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Distribution of Nosocomial Infections Among Newborn Infants in Neonatal Intensive Care Units

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ABSTRACT

Background: Nosocomial infections (NIs) are one of the most important agents that causes morbidity and high rate of mortality especially in newborn infant patients, who were admitted in neonatal intensive care units (NICUs), and this is due to immaturity of the immune system functions, and impaired defense mechanisms.

Nosocomial infection can be defined as an infection during hospitalization , that was not present or incubating at the time of admission in neonatal intensive care unit such as; bloodstream, pneumonia, urinary tract, central nervous system and any abscess that appear on neonate skin or soft tissues.

Patients and Methods: The current cohort study has been initiated on (130) from the total 286 newborn infants aged (3 - 28) days after birth who were admitted to NICU in the same hospital, and their staying time was more than 72 hours and not transferred to another unit through the time of study, from August 2011 through April 2012 by culturing blood and swab samples from neonates, who were suspected of having nosocomial infections. The work flow was divided into two parts; the first included blood and swab samples were taken from infants in NICU and the second included swabs that taken from the environment and instruments of the NICU and delivery rooms, for assessment the microbial isolates; then the chosen specimens was cultivated onto the appropriate culture media and the microbial growth were identified via the proper assisting identification kits.

Results: The distribution of nosocomial infections among neonates who were admitted to NICU; the more frequently infection was blood stream infections; Followed by respiratory infection, umbilical infection, conjunctival infection and lastly nasal infection. The distribution of neonates with nosocomial infections in relation to gestational the ongoing work shows that preterm infants (<37 weeks), were more susceptibility to nosocomial infections than full term infants (≥37 weeks). In addition the distribution of neonates with nosocomial infections in relation to birth weight as shows that neonates with birth weight (1000-1449) grams are in high risk factor of infection; more than others with birth weight (1500-2499), while neonates with birth weight (≥2500) grams was at the least occurrence rate.

Conclusions: The premature infants, the low birth weight of the newborn and the long staying in neonatal intensive care unit for treatment and stability condition, were in high risk for infection with neonatal bloodstream and pneumonia infections more than in full term infants. Also maternal characteristics such as; living (rural), age (less than20 years), mode of delivery (cesarean section) and maternal underlying disease, irregular health care visiting were predisposing factors that increased for nosocomial infections development.

KEYWORDS Nosocomial Infection, Neonates, Intensive care units

Introduction:

Neonate defined as human infant from the time of birth through the 28th days of life (Mosby, 2009).

There are two terms of onset of nosocomial infections (NIs); early onset infection (EOI) and late onset infections (LOI). EOI; confirmed infection within first three days of life (baby birth), whereas LOI; occur after the third day (Olsen et al., 2009).

Nosocomial infections have increased in the neonatal intensive care units (NICU) over the last decade but, the survival rates of very low birth weight (VLBW) infants, increased with the broad use of exogenous surfactant and new ventilation techniques (Natasha et al., 2011).

The combination of an immature and slow responding immune system increases the risk of infection in the neonate. One reason for the increased of risk factor for the infection is that antibodies which protect mother from infections, do not cross through the placenta to the fetus until approximately (30) weeks of gestation. The antibodies present at birth, take time to reach optimum levels which also affects the protection provided (Wong, 2003).

The prolonged hospital stay and decreasing gestational age, increased the risk of infection by resistant hospital pathogens (Adams et al., 2005)

Unfortunately, hospitals in developing countries are at high risk of infection transmission, and improvement in neonatal outcomes are subverted by hospital acquired infections, and their associated mortality and cost (Ahmed 2008).

The most common hospital infections which occurred in the NICU are; bloodstream infections (32%-53%) followed by bronchopneumonia or labor pneumonia (12%-18%), ear (8%-21%), gastrointestinal infections and necrotizing enterocolitis (5%-11%), and urinary tract infections (l7%) (Wong, 2003).

Patients and methods:

From the study, we exclude any neonate proved to be infected at the time of admission and any neonate died or discharged before 48 hour. From total 286 neonates admitted to Al-Yar-

mouk teaching hospital NICU during the study period, 80 neonates were discharged from the NICU in the first 48 hour, 16 neonates died and 60 neonates have the signs of infections at the time of admission; so the final total sample that met inclusion and exclusion criteria included 130 neonates who were admitted without infection at the time of admission and remained more than 48 hour.

