

# Kidney Failure in the Emergency Department of the Teaching Hospital of Treichville: Incidence and Associated Factors with Mortality

Serge Didier Konan\*, Mahamat Djibrine Djibrine, Sery Patrick Diopoh, Astrid Affi Aka, Claude Kolo Ouattara, Marie Dominique Kouadio, Ophélie Gnamon, Kouamé Hubert Yao

Nephrology-Internal Medicine Department, Teaching Hospital of Treichville, Abidjan, Côte d'Ivoire  
Email: \*sergedidier.konan@gmail.com

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## Abstract

**Context:** Kidney disease is now recognized as a major public health issue with an increasing trend worldwide. **Objectives:** To determine the incidence and describe the profile of patients admitted for kidney injury in the emergency department. **Materials and Methods:** This was a prospective and analytical study conducted over six (6) months from March 2021 to August 2021 at the medical emergency department of the Teaching Hospital of Treichville in Abidjan (Cote-d'Ivoire). Sampling was exhaustive, and data were collected using pre-established forms, entered into Epi Data software, and analyzed using STATA SE version 16 and SPSS version 25. **Results:** Out of 2043 patients admitted to the emergency department during the study period, 285 cases of kidney injury were observed, representing a prevalence of 13.9%. Furthermore, 218 cases were newly discovered, corresponding to an incidence of 10.6%. The mean age was  $48.69 \pm 16.62$  years, with a sex ratio of 1.69 and a male predominance, accounting for 62.8% of patients. Comorbidities included hypertension in 54.1% of cases, followed by diabetes in 24.3%. The most commonly observed clinical signs were anemia syndrome in 61% of patients and pulmonary condensation syndrome in 49.5% of cases. Kidney injury was severe in 52.98% of cases. It was undetermined in 44.5% of cases, chronic kidney disease (CKD) in 34.4%, and acute kidney injury in 21.1% of patients. Hemodialysis was initiated in 54 out of 151 patients who had an indication for it. In total, 51 patients (23.4%) died. In multivariate analysis, altered consciousness was the main risk factor associated with mortality [(p < 0.001; OR (95% CI) = 3.59 (1.84 - 7.04)]. **Conclusion:** Kidney failure is common in the medical emergency department of the Teaching Hospital of Treichville and is associated with high mortality.

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## Keywords

Kidney Injury, Medical Emergencies, Mortality

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### 1. Introduction

Kidney disease is a major public health issue today. Up to 7% of hospitalized patients present with Acute Kidney Injury (AKI), with an increasing trend and potentially life-threatening consequences for patients [1].

In our work setting, the medical emergency department serves as the main entry point for patients into our facility. These patients are admitted under various clinical circumstances requiring nephrology consultation and specific management of their kidney condition.

The choice of our study is justified by the absence of previous studies in the medical emergency department of the Teaching Hospital of Treichville on the one hand, and the scarcity of studies in this context on the other.

### 2. Objectives

#### General Objective:

To contribute to better management of kidney disease patients in the medical emergency department of Treichville Teaching Hospital.

#### Specific Objectives:

- To determine the incidence of kidney injury in the medical emergency department;
- To describe the sociodemographic characteristics of the patients;
- To describe the clinical and paraclinical characteristics of incident cases of renal failure;
- To identify factors associated with mortality in incident cases of kidney disease.

### 3. Materials and Methods

This was a prospective and analytical study conducted over six (6) months from March 1, 2021, to August 31, 2021.

All patients presenting with elevated serum creatinine levels were included, regardless of gender or origin.

Data collection was performed using a standardized survey form, and the data were subsequently entered into the EpiData software.

The variables studied were:

- Epidemiological (age, gender, occupation);
- Anamnestic (history of edema, diabetes, high blood pressure, Chronic Kidney Disease [CKD], obesity, smoking, alcoholism, sedentary lifestyle);
- Clinical (reason for admission, blood pressure at admission, level of consciousness, lower limb edema, acute pulmonary edema, clinical anemia, pleuropulmonary

examination, neurological examination, other systems, and urinary dipstick test);

- Paraclinical (serum creatinine levels > 14 mg/L, plasma urea, eGFR, 24-hour proteinuria, complete blood count, blood electrolytes, calcium levels, blood glucose, renal ultrasound);
- Evolutionary (favorable clinical outcome, death, transfer, discharge against medical advice, and evolution of renal function).

