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Bacteriological profile of neonatal sepsis in atertiary care hospital

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ABSTRACT

Neonatal sepsis is still one of the major causes of morbidity and mortality , in spite of recent advances in health care units[1,7].The estimated global burden for neonatal sepsis was 2,202 per 100,000 live births, with mortality between 11% and 19%. More than 40% of under-five deaths occur in the neonatal period, resulting in 3.1 million newborn deaths each year[2,9].Neonatal sepsis is described as a clinical syndrome characterized by signs and symptoms of infection with or without accompanying bacteremia in the first month of life[3,4].Timely diagnosis of sepsis in newborn, especially in those with risk factors is important in controlling the mortality and morbidity. The knowledge of bacterial spectrum and the antibiogram of the pathogens will help in adapting appropriate control measures and antibiotic policy [5].

Keywords: Neonatal sepsis, preterm, Early onset sepsis, Late onset sepsis

INTRODUCTION

Neonatal sepsis is described as a clinical syndrome characterized by signs and symptoms of infection with or without accompanying bacteremia in the first month of life. Premature rupture of membrane, Preterm delivery (<37 weeks), Multiple per vaginal examination, APGAR score less than 7, Amnionitis, Meconium stained liquor, Low birth weight(<2.5kg), birth asphyxia, and other factors such as delivery settings, type of delivery, antenatal care received, newborn mixed feeding, and some cultural practices for cord care are believed to contribute to the incidence of neonatal sepsis It encompasses various systemic infections of the newborn such as septicemia, meningitis, pneumonia, arthritis, osteomyelitis, and urinary tract infections. [3,12]

Neonatal sepsis can be classified into two types depending upon whether the onset of symptoms is before 72hours of life (early-onset neonatal sepsis—EONS) or later (late-onset neonatal sepsis—LONS)[6]. The clinical presentation and risk factors are different for EOS and LOS ,though the bacteria associated with both early and late onset sepsis is the same in India.[5,11]Early onset sepsis presents with pneumonia whereas in late onset sepsis, meningitis and bacteremia are the common presentations[5]. The diagnosis of neonatal sepsis is based on clinical presentation and the laboratory investigations including Creactive protein, procalcitonin, complete blood count, differential count, blood cultures and molecular methods: PCR. Blood culture remains the gold standard in diagnosis of neonatal sepsis with the identification of the pathogens and the antibiotic susceptibility pattern of the isolate.

Globally, sepsis is still one of the major causes of morbidity and mortality in neonates, in spite of recent advances in health care units[1].The estimated global burden for neonatal sepsis was 2,202 per 100,000 live births, with mortality between 11% and 19%. More than 40% of under-five deaths occur in the neonatal period, resulting in 3.1 million newborn deaths each year.Timely diagnosis of sepsis in newborn, especially in those with risk factors is important in controlling the mortality and morbidity. The knowledge of bacterial spectrum and the antibiogram of the pathogens will help in adaptingappropriate control measures and antibiotic policy [5]

MATERIALS AND METHODS

Neonates with perinatal risk factors such as premature rupture of membranes, multiple per vaginal examination, low birth weight, APGAR score less than 7 or clinical features suggestive of sepsis were included in the study. Neonates

already on antibiotics or Neonate <1.5kg and gestational age <28 weeks and Neonates with major congenital malformation were excluded from the study

A Prospective observational study was conducted among the different neonates from December 2020- July2021 and sample size was calculated using N master sample size software.Blood samples are collected under strict aseptic precautions. Around 1 ml of blood is drawn with sterile syringe and inoculated onto the blood culture media(Brain heart infusion broth-5ml).It is incubated at 37 degree celcius. Turbidity is observed daily and is subcultured on Nutrient Agar, Sheep's Blood Agar, and MacConkey for routine bacterial isolation following the standard operating procedures. Isolates were identifified using conventional methods based on their reaction in biochemical tests. Antimicrobial susceptibility testing was performed by Kirby-Bauer disc diffusion method strictly adhering to the standards stipulated in CLSI 2021 guidelines. The following antibiotics (Hi- Media Disc in µg) were tested for Antibiotic Susceptiblity testing - Oxacillin (OX 30mcg), vancomycin (VA 30mcg), Gentamycin (GEN 10mcg), Erythromycin (E 15mcg), Clindamycin (CD 2mcg), Co-trimoxazole (COT 20/10mcg), Linezolid (LZ 30mcg), Ampicilin (AMP 10mcg), Ciprofloxacin (CIP 5mcg), Piperacillin plus Tazobactum (PTZ100/10mcg), Ceftriaxone (CTR 30mcg), Amikacin (AK 30mcg), Imipenem (10mcg)

