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# Antibiotic Prescribing Pattern in Neonatal Intensive Care Unit of Tertiary Care Teaching Hospital of North India: An Observational Study

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## Abstract

**Background**: Newborns are a special group of population who due to their underdeveloped immune system are more receptive to infections. Hospitalized newborns need multiple medications to survive. Antibiotics are among the most commonly prescribed drugs in neonatal intensive care unit (NICU). Antimicrobial resistance posing a major threat to human health worldwide can be reduced by the thoughtful use of antibiotics. The aim of our study was to observe and analyse the prescribing pattern of antibiotics in NICU in a tertiary care teaching hospital.

**Materials and Methods**: A prospective observational study was conducted for period of six months. Prescriptions of 150 neonates were evaluated out of which 100 neonates were enrolled in the study who were fulfilling the required inclusion criteria. Demographic details, data on antibiotic use were recorded.

**Results**: Out of 100 neonates included 75 were males and 25 were females. Mean Gestational age and Mean birth weight (±SD) were 36.02±3.63 days and 2341.45 ±741.75 gms. The most common admission diagnosis was respiratory distress syndrome, followed by prematurity and sepsis. A total of 291 prescriptions (2.9±2.34), were given to neonates. All the 100 neonates were prescribed antibiotics. Total drugs prescribed were 373 out of which 347 were antibiotics. Ampicillin was the commonly prescribed antibiotic followed by gentamicin, cefotaxime, amikacin, meropenem, netilmicin and vancomycin. In fixed dose combination piperacillin + tazobactum was prescribed. All the antimicrobial agents were prescribed by generic names.

**Conclusion**: The present study suggests that there is high use of antibiotics in neonates and there is need of proper guidelines to prevent the unnecessary use of antibiotics.

**Keywords**: Antibiotics, Neonates, Prescriptions

## Introduction

Newborns are a special group of population who due to their underdeveloped immune system are more receptive to infections [1]. Hospitalized newborns need multiple medications to survive and most of the times evidences related to safety and efficacy of certain drugs in adults is extrapolated to neonates thus making their efficacy and safety in neonates implausible. Neonates, due to peculiar

physiology the pharmacokinetic findings of drugs in older patients and neonates differ hence cannot be generalized to neonates [2,3]. Neonatal sepsis is a prime cause of morbidity and mortality worldwide. Antibiotics are the indispensable drugs for the management of neonatal septicemia and are among the most commonly prescribed drugs in neonatal intensive care unit (NICU). Antimicrobial resistance posing a major threat to human health worldwide can be reduced by the thoughtful use of antibiotics. The consequences like drug resistance, adverse drug reactions and drug-drug interactions can be avoided by paying more attention while prescribing antibiotics to neonates [4,5]. Number of challenges confronted by pediatricians managing neonates during the day-to-day practice due to the shortage of appropriate drugs and other facilities [6,7].

Hence, enforcement of elaborated rational knowledge of antibiotic prescribing pattern in neonates in clinical practice must be is the need of the hour. Thus, the aim of our study was to observe and analyse the prescribing pattern of antibiotics in NICU in a tertiary care hospital

**Material and Methods**

This prospective observational study was conducted at Government Medical College Jammu during June-November 2021. The clearance from ethical committee was taken. Out of 100 neonates included admitted to the NICU for more than 24 hours during the study period were included in the study. Neonates died or discharged within 24 hours of admission were excluded from the study. Study was carried out by evaluating medication records of admitted neonates. Data pertaining to gestational age, birth weight, gender, diagnosis, and patient outcome as percentages of survival, discharge and death were recorded. Details of antibiotics administered to each patient were recorded.

**Statistical Analysis**

Data was analysed with the help of computer software MS Excel for windows and SPSS version 17. The collected data was presented as percentages and mean ± standard deviation (SD) as deemed appropriate for qualitative and quantitative nature of data.

**Results**

Prescriptions of 100 neonates were evaluated. Out of 100 neonates 75 were males and 25 were females. Mean Gestational age and Mean birth weight(±SD) were 36.02±3.63 days and 2341.45 ±741.75 gms (Table 1). The most common admission diagnosis was respiratory distress syndrome, followed by prematurity and sepsis. (Figure 1). A total of 291 prescriptions (2.9±2.34), were given to neonates. All the 100 neonates were prescribed antibiotics. Total drugs prescribed were 373 out of which 347 were antibiotics. Ampicillin was the commonly prescribed antibiotic followed by gentamicin, cefotaxime, amikacin, meropenem, netilmicin and vancomycin (Table 2). The therapeutic class according to Anatomical therapeutic chemical classification with highest number of off label drug use was Group J(Anti-infective for systemic use) with approximately 97% followed by Others(Figure 2). A total of 347 antibiotics were prescribed to the neonates. Majority of the neonates (41%) received 2 antibiotics ,19% neonates received >5 medications while 14% neonates received 3 antibiotics (Figure 3). In fixed dose combination piperacillin + tazobactum was prescribed. All the antimicrobial agents were prescribed by generic names. In our study drugs prescribed in NICU as per prescription were ampicillin (26.5%) followed by gentamicin (21.3%), cefotaxime (21%), amikacin (11.7%), meropenem (7.2%), netilmicin (5.8%), vancomycin (4.1%), fluconazole (2.4), linezolid (2.4%), colistin (2.1%), cloxacillin (1.7%), piperacillin-

