RESEARCH ARTICLE

Comparative and Optimization of administration of Dexlansorazole through nasogastric tubes using an oral liquid vehicle as a suspending agent

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ABSTRACT

Proton pump inhibitors (PPIs) are widely used for the treatment of various acid-related disorders. For intensive care patients Stress-induced gastrointestinal tract bleeding (SGIB) is common, Dexlansoprazole is a PPI that suppresses gastric acid secretion by specific inhibition of the (H^+,K^+)-ATPase in the gastric parietal cell. The aim of this study was to compare the behavior of the dexlansoprazole during the transit of the pellets through the nasogastric tube and to optimize the mode of administration. In this experiment we designed to study the influence of four variables: the tube material (silicone or polyurethane), the solvent used to disperse the pellets (water or apple juice), the mode of administration and the rinse volume . We counted the pellets before administration to tube and at the tube outlet, and assayed the dexlansoprazole by UV spectrometry. The assay showed that transit of dexlansoprazole through the tube, was nearly 85.5 to 99.6%. There is asignificant improvement was obtained by the variables 'diluent' and 'mode of administration'. The variable 'rinse' had a significant influence. Dexlansoprazole is thus the choice of Proton pump inhibitor for the treatment of patients by nasogastric tube, using a polyurethane tube and a rinse 10 ml of apple juice.

Keywords: Dexlansoprazole, water, apple juice and nasogastric tube.

1.0 INTRODUCTION

Proton pump inhibitors (PPIs) are widely used for the treatment of various acid-related disorders. For intensive care patients Stress-induced gastrointestinal tract bleeding (SGIB) is common, Dexlansoprazole is a PPI that suppresses gastric acid secretion by specific inhibition of the (H^+,K^+)-ATPase in the gastric parietal cell. By acting specifically on the proton pump, dexlansoprazole blocks the final step of acid production, and reduces the associated mortality. The PPIs are sensitive to gastric acid and are formulated to resist breakdown in the stomach and favour intestinal absorption [1-5]. The intensive care patients are unable to swallow for this reason, PPIs have to be administered by gastric tube after dispersion of pellets or pellets in water, or in some fruit juices [6-7]. A number of studies have already been conducted on the administration of omeprazole [6-10], lansoprazole [6,9-13] through nasogastric tubes.

The objective of the study was to compare the suitability of administration of dexlansoprazole delayed release capsules 60 mg through nasogastric (NG) tube 16F. In this study, mainly we observe optimum medium for delivery, mode of administration and the behaviour of the enteric coated pellets when administered through nasogastric tubes 16F. These experimental conditions as close as possible to clinical practice.

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2.0 MATERIALS AND METHODS

2.1 Materials:

Dexlansoprazole DR capsules 30 mg (Kapedex) was supplied by Tap pharmaceuticals and formulated in our lab. The dexlansoprazole DR capsules was formulated in gelatin capsules containing enteric coated pellets or pellets which are gastric resistant pellets. The pellets were dispersed in apple juice or water, and injected into the nasogastric tube using a 60 ml catheter-tip syringe with the plunger (Becton Dickinson). Two types of 16 French gauge gastroduodenal tubes were used: polyurethane tubes

(Salem type, length 120 cm, internal diameter 3.8 mm) and silicone tubes (Levin type, length 125 cm, internal diameter 3 mm, Vygon). Apple juice (Tropicana 100%, 1284CB, Schreiber Dynamix Dairies) and purified water.

2.2 Method:

The administration solvents (Water and apple juice) and NG tubes used in our experiments were chosen as closely as possible to those commonly used in intensive care to compare the recovery of kapidex and our lab product.

Administered the dexlansoprazole pellets through the nasogastric tube positioned (figure 1), as it would be in a reclining patient. In this study we observed the influence of four variables: the 16 French gauge tube material (silicone or polyurethane), the nature of the solvent (water or apple juice), the rinse volume and the administration pattern. We have carried out 16 separate experiments (Table 1), each repeated three times. Before each administration, the tubes were rinsed with the solvent chosen to carry the pellets.

