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ORIGINAL ARTICLE

INCIDENTS IN BEDSIDE HEMODIALYSIS SESSIONS IN INTENSIVE CARE UNITS

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ABSTRACT

Objective: to analyze incidents during bedside hemodialysis sessions held in Intensive Care Units. Method: cross-sectional, retrospective study, developed in Intensive Care Units of Goiânia, Brazil. Analysis of incidents identified in bedside hemodialysis sessions was performed between March and April 2018. Descriptive analysis was performed for categorical data and for continuous data, mean and standard deviation of the mean. Results: 873 sessions were analyzed, and 563 incidents were recorded. Among those reported, 259 (46%) were inherent to the treatment. Near miss was the most frequent type of incident, generating delay in the beginning of the session, and no support from the multi-professional team ($p<0.05$). In 132 (56.12%) of the notifiable circumstances, the professional worked for more than 12 uninterrupted hours ($p<0.05$). Conclusion: the analysis of the results allows students and experts in the area to subsidize improvement strategies for the service.

DESCRIPTORS: Quality of Health Care; Sentinel Surveillance; Patient Safety; Patient Harm; Nephrology Nursing.

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INTRODUCTION

Healthcare incidents are events or circumstances that may result in harm to the patient. They occur every day in various health care settings and establishments, and can generate injury, suffering, disability, and death[1-2].

The World Health Organization (WHO) classifies incidents into reportable circumstances, with significant potential for harm: near miss, when it did not reach the patient; incident without harm, which reached the patient but did not generate harm; and incident with harm to the patient, known as Adverse Event (AE)[1].

Higher complexity levels of care, such as the Intensive Care Unit (ICU), are prone to incidents. Criticality requires the use of complex health technologies, and the urgency in making risk decisions, often associated with a deficit of information about the patient's history, makes the patient vulnerable to harm[3].

Among the invasive treatments commonly performed in ICU patients, bedside hemodialysis (HD) is quite common[4]. The absolute number, incidence rates and prevalence in hemodialysis treatment are constantly growing[5]. Therefore, the HD service needs incident reduction and harm mitigation pathways.

A Scottish study of patients in HD in the ICU identified 9.6% of deaths caused by infections and 3.5% related to organizational and human errors, such as inadequate medical decisions, lack of knowledge in the management of hyperkalemia and prescriptions, and technological insufficiency for intervention in vascular accesses[6].

In Brazil, a study conducted with patients with chronic kidney disease (CKD) identified 1,272 AE. The most prevalent were inadequate blood flow, bleeding from venous access and coagulation of the extracorporeal system (ES). Of these AE, 0.9% were severe and 0.8% led to death[7].

To reduce AEs, it is necessary to understand the causes and contributing factors[8]. However, underreporting is a reality and a problem at local and national levels[9].

The nursing team has a key role in patient safety, since it acts in the identification, management, and proposition of plans capable of significantly reducing incidents[10].

From this perspective, this study, a pioneer in Brazil, aimed to analyze incidents occurring during bedside HD sessions in the ICU.

METHOD

This is a cross-sectional study conducted in an ICU in the city of Goiânia-GO, Brazil, in 2018. In this city, there are twelve clinics that provide outsourced HD services in the ICU. Among these, a clinic with care in ten ICUs of private institutions for the care of adult patients was chosen by convenience to compose the sample of this study.

The clinic in question offers services through a team of five nephrologists, one nephrology nurse supervisor, and ten nursing technicians. The technicians perform and follow all the bedside HD sessions, working on a twelve-hour work for 36 hours rest schedule.

For each HD session, supplies were sent to the site: a HD machine and a water treatment machine, known as portable reverse osmosis, as well as a nursing technician.

The clinic nurse's function is to supervise remotely, by telephone, in addition to supervising face-to-face with daily visits. The ICU nurse contributes to the supervision inside the unit where the HD sessions are performed.

In the ICU, different types of HD sessions are performed: conventional, isolated ultrafiltration, continuous HD, and sustained low efficiency dialysis (SLED), as prescribed by the medical nephrologist team.

The source of data for this study were the notifications made in March and April 2018 by the nursing team in the ICU bedside HD prescription form completed at the end of each session, regardless of whether there was an incident. All the notifications made during the study period were read, followed by the transcription of these notifications into a semi-structured instrument, prepared by the researcher to collect the notified data.

The instrument developed for data transcription was based on the Minimal Information Model for Patient Safety Incident Reporting and Learning Systems[8]. In this instrument, we recorded information about the HD session (HD reason, payment source, HD modality, use of heparin, prescribed and elapsed HD time, delay in start/end, session interruption); about the incidents (types and reasons); about the professional who performed the session (working hours, number of sessions performed in the day, team support in the sessions); and also information about the individual who suffered the incident (gender, age, comorbidities, access to HD).

