Acta Scientific MEDICAL SCIENCES (ISSN: 2582-0931)

Volume 5 Issue 8 August 2021

Research Article

Diabetic Acidoketosis in the Democratic Republic of Congo: Clinical Epidemic Approach (79 Colliged Cases)

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Received: June 07, 2021

Published: July 08, 2021

Abstract

Introduction: Diabetes is a major cause of morbidity and mortality. It is therefore a costly disease for the patient, families and society. The goal is to study the epidemiological and clinical aspects, to report the factors causing decompensation and the evolutionary modalities with a view to improving care in Mbujimayi (DRC).

Materials and Methods : This study was prospective in nature, lasting from January 01, 2020 to December 31, 2020. It was carried out at the Dipumba General Referral Hospital. Covering 310 diabetic patients, 79 of whom had developed ketoacidosis either a frequency of 25.5% in whom the basic sociodemographic and epidemiological variables were studied. The data collected was encoded on an Excel software table (Microsoft 2007) then imported for processing on Epi Info software version 6.0 and the test processing was done on professional Word XP software, the test used is Kh2 with $P < 0.05$.

Results: The frequency of diabetic ketoacidosis was 25.5% of cases in the Internal Medicine department. For all of our patients, ketoacidosis is predominant in people under 40 years of age. Ketoacidosis occurs in any diabetic patient, the average age of our patients was 42.3 Plus or minus 3.6 years with the target age range between 56-70 years, the male sex was more concerned with 54, 4% against 45, 6% for the female sex, the clinic of which can be superimposed on that described by the literature. Infections ranked first as a trigger in our study with 64.6% and followed by discontinuation of treatment 13.9%. The course is marked by a mortality of 25 cases or 31.64%.

Conclusion: Ketoacidosis remains a therapeutic emergency that requires careful management, especially in the acute phase. The infections revealed ketoacidosis in the majority of our patients.

Keywords: Ketoacidosis; Diabetes ; Mortality

Introduction

Diabetes is a major cause of morbidity and mortality. It is therefore a costly disease for the patient, families and society. Much of this morbidity can be prevented with good glycemic and blood pressure control, and regular check-ups for complications and early intervention [4]. Its course is punctuated by complications, among which, ketoacidosis is still frequent with worrying mortality [9]. Diabetic ketoacidosis results from partial or complete insulin deficiency, combined with an increase in the counterregulating hormones, catecholamines, glucagon, cortisol and growth hormone [19].

Globally, the incidence of DKA is estimated to be 4.6 to eight episodes per 1,000 diabetic patients. This complication accounts for about 4 to 9% of the causes of hospitalizations for diabetes. The mortality rate is on average less than 5% with extremes ranging from 0 to more than 15%. These differences are mainly explained by the experience of the centers, the age of the patients and the presence of comorbidities [13].

In the Democratic Republic of Congo, a study conducted in 2014 at Sendwe Hospital in Lubumbashi, revealed a hospital prevalence of diabetic ketoacidosis of 5% and a mortality rate of 27.5%, higher than those reported by others authors [6]. And another carried out in 2002 at the general referral hospital in Kinshasa which reported a prevalence of 29.2% [7].

Aim of the Study

In this context, the aim of this study is to study the epidemiological and clinical aspects of our patients, to report the factors at the origin of ketoacidosis decompensation and the evolving modalities with a view to improving the care of diabetic patients in our environment and provide analytical data for further research.

Materials and Methods

Nature and study framework

This is a prospective study carried out over a period from January 1, 2020 to December 31, 2020. Covering 79 patients admitted for diabetes with ketoacidosis decompensation in the internal medicine emergency department of the General Reference Hospital Dipumba in Kasai Orientale in the town of Mbujimayi, in the Democratic Republic of Congo.

Inclusion and exclusion criteria

All patients with diabetes complicated by ketoacidosis were included in this study. All diabetic ambulatory patients or having had another type of coma were excluded.

