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AUTOIMMUNE ENIGMA: A DETAILED CASE REPORT ON TYPE 1 DIABETES MELLITUS, DIABETIC KETOACIDOSIS, CELIAC DISEASE AND HASHIMOTO'S THYROIDITIS

Paediatrics

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ABSTRACT

Autoimmune diseases often involve multiple organs or tissues and can coexist with other autoimmune disorders due to shared genetic susceptibility. Type 1 Diabetes Mellitus (T1DM) is frequently associated with other autoimmune conditions such as Celiac Disease (CD) and Hashimoto's Thyroiditis (HT). This case report focuses on an 11-year-old child diagnosed with multiple autoimmune disorders, including Type 1 Diabetes Mellitus (T1DM), Diabetic Ketoacidosis (DKA), Celiac Disease (CD), and Hashimoto's Thyroiditis (HT). The study sheds light on the complexities of diagnosing and treating interconnected autoimmune diseases in paediatric patients. Shared genetic susceptibility is evident among these conditions, underscoring the need for regular screening for associated disorders in T1DM patients. The management involved a comprehensive, multidisciplinary approach, incorporating insulin therapy, intravenous fluids, and a gluten-free diet. The report emphasises the importance of early detection and collaborative healthcare strategies to optimise patient outcomes in such challenging cases. The findings can contribute to improved patient care by enhancing understanding of the complex interaction between autoimmune disease and more effective treatment strategies.

KEYWORDS

Autoimmune Disease, Celiac Disease, Hashimoto Thyroiditis, Hypothyroidism, Type 1 Diabetes Mellitus, Diabetic Ketoacidosis

INTRODUCTION

Autoimmune diseases in children are generally difficult to diagnose and treat. Sometimes an autoimmune disorder affects many organs or tissues in a patient, which leads to many other autoimmune diseases in the patient. [1] Many autoimmune diseases share their genetic susceptibility. [2] T1DM may be associated with several other autoimmune diseases like Celiac disease, Hashimoto thyroiditis, etc. T1DM is an autoimmune chronic disorder characterised by the destruction of pancreatic Beta cells responsible for insulin production, which results in a loss of insulin production. [3] New-onset T1DM is the most common cause of DKA. [4] Celiac Disease is an autoimmune disorder that is triggered by gluten protein ingestion in genetically susceptible individuals and mainly affects the small intestine. [5] Gluten is an alcohol soluble protein naturally found in certain grains like wheat, rye, barley, etc. [6] CD may be either asymptomatic or present with typical symptoms like diarrhoea and weight loss in children. [2] CD is diagnosed by serological tests such as anti-endomysial and anti-transglutaminase and confirmed by duodenal biopsy. A lifetime gluten free diet is recommended for the management of CD. [6] Many studies support the coexistence of T1DM with other autoimmune disorders like Celiac Disease and Hashimoto's Thyroiditis. [1,6] The NICE guideline recommends that T1DM patients be screened for thyroid function yearly and for CD if they have unexplained weight loss. [6] A study suggests exposure to gluten by a CD patient can induce many other autoimmune diseases in that individual. [7] DM with CD increases dietary restrictions and makes food choices more limited for the patient, as the diet should not only be gluten-free but low in sugar and fat as well. CD causes poor absorption of food in diabetic patients, which can lead to hypoglycemia. HT can cause glycemic instability through alterations in glucose uptake and metabolism in diabetic patients. HT can increase insulin resistance in the diabetic individual as well. On the other hand, DM makes it difficult for HT patients to take thyroxin on an empty stomach to avoid morning hypoglycemia. The presence of food in the stomach can cause malabsorption of thyroxin. [6] Here we present the case of an 11-year-old child who was diagnosed with T1DM, DKA, CD, and HT with the purpose of increasing awareness about the association of autoimmune diseases, their diagnosis guidelines, and the challenges of treating such diseases.

