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ORIGINALES

Analysis of drug incompatibilities in a cardiac intensive unit: a cross-sectional study

Análise das incompatibilidades medicamentosas em uma unidade cardiointensiva: estudo transversal

Análisis de incompatibilidades medicamentosas en una unidad cardiointensiva: estudio transversal

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ABSTRACT:

Objective: To evaluate the incompatibilities of intravenous medications in cardiac patients admitted to a cardiac intensive unit, associating possible incompatibilities with the severity and characteristics of the adverse event.

Method: Cross-sectional, observational, and quantitative study, held in a Cardiac intensive Unit of a University Hospital in the city of Rio de Janeiro. Data collection took place from March to June 2018. Micromedex® identified and classified drug incompatibilities.

Results: We analyzed 111 prescriptions with a total of 1,497 prescription drugs, the average number of prescription drugs was 13.49 (6 ± 24), 580 (38.74%) intravenously in which 41.38% were administered simultaneously with another medicine. The study showed 121 incompatibilities and the drug classes that had the highest number of incompatibilities were diuretics, hypnotics and sedatives, cardiovascular stimulants (vasoactive amines), antibiotics for systemic use, corticosteroids for systemic use, cardiovascular vasodilators, and antiarrhythmic agents. We highlight the incompatibilities classified as moderate, furosemide with hydrocortisone, and midazolam with omeprazole, and severe fentanyl with amiodarone.

Conclusion: The study highlights the importance of medication scheduling and administration by the nursing team based on pharmacological knowledge. We expect that the chart of recommendations prepared in the study with nursing care related to incompatibilities with greater potential for severity and its events can contribute to drug safety.

Keywords: Drug incompatibility; Administration, Intravenous; Infusions, Intravenous, and Patient Safety.

RESUMO:

Objetivo: Avaliar as incompatibilidades de medicações intravenosas em pacientes cardiopatas internados em uma unidade cardiointensiva, associando as possíveis incompatibilidades com a gravidade e característica do evento adverso.
Método: Estudo transversal, observacional e quantitativo. Realizado em uma Unidade Cardiointensiva de um Hospital Universitário do município do Rio de Janeiro. A coleta de dados ocorreu de março a junho de 2018. Para a identificação e classificação das incompatibilidades medicamentosas, foi utilizado o Micromedex®.
Resultados: Foram analisadas 111 prescrições, com um total de 1.497 medicamentos prescritos, a média de medicamentos por prescrição foi 13,49 (6 ±24), sendo 580 (38,74%) por via intravenosa, destes, 41,38% foram administrados simultaneamente com outro medicamento. O estudo apresentou 121 incompatibilidades e as classes medicamentosas que apresentaram maior número de incompatibilidades foram diuréticos, hipnóticos e Sedativos, estimulantes cardiovasculares (aminas vasoativas), antibióticos de uso sistêmico, corticoides de uso sistêmico, vasodilatadores cardiovasculares e antiarrítmicos. Destacando-se as incompatibilidades classificadas como moderadas, a furosemida com hidrocortisona e o midazolam com omeprazol e grave o fentanil com amiodarona.
Conclusão: O estudo destaca a importância do aprazamento e administração de medicamentos pela equipe de enfermagem com base em conhecimentos farmacológicos. Espera-se que o quadro de recomendações elaborado no estudo, com os cuidados de enfermagem relacionados as incompatibilidades com maior potencial de gravidade e seus eventos, possa contribuir para segurança medicamentosa.

Palavras-chave: Incompatibilidade de Medicamentos; Administração Intravenosa; Infusões Intravenosas e Segurança do Paciente.

RESUMEN:

Objetivo: Evaluar las incompatibilidades de los medicamentos intravenosos en pacientes cardíacos ingresados en una unidad cardiointensiva, asociando posibles incompatibilidades con la gravedad y las características del evento adverso.
Método: Estudio transversal, observacional y cuantitativo. Realizado en una Unidad Cardiointensiva de un Hospital Universitario en la ciudad de Rio de Janeiro. La recopilación de datos se realizó de marzo a junio de 2018. Para identificar y clasificar las incompatibilidades de medicamentos se utilizó Micromedex®.
Resultados: Se analizaron 111 recetas, con un total de 1,497 medicamentos recetados, el número promedio de medicamentos recetados fue 13,49 (6 ± 24), 580 (38.74%) por vía intravenosa, de los cuales el 41.38% se administraron simultáneamente con otro medicamento. El estudio mostró 121 incompatibilidades y las clases de drogas que tuvieron el mayor número de incompatibilidades fueron diuréticos, hipnóticos y sedantes, estimulantes cardiovasculares (aminas vasoactivas), antibióticos para uso sistémico, corticosteroides para uso sistémico, vasodilatadores cardiovasculares y agentes antiarrítmicos. Destacando las incompatibilidades clasificadas como moderadas, furosemida con hidrocortisona y midazolam con omeprazol y fentanilo severo con amiodarona.
Conclusión: El estudio destaca la importancia de la programación y administración de medicamentos por parte del equipo de enfermería con base en el conocimiento farmacológico. Se espera que el cuadro de recomendaciones preparado en el estudio, con atención de enfermería relacionada con incompatibilidades con mayor potencial de gravedad y sus eventos, pueda contribuir a la seguridad de los medicamentos.

Palabras clave: Incompatibilidad de Medicamentos; Administración Intravenosa; Infusiones Intravenosas y seguridad del paciente.

INTRODUCTION

The administration of medications is a usual activity in patients hospitalized in intensive cardiological therapies. Due to a large number of medications administered and the limited number of venous access routes, drug incompatibilities appear as a frequent problem in clinical practice [(1)].

Intravenous medications should be infused in an exclusive route for each medication. However, in clinical practice, most infusions are administered via a “Y” connector, whereby medications are mixed in the catheter lumen before reaching the bloodstream, which may favor the occurrence of drug incompatibilities [1].

Drug incompatibility is defined by an in vitro interaction as a result of a chemical reaction between the active ingredient and the component of another drug when combined in the same syringe, equipment, or bottle during preparation or administration [2,3].

The concomitant administration of incompatible drugs is considered a medication error, classified as an avoidable adverse event for patients undergoing infusional therapy [1].

According to the World Health Organization (WHO), medication errors cause at least one death per day and harm approximately 1.3 million people annually only in the United States. The cost associated with medication errors has been estimated at $ 42 billion per year worldwide or almost 1% of total global health expenditures [4].

In Brazil, a study with 104 prescriptions identified a total of 304 drug incompatibilities, with an average of 2.33 incompatibilities per prescription. We noticed that in 63% of the analyzed cases, drugs administered in bolus are incompatible with those of continuous administration [5].

Incompatibilities can have several consequences. A review study showed that among the main adverse events caused by drug incompatibility, the most reported were: ineffective therapy, which leads to longer hospital stays and higher hospital costs; the occlusion of the catheter that can lead to infections and the occurrence of thromboembolic events, caused by the precipitation of the medication that can cause death. In this sense, the multi-professional team must implement measures to avoid this problem [6].

This study aimed at the incompatibility of intravenous drugs in cardiac patients in an intensive care unit of a university hospital in the State of Rio de Janeiro (Brazil). In this sense, we elaborated the following research question: what are the main intravenous drug incompatibilities found in cardiac patients?

To answer the research question, we aimed to assess the incompatibilities of intravenous medications in cardiac patients hospitalized in an intensive care unit, associating the possible incompatibilities with the severity and characteristics of the adverse event.

MATERIAL AND METHOD

This is a descriptive study with a cross-sectional design of a non-participating observational nature with a quantitative approach of the data, following the twenty-two items of the STROBE statement [7,8]. In this study, the primary outcome was to identify the main intravenous drug incompatibilities. We identified the incompatibilities through the patient's medical prescription and direct observation of the patient's intravenous infusion devices.

The research was carried out in a cardiac intensive unit, with nine beds at a public university hospital, located in the city of Rio de Janeiro. These beds had critically ill patients who need continuous assistance. Most of these patients use intravenous medications through peripheral venous access (together with a multipath extensor) or central venous catheter (mono, double or triple lumen). Nurses carried out and schedule the medical prescriptions daily.

The inclusion criteria in the study were cardiac patients, admitted to the cardiac intensive unit, with more than one venous medication prescribed and who had punctured venous access. The exclusion criteria were patients under 18; with prescriptions not scheduled by nurses and hospitalization time of fewer than 24 hours (aiming to allow the professional to have adequate planning for infusional therapy).

