YOĞUN BAKIM ÜNİTESİNDE SÜREKLİ RENAL REPLASMAN TEDAVİSİ UYGULANAN HASTALARDA GELİŞEN KOMPLİKASYONLAR VE HEMŞİRELİK GİRİŞİMLERİ

Derya TÜLÜCE

Assist. Prof., PhD., RN; Nursing Department, Faculty of Health Sciences, Osmaniye Korkut Ata University, Osmaniye, Turkey. ORCID ID: https://orcid.org/0000-0002-1340-013X drytlc87@gmail.com

Burcu BAYRAK KAHRAMAN

Assoc. Prof., PhD., RN; Faculty of Health Sciences Nursing Department, Bilecik Seyh Edebali University, Bilecik, Turkey. burcumbayrak@hotmail.com

Tuba ŞİMŞEK

RN; Harran University Research and Application Hospital, Şanlıurfa, Turkey. tubcaa@gmail.com

Öz

Bu çalışma, yoğun bakım ünitesinde sürekli renal replasman tedavisi uygulanan hastalarda gelişen komplikasyonları ve bu komplikasyonları önlemeye yönelik hemşirelik girişimlerini belirlemek amacıyla yapılmıştır. Hastaların sosyodemografik ve klinik özellikleri ile birlikte komplikasyon gelişme durumu ve gelişen komplikasyona yönelik hemşirelik girişimleri belirlendi. Veriler ortalama, standart sapma ve frekans ile değerlendirildi. Tanımlayıcı tipte olan bu çalışmada bir üniversite hastanesinin genel yoğun bakım ünitelerinde 02 Ocak 2019 ile 02 Ocak 2020 tarihleri ??arasında yatan 27 hastaya toplam 48 CRRT uygulanmıştır. Hastaların yaş ortalaması 62.92+20.13, APACHE II 25.92+5.33'dir. Yoğun bakımda kalış süresi 23.73+23.67 gündür. SRRT uygulanan hastalarda sık görülen ilk üç komplikasyon; %75.0 hipotansiyon, %47.9 damar yolu sorunu, %43.8 sistem pıhtılaşmasıdır. Sık görülen komplikasyonlarla ilgili hemşirelik girişimleri hastaya uygun pozisyon verilmesi, hemofiltrasyon cihazının basınç göstergelerinin kontrol edilmesi, cihaz göstergelerinde arter ve ven basınçları ve ultrafiltrasyon hızının kontrol edilmesi, saatlik sıvı giriş çıkış takibi yapılması, vital bulgular saatlik izlenmesi şeklinde tanımlanmıştır. SRRT uygulanan hastalarda ve yoğun bakım ünitesindeki hemşirelerde temel hemşirelik girişimlerini uyguladığı birçok komplikasyonun geliştiği saptandı. Ancak bu hemşirelik müdahalelerinin düzeylerinin yeterli olmadığı belirlendi.

Anahtar Kelimeler: SRRT Tedavisi; SRRT Komplikasyonları, Hemşirelik Bakımı, Yoğun Bakım

COMPLICATIONS DEVELOPED IN PATIENTS WITH CONTINUOUS RENAL REPLACEMENT THERAPY IN THE INTENSIVE CARE UNIT AND NURSING INTERVENTIONS

Abstract

This study is to determine the complications developing in patients undergoing continuous renal replacement therapy in an intensive care unit and nursing interventions to prevent these complications. Along with the socio-demographic and clinical characteristic of the patients, complication development status and nursing interventions for developing complications were determined. Data were evaluated with mean, standard deviation and frequency. In this descriptive study, a total of 48 CRRTs were applied to 27 patients hospitalized in the general intensive care units of a university hospital between 02 January 2019 and 02 January 2020. The average age of the patients is 62.92+20.13, APACHE II 25.92+5.33, the duration of stay in intensive care is 23.73+23.67 days. Common first three complications in patients undergoing CRRT; 75.0% hypotension, 47.9% vascular access problem, 43.8% system clotting. Nursing interventions related to common complications have been defined as giving the patient an appropriate position, checking the pressure indicators of the hemofiltration device, checking the arterial and venous pressures and ultrafiltration rate on the indicators of the device, hourly fluid inlet and outlet was followed, vital signs were monitored hourly. It was found that many

complications developed in patients undergoing CRRT and nurses in the intensive care unit applied basic nursing interventions. There were not sufficient.

