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(RESEARCH ARTICLE)

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Clinical laboratory contribution to the diagnosis and monitoring of pediatric diabetic ketoacidosis

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Abstract

Diabetic ketoacidosis (DKA) is a serious complication of childhood diabetes, which is all the more concerning when it reveals the disease. It constitutes a real public health issue, particularly because it can be prevented through early diagnosis. This study is retrospective, descriptive, and single-center, including 39 children hospitalized at the Cheikh Khalifa International University Hospital in Casablanca, Morocco, over a four-year period between 2018 and 2022. This study highlights a male predominance (56.4%) with a median age of 9 years. The most frequent clinical signs at admission were polyuropolydipsia syndrome (79.5%), weight loss (51%), polyphagia (30.8%), dyspnea (48%), digestive disorders (38%), vigilance disorders (25%) and secondary enuresis (10%). The mean blood glucose level at admission was 4.85 g/L ± 1.38, with glycosuria and ketonuria present in 77% of cases. Mild to moderate ketoacidosis was found in 35.9% of children. Biologically, hyperleukocytosis (79%), high CRP (21%), and high HbA1c were observed in 100% of cases (mean 11.3%, range 8.2-15.1%). DKA was mild to moderate in 35.9% of cases. The role of the laboratory is essential for diagnosis, monitoring, and identification of triggering factors, contributing to better management and prevention of recurrences.

Keywords: Diabetes; Ketoacidosis; Pediatrics; Biomarkers; Acid-base balance.

1. Introduction

L' Diabetic ketoacidosis is a serious complication of childhood diabetes and is itself a serious factor when it leads to the onset of diabetes. It constitutes a major public health issue since it can be prevented.

In Morocco, more than 2 million people have diabetes and the number of diabetic children is estimated at more than 15,000. Diabetic ketoacidosis is characterized by a triad combining hyperglycemia, ketonuria and acidosis. It represents a formidable complication, being the main acute cause of morbidity and mortality in children [1].

It is a diagnostic and therapeutic emergency threatening the child's life prognosis and requiring hospitalization in an appropriate department with close clinical and biological monitoring and surveillance [2].

The role of the medical biology laboratory is crucial in the early detection of this entity, monitoring of clinical progress under treatment, and the search for a triggering factor (infection, therapeutic error, acute stress, etc.).

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2. Materials and methods:

This is a retrospective, descriptive, single-center study of 39 children hospitalized for diabetic ketoacidosis in the pediatric intensive care and mother-child hospitalization departments of the Cheikh Khalifa International University Hospital in Casablanca, Morocco, over a 4-year period from July 7, 2018 to September 19, 2022.

The present study included all patients hospitalized in the pediatric intensive care unit of Sheikh Khalifa University Hospital aged 28 days to 18 years meeting the following biological criteria defined by the International Society for Pediatric and Adolescent Diabetes (ISPAD) Guideline of 2018:

- Blood sugar > 2 g/L
- Ketonuria
- pH < 7.3 and/or HCO3 - < 15 mmol /L [3]

3. Results

In a cohort of 39 children hospitalized for diabetic ketoacidosis (DKA), a slight male predominance was observed, representing 56.4% of cases, with a sex ratio of 1.29. (Figure1)

