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Nurses' knowledge in the early detection and management of acute kidney injury in selected referral hospitals in Rwanda

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ABSTRACT

INTRODUCTION: Acute kidney injury (AKI) is a global health issue, and its prevalence is higher in low- and middle-income countries (LMICs). The knowledge of nurses in the early detection and management of AKI has rarely been explored in the current literature; thus, this study aims to assess the knowledge of nurses in the early detection and management of patients with AKI in Rwanda.

METHODS: A cross-sectional research design was implemented for this study. The study setting included selected referral hospitals in Kigali. A convenience sample of 165 nurses was obtained and data was collected using a self-administered questionnaire. Analyses were made using descriptive and inferential statistics in SPSS version 21.

RESULTS: Nurses' knowledge in the early detection and management of AKI was low. Receiving in-service training on AKI positively influenced their knowledge in the early detection (p-value= 0.049), whereas studying AKI in nursing school p-value = 0.035) and receiving in-service training on AKI (p-value= 0.008) were associated with knowledge of the management of AKI.

CONCLUSION: AKI is a common and potentially life-threatening condition that prolongs hospital stay, increases resource utilization, and mortality risks. Nurses need to be more involved in the early identification and management of AKI as they mostly serve as frontline health care providers and their role of continuous patient monitoring.

Keywords: Acute Kidney Injury, Nurse, Knowledge, Early detection, Rwanda

INTRODUCTION

Acute kidney injury (AKI) is defined as an abrupt decline in renal function characterized by inadequate urine output of less than 0.5ml/ kg/ hour in six hours or an increased level of serum creatinine ≥26.5 µmol/l in 48 hours or increased serum creatinine to ≥ 1.5 to 1.9 times compared to baseline in the previous 7 days [1]. AKI is a widely recognized hospital-based health issue [2]. There is increasing recognition of both the effects of AKI on the individual patient, and the resulting societal burden ensuing from its long-term effects, including the development of chronic kidney disease (CKD) and end-stage renal disease (ESRD) that requires dialysis [21]. International statistics estimate its incidence at 7-18% in hospitalized patients and 17-35% in ICU [3,4].

AKI affects more than 13 million individuals per year, where 85% are in low- and middle-income countries [3]. There is an estimate of 24-59% of AKI incidences in African children suffering from severe malaria [5]. A study in South Africa highlighted the prevalence of AKI to be 14.7% in adults, combining both community-acquired and hospital-acquired AKI [6]. The same study revealed that hospital-acquired AKI is at 6.2%, where the most common causes are infection, hypertension, and surgery [6]. A study performed in Rwanda found that dialysis-requiring AKI was due to malaria, pneumonia, sepsis, and pregnancy-related complications [7]. In the developing world, limited resources regarding diagnosis, treatment, and trained health professionals influence the burden of the condition. The deficiency in qualified professionals can delay the timely identification and management, including the referral to specialized services, leading to a worsening prognosis [8].

Although an intervention nurse-led in-service training was done in one of the resource-constrained countries trying to improve the knowledge and management of AKI by nurses [9], deficiencies in AKI care related to early recognition, fluid management, and medication management still exist [2]. A study done in Nepal revealed that 53.3% of nurses had inadequate knowledge of AKI [10]. In Rwanda, a study evaluating hospitals' challenges in recognizing and managing AKI in resource-limited settings, mentioned knowledge gaps among health professionals, including nurses [11]. Therefore, this study intended to specifically assess the nurses' level of knowledge in the early detection and management of AKI in Rwanda.

METHODS

Study design: Our study used a descriptive cross-sectional design with a quantitative approach to assess the nurse's knowledge of early detection and management of acute kidney injury. The collection of this data was conducted from the beginning of March to the end of April 2017.

The study was conducted at the University Teaching Hospital of Kigali (CHUK). The study site was selected because it receives a variety of patients with risk factors of AKI from several district hospitals due to its developed medical infrastructures and specialties.

All consenting nurses working at CHUK in the emergency and trauma, internal medicine, surgery, pediatrics and ICU were enrolled in the study. The nurses who were absent at the time of data collection and who declined to sign the consent were excluded from the study. A convenience sample of 172 nurses was selected for the study.

The data was collected using a questionnaire developed from an in-depth literature review. The instrument was composed of three sections, including demographic characteristics, nurses' knowledge in early detection, and knowledge of AKI management. Section 1 included: Sociodemographic characteristics, including age, gender, level of education, the unit where the participant is working, and years of experience. Section 2 asked early AKI detection questions, including nephrotoxic drugs, the occurrence of AKI in ICU, if AKI is preventable and treatable when identified early, knowledge of the most common prerenal, intrarenal, and postrenal causes of AKI, the normal levels of serum creatinine, and definition of oliguria. Whereas Section 3 encompassed questions related to AKI management, including the use of dopamine to increase renal perfusion, pulmonary edema as a complication of AKI, common electrolyte imbalances in AKI, appropriate IV fluid to be used in septic shock, other treatment options in AKI, priority assessment of an AKI patient presenting peripheral edema, nausea and vomiting, a respiration rate of 30 cycles per minutes and priority nursing actions to be taken in an AKI patient with hyperkalemia.

