

Oral medicine administration errors in a patient with an enteral feeding tube

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<https://doi.org/10.55971/EJLS.1316049>

Received: 17.06.2023

Accepted: 24.06.2023

Available online: 30.10.2023

ABSTRACT

Proper nutrition is vital for all patients with an expected lifespan. It is strongly recommended that patients whose oral intake is impaired or suspected to be impaired should be provided nutritional support. Concurrent medication administration during enteral nutrition may result in complications unless necessary precautions are taken. This study presents a case of a 94-year-old male patient with poor general health condition and being treated in a palliative care service. The patient was fed with an enteral feeding tube for seven drugs. There have been two tube occlusions causing the replacement of the tube since the enteral feeding tube was placed. The clinical pharmacist checked how the patient's drugs were given through a nasogastric tube and how the patient's relatives administered the drugs. Inappropriate dosage form selections and errors in administration through the nasogastric tube were identified. The interaction and incompatibility of the patient's medications with the nutritional formula were also investigated. The clinical pharmacist informed the person giving the medicine to the patient about the correct administration of the medicine from the tube. The proper method for administering medications from the tube was ensured accordingly. Following the clinical pharmacist's training, it was observed that the nasogastric tube was correctly used to administer the drug and the patient being monitored had no tube obstruction in the later phases of the treatment. It may be beneficial for a pharmacist to review drug dosage forms and applications in patients with a feeding tube in order to ensure correct administration and avoid undesired drug interactions.

Keywords: Clinical pharmacy, enteral feeding tube, nasogastric tube, palliative care

1. INTRODUCTION

Palliative care aims to improve and sustain patients' and their families' quality of life [1]. Nutrition is essential for patients to recover and considered a sign of good health [2]. Enteral nutrition must be given through an enteral feeding tube if the patient consumes a maximum of fifty percent of their daily nutritional needs, there are no contraindications or

broncho-aspiration hazards and their life expectancy is shorter than six weeks [3]. Drug administration in enteral feeding patients is a complex and substantially critical issue during clinical practices. Moreover, the patients with enteral feeding tubes are more vulnerable to errors and challenges such as tube occlusion, incorrect administration techniques and inadequate dosage form selection when they have to take oral drugs [4]. This case study highlights

several medication errors that happened during drug administration via an enteral feeding tube.

2. CASE REPORT

A 94-year-old man was admitted to the palliative care service due to poor general condition, and he had chronic diseases such as diabetes, hypertension, Alzheimer's and decubitus ulcer. The patient had been fed by using an enteral feeding tube for seven months. Seven drugs (Table 1) and a specific product with 1kcal/ ml for diabetes treatment were given to the patient through the enteral feeding tube. A total of two tube occlusions leading to tube replacement occurred since the enteral feeding tube was inserted.

All the drugs were crushed by the patient's relatives, mixed with the enteral nutrition product and given to the patient. The tube was rarely flushed with water after this application.

3. FINDINGS

The errors observed in the administration of oral drugs are described below.

3.1. Inappropriate dosage form selection and oral medication preparation

Donepezil hydrochloride/ Metoprolol succinate/ Olanzapine / Quetiapine fumarate film tablet

The film coating can protect tablets containing active pharmaceutical components that are susceptible to light, moisture or oxidation, resulting in improved medical product stability throughout manufacturing and storage. Furthermore, film coating has the ability

to control tablet drug release patterns in terms of rate, site and time. Film coating is also applicable to mask the taste and improve patient compliance. However, coated dosage forms should be administered with a special caution when they are given through an enteral feeding tube. Tablets coated only to improve the tablet's appearance and mask the unpleasant taste can be crushed when administered through an enteral feeding tube. However, when those coated to protect from moisture, light and air are crushed, the stability of the active drug substance may be impaired. In the case of crushing the tablets coated with polymer to provide a controlled release and protect the drug from gastric irritation, the release properties of the drug may change and obstruct the tube [5].

