Risk factors for ineffective renal perfusion among elderly hospitalized in an ICU

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Abstract

Acute kidney injury (AKI) is defined as a syndrome characterized by sudden and potentially reversible loss of kidney function, leading to accumulation of nitrogenous substances (urea and creatinine). The aim of this study was to identify factors related to the risk of ineffective renal perfusion, showing associations with clinical and therapeutic characteristics. This was a retrospective, cross-sectional study with a descriptive and correlational analysis conducted in a general adult intensive care unit (ICU) of a large private hospital. The convenience sample consisted of 288 patients. All medical records of elderly patients who were admitted to the ICU from November 2016 to January 2017, regardless of their clinical diagnosis, were included. To statistically analyze the relationship between the covariates and the change in serum ICU admission and discharge values from the ICU, the ANOVA and Chi-squared tests were used. Among elderly inpatients, individuals aged between 60 and 89 years were concentrated and were mostly female. Regarding the epidemiological profile, there were more diabetes mellitus and systemic arterial hypertension comorbidities. It is noted that the elderly were exposed to many risk factors for AKI during hospitalization. The covariates that showed statistically significant results when compared with the change in urea values at ICU admission and discharge were gender, age, pre-existing nephropathies, SAH, DM and neoplasms. When the comparison was made between the covariates and the change in creatinine values, only the health problems represented by hypertension, DM, CHF and neoplasms had significant results. In this context, it is essential that nurses properly identify and plan care in the presence of risk factors for the development of AKI.

Keywords: Acute kidney failure. ICU. Elderly.

INTRODUCTION

Aging is a natural process characterized by physical, psychological and social changes that uniquely affect individuals with prolonged survival, called senescence. The changes that occur during aging imply an increased risk for disease onset among the elderly, called senility[1]. The kidneys, as well as the other systems of the elderly, undergo gradual morphological and functional alterations. The process of renal aging begins from the age of 40 and the weight of the kidneys can reach about 180g, compared to the values of 230 to 250g of adulthood, with

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decreased glomerular filtration rate due to structural changes and volume of the glomeruli[2].

Glomerular filtration rate (GFR) is the most commonly used test for renal function assessment and its measurement is performed by endogenous creatinine clearance[2]. For the elderly, normal values range from 80 to 120 ml/min for a body area of 1.73 m^2[3].

In addition to glomerular filtration rate, serum urea and creatinine levels are also commonly requested for kidney function evaluation. Both kidney biomarkers are essential not only to diagnose acute kidney injury, but also to help differentiate between prerenal injury, acute tubular necrosis (ATN) and postrenal acute kidney injury[4].

Among the most common kidney diseases in the elderly is acute kidney injury (AKI), which is defined as a syndrome characterized by the sudden loss of kidney function and is potentially reversible regardless of etiology, causing an accumulation of nitrogenous substances (urea and creatinine), whether or not accompanied by decreased diuresis[5].

The elderly are susceptible to develop kidney injury, due to the aging process of this organic system giving rise to risk factors for the development of the disease, such as a high number of comorbidities, excessive use of medications and performing interventional and surgical procedures[2].

Other risk factors for the development of AKI include sepsis, hypovolemia, hemorrhages, neoplasms, pancreatitis, gastroenteritis, liver disease, chronic non-communicable diseases such as diabetes mellitus, systemic arterial hypertension, coronary artery disease, chronic kidney disease and congestive heart failure. Contrast administration for exams and procedures also contributes to the development of the disease[6].

Particularly in intensive care units (ICUs), which are intended to treat patients with complex and specialized care, excessive diagnostic and drug interventions, which associated with clinical factors predispose the patient to AKI.

AKI is one of the most important complications observed in hospitalized patients. Its incidence varies according to the patients' clinical conditions, being higher in intensive care units (ICU - 20 to 40%) and lower in units where care is intermediate (1 to 7%)[7].

In addition to being a common complication in critically ill patients, AKI is an independent risk factor for death. Despite recent evidence of decreased mortality in recent years from AKI in ICU patients, the prognosis remains severe, with mortality around 50%; despite technological advances in the management of these critically ill patients and new dialysis techniques[7].

