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Bacteriological Causes of Neonatal Sepsis in Paediatric ward at Khartoum North Teaching Hospital, Sudan

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Abstract:

Neonatal sepsis can be defined as the presence of positive cultures, whether in the blood, CSF, or urine associated with systemic clinical features of infection.

***Methodology and results**: A cross-sectional prospective hospital based study was conducted in pediatric ward, Khartoum North Teaching Hospital to determine the bacteriological causative agents of neonatal sepsis in the pediatric ward. It included all the neonates (120 neonates) who admitted to general pediatrics ward as neonatal sepsis between January 2013 and June 2013. Data was analyzed by using SPSS.*

Laboratory tests including blood culture was done and found to be positive in two third (81) of patients and negative in one third (39). The most common isolated organisms were E-coli 39 (48.2%), staphylococcus aureus 23 (28.3%), and Group B streptococci (GBS) 19 (23.5%). Gram negative E-coli was found in two thirds of deaths in

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this study. So it is considered to be the most fatal organisms that caused neonatal sepsis in the pediatric ward.

Recommendations: *Early diagnosis of neonatal sepsis, aggressive management as well as applying infection control protocols may decrease the neonatal mortality and morbidity.*

Key words: neonatal sepsis, bacteriological causes, Khartoum North Teaching Hospital, Sudan

INTRODUCTION

Neonatal sepsis can be defined as the presence of positive cultures, whether in the blood, CSF, or urine associated with systemic clinical signs of infection such as fever, temperature instability, poor feeding and respiratory distress (Vergnano, S.2005). The World Health Organization estimates that globally there are about 5 million neonatal deaths per year, 98% percent of them are occurring in developing countries in the first week of life (WHO 1999).

The routes of Infection could be:

1. Prenatal: Trans-placental or ascending transmission. It occurs primarily with Listeria monocytogenes (Soman, M. 1985).
2. Early onset from (birth to 5 days): Maternal flora transmitted peri-partum members of the maternal genital flora, such as group B streptococcus (GBS) and Escherichia coli (E. coli) (Kaufman, D. 2004).
3. Late onset (5 to 30 days): nosocomial and the risk factors are contact with hand of colonized personnel or contact with contaminated equipment.
4. Late more than 30 days: nosocomial and the risk factors are indwelling intravascular devices, extreme prematurity, broncho-pulmonary dysplasia, short gut

syndrome, complex congenital malformation (Baltimore, S. 1999).

The bacteria most often implicated in neonatal sepsis in developing countries differ from those seen in developed countries (Karthikeyam, G. 2007). The "gold standard" for diagnosing neonatal sepsis remains the blood culture, even though, in many cases, blood cultures are negative in the face of strong clinical indicators of septicemia. False-negative blood cultures in apparently septic neonates may result from insufficient sample size. One study estimated that as many as 60% of blood cultures would be falsely negative for common neonatal pathogens if only 0.5 ml of blood is sampled in low colony- count (4 CFU/ml) sepsis (Kellogg, J.A.1997).

Frequently present are abnormalities in the peripheral white blood cell count, including an increased or decreased absolute neutrophil count, an elevated band count, an elevated ratio of bands to total neutrophils, or leucopenia. The elevations in the C-reactive protein level have been investigated as a potential early marker of GBS sepsis but are unreliable (Chan, D.K. 1997).

METHODOLOGY

A cross-sectional prospective hospital based study was conducted in pediatric ward, Khartoum North Teaching Hospital to determine the bacteriological causative agents of neonatal sepsis in the ward. It included all the neonates (120 neonates) who admitted to general pediatrics ward as neonatal sepsisin a six months period between January 2013 and June 2013.

The blood sample collection, handling and transport were done by using complete aseptic technique. 4.5 ml venous blood was drawn; 2.5 ml blood was inoculated into Tryptone Soy

Broth (TSB) for culture and the remaining 2 ml blood was used for full blood cell count.

All blood cultures were incubated aerobically at 37°C and inspected daily for 7 days for presence of visible microbial growth. For blood cultures that showed signs of microbial growth, subcultures were made onto blood, chocolate and Mac-Conkey's agar .The blood and Mac-Conkey'sagar plates were incubated in aerobic and chocolate agar in microaerophilic atmosphere using a candle jar at 37°C for 24-48 hrs. All positive blood cultures were identified by their characteristic appearance on their respective media, gram staining reaction and confirmed by the pattern of biochemical reactions using the standard method.

The data was analyzed by using SPPS(statistical package of social science). The ethical clearance was approved from Khartoum North Teaching Hospital, and a verbal consent was obtained from the parents after counseling. The history and clinical examination was conducted by the author.