Keywords: CRRT Treatment; CRRT Complication; Nursing Care; Intensive Care

1. INTRODUCTION

Acute kidney diseases are a common problem with high mortality in patients in intensive care units. Renal replacement therapy is often used to resolve this problem. There are several types of renal replacement therapy. These are: intermittent haemodialysis, continuous low-effect dialysis and continuous renal replacement therapy (CRRT) (1). CRRT is an effective method for removing fluid and toxic substances in hypotensive patients needing nutritional support, who develop multi-organ failure in intensive care, and for enabling solute cleaning and fluid withdrawal for 24 hours (2). As it is a complex treatment method, it is preferred to be applied by trained nurses in intensive care. For this reason, four basic nursing principles have been determined in monitoring CRRT. These principles are: continuous evaluation of indications for proper mode effect, ensuring good vascular access, avoiding unnecessary interruptions and preventing complications (3). Since hemofiltration application is an interventional procedure and requires technical equipment and experience in intensive care units, it causes many technical or physiological complications such as clotting, vascular access problems, air in the set, hypotension, hypothermia and bleeding (3,4). Prevention of these complications depends on the experienced intensive care nurse's implementation of cause-oriented care interventions (5). Nurses managing the CRRT process know CRRT training goals, types of kidney failure, kidney replacement treatments and dialysis principles and other dialysis-related issues such as types of access and locations, fluid management, anticoagulation, laboratory tests, and documentation. This process also includes the operation of the devices used during CRRT and management of the alarm system (3). In the light of this information, the few publications which are available contain general information about CRRT and nursing care, but any research on CRRT complications and applied nursing interventions is not found. For this reason, this study was carried out to determine the complications developing in patients undergoing continuous renal replacement therapy in an intensive care unit and nursing interventions to prevent complications. This study was carried out descriptively in order to determine the complications developing in patients undergoing continuous renal replacement therapy in an intensive care unit and nursing interventions to the these complications.

2. MATERIALS AND METHODS

2.1. Study design

The study was performed as a descriptive study.

2.2. Setting and participant

Research data was obtained in XXX University Hospital, Turkey between 02 January 2019 and 02 January 2020. This study included patients who were in the general intensive care units of the university hospital, who were over the age of 18, planned to have continuous renal replacement therapy and who accepted the research by himself / his first-degree relative. Patients who were under 18 years of age, who were not willing to participate in the study, either themselves or by their first degree relatives, and who underwent intermittent haemodialysis or peritoneal dialysis were excluded.

In the intensive care unit where the study was conducted, a total of 53 CRRTs were applied to a total of 33 patients. However, 27 patients who met the inclusion criteria between the dates determined were included in the study and 48 CRRTs were applied to these patients.

2.3. Data collection

The patients who started the CRRT and met the research criteria were included in the study. Research data consist of nursing interventions recorded on observation forms while applying CRRT treatment to the patient. The research data were collected currently from nurse forms with the data collection form developed by the researchers.

Data collection form: The data collection form consists of 23 questions that question nursing interventions related to the following topics: patient's age, gender, height, weight, diagnosis of hospitalization, concomitant diseases, invasive mechanical ventilation support, Glasgow Coma Scale, APACHE II score, Rifle Score , duration of stay in intensive care unit, form of getting out of the intensive care unit, diet, drugs used, creatine before CRRT, BUN value and blood gas values, CRRT duration, catheter location, anticoagulant status, inotropic drug status, complication development status and developing complications (Vascular access problems, Bleeding / thrombosis, System clotting, Hyperglycaemia, Air in the set, Hypocalcaemia, Hypotension, Hypophosphatemia, Hypothermia, Metabolic alkalosis, Membrane reactions and Catheter related infections)

2.4. Ethical approval

In order to conduct the study, the necessary written permissions were obtained from the chief physician of XXX University hospital and the XXX University Clinical Research Ethical Committee of non-invasive clinical researches (number: 18/12/34), and the informed consent of the conscious patients who met the criteria for inclusion in the study were obtained from themselves and also were obtained from the first degree relatives of the unconscious patients.

