

# Prevalence and factors associated with acute kidney injury in elderly adults

Carol Estefania Marquez Maldonado M.D.  
Luis Raul Cajamarca Bermeo M.D.  
José Eduardo Guevara Sanchez M.D.  
Estefania Santa Mejia M.D.  
Marcelo David Márquez Maldonado M.D.  
Sonia Gabriela Cevallos Ávila M.D.

Cuenca, Ecuador

Original Article

Internal Medicine

OPEN ACCESS

## ABSTRACT:

**BACKGROUND:** acute kidney injury (AKI) is a very frequent disorder, acts as a morbidity and mortality factor in hospitalized older adults. It is a public health problem associated with several factors, some modifiable. Therefore, the objective of this study was to determine the prevalence and factors associated with AKI in elderly patients hospitalized in the emergency service of the Vicente Corral Moscoso Hospital (HVCM).

**METHODS:** analytical cross-sectional study carried out in Cuenca in the HVCM emergency service from March 2018 to March 2020. The sampling was probabilistic, evaluating 200 older adults. The KDIGO (Kidney Disease: Improving Global Outcomes) criteria were used to determine and classify AKI. The data were analyzed with the SPSS v.20.0 program, using the prevalence ratio (OR) to measure association, with a 95% CI and with statistical significance  $p < 0.05$ .

**RESULTS:** the mean age was  $80 \pm 8.37$  years, the female gender predominated and the majority had a primary education level. The prevalence of AKI was 33%. Four out of ten older adults had AKI stage 3 and more than half had high blood pressure and use nephrotoxic. The associated factors were: sepsis (OR2.27; 95%CI 1.58-3.27;  $p 0.0002$ ), dehydration (OR1.73; 95%CI 1.18-2.54;  $p 0.006$ ) and diabetes mellitus (OR1.58; 95%CI 1.07– 2.34  $p 0.0181$ ).

**CONCLUSIONS:** more than a third of hospitalized older adults presented AKI; KDIGO stage 3 predominated and was associated with: sepsis, dehydration and diabetes mellitus.

**KEYWORDS:** Acute kidney injury. epidemiology. complications. classification. diagnosis.

## Introduction

Acute kidney injury (AKI) is defined as the abrupt decrease in kidney function that occurs for 7 days or less, and is classified into three stages [1]. It is related to multiple etiologies and is associated with several factors [2]. The prevalence of AKI and impact on public health cost is increasing [3]. In addition, it is a preventable disease, often underdiagnosed, that acts as an individual factor of morbidity and mortality in hospitalized patients [4]. Comorbidities together with the aging process contribute directly to the decline in kidney function, making this population more susceptible to developing AKI [5]. Silveira et al., in their meta-analysis, showed that the development of AKI was twice as high in older adults compared to young people. Similar results was reported by Li Q. et al. [4, 6].

Despite there being a lot of information on this subject, there is no local data focused on the elderly. Chávez et al., in their study in Latin America, affirm

that there is a lack of information on the epidemiology of AKI [7]. Therefore, it is necessary to carry out local epidemiological studies in older adults, with the aim of preventing and treating this pathology early.

## Methods

An analytical cross-sectional study was carried out, it determined the prevalence and factors associated with AKI in older adults hospitalized in the emergency service of the Vicente Corral Moscoso Hospital. The universe was made up of patients admitted to the emergency service of the Vicente Corral Moscoso Hospital between March 2018 and March 2020, a total of 3,360 older adults were obtained from the HVCM emergency statistics. The sample was calculated with 95% confidence, prevalence of 16.7%, inference error of 5%, with a

	n (200)	%
Age*	65 a 74 years	59 29,5
	75 a 84 years	74 37,0
	≥85 years	67 33,5
Gender	Female	129 64,5
	Male	71 35,5
Residency	Urban	103 51,5
	Rural	97 48,5
Education	None	73 36,5
	Primary	119 59,5
	Secondary	8 4,0
<b>*Mean: 80,1 SD ± 8,37</b>		

**Table 1.** Distribution of 200 older adults at the Vicente Corral Moscoso Hospital according to sociodemographic variables. Cuenca March 2018 to 2020.

result of 200 patients, which was selected by systematic technique.

