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Original article

CHRONIC KIDNEY INJURY AT AN INTENSIVE CARE SERVICE: CLINICAL CHARACTERISTICS AND OUTCOMES

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ABSTRACT: The objective in this quantitative and retrospective documentary study was to characterize the clinical-demographic profile and outcome of kidney failure patients submitted to dialysis therapy at an adult intensive care unit of a general hospital in the South of Brazil. The data were collected between January and February 2013 and the sample consisted of 74 patient histories. The prevalence of men was identified, with a mean age of 63.43 ± 14.73 years, clinical motives were the most frequent cause of hospitalization and one or more associated comorbidities. The most prevalent kidney injury was acute chronic, pre-renal injury. The most recurrent motive for the injury was septic shock. The preferred treatment was conventional hemodialysis using a catheter. The most common outcome was death. The, the identification of risk factors and knowledge about the associated factors supports the rapid identification of problems and the implementation of nursing actions.
DESCRIPTORS: Inpatients; Renal insufficiency; Critical care; Renal dialysis.

LESÃO RENAL AGUDA EM UNIDADE DE TRATAMENTO INTENSIVO: CARACTERÍSTICAS CLÍNICAS E DESFECHOS

RESUMO: Estudo quantitativo, documental, retrospectivo, que objetivou caracterizar o perfil clínico-demográfico e o desfecho de pacientes com insuficiência renal, submetidos à terapia dialítica em uma unidade de terapia intensiva adulto de um hospital geral da região sul do Brasil. Os dados foram coletados no período de janeiro a fevereiro de 2013 e a amostra, constituída por 74 prontuários. Identificou-se prevalência do sexo masculino, média de 63,43 ± 14,73 anos, o motivo clínico foi o mais frequente para internação, com uma ou mais comorbidades associadas. A lesão renal com maior prevalência foi a crônica agudizada, pré-renal. Com relação aos motivos que levaram à lesão, o choque séptico foi mais recorrente. O tratamento de escolha foi hemodiálise convencional, por cateter. O desfecho mais comum foi o óbito. Desta forma, a identificação de fatores de risco e conhecimento dos fatores associados fornece subsídios para rápida identificação de problemas e implementação de ações de enfermagem.
DESCRITORES: Pacientes internados; Insuficiência renal; Terapia intensiva; Diálise renal.

LESIÓN RENAL AGUDA EN UNIDAD DE TRATAMIENTO INTENSIVO: CARACTERÍSTICAS CLÍNICAS Y DESFECHOS

RESUMEN: Estudio cuantitativo, documental, retrospectivo, con objeto de caracterizar el perfil clínico-demográfico y el desfecho de pacientes con insuficiencia renal, sometidos a la terapia dialítica en una unidad de terapia intensiva adulto de un hospital general de la región sur de Brasil. Los datos fueron recolectados en enero y febrero del 2013 y la muestra incluyó a 74 archivos. Fue identificada prevalencia del sexo masculino, edad media 63,43 ± 14,73 años, el motivo clínico fue el más frecuente para internación, con una o más comorbilidades asociadas. La lesión renal con mayor prevalencia fue la crónica agudizada, pre-renal. Respecto a los motivos de la lesión, el choque séptico fue el más recurrente. El desfecho más común fue el óbito. Así, la identificación de factores de riesgo y el conocimiento de los factores asociadosapoyan la rápida identificación de problemas y la implementación de acciones de enfermería.
DESCRIPTORES: Pacientes internos; Insuficiencia renal; Cuidados críticos; Diálisis renal.

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INTRODUCTION

The term Acute Kidney Injury (AKI) is used to reflect the whole spectrum of Acute Renal Failure (ARF), acknowledging that an acute decline in the renal function is frequently secondary to an injury that provokes functional or structural alterations in the kidneys[1]. Despite technological advances, increased survival rates and sophisticated therapeutics, AKI remains one of the most frequent complications at Intensive Care Units (ICU). The association of risk factors, clinical evolution and multiple interventions in ICU patients contribute to maintain the high morbidity and mortality rates of AKI, without significant improvements in these rates for at least two decades[2-3].

