

Episode 16 - Diabetes in Children

Epidemiology

1 in 500 children. 97% of cases are type1 diabetes mellitus. The most common cause is autoimmune destruction of beta-cells in the islets of Langerhans.

Pathophysiology

Poor control in childhood leads to the long-term complications of diabetes seen in adulthood. Vascular disease does not present in childhood. Main issues are hypoglycaemia and hyperglycaemia. Children may not be aware of hypoglycaemia. Hyperglycaemia may be precipitated by starvation, illness, injury and surgery, all of which lead to a surplus of counter-regulatory hormones.

Perioperative management

- It is not just about glucose - it is about the metabolism of all energy substrates.
- Minimise fasting times (no more than one missed meal).
- All diabetics should have some form of background insulin at all times.

Blood glucose monitoring

	Monitoring interval (preoperative)
Target plasma glucose is 6-10 mmol/L	1 hourly
Major surgery	every 30 minutes
Aged < 3 years	(this is also the monitoring interval during intraoperative care)
Glucose < 6 mmol/L	

Hyperglycaemia

Perioperative target range is 6-10 mmol/L. Commence treatment for hypoglycaemia if it falls below 6 mmol/L but only commence treatment for hyperglycaemia if glucose is > 14 mmol/L. Step i) exclude diabetic ketoacidosis (ketones, pH, potassium); step ii) commence VRII.

Insulin

Insulin formulation	Perioperative management
Long-acting (once daily)	Continue as usual (night before surgery)
Intermediate-acting (twice daily)	Normal evening dose (night before surgery) Half-morning dose (day of surgery)
Short-acting (three times daily, with meals)	Omit until eating and drinking normally (aim to avoid post-operative nausea and vomiting, and ileus).
Metformin	Omit on day of surgery (risk of lactic acidosis) unless minor procedure of short duration.

Preoperative optimisation for elective surgery

There is some benefit to optimising preoperative glucose control in adults but it does not improve the complications that have already manifested themselves, e.g. ischaemic heart disease, cerebrovascular disease, renovascular disease. In children it may be beneficial if stabilising their glucose control leads to a reduced risk of perioperative hypoglycaemia or hyperglycaemia.

Emergency surgery

- Unwell with likely metabolic upset (fluids, electrolytes, acid-base).
- Pain (increase in circulating counter-regulatory hormones).
- Missed meals and unpredictable fasting times (emergency list)
- At risk of diabetic ketoacidosis (measure ketones and pH alongside blood glucose)
- Monitoring (1-2 hourly preoperatively, every 30 minutes intraoperatively)
- Management - variable rate insulin infusion and consultation with diabetic specialist team (the fluids that run alongside the insulin are the same as those used in adult practice - 0.45% sodium chloride with 5% glucose, and 0.15% potassium chloride (which is 20 mmol/L)).

Hypoglycaemia

Presentation - children might not be aware of hypoglycaemia and may not present in the same manner as adults. Symptoms and signs include: sweating, pallor, headache, lethargy, irritability.

Treatment should be considered for a glucose of < 6 mmol/L (shortened monitoring interval, glucose supplementation). The key thing is to prevent it dipping below 4 mmol/L.

Do not wait for intravenous access. It is a medical emergency. Commence with enteral glucose or glucose containing gels that can be given via the buccal route or if necessary, intramuscular Glucagon.

	Treatment of hypoglycaemia (monitoring every 15 minutes)
< 6 years (20 kg)	Glucogel $\frac{1}{2}$ tube (buccal) Glucagon 0.25 mg (intramuscular) Glucose 10% 2 ml/kg (intravenous) = 200 mg/kg
> 6 years (20 kg)	Glucogel 1 tube (buccal) Glucagon 0.5 mg (intramuscular) Glucose 10% 2 ml/kg (intravenous) = 200 mg/kg
> 12 years (40 kg)	Glucogel 1 tube (buccal) Glucagon 1 mg (intramuscular) Glucose 10% 2 ml/kg (intravenous) = 200 mg/kg

Note: 200 mg/kg of intravenous glucose is predicted to raise plasma glucose by about 3 mmol/L (60 mg/dL). This may be short lived however, depending on the rate of glucose consumption. Monitoring should continue until measurements have stabilised. A glucose infusion should be commenced if this does not occur (start at 5 mg/kg/min = 3 ml/kg/hr of 10% Glucose or 6 ml/kg/hr of balanced crystalloid solution with 5% glucose). Requires ongoing review.
