



# Canberra Health Services

## Procedure

### Endocrine Dynamic Testing

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## Purpose

This document describes protocols for tests commonly performed in the Diabetes and Endocrine Service at Canberra Hospital Health Service (CHHS).

These tests take place in the Diabetes and Endocrine Service's procedure room and on some occasions may be performed on the ward.

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## Alerts

Any dynamic or provocative test has potential for side effects or adverse reactions. These are uncommon in experienced hands with appropriate precautions taken. Precautions, contraindications and adverse reactions are outlined in the protocols for each test and should be reviewed before each test is undertaken.

Important adverse reactions in various tests include:

- Cannula related complications - blood loss, infection
- Minor reactions to provocative agents e.g. nausea, vomiting
- Dehydration
- Hypotension
- Hypoglycaemia
- Allergic or anaphylactic reaction to a provocative agent

To minimize potential adverse events the following should be considered:

- "Tests should only be performed and supervised by experienced personnel (see definition under "Scope" below)
- All Endocrine Dynamic Tests are to be performed within the endocrine unit or on Ward 6A ( with exception of Short Synacthen Test, Oral Glucose Tolerance test and Low Dose Dexamethasone Test).
- Staff must have detailed knowledge of the particular test protocol and provocative agents. Specialized nursing/medical staff familiar with these tests is essential if they are to be performed safely and give accurate results.
- Tests must be performed in an environment where emergency resuscitation facilities and experience are available. Deaths and serious morbidity can occur.
- It may be necessary to adjust protocols for particular individuals or circumstances, and the same protocol cannot automatically be safely applied to all patients. Prior to the test, consideration should be given to any particular customization or precautions required for the individual patient. This should be discussed with the consultant concerned or a Senior Endocrine Specialty Registrar (Advanced Trainee).

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- Appropriate laboratory back-up is essential, particularly for tests involving fasting, hypoglycaemia or water deprivation. Facilities are required for immediate results.
- A medical officer must always be readily available, and in certain tests (eg. insulin Tolerance Test) must be immediately available in the Endocrine Unit/ward.
- Experienced personnel are required to place intravenous cannulas

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## Scope

This document applies to adult and adolescent (age 16 years and over) patients undergoing investigation for Endocrine and metabolic disorders at CHHS

Patients must be referred by an Endocrinology consultant or Endocrinology Registrar. NB: exception- Short Synacthen Test can be referred by other medical officers and GPs.

Dynamic Endocrinology Tests are only to be performed by:

- Registered Nurse Level 2 deemed competent in Dynamic Endocrine Testing
- Medical officers working within the Endocrine Unit.

### Exceptions

Short Synacthen Test - this may be performed by other medical officers under the guidance of a senior Endocrine Trainee Registrar or Endocrine Consultant or a Registered Nurse Level 2 deemed competent in Endocrine Dynamic Testing.

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## Section 1 – Background Information

Basal or unstimulated hormone levels frequently do not provide sufficient diagnostic information in the investigation of endocrine and metabolic disorders. A range of dynamic or provocative tests are available to assess the dynamic responses of hormonal and metabolic axes. These tests may involve:

1. Stimulation of a hormonal axis by releasing hormones or other agents e.g. Synacthen to stimulate release of cortisol from adrenal glands
2. Attempted suppression of a hormonal system e.g. suppression of cortisol production by dexamethasone in a dexamethasone suppression test
3. Physiological stimulation of a hormonal system or challenge of a metabolic or hormonal system e.g. water deprivation to assess water regulation within the body.

### Blood Sampling:

- Most tests require the insertion of one IV cannula through which provocative agents are administered and/or periodic blood samples drawn. A large vein in the cubital fossa is the preferred insertion site. Occasionally separate infusion and sampling

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cannulas are required or desirable. Butterfly needles are useful for single samples, but are not recommended where multiple samples are to be taken.

- All samples are drawn using aseptic technique.
- Gloves should be worn for protection as standard practice.
- When sampling from cannulas it is imperative that sufficient void volume (“drawback and discard”) be removed before the blood sample for analysis is collected otherwise the sample will be diluted and results inaccurate. 5ml fluid should be withdrawn and discarded prior to the drawing of the blood sample. Cannulas should be flushed with 0.9% sodium chloride.

