ASSESSMENT, EVALUATION, AND ANALYSIS OF THE MEDICATION ERRORS OF THE PATIENTS ADMITTED AT THE EMERGENCY DEPARTMENT OF A TERTIARY CARE TEACHING HOSPITAL OF A SOUTH INDIAN CITY

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ABSTRACT

Objective: The study was to assess, evaluate, and analyze the medication errors of the patients admitted at the emergency department (ED) of a tertiary care teaching hospital.

Methods: The study was conducted for 6 months. Data were collected from the patients admitted in the ED. The collected data were analyzed to identify the medication and prescription errors in emergency unit in hospital by using drug information tools such as micromedex, drug interaction checker, stockley drug interaction text, BNF, and reputed journals.

Results: A total of 200 patients were enrolled in the study, according to the inclusion and exclusion criteria in which 108 were males and 92 were females. 340 medication errors were obtained in 122 patients and 78 patients did not have any error. Medication errors were more common in the age group of 61-70 years (49%). In 340 medication errors, drug-drug interactions (DDIs) were the most (63.3%), followed by drug duplication (13.53%) and drugs given without indication (8.5%). In DDIs moderate interactions where the mostly seen the error. On prescription analysis, drugs prescribed without strength (67.6%), omission error (16.4%), drugs prescribed without frequency (16%) were the most commonly seen. The most common pharmacological classification of drugs associated with medication errors was antibiotics (25.6%), antihypertensive drugs (13.65%), and antiplatelet drugs (12.9%).

Conclusion: Incidence of medication errors was mainly due to the use of antibiotics. Due to the fast paced nature and overcrowding in the ED, a number of prescription errors were obtained.

Keywords: Medication errors, Emergency department, Drug-drug interactions, Drug duplications.

INTRODUCTION

The goal of drug therapy is the achievement of defined therapeutic outcomes that improve a patient's quality of life while minimizing patient risks known and unknown associated with therapeutic use of drugs and other pharmaceutical agents. The incidents and hazards that result from such risk have been defined as adverse drug misadventure, and it includes adverse drug reaction and medication errors [1] in 1910, Richard Clark published the first study that looked at error rates in clinical diagnosis. Since then, several studies have looked at the problem of medication errors. Medication errors are a common occurrence and continue to be a problem in the health care industry. Approximately, 7,000 deaths occur each year and medication errors occur in just about 1 of every 5 doses given in hospitals [2]. Medication errors may be committed by both experienced and inexperienced staff, including pharmacists, physicians, nurses, supportive personnel (e.g., pharmacy technicians), students, clerical staff (e.g. ward clerks), administrators, pharmaceutical manufacturers, patients and their caregivers, and others. Errors are possible at any step of the process, from medication selection and ordering, to order transcription, to drug formulation, to drug dispensing, to drug administration [3].

The National Coordinating Council for Medication Error defines a medication error as being "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, health-care products, procedures, and systems including Prescribing, order communication, product labeling, packaging and nomenclature, compounding, dispensing, distribution, administration, education monitoring, and use [4].

Type of medication errors

Prescribing errors

Selecting improper drug (based on indications, contraindications, known allergies, drug-class duplications, and drug-drug interactions [DDIs]), dose, dosage form, quantity, route of administration, concentrations, rate of administration, or instructions for the use of a drug product ordered by a physician.

Wrong dose

Administration of a drug in a dose above or below the prescribed dose.

Wrong dosage form

Administration of a drug in a pharmaceutical form that is different from the prescribed.

Wrong time

Administration of a dose more than 30 minutes before or after the scheduled administration time, unless there is an acceptable reason.

Wrong administrating technique

Improper technique in the administration of a drug.

Unauthorized drug

Giving a non-prescribed drug.

Wrong frequency

When the interval prescribed by the physician was not reached to the patient correctly.

Omission error

The prescribed drug was not given to the patient, or the administration was not recorded.

Wrong route

A medication is administered to the patient using a different route than what was ordered.

Wrong monitoring

Failure to monitor the clinical and laboratory data before, during and after a product administration to assess the patient's response to the prescribed medication.

Other medication errors

Any other errors not described above [5].

