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# **Original Research Article**

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# Study of current status of bacteriological prevalence and profile in an inborn unit of SNCU in central India

# Avyact Agrawal, Sukarn Awasthi\*, Pawan Ghanghoriya, Shivraj Singh

Department of Pediatrics, NSCB Medical College, Jabalpur, Madhya Pradesh, India

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# \*Correspondence: Dr. Sukarn Awasthi.

E-mail: sukarnawasthi@gmail.com

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## **ABSTRACT**

**Background:** About 43% of the under-five child mortality is contributed by neonatal death. According to National Neonatal Perinatal Database (NNPD) in inborn births, Klebsiella pneumonia was the most commonly associated pathogen, followed by Staphylococcus aureus. Hence to know the prevalence and profile of bacterial infection in the inborn unit of an SNCU in Central India, this study was done.

**Methods:** This is a cross sectional study done in the Inborn Unit of SNCU, Department of Paediatrics, Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur (M.P.), INDIA done between 1st March 2015 to 31st August 2016 where the blood sample and data collection of the suspected patients was done. Samples were then sent for culture and sensitivity testing. All the details then entered in Microsoft Excel Sheet and data was analysed using SPSS v 20.

**Results:** The prevalence of bacteriologically positive sepsis was found to be 5.06% (in 43patients out of 850 examined cases). It was more prevalent among males that is in 24 among total 43 culture positives (55.8%), low birth weight were 37 (86% of culture positive patients) and preterm were 35(81.4% of culture positive patients). The most common pathogen associated was found to be *Klebsiella pneumonia* which was detected in 16 patients (37.2% of all bacteriologically positive patients) followed by *E. coli* and Pseudomonas, each in 7 patients (16.28%).

**Conclusions:** Though we are on the track of minimising morbidities still we have a high prevalence of neonatal sepsis in inborn unit so sepsis related morbidities can be prevented if timely interventions are done.

Keywords: Bacteriological prevalence, Bacteriological profile, Central India, Inborn unit, SNCU

#### INTRODUCTION

An infant's birth is one of the most emotional events that can occur in one's life time. After nine months of anticipation and preparation, the neonate arrives with a flurry of excitement. But the transition from the intra uterine to extra uterine life is a critical event in life. Neonatal sepsis is a clinical syndrome characterised by signs and symptoms of infection with or without accompanying bacteremia in the first month of life. It encompasses septicemia, meningitis, pneumonia, arthritis, osteomyelitis and urinary tract infection.<sup>1</sup>

Neonates have limited ability to combat with infections which makes them susceptible to septicaemia. Overwhelming infections of the lungs and meninges is common and later can be devastating with permanent neurological sequel.<sup>2</sup> The onset of symptoms occur within 72 hour of life or after that which makes them classified as Early Onset Sepsis and Late Onset Sepsis respectively.<sup>3</sup> Of all the neonatal deaths, about 40% occur within first 24 hours, half within first 72 hours and three fourth within first 7 days of birth.<sup>4</sup> Neonatal sepsis is the most important cause of morbidity and mortality especially among LBW and preterm babies in developing

countries.<sup>5</sup> As per Indian data the incidence of neonatal sepsis according to National Neonatal Perinatal Database (NNPD) is 30 per 1000 live births. In inborn births, *Klebsiella pneumonia* was the most commonly associated pathogen, followed by *Staphylococcus aureus*.<sup>5</sup> About 43% of the total under-five child mortality is contributed by neonatal death. The states contributing maximum to the mortality being Madhya Pradesh, Uttar Pradesh, Bihar, Rajasthan.<sup>6</sup> Hence in 2000 Millennium Development Goal(MDG)- 4 was developed to reduce under five child mortality by two thirds of its 1990 level upto 2015.<sup>7</sup>