**Specimen collection requirements:**

- Specimens should be collected, stored and transported according to ACT Pathology Handbook
- Samples should be documented on Endocrine Tests Form (Attachment A) (copy to pathology, original scanned into patient clinical record). A copy of the form can be printed from the Clinical Forms Register <https://actgovernment.sharepoint.com/sites/intranet-health/CFR/Clinical%20Record%20Forms%20NEW/Endocrine%20Tests.pdf>
- All patients attending the Endocrine Unit for invasive procedures or for procedures requiring administration of diagnostic IV drugs are admitted as Day Stay patients and require informed written consent. Exception: Short Synacthen Test and Glucose Tolerance Test where informed verbal consent is obtained and documented.
- All tests must be done under basal conditions
- 30 minutes initial rest (laying or comfortably sitting) is essential.
- IV cannula, if required, is to be inserted at the start of the initial rest period
- Morning test times are essential for most tests and preferable for all.
- Inform Endocrine Laboratory at ACT Pathology at least 24 hours ahead of time regarding scheduled tests
- Notify Endocrine Consultant/Registrar immediately in event of adverse reactions.

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**Section 2 – Short Synacthen Test**

**Purpose**

The Short Synacthen test is used to assess the response of the adrenal cortex to stimulation in suspected adrenocortical insufficiency (primary, secondary or tertiary) or in the diagnosis of congenital adrenal hyperplasia.

**Alerts**

DO NOT PROCEED if the patient has:

- Acute psychosis
- Cushing’s disease or syndrome (Untreated)
- Recent viral disease or immunisation with live virus

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- Pregnancy- exclude with urine pregnancy test
- Breastfeeding
- Hypersensitivity to ACTH (Synacthen)

Proceed with caution if the patient has:

- Bacterial infection
- Heart failure- medical officer assessment prior to test required
- Asthma
- Drug allergies
- Diabetes Mellitus (Check cBGL prior to ACTH administration and inform Medical Officer if cBGL > 10 mmol/l. Test cBGL at conclusion of test and notify Medical Officer if cBGL 15 mmol/l or over.
- Hypertension (moderate to severe)

NOTE:

- The Synacthen test gives unreliable results in the six weeks following pituitary surgery.
- Patients on the contraceptive pill or oral hormone replacement therapy should cease 6 weeks prior to the test. May continue topical hormone application.
- Steroid medication should be withheld for 24 hours prior to test.
- Test should be performed in the morning. There is no requirement to fast.
- Patient to be observed throughout the test.
- Hypersensitivity reactions (if they occur) tend to occur within 30 minutes of injection of Synacthen.

### Equipment

- Pathology Order (in patient's clinical records) requesting "Short Synacthen Test. ACTH/Cortisol at 0 minutes, Cortisol at 30 and 60 minutes"
- Medication Chart
- Synacthen 250 micrograms.
- IV starter pack
- /22 gauge Introcan Safety IV cannula
- 0.9% Sodium Chloride Solution for IV injection 10mL x 4
- 10 ml syringe x 4
- Safeflow Extension Set
- Tourniquet
- Sterile Gloves
- PPE – goggles, gloves
- Vacuette Holdex
- Alcohol wipes
- Lithium Heparin/or Serum tubes x 3
- EDTA tube x 1
- Serum tubes x3 for discard.
- Ice
- Specimen bag

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**Procedure**

1. Obtain prescription for “Synacthen 250 micrograms IMI” on medication chart from Medical Officer
2. Obtain Pathology Order form from referring medical officer or Registrar in patient’s clinical record.
3. Obtain Synacthen 250 micrograms from The Canberra Hospital Pharmacy (Imprest)
4. Confirm identity of patient using 3 identifying elements (name, date of birth, URN or address)
5. Explain the procedure to the patient and ensure patient comfort
6. Obtain and document verbal consent for the procedure
7. Obtain and document baseline observations including Blood pressure – lying and standing, pulse, respirations, Oxygen saturation, temperature and cBGL.
8. Obtain medical history to exclude above alerts and ascertain allergies.
9. Insert IV cannula (see the [Intravascular Access Device Policy](#))
10. Attach primed Safeflow Extension Set
11. Flush cannula with 0.9% Sodium Chloride Solution for IV injection 10mL
12. Ensure patient rests for 30 minutes prior to commencement of test
13. Collect samples (ensuring 5ml drawback is discarded) and subsequently administer Synacthen as below:

Blood Sample Times	0 minutes	30 minutes	60 minutes
ACTH	S  Place sample immediately on ice/walk to pathology immediately after collection		
Cortisol	S	S	S
Synacthen administration (post blood collection)	S		

**S = Sample at this time point**

**Note:**

1. Flush cannula with 0.9% sodium chloride between sample collections
2. Ensure sufficient drawback and discard with each sampling
3. Observe patient during test for side effects of Synacthen. Perform vital signs if clinically indicated and document any side effects.

14. Document sampling and Synacthen administration times on Endocrine Test Form (Attachment A). A copy of the form can be printed from the Clinical Forms Register <https://actgovernment.sharepoint.com/sites/intranet-health/CFR/Clinical%20Record%20Forms%20NEW/Endocrine%20Tests.pdf>

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Do not refer to a paper based copy of this policy document. The most current version can be found on the CHS Policy Register



15. Obtain and document post procedure observations prior to discharge.
16. Administer steroid dose AFTER completion of test if requested by referring doctor and chart in the patient’s clinical record.
17. Remove cannula.
18. Deliver samples (ACTH on ice) together at end of test with the copy of Endocrine Test form and request form
19. Discharge patient.

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### Section 3 – Water Deprivation Test

#### Purpose

Water deprivation is most commonly used in patients presenting with polyuria and polydipsia to assist in distinguishing central diabetes insipidus (DI), nephrogenic diabetes insipidus and psychogenic (habitual) water drinking (Primary Polydipsia). Under normal circumstances, water deprivation is associated with declining urine volumes, increasing urine osmolality and maintenance of normal serum osmolality. Such effects are mediated by increased ADH (vasopressin) secretion by the posterior pituitary and its action on the collecting ducts of the kidney. A test dose of Desmopressin may be given at the end of the test if needed to distinguish between central and nephrogenic DI.

#### Alerts

1. This test is potentially very dangerous and must be undertaken with great care. Patients unable to conserve water may become critically dehydrated within a few hours of water restriction.
2. Water Deprivation test can only be ordered by an Endocrinologist or Endocrinology Registrar.
3. Inpatient (day stay) test either in Endocrine Unit procedure room or Endocrine Ward 6A
4. Fasting and water restriction commencement time determined by referring Endocrinologist.
5. Patient must remain fasted throughout test.
6. Patient must be observed constantly for the duration of the test.
7. Fluid balance must be recorded for the duration of the test.
8. Notify Clinical Chemistry/Endocrine laboratory at ACT Pathology (preferably with 48 hours notice) of date/time and patient details and confirm with laboratory on morning of the test prior to commencement.

#### Equipment

- Pathology Orders (in patient’s clinical record requesting:
  - Water Deprivation Test
  - Urine- Osmolality and Sodium Na+
  - Serum- Osmolality and UEC
- Medication chart with Desmopressin order.
- Desmopressin from Pharmacy

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- PPE – goggles, gloves
- Vacuette Holdex
- 21 gauge Hypodermic needles (multiple)
- Alcohol wipes
- Dry injection swab Pur-zellin
- Tourniquet
- Lithium Heparin tubes (multiple)
- Yellow top urine specimen jars (multiple)
- Measuring jug
- Urinal or bedpan
- Urine testing equipment (Clinitek 50 urinalysis machine or Siemens Multistix strips for urinalysis)
- Pathology Specimen bags (multiple)
- Weight scales (for patient)
- Sphygmomanometer
- Mews Observation chart, Fluid Balance Chart, Progress notes, Consent form

**Procedure**

1. Admit patient and obtain written consent for the procedure (RMO Medical admission)
2. Confirm identity of patient using 3 identifying elements (name, date of birth, URN or address) and apply identification/allergy bands
3. Explain the procedure to the patient and ensure patient comfort
4. Obtain and document baseline observations including Blood pressure – lying and standing, pulse, respirations, Oxygen saturation, temperature, weight (dressed but shoes removed), allergies and fasting commencement time.
5. Collect blood and urine samples, weight and observations as per table below:

Serum Osmolality and Sodium Na+	Second hourly
Urine Osmolality and Sodium Na+	Hourly if able (minimum second hourly)
Urine Specific Gravity and amount	Hourly if able (minimum second hourly)
Weight	Second hourly
Vital signs, fluid balance	Second hourly

**Send pathology samples to laboratory AFTER EACH COLLECTION marked as “URGENT”**

6. Results are to be continually reviewed by Endocrinologist or Endocrine Registrar.
7. Record any symptoms in the patient’s clinical record.
8. Liaise with Endocrinologist regarding cessation of the test. Water restriction test in people ≥16 years of age is continued and discussed with the Endocrinologist or Endocrine Registrar until one of the following end points is reached:
  - The urine osmolality reaches a clearly normal value (above 600 mosmol/kg), indicating that both ADH release and effect are intact. Patients with partial DI may have a substantial rise in urine osmolality, but not to this extent.

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- The urine osmolality is stable on two or three successive hourly measurements despite a rising plasma osmolality
  - The plasma osmolality exceeds 300 mosmol/kg or the plasma sodium is greater than 145 meq/L.
  - $\geq 5\%$  dehydration (5% weight loss)
9. In the last two settings, desmopressin is administered (10 mcg by nasal insufflation or 4 mcg subcutaneously or intravenously).
10. **Monitor urine and serum osmolality and Sodium and urine volume every 30 minutes over the next two hours.** The two-hour monitoring period is particularly important if there is dilatation of the urinary bladder by previous high urine volumes. In this setting, any concentrated new urine might be diluted with post-micturition residual urine (which could be as much as 200 to 400 ml). A plateau in urine osmolality should be reached in two consecutive samples prior to termination of the test.
11. Patient can now eat and drink. Provide meal.

**Alert:**

This test is potentially dangerous and must only be performed by experienced personnel and closely supervised. In patients with a history of seizures or cardiovascular or cerebrovascular disease the test should not be performed.

Excessive water deprivation may cause significant dehydration and electrolyte disturbance, especially hypernatremia.

Desmopressin administration at the end of a test needs careful supervision to avoid over hydration and electrolyte disturbance. The patient will need education regarding avoiding excessive fluid intake for several hours after discharge.

12. Perform and document vital signs immediately prior to discharge
13. Discharge patient.

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## Section 4 – Insulin Tolerance Test

### Purpose

The insulin tolerance test is performed to assist in the diagnosis of disorders of hypothalamic-pituitary function. Hypoglycemia causes a major stress response, with increases in plasma corticotropin (ACTH) and serum cortisol, growth hormone, and prolactin, and activation of the sympathetic nervous system.

### Alerts

1. Insulin Tolerance test is to be ordered by an Endocrinologist or Endocrine Registrar only.
2. The test should be conducted in Endocrine Unit (Inpatient Day Stay) or Ward 6A as inpatient.

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3. Patient must have had an ECG within previous 6 months to exclude any obvious evidence of ischaemic heart disease. If not arrange for ECG referral from referring doctor and have patient attend ECG.
4. Consider ceasing Oral Contraceptive Pill and Hormone Replacement Therapy 6 weeks prior to test
5. Notify Clinical Chemistry/ Endocrine laboratory at least 48 hours prior to test and confirm on morning of the test.
6. The patient fasts for at least eight hours before the test
7. The patient must remain supine during the procedure in either a recliner chair or bed.
8. Two clinicians must be present at all times. The Endocrine Nurse and Medical Officer (preferably the Advanced Trainee Registrar).
9. A syringe containing 50% Dextrose solution should be at the bedside throughout test.
10. Insulin dose is calculated on weight. The usual dose is 0.15 U/kg, but different doses may be indicated in certain patients:
  - In patients thought to have hypopituitarism or primary adrenal insufficiency, the insulin dose is decreased to 0.1 U/kg because these conditions may be associated with decreased release of other counter regulatory hormones such as epinephrine and growth hormone.
  - In patients with obesity, diabetes mellitus, suspected Acromegaly or Cushing's syndrome, the dose is increased to 0.25 U/kg because insulin resistance is likely.

