

Evaluation of the profile of drug therapy administered through enteral feeding tube in a general hospital in Rio de Janeiro

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Enteral nutrition (EN) is the method of choice for patients that cannot adequately receive oral feeding despite good gastrointestinal tract condition. Enteral diets may be administered through tube or ostomy placed in the stomach, duodenum or jejunum. The administration of drugs via enteral feeding tube (EFT) is a common practice in hospitals due to patient clinical status, and requires special attention from professionals involved in this process. This study entailed an analysis of the profile of drug therapy through EFT based on evaluation of medical prescriptions of the Medical Clinic of the Hospital dos Servidores do Estado (HSE) of Rio de Janeiro sent to the Pharmacy Service between January and June 2007, according to standard protocols in place. Prescription of drugs via EFT outside recommended guidelines was observed, besides potential drug-nutrient incompatibilities associated with this practice. These results point to the need for improvement of enteral route access and the adoption of measures to promote safe and effective use of drugs and nutritional therapy.

Uniterms: Enteral nutrition. Drugs/prescriptions. Hospital pharmacy. Pharmaceutical care.

A nutrição enteral (NE) é o método de escolha para alimentar pacientes que não podem receber alimentação por via oral de forma adequada, mas que estejam com a função gastrointestinal satisfatória para a absorção dos nutrientes. As dietas enterais podem ser administradas através de cateteres ou ostomias, posicionados no estômago, duodeno ou jejuno. A administração de medicamentos através de cateter de nutrição enteral (CNE) é uma prática muito comum no ambiente hospitalar, devido ao estado clínico do paciente, necessitando atenção especial dos profissionais envolvidos neste processo. O estudo constituiu uma análise do perfil da terapia medicamentosa através de CNE por meio de uma avaliação das prescrições médicas da Clínica Médica do Hospital dos Servidores do Estado (HSE) do Rio de Janeiro encaminhadas ao Serviço de Farmácia, de janeiro a junho de 2007, tendo como padrão protocolos existentes. Foi observada a prescrição de medicamentos através do CNE fora das recomendações contidas nas referências, além de possíveis incompatibilidades fármaco-nutriente associadas a esta prática. Os resultados demonstraram a necessidade de melhoria na utilização dessa via e adoção de medidas a fim de promover um uso seguro e eficaz de medicamentos e da terapia nutricional.

Uniterms: Nutrição enteral. Medicamentos/prescrição. Farmácia hospitalar. Assistência farmacêutica.

INTRODUCTION

Enteral nutrition (EN) is indicated for patients who, for some reason, are unable to ingest food orally despite their digestive system functioning both anatomically

and physiologically (SENPE, 1998). The access routes to the digestive tube for insertion of the enteral feeding tube (EFT) may vary according to gastrointestinal tract pathology and general patient clinical status. The most used access approaches are nasoenteral route, gastrostomy and jejunostomy. EN may be administered through EFT by intermittent or continuous forms (Waitzberg *et al.*, 2000).

High number of patient candidates to receive EN

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need treatment with one or more drugs that may also be administered through the EFT (Beckwith *et al.*, 2004). The use of an inappropriate method of drug administration via this route can lead to failures both to medication and nutritional therapy (Gámez Lechuga *et al.*, 1998). Problems related to administration of drugs via EFT may result from a series of incompatibilities such as physical, pharmaceutical, physiological, pharmacological and pharmacokinetic (Izco *et al.*, 2001).

Physical incompatibility happens when physical change occur after mixing the EN and the drug. This may lead to formation of precipitates or to viscosity changes hindering nutrient or drug absorption due to catheter obstruction (Izco *et al.*, 2001). Furthermore, the grinding of solid oral medications or the administration of drugs with extreme pH values may cause mechanical problems as well as catheter obstruction (García de Tiedra, Alonso Herreros, 2004; Gámez Lechuga *et al.*, 1998).

When the manipulation of pharmaceutical forms modifies the efficacy of the product and its tolerance by the patient it constitutes a pharmaceutical incompatibility. Also, some pharmaceutical forms, such as enteric coated tablets or controlled release tablets need special care when administered via catheters (Izco *et al.*, 2001).

