

**CLINICO BACTERIOLOGICAL STUDY ON NEONATAL SEPTICEMIA**A. Krishna Prasad<sup>1</sup>, K. Koteswara Rao<sup>2</sup>, K. Adi Reddy<sup>3</sup>, Solomon Saawan P<sup>4</sup>, S. Anusha<sup>5</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT:** Neonatal septicemia remains a significant cause of morbidity and mortality in the new born, more so in developing countries like India due to delivery and post natal follow up in an unclean environment having more chances of contamination with infective organisms. Infection is more common in the neonatal period than at any other time in life.<sup>1</sup> This is partly attributable to exposure to large number of organisms, but is also due to a relative failure of the neonatal host defenses to clear microorganisms from blood and tissues. The rate of infection and type of organism causing sepsis in a neonate vary with demography. In India, the incidence of neonatal septicemia is 10-30/1000 live births,<sup>2</sup> whereas in western countries it is 1-8/1000 live births.<sup>3</sup>

**KEYWORDS:** Neonatal, Sepsis, Staphylococcus, CRP, Bandemia.

**INTRODUCTION: STUDY METHOD:** The study was undertaken in the NICU, Department of Pediatrics, Govt. General Hospital, Kakinada in collaboration with Department of Microbiology, Govt. General Hospital, Kakinada from August 2014 to July 2015. All neonates admitted to NICU with clinical suspicion of neonatal sepsis were included in this study. This is a Prevalence study. The study includes 150 neonates.

**RESULTS:**

- 150 cases with clinical suspicion of neonatal sepsis were studied, out of which 98 were culture positive.
- Males had higher preponderance to neonatal sepsis than females.
- Rate of culture positivity was higher in males than in females
- Early onset sepsis was suspected in 42 babies and 24[57.14%] of these babies were culture positive. Late onset septicaemia was suspected in 108 cases and 74 cases [68.51%] of these were culture positive.
- Babies weighing more than 2.5kg were 94 out of which 66[67.34%] were culture positive. Babies weighing <2.5kg were 56, out of which 32[57.14%] were culture positive.
- In the study, term babies were 106[70.66%] and preterm 44[29.33%].
- Our study had more of term babies 68 cases [69.38%] than preterm 30 cases [30.61%] which were culture positive.
- When the symptomatology of the cases was studied it was noticed that history of difficult resuscitation [24 cases] and per partum fever [20 cases] were commoner risk factors<sup>4</sup> than PROM [10 cases] and foul smelling liquor [4cases].
- The commoner presenting symptoms and clinical features were change in feeding habits among 116 babies, fever or hypothermia in 112 babies, lethargy in 92 cases, neurological signs like excessive cry, seizures in 64 and 24 each.

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- When septic screen was done, CRP was above 6 micro grams /lit in 132 cases (88%), Band count >20% of the total WBC in 117 cases (78%), Micro ESR >15mm in the 1<sup>st</sup> hour in 78 cases (52 %) and Absolute neutrophil count <1500 cells /cu.mm in 63 cases (42%) was noted.
- The positive predictive value of CRP as a septic screen parameter<sup>5</sup> was 68.93% and that of Bandemia positive cases was 70.08%, but when both these parameters was considered together the positive predictive value increased to 71.46 %.
- Staphylococcus aureus was the commonest pathogen isolated among the culture positive cases 46 (46.9%) followed by coagulase negative staphylococcus 22 cases (22.44%). Rest being klebsiella and E.coli at 12 cases (12.29%) each and pseudomonas at 6 cases (6.12%)
- It was found that in both early onset and late onset septicemiastaphylococcus was the predominant organism<sup>6</sup>.
- In our study staphylococcus aureus was the commonest isolate in both preterm and term babies
- Our results showed resistance of the isolated organisms to commonly used antibiotics namely Ampicillin (72.5%), penicillin (76.4%) and susceptibility to higher antibiotics Cefoperazone (94.1%) and amikacin (92.1%).

