

CASE REPORT

Open Access



Case report: Bilateral Cataracts and Diabetic Nephropathy as Complications of Type 1 Diabetes Mellitus in 14 Years Old Girl

Fiona Paramitha^{1*}, Haryudi Aji Cahyono^{2,3}

Affiliation and email

1. Faculty of Medicine, Universitas Negeri Surabaya: fionaparamitha@unesa.ac.id
2. Department of Pediatrics of dr. Saiful Anwar General Hospital: haryudi_aji2000@yahoo.co.id
3. Faculty of Medicine, Universitas Brawijaya

DOI:

Volume: 1

Issues:1

Abstract

This case highlights the challenges of managing Type 1 Diabetes Mellitus (T1DM) in pediatric patients, particularly when poor glycemic control leads to serious complications such as diabetic nephropathy and early-onset cataracts. A 14-year-old female with a history of inconsistent insulin adherence, significant genetic predisposition, and limited family support presented with symptoms of malnutrition, visual impairment, and chronic hyperglycemia. Laboratory tests confirmed sustained hyperglycemia with an HbA1c of 11.2%, accompanied by early signs of nephropathy and advanced cataracts. Multidisciplinary management, including intensive insulin therapy, cataract surgery, nephrology consultation, and nutritional support, was implemented to stabilize her health. Despite the initial challenges of maintaining glycemic control, successful intervention through close endocrine and ophthalmologic coordination allowed for improved metabolic stability and vision restoration. This case underscores the necessity of a holistic approach to pediatric T1DM, addressing not only glycemic management but also education and psychosocial support. Long-term follow-up and preventive care remain crucial to optimize outcomes and prevent further complications, with an emphasis on continuous patient and family education to ensure adherence. This case advocates for an early, structured intervention strategy to improve the quality of life and mitigate the risks of T1DM complications in the pediatric population.

Keywords:

pediatric type 1 diabetes mellitus, glycemic control, diabetic nephropathy, diabetic cataracts, multidisciplinary management.

*Correspondence:

Name: Fiona Paramitha

E mail : fionaparamitha@unesa.ac.id

Introduction

Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disease that causes the pancreatic beta cells that produce insulin to be destroyed, resulting in complete insulin insufficiency (1). Since the condition usually first appears in infancy and teens, lifelong care is required to avoid consequences (2). The risk of microvascular problems, such as diabetic retinopathy and nephropathy, can be considerably raised by inadequate glycemic management (3). The patient's condition could worsen if insulin administration compliance is poor. The most common results in severe clinical symptoms of poorly managed T1DM include early diabetic nephropathy and bilateral cataracts (3,4). The patient may express profound clinical manifestation due to a combination of her genetic susceptibility, a lack of family support, and insufficient diabetes education, highlighting the difficulties in managing this chronic condition.

Many cases of T1DM were diagnosed when the patients were impacted by diabetic ketoacidosis (5). Usually, the patients were treated with a basal-bolus insulin regimen, followed by routine evaluation by a pediatrician (2). Maintaining the patient's consistency to adhere to the therapy is difficult. In many cases, over time, the patient's adherence to the therapy deteriorates, leading to chronic hyperglycemia (6). This clinical situation demonstrates the complex interplay between hereditary factors—such as the family's history of type 1 diabetes—and psychosocial factors—such as education and support networks—that influence health outcomes. The need to treat both medical and psychosocial aspects in the treatment of childhood diabetes is highlighted by the lack of consistent adherence to medication.

The production of advanced glycation end-products (AGEs), which can cause inflammation and oxidative stress and ultimately destroy vital organ tissue, is known to be accelerated by chronic hyperglycemia (7). In this instance, diabetic nephropathy and cataracts developed early as a result of the patient's extended exposure to elevated blood glucose levels (3,4). This link demonstrates how urgently strict glycemic management is required to reduce the risk of complications from diabetes. Also, it highlights the crucial window of time for intervention in children, when glycemic stability is crucial for both short-term health and long-term quality of life.

Nutritional problems, as seen by symptoms of mild malnutrition and marked weight loss, exacerbated our patient's troubles (8). Because malnutrition can worsen metabolic instability and further complicate the clinical picture, this feature emphasizes the connection between managing diabetes and nutritional health. Since good nutrition is essential to optimal glucose control and general well-being, treating nutritional deficiencies through dietary guidance and support becomes crucial in controlling pediatric type 1 diabetes.