. The data collected were typed into the Microsoft Excel® program. The first analysis was reading the notifications to classify them, and the typing was done so that each incident was characterized as an observation. Then, the notifications were grouped according to the WHO international classification of patient safety[1], in notifiable circumstances, near miss, incident without harm and AE.

Adverse events were divided into adverse events inherent to the treatment, when the failure in the assistance processes and health technologies was not evident, and avoidable adverse events, when the damage occurred due to avoidable failures during the process. Subsequently, descriptive analysis was performed for categorical data, presented as absolute (n) and relative (%) frequencies, and for continuous data as mean and standard deviation. To test the homogeneity of the groups with respect to proportions, the two-tailed Fisher's Exact Test was used.

The Shapiro-Wilk test was performed to test the normality of the continuous data, and then the Mann-Whitney U test was performed to compare the continuous data in the absence of normality. The significance level used for all tests was 5%. STATA® version 14.0 software was used in this analysis.

This research was approved by the Human Ethics Committee and has a Certificate of Submission for Ethical Consideration, under Opinion No. 1,922,585.

RESULTS

There were 873 bedside HD sessions, in which there were 627 notifications. Of these, 563 (89.79%) had incident records.

Total incidents reported were 563, most of them in male patients 305 (54.17%), in HD sessions with no described reason 289 (54.22%), with diabetes 115 (45.63%), in patients with non-SUS health insurance 532 (94.49%), who underwent HD by catheter 500 (88.81%), SLED modality 384 (68.33%), without heparin 497 (88.28%) and in therapies with time prescribed equal to the time performed 451 (80.11%).

Among the total incidents reported, the most frequent category was incidents inherent to the treatment, with 259 (46.00%) reported. Specifically for this type of incident, clinical changes during the sessions are highlighted in 181 (32.14%) of the occurrences, the most frequent being hypotension (63.09%). The other signs and symptoms category was composed of hyperglycemia (0.69%), cyanosis (0.69%), and decreased level of consciousness (1.37%) (Figure 1).

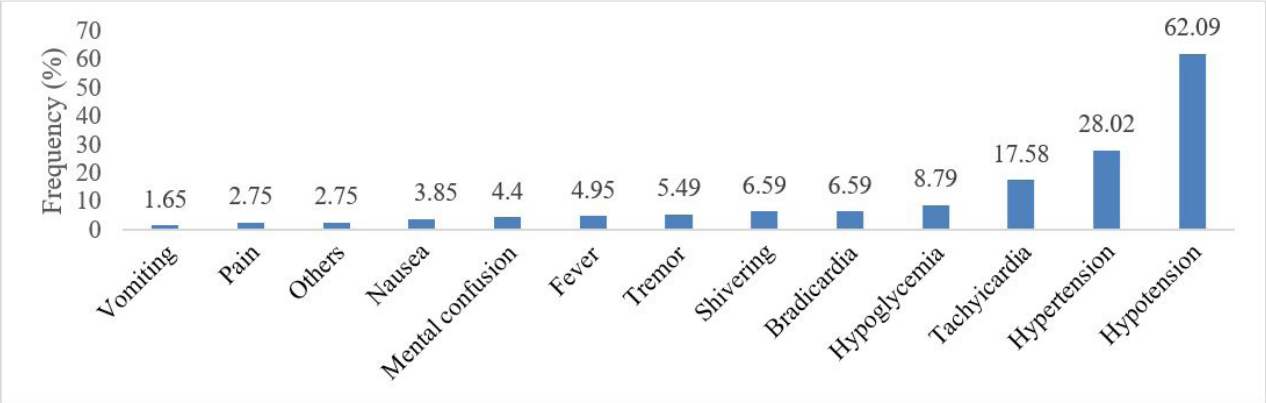

Figure 1 - Frequencies of the 181 Incidents related to signs and symptoms of patients on hemodialysis at the bedside in ICU. Goiânia, GO, Brazil, 2018. Source: Authors (2018)

The second category of incidents with more notifications was related to health technologies, 158 (28.06%), with emphasis on failures of health technologies in the clinic 105 (66.46%), of which 41 (39.05%) were related to water leakage in reverse osmosis. The frequency of notifications of incidents related to care delivery was also relevant 115 (20.43%), with the most frequent incidents related to the use of the catheter for HD, 51 (44.35%). The highest frequency was incompatibility of access with the prescribed flow: 44 (86.28%) of the incidents reported in this category.

