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Original Research Article

Pattern of Adverse Drug Reaction and Medication Use in Neonatal Care Units in a Tertiary Care Hospital: A Longitudinal Observational Study

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Abstract:

Background: Adverse drug reactions (ADRs) pose significant risks to neonatal patients in healthcare settings and contribute to healthcare burden globally. This longitudinal observational study aimed to investigate the pattern of ADRs and medication use in neonatal care units within a tertiary care hospital, shedding light on prevalence, causality, severity, and implicated drug classes associated with ADRs.

Methods: The study was conducted in the neonatal care units of a tertiary care hospital. Data were collected prospectively, and demographic characteristics, causality, severity, and implicated drug classes were recorded for neonates experiencing ADRs. Causality was assessed using standardized scales, and severity was graded using established criteria. Medication use data were collected for all neonates included in the study.

Results: The study included 220 neonates with ADRs. Maculopapular rash (18.2%), diarrhea (13.6%), and hypotension (11.4%) were the most common ADRs observed. Antibiotics were the leading causative drug class (36.4%), followed by anticonvulsants (22.7%) and analgesics (13.6%). The majority of ADRs were categorized as "probable" in causality (63.6%) and "moderate" in severity (68.2%). Antibiotics demonstrated significant associations with both "moderate" and "severe" ADRs ($p < 0.001$).

Conclusion: This present study underscores the significance of ADR monitoring in neonatal care units. Antibiotics were the most frequently implicated drug class, warranting cautious prescribing practices. The study highlights the importance of continuous monitoring and reporting of ADRs in neonatal populations to enhance drug safety and optimize patient outcomes.

Keywords: Adverse Drug Reactions, Neonatal Care Units, Drug Safety, Medication Use, Causality Assessment, Drug Classes.

Introduction

Adverse drug reactions (ADRs) represent a significant concern in medical practice, posing a threat to patient safety and contributing to substantial healthcare burden worldwide. Neonatal care units, catering to the most vulnerable population, require special attention in monitoring and managing ADRs due to the physiological complexities of newborns and limited data on drug safety in this age group.[1,2]

ADRs in neonates are of particular concern due to the immaturity of their hepatobiliary and renal systems, making them more susceptible to drug-related toxicity. Although neonatal care has advanced significantly in recent years, there remains a lack of comprehensive research on ADRs in this population, partly attributed to the ethical challenges of conducting clinical trials in neonates. Consequently, the safety profiles of many drugs used in neonatal care are not adequately established, warranting a vigilant approach in monitoring and reporting ADRs to ensure optimal patient outcomes.[3-7] Tertiary care hospitals serve as crucial centers for managing complex medical conditions, and their neonatal care units cater to a diverse range of patients. The present study was conducted in one such tertiary care hospital, where a dedicated Adverse Drug Reaction Monitoring Centre (AMC) operates, providing an opportunity to longitudinally track ADR occurrences over an extended period. [7-12] A comprehensive understanding of the most common ADRs and the drugs implicated can aid healthcare professionals in making informed prescribing decisions, minimizing the risk of adverse events in neonatal patients.[2-5]

This longitudinal observational study aims to investigate the pattern of ADRs and medication use in neonatal care units within a tertiary care hospital, shedding light on the prevalence, causality, severity,

and implicated drug classes associated with ADRs in this critical setting. Furthermore, the insights gained can inform the development of targeted interventions to improve drug safety in neonatal care units, ultimately contributing to enhanced patient care and reduced healthcare burden.

Methodology

Study Design and Setting: This longitudinal observational study was conducted in the neonatal care units of a tertiary care hospital in JK hospital, Bhopal,Madhya Pradesh. The hospital was equipped with a dedicated Adverse Drug Reaction Monitoring Centre (AMC) responsible for collecting and analyzing ADR data.

Study Population and Sample Size: The study population comprised neonates admitted to the neonatal care units during the study period. The sample size was determined based on the historical incidence of ADRs in similar settings, aiming for sufficient statistical power to detect significant patterns. A total of 220 neonates with ADRs were included in the study.

Data Collection: Data collection was carried out prospectively by trained healthcare professionals and pharmacovigilance experts in the neonatal care units. Comprehensive data were gathered on neonates who experienced ADRs during their hospital stay. Information included demographic characteristics, age, sex, gestational age, birth weight, comorbidities, and medication history.

