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Referrals for Hypoglycemia to the Pediatric Endocrine Clinic: Is It For Real?

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Introduction

Concerns about hypoglycemia in otherwise healthy school-aged children is a common reason for referral to the pediatric endocrine clinic. These concerns are typically based on nonspecific symptoms such as feeling shaky, having headaches, feeling dizzy or lightheaded, or having “spells.” Endocrine causes of hypoglycemia are serious and can be life threatening. Such causes include adrenal insufficiency,^{1,2} growth hormone deficiency,³ and hyperinsulinism.^{4,5} However, all of these diagnoses are extremely uncommon and the majority would be diagnosed before a child reaches school age. Children who are thought to have symptoms of hypoglycemia are often made to eat frequent snacks and may even have their sleep disrupted to facilitate this. This can create anxiety and further concern, exacerbating the situation. We aimed to determine the incidence of true hypoglycemia in patients who were referred to a tertiary outpatient pediatric endocrinology clinic for evaluation of presumed abnormally low blood sugars.

Methods

This retrospective study was approved by the Indiana University Institutional Review Board. Medical records were identified in our clinical billing database by searching for the International Classification of Diseases-9 (ICD-9) 251.1 and 252.2 billing codes. Exclusion criteria included being <5 years of age, having a known chronic condition associated with hypoglycemia, or a misdiagnosis (error in coding). Data collected included age, gender, body mass index standard deviation score (BMI SDS), symptoms, interventions that had been implemented because of concern for hypoglycemia such as frequent snacks and/or glucometer blood sugar testing, laboratory data, testing ordered in the endocrine clinic, disposition, and whether or not the patient returned to clinic.

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Author Contributions

DWH contributed to the design, data acquisition, analysis and interpretation. He drafted, edited, reviewed and gave final approval for the manuscript. EAE contributed to conceptualization/design, data analysis and interpretation. She edited, reviewed and gave final approval for the manuscript.

Declaration of Conflicting Interests

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Supplemental Material

Supplemental material for this article is available online.

The proportion of patients with individual clinical features were calculated and the median (range) for continuous variables determined.

Results

The database search revealed a total of 178 patients with ICD-9 codes consistent with hypoglycemia. Nineteen patients were excluded due to age, 35 patients had known chronic diseases, 14 patients were excluded for an incorrect billing code, and 2 were excluded because records were unable to be obtained. This left 108 patients in the dataset for analysis.

Patient characteristics are described in Table 1. The cohort had a slight female predominance (57%), and median BMI SDS was 0.34. The median age at the time of the outpatient visit was 10.9 years (range = 5.1-18.0 years). The patients were primarily Caucasian (86%). As seen in Figure 1, the most common symptoms reported were feeling shaky, dizzy/lightheaded, and headache. Prior to the visit, 5 patients (5%) had a documented central glucose between 40 and 60 mg/dL on a blood sample drawn at an outside facility.

Evaluation in the pediatric endocrine clinic included a hemoglobin A1c (HgbA1c) in 49 patients (45%) and a random serum glucose in 23 (21%), all of which were normal. Thirty-three patients (31%) were sent home with a glucometer and 15 (14%) with an order for a STAT serum glucose at the time of an episode, none of which have been received.

Due to lack of concern for true hypoglycemia, the majority of the patients, 92 of 108 (85%), were discharged from clinic without follow-up. Follow-up was scheduled for 3 patients (3%), who failed to return to clinic. Three other patients (3%) scheduled for follow-up made the return appointment and were subsequently discharged. Eight patients (7%) were scheduled for a controlled fast and had a normal result. One patient (1%) had a controlled fast that ultimately led to a diagnosis of adrenal insufficiency. Dispositions following the initial outpatient visit are shown in Figure 2.

Discussion

True pathological hypoglycemia in otherwise healthy school-aged children is extraordinarily rare. Given the critical importance of glucose homeostasis for numerous cellular functions, the body has multiple physiologic mechanisms in place to ensure euglycemia in normal individuals.⁶ These include a tightly regulated interplay between insulin and glucagon, counterregulatory hormones including catecholamines and cortisol, and behavioral defenses such as hunger. Nonetheless, concerns about hypoglycemia are common among the lay population and are also sometimes suggested by school nurses and other providers as an explanation for vague unexplained symptoms in otherwise healthy children. This creates tremendous anxiety for parents, who are then consumed with worry that their child will experience syncope or worse unless frequent snacks are given, even in the setting of overweight or obesity. Picking up on a parent's anxiety may have the undesirable effect of causing somatic hypervigilance in the child and exacerbation of symptoms, thus creating a vicious cycle that only compounds the situation.⁷ While well intentioned, giving families glucometers with which to test blood sugars at home often backfires due to the intrinsic inaccuracies of these devices and the fact that they typically read lower than serum glucose

since they are intended to be used by individuals with diabetes.^{8,9} The definition of true pathological hypoglycemia is somewhat controversial but has traditionally been thought of as a central glucose of less than 40 mg/dL. If sufficient concern for hypoglycemia is present, children are admitted to the hospital for a ~15- to 24-hour challenge fast during which a “critical sample” is obtained if a hypoglycemic event occurs.¹⁰⁻¹²

Our patient who was diagnosed with adrenal insufficiency was an 8-year-old girl with a history of hypoglycemia during times of illness. On one occasion she had a glucometer reading in the 20s (mg/dL) while in an ambulance traveling to the emergency department, and the other instance was a central glucose of 46 mg/dL while hospitalized for fever, vomiting, and diarrhea. Due to this history, she was admitted for a diagnostic fast. During the 24-hour fast, her lowest point of care glucose was 78 mg/dL. However, she was symptomatic at that time, feeling jittery and dizzy. A critical sample was sent, which revealed an appropriately elevated β -hydroxybutyrate of 0.63 mmol/L, a low c-peptide of 0.9 ng/mL, and a low insulin level of 4.01 μ U/mL. However, a cortisol was <0.4 μ g/dL and a subsequent ACTH stimulation test revealed a peak cortisol of 1.6 μ g/dL, well below the normal response of 18 μ g/dL. That she never developed hypoglycemia during the fast despite profound hypocortisolism is emblematic of the body’s ability to preserve normal glucose homeostasis if at all possible!

In conclusion, referrals for hypoglycemia in healthy school-aged children based on vague, nonspecific symptoms lead to unnecessary cost¹³ and unwarranted concern. In children with intermittent symptoms or “spells,” obtaining a central glucose at the time of an episode is recommended. In other patients, measuring the HgbA1c is an excellent way of obtaining objective information. In the absence of a documented low serum glucose or abnormal HgbA1c, reassurance should be provided to parents and patients with regard to normal physiological defenses against hypoglycemia. Nutritional counseling regarding the avoidance of concentrated simple sugars such as sugared beverages and the importance of a well-balanced and healthy diet is also beneficial.¹⁴

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Figure 1.
Percentage of different symptoms reported by patients referred for hypoglycemia.

Figure 2.
Disposition and outcomes of patients referred for hypoglycemia.

Table 1.**Patient Characteristics.**

Gender, female	57%
Median age at initial visit, in years (range)	10.9 (5.1-18.0)
Median BMI SDS (range)	0.34 (−3.42 to 2.64)
Ethnicity	
Caucasian, n (%)	93 (86%)
Refused/other/ unknown, n (%)	15 (14%)
Patients with outside serum glucose <60 mg/dL, n (%)	5 (5%)

Abbreviations: BMI, body mass index; SDS, standard deviation score.