AKI in inpatients is characterized by the abrupt reduction in the Glomerular Filtration Rate (GFR) over variable time periods, resulting in the inability of the kidneys to perform excretion, maintain the acid base balance and hydroelectrolytichomeostasis[4].The complications of AKI are responsible for significantly contributing to increase the morbidity rates of critical patients[5]. Despite its potentially catastrophic nature, in principle, AKI is reversible, without chances of recovery without affecting other organs[3,6].

Studies[3,7] reveal that the presence of conditions determining hypoperfusion and renal ischemia is directly related with the development of AKI and that patients with reduced renal functional reserves are more susceptible to developing this complications, despite small kidney injuries. Advanced age, presence of Diabetes Mellitus, Arterial Hypertension and Congestive Heart Failure, besides chronic use of non-hormonal anti-inflammatory agents, are considered risk factors for AKI[7].

The development of complications during ICU hospitalizations, such as infections, sepsis, hemorrhages, surgeries and need for dialysis can lead to higher degrees of patient severity and AKI. In inpatients, AKI is considered one of the most important complications, with incidence rates varying with the patients' clinical conditions, being higher at ICUs (20 to 40%) and lower at intermediary services (1 to 7%)[8-9].

Different factors can contribute to high mortality rates in AKI, particularly the non-identification of risk factors, late diagnosis of the disease or lack of knowledge on factors associated with mortality. The incidence of ICU patients evolving to AKI ranges between 17% and 35%, with 49% to 70% needing dialysis treatment. Mortality due to AKI at ICUs ranges between 50% and 90% and is associated with prolonged hospitalization, use of therapies involving advanced technologies, type of ICU and study population. AKI is the most frequent complication in ICU patients[9]. In function of the associated complications and clinical conditions of intensive care patients, besides the significant rate of non-improvement despite continuing efforts in search of the ideal treatment, insufficient or late diagnosis should be considered as factors contributing to high mortality rates[8].

In this context, the objective in this study was to characterize the clinical-demographic profile and outcome of kidney failure patients submitted to dialysis therapy at an adult intensive care service.

METHOD

Quantitative and cross-sectional retrospective documentary study undertaken at an adult Intensive Care Unit. A convenience sample was constituted of 74 patient histories, based on the following inclusion criteria: patients over 18 years of age, diagnosed with Renal Failure, submitted to dialysis therapy between January 2011 and December 2012, with complete patient records.

Eight patient histories were excluded of patients who evolved to AKI but did not need dialysis therapy, four histories of patients with non-acute chronic renal failure, three unreadable histories and one with inappropriate records, totaling 16 excluded histories.

To collect the data, a research tool was elaborated with information to identify the patients' demographic and clinical profile, highlighting the age, sex, background comorbidities, type of hemodialysis and outcome.

The data were collected between January and February 2013 and transcribed to the database in

a worksheet in Microsoft Office Excel for descriptive analysis. The results of the nominal variables were expressed in frequency analyses and the results of the continuous variables as mean ± standard deviation.

To verify the association between the outcome and other nominal variables, Chi-squared or Fisher's Exact Test was used according to the test premises. To verify the association between continuous variables, One-Way Variance Analysis or the t-test was use, according to the test premises. To verify the normality of the data, the Kolmogorov-Smirnov test was used. For all variables, significance was set as $p< 0.05$.

The project received approval from the Research Ethics Committee of the *Federação de Estabelecimento de Ensino Superior em Novo Hamburgo*–Feevale on February 25th 2013 under opinion 184-947.

RESULTS

The results demonstrate the predominance of men among the renal failure patients, between 23 and 86 years of age, with an average age of 63.43 ± 14.73 years, clinical aspects as the most frequent reason for hospitalization and one or more associated comorbidities, according to Table1.