**CONCLUSION:** The diagnosis of neonatal septicemia should be based on high index of clinical suspicion with the subtle clinical features like change in feeding habits, lethargy and altered body temperature being the important presenting features. Although blood culture is the gold standard for diagnosing neonatal sepsis<sup>7</sup>, it takes time. Hence septic screen can allow early diagnosis. In the present study, Staphylococcus aureus was the commonest isolate followed by CONS.

**MATERIALS AND METHODS: Source of Data:** All neonates admitted to NICU, Department of Pediatrics, Govt. General Hospital, Kakinada from August 2014 to July 2015, with clinical suspicion of neonatal sepsis were included in this study. The study includes 150 neonates.

**Inclusion Criteria:** The babies in the study needed to have any of the following risk factors in mother: Prolonged rupture of membranes (PROM)for >24 hour, Foul-smelling liquor during delivery, Dai (Mid-wife) handling, Maternal urinary tract infection within 2 weeks prior to delivery, Peripartum fever, Difficult resuscitation, More than 3 vaginal examination during labour.

Babies showing any 2 of the following clinical features: Poor feeding/refusal of feeds, Lethargy, Altered body temperature- hypothermia or hyperthermia, Excessive cry, Tachypnea/apnea, Seizures, Abdominal distension, diarrhea, Vomiting, Poor neonatal reflexes.

**Exclusion Criteria:** Babies born with congenital anomalies, extremely low birth weight babies are excluded from the study.

**Method of Collection of Data:** Diagnosis of early onset (<72 hours) and late onset (>72 hours) sepsis was based on the time of onset of symptoms.<sup>8</sup> Birth weight and gestational age at birth were recorded along with details regarding antenatal, natal, post natal events. Under strict aseptic precautions blood samples were drawn and sent for septic screen, blood culture and other investigations.

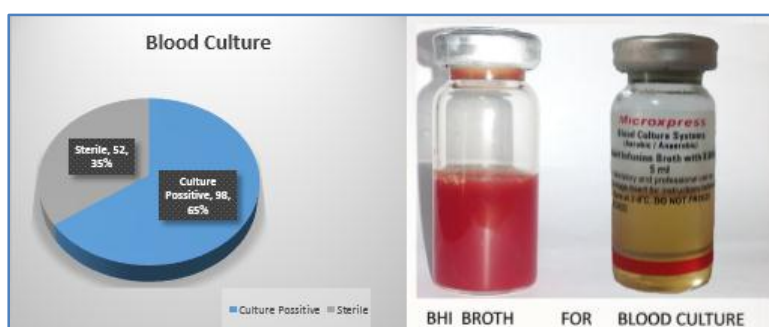
Septic screen include absolute neutrophil count, band count, micro ESR and C-reactive protein (CRP).<sup>9</sup>

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Other investigations like lumbar puncture, urine analysis, chest X-Ray was done depending on the requirement. The data was collected and analyzed and interpreted.

**BLOOD CULTURE TECHNIQUE AND SAMPLE COLLECTION:** The site chosen for collection of blood sample was treated with 70% Isopropyl alcohol and later concentrically swabbed with 10 % povidone iodine to avoid contamination with skin commensals. Micro samples of 1 to 2 ml of blood, preferably from ante cubital fossa venipuncture site were collected into 15 ml of Brain heart infusion broth. After overnight incubation, the growths were sub-cultured on to a blood and Mac Conkey's agar and identification of pathogen was done. The sensitivity of these organism to various antibiotics was studied using disc diffusion method.

**RESULTS: Culture Positivity:** During the study period from August 2014 to July 2015, 150 cases with clinical suspicion of neonatal sepsis were studied; out of which 98 were culture positive.

