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Original Research Article

Clinical profile and outcome of neonates with suspected sepsis form a rural medical college hospital of South India

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ABSTRACT

Background: Sepsis is an important cause of neonatal mortality and morbidity. Nonspecific and subtle clinical features coupled with expensive, time consuming and unavailable definite laboratory tests challenges its accurate diagnosis in clinical practice. Sepsis is traditionally suspected in neonates based on clinical features, maternal and neonatal risk factors and is treated by empirical antibiotics. These risk factors and clinical features are variable depending on geographical, cultural and socio-economic background. We studied the clinical and bacteriological profile of high risk neonates for sepsis development in our Neonatal Intensive Care Unit (NICU), to make the precise clinical diagnosis and prevent inadvertent use of antibiotics.
Methods: A prospective observational study was conducted on 200 neonates with suspected sepsis either by high risk factors and /or clinical features admitted to NICU for a period of nine months. After clinical examination, septic screen including blood culture was done and antibiotics were started as per the NICU protocol.
Results: Of the 200 neonates studied, 20.5% had positive blood culture with Coagulase negative staphylococci (CoNS) and contaminants. 89.5% had early onset of sepsis (EOS). Neonatal profile showed 60.5% males, 55% inborn, 37.5% premature, 49.5% low birth weight babies. Maternal profile showed 49.5% Primigravida, 73% aged above 20 years at delivery and 97.5% literates. Outcome of admitted neonates showed, 72% were discharged after improvement, 10.5% died and 17.5% discharged against medical advice. Death due to respiratory distress syndrome was common in preterm and male neonates.
Conclusions: EOS was common in our NICU. Blood culture showed more CoNS and contaminants necessitating the need for better blood sampling and hand wash technique.

Keywords: Bacteriology, Neonatal sepsis, Newborn, Risk factors, Sepsis

INTRODUCTION

Neonatal sepsis is a clinical syndrome with systemic signs of circulatory compromise caused due to invasion of the blood stream with bacteria.[1] The incidence of neonatal sepsis, according to the data from the National Neonatal Perinatal Database (NNPD, 2002-03) is 30 per 1000 live births.[2] World health organisation has estimated neonatal infections to cause about 1.6 million deaths worldwide and in that 40% of all neonatal deaths due to sepsis occur in developing countries.[3] Diagnosis and management of neonatal sepsis is challenging due to nonspecific clinical

feature and variable laboratory parameters. Blood culture, the gold standard for diagnosis of neonatal sepsis is time consuming and becomes reliable only if performed diligently. Though there are many studies on organisms causing neonatal sepsis and their antibiotic sensitivity pattern, there is no single standardized treatment protocol which can be uniformly applied to all Neonatal Intensive Care Unit (NICU) throughout the country. These variations are probably due to cultural difference in customs and practices during perinatal period resulting in different maternal, neonatal risk factors along with the environmental differences between rural and urban areas.[4,5] This is augmented by differences in the interventions and hospital practices like hand wash, blood collection methods in different hospitals in the same area.[5] Delay in the identification and treatment of neonatal sepsis are among the main contributors to the high neonatal mortality.[6] To recognise high risk factors for sepsis development in our region, we studied neonatal profile and outcome of admitted neonates with suspected sepsis.

Objective of present study was to know the clinical, bacteriological profile and outcome of high risk neonates with suspected sepsis admitted to our NICU.

METHODS

Prospective observational single centre study was conducted at NICU from PES Institute of Medical Sciences and Research, Kuppam for a period of 9 months from January to September 2015. Our NICU has 10 incubators, 4 ventilators and 8 phototherapy units. There is availability of arterial blood gas, pulse oximeters, surfactant therapy and a 24 hour laboratory as well as radiology services. NICU has nurse to patient ratio of 1:1 for ventilated babies and 1:4 for other babies, a paediatrician exclusively posted to NICU in addition to a postgraduate resident and an intern.

Inclusion criteria

All the neonates admitted to NICU either by one or more high risk factors like premature rupture of membranes >24 hours, amnionitis, meconium stained liquor, low birth weight (LBW <2.5 kg), preterm (<37 weeks), >3 per vaginal examinations during labour, requiring active resuscitation in the labour room, Dai handling, fever in the mother during labour, urinary tract infection in the mother.[7-9] This also includes one or more established clinical features suggestive of sepsis such as fever, hypothermia, poor feeding, poor activity, respiratory distress, apnoeic spells, hepatosplenomegaly, abdominal distension, vomiting, seizures, signs of either circulatory or respiratory dysfunction.[8,9] They were screened with septic screen including total leucocyte count, C-Reactive Protein (CRP) and blood culture at admission. Neonates with suspected sepsis in less than 3 days were considered to have early onset sepsis (EOS) and later as late onset sepsis (LOS).

