ORIGINAL RESEARCH

A study to analyze Blood culture result to find out Early onset Neonatal septicemia from Neonatal ward of a tertiary care center

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ABSTRACT
Neonatal sepsis is defined as a blood stream infection whichdevelops within28days afterbirthor up tofour weeks. It is an important cause of mortality among neonates. Basedonthe time of onset, it is categorized into early onset neonatal sepsis (EONS) and late onset neonatal sepsis (LONS). It encompasses systemic infection of the new born including septicemia, meningitis, pneumonia, arthritis, osteomyelitis, congenital syphilis and urinary tract infection. In This study blood sample from neonate with 2 or more risk factor suggestive of EONSwas collected from cord blood and Peripheral vein. A total of 100 blood samples were collected for culture . In 65.7% cases clinically significant with sepsis screen positive EONS was found using cord blood and 60% using peripheral veinblood . *Klebsiella spp(20.8%)*was found to be most common isolates followed by *E.coli(16.7%), Staphylococcus aureus (16.7%), Pseudomonas spp(12.5%)* and *Enterococcus spp(12.5%).*Finding suggestive of Cord blood superiority compare to peripheral vein blood in finding causative agent of EONS.

Key words: Septicemia, Neonate, Blood culture

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INTRODUCTION

Neonatal sepsis is the most common cause of neonatal mortality. It account for nearly 3 million neonatal deaths per year and an estimated neonatal mortality rate of 23. 9 per 1000 live birth globally.(1)The clinical manifestation of sepsis in newborninfants is usually non-specific; thereby diagnosis of sepsis only by clinical findings is difficult.

The usual practice is to collect blood sample by venipuncture from the neonates and sent for culture and hematology. Collection of blood sample can induce pain or infection or iatrogenic anemia to the neonates. There are very few previous documented reports of early predictive screeningmethods for neonatal sepsis by using cord blood sample.The definitive diagnosis of sepsis is made by a positive blood culture, which requires a minimumof 48-72 hours, yields a positive result in 30-40% of cases. Blood culture remains the gold standard for diagnosis of neonatal sepsis, yet it is important to develop effective screening tools which can presumably diagnose or exclude neonatal sepsis at the time of presentation(2). Early diagnosis of neonatal sepsis is still a great challenge.

Currently, there is inadequate published data to support routine use of umbilical cord blood for hematological sepsis score and culture in neonatal sepsis so the purpose of this study is to evaluate the utility of umbilical cord blood in neonates at high risk for EONS in comparison to peripheral venous blood.

AIM

Study was aimed to analyze blood culture in detection of Early onset Neonatal septicemia.

MATERIAL AND METHODS

This was a cross sectional study carried out in Department of Microbiology in association with Dept of Pediatrics of a tertiary care hospital. Study was conducted over a period of one year from January 2019 to January 2020.

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Inclusion Criteria: Neonates with presence of 2 or moreof the following risk factors were included in the study for collection of blood specimenusing sequential sampling method:

a) Prematurity (< 37 weeks)
b) Preterm Premature rupture of membranes
c) More than 3 vaginal examinations after rupture membranes or 1 unclean vaginal examination
d) History of maternal fever
e) Foul–smelling liquor
f) Chorioamnionitis(maternal fever >100.4, uterine tenderness, leucocytosis)
g) Prolonged rupture of membrane (>18hrs) 47
h) Prolongedlabour> 24 hours
i) Perinatal asphyxia (apgar score of <4 in 1 minute)
j) Meconium stained liquor

Exclusion Criteria: Neonates born with lethalcongenital anomalies

Study Method: Umbilical cord blood is collected at birth post stabilization of neonate. Post-delivery the umbilical cord is clamped on both placental and umbilical end and is cut between each pair of clamps. The placental end is wiped with 70% isopropyl alcohol and with a 22 gauge syringe, 4-6ml of blood is collected from the placental end of umbilical artery or vein. 2 ml of cord blood is transferred to anticoagulant EDTA bulb for analyzinghematological parameters, sepsis screen (CBC with ANC, toxic granules, I:T ratio. I:M ratioandCRP)and for peripheral smear for Hematological sepsis score.

The 2-3 ml of blood sample is collected in Bact/alert pediatric blood culture bottle and remaining blood were collected in EDTA vial for other investigation.