Patient criteria which included are neonates without any sign of infection and remained hospitalized for at least 48 hour.

From the current study, we exclude any neonate proved to be infected at the time of admission and any neonate died or discharged before 48 hour.

In order to detect any risk factors of infection either maternal, natal or postnatal the variables included were; admission date, gestational age, birth weight, sex, mother living, mother age, place of living, mother health care visit during pregnancy.

A complete clinical assessment was carried out to all neonates in the unit by neonatologist on duty, and standard data collection form was carried out. Birth weight was measured in addition to clinical signs of sepsis; respiratory dysfunction (apnoea, signs of respiratory distress), circulatory dysfunction (poor peripheral circulation, hypotension, and prolonged capillary refill), gastrointestinal tract (GIT) dysfunction (abdominal distension, feeding intolerance, hepatomegaly and jaundice) and neurological dysfunction (irritability, hypotonia, lethargy).

In the current study, the work flow was divided into two parts; the first included blood and swab samples were taken from infants in NICU and the second included swabs that taken from the environment and instruments of the NICU and delivery rooms, for assessment the microbial isolates; then the chosen specimens was cultivated onto the appropriate media and the microbial growth were identified via the proper assisting identification kits.

Results:

The distribution of nosocomial infections among neonates who were admitted to NICU; the more frequently infection was blood stream infections 79 cases (60.8%); Followed by respiratory infection 30 cases (23.1%), umbilical infection 12 case (9.2%), conjunctival infection 6 cases (4.6%) and lastly nasal infection 3 cases (3%).

Infections	No .of cases (%)
Neonatal bloodstream infections	79 (60.8)
respiratory infections	30 (23.1)
Umbilical infections	12 (9.2)
Conjunctival infections	6 (4.6)
Nasal infections	3 (2.3)
Total	130 (100)

On the other spectrum end the distribution of neonates with nosocomial infections in relation to gestational the ongoing work shows that preterm infants (<37 weeks), were more susceptibility to NIs 92 cases (70.7%) neonates than full term infants (≥37 weeks) 38 cases (29.3%) neonates.

Gestational age (weeks)	No .of cases (%)
Premature(less than37 weeks)	92 (70.7)
Mature (equal or more than 37 weeks)	38 (29.3)
Total	130 (100)

Also in the present work the distribution of neonates with nosocomial infections in relation to birth weight as shows that neonates with birth weight (1000-1449) grams are in high risk factor of infection 62 cases (47.7%); more than others with birth weight (1500-2499) grams 43cases (33.1%), while neonates with birth weight (≥2500) grams was 25 cases (19.2%).

Birth weight (gm)	No. of cases (%)
1000 - 1499	62 (47.7)
1500 - 2499	43 (33.1)
≥ 2500	25 (19.2)
Total	130 (100)

Beside all above data the current work shows that outcome of patients in NICU after birth, will end either with the tragedy image as 59 cases (45.4%) of patients were died and 71 cases (54.6%) were discharged after recovery from the illness. All died cases were having NBSI and respiratory infections.

State of patients	No .of cases (%)
Dead	59 (45.4)
Discharged	71 (54.6)
Total	130 (100)

Another aspect clarified in this study was that distribution of the duration of admission of neonates in NICU after birth and having nosocomial infections; with a mean equal to 12 days.

Duration of admission of patients in NICU (Days)	No .of patients (%)
< 5	8 (6.2)
5-9	14 (10.8)
10-14	31 (23.8)
15-19	32 (24.6)
≥20	45 (34.6)
Total	130 (100)

Discussion:

Nosocomial bloodstream infections are one of the most important infections and the more frequent among newborns who were born in hospitals especially in developing countries. Neonatal sepsis is a clinical syndrome resulting from pathophysiologic effect of systemic infection in the first month of life (Bas et al., 2010).

The susceptibility of the human neonate to over whelming bacterial infection is well established and is commonly attributed to immaturity of the neonatal host defenses (Natasha et al., 2011).

