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Diabetic Ketoacidosis and Decompensating Factors in Ouagadougou (Burkina Faso)

Cetoacidose diabétique et facteurs de décompensation à Ouagadougou (Burkina Faso)

Bagbila Wend Pagnangdé Abraham Hermann^{2,4}, Sagna Yempabou^{2,4}, Drabo Robinson¹, Bognounou René¹, Zougrana Lassane^{1,3}, Guira Oumar^{1,3}, Ouedraogo Sampawindé Macaire^{1,3}, Drabo Youssoufou Joseph^{1,3}

ABSTRACT

Background. Ketoacidosis (DKA) is the most common acute hyperglycemic complication of diabetes mellitus. The aim of the study was to describe the epidemiological, clinical and evolutionary aspects of DKA in the internal medicine department of the Yalgado Ouédraogo University Hospital in Ouagadougou (Burkina Faso). **Materials and methods.** This was a cross-sectional descriptive study conducted in the internal medicine department of the CHU-YO over a period of 2 years. Included were all diabetic patients aged 15 years or older hospitalized for DKA. **Results.** A total of 75 patients were included in the study out of 1443 admissions such as a prevalence of 5.2%. The mean age was 54.9 years, and the sex ratio (male/female) was 1. The age group over 40 years was the most represented with 65.34% (n=49) of patients. Ketoacidosis initiated diabetes mellitus in 34.7% (n=26). Type 2 diabetes was predominant with 73.9% (n=55). At admission, the three main clinical signs were dehydration, ketonic breath and coma with 38.7% (n=29), 34.7% (n=26) and 25.3% (n=19) of patients respectively. The main decompensating factors were infections, diet deviations and treatment interruption with 77.3% (n=58), 42.7% (n=32) and 34.7% (n=26) of patients respectively. The average length of stay was 9 days (range: 2 to 20 days). Progression under treatment was marked by 6.7% of deaths. **Conclusion.** DKA remains a serious complication that can be life-threatening if not adequately managed.

RÉSUMÉ

Introduction. L'acidocétose diabétique (ACD) est la plus fréquente des complications hyperglycémiques aiguës du diabète sucré. Notre travail avait pour but de décrire les aspects épidémiologiques, cliniques et évolutifs de l'ACD dans le service de médecine interne du CHU Yalgado Ouédraogo de Ouagadougou (Burkina Faso). **Matériels et méthodes.** Il s'est agi d'une étude transversale à visée descriptive menée dans le service de médecine interne du CHU-YO, sur une période de 2 ans. Étaient inclus tous les patients diabétiques âgés de 15 ans ou plus hospitalisés pour ACD. **Résultats.** Au total, 75 patients ont été inclus dans l'étude sur les 1443 admissions soit une prévalence de 5,2%. L'âge moyen était de 54,9 ans, et le sex-ratio (hommes/femmes) de 1. La classe d'âge des plus de 40 ans était la plus représentée avec 65,34%(n=49) des patients. L'acidocétose inaugurait le diabète sucré chez 34,7% (n=26). Le diabète de type 2 était prédominant avec 73,9% (n=55). A l'admission, les trois principaux signes cliniques étaient la déshydratation, l'haleine cétonique et le coma avec respectivement 38,7% (n=29), 34,7% (n=26) et 25,3% (n=19) des patients. Les principaux facteurs de décompensations étaient les infections, les écarts de régimes et l'interruption thérapeutique avec respectivement 77,3% (n=58), 42,7% (n=32) et 34,7% (n=26) des patients. La durée moyenne du séjour était 9 jours (extrêmes : 2 à 20 jours). L'évolution sous traitement a été marqué par 6,7% de décès. **Conclusion.** L'ACD demeure une complication grave pouvant engager la prise en charge le pronostic vital si une prise en charge adéquate n'est pas menée.

¹ Internal Medicine Department, University Hospital of Ouagadougou, Burkina Faso.

² Internal Medicine Department, Souro-Sanou University Hospital Center Bobo-Dioulasso, Burkina Faso.

³ UFR/SDS, Joseph Ki-Zerbo University, Ouagadougou, Burkina Faso.

