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RESEARCH ARTICLE

A Study on the Errors with Intravenous Administration of Drugs in a Tertiary Care Hospital

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ABSTRACT:
The aim of the study is to monitor and observe the incidence of intravenous drug administration errors in the general medicine department of a tertiary care hospital. Preparation and administration of the intravenous drugs to in-patients of the general medicine department was monitored by direct observational method. In a total of 329 intravenous administrations, 54.71% of errors were observed in the patient population out of which 74.78% showed at least one error. The results revealed that the flow rate error 45% were more prevalent among the overall study population followed by reconstitution error 26%, wrong mix errors were found to be 23% and incompatibility were found to be 10%. Errors were observed in both intravenous infusions as well as in intravenous bolus injections. Since intravenous administration of drugs have advantages of quicker delivery of drug to the target site via blood, proper care should be taken by nurses and other health care professionals in the IV drug administration. Errors can be minimized by utilising advanced techniques like small infusion smart pumps and automated flow rate infusion set.

KEYWORDS: Bolus, Intravenous administration, Flow rate, Medication error.

INTRODUCTION:
Intravenous therapy is a complex process usually requiring the preparation of the medicine in the clinical areas before administration to the patient which involves dilution, transfer of fluid from one ampoule to another, or dissolving of drug in the solvent. Intravenous administration is a preferred route of administration for its advantages such as bypassing first pass metabolism, rapid onset of action, reproducible effects and entire administered dose reaches the systemic circulation immediately – the dose can be accurately titrated against response [1].

However there are various disadvantages of intravenous dosing limiting its extensive usage such as need for skilled professional, inability to withdraw the drug, usage of a cannula causes discomfort to patients which may also be prone to infections and irritation to the local area. Further, administration of intravenous medications is often associated with various errors due to the lack of monitoring.

The various stages at which errors can be observed are prescribing, dispensing, preparation and monitoring. There have been reports of deaths and harm following medication errors such as wrong drug, dose, diluents, and cross contamination errors with intravenous therapy. Such errors generally arise during the preparation and administration of intravenous medication. Hence there is a necessity for medication errors to be monitored to improve quality of life in patients [2]. In the United States (US), 60% of serious and life threatening medication errors in general inpatients involved IV drugs [3]. In

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United Kingdom (UK), about 56% of errors involved IV drugs [4]. In paediatric patients, 54% of potential adverse drug events due to medication errors involved IV drugs [4]. Three studies investigated only IV medication errors: one of them found 151 (84.4%) errors in 179 observed drug administration's [5]; the other reported an error rate of 24.7% for 320 observed preparations and administration [6]. A recent study found an error rate of 49% in 430 IV drug preparations and administration [7]. Medication errors are the 8th leading cause of death in the US [8]. There are studies in which the relationships of the nurses have been studied in support to medication errors however which did not show any statistical significance [9,10,11]. The purpose of this study is to observe the occurrence of errors while preparing and administering intravenous therapy. Prevention of such errors can lead to safer and better therapeutic outcome.

MATERIAL AND METHODS:

A prospective observational study was carried out in a tertiary care hospital to observe and monitor the administration of intravenous therapy and its errors. It was carried out by direct observation of the nurses during intravenous administrations by nursing staff.

Subjects who were receiving intravenous therapy were included in the study. Subjects were selected from the both male and female general medicine in patient department. There were 6 units of these wards, out of which 3 were male units and 3 were female units. The study was carried out for a period of 6 months during which all intravenous therapy that were prepared and administered was observed. All those preparations that had not been observed were not included in the study.

Administrations were observed for a period of three months between February 2015 and April 2015 during which an observer was present in the wards between 8.00 am and 12.00pm, or 1.00 pm and 2.30pm, which was the regular time at which daily intravenous drugs were administered.

Selection of subjects was based on the willingness of the nurse to participate in the study. A data collection form was prepared which included the prescribed medication to the patient along with a drug checklist and a record of all the actions associated with the drug preparation and administration.

Any deviation from the standard was observed and recorded. All such deviations were considered as an error.

List of factors that contributed to deviations from the standard procedure.

Pre – preparation [9]

- Read medication list
- Right drug chosen
- Used aseptic techniques -hand washing , sterile areas not touched, preparation platform was cleaned

Preparation

- Proper reconstitution of the drug
- Proper Admixture of drugs
- Correct Infusion rate and infusion volume
- Omission or any deleted drugs

Administration

- Given to the right patient at the right time
- Whether the medication administration was recorded
- Whether intravenous infusions were checked by two nurses
- Whether dangerous drugs were administered by two nurses

The package inserts were used as reference for intravenous drug preparation. Data collection was carried out during the weekdays. All the ward staffs were informed regarding the aim of the study however the word "error" was avoided. The collected data were entered into software spreadsheet applications and was analyzed using graph prism pad version 6.0. The data were tabulated using Microsoft Excel. The assessment factors used were chi-square test and two-tailed Fisher Exact Test. A p value of <0.05 was used as to represent statistical significance.

RESULTS:

A total of 113 patient prescriptions were included in the study, which satisfied the inclusion criteria. Out of the total study population 45% were male patients and 55% were female patients.

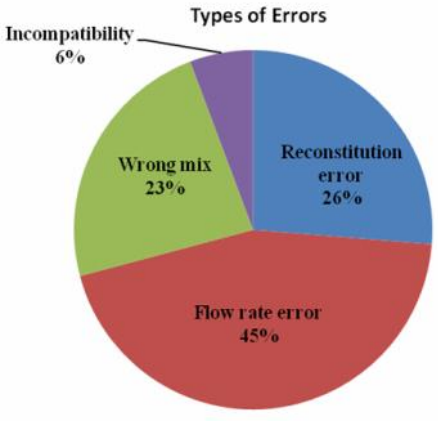

Figure 1: Types of errors

28% of females were in the age group between 49-58 years and 26% of males in the age group 39-48 years. It was observed that there was more number of female patients than males. Of the total population included, at least one error was observed in every patient prescription.