A multidisciplinary strategy encompassing endocrinology, nephrology, ophthalmology, and nutrition is essential to managing complications (1). Comprehensive management, which includes extensive insulin medication, renal function monitoring, cataract surgery, and nutritional support, requires coordinated care. Through education and self-management techniques, this comprehensive approach tries to empower the patients and their families and stabilize their health (1,9). The long-term objective is to improve the patient's quality of life while lowering the likelihood of problems from poorly managed type 1 diabetes in the future.

This case presentation's goal is to highlight the difficulties in treating Type 1 Diabetes Mellitus (T1DM) in children, with a focus on how inadequate glycemic control can result in complications including diabetic nephropathy and cataracts. It seeks to show that to successfully address these issues, a multidisciplinary strategy involving endocrinology, nephrology, ophthalmology, and nutrition is required. It also emphasizes the significance of patient and family education in encouraging treatment adherence. A complete management strategy that improves the patient's quality of life and reduces future health risks is also fostered by the presentation, which promotes proactive screening and early action to stop the progression of problems.

Case Presentation

The patient was a 14-year-old girl who had been experiencing unintended weight loss, increased thirst, and frequent urine for the past year, combined with gradually increasing hazy eyesight. After experiencing an episode of diabetic ketoacidosis (DKA) that necessitated hospitalization, she was diagnosed with Type 1 Diabetes Mellitus (T1DM) at the age of 10. She was first put on a basal-bolus insulin regimen, but she has not always followed it. Her father and a paternal aunt also have T1DM, indicating a substantial genetic propensity to the illness. Regular follow-ups helped manage her glycemic control throughout the years, but as she grew older, adherence issues surfaced, in part because of a lack of family support and diabetes education, which resulted in chronic hyperglycemia.

She experienced protracted episodes of hyperglycemia in recent years because of her diabetes treatment failed even further. Secondary malnutrition may have developed when chronic symptoms including nausea, dizziness, and weariness were paired with a 10% drop in body weight during the previous 12 months. Her impaired vision, which started six months before her present hospitalization, gradually became worse until it was affecting her everyday activities. She had an early cataract formation verified by her initial ophthalmologic evaluation, but her poor glycemic control delayed surgery. Due to her increased hyperglycemia and continued visual loss, she needed to be reassessed and admitted for full management.

A physical examination showed bilaterally verified progressive, mature cataracts and significantly decreased visual acuity in both eyes. There were obvious symptoms of mild malnutrition, such as decreased muscle mass and subcutaneous fat. The vital signs remained steady, and the neurological, pulmonary, gastrointestinal, and cardiovascular examinations revealed no noteworthy results. Laboratory tests revealed a random blood glucose level of 230 mg/dL and a high HbA1c level of 11.2%, which is indicative of persistent hyperglycemia. With a protein-to-creatinine ratio of 400 mg/g and an increased serum creatinine of 2.3 mg/dL, further testing revealed early diabetic nephropathy. A blood urea nitrogen (BUN) level of 45 mg/dL and elevated triglycerides further indicated metabolic instability. Her visual acuity was reduced to 1/300 in both eyes due to grade IV cataracts, which were confirmed by ophthalmologic evaluation and required surgery.

Diabetic nephropathy and bilateral diabetic cataracts were found to be complications of the patient's poorly managed type 1 diabetes. One of the main causes of these hastened consequences was probably the extended hyperglycemia brought on by irregular insulin adherence. A multidisciplinary treatment strategy was put into place to deal with glycemic control

and stop additional issues. In addition to a thorough diabetes education program for the patient and her family, intensive insulin therapy was begun with careful monitoring for dose modifications to improve HbA1c levels.

The patient's vision was much improved by the successful bilateral cataract surgery that was part of the ophthalmologic care. To prevent further renal impairment, she was also referred to nephrology for close monitoring of kidney function and the implementation of preventive treatments. To combat malnutrition and advance general health, nutritional support and dietary counseling were implemented. Her glycemic control, kidney function, and visual health will all be monitored at regular follow-up appointments, guaranteeing a thorough approach to managing her type 1 diabetes and its associated consequences.

Discussion

One of the most important and difficult elements of managing Type 1 Diabetes Mellitus (T1DM) is dealing with problems brought on by hyperglycemia, especially when there has been inadequate glycemic control for a long time. Long-term hyperglycemia causes the non-enzymatic glycation of proteins and lipids to produce advanced glycation end-products (AGEs) more quickly (7). By encouraging inflammatory reactions and raising oxidative stress, these AGEs can result in significant tissue damage, particularly detrimental to delicate organs like the kidneys and eyes (10). The expedited timeline of consequences that might occur when blood glucose is not regularly maintained is demonstrated by the patient's development of diabetic nephropathy and early-stage cataracts within a few years after diagnosis (11,12).

