Study of Risk Factors Associated with Neonatal Septicemia and Its Bacteriological Profile at one of the Tertiary Care Hospitals of Gujarat, India

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### Abstract:

**Introduction:** Neonatal sepsis is a leading cause of morbidity & mortality in developing countries especially like India. As per involvement of different organisms, mortality rates differ among neonates. So, early detection of causing organism along with the identification of risk factors helps to prevent mortality among Neonates in India. **Objectives:** To study the risk factors associated with neonatal septicemia and its bacteriological profile at one of the tertiary care hospital of Gujarat. Method: The study was prospective observational research study in which purposive sampling technique was used to identify the 106 neonates blood culture positive to sepsis admitted in NICU of one of the tertiary care hospital in Gujarat in time period of 1 year from Nov 2021 to Oct 2022. Results: Out of 106 neonates, common factors associated with neonatal septicemia were gender, prematurity, law birth weight, gestational age & onset of septicemia. Meconium stained liquor, Pregnancy induced hypertension and Oligohydramnios were the commonest maternal risk factor associated with neonatal sepsis. Blood culture proven sepsis in neonatal septicemia was predominantly caused by Gram negative organism Klebsiella pneumonia. Conclusion: Neonatal septicemia is more common in preterm and low birth weight neonates. Early onset septicemia is more common which can be curtailed by clean vaginal deliveries. Prematurity and low birth remains the major presentation for admission in NICU followed by respiratory distress syndrome. Maternal risk factors like meconium stained liquor, pregnancy induced hypertension oligohydramnios, & leaking per -vaginal are associated With increase in the incidence of neonatal septicemia.

Keywords: Blood culture, Bacteriological profile, Maternal risk factor, Neonatal septicemia

### Introduction:

A bacterial infection remains an important cause of morbidity and mortality in neonates. It might be possible to reduce these factors by early detection and appropriate management.<sup>[1]</sup> Neonatal septicemia or sepsis neonatorum refers to systemic infection of the new born.it is characterized by a constellation of nonspecific symptomatology in association with bacteremia. Prompt recognition, appropriate antimicrobial therapy and judicious supportive care are the key determinants of positive outcome in this serious pediatric emergency.<sup>[2]</sup> Septicemia in neonates can results in sepsis which means clinical syndrome of bacteremia present with systemic sign and symptoms of infection in age between births to 28 days of life, also manifested by isolation of bacterial pathogens which can able to gain access into blood stream causing early onset septicemia which occurs in the first 72 hours of life or late onset septicemia which occurs after 72 hours of life in neonates.<sup>[3]</sup>

There are several factors which have been found that can increase the risk of septicemia in neonates. These factors includes age, gender, convulsion,

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glucose level, late onset sepsis, lack of antenatal checkup and care, pre-term labor, low birth weight, fever, socio-economic conditions and lack of hygiene.<sup>[4]</sup> Due to lack of knowledge and availability during pregnancy some women do not visit for antenatal checkup therefore missing an opportunity of screening and treatment for infections which can be transmit to their neonates. In developing countries due to home delivery or delivery conducted by birth attendants can increase the risk of newborn developing septicemia. These all factors needs appropriate management to prevent transmission of septicemia in neonates.<sup>[5]</sup>

Neonatal septicemia is caused by bacteria which include: Klebsiella Pneumoniae, Staphylococcus Aureus, E. coli, Group B streptococci and Acinetobacter Baumannii etc. Birth weight, prematurity, infections, birth asphyxia and other factors like antenatal factors can lead to incidences of septicemia in neonates.<sup>[6]</sup>

Neonatal sepsis is a leading cause of morbidity and mortality in developing countries especially like India. As per involvement of different organism, mortality rates differ. So, early detection of causing organism can helps to prevent morbidity and mortality rates in India among Neonates.<sup>[7]</sup>

Thus, the study has been carried out to contribute to the research for neonatal septicemia. The present study was conducted with the aim to study risk factors in terms of maternal as well as neonatal and bacteriological profile from blood culture among neonates.

