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RESEARCH

Nursing Activities Score and Acute Kidney Injury

Nursing Activities Score e a lesão renal aguda

Nursing Activities Score y lesión renal aguda

Filipe Utuari de Andrade Coelho[I], Mirian Watanabe[II], Cassiane Dezoti da Fonseca[III], Katia Grillo Padilha[IV], Maria de Fátima Fernandes Vattimo[I]

[I] Universidade de São Paulo School of Nursing, Postgraduate Program in Adult Health. São Paulo, Brazil.
[II] Universidade de São Paulo, School of Nursing. São Paulo, Brazil.
[III] Universidade de São Paulo, School of Nursing, Laboratory Animal Research Department. São Paulo, Brazil.
[IV] Universidade de São Paulo, School of Nursing, Department of Medical-Surgical Nursing. São Paulo, Brazil.

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ABSTRACT

Objective: to evaluate the nursing workload in intensive care patients with acute kidney injury (AKI). **Method**: A quantitative study, conducted in an intensive care unit, from April to August of 2015. The Nursing Activities Score (NAS) and Kidney Disease Improving Global Outcomes (KDIGO) were used to measure nursing workload and to classify the stage of AKI, respectively. **Results**: A total of 190 patients were included. Patients who developed AKI (44.2%) had higher NAS when compared to those without AKI (43.7% vs 40.7%), $p < 0.001$. Patients with stage 1, 2 and 3 AKI showed higher NAS than those without AKI. A relationship was identified between stage 2 and 3 with those without AKI ($p = 0.002$ and $p < 0.001$). **Conclusion**: The NAS was associated with the presence of AKI, the score increased with the progression of the stages, and it was associated with AKI, stage 2 and 3.
Descriptors: Workload; Intensive Care Unit; Acute Renal Injury; Nursing; Nephrology.

RESUMO

Objetivo: avaliar a carga de trabalho de enfermagem em pacientes de terapia intensiva com lesão renal aguda (LRA). **Método**: estudo quantitativo, em Unidade de Terapia Intensiva, no período de abril a agosto de 2015. O Nursing Activities Score (NAS) e o Kidney Disease Improving Global Outcomes (KDIGO) foram utilizados para medir a carga de trabalho de enfermagem e classificar o estágio da LRA, respectivamente. **Resultados**: foram incluídos 190 pacientes. Os pacientes que desenvolveram LRA (44,2%) possuíam NAS superiores quando comparados aos sem LRA (43,7% vs 40,7%), $p<0,001$. Os pacientes com LRA nos estágios 1, 2 e 3 de LRA demonstraram NAS superiores aos sem LRA, houve relação entre os estágios 2 e 3 com os sem LRA, $p=0,002$ e $p<0,001$. **Conclusão**: o NAS apresentou associação com a existência de LRA, visto que seu valor aumenta com a progressão dos estágios, tendo associação com os estágios 2 e 3 de LRA.
Descritores: Carga de Trabalho; Unidades de Terapia Intensiva; Lesão Renal Aguda; Enfermagem; Nefrologia.

RESUMEN

Objetivo: evaluar la carga de trabajo de enfermería en pacientes de cuidados intensivos con lesión renal aguda (AKI – acute kidney injury). **Método**: un estudio cuantitativo en la Unidad de Cuidados Intensivos en el período desde abril hasta agosto de 2015. El Nursing Activities Score (NAS) y el Kidney Disease Improving Global Outcomes (KDIGO) fueron utilizados para medir la carga de trabajo de enfermería y clasificar el estadio de AKI, respectivamente. **Resultados**: en total, se incluyeron 190 pacientes. Los pacientes que desarrollaron AKI (44,2%) tenían NAS superior en comparación con los pacientes sin AKI (43,7% vs 40,7%), $p<0,001$. Los pacientes con AKI en los estadios 1, 2 y 3 de AKI mostraron NAS más alto que aquellos sin AKI. Hubo una relación entre los estadios 2 y 3 y los pacientes sin AKI, $p=0,002$ y $p<0,001$. **Conclusión**: NAS se asoció con la existencia de AKI porque su valor aumenta con la progresión de los estadios y tiene asociación con los estadios 2 y 3 de AKI.
Descriptores: Carga de Trabajo; Unidades de Cuidados Intensivos; Lesión Renal Aguda; Enfermería; Nefrología.