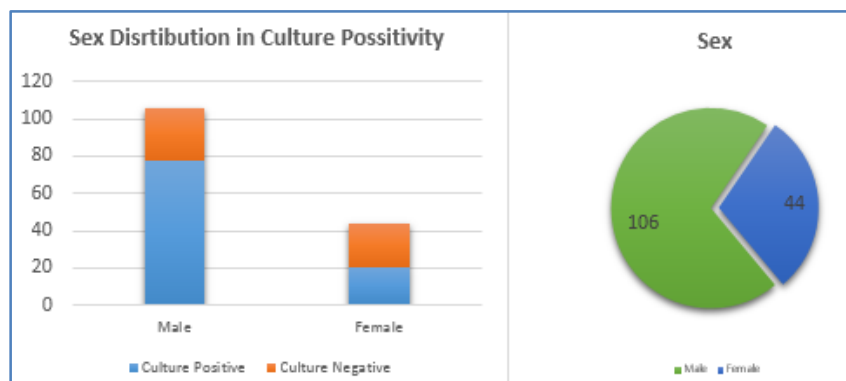


**Sex Distribution:** Our study period males had a higher preponderance to neonatal sepsis than females. Out of 150 cases, 106(70.66%) males had features suggestive of neonatal sepsis and 44(29.33%) females had features suggestive of neonatal sepsis.<sup>10</sup>

Sex	Total	Culture Positive	%	Culture Negative	%
Male	106	78	73.58	28	26.41
Female	44	20	45.45	24	54.54
	150	98		52	

Table 1

The rate of culture positivity was higher in males 78(73.58%) than in females 20(45.45%) with a p value of 0.0018.

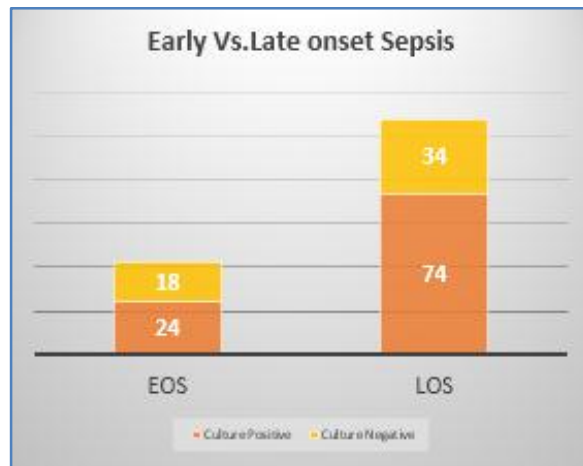


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**Early vs. Late Onset Sepsis:** Early onset sepsis (EOS) was suspected in 42 babies and 24(57.14%) of the babies were culture positive. Late onset septicemia (LOS) was suspected in 108 cases and 74 cases (68.51%) of these were culture positive.

Sepsis	Total	Culture positive	%	Culture Negative	%
Early onset	42	24	57.14	18	42.85
Late onset	108	74	68.51	34	31.48
	150	98		52	

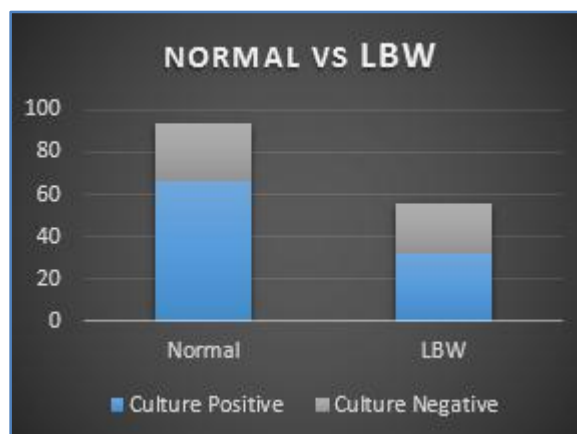
Table 2



**Normal vs. Low Birth Weight:** Babies weighing more than 2.5kg were 94 out of which 66(67.34%) were culture positive. Babies weighing <2.5kg were 56, out of which 32(57.14%) were culture positive.

