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RESEARCH ARTICLE

OPTIMIZING DRUG DELIVERY VIA NASOGASTRIC TUBE: CHALLENGES, RISKS AND CLINICAL STRATEGIES

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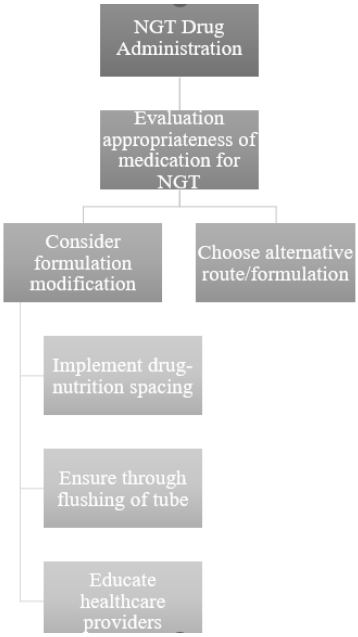
Abstract: Enteral nutrition is an essential method for administering food and drugs to critically sick patients who experience swallowing difficulties due to anatomical defects, chronic diseases or neurological disorders. Nasogastric tubes (NGT) are often used to short term feeding and drug administration in hospitalized patients. Not all medications are appropriate for nasogastric feeding tube administration as crushing certain solid dosage forms could result in complications like NGT obstruction, adverse drug events, altered absorption, drug incompatibility, decreased therapeutic efficacy or even toxicity. This review explores the major challenges corelated with NGT drug administration, emphasizing risks related to drug stability, bioavailability and interactions with enteral nutrition. Furthermore, it outlines clinical strategies to optimize drug delivery, selection of drug, formulation modification, and evidence based administration techniques to minimize complication. By implementing standardized protocol to NGT drug administration can enhance patient efficacy, minimize medication errors and improve patient safety in clinical practice.

Keywords: Nasogastric tube, appropriate dosage forms, clinical strategies, standardized protocol.

INTRODUCTION

Enteral nutrition is one of the main approaches for providing food and drug therapy to critically ill patients with a swallowing function damaged by anatomical malformations, chronic diseases, or neurological pathologies[1]. Nasogastric tubes (NGT) are widely used in hospitals for short-term enteral feeding as well as for drug administration[2]. Enteral nutrition is favoured over parenteral nutrition for the restoration of gut integrity, reduced risk of infection and better clinical outcomes during therapy over the past ten years[3]. Although NGT are the most common means of providing nutrition and medication, it poses many problems, including the risks of drug stability, bioavailability and interaction with enteral nutrition[4]. Without proper care in administering, medications given via NGT may cause some complications: Diarrhea, tube obstruction or clogging, medication errors, decreased therapeutic effect[5].

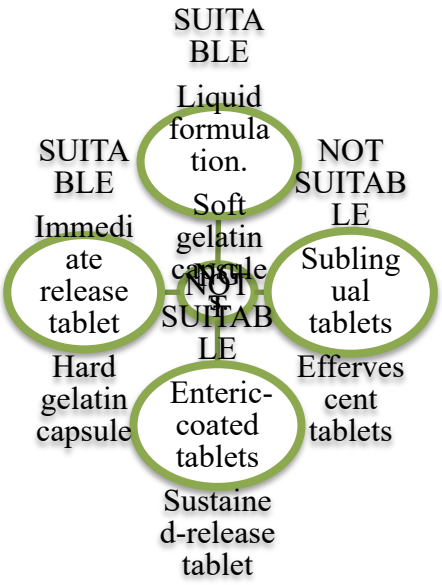
Many pharmaceutical formulations are unsuitable for NGT administration due to their physicochemical properties. Enteric-coated tablets should not be crushed, as they protect drugs from gastric acid or prevent gastric irritation[1]. Sublingual tablets are designed for rapid dissolution in the mouth and should not be altered[2]. Sugar-coated tablets, which mask unpleasant tastes and protect from environmental factors, may lose their effectiveness when crushed[3]. Modified-release (MR) formulations, including extended-release (ER) and controlled-release (CR) drugs, regulate drug release over a specific period, and crushing them may lead to dose dumping, increasing toxicity risks[4]. Similarly, cytotoxic medications should be handled with caution, as crushing them can pose health risks to caregivers and healthcare providers.



Safe NGT drug administration requires multidisciplinary collaboration among physicians, pharmacists, and nurses[1]. However, a significant knowledge gap exists among healthcare professionals regarding which medications should not be crushed before NGT administration[2]. Standardized protocols, such as those from the American Society for Parenteral and Enteral Nutrition (ASPEN), are crucial to ensuring safe and effective drug delivery via NGT[3]. Implementing evidence-based guidelines can minimize complications and enhance patient safety in clinical practice.

Challenges in NGT Drug Administration
Pharmaceutical Formulation Concerns

Many oral medications are not suitable for nasogastric tube (NGT) administration due to their formulation properties. Enteric-coated (EC), sustained-release (SR), controlled-release (CR), and sublingual medications should not be crushed as it alters their pharmacokinetics and pharmacodynamics, leading to reduced therapeutic efficacy or increased toxicity[12]. Crushing these formulations may lead to dose dumping, causing severe adverse effects, and can compromise drug stability[3]. Inappropriate modification of drug formulations may result in increased gastric irritation, decreased absorption, and drug degradation due to enzymatic activity in the gastrointestinal tract.



