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Clinical and Microbiological Profile of Neonatal Infections in the Neonatal Intensive Care Unit

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Abstract

Neonatal infection is a foremost cause of admissions in Neonatal Intensive Care Units (NICUs), accounted annually about 1.6 million newborns death in developing countries and a big hurdle for achievement of the Millennium Development Goal for child survival. Bacterial sepsis and meningitis are among the predominant causes. Prevalence of etiological agent varies with the time and region, surveillance is needed to manage and reduce newborn infections. Various clinical specimens were collected from infectious neonates admitted in NICUs from various children hospitals of Surat, Gujarat, India, over a period of 25 months. Pathogens were isolated and identified by following strict microbiological standards. Prevalence of different infections was studied, specifically in Low Birth Weight (LBW), preterm and normal delivered babies. In our study, positivity was found in 21.22% cases. Among them, incidences of culture proven sepsis were observed higher (73.39%). Infections were chiefly seen in LBW and preterm babies and surprisingly in vaginal delivered babies, indicate vertical transmission of infection. E.coli (n=83) found as a major cause of infections followed by K. pneumoniae. The fulminate nature of neonatal infections and its high mortality rate has posed a challenge in NICUs and could be manage by its early diagnosis. LBW and preterm babies again signify as predisposing factors. Higher rates of infections, in normal delivered babies highlight the maternal factor as important risk factor.

Keywords: Neonatal infections, bacterial sepsis, neonatal mortality, LBW.

Introduction

Infection of the bloodstream, meninges and various organs is significant cause of morbidity and mortality in neonatal intensive care units (NICUs)[1-4]. Neonates are more prone to infections due to poor immune response and may acquire infections via different ways: In utero (transplacental and ascending), intrapartum, or postnatally. Neonatal sepsis is higher among all the incidences. However, varies considerably over time and with geographic location[5].

Neonatal sepsis is defined as a clinical syndrome of bacteremia with systemic signs and symptoms of infection in the first 4 weeks of life. As per Data from the Pediatric Prevention Network of the Centers for Disease Control and Prevention[6] and the National Nosocomial Infection Surveillance system[7] it is recognized as the most frequent infections.

When pathogenic bacteria gain access into the blood stream, they may cause overwhelming infection without much localization (septicemia) or may get predominantly localized to the lung (pneumonia) or the meninges (meningitis)[8]. Microbial agents may enter and contaminate the fetus through the placental route, ascending route (after membrane ruptures) or at last when passing through the birth canal, or later, by contact with the extra-uterine environment[5,9]. At last, the fetus may be contaminated even by instrumentation during pregnancy or delivery (an additional risk factor)[10]. Infected newborn do not signify specific signs and symptoms and thus it is difficult to diagnose in early lives particularly in low birth weight (LBW) and preterm babies and therefore these are essential determinant of neonatal mortality[11].

WHO has defined LBW as birth weight less than 2500 grams[12] and is a reliable indicator in monitoring and evaluating the success of maternal and child health[13]. Asia is the region with the highest incidence (19.7%)[14,15] of babies with LBW. Infection is 3 – 10 folds higher even in preterm babies (less than 37 weeks gestational age). Preterm infants as have compromised immune response often require invasive procedures and provide a chance of pathogen to enter[12]. Of course, maternal genital tract infection is considered to be a significant root of preterm labour and increased threat of infection of the fetus.

Although gram positive cocci are believed to be the most common pathogens in neonatal patients, epidemiological studies documented higher morbidity and mortality rates with gram-negative infections[2,16].

Material and Methods

The present study was carried out during December 2010 to January-2013. The different clinical samples were collected from the various neonatal care units situated in Surat, Gujarat, India. A total of 1611 neonatal patients (less than 30 days of age) were included in the study. If empirical antibiotics were already started, in cases were babies thought to have high level

of infection, the collection was timed before the next dose of antibiotic was due. In case of positivity, pathogens from the specimens were isolated and identified by following strict microbiological standards according to Bergey's manual of determinative bacteriology, 9th edition. Prevalence and incidence of different infections were studied, specifically in LBW babies, preterm babies and babies born by normal vaginal delivery.

Results and Discussion

Clinically manifested infections were diagnosed in 342 (21.22%) babies' altogether, admitted to NICUs during period of December 2010 and January 2013. Out of these, incidences of culture proven sepsis were observed higher that was 73.39% compare to other infections (figure 1). Male to female ratio was higher (table 1). Infections predominantly found in babies with LBW/VLBW as represented in table 2. Surprisingly higher infectivity rate diagnosed in the cases with normal delivery (table 3) indicates vertical transmission from maternal genital tract and therefore maternal risk factors should consider seriously. Gram negative pathogens proved as leading cause of infections in NICUs even though *S.aureus* and *Streptococcus spp*. had significant role (table 4). In present study, 25.83 % of infected neonates were preterm and infections rate was found more common in them compare to full term and post term babies.