The most frequent comorbidities in the study included: obesity; peripheral vascular conditions, hepatitis C, smoking, rheumatoid arthritis, acute cholecystitis, esophageal varices, dyslipidemia, depression, osteomyelitis, subdural hematoma, endocarditis, hypothyroidism, acute myocardial infarction, exogenous intoxication, Parkinson's disease, chronic ulcerative rectocolitis, polycystic kidneys and Sjögren Syndrome.

Concerning the kidney failure date, 54 patients (73%) suffered from pre-renal acute Chronic Kidney Failure. The frequency of one or more diseases was analyzed during the ICU hospitalization, sepsis being the most frequent, followed by respiratory problems, renal failure and septic shock; oscillation in serum creatinine levels at different times; and urinary volume, according to Table 2.

Table 3 displays the main causes of AKI at the ICU, with the predominance of septic shock, followed by metabolic acidosis and sepsis. Regarding the hemodialysis modality, the continuous method was predominant; the most frequent type of anticoagulation was regional. In17 (22.9%) patients, no anticoagulant was used, but simply salinization of the system. In this information, the results in the table were superior to 100%,as some patients used more than one type of anticoagulant while hospitalized. Therefore, Table 3 shows 87 registers(117.5%) of anticoagulation. The predominant access for dialysis was the hemodialysis catheter.

Some patients were submitted to both types of hemodialysis mentioned, so that the sum (95) (128.38%) was higher than N(74 -100%). No peritoneal dialysis was registered at the time of the data collection.

As for the outcome of patients submitted to dialysis therapy at the ICU, death was predominant(54 patients) (72.9%), 17 (22.9%) patients were discharged to an inpatient service and three were transferred to another hospital. When analyzing the cause of the deaths, the main motive was multiple organ dysfunction, followed by septic shock and sepsis.

In Table 5, the association between the outcome and the other research variables is presented. It was verified that33 (61.11%)patients who evolved to death were men, with a mean age of 65.26 ± 13.23 years; white; clinical reason for hospitalization; forwarded to ICU from inpatient service, pre-renal AKI, serum creatinine levels superior to 3mg/dL, using a hemodialysis catheter and needing vasopressor therapy.

For the demographic variables, in terms of age, the patients who died had a higher mean age (65.26 ±13.23 years) when compared to the patients discharged to the inpatient service (59 ± 18.06 years).No statistically significant difference was found between death and the patients' sex ($p>0.38$).

As regards the serum creatinine levels at the end of the treatment, whether due to discharge to the

Table 1 – Profile of patients and characteristics at the moment of hospitalization. Novo Hamburgo, RS, Brazil, 2013

Variables	n	%
Sex		
Male	46	62.2
Female	28	37.8
Age (a)	63.43 (sd 14.73)	
Ethnic origin		
White	36	48.6
Mulatto	3	4.1
Not identified in the patient history	35	47.3
Reason for hospitalization		
Clinical	56	75.7
Surgical	18	24.3
Place of origin		
Emergency	21	28.4
Inpatient service	43	58.1
Others	10	13.5
Comorbidities		
Respiratory problems	44	59.46
Systemic arterial hypertension (SAH)	33	44.59
Diabetes Mellitus	22	29.73
Cardiopathies	19	25.68
Tumors	16	21.62
Cerebrovascular accident	12	16.22
Liver cirrhosis	7	9.46
Septic shock	6	8.11

Table 2 – Data on Acute Kidney Injury during patient hospitalization. Novo Hamburgo, RS, Brazil, 2013

Variables	N	%
Type of kidney injury		
Acute	20	27
Chronic acute	54	73
Diseases during hospitalization		
Sepsis	34	45.95
Respiratory problems	14	18.92
Acute kidney failure	13	17.57
Septic shock	6	8.11
Cardiogenic shock	3	4.05
Encephalopathy	2	2.70
Endocarditis	2	2.70
Acute myocardial infarction	2	2.70
Cardiorespiratory arrest	2	2.70
Hypovolemic shock	1	1.35
Pericardial effusion	1	1.35
Abdominal wall hematoma	1	1.35
Hypotension	1	1.35
Liver failure	1	1.35
Mediastinitis	1	1.35
Urine volume		
Anuria	22	29.7
Oliguria	52	70.3
Classification of acute kidney injury		
Pre-Renal	61	82.4
Renal	6	8.1
Post-Renal	7	9.5