Birth Weight	Total	Culture Positive	%	Culture Negative
>2.5 kg	94	66	67.34	28
<2.5 Kg	56	32	57.14	24
	150	98		52

Table 3

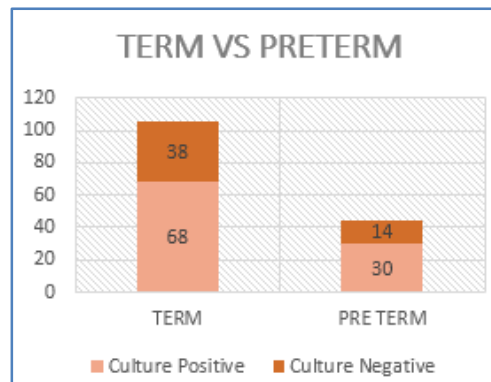


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**Term vs. Preterm:** In our study, term babies were 106(70.66%) and preterm 44(29.33%). Our study had more of term babies 68(69.38%) than preterm babies 30(30.61%) which were culture positive.

Gestational Age	Total	%	Culture Positive	%	Culture Negative
TERM	106	70.66	68	67.34	38
PRETERM	44	29.33	30	57.14	14
	150		98		52

Table 4

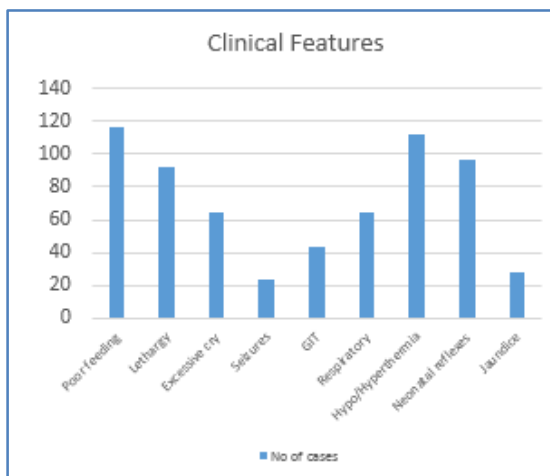


**Symptomatology:** It was noticed in our study that difficult resuscitation (24 cases) and per-partum fever (20 cases) were commoner risk factors than PROM (10 cases) and foul smelling liquor (4 cases).

Risk Factor	No. of Cases
PROM	10
Foul smelling liquor	4
Dai handling	8
Vaginal examinations > 3	12
Maternal UTI	4
Difficult resuscitation	24
Peripartum fever	20

Table 5

**Clinical Features:** Clinical features among the suspected sepsis babies in our study were as follows.



Clinical Features	No. of Cases
Poor feeding	116
Lethargy	92
Excessive cry	64
Seizures	24
GIT	44
Respiratory	64
Hypo/Hyperthermia	112
Neonatal reflexes	96
Jaundice	28

Table 6

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In our study, we noticed change in feeding habit among 116 babies, fever or hypothermia in 112 babies, lethargy in 92 cases, neurological signs like excessive cry, seizures in 64 and 24 cases each.

Gastrointestinal symptoms like vomiting, diarrhea, abdominal distension was noticed in 44 cases, Respiratory symptoms like tachypnea or apnea in 64 cases and sluggish neonatal reflexes in 96 cases and jaundice in 28 cases.

### 8. Septic screen:

When septic screen was done, CRP was above 6 micrograms/l in 132 cases (88%), band count >20% of the total WBC count in 117 cases (78%). Micro ESR > 15 mm in the first hour in 78(52%) and absolute neutrophil count (ANC) <1500 cells /cu.mm in 63(42%).

Parameters	No. of Cases	%
ANC<1500 cells /cu.mm	63	42
Bandemia	117	78
↑micro ESR	78	52
↑ CRP	132	88

Table 7

### Statistical Data:

Parameters	Culture Positive	%	Culture Negative	%
ANC<1500 cells /cu.mm	52	53.06	11	21.11
Bandemia	82	82.67	35	67.37
Micro ESR	60	61.22	18	34.61
CRP	91	92.84	41	78.84

Table 8

When the parameters of the neonatal sepsis screen were studied, band count was positive in 82(82.67%) of culture positive cases with a sensitivity of 83.67% and positive predictive value of 70.08%. Similarly CRP was positive<sup>11</sup> in 91(92.84%) of the culture positive cases with a sensitivity of 92.8% and positive predictive value of 68.93%. Absolute neutrophil count<sup>12</sup> was low in 52 cases (53.06%) of the culture positive cases with a sensitivity of 53.06% and Micro ESR was high in 60(61.22%) of the culture positive cases with a sensitivity of 61.22%.

