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Role of umbilical cord blood culture in prediction of early onset sepsis among newborns with high risk factors in a tertiary care hospital: a prospective analytical study

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Abstract
Objective: To evaluate the role of umbilical cord blood culture in neonates at high risk of early onset sepsis
Study Design: *Prospective analytical study*
Setting and Participants: *Newborns delivered by labour natural/LSCS having two or more risk factors for sepsis admitted at Neonatology Division, Department of Pediatrics, Coimbatore Medical College Hospital, Coimbatore, tertiary care hospital in Tamilnadu.*
Methodology: *Neonates who were at risk of developing sepsis based on presence of two or more risk factors for early onset sepsis were enlisted. These risk factors were prematurity (<35 completed weeks),prolonged rupture of membrane (>18 hours), premature rupture of membrane, prolonged labour (> 24 hours), foul smelling liquor, maternal fever (>100.4 f), frequent vaginal examinations (>3) and birth asphyxia. Umbilical cord blood, peripheral vein blood and sample for sepsis screen were collected within 24 hours of birth of neonates with presence of two or more risk factors for neonatal sepsis.*
Results: *The present prospective cohort study was conducted among 400 neonates having risk of developing early onset sepsis . Among 400 neonates 116(29%) were positive for sepsis screen ,sensitivity and specificity of sepsis screen was 76% and 75% respectively when compared to UCBC,57% &76% when compare to PVBC. Among 400 neonates 30 (7.5%) found to have UCBC result positive while remaining did not show any growth and 26(6.5%) found to have PVBC positive while remaining did not show any growth. Culture isolates in UCBC samples Group B Streptococci grown in 1sample both in UCBC and PVBC. Staphylococcus aureas was found in 6 UCBC sample and 7 in PVBC samples .Klebsiella was found in 7 samples in UCBC and found positive in 8 PVBC samples. Acinetobacter grown in 8 UCBC samples and 7 in PVBC samples. Pseudomonas found positive only in UCBC.E.coli was found in5 samples in UCBC and 2 samples in PVBC, 2 samples were positive for CONS in UCBC and 1 sample in PVBC. In UCBC 370 (92.5%) samples did not show any growth,in PVBC 374(93.) samples did not show any growth*
Conclusion: *Blood culture obtained from an umbilical cord has good diagnostic validity for etiological diagnosis of early onset sepsis in high risk neonates as compared with PVBC. Organisms grown in umbilical cord blood samples are comparable with venous blood culture*
Key Words: *sepsis, culture, umblical cord, peripheral vein*

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I. Introduction

Neonatal sepsis is a major cause of neonatal mortality. The clinical outcome mainly depends on the early diagnosis and peripheral venous blood culture. Despite recent advances in anti-microbial therapy and the increasing sophistication of neonatal intensive care, the mortality from sepsis remains high. Peripheral venous blood culture is the most widely practiced diagnostic method. However, it is often difficult to obtain blood from preterm neonates. But if the umbilical cord blood is used to diagnose early onset sepsis, babies would not need to have blood drawn via peripheral vein and would experience less pain. Hence my study was carried out to evaluate the role of umbilical cord blood culture in neonates at high risk for early onset neonatal sepsis in comparison to peripheral venous blood culture.

II. Methodology

Study Design: prospective analytical study
Study Centers: Neonatology Division, Department of Pediatrics, Coimbatore Medical College Hospital, Coimbatore, Tamilnadu, India
Duration of the Study: March 2018 to February 2019

III. Materials & Methods

Subjects:

Neonates who were at risk of developing sepsis based on presence of two or more risk factors for early onset neonatal sepsis enlisted. These risk factors were prematurity (<35 completed weeks), prolonged rupture of membrane (>18 hours), premature rupture of membrane, prolonged labour (> 24 hours), foul smelling liquor, maternal fever (>100.4 f), frequent vaginal examinations (>3) and birth asphyxia. Umbilical cord blood, peripheral vein blood and sample for sepsis screen were collected within 24 hours of birth of neonates with presence of two or more risk factors for neonatal sepsis.

A. Inclusion Criteria:

Newborns with two or more risk factors for sepsis

B. Exclusion Criteria:

a) Newborns with congenital anomalies
b) outborn babies

Procedure/Intervention:

Umbilical cord blood collection

The umbilical cord was clamped on both placental and umbilical end and blood was drawn from placental end of umbilical vein by 22gauge syringe, 2 ml blood was collected . The needle from syringe was replaced with a new sterile needle and the culture bottle top was wiped with alcohol. 1 mL of blood was injected in an aerobic blood culture bottle and sent to the laboratory.