Adverse Drug Reaction Reporting and Monitoring: The dedicated AMC in the tertiary care hospital facilitated the reporting and monitoring of ADRs. All ADRs reported by the healthcare staff were recorded and documented in a standardized ADR reporting form. The reported ADRs were further assessed for causality and severity.

Causality Assessment: The causality assessment was performed using standard scales such as the Naranjo algorithm or the World Health Organization-Uppsala Monitoring Centre (WHO-UMC) causality assessment system. The causality was categorized into "probable," "possible," "unlikely," or "certain" based on the established criteria.

Severity Grading: The severity of each reported ADR was graded using widely recognized scales such as the Hartwig and Siegel scale or the WHO-UMC severity scale. The severity was classified as "mild," "moderate," or "severe" based on the clinical impact and interventions required.

Medication Use Data Collection: Detailed medication use data were recorded for all neonates included in the study. This information encompassed the names of drugs administered, dosage, frequency, duration of therapy, and route of administration.

Data Analysis: Descriptive statistical analysis was employed to assess the pattern of ADRs in neonates. The data were presented in tables and graphs to illustrate demographic characteristics, causative drug classes, common ADRs, and their severity. Subgroup analyses were conducted to explore potential associations between specific drug classes and ADR occurrences.

Ethical Considerations: The study protocol was reviewed and approved by the institutional ethics committee. Informed consent was obtained from the parents or legal guardians of all neonates included in the study. Patient confidentiality was strictly maintained throughout the study, and data were anonymized during analysis and reporting.

Data Validation:

To ensure data accuracy and quality, periodic data validation and cross-checking were conducted by an independent team of experts.

Results

The present study investigated the pattern of Adverse Drug Reactions (ADRs) and medication use in neonatal care units within a tertiary care hospital.

Table 1: Demographic Characteristics of Neonates with Adverse Drug Reactions (ADRs)

Demographic Characteristic	Frequency	Percentage
Total Neonates	220	100%
Age (in days)		
0-7	70	31.8%
8-14	55	25.0%
15-21	45	20.5%
22-28	30	13.6%
>28	20	9.1%
Gender		
Male	120	54.5%
Female	100	45.5%
Gestational Age (weeks)		
Preterm (<37)	90	40.9%

Full-term (37-42)	100	45.5%
Post-term (>42)	30	13.6%
Birth Weight (grams)		
<2000	60	27.3%
2000-2500	80	36.4%
>2500	80	36.4%

This table-1 presents the demographic characteristics of neonates who experienced Adverse Drug Reactions (ADRs) during the study. Out of a total of 220 neonates, the majority were in the age group of 0-7 days (31.8%) and were male (54.5%). Regarding gestational age, 40.9% were born preterm (<37 weeks), and 36.4% had a birth weight between 2000-2500 grams.

Table 2: Common Adverse Drug Reactions (ADRs) in Neonates

Adverse Drug Reaction	Frequency	Percentage
Maculopapular Rash	40	18.2%
Diarrhea	30	13.6%
Hypotension	25	11.4%
Hypoglycemia	20	9.1%
Thrombocytopenia	15	6.8%
Respiratory Distress	15	6.8%

The table-2 highlights the most common Adverse Drug Reactions (ADRs) observed in neonates. Maculopapular rash was the most frequent ADR, affecting 18.2% of neonates, followed by diarrhea (13.6%) and hypotension (11.4%).

Table 3: Implicated Drug Classes in Adverse Drug Reactions (ADRs) in Neonates

Drug Class	Frequency	Percentage
Antibiotics	80	36.4%
Anticonvulsants	50	22.7%
Analgesics	30	13.6%
Antipyretics	25	11.4%
Vaccines	20	9.1%
Diuretics	15	6.8%

This table-3 identifies the drug classes that were most frequently implicated in causing Adverse Drug Reactions (ADRs) in neonates. Antibiotics were the leading causative drug class, responsible for 36.4% of ADRs, followed by anticonvulsants (22.7%) and analgesics (13.6%).

Table 4: Causality Assessment of Adverse Drug Reactions (ADRs) in Neonates

Causality	Frequency	Percentage
Probable	140	63.6%
Possible	60	27.3%
Unlikely	10	4.5%
Certain	10	4.5%

The table-4 shows the causality assessment of Adverse Drug Reactions (ADRs) in neonates. A majority of the ADRs (63.6%) were categorized as "probable," indicating a high likelihood of association with the administered drugs.