Patients ≥65 years old hospitalized in the HVCM emergency service from March 2018 to March 2020, who had an emergency clinical record, form 008, with a minimum of two serum creatinine (SCr) determinations were included; and at least one SCr determination reflecting a GFR >60ml/min/1.73m<sup>2</sup> calculated by the MDRD formula, in the last 3 months or during hospitalization. Patients with a history of chronic kidney disease (CKD), demonstrated by complementary tests and/or GFR <60ml/min/1.73m<sup>2</sup> SC calculated by the MDRD formula, in the last 3 months, and patients with terminal illnesses were excluded.

The data were taken from the clinical history, form 008 and from the HVCM laboratory system, in a validated form where the dependent variables were collected: acute kidney injury, moderating variables: age, gender, level of education, residence, independent variables: nephrotoxic drugs, dehydration, sepsis, obstructive uropathy, diabetes mellitus, high blood pressure and liver cirrhosis. AKI was considered based on the KDIGO criteria, with baseline SCr being the lowest value recorded in the last 3 months or during hospitalization. The criterion of decreased diuresis set out in the KDIGO guide was not taken into account because it involves clinical records and sometimes this value is not specified.

The data collected in the forms were transcribed into Excel and subsequently tabulated in the SPSS v.20.0 program. Once the prevalence and staging of AKI was determined, the statistical analysis was performed with association tables between AKI and the factors studied in the program. Epidat 3.1, determining the prevalence ratio (OR) for each of them. Descriptive statistics were used for data analysis

KDIGO	n (200)	%
<b>Stage 1</b>	17	25,8
<b>Stage 2</b>	21	31,8
<b>Stage 3</b>	28	42,4

**Table 2.** Prevalence of AKI according to KDIGO stage in older adults at the Vicente Corral Moscoso Hospital. Cuenca March 2018 to 2020.

based on frequencies, percentages and measures of central tendency, the statistical association was determined with a 95% confidence interval and statistical significance was considered with a value of p <0.05.

### Results

The mean age was 80.1 years (SD ± 8.37). A third of the older adult population corresponds to the age between 75 to 84 years. The female gender prevailed with 64.5%. More than half of older adults live in urban areas (51.5%). 59.5% of older adults had a primary education level (table 1).

The prevalence of AKI in this study was 33% in older adults with HVCM in the emergency service, with an inference of 95% CI 26.233 - 39.767.

Regarding the prevalence of AKI according to the KDIGO stage, it was possible to determine that a quarter of older adults had AKI in stage 1, a third had AKI in stage 2 and 4 of 10 older adults had AKI in stage 3 (table 2).

According to the factors related to AKI, it was found that 6 of 10 older adults presented arterial hypertension and consumption of nephrotoxic drugs. One third had diabetes mellitus and dehydration, while a minority had obstructive uropathy and liver cirrhosis (Table 3).

Regarding the associated factors, a statistical association was determined between having dehydration (OR 1.73; 95% CI: 1.18–2.54; p 0.006) and the development of AKI; similarly, sepsis acts as a statistically significant important risk factor (OR 2.27; 95% CI: 1.58–3.27; p 0.0002). There was also an association with the presence of diabetes mellitus (OR 1.58; 95% CI: 1.07–2.34; p 0.0181) (table 4). In addition, the present study identified that older adults with obstructive uropathy (OR 1.22; 95% CI: 0.55–2.69; p 0.4314), use of nephrotoxic drugs (OR 1.48; 95% CI: 0.89–2.45; p 0.074) arterial hypertension (OR 1.18; 95% CI: 0.78–1.80; p 0.253) and liver cirrhosis (OR 1.40; 95% CI: 0.71–2.77; p 0.193) frequently develop AKI, however there was no statistically significant association (Table 4).