Procedure:

One Dexlansoprazole 30-mg capsule was then opened and the pellets emptied into 60 ml catheter-tip syringe. Added water or apple juice to the syringe up to the mark. The plunger was then replaced and, with the tip up, the syringe side to side shaken until the pellets in the tip moved into the body of the syringe. The syringe containing the mixture was always shaken during the administration to prevent pellets adhering to the syringe wall and the tip requires elevation and lowering to prevent accumulation of the pellets near the tip and we maintained a constant flow rate of injection to limit tube obstruction. The pellets were then recovered in a plastic beaker placed under the end of the tube and repeat the same for Kapidex as mentioned in table 1.

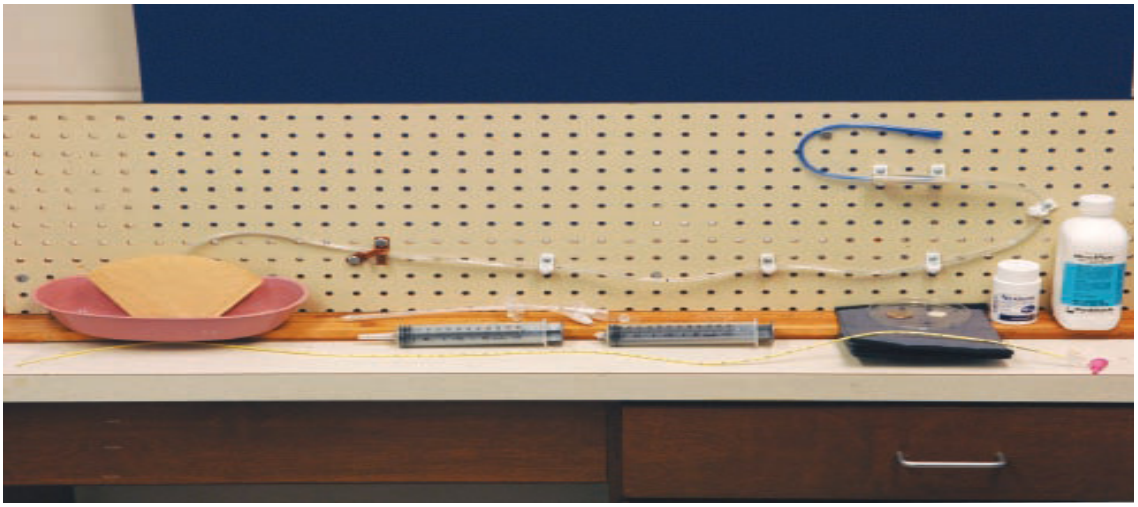

Figure 1: Tubing position

2.3. Analysis of samples:

The pellets were collected at exit of tube, counted and were analyzed for assay of dexlansoprazole to compare the Kapidex to our lab product.

2.3.1. Assay of active ingredient

The suspension of pellets collected at the tube exit was filtered on a 0.45 mm screen to recover the pellets. These were then dissolved in pure methanol. After complete dissolution by sonication, the suspension filtered through 0.45 micron filter. The clear solutions obtained were then diluted 10-fold and assayed by UV spectrophotometry at 285 nm. We determined the percentage of active ingredient recovered at the tube exit relative to the initial dose injected into the tube.

2.3.2. Counting of pellets

In addition to the assay, the pellets were counted before and after transit through the tube.