Similarly peripheral venous blood sample was also collected within 6 hours of birth for Blood culture in same way as for UCB culture before starting antibiotics according to NICU protocols.(1)Demographic, birth & clinical details of all the participant was recorded in the predesigned proforma.

RESULT AND DISCUSSION

Over past two decades neonatal morbidity associated with sepsis has increased due to changing microbial spectrum. Establishment of early diagnosis of neonatal sepsis is a challenge because of varied clinical presentations. For definite diagnosis of sepsisperipheral bloodculture results are considered gold standardbut it is time consuming. The other recent available markers are sensitive but expensive. Hence, they have limited use in financially constrained setup. Therefore, there is always a need for an infallible cost-effective test for early detection of sepsisthat could be easily performed. In this study we have evaluated the effectiveness & importance of blood culture from umbilical cord blood and peripheral venous blood in the detection of the early onset neonatal sepsis.

We have categorized culture result according to clinical status of neonate in following categories:

No sepsis-Sterile Blood culture with no clinical signs of sepsis

Probable sepsis- Sterile Blood culture with presence of signs of sepsis and positive/Negative septic screen

Proven sepsis- Positive Blood culture with presence of signs of sepsis andpositive/Negative septic screen

In our study 100 neonates were includedby sequentialsampling methodwhich were delivered in our setup during study period. All having presence of 2 or more perinatal risk factors for early onset sepsis.

Out of 100neonates, 41 were female & 59 were malein which 15 male(71%) and 6 female(29%) neonatesdevelop sepsis& 9male (64%) and 5 female(36%) develop probable sepsis. (Table-1)

Males were predominant in our study which is consistent with other studies by Pramana et al(58% were male, 42% were female), Makkar.M et al(56% were male, 44% were female), Dutta NR et alattributed male predominance to globulin synthesizing factors on X chromosome thus making males more susceptible to infections[3,4,5,].

Although laboratory markers of sepsis complement the diagnosis, demonstration of organisms from patient's blood remains the gold standard for diagnosing neonatal sepsis. An inadequate amount of blood samples, faulty collection techniques, and antibiotic exposure (both intra-partum and post-partum) are hindering factors that can reduce the sensitivity of blood culture. For all 100 neonates both umbilical cord blood &peripheral vein blood were use for cultures using BACTEC blood culture vials.In UCBCulture out of 100 neonates, 27 were culture positive & 73 were sterile.Out of 27 culture positive 23 belong to sepsis (65.7%; clinically significant with sepsis screen positive) & 4 belong to no sepsis category (6%; probably contaminant,not clinically significantwith sepsis screen negative) and in 73 sterile UCBC , 12 belong to sepsis (34%; clinically significantwith sepsis screen can be positive/Negative) & 61(93.8%; not clinically significant with sepsis screen negative)belong to no sepsis. (Table-2)

In PVBCount of 100 neonates, 24 are culture positive in which 21 belong to sepsis (60%; clinical significant with sepsis screen positive) and 3 belong to no sepsis (4.6% ; probably contaminants, not clinically significantwith sepsis screen negative) and in 76 sterilePVBC, 14 belong to sepsis(35%; clinical significant with sepsis screen can bepositive/negative) & 62 belong to no sepsis(95.3%; not clinically significant with sepsis screen negative).

These results are consistent with the study by Kalathia et al who reported in their study ,out of 45 newborn, 11 were UCBC positive & 8 were PVBC positive, in diagnosis of EONS),Ramrajmeena et alalso reported,

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out of 80 newborn, 17 were UCBC positive & 15 were PVBC positive, in diagnosis of EONS .(6,7)

In a study conducted by Kalathia et alin 2016, umbilical cord blood culture(11 out of 45 positive) was reported as a useful method to increase etiological diagnosisof blood stream infection in high risk neonates (24.4% positivity of UCBC)(6)

Despite the advantages of UCBC, itis also documented that UCBCresults had excess of contamination lacking clinical correlation. In astudy conducted by Pollin et al.in 1981, tostudy the use of UCBC for detection of early onset neonatal sepsis in high risk neonates, six UCBC cultures were positive out of 200 samples of which only one culture had clinical correlationand was considered significantwhile the remaining werecontaminants (commonly *Corynebacterium*, *Proprionibacterium* species, *Staphylococcus epidermidis*).(8)

Similarly in the study conducted by N.Fos et al 45in 2009, to study the blood culture from umbilical vein in the diagnosis of EONS, 13 UCBC cultures were positive out of 30samples of which seven had clinical correlation & was considered significantwhile the remaining 6 were contaminants (commonly Coagulase negative Staphylococcus , Streptococcus viridians).(9)