### **Equipment**

- As per venepuncture policy.
- As per IV therapy policy.
- As per capillary BGL policy.
- 500 mls N/ Saline.
- Intravenous infusion set- Infusomat Space line- Neutrapur
- Braun pump.
- Gold (Serum), Grey (Fluoride) and Pink (EDTA) topped pathology tubes.
- Blood gas syringes
- Ice for ACTH levels (pink tube) and blood gas tube
- Prior to the test arrange for hypo foods (juice and Jatz) and lunch to be available to be given to patient at completion of the test.
- 50% Dextrose IV solution 50ml
- 50ml luerlock syringe
- Novorapid insulin
- Medication orders for Novorapid Insulin and 50% Dextrose
- Insulin syringe
- Alcohol wipes
- Progress Notes, Fluid Balance Chart, Mews Chart, Endocrine Tests Chart
- Pathology Order for Insulin Tolerance Test (Baseline samples to include complete pituitary profile – ACTH, Cortisol, GH, IGF-1, E2/Testosterone, LH, FSH, Prolactin, TSH, FT4 and Glucose
- Fluid order in the patient's clinical record for 0/9% sodium chloride TKVO.

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- Patient Identification labels.
- Pre-printed specimen labels.
- IV Hydrocortisone 100mg

## Procedure

### *Special Pre-Test Instructions*

- Arrange for medical officer Advanced Trainee Endocrine Registrar to be present during test and until hypoglycaemia is resolved.
- Arrange date and time of test with the patient and ward bed if indicated.
- Instruct patient to fast from 12 midnight (at least 8 hours) prior to the test and educate regarding test procedure. Patient may drink plain water until 6 a.m. Advise patient to wear comfortable light clothing and change of clothes (profuse sweating during test).
- No Cortisone tablets or similar steroid tablets, inhalers or cream to be taken the evening prior to the test.
- No Cortisone or Thyroxine tablets are to be taken on the morning of the test.
- If the patient is on glucocorticoid replacement, discuss duration of withdrawal with consultant.
- In women pregnancy needs to be excluded.
- Consider cessation of estrogen replacement with OCP and HRT 6 weeks prior to test.
- Obtain Insulin and Dextrose 50% order on medication chart.
- Obtain order for N/Saline 500 mls to keep the vein open (TKVO).
- Notify Clinical Chemistry (extension 42809) of test and obtain contact person name > 48 hours prior and confirm on the morning of test.
- Obtain pathology Order for:
  - “Insulin Tolerance Test- ACTH, Cortisol, GH, IGF-1, E2/Testosterone, LH, FSH, Prolactin, TSH, FT4, FT3 and Glucose” for baseline.
  - “Insulin Tolerance Test- Cortisol, GH and Glucose” with Glucose marked as “urgent”.
- Arrange for Courier to transport specimens on day of test. (will need to be available for two hours) Phone 0413515365.

## Day of Test

1. Ensure glucometer has been calibrated and glucose controls performed.
2. Admit patient (Day Stay inpatient Medical admission) and obtain written consent for the procedure
3. Confirm identity of patient using 3 identifying elements (name, date of birth, URN or address) and apply identification/allergy bands
4. Explain the procedure to the patient and ensure patient comfort
5. Obtain and document baseline observations including Blood pressure – lying and standing, pulse, respirations, Oxygen saturation, temperature, cBGL, weight, allergies and fasting commencement time. An accurate body weight without shoes or jacket should be obtained on the morning of the test.
6. Insert two intravenous lines (one into each cubital fossa). One for blood sample collection and one for 0/9% sodium chloride TKVO and drug administration.

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7. Collect baseline samples including complete pituitary profile: TSH, FT4, FT3, Prolactin, E2/Testosterone, LH, FSH, IGF-1, GH, ACTH, cortisol and glucose.
8. Attend BGL on glucometer.

**Alert:**

If BGL is outside normal limits discuss with Registrar.

