Administration of drugs to patients with swallowing difficulties

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Patients who are unable to swallow due to a debilitating condition become dependant on an enteral feeding tube both for nutritional needs and for administration of medicines. In general medicines are unlicensed for use in enteral tubes, due to the specialist area and due to the limiting licence conditions.[1] Information regarding this mode of administration is very scarce and also associated with increased risk of tube obstruction, increased toxicity and reduced efficacy due to an inadequate administration method.[2] It must be kept in mind that any instructions regarding the administration and cautions of an oral dosage formulation also apply when one considers administering the medicine down an enteral feeding tube. Possibly the enteral feeding tube must be used as the last option for administering medicines.

Introduction

This article aims to highlight a few issues which one encounters when advising about how best to administer a medicine to a patient who cannot swallow or who has an enteral feeding tube.

The British Association for Parenteral and Enteral Nutrition (BAPEN) established a multi professional working group in early 2002 led by the British Pharmaceutical Nutrition Group (BPNG) to develop information resources on this subject. In 2003 BAPEN launched Guidance on administering drugs via enteral feeding tubes which brings together a concise compilation of information regarding techniques in this mode of administration in a concise way.[1]

Unfortunately, crushing tablets is mistakenly taken for granted by some healthcare professionals without considering that the properties of the medication may be affected. As a result of this practice, the treatment may not be effective and may actually cause toxicity and in extreme cases fatality has occurred – eg. A fatality occurred from administration of labetalol and crushed extended-release nifedipine because the sustained release property of nifedipine was broken down and therefore affected its bioavailability.[3]

Alternative routes

When patients are on multi drug regimens and then are suddenly switched to an enteral route, the treatment needs to be revised and the necessity of each medication evaluated for temporary discontinuation or changed to an alternative route such as an injection. Consideration could also be made to change a medicine to a different drug which has the same pharmacological effects but would be available in an alternative route to oral.

When changing formulations, dose equivalencies need to be taken into account eg. phenytoin, digoxin and fusidic acid. 1g of sodium fusidate is approximately equivalent to 0.98g of fusidic acid, therefore doses of fusidic acid suspension appear relatively higher.[4] Carbamazepine suppositories need to be adjusted to be equivalent to the oral dose. Therefore dosage or frequency adjustments may be necessary when changing administration routes especially from one agent to another.[2] Avoid changing the brand of the product used since formulations of the same drug may vary between manufacturers.[5]

Issues with liquid formulations

Liquids, soluble or dispersible tablets are the preferred formulation for administration via feeding tubes however not all liquids are suitable for use in enteral tubes.[4,6] They may be too viscous for administration *via* this route and may also be associated with 'bezoars' which consist of indigestible concretions which may form in the stomach of patients with impaired gastric emptying. Some liquids are not recommended for enteral tube administration because they are absorbed or bound to the plastic tubing eg. diazepam liquid and phenytoin liquid.[6]

The excipients in liquids also need to be considered for their side effects when given enterally. Many sweeteners cause or worsen diarrhea, however sorbitol most commonly causes GI problems.[2] Cumulative sorbitol doses of 7.5 to 30g may cause adverse effects, with symptoms being particularly severe above 20g.[6] The content of sorbitol varies depending on the manufacturer and the concentration of the preparation. Care must be taken as to the volumes used and the fact that a patient may be taking multiple liquids which may lead to large concentrations of sorbitol and therefore increase the possibility of associated side effects.

Osmolality of liquids is also associated with GI adverse effects such as diarrhoea. Many liquids have an osmolality higher than 1000mOsm/kg which is much higher than the osmolality of GI secretions (100-400mOsm/kg). However the osmolality data of many liquids is not readily available. These adverse effects may be avoided by diluting the liquid although this procedure cannot be generally recommended due to the manufacturer warning against its dilution and due to lack of stability information.

Although not all elixirs and suspensions are recommended for administration via an enteral feeding tube (some may cause clogging), they are generally preferable to syrups since the latter have an acidic pH and 'clump' when in contact with enteral feeds.

Issues with oral solid dosage forms

When an alternative route is not possible and liquid preparations are not available, solid oral dosage forms including tablets and capsules is usually considered. However one must be aware that generally an unlicensed use of the medicine is occurring and that the responsibility lies with the prescriber, dispenser and/or person responsible for providing or administering the drug.[7] Crushed tablets are the most frequent cause of obstruction of feeding tubes which results in increased morbidity and trauma to the patient besides the cost of replacing the tube.[8] This may require surgical intervention.[6]

Tables 1 and 2 below give examples of preparations that should not be crushed. However the properties of the drug must be also considered, such as light sensitivity or water sensitivity which would be a major contributory factor in the degradation of the drug during the crushing process. Medications may be offensive-tasting and may cause irritation of the oral mucosa or gastric lining if crushed and therefore consideration has to be given to the site of entry ie. directly into the buccal cavity or *via* a nasogastric tube.