Data analysis and processing were performed using STATA SE version 16 and SPSS version 25.

Qualitative variables were expressed as proportions, while quantitative variables were expressed as mean  $\pm$  standard deviation.

The Chi-square test and Fisher's exact test were used to assess the association between variables and the occurrence of death.

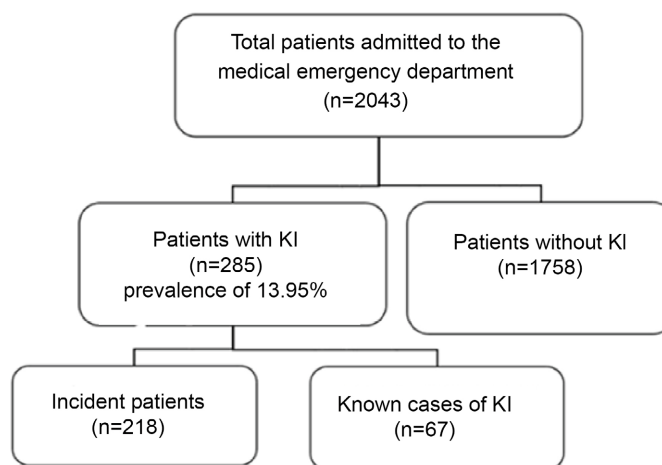
Statistical significance was set at a p-value less than 0.05.

Informed consent was obtained from each patient.

Anonymity was ensured during data processing.

## 4. Results

We identified 218 new cases of kidney injury among 2043 patients admitted during the study period, representing an incidence of 10.67% and a prevalence of 13.95%. (**Figure 1**)



**Figure 1.** Flowchart of patients admitted to the medical emergency department.

The majority of patients were male, with a male-to-female sex ratio of 1.69.

The mean age was  $48.69 \pm 16.62$  years, with extremes ranging from 17 to 85 years. The most affected age group was between 55 and 64 years (22.9%).

The main comorbidities were high blood pressure in 54.1% of cases, followed by diabetes in 24.3%.

Patients were primarily admitted for impaired kidney function (56.0%) and deterioration of general health (53.7%).

The most frequently observed clinical signs were anemia syndrome (61.0%) and pulmonary consolidation syndrome (49.5%).

Hyponatremia (61.9%) followed by hyperkalemia (48.2%) were the most commonly observed biological abnormalities.

Indeterminate-type of kidney disease was observed in 44.5% of cases, followed by Chronic Kidney Disease (CKD) in 34.4% of patients and Acute Kidney Injury (AKI) in 21.1% (**Table 1**). Indeterminate-type of kidney disease was the cases where we didn't have enough proof to say whether it was acute or chronic kidney failure.

**Table 1.** General characteristics of new cases of kidney injury.

Variables	Number (New cases of ki) n = 218)	Percentage
<b><i>Gender</i></b>		
Male	137	62.8%
Female	81	37.2%
<b><i>Age (years)</i></b>		
15 - 24	21	9.6%
25 - 34	30	13.8%
35 - 44	40	18.3%
45 - 54	35	16.1%
55 - 64	50	22.9%
≥ 65	42	19.3%
<b><i>Education level</i></b>		
Primary	27	12.4%
Secondary	48	22.0%
University	54	24.8%
Not educated	89	40.8%
<b><i>Marital status</i></b>		
Single	90	41.3%
Married	108	49.5%
Widowed	18	8.3%
Divorced	2	0.9%
<b><i>Profession</i></b>		
Merchants	44	20.2%
Farmers	18	8.2%
Pupils/Students	21	9.6%
Unemployed	11	5.1%
Housewives	34	15.6%
Drivers	17	7.9%
Firefighters	9	4.1%
Retired civil servants	26	11.9%

