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Elevation of Serum Lipase During Diabetic Ketoacidosis: What Are the Interpretations?

Hassan Aden Neima[1], S. Rafi[2], S. Ijdda[3], G. El Mghari[4]

[1,2,3,4]N. El Ansari Department of Endocrinology, Diabetes, Metabolic Diseases and Nutrition, Mohammed VI University Hospital, Marrakech, Morocco.

Abstract:

Background: Diabetic ketoacidosis (DKA) is a life-threatening metabolic complication of diabetes mellitus and may be associated with elevated pancreatic enzymes, complicating the diagnosis of acute pancreatitis. The interpretation of hyperlipasemia in DKA remains challenging, as it may occur without true pancreatic injury. This study aimed to investigate the association between DKA and acute pancreatitis and to evaluate severity using the Ranson score.

Methods: We conducted a prospective observational study including 75 adult patients admitted for DKA at the Department of Endocrinology and Metabolic Diseases, CHU Mohamed VI, Marrakech, over a one-year period. Clinical, biological, and radiological data were collected. The severity of pancreatitis was assessed using the Ranson score, and statistical analysis was performed using SPSS and JAMOVI software.

Results: The mean age of patients was 45 years, with a slight female predominance (sex ratio 0.7). DKA revealed newly diagnosed diabetes in 34 cases and was associated mainly with type 1 diabetes (33 cases). Hypertriglyceridemia was present in 52% of patients, and serum lipase was elevated in the majority. CT imaging showed predominantly mild to moderate pancreatitis (46.7% stage A, 49.3% stage C, and 4% stage E). A strong association was found between admission pH, radiological stage, and high Ranson score ($p < 0.001$). Hypertriglyceridemia was significantly correlated with elevated lipase levels ($p < 0.001$), whereas no association was found between lipase levels and the Ranson score. Clinical outcomes were favorable in most cases, with only one death reported.

Conclusion: Hyperlipasemia and hypertriglyceridemia are common in DKA and may mimic or coexist with acute pancreatitis. However, elevated lipase alone is not sufficient for diagnosis. A combined approach including clinical assessment, biochemical markers, and imaging is essential for accurate diagnosis and management. Early and appropriate treatment of DKA leads to favorable outcomes and reduces complications.

Keywords: Diabetic ketoacidosis; Acute pancreatitis; Hyperlipasemia; Hypertriglyceridemia; Ranson score; Diabetes mellitus; Computed tomography; Metabolic complications

Introduction:

Diabetic ketoacidosis (DKA) is a serious metabolic emergency in diabetes, the management of which has been well established for several decades. Nevertheless, it continues to represent a major clinical challenge worldwide, not only because it frequently constitutes the first presentation of type 1 diabetes. In clinical practice, a serum lipase level exceeding three times the upper limit of normal is generally considered a

biological criterion suggestive of this condition [1,2]. However, in patients with DKA, the interpretation of hyperlipasemia remains complex, as several studies have shown that significant elevations of pancreatic enzymes can occur in the absence of any objectively detectable pancreatic injury [3,4]. In this context, the present prospective study aims to explore the association between DKA and acute pancreatitis, using the Ranson score as an indicator of severity.

Materials and Methods:

This was a prospective observational study involving 75 patients, conducted in the Department of Endocrinology and Metabolic Diseases at CHU Mohamed VI in Marrakech over a one-year period. The study included adult patients hospitalized for diabetic ketoacidosis associated with acute pancreatitis, with clinical, biological, and radiological data collected from medical records. The severity of pancreatitis was assessed using the Ranson score, and statistical analysis was performed using SPSS and JAMOVI software, in accordance with ethical considerations and data confidentiality.

Results:

The study included 75 patients with a mean age of 45 years, showing a slight female predominance (44 women and 31 men, sex ratio 0.7). Most patients were from Marrakech, while 28 came from surrounding areas. All patients presented with diabetic ketoacidosis, including 34 cases of newly diagnosed diabetes, 33 cases of type 1, and 8 cases of type 2 diabetes. Only one patient was exposed to a medication potentially triggering pancreatitis (quetiapine), while the majority had no identifiable drug-related risk factors. Abdominal pain was present in all patients. Admission blood glucose levels and pH indicated severe ketoacidosis in a large proportion of patients, accompanied by biological inflammatory syndrome and hypertriglyceridemia in more than half. Serum lipase was elevated in the majority of cases, suggesting a frequent occurrence of associated acute pancreatitis. Abdominal computed tomography (CT) revealed that 46.7% of patients had stage A pancreatitis, 49.3% stage C, and 4% stage E, indicating mainly mild to moderate forms. Statistical analysis showed that admission pH and radiological stage were strongly associated with a high Ranson score ($p < 0.001$), confirming that the severity of ketoacidosis and radiological stage predict pancreatitis severity .

