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Efficiency of strategies for preventing medication administration errors in pediatric inpatients

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Summary

Aim: Children constitute a population at high risk for medication errors. The risk of errors and the effect increases due to the physiological characteristics of children, medications prepared in small doses and lack of pediatric forms of many drugs. This study was conducted to examine the efficiency of prevention strategies in pediatric medication administration errors.

Material and Method: This research used the undisguised observation method in collecting data. Medication doses were observed in pre-intervention phase (1686 doses) and post-intervention phase (1460 doses). Prevention strategies were applied for factors contributing to medication administration errors. The pre-post intervention data were evaluated using chi-square analysis. Necessary permissions were obtained from the ethics committee of the hospital (B.30.2..0.70.10.00-3435) and the nursing school (B.30.2..0.82.00.00/1407) where the study was conducted. Nurses were informed about the objective and method of the study, their questions were answered and consents were taken.

Results: The rate of medication administration errors was 28.2% in the pre-intervention phase and 21.4% in the post intervention phase. The most frequent errors were wrong time and wrong dose errors. In the observations, it was determined that the inadequacy of medication preparation and administration protocols, workload and equipment inadequacies contributed to error.

Conclusions: The results of this study support that medication errors are a universal problem. Our results are similar with the results of international studies. The outcomes of the study show that medication administration errors are multifactorial and understanding the latent conditions of errors has vital importance. The results obtained in our study point to the importance of systematic approach for prevention of medication errors. (*Türk Arch Ped* 2013; 48: 299-302)

Key words: Medication administration errors, nursing, observation, pediatric, technique

Introduction

Children constitute a population at high risk in terms of medication errors. The developmental properties of this population, lack of pediatric forms of many drugs and administration by reconstitution increase the risk and impact of error (1,2,3). Although electronic methods used to prevent medication errors are efficient in prescription errors, the desired results could not be obtained in administration errors (3,4).

The results of very disciplined studies show that most factors leading to medication errors are related with the system (1,5). It is a remarkable outcome that the rates of medication administration errors are still high despite the emphasis on the system approach in the studies performed in

the last 20 years (3,6,7,8,9). Recent studies have emphasized the frequency and reasons of pediatric medication errors and lack of interventional studies directed to prevent these errors (2,3,7,9). In the study performed by Otero et al. (2) aimed to decrease prescription and administration errors, the importance of preventive initiatives in increasing patient safety was emphasized. In our country where patient safety has drawn attention in recent years, there is very limited information about the frequency of pediatric medication errors (9,10). There are no studies defining the factors which lead to medication errors. It is clear that definition of the frequency and reasons of pediatric medication errors and evaluation of the efficiency of preventive interventions will be directive

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in methods directed to patient safety. In this study, pediatric medication errors and the efficiency of the methods directed to prevent the factors leading to these errors were evaluated.

Material and Method

In this interventional study, observation method was used in defining the frequency and types of medication administration errors and the factors leading to errors. Preventive methods were applied for the reason leading to each error found.

This study was conducted in the pediatrics ward of a university hospital. Mothers are present at the side of their children for 24 hours in this clinic which has 52 beds and 25 nurses. Each nurse works for 12 hours (08-20, 20-08) and the patient: nurse ratio ranges between 1:5 and 1:11 depending on the intensity of patient care. Regular treatment hours are 10-12-14-18-22-24-02 and 06. Medication orders are recorded manually in the nurse observation form and a drug chart is used for each drug administration. The sample of the study was composed of the drug doses administered by the nurses at the hours of 10-18-22-06. 1 686 drug doses were observed before intervention and 1 460 drug doses were observed after intervention. The mean age of the nurses who were all university graduates was 30.6 (SD:6.1) (23-44). The nurses had been working in this clinic for 1-14 years.

An observation form was used in data collection. The observation form includes an area where the date, time, patient name, drug name, drug dose, drug administration, time of administration are noted and errors and reasons are marked.