Certainly, several factors contribute to the maintenance of this condition, highlighting the lack of identifying risk factors for the development of AKI, a late diagnosis and the lack of knowledge of factors associated with mortality.

The nursing process is a dynamic strategy used to make care systematic, with the aim of guiding care and promoting quality in the care provided. This process comprises five phases which are: investigation, diagnosis, planning, implementation and evaluation. These steps are related to each other and facilitate the construction of clinical judgment by nurses, when properly developed[8].

The North American Nursing Diagnosis Association (NANDA) is an organization that regulates and defines nursing diagnoses, which constitute the second stage of the process. Nursing diagnoses direct care, prioritizing each patient's individual needs, make it easier to choose the most appropriate interventions, and allow subsequent evaluation of the care provided[9].

Regarding the renal system, we find in the NANDA taxonomy the diagnosis of Ineffective Renal Perfusion Risk, which is by definition: vulnerability to reduced blood circulation to the kidneys, which may compromise health[9].

Given this context, the high mortality due to AKI among elderly in an intensive care unit, reinforces the need for prevention and proper performance of the nurse in identifying the risk factors, listing the nursing diagnosis of *ineffective renal perfusion risk* and then establishing the plan of relevant care. This process, when associated, seems to be an effective method to prevent the development of acute kidney injury in elderly patients admitted to an ICU. Thus, the aim of the study was to describe the variation of urea and creatinine in elderly

patients admitted to an intensive care unit and to identify, in the medical records of elderly patients admitted to a general ICU, the factors related to the ineffective renal perfusion risk[9] and show associations with personal, clinical and therapeutic characteristics.

MATERIALS AND METHODS

This was a retrospective, cross-sectional study with a correlational descriptive analysis of data collected from electronic medical records of elderly individuals who were admitted to an intensive care unit. The study was conducted in a general adult intensive care unit, located in a large private hospital located in the southern region of the city of São Paulo, for the clinical and surgical treatment of adults and the elderly. During the research period, the hospital had 264 beds, of which 47 were ICU beds.

The sample was collected by convenience, not random, calculated by an expert in the area, totaling 288 records. Inclusion criteria were the medical records of elderly individuals aged over 60 years admitted to the ICU from November 2016 to January 2017, regardless of clinical diagnosis.

In compliance with Resolution No. 510/2016 of the National Health Council (CNS), this project was submitted and approved by the Research Ethics Committee of the São Camilo University Center under CAAE 59749716.2.0000.0062.

Relationship analysis considered dependent variables as variations in urea and creatinine values at ICU admission and discharge, and independent variables as personal, clinical and therapeutic data.

For data collection the authors prepared an *Information recording instrument*. A form in which information was extracted from the electronic medical records of patients regarding the independent variables age, gender, current clinical diagnosis, length of stay, pre-existing diseases, nephrotoxic drugs and contrast scans performed, as well as the dependent variables urea and creatinine test values. The normal urea value considered in this study was between 20 and 50 mg/d, and creatinine values were 0.5 to 0.9 mg/dl for women and 0.6 to 1.2 mg/dl for men, results above the upper limit were considered altered.

All medical records of elderly patients admitted to the ICU were consulted, selecting those who met the inclusion criteria of the sample.

At the end of collection, the data were stored in an Excel 2010 for Windows database.

The data from this study were submitted to statistical tests indicated for the preparation of the final report. A descriptive and correlational analysis was performed by a specialist in the field.

In this statistical analysis we used the software: SPSS V20, Minitab 16 and Excel Office 2010, as well as parametric statistical tests, because the data are quantitative and continuous. Moreover, the sample was larger than 30 subjects, which according to the Central Limit Theorem, ensures that the distribution tends to a Normal distribution. Thus, parametric tests were used directly, as they are more powerful than nonparametric tests.

The ANOVA test was used to obtain the relationship between the length of stay and changes in urea and creatine serum values at ICU admission and discharge. Analysis of variance (ANOVA) is a parametric test that compares averages using variance.

