Oral Glucose Tolerance Test with insulin

Test Name: CHILD GLUCOSE TOLERANCE TEST WITH INSULIN DFT

Principle

The increasing prevalence of obese children has also resulted in an increased number of children at risk of developing insulin resistance, which can lead to hyperinsulinaemia and eventually type 2 diabetes mellitus. In contrast to the diagnostic assessment of diabetes, the diagnosis of insulin resistance is less clear, depending on the given situation of an individual. There are no clear criteria to define insulin resistance in children at present.

Indication

- Obese patients with clinical signs of insulin resistance (acanthosis nigricans) and/or a family history of diabetes.

Precautions

- This test should not be performed in patients who fulfil the criteria for diabetes mellitus: Two diagnostic glucose results on separate occasions (either fasting plasma glucose ≥ 7.0 mmol/L or random plasma glucose of ≥ 11.1 mmol/L), or one diagnostic glucose result and clinical symptoms of diabetes e.g. polydipsia, polyuria, ketonuria and rapid weight loss
- This test should not be performed on patients who are under physical stress e.g., post surgery, trauma or infection or extreme psychological stress as these may give misleading results.
- This test should not be performed on patients with hypokalaemic periodic paralysis.
- Do not perform this test at the same time a synacthen test. However, the oral glucose tolerance may be performed after the synacthen test.

Side Effects

Some patients feel nauseated and may have vasovagal symptoms during this test.

Preparation

- Before subjecting a patient to an OGTT ensure that there has been an appropriate diagnostic work-up (see WHO guidelines).
- OGTT must NOT be performed if the fasting capillary (finger prick) or venous blood glucose concentration is > 7.0 mmol/L or a random glucose > 11.0 mmol/L.
- Do not perform glucose tolerance tests on patients known to be suffering from an infection, patients with uncontrolled thyroid dysfunction, or patients recovering from severe stress (e.g., surgery) as these alter insulin sensitivity.
- Ensure that the child has had an adequate diet (minimum of 150 g/day of carbohydrate) for at least 5 days before the test.
- Fast the patient overnight (4 hours for infants) but avoid more prolonged fasting. Drinks of water (no sweet drinks) are allowed during this period.
- Physical exercise is not allowed in morning prior to and/or during the test.
- Test should be performed in the morning.

Protocol

1. Ensure the patient's fasting blood glucose concentration, checked with a capillary blood sample obtained by finger prick testing with a glucometer, is ≤7.0 mmol/L before proceeding with the test. If the result is higher, take a venous blood sample and send it to the lab to confirm the glucometer result.

2. Prepare the glucose load using **ONE** of the following:
   - ***POLYCAL® (Nutricia Clinical) liquid*** **(contains 0.66g anhydrous glucose per mL; 1.51 mL = 1g anhydrous glucose):** Dose of POLYCAL must be adjusted for the weight at a dose of 2.64 mL POLYCAL/kg body weight (maximum dose 113 mL POLYCAL, equivalent to a 75g glucose load). Add water to make up to a volume of 200 mL.

OR

- ***Glucose tolerance test (Rapilose) Solution:*** Contains 75g anhydrous glucose in 300 mL. For children weighing less than 43kg, the dose is 7 mL (1.75g anhydrous glucose)/kg body weight. The total dose should not exceed 75g anhydrous glucose. If the volume is less than 200 mL, add water to make up to 200 mL.

3. Take a basal sample for glucose and insulin (t = 0). Write t = 0 on the tube of blood. Besides sending the sample to lab, use the sample to check bedside point of care blood glucose and record it in the notes.
4. The child should drink the glucose load over a period of about 5 min.
5. Take further blood samples for glucose and insulin at 120 min after finishing the glucose drink and record the sampling time on the tubes. Besides sending the sample to lab, use the sample to check bedside point of care blood glucose and record it in the notes.

Time Points:

Time (min)	Procedure	Blood Samples
0	Take blood then administer glucose load	Glucose, Insulin, POCT glucose
120	-	Glucose, Insulin, POCT glucose

Samples

Glucose 1.2 mL fluoride oxalate tube (yellow top). A drop of blood for bedside blood glucose measurement.

Insulin 1 mL lithium heparin (orange top)

On completion of the test, immediately send all the samples together to the laboratory. The insulin samples must reach the lab within 4 hours of collection.

Interpretation

The 2010 consensus statement recommends there is no clear cut-off to define insulin resistance in children and surrogate measures such as fasting insulin are not ideal.

The following cut-off values taken from SPEG[2] provide useful guidance:

- Fasting insulin is <60 pmol/L in pre-pubertal children or children younger than 10 years or <120 pmol/L in children post pubertal children.
- Peak during the test is normally <600pmol/L.
- Fasting insulin of 120 - 300 pmol/L or peak insulin of 600 - 1800 pmol/L is suggestive of mild to moderate insulin resistance.
- Fasting insulin of >300 pmol/L or peak insulin of >1800 pmol/L is suggestive of severe insulin resistance.

References

1. Levy-Marchal C., Arslanian S., Cutfield W., Sinaiko A., Druet C., Marcovecchio M.L., Chiarelli F. & the Insulin Resistance in Children Consensus Conference Group (2010) Insulin resistance in children: Consensus, perspective and future directions. JCEM 95(12): 5189 – 5198.
2. Managed clinical network of Scottish Paediatric Endocrine Group (SPEG MCN) Dynamic function test handbook for Clinicians January 2012