



Microbiological Profile and Sensitivity Data among the Neonatal Population from a Tertiary Care Hospital in South India

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Authors contributions

This work was carried out in collaboration among all authors. Author RM collected the patient data, did the data entry, and wrote the manuscript. Author BB planned the study, collected the data, reviewed and edited the manuscript. Authors SM and SM helped in collection of data, and writing the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Background: Sepsis is one of the most common causes of mortality and morbidity among neonates. The prevalence of microorganisms varies with regions, and the sensitivity pattern also changes over time.

Aim: To study the prevalence of various microorganisms and their sensitivity pattern among the neonatal population in a tertiary care hospital in South India.

Methods: This was a retrospective descriptive study. We screened the records of all neonates admitted to the hospital during a period starting from January 1st, 2016, to September 30th, 2018. The details of the patients with any sterile body fluids showing microbial growth were collected. Descriptive analysis was done using IBM SPSS version 20.

Results: There were 77 organisms isolated during the study period, with the majority among outborn babies. Seventy-two isolates were from blood, two from CSF and urine, with one from the central line. The most common organism was *Klebsiella* (22%), followed by *Burkholderia cepacia* (12%), *Staphylococcus aureus* (9%), and *Streptococcus agalactiae* (7%). 9% of the organisms

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were fungus, with the most common being *Kodamaea Ohmeri*. Among the antibiotics tested for sensitivity, Meropenem had the maximum sensitivity ratio (84%), followed by Co-trimoxazole (83%) and Vancomycin (82%). Piperacillin tazobactam sensitivity was only 56%, and Ciprofloxacin was sensitive in 65% of cases. Most (6 out of 7) of the fungal isolates were sensitive to fluconazole.

Conclusions: *Klebsiella* remains to be the most common organism causing severe infection in young infants. Worrying rise in the incidence of uncommon organisms (like *Kodamaea Ohmeri*, GBS, *Burkholderia*) and carbapenem resistance was noted. It is, therefore, essential to update the antibiotic policy of the neonatal units on a timely basis.

Keywords: Microbiological profile; neonatal sepsis; antibiotic therapy; antibiotics.

1. INTRODUCTION

1.1 Background

Neonatal sepsis is a cause of substantial mortality and morbidity all over the world [1]. About 2.7 million deaths occur globally due to neonatal sepsis [2]. The precise estimates of neonatal sepsis burden vary between high-income and low-income countries [1]. A broad spectrum of organisms causing sepsis has emerged over recent times, and limited data exist on this new trend [3]. With case fatality rates of sepsis between 25% and 65%, India has the highest incidence globally [4]. Antibiotics are the most commonly prescribed medications in neonatal intensive care units (NICUs), and in industrialized countries, about 1% of neonates receive antibiotic therapy [5]. Though the benefits of antibiotic therapy when indicated are enormous, the continued use of antibiotics without any microbiological justification is dangerous and could lead to adverse events [5,6]. The choice of antibiotic and duration of empiric treatment must be center-based [6]. We conducted a retrospective study to identify the microbiological profile of the common organisms causing neonatal sepsis in our NICU.

1.2 Aim

To study the incidence of neonatal sepsis in a tertiary care NICU and outline the profile and sensitivity of the organisms causing sepsis.

2. METHODOLOGY

2.1 Study Design and Population

This retrospective descriptive study was conducted over 36 months between January 2016 and September 2018 at the Neonatal Intensive Care Unit in Aster Mims Hospital, Kerala, India. Newborns admitted to the neonatal

ICU and diagnosed with culture-positive sepsis, during this study period were identified, and their data was collected. After identifying the isolated organisms, the sensitivity of antibiotics to these organisms was outlined. Descriptive analysis was done using IBM SPSS version 20.

3. RESULTS

A total of 1570 neonates were admitted during the study period. Neonatal sepsis affected 77 of them, with 60 being outborn and 17 inborn. The majority (53) of neonates had early-onset neonatal sepsis (EONS), and 24 of them had late-onset neonatal sepsis (LONS).

The total incidence of sepsis was 4.4%. The hospital-acquired infection rate was 0.9% (3.8 per 1000 [7] NICU days). The mortality rate among sepsis affected population was 12.9%. 16 (20%) of the affected neonates had meningitis.

Blood (72, 93.5%) was the primary site from where organisms were isolated, while cerebrospinal fluid and pus had two isolates each (2.6%). 1 organism was isolated from the central line (1.3%).

Upon gram staining of the isolated organisms, 55 were gram-negative (71.4%), and 16 were gram-positive (20.8%), 6 (7.8%) of the organisms belonged to the fungal group.

