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ERRORS IN THE PREPARATION AND ADMINISTRATION OF INTRAVENOUS DRUGS

ERROS NO PREPARO E NA ADMINISTRAÇÃO DE MEDICAMENTOS INTRAVENOSOS

ERRORES EN LA PREPARACIÓN Y ADMINISTRACIÓN DE MEDICAMENTOS INTRAVENOSOS

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Objective: to identify errors in the preparation and administration of intravenous drugs. Method: observational and descriptive study. 694 doses of intravenous medications performed by nursing professionals in adult patients were observed in the Emergency, Inpatient and Intensive Care Units of a small hospital in the recôncavo of Bahia, Brazil. Data were collected in March and April 2019, through non-participant observation, using two observation scripts as instruments. Descriptive variables were analyzed using the absolute and relative frequency distribution. Results: the occurrence of 60% of errors in the preparation technique and 75% of errors in the technique of administering intravenous drugs was highlighted. Conclusion: both in the preparation and administration of intravenous medications, errors in technique and time were identified, pointing out the need to implement strategies aimed at patient safety.

Descriptors: Medication Errors. Administration, Intravenous. Nursing, Team.

Objetivo: identificar os erros no preparo e na administração de medicamentos intravenosos. Método: estudo observacional e descritivo. Foram observadas 694 doses de medicamentos intravenosos realizadas pelos profissionais de enfermagem em pacientes adultos nas unidades de Emergência, Internamento e Unidade de Terapia Intensiva de um hospital de pequeno porte do recôncavo da Bahia, Brasil. Os dados foram coletados em março e abril de 2019, por meio da observação não participante, tendo como instrumentos dois roteiros de observação. As variáveis descritivas foram analisadas por meio da distribuição de frequência absoluta e relativa. Resultados: destacou-se a ocorrência de 60% de erros de técnica do preparo e 75% de erros de técnica de administração dos medicamentos intravenosos. Conclusão: tanto no preparo quanto na administração dos medicamentos intravenosos, foram identificados erros

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de técnica e de horário, apontando a necessidade de implementação de estratégias voltadas para a segurança do paciente.

Descritores: Erros de Medicação. Administração Intravenosa. Equipe de Enfermagem.

Objetivo: identificar errores en la preparación y administración de fármacos intravenosos. Método: estudio observacional y descriptivo. Se observaron 694 dosis de medicamentos intravenosos realizados por profesionales de enfermería en pacientes adultos en las Unidades de Urgencias, Hospitalización y Cuidados Intensivos de un pequeño hospital en el interior de Bahía, Brasil. Los datos se recolectaron en marzo y abril de 2019, mediante observación no participante, utilizando dos guiones de observación como instrumentos. Las variables descriptivas se analizaron mediante la distribución de frecuencia absoluta y relativa. Resultados: se destacó la ocurrencia de 60% de errores en la técnica de preparación y 75% de errores en la técnica de administración de fármacos intravenosos. Conclusión: tanto en la preparación como en la administración de medicamentos por vía intravenosa se identificaron errores en la técnica y en el tiempo, señalando la necesidad de implementar estrategias orientadas. a la seguridad del paciente.

Descriptores: Errores de Medicación. Administración Intravenosa. Grupo de Enfermería.

Introduction

Error can be defined as a preventable occurrence with the potential to cause unnecessary harm to the patient. Adverse event (AE) is the incident that results in harm to the patient[1]. These incidents, which affect patient safety, are considered a health problem with international repercussions. In the United States, a high number of deaths is observed annually due to errors and AEs, with a higher mortality rate than those related to traffic accidents, lung cancer or acquired immunodeficiency syndrome[2]. Brazil has one of the highest rates of avoidable AEs in the world[3].

In Brazil, in 2016, most reported healthcare-related events, including AEs, were classified as events that caused mild-degree damage, followed by no harm. There were 276 reported adverse events that resulted in death in the same year[4].