Medication errors increase cost, significantly prolongs hospital stay, and increase the risk of death almost 2-fold. Several easily identifiable factors associated with large populations of medication errors includes inadequate knowledge regarding drug therapy such as age, impaired renal function and drug allergy, need for calculation of drug dose, specialized drug formulation characteristics, and medication prescribing nomenclature. Other most common factors contributed to medication error include lack of drug information, incorrect diagnosis, drug-drug related reactions, dose miscalculations, incorrect drug administration, and lack of patient education. Of course, not all medication errors lead to morbidity or mortality, but the relatively high incidence makes it a problem still worth dealing with [6].

According to McGovern the ten golden rules for the safe administration of medication are
- Administer the right drug
- Administer the drug to the right patient
- Administer the right dose
- Administer the drug by the right route
- Administer the drug at the right time
- Teach the patient about the drugs they are receiving
- Take a complete patient drug history
- Find out if the patient has any allergies
- Be aware of potential DDIs
- Document each drug administered [7].

In a study by the FDA that evaluated reports of fatal medication errors from 1993 to 1998, the most common error involving medications were related to administration of an improper dose of medicine, accounting for 41% of fatal medication errors. Giving the wrong drug and using the wrong route of administration each accounted for 16% of the errors. Almost half of the fatal medication errors occurred in people over the age of 60. Older people may be at greatest risk for medication errors because they often take multiple prescription medications [8].

ED was ranked as the fifth leading location of medication errors in the calendar year 2002. More than 300 unique facilities collectively reported more than 3440 medication errors. The majority (94.8%) of errors did not result in patient harm. However, 5.2% did result in various levels of harm with two fatalities reported [9].

Improper dose/quality and prescribing errors (27%) were the most common types of errors committed. The research has also suggested that overcrowding, availability of providers, poor teamwork availability of inpatient bed, and availability of alternating sources of medical care may be further contributing to medication errors in ED. Patients who present to the ED tends to be previously unknown to the practitioners; often there is little to no immediate access to medical records and dose with that knowledge are usually unavailable. The most common errors that occurred were in the administration phase (36%), and the most common type was improper dose/quantity (18%). The ED lacks the ability for directly follow-up, and thus, adverse interactions between medications prescribed in the ED may go unnoticed by the providers [10].

A prospective study was conducted in Chennai to assess the effectiveness of medication reconciliation and medication error prevention in an ED. The study was conducted in 80 patients and identified 381 medicational discrepancies and 13 prescribing errors. Out of 381 patients, 6 patients do not have any discrepancies [11].

A cross-sectional study was conducted in Tehran, Iran, for assessing the incidence and type of medication errors in 500 patients. The error rate was found to be 0.41 errors per patient and 0.16 errors per ordered medication. The study identified 204 medication errors in 110 patients. Prescription errors were the most common (60%) medication error by physician. Omission error was the most common medication errors by nurses (16.2%). The class of drugs that causes most of the medication errors were anticoagulants and thrombolytics (41.2%) followed by antimicrobial agents (37.7%) and insulin (7.4%) [12].

Of course, not all medication errors lead to morbidity or mortality, but the relatively high incidence makes it a problem still worth dealing with. The emergency department (ED) is the front line of preventing medication error, and the first we need to do is to raise our awareness of the problem and choose strategies to eliminate the error and mitigate harm if errors do occur [13].

To decrease the occurrence of medication errors, it is important to work toward developing strategies to combat the risk of medication errors at all steps in the medication-use process. The relevant strategies identified were medication-error analysis, computerized provider order entry systems, automated dispensing cabinets, bar-coding systems, medication reconciliation, standardizing medication-use processes, education, and emergency medicine clinical pharmacists [14].

A number of published reports have confirmed the adverse impact of these errors on patients' health and health care. Therefore, the medication errors should be minimized as far as possible, and the nature should be identified so that effective systems can be implemented for prescribing, transcribing, dispensing, and administering the medications. Pharmaceutical care is the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve patients' quality of life [15].

The aim of the study was to identify the medication errors and analyzing the prescription errors of the patients admitted in the ED of a tertiary care teaching hospital.