To obtain the relationship between covariates gender, age, risk factors for AKI, contrast-enhanced imaging and drugs used with changes in serum urea and creatinine values from ICU admission to discharge, the Chi-squared test was used. This test is used to verify whether or not two variables and their levels are statistically dependent (are associated).

All statistical tests used for this study were made assuming a significance level of less than 0.05 (5%). All confidence intervals constructed throughout the study were constructed with 95% statistical confidence ($p<0.05$).

RESULTS

After a joint analysis of the 288 medical records, 164 patients (57%) were women, 183 (63.53%) were aged 60 to 79 years; most of

the elderly 270 (93.75%) remained hospitalized for up to 14 days in the ICU. Among the risk factors for AKI, 223 elderly (77.43%) had systemic arterial hypertension, 115 (39.93%) diabetes mellitus, 45 (15.62%) neoplasms, 41 (14.23%) pre-existing nephropathies, 35 (12.15%) cerebrovascular disease, 35 (12.15%) congestive heart failure, 25 (5.20%) coronary artery disease, 21 (3.63%) pneumonia, 15 elderly (2.59%) had septic shock, 8 (2.77%) had gastroenteritis, hepatitis appeared in 6 elderly (2.08%), 4 elderly (1.38%) had acute respiratory failure, 3 (1.04%) had hypovolemic shock and pancreatitis was diagnosed in only one individual (Table 1).

Analyzing the clinical diagnoses of patients separated by body systems, it was found that 133 (33.06%) presented diseases of the cardiovascular system, 75 (18.98%) of the respiratory system, 45 (11.39%) of the digestive system, 41 (10.37%) of the genitourinary system, 31 (7.84%) of the nervous system, 22 (5.56%) of the musculoskeletal system, 19 (4.81%) of the immune system, 15 (3.79%) presented hydroelectrolytic imbalance, 9 (2.17%) of the integumentary system, 3 (0.75%) endocrine system and 2 (0.5%) presented diseases related to the lymphatic system. In this context, it can be identified that there is a prevalence of diseases of the cardiovascular system followed by diseases of the respiratory system among the elderly in the ICU (Table 1).

Regarding the performance of exams administered, it was found that 205 (71.18%) did not perform any contrast-enhanced imaging exam and 83 (28.82%) underwent some contrast exam, and most of them performed an examination related to the cardiovascular system (cardiac catheterization; angioplasty/ angiography) (Table 1).

When analyzing the medication received by the elderly during ICU stay, 155 (27.33%) used non-steroidal anti-inflammatory drugs 139 (24.51%), 95 (16.95%) received vasoactive drugs, 92 (16.22%) received diuretics 52 (9.17%) received antihypertensive angiotensin converting enzyme (ACE inhibitor) inhibitors and 34 (5.99%) received immunosuppressants. Among 288 elderly, only 21 (7.29%) individuals did not use any of the drugs mentioned above (Table 1).

Table 1– Distribution of independent variables. Sao Paulo/SP, 2018

Age	**N(%)**
≥60 ≤ 69	94(32.63)
≥70 ≤ 79	89(30.90)
≥80 ≤ 89	81(28.12)
≥ 90	24 (8.3)
Mean (SD)	
72 (32.44)	
95% (3.74)	
Range 60-95	
Sex	
Woman	164 (56.90)
Man	124 (43.05)
Hospitalization in the ICU	
≥0 ≤ 14	270 (93.75)
≥15 ≤ 30	14 (4.86)
≥ 30	4 (1.38)
Health Conditions	
Systemic arterial hypertension	223 (38.64)
Diabetes mellitus	115 (19.9)
Neoplasms	45 (7.79)
Pre-existing Kidney Diseases	41 (8.29)
Brain vascular disease	35 (6.06)
Congestive heart failure,	35 (6.06)
Coronary artery disease,	25 (4.33)
Pneumonia	21 (3.06)
Septic shock,	15 (2.59)
Gastroenteritis,	8 (1.38)
Liver Diseases	6 (0.69)
Acute breathing insufficiency	4 (0.69)
Hypovolemic shock	3 (0.5)
Pancreatitis	1 (0.17)
Clinical Diagnostics (Bodily Systems)	
Cardiovascular,	133 (33.67%)
Respiratory,	75 (18.98%)
Digestive,	45 (11.39%)
Genitourinary,	41 (10.37%)
Nervous	31 (7.84%)
Skeletal muscle,	22 (5.56%)
From the immune,	19 (4.81%)

