

Utility of Umbilical Cord Blood Culture in the Diagnosis of Early Onset Sepsis: A Cross-sectional Study

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ABSTRACT

Introduction: Umbilical cord is the first source of blood from the neonate. The clinical signs associated with sepsis are frequently non specific and subtle in the neonates making the diagnosis of infection difficult. Umbilical cord blood does not involve pain infliction, avoids iatrogenic blood loss and procedural complications.

Aim: To evaluate the utility of Umbilical Cord Blood Culture (UCBC) in the diagnosis of Early Onset Sepsis (EOS).

Materials and Methods: The present study was a cross-sectional study carried out in Neonatology unit of Department of Paediatrics, Rural Medical College, Loni, Maharashtra, India, for the period of mid-March 2021 to mid-September 2021. Neonates delivered in Rural Medical College to the mothers having the risk factors for EOS were included in this study. Informed consent was taken prior to start of study. Thus, 68 samples were collected and studied. UCBC was collected with all aseptic precautions immediately

after the umbilical cord was cut after the birth of the baby, venous blood sample was collected within one hour of birth. The data was presented as count and percentages.

Results: Majority were female neonates 40 (58.8%). On analysing maternal risk factors it was seen that 8.8% had previous low birth weight and 13.2% had Rh negative status. Analysis for presence of risk factors for sepsis majority 79.4% were multiple times examined per vaginally, followed by 36.8% had foul smelling liquor, 11.8% had febrile illness and 5.8% had birth asphyxia. On umbilical cord culture and sensitivity, most common microorganism identified was *Staphylococcus aureus* 8 (11.8%), followed by 8.8% *Pseudomonas* species. So, present study shows that 35.3% (24 cases) had positive culture reports using utility of UCBC in 68 patients.

Conclusion: Study concludes that umbilical cord blood sampling and culture can be used as a tool for diagnosing bacterial sepsis in neonates especially the high-risk neonates.

Keywords: Antibiotics, Birth weight, Haematology, Neonatal septicaemia

INTRODUCTION

Being an initial haematological source, umbilical cord blood can be a beneficial diagnostic examination for EOS in neonates, but it is not used commonly [1]. Blood culture from the peripheral vein still remains as the gold standard for neonatal sepsis. However, due to inadequate sample volume, administration of antibiotics prior to sample collection and administration of intrapartum antibiotics, there is inconsistency in blood culture sensitivity [2]. Organisms responsible for neonatal sepsis is important to identify for appropriate antibiotic selection and administration as duration of treatment depends on it [3,4].

The clinical signs associated with sepsis are frequently non specific and subtle in the neonates making the diagnosis of infection difficult. Moreover, awaiting the clinical emergence of the sepsis before beginning treatment diminishes the chances of successful outcome. The procedure of withdrawing blood from peripheral vein is very painful and it even requires skilled and trained healthcare personals. For proper culture, proper technique and time is required. Whereas, on other hand the withdrawal of umbilical cord blood is painless and less complicated.

It is seen that the UBCC is reliable and safe for evaluation of sepsis among the asymptomatic neonates. It can also be used for screening purpose of EOS among the high-risk group. UCBC shows around ~20-47% positivity in high-risk neonates [1-5]. Present study was thus undertaken to evaluate the utility of UCBC in the diagnosis of EOS.

MATERIALS AND METHODS

A cross-sectional study was carried out in Neonatology unit of Department of Paediatrics, Rural Medical College, Loni, Maharashtra,

India for the period of six months mid-March 2021 to mid-September 2021. Neonates delivered in Pravara Rural Hospital to the mothers having the risk factors for EOS were included in this study. Institutional Ethical Committee (IEC) approval was taken Number (PIMS/DR/RMC/2021/462). Informed consent was taken from the parents before including the case in the study.

Inclusion criteria: All singleton neonates delivered in PRH with birth weight >1500 gm and >32 weeks those were at risk of developing EOS based of presence of two or more risk factor such as:

- Preterm
- Low birth weight
- Premature or prolong rupture of membrane (>18 hours)
- Prolong labour (>24 hours both stages) and difficult delivery with instrumentation
- Febrile illness in the mother during or within two weeks of delivery
- Meconium foul smelling and/or meconium stained liquor Amnii
- Birth asphyxia
- Urinary Tract Infection (UTI)
- Foetal distress
- Single unclean or more than three vaginal examination during labour.