The Bulletin of Patient Safety and Quality in Health Services makes available to the National Health Surveillance System (NHSS), through the NOTIVISA System, the results obtained from the analysis of healthcare-related data reported by the Centers of Patient Safety (CPS) of health services in Brazil. According to this bulletin, in 2016, among the reported deaths resulting from AE related to health care, the most frequent occurred in the categories classified as "other" and in "Failures during health care", in which medication errors are included. Thus, even with the possibility of underreporting of adverse events in our country, medication errors are important causes of death among the adverse events reported in health care[4].

The American Society of Health System Pharmacists (ASHP) defines medication errors as any preventable event that may cause or lead to inappropriate use of medications or harm to the patient while the medication is in the control of the health professional, patient or consumer[5].

Recently, the World Health Organization launched the third global challenge entitled "Medication without Harm", aiming to continue raising awareness of health institutions and governments, because medication errors still occur on a large scale, causing harm to patients[6].

In Brazil, the National Patient Safety Program (NPSP), established by Ordinance MS/GM n. 529 of April 1, 2013, advocates the development and implementation of a set of basic protocols to minimize errors and AEs. Among the patient safety priorities, problems related to the prescription and administration of medications deserve to be highlighted, since they are responsible for the greater number of adverse events in health institutions[7].

The error is considered, in the Swiss Cheese Theory, created by James Reason, as part of the human being. That is why the possibilities of making mistakes will never be nullified. However, it is possible to transform the environment where humans act, making it

safer, with drawings of systems and methods that avoid errors, preventing them from permeating the multiple and incomplete layers of protection and causing devastating damage. Thus, errors in health care are neither voluntary nor individual attitudes. They are consequences of a sequence of events, not of a single isolated act, and are related to a context and the development of a care process that needs to be rethought[7-8].

Although the preparation of medicines requires scientific knowledge in hospital institutions, nursing professionals usually perform it as a simple and routine task. However, inadequate management of medications can reduce microbiological safety and therapeutic efficacy, bringing undesirable consequences to patients or modifying the expected therapeutic outcome[8]. To ensure this result, scientific principles should be applied in the preparation and administration of intravenous drugs, in addition to ensuring the administration of the right medication, also considering the right pharmaceutical form, patient, time, route, dose, action, registration and monitoring[9].

Thus, the preparation and administration of intravenous drugs is the work of the nursing team that acts at the tip of the medication process, being the last opportunity to intercept the occurrence of possible error in this process. However, in a small-sized hospital in Bahia's bay, there was a low frequency of notification of errors in the preparation and administration of intravenous drugs, indicating possible underreporting, due to the fact that, since the implementation of the notification form of adverse events in 2017, until April 2019, there were only nine notifications of errors related to the preparation and administration of medications.

Considering that intravenous drugs pose potential risks to the patient, due to their rapid action in the bloodstream, the present study has as an investigation question: What are the most frequent errors in the preparation and administration of intravenous drugs in a small-sized hospital in Bahia's bay?

This study aimed to identify errors in the preparation and administration of intravenous drugs in a small-sized hospital in Bahia's bay.

Method

This is an observational, descriptive study, carried out in a small-sized private hospital located in Bahia's bay region, which began its activities in May 2003. Currently, this health institution has 50 beds, distributed in the following sectors: emergency, inpatient unit, intensive care unit (ICU) and surgical center. It also provides outpatient care with medical specialties such as orthopedics, urology, angiology, general practitioner, cardiology, gastrology, neurology and otorhinolaryngology, as well as diagnostic tests. The health team is composed of Social Worker, Biomedical professionals, Nurses, Pharmacists, Physiotherapists, Doctors, Nutritionists, Psychologists and Nursing Technicians. The hospital does not offer Pediatrics and Obstetrics.

