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Microbiological Profile and Risk Factors Associated with Either Onset Sepsis - Study from A Tertiary Care Hospital India

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Abstract

Aim: Identify organisms and risk factors associated with neonatal sepsis.

Worldwide 12% of children are born prematurely (2% of LBW), develop EOS by organisms of maternal genital tract and while resuscitation making up greatest onslaught of death among neonates in proximity. For LOS nosocomial source or community acquired infections are responsible.

Methodology: Blood culture bottles of neonates with probable sepsis routinely received in Department of Microbiology from NICU SKIMS were analyzed on BAC T /ALERT 3D system and VITEK 2 COMPACT to determine AST pattern of isolates. Clinical detail was also noted for either onset septicemia of such neonates.

Results: Blood culture confirmed NNS was proven 14.835% (n=178) among the provisionally diagnosed NNS (n=1200). Bacteremia was observed in 126(71%) neonatal isolates yeilding 73(41%) Gram positive (GP) organisms and with preponderance towards EOS (Chi-square=33.49; p value <0.001) and 53Gram negative (GN) organisms.52 (29%) grew candida sp (NAC = 100%) with preponderance to LOS). Preterm neonates (Chi – square =11.440; p- value < 0.001). LBW and VLBW (Chi-squared test ($\chi 2$) was 9.067) and two-tailed p-value was <0.05) were inclined towards the acquisition of sepsis in early neonatal period.

Conclusion: Perinatal risk factors both maternal and fetal are to be considered with seriousness. Antibiogram should be strictly maintained and followed to avoid any irreparable loss of precious lives.

Keywords: Neonatal sepsis (NNS), Early neonatal septicemia (EOS), late neonatal septicemia (LOS), Gram positive (GP), Gram negative (GN). Non albicans candida (NAC)

Introduction

Early-onset infections are caused by organisms present in maternal genital tract and occur due to ascending infection following rupture of membranes or during birth of the baby through infected birth canal and at the time of resuscitation[1].Though in severe sepsis, neonate may be symptomatic at birth,[2]mostly they are subtle[3].For late

onset, nosocomial source as a complication of neonatal intensive care or community acquired infections are responsible.[4] Spectrum of organisms that cause neonatal sepsis changes over time ,varies with time of presentation, varies from region to region and have developed multi-drug resistance over the last two decades. Therefore, knowledge of pattern of bacterial isolates and their antimicrobial susceptibility pattern is useful for prompt treatment of patients, in this vulnerable age group with immature immune system. Also, the delay in this process is directly responsible for the high morbidity and mortality due to NNS.[3]

Material methods

Samples for blood culture routinely received were analyzed on BAC T /ALERT 3D and processed further for VITEK 2 COMPACT system to identify organisms to the species level. Repeat blood culture was done if growth was not in accordance with clinical status of neonate.

NNS was categorized on the basis of time of presentation as per standard guidelines as EOS (less than 72h) and LOS (more than 72h)[5]

Inclusion criteria

- Age group of first 28 days of life with probable diagnosis of septicemia.

Exclusion criteria

- Age group of more than 28days of life**.**
- Flag negative blood culture samples on BAC T ALERT.

Clinical details and peri-natal risk factors of neonates with blood culture proven sepsis were noted for either onset.

Institutional Ethical Committee clearance was obtained.

Results

There were 1200 admissions with clinical suspicion of neonatal sepsis, majority as EOS(n=780,65%) and lesser with LOS (n=420, 35%) out of which 178 neonatal blood samples (14.83%) ;(male, n=103 and females, n=75) yielded microbial growth of clinical importance. (EOS; N=98; LOS; N=80) 91 (93%) isolates of EOS origin are from Inborn neonates (hospital born) and 7 (7%) isolates from out born (home delivered) neonates. 65 (81.25%) isolates of LOS origin are from Inborn neonates and 15 (18.75%) of LOS isolates were from out born neonates**.**

Table 1: Association of Gestational age with onset of NNS

Gestational age	EOS	LOS
	Frequency(N)	Frequency(N)
TERM	78	78
PRETERM	20	2
TOTAL	98	80
Chi –square =11.440; p-value< 0.001*		

Table 2: Association of birth weight with onset of infection

Birth weight	EOS	LOS
	Frequency(N)	Frequency(N)
Normal	70	70
LBW	17	9
VLBW	11	1
TOTAL	98	80
Chi –square =9**.067, p**-value=0.011*		

Table 3: Association of maternal risk factor with onset of NNS

Risk factors	EOS	LOS
	Frequency(N)	Frequency(N)
Positive	85	16
Negative	13	64
TOTAL	98	80
Chi –square = 79.92; p-value <0.001*		

Table 4: Maternal risk factors associated with NNS

RISK FACTORS	Frequency (n)	%
Fever (chorioamnionitis)	36	35%
UTI	65	64.36%
Total	101	100%

