

**Emerging Incidence of Candidemia in Neonatal Intensive Care Unit and Sick Newborn Care Unit in a Tertiary Care Hospital in Eastern India**Atul Shekhar<sup>1</sup>, Shashank Kumar<sup>2</sup>, Bankey Behari Singh<sup>3</sup><sup>1</sup>Senior Resident, Department of Pediatrics, Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India<sup>2</sup>Senior Resident, Department of Pediatrics, Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India<sup>3</sup>Professor & HOD, Department of Pediatrics, Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India

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**Abstract:****Background:** NICUs and SNCUs, especially resource-limited ones, are increasingly concerned about candidemia, a fungal bloodstream infection caused by *Candida* species. Prematurity, low birth weight, and protracted hospital stays put neonates in danger.**Methods:** From April 2022 to May 2023, 235 neonates in the NICU and SNCU at Anugrah Narayan Magadh Medical College & Hospital (ANMMCH), Gaya, Bihar, participated in this prospective observational study. Analyses included demographics, clinical risk factors, and test results. *Candida* species were isolated from blood cultures and tested for antifungal susceptibility.**Results:** Candidemia affected 19.1% of infants. Key risk factors included low birth weight (<1500 g), preterm birth (<32 weeks), prolonged hospital stay, invasive procedures, and prolonged antibiotic use. The most common species was *Candida albicans*, followed by *C. parapsilosis*, *tropicalis*, and *glabrata*. Amphotericin B and caspofungin were most effective, however, several isolates were fluconazole-resistant.**Conclusion:** The high incidence of candidemia highlights the need for targeted antifungal therapies and stringent infection control practices in NICUs and SNCUs. Effective treatment options such as amphotericin B and caspofungin are recommended, given observed resistance patterns.**Keywords:** Candidemia, Neonatal intensive care unit, *Candida* species, Antifungal resistance.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

A serious problem in neonatal intensive care units (NICUs) and sick newborn care units (SNCUs), especially in healthcare settings with limited resources, is candidemia, a bloodstream infection brought on by *Candida* species [1,2]. Given the underdeveloped immune system and the length of hospital stays frequently necessary for preterm or severely ill infants, candidemia poses special issues in neonates. Factors include prolonged use of broad-spectrum antibiotics, invasive procedures, and higher susceptibility because of newborns' immature immune responses are all linked to the high frequency of candidemia in NICUs and SNCUs [3,4]. Because candidemia can cause serious problems, such as neurodevelopmental deficits and prolonged hospitalization, it is linked to high rates of morbidity and mortality, particularly in newborns with extremely low birth weights [5].

Candidemia is a growing and serious issue at tertiary care facilities in Eastern India, where resources and access to healthcare may be limited. According to

studies, the prevalence of candidemia in newborns is gradually rising in this area, which is consistent with worldwide patterns of an increase in candidemia cases [6,7]. Nevertheless, information on regional epidemiological trends, risk factors, and efficient therapy or preventative strategies specific to Eastern Indian neonatal populations is still lacking [8]. Developing focused therapies that can lower the disease burden and enhance neonatal outcomes requires an understanding of the unique risk profile and resistance patterns of *Candida* species in this setting [9].

Investigating the rising prevalence of candidemia in NICUs and SNCUs at a tertiary care hospital in Eastern India is the goal of this study. To help develop efficient infection management plans and enhance clinical results in neonatal care settings, it aims to determine risk factors, isolate the most common species of *Candida*, and evaluate their patterns of antifungal susceptibility.

## Methodology

**Study Design:** This was a prospective observational study conducted to assess the incidence of candidemia in the neonatal intensive care unit (NICU) and sick newborn care unit (SNCU) of Anugrah Narayan Magadh Medical College & Hospital (ANMMCH), Gaya, Bihar. Data was collected over a period of 13 months, from April 2022 to May 2023.

**Study Population:** The study comprised 235 NICU/SNCU infants. The inclusion criteria were newborns admitted for more than 48 hours with sepsis symptoms as fever, lethargy, poor feeding, or respiratory distress. Neonatals with congenital immunodeficiencies, those receiving antifungal medication at the entrance, and those discharged or moved before 48 hours were excluded.