RESULTS

The total number of neonates included in this study was 120. The male: female ratio was 1.26: 1. Two thirds (81) of neonates were weighing more than 2.5 kg while one third (39) ranging from 1.5 to 2.5 kg.A history of maternal fever or infection during pregnancy was positive in 53 (44.2%) of the mothers and negative in 67 (55.2%) (Fig.1).

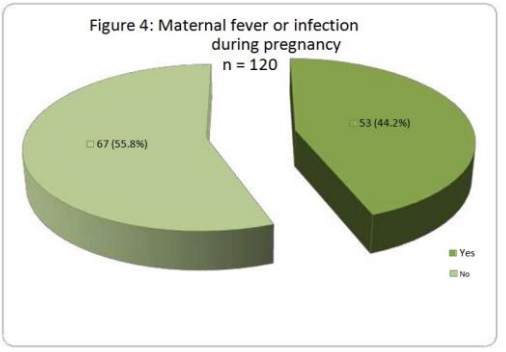
Regarding place of delivery 88 (73.3%) of the neonates were outcome of hospital deliveries, and 32 (26.7%)were outcome of home deliveries. Two thirds of the neonates were outcome of normal vaginal delivery, one quarter were outcome of caesarian section (elective or emergency) and only 6 (5%) were outcome of assisted vaginal delivery. Regarding the duration of the rupture membranes 84 (70%) of the mothers has

duration of less than 18 hours, 21 (17.5%) of them had duration of more than 18 hours, and the rest under went to caesarian section before rupture of membranes.

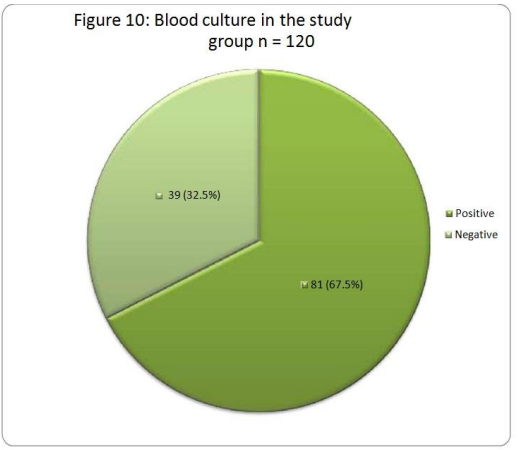
Among all neonates 87 (72.5%) of the neonates didn't need resuscitation after delivery while 33 (27.5%) of them received resuscitation. In this study mortality rate was 24.1% (29 neonates).

A blood culture was positive in two third (81) and negative in one third (39) (Fig.2).The most common isolated organisms were E coli 39 (48.2%), staphylococcus aureus 23 (28.3%), and GBS 19 (23.5%) (Fig.3).Total White blood cells (TWBCs) in the normal rang in 92 (76.7%) of neonates, high in 19 (15.8%), and low in 9 (7.5%) (Table1). Neutrophils count in the normal rang (4200 to 12000) in 67 (55.8%) neonates, high in 37 (30.8%) and low in 16 (13.3%) (Table2). A gram negative E coli was found to be the most fatal organisms in this study.It was the causative organism in19 (65.5%) of deaths, GBS 7 (24.1%), staph aureus 1 (3.4%) and 2 (6.8%) deaths had a negative blood culture (Table 3).

(Figure1): showed maternal fever or infection during pregnancy



(Figure2): showed the result of blood culture in the study group



(Figure3): showed the common isolated organisms in the study group.

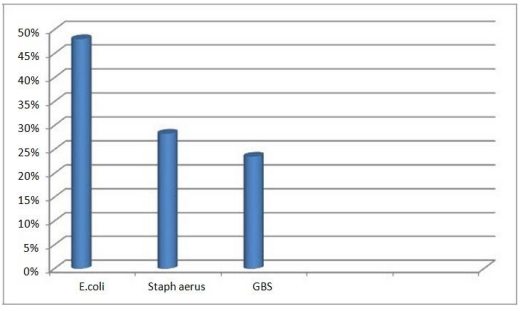


Table1: TWBCs in the study group (n = 120)

	Frequency	Percentage
Leucopenia	9	7.5
Normal	92	76.7
Leukocytosis	19	15.8
Total	120	100.0

Table 2: Neutrophils count in the study group (n = 120)

	Frequency	Percentage
Neutropenia	16	13.3
Normal	67	55.8
Neutrophilia	37	30.8
Total	120	100.0

Table 3: Distribution of deaths according to bacterial culture (n = 29)

	Frequency	Percentage
E- coli	19	65.5%
GBS	7	24.1%
Staph. Aureus	1	3.4%
Negative culture	2	6.8%
Total	29	100.0

DISCUSSION:

The pathogens most often implicated in neonatal sepsis in developing countries differ from those seen in developed countries. Overall, Gram negative organisms are more common and are mainly represented by Klebsiella, E. coli, Pseudomonas, and Salmonella spp. Of the Gram positive organisms, Staphylococcus aureus (Karthikeyam, G. 2001), Coagulase negative staphylococci (CoNS) (Malik, A. S., Pennie R.A., 1994), Streptococcus pneumonia (S. pneumonia) (Muhe, L., et al, 1999) and Streptococcus pyogenes (S. pyogenes) (Gatchalian, S. R., et al, 1999) are most commonly isolated.