Table-1
Gender wise distribution of neonatal patients

Patient's characteristics	No of suspected Cases	No of Positive Cases
No of neonates	1611	342
No of male	1001	260
No of female neonates	610	082

Table-2
Distribution of neonatal patients as per their Birth weight

Patient's characteristics	Total No of Cases	Positive Cases
	1611	**342**
VLBW Neonates	048	016
LBW Neonates	202	069
NBW Neonates	1361	257

Table-3
Distribution of positivity according to mode of delivery

Type of delivery	No of suspected cases	No of positive cases
No of neonates	1611	342
Normal vaginal	1292	273
LSCS	0319	069

Table-4
Organisms wise distribution

Isolates Type	Total No.
E.Coli	83
Klebsiella Spp	58
Pseudomonas Spp	27
Acinetobacter spp.	20
Enterobacter spp.	16
Citrobacter spp.	07
S.aureus	56
CONS	47
Streptococcus Spp	26
Candida albicans	12

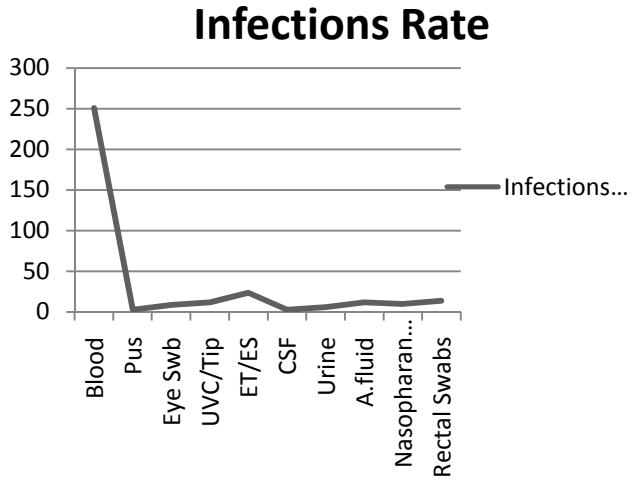

Figure-1
The profile of infections in neonates

Discussion: In both developed and developing countries, neonatal infections like sepsis, meningitis, pneumonia, and soft tissue infections, accounted as the most common cause of death in newborns[17,18] with the frequency of 6% to 25%. In our study, positivity was found in 21.22% of the cases while the study in Europe (8-10%)[19] and in Turkey (2.1-17%)[20] documented variously. Among the positive cases, incidences of culture proven sepsis were observed higher (73.39%) compare to other infections.

The prevalence of LBW is a good indicator of mother's health and nutritional status but regrettably epidemiologically infections were predominantly seen in LBW babies. The incidence of LBW in Asia as a whole is quite higher (19.7%) compare to Europe (6.5%) and USA (7.0%). We documented incidences of LBW-15.51% that is in accordance with that of Asia. There has been growing evidence to support the view that clinical and subclinical infection is an important cause of preterm birth. We documented higher (25.83%) rate of infections in preterm babies. Similar to our results, Gessener et al reported[21] the higher ratio of preterm infections also in developed countries.

In developing countries, the incidence of infections in neonates in NICU increases (17-25%) and is inversely proportional to gestational age and birth weight for example, infection rate in newborns with LBW lower than 1 500 g documented 5-32%, in babies weighing less than 1 000 g – up to 40%, and neonates born earlier than 25th week of pregnancy – even up to 46%[22]. Even Szczapa[23,24] reported 15-25% of infections premature infants and LBW babies (weight below 1500 g) it is up to 40%. Similar results were obtained in our research.

In last twenty years, however, due to medical achievements the survival rate of premature and extremely low birth weight infant's increased[25] but these babies always at a higher risk of post infections (as need prolonged hospitalization)[2,26] and thus the efforts of medical staff and diagnostic procedures are the best hopes for health and life of these infants[27].

As per the historical reviews, predominant organism causes neonatal infections are changeover the time[28,29] and prospective microbiological surveillance is therefore needed to guide empirical therapy. In NICU, infections are usually caused by Gram-positive bacteria (57-70%), but in our research gram negative isolate (*E.coli*) found as predominant isolates. However, Gadzinowski and Zięba[30,31] reported similarly, but predominant isolated noted by them were *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*.

Conclusion

Bacterial infection is a leading cause of morbidity and mortality in the neonatal age. Every effort must be taken to prevent, recognize (with a high level of suspicion) and treat infection and therefore, knowledge of causative agent and their prevalence is very important. The choice of empiric antibiotic therapy in neonatal infections presents a problem and thus bacterial isolates which are true victims responsible is of considerable value. As there is a trend of changing pattern of organisms responsible for bacterial infection in the newborn time it time surveillance of it is necessary.

In our representation, the main objective was to confirm the prevalence of infections among the clinically suspected babies and to identify the etiological agent for the same. Positivity was diagnosed in about 21.22% of neonates, more frequently in males. Sepsis was the main cause of newborn's infectivity. LBW and preterm, found as important predisposing factors. Surprisingly higher frequency was established in vaginal delivered babies that indicate vertical transmission from maternal genital tract and therefore maternal risk factors should consider seriously. The most common etiologic factors were Gram-negative rods including *E.coli* followed by *K. pneumoniae*.

Neonatal infection is one of the major causes of neonatal morbidity and mortality in India and thus their incidences, its microbial profile, various perinatal and maternal risk factors that predispose the neonatal infections is of importance.

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