Donepezil hydrochloride is a film-coated tablet [6]. Micromedex® and Lexicomp® recommend the administration of this drug regardless of mealtimes [7,8]. Unfortunately, no specific data is available in these two databases regarding the enteral tube administration for this dosage form [9].

Metoprolol succinate tablets can be split into two parts or more whenever necessary; however, it is not recommended to crush or chew them as stated in the prospectus [6]. Although Micromedex® and Lexicomp® provide recommendations for metoprolol succinate capsule and some metoprolol tartrate forms, there is no information about metoprolol succinate film-coated tablet administration in the nasogastric tube [7,8]. Similarly, the handbook does not include any information or data regarding metoprolol succinate while only a limited amount of information is available about metoprolol tartrate in this handbook [9].

Table 1. Medicines administered through the patient's enteral feeding tube

Drug / Dose (tablets)	Dosage form	Time of use (hr)
Allopurinol 300mg	Tablet	18
Donepezil hydrochloride 5mg	F.C. Tablet	22
Metoprolol succinate 50mg	F.C Tablet	10-22
Nebivolol 5mg	Tablet	10
Olanzapine 5mg	F.C Tablet	10-22
Pantoprazole 40mg	E.C. Tablet	06
Quetiapine 25mg	F.C. Tablet	22

*F.C.: film-coated, E.C.: enteric coated

Olanzapine is a film-coated tablet and can also be administered regardless of meal times; however, there is no specific data on enteral tube administration as well [6-9].

Quetiapine fumarate is a film-coated tablet, too. It might be administered together with foods or not [6]. Despite the presence of some recommendations in Micromedex® and Lexicomp® regarding immediate and extended-release forms or suspensions, no information is provided for film-coated tablet dosage forms [7,8] neither in Micromedex® and Lexicomp® nor in the handbook [9].

Unfortunately, despite the presence of the above-mentioned information, all these drugs were used by this patient by crushing due to the lack of any other available alternative forms in the hospital.

Pantoprazol enteric-coated tablet

It is advised that enteric-coated (gastro-resistant tablet) should not be crushed or chewed [6]. Similarly, it is recommended that tablets containing pantoprazole should be swallowed whole, not chewed or crushed [10]. In Micromedex® and Lexicomp®, there are some recommendations about delayed release suspension forms but no information is provided for film-coated tablet dosage forms [7,8]. Based on the "Handbook of Drug Administration via Enteral Feeding Tubes," it is mentioned that Pantoprazole tablets can be crushed and dissolved in 10 mL of 8.4% sodium bicarbonate for administration through an enteral feeding tube. When kept at 5°C, this solution is stable for two weeks. Although the peak plasma concentration remains unchanged compared to orally administered tablets, the bioavailability is reduced to 75% of the oral equivalent [9]. Also, pantoprazole is sensitive to gastric acid and can deteriorate in acidic pH settings, just as other proton pump inhibitors (PPIs). Therefore, there is a danger of degradation when split tablets are given through an enteral feeding tube, which could lead to diminished pharmaceutical effectiveness [4]. In addition, crushing the enteric-coated tablets may obstruct the tube [11]. The physician was recommended by the clinical pharmacist that pantoprazole should be dissolved in sodium bicarbonate. However, the recommendation was not accepted, considering that it would be a problem to prepare an 8.4% sodium

bicarbonate solution every day in the hospital. Therefore, pantoprazole tablets were taken by the patient by crushing.

All tablets were crushed together and mixed with an enteral nutrition product

In this case, the patient's all drugs were crushed together and mixed with the enteral nutrition formula. The American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines recommend not combining drugs for administration through an enteral feeding tube. Instead, each drug should be administered separately due to the potential for physical and chemical incompatibility, tube blockage, or alternations in pharmacodynamics [12]. The person administering the drug to the patient was informed about this recommendation by the clinical pharmacist. It was ensured that the drug was administered from the tube by using the correct method.

