

## Improving Nurse Skill of Medication Administration via Enteral Feeding Tube

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### ABSTRACT

**Background:** Medication administration via enteral feeding tube (EFT) is complex and prone to errors. To reduce these risks, guidelines for the safe administration of medication via EFT have been available for many years.

**Objective:** To improve medication administration via EFT in a Gastroenterology wards in the medical center of south Taiwan.

**Method:** An education program was providing to improve medication administration via EFT. The assessment was used to evaluate the practice of nurse staff before and after education program.

**Interventions:** Implemented interventions included: (1) developing a protocol for nurses about the techniques of administration of enteral feeding tube medication; (2) providing tabletop displays for doctors about the best practices for prescribing for patients with enteral feeding tubes; (3) developing a standard procedure for administering Nexium® through nasogastric tubes; (4) updating patient-education pamphlets about EFT; and (5) enhancing the quality of nurse auditing of enteral feeding tube and medication-administration techniques.

**Results:** A total of 24 nurses was participated and complete the baseline questionnaire. Paralleling the improved awareness of correct EFT drug delivery procedures among nurses, the ordinary drug delivery error rate fell from 60.83% to 2.42%. The Special drug error rate similarly fell from 65.28% to 1.33 %.

**Conclusion:** This project involved a multidisciplinary team of physicians, nurses, and pharmacists who developed standard protocols for EFT and specific medication administration recommendations for EFT, revised nursing practice standards, and greatly improved to overall medication administration process in patient with EFT.

### Keywords

Medication administration, Enteral feeding tube (EFT), Nurse skill.

### Background

When hospitalized patients cannot eat normally due to disease or treatment, they require enteral feeding and drug delivery via a nasogastric tube. Research has indicated that the incidence rate of enteral feeding tube(EFT) occlusion among hospitalized patients

was 23%-35%, and 75% of these cases involved drug occlusion [1]. Clinically, when EFT occlusion occurs, the tube must be removed and reinserted; this may result in patient discomfort and possible injury including coughing, vomiting, tears, injury to and bleeding of the nasal mucous membrane, and aspiration pneumonia. It also gives a negative impression to the patient and family members during the process. Medication administration via enteral feeding tube (EFT) is complex and prone to errors. To reduce these risks, guidelines for the safe administration of medication via EFT have

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been available for many years.

Correct delivery of medication administration via enteral feeding tube requires special skills. Several skills are involved in giving enteral medication, including preparing the medications, flushing the tube, verifying tube position and assessing for potential complications. Nurses need to consider the form of medication (solid or liquid), dilution and syringe size. There are two ways for preparing solid dosage form to be administered through EFT, dispersing and crushing. Dispersing method is used if the tablet disperses completely within 2 min [2]; Tubes should be rinsed before and after each drug administration to prevent drug-food incompatibilities [3].

Nurses' knowledge related to enteral medication administration is essential to achieve optimal patient outcomes. Therefore, that integrated intervention program that focuses on promoting correct administration of drugs via enteral feeding tubes significantly increased knowledge of nurses especially in the aspects of medication preparation, tube flushing, and recognizing dosage forms characteristics [4].

This study was designed to determine the effectiveness of clinical educational program in progressing the nurses' knowledge and practice regarding medications administration via enteral tubes.

## Material and Methods

This intervention study was carried out to compare nurses' knowledge and practices regarding drug delivery via enteral feeding tubes before (pre-test) and after (post-test) implementation of the educational program.

### Study setting and sample

Registered nurses (RNs) in a Gastroenterology wards in the medical center of south Taiwan were enrolled in the study. Nursing practice was primarily based on individual past experiences and consultation with colleagues, with older nurses teaching procedures to the younger RNs.

### Study design

A quantitative quasi experimental design one group Pre-post test. The questionnaire was developed following an extensive literature review and mainly based on the findings of the same study. The questionnaire focused on the RNs' practice.