The unit of analysis used in the present study were the doses of intravenous medications prepared and administered by the nursing team (nurses and nursing technicians). The inclusion criteria adopted were: doses of intravenous drugs prepared and/or administered in inpatients in the emergency, ICU and/or hospitalization sectors; and doses of medications registered in medical prescription. Exclusion criteria were: doses of drugs prescribed in emergencies, vasoactive and antiarrhythmic drugs and/or electrolyte solutions, doses of drugs prepared and administered in patients in situations of contact or respiratory precautions and in cardiorespiratory arrest.

The Surgical Center sector was not included in data collection, as 98% of intravenous medications are prepared and administered by the anesthesiologist.

The present study used the convenience sample. For the calculation of the sample size, the prepared and administered dose was considered as the unit of analysis for the error. To determine the sample representativeness of each sector, the monthly drug dispensing report of the satellite pharmacy of that hospital was used, referring to December 2018.

The sample calculation was performed considering the value of monthly doses in the sectors of the hospital studied and using the

formula for sample calculation of cross-sectional studies of finite population, a confidence level of 95%, a ε of 0.05 and a critical value of 1.96. The study considered that 80% of medication errors could be observed in the preparation and administration of medications, according to a national study conducted in a hospital unit[10-11].

The monthly drug dispensing report indicated 2,324 doses of intravenous drugs prepared and administered in the ICU, 3,277 doses in the emergency room and 4,223 doses in the inpatient unit. For the present study, the sample calculation indicated 223 doses for the ICU, 229 doses for emergency and 232 doses for inpatient unit, totaling a sample of 684 doses.

Data were collected through non-participant observation, conducted by a team of four nurses duly qualified for the application of the research instruments. The team's training aimed to guide them regarding the identification of errors in the preparation and administration of intravenous drugs, the way to identify themselves at the time of collection with professionals and the patient, impartiality and non-interference in procedures during observation, ethical posture during the approach to professionals and the quality of observation record.

The team was trained in four theoretical meetings of four hours each, which addressed the processes of preparation and administration of intravenous drugs, medication errors, ethics in research with human beings and direct observation of the process of preparation and administration of intravenous drugs. Subsequently, a pilot study was conducted to test the data collection instruments. Each observer followed the preparation and administration of three doses. After each observation, the doubts were discussed. The pilot study was conducted during two days in February, totaling 12 hours of observation. No adjustments were made to the observed items. The observations of the pilot study were not included in the study result.

Data collection was performed in the emergency room, ICU and inpatient unit, in March and April 2019, in the morning, afternoon and night shifts. Two observation guides were used – called drug preparation observation guide and drug administration observation guide – elaborated, validated and authorized together with the group of multicenter project researchers[10-12].

The error was considered as any discrepancy identified between preparation and/or administration of the drug and the guidelines for preparation and administration of the Ministry of Health[9]. Upon identifying some inadequacy not indicated in the guide, the collaborator should include the description in the last item of the instrument. The schedule was considered inadequate when exceeding 60 minutes before or after the prescribed time. The basis was the definition and classification of medication errors according to the ASHP[5].

The records were made in the instruments, initially identifying the drug prepared and administered. Then, the preparation and administration were checked and compared with the medical prescription, observing the adequacy regarding the patient's name, name of the medication, dose, prescribed route and time, as well as the correct technique. These aspects were included in the guide as points of observation.

The quantitative data were validated by double typing in an Excel for Windows spreadsheet. Then, the processing and analysis of the information were performed in the Statistical Package for the Social Sciences (SPSS) version 22.0. Descriptive analysis of the collected data was performed according to the descriptive variables selected through the absolute and relative frequency distribution.

The study is part of the research project entitled "Safety in the Preparation and Administration of Intravenous Drugs in Inpatients" submitted and approved by the Human Research Ethics Committee under protocol number 3.153.837. All ethical requirements listed in Resolutions n. 466/2012 and n. 510/2016 of the National Health Council were fully respected.

It should be noted that the data were collected after signing of the Informed Consent Form, ensuring the confidentiality and privacy of the participants during all phases of the research[13].