## Continued

<i>Comorbidities</i>		
High blood pressure	118	54.1%
Diabetes	53	24.3%
HIV	31	14.2%
Hepatitis B	3	1.4%
Tobacco use	21	9.6%
Alcohol use	36	16.5%
Heart disease	12	5.5%
Stroke	22	10%
Tuberculosis	14	6.8%
<i>Reasons for admission</i>		
Impaired kidney function	122	56.0%
Altered general condition	117	53.7%
Digestive disorders	110	50.4%
Altered consciousness	78	35.8%
Anemia	67	30.7%
Dyspnea	64	29.5%
Fever	50	22.9%
Edema	34	15.6%
High blood pressure	25	11.5%
Cough	11	5.0%
Gastro-intestinal bleeding	10	4.5%
Respiratory distress	8	3.7%
<i>Clinical signs</i>		
Hypertension	90	41.28%
Grade 3 Hypertension	63	28.9%
Anaemia syndrome	133	61.0%
Pulmonary condensation syndrome	108	49.5%
Lower limb edema	74	33.9%
Dyspnea	56	25.6%
Oliguria	51	23.3%
Fever	49	22.4%
Extracellular dehydration	41	18.8%
Acute pulmonary edema	34	15.5%
Anuria	23	10.5%
Motor deficit	23	10.5%
Jaundice	14	6.4%
Seizures	14	6.4%
Coma	80	36.69%

## Continued

<b><i>Blood urea levels</i></b>		
<0.5 g/L	10	4.6%
[0.5 - 1.99 g/L]	106	48.6%
>2 g/L	102	46.8%
<b><i>Hemoglobin levels</i></b>		
Hb < 8 g/dL	120	55%
Hb [8 - 12[ g/dL	77	35.3%
Hb ≥ 12 g/dL	21	9.6%
<b><i>Other biological abnormalities</i></b>		
Hyperkalemia	106	48.62%
Hyponatremia	135	61.92%
Hypercalcemia	24	11.00%
Hypocalcemia	71	32.56%
Thrombocytopenia	73	33.48%
Hyperglycemia	88	40.36%
<b><i>Types of renal failure</i></b>		
Acute Kidney Injury (AKI)	46	21.1%
Chronic Kidney Disease (CKD)	75	34.4%
Indeterminate kidney disease	97	44.5%
<b><i>Indications for hemodialysis</i></b>	151	69.26%
Hemodialyzed patients	54	24.77%
<b><i>Discharge outcomes from the emergency department</i></b>		
Favorable	4	1.8%
Transferred	158	72.4%
Discharged against medical advice	5	2.4%
Deaths	51	23.4%

A total of 54 patients underwent hemodialysis sessions, representing 35.76% of cases. Poorly tolerated uremia in 46 patients (85.1%), followed by acute pulmonary edema in 38 patients (70.3%) and hyperkalemia in 35 patients (64.8%), were the main indications for emergency dialysis (**Table 2**).

Mortality was observed in 23.4% of our patients.

Altered consciousness ( $p < 0.001$ ) and HIV ( $p = 0.03$ ) were the factors associated with mortality. (**Table 3**)

**Table 2.** Characteristics of 54 patients who underwent emergency hemodialysis.

<i>Dialysis Indications</i>	<b>Hemodialyzed Patients (n = 54)</b>	<b>Percentage</b>
Severe uremia	46	85.1%
Acute Pulmonary Edema (APE)	26	48.1%
Hyperkalemia	35	64.8%
Uremic encephalopathy	28	51.8%
Anuria lasting more than 24 hours	13	24.0%
Metabolic acidosis	2	3.7%