The instance also demonstrates how some organs are impacted by chronic hyperglycemia, with nephropathy and cataracts serving as two notable side effects. The polyol pathway, which turns extra glucose into sorbitol and causes osmotic stress in the lens, is the cause of cataract development in diabetics (4). As demonstrated in this case, this osmotic imbalance can lead to lens clouding, which impairs vision and causes early-onset cataracts (4,13). Another problem seen in this instance is diabetic nephropathy, which results from long-term exposure to elevated blood glucose levels and alters the kidneys' structure and function. Over time, renal function deteriorates due to protein leakage (proteinuria) caused by the glomeruli being damaged by this chronic hyperglycemia. Nephropathy's early phases are indicated by early indicators, such as an increased protein-to-creatinine ratio (2).

In addition to focusing on glucose management, proactive screening, and preventative actions are necessary to manage hyperglycemia-induced complications in type 1 diabetes (2,6). In this patient's situation, chronically high glucose levels caused by inadequate insulin therapy adherence and a lack of family support sped up the development of problems (3,12). Regular renal and ophthalmologic function evaluations are essential for early identification because they enable prompt actions to stop or slow additional damage (3).

In children with Type 1 Diabetes Mellitus (T1DM), controlling blood sugar levels is crucial, especially if surgery is needed to treat complications like cataracts. An acceptable degree of glycemic control must be achieved before elective surgeries since poor glycemic stability raises surgical risks, such as delayed wound healing, infection, and anesthesia-related problems. The patient's quality of life and visual health were negatively impacted in this instance since her cataract surgery was delayed due to her persistently high blood sugar levels (12). Achieving stable blood sugar levels in children can be more difficult because of growth-related hormonal changes, adherence problems, and, in this situation, a lack of structured family support.

Poor glycemic control necessitates delaying cataract surgery, which emphasizes the significance of preoperative stabilizing measures for diabetic patients (12). This may entail modifying insulin therapy for kids, possibly with a more rigorous monitoring regimen to control blood sugar levels in the weeks before surgery. A perioperative plan that includes customized insulin dosage and frequent glucose tests can be developed by endocrinologists in close collaboration with pediatricians and ophthalmologists to reduce intraoperative and postoperative hazards (6). The choice to postpone surgery further emphasizes how crucial time is when dealing with pediatric issues. Early detection of surgical needs and proactive planning can assist avoid delays that could exacerbate a patient's symptoms, especially since diabetic complications in children progress more quickly than in adults (9,12).

Postponing surgery because of hyperglycemia adds a layer of psychological and physical stress for children, especially when cataracts interfere with everyday activities and education. Her vision restoration has been delayed by poor glycemic management, which may contribute to the difficulties of managing chronic illness during adolescence by influencing social participation and academic achievement (4,14). A preoperative strategy that prioritizes family education and provides resources for improved self-management can facilitate addressing glycemic instability and preparing for necessary procedures. By establishing precise protocols for glucose control during these times, surgical delays can be prevented, and short-term and long-term recovery can be improved (11,14).

When treating complicated cases of type 1 diabetes mellitus (T1DM), particularly in young patients with severe complications like this one, a multidisciplinary approach is essential. To handle the wide range of issues brought on by persistent hyperglycemia, the patient's care in this instance required coordinated efforts from the endocrinology, ophthalmology, nephrology, and nutrition departments (15). Endocrinologists play a crucial role in preventing additional problems and stabilizing the patient before surgery by enhancing glycemic control with customized insulin therapy. Ophthalmologists were consulted in addition to endocrinologists to determine the extent of the cataracts, schedule the procedure, and direct post-operative care to maximize her visual recovery. Without interdepartmental coordination, it would have been difficult to carry out the timely and suitable actions made possible by this collaboration (3).

Given the patient's possible malnutrition and the early indicators of diabetic nephropathy, nephrology, and nutrition must be part of the treatment team. Monitoring renal function and directing treatment plans to prevent the development of end-stage renal disease (ESRD) are critical tasks for nephrologists (16). These tasks include determining proteinuria levels and modifying dietary recommendations to prevent additional kidney strain. To address both hyperglycemia and malnutrition, a dietitian or nutritionist can provide tailored nutritional counseling at the same time (17). This includes teaching her about balanced meals that take into account her nephrology condition and diabetes. This component of care is essential for keeping renal function from deteriorating and addressing malnutrition, which is a common problem in

individuals with type 1 diabetes who have weak appetite and chronic hyperglycemia (17,18).

