

Glucagon Stimulation Test for Growth Hormone

Test Name: CHILD GLUCAGON STIMULATION FOR GROWTH HORMONE DFT

Principle

This test is commonly used for the evaluation of growth hormone deficiency (GHD). Glucagon causes blood glucose to increase leading to insulin release and therefore indirectly stimulating GH and ACTH release through provocation of the hypothalamic-pituitary axis.

Indication

• See Diagnosis of Growth Hormone Deficiency

Precautions

- The test should not be performed on a patient with phaeochromocytoma or insulinoma as it may provoke an attack.
- The test should not be carried out following starvation of >48 hours or in the presence of a glycogen storage disease. The inability to mobilise glycogen may result in hypoglycaemia.
- The test should not be carried out in patients with severe hypocortisolaemia (9 am level <100 nmol/L).
- Thyroid function must be normal as thyroxine deficiency may reduce the GH response.

Side Effects

Nausea and abdominal pain are common (30%) and patients may rarely vomit.

Preparation

- Thyroid function and cortisol must be checked to rule out panhypopituitarism.
- GH should be stopped for at least 4 weeks prior to the test.
- Patients must fast for 8 hours prior to the test (only water is allowed).
- A small amount of water may be swallowed during the test.
- Sex steroid priming may be necessary, see Diagnosis of Growth Hormone Deficiency

Protocol

Children can become hypoglycaemic after glucagon administration, usually 90 – 120 minutes post dose. Children <8 yrs of age are at particular risk. Check glucose levels (by glucose meter) at the time of every sample. Check that the child is responsive at the time of every sample. If they do not respond, then follow instructions for the emergency management of hypoglycaemia.

- 1. Insert an indwelling 22 gauge, blue, cannula and take a basal blood sample (t = -30). Wait 30 minutes before taking the baseline (t = 0) sample for growth hormone as cannulation may cause GH to rise.
- 2. Check glucose level by meter.
 - If glucose < 2.6 mmol/L at the start of the test DO NOT PROCEED WITH TEST & DO NOT ADMINISTER GLUCAGON. Discuss with endocrine team. It may be necessary to administer 10% glucose 2 ml/kg throughout the test. Take a sample for glucose and growth hormone before administering glucose.
 - If glucose level > 2.6 mmol/L then administer *glucagon:*

Generic	Route	Dose	Frequency
Glucagon	i.m	30 micrograms/kg of body weight	Bolus
		up to a maximum dose of 1 mg.	

- 3. Take further blood samples for growth hormone at 60, 90, 120, 150 and 180 min post glucagon administration.
- 4. Observe for signs of hypoglycaemia throughout the test and record in patient's notes.
- 5. Remember to check the child's glucose level by meter and the responsiveness at every sample.

Endocrine Dynamic Function Test Protocols for use	Page 34 of 100	
See the Intranet for the latest version	Version Number: 8	August 2024



6. A sweet drink and a full meal must be eaten and tolerated after the test and the child should be observed for 1 hour after the test. Blood glucose (by meter) must be >4 mmol/L before discharge.

Time Points:

Time post glucagon (min)	Procedure	Blood Sample
-30	Check blood glucose using meter. Check ketones using meter if blood glucose <3.0 mmol/L.	Growth hormone
0	Check blood glucose using meter	Growth hormone
60	Check blood glucose using meter	Growth hormone
90	Check blood glucose using meter	Growth hormone
120	Check blood glucose using meter	Growth hormone
150	Check blood glucose using meter	Growth hormone
180	Check blood glucose using meter	Growth hormone

Samples

Growth Hormone 1.2 mL clotted blood (white top)

Interpretation

- A peak plasma GH concentration of ≥7 μg/L indicates a normal response to the test and no further investigations are required.
- A peak plasma GH concentration of <5 μ g/L is diagnostic of growth hormone deficiency but requires a second GH provocation test to confirm the diagnosis.
- A peak plasma GH concentration of 5–7 μ g/L may still be indicative of GH deficiency and requires further investigation.
- In adults, a peak plasma GH concentration of <3 μg/L is diagnostic of growth hormone deficiency.
- Peak GH responses are also highly dependent on both short-term nutritional status and on BMI –
 higher peak GH levels after short-term fasting and in those with lower BMI.

References

- 1. Basildon and Thurlow University Hospitals NHS Foundation Trust Clinical Biochemistry Department paediatric department Glucagon Stimulation test Paediatric protocol
- 2. Lim S.H., Vasanwala R., Lek N. and Yap F. (2011) Quantifying the risk of hypoglycaemia in children undergoing the glucagon stimulation test. *Clinical Endocrinology* **75**: 489 494
- 3. Strich D., Terespolsky N. and Gillis D. (2009) Glucagon stimulation test for childhood Growth Hormone deficiency: Timing of the peak is important. *The Journal of Pediatrics* 415 419
- 4. Secco A., di lorgi N., Napoli F., Calandra E., Ghezzi M., Frassinetti C., Parodi S., Casini M.R., Lorini R., Loche S. and Maghnie M. (2009) The Glucagon Test in the diagnosis of growth hormone deficiency in children with short stature younger than 6 years. *JCEM* **94**(11): 4251-4257

Endocrine Dynamic Function Test Protocols for use	Page 35 of 100	
See the Intranet for the latest version	Version Number: 8	August 2024