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Protocol for dilution of standardized anti-infective injectable drugs in the Public Hospital Network of the state of Tocantins

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***Keywords*— Medication errors.**

***Abstract*—** *Antimicrobials act on microorganisms by inhibiting their growth or causing their destruction, and their misuse leads to increased health-related costs. Failures in dispensing and administration mean that the last barriers to patient safety, where errors could be avoided, have been broken. Thus, safe and effective strategies are needed in institutions to ensure health care quality by minimizing the occurrence of medication errors. To develop a dilution protocol to assist health professionals in preparing standard injectable anti-infective drugs in the Public Hospital Network of the State of Tocantins. This is documental, descriptive research, carried out through the analysis of anti-infectiousinjectable drugs, developed by consulting information from sources such as the*

Medication dilution. Patient Safety

Handbook on Injectable Drugs (Trissel), clinical and hospital pharmacy books, as well as laboratory package inserts and pharmaceutical guides. From the 108 standardized anti-infective drugs, 40 injectable drugs were analyzed. Therefore, it is essential to understand the different medication processes, how to develop them, recognize the possible weaknesses, propose measures for their prevention and improve patient safety. The implementation of a protocol of dilution and stability for the administration of injectable anti-infectious drugs is of great importance aiming to minimize the rate of errors related to drug preparation.

I. INTRODUCTION

Antimicrobials are natural or synthetic substances that act on microorganisms by preventing their growth or causing their destruction [1]. Their improper and exacerbated use leads to increased health-related costs, as well as increased microbial resistance. These factors can worsen infectious diseases, increasing the number of adverse reactions and hospitalization times [2, 3].

A medication error is determined as any avoidable event that may cause or induce inappropriate use of medication, or harm the patient, at any stage of drug therapy. Medication errors are one of the most common failures in health care [4]. The identification of these errors can assist in the development of new practices that ensure the appropriate and rational use of medicines, continuously improving patient safety [5].

The rational use of antimicrobials should be guaranteed, as the administration of a dose below or above the prescribed or recommended one may impair the outcome of therapy, causing ineffectiveness or toxicity of the treatment, respectively. Furthermore, antibiotics act on invading bacterial cells and also alter the host's natural microbiota, which represents an additional risk for the hospital, due to the viability of selecting resistant bacteria [6].

The medication practice in the hospital environment can be determined as a complex system. With several indispensable processes, independent and constituted by a multidisciplinary team that includes professionals from different areas of knowledge (physicians, pharmacy, and nursing staff), having a common goal, the provision of health care to patients with quality, efficacy, and safety [7].

As for drug preparation, where dilution is performed, scientific principles must be applied, ensuring the expected therapeutic result. Therefore, it is necessary to know what to dilute, the amount to be administered in the peripheral and/or central venous access, how long the administration can be prepared, and under which environmental conditions (light, temperature, and humidity) [8,9].

Several segments are concerned about establishing activities that collaborate with the rational use of medications in the hospital environment. In this context, a protocol for drug dilution can help prepare and administer injectable drugs, with information accessible to all involved [10].

Failures in the form of dispensing and administration mean that the last barriers to patient safety, where errors could be avoided, have been broken. Therefore, safe and effective strategies are needed in institutions to ensure health care quality by minimizing the occurrence of medication errors [11].

Considering the need for a tool aimed at patient safety, this work aimed to develop a dilution protocol to assist health professionals in preparing standard injectable anti-infective drugs in the Public Hospital Network of the State of Tocantins.

II. MATERIALS AND METHODS

This is documental, descriptive research, carried out through the identification and analysis of the standardized anti-infective injectable drugs in the Public Hospital Network of the State of Tocantins (Portaria/SES/GASEC Nº 425, from August 19, 2020) [12].

In this list of hospital drugs, from the 665 items divided into 18 therapeutic groups, we used those from group 5 - Anti-infectious Diseases, which includes 40 injectable drugs. Only the injectable anti-infective drugs were included in the study, excluding the other pharmaceutical forms. The table was developed by consulting technical-scientific information in sources such as Handbook on Injectable Drugs, 15th edition (Trissel), clinical and hospital pharmacy books, as well as laboratory package inserts and pharmaceutical guides. The research data were grouped and tabulated using the Word for Windows® program tool, with the outcome being a didactic-institutional material for a quick consultation. There was no need to submit to the Research Ethics Committee, resolution of the CNS (466/2012) because this is research

whose information was obtained in materials already published and available in the literature.

