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Adverse events in hemodialysis: reports of nursing professionals

EVENTOS ADVERSOS EM HEMODIÁLISE: RELATOS DE PROFISSIONAIS DE ENFERMAGEM

EVENTOS ADVERSOS EN HEMODIÁLISIS: TESTIMONIOS DE PROFESIONALES DE ENFERMERÍA

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ABSTRACT

This cross-sectional and quantitative study analyzed the knowledge of nursing professionals about adverse events (AE) in a hemodialysis unit of a teaching hospital. Data collection occurred from February to April, 2011, based on interviews with 25 professionals. Data analysis identified 517 reports of 32 types of AE; the most cited were obstructed catheter, accidental withdrawal of the needle and clotting of the extracorporeal system. Causes related to the patient were mentioned in 42.8% of the reports. The main measures adopted were the implementation/change of protocols and continuing education, with the latter being the primary suggestion for the prevention of AE. The results can contribute to a critical analysis of the quality of care in hemodialysis units, resulting in the development of actions that help to promote patient safety.

DESCRIPTORS

Renal dialysis
Nursing care
Security measures

RESUMO

O presente trabalho trata-se de estudo transversal e quantitativo que analisou o conhecimento dos profissionais de enfermagem sobre Eventos Adversos (EA) em uma unidade de hemodiálise de um hospital de ensino. A coleta dos dados ocorreu de fevereiro a abril de 2011, a partir de entrevistas com 25 profissionais. A análise dos dados identificou 517 relatos de 32 tipos, sendo os mais citados: cateter obstruído, retirada acidental da agulha e coagulação do sistema extracorpóreo. As causas relacionadas ao paciente foram mencionadas em 42,8% dos relatos. As principais condutas foram implementação/alteração de protocolos e educação continuada, sendo a última a principal sugestão para a prevenção. Os resultados podem contribuir para uma análise crítica sobre a qualidade do cuidado em unidades de hemodiálise, gerando o desenvolvimento de ações que auxiliem a promoção da segurança dos pacientes.

DESCRITORES

Renal dialysis
Nursing care
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RESUMEN

Este estudio, transversal y cuantitativo, analizó el conocimiento de los profesionales de enfermería sobre Eventos Adversos (EA) en una unidad de hemodiálisis de un hospital de enseñanza. La recolección de datos se realizó de febrero a marzo de 2011, a partir de entrevistas con 25 profesionales. El análisis de datos identificó 517 testimonios de 32 tipos, habiendo resultado los más citados: catéter obstruido, retiro accidental de la aguja y coagulación del sistema extracorpóreo. Las causas relacionadas al paciente fueron mencionadas en 42,8% de los testimonios. Las principales conductas fueron: implementación/alteración de protocolos y capacitación permanente, tratándose ésta última de la principal sugerencia para la prevención. Los resultados pueden colaborar a realizar un análisis crítico sobre la calidad del cuidado en unidades de hemodiálisis, generando el desarrollo de acciones que ofrezcan ayuda en la promoción de la seguridad de los pacientes.

DESCRIPTORES

Diálisis renal
Atención de enfermería
Medidas de seguridad

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INTRODUCTION

Renal failure occurs when the kidneys are incapable of removing waste products that originate from cell metabolism or regulating functions[1]. Renal failure affects millions of individuals, and renal replacement therapies represent a chance of survival for these patients. These treatments filter and purify blood, removing waste liquid and uremic products. In Brazil, approximately 92,901 individuals undergo this type of treatment, 90.6% of whom undergo hemodialysis[2].

Hemodialysis is performed by venous access that enables high blood flow. The blood is transported by an extracorporeal circulation system into a capillary filter in which it is purified and then returned to the body. This process is usually performed three times a week for a period of three to four hours[3].

Hemodialysis centers are places susceptible to the occurrence of adverse events because of various risk factors such as invasive procedures, complex equipment, critical patients, high turnover of patients, and the administration of potentially harmful medication (e.g., heparin). One study conducted in four hemodialysis centers in the United States reported that 88 adverse events occurred out of 64,541 dialysis treatments (one case for every 733 treatments) over a period of 17 months[4].