2.5. Statistical data

The data were analyzed using the 22.0 (Statistical Package for Social Sciences) program. Data for continuous variables were determined using mean and standard deviation, and data for categorical variables were determined using frequency and percentage. In the tests, the statistical significance limit alpha level was accepted as $p < 0.05$.

3. RESULTS

When the demographic characteristics of the patients were examined, the average age was 62.92 ± 20.13, the average height was 166.96 ± 6.22 and the average weight was 77.33 ± 13.20. 56.3% of the patients were male (Table 1).

When the disease-related features of the patients were examined; it was determined that 27.1% of the patients were hospitalized in the intensive care unit with the diagnosis of cardiac arrest, 58.3% had hypertension, 89.6% had invasive mechanical ventilation and 88.89% had enteral nutrition support.

The average of Glasgow coma scale of the patients was 5.60 ± 3.01, the average of APACHE II was 25.92 ± 5.33, and the average stay in intensive care unit was 23.73 ± 23.67 days. The most commonly used drug was determined to be mucolytic, antibiotic and proton pump inhibitor (100%, 100% and 91.7%, respectively), and the mean values of some laboratory findings before CRRT were determined as follows: creatine 2.92 ± 1.45, BUN 146.83 ± 67.05, Na^+ 136.15 ± 17.75, K^+ 6.06 ± 13.70 and glucose 115.25 ± 49.49. Blood gas values were determined as follows: pH 7.33 ± 0.10, HCO^{3-} 22.23 ± 5.74, $PaCO_2$ 45.11 ± 12.23, PO_2 102.74 ± 47.36, SPO_2 88.89 ± 18.74. It was also determined that CRRT duration average was 18.50 ± 14.55, CRRT amount average was 63.96 ± 38.91 and in 83.3% of the patients the catheter site was V. Femoralis and 100% received heparin support, 77.1% used inotropic medication and 97.9% had complications (table 1). In addition, 77.78% of the patients were found to be exitus.

Table 1: Socio-demographic and disease-related features of patients (n=27)

	% / X±sd

Age	62.92±20.13
Gender	
Female	%43.8
Male	%56.3
Height	166.96±6.22
Weight	77.33±13.20
Intensive Care Hospitalization diagnosis	
Cardiac arrest	%27.1
Respiratory Failure	%16.7
Cerebrovascular accident	%14.6
Heart failure	%4.2
pneumonia	%16.7
General condition disorder	%4.2
Other	%16.8
Existing chronic diseases *	
Mental retarder	%6.3
Hypertension	%58.3
Diabetes mellitus	%33.3
Serebrovasculer disease	%25.0
Heart failure	%29.2
COPD	%6.3
Substance abuse	%4.2
Chronic Kidney Disease	%10.4
Respiratory Failure	%2.1
Invasive mechanical ventilation support	
Yes	%89.6
No	%10.4
Glasgow Coma Scale	5.60±3.01
APACHE II	25.92±5.33
Rifle Score	
N	%18.52
R	%14.81
I	%14.81
F	%51.86
Duration of stay in intensive care	23.73±23.67
Exit from intensive care	
Died	%77.78
Transfer to Clinic	%18.52
Discharge at home	%3.70
Nutrition	
Enteral	%88.89
Parenteral	%7.41
Oral	%3.70
Drugs Used *	
Albumin	%12.5
Proton pump inhibitor	%91.7
Mucolytic	%100.0
Antibiotic	%100.0
Dopamine	%81.3
Antithrombotic	%62.5
Steroid	%54.2

Bronchodilator	%66.7
Anticoagulant	%10.4
Diuretic	%60.4
Creatine value before CRRT	2.92+1.45
BUN value before CRRT	146.83+67.05
Blood gas values before CRRT	
pH	7.33+0.10
HCO^{3-}	22.23+5.74
$PaCO_2$	45.11+12.23
PO_2	102.74+47.36
SO_2	88.89+18.74
Na^+	136.15+17.75
K^+	6.06+13.70
Glucose	115.25+49.49
CRRT duration	18.50+14.55
CRRT amount	63.96+38.91
Catheter Location	
V. Femoralis	%83.3
V. Subclavian	%6.3
V. Jugularis	%10.4
Anticoagulant status	
Heparin	%100.0
Inotropic drug status (during the procedure)	
Yes	%77.1
No	%22.9
Complication development status	
Developed	%97.9
Not developed	%2.1

* more than one answer

Complications seen in patients undergoing CRRT were determined as follows: 75.0% hypotension, 47.9% vascular access problem, 43.8% system clotting, 29.2% hypothermia, 20.8% air in the set, 20.8% hyperglycaemia, 14.6% membrane reactions, 14.6% bleeding-thrombosis, 12.5% metabolic alkalosis, 8.3% catheter-related infection and 2.1% hypocalcaemia (table 2).