Out of 98 isolates from EOS, 20(20.4%) are from preterm (<37W) and of 80 LOS isolates 2 isolates (2.5%) are from preterm neonates. (Table 1). Isolates of 17 LBW (2500-1500g) neonates were from EOS and 9 isolates of such neonates were from late onset, accounting for 17.3% and 11.3% of total sepsis of respective onset categories. Isolates from VLBW neonates (<1500g) accounted for 11 isolates (11.2%) EOS and 1isolate (1.3%) of late onset origin. (Table 2*)* A total of 101 [EOS=85 (84%); LOS=16 (16%)] isolates were observed to have association with maternal risk factors, fever, 36 (35%) and UTI, 65 (64.36%). [table 3,4]

Table 5:	Distribution of isolates.			
	Isolates	Total Frequency(N)	EOS (N)	LOS (N)
Total isolates (n=1200)	Clinically significant isolates (n=178)	178	98	80
Clinically	Gram positive isolates	73	63	10
	Gram negative isolates	53	25	28
	Yeast (NAC)	52	10	42

Out of 178 isolates ,73(41. %) yielded Gram positive organisms, 53(30%) were Gram negative organisms and 52 (29%) demonstrated yeast. (Table 5) Majority Gram positive isolates showed preponderance towards EOS and were S. aureus (n=27); followed by S. epidermidis (n=21) and 5 isolates of Enterococcus sp;

Among Gram negative isolates, Klebsiella pneumoniae was most found isolate(N=20) followed by Acinetobacter Baumannii (n=14). All yeast isolates were NAC, most found among was C. Krusie.

Discussion

Prevalence of blood culture proven neonatal sepsis was 14.83% (n = 178) among provisionally diagnosed NNS (n = 1200), similar to observations by Dr. Gargi Pathak et al. (17%).[6]However higher prevalence has been observed in studies conducted by Shah et al (31.6%).[7] Ratio of males to female neonates with NNS was 1:0.7 (male, n=103 and females, n = 75)consistent with local literature reported by Kumar M k et al (1. 5: 1) (60% male versus 40% female).[8]However observations of Aijaz et al were in contradiction (1.3:2).[9] Inborn: out born ratio is similar to findings of Seyval et al.[10]

Incidence of EOS was more than LOS. consistent with the study conducted by V Mehara et al.[11]However a study by Eman M et al, demonstrated 55.8% as LOS.[12] The preponderance of NNS as EOS in our study is contributed to various factors including predominance of inborn and association with perinatal risk factors, add up to the cohort. In contrary Rahim et al reported higher

proportion (27.03%) of out born admitted in NICU with NNS.[13]

The findings of more number of health institution deliveries in our study are probably due to Janani Suraksha Yojana and Janani Shishu Sawasthaya Karyakram Scheme of National Rural Health Mission however, because of smaller cohort of out born we could not establish relative risk of out born to NNS and hence not with the onset of sepsis.

Perinatal risk factors LBW, VLBW and prematurity were significantly related with EOS. (p value <0.001) also demonstrated by Oddie S, Embleton et al.[14] 22 neonates (12.35%) were preterm which is less than number (42.8%) found by Seyal et al.[10]

Attributed to better antenatal and perinatal care and more inborn, our findings are understandable. Premature and LBW babies are relatively immunologically weak which increases risk of sepsis. Moreover, are likely to be subjected to different procedures, which increases chance of acquisition of sepsis in early neonatal period. EOS could be affected by multiple factors and targeted prevention may reduce the incidence of EOS.

Preponderance of Gram-positive organisms (72%) in this study, is similar to F. aku et al.[15]Since Cons (Staphylococcus epidermidis) and Staphylococcus aureus are the major normal flora of skin and in the nose respectively, suboptimal hand hygiene by persons who handle neonates, manipulation of peripheral intravenous lines set up on neonates could contribute to the acquisition of these bacteria. Predominant isolate from LOS is of yeast 29.21%, (n=52), all non-albicans Candida (NAC) similar to study by Koppad et al[16], Widespread use of triazoles (S.R. Rongpharpi et al)[17], use of medical catheters, high-level and prolonged use of antibiotics, preterm birth with low birth weight (Yu Yet al)[18], has contributed to selective increase in C. krusei infection.

Conclusion

The study found both maternal and neonatal factors as possible independent risk factors to have a strong association with risk of neonatal sepsis. The study observed that majority of neonates were males, preterm neonates, LBW, those who needed interventions, h/o maternal fever and were outborns. Therefore, encouraging mothers to utilize antenatal services might help to minimize the risk factors of adverse birth outcomes.

Also in this study Gram positive organisms were found to be responsible for early onset sepsis which are colonisers of skin. Therefore strict need of hand hygiene, avoiding repeated per vaginal examinations in mothers especially having absent membranes, strict asepsis during delivery of newborn, proper sterilization of instruments used during delivery and resuscitation of newborn could be a key factor in reducing neonatal sepsis.

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