CORRESPONDING AUTHOR **Filipe Utuari de Andrade Coelho** E-mail: filipe.coelho@usp.br

INTRODUCTION

Acute kidney injury (AKI) has demonstrated a great impact on the morbidity and mortality of critical patients in the last decades[1]. An AKI incurs an increased need for intensive clinical support, which, in turn, is characterized by a greater amount of care provided to these patients. The nursing team is involved in this context because it is the group most related to direct care during acute renal failure (ARF) complications; however, this scenario leads to a greater chance of nursing work overload.

Critical patients are more susceptible to developing AKI, due to clinical instability and the existence of risk factors. Currently, AKI has an incidence of around 40%, and mortality of up to 60% in intensive care units (ICUs)[2], in addition to: a greater use of vasoactive drugs (VAD), need for mechanical ventilation (MV), increased length of stay, need for renal replacement therapy (RRT), and the possibility of progression to chronic kidney disease[2-3].

The definition and classification of AKI have undergone modifications over the years, in order to promote conditions of early identification, and more successful interventions. The most recent definition is proposed by the Kidney Disease Improving Global Outcomes (KDIGO) group, which defines AKI by an increased serum creatinine, with values greater than or equal to 0.3mg/dl in 48 hours, or a elevation of 1.5 to 1.9 times the baseline creatinine value in seven days, and a reduction of urine flow of 0.5 ml/kg/h over the period of 6-12 hours[4]. This definition accurately determines the variation of serum creatinine level to be considered, but also maintains the urinary flow as a marker of renal dysfunction, allowing the dynamic analysis of more than one marker to diagnose AKI in the critical patient.

The definition of clinical AKI by KDIGO enabled health professionals to exercise early bedside identification. The nurse is the professional who works closest to the critical patient, and who must subsidize the knowledge to interpret, together with the whole team, the composition of clinical characteristics that lead to the diagnostic formulation and early interventions.

The high frequency of patients with AKI in ICUs, also due to the early identification of this syndrome, requires a nurse prepared to provide safe, quality of care. This scenario of complexity still requires adequate nursing professional staffing, with nurses trained to meet the great care demand of patients with AKI; however, little is known about quantifying this nursing work.

The Nursing Activities Score (NAS) is among the existing instruments to assess nursing workload in the ICU[5]. The NAS was developed from the Therapeutic Intervention Score System (TISS-28), which was composed of instruments that measured the severity of the patients, as well as the nursing workload in intensive care[5]. However, the TISS-28 needed to be adjusted, since it did not include most of the activities performed by nurses. Existing and missing activities in the TISS-28 were included into the NAS, which was divided into seven major categories with a total of 23 items, and weights ranging from 1.2 to 32.0[5-6]. The sum of these items represents the percentage of time spent by nurses, per shift, in direct patient care, with each point of the NAS corresponding to 14.4 minutes of care provided, with a maximum score of 176.8%[6-7]. Scores above 100% indicate the need for more than one nursing professional to provide patient bedside care. This feature shows the functionality of the score, to propose appropriate professional staffing, as well as to include the characteristic care for a critical patient, which is fundamental in patients with AKI, such as measurement of urinary flow, ventilatory treatment and support, as well as renal replacement therapy[6-9].

Despite the relevance of the workload measurement using NAS, few studies discuss this issue, especially regarding its use in patients with AKI in specialized ICUs. In the national literature, only one study investigated NAS in patients with nephropathy due to chronic kidney disease (CKD), and this was in a setting outside the intensive care setting[10].

Some studies in specialized ICUs describe NAS scores between 60% and 80% for cardiac ICU patients[11-13], 62.9% for neurological patients[12], 70.4% for burn patients[14], and 71.3% in trauma patients[15]. In general Brazilian ICUs, the NAS data show values around 60.0%[15-18].

Thus, studies that relate the nursing workload to the AKI patient, using the NAS in ICUs, can contribute to the promotion of quality nursing care, and support adequate professional staffing. Therefore, this study aims to verify the association of the workload, through NAS, in ICU patients with AKI as classified by KDIGO.

METHOD

Ethical aspects

This study was approved by the Ethics Committee of the institution, and followed Resolution No. 196/96 of the National Health Council on research with human beings.