No. of trails	Material of tubing	Solvent	No. of pellets	Administration volume (mL)	Rinse volume(mL)	Recovery of pellets	Recovery of assay (%)
Kapidex							
1	Silicone	Water	275	1x40	NA	235	85.7
2	Silicone	Apple juice	269	1x40	NA	252	93.8
3	Silicone	Water	277	1x30	10	257	92.2
4	Silicone	Apple juice	271	1x30	10	268	95.6
5	Polyurethane	Water	279	1x40	NA	251	89.7
6	Polyurethane	Apple juice	270	1x40	NA	264	97.8
7	Polyurethane	Water	267	1x30	10	253	94.6
8	Polyurethane	Apple juice	274	1x30	10	272	99.2
Dexlansoprazole DR capsules							
9	Silicone	Water	284	1x40	NA	250	87.6
10	Silicone	Apple juice	280	1x40	NA	263	94.1
11	Silicone	Water	285	1x30	10	269	93.7
12	Silicone	Apple juice	279	1x30	10	267	95.7
13	Polyurethane	Water	273	1x40	NA	251	91.8
14	Polyurethane	Apple juice	281	1x40	NA	277	98.6
15	Polyurethane	Water	283	1x30	10	272	95.2
16	Polyurethane	Apple juice	281	1x30	10	280	99.5

* For each experiment, three assays were done.

Table 1: Experiments performed to compare the impact of material-related and administration pattern-related parameters on dexlansoprazole transit through nasogastric tubes

3.0 RESULTS

The assay of the dexlansoprazole showed a recovery rate of 85.7 to 99.6% with significant variations between administration pattern and solvent. No significant difference was found regards concentration of active ingredient or quantity of pellets obtained at the tube exit.

In this study, we observed a significant change in the quantity of pellets collected from one administration pattern to another (85.2 to 99.6% of dexlansoprazole recovered, with a variability of about 15%). The 'solvent' and 'administration pattern' factors gave significant improvement in the recovery of pellets. The 'rinse volume' also influence to the recovery of pellets.

4. DISCUSSION

4.1.1. Influence of administration pattern

We investigated whether it was preferable to administrate the dexlansoprazole pellets. Hence, the administration pattern also influenced the recovery of pellets by using different administration patterns, rinse volume.

4.1.2. Influence of solvent

In intensive care patients the solvents most often used are water and fruit juice (e.g., apple juice, orange juice). We consider apple juice (pH:3.2) because it maintains an acidic medium. the enteric coating pellets maintain and shows gastro-resistance property when they arrive in the stomach. Accordingly, we preferred to focus our study on the two solvents recognised as being suited to the administration of dexlansoprazole by nasogastric tube: water and apple juice. When we used water and apple juice the recovery was observed 72 % and 86%. Finally the study shows that there is a significant difference to recovery of pellets between these two solvents to recover the pellets.

4.1.3. Influence of dosage form

The analysis of pellet size suggested some possible explanations for the tube obstruction observed and demonstrated by measurement of the pellets and by the inconsistency of the pellet size based on concentrations and quantities of pellets obtained. All the administrations of dexlansoprazole was accompanied by a dual evaluation of the final quantity recovered: by assay and by counting of pellets. This dual evaluation revealed the variations in pellet size.

4.2.2. Influence of nature of tubing

We observed that the nature and material of the tube played a significant role in the delivery of dexlansoprazole DR pellets (polyurethane tubes favoured the flow of dexlansoprazole pellets). However, it is impossible to correlate this difference to the tube material because for the same gauge (16 French), the two types of tube used did not have the same internal diameter. The 16 French gauge silicone tube had a smaller internal diameter than the 16 French polyurethane tube (3mm versus 3.8 mm). Thus, the influence of the tube material on the behaviour of the dexlansoprazole pellets is not precisely known.

5.0 CONCLUSION

Based on the above data, 99.0 % of pellets recovered from polyurethane nasogastric tube (16F) with apple juice as a solvent for both Kapidex and our lab products are similar in nature. Hence dexlansprazole is the choice for the treatment of intensive care patients through a nasogastric tube using a polyurethane tube, apple juice 30 ml as a solvent and 10 ml as a rinse for the administration can be considered.

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