CASE PRESENTATION

An 11-year-old boy was being diagnosed with Type 1 Diabetes mellitus, diabetic ketoacidosis, coeliac disease, and Hashimoto's thyroiditis and was being treated in the paediatric endocrinology ward. As the family's second child, he was born at term via normal vaginal delivery to a healthy mother. The patient, at the age of 11, was admitted to the hospital with the chief complaints of Polyuria, Polydipsia, and difficulty breathing. There was also a history of weight loss and decreased appetite. His physical examination demonstrates that he was a conscious, oriented child with no major neurological deficit. Along with it, the child's respiratory system shows that he has "tachypnea." "Kussmaul breathing "and "equal bilateral air entry in the respiratory system" His abdomen is soft without any abnormalities. In terms of Anthropometry, his height is recorded as 138 cm and his weight as 26 kg. Certain necessary laboratory investigations are depicted in Table 1, and several other tests were performed, such as ultrasonography, which reveals mild ascites and hepatomegaly. An UGI endoscopy was further done in addition to the laboratory analysis, which further confirmed the diagnosis of celiac disease. Following a biopsy, significant results that were consistent with celiac disease were found. Villi atrophy, focal crypt hyperplasia, an increase in the number of intraepithelial lymphocytes per 100 enterocytes, and a significant chronic lymphoplasmacytic infiltration in the mucosa were all seen during the biopsy. These results support a diagnosis of celiac disease with a modified Marsh-Ober-Huber Type 3B classification and Grade B1 severity. The patient was found to have a positive widal test, which may indicate the presence of an infectious disease such as typhoid.

All the investigations collectively confirm the diagnosis of celiac disease with diabetic ketoacidosis, diabetes mellitus, and Hashimoto's thyroiditis. An appropriate course of treatment was determined based on the diagnosis and included the following IV fluid dosages: 110 ml/hour of IV fluid, IV fluid N.S. (0.9%) + Kcl (1:100), IV fluid DNS (0.45%) @110 ml/hour + Kcl (7.5 in 500 ml) (fluid was varied based on blood sugar), Twice daily injections of INJ. PANTOPRAZOLE 40 mg and INJ. PIPTAZ 2.25 gm in 100 NS 3 times every day, INJ. CEFTRIAXONE 1 gm (BD), INJ. ONDANSETRON 4 mg (SOS), Subcutaneous insulin was started concurrently with the patient's diagnosis of diabetes after initially receiving an insulin infusion. A

gluten-free diet was advised after It was diagnosed with celiac disease. During discharge, the patient was recommended the following: Insulin Aspartate and the dosage recommendations were as follows: before breakfast, after breakfast, Before lunch, and After Lunch. At follow-up, he was prescribed Insulin aspartate (5 units), Insulin glargine (8 units), and other drugs such as INJ PANTOPRAZOLE (20 mg IV OD) for acid reflux, INJ ONDANSETRON (2 mg IV OD) for nausea, and TAB LEVOTHYROXINE (50 mcg) as thyroid hormone replacement.

Table 1

Table category	Table Name	Result	Reference Range
Hematologic	Haemoglobin	8.0 g/dl (Low)	13-17g/dl
Hematologic	Neutrophils	33.4%(Low)	40-80%
Hematologic	Lymphocytes	54.6%(High)	20-40%
Hematologic	TRBC	4.46millions/cumm(Low)	4.5-5.5 millions/cumm
Hematologic	MCV	58.8F(Low	83-101FL
Hematologic	MCH	17.9pg(Low)	27-32pg
Hematologic	Reticulocyte	3.0%(High)	0.5-2.5 %
Biochemistry	Iron	9.9 g/dl(Low)	59-158g/dl
Biochemistry	Total Iron binding Capacity	149.95g/dl(Low)	250 – 450g/dl
Biochemistry	Plasma glucose level	600 mg/dl(High)	60-139 mg/dl
Biochemistry	Albumin	3.5 g/dl (Low)	3.8 -4.4 mmol//L
Biochemistry	Serum creatinine	0.65 mg/dl (Low)	0.7-1.3 mg/dl
Biochemistry	Sodium	130.8mmol/L(Low)	135-145mmol/L
Biochemistry	Potassium	3.22mmol/L (Low)	3.4 -4.7mmol/l
Biochemistry	TSH	5.71ml (High)	0.465-4.68/ml
Biochemistry	HbA1c	16.1 %(High)	>6.5%
Biochemistry	Anti-Thyroid Peroxidase (TPO)	32.20 U/ml(High)	<9
Biochemistry	TTG-IgA antibody	>150(Positive)	Negative: <12 Equivocal :12 -18 Positive: > 18
Urine test	Urine Ketone	Positive	
Urine test	Clarity	Turbid	
Urine test	Glucose	Present	
Urine test	Pus Cells	1-2 /HPF	2-3 /HPF