The same principles are true when considering splitting tablets. As a general rule tablets which are not scored, should not be split, let alone crushed. If a tablet is scored, then it is usually considered by the manufacturer to be suitable for division, although this may still be a problem if the tablet does not break evenly into equal sizes.[9] The halved tablet is then exposed and therefore stability cannot be guaranteed.

The same reasoning holds for opening capsules where the powder may be light-sensitive eg. nifedipine or irritant eg. doxycycline hydrate. Some capsules contain enteric-coated granules which should not be crushed eg. omeprazole, however controversial methods exist of how such granules may be administered via an enteral feeding tube.

Drug-feed interactions

Besides problems associated with the formulation of the drug, other problems include the correct timing of drug administration in relation to feeding times and the importance of flushing the feeding tube before and after each drug administration in order to prevent drug-nutrition incompatibilities.[8] Generally, if the absorption of a medicine is affected by food, the same will happen with enteral feeds. Avoiding drug interactions is largely dependent on whether the feed is being administered in an intermittent

Table 1: Formulations that should not be crushed or opened [2,7,9,10,11,12]

Unscored tablets
Unusually thick or oddly shaped tablets
Film and sugar coated tablets
Enteric or protective coated tablets
Sustained release preparations
Sustained release granules eg. omeprazole
Microencapsulated products
Buccal or sublingual preparations
Chewable tablets
Bitter tasting

Table 2: Classes of drugs that should not be crushed or opened [2,7,9,10,11,12]

Antibiotics
Drugs with teratogenic, carcinogenic or cytotoxic properties such as antineoplastics
Teratogenic or Carcinogenic drugs
Nitrates
Steroids
Pancreatic enzymes
Hormone preparations
Prostaglandin analogues
Irritant drugs; also corrosive to oral mucosa and GI tract.
Staining oral mucosa and teeth
Drugs causing allergic reactions
Cross contamination is also possible from the crushing device

or continuous regimen and how often medicines need to be administered.[6] A classical example of a problematic drug for administration via an enteral feeding tube is phenytoin. Phenytoin absorption may be impaired both due to interaction with the enteral feed and due to binding to the feeding tube. An adequate approach needs to be planned out depending on the frequency of the dose which needs to be timed in between feeds. Usually a 2 hour feed-free period is required before and after phenytoin liquid administration. Appropriate monitoring is important to check the blood levels of phenytoin and especially when any changes are being made both with the drug and the feed. Such interactions need to be noticed and followed up. If doses were adjusted due to lack of therapeutic response, toxicity may ensue when feeds are discontinued (or changed to oral or parenteral), particularly in drugs with a narrow therapeutic index[6] such as phenytoin. Adding medicines to the enteral feed is never recommended due to possibility of microbial contamination and lack of information on interactions and stability.[6]

Besides interactions related with feeds, interactions are also possible with tap water although this has been rarely reported. Drugs such as ciprofloxacin and doxazocin, may chelate with the ions in tap water used to administer the drug. In these cases deionized water should be used.[6]

Practice Points for administering medicines via an enteral feeding tube

- Try to use an alternative route to the oral route.
- If no alternative exists, use dispersible tablets or liquid (caution with syrups)
- If a tablet or capsule has to be used, consider the properties of the formulation
- Time the medicines administration in between feeds to avoid drug-feed interaction
- Correct flushing techniques are important to avoid blockage of tube

Other issues related to feeding tubes

The type, size and placement of tube is an important factor which may influence the administration of the drug eg. fine bores are unsuitable for thick liquids. The site of placement of the tube should be noted before administering a drug to avoid a situation where the placement may extend beyond the main site of absorption of the drug. Drugs that may be affected by this include cephalexin, ketoconazole; and also drugs that have a narrow therapeutic window eg. digoxin, warfarin, theophylline, carbamazepine, sodium valproate, phenytoin, and other anticonvulsants.[6,7,13] It is necessary to monitor the patient for signs of reduction in efficacy of these medicines.

Blockage of the tube occurs when the precautions mentioned above are not taken into consideration. It is important to take precautions as well as assessing the possibility that a particular drug may cause obstructions such as bulk forming medicines (laxatives) as well as sucralfate. The drugs must be administered separately. A correct administration technique is required with adequate flushing between drugs to avoid blockage which must be recorded especially in cases of fluid restriction.

Conclusion

Administering drugs through this route requires trained and experienced healthcare professionals due to the highly specialized area. Each drug must be analysed as to the best possible way to be administered without tampering with its properties. If the oral dosage form is being used differently than the manufacturer intended it, then the responsibility lies with the prescriber and must be aware that this is an unlicensed use.

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