

# Hepatic Glycogenosis: A Rare Complication of Type 1 Diabetes Mellitus

Chaima Jemai<sup>1</sup>, Yasmine Fakhfakh<sup>1</sup>, Zohra Hadj Ali<sup>1</sup>, Yosra Htira<sup>1</sup>, Faika Ben Mami<sup>1</sup>

1. Department C, National Institute of Nutrition of Tunis, Tunis, TUN

**Corresponding author:** Chaima Jemai, jemaichaima87@yahoo.fr

Review began 11/22/2024

Review ended 11/26/2024

Published 11/29/2024

© Copyright 2024

Jemai et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.74766

## Abstract

Type 1 diabetes mellitus (T1DM) is a common autoimmune pathology requiring lifelong insulin therapy. We report the case of a 12-year-old girl with T1DM admitted to Department C of the National Institute of Nutrition of Tunis for diabetic ketosis. She had suffered from T1DM for five years, with poor glycemic control (hemoglobin A1C = 10%) and poor therapeutic adherence. On examination, she had abdominal bloating with homogeneous hepatomegaly. Her height was 146 cm (less than the second percentile), her weight was 38 kg (less than the second percentile), and her body mass index was 17.8 kg/m<sup>2</sup>. Tanner's stage was S1P1A1. Biological investigations showed mixed dyslipidemia, normal liver and renal functions, and normal thyroid-stimulating hormone levels. The aspartate aminotransferase/alanine aminotransferase ratio was 1.35. Ultrasound of the abdomen revealed hepatomegaly with a liver span of 19 cm. Based on the clinical history and investigations, Mauriac syndrome was the most likely diagnosis of our patient. A holistic multidisciplinary approach, in collaboration with the child psychiatrist, was opted to optimize diabetes management and reduce hepatic metabolic overload. Further investigations were conducted to rule out differential diagnoses, especially viral and autoimmune hepatitis. Poor acceptance of type 1 diabetes leads to non-compliance with insulin therapy. Then, energy metabolism becomes defective with growth retardation and pubertal delay. Glucose accumulates in the liver leading to metabolic liver disease. Liver damage could be irreversible. Therapeutic education, a good doctor-patient relationship, and family support are the cornerstones of managing T1DM diabetes complicated by Mauriac syndrome.

**Categories:** Endocrinology/Diabetes/Metabolism, Pediatrics, Medical Education

**Keywords:** education, hepatic glycogenosis, hepatomegaly, mauriac syndrome, type 1 diabetes mellitus (t1dm)

## Introduction

Type 1 diabetes mellitus (T1DM) is a chronic disease characterized by autoimmune destruction of pancreatic beta cells, which secrete insulin, a key hormone in glycemic homeostasis [1]. Patients with T1DM require life-long insulin replacement.

Novel technologies, such as automated insulin delivery systems, have substantially impacted the quality of life and the diabetes balance of these patients worldwide. However, these expensive technologies are unaffordable in developing countries such as Tunisia, where multiple daily insulin injections remain the only possible therapeutic option. Yet, this is very constraining in real life and could have many psychological issues and poor therapeutic compliance resulting in the development of related T1DM complications [2,3].

We aim to enrich the scientific literature by presenting this case. The case was previously presented as a meeting abstract at the 26th European Congress of Endocrinology.

## Case Presentation

We report the case of a 12-year-old T1DM girl admitted to Department C of Diabetology and Therapeutic Dietetics of the National Institute of Nutrition of Tunis for diabetic ketosis. She had T1DM for five years with poor therapeutic compliance resulting in a hemoglobin A1c (HbA1c) level above the goal (HbA1c = 10%) and repeated emergency hospitalizations.

On physical examination, she had abdominal distension. The hepatic area was tender and the liver was enlarged. A familial history of hepatic disease was ruled out. She denied any symptoms such as fever, diarrhea, abdominal pain, nausea, and vomiting. She also denied medication, herbal intake, and viral infections. Her height, weight, and body mass index were 146 cm (less than the second percentile), 38 kg (less than the second percentile), and 17.8 kg/m<sup>2</sup>, respectively. Tanner's stage was S1P1A1. There were no other relevant findings.

Biological investigations showed mixed dyslipidemia and normal liver and renal functions. Viral serologies (hepatitis B and C, cytomegalovirus, and Epstein-Barr virus) and autoimmune panel (anti-nuclear, anti-LKM1, anti-smooth muscle, and anti-mitochondrial antibodies) were negative. Thus, the differential diagnoses of viral and autoimmune hepatitis were ruled out. Laboratory findings are detailed in Table 1.