Results

There was the independent and dissociated observation of 336 doses of intravenous drug preparation and 358 doses of administrations, totaling 694 doses. The preparation doses were mostly observed in the inpatient unit. On the other hand, those of administration were observed in the ICU. Regarding the work shift, the doses of preparation were observed in a higher amount in the afternoon shift; doses of administration, in the night shift. Both preparation and administration were mostly performed by nursing technicians from the surveyed units (Table 1).

Table 1 – Distribution of the number of doses drugs prepared and administered in adult inpatients according to hospital unit, professional category and work shift. Santo Antônio de Jesus, Bahia, Brazil – 2020

Variables	n	%
Unit where the preparation doses were observed		
Emergency	108	32
ICU	105	31
Inpatient	123	37
Unit where the administration doses were observed		
Emergency	107	30
ICU	133	37
Inpatient	118	33
Professional responsible for preparing the doses		
Nursing technician	277	82
Nurse	59	18
Professional responsible for administering the doses		
Nursing technician	286	80
Nurse	72	20
Work shift when the observed doses were prepared		
Morning	108	32
Afternoon	117	35
Night	111	33
Work shift when the observed doses were administered		
Morning	109	30
Afternoon	122	34
Night	127	36

Source: Created by the authors.

The observation revealed errors in the preparation of intravenous drug doses, 60% of which related to the technique. No dose, route and/or patient errors were identified. Among the types of technical errors in the preparation of intravenous drugs, the following stood out: non-use of personal protective equipment (PPE) and non-identification of the prepared medication. This table also shows a high percentage of absence of hand hygiene before preparation, disinfection of ampoules and disinfection of the bench (Table 2).

Table 2 – Distribution of the types of errors in the preparation and administration of doses of intravenous drugs in adult inpatients. Santo Antônio de Jesus, Bahia, Brazil – 2020 (continued)

Types of errors observed	No		Yes	
	n	%	n	%
Types of errors in preparation				
Technique	203	60	133	40
Schedule	8	2	328	98
Types of errors in preparation				
Dose	-	-	336	100
Route	-	-	336	100
Patient	-	-	336	100

Table 2 – Distribution of the types of errors in the preparation and administration of doses of intravenous drugs in adult inpatients. Santo Antônio de Jesus, Bahia, Brazil – 2020 (conclusion)

Types of errors observed	No		Yes	
	n	%	n	%
Types of errors in the technique of preparation of doses (1)				
Use of medical prescription	321	95	15	5
Disinfection of the bench	267	80	69	20
Disinfection of ampoules	219	65	117	35
Hand hygiene	185	55	151	45
Correct identification of the prepared drug	159	47	177	53
Use of PPE	128	38	208	62
Material contamination	3	1	333	99
Types de errors in administration				
Technique	268	75	90	25
Schedule	12	3	346	97
Dose	-	-	358	100
Route	-	-	358	100
Patient	-	-	358	100
Types of errors in the administration technique (1)				
Use of medical prescription	213	60	145	40
Patient identification	188	52	170	48
Patient guidance	256	71	102	29
Hand hygiene	148	41	210	59
Prescription or label conferral	216	60	142	40
Use of PPE	178	50	180	50
Disinfection of the tip of the intravenous access device	119	33	239	67
Material contamination	7	2	351	98
Returned for monitoring	212	59	146	41
Administration conferral	313	87	45	13

Source: Created by the authors.

Notes: Conventional signs used:

- Numerical data equal to zero not resulting from rounding.

(1) One observed dose presented several types of errors.

Regarding the observation of the administered doses, the highest percentage of errors was related to the technique. No dose, route and/or patient errors were identified during the observation of medication administration (Table 2). Among the types of technical errors in the administration of intravenous drug doses, the following stood out: absence of disinfection of the tip of the intravenous access device, non-hygiene of the hands and non-identification of the patient.