Adverse events are incidents that occur during care delivery and have the potential to harm patients. The harm can be physical, social or psychological, including disease, injury, suffering, disability or death[5].

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The increasing occurrence of these events worldwide has caused concern for specialists, researchers, managers and health workers. Data from the World Health Organization show that every year tens of millions of people worldwide experience disabling injuries or death because of adverse events[6].

Nurses are responsible for performing a great proportion of care actions and, therefore, are in a privileged position to reduce the chances of incidents occurring and affecting patients. They can also detect complications early and take measures to minimize harm[7].

Nursing staff working in hemodialysis centers should have knowledge of adverse events to identify related risks and situations that favor their occurrence and seek alternatives to minimize failures, adopting methods to analyze risks and ensure the quality of care.

This study's objective was to analyze, from 2005 to 2010, the knowledge of nursing workers concerning adverse events and to identify the occurrence of this type of event, its causal factors, measures taken, and suggestions to prevent these events in a hemodialysis center.

METHODS

This is a cross-sectional study with a quantitative approach performed in a hemodialysis center of a university hospital in Goiânia, GO, Brazil. The center had 17 hemodialysis machines: 14 for patients with negative serology for Hepatitis B, two for patients with positive serology for Hepatitis B and one for emergencies. Treatment was provided in the mornings and afternoons, from Monday to Saturday. The center cared for 34 patients per day, and each patient underwent three sessions per week, totaling 204 weekly hemodialysis sessions.

The nursing staff from the Renal Replacement Therapy service worked in the hemodialysis center, in the Intensive Care Unit and in Peritoneal Dialysis on rotating shifts. The staff comprised 42 nursing workers: eight nurses, 27 nursing technicians and seven nursing auxiliaries. Those working in the hemodialysis center at the time of data collection were included in the study. Of the 28 workers who met the inclusion criteria, three refused to participate, resulting in a loss of 10.7%. Hence, 25 nursing workers participated in the study.

Data were collected in February, March and April of 2011. An interview script with open and closed questions was used. The script addressed the professionals' characterizations, adverse events, whether the events occurred in the center, causal factors, measures and preventive actions taken. Experts from the field of patient safety analyzed the instrument. Each professional was interviewed once in the center itself during working hours on days and times previously scheduled according to their availability.

Data obtained from closed questions were included in a database in Microsoft Excel, version 2007, and statistically analyzed using the Statistical Package for the Social Sciences (SPSS), version 15.0. Data originating from open questions were grouped and characterized by similarity of content.

Pearson's Chi-square test was used to compare the reports of adverse events provided by the different professionals. The level of significance was fixed at 5%, that is, $p<0.05$. The results are presented in tables by descriptive statistics.

The project complied with the guidelines provided by Resolution 196/96, Brazilian National Council of Health [8] and was approved by the Ethics Research Committee, *Hospital das Clinicas*, Federal University of Goiás, GO, Brazil (Protocol No. 064/2008). All workers included in the study voluntarily consented and signed free and informed consent forms.

RESULTS

Seven (28%) of the 25 nursing workers in the study were nurses (N), 16 (64%) were technicians (T), and two (08%) were auxiliaries (A). Table 1 presents the characteristics of these professionals.

As for knowledge concerning adverse events, 12 workers were not able to define adverse events (one N, nine T, two A); nine (three N, six T) defined adverse events as *incidents, complications or unexpected events that occur during treatment*; three nurses defined them as *events or failures in care delivery that harm the patient* and one technician reported an adverse event to be *an accident that should not happen*.

With regard to the occurrence of adverse events between 2005 and 2010, the workers reported 517 events that they witnessed or were aware of, which were distributed into 11 categories (Table 2).

