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Effect of scientific principles of gavage feeding in oral medicine administration on knowledge and function of nurses in Intensive Care Unit (ICU)

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ABSTRACT

Medication through an enteral feeding tube is one of the main cares in patients hospitalized in the intensive care unit continuously being a challenge. Correct delivery of medication through an enteral feeding tube requires specific knowledge and skills in this field. The nurse as the main responsible for administering a drug, has a very important role in this regard. This study was carried out as a quasi-experimental study on 90 cases of ICU nurses. First, using a questionnaire (pretest), the level of knowledge and practice in intensive care unit was measured. The training course for speech, along with a pamphlet and face to face, was held and again after a month their awareness and performance was measured by questionnaire (post-test). For analysis of data, SPSS software (version 21) and paired tests and chi-square was used. Results showed the mean score of nurses' knowledge prior to applying scientific principles ($12/9889 \pm 2/04167$) and their knowledge after that ($19/3333 \pm 0/71893$); mean performance score prior to applying scientific principles was significantly difference with the average score of their next performance ($P=0/0001$). Also results indicated that the average of all subscales of knowledge and practice (preparation, dosage forms, thumbs up and tubal obstruction, drug interactions and side effects) significantly increased after the application of scientific principles ($P=0/0001$). This study showed that the application of scientific principles in accordance with the instructions provided, significantly increases knowledge and practice of nurses.

Keywords: Knowledge, nurse, enteral feeding tube, enteric coated tablets, sustained release tablets, performance

INTRODUCTION

Intensive care units are the most important and vital part of any hospital that patients with complicated exigent circumstances to protect the life and customs clearance, need special care, are admitted in these sectors [1]. ICU requires comprehensive and complete care. However, there's still a large gap between the ideal theory and real practice [2]. Thus, use of a comprehensive guide, can reduce this gap and increase the quality of nursing care in intensive care unit [3]. According to the research we find, one of the primary care for patients in intensive care is

prescription medicines through a feeding tube, which is still a challenge. Offload medicines through a tube feeding requires special skills include understanding the nature and form of the drug, preparation, review of the pipe positions, washing pipe before, between and after drug administration, pouring drugs into the pipe separately, checking the potential side effects of the drug, and the effect of drug absorption and the effect of food on drug absorption, diameter and the size of the syringe [4]. There are two ways to prepare solid drugs which are given through a feeding tube. Dissolve and crushing. The dissolve method will use when the tablets completely dissolve in 2 minutes [4]. Usually sugar-coated pills or films can normally be shattered. On the contrary, controlled-release drugs and enteric coats cannot become powder. Breaking these two categories will damage their special property. Enteric coating drugs having a cover that should not be open in the stomach. Breaking this coat may cause damage or gastric ulcer, or due to stomach acid the influence of the drug would reduce, or the drug is released in a location other than the original location. Slow-release drugs also are designed in such a way that releasing in the longer period, and broken tablets may not imply acceptable efficacy. By breaking the cover of modified release drugs, patients may have higher blood level of the drug at beginning of medication and therefore experience the adverse drug reactions (especially about drugs narrow therapeutic range). At the end, they experience the lower blood levels of drug and the risk of relapse symptoms increases [5]. Other forms include sublingual tablets or capsules, light or moisture-sensitive drugs, potentially carcinogenic drugs, effervescent tablets and soft gel capsules [5]. In recent studies, the administration of medication through a feeding tube, was a challenge. Belknap et al (1997) were found 74% of hospitals, at least one to three wrong ways in the implementation of drug therapy are applied by enteral feeding tube [6]. In the study of Gunter et al. (2013), which was based on the assessment of knowledge and practice, best performance of prescribe medication through an enteral feeding tube and preventing its complications were discussed particularly (such as tubal obstruction, drug – Food interactions & inadequate intake of medicine). Tube blockage is a repeatable problem (20% -45% of pipes during use, will get obstruction) which mostly need replacement [7-8]. Medication through a feeding tube, needs correct application of prescription techniques to ensure appropriate bioavailability of the drug that don't cause complications in patient care [9-10]. Various studies show that the usual functions, could interfere with proper administration of medications [11-12]. In a study by Guenter which 823 nurses was attended, results demonstrated that only 72% of nurses, doesn't added medicines to food. In a continuous feeding, 95% of people stopped nutritional while have prescribing medicines, 89% of nurses were washing pipes before taking medication, 89% of nurses were washing tube after drug administration. Nurses which washed the pipe before and after drug administration was used 26%, 70%, 4% and 3% of sterile water, tap water, normal saline and other fluids respectively [13]. The nurse's role as closest person to patients and responsible for treatment and medication of hospitalized patients is remarkable. Therefore, focus on nursing education and knowledge of medicine administration in correct ways, is essential for nurses to perform their duties in the best way. This study was conducted to concept the effect of the application of scientific principles for administering oral medication, in patients with a feeding tube, especially on the knowledge and practice of nurses in the intensive care unit.