III. RESULTS AND DISCUSSION

Of the 108 standardized anti-infective drugs, 40 injectable drugs were analyzed. The analyzed data were inserted into a table, which presents the active ingredient, route of administration, reconstitution, and dilution, stability after reconstitution and dilution, infusion time, and additional observations with such drugs. This material, represented in Chart I, was developed in a way that it can be updated, containing the procedures and the sources of each information obtained.

on the importance of the work or suggest applications and extensions.

Given the results, several studies have detected that the administration of antibiotics requires strict control as to the timing and appropriate dilutions in order not to compromise their stability and selection of resistant bacterial strains. Adverse events in inadequate administration may occur, affecting the safety and quality of the patient's medication The administration of the correct dose, concentration, and infusion time of an antibiotic is largely dependent on the entire multidisciplinary team at the hospital [20,21,22,23].

Conducted a study in a university hospital, where he asked nurses to write down doubts presented by nursing assistants and technicians, regarding the preparation and administration of medications and evidenced that most (40.4%) were related to dilution [24]. In 2020, a study found that the higher doses and volumes of diluents can influence the form of preparation and administration of the medication and lead to therapeutic failure [20].

In research related to antimicrobial dilution errors, 416 prescriptions that needed to be diluted were examined, and it was found that the degree of dilution was not specified in 39.7% of the drugs, and among those prescribed, 57.1% were not correct. Therefore, when dilution is not performed correctly, it can cause adverse consequences to the patient, such as incompatibilities and increased treatment time. Thus, the dilution must occur precisely, minimizing risks for the patient and the hospital community [25].

In a hospital analysis about prescription errors of injectable drugs, 1,386 prescriptions were examined, of these, 184 errors were found, 30.43% correspond to prescriptions that did not contain any observation regarding the time of drug infusion. The identified dilution errors showed a rate of 14.13%, of these, 10.87% are related to incorrect dilution, causing therapeutic ineffectiveness, loss of stability, besides risks to the patient's health. It was also identified prescriptions with the omission of data on the dilution in 3.26%, leading to error in the preparation and administration of medicines [26].

Thus, dilution errors can lead to therapeutic failure, increased costs for institutions, unwanted reactions in patients, and affect the quality of care [25].

As for the infusion speed of drugs, it must be observed and precisely performed, because the administration time is related to classic adverse reactions, such as the "red man syndrome", which results from a rapid infusion of vancomycin. It is therefore fundamental to determine the infusion rate in the prescription, considering the best scientific evidence available, preventing the occurrence of preventable adverse events [27].

In another study, 3,931 prescriptions were analyzed. After checking the pharmaceutical interventions, 16 types of errors were identified, such as illegible prescriptions (6.6%), lack of information such as prescriptions without dose (18.2%) and absence of route of administration (7.2%), as well as errors related to dilution and/or time of drug infusion were found with 5.3% of cases [28]

A study examined 79 prescriptions for antimicrobials, and regarding the errors in prescriptions, it was verified that most of them had the absence of the route of administration (92.4%), followed by the absence of posology (51.9%), absence of dose (49.4%), and contraindicated abbreviation (40.5%) [29]. Reinforcing the need for greater awareness of prescribing professionals and the participation of pharmacists in the process of reviewing prescriptions before dispensing.

Although the medicine is safe in its intrinsic sense. This is not enough; it is necessary to ensure safety in its use process [30]. Thus, to deal with the problem of medication errors among hospitals, it is essential to understand the different medication processes, how they develop and recognize possible weaknesses, to propose measures for their prevention and improve patient safety [31]

Chart I - Dilution protocol for injectable anti-infective drugs standardized in the Tocantins State Hospital Network.

