



ERRORS IN THE INTRAVENOUS DRUG ADMINISTRATION IN GENERAL MEDICINE DEPARTMENT OF TERTIARY CARE TEACHING HOSPITAL

ABSTRACT

The preparation and administration of intravenous drugs are associated with considerable risks. Any deviation of preparation or administration of an IV dose from the original prescription or any act in the preparation or administration leads to errors in the administration of intravenous medications. Sometimes this will result in severe Adverse Drug Reactions (ADR's) in patients. So, it is imperative to assess the incidence and clinical importance of intravenous drug administration errors. The data for the present study was collected by patient interview and chart review method for a period of 6 months. A total of 97(43%) errors were observed out of 225 cases. Most of the errors were related to wrong rate of drug administration 68 (70.10%) followed by wrong preparation errors 19 (19.58%) and omission errors 6 (6.18%) and least frequently observed errors were wrong time errors 4 (4.12%). These observed errors can be prevented by a change in procedures regarding preparation and administration. Clinical Pharmacists have potential role in teaching about preparation and administration of IV medication to the nurses and other health care professionals to reduce the incidence of IV medication errors.

Key words: Intravenous drug administration, Medication errors, Intravenous medication errors, Clinical pharmacist

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INTRODUCTION

Medication errors' are defined as "any preventable event that may cause or lead to an inappropriate medication use or patient harm while in the control of the health care professionals, patient or consumer".¹ "IV Medication errors" is defined as any deviation of preparation or administration of an IV dose from the original prescription or any act in the preparation or administration, which deviated from the manufacturer's instructions or the hospital drug policy. An IV dose was defined as an administration of a drug directly into the vein via injection or infusion and included preparation of the drug dose.² Intravenous (IV) therapy usually needs to be prepared immediately before administration.

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This may involve dissolving of powder, dilution or transfer of injection fluid from the original vial or ampoule into a container (a syringe or an infusion bag). These processes present multiple opportunities for errors.³ "Types of medication administration errors" were classified to 8 - mutually exclusive categories, according to the definition of the "American Society of Health System Pharmacists"

DEFINITION OF ERRORS:

WRONG DRUG PREPARATION ERROR:

Drug product incorrectly formulated or manipulated before administration (incorrect reconstitution or dilution, physicochemical incompatibility of drugs mixed in same container, wrong pharmaceutical form.)

WRONG RATE ADMINISTRATION ERROR:

Inappropriate rate of administration by IV route of a medication to the patient whatever the technique (direct IV, perfusion by gravity or infusion.)

WRONG DOSE ERROR: Administration to the patient of a dose greater than or less than the amount prescribed.

WRONG TIME ERROR: Administration to the patient medication at a different time from the prescribed or predefined time.

- **Unauthorized drug error:** Administration to the patient an non - prescribed medication
- **Omission error:** Failure to administer an ordered dose to the patient.
- **Physicochemical compatibility:** Simultaneous administration to the patient of two or more medication via same manifold.⁴

The incidence of errors associated with injectable medications is higher than with other formulations.^{5,6} Studies also suggest that half of all harmful medication errors originate during drug administration; of those errors, about 2/3 involve injectable.^{7,8}

RISK FACTORS:

Several factors can increase the risk of errors and patient harm with injectable d rugs, for example:⁹

- Drugs having a narrow therapeutic index.
- Concentrated formulations that need to be diluted further.
- Multiple manipulations required to prepare the medication (e.g., vial - to syringe transfer syringe-to-syringe transfer, dilution, or use of a filter).
- Reconstitution of powders for which special diluents are required use of part of a vial or an ampule or the need for more than one vial or ampule for a single dose.
- Nonstandard handling or special precautions that might be necessary, such as light protection, an inline filter, or drug incompatibilities.
- Preparation of the drug in a clinical area (e.g., the nursing unit) instead of in a pharmacy; in such instances, labeling of the product is more likely to be limited or absent.¹⁰

It is estimated that 1 - 2% patients admitted to hospitals in USA are harmed as a consequence of Medication errors (MER's). These errors are also major cause of adverse events. Less is known about the medication errors in the other parts of the World including the Middle East. Medication administration errors are most often made by nurses administering medication on the patient care unit.¹

AIM OF THE STUDY:

The main aim of the study was “to assess the incidence of intravenous drug administration errors in GM department of tertiary care teaching hospital”

OBJECTIVES OF THE STUDY:

- To determine the incidence and frequency of intravenous drug administration errors.
- To categorize the different types of intravenous drug administration errors.