Sample size

The sample size was calculated by the following formula: $n = \frac{Z^2 xP(1-P)}{d^2}$

For a minimum expected sample of n+.$\frac{n}{10}$

With:

n = The minimum sample size

z = The confidence coefficient at the 95% threshold (1.96);

p = Prevalence of the pathology studied;

1-p = Complement of the prevalence;

d = Degree of precision (0.05)

So n= $\frac{(1.96)^2 x0.05(1-0.05)}{(0.05)^2} = \frac{(3,8)\ x0.05(1-0.05)}{0,0025} = 72.2\ cases$

In the present study, the main event studied is complications of type 1 diabetes. The sample size was calculated from the prevalence of ketoacidosis estimated at 5% reported by Kambola P., *et al*. [6] in Lubumbashi, a city in the Democratic Republic of Congo. Therefore, the probability of the adopted event of interest is 0.05. Taking into account 10% due to study bias and other types of error, our minimum sample size should be presentative. Or an expected minimum sample greater than or equal to 79 cases.

Study parameters

The diagnosis of diabetic ketoacidosis was made by dyspnea of acidosis or dyspnea of Kusmaul, hyperglycemia greater than 300 mg/dl, the presence of glucosuria and ketonuria. The typing of diabetes, in the absence of immunology and of the C-peptide assay, was presumptive based on clinical and evolutionary arguments (patient's age, his morphotype, time to onset of symptoms, family history and progress under treatment).

For each patient, we studied the following:

- Epidemiological factors (age, sex);
- Clinical manifestations on admission. Glasgow was used to classify coma as stage 1 (vigil coma), stage 2 (mild coma), stage 3 (coma carus), stage 4 (coma passed);
- Factors of ketoacidosis decompensations: After the questioning in search of a dietary error or a therapeutic interrup-

tion of the antidiabetic drugs, the complete clinical examination and the paraclinical had made it possible to search for symptomatic or non-symptomatic foci of infection, cardiovascular decompensation.

The paraclinical assessment was systematic in all patients: The blood glucose assay was performed, thus giving a high result in all our patients and in the context of an etiological search for triggering factors, thick gout (GE), examinations urine cytobacteriological (ECBU), urine sediment, Widal and Felix, blood culture and other impact assessments (urea, creatinine, chest x-ray, cardiac ultrasound, electrocardiogram, fundus) were systematically requested as appropriate.

The evolving modalities under treatment were carried out for 24 to 48 hours with hourly monitoring of all constants, blood sugar levels, ketonuria, changes in the state of consciousness and clinical signs.

Data analysis and processing

The data collected was encoded on an Excel software table (Microsoft 2007) then imported for processing on the Epi Info software version 6.0. Word processing was done on Professional Word XP Software. The results of the study are presented in the form of tables and graphs, including the observed numbers, proportions and means. In addition, the comparison of the proportions was made by means of Pearson's Chi^2 test or Yates corrected with $p < 0.05$.

Ethical consideration

Free and informed verbal consent from patients was obtained prior to their inclusion in the study. Also, good medical practices (social, clinical and laboratory) were respected. The information given by each patient was completely confidential and could not be disclosed. They were only used for research purposes.

Results

Socio-epidemiological data

During our study period, out of a total of 2224 patients hospitalized in the internal medicine department, of which 310 patients were admitted for diabetes mellitus, ie a prevalence of 13.5%. Among them 79 cases, or 25.5% for decompensation of diabetes according to the ketoacidosis mode (Figure 1). The majority of cases consulted after 96 hours with 38 cases, that is to say 48.1% following the decompensation of diabetes with a delay of 60.2 hours; a standard deviation of 10.1 hours (extreme of 18 hours and 172 hours) between the first clinical manifestations and the consultation (Graph 1).