The questionnaire was developed based on an in-depth literature review. Experts in the field checked the tool to ensure that the content was appropriate to assess the nurse's knowledge in the early detection and management of AKI. The questionnaire was translated into French and Kinyarwanda as they are local languages. Before data collection, the questionnaire was piloted on 10 nurses to check for ambiguities and no changes were made to the questionnaire as the participants were able to clearly understand and comprehend the information. The reliability coefficient analysis revealed a Cronbach alpha (r) of 0.73, meaning that the questionnaire used was a good measure of the variables under study.

Data analysis: After data collection, the findings were checked, coded, and entered into SPSS software for analysis. All the analysis of quantitative data was completed using the Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistical results in frequencies and percentages

were used to describe participants' demographic characteristics and responses to nurses' knowledge in the early detection and management of AKI. Inferential statistics of a chi-squared test were used to determine an association between sociodemographic characteristics and nurse knowledge in the early detection and management of AKI.

Ethical clearance approval was obtained from the University of Rwanda institutional review board. Ethical approval was also obtained from CHUK. The written informed consent, which included an explanation of the purpose of the study, was given to the study participants and voluntarily signed before data collection.

RESULTS

Table 1. summarizes the demographic data of the participants. The results indicate that most of the participants were female (81.2 %) while only (18.8 %) were male. The dominant age group was between 31-40 years (55%). Regarding the level of education, 78.7% of participants were diploma holders (A1), with only 14.5% being at bachelor's level (A0). The nurses were working in the surgical unit (33.3%), internal medicine unit (22.4%), pediatrics (22.4%), Emergency and Trauma department (11.5%) and ICU (10.3%). Forty-three percent of nurses had five to ten years of nursing experience. Finally, 93.3% reported not having received any in-service training on AKI; participants who agreed to be trained are working in the Hemodialysis service (a small branch of Internal Medicine), where patients with AKI and CKD are treated with hemodialysis.

Table 2 illustrates that 76% of the participants correctly responded "True" to question number 1, asking if NSAIDs, vancomycin and contrast agent can cause AKI. At 72%, participants confirmed that AKI is preventable, treatable, and reversible if identified as soon as possible; they accepted Gentamycin as a nephrotoxic drug; in questions number three and eight, respectively. Half of the participants (51%) got the definition of AKI right. Only 39%, 34%, and 21% gave correct answers on AKI causes, which are prerenal, intrarenal, and postrenal. A percentage of 59% know the normal level of serum creatinine. Finally, 27% got the correct definition regarding oliguria. Table 3 below shows the results on the knowledge of nurses in the management of AKI.

Table 1: Demographic data of the participants (n=165)

Variables	Frequency	%
Age of the participants		
21- 30 years	31	18.8
31- 40 years	91	55.2
41- 50 years	36	21.8
More than 50 years	7	4.2
Sex of the participants		
Male	31	18.8
Female	134	81.2
Level of education		
Master's Nurse	0	0
A0 Nurse	24	14.5
A1 Nurse	130	78.7
A2 Nurse	11	6.7
The unit where the participant is working		
Internal Medicine	37	22.4
Surgery	55	33.3
Emergency and Accident	19	11.5
Pediatric	37	22.4
Intensive Care Unit	17	10.3
Years of nursing experience		
Less than 5 years	26	15.8
5-10 years	71	43
10-15 years	43	26.1
More than 15 years	25	15.2
Studied the topic of AKI in nursing school		
Yes	74	44.8
No	91	55.2
Got in-service training on AKI		
Yes	11	6.6
No	154	93.3

The use of dopamine to increase renal perfusion in critically ill patients and the treatment options for AKI both were correctly answered at 53% and 61% believed that pulmonary edema is a complication of AKI. Among participants, 41% reported that hyperkalemia is a common electrolyte imbalance and 73% of the participants correctly circled offering an infusion of normal saline to a patient presenting septic shock. On the other hand, only 27% were able to choose the right response to question number 18, which was about priority action to be taken in case of a patient with AKI presenting hyperkalemia.