Klebsiella (17) was the most common isolated organism among both inborn and outborn babies affected with sepsis, followed by *Burkholderia sepacia* (9) and *staphylococcus* (7). *Kodamea Ohmeri* was the predominant fungi (4).

3.1 Common Organisms Isolated

The sensitivity of various antibiotics to the organisms isolated is outlined in the table. Meropenem had the highest class sensitivity

(88%), followed by Cotrimoxazole (83%) and Vancomycin (82%). Amikacin (44%), Ampicillin (18%) had poor sensitivity. Among antifungals, Fluconazole had a good sensitivity of 85 %.

When considering total sensitivity, Cotrimoxazole had slightly better sensitivity than Meropenem, while the remaining antibiotics had a sensitivity below 50%.

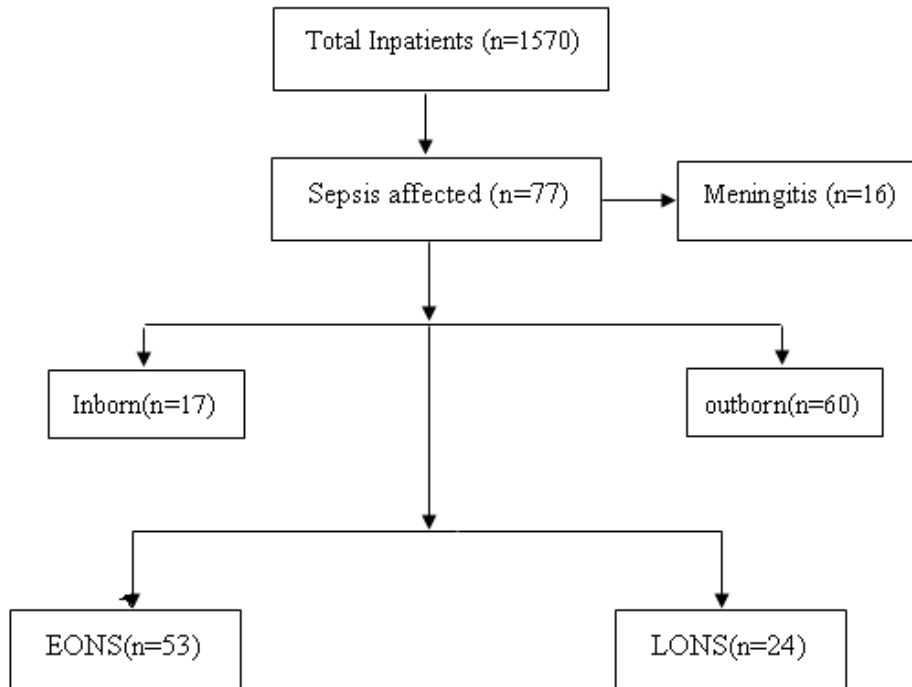


Fig 1. Flow chart of onset neonatal sepsis rate in patients

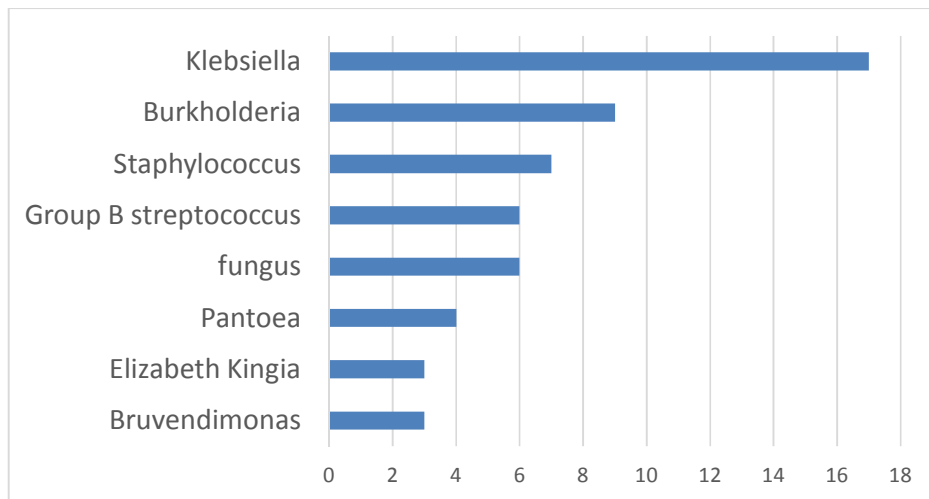


Fig. 2. Isolation of common organism

Table 1. Sensitivity of antibiotics

Antibiotics	Class sensitivity (%)	Total sensitivity (%)
Meropenem	88	63
Cotrimoxazole	83	68
Vancomycin	82	35
Imipenem	74	46
Ciprofloxacin	65	53
Colistin	64	38
Piperacillin+ Tazobactam	56	37
Gentamycin	44	32
Amikacin	44	31
Ceftriaxone	32	25
Amoxicillin + Clavulanic acid	26	12
Ampicillin	18	4
Penicillin	2	3
Fluconazole	85	