⁴ Higher Institute of Health Sciences, Bobo-Dioulasso, Burkina Faso.

Corresponding author:

Bagbila Wend Pagnangdé
Abraham Hermann: Assistant in
Endocrinology

Email:

bagbilaabraham@outlook.fr

Phone: +22678005736

Full mailing address : 01 BP 799
Bobo-Dioulasso (Burkina Faso)

Keywords: Ketoacidosis -
decompensating factors - diabetes
mellitus - Ouagadougou - Burkina
Faso.

Mots-clés : Acidocétose – facteurs de
décompensation – diabète sucré –
Ouagadougou – Burkina Faso.

INTRODUCTION

The International Diabetes Federation (IDF) 2019 report estimated a prevalence of 463 million people with diabetes worldwide. Among the types of diabetes mellitus, type 1 and type 2 diabetes largely dominate [1]. Diabetic ketoacidosis (DKA) is one of the most serious and dangerous acute hyperglycemic emergencies and is

sometimes life-threatening for diabetic patients [2]. In some cases, DKA may be a way of revealing previously undiagnosed diabetes, but it can often occur in people who already have diabetes for a variety of reasons, such as poor adherence to insulin therapy [3]. DKA is characterized by insulinopenia and severe hyperglycemia. It can occur in patients with type 1 and type 2 diabetes; however, DKA is more common in

young people with type 1 (T1D) diabetes [2], [4]. In many patients, CDA and hyperosmolarity may also coexist. The frequency of ketoacidosis varies by region. The frequency of ketoacidosis has increased by 30% in the last decade, with more than 140,000 hospital admissions annually in the United States [3]. In the United Kingdom, the gross annual incidence in people with type 1 diabetes is 3.6%, corresponding to 4.8 episodes per 100 patient-years [5], [6]. Most cases occur in people with type 1 diabetes, but in some areas up to 50% of cases may occur in people with type 2 diabetes, depending on ethnicity and family history [5].

In Africa, the lack of general data is compensated by hospital data [7]-[9]. CDA accounted for 30.7% of admissions to an endocrinology service in Côte d'Ivoire over a 9-year assessment [10]. In Dakar/Senegal, it accounted for 8.4% of admissions to an intensive care unit. In the Democratic Republic of Congo, Sendwe Hospital in Lubumbashi had a hospital prevalence of 5%. In Niger, ketoacidosis accounted for 7.1% of hospital admissions. In Burkina Faso, Yaméogo et al. [9] studied the biological aspects of CDA, and Bonkougou et al. [13] reported a hospital prevalence of 6.5% in an intensive care unit. However, in Burkina Faso, no study was conducted in a referral service for the management of diabetes mellitus. Our study is therefore more specific and takes place in an internal medicine department, a referral service for the management of diabetes mellitus in Ouagadougou, Burkina Faso.

MATERIALS AND METHODS

Type of study

This was a cross-sectional descriptive study of diabetic patients hospitalised in the internal medicine department of the CHUYO for diabetic ketoacidosis over a 2-year period from 1 January 2014 to 31 December 2015. Patient records were used as the data collection means.

Inclusion criteria

Included were any diabetic patient aged 15 years or older with a diagnosis of diabetes who had a fasting blood glucose ≥ 7 mmol/L on 2 occasions or cascade blood glucose ≥ 11 mmol/L and had presented the following items suggestive of diabetic ketoacidosis:

- hyperglycemia > 2.5 g/L (13.75mmol/L)
- A ketonuria $\geq ++$
- Plasma bicarbonates < 15 mmol/L.

Diabetic patients with non-diabetic ketoacidosis or hyperglycemic decompensation without ketosis were not included.

Variables

The variables reported were:

Socio-demographic characteristics: age, sex, place of residence, occupation.

- Clinical data: type of diabetes, age of diabetes, treatment of diabetes, adherence to treatment, clinical signs of ketoacidosis.
- paraclinical data: fasting blood glucose, glucosuria, ketonuria, kalaemia, natraemia, blood bicarbonates

- Decompensating factors (infection, diet deviation, therapeutic interruption, undetermined factor, inaugural episode)
- Evolving data: length of hospitalization, treatment of ketoacidosis, mode of discharge, occurrence of complications, discharge treatment.