Hypertriglyceridemia was also strongly correlated with elevated serum lipase levels ($p < 0.001$), whereas the Ranson score was not (Table I).

Table I: Relationship between Hypertriglyceridemia and Elevated Lipase

Lipasémie	Prédicteur	Estimation	Erreur standard	Z	p	Rapport des cotes (odds ratio)
1 - 0	Ordonnée à l'origine	13.6	318.595	0.0427	0.966	814821
	HyperTG :					
	1 – 0	16.4	0.333	49.0453	<.001	1.26e+7
	Score de Ranson	-12.5	318.596	-0.0393	0.969	3.67e-6
2 - 0	Ordonnée à l'origine	12.5	318.596	0.0394	0.969	281450
	HyperTG:					
	1 – 0	17.6	0.377	46.8315	<.001	4.58e+7
	Score de Ranson	-12.3	318.596	-0.0392	0.969	3.82e-6
3 - 0	Ordonnée à l'origine	13.2	318.595	0.0414	0.967	527774
	HyperTG :					
	1 – 0	16.2	0.386	41.9721	<.001	1.10e+7
	Score de Ranson	-12.7	318.596	-0.0399	0.968	3.03e-6

Therapeutic management primarily consisted of insulin therapy, combined with appropriate rehydration, etiological treatment, and measures to prevent complications. The outcome was favorable in 74 patients, whereas one patient who died had stage E pancreatitis. Recurrence was rare, affecting only three patients, reflecting the effectiveness of the initial management and adherence to therapy.

Discussion:

The study included 75 patients with diabetic ketoacidosis (DKA), with a mean age of 45 years and a slight female predominance (sex ratio 0.7). Most patients were from Marrakech and its surrounding areas. From a diabetes perspective, the majority of patients had either newly diagnosed diabetes (34 cases) or type 1 diabetes (33 cases), with a disease duration of less than 5 years in 81.3% of cases. Comorbidities were rare, and nearly all patients were not exposed to any pancreatitis-inducing medications. At admission, 52% of patients had hypertriglyceridemia, reflecting the lipid disturbances induced by DKA. Serum lipase was elevated in a significant proportion of patients, suggesting the possible occurrence of acute pancreatitis. CT imaging showed that most patients had mild to moderate pancreatitis, with only 4% presenting with severe forms. A very significant correlation was observed between hypertriglyceridemia and elevated lipase levels ($p < 0.001$), whereas the Ranson score was not associated with lipase levels. These findings highlight the importance of systematically monitoring triglycerides and serum lipase in patients with DKA. Abdominal CT is recommended to confirm the diagnosis and guide management. Rapid correction of ketoacidosis, rehydration, and insulin therapy remain the cornerstones of treatment, helping to limit pancreatic complications. Mortality is low when management is early and protocol-driven. Despite the limited sample size, the monocentric nature of the study, and the lack of prolonged follow-up of lipase levels, this study provides valuable data on the frequency and correlation of hypertriglyceridemia and elevated lipase during DKA, offering practical guidance for diagnosis and clinical management.

Conclusion:

Diabetic ketoacidosis results from insulin deficiency and is characterized by hyperglycemia, acidosis, and elevated ketone bodies. Hypertriglyceridemia and elevated lipase are common and increase the risk of acute pancreatitis, although lipase alone is insufficient for diagnosis. Early management with insulin therapy, rehydration, and correction of metabolic disturbances allows for a favorable outcome. Combined evaluation of clinical features, enzyme levels, and imaging optimizes diagnosis and monitoring of complications.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare no conflict of interests.

Statement of ethical approval the present research work does not contain any studies performed on animals/humans subject by any of the authors.

Statement of informed consent

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

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