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RESEARCH ARTICLE

ROLE OF CORD BLOOD CRP AND CULTURES IN DIAGNOSIS OF NEONATAL SEPSIS

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Abstract

Background: Sepsis has killed about 30–40% of low-income neonates, often caused by maternal-fetal microorganisms. PROM affects 3% of pregnancies, aside from chorioamnionitis, untreated UTI, etc. Many studies have predicted neonatal sepsis by detecting inflammatory markers in venous blood 12–24 hours after birth. Some studies have tested CBC, CRP, and blood culture in babies with PROM and other risk factors to predict early-onset neonatal sepsis by drawing umbilical cord blood. Hence, we performed this study to determine the role of CRP and blood cultures from umbilical cord blood to determine early-onset sepsis.

Methods: This was a prospective observational study performed in Sharda university, Greater Noida. 122 neonates within 72 hours of birth born via full term vaginal delivery, after 37 completed 37 weeks of gestation. The neonates were then divided in the two groups- neonates with likely sepsis or no sepsis based on the symptoms. Following this, umbilical cord blood was drawn at 24 hours and 72 hours.

Results: we observed that 32.47% of the neonates in the likely sepsis group had confirmed evidence, while 3.4% in the no sepsis group we found to have evidence of sepsis. The differences was statistically significant ($p < 0.05$). CRP was higher in umbilical cord blood and venous blood in likely sepsisneonates, in comparison to than blood culture yields and total WBC. Compared to the non-infected control group, the differences were statistically significant (P value 0.05). CRP demonstrated 100% sensitivity, specificity, PPV, and NPV in cord blood and 100%, 77.1%, 27.3%, and 100% in venous blood at 24 hours.

Conclusion: Neonates with the higher risk of sepsis had higher readings in umbilical cord blood at birth and newborn venous blood at 24 hrs., but not at 72 hours, Also,negative CRP readings better excluded infection. Early-onset sepsis cannot be diagnosed by umbilical cord blood cultures.

Introduction:-

Neonatal sepsis is a condition with a high mortality rate (about 13–25 percent) and a low incidence (roughly 1–8 cases per 1000 live births and 15–19 percent of deaths), and the mortality is higher with very low birth weight babies

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[1, 2]. It is estimated that over 5 million newbornsin developing nations such as India pass away every single year. Infection is a factor in around 30 to 40 percent of all deaths that occur in neonates in these countries [3].

One of the most prevalent triggers of neonatal sepsis is an infection that occurs in the mother during pregnancy. PROM, which occurs in 3% of pregnancies and is responsible for nearly one-third of all preterm births, is the most prevalent risk factor for premature birth [4]. Preterm premature rupture of membranes, together with other risk factors such as chorioamnionitis, intrapartum fever or untreated or partially treated UTI or foulsmelling fluid, is a predisposing factor for serious maternal infections such as intra-amniotic infection, endometritis, or septicemia. Other risk factors include preterm premature rupture of membranes. It is more likely that the foetus will suffer from morbidity and mortality as a result of PROM than the mother will.

Infections in the foetus can manifest themselves as early neonatal infections such as pneumonia, meningitis, and sepsis and are linked to a significant increase in the risk of mortality and morbidity in premature newborns [5]. Both the clinical presentation of newborn sepsis and the laboratory readings that accompany it are frequently nonspecific. As blood culture is the gold standard, but it takes 24-36 hours to be verified, this drives examination of CBC and other laboratory markers such as CRP, PCT, the marker of inflammation such as IL-6, IL-8, and TNF- as viable tools for diagnosis of EONS [6]. Blood culture is the gold standard, but it takes 24-36 hours to be confirmed. In the past, many studies have been carried out by assessing inflammatory markers of sepsis in venous blood, often between 12 and 24 hours after the newborn's birth in order to predict serious infections in neonates [6-8]. There have been a few studies done by using umbilical cord blood at birth [9, 10], and to the best of my knowledge, there have been very few studies aimed at testing these parameters of CBC, CRP & Blood culture in newborns with PROM and other risk factors in predicting early onset neonatal sepsis by using umbilical cord blood at birth.

