

Department:	Biochemistry		
Site	All sites	Revision No:	4
Document title:	Endocrine Dynamic Function Test Protocols - Adults		

Insulin Tolerance Test

This test is the gold standard for assessing the integrity of the hypothalamo-pituitary-adrenal axis. Reproducibility among healthy volunteers is well documented but not known amongst patients with pituitary disease.

ACTH and GH are both released as part of the stress mechanism triggered by insulin induced hypoglycaemia.

Indications

1. Diagnosis of secondary adrenal failure.
2. Diagnosis of growth hormone deficiency.
3. Differentiation of Cushing's Syndrome from pseudo-Cushing's eg. Depression, Alcohol excess

Contraindications

- **Not to be used in children <16 years, refer to the Paediatric DFT protocols**
- Age >60 years
- Ischaemic Heart Disease
- Epilepsy or unexplained blackouts
- Severe panhypopituitarism, hypoadrenalism (9am cortisol <100nmol/L)
- Untreated hypothyroidism (impairs the GH and cortisol response),
- Glycogen Storage Disease
- Hypocalcaemia/Hypokalaemia

Preparations and precautions

- Patient should fast from midnight (water permitted) and be recumbent during the test.
- ECG must be normal and the patient's weight known
- Serum Cortisol must be >100nmol/L at 9am
- If patient is taking hydrocortisone the morning dose should be omitted
- For non-urgent cases, combined OCP and HRT should be stopped for 6 weeks prior to the test.
- Intravenous dextrose and intravenous hydrocortisone should be readily available

Side effects

- Sweating
- Palpitation
- Loss of consciousness
- convulsions due to severe hypoglycaemia (rare)

Author:	Katharine Hayden	Document No:	BC-CL-PR-16
Approved by:	Anne-Marie Kelly	Page 1 of 47	

Department:	Biochemistry		
Site	All sites	Revision No:	4
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Requirements:

- Soluble insulin (Actrapid):
 - 0.15U/kg for normal subjects
 - 0.10U/kg for hypopituitary subjects
 - 0.2-0.3U/kg for subjects with acromegaly, diabetes or Cushing's syndrome
- If symptomatic or biochemical hypoglycaemia is not achieved after 30 mins, consider giving additional half dose of insulin – discuss with endocrinology medical staff. This may be required for acromegalic and diabetic patients.
- 10% dextrose (250ml) or glucagon 1mg available for immediate administration for hypoglycaemia.
- 100mg ampoule of hydrocortisone, 0.9% saline available for immediate administration for hypoadrenal crisis
- Orange juice or Gluco juice
- Indwelling cannula, 3 way tap.
- 6 brown top serum tubes
- 6 yellow fluoride EDTA tubes

Procedure

PATIENT PREPARATION

- Patient should fast from midnight (water permitted) and be recumbent during the test.
- Perform a 9 am serum cortisol
- Result must be reviewed by a doctor
- If the patient is hypoadrenal for any reason (9am cortisol <100nmol/L) (or on hydrocortisone or prednisolone), the case must be discussed with senior medical staff before administration of insulin.
- Perform an ECG (which must be normal to proceed)
- Weigh the patient and document accurately, this is required to calculate the insulin dose required.

TEST

This test is potentially dangerous.
A doctor or nurse must be in attendance at all times.
Reverse hypoglycaemia with oral orange juice 150mls or Gluco juice (entire bottle), see Trust policy on treatment of hypoglycaemia in adults.
If, during the test, the patient shows severe symptoms/ signs of hypoglycaemia (drowsiness, incipient/actual loss of consciousness or fits) then terminate the test with 250ml 10% dextrose IV or 1mg Glucagon IM/IV/SC.
If feasible continue with blood sampling as adequate pituitary stimulation will have occurred.

Author:	Katharine Hayden	Document No:	BC-CL-PR-16
Approved by:	Anne-Marie Kelly	Page 2 of 47	

Department:	Biochemistry		
Site	All sites	Revision No:	4
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Minutes	Procedure	Samples
-30	Insert iv cannula	
0	Take basal blood samples Inject soluble insulin as an iv bolus	1 x brown top serum (GH and cortisol) 1 x yellow top fluoride EDTA (glucose)
30	Take samples for GH, cortisol and glucose Observe symptoms and record Take a glucometer strip reading	1 x brown top serum (GH and cortisol) 1 x yellow top fluoride EDTA (glucose)
60	Take samples for GH, cortisol and glucose Observe symptoms and record Take a glucometer strip reading	1 x brown top serum (GH and cortisol) 1 x yellow top fluoride EDTA (glucose)
90	Take samples for GH, cortisol and glucose Observe symptoms and record Take a glucometer strip reading	1 x brown top serum (GH and cortisol) 1 x yellow top fluoride EDTA (glucose)
120	Take samples for GH, cortisol and glucose Observe symptoms and record Take a glucometer strip reading	1 x brown top serum (GH and cortisol) 1 x yellow top fluoride EDTA (glucose)

If patient has a hypoadrenal crisis they should receive IV hydrocortisone 100mg and IV 0.9% saline (250-500ml or more based on clinical assessment)

Aftercare

Upon completion of test give patient a supervised meal and observe for 2 hours.

Ensure glucose is normal before discharging using glucometer.

Explain to the patient the need to eat well, to avoid strenuous exercise and to avoid driving for the rest of the day. Give the patient the aftercare advice leaflet.

Interpretation of results

The test can not be interpreted unless hypoglycaemia (**glucose < 2.2 mmol/L measured by the laboratory**) has been achieved or the patient has shown good evidence of symptomatic hypoglycaemia.

Normal Response

Glucose	<2.2mmol/L measured by the laboratory
Cortisol	Peak > 430nmol/L
Growth Hormone	Peak >6.7 µg/L

Growth hormone deficiency of sufficient severity for GH replacement to be of benefit, is present in adults whose peak GH is <3 µg/L.

The European and Endo Society guidelines and NICE define severe GHD as GH <3 µg/L and partial <5 µg/L

An inadequate GH response may occur in obese patients, and those who have had a recent spontaneous pulse of GH (high GH level at zero sample).

Author:	Katharine Hayden	Document No:	BC-CL-PR-16
Approved by:	Anne-Marie Kelly	Page 3 of 47	

Department:	Biochemistry		
Site	All sites	Revision No:	4
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Insulin Tolerance Test
Blood Glucose/Hypoglycaemia Chart

Name:

Hosp No:

Diagnosis:

ECG: Normal/Abnormal

Wt in Kg:

Dose of Insulin given:

TIME (mins)	Test Strip Glucose mmol/L	Symptoms
0		
30		
60		
90		
120		
150		

Symptoms experienced during ITT

Tick all that apply

Sweating

Tremor

Tachycardia

Hunger

Malaise

Headache

Drowsiness

Confusion

In coordination

Slurred Speech

Strange behaviour

Seizure(s)

Extra insulin given? YES/NO

Dose :

Author:	Katharine Hayden	Document No:	BC-CL-PR-16
Approved by:	Anne-Marie Kelly	Page 4 of 47	