**Data Collection:** Detailed demographic, clinical, and laboratory data were collected from medical records, including birth weight, gestational age, history of antibiotic use, invasive procedures (central venous catheter, endotracheal intubation, etc.), and duration of hospitalization. Blood samples were collected aseptically for culture and sensitivity testing from all neonates who met the inclusion criteria.

**Laboratory Procedures:** Blood samples were processed for fungal culture following standard microbiological procedures. *Candida* species were isolated, and their identity was confirmed through biochemical tests. Antifungal susceptibility testing was conducted using the Clinical and Laboratory Standards Institute (CLSI) guidelines to determine the susceptibility profile of the isolates.

**Data Analysis:** Data were analysed using statistical software to calculate the incidence of candidemia and identify associated risk factors. Descriptive statistics were used to summarize demographic and clinical characteristics. Chi-square tests and logistic regression analyses were conducted to assess associations between candidemia incidence and potential risk factors.

## Results

The study included a total of 235 neonates admitted to the NICU and SNCU at ANMMCH, Gaya, Bihar, from April 2022 to May 2023. Out of these, 45 cases (19.1%) were confirmed with candidemia. The results are presented in the following sections with relevant tables describing demographic characteristics, risk factors, and antifungal susceptibility patterns of the *Candida* species isolated.

**Table 1: Demographic and Clinical Characteristics of Neonates with Candidemia**

Characteristic	Candidemia Cases (n=45)	Non-Candidemia Cases (n=190)	p-value
Gender			
- Male	26 (57.8%)	100 (52.6%)	0.54
- Female	19 (42.2%)	90 (47.4%)	
Birth Weight			
- <1500 g	30 (66.7%)	60 (31.6%)	<0.001
- ≥1500 g	15 (33.3%)	130 (68.4%)	
Gestational Age			
- <32 weeks	28 (62.2%)	40 (21.1%)	<0.001
- ≥32 weeks	17 (37.8%)	150 (78.9%)	
Duration of Hospital Stay			
- ≥2 weeks	32 (71.1%)	70 (36.8%)	<0.001
- <2 weeks	13 (28.9%)	120 (63.2%)	

Table 1 shows the demographic and clinical characteristics associated with candidemia among neonates. Low birth weight (<1500 g), preterm birth (<32 weeks), and prolonged hospital stay (≥2 weeks) were significantly associated with higher

candidemia incidence. These findings highlight that vulnerable neonate, especially those with low birth weight and extended hospitalization, are at greater risk

**Table 2: Risk Factors Associated with Candidemia in Neonates**

Risk Factor	Candidemia Cases (n=45)	Non-Candidemia Cases (n=190)	p-value
Invasive Procedure			
- Central Line	28 (62.2%)	60 (31.6%)	<0.001
- Endotracheal Intubation	20 (44.4%)	50 (26.3%)	0.02
Antibiotic Use (≥7 days)	35 (77.8%)	90 (47.4%)	<0.001
Total Parenteral Nutrition	30 (66.7%)	60 (31.6%)	<0.001

Table 2 details the significant risk factors for candidemia among neonates. Prolonged antibiotic

use, presence of a central line, endotracheal intubation, and use of total parenteral nutrition were

more common among neonates who developed candidemia. These findings suggest that invasive

procedures and extensive antibiotic use may predispose neonates to candidemia.

**Table 3: Antifungal Susceptibility Pattern of *Candida* Isolates**

<i>Candida</i> Species	Number of Isolates (n=45)	Fluconazole	Amphotericin B	Caspofungin
<i>Candida albicans</i>	18 (40%)	15 (83.3%)	18 (100%)	17 (94.4%)
<i>Candida parapsilosis</i>	12 (26.7%)	10 (83.3%)	12 (100%)	12 (100%)
<i>Candida tropicalis</i>	9 (20%)	7 (77.8%)	9 (100%)	8 (88.9%)
<i>Candida glabrata</i>	6 (13.3%)	4 (66.7%)	5 (83.3%)	5 (83.3%)