Parent Institute is the prominent government health care facility of the area. In and around Jabalpur is tribal dominating area and our institute caters the health needs of patients not only from Jabalpur but also from nearby districts like Katni, Narsinghpur, Seoni, Umariya, Hoshangabad, Dindori etc. Being the tertiary care centre, it provides specialised health care facilities easily affordable by the poorest; provided free of cost, and with high reliability rate. It is well documented that neonatal sepsis is the prominent cause of neonatal mortality, if sepsis rates can be somehow decreased, it can lead to drastic reduction in neonatal mortality. Considering all these facts the Inborn unit in the department of Paediatrics was established, since then the overall mortality rates of paediatric population as well as the mortality within the inborn unit has dramatically decreased, which has also contributed in bringing down the overall childhood mortality of Madhya Pradesh. A very wide spectrum of organisms have been described for cases of neonatal septicaemia and this is subject to geographical alterations.8 The local microbial flora causing neonatal septicaemia needs to be studied in each setting to guide more effective and rational utilization of antimicrobial agents. Moreover, the organisms isolated are often resistant to multiple antimicrobials which make the treatment difficult and grave sequel ensue.<sup>9</sup> Hence, keeping all these facts in mind this study aims at finding out the prevalence of bacteriological positive neonatal sepsis in inborn neonates and the microbes associated with it in our hospital setup.

#### **METHODS**

Ours is a cross sectional study done in the Inborn Unit of SNCU, Department of Paediatrics, Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur (M.P.), INDIA between  $1^{\rm st}$  March 2015 to  $31^{\rm st}$  August 2016. All the neonates admitted in the inborn unit of SNCU, MCH, Jabalpur in this duration were included in the study while Neonates on prior antibiotic therapy and Neonates born outside the Medical College, Jabalpur. The adequate required sample size was estimated using the formula n=z2pq/d2

To calculate the adequate required sample size we have taken assumption to satisfying our main aims and objectives, that is, the prevalence of neonatal sepsis and its association on birth outcome. We assumed that prevalence of neonatal sepsis would be 4% with 1.5% absolute precision (2.5- 5.5%) in the studied population. This accumulates 655.6 by using above given formula. Further this number was multiplied by 1.3 as design effect to adjust the clustering. Therefore, minimum 850 subjects will be adequate numbers.

# Sampling method

Considering the best availability of the patients by reviewing the previous records of the health facility to achieve the maximum sample size we will screen all patients who have fulfilled the inclusion and exclusion criteria and ready to give the written informed consent. 2 ml of the blood sample was taken under sterile conditions, following universal precautions, which was then send for Complete Blood Count and culture positivity and sensitivity testing, also the questionnaire was entered with relevant details. All the records will be documented by using structured schedule (Case Report Form) and entered in Microsoft Excel Sheet. Analysis was done using SPSS v20 to calculate percentages, proportions, odds ratio, p-value.

## **RESULTS**

Prevalence of bacteriologically positive neonatal sepsis in Inborn unit of parent institute during the study period can be concluded as; Sepsis with positive bacteriological profile is 5.06%. Among the bacteria which were found associated with neonatal sepsis Klebsiella was the most common association 16 (37.2%), followed by *E. Coli* and Pseudomonas in 7 cases (16.28%) each and Staphylococcus was the infectious agent in 6 cases (13.95%). Among total 850 neonates admitted in Inborn unit, blood culture positive sepsis was seen among 43 patients (5.06%) and only 2 samples were CSF culture positive (0.24%). In both the CSF cultures the bacteria isolated was *E. coli*.

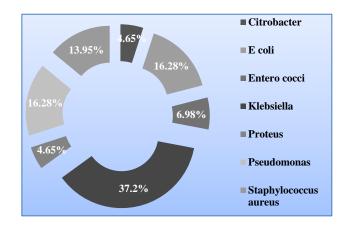


Figure 1: Bacteriological profile of neonatal sepsis.

Authors found that out of the 500 underweight admissions 37 (7.4%) had culture positive sepsis while out of the 350 admissions with normal birth weight, only

6 (1.7%) neonates had culture positive sepsis. Hence a significant association was present between underweight and culture positive sepsis (p value<0.001). Also, out of 575 full term neonates only 8 (1.4%) had culture positive sepsis while out of 275 preterm neonates 35 (12.7%) had culture positive sepsis. Hence the association between prematurity and culture positivity was found to be clinically significant (p value <0.001). Out of 370 female neonates admitted 19(5.1%) developed culture positive sepsis while out of 480 male neonates 24(5%) developed culture positive sepsis. Although culture positive sepsis is more common in male neonates but the association was not statistically significant (p value=0.92). Out of 118 CRP positive samples, 29 were blood culture positive and 19 were blood culture negative. A statistically significant association was observed between the two variables (p value<0.005).

Table 1: Association of neonatal sepsis with various parameters.

