

Knowledge and practices of nurses concerning intravenous potassium administration in a Turkish hospital

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ABSTRACT

Objective

Based on this literature review, it is clear that intravenous potassium is a potentially toxic electrolyte, which has been responsible for a large number of deaths in hospitals. In Turkey, research on intravenous potassium administration is limited in the available literature. In addition, clinical observations made by the researchers suggests there is knowledge and practice deficiencies among nurses related to potassium administration. Thus, this study aimed to determine how wide the knowledge and practice deficiencies among nurses was concerning intravenous potassium administration in a Turkish Hospital.

Design

This was a descriptive study.

Setting

This study was conducted in a university hospital in Turkey.

Subjects and Method

The sample of this study consisted of a total 105 nurses working in surgery clinics or surgical intensive care units of a university hospital, who volunteered to participate in the study. The questionnaire used in this study was developed by the researchers with the help of material obtained from the literature review. Questionnaires were distributed and collected to participants by researcher. In the calculation of knowledge and practice scores, every correct answer was assigned 1 point, while incorrect answers were assigned 0. Mean, percentage, ANOVA, the kruskal-wallis h test, the mann-whitney u test and pearson correlation were used for data analysis.

Results

The mean knowledge score of nurses on intravenous potassium administration was found to be 9.48 ± 3.21 , while the mean practice score was 10.85 ± 2.04 . These results suggest that the nurses' knowledge and practice scores were found to be relatively lower compared to 17 which is the highest scores of both knowledge and practice about intravenous potassium administration. It is also important to state that statistically significant and positive relationship was found ($r: 0.595$; $p < 0.05$). The majority of the nurses (61.9%) did not know all the elements of a correct potassium order. The differences in nurses' knowledge scores according to the type of hospital unit and training status on liquid electrolyte balance were found to be statistically significant ($p < 0.05$). Nurses with duration of employment of over 10 years were found to have higher knowledge scores than nurses with employment duration of below four years. This difference was found to be statistically significant ($p < 0.05$).

Conclusion

In light of the findings of this study it is recommended that nursing curriculum and in-service training programs in Turkey should address intravenous potassium administration more extensively and that protocols related to intravenous potassium administration be developed and implemented.

INTRODUCTION

Patient safety, which is one of the highest priority goals of patient treatment and care, is affected by various factors such as hospital environment, the complexity of the quality and the quantity of healthcare workforce, medical processes, technology, and team work. However, patients can be faced with various medical errors (Sezgin 2007). Many studies since 2004 indicate the rate of medical error faced by patients ranges from 5.7% to 12.2%. It is suggested that these errors extend the duration of hospital stay, cause permanent health problems in 5-14% of the patients, and result in death in 3-15.9% percent of cases (Michael et al 2009; Wong et al 2009; Aranaz-Andrés et al 2008; Zegers et al 2007; Herrera-Kiengelher et al 2005; Baker et al 2004).

In a report published by the Institute of Medicine in the United States of America (USA) in 2003, three out of 20 areas that were selected as top priority issues in the quality of health care services were about patient safety. These areas were medication (medication administration), hospital infections, and the health of the elderly (Institute of Medicine, 2003). Medication errors are a serious issue that can cause various illnesses, disabilities, and death. Studies show the frequency of medication errors is substantial (Valentin et al 2009; Prot et al 2005; Institute of Medicine 2003; Barker et al 2002). It is clear all hospitals should collect and report their medical errors individually as part of their quality assurance processes. However, it is very rare to find a hospital reporting its medical error. For this reason some national figures on medical errors in Turkey are used to show the importance of the topic. In Turkey, the most common reasons of medication errors are wrong medication (16%), wrong dose (41%), and wrong route of administration (16%) at physician orders (Minister of Health of the Republic of Turkey, 2012). Certain medications were found to be responsible for most deaths related to medication errors and were grouped under the category 'High-Risk Medications' (Cohen 2001). The medications in this group were insulin, intravenous anticoagulants (heparin), opioids, sodium chloride solutions with a concentration of above 0.9%, and intravenously administered potassium chloride and potassium phosphate among the medications most commonly cause side effects in patients (Cohen 2001; Hadaway 2000; Bates et al 1995).

