Original article

USE OF ANTI-INFECTIVE MEDICATIONS VIA THE GASTROSTOMY CATHETER: RECOMMENDATIONS FOR NURSING*

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ABSTRACT: Objective: to present specific recommendations in the preparation and administration of anti-infective medications via the gastrostomy catheter in the Emergency Unit of a University Hospital in the South of Brazil. Method: a descriptive-exploratory, cross-sectional, qualitative-quantitative study conducted between April and October 2015. Quantitative descriptive statistics were used, with a qualitative non-systematic review of the literature, considering national and international publications, from the combination of the keywords: profile and medications via catheter. Results: among the 568 prescriptions analyzed, there were 143 different medications prescribed, with prevalence of the anti-infectious class (25.9%) and predominance of solid forms; however, 83.3% of the medications presented some restriction in use with catheter even though there were substitution options available, demonstrating the need for a care procedure. Final considerations: among the majority of the prescribed solid medications for use via gastrostomy catheter, replacement options were available, demonstrating the need for their substitution with other forms and for the follow-up of specific recommendations by the nursing/health team.
DESCRIPTORS: Enteral nutrition; Patient safety; Drug interactions; Food-drug interactions; Nursing care.

USO DE MEDICAMENTOS COM AÇÃO ANTI-INFECCIOSA VIA SONDA GASTROENTERAL: RECOMENDAÇÕES PARA A ENFERMAGEM

RESUMO: Objetivo: apresentar recomendações específicas no preparo e administração de medicações anti-infecciosas via sonda gastroenteral no Serviço de Pronto Atendimento de um Hospital Universitário no Sul do Brasil. Método: estudo quali-quantitativo, descritivo-exploratório e de corte transversal, realizado entre abril e outubro de 2015. Quantitativamente utilizou-se a estatística descritiva e qualitativamente uma revisão não sistemática da literatura, em publicações nacionais e internacionais, a partir da combinação das palavras chave: perfil e medicações via sonda. Resultados: entre 568 prescrições analisadas, houve 143 medicamentos diferentes prescritos, com prevalência da classe de anti-infecciosos (25,9%) e predominância das apresentações sólidas; contudo, 83,3% dos medicamentos apresentavam alguma restrição de uso via sonda mesmo havendo opções de substituição disponíveis, demonstrando necessidade de protocolo assistencial. Considerações finais: entre a maioria das medicações sólidas prescritas via sonda gastroenteral, havia opções de substituição disponíveis, sendo necessária sua substituição por outras apresentações e o seguimento de recomendações específicas pela equipe de enfermagem/saúde.
DESCRITORES: Nutrição enteral; Segurança do paciente; Interações de medicamentos; Interações alimento-droga; Cuidados de enfermagem.

USO DE MEDICAMENTOS CON ACCIÓN ANTIINFECCIOSA POR SONDA GASTROENTERAL: RECOMENDACIONES PARA LA ENFERMERÍA

RESUMEN: Objetivo: presentar recomendaciones específicas acerca del preparo y de la administración de medicamentos antiinfecciosos por medio de sonda gastroenteral en el Servicio de emergencia de un Hospital Universitario en Sur de Brasil. Método: estudio cualitativo y cuantitativo, descriptivo exploratorio y de cohorte transversal, que se realizó entre abril y octubre de 2015. Para el análisis cuantitativo, se utilizó la estadística descriptiva y, para el análisis cualitativo, una revisión no sistemática de la literatura en publicaciones nacionales e internacionales, por medio de la combinación de las palabras clave: perfil y medicamentos por medio de sonda. Resultados: entre 568 prescripciones analizadas, hubo 143 medicamentos distintos prescriptos, con prevalencia de los antiinfecciosos (25,9%) y predominancia de las presentaciones sólidas; sin embargo, 83,3% de los medicamentos presentaban alguna restricción de uso por sonda mismo existiendo opciones de sustitutos disponibles, lo que muestra necesidad de protocolo asistencial. Consideraciones finales: entre la mayoría de los medicamentos sólidos prescriptos por sonda gastroenteral, había opciones de sustitución disponibles, siendo necesario sustituirlos por otras presentaciones además de obedecer a las recomendaciones específicas por el equipo de enfermería/salud.
DESCRIPTORES: Nutrición enteral; Seguridad del paciente; Interacciones de medicamentos; Interacciones alimento-droga; Cuidados de enfermería.