Statistical analysis

Data are expressed in numbers, percentages and/or averages. A descriptive analysis of the data was conducted.

Ethical considerations

Data collection and processing was done in strict compliance with the patients' anonymity. Patient names have been replaced by order numbers.

RESULTS

Sociodemographic characteristics

Table I details the socio-demographic characteristics. There were a total of 1443 patients admitted to the Internal Medicine Department in two (02) years of study. During this study period, there were 75 diabetic patients hospitalized for DKA, i.e. a prevalence of 5.2% of hospitalizations. The mean age was 54.9 ± 5 years (extremes: 18-78 years). The age group over 40 years was the most represented with 65.34% (n=49) of patients. There were 32 males, giving a sex ratio (male/female) of 1.0. 62.67% (n=47) of the population in this study were in sedentary occupations and 76% (n=) were predominantly urban residents.

Table 1: Distribution of patients by sociodemographic characteristics

	Number	%
KDA	75	5,2
Mean Age (years)	54,9	
Age	15-39	26 34,7
	40-59	27 36,0
	More than 60 years	22 29,3
Sex	M	37 49,3
	F	38 50,7
Résidence	Urban	57 76,0
	Rural	18 24,0
Occupation	Sédentary	47 62,7
	Active	28 37,3

Clinical characteristics

The various clinical characteristics of the patients are detailed in Table II. Ketoacidosis initiated diabetes mellitus in 34.7% (n=26). Type 2 diabetes was predominant with 73.9% (n=55). Diabetes has been known for at least 5 years in 45.33% (n=34) of patients. Oral antidiabetic treatment was predominant with biguanides in 57.1% (n=) and hypoglycemic sulfonamides in 22.1% (n=17) of subjects. Adherence to treatment was noted in 69% (n=34) of patients. At admission, the three main clinical signs were dehydration, ketonic breath and coma with 38.7% (n=29), 34.7% (n=26) and 25.3% (n=19) of patients respectively.

Table 2 : Distribution of DKA Patients by Clinical Characteristics

		Number	%
Diabetes type	Type I	20	26,7
	Type II	55	73,3%
	Inaugural	26	34,7
Duration of diabetes progression	Less than 1 an	5	6,7
	1-10 years	24	32,0
	Sup à 10 years	20	26,7
Treatment	Biguanides	44	58,7
	Hypoglycemic sulfonamide	17	22,7
	Insulin therapy	16	21,3
Treatment compliance	Yes	34	45,3
	No	15	20,0
	Coma	19	25,3
Clinical signs	State of shock	8	10,7
	Agitation	10	13,3
	Deshydratation	29	38,7
	Kusmaul Dyspnea	8	10,7
	Ketone breath	26	34,7

Paraclinical characteristics

The paraclinical characteristics are detailed in Table III. Mean fasting venous blood glucose on admission was 27.29 mmol/L (extremes: 14.5 mmol/L and 75.3 mmol/L). All blood glucose levels were above 13.75 mmol/L (2.5g/L). Moderate renal impairment with a clearance of less than 60 ml/min according to Cocroft and Gault was noted in 36% of patients (n=27). Patients had the following fluid and electrolyte disorders:

Hyperkalemia was present in 15.1% (n=11) and hypokalemia in 11.0% (n=8) of patients. All patients had plasma bicarbonates below 15 mmol/l. Bicarbonates were 5 mmol/l in 21.3% (n=16) of patients.

Etiological and evolutionary data

The main decompensation factors were infections, diet deviations and treatment interruption with 77.3% (n=58), 42.7% (n=32) and 34.7% (n=26) of patients respectively. Table III divides the patients according to the decompensation factors. The average length of stay was 9 days (range: 2 to 20 days). Progression under treatment was marked by 6.7% of deaths. Hypoglycemia and organic renal failure were the main complications observed during hospitalization with respectively 24.0% (n=18), 5.3% (n=4) of patients. This was followed by urinary tract infection, transtibial amputation and heart rhythm disorder with a proportion of 1.3% (n=1) each. Of the 70 patients discharged from hospital, 45 patients were on oral antidiabetes drugs and 25 on insulin.