Drug-Nutrition Interactions

Enteral feeds can interact with drugs, affecting their bioavailability. Some medications bind to feed components, leading to reduced absorption and therapeutic failure. For example, phenytoin, carbamazepine, and warfarin have demonstrated significant reductions in plasma levels when administered concurrently with enteral nutrition[4,5]. The presence of nutrients in the gut can modify drug metabolism, leading to either reduced or enhanced effects, which can compromise therapeutic outcomes. Therefore, proper spacing of drug and feed administration is critical in preventing significant drug-nutrient interactions.

Tube Blockage and Stability Issues

Improper suspension preparation and the administration of crushed tablets without appropriate dilution may cause tube occlusion. Certain medications, such as sucralfate, can precipitate and clog the feeding tube[6]. Additionally, drug stability can be affected by pH changes in the stomach or interactions with enteral feeding solutions[7]. Frequent tube blockages may necessitate additional interventions, such as tube replacement, which increases the risk of infections and patient discomfort. Using appropriate suspending agents and thorough flushing protocols can reduce the risk of tube obstruction.

Variability in Clinical Practice

The absence of standardized protocols results in inconsistencies in NGT drug administration. Lack of knowledge among healthcare professionals regarding which drugs can be safely administered through NGT leads to medication errors and potential patient harm[8]. Studies have shown that a significant proportion of nurses and pharmacists lack sufficient awareness of proper NGT drug administration practices[9]. Implementing continuous training programs and developing hospital-wide policies can ensure uniformity in drug administration practices, reducing the risk of complications and improving patient outcomes.

Risks Associated with NGT Drug Administration

Loss of Therapeutic Efficacy

Crushing modified-release medications can result in altered drug release kinetics, leading to either subtherapeutic effects or toxicity. Certain drugs, such as levothyroxine, have a narrow therapeutic index and require precise dosing, which can be disrupted by improper NGT administration[10]. Additionally, loss of drug coating can result in degradation before absorption, rendering the drug ineffective.

Adverse Drug Reactions

Changes in drug absorption and metabolism due to altered administration routes can lead to unexpected adverse effects. For instance, medications like amiodarone have significantly lower bioavailability when administered via NGT, requiring dose adjustments to maintain therapeutic levels[11]. Patients receiving multiple medications through NGT are at an increased risk of polypharmacy-related complications, necessitating careful drug monitoring and pharmacokinetic adjustments.

Patient Safety Concerns

Errors in medication preparation and administration via NGT can cause serious complications such as aspiration pneumonia, gastrointestinal irritation, and overdosing. Cases of fatal outcomes due to improper administration of controlled-release drugs via NGT have been reported[12]. Inadequate flushing and improper drug formulation selection can lead to systemic toxicity or treatment failure, significantly affecting patient safety.

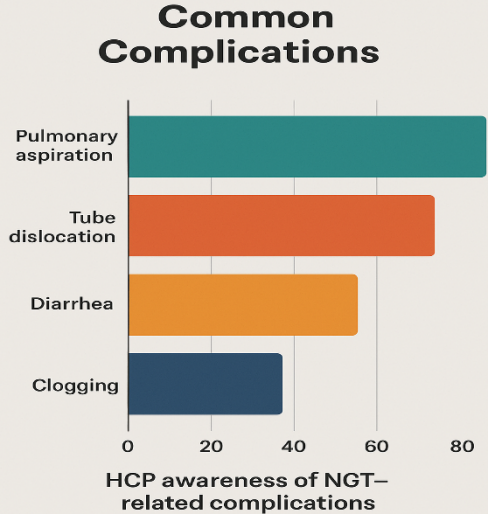
Clinical Strategies for Optimization

Standardized Protocols and Guidelines

Drug Selection and Formulation Changes When patients require medication to be submitted safely through NGT, it is important to consider using a different formulation (liquid formulations, dispersible tablets, or intravenous medications). Some medications, notably proton-pump inhibitors (PPIs), have specific recommendations for suspension based on the unique characteristics of the medications [13]. If there is not a suitable oral drug formulation, healthcare providers should work with the pharmacist to provide alternative options.

Proper Administration Techniques

Best procedures include flushing the tube before and after administration of medications, providing appropriate diluents, and segregating incompatible medications to avoid tube occlusion. For example, carbamazepine suspensions should be diluted with an equal volume of water due to the possibility of the drug binding to the tube surface. Correct medication administration order and adequate flushing of medications can further improve absorption and lessen drug interaction.



Healthcare Professional Training

Educational programs and trainings for nurses, pharmacists, and doctors can increase awareness about the recommended techniques for giving drugs via an NGT. Past studies have shown that structured training significantly improves compliance with suggested practices and decreases medication errors. Regular competency evaluations, and skills workshops, can be included in professional development programs to increase competence and application of knowledge.

CONCLUSION

Enhancing drug delivery through NGT (nasogastric tube) requires a team, essential considerations, acceptance of standard guidelines with proper medication use, and administration skills. Healthcare providers must remain knowledgeable of the unique potential risks of drug administration by NGT to promote patient safety, therapeutic effectiveness, and diminish risk. Evidence-based processes and continual education around processes to mitigate change will assist with problem solving in this aspect of patient care. Ongoing research about drug formulation compatibility and use, and administration processes will also support improved clinical outcomes and safety of patients.

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