In our study out of 100 UCBC blood culture , 27came out to be culture found positive. Of the 27 positive culture Gram negative organisms were isolated predominantly i.e. 16 (59.2%) followed by Gram positive organism i.e.11 (40.75%) .(Table-3)

Commonestisolates being Klebsiella 22.22% followed by Staphylococcusaureus 14.8%, Acinetobacter14.8%, Coagulase Negative Staphylococcus 14.8%, E.coli 11.11%, Enterococcus 11.11% and Pseudomonas 11.11% Similarly from the 100 PVB culture growth was detected in 24 samples .Of the 24 positive culture growth, Gram negative organisms were isolated predominantly i.e. 14 (58.3%) followed by Gram positive organism i.e.10 (41.66%) (Table-4)

*Klebsiella spp(20.8%)*was found to be most common isolates followed by *E.coli(16.7%), Staphylococcus aureus (16.7%), Pseudomonas spp(12.5%)* and *Enterococcus spp(12.5%).*

Our results are comparable with other studies by Mandot S et alwho documented proven sepsis confirmed byblood culture among 8% of neonateswith risk factors for EONS, most common organism isolated being *Klebsiella*,followed by *Staphylococcus aureus, E.coli* , Bhagyashree et al reported Blood culture was positive in 25% of neonates and Gram negative organisms were isolated more, commonest being *Klebsiella*, in a study by Pramana et al proven sepsis is confirmed by blood culture in 34% of neonates withrisk factors,most common organism isolated being Klebsiella , Dutta NR et al reported blood culture was positive in 23% of neonateswith Gram negative organisms were isolated in 62% culture, commonest being *Klebsiella* and commonest Gram positive organisms isolated in 37% of culture was *Staphylococcus aureus.* Kalathia et al, Namdeo et al, Mathur et al.,(3,5,10,11,12)

Table-1: Gender distribution

	DIAGNOSIS			
Gender	**No Sepsis (n = 65)**	**Probable Sepsis (n=14)**	**Proven Sepsis (n=21)**	**Total (N=100)**
	No.(%)	**No.(%)**	**No.(%)**	**No.(%)**
Female	30 (46.1)	**5(35.7)**	**6(28.6)**	41 (41.0)
Male	35 (53.8)	**9(64.3)**	**15 (71.4)**	59(59)
Total	**65 (100)**	**14 (100)**	**21 (100)**	**100(100)**

Table-2: Umbilical cord blood culture distribution

	DIAGNOSIS		
UCBC	**Sepsis (proven+probable) (n=35)**	**No Sepsis (n=65)**	**Total (N=100)**
POSITIVE	23	4	27
NEGATIVE	12	61	73
TOTAL	35	65	100

Table-3: Results of Blood culture by different collection method

	Umbilical cordblood culture	**Peripheral venous blood culture**
Positive	27	24
Negative	73	76
Total	**100**	**100**

Table-4: Organisms grown from Peripheral venous blood (PVB) culture and Umbilical cord blood (UCB) culture

Organism grown on culture	**Peripheral blood culture (n=24)**		**Umbilical Cord blood culture (n=27)**	
	N	**%**	**N**	**%**
Klebsiella spp	5	20.8	6	22.2

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Staphylococcus aureus	4	16.7	4	14.8
E.coli	4	16.7	3	11.1
Pseudomonas spp	3	12.5	3	11.1
Enterococcus spp	3	12.5	3	11.1
CONS(coagulase Negative staphylococcus)	3	12.5	4	14.8
Acinetobacter spp	2	8.3	4	14.8
Total	**24**	100.0	**27**	

CONCLUSION

Blood cultureobtained from an umbilical cord sampleis a good way to increase etiological diagnosis of bacterial sepsis in high-risk neonates as compared with PVBC. Organisms grown in umbilical cordblood samples are comparable with venous blood culture. It has certainly an additional value for diagnosis of neonatal sepsis.The definitivediagnosis of sepsis is made by a positive blood culture, which requires a minimumof 48-72 hours, yields a positive result in 30-40% of cases. Blood culture remains the gold standard for diagnosis of neonatalsepsis, yet it is important to develop effective screening tools which can presumably diagnose or exclude neonatal sepsis at the time of presentation.

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