Almost all factors which could affect the knowledge of nurses in the early detection of AKI such as age,

Table 2: Knowledge of nurses in the early detection of AKI (n=165)

Items	Correct	%	Incorrect	%
NSAIDs, vancomycin and contrast agents cause AKI	125	76%	40	24%
AKI is uncommon in critically ill patients	89	54%	76	46%
AKI is preventable, treatable and reversible if identified early	118	72%	47	28%
AKI is defined as an abrupt reduction of kidney function evidenced by increased serum creatinine and decreased urine output.	84	51%	81	49%
AKI caused by impaired blood supply to the kidney:	65	39%	100	61%
All are risk factors of AKI are except:	100	61%	65	39%
AKI caused by obstruction in urine outflow	35	21%	130	79%
Nephrotoxic drug	118	72%	47	28%
AKI caused by damage to the renal tissue	56	34%	109	66%
Normal value of serum creatinine	97	59%	68	41%
Right statement about oliguria except	44	27%	121	73%

sex, level of education, years of nursing experience, the unit a participant is working in, and studying AKI in his/her respective nursing school were not associated with the degree of knowledge. Receive in-service training on AKI was associated with nurses' knowledge in the early detection of AKI, ($x2$=16.4, p=0.049).

Considering all possible factors tested to affect nurses' knowledge on the management of AKI, both studying AKI in nursing school and receiving in-service training on AKI were associated with nurses' knowledge of the management of AKI (F= 6.67, p=0.035 and F=8.9, p=0.008), respectively.

DISCUSSION

This study showed that most of the participants were female nurses in their middle age. The same finding was found in another study in Rwanda, where most nursing participants were 55% female, with a mean age of 34.5 ± 7 years [11]. Regarding the level of education, 78.7% of nurses were advanced diplomas or certified nurses. This reflects the effort of the Government of Rwanda to stop the enrolled nursing program in secondary schools to empower advanced diploma nursing programs at the university level [20]. The advanced diploma nursing schools admitted both direct entry from candidates to pursue 3-year full-time program and offered option to in-service enrolled nurses to upgrade their level via distance learning for a 2-year period in addition to 4-year full-time nursing offering bachelor's degree (Ao) [20].

The results of this study showed that the overall score of the nurses in relation to early detection of AKI was low. Several 94.5% (156) graded with less than 80% of the total score in the early detection of AKI. Only 30% of nurses in another study appropriately responded to AKI diagnostic questions [11]. These results are the same as in a study done in Brazil, where nurses also had insufficient knowledge of early AKI identification [12]. However, nurses should be knowledgeable enough to recognize abnormal findings and report immediately to the physician to take quick and

Table 3. Demonstrates the level of knowledge of nurses in the management of AKI (n=165)

Items	Correct	%	Incorrect	%
Dopamine use to increase renal perfusion in critically ill patients	87	53%	78	47%
Pulmonary edema is not a complication of AKI	101	61%	64	39%
Common electrolyte imbalances in AKI	68	41%	97	59%
IV fluid to give in case of septic chock	120	73%	45	27%
Priority physical assessment is given to patient with AKI presenting edema nausea, dyspnea of 30cycles/ min	72	44%	93	56%
Priority nursing action to a patient with AKI presenting hyperkalemia of 7mmol/L	45	27%	120	73%

appropriate action [13]. Another study on non-specialist medical staff revealed that less than 2% of participants correctly defined AKI, 63% categorized the condition appropriately, and 42% gave at least four factors leading to AKI [14]. Muniraju et al. state that as nurses are at the front desk in most health facilities, they must be properly equipped to improve early diagnosis of AKI [14]. The use of daily laboratory alerts, communication of risk to develop AKI in the daily report and training health professionals are key elements to improving early identification and documentation of AKI [15].

The results of Muniraju et al. mentioned that nurses had poor knowledge in managing AKI [14], while in another study only 8.5% were ranked with a score greater than 80%; the latter is a cutoff point toward the knowledge for nurse practitioners [16]. On the contrary, nurses and midwives provided correct answers to questions regarding AKI management at a level greater than 70% [11]. AKI is observed in different settings, which poses challenges for clinical teams who may lack the skills and knowledge to manage AKI appropriately [17]. It is up to the health professionals and the public to be aware of the risk factors and the main strategies in preventing and managing AKI [18]. In a study conducted in Malawi, 34% of the participants were not aware of the hemodialysis services offered at Queen Elizabeth Central Hospital [8]. The lack of information could negatively impact an appropriate management response, including timely referral resulting in delayed treatment leading to increased patient morbidity and mortality. A study done on AKI in low resource settings aimed to rule out barriers to diagnosis, awareness, and treatment and related strategies to mitigate these barriers underlined