Data collection took place from March to June 2018 and was performed using an instrument developed by the researchers. The variables related to the objectives of the study included the identification of the medication (drugs in use, their medication classes, and the route of administration) and data on incompatibilities (type of infusion - intermittent or continuous, form of administration - exclusive or simultaneous, and classification of incompatibility).

To determine the sample size, we performed a sample calculation considering a population of 160 prescriptions/month, a sample error of 5%, and a maximum percentage of error of 30%, as indicated in the literature, obtaining a sample of 108 prescriptions.

The main researcher collected the data through direct observation of medication prescriptions and their administrations in hospitalized patients, using a collection instrument.

After collection, we tabulated the data in Microsoft Excel® and we did a quick/initial reading of the material to systematize and organize the data. Afterward, we imported these data into Micromedex® [9] for the identification and classification of drug incompatibilities. In this way, the data were investigated, quantified, and interpreted.

The data were analyzed based on descriptive statistics, inferential as mean, standard deviation, and confidence index to identify the most severe incompatibilities in the drugs used.

The research followed the determinations of Resolution 466/12 of the National Health Council and was approved by the institution's Research Ethics Committee (CEP) under nº 82001317800005259 on November 18, 2017.

RESULTS

We analyzed 111 prescriptions, which presented a total of 1,497 medications with an average of 13.49 (6 ± 24) medications per prescription. Intravenous was used on 580 (38.74%) and 917 (61.26%) had other administration routes.

A continuous administration was considered when performed by the infusion pump for more than one hour, and intermittent administration of medications that were infused in bolus, with fast administration, or within a period less than or equal to one hour.

The intravenous drugs identified in the prescriptions were characterized within the aspects related to administration to achieve the objective proposed by the study: type of infusion and form of administration, where they were identified, which drugs were administered simultaneously. To track them for potential incompatibility, 41.38% of the 580 intravenous drugs were administered simultaneously with another drug (Table 1).

Table 1 – Characterization of intravenous drug administration observed in the prescriptions. Rio de Janeiro, RJ, Brazil, 2019. (n = 580)

Aspects of drug administration	n	%	Mean	Standard deviation	Confidence Index*
Infusion Type					
Intermitent	428	73.79	3.85	1.61	0.15
Continued	152	26.21	1.37	1.62	0.25
Forms of administration					
Exclusive	340	58.62	3.60	2.30	0.39
Simultaneous	240	41.38	5.94	2.35	0.21

* 95% confidence index for the mean.

Then, to analyze the 240 intravenous drugs administered simultaneously, we initially chose to distribute them according to the doses administered, totaling 981 doses, classified according to Anatomical Therapeutic Chemical Classification System (ATS)/(WHO) [10], which divides medicines into different groups and subgroups according to the organ or system on which they operate and according to their chemical, pharmacological and therapeutic properties. To analyze the potential drug incompatibilities, we used Micromedex® software [9], and the compatible (284), incompatible (185), and untested (515) doses were identified, as shown in table 2.

Table 2 - Distribution of doses of drugs administered simultaneously and intravenously according to the ATC/WHO classification level and the incompatibilities observed in doses administered simultaneously. Rio de Janeiro, RJ, Brazil, 2019. (n = 981)

Drug Class (ATC/WHO*)	Drug	n	%	Compatible		Incompatible		Untested	
				n	%	n	%	n	%
J01 Antibiotics for systemic use		**180**	**18.34**	**67**	**37.22**	**18**	**10**	**95**	**52.77**
J01CF04	Oxacillin	45	4.59	21	46.67	0	0	24	53.33
J01DE01	Cefepime	35	3.57	13	37.14	0	0	22	62.86
J01DH51	Imipenem	30	3.06	14	46.67	9	30	7	23.33
J01CG02	Tazobactam	19	1.94	8	42.11	0	0	11	57.89
J01CA04	Amoxicillin	12	1.22	0	0	0	0	12	100
J01XA01	Vancomycin	9	0.92	6	66.67	1	11.11	2	22.22
J01MA02	Ciprofloxacin	8	0.81	0	0	0	0	8	100
J01CA01	Ampicillin	7	0.71	0	0	5	71.43	2	28.57