Peripheral venous blood collection

After providing routine care, peripheral vein blood collection was done using sterile technique in a separate culture bottle and labeled. Both culture samples were immediately taken to microbiology laboratory.
The results were collected, tabulated and analysed.

Data collection:

$$n = \frac{t^2 \times p(1-p)}{\text{m2}}$$

n =required sample size
t =confidence level of 95%(standard value of 1.96)
p =Expected Frequency of the Factor under study – 46%
m= margin of error of 5%(standard value of 0.05)

$$n = \frac{1.96^2 \times 0.46(1-0.46)}{0.05 \times 0.05}$$

n=382 contingency
The sample is further increased by 5% to account for contingencies such as non-response or recording error.
n+ 5% =382 + 5% = 400 samples

Stastistical Analysis

Chi Square test was used as a test of signi□cance. A p-value of less than 0.05 was considered statistically signi□cant. The validity of UCBC for diagnosis of early neonatal sepsis was measured by means of sensitivity, specificity, positive predictive value and negative predictive value. ROC curve was performed. Pearson coefficient correlation was used to assess the relationship between the variables.

IV. Observations And Results

DISTRIBUTION OF CASES –GESTATIONAL AGE

Among 400 neonates 35%(140) were between 28-34 weeks 27.5%(110) were less than 28 weeks,18%(80)were between 34-37weeks ,17.5%(70)were > 37 weeks.

MODE OF DELIVERY DISTRIBUTION

Out of 400 neonates 270(67.5%) were born by caesarian section

BIRTH WEIGHT DISTRIBUTION

Among 400 neonates 163(40.7%) were between 1-1.5 kg, 99(24.75%) were <1kg, 90(22.5%) between 1.5 to 2.5kg, 58(14.5%) were >2.5kg

MATURITY DISTRIBUTION
Out of 400 neonates, 242 babies(60.5%) were born as preterm and158(39.5%) were born as term
SEX DISTRIBUTION
Out of 400 neonates,214(53.5%) were females and 186(46.5) were male babies
PARITY DISTRIBUTION WITH STUDY SUBJECTS
Among 400 newborns 56% were born to primi mother,35% gravid 3,4% gravid 4 & gravid 2,1% born to gravida 5.

RESULT OF UCBC VS PVBC

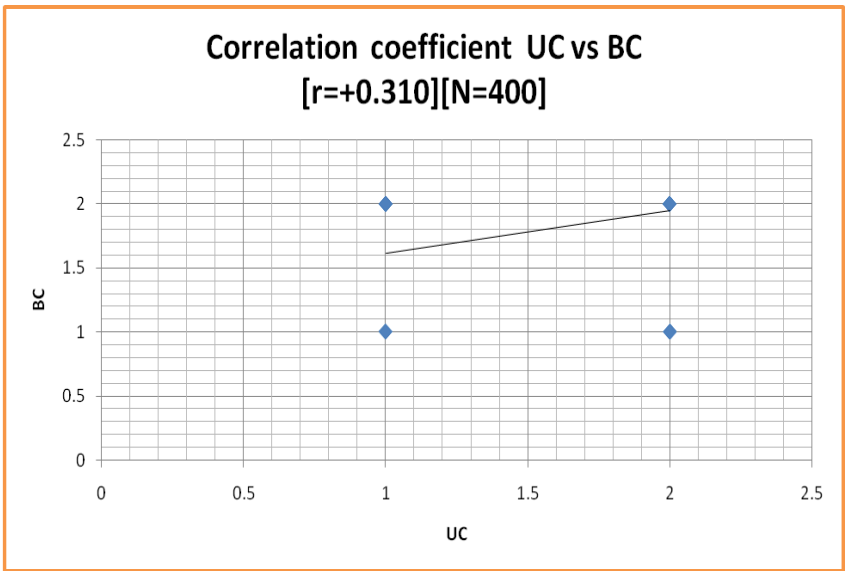
Result of Umblical cord Blood culture and Peripheral Venous Blood culture				
Culture				
Result	UCBC	(%)	PVBC	(%)
Positive	30	7.5%	26	6.5%
Negative	370	92.5%	374	93.5%
Total	400		400	