RESULTS

Out of 135 sample 58(43%)were culture positive and 77(57%) were negative .Low APGAR score at 1 minute and 5 minute with P value <0.001and maternal infection, Neonatal resuscitation (P value<0.001), mode of delivery(P value 0.16), Low Birth weight(P value 0.21), preterm(P value 0.27), PROM(P value0.89) and Multiple per vaginal examination(P value 0.94) were the risk factors for neonatal sepsis.*MRSA* was most common organism (37.9%). *Klebsiella pneumoniae* was next common organism (24.1%).CONS(12.1%), *E.Coli*(8.6%), *Enterococci faecalis*(5.2%), *Acenitobacter baumani* (5.2%), *Enterobacter aerogenes* (3.4%), *Citrobacter koseri*(1.7%). Gram negative organism were sensitive to imipenum. Gram positive organism were sensitive to vancomycin. High resistance was observed to penicillin

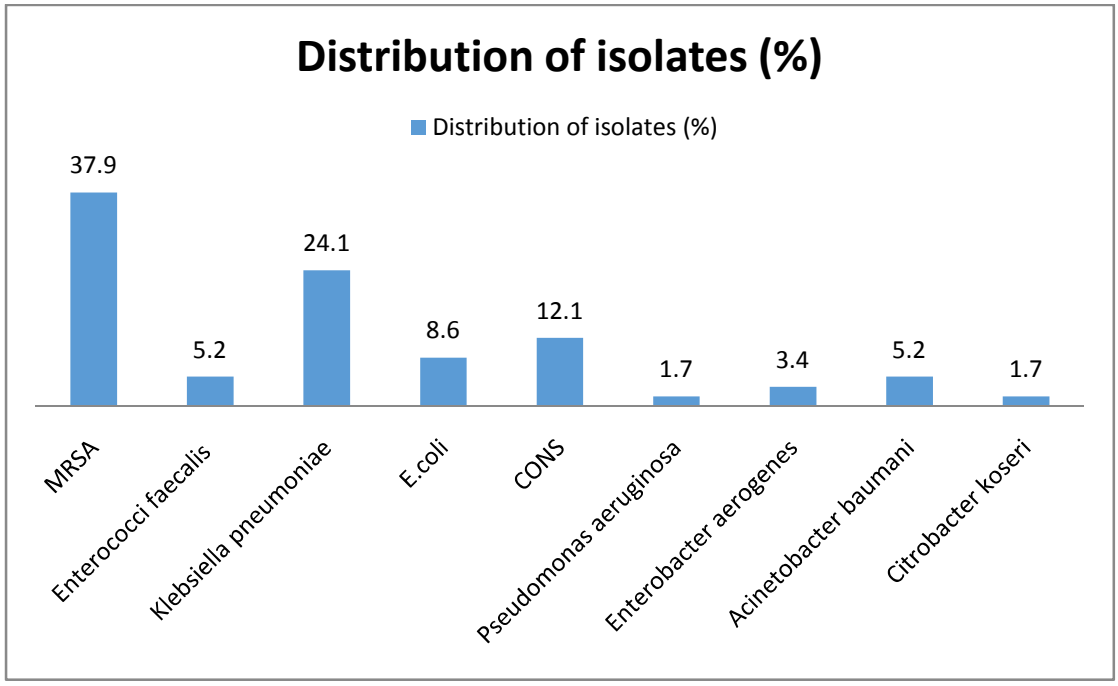

Figure.1.Distribution of isolates

Table.1. Early and Late onset Neonatal Sepsis

Day of life	Neonatal sepsis			
	Present (n=58)		Absent (n=77)	
	No	%	No	%
1-3 days	37	63.8	51	66.2
4-28 days	21	36.2	26	33.8