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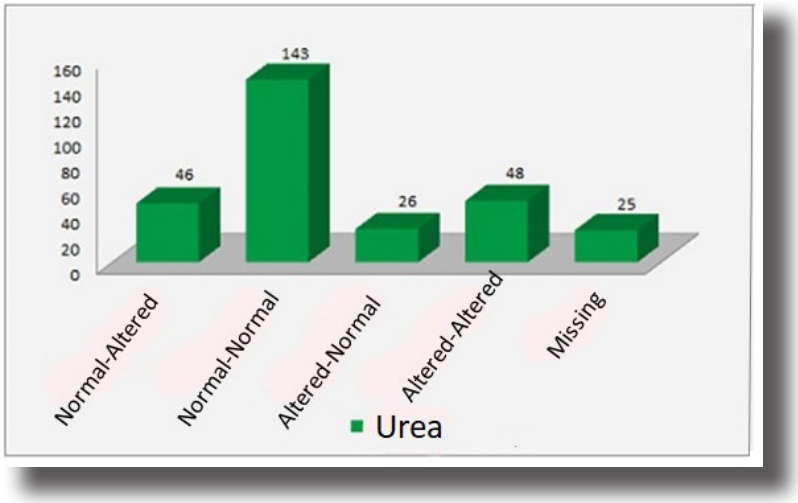
Hydroelectrolytic imbalance,	15 (3.79%)
Integumentary system,	9 (2.17%)
Endocrine system and	3 (0.75%)
Lymphatic system	2 (0.5%)
Examinations	
Cardiac catheterization,	38 (33.04%)
Angioplasty/angiography,	30 (26.08%)
Computed tomography,	21 (18.26%)
Magnetic resonance,	19 (16.52%)
CT angiography	6 (2.08%)
Magnetic resonance angiography	1 (0.86%)
Medication use	
Antibiotic Therapy	155 (27.33%)
Non-steroidal anti-inflammatory drugs.	139 (24.51%)
Vasoactive drugs	95 (16.75%)
Diuretics	92 (16.22%)
Antihypertensives (ACEI)	52 (9.17%)
Immunosuppressants	34 (5.99%)

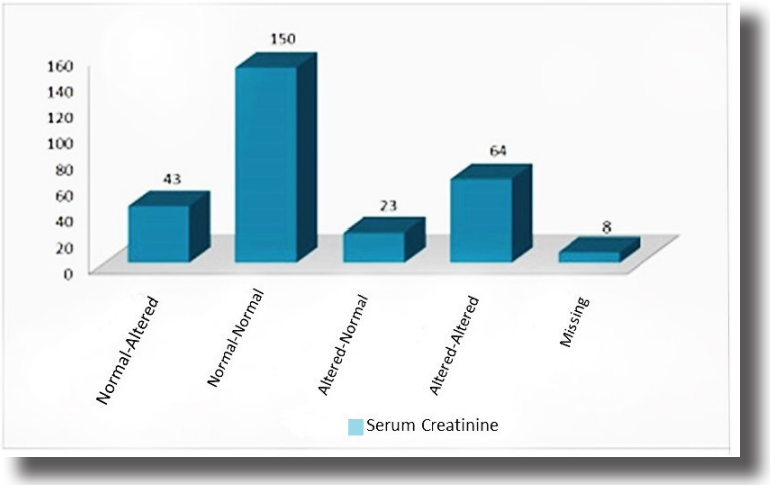
Graph 1 shows the serum value of urea at ICU admission and discharge. It should be noted that 143 (49.65%) of the subjects maintained serum urea values within a normal range from admission to discharge from the ICU. Forty-eight (16.66%) subjects were admitted with altered serum urea values and were discharged from the ICU with these values still above the normal range, 46 (15.97%) had normal serum urea values at admission and altered values at ICU discharge, and only 26 (9.02%) displayed altered serum urea values at ICU admission and normal values at discharge.