Parameters	No. (%)	χ² value	C.I value	P- value
Low birth weight	37 (86)	13.8	1.91-10.47	< 0.001
Pre maturity	35 (81.4)	49.7	0.04-0.21	< 0.001
Male gender	24 (55.8)	0.008	0.55-1.9	0.92
CRP Positivity	29 (67.4)	108.6	0.03-0.12	< 0.001

Ours is a reputed tertiary health care institute which caters the health needs of the patients from different places within M.P. Maximum patients belonged to Jabalpur 556(65%), Damoh 70(8%) and Dindori 35(4%). Among 118 patients with neonatal sepsis, 76 (64%) hailed from urban area whereas 42(36%) belonged to rural areas.703(83%) people utilised government facilities for mobilisation to the hospital whereas 147(17%) people arranged it by themselves. Among 850 cases followed up during the study duration 118(14%) neonates had sepsis and most of them 88(76%) were admitted to the inborn unit during first day of birth. Maximum duration upto which babies got admitted into the inborn unit was 25th day post birth. Duration of stay of the neonates in the inborn unit was mostly ≤7 days and 296 (34.8%) stayed for more than or equal to eight days in the inborn unit for treatment.

## **DISCUSSION**

India is a developing nation with a distant dream to achieve to achieve MDG 4 but remains unfulfilled due to the lack of appropriate neonatal care. The maintenance of neonatal health should be the priority of every society. With this idea in mind SNCUs were set up in India In India, data on neonatal sepsis are lacking and more so that of bacteriological profiles. The total neonatal

mortality rate of Madhya Pradesh is 43 per thousand live birth. 10

The prevalence of bacteriologically positive sepsis was found to be 5.06% which is comparable to the final report published by ICMR in June 2016 named as "icmr center for advanced research in newborn health" in which the prevalence was found to be 6.2% in the inborn cohort, where as in a similar study done in a neonatal unit of Kasturba hospital and medical college, Manipal from Jan 98- Dec 2004 the prevalence of bacteriologically positive sepsis was 17.8%. 11 The higher rate of sepsis may be due to lesser availability of facilities for NICU management in effective and aseptic manner at that time. 12 In a study in Shri Aurbindo Institute of Medical Science, Indore conducted from January 2012- September 2012 prevalence of sepsis was found to be 6.9% which is again comparable to present study.<sup>13</sup> In a similar study done in SP medical college, Bikaner from Jan 2104- Oct 14, the prevalence of bacteriologically positive sepsis was 7.6%, which is comparable to this study. 14 Similar prevalence was found in a study done by Joseph et al (7.8%). <sup>15</sup> The study done by Chowdhary et al found the prevalence of bacteriologically positive sepsis to be 11.2% which is higher than our study, this might be because they considered clinically suspected cases as confirmed cases of neonatal sepsis. 16 A study done in the inborn unit of CMC, Vellore in 1995-1996 reported the prevalence of culture positive bacterial sepsis as 4.4% which is comparable to current study. 17

In this study the most common bacteria found associated with neonatal sepsis in the inborn unit was Klebsiella (37.2%) followed by *E. coli* and Pseudomonas, 16.28% each, and Staphylococcus aureus was 13.95%. According to a report published by ICMR on newborn health two-thirds of isolates were Gram-negative including *Acinetobacter spp.* (21.9%), *Klebsiella spp.* (16.6%), and Escherichia coli (13.7%) in inborn cohort. A study done in SP medical college, Bikaner also showed Klebsiella as the most common (48.21%) micro-organism associated with sepsis in inborn unit. It

In an another study done in Indore, Madhya Pradesh Klebsiella was found to be the most commonly associated organism.13 Whereas in a study done in GMCH Chandigarh from 2008- 12 the most common organism was found to be Staph, aureus and Klebsiella took the second position, also a study in Manipal found most common organism to be Pseudomonas (33.2%) followed by Klebsiella (31.4%). This may be due colonisation of different bacteria in different set ups. Similarly, in a study done in 2007 in Burdwan MCH Klebsiella (34.48%) was the most common organism isolated.<sup>19</sup> Similar results were reported according to NNPD 2002-03 in which among intramural births Klebsiella was the most frequently associated pathogen (32.5%) followed by Staph. aureus (13.6%). Similar, results with Klebsiella as the most common isolate was found in other studies.<sup>20-24</sup>

Among the neonates having culture positive sepsis, 35 (81.4%) were preterm and 8(18.6%) were term. The association between prematurity and sepsis was more than than that between term maturity and sepsis and this was statistically significant (p value<0.001). This is comparable to the results in the study in Medical College, Bikaner done. <sup>14</sup> This was also comparable to the study by Khatura et al. <sup>25</sup> This increased association between prematurity and neonatal sepsis may be due to the fact that low levels of IgG antibodies in a preterm neonate as most of the IgG from the mother pass to the neonate in the latter part of pregnancy. Hence a baby born before the expected date of delivery would receive less amount of IgG antibodies from the mother, leading to decreased immunity, hence more chances of sepsis.

