

Case Report

Errors of oral medication administration in a patient with enteral feeding tube

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Received: December 2011

Accepted: April 2012

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ABSTRACT

Enteral feeding tube is employed for feeding of critically ill patients who are unable to eat. In the cases of oral medication administration to enterally fed patients, some potential errors could happen. We report a 53-year-old man who was admitted to intensive care unit (ICU) of a teaching hospital due to the post-CPR hypoxemic encephalopathy. The patient was intubated and underwent mechanical ventilation. A nasogastric (NG) tube was used as the enteral route for nutrition and administration of oral medications. Oral medications were crushed then dissolved in tap water and were given to the patient through NG tube. In present article we report several medication errors occurred during enterally drug administration, including errors in dosage form selection, methods of oral medication administration and drug interactions and incompatibility with nutrition formula. These errors could reduce the effects of drugs and lead to unsuccessful treatment of patient and also could increase the risk of potential adverse drug reactions. Potential leading causes of these errors include lack of drug knowledge among physicians, inadequate training of nurses and lack of pharmacists participation in medical settings.

Keywords: Enteral drug administration; intensive care unit; medication error

INTRODUCTION

Many patients admitted to intensive care units (ICU) can not use normal oral intake because of swallowing problems such as intubation, deep sedation or concurrent diseases, and they need to apply the other routes of nutrition and drug administration such as parenteral route or administration through feeding tube.^[1] When patients with enteral feeding tube need to take oral medications, they become subjects for higher risk of errors and problems such as tube occlusion, wrong administration techniques and inappropriate

dosage form selection.^[2,3] The medication errors in ICUs have higher incidence than any other medical units because of patients status (complex diseases, unconsciousness) and polypharmacy. As reported in one study, medication administration errors accounted for 3.3% of all administered drugs in ICUs.^[4] In another study it was shown that 74% of hospital personnel had employed at least two wrong methods of drug administration through feeding tube.^[5] In present report, we describe a case with several medication errors occurred during drug administration through enteral feeding tube.

CASE REPORT

A 53-year-old man with a past history of hypertension was admitted to the emergency department after a car accident in which he had experienced multiple traumas and right humerus fracture that necessitated immediate surgical intervention. During surgery, the patient developed cardiac arrest and after

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DOI: 10.4103/2279-042X.99677

cardiopulmonary resuscitation (CPR), was admitted to the ICU with hypoxemic encephalopathy. The patient was intubated and underwent mechanical ventilation. He also developed myoclonus seizure the day after admission to the ICU. NG tube was used as enteral route for providing the patient with nutrition and also administration of oral medications.

Patient nutritional regimen include: 200 cc/3 hr of standard enteral feeding formula at 12 am, 6 pm, 24 pm, high protein formula at 9 am, 9 pm, and high fiber formula at 3 am and 6 am.

The patient's oral medications are shown in Table 1.

Oral medications were crushed in a mortar then dissolved in 40 mL of tap water and were given to the patient through NG tube according to the scheduled time table.

FINDINGS

During 30 days of hospitalization, several errors occurred regarding oral medications administration as described below:

Inappropriate dosage form selection

Pantoprazol enteric-coated tablet

Pantoprazol like the other proton pump inhibitors (PPIs), is sensitive to gastric acid and degraded in acidic pH; therefore crushing tablets and administering the pieces via NG tube has the possibility of degradation and therefore a decreased efficacy.^[2,6]

Sodium Valproate enteric-coated tablet

Valproate is irritant for gastric mucosa and can cause nausea and vomiting, therefore its tablets should not be crushed for use through NG tube.^[1,2]

Nitroglycerin sustained-release tablet

Sustained- release dosage forms are designed to deliver drugs over a long period of time. Crushing this dosage forms could result in variable blood levels of the drug and could result in an increased risk of toxicity in early hours and decreased effect in late hours of administration.^[2,3]

Inappropriate methods of oral medication preparation

All tablets and capsule ingredients were crushed together in a mortar

According to the guidelines of the American Society for Parenteral and Enteral Nutrition (ASPEN)^[7] drugs should not be mixed together for administration through NG tube and each drug should be administered separately because of possibility of physical and chemical incompatibility, tube occlusion or changes in drugs pharmacodynamic. For example one drug can altered other drug solubility and

resulting in precipitation of the second drug and decreased efficacy.^[3]

Crushing of enteric-coated dosage forms

Enteric coated tablets are not crushed easily and usually break into small pieces that bind to each other when water is added to the mixture which increases the potential of tube occlusion.^[2]

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

One of three nurses who were responsible for patient care did not rinse the tube with water before drug administration. According to the guidelines it is necessary to rinse the tube with at least 15 mL of sterile water before and after drug administration. In case of inadequate rinse, unknown quantities of drugs may remain inside the feeding tube which may lead to drug- nutrition interaction, tube occlusion and altered drug efficacy.^[3]