Design, study site and period

This was a retrospective cohort study with a quantitative approach, conducted from April to August of 2015, conducted in an intensive care unit of a University Hospital, which had 12 beds, and that was characterized as a general ICU that treats general medical-surgical patients, independent of the specialty.

Sample, inclusion and exclusion criteria

The sample consisted of 203 patients. The inclusion criteria were patients older than 18 years of age, with at least two serum creatinine measurements (for classification by KDIGO). The exclusion criteria were patients admitted with a history of CKD, patients on dialysis, and pregnant women.

Study protocol

The patients included were followed from admission to hospital discharge, death or ICU transfer during the period described. The variables collected were: age, sex, city of origin, clinical history, length of ICU stay, outcome, use of vasoactive drug, use of mechanical ventilation, and need for RRT. The NAS was used to calculate nursing workload, and the Simplified Acute Physiology Score II (SAPS II) was used to identify patient acuity.

Serum creatinine analysis was first performed at the time of the patient's admission, or as soon as possible, and compared to another creatinine value that was subsequently collected, to determine the presence or absence of AKI. The AKI was defined according to KDIGO, which is defined as a creatinine increase of 0.3 mg/dL in 48 hours, or elevation of 1.5 to

1.9 times the baseline creatinine value in seven days, and a reduction of urine flow of 0.5 ml/kg/h over the period of 6-12 hours[4]. The AKI severity was classified into stages 1, 2 and 3, was also guided by the KDIGO criteria, as follows[4]:

- Stage 1: Serum creatinine level greater than or equal to 0.3mg/dl, or urinary volume less than 0.5ml/kg/h for 6 to 12 hours;
- Stage 2: 2.0–2.9-fold increase in serum creatinine level from baseline, or urinary volume less than 0.5ml/k/h for a period greater than or equal to 12 hours;
- Stage 3: A 3-fold increase in serum creatinine level from baseline, creatinine ≥ 4 mg/dL, or initiation of renal replacement therapy.

Statistical analysis

The data were entered into Excel 2007 spreadsheets, of Microsoft® Windows, and were analyzed using the Statistical Package for the Social Sciences (SPSS) program, version 22. The analysis of the results was made using descriptive statistics, and with inferential analysis of the association between the variables of interest. Analyses of associations between variables of interest were performed using the Chi-square, Wilcoxon-Mann-Whitney and Tukey tests. A significance level of 5% was used for all analyses.

RESULTS

A total of 190 patients were included. Among the patients included, 84 (44.2%) presented AKI, while 106 (55.8%) did not present AKI, according to the KDIGO definitions.

Table 1 shows the clinical and demographic data of patients with and without AKI. The largest number of males was in the group of patients with AKI (65.5%), compared to those without AKI (46.2%) ($p < 0.05$). The mean age of AKI patients was higher, 64.7 years, while those without AKI were 58.8 years old ($p < 0.05$).

Regarding the type of hospitalization between the two groups, clinical hospitalization was the most prevalent among patients with AKI (72.6%) ($p < 0.001$). The length of stay was approximately three times higher for patients who developed AKI (12.8 days) when compared to those who did not present with AKI (4.7 days) ($p < 0.001$).

Regarding the clinical history, patients with AKI presented higher numbers of comorbidities; systemic arterial hypertension (SAH) and diabetes mellitus (DM) affected, respectively, 57.1% and 35.7% of patients who developed AKI. Chronic obstructive pulmonary disease (COPD), 11.9%, and heart failure (HF), 17.8%, occurred around three times more in patients with AKI ($p < 0.05$).

The need for clinical support in ICU was observed by measures such as the use of vasoactive drugs (VAD). Patients with AKI required three times more VAD (44%) than those without AKI (15%) ($p < 0.001$). The use of renal replacement therapy was 16.7% among patients who developed AKI ($p < 0.001$).

Mechanical ventilation was initiated approximately three times more in individuals with AKI (59.5%) than in those without AKI (18.8%) ($p < 0.001$). The period of MV use for patients with AKI was 4.7 days, whereas for those without AKI it was 2.4 days, which was without statistical significance.