The decreased tolerance to nutritional support due to pharmacological action of the active principle or to any component of the formulation characterizes physiological incompatibility (Izco *et al.*, 2001).

Pharmacological incompatibility occurs when the drug mechanism of action causes changes in EN tolerance or in the efficacy of other administered drugs (Izco *et al.*, 2001).

Pharmacokinetic incompatibility occurs when the drug given via EFT causes changes in its pharmacokinetic properties such as bioavailability, distribution, metabolism and / or excretion (Izco *et al.*, 2001).

It is therefore essential to perform proper selection and administration of the drug via this route to avoid the complications described, with the aim of ensuring the effectiveness of the drug and nutritional therapy in patients (Gámez Lechuga *et al.*, 1998).

Numerous studies provide specific information and key recommendations for the correct administration of drugs via EFT. These works provide data on the peculiarities of the drugs that can be administered via this route and the alternatives to these drugs that should not be used.

The presence of a Multidisciplinary Team for Nutritional Therapy (MTNT) in hospitals can prevent and reduce complications and costs involved in this process, and ensure safety and efficacy in the treatment of patients (RDC n° 63, 06/07/00) (Brasil, 2000; Moura, Reyes,

2002). The incorporation of a pharmacist in the MTNT is of fundamental importance to prevent problems related to administration of drugs via EFT. This professional plays an important role in correct selection and provision of information on drugs to be administered by this route, as well as in solving problems related to it (RDC n° 63, 06/07/00) (Brasil, 2000; Gago Sánchez *et al.*, 2006).

The aim of this study was to analyze the profile of the drug therapy administered through enteral feeding tube at the Medical Clinic of the Hospital dos Servidores do Estado (HSE) of Rio de Janeiro and to put forward proposals to improve care to patients with EFT.

MATERIAL AND METHODS

A retrospective study of medical prescriptions from the Medical Clinic of HSE sent to the Pharmacy Service between January and June 2007 was performed. Initially, the analysis was estimated for a period of one year but most data were not available for this period. The medical prescriptions sent to the Pharmacy Service were counted and those in which enteral nutrition (EN) via catheter was employed, were selected.

From the selected prescriptions, data was collected on the date of prescription, the distal placement of the EFT, the drugs prescribed via the EFT and the pharmaceutical form of each drug.

The dosage available for each drug in the Pharmacy Service during the study period was also considered. This information was available on AutoEst[®], an automated system (version 5.7).

The data were compiled into Microsoft EXCEL[®] spread sheet structured for this purpose. The information was processed to create secondary spread sheets in the same software to determine the profile of drug therapy via EFT using the following data: (1) total number of prescriptions for patients using EN; (2) number of patients in use of EN; (3) number of patients using drugs through EFT; (4) total number of prescriptions for patients using drugs via EFT; (5) time in use of EFT of patients during analysis; (6) distal placement of catheter in patients using EN; (7) average number of drugs per prescription to be administered by EFT; (8) drugs prescribed by catheter; (9) percentage of pharmaceutical forms of drugs prescribed by catheter, grouped by same active principle and pharmaceutical form, not taking into account their concentration; (10) total number of items found in prescriptions for drug administration via EFT; (11) frequency of drug items prescribed for administration via catheter.

The drugs prescribed via EFT were grouped accor-

ding to their pharmacological group in the National List of Essential Drugs 2007 (Brasil, 2007), taking into consideration the same active principle and form, regardless of their concentration in the formulation.

A survey of drugs available in the institution in oral liquid form was conducted. This information identified the unfamiliarity of standardization of pharmaceutical forms of drugs available in the hospital among prescribers, as well as lack of awareness of professionals regarding the risks of modifying oral solid pharmaceutical forms.

After obtaining the relationship between drugs prescribed to patients by EFT, reference recommendations available on the use of these drugs through oral route were consulted. Careful evaluations of the use of drugs on analyzed prescriptions were performed according to the guidelines observed.

RESULTS

The Pharmacy Service of the HSE received 9975 prescriptions from the Medical Clinic between January and June, 2007. A total of 330 prescriptions were selected of 29 patients in use of EFT. The analysis of prescriptions showed that 26 (89.6%) patients received medication via catheter, representing 319 prescriptions.