MATERIALS AND METHODS

This experimental study population involved all the nurses in intensive care hospitals of Shahrekord, Iran (hospitals Hajar, Ayatollah Kashani and Imam Ali, Farrokh Shahr). Inclusion criteria was all nurses working in intensive care units that have 6 months experience in a special section and who previously had not participated in education. In addition, exclusion criteria was unwillingness to cooperate with the researcher or transfer to another section during the plan. In this study, collecting information were done Applying a two part questionnaire. The first section, demographic information including age, sex, and history of nursing in general, work experience and work times in intensive care. The second part consists of two parts: knowledge and performance measurement. The desired questionnaires was used from Doctor Dashti's paper [14], and she also adapted it from Hensence study. The questionnaire consisted of two parts: knowledge (20 questions including: 6 questions of preparation, 5 questions wash and tube obstruction, 5 questions of dosage form and 3 questions from drug interaction and side effects) and performance of ICU nurses (20 questions including: 6 questions preparation, drug interactions 5 questions, dosage form 5 questions and wash and tube obstruction, 3 questions dosage forms and a question of side effects).

Its validity has been confirmed by Dr. Dashti and the reliability of using this test method was validated (T-retest) on 12 ICU nurses in a teaching hospital for two weeks. Cronbach's alpha coefficient for knowledge questionnaire was determined 0.65 and for Questionnaire 0.6 [14].

In this study, a needing assessment was conducted in intensive care units of Shahrekord hospitals. This means that for a month, oral medications that have been used by patients with nasogastric tube were extracted and medications that should not be broken or crushed were separated. According to information obtained, it was found that a number of drugs that should not be crushed or broken have been administrated through nasogastric tube.

To continue the study, the standard medication through the enteral tube was determined by reference to the pharmacopoeia. Then the patients hospitalized in intensive care units of hospitals in this city, in the past 6 months, which had received an oral medication through a feeding tube were reviewed and oral medications prescribed were extracted. (This action, perform to evaluate required education programs.)

Medicines were listed according to Iran pharmacopoeia to be noticed the medicines that should not be broken or crushed. Then all the nurses in intensive care units of Shahrekord hospitals, including the hospital Hajar, Ayatollah Kashani hospital and Imam Ali (AS) were selected.

Using a questionnaire, the level of knowledge and practice were examined. All the nurses in intensive care, a total of 104 people were chosen. The pre-test questionnaires were distributed. Distributing and collecting questionnaires was taking a time about a month long. After reviewing the questionnaires, according to the information obtained, the training course was held. Classes "gavages drug" for speech along with booklets, for a period of two months (10 sessions) at the hospital, was held for all nurses have the opportunity to participate in this training. Training Booklets were prepared and provided to all of the staff.

Major topics include:

- Enteral feeding tube and its variants
- Different enteral nutrition
- Scientific principles of liquid and solid medication by oral gavages
- Identify enteric coated and sustained release products and identify relevant codes
- How to administer solid and liquid oral medication and their interfere with the nutrition formula
- The relationship between PH And liquid osmolality formulations and food products of enteral
- Ways to prevent drug prescribing side effect by the enteral tube such as tube obstruction.

A month after the classes, post-test questionnaires were distributed. 3 nurses due to the presence of less than 6 months in ICU (Exclusion criteria) and 11 person due to non-completion questionnaire were excluded, and finally by achieving 90 pre-test questionnaires and post-test questionnaire, the study was ended. In this study, the whole question of knowledge was considered equal to 20 (score 17 to 20 good, score 12 to 16 moderate and 12 poor knowledge). Total score of 20 questions was considered for the performance (scores 17 to 20 good performance, score 12 to 16 moderate and 12 poor performance).

RESULTS

Demographic data showed that most of the participants in this study, female (94/4%), having bachelor degree (96/7%) and cyclic working shift (97/8%), respectively. The mean age of 35.3 years, with a standard deviation 4/8478, 4/4777 and duration of nursing, SD = 10.8 years Average work experience in a special section was 7.16 years with a standard deviation 4/2247.