Table 1 – Distribution of patients with and without acute kidney injury, São Paulo, Brazil, 2016

Characteristics		Total (N = 190)				*p* value*
		Without AKI (n = 106)		With AKI (n = 84)		
		n	(%)	n	(%)	
Sex	Male	49	46.2%	55	65.5%	0.008**
	Female	57	53.8%	29	34.5%	
Type of hospitalization	Clinical	53	50%	61	72.6%	**<0.001****
	Surgical	53	50%	23	27.4%	
Clinical history	SAH	49	46.2%	48	57.1%	0.135**
	DM	30	28.3%	30	35.7%	0.343**
	COPD	4	3.7%	10	11.9%	0.033**
	HF	6	5.6%	15	17.8%	0.008**
ICU support	VAD	16	15%	37	44%	**<0.001****
	MV	20	18.8%	50	59.5%	**<0.001****
	RRT	0	0	14	16.7%	**<0.001****
Outcome	Death	8	7.5%	28	33.3%	
	Alive	97	91.5%	55	65.6%	**<0.001****
	Transfer	1	1%	1	1.1%	
		Mean	**SD**	**Mean**	**SD**	
Age		58.8	18.1	64.7	16.9	0.026***
Length of stay		4.7	5.8	12.8	21.5	0.001***
MV time		2.4	13.3	4.7	14.0	0.245***
NAS		40.7	4.2	43.7	4.5	**<0.001*****
SAPS II		35.4	12.7	46.9	14.9	**<0.001*****

*Note: AKI – acute kidney injury; SAH – systemic arterial hypertension; DM - diabetes mellitus; COPD – chronic obstructive pulmonary disease; HF – heart failure; ICU – intensive care unit; VAD – vasoactive drug; RRT – renal replacement therapy; MV – mechanical ventilation; NAS - Nursing Activities Score; SAPS II - Simplified Acute Physiology Score II; S.D – standard deviation; *p - comparison between patients with and without AKI; ** Chi-square test; *** Wilcoxon-Mann-Whitney test.*

The mortality of patients with AKI was 33.3%, compared to 7.5% for those who did not develop AKI ($p < 0.001$).

The nursing workload measured with the NAS was higher for patients with AKI (43.7%) than for those who did not develop AKI (40.7%) ($p < 0.001$).

The severity score values demonstrated by SAPS II were also higher for individuals who developed AKI (46.9) than for those who did not present with AKI (35.4) ($p < 0.001$).

Table 2 shows the association between the NAS and the AKI classification by KDIGO. Among the 84 individuals who developed AKI, 34 were classified as stage 1, with a mean NAS of 42.2, similar to patients in stage 2. No statistical difference was found between the NAS of stage 2 patients and those of stage 1; however, 35 patients classified as stage 2 AKI presented a NAS mean much higher than the patients without AKI ($p < 0.05$). On the other hand, the 15 individuals classified as stage 3 AKI had a NAS mean of 45.9, with a difference in this parameter when compared with individuals without AKI, and those in stages 1 and 2 ($p < 0.001$ and $p < 0.002$, respectively).

Table 2 – Association between the Nursing Activities Score and patients with and without acute kidney injury as defined by the Kidney Disease Improving Global Outcomes, São Paulo, Brazil, 2016

	Total (N = 190)	NAS		*p* value*		
	n	Mean	SD	Without LRA	AKI Stage 1	AKI Stage 2
Without AKI	108	40.7	4.2	-	-	-
AKI Stage 1	34	42.2	4.0	0.284*	-	-
AKI Stage 2	35	43.5	3.9	0.002*	0.483*	-
AKI Stage 3	15	45.9	5.1	**<0.001***	0.002*	0.055*

*Note: AKI - Acute kidney injury; NAS - Nursing Activities Score; SD – Standard deviation; * Tukey test.*

DISCUSSION

Literature data confirm that AKI is one of the most serious conditions in hospitalized patients, due to the great impact of their complications. When related to critical patients, outcomes can be even more aggressive. The care setting in ICU is complex, requiring preparation and availability of the entire multiprofessional team. The AKI is a situation of greater clinical complexity, and requires greater involvement and dedication by the nursing team; however, few studies demonstrate the relationship between acuity, the AKI, and nursing workload in the care provided to these patients.

This study showed a 44.2% incidence of AKI in ICU patients, a relatively higher value when compared to other national - 40.4%, 31.2% and 25.5%[3,19-20] - and international studies- 26.7% and 24.4%[21-22]. The mortality in patients with AKI was 33.3%, similar to that found in international studies, which showed values between 29.2% and 39.3%[21-22]; however, it was much higher when compared to patients who did not progress with ARF (7.5%). The profile of patients admitted to the ICU is generally associated with greater organ dysfunction, with the need for VAD, MV and RRT, which implies an increased risk of death. As a multifactorial clinical condition that is rarely isolated, ARF compromises the clinical condition of the critical patient even further.