Using tap water for dilution

Sterile water or sterile sodium chloride solutions are favored and tap water should not be used for dilution of powder drugs because it usually contains microbial pathogens, heavy metals and other contaminations.^[3]

Inadequate dilution of drug powder before administration

In the reported case, all oral drug powders were diluted together in 40 mL of tap water that result is one hyperosmolar product which may cause diarrhea, cramping, abdominal distention and vomiting.^[2]

Drug interaction and incompatibility with nutrition formula

Zinc sulfate and phosphate administration concomitant with nutrition formula: Absorption of zinc from gastrointestinal tract is incomplete and its

Table 1: Patient's oral medications

Drug	Dosage form	Time of use (hr)
Pantoprazol 40 mg	E.C tablet	6
Metoprolol 25 mg	Tablet	10-22
Clonazepam 0.5 mg	Tablet	10-22
Levetiracetam 500 mg	Tablet	10-22
N-Acetylcysteine 600 mg	Tablet	10-22
Sodium valproate 200 mg	E.C Tablet	6-14-22
Medroxyprogesterone 20 mg	Tablet	6-14-22
Multivitamin 10 cc	Syrup	12
Zinc sulfate 220 mg (equal with 50 mg elemental Zinc)	Capsule	12
Tizanidine 4 mg	Tablet	6-12-18-24
Dantrolen 50 mg	Capsule	6-12-18-24
Erythromycin 400 mg	F.C Tablet	6-12-18-24
Phosphate sandos 500 mg	Tablet	12
Nitroglycerin 2.6 mg	SR Tablet	6-14-18

bioavailability is about 20-30% and even less when used with nutrition formula containing fiber. Two and three -valence cations bind to phosphate and reduce its absorption. Furthermore, administration of zinc and phosphate at the same time with other nutritional compounds could increase the risk of tube occlusion.^[2]

DISCUSSION

As seen in this case the errors observed in the ordering and administration stages lead to improper administration of dosage of drugs, lower effect of drugs and risk of potential adverse drug reaction.

Potential leading causes of these errors could be summarized as following:

The physician may have inadequate information about oral dosage forms, pharmaceutical knowledge or selection of correct dosage forms for administration via feeding tube.

Inadequately trained and inexperienced nurses engaged in the patients' care may also contribute to such errors.^[8]

Computerized system in ordering and dispensing medicines can alert personnel when errors of drug interaction, drug incompatibility and inappropriate dosage form selection occur.^[1,9] Lack of such an organized system may lead to increased number of medication errors.

Absence of multidisciplinary team consists of different specialists including a pharmacist or pharmacotherapist, is another contributing factor in medication errors. It was previously shown that oral medication administration errors in patients with enteral feeding tube was decreased about 95% after intervention by a team of trained nurses, quality manager, dietician, pharmacy technician and hospital pharmacist.^[10]

As mentioned above, one of the important reasons for these errors is lack of participation of pharmacists in the medical settings specially ICUs. Leap *et al.* reported that when pharmacists participated in rounds as a member of critical care team, the rate of adverse drug events secondary to prescription errors were decreased by 66%.^[11]

According to what can be concluded from this report and also the standards of practice mentioned in relevant references and guidelines, pharmacist's contribution in medical rounds is inevitable due to their consultation role in different therapeutic aspects as described below:

1. Help physician in dosage form selection, choosing therapeutically equivalent medications with liquid dosage forms, or proper extemporaneous

preparation of a liquid form of administered drugs.

2. Educate nurses regarding administration of drugs through feeding tube.
3. Supervise nurses in order to reduce drug administration errors.
4. Provide standard guidelines for different medical units entitled administration of frequently administered drugs via enteral feeding tube.

We believe pharmacists must design training program for drug administration through an enteral feeding tube and provide valuable references for health care professionals. Some of the recommended references include:

Hand book of Drug Administration via enteral feeding tube by Rebecca White, Vicky Bradnam^[12] and guidelines of the ASPEN.^[7]

These are comprehensive references; provide guides about suitable dosage form for administration through an enteral feeding tube and the optimal technique to do. It is essential for Health professionals that use from these resources for making right clinical decisions, decrease errors and improve the quality of medical practice.

AUTHORS' CONTRIBUTION

All authors contributed the idea of research, design of study, data analysis and manuscript preparation.

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How to cite this article: Emami S, Hamishehkar H, Mahmoodpoor A, Mashayekhi S, Asgharian P. Errors of oral medication administration in a patient with enteral feeding tube. *J Res Pharm Pract* 2012;1:37-40.

Source of Support: Nil, **Conflict of Interest:** None declared.

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