If BGL is low test may need to be cancelled or if BGL elevated patient may require additional insulin. (NOTE it is usually more effective to give an increased initial insulin dose than in two steps.)

9. Using a 100 unit insulin syringe draw up the patient specific dose. Then add insulin dose to a 3 ml syringe and make up to 2mls with 0.9% sodium chloride. Administer insulin/ 0/9% sodium chloride by intravenous injection over 1 minute. Flush cannula with 10mls 0.9% sodium chloride after insulin administration.
  - After insulin administration the medical officer must not leave the room until patient has recovered from hypoglycaemia.
  - Patient is closely observed for symptoms of hypoglycaemia (feelings of hunger, drowsiness, detachment or anxiety, pallor, sweating, headache) which usually occur 30 to 45 minutes after insulin injection.
  - If adequate hypoglycaemia is not achieved a second similar dose of insulin should be injected intravenously. Adequate hypoglycaemia should be achieved within the ensuing 20 to 40 minutes.
  - Document symptoms of hypoglycaemia and samples/times on Endocrine Test Form (Attachment A). A copy of the form can be printed from the Clinical Forms Register
  - See the flow chart and table for sample collection requirements and timing.
    - Perform capillary BGL (cBGL) every 5 minutes.
    - Collect plasma samples (BGL, cortisol, GH) every 15 minutes until cBGL <2.5mmol/L
    - Collect plasma samples (BGL, cortisol, GH) every 5-10minutes when cBGL is between 2.0mmol/L and 2.5mmol
    - Obtain definitive plasma samples (BGL, cortisol, GH) when patient has been symptomatic for 5 minutes or plasma BGL is < 2mmol/L.
  - Plasma BGL from laboratory Blood Gas Analyser will be used to avoid delays. Most glucometers are inaccurate at low serum glucose concentrations and tend to underestimate glucose level leading to premature termination.
    - After definitive sample, reverse hypoglycaemia with 200ml of juice if only mildly symptomatic or 25ml volume 50% dextrose slowly if more significant symptoms.
  - If there is poor response to IV glucose consider IV Hydrocortisone . Refer to hypoglycaemic treatment protocol. **Do not leave the patient during the test.**
    - Perform cBGL at 15min, 30min and 60min after reversal of hypoglycaemia
    - Collect venous samples (BGL, cortisol, GH) at 15min, 30min and 60min after reversal of hypoglycaemia.
10. Provide sweet drink and sandwich as tolerated
11. Discharge patient only when hypoglycaemia has resolved (cBGL >4.5mmol/L) and haemodynamically stable.
12. Ensure patient has follow up appointment with referring doctor.

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13. Document sampling on Endocrine Test Form (Attachment A) and copy to ACT Pathology with samples. A copy of the form can be printed from the Clinical Forms Register <http://inhealth.acthmr/default.aspx>

Time	Capillary Blood BGL	0 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	Hypoglycaemia Symptoms OR pBGL<2.0mmolL	Post hypo 15min	Post hypo 30 min	Post hypo 60 min
Plasma Guucose	Li hep or FI oxalate 0.5 ml	S		S	S	S	S	S	S	S	S	S	S
GH	Li hep 0.5 ml	S		S	S	S	S	S	S	S	S	S	S
Cortisol	Li hep 0.5 ml	S		S	S	S	S	S	S	S	S	S	S
IGF-1	Li He	S		-	-	-	-	-	-	-	-	-	-
Complete pituitary profile: TSH, FT4, FT3, Prolactin, E2/Testosterone, LH, FSH, IGF-1, GH, ACTH		S											