*Article derived from the dissertation "Medications used orally and gastrointestinal probe in a prompt service: profile and care". Federal University of Rio Grande, 2017.

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Received: 10/09/2017
Finalized: 25/09/2018

INTRODUCTION

The administration of medication is one of the activities inherent to the practice of nursing. For this, it is necessary to have theoretical and practical knowledge, as well as increased attention in the supervision of the team, since the medication system includes several phases (prescribing, scheduling, dispensing, preparation and administration), where errors occur more frequently than they are registered[1-2]. The oral route is the most convenient and usually the safest, with the lowest cost and, therefore, the most commonly used. If this route is compromised or the patient presents difficulty swallowing, the gastrostomy catheter (GC) may be an alternative for the administration of medications. However, the majority of medications are not formulated to be administered via a catheter[3].

According to the World Health Organization (WHO), patient safety is a serious global public health problem. One in ten patients may be prejudiced when receiving care at health facilities. The causes of errors are usually systemic, having multiple causes such as a disorganized work environment, lack of attention and/or concentration in the preparation of medications and lack of information about the medication and the patient[4].

Specifically regarding the administration of medications via the GC, few studies have been published by nurses at the national level[5]. However, the professionals responsible for the preparation and administration of the medications need to be able to evaluate the pharmaceutical form to be manipulated, the location of the catheter and the possible interaction of enteric nutrition (EN) with the drug. Obstruction of the catheter is directly linked to improper administration of medications and foods, as a result of not irrigating after use[2-3,6]. The lack of this practice triggers discomfort for the patient and increases the workload for the health team, which may involve clearing the catheter or even changing it.

Liquid formulations are the best choice due to the low probability of catheter obstruction. However, not all liquid forms can be administered via this route. It is important to note that excipients (such as glycerol, propylene glycol and sorbitol) and the high osmotic concentration of some preparations may cause undesirable adverse effects, increasing the risk of gastrointestinal intolerance. The degree of viscosity, pH and size of the particles in suspension also need to be considered to avoid catheter obstruction[7-8].

In four studies conducted between 2010 and 2012, it was verified that the majority of medications administered by catheters in hospitals in Brazil were reported to be in the solid form[9-12], characterizing an evident predominance of prescriptions for this form. However, in preparing medications in the solid form for administration via GC, it is necessary to know how to triturate them, when not triturated, with what and how much liquid to use in the dilution. As a consequence of the trituration, the crushed medication may stick to the wall of the catheter and there may also be modifications in the bioavailability of the active compound of the medication[3,9,13].

Studies[7,14] mention the difficulty in obtaining technical information from manufacturers compatible with the literature. They have reported the divergence of information from other sources in 30% of the medicines analyzed, taking the manufacturer as the reference. They further pointed out that a medication used differently from that prescribed by the manufacturer constitutes an off-label practice, which means that the use is not authorized by a regulatory agency; however, this does not imply that it is incorrect.

In one study[9] there was a significant error rate in the preparation of GC medications in solid or liquid formulations. The study considered the aspects of trituration, dilution and mixing of medications. Since the drugs are not manipulated for the purpose for which they were developed, their use is based on empiricism[15]. Therefore, it is relevant to identify the oral and GC medications that are most used in hospital units, since, from the precise investigation of the most prescribed medications, it is possible to establish procedures that assist in the proper preparation and administration to maintain the safety of the patient. Thus, the present study aimed to present specific recommendations for the preparation and administration for the GC route of a group of anti-infective medications at an Emergency Unit (EU) of a University Hospital (UH) in southern Brazil.

METHOD

This was a quantitative, exploratory and descriptive, cross-sectional study, developed in the EU of a UH in southern Brazil. This hospital exclusively functions within the Brazilian Nation Health System (Sistema Único de Saúde - SUS), being a reference in the region for several specialties.

This study is part of a larger research project, which sought to construct management and care technologies applied to the adult patients using catheters as the medication administration route. For this, an investigation was carried out with the prescriptions of the patients hospitalized in the EU of the UH, between April and October 2015. At least one medication prescribed by the oral and GC routes, with fixed administration times, was sought. The data were collected once a week for 27 weeks, using a form, which sought data regarding the date of admission, name of the medication, form, dose, route and prescribed administration regimen, considering the patients hospitalized at that time.