In developed countries: Neonatal infection surveillance in developed countries generally identifies GBS and E coli as the dominant early onset sepsis (EOS) pathogens and CoNS the dominant late onset sepsis (LOS)pathogen followed by GBS and S. Aureus (Hyde, T. B., et al 2002). EOS disease is often more severe and case fatality rate is higher than it is for LOS disease. As the latter is usually caused by CoNS, the associated morbidity and mortality are low (Isaacs, D. 2003). This may not be the case in developing countries LOS has a higher case fatality rate, particularly when Gram negative bacteria are involved.

Among the 120 neonates included in this study, 81 (67.5%) were positive for blood culture and this is high in comparison to the study done in Ethiopia by Demissie Shitayein which 302 neonates investigated for sepsis, 135 (44.7%) were positive for blood culture (Shitaye, D, 2008).

In our study the Gram negative E-coli was found to be the most common organism isolated (48.2%) followed by staphylococcus aerus (23.3%) and the least implicated organism was found to be group B streptococcus (23.5%) whereas the most common organisms isolated in Soba University Hospital and Khartoum Teaching Hospital were staphylococcus aureus, Escherichia coli and group B streptococci, accounted for 47.5%, 25%, and 13.7%, respectively (Bashir, S. I. 2004). In most of the African studies, the incidence of GBS is low (Mulholland, E.K. et al, 1999) with the exception of South Africa (Ballot, D. E., et al,2001). InAsia, GBS is also reported to be extremely rare (Al-Harthi A. A. et al 2001). But Ayman Koutouby and Javed Habibullah in Alwasl Neonatal Unit in Dubai, United Arab Emirates the case records of all neonates admitted to the neonatal unit in a period 60 months were analyzed, 106 neonates had confirmed sepsis, theyfound that; the most common causative organisms were GBS (23%), E coli (17%), staphylococcus Epidermidis (17%) and Klebsiella pneumoniae (16%). Yetlowest mortality was observed in GBS sepsis (Koutouby, A. & Habibullah, J.1999).

In this study mortality rate was 24.1%, which was slightly lower than the result in USA (28%)(Stoll, B. et al 1994), in Saudi Arabia (28%) (Dawodu, A. et al 1997), in UAE (26%) (Koutouby, A. & Habibullah, J.1999), while higher mortality was reported in Al-Basrah, Irag (44.16%) (Jumah D. S.& Hassan, M. K., 2007).The mortality was higher in neonates whose blood culture was positive. A gram negative E coli was found to be the most fatal organisms in this study (p- value 0.00).It was the causative organism in 19 (65.5%) of the deaths, GBS 7 (24.1%), staphylococcus aureus 1 (3.4%) and 2 (6.8%) deaths had a negative blood culture. Similar results were obtained by many studies; in Saudi Arabia (Asinidi, A. et al 1999), in Dubai (Koutouby, A. & Habibullah, J.1999) and in Mexico (Rodriguez, M. et al 2003). All these studies showed a

higher incidence of gram negative micro-organisms among neonates with sepsis who died compared to those who survived.

Among the 120 neonates included in this study only 19 (15.8%) had Leukocytosis, and 9 (7.5%) had leucopenia. This result is similar to the result in the study done in Ethiopia in 302 neonates admitted with suspected cases of sepsis, 59 (19.5%) had abnormal white blood cell count (high and low) (Shitaye, D. et al 2008).

CONCLUSION AND RECOMMENDATIONS:

1. The most common organism isolated from Blood cultures was Gram negative E. coli. The mortality was higher in neonates whose blood culture results were positive for Gram negative E coli. It was found to be the most fatal organisms in this study. It was the causative organism in 19 (65.5%) of the deaths, GBS 7 (24.1%), staph aureus 1 (3.4%) and only 2 (6.8%) deaths had a negative blood culture.
2. Early diagnosis of neonatal sepsis and aggressive management can decrease the neonatal mortality and morbidity.
3. Septic screening (including blood culture and sensitivity) is very important to confirm the diagnosis, and to determine the duration of treatment so the investigations should be available.
4. Unified protocol for treatment of neonatal sepsis, and the empirical treatment should cover both Gram negative and positive organisms.
5. Application of infection control programs.

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