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Role of clinical pharmacologist in detection and prevention of administration errors: An observational and interventional study

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ABSTRACT

Medication errors occur every time and at any stage of the treatment process from prescribing to delivery of the drug to the patient. Here in this study, a clinical pharmacologist intervention program was designed for reviewing patient's medication orders and checking medication errors occurrence in order to make recommendations for correcting the probable errors with the intervention of Clinical Pharmacy Services in the hematology-oncology ward of Urmia Imam Khomeini Hospital in Urmia-Iran. Also, nurses acceptance to improve errors is reviewed as well. It is observed that trust of physicians and nurses in the views of a clinical pharmacologist will lead to a large part of the reported errors being accepted and resolvedthe CYP3A4-mediated biotransformation in rats. Verapamil can be co-administered with sitagliptin without dose adjustment due to high safety margin of sitagliptin.

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INTRODUCTION

Medication errors occur every time and at any stage of the treatment process from prescribing to delivery of the drug to the patient. Furthermore, the medication process involves all of the medical team, involving physicians, residents, pharmacists, and nurses [1,2]. Retrospective review studies have shown that 3–17% of patients in acute care hospitals experience one or more adverse events that ~50% of them were preventable [3]. Medication errors with antineoplastic drugs may be disastrous because this group of drugs are very toxic and have small therapeutic index. Also the health status of cancer patients is critical. Antineoplastic agents were the second most common cause of fatal medication errors [4,5].

From the patient's safety perspective, the prevention of anticancer drug errors in hospitals has a significant priority and several recommendations have been published in various ways to reduce the likelihood of these errors [1,6]. Clinical pharmacists and pharmacologists play important roles in detection and prevention of medication errors [7-11]. Clinical pharmacy services started during last two decades in a few teaching hospitals in Iran. There are few reports on medication errors surveillance in hospitalized patients in Iran and clinical pharmacists' interventions to prevent or reduce these errors. In our university hospital, clinical pharmacists and pharmacologists are not routinely involved in documenting patients' admission medication histories, unless specifically requested to do so. Goals of present study were to evaluate the frequency and type of medication errors in drug delivery to patients and role of clinical pharmacologist in early detection and recommendation to correct of them in the hematology-oncology ward of Urmia Imam Khomeini Hospital in Iran. Therefore, a clinical

pharmacologist intervention program was designed to review patient's medication orders, check the medication errors, make recommendations for correcting them, and review nurses' acceptance to improve errors.

MATERIALS AND METHODS

This prospective and observational study was performed after approval by Medical Ethics Committee of Urmia University of Medical Sciences in the hematology-oncology ward of an academic tertiary care 300-bed hospital in Urmia-Iran. The medical staff of the closed-format, 25-bed hematology-oncology ward consisted of board-certified intensivists attends, residents, interns and nurses. The aim of the study was to describe, evaluate and document the prevention of drug delivery (validation, preparation and dispensation) errors by clinical pharmacologist interventions in patients with cancer. We assessed the effect of clinical pharmacologist recommendations by the number and acceptance of them by the residents and nurses. The clinical pharmacologist in coordination with the professors of the ward reviewed patients medical records and monitored patients' drug treatment regimen. Delivery errors were extracted from medical records or detected during patients' monitoring. All delivery errors detected by clinical pharmacologist in 296 patients between March to September 2017 were reported in the format of medical consultation. A documentation template was designed to collect the following information: patient data (sex, age, diagnosis), prescriptions written and drug-specific recommendations and outcome measures. The clinical pharmacologist told his comments and recommendations to the residents and nurses to reform them. In this study those patients that re-admitted during the study period and received the same drugs were excluded. SPSS version 18.0 was used for data analysis. Descriptive statistic was used to determine frequency of each type of delivery errors. The units of analysis were the number and percentage of errors.

RESULTS

A total of 296 patients included in this study with a median age of 46.55 years of which 47.97% were female. The median number of drugs used per person was 6.98. A total number of 395 delivery errors on 211 patients were detected by clinical pharmacologist. This means that 71.28%

Table 1. Demographic profile of 296 in-patients hospitalized during the period under study

Sex (No.) (%)	Male (154) (52.03)
	Female (142) (47.97)
Age/Year (Mean±SD)	46.55±27.69
Average numberof drugs per patient	6.98
Patients with at least one error (%)	211 (71.28)
Average number of errors per patient	1.33

Table 2. Delivery Errors

	Type of errors (No.)	*Mechanism of errors (No.)*	*Type of recommendations (No.)*	*Result of consultation*	*Example*
Delivery Errors (395)	Improper distance between the two drugs (207)	Unabsorption due to increased motility (110)	Change in drugs delivery time	Consensus (193)	lactulose and oral medications
		Unabsorption due to stomach alkalization (97)		No Consensus (14)	fluconazole and acid suppressant agents
	Improper dilution (123)	Improper dose reaches to patient	Change in the volume of solvent	Consensus (119)	500mg cyclophosphamide diluted with 100ml normal saline instead of 50ml
				No Consensus (4)	
	Inappropriate infusion rate (52)	Overlapped two doses (18)	Change in the rate of infusion	Consensus (46)	The rate of heparin infusion was very slow, the drug don't finished before the desired time.
		Large dose of the drug delivered in short time , increased adverse drug events possibility (34)		No Consensus (6)	Vancomycin to be infused over 2 h but infused over 30 mins
	Laboratory monitoring (9)	The decision on the patient is impaired.	Drug discontinuation	Consensus (9)	The result of serum creatinine don't reported for dose adjustment
				No Consensus (0)	
	Identification of adverse drug reaction (4)	Unfamiliarity of nurses with side effects of drugs	Patient management and report to ADR center	Consensus (4)	Rash in a patient with a history of penicillin susceptibility following ceftriaxone administration
				No Consensus (0)	

of the admitted patients experienced at least one medication error that is equal to a median of 1.33 errors per patient (Table 1).