tazobactum combination (1.7%). The less commonly prescribed per prescription were caffeine citrate (0.7%), vitamin K (0.7%), ranitidine (0.7), phenobarbitone (0.3%), ciprofloxacin (0.3%) and midazolam (0.3%) (Table 2). In our study, according to the gestational age of neonates highest prescribing was observed in term neonates (53.5%) as compared to moderately preterm (25%) and very preterm (21.3%). Drugs which were more commonly prescribed in term neonates were ampicillin (48%), gentamicin (42%), cefotaxime (66%), meropenem (57%), amikacin (53%), Vancomycin (58%), netilmicin (59%), fluconazole (71%), colistin (66%), cloxacillin (60%). Drugs which were prescribed of to term neonates were vitamin k, ranitidine, phenobarbitone, midazolam. Piperacillin-tazobactum combination (60%) and linezolid (57%) were prescribed more in moderately preterm neonates (60%). Caffienecitrate was prescribed to both term neonates and very preterm neonates 50% each. Ciprofloxacin was prescribed only to very preterm neonates (Table 3).

**Discussion**

This study found that antibiotics were the most commonly prescribed drug class in neonates in a tertiary level NICU. The high rate of antibiotic exposure in our study is similar to previous studies carried out so far in literature and is probably due to the standard practice of administering antibiotics pending bacterial culture results in sick neonates and is not in a direct relation true reflection to the incidence of bacterial infection [8-10]. Amikacin, cefotaxime were most frequently used antimicrobials in previous Indian studies [8,11]. However, in our study ampicillin was the commonly prescribed antibiotic followed by gentamicin, cefotaxime, amikacin, meropenem, netilmicin and vancomycin. This variability in prescribing pattern depicts that empirical antibiotic treatment differs among different countries and in NICUs of the same country. This is due to the fact that currently no standard guidelines regarding the choice of empirical antibiotics also there is less evidence from randomized trials in favours of any particular antibiotic regimen for the treatment of suspected late onset neonatal sepsis.

**Conclusion**

Conclusions drawn from the result of this study is that there was high use of antibiotics in neonates of NICU. All the antibiotics were prescribed by generic names. As antimicrobial resistance is closely linked to inappropriate antimicrobial resistance. It should be emphasized that antibiotics should be prescribed only when they are necessary in treatment and proper guidelines should be followed in prescribing antibiotics**.**

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**Legend Figures**

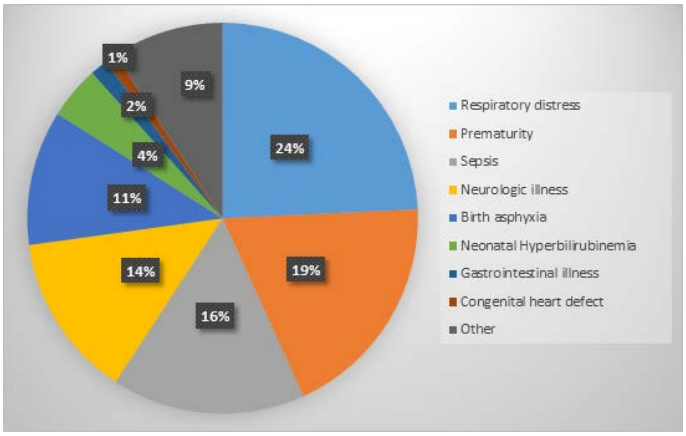


Figure 1: Primary diagnosis

*The total of percentage did not reach 100% because many neonates suffered from more than one diagnosis.

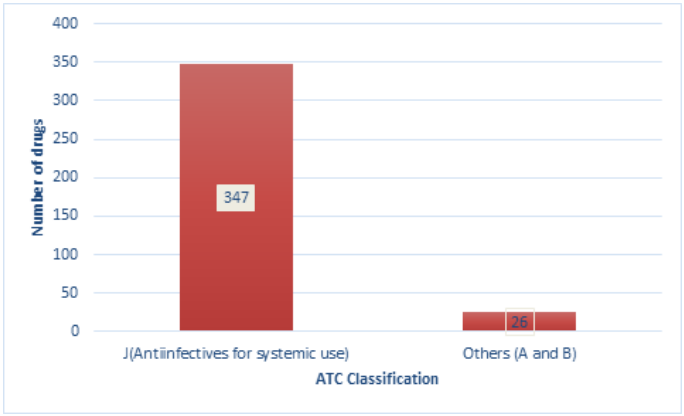


Figure 2: Frequency of drugs used in NICU by ATC (Anatomical Therapeutic Chemical) Classification