Table 3 presents a summary of the antifungal susceptibility patterns observed in the isolated *Candida* species. The majority of isolates demonstrated susceptibility to amphotericin B and caspofungin, whereas a subset of *Candida glabrata* and *Candida tropicalis* isolates exhibited resistance to fluconazole. The data indicate that amphotericin B and caspofungin may be more effective options for treating candidemia in this context, whereas fluconazole resistance may require alternative therapies. The prevalence of candidemia in the NICU and SNCU of ANMMCH was 19.1%. Significant risk factors comprised low birth weight, prematurity, prolonged hospitalisations, invasive interventions, and prolonged antibiotic administration. The predominant species isolated was *Candida albicans*, succeeded by *Candida parapsilosis*, *Candida tropicalis*, and *Candida glabrata*. Antifungal susceptibility testing indicated that amphotericin B and caspofungin were the most effective agents against the isolated species.

### Discussion

This study reports a candidemia incidence of 19.1% among neonates in the NICU and SNCU of a tertiary care hospital in Eastern India, highlighting the substantial impact of fungal infections in neonatal critical care environments. This rate is significantly elevated, consistent with recent findings from other resource-limited environments, where analogous risk factors lead to increased candidemia incidence. Ramasethu et al. conducted a study revealing a candidemia prevalence of 12.9% in an Indian NICU. Variations in regional practices and hospital-specific infection control protocols may explain the differences in prevalence rates observed across various studies [10,11,12]. This study found a significant association between low birth weight (<1500 g) and prematurity (<32 weeks of gestation) with an elevated risk of candidemia, aligning with prior research findings. Neonates with low birth weight and underdeveloped immune systems exhibit heightened vulnerability to invasive fungal infections, as documented by Pappas et al. in a multicenter cohort study [13]. Chakrabarti et al. reported analogous findings, indicating that prematurity and low birth weight are significant risk factors for candidemia in Indian NICUs [14]. This study found a strong correlation between prolonged hospital stays (2 weeks) and invasive

procedures, including central line insertion and endotracheal intubation, with the occurrence of candidemia. The findings align with a study conducted in a NICU in Southern India, which indicated that invasive devices, especially central venous catheters, notably elevated the risk of candidemia [15]. The administration of broad-spectrum antibiotics for a duration of seven days or more, recognised as a significant risk factor in this context, corresponds with global research indicating that extended antibiotic use disturbs normal flora, thereby promoting fungal colonisation and leading to bloodstream infections [16].

This study revealed that the species distribution was primarily dominated by *Candida albicans*, with *Candida parapsilosis*, *Candida tropicalis*, and *Candida glabrata* following in prevalence. This distribution reflects findings from analogous healthcare environments, indicating that *C. albicans* is the predominant cause of candidemia, while non-*albicans* *Candida* species are being increasingly documented in NICUs [17]. *C. parapsilosis*, the second most common species in this study, is associated with catheter-related infections, reflecting the high prevalence of invasive device utilization in neonates [18]. Antifungal susceptibility testing indicated that amphotericin B and caspofungin demonstrated high efficacy against all isolated *Candida* species, whereas resistance to fluconazole was noted, especially in *Candida glabrata* and *Candida tropicalis*. The findings align with patterns observed in studies from other regions of India, where fluconazole resistance among non-*albicans* species is increasingly reported [19]. Based on the observed resistance patterns, amphotericin B and caspofungin are indicated as more appropriate options for initial therapy in this context, consistent with the recommendations of Mehta et al. in their NICU infection control guidelines [20].

### Conclusion

This study emphasises the significant prevalence of candidemia in the NICU and SNCU at ANMMCH, influenced by factors such as low birth weight, prematurity, extended antibiotic use, and invasive procedures. The prevalence of *Candida albicans*, along with fluconazole resistance observed in certain non-*albicans* species, underscores the necessity for targeted antifungal treatment and

rigorous infection control protocols. Ongoing research and surveillance are crucial for developing effective preventive strategies and optimising treatment protocols for candidemia in neonates.

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