A database was constructed in the Statistical Package for the Social Sciences (SPSS), version 21.0, program, aiming for the descriptive analysis of the frequency of the oral and GC medications most used in this service(16). After the initial analysis, the identified medications were separated by group of action, according to the Medication Standardization Manual (2014)[17] of the study institution.

The qualitative step of the study was elaborated from the construction of a list of all the drugs prescribed from the group of action with the highest frequency in the study: anti-infective drugs. Information was sought regarding any restriction in GC administration, as well as the particularities of the preparation technique and other relevant considerations associated with the use of this route. In addition, alternative pharmaceutical forms for GC administration and other routes when available from the institution and the market were included. Both the restrictions and recommendations were constructed through a non-systematic review of the literature, in publications related to the subject and in nursing manuals of medications and based on consultation with the manufacturers, through the website of the Brazilian Health Regulatory Agency (ANVISA).

The bibliographic search was considered to be non-systematized, because it was difficult to obtain studies that indicated specific recommendations for the use of the drugs via GC. In this way, an expanded search in the Virtual Health Library (VHL) was performed by combining the following keywords: profile and medications via catheter. This study was developed in the second half of 2016 and its results included scientific articles, dissertations/theses and the manuals of institutions such as the Sírio Libanês Hospital (São Paulo/SP) and Risoleta Tolentino Neves Hospital (Belo Horizonte/MG), considering the period of up to five years previous.

The study was approved by the Research Ethics Committee in the Health Area of the University to which it is linked, under authorization number 17/2015.

RESULTS

During the data collection period, a total of 568 valid prescriptions were obtained for analysis, with a mean of 8.5 days of hospitalization of the patients in the EU being verified. It was identified that the length of hospitalization ranged from a minimum of one day to a maximum of 62 days.

Initially, a general profile of the medications prescribed in the EU for oral and GC routes was created, in which 143 different medications were identified. These medications were then classified by their action group, according to the Medication Standardization Manual (2014)[17] of the research institution. The most used class of medications was anti-infective agents, with 37 (25.9%) of the total. The medication Sulfamethoxazole + Trimethoprim presented two dosages (400mg + 80mg and 800mg + 160mg), which were added in the final quantitative analysis. In this group of medications, solid forms predominated and 83.3% of the drugs had some restriction for use via catheter, requiring substitution with other forms.

Table 1 presents the medications of the anti-infective action group verified in the study, showing results referring to the pharmaceutical form prescribed in the institution, its pharmacological action and whether there is a restriction for GC use or not. The drugs featured are those that showed the

highest individual frequencies.

Table 1 - Anti-infective medications, prescribed for oral and/or gastrostomy catheter use in the Emergency Unit of a University Hospital. Rio Grande, RS, Brazil, 2017 (continues)

