Anterior Pituitary Function Tests for Children (Glucagon Stimulation Test)

Indication

Pituitary function tests are often requested in the diagnostic evaluation of short children. The aim under these circumstances is to determine the status of the growth hormone (GH) axis. However, a prolonged test of GH secretion with multiple blood samples is an invasive procedure and in order to reduce the possible need for repeat investigation, it has been traditional to include the use of TRH and GnRH. Recent data suggests that additional stimulation with TRH and GnRH does not give any information that would not have been given by baseline measurements of gonadotropins, sex hormones, TSH and T4.

Our practice is to use the glucagon test for evaluation of growth hormone and cortisol secretion, and to include TRH or GnRH only if there is a specific indication for these tests.

Side effects

There is a greater risk of hypoglycaemia in children as they have smaller reserves of fat and carbohydrate and therefore, contingency plans must be available for its development. Check a blood sugar on meter with the blood test or if symptomatic. Most subjects given glucagon experience nausea and may vomit.

Preparation

Priming with sex steroids is recommended in prepubertal children who are over 10 years of age (either chronological or bone age). Prescribe stilboestrol 1mg 12 hourly for 48 hours prior to test (total of 4 doses).

This test must be performed fasting and in the morning (at least 4 hours after any food and drink - although water may be taken during the test).

Requirements

The following equipment should be immediately available: see protocol for emergency treatment of hypoglycaemia during ITT/glucagon test

1. liquid drink (squash/milk), food (toast/biscuits)
2. glucose powder, strong oral glucose solution (as for diabetics)
3. 10% glucose (500 mL) and IV giving set
4. Glucose test strips and lancets etc
5. hydrocortisone 100 mg for IV use
6. 7 plain (serum gel) tubes
7. an intravenous cannula

Drug administration: Glucagon 15 microgram/kg by IM injection, maximum 1 mg.

Procedure

| time 0 min | take 5 mL blood for FT4, TSH, LH, FSH, prolactin, GH, ACTH, IGF-1, cortisol & testosterone or oestradiol, immediately give glucagon intramuscularly |
| time 30 min | take 3 mL blood for cortisol & GH |
| time 60 min | take 3 mL blood for cortisol & GH |
| time 90 min | take 3 mL blood for cortisol & GH |
| time 120 min | take 3 mL blood for cortisol & GH |
| time 150 min | take 3 mL blood for cortisol & GH |
| time 180 min | take 3 mL blood for cortisol & GH |

Check Blood Glucose on meter
Interpretation

An adequate cortisol response is defined as a rise of greater than 200 nmol/L to above 600 nmol/L. The value of 600 nmol/L is used to exclude adrenal insufficiency in view of variation between analytical methods. An adequate GH response is a rise to a value greater than 7 micrograms/L (20 mU/L).

In children, and depending on the clinical context, a lower peak cortisol level (500 to 550 nmol/L) is occasionally acceptable. Please discuss any suboptimal results with the paediatric endocrinology department.

Reference

Protocol For The Emergency Treatment Of Hypoglycaemia During The Glucagon Test

http://www.pathology.leedsth.nhs.uk/dnn_bilm/Investigationprotocols/ProtocolfortheemergencyRxofhypoglycaemia.aspx

**Indication:**

This procedure is a guide to the treatment of children who become hypoglycaemic (glucose < 2.6 mmol/L) during or after a glucagon test, or during an insulin tolerance test. The following equipment should be immediately available during the test procedure:

1. Lucozade (or equivalent): up to 10kg give 25mls; up to 30kg give 50mls; up to 50kg give 75mls
2. Food (toast/biscuits)
3. Glucose tablets; up to 10kg give 1 tablet; up to 30kg give 2 tablets; up to 50kg give 3 tablets.
4. Glucogel; up to 10kg give half tube (5g); up to 30kg give give 1 tube (10g); up to 50kg give 1.5 tubes (15g) - administer gel to the inside of the patients cheek
5. 10% glucose (500 mL) and iv giving set (see dose below)
6. Glucose meter and strips and lancets etc
7. Hydrocortisone 100 mg for IV use.

**Emergency treatment:**

**IF THE CHILD REMAINS CONSCIOUS**

Give a drink of 25 to 75mls of Lucozade and recheck blood sugar after 15 minutes. If this is not successful, then repeat or give Glucogel. In most instances this will be sufficient to raise the blood glucose over 2 mmol/L. **DO NOT ABANDON THE TEST AT THIS STAGE**

- Lucozade: up to 10kg give 25mls: up to 30kg give 50mls: up to 50kg give 75mls
- Glucose tablets; up to 10kg give 1 tablet: up to 30kg give 2 tablets: up to 50kg give 3 tablets.
- Glucogel; up to 10kg give half tube (5g); up to 30kg give give 1 tube (10g); up to 50kg give 1.5 tubes (15g)

**IF THE CHILD BECOMES RAPIDLY UNCONSCIOUS**

- Abandon the test procedure, call Paediatric Medical Team to review child
- Do not attempt oral therapy
- Give intravenous glucose 200 mg/kg (**10% glucose at 2 mL/kg**) over 3 minutes

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<tr>
<th>Emergency IV 10% glucose bolus dose</th>
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<tr>
<td>weight</td>
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- Commence IV fluids of 0.45% Sodium Chloride/5% Glucose at a maintenance rate
- If hypoglycaemia recurs then repeat IV glucose bolus as above