Objectives

To assess, evaluate, and analyze the medication errors in the patients admitted at the ED of a tertiary care teaching hospital. Secondary objectives were to identify and assess the medication errors on parameters such as dose error, DDI, drug duplication, and drugs given without any indication and to perform a prescription analysis on various parameters such as formulation, frequency, omission errors, and strength. To notify the analyzed medication error reports to the physician immediately for alteration/modification in the therapy.

METHODS

A prospective interventional study was conducted in ED of a tertiary care teaching hospital in Davangere for 6 months.

Table 1: Age wise distribution of patients

Age groups	Number of patients (%)
18-30	38 (19)
31-40	34 (17)
41-50	36 (18)
51-60	43 (21.5)
61-70	33 (16.5)
71-80	12 (6)
81-90	4 (2)
Total	200 (100)

Table 2: Gender wise distribution of medication errors

Gender	Number of patients (%)
Male	63 (51.64)
Female	59 (48.36)
Total	122 (100)

Table 3: Age wise distribution of patients who have medication errors

Age groups	Medication errors (%)
18-30	28 (8.24)
31-40	32 (9.41)
41-50	50 (14.71)
51-60	76 (22.35)
61-70	98 (28.82)
71-80	42 (12.35)
81-90	14 (4.12)
Total	340 (100)

Table 4: Types of medication errors in

Types of errors	Number of errors (%)
DDI	256 (75.30)
Drug duplication	46 (13.53)
Drugs given without indication	29 (8.53)
Dose error	9 (2.64)
Total	340 (100)

DDI: Drug-drug interaction

Table 5: Types of prescription errors

Types	Number of prescription errors (%)
Strength	194 (67.6)
Omission	47 (16.4)
Frequency	46 (16)
Formulation	00 (00)
Total	287 (100)

Table 6: Age wise distribution of DDI

Age groups	Number of DDIs (%)
18-30	9 (3.51)
31-40	26 (10.15)
41-50	35 (13.7)
51-60	62 (24.21)
61-70	76 (29.63)
71-80	37 (14.5)
81-90	11 (4.3)
Total	256 (100)

DDIs: Drug-drug interactions

Inclusion criteria
- All patients admitted in the ED of above 18 years of age.

Table 7: Severity index of DDIs

Severity of DDI	Number of DDIs (%)
Major	87 (33.9)
Moderate	162 (63.3)
Minor	07 (2.8)
Total	256 (100)

DDIs: Drug-drug interactions

Table 8: Age wise distribution of drug duplications

Age groups	Number of drug duplications (%)
18-30	12 (26.08)
31-40	4 (8.7)
41-50	9 (19.6)
51-60	8 (17.4)
61-70	10 (21.7)
71-80	1 (2.17)
81-90	2 (4.35)
Total	46 (100)

Table 9: Age wise distribution of drugs given without indication

Age groups	Drugs given without indication (%)
18-30	6 (20.69)
31-40	2 (6.9)
41-50	5 (17.24)
51-60	3 (10.34)
61-70	10 (34.48)
71-80	2 (6.9)
81-90	1 (3.45)
Total	29 (100)

Table 10: Age wise distribution of dose error

Age groups	Dose errors (%)
18-30	01 (11.11)
31-40	00 (00.00)
41-50	01 (11.11)
51-60	03 (33.34)
61-70	02 (22.22)
71-80	02 (22.22)
81-90	00 (00.00)
Total	09 (100)

Table 11: Distribution of prescriptions showing medication error depending on drugs in the treatment charts

Number of drugs in treatment charts	Number of prescriptions showing medication error (%)
0-5	06 (6.2)
6-10	54 (55.7)
11-15	37 (38.1)
Total	97 (100)

- Prescription having minimum of 3 medications irrespective of diagnosis.
- Patient admitted for at least for 24 hrs.

Exclusion criteria
- Pregnant women, pediatric patients, and those undergone surgery.

Ethical consideration
The ethical clearance for the study was obtained from the Institutional Ethical Committee of Bapuji Pharmacy College.