### Study process and tools

This study was conducted in four separate steps: developing the questionnaire, assessment of baseline knowledge and practice of nurses (pre-test), developing a standard procedure of medication administration via enteral feeding tube and finally evaluation of knowledge and practice of nurses again with a 3 months interval (post-test); And three strategies were:

#### Strategy I

- In accordance with clinical needs, establish standard operating procedures for drug delivery via EFT based on the empirical literature

- Plan training classes
- Develop "drug dosage form, drug delivery method, and alternative drug" reminder cards

#### Strategy II

- Create "Nexium® drug delivery technique nursing instruction leaflets"
- Implement drug delivery methods according to the "enteral feeding tube technique" nursing instruction leaflets
- Produce drug delivery technique demonstration DVDs

#### Strategy III

- Monitor the techniques for EFT drug delivery and special drug delivery monthly.

### Study tool: Implementation of educational program

An educational program was designed to reduce errors when administering medication through EFT. Additionally, the program was designed to demonstrate drug delivery methods according to the "EFT" nursing instruction leaflets and "Nexium® drug delivery technique nursing instruction leaflets" in morning meeting one a week for one month.

The following interventions were gradually implemented over a period of three months:

- An evidence-based, referenced booklet on the appropriate medication administration technique and dosage forms suitable for enteral feeding tubes, was prepared by an evidence-based medical team and educated to the enrolled nurses during one training session. The seminar was held on January 10, 2012, and tests were given before and after the seminar.
- A drafting and revision of standard procedures and nursing instruction leaflets was written for administration of most highly used drugs in the ward. Revision of EFT drug delivery details were as follows [5,6]:
  - A. Use the plunger to flush the tube with 30 ml of water before performing enteric feeding for the first time each day.
  - B. Dilute highly viscous drugs 2-3 times with water.
  - C. Drugs should be sieved after grinding, and diluted with warm water.
  - D. Drugs in the form of powders, aqueous solutions, or special dosage forms should be administered separately.
- Evidence for changes in drug administration behavior following the production of drug reminder cards for physicians.

### Assessment of the influence of the educational program: post-test

Six months after completing the educational module, the nurses took another test, which consisted of the same questions as the first test. Additionally, bedside observations of nursing practice regarding enteral drug administration were carried out.

## Results

Study outcomes included RNs' knowledge and practice regarding medication administration through EFT that is presented as the percentage of correct answers to questions and mean scores of each domain of the questionnaire at pre- and post-intervention phases of the study. Also, the frequency of changes in drug administration

behavior errors by physicians was computed by dividing the number of observed errors by the total number of observations.

### Characteristics of study sample

Table 1 presented the distribution of sociodemographic and clinical data of study participants.

|                                        | Case group (n=24) |
|----------------------------------------|-------------------|
| Sex (percent of females)               | 100%              |
| Age (years)(mean ± SD)                 | 26.9 ± 3.42       |
| University degree (percent)            | 91.6 %            |
| Years of practice as nurse (mean ± SD) | 4.5 ± 1.2         |

**Table 1:** Sex, age, level of education, and years of practice as a nurse in the case at the initiation of the study.

### Nurses' Knowledge toward drug delivery through EFT

A seminar about "administering medication through enteral feeding tubes techniques (including drug characteristics and formulas" was held on January 10, 2012, and tests were given before and after the seminar. The number and percent of RNs with proper knowledge regarding different domains including medication preparation, tube flushing, recognizing dosage forms. Percent of RNs with correct answers increased significantly in all domains in after the seminar. The results showed that the trainees' error rate concerning knowledge about drug characteristics fell from 23.3% before the class to 2.5% after it.