Exclusion criteria

Neonates without blood culture and septic screen at admission and neonates with severe congenital anomalies.

At least 1 ml of blood was collected by aseptic methods from the peripheral vein of neonate with suspected sepsis before starting antibiotics. This was injected into a culture bottle with 10 ml of brain heart infusion broth and 0.025% sodium polyaenthol sulphonate anticoagulant. Bottles were incubated for 7 days at 37°C. They were sub cultured on 2nd, 4th and 7th day on MacConkey and chocolate agar. Growth was identified by colonial characteristics and standard biochemical tests. Admitted neonates were managed with antibiotics as per the NICU protocol. In this study, septic screen with CRP > 6microgram/dl was positive, TC < 5000 or >15,000/dl was considered abnormal.[7] Growth of any organism in the blood was considered as positive growth. Clinical data collected from obstetrics and neonatal case sheets and laboratory results from their records were entered into a predesigned structured Proforma. Institutional ethical clearance was taken. Data was transferred to Microsoft excel sheet 2013 version and analysed statistically by a software strata 14 version. The descriptive statistics of categorical data was analysed using percentages and frequencies and continuous data was analysed using mean and standard deviation wherever applicable. Correlation of all the risk factors with outcome was obtained by using Pearson chi-square test and Fisher's exact test. P value less than 0.05 was considered as significant.

RESULTS

Total neonates including both in and out born babies admitted during the study period with suspected sepsis was 200 (49.3%) out of 405 NICU admissions. Total live births in the institution during the study period was 1314, of which 111 were inborn admissions due to suspected sepsis. Hospital incidence of suspected sepsis was 8.4%.

Table 1: Neonatal profile of suspected sepsis.

Parameter	Variable	Number 200	%
Age at admission	<3days (EOS)	179	89.5
	>3days (LOS)	21	10.5
Sex	Male	121	60.5
	Female	79	39.5
Gestational age	Preterm	75	37.5
	Term	125	62.5
Birth weight	Low birth weight	99	49.5
	Normal birth weight	101	50.5
Place of birth	Inborn	111	55.5
	Out born	89	44.5
Type of delivery	vaginal delivery	126	63.0
	Caesarean section	74	37.0

Neonatal profile showed 55.5% inborn, 60.5% males with male to female ratio of about 1.5:1. Preterm babies and low

birth babies were 37.5% and 49.5% respectively. 63% delivered by normal vaginal route. 89.5% of neonates admitted for suspected EOS.

Table 2: Maternal profile of neonates with suspected sepsis.

Parameter	Variable	Number 200	%
Age	18-20 Years	49	24.5
	21-30 years	146	73.0
	>30 years	5	2.5
Parity	Primi gravida	99	49.5
	Multi gravida	101	50.5
Education status	Illiterate	5	2.5
	Literate/school	152	76.0
	College	43	21.5
Booking status	Booked	163	81.5
	Partially booked	37	18.5
Health status	Normal	152	76
	Abnormal#	48	24

Maternal profile of neonates with suspected sepsis showed 24.5% of women were between 18-20 years of age at the time of delivery. None were below18 years. 49.5% were primigravida, 97.5% went to school or college and only 2.5% were illiterate, 18.5% were partially booked (less than 3 antenatal visits). 24% had co-morbidities like anemia, Hyperemesis, pregnancy induced hypertension during their pregnancy[#].

41 (20.5%) out of 200 blood culture were positive. Of this Coagulase negative *Staphylococci* (CoNS) was 12 (29.2%), *Enterococcus* 7 (17%), *Klebsiella* 3 (7.3%), NFGNB 2 (4.9%), and others (*Streptococcus*, *E. coli*, fungal, MR CoNS and *Pseudomonas*) one each (2.4%). Blood contaminants were 12 (29.2%).