Table 1 – Characteristics of nursing workers of a hemodialysis center in Goiânia, GO, Brazil – 2011

Characteristics of workers	Professionals			Results	
	N	T	A	N	%
Schooling					
01 to 05 years and 11 months	-	-	-	-	-
06 to 10 years and 11 months	02	03	01	**06**	**24**
11 to 15 years and 11 months	02	09	-	**11**	**44**
More than 16 years	03	04	01	**08**	**32**
Total	07	16	02	**25**	**100**
Duration of Experience in the Renal Replacement Therapy Service					
01 to 05 years and 11 months	04	01	-	**05**	**20**
06 to 10 years and 11 months	01	14	01	**16**	**64**
11 to 15 years and 11 months	-	01	-	**01**	**04**
More than 16 years	02	-	01	**03**	**12**
Total	07	16	02	**25**	**100**
Has another job					
No	05	07	01	**13**	52
Yes	02	09	01	**12**	48
Total	07	16	02	**25**	**100**
Total weekly workload					
30 hours	04	07	01	**12**	**48**
40 hours	01	-	-	**01**	**04**
50 hours	02	01	-	**03**	**12**
60 hours	-	05	01	**06**	**24**
70 hours	-	03	-	**03**	**12**
Total	07	16	02	**25**	**100**

Table 2 - Reports of nursing workers concerning adverse events that occurred in a hemodialysis center according to categories - Goiânia, GO, Brazil – 2011

Categories of adverse events	Reports of professionals						X^2	*p*
	N		T		A			
	N	(%)	N	(%)	N	(%)		
Central venous access	49	(29.7)	89	(28.0)	10	(29.4)	0.17	0.92
Peripheral venous access	30	(18.2)	68	(21.4)	04	(11.8)	2.36	0.30
Equipment and medical-hospital material	20	(12.1)	49	(15.4)	06	(17.6)	1.24	0.54
Allergic processes	19	(11.5)	26	(8.2)	03	(8.8)	1.24	0.53
Water treatment	09	(5.4)	18	(5.7)	02	(5.9)	0.01	0.99
Coagulation in the extracorporeal system	07	(4.2)	16	(5.0)	02	(5.9)	0.23	0.89
Ran away, refused or abandoned treatment	06	(3.6)	15	(4.7)	02	(5.9)	0.47	0.78
Fall	11	(6.7)	07	(2.2)	01	(2.9)	6.17	0.04
Reaction to sterilization	04	(2.4)	13	(4.1)	02	(5.9)	6.17	0.04
Skin lesion – bandage/ hypoallergenic bandage	07	(4.2)	08	(2.5)	02	(5.9)	1.79	0.40
Medication error	03	(1.8)	09	(2.8)	-	-	0.14	0.71
Total	165*	(100)	318*	(100)	34*	(100)		

*More than one answer is provided by a professional to this question

Table 3 - Adverse events reported by nursing workers of a hemodialysis center per categories and types – Goiânia, GO, Brazil 2011

Categories and types of adverse events	Report of professionals			Frequency	
	E	T	A	N	%
Central venous access (catheter)					
Obstructed catheter	07	16	02	25	16.9
Inappropriate implantation	07	14	02	23	15.5
Crimped catheter	06	15	01	22	14.9
Infection	06	11	01	18	12.1
Inefficient clamps	06	09	02	17	11.5
Catheter accidentally removed	06	09	01	16	10.9
Punctured catheter	06	08	01	15	10.1
Catheter accidentally disconnected from bloodline	05	07	-	12	8.1
Subtotal	**49**	**89**	**10**	**148**	**100**
Peripheral venous access					
Needle accidentally removed	07	16	02	25	24.5
Infiltration	07	16	01	24	23.5
Unsuccessful puncture	05	15	01	21	20.6
Infection	07	13	-	20	19.6
Lack of needles	04	08	-	12	11.8
Subtotal	**30**	**68**	**04**	**102**	**100**
Medical-hospital equipment and material					
Hemodialysis machine malfunction	07	15	02	24	32.0
Disruption of capillary fibers	05	12	01	18	24.0
Capillaries exchanged among patients	04	11	02	17	22.7
Lack of capillaries	01	09	01	11	14.7
Lack of hemodialysis machine	03	02	-	05	6.6
Subtotal	**20**	**49**	**06**	**75**	**100**
Allergic processes					
Blood components	07	11	01	19	39.6
Bandage	07	07	02	16	33.3
Medication	05	08	-	13	27.1
Subtotal	**19**	**26**	**03**	**48**	**100**
Water treatment					
Lack of water	07	15	02	24	82.8
Free residual chlorine above permitted limits	02	03	-	05	17.2
Subtotal	**09**	**18**	**02**	**29**	**100**
Coagulation in the extracorporeal system	**07**	**16**	**02**	**25**	**100**
Ran away. refused or abandoned treatment	**06**	**15**	**02**	**23**	**100**
Fall					
Own height	04	05	01	10	52.6
Gurney	06	02	-	08	42.1
Wheelchair	01	-	-	01	5.3
Subtotal	**11**	**07**	**01**	**19**	**100**
Reaction to sterilization	**04**	**13**	**02**	**19**	**100**
Skin lesion due to continuous use of bandage/ hypoallergenic bandage	**07**	**08**	**02**	**17**	**100**
Medication error					
Error in administration	**03**	**08**	-	**11**	**91.7**
Error in prescription	-	**01**	-	**01**	**8.3**
Subtotal	**03**	**09**	-	**12**	**100**
Total	**165**	**318**	**34**	**517**	**100**