### Method:

The hospital based descriptive study was conducted between November 2021 to October 2022. All the neonates admitted within study duration in NICU of one of the tertiary care hospital in Gujarat who is having septicemia confirmed on blood culture enrolled in this study. Thus, total 106 sample size was achieved after considering inclusion and exclusion criteria for this study. All the newborn with age between 0-28 days, who have clinical symptoms suggestive of septicemia including fever, respiratory distress, not taking feed, low birth weight,

prematurity, poor cry, convulsions, meconium stained liquor with positive blood culture admitted in one of the tertiary care hospital of Gujarat was included in the study. Neonates with severe congenital illness were excluded. Also, neonates whose blood culture sample collected after initiation of antimicrobial therapy were excluded from the study. Parents of neonates who have given informed consents for their neonates were subjected to an interviewer guided questionnaire to collect information of clinical and demographic data. The questionnaire consisted of demographic details such as age, sex, date of birth, place of birth, term of gestation, birth weight, antenatal history, family history, feeding history, birth history, medication history, complications occurred during delivery, congenital disorders etc. The clinical data were collected from hospital record card of neonates. Ethical permission has been taken from the Institutional Ethical Committee.

After taking informed assent from parents of neonates blood was collected from venipuncture site by using following steps: (1) apply 1% to 2% tincture of iodine or povidone-iodine and allow to dry for 1 to 2 minutes (povidone-iodine) or 30 seconds (tincture of iodine), and (2) remove the tincture of iodine with a 70% alcohol wash. Draw 3 ml of blood and add it into blood culture bottle. The blood culture bottle contains Brain heart infusion broth with SPS anticoagulant.

### **Results:**

Neonatal septicemia was more common in male (54.71%) than in female (45.29%) neonates. Neonatal Septicemia were more common in preterm neonates (60.38%) than in term neonates (39.62%). Neonatal Septicemia were more common in low birth weight (<2500gms) babies (70.76%) than in (>2500gms) babies (29.24%). Early onset septicemia was more common (51.9%) in neonates than Late onset septicemia (48.1%). Neonatal septicemia was more common in newborn delivered with vaginal mode of delivery (52.8%) than Lower Segment Caesarean Section (LSCS) (47.2%).(Table 1)

Meconium stained liquor (MSL) (15.5%) and Pregnancy induced hypertension (PIH) and

Variables	Frequency (%)		
Gender			
Male	58 (54.71%)		
Female	48 (45.29%)		
Gestational age			
Full term	42(39.62%)		
Preterm	64(60.38%)		
Birth weight (grams)			
>2500	31 (29.24%)		
<2500	75 (70.76%)		
Categories of Low birth weight (n=75) (grams)			
ELBW (<1000)	05 (6.6%)		
VLBW (<1500)	26 (34.6%)		
LBW (<2500)	44 (58.6%)		
Onset of septicemia			
Early onset (<72hrs of life)	55 (51.9%)		
Late onset (>72 hrs of life)	51 (48.1%)		
Mode of Delivery for Septicemic Neonates			
Vaginal	(52.8%)		
LSCS	(47.2%)		

# Table 1: Distribution of Neonatal Risk Factors among Study Participants (N=106)

Oligohydramnios (5.8%) were the commonest maternal risk factor associated with neonatal sepsis. (Table 2) Outcomes of 106 neonates with septicemia was total 78 neonates gets discharged, other 19 neonates are died due to septicemia while 9 neonates have taken DAMA from the hospital.

In this study Gram negative bacteria (61.3%) were the prominent pathogen causing septicemia followed by gram positive bacteria (38.7%). From the gram negative bacteria Klebsiella Pneumonia (30.18%) was predominant followed by Acinetobacter Baumannii (17.92%). On either side, MRCONS (13.20%) was the predominant followed by Enterococcus Faecalis (12.26%) from the gram positive bacteria. (Table 3)

## **Discussion:**

Bacteriological profile plays noteworthy role for effectual management of neonatal septicemia. It is vital to identify appropriate treatment for septicemia and also for periodic epidemiological survey of causative bacterial agent. In this study, all 106 cases of septicemia were blood culture positive. The rate of incidence of gram negative & gram positive was 61.3% & 38.7%.

The finding of present study that male neonates (54.71%) are more predisposed to sepsis was comparable with other studies like, Khandharkar et al (54%),<sup>[8]</sup> Vinod kumar et al (58.5%),<sup>[9]</sup> Zakariya et al (58.3%)<sup>[10]</sup> and R. Sriram et al (66.1%).<sup>[11]</sup> A study in the tertiary care hospital of Multan by R. Aftab et al,

Maternal Risk Factor	Frequency (%)
Meconium Stained Liquor (MSL)	16 (15.5%)
Pregnancy Induced Hypertension (PIH)	6 (5.8%)
Oligohydroamnios	6 (5.8%)
Young Primi Mother	4 (3.9%)
Leaking Per-Vaginal	4 (3.9%)
Pre-eclampsia	4 (3.9%)
Severe Anemia	3 (2.9%)
Non-Progression of Labour (NPL)	3 (2.9%)
Covid-19 Positive	2 (1.94%)
Placenta Previa	1 (0.97%)
Neonates with no any maternal Risk Factor	57 (53.7%)