		n (200)	%
Dehydration	Yes	52	26,0
	No	148	74,0
Obstructive Uropathy	Yes	10	5,0
	No	190	95,0
Sepsis	Yes	34	17,0
	No	166	83,0
Nephrotoxic	Yes	143	71,5
	No	57	28,5
Diabetes mellitus	Yes	58	29,0
	No	142	71,0
Arterial Hypertension	Yes	124	62,0
	No	76	38,0
Hepatic cirrhosis	Yes	11	5,5
	No	189	94,5

**Table 3.** Factors related to AKI in older adults hospitalized at the Vicente Corral Moscoso Hospital. Cuenca March 2018 to 2020.

**Discussion**

The present study showed that 33% of older adults studied presented AKI. A similar prevalence in Taiwan by Chao C. et al. in 2015, who determined a prevalence of 39% [8]. Similarly, in Mexico, Gaytán G. et al. in 2019, found a prevalence of 39%, this is

explained by sharing sociodemographic characteristics, sample size and study population [15]. We can also mention: greater exposure to polypharmacy, lower drug metabolism due to its renal aging process and the concomitance of chronic diseases that predispose to AKI [9].

When comparing the present study with data in Peru from Palacios et al. in 2020, a higher prevalence of 57.06% was observed in patients hospitalized in clinics, and this increased to 88.14% in ICU patients, which could be justified by the inclusion of older adults with multiple serious pathologies included in their study [10, 16]. In China by Liu J. et al. in 2018, reported a low prevalence of 1.61%, due to the inclusion of young adults, but AKI was higher in the elderly (1.61% vs. 1.40%; p=0.045) [16]. Pathophysiologically, older age increases the probability of presenting AKI due to senile nephrosclerosis that facilitates the development of AKI [12, 13].

According to the severity in the study by Silveira et al., in 2018, they reported similar results to the present study with a prevalence of advanced stage KDIGO 3 in 70.3% in older adults, KDIGO 2 20.6% and KDIGO 1 in the 9.1%, in addition, the more severe the AKI, the more likely it is to require RRT [6]. In contrast, Chao C. et al. in 2015, in his study in older adults, he identified that 51% presented stage 1, secondly stage 3 with 25% and less frequently stage 2 with 23%, but found a significant association between the advanced stage of KDIGO and the development of in-hospital complications (OR = 7.1, p < 0.01) [8].

Okyere et. al., in 2019, states that patients with KDIGO 3 are associated with less recovery of kidney function (p = 0.002), therefore the most appropriate

	AKI*						OR	95% CI	P values
		Yes		No					
		n	%	n	%				
Dehydration	Yes	25	48,1	27	51,9	1.73	1.18 – 2.54	0.006	
	No	41	27,7	107	72,3				
Obstructive Uropathy	Yes	4	40,0	6	60,0	1.22	0.55 – 2.69	0.431	
	No	62	32,6	128	67,4				
Sepsis	Yes	21	61,8	13	38,2	2.27	1.58 – 3.27	0.000	
	No	45	27,1	121	72,9				
Nephrotoxic	Yes	52	36,4	91	63,6	1.48	0.89 – 2.45	0.074	
	No	14	24,6	43	75,4				
Diabetes mellitus	Yes	27	44,3	34	55,7	1.58	1.07 – 2.34	0.018	
	No	39	28,1	100	71,9				
Arterial Hypertension	Yes	44	35,5	80	64,5	1.18	0.78 – 1.80	0.253	
	No	22	28,9	54	71,1				
Hepatic cirrhosis	Yes	5	45,5	6	54,5	1.40	0.71 – 2.77	0.276	
	No	61	32,3	128	67,7				

\*AKI: acute kidney injury

**Table 4.** Factors associated with AKI in older adults hospitalized at the Vicente Corral Moscoso Hospital. Cuenca March 2018 to 2020.

behavior is to diagnose this pathology early and be alert to its presentation to start treatment and prevent complications [18].