### Nurses Practice toward drug delivery through EFT: pre-test

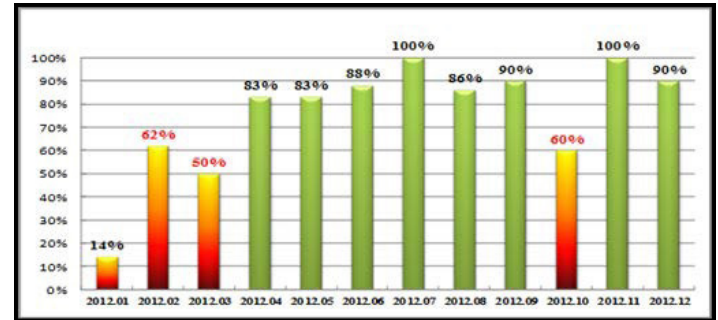
In order to assess baseline knowledge and practice regarding drug delivery through EFT, the questionnaires were filled by all nurses before the implementation of the educational program. The RNs were instructed to answer the questionnaire in relation to their knowledge and routine practice. Also, to evaluate the baseline nurses' practice, bedside disguised observations of the nurses regarding enterally medication administration were performed. All observations were recorded to pre- defined checklist questionnaire.

The project task force used a questionnaire survey to determine awareness about general drug delivery and special drug delivery methods by 24 registered nurses on the unit and persons responsible for the implementation of drug delivery. Units nurses had an error rate of 60.83% (73/120) when implementing ordinary drug delivery, and an error rate of 65.28% (94/144) when performing special drug delivery.

### Nurses Practice toward drug delivery through EFT: post-test

We complete drafting and revision of standard procedures and nursing instruction leaflets. With regard to monthly quality control monitoring of EFT drug delivery and special drug delivery methods, effectiveness was found to be quite low initially because of past habits. Following reviews at monthly ward conferences, and the production of "drug delivery reminder formulas" in March 2012, the rate of correct administration rose to 60% (3/5). A review revealed that nurses had been forgetting to flush with water after reverse drawing and before drug delivery. As a result,

slogans reminding nurses to flush were affixed to patients' water cups, and awareness was increased. As a result, the correct rate of administration achieved 100% during the first three months of 2013 (Figure 1).



**Figure 1:** Implementation rate of correct technique for EFT drug delivery.

Number and percent of RNs with acceptable practice regarding drug administration via EFT have been shown in Table 2, 3. As seen, percentage of nurses with correct answer in question domains regarding their practice related to tube flushing, recognizing dosage forms and recognizing medication preparation increased in the case group.

| Knowledge question domain         | Pre-intervention | Post-intervention |
|-----------------------------------|------------------|-------------------|
| Fully remove coat                 | 20 %             | 0.2 %             |
| Use the plunger to push           | 16.67 %          | 0.61 %            |
| Dissolve in water                 | 12.5 %           | 1.21 %            |
| Flush water before drugs delivery | 11.67 %          | 0.4 %             |
| Flush water after drugs delivery  | 0 %              | 0 %               |
| Total incorrect rate (%)          | 60.84 %          | 2.42 %            |

**Table 2:** Percent of answer of incorrect in different domains of the ordinary drug knowledge questions in the case, pre- and post-educational intervention.

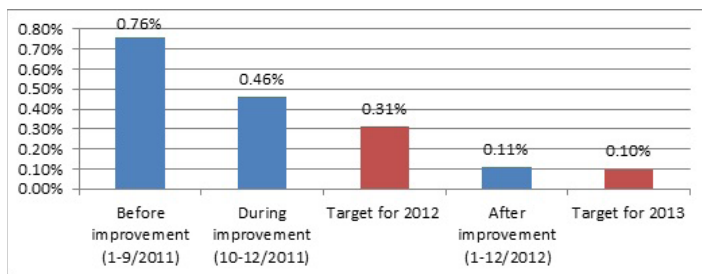
| Knowledge question domain                     | Pre-intervention | Post-intervention |
|-----------------------------------------------|------------------|-------------------|
| Place drug in feeding needle                  | 13.89 %          | 0 %               |
| Soak in 30ml of warm water for tow min        | 13.89 %          | 0 %               |
| Shake drug and push in 15ml                   | 13.89 %          | 0.67 %            |
| Shake drug again and push in 15ml             | 13.89 %          | 0.67 %            |
| Flush with 30ml of water before drug delivery | 9.72 %           | 0 %               |
| Flush with 30ml of water after drug delivery  | 0 %              | 0 %               |
| Total incorrect rate (%)                      | 65.28 %          | 1.34 %            |

**Table 3:** Percent of answer of incorrect in different domains of Special drug knowledge questions in the case, pre- and post-educational intervention.