Present study found out that, out of the neonates having culture positive sepsis 37 (86%) were low birth weight and 6 (14%) had normal weight. Hence there was an association between low birth weight and neonatal sepsis in our inborn unit, and this association was statistically significant (p value<0.001). Similar results were obtained in the study by Pradeep et al (60.94% being LBW).14 Comparable results were also found in study by Shitayee et al (60%). <sup>26</sup> This may be due to the fact that Lbw babies have low IgG stores leading to lower immunity status. Low birth weight babies whether preterm or small for date are more vulnerable to develop infections as they have poor mucosal defences and low levels of various components of complement system. Thymus is atrophic and number of T cells is markedly diminished. Neutrophil chemotaxis, phagocytosis and intracellular killing is also poor in them.<sup>5</sup>

Among the neonates having bacterial positive sepsis 24 (55.8%) were male and 19 (44.2%) were female. A higher preponderance of males towards sepsis is seen but this association was not found to be statistically significant. Comparable results were seen in the study in Bikaner Medical College where among the sepsis proven neonates in inborn unit 65.27% were male and 34.72% were female.<sup>14</sup>

In a study in the Department of Microbiology, Government Medical College, Thiruvananthapuram and Department of Paediatrics, Sree Avittom Thirunal Hospital, Thiruvananthapuram, during a period of one year from March 2012 to February 2013, among neonates having sepsis 135 (57.9%) were male and 98 (42.1%) were female. Of the culture-positive neonates, 28 (63.6%) were male whereas 16 (36.4%) were female. There is a slightly higher incidence of sepsis among males.<sup>27</sup> Neonatal sepsis is more common in males because the factors regulating the synthesis of gammaglobulin are probably situated on the X chromosome.

In this study, the number of neonates who had CRP positive values and also had bacteriological positive sepsis were 29 (67.4%) while 14 (32.6%) of CRP positive neonates did not show bacterial positivity. CRP positivity

has been significantly associated with culture proven sepsis (p value<0.001). Similar findings were seen in the study by Effat et al where 80% of CRP positive neonates were also found out to be culture positive.<sup>28</sup> Any elevation of serum CRP in the neonate always represents endogenous synthesis, since it passes the placenta in exceedingly low quantities.<sup>29</sup> Among total 850 neonates admitted in Inborn unit, blood culture positive sepsis was seen among 43 patients (5.06%) and only 2 samples were CSF culture positive (0.24%). In both the CSF cultures the bacteria isolated was *E. coli*. The incidence of CSF culture positivity has been found to be between 0.3% to 3% in various studies.<sup>30,31</sup>

#### CONCLUSION

It can be concluded that though we are on the track of minimising morbidities and mortalities but still there is a long way to go, still we have a higher prevalence of neonatal sepsis even in inborn units and most common associated bacteria is Klebsiella pneumonae, and most common indication for admission was respiratory distress which further led to neonatal sepsis. Among the patients with sepsis maximum patients were males and maximum patients belonged to urban areas and were successful in availing the government facilities for transportation upto the health facility. Neonates with sepsis were mainly preterm term and with low birth weight. Most of the neonates who had sepsis were admitted on the first day of their birth and maximum duration of stay of most of the neonates was 8 days and most of them were treated and discharged successfully.

The fetus is not "immunologically null" and the newborn baby has a well developed and functional immune system but with certain limitations. They also have enhanced vulnerability to infections and greater opportunities to get infected in the labor room and SNCU. Hands of personnel are a potent source of microbes unless due precautions are taken. The inborn neonates exposed to a variety of fomites which are potential source of pathogens such as incubators, cots, linen, suction catheters, laryngoscopes, endotracheal tubes etc.

Simple measures such as following the 5 clean practices during delivery and hand washing in a proper way will help to reduce the prevalence of neonatal sepsis in the inborn unit. Also, irrational use of antibiotics should be condemned. These steps will surely help reduce the burden of neonatal morbidity and mortality in the inborn unit

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