ACTIVE INGREDIENT AND PRESENTATION	WAY OF ADM.	REBUILDING / STABILITY	DILUTION/STABILITY	INFUSION TIME	REMARKS ADDITIONALS	REF.
ACYCLOVIR 250MG CYLINDER BOTTLE	EV	500mg - 10mL AD 1g - 20ml AD 12h TA (do not refrigerate)	100ml - SF 0.9%, SG 5%, SRL 24h TA	1h (slowly)	Rapid IV administration and other routes should be avoided.	[13]
AMICACIN SOL. INJETABLE 50MG/ML - 2ml 250MG/ML - 2ml	EV	-	100-200ml 0.9% SF, 5% SG 24h TA or 48h Under Ref.	30 - 60min	Direct EV does not apply. Maximum dose: 1.5g/day.	[13, 14, 15, 16]
	IM	-	-	-	-	
AMPICILLIN 500MG and 1G CYLINDER BOTTLE	EV	500mg - 5ml AD 1g - 7.4ml AD 1h TA or 4h Under Ref.	50 - 100ml 0.9% SF 8h TA or 24h Under Ref.	Direct EV: 3 - 5min (500mg) 10 - 15min (> 500mg) Intermittent: 15 - 30min	Reduced stability when used in SG. Maximum dose: 12g/day.	[13]
	IM	2 - 3ml (Deep)	-	-	-	
AMPICILLIN 1g + SULBACTAM 500mg AMPICILLIN 2g + SULBACTAM 1g vial	EV	3.2ml (1.5g) and 6.4ml (3g) AD 8h TA or 72h Under Ref.	50 - 100ml SF 0.9%/ 8h TA	Direct EV: 10 - 15min Intermittent: 15 - 30min	Reduced stability when used in SG. In SG 5%: 2h RT or 4h under ref. Maximum dose: 12g/day.	[13,15,16,17]
	IM	3.2ml (1.5g) and 6.4ml (3g) AD, Lidocaine 0.5 or 2% Must be used within 1h	-	-	-	
AMPHOTERICIN B 50MG VIAL-AMP	EV	10ml AD or proper diluent 24h AT or 7 days Under Ref. and protected light	490ml SG 5%. Immediate use	2h - 6h	SF or preservatives should not be used (precipitation). For administration use a protective pouch and light-sensitive	[13, 18]

					equipment. Store FA intact under ref. and protected from light.	
AMPHOTERICIN B 50MG LIPOSOMAL CYLINDER BOTTLE	EV	12ml AD 24h Under Ref. protected from light	25 to 250ml SG 5% (1:1 to 1:19 from reconstituted) 6h Under Ref.	2h	Incompatible with DES and electrolytes. The end of the syringe should be attached to the 5-micron filter supplied with the medication to aspirate the contents of the vial and insert it into the bag.	[13, 15, 16, 17, 18]

ACTIVE INGREDIENT AND PRESENTATION	WAY OF ADM.	REBUILDING / STABILITY	DILUTION/STABILITY	INFUSION TIME	REMARKS ADDITIONALS	REF.
ANIDULAFUNGIN 100MG VIAL-AMP	EV	30ml of proprietary diluent 1h Under Ref.	SF 0.9% or SG 5% - Attack dose on day 1 200mg/day diluted in 200ml After 100mg/day dilute to 100ml 24h Under Ref.	90min	-	[15, 18]
BENZYLPENICILLIN BENZATHINE VIAL 600,000IU and 1,200,000IU	IM	2 - 4ml AD Immediate use	-	-	Administration exclusively by deep IM route	[16]
BENZYLPENICILLIN POTASSIUM AMPOULE 1,000,000IU and 5,000,000IU	EV	2 - 10ml AD 24h TA or 7 days Under Ref. 6-5 T	50 - 100ml 0.9% SS, 5% SG 24h TA or Under Ref.	30 - 60min	Final volume after reconstitution is 12 ml (5,000,000 IU)	[13, 15 18, 19]
	IM	3.5ml AD	-	-	-	

		24h TA or 7 days Under Ref.				
BENZYLPENICILLIN POTASSIUM 100,000UI+ PENICILLIN PROCAINATE 300,000UI VIAL-AMP	IM	2ml AD Immediate use	-	-	Deep and slow IM use	[15]
CEPHALOTHIN 1G CYLINDER BOTTLE	EV	10ml AD 12h TA or 96h Under Ref.	100ml 0.9% SF, 5% SG 12h TA or 7 days Under Ref.	Direct EV: 3 - 5min Intermittent: 30 - 60min	-	[14,18]
	IM	5ml AD	-	-	-	[19]
CEPHAZOLINE 1G CYLINDER BOTTLE	EV	2.5ml AD 24h TA or 10 days Under Ref.	Direct IV: 10ml AD. IV intermittent: 50 - 100ml SF 0.9%, SG 5%. 12h TA or 24h Under Ref. (protected from light)	Direct EV: Slowly 3 - 5min Intermittent: 30 -60min	Store the bottles in AT protected from light. IV: do not mix with other medication. Maximum dose: 6g/day.	[13,14,15 16, 17]
	IM	2.5 ml Lidocaine 0.5%, AD	-	-	-	
CEFEPIMA 1G and 2G CYLINDER BOTTLE	EV	. 5 - 10ml AD, SF 0.9% or SG 5% 24h TA or 7 days Under Ref.	50 - 100ml SF 0.9% or SG5%. 24h TA or 7 days Under Ref.	Direct EV: 3 - 5min Intermittent: 20 - 30min	Store intact vials at 2°C to 25°C protected from light.	[13,15,17]
	IM	Doses up to 1g (volume < 3.1ml) AD, SS 0.9%, SG5%, lidocaine 0.5 or 1% 24h TA	-	-	The maximum dose for the IM route is 1g at a single site. A maximum IM dose of 2g (6.2ml), should be administered at two sites.	