Table 12: Drug wise distribution of medication errors

Drugs	Number of medication errors (%)
Antibiotics	75 (25.6)
Antihypertensive drugs	40 (13.65)
Antiplatelet	38 (12.9)
Diuretics	32 (10.9)
Antiemetics	29 (9.9)
NSAIDs	21 (7.2)
Insulin	16 (5.5)
Proton pump inhibitor	16 (5.5)
Corticosteroids	15 (5.1)
Oral hypoglycemic drugs	11 (3.75)
Total	293 (100)

Table 13: Disease wise distribution of patients in ED

Disease	Number of patients (%)
HTN	49 (18.45)
AFI	46 (17.30)
DM	39 (14.66)
CVA	20 (7.51)
Thrombocytopenia	16 (6.01)
AGE	15 (5.65)
ALD	13 (4.88)
Seizure	12 (4.51)
Anemia	10 (3.75)
IHD	10 (3.75)
Others	36 (13.53)
Total	266 (100)

HTN: Hypertension, AFI: Acute febrile illness, DM: Diabetic mellitus, ED: Emergency department

Study procedure

The investigators attended the ward rounds on a daily basis in the ED. Investigators collected patient details, co-morbidities, drugs prescribed with their doses and frequency of administration. The collected data were analyzed to identify medication errors and prescription errors in emergency unit in hospital by using drug information tools like Micromedex version 2, drug interaction checker, stockley drug interaction text, BNF, journals, etc. Investigators gave interventions to the physician-in-charge to make possible alterations or modifications.

RESULTS

A total of 200 patients assessed were found eligible as per our inclusion criteria. Out of 200 patients, 108 (54%) patients were male and 92(46%) patients were female.

A total of 200 patients were enrolled into different age groups in which majority of patients belong to the age group of 51-60 years (21.5%) followed by 18-30 years of age (19%).

Out of 200 patients assessed, 122 had medication errors. Among those 122, the proportion of medication errors was more in males 63 (51.64%) than females 59 (48.36%).

Out of 200 patients, a total of 122 patients showed the medication errors and 98 (28.82%) were in the age group of 61-70 years and 76 (22.35%) were in the age group of 51-60 years, respectively.

Upon the analysis of the data of 200 patients, 256 (75.30%) DDIs were observed and it is the most commonly occurring medication error in ED. The other medication errors were 46 (13.53%) drug duplications, 29 (8.53%) drugs given without indications and 09 (2.64%) dose errors.

On prescription analysis, a total of 287 errors were identified in which prescriptions without dose were common (67.6%) followed by omission error (16.4%).

Out of 200 patients, 122 patients showed 340 medication errors, in which 256 (75.3%) DDIs were observed and it is the most frequently occurring error and were more common in the age group of 61-70 (29.63%) followed by 51-60 (24.21%)

Out of 200 patients, 122 patients had 256 DDIs, in which 87 (33.9%) were major interactions, 162 (63.3%) were moderate interactions and 7 (2.8%) were minor interactions.

Among the 200 patients, 340 medication errors were identified, of which 46 (13.53%) drug duplications were identified gives it the second leading error in the study and were more common in the age group of 18-30 (26.08%), followed by 61-70 (21.7%).

Out of 200 patients, 340 medication errors were identified and 29 (8.53%) drugs given without indication were identified and 10 (34.48%) errors were observed in the age group of 61-70 years.

Among 200 patients, 340 medication errors were observed and 9 (2.64%) dose errors were identified and it is the least commonly found medication error in our study and mainly seen in the age group of 51-60 (33.34%).

A total number of 200 treatment charts were analyzed in our study. Among these, the treatment charts which consists of 6-10 prescribed drugs gives maximum number of medication errors 54 (55.7%) followed by 11-15 prescribed drugs 37 (38.1%).

After the identification of medication errors in 200 patients, our study reveals that the incidence of medication errors occurs mostly due to the use of antibiotics (25.6%) followed by anti-hypertensive drugs (13.65%) and diuretics (12.9%).

After the completion of our study in 200 patients, commonly found diseases in ED were 49 (18.45%) hypertension, 46 (17.3%) acute febrile illness, and 39 (14.66%) diabetic mellitus.