According to Table 1 t-test results showed that the mean score of nurses' knowledge prior to applying scientific principles (12/98) has increased to mean knowledge score after the application of scientific principles (19/33) and this increase is significant . (t= -31/82, df=89, p=/0001)

Table 1 - Average score of nurse’s knowledge before and after the application of scientific principles

Variable	Distribution	Average	Number	Standard deviation	Paired t-test		
					p-value	Df	T
awareness	The knowledge score before the application of the principles	12/9889	90	2/04167	0.0001	89	-31.82
	The knowledge score after the application of the principles	19/3333	90	0/71893			

T test results showed that the mean score of nurses' performance prior to the application of scientific principles (7/50) was less than the mean performance after the application of scientific principles (15/22). This means that after the application of scientific principles mean performance, significantly increased than before the application of scientific principles ($t=37/2$, $df=89$, $p=0/0001$).

Table 2 - Average performance score of nurses before and after the application of scientific principles

Variable	Distribution	Average	Number	Standard deviation	Paired t-test		
					p-value	Df	T
Operation	Performance score before applying principles	7/5000	90	2/17364	0.0001	89	-37/32
	performance score After the application of the principles of	15/9222	90	1/47814			

In this study, the whole question of knowledge was considered equal to 20 (score 17 to 20 good, score 12 to 16 moderate and 12 poor knowledge). Total score of 20 was considered for the performance questions (scores 17 to 20 good performance, score 12 to 16 moderate and 12 poor performance).

Table 3. Knowledge of nurses before and after the application of scientific principles

awareness	Variable	Abundance	Number	Percent
After application of scientific principles	Good	90	100	
Before the application of scientific principles	Average	52	57/8	
After application of scientific principles	Average	0	0	
Before the application of scientific principles	Weak	34	37/8	
After application of scientific principles	Weak	0	0	
	Total	90	100/0	

Table 4. Performance of nurses before and after the application of scientific principles

Operation	Variable	Abundance	Number	Percent
After application of scientific principles	Good	31	4/34	
Before the application of scientific principles	Average	3	3.3	
After application of scientific principles	Average	59	6/65	
Before the application of scientific principles	Weak	87	7/96	
After application of scientific principles	Weak	0	0	
	Total	90	0/100	

T test results showed that the average of all subscales of knowledge, significantly increased after the application of scientific principles (Table5).

Table 5. Compare the average subscale of knowledge before and after the application of scientific principles in nurses

sub scale	Average	Number	Std.Deviation	T		
				T	Df	p-value
Preparation before	3/2444	90	1/29225	-12/07	89	0/0001
Preparations later	6/000	90	2/13294			
previous Dosage forms	2/8889	90	1/10611	-10/04	89	0/0001
Dosage forms later	5/000	90	1/87233			
Wash and previous obstruction	3/7111	90	1/01941	8/2	89	0/0001
Wash and obstruction after	5/0111	90	1/10661			
previous interfere	2/3444	90	0/65619	6/1	89	0/0001
After interference	3/1111	90	1/05409			
previous complications	0/7667	90	0/42532	2/9	89	0/004
Complications	0/9000	90	0/30168			

T test results showed that the mean scores of all subscales of performance, significantly increased after the application of scientific principles (table6).

Table 6. Compares the average performance the before and after the application of scientific principles in nurses

sub scale	Average	Number	Std.Deviation	T		
				T	Df	p-value
previous Preparation	5000/3	90	1/21091	-17/15	89	0/0001
later Preparations	6778/5	90	0/55744			
previous Dosage forms	7889/0	90	0/71098	-17/14	89	0/0001
later Dosage forms	1556/2	90	0/63443			
Wash and previous obstruction	8889/1	90	1/02161	14/8	89	0/0001
Wash and later obstruction	4889/3	90	0/78245			
previous interfere	0111/1	90	0/93008	23/7	89	0/0001
later interference	7889/3	90	0/98864			
To complications	2778/0	90	0/45041	-8/12	89	0/0001

DISCUSSION

Assessment demographic data of this study was indicated that most of the participants was female (%94/4), have bachelor degree (96/7%) and cyclic working shifts (97/8%). The mean age was 35.3 years, with a standard deviation of 4/8478, duration of nursing 10.8 years with standard deviation of 4/4777. Average work experience in a special section was 7.16 years with a standard deviation 4/2247. In Dr. Dashti study, more participants in intervention group was female (90/3%), have bachelor (100%). The mean age was 32.1 years and the mean duration of 5.5 years of nursing. So this research was consistent with presented studies (94).