Exclusion criteria:

- 1) Baby weight <1500 gm
- 2) Gestational age <32 weeks
- 3) Baby without above risk Factors
- 4) Outborn Babies

UCBC and Processing

The umbilical cord was clamped at the placental side and the infant side. Thereafter the cord was cut and handed over to the nurse. The cord was wiped three times with 70% isopropyl alcohol using sterile technique. Using a sterile 22-gauge needle and syringe, approximately 2 mL of blood was drawn into the syringe from the umbilical vein or artery from placental end. Syringe was replaced with a new sterile needle and the top of culture bottle was wiped with alcohol. Then 2 mL of blood was injected in an aerobic blood culture bottle and sent to the microbiology laboratory. Sample was processed for five days and sample which was reported positive, detail antibiotic sensitivity was done. Thus, such 68 samples were collected and studied.

STATISTICAL ANALYSIS

The data was collected in Microsoft Excel sheet and results were presented as count and percentage.

RESULTS

Utility of UCBC in 68 patients were evaluated and majority patients were female children's (58.8%) [Table/Fig-1]. Female preponderance was more with female:male ratio of 1.4:1. Mean birth weight was 2276.83 grams. Majority 45.5% had birth weight <2000 grams (very low birth weight). Only 32.4% had normal birth weight i.e >2500 grams. On analysing maternal risk factors it was seen that previous neonatal death were 47.8%, 8.8% were previous low birth weight and 13.2% had Rh negative status. Laboratory investigation and risk factors for sepsis is shown in [Table/Fig-2,3]. Only 10.3% neonates had positive CRP levels for sepsis. [Table/Fig-4] shows that on UCBC, 35.3% were culture positive and most common microorganism identified was *Staphylococcus aureus* 11.8%, followed by 8.8% *Pseudomonas* species and so on.

Parameters	Frequency	Percentage
Gender		
Male	28	41.2
Female	40	58.8
Birth weight in grams		
<2000	31	45.5
2000-2500	15	22.1
>2500	22	32.4
Risk factor		
Previous baby low birth weight present	6	8.8
Rh positive	59	86.8
CRP		
Negative	61	89.7
Positive	7	10.3

[Table/Fig-1]: Demographic and other investigations (N=68).
Maternal risk factors for sepsis

Parameters	Mean±SD
Haemoglobin (g/dL)	18.31±2.2
Total leukocyte count (cells/μL)	11436.8±5695.2
Neutrophil (cells/μL)	52.56±16.9
Monocyte (cells/μL)	10.53±8.16
Lymphocyte (cells/μL)	32.35±17.88
Eosinophil (cells/μL)	2.31±2.77
Basophil (cells/μL)	0.05±2.23
Platelet count (cells/μL)	245.88±60.11
PCV (mL)	56.84±7.04
ESR mm/hr	8.32±5.26

[Table/Fig-2]: Laboratory investigation in neonates.
PCV: Packed cell volume; ESR: Erythrocyte sedimentation rate

Risk factors for sepsis	Count	Percentage
Febrile illness	8	11.8%
Foul smelling liquor	25	36.8%
Birth asphyxia	4	5.8%
Multiple Per/Vaginal examination	54	79.4%

[Table/Fig-3]: Presence of risk factors for sepsis (N=68).
Multiple risk factor

Umbilical blood cord culture	Count	Percentage
<i>Acinetobacter</i>	2	2.9
<i>Candida</i> species	1	1.5
Coagulase negative staphylococci	2	2.9
Contaminant growth (gram positive anaerobic bacilli)	3	4.4
<i>Klebsiella oxytoca</i>	1	1.5
<i>Pseudomonas</i> species	6	8.8
<i>Staphylococcus aureus</i>	8	11.8
<i>Streptococcus</i> species	1	1.5
Sterile	44	64.7

[Table/Fig-4]: Umbilical blood cord culture (N=68).