During the analysis period, 21 patients remained in use of EFT for up to 30 days, 5 patients for up to 60 days and 3 patients for a period greater than or equal to 90 days, at the Medical Clinic.

Among 29 patients studied at this period, 16 patients (55.1%) had distal post-pyloric EFT placement and 13 patients (44.9%) had distal stomach EFT placement.

Patients using drugs via EFT were found to be receiving an average of 4.1 drugs per prescription through this route.

Some drugs were prescribed in different doses and pharmaceutical forms. Figure 1 shows the distribution of pharmaceutical forms of drugs prescribed during the analyzed period.

On prescriptions of patients in use of drugs via EFT, 1,327 medicines were administered by this route. These drugs were grouped by pharmaceutical form, with captopril being the most prescribed, as shown in Table I.

The largest group of drugs prescribed to be administered through via catheter were the anti hypertensive agents (30.9%), followed by anticonvulsants (10.0%) and anti-ulcer drugs (7.0%) (Figure 2). For this analysis, the antibacterial drugs, antifungal and the antiparasitic were considered Anti-Infective Agents, according to the classification of the National Essential Drugs List, 2007 (Brasil, 2007).

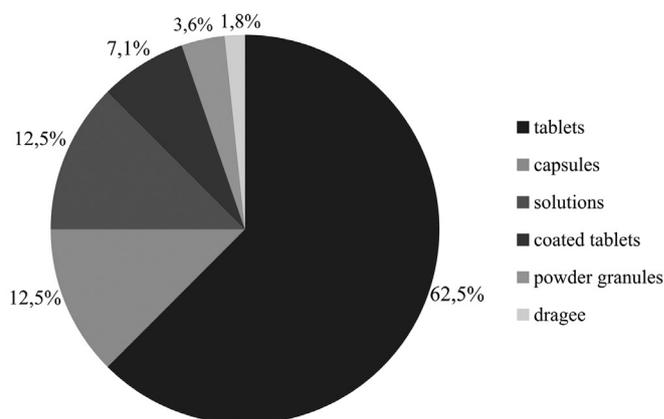


FIGURE 1 - Percentage of pharmaceutical forms of medicines prescribed by enteral feeding tubes between January and June, 2007 among the 26 patients analyzed at the Hospital dos Servidores do Estado in Rio de Janeiro.

Among 49 drugs prescribed in solid oral pharmaceutical forms, 17 (34.7%) were also available on oral liquid form, implying that at least 290 prescriptions (21.8%) could have reduced the risk of catheter obstruction.

The care taken in administration by EFT of the 56 drugs prescribed to the 26 patients was investigated based on the references used (Hidalgo *et al.*, 1995; Gámez Lechuga *et al.*, 1998; Izco *et al.*, 2001; Beckwith *et al.*, 2004; Garcia di Tiedra, Alonso Herreros, 2004; Alonso Herreros *et al.*, 2004; Piñeiro Corrales, Olivera Fernández, Guindel Jiménez, 2006).

Analysis of prescription drugs regarding the distal placement of the EFT showed the prescription for one patient of haloperidol solution and one patient of *N*-acetylcysteine powder with post-pyloric placement outside the guidelines found in the references consulted.

The same analysis was done on the administration of medicines by EFT with regard to the pharmaceutical forms available. Three patients were found using the nifedipine retard coated tablet, in disagreement with the reference recommendations (Hidalgo *et al.*, 1995; Izco *et al.*, 2001; López *et al.*, 2003; Beckwith *et al.*, 2004)

DISCUSSION

The use of medicines via EFT is commonly performed and of great relevance in clinical practice. The use of drugs by oral route is chosen due to its lower costs and iatrogenic effects (Gámez Lechuga *et al.*, 1998), since it is more physiological and has fewer complications than the parenteral route (Izco *et al.*, 2001).