In this study, a difference between the physician's order and the drug given to the patient was considered medication administration error. The medication error classification made by the American Society of Health-System Pharmacists (ASHP) (11) was used in definition of error types and a deviation of one hour from the time when the drug should be given to the patient was considered time error. The pre-intervention observation data of the study were collected in a period of one year. The post-intervention observation data were collected in 3 months one year after the error prevention methods were applied. Before observation, drug orders, nurse record forms and drug cards were checked and the drug administration times, drug administration routes and the amounts of drugs administered were recorded on the observation form. The nurse was expected to recognize a life-threatening error in the drug administration period. If the error was not recognized, the nurse was warned and the error was prevented (preparation of a 10-fold higher dose, wrong medication). This was recorded as an error in the observation form, but was not an error actually.

Prevention methods directed to each reason of error defined in the first observation data were planned. These methods were shared with the hospital administration and applied. These methods included: 1. Physical changes in the medication preparation room. 2. Putting warning writings on the doors of the treatment room 3. Preparation of signalling arm-bands for the nurses to wear to prevent splitting during preparation and application of medication 4. Contacting with the hospital pharmacy to bring medications to the clinic earlier. 5. Preparation of medication methods (the method which

includes medication times, steps which should be taken note of in administration of medications, information related with preparation, administration and follow-up of frequently used medications) 6. Decrease in the nurse/patient ratio due to an increase in the number of nurses.

The necessary approvals were obtained from the ethics committee (B.30.2..0.82.00.00/1407) and the hospital (B.30.2..0.70.10.00-3435). All nurses were informed about the objective of the study and all nurses gave consent to participate in the study.

The numerical and percentage distributions of error frequencies were determined. Chi-square analysis was used in determining the difference between the pre-intervention and post-intervention period. The total frequency of medication administration error was calculated by dividing the errors observed by the total medication doses administered and missed and by multiplying with 100. Although multiple factors were present in each error, the main factor leading to that error was noticed.

Results

51.4% of 1686 medication doses observed before intervention and 56% of 1460 medication doses observed after intervention were administered in the daytime (08-20) % study. The time at which most medications were administered was 10:00. At this treatment time, a drug dose with a rate of 26.6% before intervention and with a rate of 29.2% after intervention was administered. While an error was made in 475 (28.2%) of a total of 1686 drug doses before intervention, an error was made in 313 (21.4%) of 1460 drug doses after preventive interventions.

It was found that nurses most frequently made time and dose errors during drug administration process (Table 1). The rate of time errors was 10.6% before intervention, while it was found to be 7,0% after intervention. The rate of dose errors was 10.3% before intervention, while it was found to be 7.3% after intervention. After intervention it was found that time errors significantly decreased by a rate of 3.6% (χ^2 : 12.308 P: 0.000) and dose errors significantly decreased by a rate of 3% (χ^2 : 8.717, P: 0.003). No significant difference was found in administration technique and dose missing error rates before and after intervention. When the total error rate was examined, it was found to be 28.2% initially and 21.4% after preventive interventions. The difference is statistically significant (χ^2 : 18.904, P: 0.000).

No significant difference was found in work load which was the most important factor leading to error before and after intervention (Table 2). The rate of error originating from delayed arrival of drugs from the pharmacy to the clinic was 6% and decreased to 2.1% after intervention which was significant (χ^2 : 30.371, P: 0.000). The rate of error originating from insufficiency of the methods directing drug administration was 4.5% before intervention and 2.3% after intervention. The difference was significant (χ^2 : 11.816, P: 0.001). Another factor for which a significant difference was found before and

after intervention was splitting (χ^2 : 21.099, P: 0.001). No significant difference was found in terms of insufficiency of infusion pump and errors originating from patient-related factors before and after intervention.

Discussion

The fact that the data of this study were collected by observation technique in a long time period at the hours at which most drugs were administered in the daytime and night time increased the objectivity of the results. Most studies in this area are based on data obtained by examination of retrospective records, by qualitative method or by questionnaire method (6). Allard et al. (12) reported that observation of the dose administered was more efficient in obtaining objective results in medication administration errors compared to examination of medical reports or retrospective records.