Paralleling the improved awareness of correct EFT drug delivery procedures among nurses, the ordinary drug delivery error rate fell from 60.84% to 2.42%. The Special drug error rate similarly fell from 65.28% to 1.33 %.

From October 2011 to December 2012, this unit provided enteral feeding to hospitalized patients using EFT for a total of

2,322 person-days. Following intervention via this project, the EFT occlusion rate fell from the original 0.76% to 0.11%. This exceeded the target of 0.31%, and represented a 144% attainment rate. Because of this major improvement, the target value was reset to 0.1% in 2013 (Figure 2).



**Figure 2:** Comparison of EFT occlusion rate before, during, and after improvement.

## Conclusion

This project involved a multidisciplinary team of physicians, nurses, and pharmacists who developed standard protocols for EFT and specific medication administration recommendations for EFT, revised nursing practice standards, and greatly improved to overall medication administration process in patient with EFT. Due to this evidence-based medical project, the hospital has incorporated drug delivery methods in its "EFT enteral feeding and drug delivery" technical standards, and has produced the nursing instruction leaflets "care guidelines for administration of Nexium®/ Takepron®" and "EFT drug delivery skills and methods"; these materials have been posted on the hospital's website in order to provide extension via downloading by other units.

After uncovering a clinical problem, this project achieved improvement by empirical steps. Following a search of the literature, critical appraisal of papers, and consideration of the characteristics of different areas of specialization, the project achieved consensus by a team of medical personnel, drafted standard procedures for EFT drug delivery, and produced nursing instruction leaflets on EFT drug delivery skills and methods and special drug administration techniques. The project thus increased the knowledge and skills about medication administration via enteral feeding tube and effectively reduced the EFT occlusion rate. In the future, an effort must be made to improve the information system so that, when a physician prescribes drugs, the system can actively identify whether these drugs are suitable for EFT delivery, and provide alternative drug options if necessary. The system should also be able to ensure that pharmacists confirm the appropriateness of EFT drug delivery; this would enhance the correctness of EFT drug delivery and achieve the goal of optimal patient-centered care.

## Discussion

Many medication errors have been made at the administering stage, especially when medication has to be delivered through EFT. We found that integrated intervention program that focuses on promoting correct administration of drugs via EFT significantly increased knowledge of nurses especially in the aspects of

medication preparation, tube flushing, this finding is similar to the results of Van den Bemt et al. and Hanssens et al. [2,7]. Additionally only 28 % of nurses in Philips' study flushing a tube after giving medication. Liquid form medication are diluted by 58% (105/181) of participants; 36.5% occasionally, 12.7% usually, 8.8% always. Our study founds were comparable to the findings of others who reported [8].

This study was designed to first assess the knowledge and practice of acute care nurses regarding drug administration via EFT and secondly evaluate the educational programs provided from in improving the nurses' knowledge and practice in this scope. This questionnaire evaluated respondents' knowledge regarding the method of enteric-coated pellets preparation, the subsequently these process of via EFT. When administering special drugs via EFT, users must employ special EFT drug delivery techniques [9]. In this study, this method was designed from Yeh et al. suggested that Nexium® tablets placed into a 60 mL syringe and mixed in 50 mL of water. Place the plunger into the syringe and shake the mixture well. To make sure there are no medicine pellets stuck in the tip of the syringe. The syringe is attached to the EFT and the plunger is pushed down to empty the syringe into the tube. Then flush the tube with required the 50 mL of distilled water for the first injection to avoid loss of Nexium®. In this study delivered via EFT is affected by the administration process, which may affect the quality of pharmacotherapy and the cost-effectiveness of healthcare [10]. According the above, this program significantly increased nurses' knowledge in recognizing enteric-coated pellets, correct crushing of solid drugs, and correct drug administration via EFT.

## Limitations of the study

The major limitation of this research was that the study suffers from lack of control group, assessment of nurses' practice just by questionnaire and not by direct disguised observation.

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