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COMPREHENSIVE EVALUATION OF MEDICATION ERRORS INCIDENCE AT A TERTIARY CARE HOSPITAL

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ABSTRACT: Introduction: Monitoring and assessment of the medication errors in hospitals can help in reducing the medical treatment costs and minimizing the risk of harm to the patients. This study aims to determine the frequency and types of medication errors and to assess the consequences of the errors which occurred. **Materials and Methods:** A prospective, cross-sectional study was conducted in the ICU and medicine wards at a tertiary care hospital, India. The in-patient's case sheets were reviewed on a daily basis, and were evaluated to find out any suspected medication errors. **Results:** During the study period of 6 months, 700 prescriptions were analysed for medication errors. Among them, 300 medication errors were identified, out of which (52.33%) were prescribing errors, (41.66%) were administration errors, (4.66%) were monitoring errors and (1.33%) were dispensing errors. Incomplete prescriptions (55.41%), documentation errors (43.2%), omission errors (19.2%) and wrong time administration of medicine (13.6%) were the common types of medication errors. Of the total errors (80.33%), had the potential to cause harm, (16.33%) caused no harm to patients but required monitoring, and (3.33%) errors caused temporary harm which required treatment. **Conclusion:** Although a small percentage of medication errors identified were harmful to patients, it is important to take measures to prevent or minimize the medication errors in the interest of patients. This can be achieved by including clinical pharmacist as a part of the health care team in the hospitals as well as educating the health care professionals especially the nurses regarding the administration errors.

INTRODUCTION: The importance of monitoring and assessment of the medication errors in hospitals can help in reducing medical treatment costs and minimizing the risk of harm to the patients.

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The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) states that "A medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, healthcare products, procedures and systems, including prescribing; order communication; product labelling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; use" [1].

The most common breach in safety that occurs in hospital settings are medication errors [2]. The goal of drug therapy is the achievement of defined therapeutic outcomes that improve a patient's quality of life while minimizing patient risk. There are inherent risks, both known and unknown, associated with the therapeutic use of drugs (prescription and non prescription) and drug administration devices. The incidents or hazards that result from such risk have been defined as drug misadventuring, which includes both adverse drug reactions (ADRs) and medication errors [3]. Various studies have identified the factors contributing to medication errors, which are broadly classified as patient, system and personal factors [4].

The high prevalence of medication errors and inappropriate prescribing is a major issue within healthcare systems, and can often contribute to adverse drug events, many of which are preventable. As a result, there is a huge opportunity for pharmacists to have a significant impact on reducing healthcare costs, as they have the expertise to detect, resolve, and prevent medication errors and medication-related problems [5]. There is a serious lack of studies on this topic in this region which needs to be addressed if the issue of medication error is to be fully understood and addressed [6].

The primary objective of this study was to identify all types of medication errors occurring, despite of their potential to cause patient harm during patients hospitalization. And the secondary objectives were to determine the frequency and types of medication errors and to assess the consequences of those errors occurred to all in-patients admitted in medicine wards and ICU in hospital.

MATERIALS AND METHODS: This prospective, cross-sectional study was conducted for a period of 6 months from Oct 2016 to March 2017 in the Intensive Care Unit (ICU) and four medicine wards at a tertiary care hospital in India. All in-patients who were admitted to ICU and medicine wards of the hospital were included in the study. Pregnant and lactating women and paediatrics were excluded from this study.

Data Collection Procedure: The patient's admission charts were randomly selected and medication charts of each patient were reviewed and evaluated on a daily basis to find out any suspected medication errors.

Classification of medication errors were according to the World Health Organization classification which describes the medication errors into: prescribing errors, administration errors, dispensing errors and monitoring errors [7]. Furthermore, we have also considered severity according to the National Coordinating Council of Medication Error Reporting and Prevention.

In order to detect administration errors, nurses were monitored randomly to find out if there is any deviation from administration procedure or delay in medication administration from the physician order, furthermore errors like; omission errors, wrong dose, wrong time, wrong route, technique error and documentation errors were also in concern for detection.

Prescribing errors were considered as any error which arise from resident or physician in-charge, which often include illegible prescription, improper or inadequate documentation of patient details during the hospital stay, prescribing drugs to which the patient is already allergic to, incorrect dose, incomplete prescription, prescribing of a contraindicated drug or not taking into consideration a potential drug interaction, prescribing drug to a wrong patient, ambiguous order or overdose, wrong medication, wrong frequency or wrong route of administration [6].

Monitoring errors were considered as failure of the nurse or the resident in-charge to review a prescribed regimen for appropriateness and detection of drug-related issues; failure to use appropriate or adequate clinical or laboratory data for assessment of patient response to prescribed therapy; drug not ceased following inadequate treatment response or inadequate monitoring of a patient after administration of the narrow therapeutic index drugs [8].

Dispensing errors were considered in this study as any deviation from the drug written in the prescription and the drug which actually dispensed from the pharmacy. Moreover, delay in dispensing the medications were also considered as dispensing errors.