MATERIALS AND METHODOLOGY:

The study “ERRORS IN THE INTRAVENOUS DRUG ADMINISTRATION IN GENERAL MEDICINE DEPARTMENT OF TERTIARY CARE TEACHING HOSPITAL”, which was carried out in the Department of General Medicine” IP at Rajiv Gandhi Institute of Medical Sciences (RIMS), Kadapa, a 750 bedded multi-disciplinary tertiary care teaching hospital. The study was approved by the Institutional Ethics and Research Committee of Rajiv Gandhi Institute of Medical Sciences, Kadapa (RC. No.3349/Acad./2013-14/Dated 19-11-2013).

PERIOD OF STUDY: 6 – months i.e., December 2013 to May 2014.

TYPE OF STUDY: A Prospective observational study.

STUDY POPULATION:A total of 225 cases.

A) INCLUSION CRITERIA:

- Patients receiving intravenous drugs which are incorrectly formulated or manipulated before administration.
- Patients receiving intravenous drugs with inappropriate rate of administration.
- Patient who failed to receive the prescribed dose.

B) EXCLUSION CRITERIA:

- Doses that had to be administered continuously over 24 hours and medication that had to be given as required were excluded from the observation as these were given outside peak times of drug administration.
- Patient receiving only IV fluids.
- Patients taking Intramuscular and Subcutaneous injections were excluded as well.

PATIENT DATA COLLECTION PROFORMA:

This data collection form was developed by consulting physicians and staff of pharmacy department. This form was used to document observations including the patient demographic details (Name, Age, Reason for Hospitalization), Name of the drug, the solvent, the route of administration and the time over which the dose was administered.

DRUG INFORMATION TEXTS: These are used to assess the recommended administration rate of the drugs, diluents used for reconstitution and to check the incompatibilities with other drugs. The following are the literature used to analyze the collected data;

- ✓ Drugdex - Drug evaluation monographs in Micromedex 2.0
- ✓ (Computer drug database)
- ✓ AHFS Drug Information 2010, 2011.
- ✓ British National Formulary 52th Edition.
- ✓ Published leaflets of Pharmaceutical companies.

METHOD OF DATA COLLECTION:

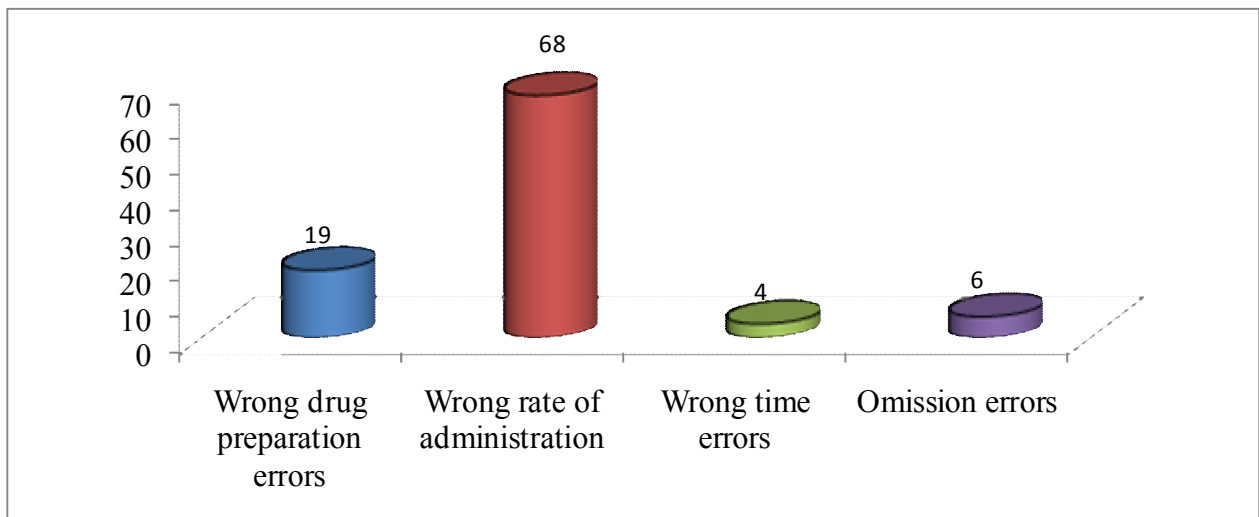
The data for the present study was collected by “Patient interview” and “Chart Review Method”, which is well suited to identify the prescribed drugs for the individual patients. Data regarding IV admixtures prescribed to the patient will be collected into data collection form by direct observations and this data will be noted from the date of admission to till date of discharge of the patient.