Name of the drug (dose)	Trade name / Presentation	Pharmaceutical form found in the study	Pharmacological action	Administration via Catheter Y = YES N = NO Y* = YES WITH RESTRICTIONS
Abacavir (300mg)	Ziagenavir® ABC	Coated tablet	Antiretroviral	Y*
Aciclovir (200mg)	Zovirax®	Simple tablet	Antiviral	Y
Albendazole (400mg)	Zentel®	Chewable tablet	Antiparasitic	N
Amoxicillin (500mg)	Amoxil®	Hard gelatine capsule	Antibacterial	Y*
Amoxicillin + Clavulanate Potassium (500mg + 125mg)	Clavulin®	Coated tablet	Antibacterial	Y
Ampicillin (500mg)	Binotal®	Hard gelatine capsule	Antibacterial	N
Azithromycin (500mg)	Zitromax®	Coated tablet	Antibacterial	N
Ciprofloxacin (500mg)	Cipro®	Simple tablet	Antibacterial	Y*
Clarithromycin (500mg)	Klaricid®	Coated tablet	Antibacterial	N
Clindamycin (300mg)	Dalacin®	Hard gelatine capsule	Antibacterial	Y*
Dapsone	-	Simple tablet	Antifungal	Y*
Efavirenz (600mg)	Stocrin® EFZ	Coated tablet	Antiretroviral	N
Ethambutol + Isoniazid*	-	Coated tablet	Tuberculostatic	N
Fluconazole (150mg)	Zoltec®	Hard gelatine capsule	Antifungal	Y*
Itraconazole (100mg)	Sporanox®	Hard gelatine capsule	Antifungal	N
Ivermectin (6mg)	Revectina®	Simple tablet	Antiparasitic	N
Lamivudine (150mg)	Epivir® 3TC	Coated tablet	Antiretroviral	Y
Lamivudine + Zidovudine (150mg + 300mg)	Biovir®	Coated tablet	Antiretroviral	Y
Levofloxacin (500mg)	Levaquin®	Coated tablet	Antibacterial	Y*
Lopinavir + Ritonavir	Kaletra®	Coated tablet	Antiretroviral	N
Metronidazole (400mg)	Flagyl®	Coated tablet	Antibacterial and Antiparasitic	N
Nitrofurantoin	Macrodantina®	Simple tablet	Antibacterial	N
Ofloxacin (600mg)	Flogirax®	Coated tablet	Antibacterial	N
Oseltamivir	Tamiflu®	Hard gelatine capsule	Antiviral	Y*
Pyrazinamide * (500mg)	-	Simple tablet	Tuberculostatic	Y*
Pyrimethamine (25mg)	Daraprim®	Simple tablet	Antiparasitic	Y
Primaquine (15mg)	Primakinder®	Dragée	Antiparasitic	N
Raltegravir (400mg)	Isentress®	Simple tablet	Antiretroviral	N
Rifabutin (150mg)	Mycobutin®	Simple tablet	Antibacterial and Tuberculostatic	Y*
Rifampicin + Isoniazid + Pyrazinamide + Ethambutol	RHZE®	Coated tablet	Tuberculostatic	N

Ritonavir (100mg)	Norvir® RTV	Soft gelatine capsule	Antiretroviral	N
Sulfadiazine (500mg)	Suladrin®	Simple tablet	Antibacterial and Antifungal	N
Sulfamethoxazole + Trimethoprim – (400mg + 80mg and 800mg + 160mg)	Bactrim®	Simple tablet	Antibacterial e Antifungal	N
Telzir	Fosamprenavir®	Coated tablet	Antiretroviral	N
Tenofovir	Vired® TDF	Simple tablet	Antiretroviral	N
Tenofovir + Lamivudine*	-	Coated tablet	Antiretroviral	N

*Non-commercial drugs, available only in public health services[2].

In this group, 15 (40.6%) of the medications came as coated tablets, followed by 13 simple tablets (35.1%), 6 hard gelatin capsules (16.2%), 1 soft gelatin capsule (2.7%), 1 dragée (2.7%) and 1 chewable tablet (2.7%). Of these medications, 23 (62.2%) have another substitution option for administration, such as oral suspension or injectable solution.

Among all the prescribed medications in this group, 22 (59.4%) cannot be administered via the GC and 10 (27%) can, however, with some type of restriction, highlighting the urgent need for a care procedure related to this topic.

DISCUSSION

It is known that the route of administration to be used depends on the form of the medications available and the clinical condition of the patient. However, in this and other studies[7,10-12,14-15,18], a high proportion of solid forms was found, which have the possibility of being exchanged for liquid forms for gastrointestinal or even intravenous routes. Considering the safety of the patient in the case of catheter use, preference should be given to liquid forms, such as suspensions, syrups and solutions[8].

The group of anti-infectious drugs is the set of medications and formulas responsible for fighting bacteria, viruses, parasites and fungi. They constitute the medication class with the second greatest financial impact for health institutions[19]. Of the medications found, the antibacterial, antiparasitic, antifungal, antiviral, antiseptic, scabicidal and pediculicidal classes were highlighted. The use of various anti-infective agent subgroups is justified by the high complexity of the clinical cases that are treated in the EU and by the long period of hospitalization of the patients in that unit. In this group, Clarithromycin, Sulfamethoxazole + Trimethoprim, Pyrimethamine and Azithromycin were the most frequently prescribed drugs.

Albendazole was prescribed in the form of a chewable tablet, however, is also available on the market in the form of a simple tablet and an oral suspension. The manufacturer does not report the preparation that should used be in cases of GC administration, only that tablets should be chewed or taken with water[20]. However, one author reported in her manual that oral tablets are designed to be absorbed by the oral mucosa and overcome the effects of first-pass metabolism of the liver[21], which would contraindicate catheter use.

