 15-21 days 4. 22-28 days	8 9 8 --	32 36 32 --
3	**Hospital Stay** 1. < 2 Days 2. 3-5 Days 3. 6-8 Days 4. >8 Days	 -- 15 10 --	 -- 60 40 --
4	**Type of delivery** 1. Normal viginal delivery 2. C-section 3. Vacuum Extraction delivery	 8 16 1	 32 64 4
5	**Birth Weight** 1. < 2.5 kg 2. 2.5- 3 kg 3. 3.1-3.5 kg 4. > 3.5 kg	 6 17 2 --	 24 68 8 --

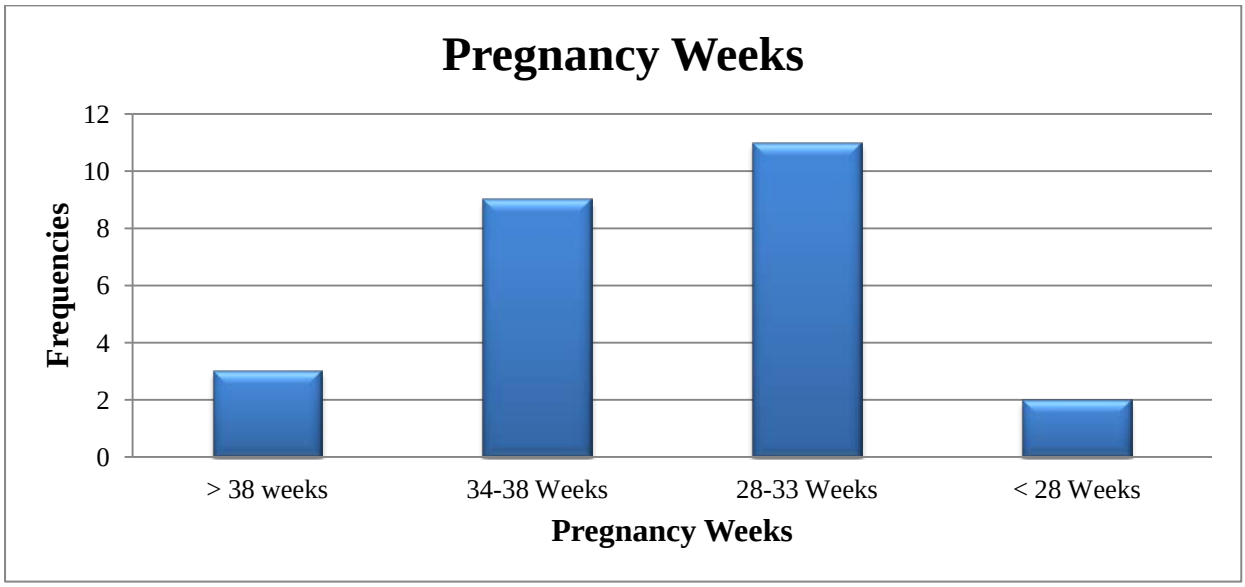
The results shows that 52% female and 48% male patients, most of the age of these patients were between 08-14 days (36%), in period of hospital stay most patient stay in hospital 03-05 days (60%) and 06-08 days were 40%, most of the delivered babies were through C-section 16 (64%), birth weight of babies at the time of delivery was 2.5-03 kg 17

(68%), common pathogen was assess Klebsella 14 (56%) while Acenotubactor (12%) and MRSE (12%) were also other common pathogens, in source of infection blood is the most common source of infection 12 (48%) and at the end pregnancy weeks were assessed and most of the deliveries occurs in pregnancy weeks between 28-33 weeks 11 (44%) which show prematurity.

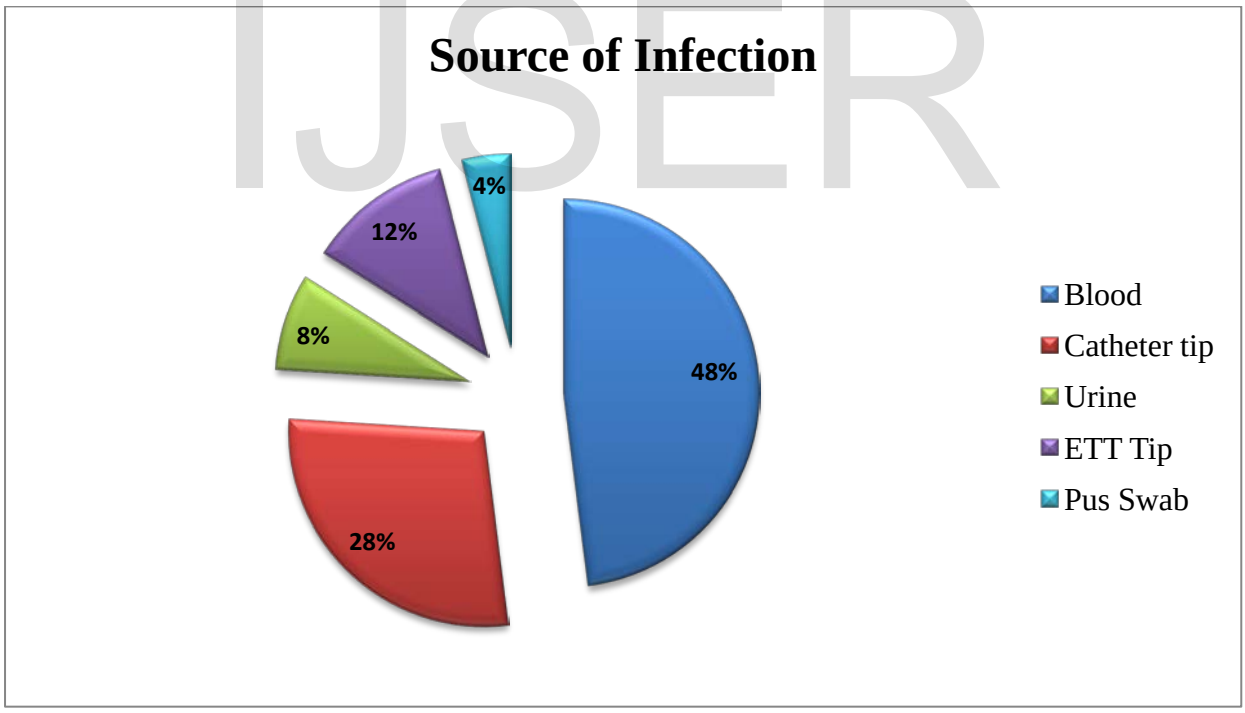
Graph 1.1: <u>Types of Pathogens Responsible for Causing Nosocomial Infection.</u>