MODE OF ANALYSIS OF DATA (STATISTICAL ANALYSIS):

Table 17: Frequency of all types of Intravenous drugs administration errors

Type of Errors	No. of Errors	Frequency (%)
Wrong drug preparation errors	19	19.58%
Wrong rate of administration	68	70.10%
Wrong time errors	4	4.12%
Omission errors	6	6.18%
Total errors	97	100%

Figure 16: Frequency of all types of Intravenous drugs administration errors



A. Details on frequency of Wrong Drug Preparation Errors:

Out of 19 wrong drug preparation errors, Ranitidine is the most frequently used drug 7(36.84%), followed by Pantoprazole 6(31.57%), Ceftriaxone 4(21.05%) and Piperacillin - Tazobactam 2(10.05%).

B. Details on frequency of Wrong Rate of Administration Errors:

Out of 68 Wrong Rate Administration Errors, Ceftriaxone is the most frequently used 22(32.35%) followed by Pantoprazole 17 (25.00%) and Furosemide 12(17.64%).

The obtained results will be subjected to descriptive analysis of percentages (%).

RESULTS

FREQUENCY OF ALL TYPES OF INTRAVENOUS DRUGS ADMINISTRATION ERRORS:

A total of 97(43%) errors were observed out of 225 cases. Most of the errors were related to wrong rate of drug administration 68 (70.10%) followed by wrong preparation errors 19 (19.58%) and omission errors 6 (6.18%) and least frequently observed errors were wrong time errors 4 (4.12%).

C. Details on frequency of Wrong Time Errors:

Out of 4 Wrong Time Errors, Augmentin is the frequently used wrong time error 3 (75%) followed by Diazepam 1(25%).

D. Details on frequency of Omission Errors:

Out of 6 Omission errors, Ceftriaxone is the most frequently used error 3 (50.00%), followed by Pantoprazole 1 (16.66%), Furosemide 1 (16.66%) and Ondansetron 1(16.66%) time.

Table 18: Details on frequency of Wrong Drug Preparation Errors

No. of Wrong drug preparation errors	Name of the drugs	Frequency (n=19)	Frequency (%)
1	Ranitidine	7	36.84%
2	Pantoprazole	6	31.57%
3	Ceftriaxone	4	21.05%
4	Pipercilintazobactum	2	10.5%
Total	4	19	100 %

Figure 17:Details on frequency of wrong drug preparation errors

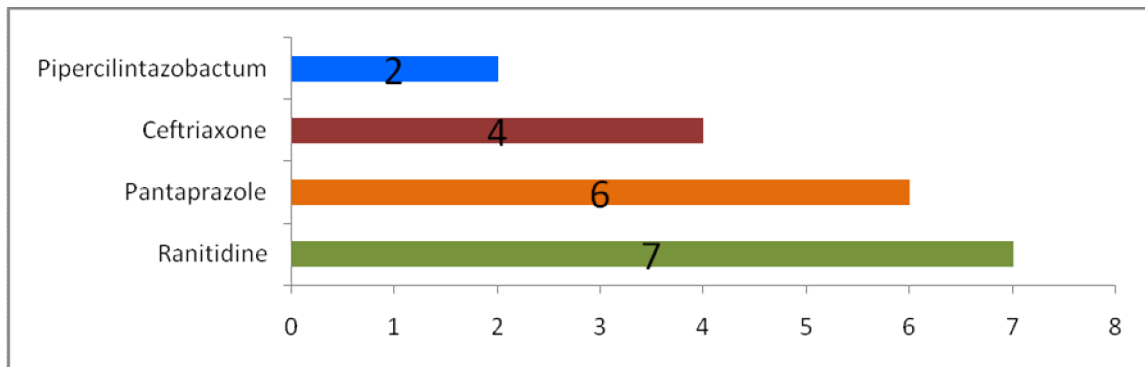


Table 19: Details on frequency of Wrong Rate of Administration Errors

No. ofWrong Rate Administration Error	Name of the drugs	Frequency (n = 68)	Frequency (%)
1.	Ceftriaxone	22	32.35%
2.	Pantoprazole	17	25.00%
3.	Furosemide	12	17.64%
4.	Ondansetron	10	14.70%
5.	Hydrocortisone	4	5.88%
6.	Amikacin	3	4.41%
Total	6	68	100%