There were 29 (5.15%) incident notifications in which the reasons were not reported, making it impossible to classify them by type. All identified incidents were classified according to the WHO nomenclature(1) and presented in Table 1.

Table 1 - Classification of incidents reported in bedside hemodialysis sessions in Intensive Care Units. Goiânia, GO, Brazil, 2018

Incident classification	**n**	**%**
Notifiable Circumstance	235	41,74
Adverse Events	312	55,41
Treatment Inherent Adverse Event	223	39,61
Avoidable adverse event	89	15,81
Near miss or near miss	10	1,78
Incident not described	6	1,06

Source: Authors (2018)

AEs totaled 312 (55.41%) of the reported incidents and were divided into inherent to treatment and preventable AEs. The AEs inherent to treatment stood out, 223 (39.61%), mainly due to signs and symptoms presented by the patient, such as hypotension, hypertension, and tachycardia.

Avoidable AEs, representing 89 (15.81%) of the reported incidents, were mainly due to failures in health technology. And the most common near misses were the programming of the wrong HD machine, especially regarding the dialysate flow. In six (1.06%) incidents, there was not enough information to classify the incident according to the WHO nomenclature(1).

In 335 (53.43%) of the 627 notifications evaluated, the technicians had been working for more than 12 continuous hours, and in 528 (84.21%) they had already performed at least three HD sessions that day. A significant association was observed between the time spent working for more than 12 hours by the technician responsible for the session, and notifiable circumstances (p<0.001). Avoidable AE and AE inherent to treatment were statistically associated with working time shorter than 12 hours, with p=0.005 and p<0.0001, respectively (Figure 2).

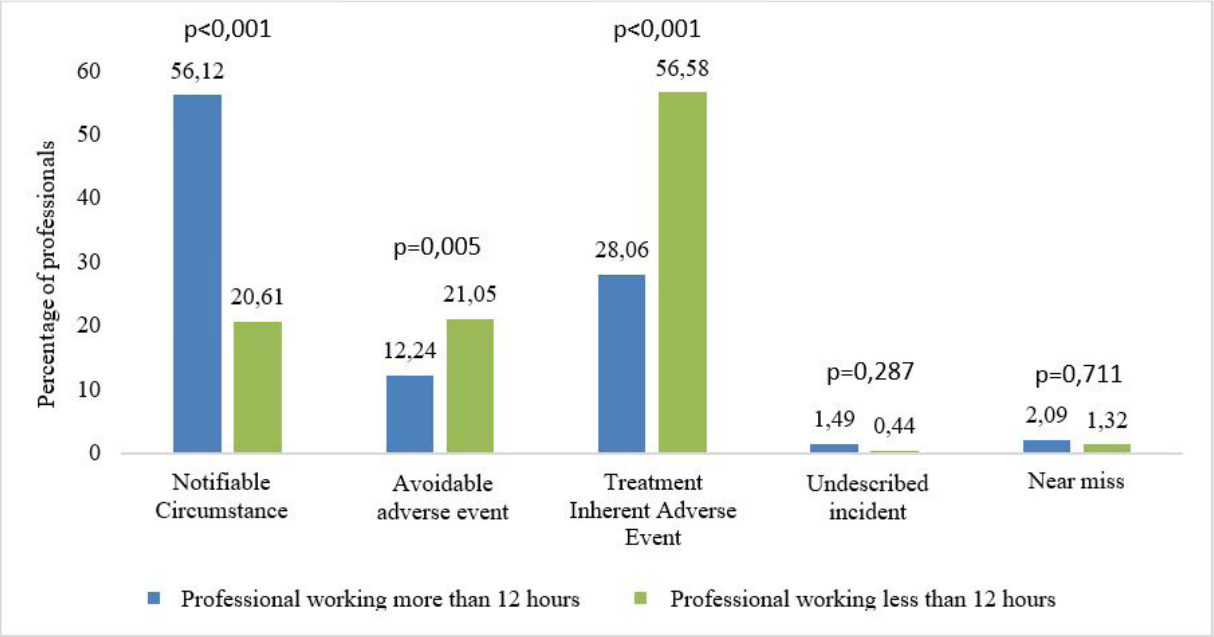

Figure 2 - Relationship between uninterrupted work time and incident classification. Goiânia, GO, Brazil, 2018. Source: Authors (2018)

Among the notifiable circumstances, it was observed in the 627 notifications that there was a higher frequency of session delay (16.42 vs. 4.79%, p<0.001); higher frequency of momentary interruption of the session (12.24% versus 6.16%, p=0.009), higher frequency of delay in ending the session (3.88% versus 1.03%, p=0.039), and finally, higher frequency of support by staff (25.08% versus 17.20%, p=0.001) in sessions conducted by technicians who had been working for more than 12 hours compared to those who had not been working for more than 12 hours.