ACTIVE INGREDIENT AND PRESENTATION	WAY OF ADM.	REBUILDING / STABILITY	DILUTION/STABILITY	INFUSION TIME	REMARKS ADDITIONALS	REF.
CEFOTAXIME 1G CYLINDER BOTTLE	EV	10ml AD 24h TA or 7 days Under Ref.	50 - 100ml 0.9% SS, 5% SG 24h TA or 5 days Under Ref.	Direct EV: 3-5min Intermittent: 20-30min	-	[13]
	IM	3ml AD or Lidocaine 1% S/V 12h TA or 7 days Under Ref.	-	-	-	
CEFTAZIDIME 1G CYLINDER BOTTLE	EV	10ml AD 24h TA or 7 days Under Ref.	50 - 100ml SF 0.9%, SG 5% 24h RT or 7 days Under Ref.	Direct EV: 3-5min Intermittent: 15-30min	Reconstitution generates some carbon dioxide bubbles, but this is eliminated in 1 to 2min. Reconstituted solutions range from light yellow to amber. Maximum dose: 6g/day.	[13,15,17]
	IM	3ml AD or lidocaine 0.5-1.0% S/V 24 TA or 7 days Under Ref.	-	-	-	
CEFTAZIDIME 2000MG + AVIBACTAM 500MG POWDER FOR SOLUTION FOR INFUSION VIAL	EV	10ml AD Immediate use	100ml SF 0,9% , SG 5%, RL 12h TA or 24h Under Ref.	2h	It should be stored in TA and protected from light.	[17]
CEFTAROLINE FOSAMILA 600MG POWDER FOR SOLUTION FOR INFUSION VIAL	EV	20ml AD 6h TA or 24h Under Ref.	250ml 0.9% SF, 5% SG 6h TA or 24h Under Ref.	1h	Store at 2 to 8°C.	[17,18]
CEFTRIAXONE IV 500 MG and 1G Cylindrical Bottle	EV	5ml (500mg) and 10ml (1g) AD IV. Direct 10-20ml of saline solution 2 days TA or 10 days Under	50-100ml SF 0.9%, SG5%. 24h TA or 3 days Under Ref.	Direct EV: 2-4min Intermittent: 15-30min	Store at RT protected from light. After reconstitution, normal exposure to light is permitted. Incompatible with	[13,17,18]

		Ref.			calcium-containing solutions such as ringer and ringer lactate.	
CEFTRIAXONE IM 500MG VIAL-AMP	IM	3.6ml AD or lidocaine 1% S/V 6h TA or 24h Under Ref.	-	-	-	[15,17]
CEFUROXIME 750MG VIAL-AMP	EV	8.3ml AD 24h TA or 48h Under Ref.	50-100ml SF 0.9%, SG 5% 24h RT or 7 days Under Ref.	Direct EV: 3-5min Intermittent: 15-60min	It should be protected from light. It should not be mixed with sodium bicarbonate or aminoglycosides.	[13,17]
	IM	3ml AD 24h TA or 48h Under Ref.	-	-	-	

ACTIVE INGREDIENT AND PRESENTATION	WAY OF ADM.	REBUILDING / STABILITY	DILUTION/STABILITY	INFUSION TIME	REMARKS ADDITIONALS	REF.
CIPROFLOXACIN 2MG/ML SOLUTION INJECTABLE 100ML POUCH	EV	-	-	60min	Infusion should be slow, in a large-caliber vein, to minimize patient discomfort and reduce the risk of venous irritation. A light-sensitive infusion set is not required.	[13]
CLARITHROMYCIN 500MG VIAL-AMP	EV	10ml AD 24h TA or 48h Under Ref.	250ml 0.9% SF, 5% SG 6h TA or 48h Under Ref.	60min	It should not be administered by direct IM and IV. It should be protected from light.	[13,16, 17,18]