In Graph 2 below, it is noted that 150 (52.08%) elderly patients were admitted to the intensive care unit with normal serum creatinine exam values and were discharged maintaining these values within the normal range; 64 (22.22%) were admitted and discharged from the ICU with abnormal serum creatinine exams; 43 (14.93%) had normal serum creatinine values at ICU admission and altered at discharge and 23 (7.98%) had altered serum creatinine values at ICU admission and normal values at discharge. Moreover, 8 (2.77%) individuals did not have serum creatinine values available in electronic medical records and were characterized as losses (Missing).



Note: The hyphen between the classification of urea results represents the change that occurred between serum urea values at ICU admission and discharge.

Graph 1– Distribution of patients regarding the values of serum urea at ICU admission and discharge. Sao Paulo, 2017.



Note: The hyphen between the classification of creatinine results represents the change that occurred between serum urea values at ICU admission and discharge.

Graph 2– Distribution of patients regarding the values of serum urea at ICU admission and discharge. Sao Paulo, 2017.

When the alterations of the urea and creatinine tests were compared with the days the elderly patients were hospitalized in the ICU, no statistical significance was obtained.

When correlating urea values to gender (Table 2), it was statistically significant (p=0.019) among women (66%) who maintained serum urea values within a normal range from ICU admission to discharge and between elderly men (56%) who were admitted to the ICU with altered urea values and were discharged with these values within the normal range.

Correlating the urea values with age, those aged between 60 and 64 years (26%) and had abnormal urea upon admission and normal urea at discharge from the ICU were statistically significant (p=0.01). The age group of 65 to 69 years old (18%) was predominantly the elderly who were admitted and were discharged with normal urea values, and the elderly aged 75 to 79 (23%) years who maintained altered exams in both admission and discharge from the ICU. Also, individuals aged between 80 and 84 years (24%) showed results of normal urea upon admission and altered values at discharge from the ICU.

Thus, it can be noted that the older the individual is, the greater their chance of displaying altered urea values at the time of hospital discharge, and that among the younger elderly the chance of normalizing serum urea values from the moment of admission to the discharge from the ICU is higher.

Table 2 – Relationship of urea change with the qualitative variables gender and age. Sao Paulo, 2017.

UREA		Altered-Altered		Altered Normal		Normal Altered		Normal Normal		Total		p. value
		N	%	N	%	N	%	N	%	N	%	
GENDER	Female	22	46%	12	44%	23	50%	94	66%	151	57%	0,019
	Male	26	54%	15	56%	23	50%	48	34%	112	43%	
YEAR	60 to 64 years	7	15%	7	26%	5	11%	27	19%	46	17%	
	65 to 69 years	9	19%	6	22%	4	9%	26	18%	45	17%	
	70 to 74 years	7	15%	3	11%	6	13%	23	16%	39	15%	
	75 to 79 years	11	23%	1	4%	6	13%	26	18%	44	17%	
	80 to 84 years	7	15%	3	11%	11	24%	16	11%	37	14%	0,010

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UREA												p. value
		N	%	N	%	N	%	N	%	N	%	
	85 to 89 years	6	13%	2	7%	10	22%	14	10%	32	12%	
	90 to 94 years	1	2%	3	11%	4	9%	10	7%	18	7%	
	95 to 100 years	0	0%	2	7%	0	0%	0	0%	2	1%	

[a](p<0,05)

Table 3 shows that, as for risk factors, there were statistically significant (p<0.001) relationships between individuals with pre-existing nephropathies who maintained altered urea values at ICU admission and discharge was statistically significant, between individuals with diabetes *mellitus* (22%) who had altered urea upon admission and normal values at discharge from the ICU, among elderly with systemic arterial hypertension (43%) who had normal urea upon admission and altered urea at discharge from the ICU as well as those diagnosed with neoplasms (8%) who maintained a normal value of urea upon admission and discharge from the ICU.

