

Two Sites Blood Cultures Compared to Standard Single Site Blood Culture in Diagnosis of Neonatal Sepsis

Two Sites VS Single Site Blood Culture in Diagnosis of Neonatal Sepsis

Haris Abdullah, Mimpal Singh, Shahida Nazir, Aneela Anjum and Liaqat Ali

ABSTRACT

Objective: To compare the yield of two sites blood cultures versus standard single site blood culture for the diagnosis of neonatal sepsis.

Study Design: Randomized Controlled Trial study

Place and Duration of Study: This study was conducted at the Neonatal Unit of Pediatric Medicine Unit-II, Mayo Hospital Lahore from March 1st, 2019 to August 31st, 2019.

Materials and Methods: 70% isopropyl alcohol were used to clean the skin upto 30 seconds to collect blood cultures, then cleaned again with 51-2% tincture of iodine and isopropyl alcohol. Blood samples of 11 mL were taken from each of the two peripheral veins and were inoculated into vials of BactT/Alert (Paed Plus). Observe cultures for 5 days before reporting a negative result. Single blood culture was taken of group-A and two blood culture was taken from group-B. In group- B, even single positive blood cultures were taken as significant and its yield was compared with group-A. Data were analyzed using SPSS v25.20. Data were stratified for age and gender to deal with effect modifiers. Post-stratification, Chi-Square was applied. A p-value ≤ 0.05 was considered significant.

Results: Total 150 neonates with suspected sepsis were enrolled for this study. Neonates were divided into two groups i.e. Group-A (Single site blood culture) and Group-B (Two site blood culture). In group-A, 54(72.40%) patients were male and 21(28.0%) were female. In group-B, 44 (58.7%) patients were male and 31 (41.3%) were female. In group-A, mean age was 14.94 ± 7.69 days and 13.85 ± 7.44 days in group-B. In single site blood culture group, 23 (30.7%) patients had positive yield and 42(56.0%) patients had positive yield two site blood culture group with a p-value of 0.002, which is statistically significant.

Conclusion: Two blood cultures collected synchronously from 2 places to increase pathogen detection rates as compare to conventional 1 culture blood.

Key Words: Neonatal Sepsis, Single Site Blood Culture, Two Site Blood Culture

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INTRODUCTION

Neonatal sepsis is the leading cause of neonatal deaths globally¹. The incidence of neonatal sepsis in Pakistan is approximately 31.3/1000 live birth. Initial diagnosis and targeted treatment are key to reduce neonatal mortality from sepsis and the burden of antibiotic resistance development². Blood cultures are still an important and Gold standard measure for the diagnosis of infection³.

Blood cultures in the neonatal period are contested in terms symptomatic accuracy due to intra-partum antibiotic, use previous antibiotic in referring hospitals, and growth of low microbial colonization number⁴. Different approaches were applied to increase the output of blood cultures. Such approaches involve the sort of large volumes of blood in vials, automatic systems to monitor the blood culture on regular basis and the adoption of numerous blood cultures, and the use of 2 or more than 2 blood cultures, maintaining a blood to broth ratio of 1:5 to 1:10 to avoid samples from indwelling catheters due to risk of contamination and use of repeat blood cultures.⁵ In a study conducted by Tomar et al found that two blood cultures collected synchronously from 2 places to increase pathogen detection rates as compare to conventional 1 culture blood. They included 475 neonates with suspected sepsis out of which 185 patients had only the first positive culture (38.9%). When they added positives in the 2nd culture, the output improved up to 221 (46.5%).

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Adding the 2nd culture improved culture output upto 36 (7.6%; 95% CI 2.41 to 12.79; p=0.018)⁶. Wiswell et al were one of the first to document the two sites benefit of blood culture in the early examination of newborn sepsis. They collected two sample of blood cultures (aerobic and 1 anaerobic) from various places during the first week of life from 460 infants. Bacteremia was diagnosed in 8 cases, although contamination of the skin flora in 10 cases was confirmed.⁷ Sarkar et al also conducted a study with two peripheral blood cultures in diagnosis of neonatal sepsis⁸. In a study, 73.1% were detected with first blood culture and 89.7% were detected with second blood culture.^{9,10}

MATERIALS AND METHODS

This study was conducted at Neonatal Unit of Pediatric Medicine Unit-II, Mayo Hospital Lahore. Duration of Study: March 1, 2019 to August 31, 2019.

Study Design: Randomized Controlled Trial

Sampling Technique: Non-Probability Consecutive Sampling

Sample Size: Sample size of 150 (75 in each group) was calculated at 5% level of significance and 80% power of test and taking an expected percentage of yield in first culture as 73.1% and 89.7% in second culture.

Sample Selection:

Inclusion Criteria: All neonates of either gender having > Until the 28 days of life 130 weeks of gestation admitted to the unit. Patients with suspected neonatal sepsis as defined in operational definition.

Exclusion Criteria: Infected children who took antibiotics prior to sampling will be excluded.