Intravenous potassium administration is a high-risk practice with regard to patient safety and can cause ventricular tachycardia, ectopic beats and ventricular fibrillation if given incorrectly. Therefore, it is critical that all healthcare personnel, but especially nurses, be knowledgeable about the potential risks of intravenous potassium administration. In a study conducted with the aim of assessing the need for pharmacological knowledge of nurses, it was found nurses had limited pharmacological knowledge (King 2004). In another study conducted to determine the knowledge level of nurses about high-risk medications, it was found 75.4% did not have enough knowledge about the administration of high-risk medications, and 31.8% did not know that 15% potassium chloride solution should never be administered as intravenous bolus (Hsaio et al 2010). Deaths concerning administration errors of intravenous potassium are highly debated in case studies on the subject, since medications with similar-sounding names, shaping, colour of the ampoule etc can be confused with potassium (Moyen et al 2008; Wetherton 2003).

Research on medication administration errors including intravenous potassium by nurses in Turkey is limited in the available literature. Thus, this study was designed to identify the knowledge and practices of nurses concerning intravenous potassium administration. One of the main reasons for carrying out this study was to close this knowledge gap. In addition, the results of this study can help to develop a high risk medicines management protocol.

METHOD

This was a descriptive study that aims to examine the knowledge and practices of nurses concerning intravenous potassium administration. The study was conducted in surgery clinics and surgical intensive care units of

a university hospital in Turkey. These clinics and units did not have a set protocol regulating intravenous potassium administration. Physicians give written orders about potassium solutions and nurses prepare them accordingly. A total of 105 nurses working in these clinics and units who volunteered to take part in this research were included in the study. A questionnaire was prepared by the researchers using information from existing literature about the subject and was used to collect data. The questionnaire consisted of two parts. The questions under Part I collected data on demographic characteristics of the nurses. Part 2 included close-ended questions on intravenous potassium administration. The questions in the questionnaire were tested for structure and clarity by the researchers in a pilot study. No revisions to the questions were indicated.

Ethical approval by Local Ethics Committee was obtained prior to the study. Participants were instructed on how to fill in the questionnaire. A written consent was obtained from all participants. Participants who were willing to participate in the study were given the questionnaire. The forms were collected on the same day at the end of the shift. Filling in the questionnaire took approximately 20 minutes.

SPSS 15 (Statistical Package for the Social Sciences) was used to analyse the data. In the calculation of knowledge and practice scores, every correct answer was assigned 1 point, while incorrect answers were assigned 0. The maximum scores of both knowledge and practice that participants could achieve on the form were 17 while the minimum score was 0. Mean, percentage, ANOVA, the kruskal-wallis h-test, the mann-whitney u-test and pearson correlation were used for data analysis.

RESULTS

Of all participants, 41.9% were between 19–24 years of age, 90.5% were female, 65.7% held an undergraduate degree, 56.2% had been working as a nurse for less than five years, and 70.5% had been working in the same clinic for less five years. 7.7% of the participants were administering potassium almost every day. The rates of those who underwent training on fluid- electrolyte balance, on intravenous potassium administration, and on patient safety were 67.6%, 48.6%, and 66.7% respectively. 94.3% of the participants stated they kept a potassium ampoule for emergent situations in their clinics, and 81% indicated that solutions containing potassium were not prepared in pharmacies.