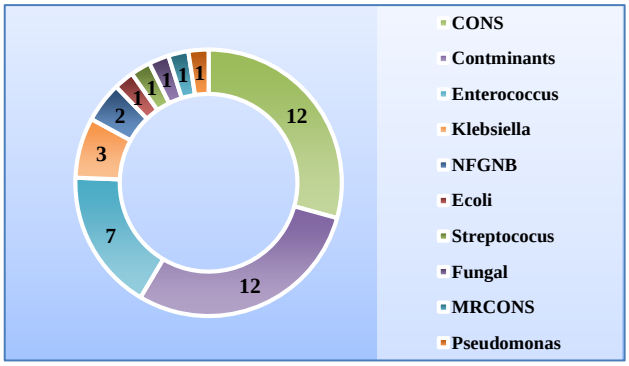

Figure 1: Bacterial profile of neonates with suspected sepsis.

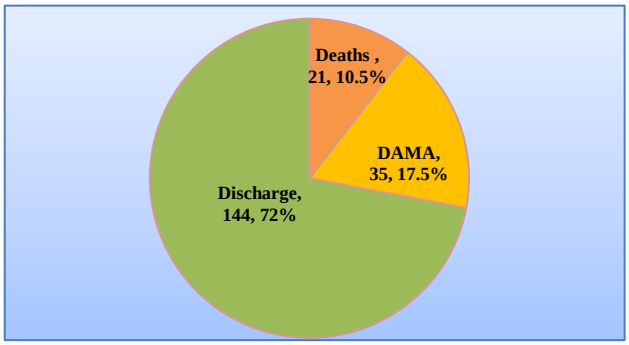

Figure 2: Outcome of neonates with suspected sepsis.

Table 3: Comparison of neonatal profile between dead and discharged neonates with suspected sepsis No-165 (DAMA excluded).*

Para-meter	Variable	Deaths no., (%) 21 (12.7)	Discharge no., (%) 144 (87.3)	P value	Death discharge no. 165*
Onset of sepsis	Early	19 (90.5)	127 (88.2)	0.76	146
	Late	2 (9.52)	17 (11.8)		19
Sex	Male	13 (61.9)	93 (64.6)	0.81	104
	Female	8 (38.1)	51 (35.4)		61
Gestational age	Preterm	12 (57.1)	49 (34.1)	0.40	61
	Term	9 (42.9)	95(65.9)		104
Birth weight	Normal	8 (38.1)	73 (50.7)	0.28	81
	Low	13 (61.9)	71(49.3)		84
Place of Birth	In Born	12 (57.1)	79 (54.9)	0.84	91
	Out Born	9 (42.8)	65 (45.1)		74
Type of the delivery	Normal	12 (57.2%)	92 (63.8%)	0.55	104
	Caesarean	9 (42.8%)	52 (36.2%)		61
	Multi	13 (61.9)	74 (51.4)		87

Out of 200 neonates admitted 144 (72%) were discharged, 21 (10.5%) died, 35 (17.5%). were discharged against medical advice (DAMA).

Maternal and neonatal profile of discharged and dead neonates was not statistically significant after removing 35 DAMA neonates*.

Comparison of neonatal profile with disease wise mortality after excluding neonates with DAMA showed no statistical significance for primary diagnosis of birth asphyxia and sepsis in high risk neonates, whereas deaths due to Respiratory Distress Syndrome(RDS) was statistically significant in premature and male neonates (P <0.05). Case fatality rate due to sepsis is (5/52) is 9.6%.

Table 4: Comparison of maternal profile between dead and discharged neonates with suspected sepsis No-165.*

Parameter	Variable	Deaths no., (%) 21 (12.7)	Discharges no., (%) 144 (87.3)	P value	Death discharge no. 165*
Parity	Primi	8 (38.1)	70 (48.6)	0.36	77
	Multi	13 (61.9)	74 (51.4)		87
Educational status	Illiterate	0 (0%)	5 (3.5%)	0.42	5
	School	136 (1.9%)	116 (80.6%)		129
Booking status	College	8 (38.1%)	23 (15.9%)	0.56	31
	Booked	17 (80.9%)	115 (79.9%)		132
Health	Un booked	4 (19.1%)	29 (20.1%)	0.1	33
	Normal	11 (52.4%)	113 (78.5%)		124
Status maternal age	Abnormal	10 (47.6%)	31 (21.5%)		41
	≤20	4 (19.1%)	35 (24.3%)		39
Parity	21-30	16 (76.2%)	106 (73.6%)	0.51	122
	≥31	1 (4.7%)	3 (2.1%)	0.36	4
	Primi	8 (38.1)	70 (48.6)		77

Table 5: Comparison of disease wise mortality with sex and gestational age No-165.*