Another drug that cannot be triturated is Sulfamethoxazole + Trimethoprim, as the active compound and excipients may cause catheter obstruction. It is easily substitutable as it is available in the institution as an oral and injectable suspension[2,7,20,22].

The capsules of Fluconazole and Amoxicillin should be opened and their components mixed in water for complete solubilization and then administered via the GC[2,18,22-23]. However, it is indicated that an alternative substitution should be sought, since there is a risk of loss of capsule contents causing underdosing[21]. The manufacturers do not mention another route of use other than the oral route, in which the capsules must be ingested whole[20]. Some authors[18,22] reported no studies on efficacy,

safety and pharmacokinetics, and do not advise GC administration, suggesting its replacement with oral (Amoxicillin) or injectable suspension (Fluconazole).

The granules of the Itraconazole capsule do not dissolve in water, which prevents it from being administered via GC. If given orally, it should be immediately after a meal to obtain the maximum degree of absorption. Due to the absence of another replacement alternative, it is suggested that the drug be replaced by a similar active compound[20-22]. For Amoxicillin + Clavulanic Acid, the use of the oral suspension is also indicated and the manufacturer does not mention GC administration[20-21].

In the case of Azithromycin, Metronidazole and Sulfadiazine, the manufacturers only report oral administration, as indicated in the package insert[19], and do not recommend that these medications be chewed. This indicates that they their form of presentation should not be altered. Some authors[2,18,22,24] recommend replacement of Azithromycin and Metronidazole tablets with an oral or injectable suspension as, if crushed, these tablets may lead to obstruction of the catheter. If the choice is oral suspension, it needs to be administered one hour before or two hours after EN, as there is a significant reduction in availability and efficacy when given simultaneously[18,22].

Other drugs that may interact with EN are Ciprofloxacin, Clindamycin, Levofloxacin, Dapsone, Oseltamivir and Rifabutin. They can be administered via GC, however, they must be separated from the EN, as it can lead to decreased absorption. It is recommended to suspend EN an hour before and restart it one hour after the drug administration[14-15,18,21-22]. Other authors[2] further add that, in the case of Ciprofloxacin, gastric catheters produce a greater loss in absorption when compared to enteral ones. The injectable solution is a replacement alternative for the first three medications.

The literature advises against the medications Clarithromycin, Ampicillin, Ivermectin, Nitrofurantoin, Ofloxacin and Primaquine being administered via GC, since they do not present studies on efficacy, safety and pharmacokinetics. The alternative use of Clarithromycin and Ampicillin as an oral and injectable suspension and Nitrofurantoin as an oral suspension[2,18,20-22] should be evaluated. The combination drugs Ethambutol + Isoniazid and Rifampicin + Isoniazid + Pyrazinamide + Ethambutol (RHZE®) also do not present GC administration data, however, if used orally they should preferably be administered on an empty stomach[2,6,20].

Empirically, in the nursing care quotidian, it has been observed that this medication forms a paste when it is crushed and diluted in distilled water, requiring the use of warm water to better solubilize it. Therefore, it is believed that there is a greater risk of catheter obstruction, as well as the increased chances of underdosing, since it is more difficult to fully dissolve the medication. In addition, Pyrazinamide, which was also prescribed individually, can be administered via GC, preferably at the gastric level and separated from the EN. Since there is a risk of catheter obstruction, replacement with oral solution is suggested[2,23].

With immediate release solid drugs that do not have a replacement alternative on the market or in the institution, it is recommended to triturate until a fine powder is obtained, which can be dissolved in 15ml to 30ml of distilled water. However, attention should be paid to the controlled release tablets, since trituration changes the release profile, significantly affecting the pharmacological effect. In addition, the catheter should be flushed before and after each administration to avoid obstruction[8].

The use of antiretrovirals (ARVs) aims to improve the quality of life of the individual, prevent virus replication and minimize mortality among those infected[19]. In order to achieve the desired therapeutic goal, the drugs can not undergo changes in their composition.