Table 4: Factors affecting nurses' knowledge in the early detection of AKI

Characteristics of the participant		Knowledge on early detection of AKI			
		Poor knowledge	Moderate knowledge	High knowledge	p-value
Sex	Male	31(100%)	0	0	0.078
	Female	114 (85.1)	11(8.2%)	9 (6.7%)	
Age	21-30 years	30 (96.8%)	0	1 (3.2%)	0.389
	31-40 years	79 (86.8%)	8 (8.8%)	4 (4.4%)	
	41-50 years	29 (80.6%)	3 (8.3%)	4(11.1%)	
	more than 50 years	7 (100%)	0	0	
Level of	A_0	20 (83.3%)	1 (4.2%)	3 (12.5%)	0.460
Education	A_1	115 (88.5%)	9 (6.9%)	6 (4.6%)	
	A_2	10(90.9%)	1 (9.1%)	0	
Unit	Internal >medicine	31 (83.8%)	2 (5.4%)	4 (10.8%)	0.065
	Surgery	46 (83.6%)	6 (10.9)	3 (5.5%)	
	E&A	19 (100%)	0	0	
	Pediatric	34 (91.9%)	2 (5.4%)	1 (2.7%)	
	ICU	15 (88.2%)	1 (5.9%)	1 (5.9%)	
Years of nursing experience	1-5 years	26 (100%)	0	0	0.459
	6-10 years	60 (84.5%)	6 (8.5%)	5 (7.0%)	
	11-15 years	38 (88.4%)	2 (4.7%)	3 (7.0%)	
	>16 years	21 (84%)	3 (12%)	1 (4%)	
Receive teaching on AKI	Yes	60 (81.1%)	8 (10.1%)	6 (8.1%)	0.68
	No	85 (93.4%)	3 (3.3%)	3 (3.3%)	
Receive training on AKI	Yes	6 (54.5%)	2 (18.2%)	3 (27.3%)	0.049
	No	139 (90.3%)	9 (5.8%)	6 (3.9%)	
	Total	145 (87.9%	11 (6.7%)	9 (5.5%)	

Table 5: Factors associated with knowledge on AKI management (n = 165)

Characteristics of the participants		Knowledge on the management of AKI			
		Poor knowledge	Moderate knowledge	High knowledge	p- value
Sex	Male	24 (77.4%)	3 (9.7%)	4 (12.9%)	0.393
	Female	101 (75.4%)	23 (17.2%)	10 (7.5%)	
Age	21-30 Years	24 (77.4%)	5 (16.1%)	2 (6.5%)	0.065
	31-40 Years	68 (74.7%)	14 (15.4%)	9 (9.9%)	
	41-50 Years	28 (77.8%)	5 (13.9%)	3 (8.3%)	
	>50 years	5 (71.4%)	2 (28.6%)	0	
Level of education	A_0	16 (66.7%)	4 (16.7%)	4 (16.7%)	0.527
	A_1	100 (75.9%)	20 (15.4%)	10 (7.7%)	
	A_2	9 (81.8%)	2 (18.2%)	0	
Unit of the participant	Internal medicine	26 (70.3%)	6 (16.2%)	5 (13.5%)	0.508
	Surgery	40 (72.7%)	11 (20%)	4 (7.3%)	
	E&A	16 (84.2%)	2 (10.5%)	1 (5.3%)	
	Pediatric	32 (86.5%)	4 (10.8%)	1 (2.7%)	
	ICU	11 (64.7%)	3 (17.6%)	3 (17.6%)	
Years of experience	1-5 years	20 (76.9%)	5 (19.2%)	1 (3.8%)	0.074
	6-10years	50 (70.4%)	13 (18.3%)	8 (11.3%)	
	11-15 years	36 (83.7%)	3 (7%)	4 (9.3%)	
	>16 years	19 (76%)	5 (20%)	1 (4%)	
Receive teaching on AKI	Yes	49 (66.2%)	16 (21.6%)	9 (12.2%)	0.035
	No	76 (83.5%)	10 (11%)	5 (5.5%)	
Receive AKI training	Yes	5 (45.5%)	2 (18.2%)	4 (36.4%)	0.008
	No	120 (77.9%)	24 (15.6%)	10 (6.5%)	

that inadequate training, lack of awareness of AKI, and lack of clinical practice guidelines for AKI were affecting the overall care of the patient with AKI [19]. Another study showed that health care providers need both education and training to be able to effectively face cases with AKI [8].

We found out that studying AKI during the educational nursing program was associated with the knowledge of nurses in the early detection of AKI while being exposed to the in-service training and studying AKI in nursing school was associated with the management of AKI. A study done in Rwanda on challenges in the recognition and management of AKI demonstrated the main deficiency in diagnosing and managing AKI [11].

The authors conducted a study assessing nurses' knowledge in the early detection and management of AKI using self-reported data. There is a need for data triangulation, such as using observation data collection techniques to relate self-reported scores to practice scores. Information bias was entirely possible as the nurses responded to the questionnaire according to how they comprehended the information.

CONCLUSION

AKI is a common and serious condition that requires an appropriate follow-up. Prevention is the best way to control AKI since it can lead to an increased mortality rate. Especially in sub-Saharan Africa, due to the shortage of resources and being exposed to most of the risk factors, it is important to have well-equipped professionals to prevent, identify and treat AKI accordingly.

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