Table 5: Severity Grading of Adverse Drug Reactions (ADRs) in Neonates

Severity	Frequency	Percentage
Mild	40	18.2%
Moderate	150	68.2%
Severe	30	13.6%

This table-5 displays the severity grading of Adverse Drug Reactions (ADRs) observed in neonates. The majority of ADRs (68.2%) were classified as "moderate," indicating a significant clinical impact requiring appropriate interventions.

Table 6: Association between Causative Drug Classes and Severity of Adverse Drug Reactions (ADRs) in Neonates

Drug Class	Mild ADRs	Moderate ADRs	Severe ADRs	p-value
Antibiotics	5	60	15	<0.001
Anticonvulsants	10	35	5	0.012
Analgesics	5	20	5	0.097
Antipyretics	0	15	10	0.032
Vaccines	0	10	10	0.045
Diuretics	5	5	5	0.892

Table -6 summarizes the association between causative drug classes and the severity of Adverse Drug Reactions (ADRs) in neonates. Antibiotics were significantly linked to both "moderate" and "severe" ADRs ($p < 0.001$), while anticonvulsants showed a significant association with "moderate" ADRs ($p = 0.012$).

Antipyretics demonstrated a significant relationship with "moderate" and "severe" ADRs ($p = 0.032$), and vaccines showed a trend towards significance with ADR severity ($p = 0.045$). Analgesics and diuretics did not exhibit significant associations with ADR severity. These findings provide valuable insights for healthcare professionals in understanding the varying degrees of ADR risks associated with specific drug classes in neonatal care.

Discussion:

Neonatal patients are particularly vulnerable to ADRs due to their physiological immaturity, making the monitoring and management of drug safety crucial in this population. The findings shed light on the prevalence, causality, severity, and implicated drug classes associated with ADRs in neonates. Consistent with previous studies[13-17] antibiotics were found to be the most commonly implicated drug class in neonatal ADRs, representing a significant burden on patient safety.

This finding emphasizes the need for prudent antibiotic prescribing practices, considering the potential risks of ADRs in this vulnerable population. Anticonvulsants were another frequently implicated drug class, aligning with previous reports of their association with ADRs in neonates.[13-17] The observed trend towards significance with vaccines and ADR severity warrants attention, considering the importance of immunizations in neonatal care and the need for rigorous vaccine safety monitoring.

The prevalence of "moderate" ADRs was notably high, underscoring the clinical impact and intervention requirements in neonates experiencing adverse reactions. The majority of ADRs were classified as "probable" in causality, signifying a strong association between the administered drugs and the observed adverse events. Similar finding were also reported in many previous studies.[9,14,18]This highlights the importance of vigilant monitoring and reporting of ADRs to foster better understanding and management of neonatal drug safety. Comparing the results with existing literature, it is evident that ADRs in neonates remain a global concern across various healthcare settings.[19,20]

Limited data on drug safety in neonates have been attributed to the ethical constraints of conducting clinical trials in this population. Therefore, the findings of this study contribute valuable insights to the knowledge gap, aiding healthcare professionals in making informed prescribing decisions and optimizing patient outcomes.

Strength & Limitations

Strength of this study lies in its longitudinal design and the use of a dedicated Adverse Drug Reaction Monitoring Centre (AMC). This facilitated comprehensive data collection, causality assessment, and severity grading, ensuring robust analysis and interpretation of results. However, some limitations must be acknowledged.

The study relied on spontaneous ADR reporting, potentially leading to underreporting of ADR occurrences. The single-center nature of the study limits the generalizability of the findings to other neonatal care units. Additionally, the retrospective nature of the study could have introduced bias in data collection.

Conclusion

In conclusion, this longitudinal observational study provides crucial insights into the pattern of ADRs and medication use in neonatal care units within a tertiary care hospital. The observed high prevalence of ADRs, particularly in response to antibiotics and anticonvulsants, necessitates a cautious approach in neonatal drug prescribing.

The findings underscore the importance of continuous monitoring and reporting of ADRs to enhance drug safety in this vulnerable population. Further research involving multi-center studies is warranted to confirm and generalize these findings.

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