### Table 2: Distribution of Septicaemic Neonates according to Maternal Risk Factors (N=106)

Table 3: Distribution of Neonates according to Bacteriological Profile from Blood Culture Report (N=106)

Organism	Culture Positive Cases (%)
Klebsiella Pneumonia	32 (30.18%)
Acinetobacter Baumannii	19 (17.92%)
Methicillin-Resistant Coagulase-Negative	14(13.20%)
Staphylococci (MRCON)	
Enterococcus Faecalis	13 (12.26%)
Escherechia Ecoli	11(10.37%)
Coagulase-Negative Staphylococci (CoNS)	8 (7.5%)
Staphylococcus Aureus	4(3.77%)
Pseudomonas SPP.	3 (2.83%)
MR Staphylococcus Aureus	1 (0.9%)
Streptococcusspp.	1(0.9%)

has also reported 55.8% male and 44.2% female neonates in culture proven sepsis.<sup>[12]</sup> A study Hoque et al conducted in Bangladesh, has also having similar finding like us, with male preponderance with M:F ratio 1.3:1.<sup>[13]</sup> Also the study done by Jimba Jatsho et al in 2020, male neonates with septicemia were 57.3% and female 42.7%.<sup>[14]</sup> In present study, early onset septicemia was found to be higher 51.9% and Late onset septicemia 48.1% of neonates which was similar with the study done by Jimba Jatsho et al 74.1 % and 25.9% respectively for onset of septicemia.<sup>[14]</sup> The most important factor predisposing to infection is prematurity. Preterm infants have a 3-10 fold higher incidence of infection than full-term infants. Premature babies have less immunogenic ability to resist and combat infections; also require prolonged intravenous access and other invasive procedures that impair barrier and clearance mechanisms, so they are at highest risk of acquiring sepsis. Vinod Kumar et al showed 58.5% pre-mature neonates, which was quite comparable with present study (60.38%) in having more pre-mature neonates with sepsis.<sup>[9]</sup> Study done by Georgia Anna Sofouli in 2023 also showed neonatal septicemia in 45 preterm neonates and 18 term neonates with blood culture positive in derivation study and 70 preterm neonates and 24 term neonates with blood culture positive in validation study.<sup>[15]</sup>

Neonatal sepsis is a frequent complication of very low birth weight (VLBW) infants and it is an important cause of neonatal morbidity and mortality. According to various studies carried out at different part of the country at different time, has showed Gram Negative organisms as the commonest one responsible for sepsis in India. But the results shows variation in different geographical area. In present study, most common organism causing neonatal sepsis was Gram negative organisms. In this study most predominant organism isolated was Klebsiella Pneumoniae followed by Acinetobacter Baumannii, Escherichia Coli, Staphylococcus Aureus, CONS, Pseudomonas Aeruginosa, Burkholderia and Streptococcus Species.

Neonatal sepsis is a frequent complication of very low birth weight (VLBW) infants and it is an important cause of neonatal morbidity and mortality. It is clear that the sepsis is inversely proportional to birth weight of neonates and low birth weight increases the chances of sepsis. In developing countries are at increased risk of neonatal infections because of poor intrapartum and postnatal infection control practices.

By empowering mothers to pursue antenatal care may allow the detection of factors at risk for undesirable delivery consequences such as neonatal septicemia, with that appropriate management of maternal and new born can also reduce the risk in neonates. Importance of antenatal health checkup, institutional deliveries, early and exclusive breast feeding of newborns should be promoted.

By improving qualitative care through sepsis specific guideline, strengthen infection prevention and control programme and best practices during labour, child birth and postnatal care can reduce the transmission rate of septicemia in neonates.

### **Conclusion:**

Maternal and neonatal factors can increases the risk of neonatal sepsis. This study found that prematurity (60.38%), low birth weight (70.76%) and Meconium stained liquor (15.5%) factors to increase the risk of septicemia in neonates. This study suggests that gram negative bacteria are the leading cause of neonatal septicemia. So, the study suggests that surveillance of antimicrobial resistance is necessary & also, in the hospital antibiotic policy should be formulated. Health education is also plays a key role to reduce transmission of infection in neonates.

### **Declaration:**

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### Conflict of Interest: Nil

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