Variables (No-165) Mortality rate%		Sex		P value	Gestational age		P value
Death, 21	**Discharge, 144**	**Male 13/93**	**Female, 8/51**		**Preterm, 12/49**	**Term, 9/95**	
Birth asphyxia 38.1%							
Death	8	8	0	0.184	1	7	0.913
Discharge	43	35	8		6	37	
RDS 38.1%							
Death	8	8	0	0.021^	7	1	0.014^
Discharge	49	28	21		20	29	
Sepsis 23.8%							
Death	5	3	2	0.92	4	1	0.126
Discharge	52	30	22		23	29	

Table 6: Comparison of disease wise mortality with birth place and weight No-165.*

Variables (No-165) Mortality rate%		Birth		P value	Birth weight		P value
Death, 21	**Discharge, 144**	**Inborn 12/79**	**Outborn, 9/65**		**LBW, 13/71**	**NBW, 8/73**	
Birth asphyxia 38.1%							
Death	8	3	5	0.73	1	7	0.497
Discharge	43	19	24		10	33	
RDS 38.1%							
Death	8	5	3	0.79	7	1	0.059
Discharge	49	33	16		24	25	
Sepsis 23.8%							
Death	5	4	1	0.23	5	0	0.162
Discharge	52	27	25		37	15	

DISCUSSION

Sepsis constitutes an important cause of neonatal mortality.[3] Variations in its incidence and bacteriology is due to dissimilarities in geographic, cultural and environmental factors as well as hospital practices.[4,5] Early and accurate clinical diagnosis based on maternal and neonatal risk factors, knowledge on prevailing organisms in NICU environment and their antibiotic sensitivity

pattern by periodic audits is essential in order to treat neonatal sepsis effectively with appropriate antibiotics.[10]

Neonatal profile showed 60.5% males similar to other studies where 61.5% and 62.3% were reported.[3,9] Male neonates are more prone for sepsis due to X-linked immune regulatory gene factor.[5] Male preponderance is also due to gender inequality, affordability and accessibility to healthcare facilities.

In present study EOS was 89%, similar to various studies which reported 92.5%, 83% and 70.3% respectively.[10,11,13] Some other studies reported 58% and 53.3% LOS.[7,12] This difference could be due to admission of more out born and referred neonates from other hospitals having different birthing and feeding practices.

Present study had 49.5% low birth weight and 37.5% preterm neonates, a study showed 71.8% preterms and 65.6% low birth weight neonates.[13]

A case control study from Nepal showed 48% of EOS seen in preterms and LBW neonates.[1] This disparity depends on hospital admission policy, availability of NICU facilities for caring preterm and low birth weight babies, presence of other referral hospitals nearby, apart from neonatal sepsis being more common in preterm and LBW babies. In present study 63% of neonates were delivered by vaginal route and two other studies showed 47.6% and 77% respectively, which depends on various maternal and foetal risk factors necessitating instrumental delivery and caesarean section.[7,14]

In this study 55.5% were inborn and 45.5 % out born. In another study from a tertiary care hospital showed that 68% of culture positive neonates were out born.[4] Maternal profile showed 73% were in 21-30 age group with none below 18 years, and 24,5% between 18 to 20 years whereas in a study by shah G, 13 % were below 20 years at the time of delivery.[14] Present study had 49.5% primigravida, whereas 72% seen in another study.[14]

81% of the mothers in present study were booked and 24% had associated co-morbidities like hyperemesis, anemia, and Pregnancy induced hypertension. In present study 97.5% of mothers were literates who had attended school or college, higher than a study which showed 77%.[14]

Blood culture was done at admission in 200 high risk neonates who were suspected to have clinical sepsis among 405 NICU admissions due to various causes, of which culture positivity was seen in 41 (20.5%) neonates. Culture positivity rate from different studies was 8.9%, 22%, 28%, 37.7% and 36.4% respectively.[3,7-9,11] These variations are due to dissimilarities in number of risk factors, blood sampling methods, hand hygiene and prior use of antibiotics. Low culture positivity in our study was due to inclusion of neonates at admission based on one or more risk factors for sepsis development, who probably had no bacteraemia at the time of blood sampling as well as sampling techniques. Out born neonates who were already on antibiotics at the time of blood sampling could have contributed to further low culture positivity.

The common bacteriology of neonatal sepsis differed in various studies, Staphylococci, Klebsiella, Acinetobacter, CoNS were common in some studies.[7-9,13] Present study had 29.2% CoNS and contaminant growth each, similar to a study with 28.5% CONS growth.[5] Our NICU bacterial profile stresses the need for proper hand wash and blood sampling techniques.[5] 10.5% of the admitted neonates with suspected sepsis died, 72% were discharged home after improvement and 17.5% left the hospital against medical advice due to various reasons like affordability, very sick neonate with less chances of survival and other logistic issues.