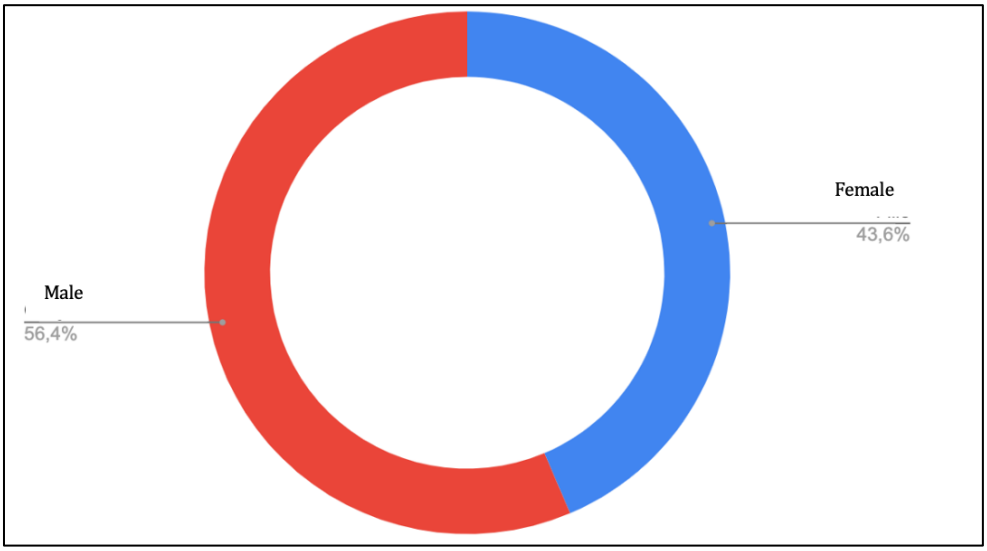

Figure 1 Distribution of patients by gender

The median age of patients was 9 years, with extremes ranging from 13 months to 17 years. (Figure 2)

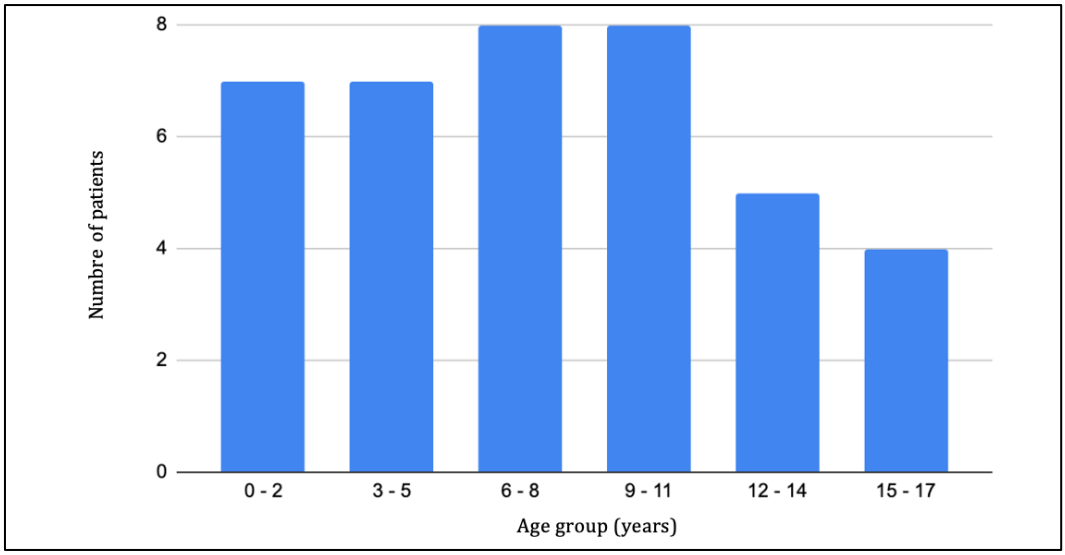

Figure 2 Distribution of patients by age

The symptoms at admission were dominated by polyuria-polydipsia syndrome, present in 79.5% of cases. Weight loss was reported in 51% of patients, polyphagia in 30.8%, while dyspnea was observed in 48%. Digestive signs, mainly abdominal pain and vomiting, were found in 38% of children. Vigilance disorders were noted in 25% of cases, and secondary enuresis in 10%.(Figure 3)