J01DH02	Meropenem	6	0.61	2	33.33	1	16.67	3	50
J01MB05	Clavulanic Acid	4	0.41	0	0	0	0	4	100
J01GB03	Gentamycin	3	0.3	3	100	0	0	0	0
J01XB	Polymyxin B	2	0.2	0	0	2	100	0	0
N05C Hypnotics and Sedatives		**162**	**16.51**	**98**	**60.49**	**44**	**27.16**	**20**	**12.35**
N01AH51	Fentanyl	70	7.14	56	80	5	7.14	9	12.85
N05CD08	Midazolam	64	6.52	24	37.5	39	60.93	1	1.56
N05CM18	Dexmedetomidine	28	2.85	18	64.29	0	0	10	35.71
A02 Medicines for gastric disorders		**156**	**15.9**	**7**	**4.49**	**8**	**5.13**	**144**	**92.31**
A02BC01	Omeprazole	109	11.11	0	0	8	7.34	104	95.41
A02BA02	Bromopride	40	4.08	0	0	0	0	40	100
A03FA04	Ranitidine	7	0.71	7	100	0	0	0	0
C03 Diuretics		**135**	**13.76**	**36**	**26.67**	**46**	**34.07**	**53**	**39.26**
C03CA01	Furosemide	135	13.76	36	26.67	46	34.07	53	39.26
N02 Analgesics		**93**	**9.48**	**1**	**1.07**	**4**	**4.3**	**88**	**94.62**
N02AX02	Tramadol	59	6.01	1	1.7	4	6.78	54	91.53
N02BA09	Dipyrone	34	3.47	0	0	0	0	34	100
H02 Corticosteroids for systemic use		**79**	**8.05**	**24**	**30.38**	**14**	**17.72**	**41**	**51.92**
H02AB09	Hydrocortisone	63	6.42	16	25.40	14	22.22	33	52.38
H02AB02	Dexamethasone	16	1.63	8	50	0	0	8	50
CO1D Cardiovascular Vasodilators		**54**	**5.50**	**3**	**5.55**	**14**	**25.93**	**37**	**68.52**
C01DA52	Nitroglycerin	54	5.50	3	5.55	14	25.93	37	68.52
C01C Cardiovascular Stimulants		**35**	**14.58**	**11**	**31.43**	**20**	**57.14**	**4**	**11.43**
C01CA07	Dobutamine	29	12.08	5	17.24	20	68.97	4	13.79
C01CA03	Norepinephrine	6	2.50	6	100	0	0	0	0
B05XA Electrolyte Solution		**35**	**3.57**	**18**	**51.43**	**4**	**11.43**	**13**	**37.14**
B05XA01	Potassium chloride	31	3.16	18	58.06	4	12.9	9	29.03
B05XA15	Ringer Lactate	4	0.41	0	0	0	0	4	100
C01B Antiarrhythmics		**22**	**2.24**	**6**	**27.27**	**11**	**50**	**5**	**22.73**
C01BD01	Amiodarone	22	2.24	6	27.27	11	50	5	22.73
A10A Insulin and Analogs		**19**	**1.94**	**9**	**47.37**	**2**	**10.53**	**8**	**42.11**
A10AB01	Regular Insulin	19	1.94	9	47.37	2	10.53	8	42.11
P03AXvAntiphysetic		**6**	**0.61**	**0**	**0**	**0**	**0**	**6**	**100**
P03AX05	Dimethicone	6	0.61	0	0	0	0	6	100
C07A Beta-blocking Agents		**2**	**0.20**	**2**	**100**	**0**	**0**	**0**	**0**
C07AA05	Propanolol	2	0.20	2	100	0	0	0	0
V03AB Opioid antagonist		**2**	**0.20**	**2**	**100**	**0**	**0**	**0**	**0**

V03AB15	Naloxone	2	0.20	2	100	0	0	0	0
A11 Vitamin		**1**	**0.10**	**0**	**0**	**0**	**0**	**1**	**100**
A11VA	Thiamine	1	0.10	0	0	0	0	1	100
Total		**981**	**100**	**284**		**185**		**515**	

*ATC: Anatomical Therapeutic Chemical Classification System; WHO: World Health Organization [10].