Table 3 : Distribution of patients according to decompensation factors

Decompensation factors	Number	%	
Infections	58	77,3	
Dietary deviation	32	42,7	
Inaugural episode	26	34,7	
Therapeutic Interruption	Insulin stop	6	8,0
	ADO stop	4	5,3
Undetermined	02	2,7	

DISCUSSION

Data from our study cannot be extrapolated to the general population. However, our study offers a unique opportunity to study DKA in a diabetes mellitus management referral service.

Our study showed that patients hospitalized for DKA had a mean age of 54.9 years, a sex ratio of 1, a sedentary occupation in 62.7% (n=47) and were predominantly urban residents in 76% (n=) of cases. DKA initiated diabetes in 34.7% (n=26) of cases. Hospitalized patients were predominantly dehydrated or comatose in 38.7% (n=29) and 25.3% (n=19) of cases, respectively. The main factors of decompensation were infection, diet deviation and therapeutic interruption with respectively 77.3% (n=58), 42.7% (n=32) and 34.7% (n=26) of the cases.

The prevalence in the continental and general literature is variable, being in line [2], [12] or higher than the prevalence in our study [7], [11]. CDA remains a frequent metabolic complication in diabetic subjects, with prevalence rates as high as 30.7% in the Ivorian series [10] and 48.9% in the Congolese series [12].

The data in the literature regarding age and sex also vary from one study to another. The average age varied from 40 to 55 years depending on the study [3], [6], [7], [11]-[14]. Note study reported a slight male predominance. Some authors reported a clear male predominance[8], [12], [13], [15], [16] while others reported a female predominance[11], [14].

Age and gender were not reported to be predisposing factors for CDA [13], [17]. All studies are unanimous on the predominant age group of over 40 years old [4], [7], [12], [14], [15].

Dehydration, dehydration, ketonic breath, and altered state of consciousness were the three main clinical signs observed at the admission of patients in our study. These signs are also reported in the different studies in different proportions depending on the authors. Bonkougou reported comatose state, dyspnea and shock respectively in 64.1%, 12.8% and 97.4% of patients. Wade[11] reported dehydration and hypotension in 51% and 20% of patients, respectively; Kakoma[12] in an inpatient department reported dyspnea, dehydration, and coma in 80.4%, 76.5%, and 58.8% of patients, respectively. This difference would be due to the specificity and mode of admission of patients in the different services; the resuscitation services admitting patients with severe forms. The high frequency of clinical signs would be due to a delay in consulting patients. In Africa, patients would only be consulted at the consultation stage. In developed countries such as France, early diagnosis leads to a reduction in serious clinical signs on admission[18]. Infection was the primary decompensating factor in our study. This was followed by diet deviations and therapeutic interruption. All the studies are unanimous on these decompensating factors[3]-[5], [7], [11]-[15], [19], [20]. However, some authors reported a small proportion of factors such as myocardial infarction[14] and corticosteroid therapy[15].

The lethality in our study is higher than that admitted in the literature, which is less than 5%[13], [13], [17].

African authors also reported a high lethality. Lokrou[15] reported a lethality of 5.1%, Kakoma[12] reported a higher lethality with a lethality of 27.5%, Ndebele reported a lethality of 16.5%, Mahamane[7] and Wade[11] reported a lethality of 4%. These different proportions may be due to the experience of the centers, the age of the patients and the presence of comorbidities. These epidemiological data reflect those of developed countries, as a higher lethality of ketoacidosis is reported in the different series. Africa is defined by low health coverage and insufficient technical facilities for efficient management of the various pathologies. This accounts for the complications observed during hospitalization. This study raises several questions? are there other risk factors for the occurrence of DKA? How can management be optimized to reduce morbidity/mortality related to DKA? Further studies are needed to answer these questions.

CONCLUSION

DKA is the most frequent acute metabolic complication of diabetes mellitus with high morbidity and mortality in our regions due to the low health coverage and insufficient technical facilities. Infection was the most frequently encountered decompensating factor, hence the awareness of diabetic patients of the need for early consultation at the first signs of infection.

CONFLICTS OF INTEREST:

The authors do not declare conflicts of interest.

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