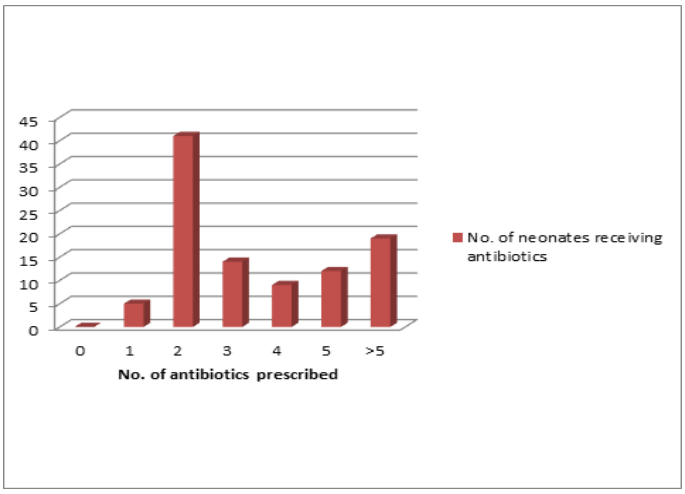


Figure 3: Number of antibiotics received by neonates.

| Variable | n | (%) |
|---|---|---|
| **Sex** | | |
| **Male** | 75 | 75% |
| **Female** | 25 | 25% |
| | | |
| **Gestational age** | | |
| **<32 weeks** | 17 | 17% |
| **≥32 weeks and <37 weeks** | 25 | 25% |
| **≥37 weeks** | 58 | 58% |
| **MEAN Gestational age** | 36.02±3.63 | |
| | | |
| **Age (days)** | | |
| **<7 days** | 82 | 82% |
| **>7 days** | 18 | 18% |
| **Mean age** | 4.89 | |
| | | |
| **Birth weight(gms)** | | |
| **Birth weight<1500** | 13 | 13% |
| **Birth weight≥1500 and<2000** | 25 | 25% |
| **Birth weight≥2000** | 62 | 62% |
| **Mean birth weight(±SD)** | 2341.45 ±741.75 | |
| **Mean birth weight(±SD)** | 2341.45 ±741.75 | |
| | | |
| **Type of patient** | | |
| **Medical** | 95 | 95% |
| **Surgical** | 5 | 5% |
| | | |
| **Length of stay** | | |
| **<7 days** | 27 | 27% |
| **>7 days** | 73 | 73% |
| **Mean hospitalization length(±SD)** | 15.4 ±10.54 | |
| | | |
| **Outcome at the time of discharge** | | |
| **Recovery** | 92 | 92% |
| **Death** | 6 | 6% |
| Referred | 2 | 2% |

Table 1: Demographic and clinical data of neonates admitted to NICU, N = 100

| | Drug | Total medicines prescribed | Percentage per prescription |
|---|---|---|---|
| | Ampicillin | 79 | 27.1% |
| | Gentamycin | 76 | 26.1% |
| | Cefotaxime | 61 | 21.0% |
| | Amikacin | 44 | 15.1% |
| | Meropenem | 22 | 7.6% |
| | Vancomycin | 17 | 5.8% |
| | Netilmicin | 17 | 5.8% |
| | Fluconazole | 7 | 2.4% |
| | Linezolid | 7 | 2.4% |
| | Colistin | 6 | 2.1% |
| | Cloxacillin | 5 | 1.7% |
| | Piperacillin-tazobactum combination | 5 | 1.7% |
| | Ciprofloxacin | 1 | 0.3% |
| | | 347 | |

Table 2: Antibiotics prescribed in NICU as per prescription, total prescriptions=291

| Antibiotics prescribed in NICU | Term (≥37) n (%) | Moderately preterm≥32 and <37 n (%) | Very preterm <32 n (%) | Total |
|---|---|---|---|---|
| Ampicillin | 38(48) | 25(32) | 16(21) | 79 |
| Gentamicin | 31(41) | 25(33) | 20(26) | 76 |
| Cefotaxime | 40(66) | 11(18) | 10(16) | 61 |
| Meropenem | 13(59) | 4(19) | 5(24) | 22 |
| Amikacin | 22(50) | 9(20) | 13(30) | 44 |
| Vancomycin | 10(59) | 2(12) | 5(29.4) | 17 |
| Netilmicin | 10(59) | 4(24) | 3(18) | 17 |
| Fluconazole | 5(71) | 1(14) | 1(14) | 7 |
| Linezolid | 2(29) | 4(57) | 1(14) | 7 |
| Colistin | 4(66) | 1(17) | 1(17) | 6 |
| Cloxacillin | 3(60) | 2(40) | 0 | 5 |
| Piperacillin-tazobactum combination | 2(40) | 3(60) | 0 | 5 |
| Ciprofloxacin | 0 | 0 | 1(100) | 1 |
| | 180(52) | 91(26) | 76(22) | 347 |

Table 3: Antibiotics prescribed to neonates according to their gestational age (weeks)