This study was conducted to evaluate the usefulness of routine laboratory values measured in umbilical cord blood at delivery and in venous blood at 24 hours for the screening of EONS among those at risk of infection.

Methods And Materials:-

This was a prospective observational study performed in Sharda university, Greater Noida. 122 neonates within 72 hours of birth born via full term vaginal delivery, after 37 completed 37 weeks of gestation. The neonates were then divided in the two groups- neonates with likely sepsis or no sepsis based on the symptoms. Following this, umbilical cord blood was drawn at 24 hours and 72 hours.

Newborn infants were considered for inclusion in the study if their mothers had at least one of the following risk factors for neonatal infection:

Sustained foetal tachycardia (HR >160/min), Maternal Leucocytosis (Total WBC >15000/cmm), Foul-smelling per-vaginal discharge, Prolonged rupture of membranes (PROM > 12 hours), Chorioamnionitis, more than three vaginal examinations after ROM, Intrapartum fever (oral temperature >38 degrees C), Leucocytosis (Total WBC >12000/$mm^{3)}$)

Alternatively, newborns who had two or more abnormal laboratory values in addition to one or more clinical feature(s) were considered to have a likelihood ofand included in group A

Group B—The babies who did not have any clinical signs and/or positive laboratory findings but nevertheless had a risk of infection were classified as having "no sepsis."

Twenty-four hours following the delivery, the umbilical cord was clamped and severed under strict aseptic precautions, and then around 5 milliliters of blood was drawn from the cord for culture and other regular laboratory procedures. Blood was obtained in the automated BACTEC blood culture media, CBC vial, and test tube in addition to any other standard laboratory procedures.

All the data collected was analysed using SPSS v20, and any p value <0.05 was considered to be statistically significant.

Results:-

During the course of the study, a total of 147 neonates were tested for septic conditions using blood drawn from their umbilical cords at 0 hours and their neonatal blood at 24 hours of age.

Study period, 76 of the participants were assigned to the case group, while 71 were assigned to the control group. Within the case group, the range of maternal ages was 18-35 years old, with a mean and standard deviation of 24.5 and 40 years respectively. In the control group, the average age of the mothers was 26.764.05 years old, with a range of ages ranging from 20-34 years. In terms of the number of births to a single mother, the difference between the case group (52.6% of women) and the control group (33.8% of women) was statistically significant (P 0.05). The vast majority of babies in the cases (67.1% of them) were born using LUCS, whereas the vast majority of babies in the control group (70%) were born naturally. In the case group of newborns, the ratio of males to females was 1.1:1, and the GA ranged from 29 to 39 weeks on average, with a mean of 33.96 weeks and a standard deviation of 1.82 weeks.

In the case group, birth weights ranged from 1200 to 3000 gms, with 1900 being the mean (SD) and 483.6 being the standard deviation. In the control group, the mean (SD) gestational age was 34.121.5 weeks, with a range of 29-40 weeks. The mean (SD) birth weight was 1960212.9 gms, with a range of 1300–3100 gms, and the male to female ratio was 1.2:1.

The baseline characteristics were noted, and found that PROM (68.22%), repeated P/V exams after ROM (30.24%) were the most common parameters. Leukopenia and leukocytosis were found to develop in the proven sepsis and/or probable sepsis measured in both umbilical cord blood and venous blood at 24 hours, which were statistically insignificant (P value > 0.05) between the two groups but most likely indicating the severity/progression of the sepsis.