**Table 3.** Factors associated with mortality in Kidney Injury (KI).

<b>Factors</b>	<b>P-value</b>			
	<b>Total = 218</b>	<b>Deaths n = 51</b>	<b>Alive n = 167</b>	
<b>Age Groups</b>			<b>0.77</b>	
15- 24	21 (9.63%)	5 (9.8%)	16 (9.5%)	
25 - 34	30 (13.76%)	5 (9.8%)	25 (14.9%)	
35 - 44	40 (18.34%)	8 (15.6)	32 (19.1)	
45 - 54	35 (16.05%)	9 (17.6)	26 (15.5)	
55 - 64	50 (22.93%)	11 (21.5)	39 (23.3)	
≥65	42 (19.26%)	13 (25.4)	29 (17.3)	
<b>Gender</b>			<b>0.18</b>	
Male	137 (62.84%)	28 (54.9)	109 (65.2)	
Female	81 (37.15%)	23 (45.0)	58 (34.7)	
<b>Reasons for admission</b>				
High blood pressure	25 (11.46%)	3 (5.8)	22 (13.1)	0.15
Altered General Condition	117 (53.66%)	23 (45.0)	94 (56.2)	0.16
Altered Consciousness	78 (35.77%)	31 (60.7)	47 (28.1)	<b>&lt;0.001</b>
Digestive Disorders	110 (50.45%)	18 (31.3)	92 (44.3)	0.90
Dyspnea	64 (29.35%)	19 (37.2)	45 (26.9)	0.16
Cough	11 (5.04%)	5 (9.8)	6 (3.5)	0.07
Chest Pain	7 (3.21%)	1 (1.9)	6 (3.5)	0.56
<u>Gastrointestinal Bleeding</u>	10 (4.58%)	3 (1.9)	7 (1.7)	0.93
Fever	50 (22.93%)	12 (23.5)	38 (22.7)	0.90
Anaemia	67 (30.73%)	14 (27.4)	53 (31.7)	0.56
Respiratory Distress	8 (3.66%)	4 (7.8)	4 (2.39)	0.06
<b>Comorbidities</b>				
Hypertension	118 (54.12%)	27 (52.9)	91 (54.4)	0.84
Diabetes	53 (24.31%)	14 (27.4)	39 (23.3)	0.55
HIV	31 (14.22%)	12 (23.5)	19 (11.3)	0.03

## Continued

Hepatitis B	3 (1.37%)	1 (1.9)	2 (1.1)	0.68
Tobacco use	21 (9.63%)	5 (9.8)	16 (9.5)	0.96
Alcohol use	36 (16.51%)	8 (15.6)	28 (16.7)	0.85
Heart disease	12 (5.50%)	4 (7.8)	8 (4.7)	0.40
<b><i>Clinical signs</i></b>				
Extracellular Dehydration	41 (18.80%)	12 (23.5)	29 (17.3)	0.35
Oligo-anuria	59 (27.06%)	13 (25.4)	46 (27.4)	0.92
Motor Deficit		6 (11.7)	17 (10.1)	0.74
Coma	80 (36.69%)			
Anemia Syndrome	133 (61%)	31 (60.7)	102 (61.0)	0.97
Fever	50 (22.93%)	12 (23.5)	38 (22.7)	0.90
Pulmonary Condensation Syndrome	108 (49.54%)	26 (50.9)	82 (49.1)	0.87
<b><i>Hemoglobin Levels</i></b>			0.83	
Hb < 8	120 (55.04%)	27 (52.9)	93 (55.6)	
Hb [8 - 12[	77 (35.32%)	18 (35.2)	59 (35.3)	
Hb ≥ 12	21 (9.63%)	6 (11.7)	15 (8.9)	
<b><i>Other Biological Abnormalities</i></b>				
Hyperkalemia	106 (48.6%)	27 (52.9)	79 (47.3)	0.18
Hyponatremia	135 (61.92%)	32 (62.7)	103 (61.6)	0.34
Hypocalcemia	71 (32.56%)	15 (29.4)	56 (33.5)	0.15
Thrombocytopenia	73 (33.48%)	15 (29.4)	58 (34.7)	0.66
Hyperglycemia		23 (45.0)	65 (38.9)	0.79
<b><i>Type of Renal Failure</i></b>				
Acute Kidney Injury (AKI)	46 (21.10%)	18 (35.2)	28 (16.7)	0.85
Chronic Kidney Disease (CKD)	75 (34.40%)	16 (31.3)	59 (35.3)	0.60
Indeterminate kidney disease	97 (44.49% <sup>o</sup> )	17 (33.3)	80 (47.9)	0.067

Multivariate analysis using binary logistic regression showed that the presence of altered consciousness was significantly associated with death in kidney injury patients (Table 4). Patients with kidney injury who had altered consciousness were 3.5 times more likely to die than those without it.

**Table 4.** Multivariate analysis using binary logistic regression of factors associated with death related to Kidney Injury.

