Hypo / Hyperglycaemia

Definition

An abnormally high (hyper) or abnormally low (hypo) level of glucose present in the bloodstream.

Blood glucose levels are derived from carbohydrates. The carbohydrates are broken down in the digestive tract, and are then absorbed into the bloodstream. The blood glucose levels are usually tightly controlled, so that optimum levels of glucose are maintained in the blood at all times. The level of glucose in the blood needs to be between 60 – 100mg of glucose per 100ml of blood. Blood glucose levels are taken as millimoles per litre, and normal levels record at around 3.3 – 5.5 mmols/l.

The endocrine system provides the main regulatory mechanism, and this releases hormones into the bloodstream which control the metabolism.

The pancreas produces insulin and glucagon, which are both needed in the regulation of blood glucose.

Insulin facilitates the entry of glucose from the blood into cells, such as the liver, where the glucose can be stored as glycogen, which is an energy source.

Glucagon reverses this process by converting the stored glycogen back into glucose. This glucose is then released into the bloodstream.

Hypoglycaemia
Unlike other cells in the body, the brain can use only glucose as its source of energy. If the glucose levels in the blood become too low, the brain cells are literally starved. The signs and symptoms of low blood sugar (listed below) are as a result of the starving brain cells becoming disordered, and the release of adrenaline that this disorder causes.

Hypoglycaemia can result from:

- Insufficient dietary intake of carbohydrate.
- Anxiety due to the nervous tissue requiring more energy than usual.
- Over exertion resulting in a 'burn off' of too much glucose.
- Infection due to the increased metabolic rate utilising more glucose.
- Excess insulin being present for the level of glucose in the blood at a particular time. (See Diabetes)

Hyperglycaemia
The glucose levels in the blood become too high, resulting in a build up of acid. The signs and symptoms of high blood sugar (listed below) are as a direct result of the body trying to excrete this acid build up. Hyperglycaemia usually occurs in patients with undiagnosed diabetes or poorly controlled Type 1 diabetes (see below). This condition is much less common than hypoglycaemia. If the glucose levels become very high then this can induce similar physical signs and symptoms to hypoglycaemia and can eventually lead to coma.

Possible signs and symptoms

Hypoglycaemia	Hyperglycaemia
Fast onset: 2 minutes to 1 hour	Slow onset: 12 to 48 hours
Deteriorate rapidly: Weakness, dizziness, confusion, memory loss lack of coordination, slurred speech, bizarre, uncharacteristic, uncooperative, possibly violent behaviour.	Deteriorate slowly during onset: Drowsy, lethargic behaviour, can show similar signs and symptoms to hypoglycaemia.
Unconsciousness within 1 hour untreated.	Unconsciousness if left
Skin: pale, cold and clammy	Skin: dry and warm
Breathing: normal, or shallow and rapid	Breathing: deep, sighing breaths
Pulse: rapid	Pulse: rapid
Other possible symptoms:	Other possible symptoms:
Tonic/Clonic convulsions (fitting) Signs and symptoms can be confused with drunkenness	Excessive thirst Excessive urination Hunger

Diabetes

Diabetes is the name for a condition suffered by a person who has lost the ability to naturally regulate their blood glucose levels.

Insulin breaks down the glucose that we digest, so that it can be used by the cells of the body or stored for later use. In summary, insulin reduces the amount of sugar in the blood.

Hypo / Hyperglycaemia

In Type 1 diabetics the pancreas cannot produce insulin at all, so whenever insulin is required it must be injected.

Type 2 diabetics do produce insulin, but the insulin is not very effective, or there is not enough. This means that Type 2 diabetics have an insulin deficiency that will vary from person to person. This form of diabetes can be controlled by monitoring the diet without the need for medication, but can also require the person to take tablets, and in some cases there will still be the need for insulin injections.

It is essential that all diabetic patients monitor their blood glucose levels carefully and take the appropriate action required to maintain normal glucose levels. This is achieved by regularly measuring blood glucose using a finger prick test (a small drop of blood is absorbed onto a test stick, which is then inserted into a machine that measures the glucose concentration.)

Management

Hypoglycaemia
The treatment for hypoglycaemia is to increase the blood glucose levels as quickly as possible, and then to try to maintain them at a reasonable level so that the condition does not re-occur.

There are various ways that this can be done:

For the conscious casualty
The dental team need to give the casualty glucose in any convenient form available. The following are suitable:

- Glucose tablets (e.g. Lucozade tablets)
- Glucose drink (sparkling, if possible – isotonic sports drinks are ideal) alternatively glucose
- Powder can be mixed with water
- Two teaspoons of sugar (or 2 -3 sugar lumps)
- Chocolate
- 200ml milk

Once the condition of the casualty starts to improve, you must then give them some slow – release carbohydrate (biscuits, bread or bananas are ideal). Think of a roller-coaster ride – the blood glucose levels have dropped quickly. When glucose is then consumed a 'sugar rush' is created, causing an equally rapid rise in the blood glucose level. Once the peak is hit, however, the levels will start to drop again. The following intake of a slow – release carbohydrate will help prevent this drop from becoming too low again, and will give the casualty time to return home and administer any further medication if necessary.