In this study, a large number of prescriptions of drugs in their pharmaceutical solid oral form was noticed

TABLE I - Frequency of medications prescribed for administration through enteral feeding tubes among the 26 patients assessed between January and June, 2007 at the Hospital dos Servidores do Estado (HSE) in Rio de Janeiro

Drug	PF	Prescription		Drug	PF	Prescription	
		N	%			N	%
Captopril	Tablet	222	16.73	Levothyroxine	Tablet	15	1.13
Phenytoin	Tablet	90	6.78	Simvastatin	Tablet	14	1.06
Ranitidine*	Tablet	81	6.10	Spironolactone	Tablet	13	0.98
Bromopride*	Capsule	76	5.73	Amlodipine	Tablet	12	0.90
Baclofen	Tablet	68	5.12	Omeprazole	Capsule	12	0.90
Potassium chloride 6%	Solution	49	3.69	Nortriptyline	Capsule	11	0.83
Ciprofloxacin	Tablet	47	3.54	Hydralazine	Dragee	11	0.83
Hydrochlorothiazide	Tablet	45	3.39	Digoxin*	Tablet	11	0.83
Atenolol	Tablet	39	2.94	Dipirone*	Tablet	8	0.60
Acetylsalicylic acid	Tablet	33	2.49	Polystyrene sulfonate	Powder granule	8	0.60
Fluoxetine*	Capsule	30	2.26	Thiabendazole*	Capsule	7	0.53
Retard Nifedipine	Coated tablet	30	2.26	Metoclopramide*	Tablet	7	0.53
Folic acid	Tablet	28	2.11	Vitamin B1	Tablet	7	0.53
Haloperidol	Solution	28	2.11	Tramadol	Capsule	6	0.45
Carbamazepine*	Tablet	26	1.96	Trimethoprim + sulfamethoxazole*	Tablet	6	0.45
Sertraline	Tablet	26	1.96	Alopurinol	Tablet	6	0.45
Prednisone	Tablet	25	1.88	Lactulose	Solution	5	0.38
Diazepam	Tablet	24	1.81	Bromazepam	Tablet	4	0.30
Dipirone	Solution	23	1.73	Fluconazole	Capsule	4	0.30
Risperidone	Tablet	20	1.51	Morphine	Tablet	3	0.23
Mineral Oil	Solution	20	1.51	Clonazepam*	Tablet	1	0.08
Carvedilol	Tablet	19	1.43	Ferrous sulfate*	Coated tablet	1	0.08
Furosemide	Tablet	19	1.43	Dexchlorpheniramine*	Tablet	1	0.08
Metformin	Tablet	19	1.43	Albendazole*	Coated tablet	1	0.08
Phenobarbital*	Tablet	17	1.28	Metronidazole*	Tablet	1	0.08
Paracetamol	Solution	15	1.13	Norfloxacin	Tablet	1	0.08
Clonazepam	Solution	15	1.13	Acetylcysteine	Powder granule	1	0.08
Amoxicilin + Clavulanate*	Tablet	15	1.13	Vitamin B*	Coated tablet	1	0.08

PF: Pharmaceutical Form

*: Liquid oral pharmaceutical form available in the Pharmacy Service of the HSE

when equivalent liquid formulations were available. This suggests a possible lack of dosage forms of medicines available in the hospital to the prescribers, and also limited knowledge of professionals about the risks of the practice of modifying solid oral forms.

On the other hand, liquid formulations have problems and limitations inherent to their use related to the viscosity, osmolarity and the amount of sorbitol present

in these formulations (Beckwith *et al.*, 2004).

The administration of some oral liquids with high viscosity through the catheter could be hard or induce catheter obstruction, as occurs with the suspension of amoxicillin + clavulanate. These medications should be diluted in water to improve administration and prevent obstruction of the catheter (Gámez Lechuga *et al.*, 1998; Garcia di Tiedra, Alonso Herreros, 2004).

