

Both hypoglycaemia (low blood glucose level) and hyperglycaemia (high blood glucose level) occur in children.

HYPOGLYCAEMIA

INTRODUCTION

A low blood glucose level is defined as $<4.0\text{mmol/L}$, but it must be remembered that the clinical features of hypoglycaemia may be present at higher levels. Clinical judgement is as important as a blood glucose reading. The reversal of hypoglycaemia is an important pre-hospital intervention. Hypoglycaemia if left untreated may lead to the patient suffering permanent brain damage and may even prove fatal.

Causes of hypoglycaemia

DIABETES MELLITUS

Diabetes mellitus (DM) may be due to a relative excess of insulin over available glucose in the management of DM as in adults. However, the classical symptoms of hypoglycaemia in an adult may NOT be present and children may have a variety of odd symptoms with low blood sugars. Listen to the parents and if in any doubt check a blood glucose level.

OTHER CAUSES OF 'LOW' BLOOD GLUCOSE LEVELS:

Seriously ill or injured babies and sometimes children may burn up all their liver stores of glycogen and become hypoglycaemic. This is why it is crucial to check the blood glucose level in any child with a decreased conscious level (*refer to decreased level of consciousness guideline*).

- there are also some rare metabolic illnesses of profound hypoglycaemia in children (usually babies). They, too, cannot mobilise any more sugar from the liver.

MANAGEMENT OF HYPOGLYCAEMIA

If the child is conscious, where possible, give **oral glucose tablets, gel or drinks**. It can be very difficult to gain cooperation e.g. in aggressive, confused toddlers and unfortunately parents are only likely to call you if they are having a problem.

Dextrose 40% gel MAY be given (*refer to Dextrose 40% gel protocol for dosages and information*) in children with a decreased level of consciousness it should be applied to the buccal mucosa and care taken to avoid aspiration.

Glucagon may be used intramuscularly (*refer to glucagon protocol for dosages and information*) while vascular access is sought. It may be life-saving in a difficult situation though is not popular with hospital paediatricians, because it often causes severe vomiting which can make it impossible for the child to take oral fluids /food.

Intravenous **glucose 10%** may be given (*refer to glucose 10% protocol for dosages and information*). The dose may be titrated to the response and less may be required. Glucose 50% must **NOT** be used as it may cause brain damage, even in older children.

If you are so close to the hospital that treatment need not be carried out, do give a pre-alert that the child is hypoglycaemic, so that they can have suitable glucose solutions ready to give on arrival.

Hypoglycaemia in NON diabetic children and babies.

The same principles and treatment apply as for diabetics but remember they have already burnt up their liver stores of glycogen, so glucagon is much less likely to work. If the situation is desperate, it is worth a try but attempts to obtain vascular (remember intraosseous) access should be continued because it cannot be expected that glucagon will have a significant effect.

HYPERGLYCAEMIA

Causes of hyperglycaemia

DIABETES MELLITUS (DM)

For background of the pathophysiology of this illness, *refer to glycaemic emergencies guideline*.

Diabetes mellitus can occur in infants. Such children may be very difficult to manage, so called "brittle". They may have a special protocol, ask and listen to the parents.

Type 1 (insulin dependent) DM is nearly universal in children though occasional Type 2 (non insulin dependent) DM is now seen, usually in association with severe obesity.

DIABETIC KETOACIDOSIS (DKA)¹

Diabetic Ketoacidosis (DKA) in new diabetics may occur relatively rapidly in children, sometimes without a long history of the classical symptoms. Severe acidosis and Kussmaul's breathing (deep sighing respiration) are common.

True shock (circulatory failure) as opposed to dehydration, is relatively uncommon in children with DKA. The severity of the raised glucose is not a good indicator of the onset of DKA and certainly most children with a blood glucose level of <11 are unlikely to have DKA. Nevertheless children with quite severe DKA (perhaps with blood glucose levels in the 20s) may still appear quite well. It is important to know whether illness is due to DKA in children because the fluid management is crucial. If children are given fluid too fast in DKA they can get cerebral oedema and die. This is a much more common complication than in adults particularly in very small children and adolescents (ketone meter, where available, may be useful in a diabetic child in differentiating DKA from infection).

OTHER CAUSES OF 'RAISED' BLOOD GLUCOSE LEVELS:

- spurious testing – the child's fingers may have been in contact with sugary things like sweets before testing
- quite commonly, suddenly seriously acutely ill or convulsing children may have a raised blood glucose level on testing with a glucose meter. This is usually due to the stress of the physical problem. It should be reported to the hospital so that it can be rechecked when the crisis is over. It requires no other treatment.

MANAGEMENT OF HYPERGLYCAEMIA²

Assess and start to correct:

- **AIRWAY**
- **BREATHING**
- **CIRCULATION**
- **DISABILITY** (mini neurological examination)
- **Evacuation**

Usually **NO** active treatment will be required except timely medical attention and good handover.

Uncommonly the child will be shocked with evidence of circulatory collapse.

Administer high concentration oxygen (O₂) via a non-re-breathing mask, using the stoma in laryngectomee and other neck breathing patients. High concentration O₂ should be administered routinely, whatever the oxygen saturation

Obtain intravenous access (intraosseous if the child is in a life threatening situation and only this is possible).

In **extremely exceptional** circumstances (where there is tachycardia and a prolonged capillary refill time) intravenous saline may be given **very slowly** in a dose not exceeding 10ml/kg. Excessive fluid administration may cause cerebral oedema.

Key Points – Glycaemic Emergencies

- Both high and low blood glucose levels occur in children.
- Usually, in hyperglycaemia, no active treatment will be required except timely medical attention and good handover.
- Administer high concentration O₂ therapy.
- In hypoglycaemia administer glucose: in conscious children administer oral glucose tablets, gel or drinks; in children with a decreased level of consciousness apply Dextrose 40% gel to the buccal mucosa, taking care to avoid aspiration; glucagon may be used intramuscularly; intravenous glucose 10% titrated to the response.

REFERENCES

¹ Dunger DB, Sperling MA, Acerini CL, Bohn DJ, Daneman D, Danne TPA, et al. European Society for Paediatric Endocrinology/Lawson Wilkins Pediatric Endocrine Society Consensus Statement on Diabetic Ketoacidosis in Children and Adolescents. *Pediatrics* 2004;113(2):e133-140.

² National Collaborating Centre for Women's and Children's Health. Type 1 diabetes – diagnosis and management of type 1 diabetes in children and young people. London: RCOG Press, 2004.

METHODOLOGY

Refer to methodology section.