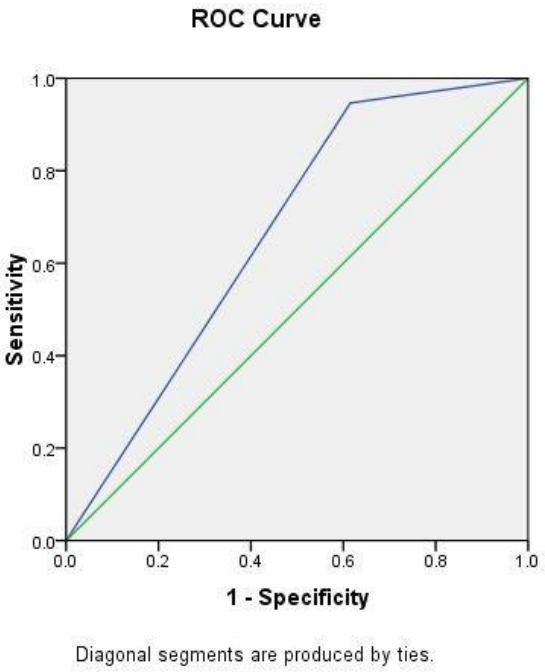
COMPARISON OF SEPSIS SCREEN RESULTS WITH UCBC
Out of 400 ,116 were positive for sepsis screen, Among 116 ,23 were positive for umbilical cord blood culture. Which is statistically significant. Comparison of sepsis screen results with UCBC results found to have sepsis screen sensitivity of 76.6% and specificity 74.8%. Positive predictive value 19.6% Negative predictive value97.5%
COMPARISON OF SEPSIS SCREEN RESULTS WITH PVBC
Out of 400, 116 were positive for sepsis screen , and among 116 ,15 were positive for blood culture,which is statistically insignificant. In comparison to PVBC,sensitivity of sepsis screen was found to be 57.6% and specificity was 72%. Positive predictive value12% Negative predictive value 96%

COMPARISON OF UCBC VS PVBC

UMBLICALCORD BLOOD CULTURE	PERIPHERAL VENOUS BLOOD CULTURE			
	POSITIVE		NEGATIVE	
	FREQUENCY	%	FREQUENCY	%
POSITIVE	22	84%	8	2%
NEGATIVE	4	15%	366	97.8
TOTAL	26		374	

IN Comparison to PVBC ,the sensitivity of UCBC was found to be 84% and specificity of 97%. Positive predictive value 73% Negative predictive value 98%.





ORGANISM	*UCBC*		*PVBC*
	FREQUENCY	*%*	*FREQUENCY*
Group B streptococci	*1*	*.2%*	*1*
Staphylococcusaureus	*6*	*1.5%*	*7*
Klebsiella	*7*	*1.5%*	*8*
Acinetobacter	*8*	*2%*	*7*
Pseudomonas	*1*	*.2%*	
E.COLI	*5*	*1.25%*	*2*
CONS	*2*	*.5%*	*1*

Culture isolates in UCBC samples Group B Streptococci grown in 1sample both in UCBC and PVBC. Staphylococcus aureus was found in 6 UCBC sample and 7 in PVBC samples .Klebsiella was found in 7samples in UCBC and found positive in 8 PVBC samples. Acinetobacter grown in 8 UCBC samples and 7 in PVBC samples. Pseudomonas found positive only in UCBC.E.coli was found in5 samples in UCBC and 2 samples in

PVBC, 2 samples were positive for CONS in UCBC and 1 sample in PVBC.In UCBC 370 (92.5%) samples did not show any growth in PVBC 374(93)samples did notshow any growth. 0rganisms grown in both umbilical cord blood culture andperipheral venous blood culture were comparable.

V. Discussion

The present prospective cohort study was conducted among 400 neonates having risk of developing early onset sepsis . Among 400 neonates 116(29%) were positive for sepsis screen, sensitivity and specificity of sepsis screen was 76% and 75% respectively when compared to UCBC,57% &76% when compare to PVBC. Among 400 neonates 30 (7.5%) found to have UCBC result positive while remaining did not show any growth and 26(6.5%) found to have PVBC positive while remaining did not show any growth Culture isolates in UCBC samples Group B Streptococci grown in 1sample both in UCBC and PVBC. Staphylococcus aureas was found in 6 UCBC sample and 7 in PVBC samples .Klebsiella was found in 7 samples in UCBC and found positive in 8 PVBC samples. Acinetobacter grown in 8 UCBC samples and 7 in PVBC samples. Pseudomonas found positive only in UCBC.E.coli was found in 5 samples in UCBC and 2 samples in PVBC, 2 samples were positive for CONS in UCBC and 1 sample in PVBV.In UCBC 370 (92.5%) samples did not show any growth,in PVBC 374(93.) samples did not show any growth.

VI. Conclusion

Blood culture obtained from an umbilical cord has good diagnostic validity for etiological diagnosis of early onset sepsis in high risk neonates as compared with PVBC. Organisms grown in umbilical cord blood samples are comparable with venous blood culture.

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