Among the patients with AKI, the prevalence of males in relation to those without AKI was also observed, which is consistent with national and international studies[21-22]. Age is a risk factor for the development of AKI, and this study showed a higher age among patients with AKI. These data corroborate other investigations demonstrating that most cases of AKI are concentrated among elderly patients admitted to the ICU[19-22]. This fact confirms epidemiological data, showing an aging of the world population. In Brazil, information from the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE) indicates that, in 2009, the number of elderly reached 21 million, a scenario that may affect the data on the incidence of AKI in the short-, medium- and long-term[23].

In addition to epidemiological characteristics, this study showed that supportive measures in the ICU were visibly more frequent in patients with AKI, such as the use of VAD, which was around three times greater for individuals with AKI. Additionally, there was an increased use of medications for hemodynamic support in critically ill patients, such as those for maintaining blood pressure, to avoid deviations leading to tissue hypoperfusion[19,21-22].

The use of MV is associated with respiratory decompensation, of an infectious or other origin. Among the individuals who developed AKI, the majority required MV for longer periods than what was seen in patients without AKI. This association was also verified in other studies, and is related to the complexity of the seriously ill patient with the need for an artificial airway, due to pulmonary complications[19,21-22].

The RRT is intrinsically associated to AKI, and its need was verified among patients with AKI. The SAPS II for patients with AKI was greater than those without AKI, confirming a higher acuity and mortality risk for these patients. The patient with AKI showed greater acuity, and this is related to his previous clinical history, and a need for more specific and invasive clinical management, which resulted in an increased risk of complications and mortality[22-24].

The greater acuity, use of advanced clinical support, and increased length of stay result in increased costs for hospital services. According to data from the National Health Service of England[25], the expenditures for patients with AKI in ICU exceeded 1 billion euros in 2011. In addition to the obvious costs, there is also an increase in care provided by the nursing team to these individuals, related to higher nursing workload.

In this study, the nursing workload of patients with AKI was higher than for those without AKI. Increased severity of AKI proportionally increased the NAS of those patients. There are no other studies available in the literature that relate AKI and the NAS[6].

The NAS of individuals with AKI in this study sample was from a general ICU, without separation by specialties, since the value found was lower when compared to the NAS of specific ICUs, such as cardiology, burn, trauma and neurological patients[12-15]. However, studies in these specialized ICUs are necessary for a better understanding, and to compare the NAS of patients with and without AKI under different conditions.

The KDIGO classification was developed with the purpose of refining the criteria for inclusion of the patients at each stage, which in the previous classifications presented difficulties in allocating some types of patients, especially those who started RRT[26]. In stages 2 and 3, the physiological complications were intensified[24-26], which reflected an increased nursing workload to provide the necessary care, according to the patient acuity.

The results of this study confirm the impact of AKI, and its stages of acuity, on nursing workload. The occurrence of AKI already requires a greater nursing workload. As the AKI worsens, the burden related to these patients increases. This suggests that the qualitative and quantitative adequacy of the nursing staff, using the NAS as a workload reference, is critical to the performance of safe, quality patient care.

Among the aspects related to the training of the team members is the investment in preparing them to identify risk factors for the development of AKI, such as advanced age and the existence of comorbidities, as this study showed, as well as the recognition of classifications, and signs and symptoms.

In summary, the results found in this study demonstrated the important association of the NAS with AKI in ICU patients, confirming that patients who develop AKI are more severe and, as the AKI worsens, there is a greater nursing workload required to manage care for these individuals.

Studies with larger samples and the involvement of more centers may provide data that are more comprehensive, and promote more detailed discussions on proposals for the promotion of quality intensive care. This study allowed only for the identification of prevalent cases of AKI. Data collection was directly related to the evolution of AKI, and the clinical outcome of those patients occurred in a single period. Despite these limitations, the study identified risk factors involved in patients with AKI that will allow the development of health care planning and actions.

CONCLUSION

The NAS of patients with AKI was higher when compared to individuals who did not develop AKI. The NAS increased with the acuity of AKI, according to KDIGO criteria, confirming a greater need for nursing care for these patients.

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