Data Collection Procedure: After approval of the synopsis from the ethical review committee, informed consent was taken from the guardian of the child. All patients fulfilling the operational definition were recruited. Patients fulfilling definition were randomly divided in 2 groups, group-A and B by lottery method. 70% isopropyl alcohol were used to clean the skin up to 30 seconds to collect blood cultures, then cleaned again with 51-2% tincture of iodine and isopropyl alcohol. Blood samples of 11 mL were taken from each of the two peripheral veins and inoculated into BactT/Alert vials (Paed Plus). Cultures observed for 5 days before reporting a negative result. Ingle blood culture was taken of group-A and two blood culture was taken from group-B. In group-B, even single positive blood cultures were taken as significant and its yield was compared with group-A.

Data Analysis Plan: Data were analyzed using SPSS v25.0. Mean and standard deviation were calculated for the quantitative variable like age. Frequencies and percentages were calculated for qualitative variables like gender and yield. Data were stratified for age and gender to deal with effect modifiers. Post-stratification,

Chi-Square was applied. A p-value ≤ 0.05 was considered significant.

RESULTS

Total 150 neonates with suspected sepsis were enrolled for this study. Neonates were divided into two groups i.e. Group-A (Single site blood culture) and Group-B (Two site blood culture). In group-A, 54(72.40%) patients were male and 21 (28.0%) were female. In group-B, 44(58.7%) patients were male and 31(41.3%) were female. In group-A, mean age was 14.94 ± 7.69 days and 13.85 ± 7.44 days in group-B. In group-A, 40(53.3%) patients were in 0-14 days age group, while 35(46.7%) were in 15-28 days. In group-B, 41(54.7%) patients were in 0-14 days age group, while 34(45.3%) were in 15-28 days. In single site blood culture group, 23(30.7%) patients had positive yield and 42(56.0%) patients had positive yield two site blood culture group with a p-value of 0.002, which is statistically significant.

Table No.1: Comparison of gender distribution between groups

Gender	Groups		Total
	Single site blood culture	Two site blood culture	
Male	54	44	98
	72.0%	58.7%	65.3%
Female	21	31	52
	28.0%	41.3%	34.7%
Total	75	75	150
	100.0%	100.0%	100.0%

Table No.2: Comparison of age distribution between groups

Age Groups	Groups		Total
	Single site blood culture	Two site blood culture	
0-14 days	40	41	81
	53.3%	54.7%	54.0%
15-28 days	35	34	69
	46.7%	45.3%	46.0%
Total	75	75	150
	100.0%	100.0%	100.0%

DISCUSSION

In this study we have observed that taking two blood cultures increased the culture yield up to 25.3%. Primary morbidity was Comparable in children with one or two positive cultures, but greater than in children with two infertile cultures. In the past cultural-positive researches in infant have described isolation rates 25% to 60%¹¹⁻¹³. Despite that some researches had indicated a decrease rate in the positivity of culture. This may be due to the lower amount of blood collected to

administrate the antibiotics before sampling¹³⁻¹⁵. Wiswell et al.⁷ was one of the first to document the two sites benefit of blood culture in the earlier examination of newborn sepsis. They collected two sets of blood cultures (aerobic and 1 anaerobic) from various places during the first week of life from 460 inborn infants. Bacteremia was diagnosed in 8 cases, although contamination of the skin flora in 10 cases was confirmed. This study was retrospective that only included neonates up to 7th days of life.

Sarkar et al⁸ in a prospective research blood cultures were collected from 2 different distal places within 15 to 30 minutes in 216 newborn with suspected sepsis. In their research 22 episodes of cultured sepsis occurred in 20 (9.2%) of 216 infants. All infants who have positive cultures developed the same organism with pattern susceptibility from 2 distal places. Blood cultures from both sites were negative for the remaining 196 neonates. They documented no benefit of two-site culture in detecting neonatal sepsis. The difference in the results of this study may be because of small size of sample and the involvement of only inborn neonates.

CONS and *Candida* spp. are often isolated organisms in newborns who have been admitted in neonatal intensive care center.¹⁶ Since the particular microbes are element of the skin flora, those can be less contaminant in the blood culture process if the skin is not prepared well before the culture is performed¹⁷⁻¹⁹.

Struthers, et al²⁰ was carried out a prospective study to differentiate pathogenic from contaminating CONS and reduce the use of antibiotics. After 48 hours of life, 100 pairs of cultures were taken from two percutaneous sites from 69 babies with suspected sepsis. They also considered one positive culture of CONS as contaminant and both positive cultures as infection. They differentiated between contaminating CONS in 5 new born grown in only one of the two cultures and pathogenic CONS in 16 neonates with both positive cultures. In contrast, a large proportion of the isolates in this study were reported as contaminants.

CONCLUSION

Two simultaneous blood cultures significantly improved the rate of where septic infants have a high rate of admissions. Two blood culture policy helps exclude contamination in units with high rates of these organisms.

Author's Contribution:

Concept & Design of Study:	Haris Abdullah, Mimpal Singh
Drafting:	Shahida Nazir, Aneela Anjum
Data Analysis:	Aneela Anjum, Liaqat Ali
Revisiting Critically:	Haris Abdullah, Mimpal Singh
Final Approval of version:	Haris Abdullah, Mimpal

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Conflict of Interest: The study has no conflict of interest to declare by any author.

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