CLINDAMYCIN 150MG/ML SOLUTION INJECTABLE 4ML AMPOULE	EV	-	Doses below 50mg - 50ml, and doses of 900mg or more - 100ml 0.9% SS, 5% SG or RL 24h TA	Intermittent: 10-60min	-	[13,15, 17]
	IM	Deep	-	-	IM - Do not dose > 600mg.	
CHLORAMPHENICOL 1G CYLINDER BOTTLE	EV	10ml AD 30 days AT (protected from light)	50-100ml 0.9% SS, 5% SS, RL 24h RT or under Ref.	Direct EV: 1min Flashing: 30min	After reconstitution discard the solution if it becomes turbid.	[13]
ERTAPENEM 1G CYLINDER BOTTLE	EV	10ml AD or SF 0.9%. (Dilute immediately)	50ml SF 0.9% 6h TA or 24h Under Ref. (Use within 4 hours of removal from refrigeration)	30min	Do not dilute in 5% SG.	[13,17]
	IM	3.2ml lidocaine 1% S/V (Administer within 1h)	-	-	-	
FLUCONAZOLE 2MG/ML SOLUTION INJECTABLE 100 ML POUCH	EV	-	-	1-2h	Store in RT, protected from direct light. Does not require a light-sensitive infusion line.	[13,16, 17]
GANCICLOVIR 500MG LYOPHILUS POWDER VIAL	EV	10ml AD 12h TA (do not refrigerate due to possible precipitation)	100ml 0.9% SF, 5% SG 24h AT and 48h Under Ref.	60min	Photosensitive. Handle with caution (teratogenic and carcinogenic potential). Do not mix with other IV drugs.	[15,16]

ACTIVE INGREDIENT AND PRESENTATION	WAY OF ADM.	REBUILDING / STABILITY	DILUTION/STABILITY	INFUSION TIME	REMARKS ADDITIONALS	REF.
GENTAMICIN SOLUTION INJECTABLE AMPOULE	EV	-	50-200ml SF, SG 5%. 2h TA	30 min-2 h	Administer with an interval of 1-2h with penicillins and 1h	[13,17,18]

20MG/ML-1ml 40MG/ML-1ml 40MG/ML-2ml					with cephalosporins, due to physical inactivation.	
	IM	Deep	-	-	-	
IMIPENEM 500MG + CILASTATIN 500 MG CYLINDER BOTTLE	EV	10ml 0.9% SF or 5% SG 4h TA or 24h Under Ref.	100ml - SF 0.9%, SG 5% 4h TA or 24h Under Ref.	20-30min	It should never be reconstituted with diluents containing lactate. Incompatible with sterile water for injection. Maximum dose: 4g/day.	[13,15]
	IM	2ml Lidocaine 1% S/V Use within 1h	-	-	-	
LEVOFLOXACIN 5MG/ML SOLUTION FOR INJECTION 100 ML POUCH	EV	-	-	At least 60min, doses of 750mg should be infused over 90min	It should not be administered by any other route, as well as in bolus. Store in AT and protected from light. Maximum dose: 750mg/day.	[13]
LINEZOLID 2MG/ML SOLUTION INJECTABLE 300 ML POUCH	EV	-	-	30min-2h	Store in AT and protected from light. The packaging should be kept in its protective wrapper until the moment of use. Maximum dose: 600mg Ev every 12 hours.	[15,16,17]
MEROPENEM 500MG and 1G Cylindrical Bottle	EV	10ml (500mg) and 20ml (1g) AD 2h TA or 12h Under Ref.	100ml - SF 0.9%, SG 5% 2h TA or 18h Under Ref (SF) 1h TA or 8h Under Ref (SG)	Direct EV: 3-5min Intermittent: 15-30min	After adding the diluent, shake to dissolve and let stand until the solution clears.	[13,16,17]
METRONIDAZOLE 5MG/ML SOLUTION INJECTABLE 100	EV	-	-	30min-1h	Store in AT and protected from light.	[13]

ML POUCH					Do not refrigerate (crystal formation). Maximum dose: 4g/day.	
MICAFUNGIN 50MG CYLINDER BOTTLE	EV	5ml 0.9% SF or 5% SG 24h TA	100ml - SF 0.9%, SG 5% 24h AT (protected from light)	60min	No light-sensitive equipment is required.	[13,16,18]