In the total study population, around 1305 drug had been administered out of which 329 drugs were given as intravenous drug administration. Out of the given 329 drugs, 180 drugs were observed to be administered wrong.

Based on the type of error, the intravenous medication errors were grouped into four (figure 1). The results revealed that the flow rate error of 45% were more prevalent among the overall study population followed by reconstitution error of 26%, wrong mix errors 23% and incompatibility 10%.There were 21 different drugs that were commonly used in the department of general medicine out of which errors were observed in almost all the drugs, either in the preparation or the administration stages. However no errors were observed during the preparation and administration of furosemide, phenytoin, hyoscine, sodium valproate and ondansetron.

Table 1: List of the commonly used drugs

Commonly Used Drugs	No Of Patients	No Of Errors Seen	Percent
Cefotaxime	32	29	90.62%
Gentamicin	13	13	100%
Deriphyline	15	15	100%
Rantidine	53	11	20.75%
Lasix	6	0	0
Emeset	31	0	0
Cefotaxime+Sulbactam	5	5	100%
Ciprofloaxacin	22	22	100%
Metronidazole	18	18	100%
Ivf Dns	17	17	100%
Ivf Rl	22	22	100%
Ivf Ns	7	7	100%
Heparin	2	0	0%
Tigecycline	1	1	100%
Phenytoin	1	0	0%
Hydrocortisone	7	7	100%
Dexamethasone	7	7	100%
Piperacillin + Tazobactam	2	2	100%
Sodium Valproate	1	0	0%
Hyoscine	1	0	0%
Pantoprazole	4	4	100%

On observation, about 66.36% were IV bolus administrations and 33.74% were IV infusions. The incidence of intravenous errors was compared between intravenous infusions and intravenous bolus using Chi-square test which showed a p value of < 0.0001 that was statistically significant. The analysis showed that there was higher incidence of intravenous errors in intravenous infusions (74.77%) than intravenous bolus injection (44.49%).

The incidence of IV errors between genders was calculated using Fisher's exact test and Chi-square test. The percentage of male patients with IV errors was 94.41% and for female 96.77%. The results were not statistically significant.

Table 2: Incidence of IV errors between genders

TEST	P value	One tailed/two tailed
CHI –SQUARE TEST	0.6565	Two
FISHER'S EXACT TEST	0.4944	Two

The incidence of IV errors between adult and geriatric group was calculated using Fisher's exact test. Out of total study population adult was 39 in males and 50 in females, in geriatric male was 12 and female patients 12 in number. The results were not statistically significant.

Table 3: Incidence of IV errors between adult and geriatric group

TEST	P value	One tailed/two tailed
FISHER'S EXACT TEST	0.6478	Two

Evaluation of the work carried out by the nurses while and before the administration of intravenous therapy was also observed. All the patients' prescription was read and the identification of the patient was read by the nurse. Aseptic techniques were used for only 20% of the recorded prescriptions. Around 87% of the administrations were recorded by the nurses. Only 6% of the IV infusions were cross-checked by two nurses. Various emergency drugs like heparin, hyosicne, phenytoin, dexamethasone, hydrocortisone and sodium valproate were also administered for which proper monitoring was not carried out by two nurses.

DISCUSSION:

Intravenous administration errors were observed commonly in the general medicine wards. Various types of errors like flow rate error in infusions, reconstitution errors, wrong mix errors and incompatibility of intravenous drug were observed, where flow rate errors were the highest 45% followed by reconstitution and wrong mix errors. There was higher incidence of error seen in intravenous infusions than in intravenous bolus administration.

It was observed that errors occurred due to the inappropriate techniques and due to various factors like work load, poor indent supply and time factor. Other errors like delayed administration errors and omitted drugs were not observed as collection of data was done only during the day from 8.00 AM to 3:00 PM. Flow rate errors occurred mainly due to inappropriate calculation done by nurses.

It was found that the observation of nurses during drug administration at a UK hospital did not significantly affect the administration errors; nor did tactful

interventions made by the observers to prevent serious errors. However, concerns about the validity and reliability of observational methods for identifying medication administration errors may be unfounded. [8, 12]

In Barbara A. Mark 2009 et.al, the relationship between nurse staffing and medication errors were studied in this article where no evidence supporting that there is any impact of the nurse staffing on any medication errors. However, in the current study medication errors were observed due to the inadequacy in work carried out by the staff. [13]Out of the total errors observed only few administrations showed negative effects like pruritis, swelling at the site of administration, rigor, and nausea. The intravenous cannula was not changed until and unless there was any pain or swelling at the site of administration.

Errors can be minimized by utilising advanced techniques like small infusion smart pumps and automated flow rate infusion set.[14] Intravenous administration of drugs is the most essential route of administration as it has advantages of quicker delivery of drug to the target site. Thus proper care should be taken by nurses and other health care professionals in the administration of intravenous drugs.

CONCLUSION:

In this study, intravenous administration errors were observed in the patients who were admitted in the general medicine wards. The incidence of error was observed to be more frequent in intravenous bolus injections when compared to intravenous infusion administration of therapy. Intravenous administration of therapy is the most essential route of administration hence proper methods and care should be practiced by nurses and health care professionals to avoid errors.

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