Table 2. The speed of complications seen in patients undergoing CRRT

Developing complications	%
Hypotension	75.0
Vascular access problems	47.9
System clotting	43.8
Hypothermia	29.2
Air in the set	20.8
Hyperglycaemia	20.8
Membrane reactions	14.6
Bleeding, thrombosis	14.6

Metabolic alkalosis	12.5
Catheter-related infections	8.3
Hypocalcaemia	2.1

Nursing interventions for complications developing in patients undergoing CRRT were given in table 3.

Table 3. Nursing interventions for complications developing in patients undergoing CRRT

Developing Complication	Nursing Intervention	%
Vascular access problems	The patient was given the appropriate position	47.9
	Lumens of catheter were checked	47.9
	Pressure indicators of hemofiltration device were checked	47.9
	At the request of the physician, each lumen of the catheter was washed with an anticoagulated saline solution.	35.4
	The hemofiltration system was stopped briefly and each lumen of the catheter was washed with 10 ml of saline.	33.3
System clotting	Arterial and venous pressures in the indicators of the device, ultrafiltration rate, colour of blood circulating in the haemofilter line were regularly checked	43.8
	Hemofiltration set was changed	29.2
	Clotting times of the patient were checked	20.8
	Washing of haemofilter and system line with saline was provided	20.8
	All blood in the set was given to the patient before the set was changed.	14.6
	ACT-Activated Coagulation Time level was checked at the beginning of treatment, one hour later and every 4 hours thereafter.	2.1
Air in the hemofiltration set	Air detectors in the set were checked one by one	20.8
	It was checked whether the alarms of the device were on or not.	18.8
	All connections were tightly closed	14.6
	Drip chambers were filled at the proper level	14.6
Hypotension	Hourly fluid inlet and outlet was followed	72.9
	Vital signs were monitored hourly	72.9
	Vasoactive drugs were started with the request of a physician	35.4
	The amount of replacement fluid has been increased	10.4
Hypothermia	Body temperature was measured regularly	29.2
	Patient was warmed with warming blankets	27.1
	Lines of the hemofiltration set, dialysate fluids, replacement solution were heated with a blood warming device	2.1

	The haemofilter, the arterial and venous connection lines of the system were wrapped with aluminium foil and the blood circulating in the system was warmed.	-
Bleeding, thrombosis	The patient was closely monitored for signs and symptoms of bleeding	12.5
	Bleeding and clotting times were checked	6.3
Hyperglycaemia, hypocalcaemia, hyperphosphatemia, metabolic alkalosis,	Urea and creatinine values were checked	37.5
	Serum electrolyte values were checked	37.5
	Blood sugar monitoring was done	37.5
	Blood gas monitoring was done	37.5

4.   DISCUSSION

Continuous renal replacement therapy is an extracorporeal process with risks and complications (3). In this process, the role of the nurse in the care of CRRT patients is great. The establishment and discontinuation of the treatment, the application of the fluid, the adjustment of the fluid according to the doctor's request, the monitoring of electrolytes, anticoagulation management and hemodynamic monitoring are among the interventions in this role (6). Along with these interventions, an important part of patient care is the prevention of complications that may develop during CRRT (3). One of the complications seen during CRRT is hypotension. It is stated that hypotension occurs in more than a third of patients, but it is not often related to the dialysis CRRT procedure (4). For this reason, permanent renal replacement therapy is preferred instead of traditional haemodialysis for hemodynamically unstable patients due to the risk of systemic hypotension (7). Despite this, hypotension is also common during CRRT. As a matter of fact, in a study conducted by Silversides et al, it was determined that 87.3% of patients who underwent CRRT developed hypotension one or more times (8). In our study, the most common complication was determined to be hypotension. Monitoring of fluid inlet and outlet hourly, monitoring of vital signs also on an hourly basis, increasing the amount of replacement fluid when necessary, and administering vasoactive medications at the request of a physician are stated as nursing interventions for hypotension during CRRT by Terzi (5). In our study, the first three nursing interventions were determined as follows in half of the situations in which hypotension developed: hourly monitoring of fluid inlet and outlet, hourly monitoring of vital signs, and initiation of vasoactive drugs with the request of a physician. Considering this point of view, it can be said that the interventions of the nurses in the intensive care unit where the study was conducted are compatible with the literature, but not at the desired level.