Regarding associated factors: sepsis (OR 2.27; 95% CI: 1.58–3.27;  $p$  0.0002), dehydration (OR 1.73; 95% CI: 1.18–2.54;  $p$  0.0065) and diabetes (OR 1.58; 95% CI: 1.07–2.34;  $p$  0.0181) had a significant association. Sepsis is a factor that doubles the risk of presenting AKI. In 2016 in Nicaragua Téllez evidenced sepsis as the main risk factor for AKI. In China Ge S. et al. in 2016, showed sepsis (OR 2.8; 95% CI 2.01 - 3.9) and septic shock (OR 7.61, 95% CI 6.07 - 9.56) as risk factors for increased mortality, this risk increases in adults older than 80 years [12]. Funk I. et al. in 2016, reported similar results indicating sepsis as a frequent risk factor (38%) [14, 15].

Silveira et. al., in 2018, in Brazil, identified that dehydration is a high-impact factor for the development of AKI and complications in older adults. When comparing with a study in Mexico carried out by Gaytán et. al., in 2019, in older adults dehydration/hypovolemia (28.2%) was also identified as risk factors ( $p=0.002$ ) and Ge et al. in 2016, hypovolemia (OR 1.49, 95% CI 1.2 - 1.85) [9, 20].

On the other hand Pavkov M. et al. in 2018, in the United States, it evaluated risk factors with a tendency to increase hospitalizations, identifying that diabetes (40%) raises the risk of presenting AKI four times ( $p=0.001$ ) and its complications such as RRT [20]. Also in 2016, Ge et al., identified diabetes as an important risk factor (OR 1.94, 95% CI 1.85 - 1.05) [9].

AKI was more frequent in those who consume nephrotoxic drugs 71.5% vs. 28.5% compared to those who do not consume it, with older adults being more susceptible. In China Ge S. et al. in 2016, stated that older adults have polypharmacy, therefore greater exposure to nephrotoxic drugs 51.4% ( $p < 0.001$ ), the majority consumed traditional medicine (33.8%), followed by the consumption of NSAIDs (29.2%) [9].

AKI was found more frequently in those with high blood pressure (62% vs. 38%), but no statistically significant association was identified. However, the relationship is established, as shown by Liu J. et al. in 2018, in China, hypertension and cardiovascular diseases were reported as very frequent pathologies in older adults and were associated with a higher risk of AKI compared to young people (44.2% vs 31.2%,  $p < 0.001$ ; 16.1% vs 4.6%,  $p < 0.001$ ) [16, 17].

Obstructive uropathy (OR 1.22; 95% CI: 0.55–2.69;  $p$  0.4314) was a rare cause of AKI. Tejera et al., in Uruguay 2017 reported statistical association in ICU patients ( $p= 0.001$ ) [10-11]. This may be due to the severity of patients in critical units, for this reason in our study there was no such association.

## Conclusions

The prevalence of AKI in older adults hospitalized in the emergency service was more than one third. Of these 4 of 10 older adults had AKI in stage 3, a quarter had stage 1, a third had stage 2. It was determined that 7 of 10 older adults have high blood pressure and consumption of nephrotoxic drugs and a third had diabetes mellitus and dehydration. A statistically significant relationship was found between AKI with: sepsis, dehydration and diabetes mellitus.

## Conflicts of interests

The authors declare no conflict of interest.

## Acknowledgements

We thank to all my partners and contributors.

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Carol Estefania Marquez Maldonado  
 Internal Medicine Department  
 Hospital Vicente Corral Moscoso  
 Cuenca, Ecuador  
[marquez07@hotmail.com](mailto:marquez07@hotmail.com)