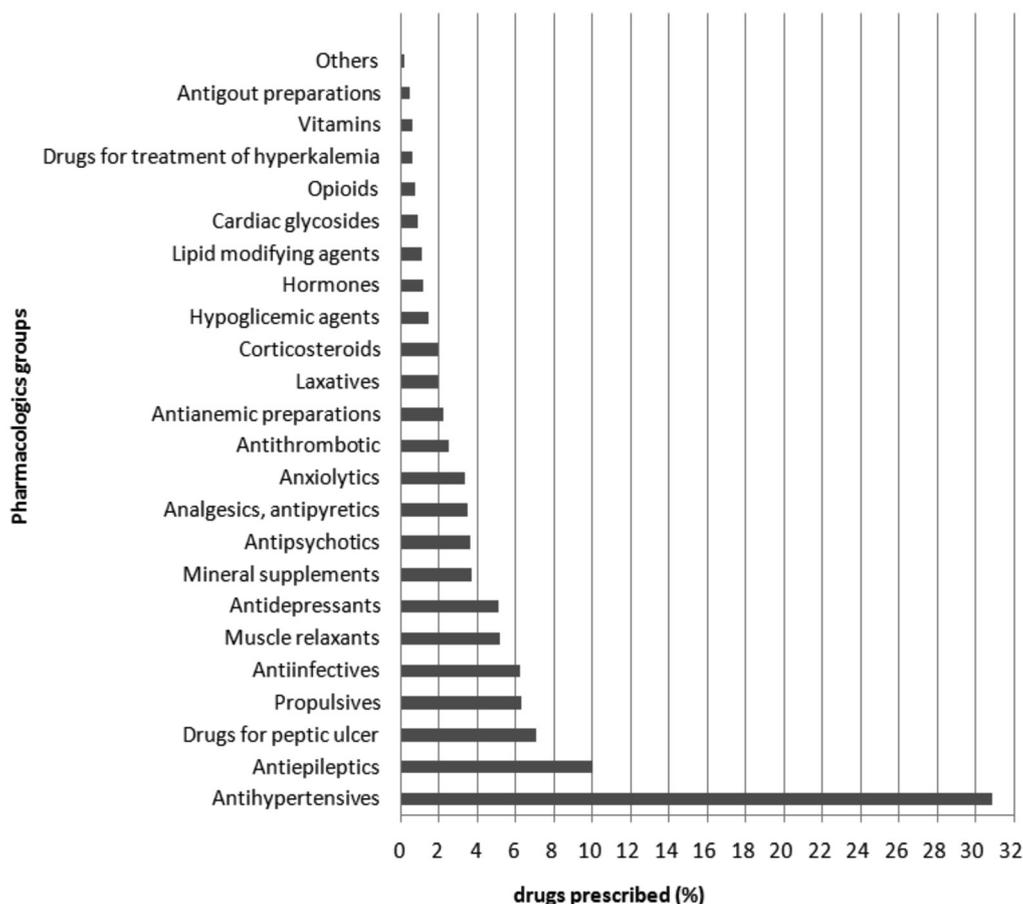


FIGURE 2 - Pharmacological group of drugs prescribed by enteral feeding tubes between January and June, 2007 among the 26 patients analyzed at the Hospital dos Servidores in Rio de Janeiro.

Other problem related to the administration of liquid forms through the EFT include high osmolarity which can cause gastrointestinal problems such as diarrhea, abdominal distension and vomiting. For instance, this can be observed upon administration of lactulose and the chloride potassium solutions of potassium chloride at 6%. Dilution before administration is a way of reducing these effects (Beckwith *et al.*, 2004).

The sorbitol present in liquid formulations is a frequent cause of abdominal distension and aerophagia with daily dose of 10 g, while abdominal spasms and diarrhea can occur at a daily dose of 20 g. The recommended change is to try the pharmaceutical form or to use alternative therapy available. The solution of paracetamol is an example of a product with a high amount of sorbitol in its formulation that was found in the prescriptions analyzed (Gámez Lechuga *et al.*, 1998; Beckwith *et al.*, 2004).

Among the oral pharmaceutical forms prescribed via EFT, solid forms were more commonly used. When prescribing medications in the form of tablets to patients using EFT, grinding and mixing in water is suggested to

administer it as a suspension. The opening of capsules and preparing them as in the previous case is recommended. However, the suspensions prepared in this manner may be related with the obstruction of the EFT, representing a critical point of the process. An alternative to avoid this problem is the use of liquid formulations when they are available or parenteral preparations that can be administered orally, such as the tramadol (Hidalgo *et al.*, 1995; Garcia di Tiedra, Alonso Herreros, 2004).