The various steps of evaluation for each patient included checking the medication chart, patient's admission details such as medical history documentation and evaluation of the patient's past medical history with the concurrent medications and possibility of drug-drug interactions. All the prescriptions medication was assessed by using the Micromedex Drug-Reax database to find out the possible errors [9].

Ethical Approval: Ethical committee clearance was obtained from Institutional Ethical Review Board of Hospital with a reference Number of: IERB no: Al am/2017/110 before commencement of study. Informed consent was obtained from all individual participants included in the study.

RESULTS: During the study period of 6 months, 700 prescriptions were collected from 700 patients and analysed for medication errors. Among them, 300 medication errors were identified. Majority of patients involved with medication errors were female patients 158 (53%) and 142 (47%) were male patients. Distribution of medication errors according to the age group were 137 (45.66%) in the age group of 30-60 years followed by 96 (32%) in the age group of 60-80 years and 48 (16%) in 18-30 years of age and the lowest number of errors 19 (6.33%) occurred in patients of age more than 80 years old. Of the 300 medication errors identified, 157 (52.33%) were prescribing errors, 125 (41.66%) were administration errors, 14 (4.66%) were monitoring errors and 4 (1.33%) were dispensing errors as shown in **Table 1**.

TABLE 1: TYPES AND FREQUENCY OF MEDICATION ERRORS

Type of error	Frequency (%)
Prescribing errors	157 (52.33%)
Administration errors	125 (41.66%)
Monitoring errors	14 (4.66%)
Dispensing errors	4 (1.33%)

Of the total administration errors, 54 (43.2%) were found to be documentation errors, 24 (19.2%) - omission errors, 17 (13.6%) - wrong time of administration, 9 (7.2%) - wrong rate of infusion, 9 (7.2%) - wrong dose and 4 (3.2%) - wrong technique. The details of the same are shown in **Table 2**.

Among prescribing errors, 87 (55.41%) were found to be incomplete prescriptions, 34 (21.65%) writing illegibly, 18 (11.46%) drug-drug interaction, 8 (5.09%) incorrect dose, 4 (2.54%) contraindicated. The details of the same shown in **Table 3**.

TABLE 2: TYPES AND FREQUENCY OF ADMINISTRATION ERRORS

Type of administration errors	Frequency (%)
Documentation	54 (43.2%)
Wrong time	17 (13.6%)
Omission error	24 (19.2%)
Wrong dose	9 (7.2%)
Wrong rate of infusion	9 (7.2%)
Wrong drug	4 (3.2%)
Wrong technique	4 (3.2%)
Wrong route	2 (1.6%)
Wrong dosage form	1 (0.8%)
Wrong duration	1 (0.8%)
Total	125 (100%)

TABLE 3: TYPES AND FREQUENCY OF PRESCRIBING ERRORS

Type of prescribing errors	Frequency (%)
Incomplete prescription	87 (55.41%)
Writing illegibly	34 (21.65%)
Drug-drug interaction	18 (11.46%)
Incorrect dose	8 (5.09%)
Contraindicated	4 (2.54%)
Prescribing two drug of same type	2 (1.26%)
Lack of instruction of nurse	2 (1.26%)
Wrong dosage form	1 (0.63%)
Wrong drug	1 (0.63%)
Total	157 (100%)

Among the total monitoring errors, 13 (92.85%) were found to be lack of monitoring and 1 (7.14%) was failure to use appropriate clinical test. Furthermore dispensing errors were monitored to be 3 (75%) delay in dispensing and 1 (25%) dispensing of wrong medicine.

TABLE 4: DISTRIBUTION OF MEDICATION CLASSES INVOLVED IN MEDICATION ERRORS

Medication class	Frequency (%)
Antibiotics	50 (16.66%)
Antidiabetics	45 (15%)
Antihypertensives	36 (12%)
Antiasthmatic	26 (8.66%)
Gastrointestinal agents	23 (7.66%)
Analgesics	19 (6.33%)
Antifungal	16 (5.33%)
Diuretics	11 (3.66%)
Anticoagulants	11 (3.66%)
Anticonvulsants	10 (3.33%)
Electrolytes	8 (2.66%)
Antiviral agents	3 (1%)
Antituberculosis	2 (0.66%)
Corticosteriods	2 (0.66%)
Antiemetics	2 (0.66%)
Antacids	1 (0.33%)
Anticancer	1 (0.33%)
Total	266 (88.66%)

The most frequent therapeutic class of drugs involved in medication errors were antibiotics (50, 16.66%), anti-diabetics (45, 15%), anti-hypertensives (36, 12%), anti-asthmatics (26, 8.66%), drugs used in the gastrointestinal system (23, 7.66%) and analgesics 19 (6.33%), details are shown in **Table 4**. Also, 81(27%) of the medication errors reached to the patients and 219 (73%) did not reach to the patients. It was found that, 241 (80.33%) of the total errors had the potential to cause harm, 49 (16.33%) of the errors caused no harm to patients but required monitoring, and 10 (3.33%) of the errors caused temporary harm requiring treatment, details are shown in **Table 5**.