Were found 14 therapeutic subgroups among the intravenous drugs for simultaneous administration, classified by the ATC. There was a higher frequency in the subgroups of antibiotics for systemic use, highlighting oxacillin, cefepime and imipenem, the hypnotics and sedatives, among them fentanyl and midazolam, among the drugs for gastric disorders omeprazole was administered more frequently, furosemide is the diuretic of choice in the unit studied and tramadol was the most used analgesic.

The drug classes that showed the greatest number of incompatibilities were: diuretics, hypnotics and sedatives, cardiovascular stimulants (vasoactive amines), antibiotics for systemic use, corticosteroids for systemic use, cardiovascular vasodilators, and antiarrhythmic agents.

The medications with the highest number of incompatibilities were Furosemide (46 - 34.07%), Midazolam (39 - 60.94%), Dobutamine (20 –68.97%) Hydrocortisone (14 – 22.22%), Nitroglycerin (14 –26.42%), and Amiodarone (11 –52.39%).

The study identified 185 (one hundred and eighty-five) incompatible doses, but when excluding repeated doses, we found a total of 121 drug incompatibilities.

To perform the classification of the severity of the adverse event, we followed the definitions of Micromedex®. We consider a ‘severe’ event when the incompatibility is fatal and/or require medical intervention to minimize or prevent severe adverse effects. A 'moderate' event is when the incompatibility can result in an exacerbation of the patient's condition and/or require a change in therapy. Drug incompatibility as 'mild' is when the interaction would have limited clinical effects. Manifestations may include an increase in the frequency or severity of side effects, but they would generally not require a major change in therapy.

Medicines for which information is not available were classified as 'untested'; in these cases, simultaneous administration should be avoided, if possible.

Table 3 shows the classification of incompatible medications for the number of doses administered and their severity.

Table 3 – Description of the drug incompatibilities found and their classifications regarding severity Rio de Janeiro, RJ, Brazil 2019. (n = 121)

1st Drug	2nd Drug	Doses	Classification
Furosemide	Regular insulin (variable)	2	Moderate
	Midazolam	4	Not classified
	Polymyxin B (variable)	2	Not classified
	Dobutamine (variable)	20	Not classified
	Hydrocortisone	4	Moderate

	Nitroglycerin (variable)	14	Not classified
	Amiodarone	4	Not classified
Meropenem	Midazolam	1	Not classified
Ampicillin	Imipenem (variable)	1	Not classified
	Tramadol	4	Not classified
	Midazolam (variable)	10	Not classified
Fentanyl	Amiodarone (variable)	5	Severe
Midazolam	Omeprazole	9	Moderate
	Imipenem (variable)	12	Not classified
	Hydrocortisone (variable)	13	Not classified
Amiodarone	Potassium chloride (variable)	3	Not classified
Tramadol	Ampicillin	4	Not classified
Imipenem	Vancomycin (variable)	1	Not classified
	Midazolam	7	Not classified
	Ampicillin (variable)	1	Not classified
Total		**121**	

We highlight incompatibilities with greater potential for severity such as moderate in furosemide x hydrocortisone and midazolam x omeprazole, and severe in fentanyl x amiodarone.

DISCUSSION

Incompatibilities related to the administration of simultaneous medications are a major problem, especially in intensive care where administration of intravenous medications is part of daily clinical practice [11,12].

In this study, the mean of 13.49 drugs per prescription shows a large number of drugs per patient, showing a profile of poly-pharmaceutical patients in the cardiac intensive unit. The presence of polypharmacy and intravenous administration are indicators that reflect the severity of the population studied and are risk factors for the occurrence of drug incompatibility [13].

Ratifying the occurrence of polypharmacy in intensive care units, a study carried out with critically ill patients presented similar results in 3 months. it identified 1,019 prescription drugs with a mean of 10.2 ± 3.4 drugs per prescription [1].

To prevent incompatibilities in poly-pharmaceutical patients, the nurse has the challenge of scheduling the drugs and managing infusional therapy to reduce adverse events not only with incompatibilities but also with drug interactions. In practice, the patient is exposed to the risk of drug incompatibilities when he has a high number of prescribed drugs and greater than the capacity for exclusive administration. The use of more than six drugs per day increases the risk of drug interactions 9.8 times and the prevalence of incompatibilities is strongly associated with the number of drugs prescribed [14-16].