Discussion

Errors in the preparation and administration of drugs constitute a public health problem due to their occurrence, especially when referring to intravenous medications. In this case, improper handling may lead to adverse events in patients resulting from their action in the bloodstream. This condition requires that this practice be exercised correctly and safely, so that errors are minimized and prevented[14].

The fact that nursing technicians were the most observed professional category in this study is in agreement with findings in the national literature[14-15]. Moreover, the shared responsibility of nurses and nursing technicians in drug administration is regulated by Resolution n. 564/2017 of the Federal Nursing Council (COFEN)[16].

However, according to COFEN, in Brazil, there are 1,250,953 nursing technicians, 536,325

nurses and 413,952 nursing assistants[17]. These data inform that the number of nursing technicians is more than twice the number of nurses. These, in their daily clinical practice, due to the high workload, tend to transfer the responsibility of the preparation and administration of intravenous drugs to technical-level professionals, distancing from direct patient care and prioritizing management actions in the units.

Nevertheless, medication error triggers several impacts on the patient's health, which may result in death or complications in the clinical picture, with prolonged hospitalization, which generates physical damage to the patient and burdens for the institution[18].

The technical error was identified in 60% of the prepared doses. A study conducted in Germany identified an index of 56%[19]. Studies[8,14-15,18,20] with adult population showed compatible results. Nonetheless, a study[21] conducted in Vietnam revealed a much lower index (15.7%).

In this research, the main types of errors observed in the intravenous drug preparation technique were the non-use of PPE (62%), incorrect identification of the prepared medication (53%), lack of hand hygiene (45%), non-disinfection of ampoules (35%) and non-disinfection of the bench (20%). These are also the main types of errors observed in national studies[8,14-15,18,20].

The execution of intravenous medications with quality, safety and efficacy requires compliance with minimum requirements to ensure the total absence of chemical and biological contamination[13]. Microbiological safety may be decreased when nursing professionals do not perform hand hygiene, do not clean the bench before preparing medications, do not use masks to prepare solutions and do not disinfect ampoules[8-9].

The risk of contamination in the removal of the dose of the ampoule-vial drug is related to the type of vial, characteristics of the needle or other puncture device used to remove the dose, number of perforations in the rubber, physical characteristics of the rubber, aseptic technique used, air injection into the vial and efficiency of preservatives[8-9,13].

Hand hygiene was not performed correctly. In the disinfections of the ampoules, non-sterile cotton soaked in 70% alcohol was used, without mechanical friction movement and not waiting 15 seconds to dry the solution. These findings were also present in other descriptive studies of observation of errors in the preparation and administration of medications[15].

During the preparation of the medications, the bench was not disinfected in 20% of the doses. Clean and disinfected surfaces can reduce the number of microorganisms by about 90%, while surfaces that have only been cleaned reduce them by 80% for only two hours. Therefore, medicines and materials/supplies should be stored, accessed and prepared on a clean area or surface according to the cleaning and disinfection handbook of the National Health Surveillance Agency (ANVISA)[8,22].

The Prevention measures for Healthcare-Related Infection recommended by ANVISA should be followed concerning the preparation and administration of drugs, paying attention to the disinfection of the environment and surfaces, hand hygiene, use of protective equipment, disinfection of ampoules, vials, points of addition of medications and connections of the infusion lines[23].

Non-hygiene of the hands, non-use of PPE (masks, gloves and cap), non-disinfection of ampoules and non-disinfection of the tip of the device of intravenous access lead to bacterial translocation to the infusion site of the patient's dose and skin, increasing the risk of infectious phlebitis and catheter-related bloodstream infection. These individual measures are simple, inexpensive and prevent the spread of healthcare-related infections.

As for therapeutic efficacy, it may be reduced when the chemical and physical stability of intravenous drugs is not guaranteed, which may compromise the therapeutic effect of the drug. Therefore, when reconstituting or diluting medications, the appropriate diluent should be used, according to the Dilution Protocol, considering the time of preparation

and verifying the stability period after reconstitution/dilution[8-9,13].