Results showed that the level of knowledge of nurses after the application of scientific principles were significantly increased in compare to past. Also, results showed that mean knowledge score Nurses the application of scientific principles, than the average knowledge score before using scientific principles, increased and this increase is significantly. Initial results of studying nurses in ICU, confirms that their awareness in administration through a feeding tube is poor. Belknap (1997) found that about 74 percent of the nurses were applied at least one bad practice in oral administering medication through a feeding tube [6]. In Dashti study, knowledge and practice in both intervention and control groups of nurses in ICU has been measured by pre-test questionnaire and after the period of training, has been measured by post-test questionnaire. The results, says that half of the nurses have inadequate knowledge about the structure and solid form of oral medications and medication through a enteral feeding tube rules and findings of several concomitant studies is in the same way. They found that many nurses, prescribe sustained-release and enteric coat medicines through an enteral feeding tube when a liquid dosage form of drug is not available. It also states that the training program, focusing on promoting the proper administration of medications via enteral feeding tube, are important to increases the nurses' knowledge about preparation, washing pipe, recognition of drug-drug interaction / drug Food and drug structure knowledge by clinical pharmacologists [1-4]. These findings are similar to results of Hensens study (2006). Hensens study used questionnaires, for estimating knowledge and practice before and after training. Results indicated that nurses knowledge increased in the case of sustained-release code, from 0% to 40%, crushing and correct preparation of solid drugs, from 35% to 90%, the possibility of drug interactions with food or feeding tubes, the 51% to 88% and proper administration of medications in patients with feeding tubes from 32% to 83% [15].

In this study, ZO et al (2011) pointing to poor knowledge of nurses and physicians, in connection with the administration of medication through nasogastric tubes. The knowledge of nurses by pre-test questionnaire, implies that the correct answer about medicines that should not be crushed or broken was 30%. Three months re-education and intervention programs were evaluated by post-test questionnaire. In these results, the correct answer about medicines that should not be crushed and broken or opened are reached to 100 per cent [16].

The results showed that the average of all subscales of consciousness (including preparation, dosage forms, washing and obstruction of tube, drug interactions and side effects), after training significantly increased. Dr. Dashti study also showed the training of nurses in the hospital, by the clinical pharmacist plays an important role in improving the

knowledge of them, especially in the field of preparation, washing pipe, identify drug-food interactions, the structure and dosage forms (1, 4) .

Results showed that nurses' performance after the application of scientific principles has increased in comprised the performance score before the application of scientific principles and this increase was significant. The results showed that the average nurses' performance score after application of scientific principles than the mean performance score before the application of scientific principles is increased, and this increase was significant. The study entitled "Correction of quality of oral medication in patients with a feeding tube" was performed by Bemt. This observational study compared the outcomes before and after the application of quality reform program prescribed in patients with a feeding tube in the two hospitals located in south Netherlands. In This regular schedule, nursing teams, nutrition, and pharmacy and medicine technician was formed and intervention program lasted for 2 months. Check performance results before and after treatment in two hospitals, showed that in Hospital No. 1, the number of tubal obstruction significantly reduced and in Hospital No. 2, medication errors significantly decreased (4).

Test results showed that the average performance of all sub-scales (including preparation, dosage forms, wash and tubal obstruction, drug interactions and side effects), before and after training significantly increased. Boullata studies (2009) states that American Society for Parenteral and Enteral Nutrition (ASPEN) has recently released guidelines for prescribing medication through enteral feeding tube [17]. By presence of all these resources, assessing the performance of nurses in various locations demonstrate the use of inappropriate technique in a wide range [18-24]. According to a study the reason of using improper techniques was relying on knowledge or information of itself or other coworkers instead of using the methods and procedures of institutions and pharmacists [18, 23].

Also, limited scientific content of academic programs, play an important role in this regard. Pharmacologists also as a member of the team, is responsible for teaching them, care about drug information, including physical and chemical properties of certain drugs, pharmaceutical formulations, dosage forms and drug compatibility and medicine commentaries stability. Kelang also recommended when administering medication through an enteral feeding tube, recommendations and guidelines of ASPEN should be considered [25]. Leap study (1999) also states that when pharmacologists have been presented as a member of the care team, the secondary adverse effects of prescribing errors will reduce about 66% [26].