Each class of drug attacks the HIV virus in a different way. Generally drugs of two or even three classes are combined to ensure a potent attack against the virus. The first class of drugs (nucleoside reverse transcriptase inhibitors) is indicated as the first-line therapy for HIV infection. The drug Abacavir (ABC) is used in combination with other ARVs. It is produced in the form of a coated tablet which, if given orally, may be ingested with or without food. However, with regard to catheter administration, the manufacturer does not mention the specificities of preparation and administration. It has an oral solution as a replacement alternative, which must be separated from EN. Care should be taken with possible hypersensitivity reactions, such as systemic respiratory and/or gastrointestinal symptoms, usually with fever. The oral solution contains saccharin and sorbitol in the composition, which can cause abdominal pain and diarrhea[2,19-20].

Lamivudine + Zidovudine is given as a fixed dose combination, which is more convenience for the patient. It was prescribed in the form of a coated tablet, and, because it is combined, it is not substitutable, only in separate forms, where Lamivudine (3TC) is available as an oral solution and Zidovudine (AZT) as an oral and injectable solution. The manufacturer reports that there is no problem in maceration of the tablets cited[20]. Lamivudine (3TC), which was also individually prescribed, is used for the prevention of the maternal-fetal transmission of HIV and for the treatment of chronic hepatitis B[19].

Closing the first class of ARVs, Tenofovir (TDF) was prescribed in its individual form and combined Tenofovir + Lamivudine in the form of coated tablet. This drug has no other substitution option available, and the manufacturer contraindicates trituration of the tablet[20].

Efavirenz (EFZ) is part of the second class of ARVs (non-nucleoside reverse transcriptase inhibitors) and is used in combination with other ARVs. It should preferably be given at night and on an empty stomach. Alternatively, the oral solution may be substituted, since the tablet is difficult to triturate and the coating may obstruct the catheter[2,19,21].

Fosamprenavir is a member of the third class of ARV (protease inhibitor) medications and is one of the medications of choice at the start of treatment. The manufacturer reports that the tablet is intended for oral administration only; however, it has an oral suspension as an alternative substitution. There are no studies related to the pharmacokinetics in GC administration, however, if necessary, preference is given to the liquid formulation, separate from EN[20].

Lopinavir + Ritonavir was prescribed as a coated tablet, and the manufacturer only refers to oral administration and indicates the oral solution as a replacement alternative. Unlike other combination drugs that may be administered separately, Lopinavir is only available in combination with Ritonavir. It is important to highlight that this combination presents numerous and significant interactions[2,20]. Ritonavir (RTV), separately, has been prescribed as a soft gelatin capsule and has an oral solution as an alternative for GC administration, since the manufacturer advises that the drug cannot be broken, opened or chewed[2]. Finally, Raltegravir, from the fourth class (integrase inhibitors), was prescribed as a single tablet; however, there is no data available for GC administration[2]. Table 2 provides a synthesis of the guidelines for drug delivery via the catheter and the replacement alternatives available on the market.

Table 2 - Synthesis of guidelines for the administration of anti-infective drugs, via the catheter and the replacement alternatives available on the market. Rio Grande, RS, Brazil, 2017 (continues)

Name of the drug	Catheter Route Administration Guidelines	Replacement alternative
Abacavir	The manufacturer does not mention preparation and administration specificities[2,19-20].	Oral solution, which must be separated from EN.
Albendazole	The manufacturer does not mention preparation and administration specificities[20].	Simple tablet and oral suspension.
Amoxicillin	The capsules should be opened and their components mixed in water for complete solubilization[2,18,22-23].	Oral suspension.
Ampicillin	There are no studies on efficacy, safety and pharmacokinetics[2,18,20-22].	Oral and injectable suspension.
Azithromycin	The manufacturer does not recommend changing the form of presentation of these medications [20].	Oral suspension (one hour before or two hours after EN) and injectable[17,21].
Ciprofloxacin	Can be administered via GC, however, must be separated from EN, as it can lead to decreased absorption.	Injectable Solution.
Clarithromycin	There are no studies on efficacy, safety and pharmacokinetics[2,18,20-22].	Oral and injectable suspension.
Clindamycin	Can be administered via GC, however, must be separated from the EN, as it can lead to decreased absorption[14-15,18,21-22].	Injectable Solution.

