

Factors Associated with Mortality in Diabetic Patients with End-Stage Renal Failure Starting Emergency Hemodialysis

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Abstract

Background: Diabetic nephropathy is the leading cause of end-stage chronic kidney disease with poor prognosis in resource-limited settings. This study aimed to determine factors associated with mortality in patients starting dialysis treatment for end-stage chronic renal disease in an emergency context. **Patients and Methods:** This was a retrospective study from January 2020 to December 2022 at CHU-B. Data from 79 diabetic patients requiring emergency dialysis were compared with those of 79 non-diabetic patients with an end-stage renal disease requiring emergency dialysis. Data were collected from the Nephrology Department registry. We studied their initial clinical and biological profiles and factors related to mortality. **Results:** Out of 545 compiled records, 79 diabetic chronic kidney disease patients needing dialysis were included (group 1). A control group of 79 non-diabetic chronic kidney disease patients requiring emergency dialysis was also included (group 2). The average age of patients was 53.5 ± 17 years, and the duration of diabetes at dialysis initiation was 14.8 ± 4.3 years. Twenty-three percent were hypertensive. Fifty-two percent of patients experienced intra-dialytic hypotension. Death occurred in 22% of patients. Results show that age (adjusted OR 1.955; CI: 1.025 - 1.086; p-value: < 0.001) and intra-dialytic hypotension (adjusted OR 2.412; CI: 1.901 - 2.201; p-value: < 0.001) are independent and significant risk factors for mortality in diabetic patients admitted with end-stage renal disease requiring emergency dialysis. **Conclusion:** Emergency dialysis in diabetics is associated with unfavorable outcomes in terms of mortality. Despite

follow-up, renal involvement remains poorly explored, emphasizing the need for physician awareness.

Keywords

Diabetic Nephropathy, Emergency Dialysis, Republic of the Congo

1. Introduction

Diabetes is a chronic condition that can progress to predominantly vascular complications affecting the microcirculation of vital organs [1]. According to the latest estimations by the International Diabetes Federation (IDF), the total number of people with diabetes will increase from 537 million in 2022 to 643 million in 2035 [2]. Diabetic nephropathy (DN) is a microangiopathy occurring in approximately 30% of diabetic individuals according to studies [3]. In the United Kingdom, diabetic nephropathy (DN) affects between 20% and 50% of individuals with diabetes. It stands as the most prevalent factor leading to end-stage kidney disease (ESKD) in various populations, contributing to 28% of cases starting renal replacement therapy (RRT) [4], with corresponding figures of 44% in the United States and 38% in Australia [5]. A growing body of evidence suggests that diabetic nephropathy (DN) doesn't always follow a consistently worsening path. There's substantial diversity in how chronic kidney disease (CKD) progresses among individuals, and it's not unusual for albuminuria to improve or regress [6].

Its progression is silent, often detected late after 5 to 10 years of diabetes. Factors contributing to its onset and progression are genetic, environmental, clinical, and biological. Effective control of these factors could prevent its development and slow its progression [3].

Although most diabetic patients do not reach the stage of end-stage renal disease (ESRD), diabetes has become the leading cause of dialysis, with the incidence of ESRD due to DN doubling in the United States between 1991 and 2001 [7]. In France, approximately 1 in 5 patients undergoing dialysis for ESRD is a diabetic patient, equivalent to those requiring dialysis due to arterial hypertension (HTA) or vascular nephropathy [8]. Due to the potential progression to end-stage renal disease, DN remains a major complication of diabetes due to its prognosis. Currently, DN is the leading cause of ESRD [9] [10]. In the absence of renal replacement therapies, the prognosis for ESRD remains reserved, especially in under-equipped environments.

In Brazzaville (Republic of Congo), managing patients with end-stage renal disease poses a significant healthcare challenge due to the limited number of nephrologists, the absence of hemodialysis units in the only university hospital, and the high cost of dialysis in private facilities. Additionally, peritoneal dialysis and kidney transplantation are not yet available in Congo. In 2019, at the University Hospital of Brazzaville, the frequency of dialysis emergencies for all causes

was 34% [11]. This study aims to determine the factors associated with mortality in diabetic patients starting dialysis treatment for end-stage chronic renal disease in an emergency context.

2. Patients and Method

This was a retrospective study conducted in the nephrology department of the University Hospital of Brazzaville in the Republic of Congo. This department is the only one dedicated exclusively to specialized nephrology care in the capital city. From January 2020 to December 2022 (3 years), we studied patients admitted with end-stage chronic kidney disease initiated on emergency dialysis, having previously given informed consent.