In Goudarzi study the importance of in-service training expressed on knowledge and practice of nurses. In this study, courses of in-service training, clinical nurses motivated to learn more and offer better performance is shown. In various surveys, the nurses felt the need for new knowledge, to provide optimal care to express and have announced that with increasing knowledge and practice, they can do their jobs in better way (27).

The performance before and after the application of scientific principles determined that, however, the awareness and knowledge of the application of principles, significantly increased, but the performance have not promote as well as the awareness. Dr. Dashti studies states that a gap between theory and practice can be seen that it is possible to relate physicians' duty nor nurses, in writing orders related for prescription medication through an enteral feeding tube. Since the important role of physicians in prescribing medication through an enteral feeding tube close cooperation between the medical team including physicians, pharmacists and nurses is essential. In addition, protocols of reasonable guidelines should be provided. Although there are guidelines, change does not cause performance in lake of an active strategy and planning, [1 to 4].

In this study, results showed that only 22/22% of the respondents individually prescribed medications that after the application of the principles it increased to 71/11%. The results showed that 13/33 % of the respondents will not crush the enteric coat tablets and sustained-release drugs when administered through the enteral tube that after application of scientific principles it increased to% 17/11. The results showed that only% 17/78 of respondents do not mix drugs with food which after the application of scientific principles increased to % 56/95. The results showed that only 28/89% of the respondents, individually prescribed medications at the same time which after the application of scientific principles increased to 91/11%. The results showed that only 6/67% of respondents consider drug-food interactions that after the application of scientific principles increased to% 41/11. The study of Seifert and Johnston (2005) showed that when prescribing multiple drugs at the same time, 49% of respondents were mixed drugs. Typically 13-15% enteric coating and sustained-release drugs breaks when administered through an enteral

tube and although about 92% liquid alternative medicine recommended by a pharmacist, but only 61% will use it [28].

The results of Boullata research showed that 43% of respondents, wash the feeding tube before, during and after drug administration. 51 to 31% of the respondents were prescribed medication separately and 46-64% of respondents were diluted liquid medications first. Also 75-85% of respondents avoided crushing enteric coated and sustained release drugs [17]

Gunter study (2013), based on knowledge and practice of nurses, found that only 72% of nurses doesn't added the drug to food, in a continuous feeding, 95% of patients when prescribing medicines, stopped the nutritional, 89% of nurses were washing the medication tube before, 89% of nurses were washing tube after drug administration. The nurses which washed before and after drug administration used 26% of sterile water, 70% of tap water, 4%, 3% normal saline and other fluids [13]. Enteral guidelines prescribe medication through a feeding tube, pipe advises to wash before and after drug administration and for dilution of medicine, sterile water was used [7,8]. Instructions of enteral medication through a feeding tube, recommends to avoid mixing drugs with each other, when administered through an enteral feeding tube. Because there is a risk of physical and chemical incompatibilities and changing the therapeutic effects of medicines [29]. This is similar to intravenous administration of drugs that should never be mixed with each other since they would be together in patient's blood circulation at the end. Drug-drug interactions, when mixing liquid medication, or two or more crushed and broken drugs together, are potential to create new dangers drugs with unknown characteristics [30]. Instructions medication through an enteral feeding tube with 15 ml of water washing is recommended to be performed according to the patient's condition and then adding the next drug [29]. Washing the tube with water, after administration of a drug, helps to get the entire dose to the patient and decreased remaining medicine therefore the amount of drug remaining after the next administration, reduced risk of tube blockage. Sterile water is preferred for washing the tube between the dosing of other liquids [7,8].

Prescribing guidelines for drug administration through an enteral feeding tube recommend fluid medicines (if available) and alternative for solid drugs. Only immediate released medicines can be crushed and mixed with sterile water after powdering for administration through an enteral tube [29].

CONCLUSION

In the present study the effect of scientific principles in application of oral gavage feeding tube for patients in ICU was measured. According to the results, the application of scientific principles based on the guidelines presented, significantly increased the awareness and practice of nurses and reduce side effects of medication through a feeding tube, such as tube obstruction, drug-drug interactions and drug-food, drug toxicity and increase the efficacy of the drug and finally developed the treatment process. It was also found that clinical pharmacologists role in providing guidelines and in-service training is very valuable and important. In addition, continuous in-service training, along with performance monitoring and remove functional barriers, could remove the gap between theory and practice.

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