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TIME FOR DIABETIC KETONURIA NEGATIVATION IN NIAMEY NATIONAL HOSPITAL'S MEDICAL EMERGENCY DEPARTMENT

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Abstract

Context and Purpose: Ketosis is an acute complication and a way of revealing potentially fatal diabetes. The lack of data on the average negativation time in Niger and the evaluation of the performance of the treatment protocol motivated the conduct of this study.

Methods: This is a prospective, analytical and longitudinal study lasting eleven (11) months from September 2019 to August 2020 in the medical emergencies of the National Hospital's of Niamey. Included were all consenting patients at least 15 years of age with at least two-cross ketonuria.

Results: A total of 90 subjects were included. The sex ratio was 0.63. The mean age was 40.03±12.76 years. Only 14.4% of patients were admitted within 24 hours of onset of signs. More than half (58.9%) of the subjects had an average socioeconomic level. Ketosis was the revelation of diabetes in 53.3% of patients. The mean ketonuria on admission was 2.83±0.76 cross. The mean capillary blood glucose at admission was 3.99±1.2 g/L and 2.35±0.86 g/L at negation. Admission venous blood glucose was 23.84±8.54 mmol/L. The triggering factor was identified in 78.9% of cases. The mean amount of insulin administered up to negation was 198.94±183.86 IU and 7,67±8,5 liters for the mean amount of solute. The protocol was interrupted in its execution to 76.7% of the subjects with a responsibility of the doctor involved in 71% of the cases of rupture. The mean time to negativation was 29.13±21.72 hours. The outcome was considered favourable to 87.8% of cases.

Conclusion: The study reported a delay in negativation beyond 24 hours and interruptions in the execution of the protocol to a large majority of subjects.

Keywords: diabetic ketosis, delay, negativation, Niger.

Résumé

Contexte et objectif : La cétose est une complication aigue et un mode de révélation du diabète potentiellement mortel. L'absence de données sur le délai moyen de négativation au Niger et l'évaluation de l'exécution du protocole de prise en charge a motivé la conduite de cette étude.

Méthodes : Il s'agit d'une étude prospective, analytique et longitudinale d'une durée de onze (11) mois allant de septembre 2019 à août 2020 aux urgences médicales de l'Hôpital National de Niamey. Avait été inclus tous les patients d'au moins 15 ans consentant ayant au moins une cétonurie à deux croix.

Résultats : Au total 90 sujets avaient été inclus. Le sex-ratio était de 0,63. L'âge moyen était de 40,03±12,76 ans. Seulement 14,4% des patients avaient été admis moins de 24 heures après le début des signes. Plus de la moitié (58,9%) des sujets avaient un niveau socio-économique moyen. La cétose a été le mode de révélation du diabète chez 53,3% des patients. La cétonurie moyenne à l'admission était de 2,83±0,76 croix. La glycémie capillaire moyenne à l'admission était de 3,99±1,2 g/l et de 2,35±0,86 g/l à la négativation. La glycémie veineuse à l'admission était de 23,84±8,54 mmol/l. Le facteur déclenchant a été identifié dans 78,9% des cas. La quantité moyenne d'insuline administrée jusqu'à la négativation était de 198,94±183,86 UI et de 7,67±8,5 litres pour la quantité moyenne de soluté. Le protocole a été interrompu dans son exécution chez 76,7% des sujets avec une responsabilité du médecin engagé dans 71% des cas de rupture. Le délai moyen de négativation était de 29,13±21,72 heures. L'évolution avait été jugée favorable dans 87,8% des cas.

Conclusion : L'étude a permis de rapporter un délai de négativation au-delà des 24 heures et des interruptions dans l'exécution du protocole chez une grande majorité des sujets.

Mots clés : cétose diabétique, délai, négativation, Niger.

Introduction

Diabetic ketoacidosis which is one of the modes of revelation of diabetes is characterized by hyperglycemia, hyperacetonemia and metabolic acidosis [1]. It is the consequence of an insulinemia that is too low in the case of onset diabetes or poorly compensated for by treatment [2]. In 2009, it was the cause of 140,000 hospitalisations in the United States of America with an annual cost of over $ 2 billion [3]. Hyperglycemia is due to a lack of insulin-sensitive glucose transport in adipose tissue and muscle, the hepatic glycogenolysis (75 g/24h) and above all the gluconeogenesis (125 g/24h)

[4–7]. The presence of ketone bodies is essential for the diagnosis of ketosis decompensation [4,8]. The positivity threshold generally used is greater than or equal to 2 crosses [4,9] but the ketonuria can be less than or equal to a cross, with subnormal blood sugar levels and without glycosuria (fasting ketosis). The American Diabetes Association took 2.5g/l as a hyperglycemia threshold to define ketoacidosis, while specifying that the definition does not resolve to this alone hyperglycemia [2]. In Africa, there are few data on the time taken to negate diabetic ketonuria. But a study carried out in Cameroon between 2014 and 2015 had resulted in a delay of negativation of diabetic ketonuria between 2 and 14 hours. [4,10].