Parameters	Sensitivity	Specificity	Positive predictive value	Negative predictive value
ANC	53.06	78.88	82.53	21.11
Bandemia	83.67	32.69	70.08	67.30
Micro ESR	61.22	65.38	76.92	34.61
CRP	92.8	21.15	68.93	78.89

Table 9

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The positive predictive value of CRP as a septic screen parameter was 68.93% and that of Bandemia positive cases was 70.08%, but when both these parameters were considered together the positive predictive value increased to 71.46%.

Parameters	Total	Culture positive	Positive predictive value
CRP + Band count+ve cases	112	80	71.46%
CRP+ve cases	132	91	68.93%
Bandemia+ve cases	117	82	70.08%

Table 10

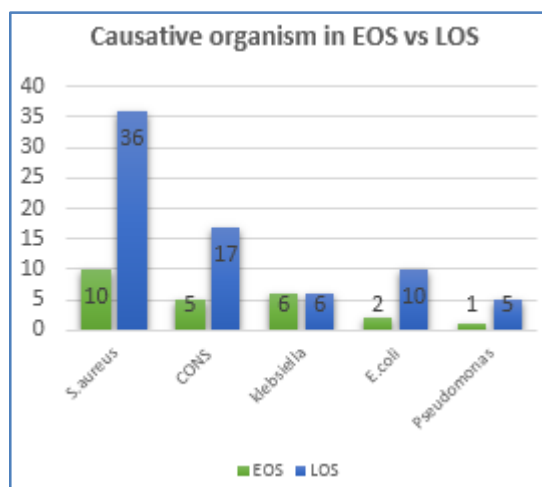
**Bacterial Isolates:** Among the culture positive cases the bacterial isolates were as follows:

Bacterial isolates	No. of cases	%
Staphylococcus aureus	46	46.93
Coagulase negative staphylococcus aureus	22	22.44
klebsiella	12	12.24
E.coli	12	12.24
Pseudomonas	6	6.12
<b>Total</b>	<b>98</b>	<b>100</b>

Table 11

Staphylococcus aureus was the commonest pathogen isolated among the culture positive cases 46(46.9%) followed by coagulase negative staphylococcus aureus (CONS) 22 cases (22.44%). Rest being klebsiella and E.coli at 12 cases (12.29%) each Pseudomonas at 6 cases(6.13%).<sup>13</sup>

Depending on Early onset septicemia and late onset septicemia the causative organism were as follows:



Causative Organism	EOS	%	LOS	%
Staphylococcus aureus	10	41.66	36	48.64
CONS	5	20.83	17	22.97
klebsiella	6	25	6	8.10
E.coli	2	8.31	10	13.51
Pseudomonas	1	4.16	5	6.75
<b>Total</b>	<b>24</b>		<b>74</b>	

Table 12

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It was found that in both early and late onset septicemia staphylococcus was predominant organism.

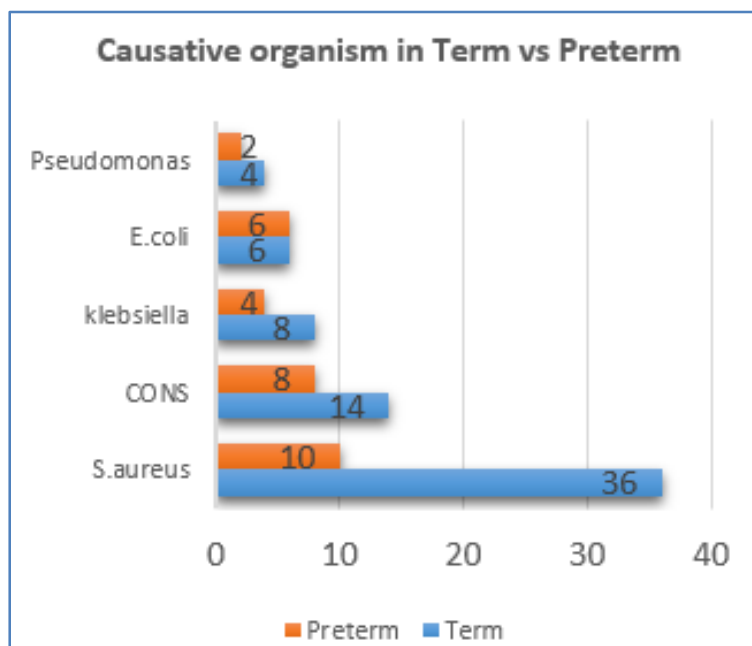
In Early onset septicemia, staphylococcus aureus was isolated in 10 cases (41.66%) followed by E.coli in 6 cases (25%) and next in order were CONS 5 cases (20.83%), Klebsiella in 2 (8.37%) and Pseudomonas in 1 case (4.16%).