Creatinine levels	Minimum	Maximum	Mean
Hospitalization	0.40	7.60	2.62 ± 1.91
Indication of hemodialysis	0.98	13.06	4.09 ± 2.15
Start of hemodialysis	0.98	13.06	4.30 ± 2.19
End of treatment	0.58	9.20	3.02 ± 1.81

inpatient service or death, a statistically significant difference was found ($p<0.01$). The length of dialysis in days for patient discharged to the inpatient service (9.88 ± 8.11) and patients who died (54 ± 5.44) was statistically longer for the deceased ($p<0.04$). The patients who died used vasopressor therapy ($p<0.04$).

Table 3 - Causes of Acute Kidney Injury and information on hemodialysis. Novo Hamburgo, RS, Brazil, 2013

Variables	N	%
Motive for AKI		
Septic shock	51	68.92
Metabolic acidosis	5	6.76
Sepsis	5	6.76
Respiratory problems	3	4.05
Hyperkalemia	3	4.05
Mediastinitis	2	2.70
Acute tubular necrosis	2	2.70
Cardiorespiratory arrest	2	2.70
Low cardiac debit	1	1.35
Tumor	1	1.35
Liver-Renal Acute Renal Failure	1	1.35
Multifactorial Acute Renal Failure	1	1.35
Uremia	1	1.35
Hemodialysis method		
Intermittent	39	52.7
Conventional	56	75.68
Anticoagulant		
Systemic	8	10.81
Regional	62	83.78
No anticoagulation	17	22.97
Access for dialysis		
Arteriovenous fistula	5	6.8
Hemodialysis catheter	69	93.2
Length of dialysis in days	6,36 ± 6,61	
Length of ICU hospitalization in days	18,76± 2,63	
Hospitalization at inpatient service in days	36,17 ± 29,90	
Use of vasopressor		
Yes	65	87.8
No	9	2.12

Table 4 – Outcome of patients in dialysis therapy at ICU. Novo Hamburgo, RS, Brazil, 2013

Variables	N	%
Patient outcome		
Discharge to inpatient service	17	23
Transfer to other hospital	3	4
Death	54	73
Outcome of patients discharged		
Needed hemodialysis	4	23.52
No need for hemodialysis	13	76.48
Cause of death		
Multiple organ dysfunction	34	62.96
Septic shock	10	18.52
Sepsis	5	9.25
Cardiorespiratory arrest	2	3.7
Hemorrhagic cerebrovascular accident	1	1.85
Cardiogenic shock	1	1.85
Heart failure	1	1.85

DISCUSSION

The predominance of male (62.2%) patients who developed AKI at the ICU is in line with other studies that found similar results, despite a slight difference between the sexes. Two other studies[2,10] aimed at characterizing acute renal failure (ARF) patients appointed 55.7% and 72%, respectively, of male patients.

Concerning age, in a study[10] undertaken in Joaçaba, state of Santa Catarina, to identify the profile of ARF patients in intensive care, the mean age ranged between 60 and 70 years. The frequency of ARF was directly proportional to the patients' age range. In a study[11] to assess the complications of hemodialysis procedures in 65 AKI patients, the age range varied between 60.9 ±16.2 years, with 32 patients (49.2%) aged 65 years or more. The same study found the predominance of white patients (93.8%). This information is in accordance with our findings, in which 48.6% of the patients were white,

Table 5 – Association between outcome of kidney failure patients on dialysis therapy and other research variables. Novo Hamburgo, RS, Brazil, 2013