Vascular access is very important in terms of achieving the flow rate that prevents clot formation in the filtration system and thus the interruption of treatment (9). Femoral vein, subclavian vein and jugular vein are common areas used for this purpose. However, the use of subclavian vein is not recommended due to the increase in the incidence of central vein stenosis. It is stated that the femoral vein should not be preferred for many reasons such as infection risk, increased pressure alarms in patients with increased intra-abdominal pressure, and preventing flow due to bending (10). However, in our study, it was determined that in majority of patients the CRRT access was achieved through the femoral vein. For the vascular access problems, controlling the patient's movements to prevent the catheter from bending, positioning the patient properly, smoothing the lumens of the catheter manually, controlling the pressure indicators of the hemofiltration device, stopping the hemofiltration system for a short time and washing each lumen of the catheter with 10 ml of saline rapidly, and if necessary washing each lumen of the catheter with an anticoagulated saline solution

by notifying the physician have been determined as the possible nursing interventions (5). In our study, it was determined that the nurses mostly gave the most appropriate position for the patient, controlled the lumens of the catheter and controlled the pressure indicators of the hemofiltration device for this problem. It is thought that this situation in our study was due to the frequent occurrence of these interventions due to the presence of femoral catheters in most of the patients and flow inhibition due to bending of the femoral catheter etc.

Another of the most common complications during continuous renal replacement therapy is coagulation of the circuit (4). In our study, clotting of the system is among the three most common complications. The main reason for this complication is the insufficient blood flow or interruption. Heparin is widely used to prevent clotting. However, increased heparin use has been associated with a risk of bleeding. Therefore, regional citrate anticoagulation is the more preferred and recommended anticoagulation method (9). Apart from this pharmacological intervention, non-pharmacologically the following elements appear as nursing interventions against system clotting: checking the indicators of the device, checking the clotting time of the patient, checking the level of ACT-Activated Clotting Time, washing the haemofilter and the system line with saline as often as necessary, giving the whole blood in the system back to the patient before changing the system when the set of the hemofiltration system is clotted (5). Nurses play an important role in minimizing the risk of circuit clotting by assessing the condition of the circuit and responding immediately to alarms to reduce clotting due to downtime (11). In addition, Dirkes and Wonnacott has specified the training of nurses, alarm troubleshooting information and rapid response to alarms as necessary points to minimize circuit breakdown and prolong circuit life. In our study as well, it was determined that the nurses mostly control the indicators of the device against this complication, then change the hemofiltration set, and control the clotting time of the patient and wash the haemofilter and system line with saline. Changing the hemofiltration set appears as the second highest nursing intervention in our study in case of system clotting. However, it is stated in the literature as an intervention that should be avoided as much as possible as it causes increase in the workload of nurses, the costs and infection risk and it causes blood loss in the patients (10,11). In addition, although it was stated by Terzi (5) that giving the entire blood in the set to the patient before the set was changed is among the appropriate nursing interventions in the case of system clotting, it was observed that this intervention was applied at a very low rate in our study.

5. CONCLUSION

As a result, the role of intensive care nurses in patient care and CRRT management is very important because they are professionals who start, monitor, evaluate and terminate treatment (3). In our study, it was determined that many of the complications mentioned in the literature developed in the CRRT patients and the nurses in the intensive care unit, where our study was conducted, applied basic nursing interventions, but the level of nursing intervention was not at the desired level.

Conflicts of Interest

No conflict of interest has been declared by the authors.

Ethical approval

In order to conduct the study, the necessary written permissions were obtained from the chief physician of XXX University hospital and the XXXUniversity Clinical Research Ethical Committee of non-invasive clinical researches (number: 18/12/34), and the informed consent of the conscious patients who met the criteria for inclusion in the study were obtained from themselves and also were obtained from the first degree relatives of the unconscious patients.

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