Among the 21 (10.5%) neonatal deaths during the study period, 5 (23.8%) neonates died primarily with the clinical diagnosis of neonatal sepsis where as other deaths in high risk neonates were due to birth asphyxia and respiratory problems like RDS. In present study, case fatality rate due to sepsis was 5/52 (9.6%) where as another study had 1.5% (7). This is due to severity of sepsis at presentation, other coexisting risk factors like prematurity and LBW, interventions and management of the neonate.

Disease wise mortality was compared with neonatal risk factors like sex, place of birth, prematurity and birth weight. Deaths due to respiratory distress syndrome was more common in males and preterm neonates ($P<0.05$^) and the same risk factors for deaths due to sepsis and birth asphyxia were not statistically significant.

The limitations of this study are that it is a hospital based single centre study which does not truly represent the community. This is an observational case study without controls. In this study though DAMA was excluded for statistical analysis, very sick neonates would have contributed to higher neonatal mortality.

CONCLUSION

EOS was common in our study with CoNS and contaminants being predominant bacterial growth. Maternal and neonatal risk factors in this study were similar to few other studies as quoted. Implementation of quality care pathways for strict hand hygiene and proper blood sampling go a long way to reduce blood contamination and better yield of positive blood cultures so that definite diagnosis of neonatal sepsis can be made.

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REFERENCES

1. Edmond K, Zaidi A. New approaches to preventing, diagnosing and treating neonatal sepsis. PLOS Med. 2010;7(3):e1000213.
2. NNPD Network. National Neonatal-Perinatal Database: Report for 2002-2003. ICMR, New Delhi: 2005. Available at http://www.newbornwhocc.org/pdf/nnpd_report_2002-03.PDF
3. Leela KV, Narayanababu R, Sugunya, Venkatamadhu P, Deepa RR. Study of Bacterial profile in neonatal sepsis and their antibiotic sensitivity pattern in a tertiary care hospital. Int J Curr Microbiol App Sci. 2016;5(6):511-21.
4. Shaw CK, Shaw P, Malla T, Malla K. The clinical spectrum and outcome of neonatal sepsis in a neonatal intensive care unit at a tertiary care hospital in western Nepal: January 2000 to December 2005 – A retrospective study. Eastern J Medicine. 2012;7:119-25.
5. Garg D, Agarwal N. Aetiology and presentation of neonatal septicaemia at tertiary care hospital of Southern Rajasthan. Int J Med Sci Edu. 2014;1:12-20.
6. Gebremedhin D, Berhe H, Gebrekirstos K. Risk factors for neonatal sepsis in public hospitals of Mekelle City, North Ethiopia, 2015: unmatched case control study. PLoS ONE. 2016;11(5):e0154798.
7. Sarasam S, Geetha, Sobha Kumar. Clinical and epidemiological profile of neonatal sepsis in referral care NICU in South Kerala. JMSCR. 2017;5(3):19329-33.
8. Priyamvada R, Ashwani K, Mma Faridi, Iqbal R Kaur, Bineeta K. Clinico-bacteriological profile of neonates born with risk factors of septicemia. IJNMR. 2014;2(1):1-6.
9. Nagaveni P, Suchitra D. clinical profile of neonate admitted with sepsis: a tertiary care experience. IOSR. 2016;15(4):49-56.
10. Oommen SA, Santosh S, Kunkulol R. Bacteriological profile of neonatal septicaemia: a retrospective analysis from a tertiary care hospital in Loni. Int J Med Res Health Sci. 2015;4(3):652-8.
11. Jain KN, Seth D, Mangal V. A clinicomicrobial association in neonatal Septicemia. Pediatric Oncall J. 2010;7:97-9.
12. Haifa A, Faten N, Nasser M, Hanadi A, Riham M, Mohammad H. Risk factors for neonatal sepsis in tertiary hospital in Jordon. JRMS. 2009;16(3):16-19.
13. Raha BK, Baki MA, Begum T, Nahar N, Jahan N, Begum M. Clinical, bacteriological profile and outcome of neonatal sepsis in a tertiary care hospital. Medicine Today. 2014;26(1):18-21.
14. Shah G, Budhathoki S, Das BK, Mandal RN. Risk factors in early neonatal sepsis. Kathmandu Univ Med J. 2006;4:187-91.

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