Another study analyzed 100 prescriptions and found 68% of prescriptions to be at least incompatible. The study evaluated 1,854 drug combinations with 271 incompatible combinations (14.6%), 372 untested (20.0%) and 1,211 were compatible (65.4%). A mean of 4.0 ± 3.3 incompatibilities was observed per prescription (average) obtained in the 68 (sixty-eight) prescriptions that presented drug incompatibilities [1].

The results of this research showed that most medications were infused through central venous access, 62 (55.86%). We observed that among patients using central venous catheters, most catheters were double-lumen. The use of multi-lumen catheters is a relevant strategy for the prevention of incompatibilities, as it allows different intravenous drugs to be administered separately, but at the same time [1].

The most frequent incompatibilities in this study were between furosemide and dobutamine (16.53%), Furosemide and Nitroglycerin (11.57%), Midazolam, and Hydrocortisone (10.74%), Midazolam and Imipenem (9.92%), and Ampicillin with Tramadol (8.26%). However, these incompatibilities were not classified according to their severity by Micromedex®. All medications are extremely important and highly usable in cardiac intensive units, which confirms the attention that nurses should have in the process of scheduling and administering them [15,16].

Another study identified that the most frequent incompatibilities were between midazolam and hydrocortisone (8.9%), cefepime and midazolam (5.2%), and hydrocortisone and vancomycin (5.2%). The studies show a profile of patients and similar drugs and the incompatibility between drugs such as midazolam and hydrocortisone are highlighted in both studies. However, this study has a slightly higher prevalence of 10.74% between midazolam and hydrocortisone, while in another study[1] we found a prevalence of 8.9%, very close results, showing the potential for incompatibility of these drugs and emphasizing the importance of a different look at scheduling and administration [1].

We could not analyze the drug bromopride and sodium dipyrone due to the absence of this item in the software used. However, the manufacturer warns of the possibility of incompatibility and recommends that dipyrone sodium should not be administered with other injectable drugs [17]. This study also identified many drugs that were untested for drug incompatibility, which shows the deficiency in the knowledge of incompatibilities and the need for further studies on the subject.

Also, among the identified incompatible doses, most (75.21%) were not classified according to the severity of the event. However, it is still important to be careful during the scheduling and administration of these medications since, besides the severity of the event, it should be avoided.

Among the incompatible doses classified as severe, fentanyl with amiodarone stands out. Concomitant use of these drugs can result in cardiac toxicity (low cardiac output) and an increased risk of fentanyl toxicity (CNS depression, respiratory depression). The nurse must monitor cardiovascular complications, discuss the adjustment of the dose or suspension of one or both drugs with the multidisciplinary team. The concomitant use of amiodarone and fentanyl can cause high plasma concentrations of fentanyl, which can cause excessive sedation and respiratory depression [16,17].

The systemic reactions caused by sedatives are potentially dangerous, most of them of a cardiorespiratory nature. The most common are hypoventilation, hypertension, hypotension, hypoxia, tachycardia, bradycardia. Some can be enhanced by the pain and discomfort of patients, requiring greater doses of sedatives, worsening hypoxia, and arrhythmia, which can lead to cardiac arrest [17].

Among the incompatibilities classified as moderate, there are 2 (1.65%) doses of furosemide simultaneously with regular insulin, 4 (3.31%) doses of furosemide with hydrocortisone, and 9 (7.44%) doses in administration simultaneous use of omeprazole with midazolam.

Concomitant use of furosemide and regular insulin may result in an increased risk of hyperglycemia; the increased need for insulin. Therefore, when the patient uses these two drugs simultaneously, the nurse must monitor the glucose levels more frequently, including the removal of the diuretic [14]. Concomitant use of furosemide and hydrocortisone may result in hypokalemia. The potassium balance must be carefully monitored by the multidisciplinary team if administration occurs simultaneously. Concomitant use of midazolam and omeprazole may result in benzodiazepine toxicity (CNS depression, ataxia, lethargy) [16].

Insulin was also highlighted in other studies as well. Fourteen of 840 pairs of drugs identified were related to insulin, with 6.67% of the frequency of interaction involving this drug [15].

With these findings, nurses need to know the profile of patients and drug therapy in the unit studied according to the medication classes and incompatibilities, which allows subsidies to plan and guide behaviors for drug safety.