Figure 18: Details on frequency of Wrong Rate of Administration Errors

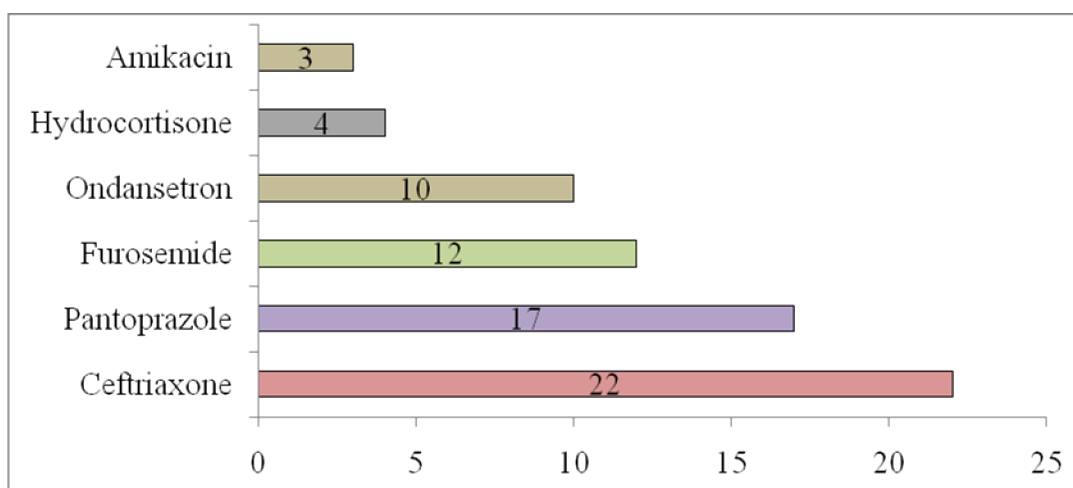


Table 20: Details on frequency of Wrong Time Errors

No. of Wrong Time Errors	Name of the drugs	Frequency (n=4)	Frequency (%)
1.	Augmentin	3	75%
2.	Diazepam	1	25%
Total	2	4	100%

Figure 19: Details on frequency of Wrong Time Errors

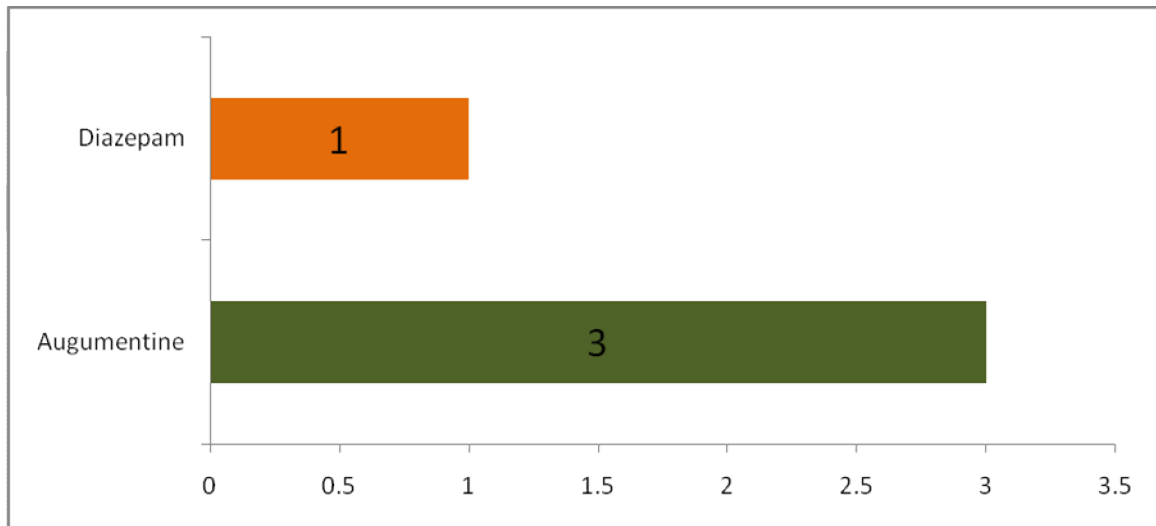
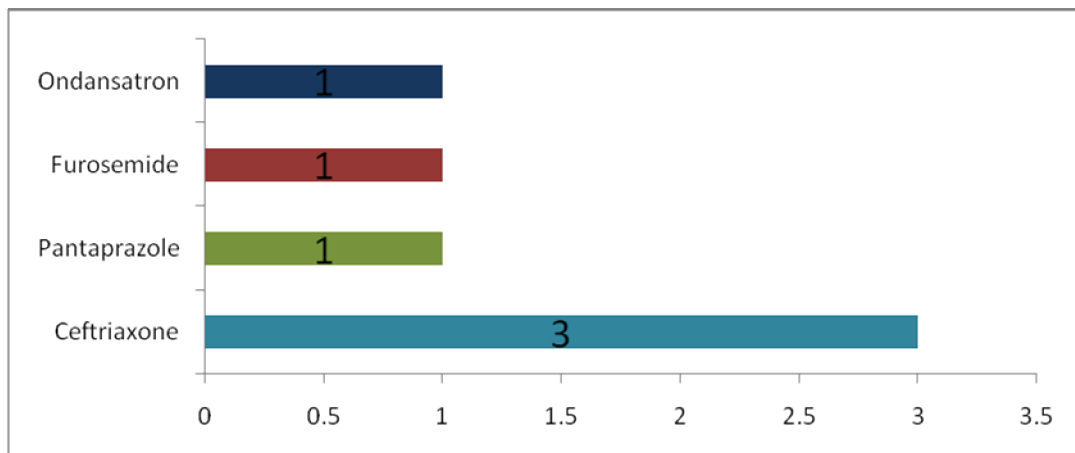