DISCUSSION

In this case report, we have discussed the case of an 11-year-old boy who has been diagnosed with Type 1 Diabetes mellitus, diabetic ketoacidosis, celiac disease, and Hashimoto's Thyroiditis (both of which are autoimmune diseases). When we interpreted the patient's health data, it was noticed that the patient at first presented with diabetic ketoacidosis, which is one of the initial signs of Type 1 diabetes mellitus and also a vital clinical sign of T1DM. This signifies the importance of Type 1 Diabetes Mellitus being mentioned in our report. It is also strongly believed that T1DM is strongly linked with both Hashimoto's thyroiditis and Celiac disease. In research, it has been found that T1DM (Type 1 Diabetes Mellitus) and Hashimoto's thyroiditis are closely associated with each other. According to reports, people with type 1 DM have CD rates ranging from 1.7% to 8.5%, which is 20 times greater than the general population. [8] Compared with other research, it was found that, according to a study by Lara et al., autoimmune polyendocrinopathy is formed when T1DM and autoimmune thyroid illness frequently co-cluster in people and families. [9] However, it should be emphasised that in another study by Szczeniak et al., it was suggested that Hashimoto's disease does not significantly influence the level of T1DM (Type 1 Diabetes mellitus) control or the emergence of associated consequences. In our study, we also found out that the child has both Type 1 diabetes mellitus and Hashimoto's thyroiditis, as well as celiac disease. [10] In our study, we discovered that the patient had several common symptoms, including iron deficiency anaemia, which is frequently observed in coeliac disease, along with polyuria, polydipsia, difficulty breathing (tachypnea), and Kussmaul breathing, which is frequently noticed in diabetic ketoacidosis.

According to a study by Alice Gallo de Moraes et al., tachypnea and the Kussmaul breathing pattern can occur in diabetic ketoacidosis, which could be a support in favour of this claim. [11] In a study, it was suggested that micro- and macrovascular comorbidities are more likely to develop in a patient who has both T1DM and CD than those who only have T1DM, so the screening issue plays a vital role that cannot be ignored. The study also suggests people with Type 1 diabetes mellitus have a 2.8-times higher chance of mortality if they have had a diagnosis of CD (coeliac disease) for more than or equal to 15 years. According to a study by West et al., patients with Celiac disease have had a slight hike in total Mortality and malignancy risk throughout the follow-ups. Furthermore, it also highlights that patients with autoimmune thyroiditis like Hashimoto's thyroiditis should get a routine Coeliac disease screening to avoid symptoms and other consequences like malabsorption, infertility, and Thyroid cancer. [11] This case has clinical significance because the patient received meticulous care and was recovering quickly. Through a multidisciplinary approach involving a doctor, clinical Pharmacist, and nursing staff, we were able to address the electrolyte and metabolic imbalances related to DKA (Diabetic Ketoacidosis). A proper regimen was decided, which included insulin therapy with several other medications such as Pantoprazole, Piperacillin and Tazobactam combinations, levothyroxine, etc. Along with it, a gluten-free diet was suggested for T1DM and CD. In a report, it was suggested that exogenous insulin supplementation and GFD (excluding rye, wheat, and barley) are the main choices of treatment; however, there is disagreement on how much gluten is safe to consume on a daily basis. Diet is crucial to treating both illnesses. Low-glycemic-index foods are advised for T1DM patients, yet GFD dietary options frequently contain foods with a high glycemic index. Therefore, when two disorders coexist, dietary treatment is challenging. [12] This complex case of T1DM (Type 1 Diabetes Mellitus), diabetic ketoacidosis, and coexisting autoimmune diseases like Hashimoto's thyroiditis and celiac disease illustrates the significance of a coordinated healthcare team in maximising patient outcomes. In order to observe a quick recovery, their parents were also provided with wise recommendations regarding his diet and the treatments they should strictly follow. Following up was scheduled appropriately, and it was seen that the patient was getting well on the advised regimen.

CONCLUSION

This case report presents a unique and challenging scenario of an 11-year-old child with Type 1 Diabetes Mellitus, Diabetic Ketoacidosis, Hashimoto's Thyroiditis, and Celiac Disease. The report emphasises the significance of early screening and a multidisciplinary approach for managing these coexisting autoimmune conditions in children. The findings can contribute to future research, clinical guidelines, and improved patient care by enhancing understanding of the complex interactions between autoimmune diseases and guiding more effective treatment strategies.

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AUTHOR'S CONTRIBUTIONS

The document's concept was developed by AD, who also worked on its writing and drafting. The editing was aided by IS. The manuscript was read and modified by SB and SC. The manuscript was edited and examined by RA. DA contributed to the editing, and evaluation of the

manuscript as well as the literature review. The final manuscript was read and approved by all writers.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

CONSENT FOR PUBLICATION

Written informed consent was obtained from the patient for the publication of this case report.

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