DISCUSSION

Present study showed female preponderance. It was seen that 58.8% were female child. Female:male ratio was 1.4:1. Study by Kalathia MB et al., [5] showed that F:M was 26:17, but in study by Ojha M et al., [6] males were more than females. M:F was 1:0.9. Jain P and Gosai M [7] showed that males were more M:F was 14:12.

Mean birth weight was 2276.83 grams. Majority 45.5% had birth weight <2000 grams. That means very low birth weight. Only 32.4% had normal birth weight i.e >2500 grams. Study by Kalathia MB et al., [5] showed that mean birth weight was 2.25 kgs, similar to present study. Study by Ojha M et al., [6] showed that, 51% neonates had a normal birth weight (>2.5 kg) whereas 33% neonates had a birth weight between 1.5 and 2.5 kg. 14 (14%) and 2% neonates had very low birth weight (<1.5 kg) and extremely low birth weight (<1 kg), respectively. Jain P and Gosai M [7] showed that among Peripheral Venous Blood Culture (PVBC) positive neonates 18 neonates had weight between 1-2 kgs, no neonate was below 1 kg but among UCBC group one neonate had weight less than 1 kg.

On analysing maternal risk factors it was seen that 8.8% had previous low birth weight and 13.2% had Rh negative status. Analysis for presence of risk factors for sepsis majority 79.4% were multiple times examined per vaginally, followed by 36.8% had foul smelling liquor, 11.8% had febrile illness and 5.8% had birth asphyxia. Study by Kalathia MB et al., [5] showed 24.44% high-risk factors. Study by Ojha M et al., [6] showed that 19% cases had foul smelling liquor. Jain P and Gosai M [7] showed respiratory distress in (28.6%) followed by 23.8% having abdominal distension while none had sclerema, bleeding and hypoglycaemia, Tyler CW jr and Albers WH [8] showed 9%, Polin JI et al., [4] showed 3%. A study by Rathi PP, [9], early-onset neonatal sepsis was present in 13% of the neonates and had occurrence of foul smelling. There are various studies since ages for UCBC such as Tyler CW jr and Albers WH [8], Polin JI et al., [4], Pyles CV et al., [10], Herson VC et al., [11], all of them collected the umbilical cord blood for diagnosis the sepsis.

On UCBC, most common microorganism identified was *Staphylococcus aureus* 11.8% and 8.8% *Pseudomonas* species. Only 10.3% neonates had positive CRP levels for sepsis. Previous data by Bhat YR et al., [12] on 2182 neonates showed 33.2% of the *Pseudomonas* which was the highly isolated organism, followed by *Klebsiella* (31.4%), *Acinetobacter* (14.4%), *S. aureus* (9.2%), *E. coli* (4.4%). In a study by Tallur SS et al., [13] *Klebsiella* and *Pseudomonas* found to be the most common organisms causing EONS. Even Chacko B and Sohi I [14] found majority of *Pseudomonas* (60%).

So, present study shows that 35.3% (24 cases) had positive culture reports using UCBC in 68 patients. Study by Kalathia MB et al., [5] showed 24.44% positive rate on UCBC and *Pseudomonas* was most common organism found. Results were similar to present study. Study by Ojha M et al., [6] showed 32% had positive sepsis findings. Similar findings were seen in present study. Even Pryles CV et al., [10], Chacko B and Sohi I [14], and Fos NI et al., [15] showed 31%, 20.6%, and 28% positive rate, respectively. Pais M et al., [16] also showed most common organism found as *Pseudomonas* 11.46%. Same results were seen by Meena R et al., [17] where, UCBC was positive in 21.2%. All culture positive neonates were subclinical cases, which suggest early diagnosis of sepsis and helps in further management.

Limitation(s)

The study sample size was small and patients history was not complete in some cases.

CONCLUSION(S)

Study concludes that UCBC can be used as a tool for diagnosing bacterial sepsis in neonates especially the high-risk neonates. One more risk factor exceptionally identified was the multiple per vaginal examinations. Doctors should take utmost care and follow aseptic conditions so as to decrease the further complications.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Apr 11, 2022
- Manual Googling: Jun 27, 2022
- iThenticate Software: Jul 05, 2022 (25%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Apr 06, 2022**
Date of Peer Review: **May 31, 2022**
Date of Acceptance: **Jul 06, 2022**
Date of Publishing: **Sep 01, 2022**