Table 21: Details on frequency of Omission Errors

No. of Omission Errors	Name of the drugs	Frequency (n=6)	Frequency (%)
1.	Ceftriaxone	3	50.00%
2.	Pantoprazole	1	16.66%
3.	Furosemide	1	16.66%
4.	Ondansetron	1	16.66%
Total	4	6	100%

Figure 20: Details on frequency of Omission Errors



DISCUSSION:

In this present study we observed IV drug administration errors and the study of medication errors was based on the observation technique which was considered to be the best method for detecting medication errors.^{11,12} The most frequent types of errors observed were wrong rate of administration, wrong drug preparation, omission error and wrong time errors. Most of the errors were related to wrong rate of drug administration 68 (70.10%) followed by wrong preparation errors 19 (19.58%) and omission errors 6 (6.18%) and least frequently observed errors were wrong time errors 4 (12.5%). This is similar to the study conducted by FanakFahimi et al.,¹³ and Subasyini et al.,¹⁴ in which most of the errors reported were due to fast bolus administration. This result is contrast to the studies conducted by Edgar Tissot et al.⁴ in which wrong time errors were more when compared to other types of drug administration errors. Among these wrong rate of drug administration errors Ceftriaxone 22 (32.35%), and Pantoprazole 17 (25.00%) and Furosemide 12 (17.64%) were most frequently observed drugs associated with this error, than other drugs given by IV push. These medications were given faster than the recommended time. The recommended time of administration for Furosemide was slow IV push for 1-2 minutes but it was given rapidly within 15-30 seconds and Pantoprazole was also given at faster rate than the recommended. A study conducted by Veronika Wirtz et al.,² revealed that most common type of errors on all the wards was wrong rate error. It was reported that fast rate of administration are associate with pain, phlebitis and loss of cannula patency.

Among 19 preparation errors Ranitidine 7 (36.84%) was most frequently observed than with other drugs associated with preparation errors. This is similar to the study conducted by Subasyini et al.,¹⁵ in which Ranitidine and Promethazine drugs are most frequently observed drugs with preparation errors. Manufactures and product literature from other sources suggested that Ranitidine must be diluted prior to the administration.¹⁶ In our study it is administered directly as IV push without dilution. Among 6 omission errors Ceftriaxone 3 (50%) was most commonly drug associated with this error followed by Pantoprazole, Furosemide and Ondansetron 1 (16.66%). Among 4 wrong time errors Augmentin 3 (75%) was most commonly associated with this type of error. Manufactures and drug information literature suggest that Augmentin should be administered within 30 minutes after reconstruction but in our study it was not given as per the recommended time.¹⁴

CONCLUSION:

A high rate of medication administration errors was found in the study. These observed errors can be prevented by a change in procedures regarding preparation and administration. Although

majority of errors do not cause significant effect on clinical outcomes, it may increase the risk in some extreme cases such as drugs with narrow therapeutic index. Wrong rate of administration errors were more when compared other administration errors. Explaining to the nurses about the clinical consequences of wrong injection rate can potentially reduce wrong rate errors. If drug charts were read more carefully to check for newly prescribed drugs and drug knowledge about omission of doses such as analgesics or diuretics could possibly reduce omission errors. Clinical Pharmacist can have potential role in teaching about preparation and administration of IV medication to the nurses and other health care professionals.

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