4. DISCUSSION

Neonatal bacterial sepsis is a significant cause of death in developing countries like India. Inappropriate antimicrobial consumption exacerbates the resistance of bacteria to several antibiotics. The most common organisms associated with neonatal sepsis vary with the type of infections and geographical location [8]. Therefore, information on the bacteriological profile of neonatal sepsis and their sensitivity to antimicrobials is essential to combat neonatal morbidity and mortality issues.

The incidence of sepsis in our study was 1.8%. This was significantly lower when compared to various studies across India and the world [7,9]. 20% of the affected neonates had meningitis. There has been a high incidence of meningitis in sepsis-affected neonates in various studies.

We use the Bactec method of culture for identification of organisms, which has a high sensitivity and specificity [10]. The bacterial profile revealed the prevalence of *Klebsiella* being the most common, followed by *Burkholderia sepacia*, *Staphylococcus* group, Group B streptococcus, and *Pandora*. Various studies have identified these pathological organisms as the predominant strains causing sepsis [11-13]. In this study, gram-negative sepsis was higher in comparison to those caused by gram-positive bacteria. The organisms causing sepsis may vary from place to place. During the birth process, neonates get exposed to vaginal gram-negative bacteria [12]. Among the Gram-positive isolates, *S. aureus* is a predominant nosocomial organism with transmission from health workers and relatives

[14]. *Klebsiella pneumonia* accounts for the highest infection rates caused by gram-negative bacteria. These findings were similar to the previous studies conducted among neonates [8,15]. An interesting finding in our study was the presence of *Kodameae ohmeri*, an uncommon organism, of which very few pieces of literature are available.

In our study, EONS accounted for 68.8% and LONS for 31.2% of the total sepsis, respectively. This incidence may vary among studies depending upon multiple factors like the technique of blood culture, the measures chosen for infection control, and regional variation. A study from North India showed EONS in 85% of neonates [16], while a similar study from South India also had a majority of EONS (94.4%) [17].

The antibiotic susceptibility pattern of bacterial isolates from culture was done using Broth dilution method [18]. The pattern showed maximum susceptibility towards Meropenem, Cotrimoxazole, Vancomycin, and Ciprofloxacin. The sensitivity of commonly used antibiotics like Amikacin and Cefotaxime was petite, while the isolates showed a high resistivity towards Ampicillin, Penicillin, and Amoxicillin. Fluconazole was sensitive to 85% of the fungi isolated in the study. Once the sensitivity pattern was known for a particular organism, we completed the duration of antibiotics with the most compatible one. The antibiotic sensitivity pattern isolated in our study showed insight into preparing appropriate antibiotics for reducing the incidence of sepsis in the neonatal unit. The higher incidence of resistance towards several commonly used antibiotics could be due to the emergence of antimicrobial genes in bacteria and

inadvertent use of antibiotics before hospitalization of the neonates [19,20].

Neonatal sepsis remains a life-threatening emergency of neonates, and the judicious commencement of antibiotics plays a crucial role in the treatment and survival of the affected ones. An apprehension of organisms causing infections is essential for the treatment to be effective. Ideally, the initial empirical antibiotic must be that which would cover for the prevalent bacterial organisms in that locality.

5. CONCLUSION

This study showed a high prevalence of *S. aureus* as Gram-positive and *K. Pneumoniae* as Gram-negative bacteria among suspected neonatal cases. Overall, isolates showed maximum sensitivity towards Meropenem and Quinolones, whereas penicillin had significantly high resistance. A few higher-end antibiotics like colistin also had resistance. As there has been a constant increase in the number of uncommon and highly resistive organisms, it is quintessential to update the antibiotic policy in each unit to tackle antibiotic resistance.

6. LIMITATIONS

This was a single-center study conducted in our institution with limited sample size. Further elaborate research should cover suspected neonates from different parts to determine the prevalence of neonatal sepsis and its sensitivity across the country.

CONSENT

It is not applicable.

ETHICAL APPROVAL

This study was approved by the institute ethics committee (Aster Mims Kottakkal- No.23).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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