A study that addresses the knowledge of nursing professionals about drug interactions showed that the team had insufficient knowledge about drug interactions [18]. Nurses must know about pharmacology to discuss with the multidisciplinary team the possibility of replacing drugs with a compatible therapeutic alternative, or about the indication of a venous catheter that offers a greater number of routes [15,18]. When administering two or more simultaneous medications, the nurse must check if they are physically compatible, since chemical reactions require more contact time for a significant reduction in the concentration of the drug to occur [16,18,19], and these nurses' actions reflect safe and qualified care.

Another safety measure is the routine presence of the clinical pharmacy in intensive care units [16], contributing to the reduction of drug incompatibility by guiding the nursing team in the face of some doubts that may arise during the stages of intravenous therapy.

As the nursing team is directly involved in the medication administration process, it needs fast and accurate information at the time of administration to prevent incompatibilities and ensure the effectiveness of the prescribed medication therapy, contributing to the therapeutic success and patient safety [14,15,20].

A quick consultation tool for administration in Y is another way to prevent this occurrence, considering that it is one of the items that are part of the nine items for the safe administration of medications [20].

With these results, the study produced a chart (Chart 1) as a product describing the most frequent incompatibilities and the respective adverse events that can be caused and outlined nursing care to minimize damage or prevent the event caused by the incompatibility.

Chart 1 - Description of the drug incompatibilities found with the classifications referring to severity, describing which events and behaviors should be taken. Rio de Janeiro, RJ, Brazil 2019.

Incompatibility	Event	Behaviors
Fentanyl and Amiodarone (SEVERE)	- Cardiac toxicity (low cardiac output) - Fentanyl toxicity (CNS depression, respiratory depression). - Concomitant use of amiodarone and Fentanyl may cause elevated plasma concentrations of Fentanyl	- Monitor cardiovascular complications, adjust the dose or discontinue one or both drugs, - Monitor patients for signs of excessive respiratory and central nervous system depression.
Furosemide and Regular Insulin (MODERATE)	- Increased risk of hyperglycemia; - Increased need for insulin	- Monitor glucose levels more frequently, including withdrawal of the diuretic
Furosemide and Hydrocortisone (MODERATE)	- Result in hypokalaemia.	- The potassium balance must be carefully monitored by the multidisciplinary team if administration occurs simultaneously
Midazolam and Omeprazole (MODERATE)	- Result in benzodiazepine toxicity (CNS depression, ataxia, lethargy	- Monitor patients for signs of excessive respiratory and central nervous system depression.

Source: The authors, 2019.

These strategies are very important to the nurses' scope of knowledge, emphasizing the importance of attention during the scheduling and administration of these medications since regardless of the severity classification of the event, it must be avoided to mitigate the risks.

CONCLUSION

The study shows a large number of prescription drugs (13,49) and 14 different drug classes, showing a profile of critical patients and polypharmaceuticals in the cardiac intensive unit.

Through this study, we observed that the medications with the highest number of incompatibilities were Furosemide, Midazolam Dobutamine, Hydrocortisone, Nitroglycerin, and Amiodarone.

We observed that 4.13% of the doses were classified as severe, 12.40% were classified as Moderate and 75.21% of the doses that presented incompatibility were not classified according to the severity of the event.

We identified that incompatibilities classified as severe and moderate can generate cardiac toxicity, such as low cardiac output, sedative toxicity (CNS depression, respiratory depression, hypoventilation, hypertension, hypotension, hypoxia, tachycardia, and bradycardia), Arrhythmias, which can cause also a cardiac arrest.

Thus, the importance of an assessment about the health status of each patient hospitalized in the cardiac intensive units is carried out, and the observation of the number of prescribed drugs and their particularities to provide a better choice of the infusion device and the number of lumens, reducing the risk of incompatibilities and providing a safer drug therapy.

We expect that the product elaborated in the study, an instruction with the most frequent incompatibilities, the respective adverse events that can be caused, and the most important nursing care to minimize the damage or the prevention of the event caused by the incompatibility, can contribute to drug safety at the study place and be multiplied and adapted to other units with the same characteristics.

There is still a significant number of untested drug combinations and unclassified event severities, highlighting the need for further in-depth studies on drug safety.

Some limitations of this study are the software limitation due to the large number of untested medications related to incompatibilities, not presenting the event severity classification.

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