Considering the occurrence of notification as an outcome variable, the incidents reported in sessions with no indication of the reason (p=0.015), in sessions by non-SUS

health insurance (p=0.049), in conventional HD (p<0.001), and in sessions in which the ratio between the prescribed and performed session time was the same (p=0.020) were statistically significant. On the other hand, there was a lower frequency of incidents when the HD was performed in the SLED (p=0.009) and continuous (p=0.013) modality.

DISCUSSION

Data from analyses of incidents in critically ill patients and with greater therapeutic invasion show an alarming scenario for patient safety[2]. The results are, therefore, indicators that direct the attention of health management to quality and safety actions in the service. This is necessary because, according to the Biennial Report of the International Society of Nephrology (ISN)[11], between 8 and 10% of the adult population in the world has some type of kidney injury, which may require overly complex care.

A study conducted in Brazil suggests that the gender of the patient may reflect subjectively in the workload of the nursing team, such as the weight of male patients, commonly higher than that of women, even if this is not a rule[12].

Given this profile, for patient safety, it is necessary to promote constant training of professionals, especially in the management of acute kidney injury (AKI) in patients over 60 years[11]. The knowledge of the patient's age allows for the management of human resources, since patients older than 60 years demand differentiated care and are susceptible to incidents[12].

The non-description of the diagnosis in the HD prescription was justified by the complexity of the patient admitted to an ICU with an emergency for bedside HD treatment, which is prescribed based on clinical signs and symptoms, before the conclusion of the diagnosis.

Most bedside HD sessions were performed through a non-SUS health insurance. This occurs because the ICUs where the research was carried out are not public health services, but private institutions that have an agreement with SUS.

Developing countries should invest in quality management and safety of patient care, because the data described above show the gaps in health care processes in HD services, which associated with the profile of patients show the risk of the patient who gets access to HD treatment to die, victim of an incident.

The incidents occurred more frequently in the performance of the SLED modality of HD therapy. A study carried out in Brazil, in ICU, points out conventional HD as the most prescribed modality of HD and, therefore, with higher chances of incidents[5].

This study identified more frequently hypotension, classified in this research as an incident inherent to the treatment. A research carried out in a reference unit of HD in Brazil pointed out that hospitalized patients who underwent HD presented hemodynamic instability due to the use of vasoactive drugs. It also identified that patients had hypotension, hypertension, and hypoglycemia, evolving to cardiorespiratory arrest[13].

A study conducted in Brazil refers to hypotension as the main complication of HD, with a blood pressure spike occurring in 25.5% of the identified complications(14). Currently, HD treatments have dialysis machines that help in patient safety, with advanced technology that helps to prevent hypotension, with UF control mechanisms, allowing to vary the sodium concentration of the dialysate[15].

However, despite the technological apparatus, nursing interventions are necessary

for patient safety, such as monitoring vital signs and observing signs and symptoms, actions that can reduce the occurrence and intensity of hypotension during HD.

Among the incidents that occurred during care delivery, the incidents with HD catheter, due to incompatibility of access with the prescribed flow, stand out, 44 (86.28%). A study carried out in an ICU in Brazil[5] identified the predominance of the use of double lumen catheter (CDL) as an access route for HD at the bedside, as identified in this study. Furthermore, 86.28% of incidents related to incompatibility of the CDL access with the prescribed flow were found, which could contribute to ES coagulation[16].

Incidents related to inadequate blood flow may be associated with the patient's clinical condition, technical skill of the professional, length of catheter stay, inadequate position of the catheter tip[17]. Coagulation of the ES, lines and capillaries may be due to improper functioning of the catheter for HD[13]. The ES coagulation represented 78 (30.12%) of the incidents classified as inherent to the treatment identified in this research.

A study conducted with nurses working in the care of patients in continuous HD in the ICU, identified as the main incident the loss of blood volume because the blood was not returned to the patient. This study highlights the lack of ability of the nursing professional to return the blood when the machine alarmed indicating blood coagulation[18].

The failure in technologies provided by the clinic was the most frequent type of incident involving health technologies, 105 (66.46%), especially the reverse osmosis machine leak, 41 (39.05%), and lack of water three (60.00%). A study conducted in a sentinel hospital in Brazil identified 2.2% AEs related to failure in water distribution[7].

Water treatment and quality are important, since it is the largest input in HD. Ensuring this quality reduces morbidity and mortality and hospitalizations, thus requiring a surveillance system[19]. Dialysis service managers are responsible for this activity[19].