Outcome				
	Discharge to inpatient service N=17	Transfer N=3	Death N=54	P
Sex				0.38
Male	10 (58.82%)	3 (100%)	33 (61.11%)	
Female	7 (41.185)	0 (0%)	21 (38.895)	
Age	59 ± 18.06	55.33 ± 13.32	65.26 ± 13.23	0.2
Ethnic origin				
White	10 (58.82%)	0 (0%)	26 (48.15%)	0.3
Mulatto	0 (05)	0 (0%)	3 (56.56%)	
Others	7 (41.18%)	3 (100%)	25 (46.30%)	
Reason for hospitalization				0.1
Clinical	15 (88.24%)	1 (33.33%)	40 (74.07%)	
Surgical	2 (11.76%)	2 (66.67%)	14 (25.93%)	
Place of origin				0.16
Emergency	9 (52.94%)	1 (33.33%)	11 (20.37%)	
Inpatient service	6 (35.29%)	1 (33.33%)	34 (62.96%)	
Other ICU	0 (0%)	0 (0%)	3 (5.56%)	
Others	2 (11.76%)	1 (33.33%)	6 (11.11%)	
Kidney failure				0.42
Acute	11 (64.71%)	3 (100%)	40 (74.07%)	
Acute chronic	6 (35.295)	0 (0%)	14 (25.93%)	
Classification AKI				0.36
Pre-renal	15 (88.24%)	2 (66.67%)	44 (81.48%)	
Renal	2 (11.76%)	0 (0%)	4 (7.41%)	
Post-renal	0 (0%)	0 (0%)	6 (11.11%)	
Creatinine levels				
Hospitalization (a)	3.18 ± 2.32	3.11 ± 2.82	2.40 ± 1.72	0.31
Indication (a)	4.83 ± 1.92	4.57 ± 2.71	3.82 ± 2.17	0.27
Hemodialysis (a)	5.18 ± 2.04	4.57 ± 2.71	3.82 ± 2.17	0.12
End of treatment (a)	2.22 ± 1.76	5.45 ± 1.34	3.14 ± 1.72	0.01
Length of dialysis (days)	9.88 ± 1.76	6 ± 3.61	54 ± 5.44	0.04
Access fordialysis				0.6
Yes	2 (11.76%)	0 (0%)	3 (5.56%)	
No	15 (88.24%)	3 (100%)	51 (94.44%)	
Use of vasopressor				0.04
Yes	11 (64.71%)	3 (100%)	51 (94.44%)	
No	6 (35.295)	0 (0%)	3 (5.56%)	

highlighting the regional characteristics with predominant German and Italian colonization. Ethnic origin was unspecified in 47.3% of the patient histories in this study.

Concerning the reason for hospitalization, in 75.7% of the patients, this was due to clinical complications, while 24.3% were due to surgical reasons. These data are in line with a study[8] that found that part of the patients evolving to AKI was hospitalized for clinical reasons, followed by surgical causes.

The most frequent comorbidities were respiratory problems (59.46%). The development of pulmonary complications like edema, pleural effusion and infections is frequent in renal patients, due to mechanic and hemodynamic changes. The emergence of bilateral pulmonary edema is related with increased volemia and high serum levels of osmotic active substances[12].

In a study[13] that observed the outcome of cancer patients hospitalized at ICUs with AKI, the most prevalent comorbidity was SAH. The results prove that the existence of comorbidities characterized as chronic predisposes to the development of AKI. Patients with these background conditions need to be monitored more attentively, with a view to implementing protective measures and monitoring for the diagnosis and early treatment of AKI.

The occurrence of AKI in critically ill patients is significant around the world, including developed countries, alerting to the need for health professionals to deepen their knowledge on the therapeutics and early treatment, by optimizing the use of nephrotoxic drugs for example, among other conducts[14-15].

In this study, 73% of the patients presented acute chronic kidney failure, while the remainder developed acute renal failure. AKI can be classified as pre-renal, renal and post-renal, and the results at the investigated ICU revealed the pre-renal cause in 82.4% of the patients. That is the most common etiology in AKI patients and is considered as such because it provokes renal hypoperfusion, without compromising the renal parenchyma structure[16]. Cases of pre-renal AKI can be reverted on the first or second day the disease is established, provided that appropriate treatment is given[15-16]. The predominance of pre-renal AKI is related to the urinary volume. Oliguria, when the kidneys maintain a lower filtration activity level than necessary to maintain the homeostasis, occurred in 70.3% of the patients.