Table.2. Risk Factorsof Neonatal Sepsis

Risk Factors		Blood Culture positive n=58	Blood Culture Negative n=77	P value
Birth weight	Low birth weight	36	43	0.47
	Normal	22	34	
PROM	Present	21	27	0.89
	Absent	37	50	
Multiple per vaginal examination	yes	26	34	0.94
	no	32	43	
Gestational age	Preterm	23	38	0.27
	Term	35	39	
Maternal infections	Present	24	20	0.05
	Absent	34	57	
resuscitation	Given	33	2	<0.001
	Not given	25	75	
APGAR Score at 1 minute	<7	30	13	<0.001
	>7	28	64	
APGAR Score at 5 minute	<7	20	3	<0.001
	>7	38	74	

Table.3. Antibiotic sensitivity Pattern of the bacteria isolated (Sensitive = S ; Resistant = R)

Drugs/ Organisms	***MRSA N=22***		***Klebsiella pneumoniae N=14***		***CONS N=7***		***E.coli N=5***		***Enterococci fecalis N=3***		***Acenitobacter baumani N=3***		***Enterobacter auerogens N=3***		***Pseudomonas aueroginosa N=1***		***Citrobacter koseri N=1***	
Antibiotics	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
OX	0 (0%)	22 (100%)	-	-			-	-	-	-								
VAN	21 (95%)	1 (5%)			7 (100%)	0 (0%)			3 (100%)	0 (0%)								
GEN	9 (41%)	13 (59%)	5 (36%)	9 (64%)	2 (29%)	5 (71%)	2 (40%)	3 (60%)	2 (67%)	1 (33%)	1 (33%)	2 (68%)	0 (0%)	2 (100%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)
E	12 (54%	10 (45%)	-	-	4 (57%)	3 (43%)					-	-	-	-	-	-		
CD	15 (68%)	7 (32%)			5 (71%)	2 (29%)	-	-				-	-	-	-			
COT	15 (68%)	7 (32%)	6 (43%)	8 (57%)	3 (43%)	4 (57%)					2 (67%)	1 (33%)	1 (50%)	1 (50%)				
LZ	20 (91%)	2 (9%)	-	-					3 (100%)	0 (0%)								
AMP							2 (40%)	3 (60%)	1 (33%)	2 (67%)			0 (0%)	2 (100%)			0 (0%)	1 (100%)
CIP	8 (36%)	14 (64%)	5 (36%)	9 (64%)	4 (57%)	3 (43%)	2 (40%)	3 (60%)	1 (33%)	2 (67%)	1 (33%)	2 (67%)	0 (0%)	2 (100%)	0 (0%)	1 (100%)	1 (100%)	0 (0%)
PTZ			11 (79%)	3 (21%)			4 (80%)	1 (20%)			2 (67%)	1 (33%)	2 (100%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	1 (100%)
CTR			3 (21%)	11 (19%)			1 (20%)	4 (80%)					1 (50%)	1 (50%)	1 (100%)	0 (0%)	0 (0%)	1 (100

																				%)
AK	-	-	9 (64%)	5 (36%)	-	-	2 (40%)	3 (60%)	-	-	1 (33%)	2 (67%)	2 (100%)	0 (0%)	0(0%)	1 (100%)	1 (100%)	0 (0%)		
IMP	-	-	12 (86%)	2 (14%)	-	-	4 (80%)	1 (20%)	-	-	2 (67%)	1 (33%)	2 (100%)	0 (0%)	1(100%)	0 (0%)	1 (100%)	0 (0%)		
AMX	7(42%)	15 (68%)			3 (43%)	4 (57%)	-	-	1 (33%)	2 (67%)	-	-	-	-	-	-				