Variables	Adjusted OR	Confidence Interval = 95%		Adjusted P-value
		Lower	Upper	
Age				
<65 years	1.369	0.704	2.663	0.354

**Continued**

<b>High Blood Pressure</b>				
Hypertensive patients	0.921	0.471	1.802	0.809
<b>HIV</b>				
HIV positive	0.436	0.188	1.013	0.054
<b>Altered Consciousness</b>				
Coma	3.59	1.84	7.04	<b>&lt;0.001</b>
<b>Diabetes</b>				
Diabetic patients	0.894	0.416	1.921	0.774

**5. Discussion**

Out of 2043 patients admitted to the emergency department, we identified 218 new cases of kidney injury, representing an incidence of 10.67%.

This incidence is lower than that reported in France in 2016 in the REIN registry, which found 13.01% of new cases of Chronic Kidney Disease (CKD) [2].

In our study, impaired kidney function accounted for 56.0% of admission reasons, corresponding to 122 patients. Some patients were often referred to the emergency department after a plasma creatinine measurement.

This result is lower than that found by SAMAKE *et al.* in Mali in 2020, where hypercreatininemia was the reason for admission in 79.4% of cases [3].

In another earlier study conducted in Mali in 2005, AHMED found hypercreatininemia in 70% of admission cases [4].

Conversely, in Côte d'Ivoire, DIALLO D. A. *et al.* found high blood pressure as the primary reason for admission with a frequency of 40.83%, followed by general health deterioration at 12.23% [5].

In our series, as in the literature, high blood pressure was the leading comorbidity among patients with chronic renal failure. Hypertension and diabetes were the main comorbidities, with frequencies of 54.1% and 24.3%, respectively.

Hypertension and diabetes accounted for more than 50% of cases, as in most studies conducted in Sub-Saharan Africa and elsewhere [6], with respective rates of 45% and 25%.

This is due to behavioral changes in our population, where individuals adopt a Western-style diet that is poorly controlled (excess sugar, salt, polyunsaturated fats, etc.). There is also poor control and low adherence to treatment among this category of patients, who often disappear from follow-up or seek care from traditional healers.

Additionally, the literature reports that chronic poor glycemic control is the main determinant of renal damage, and good glycemic control delays its onset or progression [7].

Hypertension is considered a factor in the progression of kidney injury and the leading risk factor for chronic kidney disease in Sub-Saharan Africa [8].

In our study, cutaneous pallor associated with anemia syndrome was the most

frequently observed clinical sign, present in 133 patients (61.0%), followed by pulmonary consolidation syndrome with a frequency of 49.5%.

Our results are comparable to those of a study conducted in Senegal in 2020 by DIAWARA *et al.* on emergency hemodialysis, where clinical anemia was found in 63.6% of patients [9].

In a study conducted in Mali in 2014 by TOGO A., anemia was found in 87.3% of cases [10], and FONGORO *et al.* in 2018 found anemia in 95.1% of cases [11]. Our findings are significantly lower than those reported by DIOUF B. *et al.* in Senegal in 2019, where clinical anemia was observed in 95.34% of cases in the Thiès region [12].

In our study, blood urea levels between [0.5 g/L - 1.99 g/L] were observed in 48.6% of patients, while those with levels above 2 g/L represented 46.8%. The mean urea level was  $2.05 \pm 1.19$  g/L, with extremes ranging from 0.25 to 5.70 g/L.

Our results are comparable to those of a study conducted by DIAWARA *et al.* in Senegal in 2020, where the mean blood urea level was  $2.75 \pm 0.96$  g/L, and 35.5% of patients had azotemia greater than 3 g/L [9].

In our study, anemia was present in 55% of our patients, with hemoglobin levels below 8 g/dL. The mean hemoglobin level in our series was  $8.19 \pm 2.60$  g/dL (extremes: 3.2 g/dL and 15.5 g/dL).

Our results are similar to those reported by SAMAKE *et al.* in Mali in 2020, on the prevalence of kidney disease in the emergency department of Fousseyni DAOU Hospital in Kayes, where the mean hemoglobin level was  $9.39 \pm 2.95$  g/dl (extremes: 3 g/dL and 16.73 g/dL) [13].

Kidney disease was indeterminate in 97 patients, representing 44.5%, followed by chronic kidney disease in 75 patients (34.4%) and acute kidney injury in 46 patients (21.1%).

This large proportion of indeterminate kidney injury can be explained by the short hospital stay of some patients in the emergency department and the lack of financial resources among patients to perform additional tests that could help classify the condition as either acute or chronic kidney disease.

