Metabolic cataract in an 8-year-old diabetic boy

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Cataracts are uncommon among children with insulin-dependent diabetes mellitus (IDDM); nonetheless, they could result in significant morbidity and a decrease in the life quality of these children. Duration of diabetes and metabolic control over the disease are important contributing factors in the development and advancement of cataract among diabetic pediatric patients. Ophthalmological examination at the time of IDDM diagnosis is recommended. Furthermore, persistent poor diabetic control and/or blurred vision in IDDM pediatric patients warrant prompt ophthalmological evaluation. We present the case of an 8-year-old with poorly controlled IDDM, who presented with bilateral cataract 27 months after his diagnosis with IDDM. We believe that such a presentation is rare; thus, increasing awareness of this particular diabetic complication is imperative.

Key words: cataracts, children, diabetes mellitus.

Cataract generally refers to lens opacities that interfere with visual function. Cataracts are a common cause of visual impairment and are the most common cause of blindness worldwide[1]. Cataracts are also more common among diabetics than in the general population[2]. Lens opacifications and retinopathy are uncommon causes of visual impairment in children and adolescents. Cataracts tend to start at a younger age and progress more quickly in diabetics; visual symptoms occur more commonly due to secondary myopia with hyperosmotic changes in the lens secondary to hyperglycemia[3]. Generally, cataracts are uncommon in diabetic children and adolescents[4] and are usually associated with prolonged poor metabolic control[2,5]. Typical cataracts in diabetic children are characterized by diffuse posterior and/or anterior subcapsular or cortical ''snowflake'' opacities. Upon conducting a literature review, few cases were reported on the topic of metabolic cataracts in diabetic children. In this featured case report, we present the case of an eight-year-old boy with insulin-dependent diabetes mellitus (IDDM), poorly controlled, who developed metabolic cataracts.

Case Report

An eight-year-old boy, diagnosed with IDDM three years ago, presented to King Abdul Aziz University (KAAU) Hospital, complaining of polyuria, polydipsia and blurred vision for seven months. On presentation, his random serum glucose was 30.4 mmol/L, blood pressure 91/52, and temperature 37°C. His weight was in the 10th centile and height was in the 5th centile for his age, and his body mass index was 14. During the last five months, both parents noticed an increased weight loss in their son, of 4 kilograms (kg). The patient was the product of a full-term pregnancy, complicated by gestational DM; he was delivered by cesarean section due to macrosomia, with a birth weight of 4 kg. After a thorough medical history and physical examination, the boy had been diagnosed with cataracts in a governmental hospital seven months ago; he had no history of developmental delays, consanguinity, diabetes, or cataracts in the family. He also had no history of any surgical procedures or eye trauma in the past, and only one hospital admission three years ago when he was first diagnosed with IDDM; his total length of stay was 10 days. The boy was started on conventional

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insulin therapy of 2 units/kg/day three years ago. According to the parents, the boy was not compliant with his insulin injections due to financial issues, which was also the reason for their not seeking any medical intervention regarding his cataracts upon diagnosis seven months ago. Both parents were unemployed; the father has chronic renal failure and is on dialysis, and their main source of income was charitable donations. The parents stated that their son had been missing school days more frequently in the last five months than in the past due to the deterioration in his vision.

On examination, the boy was alert and oriented with his surroundings. Grossly, both eyes had whitish discoloration, and bilateral posterior subcapsular cataracts were identified by ophthalmoscopy, with no evidence of retinopathy. Later, these findings were confirmed by slit-lamp examination. Using a Snellen chart, the boy had a visual acuity of 8/60 in his right eye and 10/60 in his left. Laboratory investigations revealed an elevated glycosylated hemoglobin A1c (HbA1c) of 14.5% (4.8-6%), normal thyroid function, normal complete blood count, unremarkable liver and renal functions, and normal serum cholesterol and triglycerides. Urine analysis revealed no proteinuria, cell casts or any signs of infection. Upon hospital admission, the boy was assessed by a medical team including a pediatric diabetologist, an ophthalmologist and a nutritional specialist at KAAU. The medical team concurred on shifting the boy to intensive insulin therapy, after which his serum glucose readings started to show improvement. Frequent educational sessions for the boy and his parents helped them improve their son's metabolic control. The ophthalmology team scheduled the boy for corrective eye surgery.

Discussion

Cataracts were first documented in patients with IDDM by John Rollo in 1798[6]. Since then, many studies have established the clinical features that are commonly present in IDDM children and adolescents with early development of cataracts[3,7,8]; these features include long duration of IDDM, poor metabolic control (represented by HbA1c), female gender preponderance, and adolescent age[2,5,9]. Hyperglycemia without acidosis is the most common presentation of childhood IDDM. Symptoms are caused by hyperglycemia and include polyuria, polydipsia, weight loss despite initial polyphagia, and lethargy[10]. Hyperglycemia with ketoacidosis is another common presentation of childhood IDDM. Cataracts, on the other hand, are an uncommon initial manifestation of new-onset IDDM[11,12]. It is imperative in children presenting with cataracts to identify the underlying cause of their cataract prior to surgical referral.

In our patient, the duration of diabetes was three years, during most of which he was uncontrolled. Montgomery et al.[3] reported that six pediatric patients in his cohort presented with cataracts (mean) 5.17 ± 4 years after the diagnosis with IDDM, and five of them had poor diabetic control with high HbA1c values. On presentation, our patient had very high serum glucose and HbA1c; furthermore, his parents related a history of poor control over the disease represented by his poor diet, negligence regarding insulin injections, lack of physical exercise, and rare self-monitoring of blood glucose. We believe that all these factors are caused by the low educational and socioeconomic status of this patient's family.

The pathogenesis of diabetic cataract development is still not fully understood. One study reported the prevalence of cataract among pediatric diabetic patients as 1%[8]. Only a small percentage of diabetic children develop cataracts, which suggests that factors other than hyperglycemia might be involved in cataract formation[9]. Recent studies have emphasized the polyol pathway, in which glucose is converted to sorbitol. In the lens, sorbitol is produced faster than it is converted to fructose; the increased accumulation of sorbitol creates a hyperosmotic effect that results in an infusion of fluid to countervail the osmotic gradient[13]. The accumulation of intracellular sorbitol leads to osmotic changes resulting in the formation of cataracts[14,15]. Other studies have shown that osmotic stress in the lens caused by sorbitol accumulation[16] induces apoptosis in lens epithelial cells[17], leading to the development of cataract[18]. The role of osmotic stress is particularly important for the rapid cataract formation in young IDDM patients[19,20]. Increased glucose levels in the aqueous humor may induce glycation of lens

proteins, a process resulting in the generation of superoxide radicals and in the formation of advanced glycation end products[21]. In addition to increased levels of free radicals, diabetic lenses show an impaired antioxidant capacity, increasing their susceptibility to oxidative stress. The loss of antioxidants is exacerbated by glycation and inactivation of lens antioxidant enzymes[22].

The International Society for Pediatric and Adolescent Diabetes recommends an initial ophthalmological examination in newly diagnosed IDDM children and adolescents to detect cataracts[23]. Prompt ophthalmological evaluation is warranted in those with persistent poor metabolic control and/or symptoms of blurred vision. Additionally, Couper et al.[24] recommended that regular ophthalmological examination should begin by the fifth year of IDDM or at the onset of puberty to detect diabetes-associated visual complications. Maintaining a good metabolic control over the disease along with regular monitoring of blood glucose will decrease the chances of developing cataracts. Although uncommon among pediatric diabetic patients, early diagnosis/management of cataracts is imperative in maintaining healthy sight and a productive life.

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