DISCUSSION

In the present study, 135 neonates who where suspected for neonatal septicemia were investigated Our study showed 43 % culture positive neonatal sepsis .Out of positive cultures in our study 67.2% were males 32.8% were females. The factors regulating the synthesis of gamma globulins are probably situated on the X chromosomes. Presence of the one X chromosomes in the male infant confers less immunological protection compared to the female counterpart[10]

In this study neonatal septicemia were common with risk factors of low APGAR score . 55.2% of culture positive cases had low APGAR score in 1 min and 24.7% of culture negative cases had low APGAR score in 1 minute with P value <0.001. 34.5% of culture proven cases had low APGAR score in 5 minute and 3.9% of culture negative cases had low APGAR score in 5 minutes with P value of <0.001.

41.4% of culture proven cases had maternal infection and 26% of culture negative cases had maternal infections with P value of 0.05. In our study 56.9% of culture proven sepsis had neonatal resuscitation and 2.6% of culture negative cases had neonatal resuscitation with P value of<0.001 .65.5% of the culture proven cases were delivered by normal vaginal delivery and 76.6% of culture negative cases were delivered by normal vaginal delivery. 34.5% of culture proven cases were delivered by LSCS and 23.4% culture negative cases were delivered by LSCS. Mode of delivery shows P value 0.16.

In our study 62.1% of culture proven sepsis cases had low birth weight and 55.8% of culture negative cases had low birth weight with a P value 0.21 . 60.3% of culture proven sepsis were preterm and 50.6% of culture negative cases were preterm with P value 0.27

36.2% of culture proven sepsis had PROM and 35.1% of culture negative cases had PROM with a P value of 0.89.In our study 44.8% of culture proven sepsis had Multiple per vaginal examination and 44.2% of culture negative cases had multiple per vaginal examination which showed P value 0.94.

55.2% of neonates were affected by gram positive organisms and 44.8% by gram negative organisms .In our study 37% were *staphylococcus aureus* and 24.1% were *klebsiella pneumoniae* are the common organisms causing septicemia. In the present study early onset sepsis were 63.7% and late onset sepsis were 36.2% . In our study *staphylococcus aureus* was the predominant organism in both early and late onset sepsis.

In our study gram positive cocci showed high rate of resistance to penicillin 63%, fluroquinolones57% and were highly susceptible to vancomycin 98% and linezolid 96%. *MRSA* amoung gram positive cocci observed in this study was 68%. Gram negative bacilli showed high degree of resistance to gentamycin 81% cephalosporins 81% and were susceptible to imipenem .

CRP estimation was done and compared with results of blood culture and and the following results were obtained CRP shows sensitivity of 86% and specificity of 81% positive predictive value of 78.1% negative predictive value of 88.7% which is similar to study by santhakumar sundarapandia et al[8]In our study 86.2% of culture proven cases were CRP positive and 18% of culture negative cases were CRP positive . 13.8% of culture positive cases were CRP negative and 81.8% of culture negative cases were CRP negative.The Pvalue was< 0.001 which shows CRP was significant in our study

CONCLUSION

Neonatal septicemia is a leading cause of morality and morbidity in neonates in our country

1. Risk factors for neonatal sepsis in this study were low APGAR score at 1minute and 5 minute, maternal infections, neonatal resuscitation, low birth weight, preterm and mode of delivery
2. This study shows increased Early onset sepsis 63.7% and Late onset sepsis 36.2%
3. Our study shows male preponderance 67.2%
4. Blood cultures were found to be positive in 42% and negative in 57%
5. *Staphylococcus aureus* 37% was the most common organism isolated followed by *klebsiella pneumoniae* 24.1%
6. Increased incidence of MRSA has been found.68% of isolated *Staphylococcus* are methicillin resistant
7. Imipenum was found to be sensitive in most of the positive cultures
8. CRP estimation is a rapid , highly sensitive and specific test for early diagnosis and management of neonatal sepsis.
9. CRP shows sensitivity of 86% and specificity of 81% positive predictive value of 78.1% negative predictive value of 88.7%.
10. Early diagnosis will help the clinician to institute the antibiotics promptly which will help in reducing the morbidity and mortality

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