In 2010, the Ministry of Health launched the National Policy for the Management Health Technology. This measure aimed to expand the scientific production to subsidize the managers of health services in the acquisition and withdrawal of health technologies[20].

The difficulty of support from the multi-professional team in the occurrence of the incident was an important finding, comprising 185 (58.73%) notifications. A study conducted with nursing staff at a sentinel hospital in Goiânia stated that there are communication problems in hospital and outpatient HD services, increasing the risks of AEs[16].

The present study identified eight (80%) reports of communication failure due to illegibility of hemodialysis prescriptions. A field study, applied and descriptive, conducted in 2017, showed that in 35% of prescriptions there were difficulties in understanding. Illegibility can compromise treatment and patient safety, causing treatment failure, health complications, and death[21].

Like the failure in programming the machine in relation to the prescription (19.13%), a study identified 83.9% of individual failures of professionals that generated AEs in patients who underwent HD in a sentinel hospital in Goiânia[16]. The lack of professional attention compromised patient safety, verified in 5.9% of AEs reported.

The result of this research was the insufficient dimensioning of the nursing team and its influence on the occurrence of notifiable circumstances. It was observed that more incidents occurred when the team was performing more than twelve hours of continuous activities. A study conducted in European cities verified that long working hours associated with the implementation of overtime resulted in low quality patient care[22].

The dimensioning of the team must take into consideration the complexity of the scenario, the involvement of simultaneous care, number of patients, demand for care, stage of the life cycle, contingencies, and demand for nursing care[23]. Healthcare institutions are challenged by the need to adapt to the evolution of the particularities of the environment,

by means of human resource management that is concomitantly safe, efficient, and patient-centered[23].

AEs inherent to the treatment showed a percentage of 39.61%, while preventable AEs were present in 15.81% of notifications. A cross-sectional study conducted in HD identified more frequently AEs related to inadequate blood flow, while in this study the most frequently identified AE was hypotension[7].

Innovative training program involving nursing staff and supervisors, in the areas of patient safety development, resulted in significant improvement in this area, however, identified as weak areas of safety culture the non-punitive response to errors and underreporting of incidents[24]. It is important to note that the WHO adopts as a premise the non-blaming of the professional who committed the error[25].

In this study, there was a low frequency of notification of some incidents, which can be justified by the fact that they were reported in a proper instrument for incident notification and the absence of pre-established routines for notification. Possible causes for underreporting are the professional's difficulties to comply with the routine of reporting, the feeling of no improvement of processes after reporting, the absence of anonymity and confidentiality, fear of negative response from the work team, fear of punishment, among others[26].

The study had limitations, such as the difficulty of the technical nursing professional of the clinic to access the medical records of patients who received a prescription for HD. Due to the secondary data source and the retrospective analysis, the absence of information made it difficult or impossible to analyze some reported incidents. However, it is expected that the findings discussed in this study may encourage new proposals for management improvement and consequent improvement in the quality of service provided to patients who undergo HD at the bedside.

CONCLUSION

The incidents more frequently affected men, elderly, diabetics. The procedures for HD through a catheter for HD were frequent, in the SLED therapy modality, with session time between four and five hours, without heparin and session subsidized by non-SUS health insurance companies. The most frequent incidents were hypotension and health technology failures. These led to delays in starting treatment and required vigilance.

The professionals who identified the incidents were mostly the nursing technicians of the clinic that administers the bedside HD. They recorded difficulties of support from the multi-professional team and the notifiable circumstances occurred predominantly when the technician was performing more than 12 hours of uninterrupted work.

Notifiable circumstances incidents were identified, followed by AEs inherent to the treatment, which can be minimized through improvements in care management actions during bedside HD sessions.

The analysis of the types of incidents allows students and experts in the field to subsidize strategies for service improvement. Beyond the place studied, the knowledge of the reality and the proposal of improvements in patient safety foster the formulation of strategies with visionary actions to prevent these incidents in the nephrology area. Thus, suggestions and proposals were raised together with the company's professionals in face of the data found. For example, important adjustments in the dimensioning of nursing technicians and in the preventive maintenance of equipment.

Bedside HD is a complex therapy, which can generate serious AEs to the patient. Therefore, it is necessary to review the quality management of processes and risks involving this therapy, formulating effective barriers to incidents, constantly reviewing protocols and routines.

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Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work - Costa MM da, Schincaglia RM, Freitas NR de, Costa CL, Suzuki K; Drafting the work or revising it critically for important intellectual content - Barreto R dos SS; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved - Costa NN. All authors approved the final version of the text.

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