Méthodologie

– This is a prospective, analytical and longitudinal study lasting eleven (11) months from September 2019 to August 2020 in the medical emergencies of the National Hospital of Niamey. Included were all consenting patients at least 15 years of age with at least a ketonuria of two crosses. The treatment protocol consisted of:

– Determination of ketonuria by urine dipstick every hour.

– A capillary blood sugar level every hour.

– Intravenous injection of insulin (positive ketonuria) and subcutaneously (negative ketonuria).

– Rehydration of 500 ml of solutes (saline 0.9% if capillary glycemia ≥ 2.5 g/l, glucose serum 5% if capillary glycemia between 0.8 and 2.49 g/l and glucose serum 10 % or 30% bolus in case of blood sugar < 0.8 g/l).

– Treatment of decompensation factor if identified.

All patients who died before two consecutive negativations were excluded from the study.

The parameters studied were:

– Anthropological data: age; sex; provenance (urban or rural); socio-economic level which depends on monthly income and a notion of social assistance; the level of education; personal medical history (hypertension, diabetes, heart disease, nephropathy, etc.); the evolving profile of diabetes (type 1, type 2 and inaugural); medical follow-up and previous decompensations for known diabetic patients, admission time.

– Clinical data: symptoms; blood pressure; oxygen saturation; temperature (fever); capillary blood sugar and ketonuria on admission and the second negative.

– Biological data: white count; thick gout / parasite density; venous blood sugar on admission; kidney workup and blood ionogram (natremia and kalaemia).

– The triggering factor: (compliance with treatment; infections, etc.).

– Treatment (insulin: 10 IU / hour; antibiotics depending on the infectious focus; injectable artemether in cases of malaria, etc.).

– The evolution of the clinical state at the second negativation compared to the signs on admission.

– The period of negativation.

SPSS 26 statistical software was used for data analysis. Quantitative variables were expressed as mean with the standard deviation when the distribution was normal or median if not. The Chi-square test crossed qualitative variables and quantitative variables using ANOVA with a significance level <0.05.

Ethical considerations

To carry out this investigation we had the approval of the management of the NHN. Consent was obtained from each patient before the start of the questionnaires. Confidentiality was guaranteed and respected during the presentation of results on all survey sheets.

Results

By the end of the study ninety (90) patients had been selected. The sex ratio was 0.63. The mean age of the subjects was 40.03 ± 12.76 years, and patients under 45 years of age represented 58.9% of the sample. Married patients made up 80% of the sample. Subjects from urban areas were the most represented with 86.7%. Patients with a medium socioeconomic level were in the majority with 58.9% and the uneducated at the level of education represented 40% of the patients. The profession which was the most represented was the one of housewives with a frequency of 51.1%. At the field level, 46.67% of subjects were previously diabetic among these, 35.7% were type I and the rest (65.3%) type II. Of these, 67.4% were under the care of a doctor and 47.6% had a previous notion of hospitalisation for ketosis. The mean duration of diabetes was 3.66±3.65 years. The time between the first clinical signs and treatment was less than twenty-four hours for only 14.4% of the subjects.

Infections were the most reported triggering factors with 66.7% and no factor was identified in 21.1% of cases.

Vomiting is the most reported reason for hospitalisation with 43.41%.

On admission, 54.4% of subjects were febrile. On evaluation of the state of hydration, dehydration was found to 30% of patients.

The mean systolic and diastolic blood pressures were 121.08±31.05 mmHg and 76.54±18.85 mmHg, respectively. The mean pulsed oxygen saturation was 94.43 ± 7.1% and the Glasgow score averaged 12.96 ± 3.14.

The capillary blood glucose at admission was 3.99±1.2 g/l and that of the negativation was 2.35±0.86 g/ l. The mean ketonuria on admission was 2.83±0.76%.

The mean venous blood glucose was 23.84±8.54 mmol/l. By leukocyte level, more than half of the subjects (58.4%) had hyperleukocytosis with a mean of 14,613.75±8973.84/µl. The thick drop of blood revealed the plasmodium in 43.3% of the subjects with an average parasite density of 137.42±183.16 parasites/µl. Mean natremia and serum potassium were 131.62±6.28 mmol/l and 4.65±1.4 mmol/l, respectively. Serum creatinine averaged 121.47±57.7 µmol/l.

In terms of management, oxygen therapy was necessary for 16.7% of the subjects. The amount of insulin administered to patients averaged 198.94±183.86 IU and 7.67±8.53 liters for fluids. For the cure of bacterial infections, 61.1% of subjects had received antibiotic administration. Potassium was administered to 10% of patients and antimalarial medication to 37.8% of subjects. An antiemetic was injected into 36.7% of the subjects.