Table 3 – Relationship of urea change with the qualitative variables risk factors related to health problems among the elderly in an ICU. Sao Paulo, 2017.

UREA		Altered Altered		Altered Normal		Normal Altered		Normal Normal		Total		p. value
		N	%	N	%	N	%	N	%	N	%	
HEALTH DISORDERS	**Pre-existing Nephropathies**	24	17%	5	8%	8%	4	5%	4	2%	37	
	DM	30	21%	13	22%	22%	18	20%	45	17%	106	
	SAH	43	31%	21	35%	35%	38	43%	102	40%	204	
	CAD	7	5%	3	5%	5%	3	3%	9	3%	22	
	CHF	12	9%	4	7%	7%	7	8%	12	5%	35	
	Neoplasms	10	7%	1	2%	2%	5	6%	21	8%	37	
	Hypovolemic shock	0	0%	1	2%	2%	0	0%	0	0%	1	
	Pneumonia	4	3%	0	0%	0%	0	0%	14	5%	18	<0.001
HEALTH DISORDERS	Acute Respiratory Failure	0	0%	0	0%	0%	0	0%	3	1%	3	
	Brain vascular disease	7	5%	2	3%	3%	6	7%	16	6%	31	
	Liver Diseases	0	0%	1	2%	2%	1	1%	3	1%	5	
	Gastroenteritis	3	2%	2	3%	3%	0	0%	3	1%	8	
	Septic shock	0	0%	1	2%	2%	1	1%	4	2%	6	
	None	0	0%	6	10%	10%	5	6%	22	9%	33	<0.001

[a](p<0,05)

Regarding the analysis of the relationship with changes in creatinine and the variables gender and age, there was no statistically significant result, as well as when performing the analysis with the performance of contracted exams and medications administered.

Table 4 shows that when analyzing creatinine variations with clinically related risk factors, a statistically significant relationship (p<0.001) was found in the relationships between diabetic individuals who maintained altered serum creatinine values at ICU

discharge and admission, among individuals with hypertension who maintained normal creatinine values at ICU discharge and admission, and those with congestive heart failure (CHF) who were admitted with normal creatinine values and were discharged with an altered value, and among individuals with a diagnosis of neoplasia with altered creatinine values at admission and normal values at discharge from the ICU.

Table 4 – The relationship of altered urea with the qualitative variables of risk factors related to health problems among the elderly in an ICU. Sao Paulo, 2017.

CREATININE		Alterado Alterado		Alterado Normal		Normal Alterado		Normal Normal		Total		p. valor
		N	%	N	%	N	%	N	%	N	%	
	Pre-existing Nephropathies	32	18%	2	4%	6	6%	1	0%	41	7%	
	DM	34	19%	9	17%	17	18%	52	19%	112	19%	
	SAH	56	32%	19	36%	33	35%	108	40%	216	36%	
	CAD	10	6%	2	4%	2	2%	10	4%	24	4%	
	CHF	10	6%	4	8%	11	12%	10	4%	35	6%	
	Neoplasms	14	8%	5	9%	8	8%	18	7%	45	8%	
	Hypovolemic shock	1	1%	0	0%	0	0%	1	0%	2	0%	
	Pneumonia	3	2%	1	2%	1	1%	16	6%	21	4%	
HEALTH DISORDERS	Acute Respiratory Failure	1	1%	0	0%	0	0%	3	1%	4	1%	<0.001
	Brain vascular disease	4	2%	3	6%	10	11%	16	6%	33	6%	
	Liver Diseases	1	1%	1	2%	1	1%	3	1%	6	1%	
	Gastroenteritis	4	2%	3	6%	0	0%	1	0%	8	1%	
	Septic shock	3	2%	2	4%	2	2%	8	3%	15	3%	
	None		2%	2	4%	4	4%	23	9%	33	6%	

DISCUSSION

Of the two hundred and eighty-eight patients included in the sample, there were mostly females and, regarding the age group, the groups that were aged between 60 to 69 years, 70 to 79 years and 80 to 89 years of age remained almost homogeneous, and a number less significant consisted of those aged 90 to 100 years. In Brazil, the number of people in the elderly population has been increasing progressively, as in other countries. According to the demographic census of the IBGE - Brazilian Institute of Geography and Statistics (2010), women represent 55.5% of the elderly population, characterizing the feminization of old age[10]. Population aging generates an increase in chronic diseases among elderly individuals, and these diseases are frequent causes of hospitalization in this age group, also reflecting an increase in ICU admissions[11,10].