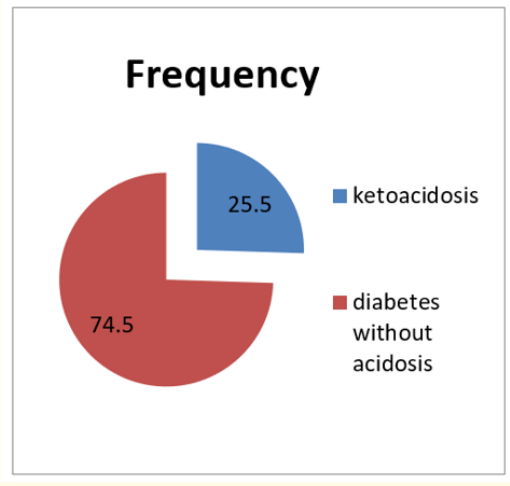
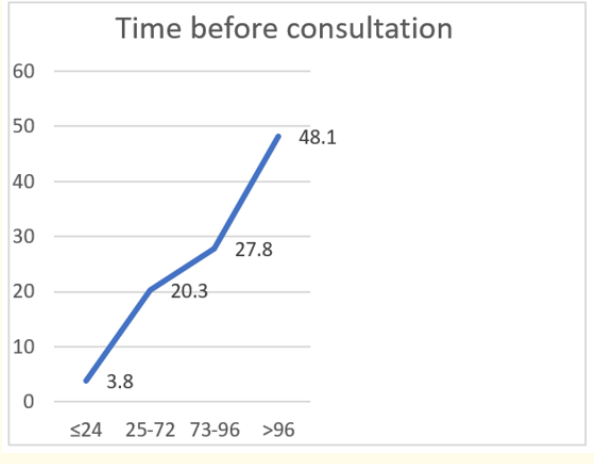


Figure 1: Prevalence of ketoacidosis.



Graph 1: Time between onset of decompensation and consultation.

The average age of our patients was 42.3 plus or minus 3.6 years. Ketoacidosis is predominant in patients under 40 years of age with 56.9% and decreased with age. The male sex was the most predominant (54.4%) with a sex ratio of 1.2. The difference is not significant (X^2_{cal}11,99<X^2_{tab} 12,6) ddl = 5α = 0, 05 (Table 1).

Age (years)	Sex		Total
	Male	Feminine	
	N (%)	N (%)	N (%)
< 25	6 (7,6)	4 (5,1)	10 (12,6)
25-40	21 (26,6)	14 (17,7)	35 (44,3)
41-55	6 (7,6)	7 (8,9)	13 (16,5)
56-70	6 (7,6)	6 (7,6)	12 (15,2)
>70	4 (5,1)	5 (6,3)	9 (11,4))
Total	43 (54,4)	36 (45,6)	79 (100,0)

Table 1: Age and sex association.

Clinical, para-clinical, and evolutionary data

The most common clinical manifestations seen in our patients were polyuria, fruity breath, physical asthenia and unconsciousness in the order of 62%, respectively; 54.4%; 51.9%; 49.4% and other clinical signs such as dehydration, weight loss, fever, digestive disorder, diarrhea, koussmaul breathing, oliguria were present in 28%, 27%, 24%, respectively, 24%, 17%, 17%, and 4% of cases (Table 2). Infections were the main factor triggering diabetic ketoacidosis-mode decompensation with 64.6%, followed by discontinuation or non-adherence to treatment with 13.9%; The risk was statistically significant for these two factors (risk multiplied by 2.5 and 4.5 respectively) ($p < 0.05$). High blood pressure, vascular accident and stroke and other factors namely ignorance of the disease, taking decoction and alcohol represented respectively 10.1%, 7.6%, 3.8% have also contributed to the glycemic imbalance until the occurrence of diabetic ketoacidosis.

Infections being the main factor triggering diabetic decompensation, ketoacidosis mode, are divided into infectious foci or type of infection. Of the 51 recorded cases of infection as triggering factors, 60.8% of cases presented with malaria infection, followed by 15.7% patients with respiratory infection; urogenital infection was found in 11.8% of cases and digestive and skin infections presented 7.8% and 3.9% of cases, respectively (Graph 2).