All or most reports including the present work, coinciding factors as; gestational age(less than 37 weeks), low birth weight, using sucker system to suction the fluid from the newborn infant at birth , the health worker cares, and the long period of staying in neonatal intensive care units, were reported as risk factors increasing the nosocomial infections, all these are agree with other studies carried out by Nagata et al.,2002; Adams et al.,2005; Natasha et al.,;2011.

According to many studies and reports, the incidence of neonatal nosocomial infections has been reported from 6.2% to 50.7%.

Yasmeen (2005), reported that (30.4%) of neonates were infected with septicemia in Al-Mansur hospital, and central pediatric hospital in Baghdad. Mahfouz et al., (2010) reported the incidence rate were (13.7%) in Abha general hospital in Saudi Arabia. Bas et al; (2010) reported that (44.9%) of suspected nosocomial sepsis, in neonatal intensive care unit in Ankara, Turkey.

In our study neonatal nosocomial infections rates was (45.5%). The variation between the reports and studies is due to different health care practices, and specific environment, differences in patient populations with respect to mean gestational age, birth weight and severity of the underlying illness, which were the main, affects that increasing of the incidence of nosocomial infections (Nagata et al 2002).

Most studies and reports including our study showed that neonatal nosocomial sepsis (60.8%) is the more frequent infection occurs among newborn infants in neonatal intensive care units.

previous studies done by Khalid et al., (2005), Mahfouz et al.,(2010) and Natasha et al., (2011) were coincide that the

most important predisposing factor to neonatal nosocomial infections, especially neonatal blood stream infections was prematurity (<37 weeks), and that was a direct correlation between the degree of prematurity and the risk of infection. The authors reported that such infants have 2-10 folds higher incidence of infection and bacteremia than do full term.

In our work, two third (70.8%) of total neonatal nosocomial infections were preterm and one third (29.2%) were full term (about 3 folds) higher than full term.

The explanation for these results is that premature infants were under high risk factor for infection because of their lack of protective maternal antibodies. The serum concentration of IgG at birth is low in premature infants in comparison with the full term baby.

The fetus produces very few antibodies before birth, after (20 to 22) weeks of gestation, an accelerated active transport of IgG across the placenta begins. The most vulnerable infants in the neonatal intensive care unit were those with gestational ages (< 37 weeks) that have acquired very few maternal antibodies benefit of protection against infections (McKenney 2001, Natasha et al., 2011).

Mahfouz et al., and Natasha et al., indicated that the most important neonatal factors predisposing to infection is low birth weight; the lower birth weight. The greater the susceptibility of the newborn to bloodstream infection by 3 -10 fold, as such patients were expected to be debilitated and their immunity could be immature (Mahfouz et al., 2010 Natasha et al., 2011).

In our study atypical example is clear that with decreasing weight, there were more numbers of neonates with nosocomial infections especially bloodstream infections .The morbidity was observed more in neonates with low birth weight (1000-1499 gm) (47.7%).

Bas et al, reported that (9.9%) neonates who were transfer in to the neonatal intensive care unit were died, and (7.4%) of them were due to neonatal nosocomial sepsis. Among the existence patients, (68.4%) were preterm and (31.6%) were full term infants. Mortality was observed in (34.1%) of neonates with birth weighting (1500gm) or less (Bas et al., 2010).

Our results were greater than Bas et al., (2010) results; this may be due to the high number of prematurity infants through the time of the study. The mortality cases certainty is due to the microorganism with high resistance to the antibiotics. Makhoul et al., (2001), in their study reported that, mortality among Gram negative bloodstream infection was higher and more than the Gram positive bacteremia (Makhoul et al., 2001).

The length of stay in the neonatal intensive care unit is known as risk factor for development of nosocomial infections. Natasha et al., (2011) reported that majority of Enterobacter bacteremia occurred after (7) days of hospitalization in the NICU indicate that the intensive care unit served as a reservoir for colonization and infection of the neonates (Natasha et al., 20 11).

Ihn et al., (2006), related mortality / morbidity, with the length of staying in neonatal intensive care unit. The length of stay can be related to the subject's unique conditions, such as birth weight or gestational age (Ihn et al., 2006).

The mean hospital stay's infants in our study were about (12 days). This was agree with Vander Zwet et al., (2006) which was (12.4) days.

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