A key component of a multidisciplinary approach is patient and family education, which supports lifestyle modifications necessary for long-term diabetes control and encourages continuous adherence to therapy (19). Diabetes educators engage with the patient and her family to teach them effective self-management practices and help them comprehend the significance of blood glucose monitoring, insulin delivery, and follow-up treatment (20). Multidisciplinary care tackles the psychological and medical facets of controlling type 1 diabetes by establishing a network of support around the patient (21). This all-encompassing strategy guarantees that every issue is handled thoroughly, enhancing the patient's quality of life and lowering the risk of further issues.

The management of Type 1 Diabetes Mellitus (T1DM) requires long-term surveillance and preventive care, especially in situations like this one when consequences from hyperglycemia have already manifested. To maintain glucose control and modify insulin regimens as necessary to avoid more issues, routine follow-up sessions are crucial. According to pediatric and endocrinology standards, screening for diabetic sequelae, including retinopathy, nephropathy, and neuropathy, should be planned regularly (3,12). Regular ophthalmologic examinations will be essential in this instance to track the stability of her eyesight following cataract surgery and identify any early indications of retinopathy (3,22). In a similar vein, frequent nephrology evaluations are essential to regularly monitor kidney function, especially when early diabetic nephropathy has already been identified and preventive measures are needed to postpone additional renal damage.

In T1DM, preventive care also includes educating patients and encouraging them to change their lifestyles in ways that reduce the chance of problems. For the patient to maintain her health over time, it is essential to make sure she and her family are aware of the significance of glycemic management, a balanced diet, and exercise (23). Quality of life can be greatly enhanced by delaying or even preventing the advancement of T1DM-related problems with long-term monitoring and adherence to preventive measures. These preventative habits can be reinforced with ongoing support from a multidisciplinary team, which includes diabetes educators and nutritionists (19,23,24). This will minimize the chance of further complications and provide the patient with the means to manage her illness on her own.

Conclusion

The difficulties of treating Type 1 Diabetes Mellitus (T1DM) in children are highlighted by this example, especially when long-term hyperglycemia has already resulted in consequences including cataracts and nephropathy. The beginning of these issues was sped up by poor glycemic control brought on by things like irregular insulin adherence, a lack of family support, and inadequate diabetes education. After being initially postponed due to hyperglycemic instability, prompt, multidisciplinary intervention—including endocrine, ophthalmologic, nephrology, and nutritional support—proved crucial in stabilizing her condition, enhancing glycemic control, and enabling successful cataract surgery. To manage her illness and reduce the likelihood of additional complications, long-term surveillance and preventive care—bolstered by continuous patient and family education—are essential.

Conflict of Interest and Acknowledgement

The authors declared that this study has received no financial support.

Financial Disclosure

The authors declared that this study has received no financial support.