The absence of an institutional protocol directed to the preparation of intravenous drugs may have favored the technical errors identified during the preparation, highlighting the absence of bolus labeling of medications. This fact can induce medication error, because, when the professional stops labeling the medication, he/she disfavors the triple conferral before administration.

In relation to the observation of the administration of drug doses, there were 75% of errors in the administration technique. National studies showed similar results[14,18,20]. However, a multicenter international study conducted in England revealed a much lower index (11.5%)[24].

Regarding the typology of the administration technique errors, the following stood out: absence of previous hand hygiene (59%), disinfection of the tip of the intravenous access device (67%), use of PPE (50%), prescription or label conferral (40%), patient identification (48%), monitoring (41%) and guidance (29%). These findings are similar to those of national studies[14,18,20].

A safe practice in the administration of medications requires knowing all aspects related to medication, such as the action, indication, contraindication, side effects and undesirable interactions in the body, forms of preparation, correct mode and route of administration. It is also necessary to pay attention to the execution of this procedure in order to provide safe actions to all those involved in the process, ensuring the administration of the right drug, in the right pharmaceutical form, to the right patient, at the right time, in the right route, in the right dose, with the right action, with the right record and with the right monitoring[13].

In the present study, schedule errors were observed in the preparation of the drug in 2% of the doses observed and in the administration of the drug in 3% of the doses. National studies corroborated the finding, observing errors in the route, dose and schedule[14,20,25].

The preparation and administration tend to be performed at incorrect times, due to the frequent practice of optimizing or advancing activities, and due to work overload. Nevertheless, it should be avoided through strategies and active supervision, since medications may have impaired stability when diluted very early and not administered, besides being exposed to contamination, light, heat and humidity. Another relevant factor is the time and duration of the action of the drugs in the body, since the administration outside the expected times may decrease this action due to the half-life of the preparation, compromising the patient's recovery[15].

There were no errors in dose, route and patient and/or medication changes, a result that agrees with that found in a study[18], in which such events did not occur during the observation period.

For institutions that seek quality of service and patient safety, an important strategy to reduce medication errors is to invest in the knowledge of nursing professionals on this subject, in order to involve them in drug safety, minimizing the factors that would cause the error. Furthermore, the inclusion of strategies to reduce human errors, such as visible step by step at the place of preparation and administration of the drug, can contribute to reduce memory lapses and the numerous interruptions that the professional suffers while preparing the drug, besides reducing the probability of errors and increasing the chance of intercepting them before resulting in injury to the patient[8].

The limitation of the study was using a convenience sample, thus having shifts and sectors with a higher number of observations. Despite this limitation, the study brings advances for nursing, as it contributes with evidence on the preparation and administration of drugs by the nursing team. It can also contribute to the development of further studies on the subject in different contexts.

Conclusion

The present study unveiled that technical and time errors in the preparation and administration of intravenous drugs occurred in the small-sized hospital in Bahia's bay. The main types of technical errors observed in the preparation were the non-use of PPE, incorrect identification

of the prepared drug, lack of hand hygiene, non-disinfection of ampoules and non-disinfection of the bench. The main technical errors observed in administration were lack of hand hygiene before drug administration and non-disinfection of the tip of the intravenous access device, non-use of PPE, non-check of the prescription or label, non-identification, non-monitoring and non-guidance of the patient.

Collaborations:

1 – conception, design, analysis and interpretation of data: Ubiane Oiticica Porto Reis, Silvia da Silva Santos Passos, Jamille Sampaio Berhends and Carolina Madeiro Meira;

2 – writing of the article and relevant critical review of the intellectual content: Ubiane Oiticica Porto Reis, Silvia da Silva Santos Passos, Luciano Marques Santos and Marcelo Silva Reis;

3 – final approval of the version to be published: Ubiane Oiticica Porto Reis and Silvia da Silva Santos Passos.

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