*More than one answer is provided by a professional to this question

The categories with the highest number of reports were related to central venous access (148; 28.6%), followed by peripheral venous access (102; 19.7%) and medical-hospital equipment and material (75; 14.5%).

The results showed no significant difference in the number of reports among the different professions ($p < 0.05$). This finding may be explained by the center's structural characteristics (closed and small environment), which facilitates access of all professionals to any event. Although there were no significant differences among the reports by profession, we consider it important to describe the composition of reports to deduce the staff's educational requirements. A total of 32 types of adverse events were identified in the different professions (Table 3).

All workers reported having either witnessed or heard about the occurrence of adverse events related to obstructed catheters, accidental removal of needles, or coagulation in the extracorporeal system.

When asked about the causes of adverse events, the participants reported 708 potential causes. These were categorized as patient-related, professional-related, or related to the service's organization (Table 4).

Table 4 - Causes of adverse events that occurred in a hemodialysis unit according to the reports of nursing workers, Goiânia, GO, Brazil 2011

Categories and types of adverse events	Report of professionals			Frequency	
	E	T	A	N	%
Patient-related					
Patient's clinical condition	60	112	13	185	61.1
Patient's or companion's carelessness	23	69	03	95	31.3
Denial of the disease	07	14	02	23	7.6
Subtotal	**90**	**195**	**18**	**303**	**100**
Professional-related					
Individual failure	60	108	04	172	83.9
Professional's unpreparedness	09	07	-	16	7.8
Inattention	06	05	01	12	5.9
Communication failure	02	02	-	04	1.9
More than one job	-	01	-	01	0.5
Subtotal	**77**	**123**	**05**	**205**	**100**
Related to the service's organization					
Poor quality/inadequate material resources or old/defective/ unmaintained equipment	41	51	13	105	52.5
Lack of material resources	08	25	02	35	17.5
Technical problem in water treatment/supply	10	21	02	33	16.5
Excessive workload	03	05	-	08	4.0
Lack of electricity	05	02	-	07	3.5
Inappropriate human resources	04	04	01	06	3.5
Inappropriate physical structure	01	01	-	02	1.0
Lack of training	02	-	-	02	1.0
Lack of specific protocols	01	-	01	02	1.0
Subtotal	**75**	**106**	**19**	**200**	**100**
Total	**242***	**424***	**42***	**708**	**100**

*More than one answer is provided by a professional to this question

We note that 303 (42.8%) adverse events were related to patients, 205 (28.9%) were related to professionals, and 200 (28.3%) were related to the service's organization.

With regard to the measures adopted by the center to prevent adverse events, there were 106 reports from which two categories emerged: *directed to the service* (60; 56.6%) and *directed to the professionals* (46; 43.3%).