Most medication errors were related to improper distance between the two drugs (52.40%). The majority of errors were between lactulose and oral medications, and between fluconazole and acid suppressant agents.

Improper dilution was the second delivery errors (31.14%) which was most often seen with vancomycin and cyclophosphamide. The third common error was inappropriate infusion rate (13.17%) that the most of vancomycine and filgrastim were involved.

In 2.28% of errors, the clinical pharmacologist find that laboratory results due to the increased creatinine and PTT was not reported to the resident. Adverse drug reactions were 1.01% of the errors, which was diagnosed by the clinical pharmacologist. Warfarin, haloperidol and ceftriaxone were involved in this event that was not serious reactions. Clinical pharmacologist provided recommendations to correct delivery errors upon their detection and after informing the senior oncologist and head nurse. Nurses accepted 371

out of these 395 (93.92%) clinical pharmacologist's recommendations. The details of errors such as type of error, mechanism of error, type of recommendation, result of consultations and examples of errors are listed in Table 2. Main reasons for rejecting the remaining recommendations were expressed as lack of relevant information for immediate pharmacotherapy. The attendance of clinical pharmacologist was limited to morning shifts, and patients who were admitted to evening and night shifts had their orders performed before the pharmacologist's visit.

DISCUSSION

Medication errors detection and pharmacologist intervention are very important factors for quality of patient safety [11,12]. Our study has shown that the clinical pharmacologist intervention is effective at reducing the prevalence per patient of delivery errors and improve medication use at hospitalized patients in hematology-oncology ward. Although pharmaceutical care providing by clinical pharmacist/pharmacologists in hospitals is new in Iran, nevertheless clinical pharmacists/pharmacologists actively participated in medical treatment team in the teaching hospitals. Albeit our hospital has not this unit yet. The methodology used was direct observation of medication administration, which is the most efficient and practical medication-error-detection method and one that produces valid and reliable results [13].

Our results demonstrated that delivery errors occurred frequently at our hospital, at a rate of 71.28%, which is relatively higher than the rate of errors reported in published literatures, ranging from 56.4% to 61.6% [14,15]. But in other researches this rate was very low in comparison our study (2% and 12.8%) [1,16]. The difference between the findings of the current study and those of others cited here might be partly explained by the nature of the study settings. However, difference in methods used to calculate delivery error rate in the studies and lack of trained personnel must be considered. Most importantly, it's the first time in our hospital that the clinical pharmacologist intervenes in the treatment process. Irrespective of the reasons, however, delivery errors of this magnitude threats patient safety and erode public confidence in medical care system.

The most common types of drug delivery errors were improper distance between the two drugs (wrong time) which included 52.40% of the errors. This type of error was the most error in other studies also [14-17]. We observed in this study that the lack of knowledge about the effect of drugs on absorption was the main cause of this error, for example, giving a laxative (Lactulose) to a patient witch taking oral medication simultaneously.

The next most common error was wrong dilution of parenteral drugs: in 31.14% of errors, the drug was not diluted according to the recommendations of product catalog. The main drugs involved in this type of error were vancomycin and cyclophosphamide. These findings are accordance to results of Gonzalez et al study [13].

13.17% of errors were wrong infusion rate. Vancomycine and filgrastim were the main drugs involved. In other studies, [13,18], this type of errors was in the same rank as our study, but in terms of number, they were less. It seems that in our study, nurses relied on their colleagues' more than factory recommendations. Not reporting laboratory results to physicians and nurses' unfamiliarity with side effects of drugs were other errors, which were 2.28% and 1.01%, respectively. Although these errors were rare and did not harm the patients, on the other hand clinical pharmacologist recognized them in a timely manner, but we concluded that nurses education about the importance of laboratory results report and side effects of drugs can be important for patients safety.

Percent of accepted recommendationsin our study was 93.92%. This percent in the case of Ho,L. et al and Leape L. et al, study was 99% [19,20].The reason for not accepting of some recommendations was that counseling was initiated after the start of the treatmentand most of the orders were run before the clinical pharmacologist attendance in ward.

LIMITATIONS

To our knowledge, this is the one of few studies that have investigated the effect of pharmacologic consultation in an Iranian hospital for patients with cancer with the aim of reducing administration errors. Our priority was to describe the incidence of administration errors byusing observational method to prevent them. Effects of administration errors on costs of care, morbidity, and mortality of patients have not been studied. Thereforewe could not to evaluate relationship between these errors and costs imposed on the health system.

CONCLUSION

Here in this study, it is observed that nurses can be trained in terms of how to deliver medication, the proper method of dilution, the distance between drugs and etc. The

trust of physicians and nurses in the views of the clinical pharmacologist led to a large part of these errors being accepted and resolved. Clinical pharmacologist full-time attendance in ward seems to be preventing more errors.

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CONFLICT OF INTEREST

The authors declare that this research does not have any conflict of interest with anyone or any Institute.

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