Moreover, the reduction of the pharmacological effect is observed through the grinding of pharmaceutical forms of enteric coated tablets due to the action of the gastric pH when the distal positioning of the catheter is in the stomach (Garcia di Tiedra, Alonso Herreros, 2004). In the analysis, two patients using omeprazole with gastric catheter were found. In this case, the correct procedure is to open the capsule and release the contents into a 5% glucose solution or in fruit juice with no grinding (Izco *et al.*, 2001). Three patients using retard nifedipine were also found. The oral drugs in retard or controlled-release forms are contraindicated for open grinding or for administra-

tion via catheter, as they can increase the speed of release of the active principle by increasing the absorption and plasma to toxic levels or to a lesser degree, lead to loss of the maintenance effect of plasma levels with time. In this case, liquid dosage forms should be chosen or options that do not have controlled-release, adapting for dose and dose range. (Hidalgo *et al.*, 1995; Izco *et al.*, 2001; López *et al.*, 2003; Beckwith *et al.*, 2004; Garcia di Tiedra, Alonso Herreros, 2004).

The administration of drugs with extreme values of pH (<3.5 or >10) together with EN may lead to precipitation of the drug and consequent obstruction of the catheter, it being indicated to interrupt EN 1h before, and resume it 2h after, drug administration. Also, cases must be considered where the distal placement of the catheter is post-pyloric and the middle pH is alkaline (duodenum and jejunum). In this case it is contraindicated to administer dosage forms with acidic pH that may lead to precipitation of the drug and consequent therapeutic failure (Gámez Lechuga *et al.*, 1998; Izco *et al.*, 2001; Garcia di Tiedra, Alonso Herreros, 2004). In the analysis, prescriptions drugs were found with pH <3.5, such as metoclopramide tablet, fluoxetine capsule, haloperidol solution and *n*-acetylcysteine powder. The use of haloperidol solution and *n*-acetylcysteine powder administered through a post-pyloric catheter was observed in 2 patients.

When drug administration by EFT causes changes in pharmacokinetic properties such as bioavailability, distribution, metabolism and/or excretion or when I produces undesirable gastrointestinal effects, the procedure to be used is the interruption of nutrition 1h before and 2h after the administration of drugs such as atenolol, ciprofloxacin, digoxin, phenytoin, levothyroxine and norfloxacin. However, some drugs are more tolerable when administered concurrently with NE, such as acetylsalicylic acid, amoxicillin + clavulanate, amlodipine, carvedilol, dexchlorpheniramine, diazepam, furosemide and spironolactone (Izco *et al.*, 2001).

According to the references studied, some oral solid medications that are not commercially available in liquid formulation, allows preparation through the development of an extemporaneous suspension. In these cases, the best alternative is the preparation of such formulations by the Department of Pharmacy of the institution and sending them in a ready form for administration. Among the drugs found, folic acid, allopurinol, baclofen, captopril, spironolactone, furosemide, hydrochlorothiazide and prednisone could benefit from this preparation (Hidalgo *et al.*, 1995; Izco *et al.*, 2001; Piñeiro Corrales, Olivera Fernández, Guindel Jiménez, 2006).

FINAL CONSIDERATIONS

The prescription of medicines via EFT is a procedure widely used in clinical practice. As can be observed in this study, the results showed that it is necessary for the health team involved in patient care to pay greater attention to ensure this practice is performed safely and effectively.

The administration of medications via catheter requires correct selection of the dosage form and the correct form of administration to ensure the effectiveness of pharmacotherapy, a reduction in adverse effects, prevention of catheter obstruction, and avoidance of problems related to possible complications that may cause nutritional failure.

The pharmacist, as part of the MTNT, has the responsibility to improve health through the safe and efficient use of medicines. Pharmaceutical intervention can be decisive in the detection and management of possible drug-nutrient interactions in the prevention and identification of problems, by finding practical solutions, especially concerning guidelines for preparation and administration of medicines. The development of guides and manuals with guidelines for carrying out this practice, disclosure of the standard drugs at the institution available to prescribers, the inclusion of medicines with liquid formulations in the standardization and development of extemporaneous formulations designed for this purpose, also number among the actions of the pharmacist.

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