During hospitalization, because they are exposed to factors that may cause kidney damage, elderly individuals are susceptible to developing the disease, characterized by a rapid decline in glomerular filtration rate (GFR). AKI affects 5 to 7% of hospitalized elderly and up to 20% of elderly patients admitted to an intensive care unit[12]. The two tests commonly requested for kidney function evaluation are serum urea and creatinine dosage[13].

In the present study, the personal, clinical and therapeutic variables were compared with the serum values of urea and creatinine

upon ICU admission and discharge, so that the nursing diagnosis "ineffective renal perfusion risk" could be verified. Among elderly patients admitted to the ICU, kidney changes in senescence associated with risk factors present in these units favor the development of kidney injury. According to Morton, *et al.*[13], 20% of elderly patients admitted to an intensive care unit have acute kidney injury.

The relationship between the changes in urea values and gender was statistically significant (p=0.019) among the group of elderly women who maintained the serum urea levels within the normal range during hospitalization until ICU discharge, as well as among men who were admitted with altered urea results and were discharged from the ICU within the normal range. On the other hand, in a study by Rolim[15], with 106 hospitalized patients with clinical diagnosis of acute kidney injury, 75.5% of the sample was represented by the elderly, 55.7% by males, showing that being male is a risk factor for the development of the disease. However, there are no studies showing the real reason that there are more men with acute kidney injury than women, but it is hypothesized that the cause of this predominance is because men generally do not refer to preventative habits, which are often adopted by women[14]. When correlating creatinine values with gender, there was no statistically significant result.

Age was statistically significant (p=0.010) in the relationship between the group of older people who demonstrated a variation of normal urea values upon ICU admission and altered values at discharge showing a vulnerability in developing AKI, confirming the data found in the literature[1]. When correlating creatinine values with age, there was no statistically significant result.

Regarding the period of hospitalization, according to the 2nd Brazilian ICU Census of the Brazilian Intensive Care Association (2003), the average length of stay of patients in the adult ICU in Brazil is one to six days. In the present study, most elderly patients remained in the hospital for a period of 0 to 14 days and there were no statistically significant results between the change in urea and creatinine values from ICU admission to discharge with hospitalization time. It is known that the clinical diagnosis and severity of health are factors that directly influence the average length of stay of patients in an ICU. Older people often have a higher severity profile than young adults admitted to an ICU, which explains the length of stay in this age group[15].

The length of stay of the elderly in the ICU is related to the development of AKI, indicating hospitalization longer than seven days as a risk factor for the disease's manifestation[16].

The two diseases that stood out among the elderly participants in this research were systemic arterial hypertension, represented by 77.43% of participants, and diabetes mellitus being 39.93% among the participants. In addition to being the more common among the elderly, diabetes mellitus and systemic arterial hypertension are two of the main chronic diseases that lead to the development of kidney injury[16]. In this study, the relationship between the group of elderly patients with diabetes admitted with altered urea values and who were discharged from the ICU with these values within the normal range was statistically significant (p <0.001), indicating that these individuals were able to recover their kidney function during the period of hospitalization. However, when individuals with diabetes were related to serum creatinine values, the most prominent group was elderly people admitted with altered serum creatinine and maintained these values above the normal range until ICU discharge (p<0.001).

Diabetes consists of persistent elevated blood glucose values, which causes direct endothelial damage and subsequently disruption of the glomerular basement membrane. This membrane acts as a mechanical and electrostatic barrier and, when broken, leads to the extravasation of proteins such as albumin through the glomerulus. This, in turn, increases the glomerular membrane's existing fissures, causing it to lose its filtering capacity, thus, compromising kidney function[17].