### How to cite this article

Jemai C, Fakhfakh Y, Hadj Ali Z, et al. (November 29, 2024) Hepatic Glycogenosis: A Rare Complication of Type 1 Diabetes Mellitus. Cureus 16(11): e74766. DOI 10.7759/cureus.74766

	Patient's value	Normal range
Fasting glycemia (mmol/L)	13.1	4.1–6.1
HbA1c (%)	10	4.5–6
Triglyceridemia (mmol/L)	3.13	0.4–1.7
Cholesterolemia (mmol/L)	6.14	3–5.2
HDL-cholesterol (mmol/L)	1.73	>1.03
Creatinemia (μmol/L)	20.4	135–145
TSH (IU/L)	3.07	0.34–5.6
AST (IU/L)	65	<45
ALT (IU/L)	48	<40
AST/ALT ratio	1.35	

TABLE 1: Laboratory findings of the patient.
HbA1c: hemoglobin A1c; HDL: high-density lipoprotein; TSH: thyroid-stimulating hormone; AST: aspartate aminotransferase; ALT: alanine aminotransferase

Ultrasound examination revealed homogenous hepatomegaly with a liver span of 19 cm. Intrahepatic biliary ducts showed no ectasia, and the gallbladder had no calculi. Uncontrolled diabetes, hepatomegaly, growth retardation, impuberism, dyslipidemia, and the aspartate aminotransferase/alanine aminotransferase ratio >1 were features in favor of Mauriac syndrome in our patient.

Discussion

Mauriac syndrome was first described in 1930. It is a rare complication of diabetes mellitus typically diagnosed in children and adolescents with poorly controlled T1DM [4]. In our case, many features were noted such as unbalanced diabetes, hepatomegaly, growth retardation, impuberism, cushingoid features, hypercholesterolemia, and elevated liver transaminases [5]. No presentation is specific to this syndrome, as one or more features could coexist in the same patient, but hepatomegaly and elevated liver are leading symptoms [6,7]. The full pathogenesis of Mauriac syndrome has not been fully elucidated. However, it is mainly characterized by glycogen accumulation in the hepatocytes.

In these patients, chronic hyperglycemia is often associated with high doses of insulin to try to control diabetes. Insulin inhibits glucose-6-phosphatase and stimulates glucokinase and glycogen synthetase which promotes hepatic glycogenogenesis. Thereby, chronic hyperglycemia and hyperinsulinism seem to act in combination to enhance hepatic glycogenogenesis with a remarkable snowball effect resulting in progressive enlargement of hepatocytes due to glycogen accumulation and clinical hepatomegaly [7-9].

Stature and puberty retardation are other common features of Mauriac syndrome in children. Their pathogenesis seems to be enhanced by glucogen liver sequestration associated with an insufficient supply of glucose to different tissues [10].

Some studies have reported a complete reversibility of symptoms through optimal glycemic control [11-14]. Thereby, a holistic multidisciplinary approach, in collaboration with the child psychiatrist, was opted in our case to optimize diabetes management and reduce hepatic metabolic overload, while achieving a resumption of height and weight growth and secondarily physiological puberty. Therapeutic education was resumed and insulin doses were adjusted according to glycemic cycles. Regular and timely consultations were planned with the patient and her family for further follow-up.

Conclusions

Despite scientific progress, T1DM management continues to be challenging in some cases, such as those complicated with Mauriac syndrome. This is a rare complication noted in young patients with uncontrolled T1DM and chronic hyperglycemia resulting in hepatic accumulation of glycogen and leading to metabolic liver disease with possible irreversible liver damage. Subsequently, energy metabolism becomes defective with growth retardation and pubertal delay. Thus, caregivers should coordinate to enhance the care of patients with T1DM. Therapeutic education, a good doctor-patient relationship, and family support are the main cornerstones of managing T1DM complicated by Mauriac syndrome.

## Additional Information

### Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

**Concept and design:** Chaima Jemai, Yasmine Fakhfakh, Zohra Hadj Ali, Yosra Htira, Faika Ben Mami

**Acquisition, analysis, or interpretation of data:** Chaima Jemai, Yasmine Fakhfakh, Zohra Hadj Ali, Yosra Htira, Faika Ben Mami

**Drafting of the manuscript:** Chaima Jemai, Yasmine Fakhfakh, Zohra Hadj Ali, Yosra Htira, Faika Ben Mami

**Critical review of the manuscript for important intellectual content:** Chaima Jemai, Yasmine Fakhfakh, Zohra Hadj Ali, Yosra Htira, Faika Ben Mami