In contrast, in a study conducted by DIAWARA *et al.* in Senegal in 2020, CRF was the most common type of kidney injury, with a frequency of 69.15%, while acute kidney injury accounted for 30.85%.

Of the 218 new cases, 151 patients had indications for hemodialysis, representing 69.2%. Among these 151 patients, 54 underwent emergency hemodialysis, representing 35.76%.

Several reasons may explain the high number of patients who did not undergo hemodialysis, including:

- Financial barriers preventing access to dialysis catheters;
- Limited access to dialysis at the teaching hospital due to exceeded daily quotas or technical issues with dialysis generators, leading to referrals to private facilities outside the hospital;
- Patients often presenting with severe anemia requiring urgent blood transfusion

before dialysis, which could delay the initiation of dialysis.

Our results are lower than those reported by DIAWARA *et al.* in Senegal in 2020 (40.68%) and significantly lower than those reported in France in 2016 in the REIN registry, where 96% of new CKD cases received dialysis [2].

In our series, the main indications for emergency hemodialysis were poorly tolerated uremia in 46 patients (85.1%), followed by acute pulmonary edema in 38 patients (70.3%) and hyperkalemia in 35 patients (64.8%).

In contrast, in the studies by SANE and KOROMA, uremia accounted for 56.7% and 62.5%, respectively, while hyperkalemia accounted for 43.2% and 15.1%, respectively [14] [15].

These results differ from those in the literature, where hyperkalemia is often the main indication for dialysis [16]-[19].

In our regions, hyperuremia remains the most frequent indication for emergency hemodialysis. This could be explained by delayed patient consultations, with most presenting late with uremic manifestations, digestive complications, or even neurological symptoms, as well as limited access to dialysis due to a shortage of dialysis centers in certain areas or regions.

Of the 218 patients, 51 died, representing 23.4%, with a mean hospital stay in the emergency department of  $2.9 \pm 1$  days (range: 0 - 10 days).

In our series, univariate analysis showed no statistically significant correlation between mortality and sociodemographic characteristics.

However, the results showed a statistical link between admission reasons and mortality. Altered consciousness was statistically significant, with a p-value of 0.00.

In univariate analysis, HIV infection was the only comorbidity significantly associated with mortality, with a p-value of 0.03.

Multivariate analysis using binary logistic regression showed that the presence of altered consciousness was significantly associated with mortality in patients with kidney injury. Patients with altered consciousness had a 3.5 times higher risk of death than those without it. This finding is corroborated by a study conducted in an intensive care unit at the Teaching Hospital of Bordeaux (France), where patients treated for severe acute kidney injury in an intensive care unit had five times higher risk of death when they presented with altered consciousness [20].

The proportion of deaths in our context can be explained by the severe nature of the kidney injury at admission, with severely altered higher brain functions. Altered consciousness accounted for 35.8% of admission reasons. Coma was observed in 80% of patients, motor deficits and seizures in 16.9% of patients upon admission, and uremic encephalopathy was the indication for hemodialysis in 51.8%. A large percentage of patients were admitted with hyperuremic encephalopathy (altered consciousness and coma), and others with conditions such as sepsis. All those can explain the high cases of mortality.

Limited access to renal replacement therapy, difficulties in transferring patients to intensive care unit due to a lack of available beds for those with severe altered

consciousness, and other factors may also explain this proportion.

Better access to hemodialysis and to renal replacement therapy in general, could be a solution to lower the amount of deaths in our context of work.

## 6. Conclusions

Kidney injury is common in the medical emergency department of Treichville Teaching Hospital, with an incidence of 10.6%.

It predominantly affects young adults, with a male predominance. Hypertension and diabetes were the most represented comorbidities, accounting for 54.1% and 24.3%, respectively. Dialysis was indicated in 69.2% of patients, but only one-third (35.7%) underwent emergency hemodialysis. Mortality was observed in 23.4% of cases, corresponding to 51 patients. HIV infection and altered consciousness were the factors associated with mortality in univariate analysis. However, in multivariate analysis, only altered consciousness remained significantly associated with mortality, as determined by binary logistic regression of factors related to kidney injury deaths.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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