As for systemic arterial hypertension, elevated blood pressure causes a thickening and rigidity of the renal vascular system,

causing mechanical damage to the vessels, which will increase vascular permeability with fibrin and platelet deposition in the vessel wall activating mediators of the blood vessel coagulation and cell proliferation. Thus, there is a marked constriction or complete obstruction of the vessel lumen, resulting in severe glomerular ischemia, which will decrease the glomerular filtration rate, compromising kidney function[17].

Systemic arterial hypertension (SAH), when associated with urea and creatinine values, presented significant statistical results. A considerable number of elderly hypertensive patients had altered urea values at ICU discharge, which agrees with what is found in the literature about renal alterations caused by systemic arterial hypertension. In contrast, most elderly patients maintained serum creatinine values within the normal range throughout their ICU stay, which seems to be related to possible interventions to prevent the development of the disease.

Among individuals with pre-existing nephropathy, those who maintained altered urea values at ICU admission and discharge were significant ($p<0.001$). Pre-existing nephropathy hinders the reestablishment of kidney function. In some cases of pre-existing nephropathies, such as chronic kidney disease, serum urea and creatinine values are often altered due to progressive and irreversible lesions[12]. Although in the present study there was no significant relationship between individuals with pre-existing nephropathy and creatinine variations.

Moreover, the relationship of neoplastic patients with changes in serum urea and creatinine values upon admission and discharge from the ICU were also statistically significant. The exams reported normal results for urea and reported that creatinine was altered upon patient admission to the ICU. The literature indicates that these patients are at high risk for developing kidney dysfunction, and in this study the elderly who had neoplastic diseases had improved test results or maintained these values within the normal range ($p<0.001$), demonstrating that this risk seems to have been considered and that there were preventive actions for the development of the disease.

Analyzing the clinical diagnoses of elderly patients included in this study, a prevalence of cardiovascular disease was noted, including congestive heart failure (CHF), followed by respiratory system diseases.

In this study, a significant ($p<0.001$) relationship of creatinine alterations was found among individuals diagnosed with CHF who had normal creatinine values at ICU admission and change at their ICU discharge. Acute kidney injury is one of the main complications of CHF and is considered a risk factor predicting mortality in hospitalized patients with decompensated CHF[18].

Heart disease affects not only the heart but also the blood vessels that are responsible for transporting blood and oxygen to the other organs of the body. Clinical diagnoses such as congestive heart failure, acute myocardial infarction, atherosclerosis and cardiogenic shock are diseases that impair this blood supply. Decreased cardiac output, when associated with blood redistribution mainly to the brain and heart, aggravates renal hypoperfusion, resulting in a decreased glomerular filtration rate12,19. Hata et al. (2010), in a retrospective study with 376 Individuals admitted to the ICU for right heart failure (RHF) had acute kidney injury in their results in 73% of the sample. The complication was related to the high in-hospital mortality[20].

Because elderly in an ICU are exposed to many risk factors for the development of AKI, it is essential that nurses have a critical and holistic view of these patients, so that they can provide individualized nursing care[21].

Although the clinical situation, renal perfusion risk in the elderly in ICU is not among the problems identified by nurses in this unit. They considered the presence of risk factors for the development of AKI in these patients. This can be observed by analyzing the results of the change in urea and creatinine values at admission and discharge from the ICU, which are indicative that most hospitalized elderly were discharged with these values within the normal range. This shows that nursing actions are aimed at improving and maintaining the kidney flow of the elderly patient.

CONCLUSION

Among the comparisons performed through statistical tests, the period of hospitalization was not related to changes in serum urea and creatinine values. When the comparison was made between the variables and the change observed within ICU admission and discharge values, the elderly and the hypertensive patients demonstrated worse exams. Younger and diabetic elderly showed an improvement in serum urea values. As for the creatinine values, the elderly with CHF demonstrated alterations in the exams and the elderly with neoplasms demonstrated normalized creatinine values during their hospitalization period.

The role of nurses in the prevention of acute kidney injury is broad and indispensable. In this context, it is suggested that these risk factors be monitored allowing the nurse to choose interventions and nursing actions focusing on the renal system, preventing the development of the disease.

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