

## GLUCAGON STIMULATION TEST - ADULTS

### INTRODUCTION

This test is used in the assessment of growth hormone (GH) and ACTH/cortisol reserve, especially when insulin-induced hypoglycaemia is contraindicated e.g. history of convulsions, hypoglycaemia or heart problems. Glucagon works by stimulating the release of GH and ACTH by a hypothalamic mechanism, indirectly stimulating cortisol secretion. GH response to glucagon is slow so the samples taken towards the end of the test are important.

### CONTRAINDICATIONS AND SIDE EFFECTS

- This test is unreliable in patients with diabetes.
- Pheochromocytoma or insulinoma (may provoke an attack)
- Starvation of >48 hours or glycogen storage disease (may result in hypoglycaemia)
- Severe hypocortisolaemia. If the 9am cortisol is below 50nmol/l, there is no need to perform the test for ACTH reserve, and it will only be performed for GH. In that case patients must be on their usual hydrocortisone replacement therapy, which should not be interrupted.
- Thyroxine deficiency may reduce GH and cortisol response, ensure patient is euthyroid.
- Severe coronary artery disease or uncontrolled hypertension.
- Active Cushing's or Acromegaly.
- Elevated ALT or AST.
- Nausea is a common side-effect (30%) and, rarely, patients may vomit.
- Hypersensitivity reactions to the agent used in the test, such as rash, skin itchiness, breathing difficulty etc. may occur, but these reactions are rare.

### PATIENT PREPARATION

Patients should be fasting from 10pm (water only), and the test is performed in the morning. Warn the patient that they may feel nauseated for the first part of test.

### Baseline Tests

Thyroid function (TSH and free T4) and cortisol levels **must** have been checked prior to undertaking this test to rule-out panhypopituitarism.

### Concurrent medication

GH should be stopped for at least 2 weeks prior to the test. If on hydrocortisone, omit dose from the afternoon on the day before the test. Recommence usual medication after the test.

**PROTOCOL**

1. The patient should rest in bed during the test.
2. Cannulate the patient and wait 30 minutes before taking baseline (time 0) samples, for glucose, growth hormone (GH) and cortisol.
3. Inject intramuscular glucagon (see box below).

**Glucagon dosage:**

- 1mg for adults weighing less than 90kg.
- 1.5mg for adults weighing more than 90kg.

4. Continue to take samples as per pro-forma at 60, 120, 180 and 240 minutes.
5. After completion of the test, check with the patient for any discomfort related to the examination and patient's vital signs, such as blood pressure, pulse and temperature. The patient should be advised to have a meal soon after.

**INTERPRETATION**

An adequate cortisol response is defined as an increase to greater than 450 nmol/L.

Severe GHD defined as  $GH < 3 \mu\text{g/L}$  and partial GHD  $GH < 5 \mu\text{g/L}$  There is probably a blunted response in hypothyroidism and obesity.

**SENSITIVITY & SPECIFICITY OF TEST**

This test is generally considered to be a slightly less reliable test of the ability of the pituitary to secrete GH and ACTH than the insulin stress test, but its diagnostic efficacy is defined by the response to the ITT. It is an excellent alternative in patients who cannot tolerate hypoglycaemia because of epilepsy, ischaemic heart disease or hypopituitarism.

**CONTACTS**

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**REFERENCES**

Imperial endocrinology handbook. <http://imperialendo.co.uk/Bible2018.pdf>. (accessed 22/05/2018)