DISCUSSION

The study conducted was a prospective interventional for 6 months. A total of 200 patients were included in the study according to the inclusion criteria. In 200 patients, 108 (54%) were males and 92 (46%) were females. The important finding of our study was that, among 200 patients, 122 patients (61%) showed at least one medication error. This was similar to the study conducted by Dabaghzadeh *et al.*, on medication error in ED on large care teaching hospital, Tehran. In their study, they included a total of 275 patients in which 139 (50%) had at least one medication error [15].

Our study reveals that the incidence of medication errors was more in males than in females. In a total of 122 patients who had medication errors, 63 (52%) were males and 59 (48%) were females. Similar to a study conducted by Karna *et al.*, where, the domination of males (77.4%) over females (22.6%) in medication errors is clearly visible [6].

In 200 patients, 340 medication errors were observed. Among these, 256 (75.5%) were DDIs. Thereby, it was the most commonly seen medication error in ED in our study. This was similar to the study conducted by Pote *et al.*, on medication prescribing error in a public teaching hospital in India. In their study, a total of 157 errors were identified from 304 patients in which 107 (68.2%) were DDIs. Our study result was similar to another study conducted by Poornima *et al.*, on common prescribing errors in Government general hospital, India. Their study shows that, in 30 cases 26 medication errors were identified. In which 44 (33.58%) DDIs were obtained, and thus it becomes the leading error in their study [10].

While considering the severity index of DDIs, our study shows that moderate interactions were the commonly seen DDI, that is in 256 DDIs, 162 (63.3%) were moderate DDIs, which was similar to the study

conducted by Pote *et al.* In their study, the total of 157 errors identified, 97 (61.8%) were moderate DDIs and has the largest contribution [14].

Drug duplication was the second most leading error in our study. In a total of 340 medication errors, 46 (13.53%) were drug duplications. This result was similar to the study conducted by Nikitha *et al.*, on medication error in pediatric and medicine unit of a tertiary care teaching hospital, Davangere. Their study results show that in 100 cases 124 medication errors were observed. In which 19 (15.32%) were drug duplication as their second most error in their study [7].

In our study, drugs given without indication were the third most occurring errors in ED. That is in 340 medication errors, 29 (8.53%) drugs given without indication were obtained. This is in contrast with the result obtained by Nikitha *et al.*, in which drugs given without indication was the leading error in their study [7].

Dose error was the least occurring error in our study, that is, in 340 medication errors, 09 (2.6%) dose errors were identified which is similar to the study conducted by Pote *et al.*, as their study result shows that the dose error contributes the least; in 157 error 15 (9.5%) were dose errors [14].

Upon the prescription analysis, our study reveals that drugs prescribed without strength were the most commonly seen prescription error in ED. In a total of 287 prescription errors, strength of the drug was not mentioned in 194 drugs (67.6%). This result is similar to the study conducted by Poornima *et al.*, a total of 131 errors, strength of the drug was mentioned in 42 drugs (32.06%) [10].

Our study reveals that the rate of omission error was 16.4%, which is similar to the study conducted by Ehsani *et al.*, on medication error in the ED as their study gives an omission error rate of 14.2% [16].

The medication error in our study was mostly seen in the age group of 61-70 years (28.82%). This is similar to the study conducted by Dabaghzadeshg *et al.*, in which medication errors were more commonly seen in the age group of 50-70 (36.7%). In our study, the incidence of medication error in the ED was mostly due to the use of antibiotics (25.33%), which was similar to the study conducted by Pote on medication prescribing error in a public teaching hospital, that their study shows that antibiotic agents (29.4%) contribute to more medication errors [14,15].

CONCLUSION

The study concludes that the incidence of medication errors was greater in the ED due to overcrowding and busy nature of ED and this can be taken into account.

Any initiative to reduce the prescription error rate must involve knowledge of why, where, and when these errors occur. Inadequate knowledge of pharmacology will obviously predispose to poor prescribing, but environmental factors such as time, pressures, staff shortages, and fatigue can also be the contributory causes [17]. If not

vigilant and preventive steps were not taken in time, then the incidence may get higher and lead to life-threatening events too. The study also supports the role of pharmacists in reviewing and clarifying medication orders, and the importance of their involvement in including the safety of the medication system.

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