References

- Addissouky TA, Ali MMA, El Sayed IET, Wang Y. Type 1 diabetes mellitus: retrospect and prospect. *Bull Natl Res Cent* [Internet]. 2024;48(1). Available from: <https://doi.org/10.1186/s42269-024-01197-z>
- Wherrett DK, Ho J, Huot C, Legault L, Nakhla M, Rosolowsky E. Type 1 Diabetes in Children and Adolescents. *Can J Diabetes* [Internet]. 2018;42:S234–46. Available from: <https://doi.org/10.1016/j.jcjd.2017.10.036>
- Antar SA, Ashour NA, Sharaky M, Khattab M, Ashour NA, Zaid RT, et al. Diabetes mellitus: Classification, mediators, and complications; A gate to identify potential targets for the development of new effective treatments. *Biomed Pharmacother* [Internet]. 2023;168:115734. Available from: <https://doi.org/10.1016/j.biopha.2023.115734>
- Simunović M, Paradžik M, Skrabčić R, Unić I, Bućan K, Skrabčić V. Cataract as early ocular complication in children and adolescents with type 1 diabetes mellitus. *Int J Endocrinol*. 2018;2018.
- Ursu M, Cretu-Stuparu M, Gurau G, Nitoi L-C, Nechita A, Arbune M. An Epidemiological Perspective on New Pediatric Cases of Type 1 Diabetes and Vitamin D Deficiency in South-East Romania : A Retrospective Study. 2024;11(1162):1–12.
- Lan YY, Kovinthalpillai R, Kędzia A, Niechciał E. Age-based challenges to type 1 diabetes management in the pediatric population. *Front Pediatr*. 2024;12(September).
- Kırkgöz T, Acar S, Küme T, Kırkgöz HH, Tabanlı G, Nalbantoğlu Ö, et al. Evaluation of Serum Advanced Glycation End Product Levels and Microvascular Complications in Children and Adolescents with Type 1 Diabetes Mellitus. *Turkish Arch Pediatr*. 2024;59(1):31–7.
- Romero RG, Riera LB, Marcos NS, Constanti VA, Maza VTS de la, Luaces C. New-onset type 1 diabetes mellitus in the Paediatric Emergency Department: impact of the COVID-19 pandemic. *Ann Pediatr Endocrinol Metab*. 2023;28(3):157–8.
- de Cássia Sparapani V, Liberatore RDR, Damião EBC, de Oliveira Dantas IR, de Camargo RAA, Nascimento LC. Children With Type 1 Diabetes Mellitus: Self-Management Experiences in School. *J Sch Health*. 2017;87(8):623–9.
- Du C, Whiddett RO, Buckle I, Chen C, Forbes JM, Fotheringham AK. Diabetes Development. 2022;1–18.
- Quintos JB, Torga AP, Simon MA. Diabetes cataract in a 10-year-old girl with new-onset type 1 diabetes mellitus. *BMJ Case Rep*. 2019;12(1):2018–9.
- Abel ED, Gloy AL, Evans-Molina C, Joseph JJ, Misra S, Pajvani UB, et al. Diabetes mellitus—Progress and opportunities in the evolving epidemic. *Cell* [Internet]. 2024;187(15):3789–820. Available from: <https://doi.org/10.1016/j.cell.2024.06.029>
- Reiter UM, Eckert AJ, Dunstheimer D, Bechtold-Dalla Pozza S, Lüllwitz C, Golembowski S, et al. Cataract in children and adolescents with type 1 diabetes. Insights from the German/Austrian DPV registry. *Pediatr Diabetes*. 2022;23(3):362–9.
- Wu J, Zeng H, Xuan R, Lei S, Li J, Lai X, et al. Bilateral cataracts as the first manifestation of type 1 diabetes mellitus A case report. *Med (United States)*. 2018;97(42):2017–9.
- Cho J-H, Hwang J-Y, Lee S-E, Jang SP, Kim W-Y. Nutritional status and the role of diabetes mellitus in hemodialysis patients. *Nutr Res Pract*. 2008;2(4):301.
- Natesan V, Kim SJ. Diabetic nephropathy – A review of risk factors, progression, mechanism, and dietary management. *Biomol Ther*. 2021;29(4):365–72.

17. Şimşek D, Okan Bakır B. Determination of malnutrition status of children with diabetes during diagnosis. *Hum Nutr Metab*. 2021;24.
18. Hussein SA, Ibrahim BA, Abdullah WH. Nutritional status of children and adolescents with Type 1 Diabetes Mellitus in Baghdad: a case-control study. *J Med Life*. 2023;16(2):254–60.
19. Sabbah MM, Hjazee AA, Arabiat D. Adherence to diabetes management among school-aged children and adolescents living with type 1 diabetes in Jordan. *J Pediatr Nurs* [Internet]. 2024;74:110–5. Available from: <https://doi.org/10.1016/j.pedn.2023.11.021>
20. Muhammed Elamin S, Muhamad Arshad NF, Md Redzuan A, Abdul Aziz SA, Hong J, Chua XY, et al. Information needs on type 1 diabetes mellitus (T1DM) and its management in children and adolescents: a qualitative study. *BMJ Open*. 2024;14(4):1–8.
21. Zysberg L, Lang T. Supporting parents of children with type 1 diabetes mellitus: a literature review. *Patient Intell*. 2015;21.
22. Rodrigues Oliveira SM, Rebocho A, Ahmadpour E, Nissapatom V, de Lourdes Pereira M. Type 1 Diabetes Mellitus: A Review on Advances and Challenges in Creating Insulin Producing Devices. *Micromachines*. 2023;14(1).
23. Asaad M, Abu Ghazaleh H, Tzouvara V, Zhao X, Sturt J. Psychosocial-Spiritual Experiences and Outcomes in Parents of Children with Type 1 Diabetes Mellitus from the Middle East and North Africa Region: A Systematic Review. *Pediatr Diabetes*. 2024;2024.
24. Allen V, Mahieu A, Kasireddy E, Shouman W, Pourrahmat MM, Collet JP, et al. Humanistic burden of pediatric type 1 diabetes on children and informal caregivers: systematic literature reviews. *Diabetol Metab Syndr*. 2024;16(1):1–14.