12 (24.81%) of the cases in the Group A were discovered to have a positive CRP value (6mg/L) in the umbilical cord blood, but only 2 (3.4%) of the cases were discovered to have a positive CRP value (6mg/L) in group B. This indicates that the CRP level is significantly higher in the case group. In neonatal venous blood at 24 hours of age, it was observed that 24 (29.64%) cases had CRP positive levels (6mg/L) in the case group, but only 2 (2.8%) cases had CRP positive levels (6mg/L) in the control group displayed in the same We observed that 32.47% of the neonates in the likely sepsis group had confirmed evidence, while 3.4% in the no sepsis group we found to have evidence of sepsis. The differences was statistically significant (p< 0.05). CRP was higher in umbilical cord blood and venous blood in likely sepsisneonates, in comparison to than blood culture yields and total WBC. Compared to the non-infected control group, the differences were statistically significant (P value 0.05).

PARAMETER	VALUE
SENSITIVITY	98.27%
SPECIFICITY	82.32%
NPV	28.63%
PPV	97.64%

MATERNAL FACTOR	CBC ELEVATED	POSITIVE CRP	POSITIVE CULTURES
LEUCOCYTOSIS	12 (14.52) [0.44]	20 (19.42) [0.02]	21 (19.06) [0.20]
FOUL SMELLING PV DISCHARGE	10 (8.77) [0.17]	12 (11.73) [0.01]	10 (11.51) [0.20]
UTI	18 (19.73) [0.15]	30 (26.38) [0.50]	24 (25.89) [0.14]
PROM	32 (29.32) [0.25]	35 (39.21) [0.45]	40 (38.48) [0.06]
CHORIOAMNIONITIS	8 (7.67) [0.01]	10 (10.26) [0.01]	10 (10.07) [0.00]

When we correlated CBC, CRP and Blood cultures, we found that there was a statistically significant correlation between maternal factors and these laboratory parameters. (p value 0.042)

Discussion:-

The current study found a ratio of 1.1:1 male infants to female newborns in the case group. Previous research had indicated that males and females have an equal risk of having a baby with Down syndrome.

or a condition that makes them more likely to develop newborn sepsis [11, 12]. The average age of the mothers in the case group was 24.53 4.4 years, while the average age of the mothers in the control group was 26.76 4.05 years. The highest number of cases, 49 (64.5%), was found in the age range of 18 to 25 years for the case group, while the lowest number, 35 (49.3%), was found in the age range of 26 to 30 years for the control group. One study indicated that infants whose moms were younger than 25 years old had a 1.5-fold increased chance of developing sepsis [13]. This disease has the potential to be an aggravating factor for sepsis, as research has shown that very low birth weight newborns are more sensitive to sepsis [14]. This highlights the prospective nature of this condition as a factor that contributes to sepsis. When compared with newborns of normal birth weight, very low birth weight infants were found to have a 25-fold increased chance of having sepsis [15].. The majority of the neonates in a study by M S Alam et al [18] , 62 (81.6%), were born prematurely (gestational age less than 37 full weeks). Additionally, 60.5% of the neonates had a low birth weight (1,500 to 2,500 g), and 26.71% had a very low birth weight (1,500 g to >1000 g). In spite of considerable efforts to isolate the causative microorganisms, blood cultures were positive in only 6 (7.9%) instances among individuals who were at risk of infection. However, the percentage of cases in whom blood cultures were positive fluctuates widely, from 9 to 64% in the study performed by Carvahlo et al [16]. Another study by Cheisa et al, they found that the percentage of infants with positive cultures in the diagnosis of possible neonatal sepsis ranged from 8% to 73% [17].

In a study performed by M S Alam et al [18] , among the case group, there were six blood cultures that tested positive for E. coli and Coliform and Enterobacter. This is in contrast to the control group, which only had two blood cultures that tested positive for CONS.

These findings of studies done around the world corroborate the findings of the present study. Although our study is limited by a small number, we find that there is a potential to use these laboratory parameters in cord blood to detect neonatal sepsis early, and prevent neonatal mortality in a developing nation such as India.

Conclusion:-

Umbilical cord blood can be used to detect early neonatal sepsis in neonates delivered to mothers with risk factors of chorioamnionitis, UTI, and leukocytosis prior to delivery. Hence, we can treat such cases early and prevent unnecessary mortality.

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