Similar results were observed in late onset septicemia where staphylococcus aureus was cultured in 36 cases (48.64%).CONS in 17(22.97%), E.coli 6(8.10%), Klebsiella 10(13.51%), and Pseudomonas in 5(6.75%) cases.

When the causative organism of term and preterm babies were studied the results were as follows:

Organism	Term	%	Preterm	%
S.aureus	36	52.94	10	33.33
CONS	14	20.58	8	26.66
klebsiella	8	11.76	4	13.33
E.coli	6	8.87	6	20
Pseudomonas	4	5.8	2	6.66
	68		30	

**Table 13**

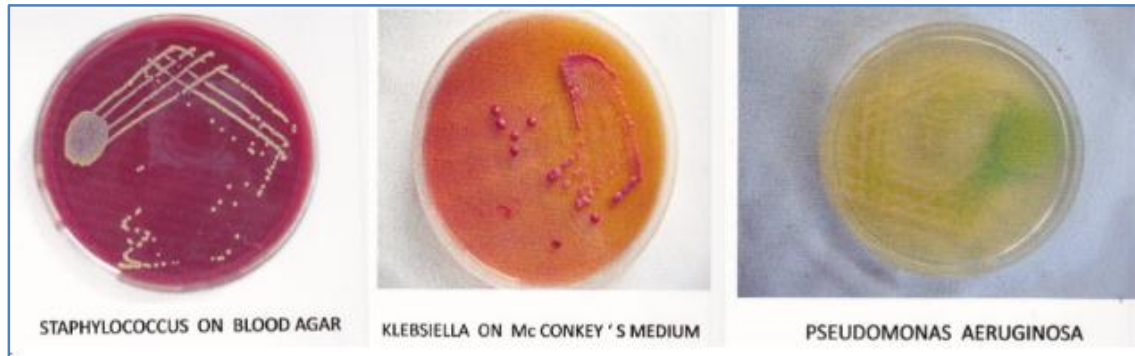


In our study, Staphylococcus aureus was the commonest isolate<sup>14</sup>in both preterm and term babies. In the term babies, Staphylococcus aureus was isolated in 36(52.94%) cases, CONS in 14(20.85%), Klebsiella in 8(11.76%), E.coli 6(8.82%) and Pseudomonas in 4(5.8%) cases. In preterm



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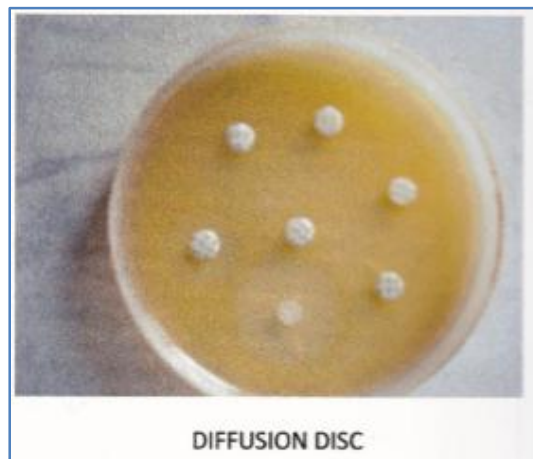
babies, *Staphylococcus aureus* was isolated in 10(33.33%) cases, *CONS* in 8(26.66%), and *E.coli* 6(20%) followed by *Klebsiella* in 4(13.33%) and *Pseudomonas* in 2(6.66%) cases.



