hypoglycaemia

KIBARU

hypoglycaemia?

- Associated with;
  - Increased mortality
  - Convulsions
  - Permanent brain injury
- The duration and number of hypoglycaemic episodes are associated with poor neurological outcomes
- Some neonates are at high risk and they need to be recognized early

The signs and symptoms of hypoglycemia may be confused with those of other disorders, such as epilepsy, tetany, sepsis, or intoxication. ▪

Hypoglycemia is always the result of an imbalance between glucose production and glucose use.

- Obtaining the critical samples of blood and urine during the hypoglycemic episode are essential to determining the specific cause and, therefore, the specific treatment needed.

Hypoglycemia, or low blood glucose (BG), is a medical emergency requiring immediate recognition and treatment

. Unfortunately, the signs and symptoms of this metabolic imbalance can be relatively nonspecific and, therefore, delay its recognition, along with the performance of critical diagnostic tests on samples of blood and urine and immediate therapy.

Pediatricians need to include hypoglycemia among the differential diagnoses of many acute problems seen in the emergency department.

Prolonged hypoglycemia and/or recurrent asymptomatic hypoglycemic episodes are associated with substantial permanent cognitive and motor deficits.

Definition

A precise (mg/dL) definition of hypoglycemia remains somewhat elusive because various sources suggest different minimal BG levels for infants and children of different ages.).

Recommendations are often made on BG and symptom associations and/or whether the source of the measurement was plasma or whole blood.

Target blood glucose levels of neonates at risk at varying

postnatal age

0- 3 hours 1.4mmol/l

3 – 72 hours ≥ 2.6 mmol/L

> 72 hours ≥ 3.3 mmol/L

hypoglycemia to any BG level 50 mg/dL (2.8 mmol/L) or less, with the understanding that some infants and children are not symptomatic at this level, whereas others may be symptomatic at even higher BG levels.

Treatment should be designed to keep BG levels above 60 mg/dL (3.3 mmol/L

The BG level in infants, children, and adults is always the result of the balance between glucose use and glucose production.

Intermediary metabolism is carefully tuned to maintain this balance, and thus *any* hypoglycemia represents a pathologic state requiring an investigation of etiology.

Hypoglycemia cannot just be treated acutely and dismissed as a variation of normal; whenever hypoglycemia is suspected or identified, it is crucial to obtain critical samples of blood and urine

When hypoglycemia occurs (either spontaneously or during a diagnostic fast):

- Obtain urine for ketones and reducing substances; store excess for organic acids.
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Obtain sufficient blood for determination of glucose, insulin, cortisol, growth hormone, lactate, and amino acids. Store excess for ketone bodies, free fatty acids, and carnitine.

In infants, more than 90% of glucose produced is consumed by the brain.

This percentage drops to approximately 40% in adults. With the exception of the brain and red blood cells, all tissues require *insulin* to initiate glucose transport and metabolism.

Thus the most common cause of excess glucose use is *hyperinsulinism*, either endogenous or exogenous (as occurs with excess administration of injected insulin

Although hyperinsulinism resulting from maternal hyperglycemia or dysregulation of endogenous insulin secretion occurs in the newborn period, occasionally congenital hyperinsulinism (persistent hyperinsulinemic hypoglycemia of infancy [PHHI]) is not identified until later in infancy or childhood

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Four different gene defects on chromosome 11 are responsible for PHHI:

- **1** Sulfonyl urea receptor defects (*SUR1*)
- **2** Defects in the inward-rectifying potassium channel *Kir6.2* gene
- **3** Regulatory mutations in the glutamate dehydrogenase (*GDH*) gene
- **4** An activating glucokinase mutation.

Gluconeogenic hormones—cortisol, growth hormone, epinephrine, and glucagon—modulate or direct the process.

Deficiencies of cortisol and/or growth hormone are associated with fasting hypoglycemia.

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Deficiencies of epinephrine and/or glucagon are associated with defective counter-regulation to insulin-induced hypoglycemia in type 1 diabetes.

Gluconeogenesis can be impaired by the ingestion of ethanol.

An estimated 5% of children with alcohol intoxication present with hypoglycemia

Three glycogen storage diseases (GSDs) are associated with hypoglycemia:

glucose-6-phosphatase deficiency (type I),

amylo-1,6-glucosidase deficiency (debrancher deficiency, type III),

liver phosphorylase deficiency (types VI and IX).

GSD type I is the most common.

All can be associated with lactic acidosis during prolonged fasting.

Glycogen synthetase deficiency, sometimes called GSD 0, an inability to synthesize glycogen, is a rare disorder, associated with ketosis and hypoglycemia during fasting but not lactic acidosis.

Galactose-1-phosphate uridyltransferase deficiency (galactosemia) causes postprandial hypoglycemia following the ingestion of galactose, by inhibiting glycogenolysis.

Alternative Fuels

During fasting or severe illness, free fatty acids (FFAs) can be mobilized from adipose tissue and used directly or oxidized by the liver to ketone bodies to be used for fuel by muscle.

Defects in fatty acid oxidation, such as medium-chain acyl–coenzyme A dehydrogenase (MCAD) deficiency, result in severe hypoglycemia with absence of hyperketonemia/ketonuria.

The diagnosis is often made by measurement of plasma acyl carnitine profiles and urinary organic acids and dicarboxylic aciduria.

Valproic acid may interfere with FFA oxidation and be associated with hypoglycemia in infants.

Chronic Therapy: Based on Specific Etiology of Hypoglycemia

- Hyperinsulinism
- Diazoxide: 5–15 mg/kg/day in 3 doses; start with maximum dose and reduce.
- Octreotide: 2–5 µg/kg/day and increase to 20 µg/kg/day SC q6–8h as needed.
- Cornstarch (uncooked): 1–2 g/kg/day q4–6h.

Partial pancreatectomy.

- Hormonal deficiencies
- Cortisol: hydrocortisone, 6–10 mg/m^2/day.
- Growth hormone: 0.3 mg/kg/wk in 7 daily doses each week.

Substrate deficiencies: Frequent feedings consisting of high-carbohydrate diet

- Glycogen storage diseases (particularly GSD I) ▪ Cornstarch: 1–2 g/kg q4–6h.
- Overnight nasogastric glucose (~8 mg/kg/min).
- MCAD deficiencies
- Avoid prolonged fasting.
- ± Oral carnitine. 100 mg/kg/day in 3–4 doses. ▪ .

Disorders of gluconeogenesis

- Fructose-1-phosphate aldolase deficiency (hereditary fructose intolerance): Avoid all fructose-containing foods.
- Fructose-1,6-diphosphatase deficiency: Avoid prolonged fasting; reduce fructose intake.
- Other enzyme defects: Avoid prolonged fasting