As regards the diseases developed during hospitalization, 45.95% of the patients in this study presented sepsis, followed by respiratory problems (18.92%) and AKI (17.57%). Other studies frequently appoint diagnoses of sepsis, also as one of the main causes of poor prognosis[17].

Serum creatinine levels are extremely important for the diagnosis and monitoring of the evolution of AKI. For this study, the mean level at the moment of the hospitalization was 2.62 ml/dl, when dialysis was indicated 4.09 ml/dl, at the start of hemodialysis 4.30 ml/dl and at the end of the treatment 3.02 ml/dl. Serum creatinine is an important marker of the nutritional status and is related with the mortality of renal patients in intensive care[18]. The creatinine remained superior to reference levels in all tests. The increase between the first and fourth test reflects the accumulation of substances the glomerular filtration would normally remove.

It should be highlighted that creatinine is a marker influenced by different factors, such as protein intake. Thus, increased creatinine can reflect an improvement in the nutritional status, despite being a hardly sensitive method, as medication use also influences this marker, among other possibilities[19].

In this research, the most use renal replacement therapy was continuous, possibly due to the better management of hemodynamically unstable patients, as it continuously offers low removal of solutes. Nursing participates actively in renal replacement therapies and is responsible for the technical part and the patient's relation with the environment, evidencing the nurses' importance in case of complications, as the detection and rapid intervention represent an important differential in the established therapy[11].

For successful renal replacement therapies, the need to maintain the dialysis circuit and catheter is highlighted. In this study, part of the patients was submitted to regional anticoagulation (using 4% trisodic citrate), considered an efficient and safe method. If associated with appropriate metabolic control, the coagulation phases that depend on serum calcium are blocked, demanding ionic calcium control in the hemodialysis circuit. In a study[20] intended to assess the use of citrate as an anticoagulant in hemodialysis, no system coagulation or important change in serum calcium levels were detected. The same study appointed salinization as a recommended alternative for patients at high risk of bleeding or when trisodic citrate cannot be used. Heparin is widely employed but exposes the patient to systemic anticoagulation and thrombocytopenia[18].

In this study, 68.92% of the patients developed AKI due to septic shock, This condition in combination with severe sepsis is one of the main causes of the development of AKI in intensive care patients, with

mortality rates much higher than patients who did not develop AKI[21].

The use of vasoactive drugs is an important risk factor for intensive care mortality, due to the patients' hemodynamic instability and, in function of the vasoconstriction mechanism, it constitutes one of the possible causes of AKI[21]. Approximately half of the ICU patients diagnosed with AKI under dialysis evolves to death due to increased clinical severity[15].

Although a statistically significant difference was identified for the serum creatinine levels at the end of the treatment in this research, it needs to be assessed as a late marker of acute kidney injury through non-renal variables like age, weight, muscle mass, protein intake, among others[22].

The death risk factors acknowledged in the literature for critical patients with AKI include: advanced age; prolonged hospitalization, presence of comorbidities; oliguria, high lactate level, hypovolemia, metabolic acidosis, sepsis, multiple trauma, as well as use of vasoactive drugs[23].

CONCLUSIONS

This research contributed to the identification of the clinical-demographic profile of ICU patients submitted to dialysis therapy. The importance of severity even at the start of the treatment and the diagnosis, as well as early diagnostic and therapeutic interventions, can help to better recognize AKI and propose appropriate treatments.

The patients' poor prognosis reveals the importance of ICU professionals' early detection of signs of AKI. Therefore, further research is needed involving more ICU patients with AKI submitted to dialysis therapy.

Identifying the signs of AKI provides support for the nurse to perceive changes rapidly, with a view to programming nursing actions that minimize complications.

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