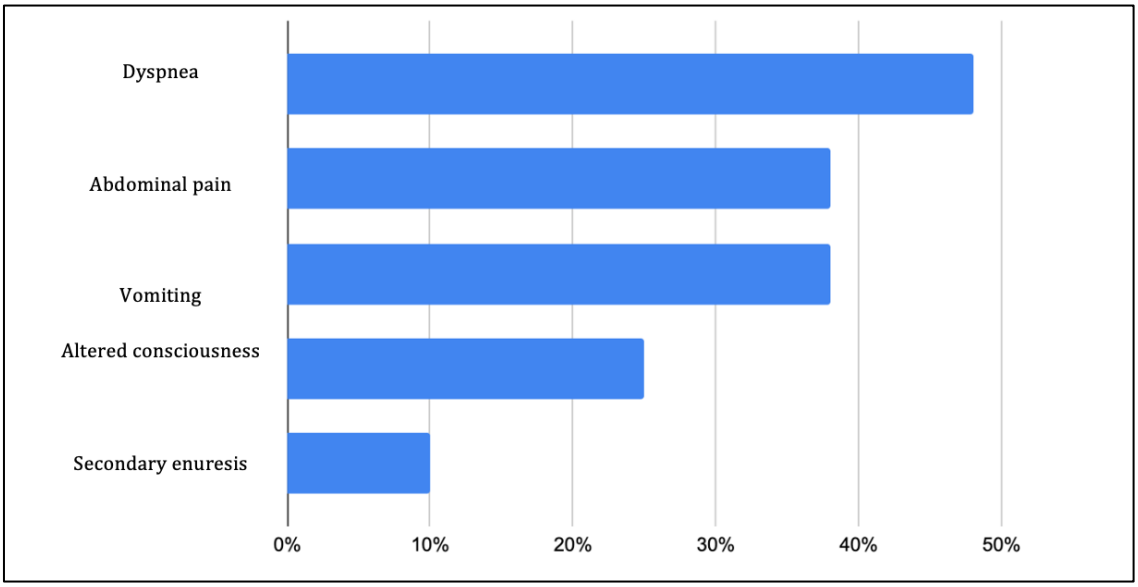

Figure 3 Distribution of symptoms among children in the study

Biologically, the mean capillary blood glucose on admission was 4.85 g/L (±1.38), with extreme values between 2.5 and 7.8 g/L. Glycosuria associated with ketonuria was detected in 77% of patients. Mild to moderate ketoacidosis was reported in 35.9% of cases, while the anion gap was widened in 95% of patients (Table 1). Furthermore, hyperleukocytosis was present in 79% of patients, and elevated CRP (>6 mg/L) was observed in 21% of cases, while 16% of patients presented with acute renal failure on admission. Finally, HbA1c was increased in all children, with a mean of 11.3%, and values ranging from 8.2% to 15.1%, reflecting chronic glycemic imbalance.

4. Discussion

The results of this study confirm that diabetic ketoacidosis (DKA) remains a common and serious complication of diabetes in children, particularly when it is the mode of presentation of the disease. The male predominance observed

in our cohort (56.4%) is consistent with data reported in several international studies, although gender is not an established risk factor.

The average age of patients, around 9 years, reflects the period in childhood when type 1 diabetes diagnoses are frequently made. The clinical symptoms, marked by polyuria-polydipsia syndrome, weight loss, and dyspnea, underscore the importance of quickly identifying warning signs to avoid progression to severe DKA. Digestive manifestations and impaired alertness, although less frequent, are signs of severity that should not be overlooked.

Biologically, the high frequency of hyperglycemia associated with ketonuria and glycosuria confirms the classic triad of DKA. The elevated HbA1c in all cases reflects a prolonged glycemic imbalance before hospitalization. The hyperleukocytosis and elevated CRP observed in some cases could reflect a nonspecific inflammatory response or the presence of a triggering factor, particularly an infection.

The importance of the medical biology laboratory is highlighted here: not only to confirm the diagnosis, but also to ensure therapeutic monitoring and contribute to the identification of triggering factors. Early and multidisciplinary management would significantly improve the vital prognosis and limit recurrences.

5. Conclusion

Diabetic ketoacidosis is a common and serious complication of type 1 diabetes in children, often revealing the disease. It mainly affects young boys, with clinical signs dominated by polyuropolydipsia syndrome, weight loss and digestive or respiratory disorders. The role of the laboratory is essential for early diagnosis, therapeutic monitoring and the search for triggering factors. Prevention is based on increased awareness, early diagnosis and appropriate therapeutic education.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflicts of interest.

Statement of ethical approval

The study was conducted in accordance with ethical standards. Approval was obtained from the appropriate ethics committee

Statement of informed consent

Informed consent was obtained from all individual participants included in the study

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