ACTIVE INGREDIENT AND PRESENTATION	WAY OF ADM.	REBUILDING / STABILITY	DILUTION/STABILITY	INFUSION TIME	REMARKS ADDITIONALS	REF.
OXACILLIN 500MG CYLINDER BOTTLE	EV	5ml AD or SF 0.9%. 3 days TA or 7 days Under Ref.	Direct: 500mg/5ml SF 0.9%, SG 5% Intermittent: 50-100ml of SS 0.9% or SS 5% 24h TA	Direct EV: 10min Intermittent: 15-30min	Caution in the elderly, as thrombophlebitis may occur.	[15,16,18]
	IM	3ml AD or SF 0.9%.	-	-	-	
PIPERACILLIN 4 G + TAZOBACTAM 500 MG VIAL	EV	20ml 0.9% SF or 5% SG 24h TA or 48h Under Ref.	50-150ml SF 0.9% or SG 5% 24h AT	30min	Incompatible with Ringer lactate.	[13,17,18]
POLYMYXIN B 500,000UI VIAL-AMPOULE	EV	10ml SG 5% or AD 72h Under Ref.	500,000IU added to 300-500ML SG 5%. 24h Under Ref.	60-90min	The vials should be stored in AT and protected from light.	[13,15,16,17]
	IM	2.0ML sterile water for injection, 0.9% SF or 1% procaine	-	-	IM administration is very painful and should be avoided.	
SULFAMETHOXAZOLE 80MG/ML +TRIMETHOPRIM 16MG/ML 5 ML AMPOULE	EV	-	125ml SG 5%; in case of hydric restriction: 75ml SG 5% 125 ml: 6h RT and 75ml 2h	60-90min	Do not dilute in SF. Do not refrigerate.	[13,16,17,18]

			RT			
TEICOPLANIN 200MG VIAL-AMP	EV	3 ml AD 24h Under Ref.	100ml 0.9% SF, 5% SG 24h TA	Direct EV: 3-5min (10ml) Intermittent: 30min	-	[13,15,18]
	IM	3ml AD	-	-	-	[17]
TIGECYCLINE 50MG LYOPHILUS POWDER VIAL	EV	5.3ml 0.9% SF 6h TA	100ml 0.9% SF, 5% SG 24h TA or 45h Under Ref.	30-60min	-	[13,15,16]
VANCOMYCIN 500MG VIAL-AMP	EV	10ml AD 24h TA or 14 days Under Ref.	100ml 0.9% SF or 5% SG 24h TA or 14 days Under Ref.	1h	Rapid infusion of vancomycin can cause red man syndrome.	[13,1516,18]

AD (Distilled Water), Ref (Reference), SF (Physiological Serum), SG (Glucose Serum), Under Ref (Under Refrigeration), RT (Room Temperature).

In his study that prescribers play a considerable role in the progress of rational use of medicines. So that their analysis in the prescription contributes to quality in therapy, an important step that should be performed by everyone involved with the patient's treatment, such as nurses, pharmacists, among others [32].

Thus, the contribution of hospital pharmacies to infection control in the hospital environment is extremely relevant. One of their main activities is to promote the rational use of antimicrobials, as well as to develop plans, preventive and educational measures in this area [33,34]. Also states that these measures, including clinical guidelines, professional interventions, and recommendations, are of utmost importance [35].

In his work, believes that the pharmacist can formulate measures to avoid the misuse of antimicrobials, high rates of hospital infection, prolonged mortality and length of hospital stay, and situations that can worsen the financial situation of hospitals and the population throughout the country's health system [36]. Therefore, the rational use of antibiotics is essential, not only for patients but also for health professionals and managers [37].

Thus, the pharmaceutical professional in the healthcare system represents one of the last opportunities to identify, correct or reduce possible errors associated with therapy. This professional is at the interface between drug distribution and use and can be considered a key player in quality assurance and medical care [38,39].

IV. CONCLUSION

In conclusion, the implementation of a dilution and stability protocol for the administration of injectable anti-infective drugs is of great importance to minimize the rate of errors related to drug preparation. It is a preventive measure, although simple, aimed at patient safety.

It is also worth mentioning the importance of the pharmacist and the other health professionals in conducting the appropriate pharmacotherapy for the patient, considering that this information must be followed carefully so that the patient receives adequate and safe treatment, one of the purposes of this tool.

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