Inadequate rinse of the tube with water before and after drug administration

The patient's nasogastric tube was rarely flushed with water before or after drug administration. Practice guidelines recommend flushing feeding tubes with 30 mL of water every four hours or before and after intermittent feeding in adult patients. Before giving the medication, it is recommended to stop the feeding, flush the tube with at least 15 mL of water, and administer the medication and later flush the tube again with at least 15 mL of water by taking the patient's fluid volume status into account. According to the guidelines it is necessary to repeat with the following medication, and flush the tube again with at least 15 mL of water. In clinical practice, there can be differences in the amount, timing, and frequency of water flushes [12]. This recommendation was given by the clinical pharmacist and the tube was flushed correctly accordingly.

3.2. Drug interaction and incompatibility with nutrition formula

Pantoprazole: Food may reduce PPI's maximum plasma concentration although this does not have a significant impact on the AUC. However, if possible, it is recommended to administer PPI approximately

30 minutes before meals to improve absorption and maximize clinical effect. Also, it is advised that PPIs be issued with an acidic juice such as apple juice or orange juice rather than milk because PPIs may not absorb when used with non-acidic juices [10]. The clinical pharmacist made this recommendation and ensured that pantaprazole was given at the right time.

4. DISCUSSION

Malnutrition increases comorbidities and lowers physical performance and quality of life. As a result, nutritional support should be integrated into palliative care treatments and the implications for quality of life and life expectancy should be assessed. Enteral nutrition is frequently used as nutritional support [13]. When the oral route is insufficient or unsafe, the enteral feeding tube is essential to provide enteral nutrition [14]. Drug administration through enteral feeding tube is complex and critical in clinical practice. Concurrent drug administration during enteral nutrition may result in problems such as tube blockage (15%) [14], diarrhea (45%) and loss of therapeutic efficacy (26%) if adequate precautions are not implemented [15]. As can be seen in this case, mistakes made during the ordering and administration of the pharmaceuticals resulted in incorrect dosage administration.

There are many potential causes for these errors. The physician may lack knowledge of oral dosage forms, pharmaceutical knowledge or the proper dosage forms for administration through the feeding tube. Such errors may also be caused by inadequately qualified and inexperienced nurses caring for patients. Demirkan et al. suggested that around 40% of prescription drugs were not administered appropriately via a feeding tube, despite 98% of nurses and 86% of doctors stating that they paid special attention to drug suitability when administered through a feeding tube [16]. In addition, the absence of a computerized system that can warn health staff when inappropriate dosage form selection errors, drug incompatibility and drug interaction occur may increase medication errors [17]. Another factor contributing to medication errors

is the lack of a multidisciplinary team comprised of various professionals, including a pharmacist. Oral medicine delivery mistakes in patients with enteral feeding tubes were reduced by 95% after intervention by a team of trained pharmacist, a quality manager, a pharmacy technician, a dietician and nurses [18].

Appropriate drug administration via a feeding tube can be improved by following the Handbook of Drug Administration [9], ASPEN standards [19], drug information on Micromedex® IBM [7] and Lexicomp® programs [8].

In conclusion, due of changing drugs efficacy and safety profiles, as well as the possibility of tube occlusion, practitioners should be more cautious when selecting drugs to be supplied by feeding tube. A pharmacist's review of drug dose forms in patients with feeding tubes might be advantageous for appropriately administering and preventing drug interactions.

Ethical approval

Not applicable, because this article does not contain any studies with human or animal subjects.

Author contribution

Concept: ÖG; Design: KTY; Supervision: KTY; Materials: ÖG; Data Collection and/or Processing: ÖG; Analysis and/or Interpretation: UO; Literature Search: ÖG; Writing: ÖG, KTY; Critical Reviews: KTY, UO.

Source of funding

This research received no grant from any funding agency/sector.

Conflict of interest

The authors declared that there is no conflict of interest.

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