**Antibiotic Sensitivity Patterns:** Antibiotic sensitivity patterns of the causative organism of neonatal sepsis in our study were;

Antibiotic	Sensitivity	%
Penicillin	24	23.5
Ampicillin	28	27.4
Amoxicillin	26	25.4
Cefotaxime	70	68.5
Ceftriaxone	56	54.9
Erythromycin	84	82.4
Azithromycin	82	80.3
Amikacin	94	92.1
Gentamycin	82	80.3
Netilmycin	88	86.3
Ofloxacin	84	82.4
Levofloxacin	84	82.4
Cefoperazone	96	94.1
Cloxacillin	88	86.3

Table 14



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Our results showed resistance of the isolated organisms to commonly used antibiotics<sup>15</sup> namely Ampicillin (72.5%), penicillin (76.4%) and susceptibility to higher antibiotics Cefoperazone (94.1%) and Amikacin (92.1%). Even the commonly used antibiotics like Cefotaxime (68.5%) and Ceftriaxone (54.9%) had low sensitivity.

The antibiotic sensitivity was checked for the commonest isolate *Staphylococcus aureus*. *Staphylococcus aureus* was less sensitive to penicillin (25%) and ampicillin (35.7%) and more sensitive to Cefoperazone (92.8%) and cloxacillin (85.7%).<sup>16</sup>

Antibiotic	Sensitivity	%	Antibiotic	Sensitivity	%
Penicillin	11	25	Amikacin	36	78.5
Ampicillin	16	35.7	Gentamycin	34	75
Amoxicillin	15	32.1	Netilmycin	36	78.5
Cefotaxime	30	67.8	Ofloxacin	37	82.1
Ceftriaxone	26	57.1	Levofloxacin	36	78.5
Erythromycin	32	71.4	Cefoperazone	43	92.8
Azithromycin	36	78.5	Cloxacillin	39	85.7

Table 15



**DISCUSSION:** Our present study yields a high culture positivity (65%) among the clinically suspected cases of neonatal sepsis. Difficult resuscitation and subtle clinical markers like poor feeding, lethargy and altered body temperatures were early and important indications for clinical suspicion of neonatal sepsis.

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Septic screen is an efficient tool in early diagnosis of neonatal Septicemia before blood culture reports are available.<sup>17</sup> among the septic screen components band count and CRP had more sensitivity at 83.67% and 92.8% in diagnosing neonatal sepsis than others.

Staphylococcus aureus was the commonest isolate (46.93%) followed by Coagulase negative staphylococcus aureus (22.44%), Klebsiella and E. coli (12.24%).

Majority of our cases (75.1%) belonged to the late onset septicemia group. Among these staphylococcus was the commonest organism (48.64%). The results were similar in early onset septicemia group where 41.6% were infected by S.aureus.

On studying antibiotic sensitivity patterns, most of the pathogens were resistant to ampicillin and penicillin and showed low sensitivity (68.5% and 54.9%) to commonly used antibiotics like Cefotaxime and Ceftriaxone.

### CONCLUSION:

- Neonatal Septicemia was diagnosed based on clinical suspicion. It was found that subtle clinical manifestations like poor feeding, lethargy and altered body temperature were common presenting features.
- Among septic screen parameters - band count and CRP showed high sensitivity in diagnosing neonatal sepsis.
- Blood culture results showed Staphylococcal aureus as the commonest isolate. It was found that Staphylococcus aureus was the commonest organism both in early onset and late onset septicemia, and also in term and preterm babies.
- The culture sensitivity patterns to isolates depicted an increasing resistance to penicillin, Ampicillin and even commonly used Cefotaxime & ceftriaxone and high sensitivity to Cefoperazone and cloxacillin<sup>18</sup>.

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