Table 1: Knowledge and Practice Scores of Nurses on Intravenous Potassium Administration (N: 105)

Knowledge and Practices	Mean Score $\pm$ SS	Minimum	Maximum
Knowledge	9.48 $\pm$ 3.21	0	15
Practice	10.85 $\pm$ 2.04	4	15

It was found 61.9% of the nurses in this study did not know all the elements of a correct potassium order. The mean knowledge score of the nurses on intravenous potassium administration was found to be 9.48 $\pm$ 3.21, while the mean practice score was 10.85 $\pm$ 2.04. These results suggest the nurses' knowledge and practice scores were found to be relatively lower compared to 17 which is the highest scores of both knowledge and practice about intravenous potassium administration. It is also important to state that statistically significant and positive relationship was found ($r: 0.595$; $p < 0.05$). In addition, the minimum and maximum knowledge scores of the nurses were 0 and 15, respectively while minimum and maximum practice scores of them were 4 and 15, respectively (table 1).

Of all participants, 98.1% stated the amount included in the potassium ampoule before administration should be checked; 97.1% stated that a tag on solutions containing potassium that reads "Contains Potassium" should be applied; 92.4% stated that the urine volume of the patients who received potassium chloride in their infusions should be observed; and 90.5% stated that the peripheral vein used for potassium administration

should be checked for irritation and inflammation. 98.1% the participants stated that potassium ampoules for emergent cases should be stored in clinics; 61.0% stated that they did not know whether a solution bottle containing potassium should be shaken before administration.

The majority of participants (98.1%) stated that they wrote “Contains Potassium” on solutions containing potassium; 97.1% stated that they checked the amount of potassium contained in the ampoule; 95.2% stated that they followed up on patients’ urine volume after potassium administration, 92.4% stated they checked the peripheral vein used for intravenous potassium administration for any possible irritations and inflammations.

The differences in the knowledge scores according to the type of clinic were found to be statistically significant ($p=0.007$ $p<0.05$). Participants working in otorhinolaryngology and plastic and reconstructive surgery clinics were found to have lower knowledge scores than those working in cardiovascular or brain surgery intensive care units ($p=0.003$ $p<0.05$). This significant difference could be attributed to the higher frequency of intravenous potassium administration in cardiovascular surgery clinics and intensive care units. The differences in knowledge scores according to training status on fluid-electrolyte balance and intravenous potassium administration were found to be statistically significant ($p=0.012$ $p<0.05$). Participants who underwent training were found to have a higher mean knowledge score than those who did not. This finding suggests education increases nurses’ level of knowledge about intravenous potassium. No statistically significant relationship was found between the mean knowledge scores of nurses and duration of employment as a nurse, duration of service in their current clinic, level of education, training status on patient safety, and willingness status to participate in a training program on the subject ($p> 0.05$).

Participants with a duration of employment over 10 years were found to have higher knowledge scores than nurses with duration of employment of below four years. This difference was found to be statistically significant ($p=0.030$ $p<0.05$). This finding suggests while participants might not possess sufficient knowledge about intravenous administration of potassium at graduation or in the first years following their graduation, they become more knowledgeable on the subject as they get more experienced over the course of their employment as a nurse. No statistically significant relation was observed between practice scores and duration of service in the current clinic, level of education, type of clinic, training status on fluid-electrolyte balance, intravenous potassium administration, or patient safety, and willingness status to participate in a training program on the subject ($p> 0.05$).

Table 2: The Relationship between the Knowledge and Practice Scores on Intravenous Potassium Administration (N:105)

Dimension	Dimension	N	R	P
Practice Score	Knowledge Score	105	0.595	0.000

A statistically significant and positive relationship (59.5%) was observed between the knowledge and practice scores of the nurses ($r=0.595$; $p<0.05$). The practice scores of nurses on intravenous potassium administration increased as their knowledge scores went up (table 2).

DISCUSSION

As the administration of medication requires the collaboration of a team that includes doctors, nurses and pharmacists. Every team member has their own specific responsibilities. More than half of the nurses in this study did not understand the requirements of a potassium order. It is crucial that nurses know about the proper form of medication order in so far as a knowledgeable nurse can warn the physician in case of an improper medication order. Literature shows that physician orders with missing information and those that are difficult to read and understand might cause errors in medication administration (Bohand et al 2009; Tubman et al, 2005; Aşti&Acaroğlu, 2000).