TABLE 5: TYPE OF HARMFUL MEDICATION ERRORS

Harmful medication errors	Number of patients affected	Frequency (%)
Drug-drug interactions	3	3.70%
Thrombophlebitis	4	4.93%
Wrong dose	3	3.70%
Total	10	3.33%

One hundred and fifty six patients experienced more than one medication error. The distribution of medication errors in those patients with more than one medication error were 75 (48.7 %) prescribing errors, 70 (44.87%) administration errors, 9 (5.76%) monitoring errors and 2 (1.28%) dispensing errors. Among the harmful errors, 4 (4.93%) were thrombophlebitis, 3 (3.70%) were drug-drug interactions and 3 (3.70%) were found to be wrong dose administration of insulin. The medication errors also were categorized according to National Coordinating Council for Medication Errors Reporting and Prevention (NCC MERP).

According to this, out of 300 medication errors identified, 146 (48.66%) were category B (occurred but didn't reach the patient), 81 (27%) category C (an error occurred that reached the patient but didn't cause patient harm), 56 (18.66%) category A (circumstances or events that has the capacity to cause error), 10 (3.33%) category D (an error occurred that reached the patient and required monitoring), 6 (2%) category F (an error occurred that may have contributed to or resulted in temporary harm and required initial treatment) and 1 (0.33%) category E (an error occurred that may have contributed to or resulted in temporary harm). Details are shown in **Table 6**.

TABLE 6: CATEGORY AND FREQUENCY OF MEDICATION ERRORS AS PER NATIONAL COORDINATING COUNCIL FOR MEDICATION ERRORS REPORTING AND PREVENTION (NCC MERP)

Category of medication errors	Frequency (%)
Category A	56 (18.66%)
Category B	146 (48.66%)
Category C	81 (27.00%)
Category D	10 (3.33%)
Category E	1 (0.33%)
Category F	6 (2.00%)
Total	300 (100%)

DISCUSSION: Medication error monitoring and assessment is an important task of healthcare team in hospitals. Unfortunately, there is a huge gap of monitoring of the medication errors globally and specifically in India. The medication errors have the potential to cause temporary or permanent harm in patients. Keeping that in mind, this study was conducted to assess the type and frequency of medication errors in medicine and ICU wards of a tertiary care hospital in India.

A total of 700 prescriptions were analysed and 300 medication errors were observed in these prescriptions. Incomplete prescriptions (55.41%), documentation errors (43.2%), omission errors (19.2%) and wrong time administration of medicine (13.6%) were the common types of medication errors that were observed. The possible causes of the medication errors were analysed to be failure to adhere to work procedure 40.66%, illegible prescriptions 20%, peak hour 17.66%, lack of attention 13%, inadequate training to staff 4.66%, and wrong labelling / instruction 4%. The results of the study were similar to a research previously carried out by Dedefo *et al*., [10]. The gender distribution of the patients associated with medication errors were 158 (53%) female and 142 (47%) male patients. Our findings were similar to the study carried out by Feleke *et al*., [11].

Prescribing errors were the most frequent category of medication errors occurred in patients followed by administration errors. High rate of prescribing errors might be due to peak hour and patient load leading to lack of attention by the healthcare team, which could affect the patient treatment, increase the hospital stay, and further cause an economic burden to hospital as well as patients. The results of the study were different with the study carried out by Patel *et al*., [3], which states that, administration errors were common type of medication errors.

Documentation of the medicines administered, is the sole responsibility of the nurse, but as we have observed in our study the highest rate of administration errors were documentation errors. Lack of importance given to complete the medication chart after drug administration and peak hour might be the possible causes of documentation errors. The results were similar to the study conducted by Feleke *et al*. [11]

Among 300 medication errors, 4 (1.33%) were found to be dispensing errors. Out of this, 3 (75%) were delay in dispensing and 1 (25%) was dispensing of wrong medicine. The frequency of dispensing errors was the lowest among other categories of medication errors. One of the reasons that have contributed to reduce the occurrence of dispensing errors was direct electronic medications order by nurse from nursing stations through the connected server to pharmacy. This effort was found to be significantly positive in order to administer the medications on time to patients and avoid the wrong drug and wrong dose errors by pharmacist. As far as our knowledge goes, this is the first study conducted in India and region for comprehensive evaluation of medication according to the World Health Organization and National Coordinating Council for Medication Error Reporting and Prevention.

CONCLUSION: According to the study results, medication errors are common in the hospital. Of the total medication errors identified, prescribing errors and administration errors were most common followed by incomplete prescriptions, documentation errors, omission errors and wrong time administration of medicine. Although, a small percentage of medication errors identified were harmful to patients, it is important to take measures to prevent or minimize the medication errors in the interest of patients. This can be achieved by including clinical pharmacist as a part of the health care team in the hospitals as well as educating the health care professionals especially the nurses regarding the administration errors.

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CONFLICT OF INTEREST: There is no conflict of interest.

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