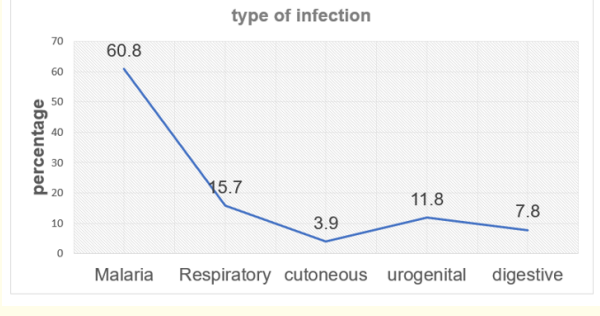
Discussion

Diabetic ketoacidosis is a metabolic imbalance resulting from the combination of insulin deficiency (relative or absolute) and an increase in the counter-regulatory hormones represented by glucagon, catecholamines, growth hormone and cortisol. It is one of the most serious and worrisome acute complications in terms of its frequency and mortality. The objective of the present study was to gain an overview of diabetic ketoacidosis, in order to be able to improve its management. The prevalence of diabetic ketoacidosis in our study was not too far from other African series [9]. This prevalence is much lower in European countries between 0.3% to 1.3%

Parameter	N = 79	%
Clinical		
Fruity breath	43	54,4
Polyuria	49	62,0
Physical asthenia	41	51,9
Unconsciousness	41	51,9
Dehydratation	28	35,4
Weight loss	27	34,2
Fever	24	30,4
Digestive disorder	24	30,4
Diarrhea	17	21,5
Kussmaul breathing	17	21,5
Oliguria	4	5,0
Triggering factor		
Infection	51	64,6
Discontinuation of treatment	11	13,9
High blood pressure	8	10,1
Stroke	6	7,6
Other	3	3,8

Table 2: Distribution of cases by clinic and triggering factor.

***Other**: Decoction, taking hyperglycemic medication (corticosteroid and non-compliance with a healthy diet.



Graph 2

[2]. This difference could be explained by the much lower level of screening in our countries.

In our series; out of a total of 2224 patients hospitalized during this study period, 310 patients were admitted for diabetes mellitus, ie a prevalence of 13.5% among them 79 patients had presented a diabetic decompensation complicated by ketoacidosis, ie 25.5%; this represents a hospital prevalence of 3.6%. Some comparable prevalence's are reported by Djorolo F., *et al*. in Benin [3], Otmane DK in Morocco [14] respectively 5.9%, 6.6% and Placide KK., *et al*. in the Democratic Republic of Congo which finds 5% [6] also in comparison with our results. The frequency of diabetic ketoacidosis in our series is higher than that of Pichard E., *et al*. which found 15.15% at the G-spot hospital [15]. Data from the literature suggest that ketoacidosis is the most common of the acute metabolic complications of diabetes and constitutes grounds for consulting patients with diabetes.

According to our data, the male sex was found to be predominant in ketoacidosis (54.4%) with a sex ratio of 1.2. This result is similar to that of Monabeka HG., *et al*. [11] who found 56% of men in one of the three different studies carried out in Congo. The influence of gender depended on the study period, the population with the type of diabetes mellitus, the quality of treatment and the attention of the diabetic to himself.

The age of onset would be around forty in black populations, such is the observation made by Pouye A., *et al*. in 2003 [16]. This corroborates at our ages in this study, whereas in Western countries it would occur a little earlier around the age of 30. This confirms that this is a condition that is more common in type 1 diabetes mellitus and therefore insulin-dependent, which mainly affects children and young adults [8]. In our series, 40-year-olds predominate with 56.9%. This frequency decreased with age; the average age was 43.3 minus 3.6 years. This age is closer to that found in the series by Monabeka HG., *et al*. and that of Guindo Is., *et al*. which finds 46.8% between 41 and 60 years [5]. These results confirm that of the literature according to which 50% of adults with diabetes are between 40 and 59 years old. Over 80% of people with diabetes fall into this age group.