In our study, it was found that the big majority of the nurses did not know that undiluted potassium ampoules should not be stored in clinics. In addition, majority of the nurses stated that there were potassium ampoules in clinics, and more than half of them reported that potassium ampoules were kept in an unlockable medication cabinet. Potassium solutions might have serious side effects if not diluted or if applied too fast. Therefore, undiluted potassium ampoules should be available only in pharmacies or be securely locked in a cabinet in the clinic only if storing it in a pharmacy is not an available option (Hsaio et al 2010; Van De Vreede et al 2008; Cronish et al 2007; Wetherton 2003; Tubman et al 2005; NHS 2002; Cohen, 2001; Hadaway 2000; Davis 1995). In a study conducted by Lankshear et al (2005) it was found that undiluted potassium solutions were found in 42.0% of the clinics and that in 80% of these clinics potassium solutions were kept in a lockable medication cabinet. Tubman reports that undiluted solutions of potassium chloride are found in 59.4% of the emergency care departments and in 71.9% of the intensive care units according to a study conducted by the National Patient Safety Association (Tubman et al 2005). In this study these figures were higher than those found in the existing literature on the subject.

These findings have significant implications for practice. Currently, potassium ampoules remain available in clinics of most Turkish hospitals and, as long as this continues, the risk that another potentially fatal error will occur increases. In addition, some hospitals have introduced extra safety measures for storing potassium ampoules in specialty areas and, undiluted potassium solutions or potassium ampoules are found only in the hospital pharmacy and infusion of the required dilution is prepared in this pharmacy in some accredited hospitals. Lack of appropriate policies, procedures, and protocols can impact medication safety. National Patient Safety Agency recommends that ready-to-use diluted infusions should be used where possible and, if an infusion of the required dilution is not available, it should be prepared in the hospital pharmacy (Van De Vreede et al 2008).

This study found the majority of participants (76.2%) either did not know that these solutions should be prepared in pharmacies or had incorrect knowledge related to this issue. Moreover, a great many of the participants stated the potassium solutions in their clinics had not been prepared in a pharmacy. The findings of this study do not quite follow what is recommended in the existing literature on the subject. Undiluted potassium solutions should be diluted with a large quantity of intravenous solution and should not be administered as intramuscular or intravenous bolus (George et al 2010; Hillin and Hicks 2010; Tubman et al 2005). More than half of the participating nurses knew undiluted potassium solutions cannot be administered intravenously as bolus or push (68.6%), and the majority of participants (80.0%) stated they correctly administered undiluted potassium solutions. In a study conducted by Hsaio et al (2010) it was found that 31.8% of the participating nurses did not know they should never administer potassium chloride as intravenous bolus. The findings of that study are parallel to those of this study.

Nurses are most involved with the medication administration phase although they provide a vital function in detecting and preventing errors that occurred in the prescribing, transcribing and dispensing stages. Nurses could make medication errors because they do not have sufficient knowledge and practice about intravenous potassium administration and medication safety. These errors may cause fatalities and incidents. The investigators found that significant increases occur in the cost of hospitalisation because of increased length of stay, patient mortality and postdischarge disability (Van De Vreede et al 2008). Appropriate policies, procedures, and protocols about intravenous potassium administration do not exist in the hospital where this study was conducted and in many other hospitals in Turkey. Therefore, protocols related to prescribing, storage, preparation and administration of intravenous potassium should be developed and these should be added in nurse training programs as well as in service training in hospitals.

In conclusion, the findings of this study suggest that nurses' knowledge and practice scores on intravenous potassium administration were slightly above the medium-level. However, the health care personnel practicing intravenous potassium should have a high level of knowledge and practical skills because of the risks associated with administration error.

CONCLUSION

The results cannot be generalised to all hospitals because this study was conducted in only one hospital in Turkey. Despite this main limitation, the study yielded important evidence on nurses' knowledge and practices about intravenous potassium in Turkey. The researchers of this study suggest protocols related to intravenous potassium administration should be developed and enforced; that this issue should be presented in in-service training programs. In addition, a similar study can be conducted with a larger sample and using the method of observation.

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