An exhaustive sampling approach was used and determined based on the total number of patient records available in the Nephrology Department registry during the 3-year study period. The patients were divided into two groups for comparison: the first group consisted of diabetic patients admitted with end-stage renal disease (ESRD) requiring emergency dialysis, and the second group comprised non-diabetic patients also in ESRD requiring emergency dialysis.

Data were collected from the Nephrology Department registry. All complete and available records during the study period were included. Data collected included demographic information, clinical history, comorbidities, laboratory test results, dialysis details, complications, length of hospital stay, and patient outcomes. The primary outcome was mortality. The notion of emergency care is defined by the first dialysis session performed immediately after evaluation by a nephrologist due to refractory acute pulmonary edema, severe metabolic acidosis, threatening hyperkalemia, or major uremia. We studied their initial clinical and biological profiles, as well as their immediate evolution. Patients with incomplete medical records with missing data.

Univariate and multivariate analyses were used to identify factors associated with poor life prognosis via logistic regression. Data were analyzed using EPI Info software version 3.3.2 (CDC, Atlanta, USA). Categorical variables were presented as percentages (%), and continuous variables were expressed as median (interquartile range, IQR) or mean (\pm standard deviation, SD). Association measures were considered statistically significant when $p < 0.05$.

3. Results

3.1. Descriptive Study

Out of 545 compiled records, 79 diabetic chronic kidney disease patients needing dialysis were included (group 1). A control group of 79 non-diabetic chronic kidney disease patients needing dialysis was also included (group 2). The demographic characteristics of the two groups were comparable. The mean age of diabetic patients was 53.5 ± 4.2 years compared to 50.2 ± 12.4 years in non-diabetic patients, with a male-to-female ratio of 1.13. The duration of diabetes at dialysis initiation was 14.8 ± 4.3 years. Fifty-four of these patients (68.35%) were followed by a general practitioner or an endocrinologist. In 55.4%

(n = 44) of diabetic patients, chronic renal failure was discovered in the emergency department. The reasons for admission of diabetic patients were dyspnea in 24% (19/79), altered consciousness in 21% (n = 17/79), and digestive disorders in 15.2% (n = 12). Twenty-three percent (n = 18/79) were hypertensive. Intra-dialytic hypotension occurred more frequently in 51.8% (n = 41/79) of diabetic patients compared to only 12.6% (n = 10/79) of non-diabetic patients. Twelve diabetic patients (15%) developed an infection related to the hemodialysis catheter. The average duration of hospitalization in intensive care for diabetic patients was 12 ± 2 days. Death occurred in 21% (n = 17/79) of diabetic patients and 16.4% (n = 13/79) of non-diabetic patients. The comparative characteristics of the two groups are presented in **Table 1**.

3.2. Analytical Study

In the multivariate analysis (**Table 2**), age and intra-dialytic hypotension were identified as independent risk factors for mortality in diabetic patients admitted with ESRD requiring emergency dialysis. Each 1-year increase in age was associated with an adjusted odds ratio (OR) of 1.955 (95% CI 1.025 - 1.086, $p < 0.001$) for mortality. Intra-dialytic hypotension also significantly increased the risk of death with an adjusted OR of 2.412 (95% CI 1.901 - 2.201, $p < 0.001$). Other factors like male gender (crude OR 1.513), hypertension (crude OR 1.032), and duration of diabetes (crude OR 1.029 for a 1-year increase) were not independent risk factors in this study, although the duration of diabetes is significant in univariate analysis ($p = 0.004$). Altered consciousness (crude OR 2.141) shows a tendency to be associated with mortality but not significantly ($p = 0.091$).

Table 1. Baseline characteristics.

Demographic characteristic	Total (n = 158)	Group 1 (n = 79)	Group 2 (n = 79)
Age (mean \pm standard deviation)	51.85 \pm 8.3	53.5 \pm 4.2	50.2 \pm 12.4
Sex (Male/Female)	82/158	42/37	40/39
Average duration of diabetes (years)	15.65 \pm 7.5	15.2 \pm 7.3	16.1 \pm 7.8
BMI (kg/m ² , mean \pm standard deviation)	28.9 \pm 4.1	28.7 \pm 4.1	29.1 \pm 4.2
Comorbidity (n)	2.4 \pm 1.1	2.1 \pm 0.9	2.5 \pm 1.2
Hypertension (n, %)	39/158 (24.6%)	18/79 (23%)	21/79 (26.5%)
Smoking (n, %)	36/158 (22.7%)	20 (25.3%)	16 (20.2%)
Previous dialysis (n, %)	60 (37.9%)	32 (40.5%)	28 (42.4%)
Serum creatinine (umol/l)	818.4 \pm 176.4	809.6 \pm 184.8	827.2 \pm 176.0
Hemoglobin (g/dL)	11.45 \pm 1.85	11,5 \pm 1.8	11.4 \pm 1.9
HbA1c mean	8.75 \pm 2.1	8.7 \pm 2.0	8.8 \pm 2.1
Intra-dialytic hypotension (n, %)	51/158 (32.2%)	41/79 (51.8%)	10/79 (12.6%)
Death (n, %)	30/158 (18.9%)	17/79 (21%)	13/79 (16.4%)

Table 2. Risk factors for mortality.