In view of our data, the clinical profile remains classic, dominated by polyuria, fruity breath, physical asthenia, unconsciousness and subsequently dehydration secondary to hyperglycemia and osmotic diuresis. 2/3 of our patients presented polyuria, i.e. 62.0%, a value much higher than that reported by Placide KK., *et al*. with 11.8% [6], but lower than that of Sarr A., *et al*. [18] which found 100% in a study of ketoacidosis in type 1 diabetic subjects in 73 cases collected in Dakar. This same series reports 65.75% of cases of dehydrated patients, comparable to those of Placide KK., *et al*. which reports 76.5% of cases. Our study only presented half of the latter with 35.4 cases. Kussmaul dyspnea, a characteristic clinical sign, was present in our series in 66.5% of cases, a result that can be superimposed on that of Sow [20] in Dakar who recorded 59% of cases. Our results are nevertheless lower than that of the literature which says that it can be present in 90 to 100% of patients [17]. This is explained by the clinical picture of the patients: they had probably mild ketoacidosis. The value of unconsciousness, ie 49.4% of our patients, agrees with what was already reported by Monabeka HG., *et al*. [11] in Congo among children and adolescents. We believe that patients who consult at HRH Dipumba are generally referred from another hospital health structure, usually small centers on the outskirts of the city where adequate care is not always guaranteed. We can also talk about late consultation; the patient being brought to the hospital only after unsuccessful home care measures because, in Africa, the majority of people with diabetes only present to the health center when complications have already manifested themselves [6]. Awareness-raising and educational information work should be carried out with health professionals from the various health structures and the general population for a rapid transfer and consultation within the normal timeframe in an appropriate health institution to hope for a reduction, as in some countries. developed the incidence of diabetic ketoacidosis.

The search for a diabetic decompensation factor, ketoacidosis mode is essential, and should be systematic in any case of diabetic ketoacidosis. The triggers for diabetic ketoacidosis are the same everywhere. As observed in our series, infections are the main trigger of ketoacidosis, at 64.6%. Newton., *et al*. [12] found the same infectious predominance with 90.3% of his sample, unlike Western data where the therapeutic interruption represented in our series with 13.9% of cases behind the infection, constitutes the main factor triggering ketoacidosis diabetic. Yan H., *et al*. [21] also endorses these results in his series. Boutabia WA [1] in Algeria in a 2008 study found this predominance at around 51.7%. Lokrou A and cool. As for them, report the same predominance [19]. Moreover, the discontinuation of treatment in our series is in agreement with those of Pouye., *et al*. [16] which finds 16% of cases in Senegal. Monabeka HG., *et al*. [11] in their series reported more discontinu-

ation of treatment than infectious factors, respectively 37% and 22% of cases. These results are linked to socio-economic difficulties and patient denial. Insulin deficiency, in this context, is secondary to the more or less voluntary discontinuation of treatment by the patient. The infections remain the same with a distribution variously reported in the literature. Our study reveals that malaria predominates with 60.8% of cases. Any diabetic ketoacidosis in a context of fever, even in the presence of an obvious infectious focus, should systematically seek malaria in endemic areas. Placde KK., *et al*. in their series, find the opposite, a predominance of urogenital and bronchopulmonary infections, respectively 30.8% and 23.1%.

Conclusion

Ketoacidosis remains a therapeutic emergency that requires rigorous management, especially in the acute phase, while respecting the therapeutic particularities of each patient and ensuring the etiologies are detected. For all of our patients, ketoacidosis predominates in those under 40 years of age with a frequency of 56.9%. The average age of our patients was 42.3 plus or minus 3.6 years; the male sex was predominant with 54.4%.

The etiological research of ketoacidosis decompensation has precisely enabled us to identify it as the main triggering factor; infections revealed ketoacidosis in the majority of our patients with 64.6%, followed by discontinuation or poor adherence to therapy. Data from the literature suggest that ketoacidosis is the most frequent of the acute metabolic complications of diabetes and constitutes grounds for consultation with diabetic patients; our study is in line with this observation. The course was marked by a mortality of 25 cases, or 31.64%.

Authors' Contribution

Bambi N is responsible for the study design, collected the data, analyzed and interpreted the data, and wrote the draft. Mulamba N, Mbaya M, Miandabu M, Kalenda K, Mbuyi K and Ciceron M participated in study design, data supervision, data collection and analysis.

Conflict of Interest

The authors declare no conflict of interest.

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