Thirty-one (12 N, 15 T, four A) reports within the category *measures directed to the service* referred to the implementation and change of protocols and routines within the center, 12 (six N, four T, two A) reports referred to the improvement of material resources, five (one N, three T, one A) mentioned reports that were sent to the purchasing department reporting the quality of material, three (two N, one A) referred to measures to improve human resources, and two (one N, one T) reports referred to material and equipment maintenance requirements. Six nursing technicians highlighted various measures: the participation of the institution in the Sentinel Hospital surveillance system (two), the constant surveillance testing of material (two), and studies and research addressing risk evaluation (two). Only one technician stated that no measures were taken.

The most frequent reports in the category of *measures directed to professionals* were related to continuous educational actions: 23 (six N, 15 T, two A) mentioned meetings to discuss problems and orientation, 11 (one N, ten T) mentioned training programs, and eight (four N, three T, one A) mentioned qualification courses. Two professionals (one N, one T) stated that no measure was taken, one nursing technician suggested greater directed monitoring on the part of nurses and another suggested improving communication among professionals.

There were 52 suggestions to prevent adverse events in the center, which were also distributed into two categories: *measures directed to the service* (34; 65.4%) and *measures directed to the professionals* (18; 34.6%) (Table 5).

Tabela 5 - Suggestions from nursing professionals to prevent adverse events in a hemodialysis center, Goiânia, GO, Brazil 2011

Categories and types of adverse events	Report of professionals			Frequency	
	E	T	A	N	%
Directed to the service					
Provide continuous education	05	09	02	16	47.1
Provide adequate human and material resources	04	04	-	08	23.5
Improve communication and teamwork	02	02	-	04	11.8
Reduce excessive workload and number of patients	02	01	-	03	8.8
Implement protocols	01	01	-	02	5.9
Implement plans of action	-	01	-	01	2.9
Subtotal	**14**	**18**	**02**	**34**	**100**
Directed to professionals and patients					
Guidance to professionals and patients	01	06	02	09	50
Sensitization and greater attention on the part of professionals	01	05	-	06	33.3
Supervision/evaluation of health conditions and alertness on the part of professionals	-	02	-	02	11.1
Reprimand	01	-	-	01	5.6
Subtotal	**03**	**13**	**02**	**18**	**100**
Total	**17***	**31***	**04***	**52**	**100**

*More than one answer is provided by a professional to this question

DISCUSSION

With regard to weekly workload, we highlight the fact that 48% of the nursing workers in the hemodialysis center worked from 50 to 70 hours a week. This workload increases the risk of failures during care delivery. The risk of professionals making a mistake significantly increases when workload exceeds 40 hours a week, when the work shift exceeds 12 hours a day, or when the professional works extra hours[9].

That almost half of the workers did not know what adverse events are and that those remaining only poorly defined adverse events show the need to more thoroughly disseminate information on the subject within the institution. One study conducted with 68 nursing professionals in the public and private networks in Rio de Janeiro, Brazil showed that 78% of professionals reported knowledge of adverse events, 9% reported having heard about adverse events but were not able to define them, and 7% reported they had never heard of the concept. Among those who knew and those who had heard about adverse events, 45% learned or heard about adverse events within the hospital itself[10].

Professionals should be aware of adverse events and their effect on healthcare delivery because the incidence of these events is an important indicator of the quality of care. The subject should be addressed in teaching institutions whether at the technical, advanced or graduate level and be constantly discussed in health facilities.

The adverse events most frequently reported by professionals were related to venous access. One study conducted in the United States reports adverse events related to the infiltration of vascular access, coagulation in the extracorporeal system, malfunctioning dialysis equipment, medication errors, and patients falls[4].

An obstructed catheter was one of the most frequently reported adverse events in this study, reported by 100% of the professionals. This event occurs when a clot forms in the catheter's lumen, preventing the patients' blood from flowing to the hemodialysis machine. One study conducted in a nephrology service in the city of Ribeirão Preto, SP, Brazil showed that of all the local complications involving catheters used by patients in hemodialysis treatment, 18% referred to catheter obstruction. This type of event may be related to the patients' clinical condition, the type of catheter, the professionals' technical ability, the duration of catheter use, and excessive and inappropriate manipulation, among other reasons[11].

Complications associated with vascular access and catheters may be severe, posing a high risk of morbidity and mortality. Hence, the role of nurses is to monitor, detect and intervene in complications occurring during

hemodialysis sessions, considering their specialty and responsibility in the hemodialysis center. Such a role does make a difference in the safety and quality of care delivered during hemodialysis procedures[12].