Stay with the casualty and let them rest until the level of response is fully alert (ABCDE)

If the patient does not respond to treatment quickly, or they are unmanageable, send for the emergency services.

Note: If the conscious casualty is having difficulty swallowing, then it may be safer to administer a Glucose Gel instead. The proprietary glucose gel available is administered into the buccal sulcus and is quickly absorbed across the vascular oral mucosa (within 1 – 2 minutes).

Once the condition of the casualty improves and it becomes safe to administer glucose orally, do this if necessary, but remember to give slow release carbohydrate also, as mentioned earlier. If the condition does not improve quickly, or deteriorates, send for the emergency services if not done already.

For the unconscious casualty
If the casualty becomes unconscious, maintain Airway and Breathing and send someone to call for the emergency services. If they have already been alerted, ensure that they are informed of the collapse as soon as possible. Ensure that the casualty is in the Recovery Position and administer oxygen. Be prepared to resuscitate if necessary.

Injection of glucagon
This hormone will increase the blood glucose levels by stimulating the conversion of glycogen into glucose. It is to be used in the unconscious hypoglycaemic patient and is administered by intramuscular (IM) injection. Do not give glucose orally to the unconscious casualty. The dose of glucagon is 1mg and the proprietary preparations all contain this dose. Try to ensure that it comes in a pre-filled syringe if possible as this will make preparation easier. The most common for this type of drug is a powder/liquid combination. The liquid is present in the syringe. Remove the needle cover and inject all the liquid through the rubber bung on the bottle of powder and then shake vigorously to ensure that the liquid/powder is mixed thoroughly. Draw the liquid back into the syringe, and then hold the syringe with the needle facing upright and flick or tap the side of the barrel to disperse any air bubbles. When the bubbles move to the top of the syringe, push the plunger gently to release the air.

The most efficient (and easiest) muscle site is the outer surface of the casualty's upper thigh. This is a large muscle and the drug will be absorbed rapidly into the bloodstream, within 5 – 15 minutes. In an emergency situation there is not usually a need to remove clothing as the needle is quite fine.

Note: It is strongly advisable to receive a practical demonstration to show the technique required in the administration of any type of injection, and so for that reason it will not be discussed within this article. Always ensure that you are wearing protective gloves before giving any form of injection, and dispose of sharps safely.

Glucagon is very short – acting so when the patient recovers consciousness they should be given slow release carbohydrates as described earlier.

Hypo / Hyperglycaemia

Hyperglycaemia
When the diabetic patient becomes unwell in the dental surgery it is usual to treat for hypoglycaemia, as this is the most likely cause of collapse. It is only when the patient fails to recover and a blood glucose measurement obtained (see below) that hyperglycaemia would be suspected. As the blood glucose levels are already high the initial treatment of giving glucose should not cause concern to dental staff (there is already too much glucose in the system) giving more in the short – term will not cause a rapid deterioration. However, if no improvement is observed then this should be stopped and the emergency services called as soon as possible

Prevention

It is important to ensure that a clear recording of diabetes is entered in the patient's Medical History along with the type (Type 1 or Type 2).

It is also important to ensure that suitable appointment times are made so as to avoid disruption of the patient's normal routine (meal times, insulin injections etc.) Dental staff should be aware that anxiety and infection both increase glucose demand and may result in unexpected hypoglycaemia. Patients who are diabetic should be asked if they have taken their medication and food as usual before any dental treatment, and when their next food and medication is due.

When patients have chronic poorly controlled diabetes, enquiries should be made as to how regularly the patient experiences low blood sugar levels or 'hypos', and the dental team need to be aware and alert to this possibility occurring. It is a good idea to suggest that the patient brings some glucose tablets or similar with them when they attend for any treatment.

Additional information and often reassurance can quickly be obtained by measuring the patient's blood glucose levels.

Devices to measure blood glucose are relatively inexpensive and are quick and easy to use. They are small, so can easily fit into your normal drug box.

The Resuscitation Council (UK) advised in 2006 that dental practices should have an automated blood glucose measurement device as part of their medical emergency and resuscitation equipment.

Storage of glucagen
Glucagen is a vaccine that is required to be stored at a safe temperature range of between 2 and 8 degrees Centigrade. AIM for 5 degrees Centigrade.

Failure to store correctly will reduce vaccine efficiency or cause vaccine failure.

- Use a dedicated vaccine refrigerator (no food items).
- Protect from light.
- Always check Glucagen for expiry date.
- Defrost and calibrate as per manufacturer's instructions.
- Store in original packaging and unopened.
- Keep vaccine away from walls and air vents in refrigerator.
- Do not keep near food or medical specimens.
- Do not store vaccine in refrigerator door or in plastic container/ trays within the refrigerator.

If the practice does not have a refrigerator you must store Glucagen in the emergency drugs box. Glucagen can be stored outside the refrigerator for up to a maximum of 18 months. Either when purchased or taken out of the refrigerator you must change the expiry date and place a new one with permanent ink.