Graph 1.2: Categories of Pregnancy Weeks,



Graph 1.3: Source of Infection Causing Nosocomial Infection.



Discussion:

For the morbidity and mortality in hospitalized neonates nosocomial infection is consider one of the most important cause especially in case of NICU (Karla, 2012). Due to

exceptional features of NICU, it reflected the epidemiology of nosocomial infections. A uniform and active surveillance system is required to regulate the elements that worsen the risk of these infections. It is a reality that this topic gain attraction now days but, relatively few studies available in the developing countries like Pakistan to illustrate the prevalence of the nosocomial infection at NICUs.

The prevalence rate of nosocomial infection varies in literature and in different cultures. Another point is also important to consider that organizational and theoretical variances occur between studies, and more attention is required while comparing frequencies of infection in different studies.

In the current study, after assessing the last 06 months record retrospectively, 400 neonates were admitted in NICU and 33 were infected, out of 33 infected neonates 25 has nosocomial infection. There were 12 males (48%) and 13 females (52%), this result is congruent with a Colombian base study where 58% were female and 42% were male neonates (Mario Augusto, 2005). Most of neonates 13 (52%) were premature; this result was congruent with a Saudian base study, that showed 50% of the neonates were premature (A.A. Mahfouz, 2010). Majority of the deliveries were caesarean section 16 (64%), this result was contradict with a Saudian base study, that showed 47% of the deliveries were through caesarean section (A.A. Mahfouz, 2010) and 08 (32%) were through normal viginal delivery.

In this current study, we found that the prevalence of nosocomial infections in our NICU was 6.25%, this result is congruent with a Colombian base study that showed 6.20 per 1000 patient-days (Mario Augusto, 2005). While a Saudi base study contradicts the current study result that showed 19.2% prevalence rate of nosocomial infection at NICU (A.A. Mahfouz, 2010).

In the current study common pathogens that responsible for causing nosocomial infection were Klebsella 14 (56%), Acenotubactor (12%) and MRSE (12%). These findings are not congruent with the other studies done in the region with the same topic. An Indian Kashmir base study results showed Klebsella is responsible for 18% of nosocomial infection in NICU (Imran Gattoo, 2015), while a Saudi base showed that Klebsella was responsible for 22% and MRSE was responsible for 10% of nosocomial infection (A.A. Mahfouz, 2010). The results of these studies showed that Klebsella is not the common bug resident in the regional NICUs.

The current study result showed that blood is the most common source for the spread of infection that was 48%, while catheter tips and EET tip is 28% and 12% respectively. This result is congruent with an Indian base study that result showed bloodstream infections 52% (Imran Gattoo, 2015), while Saudi base study showed 40.9% nosocomial infection through bloodstream (A.A. Mahfouz, 2010). A Colombian base study results showed that bloodstream infections accounted for 78% of nosocomial infection (Mario Augusto, 2005).

Recommendations:

These are some recommendations to control nosocomial infection at NICU.

- Isolation facility should be with both negative- and positive-pressure ventilations.
- Adequate space around incubator is ideally 2.5-3 m.
- Electricity, air, vacuum outlets/connections should not hamper access around the bed.
- Adequate number of washbasins should be installed. Alcohol gel dispensers are required at the NICU entry, exits, every bed space and every work station.
- There should be separate areas for clean storage and soiled and waste storage and disposal.
- Work with hospital administration for better patient to nurse ratio in the NICU.

- Policies for controlling traffic flow to and from the unit to reduce sources of contamination from visitors, staff and equipment.
- NICU protocols for prevention of nosocomial infections.
- Audit and surveillance of infections and infection control practices.
- Infection control team (multidisciplinary approach) and antibiotic stewardship.

The results of current study will assist in developing intervention approaches for the prevention of nosocomial infection in NICUs of the country. Interventions should target those procedures directly connected with the blood stream and in the use of EET and urinary catheter. Education and training required for NICU staff about prevention of nosocomial infections and improve their competencies.

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