With regard to the category of an adverse event related to peripheral venous access, all of the interviewed professionals mentioned the accidental removal of needles. The accidental removal of the needle that punctures the arteriovenous fistula is considered one of the most dangerous adverse events occurring in hemodialysis centers because the patient can bleed to death in a matter of minutes. Therefore, nursing staffs must adopt measures to reduce the risk of such an event. The European Dialysis and Transplant Nurses Association/European Renal Care Association proposed 12 recommendations to reduce the risk of disconnecting the venous line, promote the early detection of bleeding, prevent this type of event, and reduce harm from it[13].

The adverse events related to vascular access may be prevented by improvement of care processes used by nursing staffs as well as by constant evaluation of the results of practices adopted. One study evaluating the quality of care practices in hemodialysis reported four indicators to assess vascular access, three concerned with the process and one concerned with the outcome, namely, use of a double-lumen catheter for a temporary hemodialysis catheter, maintenance of double-lumen catheters, monitoring of the arteriovenous fistula, and monitoring of the complications from an arteriovenous fistula[14].

Blood coagulation in the extracorporeal system, another adverse event reported by all of the professionals, generally occurs in sessions not performed with heparin because of some counter-indication. One study conducted in four hemodialysis centers in the United States reported 19 cases of coagulation in the system over a period of 17 months. This was the second most frequent adverse event, although most of the cases occurred when heparin was not used[4].

The patient's clinical condition was the most frequently reported cause of adverse events. The patient's condition directly influences the occurrence of adverse events especially among severe patients because of their instability and the need for interventions, which render patients particularly vulnerable to adverse events[15].

Individual failures were the second most frequently reported cause of the occurrence of adverse events. There are diverse psychological and physiological factors influencing the behavior of professionals during care, which may interfere with the safety of patients. The most frequent include lack of cognitive technical abilities (perception of the situation), social (teamwork) and personal abilities (stress) [16].

An important element in the occurrence of an incident is understanding that the cause of errors and adverse events is multifactorial and that health professionals are susceptible to making mistakes when technical and organizational processes are complex and ill-planned[17]. Organizations should structure their systems to provide a safe environment that prevents workers from making mistakes[18]. All of the causes should be analyzed by the risk management service to devise corrective actions that prevent or reduce adverse events.

As for the measures adopted to prevent adverse events, we note that most measures were directed to the service, showing a concern with improving working conditions and promoting safer environments. The implementation and change of protocols and continuous education were the most reported actions. Protocols were developed to render the work process more efficient, standardizing care delivery[19].

Among the suggestions made by professionals to prevent the occurrence of adverse events, continuous education was considered the most important measure and an important action to qualify and develop human resources. The nursing staff from a hemodialysis center should develop competencies in the detection and prevention of adverse events, adopting strategies to improve care processes developed in daily practice[20]. Continuous education should be considered part of a global policy to qualify health workers focused on the need to change practices and improve the quality of care.

CONCLUSION

This study analyzed the knowledge of the nursing staff of a hemodialysis center concerning the occurrence of adverse events, their causal factors, related measures and the preventive actions adopted.

The analysis revealed that many professionals were not able to define adverse events. Nursing staff members should, however, have knowledge concerning this issue to develop the competence to detect and prevent adverse events. Lack of knowledge can be addressed by rapid and low-cost actions such as the dissemination of concepts and information concerning risk management.

The reports concerning the occurrence of adverse events indicate weaknesses in the development of the care process in the hemodialysis center, whether because of individual or systemic causal factors, posing a risk to patients.

This study contributed to providing a critical analysis of the workers in the center in relation to the structure and processes of the center as well as to the quality of care delivery. It has encouraged the adoption of measures to minimize the occurrence of adverse events such as reporting and changes in the process, among others. There is, however, a continuous need to investigate, report, and analyze the occurrence of such events to support the planning of proactive interventions such as the development of defensive barriers to prevent adverse events, achieving quality care that is not harmful to patients.

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