Our results support the finding that medication administration errors are made with a high rate in pediatrics. The rate of error was 31.3% in the study performed by Prot et al. (1) and 27.6% in the study performed by Ghaleb et al. (7). Similar error rates have been observed in other studies performed by way of observation in pediatrics clinics (13,14,15). The fact that our results show high error rates similar to the literature is valuable in terms of indicating that pediatric medication administration errors is a global problem which is expected to be solved. In addition, our results may be considered a good database for our country which has limited literature in this area.

According to our results the most frequent errors before and after intervention included timing and dosing errors, but significant reductions were provided with interventions in the rates of these errors. In studies examining pediatric medication administration errors, timing errors (24-36%) and dose errors (1.5-26.7%) were found with the highest rate (1.13-17). In the interventional study performed by Taylor et al. (18), significant reductions were provided in the rates of these errors.

As a result of interventions directed to the system, a reduction of 6.8% occurred in the total rate of errors. In the study performed by Bertsche et al. (3) in which an education program directed to prevent errors in administration of oral and gastric drugs was applied, the rates of administration error of nurses were reduced by 32.5%. In the study performed by Otero et al. (2) which included interventions directed to reduce administration errors of physicians and nurses, a significant reduction in the rate of errors was recorded. A checklist composed of 10 steps directed to prevent drug order errors was used and environmental interventions directed to reduce splittings and distractibility were applied in addition. It was reported that the checklist composed of 10 steps used during medication administration provided a significant reduction in the rate of pediatric medication administration errors (2.5%) (2). Similarly, the methods including drug preparation, administration and follow-up information were effective in reducing the frequency of errors in our study.

According to our results, the factors which caused errors included factors related with the system including work load, delayed arrival of drugs, splittings, not abiding by the methods

Table 1. Distribution of the errors made before and after intervention

Error type	Before intervention (n=1686)		After intervention (n=1460)			
	n	%	N	%	χ^2	P
Timing error	178	10.6	102	7.0	12.308	0.000
Dose error	173	10.3	106	7.3	8.717	0.003
Administration technique error	105	6.2	90	6.2	0.005	0.941
Missing error	19	1.1	15	1.0	0.073	0.788
Total errors	475	28.2	313	21.4	18.904	0.000

Table 2. Factors leading to error before and after intervention

	Before intervention (n=1686)		After intervention (n=1460)			
	n	%	n	%	χ^2	P
Work load	147	8.8	140	9.6	0.619	0.432
Delayed arrival of drugs to clinics/absence of drugs	101	6.0	30	2.1	30.371	0.000
Insufficient methods/lack of use of methods	76	4.5	33	2.3	11.816	0.001
Splitting	69	4.1	25	1.4	21.099	0.000
Insufficiency of infusion pump	47	2.8	41	2.9	0.023	0.881
Factors related with patients	35	2.1	44	3.0	2.811	0.094
Total errors	475	28.2	313	21.4	18.904	0.000

and inappropriate infusion pump. Both factors are in the upper orders in our country compared to studies performed in countries in which the nurse/patient ratio is lower and better drug distribution systems are present (1,5,19,20,21). Reason (22) recommends interventions directed to the system to prevent errors. In our study, reduction of the nurse-patient ratio and arrival of drugs at the clinic before the administration time were interventions which were realized with the decision of the administration. Reduction of work load with these interventions contributed to a reduction in the rates of all errors and arrival of drugs at the clinic before the administration time was effective in reducing the rate of timing errors.

This study is the first study in which pediatric medication errors were determined by way of observation technique in Turkey and interventions directed to decrease these errors were evaluated. Therefore, our results are important in terms of directing the investigations which will be performed in this area.

According to the results of this study, the rates of pediatric medication administration errors are high which supports the literature. A reduction in the frequency of errors was obtained with interventions performed to prevent these errors. In our country in which patient safety culture has recently started to be discussed, studies evaluating the efficiency of preventive methods are needed.

Conflict of interest: None declared.

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