**Supervision:** Chaima Jemai, Yasmine Fakhfakh, Zohra Hadj Ali, Yosra Htira, Faika Ben Mami

### Disclosures

**Human subjects:** Consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

## References

1. Patterson CC, Harjutsalo V, Rosenbauer J, et al.: Trends and cyclical variation in the incidence of childhood type 1 diabetes in 26 European centres in the 25 year period 1989-2013: a multicentre prospective registration study. *Diabetologia*. 2019, 62:408-17. [10.1007/s00125-018-4763-3](https://doi.org/10.1007/s00125-018-4763-3)
2. Yoshioka N: Psychological reluctance to insulin therapy: as an illness side of diabetes mellitus . *Diabetol Int*. 2018, 9:82-3. [10.1007/s13340-018-0349-z](https://doi.org/10.1007/s13340-018-0349-z)
3. Frank MR: Psychological issues in the care of children and adolescents with type 1 diabetes . *Paediatr Child Health*. 2005, 10:18-20.
4. Mauriac P: Gros ventre, hépatomégalie, trouble de la croissance chez les enfants diabétiques traités depuis plusieurs années par l'insuline. *Gas Hebd Med Bordeaux*. 1930, 26:402-10.
5. Trifi A, Abdellatif S, Ben Ismail K, et al.: Glycogénose hépatique: une complication rare du diabète déséquilibré (à propos d'un cas). *Méd Intensive Réa*. 2017, 26:335-8. [10.1007/s13546-017-1280-1](https://doi.org/10.1007/s13546-017-1280-1)
6. Giordano S, Martocchia A, Toussan L, et al.: Diagnosis of hepatic glycogenosis in poorly controlled type 1 diabetes mellitus. *World J Diabetes*. 2014, 5:882-8. [10.4239/wjd.v5.i6.882](https://doi.org/10.4239/wjd.v5.i6.882)
7. Julián MT, Alonso N, Ojanguren I, Pizarro E, Ballestar E, Puig-Domingo M: Hepatic glycogenosis: an underdiagnosed complication of diabetes mellitus?. *World J Diabetes*. 2015, 6:321-5. [10.4239/wjd.v6.i2.321](https://doi.org/10.4239/wjd.v6.i2.321)
8. Sherigar JM, Castro J, Yin YM, Guss D, Mohanty SR: Glycogenic hepatopathy: a narrative review . *World J Hepatol*. 2018, 10:172-85. [10.4254/wjh.v10.i2.172](https://doi.org/10.4254/wjh.v10.i2.172)
9. Moreno Tirado A, González Lázaro P, Montero Benítez MZ, Jiménez Torrecilla P: Hepatopathy of Mauriac syndrome. The importance of therapeutic adherence. *Rev Esp Enferm Dig*. 2023, 115:659-60. [10.17235/reed.2023.9513/2023](https://doi.org/10.17235/reed.2023.9513/2023)
10. Fitzpatrick E, Cotoi C, Quaglia A, Sakellariou S, Ford-Adams ME, Hadzic N: Hepatopathy of Mauriac syndrome: a retrospective review from a tertiary liver centre. *Arch Dis Child*. 2014, 99:354-7. [10.1136/archdischild-2013-304426](https://doi.org/10.1136/archdischild-2013-304426)
11. Abaci A, Bekem O, Unuvar T, et al.: Hepatic glycogenosis: a rare cause of hepatomegaly in Type 1 diabetes mellitus. *J Diabetes Complications*. 2008, 22:325-8. [10.1016/j.jdiacomp.2007.11.002](https://doi.org/10.1016/j.jdiacomp.2007.11.002)
12. de Laffolie J, Kamrath C, Burchert D, Böttcher C, Wudy SA, Zimmer KP: Reversible severe glycogenic hepatopathy in type 1 diabetes. *Wien Med Wochenschr*. 2022, 172:144-7. [10.1007/s10354-020-00795-6](https://doi.org/10.1007/s10354-020-00795-6)
13. Kleint A, Dussan M, Chandran A, Salameh M: A case of Mauriac syndrome: a teenage girl with poorly controlled diabetes. *Cureus*. 2024, 16:e64748. [10.7759/cureus.64748](https://doi.org/10.7759/cureus.64748)
14. MacDonald MJ, Hasan NM, Ansari IU, Longacre MJ, Kendrick MA, Stoker SW: Discovery of a genetic metabolic cause for Mauriac syndrome in type 1 diabetes. *Diabetes*. 2016, 65:2051-9. [10.2337/db16-0099](https://doi.org/10.2337/db16-0099)