During the execution of the management protocol, 76.7% of the patients had experienced interruptions. The doctor was blamed in 71% of protocol interruptions, the nurse in 82.6% and the patient 53.6%.

The mean time to negative ketonuria was 29.13±21.72 hours. The time to negativation was on average only 13.42±8.54 hours in the patients who had no interruption in the execution of the protocol. This time to negativation was 38.88±23.8 hours if the doctor was responsible

for interrupting execution of the protocol. This period was 36.49±23.11 hours in the case of nursing responsibility for an interruption and 37.51±24.22 hours if the patient was the cause of this rupture in the execution of the protocol.

The evolution of the clinical condition was considered favorable to negativation for 87.8% of patients.

Table I. Distribution of patients according to the interruption of the execution of the protocol and the person in charge

Responsible	Interruption	Délai (heures)	p
Doctor	Yes	38,88±23,8	0,003
	No	21,72±11,22	
Nurse	Yes	36,49±23,11	0,15
	No	21,66±12,36	
Patient	Yes	37,51±24,22	0,035
	No	29,75±19,36	

Table II. Distribution of subjects according to the interruption of the execution of the protocol and the clinical evolution

		Interruption of protocol execution		p
		Yes n (%)	No n (%)	
Evolution	Favourable	59 (74,7)	20 (25,3)	0,447
	Stationary	7 (87,5)	1 (12,5)	
	Deterioration	3 (100)	0 (0)	

Discussion

In this study, the average age is 40.03 ± 12.76 years, which agrees with data in the international literature where the average age ranges from 31 years to 45 years [3,4,11-20]. Female subjects are the majority (61.1%) in this study, it is the same in the studies of Garba AN (63.6%) [4], Lkousse MA with 56% [8] and Sola E who has 56,6% [18]. In the studies of Hara J, Bull SV, Goyal N and Shen T, the predominance is male with respectively 62.8% [3], 63% [15], 52,6% [16] et 53,1%. Diabetes is type II in 65.3% of our

The doctor had a statistically significant influence on the prolongation of the negativation time (p=0.003) as did the nurse (p=0.035). On the other hand, patients did not negatively influence the time to negativation (p=0.15).

The breaks in the execution of the management protocol were not statistically related to the clinical evolution of the patients (p=0,447).

subjects, a lower rate than that of Garba AN which has 90.9% [4] but superior to those of Hara JS (44,2%) [3], Goyal N who has 42,9% [16], and Sola E (18,9%) [18]. Ketoacidosis occurs more in type I diabetics because they are insulin dependent.

Infections are the most implicated triggering factor in our study with a rate of 66.7%, it is the same in several studies [4,8,18,21,22]. In the study of Hara J, the non-compliance with treatment is the leading trigger (45,1%) then the infections with 14,2% [3].

The mean systolic blood pressure in our study is 121.08±31.05 mmHg, it is slightly higher than that of Bull SV which has 105±17 mmHg [15].

The capillary glycemia average in our study is 3,99±1,2 g/l whereas it is 6,02±2,73 g/l for Hara J [3], 4,25 g/l for Garba AN [4], 5,88±2,45 g/l for Bull SV [15], 6,44±2,81 g/l for Goyal N [16], and 5,96±2,69 g/l in Randall L study's [17].

The average of capillary glycemia at the ketonuria negativation is 2,35±0,86 g/l in our study. It is 3,19±2,17 g/l in the Goyal N study's [16].

On admission, the mean ketonuria is 2,83±0,76 croix in our study. It is close to those of Garba AN who has 2,54 croix [4]. All the patients in the study had ketonuria on admission of at least 2

crosses, the same was true in the study of Lkousse MA [8].

The average of venous glycemia in the study is 23,84±8,54 mmol/l. It is almost similar to that of Garba AN (20,8±7,05 mmol/l) [4] but lower than those of Sola E with 30,72±12,61 mmol/l [18] et Shen T who has 34,5±19,6 mmol/l [20]. The mean of the natremia is 131,62±6,28 mmol/l in our study. It is almost identical to those of Garba AN (136,35±7,02 mmol/l) [4], Lkousse MA (135,34±6,13 mmol/l) [8]. The kaliemia is on average during our work 4,65±1,4 mmol/l, data consistent with data in the international literature ranging from 4,24 à 5,19 mmol/l [4,18,23,24].

Antibiotics were administered to 61.1% of the subjects in our study. This rate is lower than those of Garba AN (72,7%) [4] and Lkousse MA (70%) [8].

Le délai moyen de négativation de la cétonurie dans notre travail est de 29.13±21.72 heures. Il est de 12,44±7,42 heures dans l'étude de Hara J [3], de 37,3±36,1 heures dans celle de Bull SV [15].

Conclusion

The study determined a mean time to negativation of diabetic ketonuria beyond the 24th hour. It also determined the different responsibilities of the support team in extending this period

Conflit d'intérêt : None

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