Variables	Univariate analysis			Multivariate analysis		
	Crude OR	CI 95%	P	Adjusted OR	CI 95%	Adjusted p
Age	2.051	1.034 - 1.069	<0.001	1.955	1.025 - 1.086	<0.001
Male sex	1.513	1.092 - 2.096	0.013	0.907	0.497 - 1.655	0.751
Duration of diabetes (years)	1.029	1.009 - 1.049	0.004	1.013	0.986 - 1.061	0.222
Hypertension	1.032	0.814 - 1.026	<0.601	1.016	0.903 - 1.03	0.0717
Intra-dialytic hypotension	3.021	2.261 - 5.014	<0.001	2.412	1.901 - 2.201	<0.001
Altered consciousness	2.141	0.834 - 3.111	0.914	1.522	0.121 - 1.901	0.091

4. Discussion

4.1. Methodology Study

Diabetes represents a major public health issue due to the increasing vascular complications, especially diabetic nephropathy. This condition accounts for microangiopathy affecting approximately 40% - 50% of diabetic patients [12]. In a context where the number of people with diabetes is continuously rising, identifying risk factors associated with severe complications such as end-stage renal disease (ESRD) becomes crucial to improve management and prevention. The inclusion/exclusion criteria, data collection from the Nephrology Department registry, and the definition of emergency criteria were meticulously described to ensure the study's rigor. However, the study could benefit from a more in-depth analysis of comorbidities and the impact of these complications on the length of hospitalization and the long-term prognosis of patients.

4.2. Descriptive Study

The results of this descriptive study shed light on several aspects similar to previous studies. The average age of diabetic patients requiring emergency dialysis was 53.5 years, with an average diabetes duration of 14.8 years. This average age aligns with a retrospective monocentric Indian study comparing two groups of patients in ESRD requiring emergency dialysis, where group 1 (518 diabetic patients) and group 2 (379 non-diabetic patients) reported an average age of ESRD onset requiring emergency dialysis at 56 years [13]. The discovery of chronic renal failure in the emergency department was observed in 55.4% of diabetic patients, compared to 58.6% as reported by Sundqvist *et al.* [14] [15].

We report a frequency of intra-dialytic hypotension at 52%. This frequency is higher than that observed in the control group. These data are similar to those reported in the literature for non-diabetic ESRD patients estimated at 10% - 12% [16]. These results reflect the severity of these patients' medical conditions and

emphasize the importance of monitoring and managing these complications in clinical practice.

4.3. Analytical Study

The analysis of risk factors for mortality in diabetic patients admitted with ESRD and requiring emergency dialysis identified age and intra-dialytic hypotension as independent and significant risk factors for mortality. These results align with previous findings highlighting the impact of age on the progression of diabetes-related complications and renal insufficiency in these patients [13]. Shoji *et al.* identified intra-dialytic hypotension as a significant risk factor affecting mortality. The adjusted odds ratio for death was 0.79 (95% CI 0.64 to 0.98) when the lowest intra-dialytic systolic blood pressure was analyzed in 20 mmHg increments, and it was 0.82 (95% CI 0.67 to 0.98) when post-dialytic arterial hypotension was analyzed in 10 mmHg increments [17]. Additionally, intra-dialytic hypotension as a mortality risk factor in these patients reinforces the importance of strict monitoring and management of blood pressure during dialysis sessions.

Moreover, the lack of significance of certain factors such as hypertension or the duration of diabetes in multivariate analysis despite their relevance in univariate analysis might require further exploration to understand their potential role in the mortality of diabetic patients in a dialytic emergency situation.

This study had some limitations. The sample size was relatively small from a single center. We did not evaluate other potential confounding factors like nutritional status and prior nephrotoxic medication use that could impact clinical outcomes. The retrospective nature of the analysis also limited detailed data collection. Further large-scale prospective studies are needed to better understand risk factors for mortality in diabetic patients on emergency dialysis.

5. Conclusion

In conclusion, this study demonstrates that emergency dialysis in diabetic patients is associated with unfavorable outcomes in terms of mortality. This highlights the importance of promoting targeted prevention and management strategies for diabetic patients with end-stage renal disease requiring emergency dialysis, focusing on careful blood pressure monitoring and complication management while considering the impact of age on the mortality of these patients.

Conflicts of Interest

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

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