Dapsone	Can be administered via GC, however, must be separated from the EN, as it can lead to decreased absorption[14-15,18,21-22].	None
Efavirenz	Replacement suggested, as the tablet is difficult to triturate and the coating may obstruct the catheter[2,19,21].	Oral solution.
Ethambutol + Isoniazid	The manufacturer does not mention GC preparation and administration specificities[2,6,20].	None
Fluconazole	The capsules should be opened and their components mixed in water for complete solubilization[2,18,22-23].	Injectable.
Itraconazole	The granules of the capsules do not dissolve in water, which prevents GC administration[20-22].	Due to the absence of replacement alternative, the substitution of the drug with another with a similar active compound is suggested[19-21].
Ivermectin	There are no studies on efficacy, safety and pharmacokinetics[2,18,20-22].	Oral and injectable suspension.
Levofloxacin	Can be administered via GC, however, must be separated from EN, as it can lead to decreased absorption[14-15,18,20-22].	Injectable Solution.
Lopinavir + Ritonavir	The manufacturer does not mention preparation and administration specificities. It is important to note that this combination presents numerous and significant interactions[2,20].	Oral solution.
Metronidazole	The manufacturer does not recommend changing the form of presentation of these medications[20].	Oral and injectable suspension (one hour before or two hours after EN)[17,21].
Nitrofurantoin	There are no studies on efficacy, safety and pharmacokinetics[2,18,20-22].	Oral and injectable suspension.
Ofloxacin	There are no studies on efficacy, safety and pharmacokinetics[2,18,20-22].	Oral and injectable suspension.
Oseltamivir	Can be administered via GC, however, must be separated from the EN, as it can lead to decreased absorption[14-15,18,20-22].	None
Pyrazinamide	Preferably at the gastric level and separate from the EN[2,23].	Oral solution.
Primaquine	There are no studies on efficacy, safety and pharmacokinetics[2,18,20-22].	Oral and injectable suspension.
Raltegravir	No data are available indicating GC administration[2].	None
Rifabutin	Can be administered via GC, however, must be separated from EN, as it can lead to decreased absorption[14-15,18,20-22].	None
Rifampicin + Isoniazid + Pyrazinamide + Ethambutol	The manufacturer does not mention GC preparation and administration specificities[2,6,20].	None
Ritonavir	The manufacturer does not recommend changing the form of presentation of this medication[2].	Oral solution.
Sulfadiazine	The manufacturer does not recommend changing the form of presentation of these medications[20].	None
Sulfamethoxazole + Trimethoprim	It should not be triturated, since the active compound and the excipients may cause obstruction of the catheter[2,7,20,22].	Oral and injectable suspension.
Telzir	There are no studies related to the pharmacokinetics, however, if necessary, it is recommended that preference be given to the liquid formulation, separate from EN[20].	Oral suspension.
Tenofovir	Manufacturer contraindicates trituration of the tablet[20].	None
Tenofovir + Lamivudine	Manufacturer contraindicates trituration of the tablet[20].	None

SOURCE: The author (2017).

There is no single, comprehensive source in the literature that provides specific recommendations for administration via catheter of all the medications. Only the scientific journals, with studies that mainly focus on this theme, present some guidelines. Divergence among authors has proved to be a difficulty in this and other studies[7,25], in which 30.4% and 39.5%, respectively, of the medications presented divergence of information in relation to other sources.

The Manual of Nursing Medications[2] characterizes the drug and its properties, referring to oral or GC use; however, it does not present specificities when only solid presentations are available. The manufacturers, which would provide the reference guidelines, do not recognize the possibility of adapting the oral form to the GC route, hindering the correct direction to be followed, which, consequently, makes the professionals involved responsible for any consequences that may occur with patients undergoing this use.

In addition to the manufacturers, the commitment of the Ministry of Health and ANVISA should be highlighted with regard to stimulating, regulating and controlling the constitution of alternative pharmaceutical forms for anti-infective drugs, especially ARVs and tuberculostatics, since many patients with their respective pathologies are weakened and depend on the catheter to receive their medication treatment.

FINAL CONSIDERATIONS

The results found in this study evidenced solid forms of the medications prescribed to be administered via GC when the oral route becomes inadequate. However, for the majority of the medications, replacement options were available.

The lack of studies on the subject of administration of solid drugs by GC and the lack of information in the manufacturers' package inserts were considered limitations of the study. There was also divergence of information among articles and manuals, when found. Therefore, this work constitutes an important tool to support the health team in the appropriate choice for the GC route and can contribute to safety related to the preparation and administration of medications by this route.

It is suggested that permanent training is provided for the professionals and future studies are carried out for other groups of medications with the more used drugs, which are equally important in hospital units.

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