**S = Sample at this time point**

**Note:**

ACTH samples must be stored and transported on ice

**Alert:**

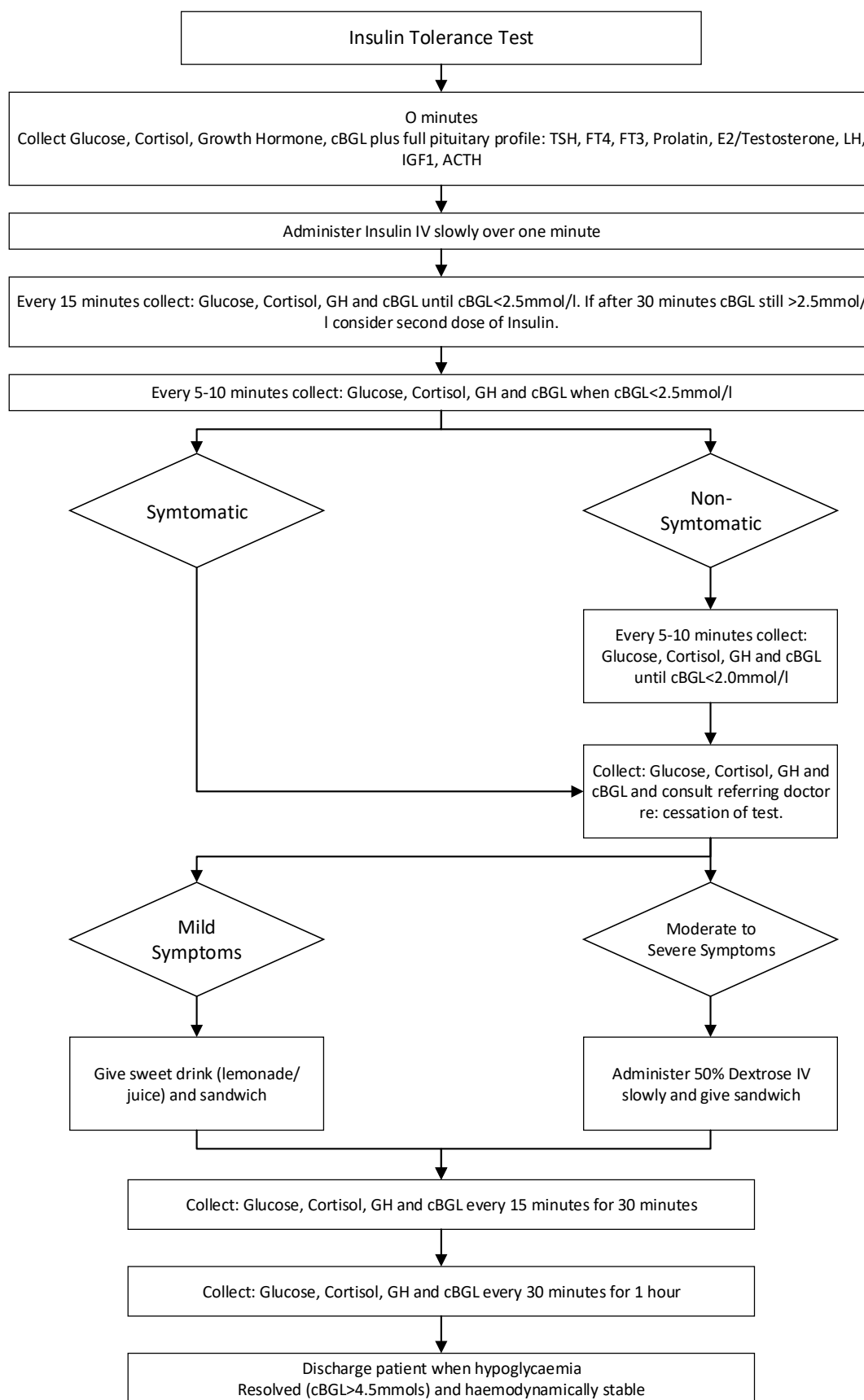
- If the patient has not become symptomatic and the meter readings have consistently been above 2.4mmol/L at '+ 30' minutes then the Registrar will need to assess the need for a further order of insulin.
- If extra insulin is given then continue the time points relative to the initial '0' time point, using additional generic forms (forms for use when extra insulin is given, without sample number). E.g. Extra insulin is given at +40 (Sample 5), so the additional forms would be marked:
  - Sample 6 - +60
  - Sample 7 - +70
  - Sample 8 - +80
  - Sample 8 - +100

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- Sample 9 - +130
- Sample 10 - +160

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## Section 5 – 2 Hour Glucose Tolerance Test (OGTT) with Growth Hormone

### Purpose

This test is performed to assist in the diagnosis of Acromegaly. Growth Hormone (GH) secretion is part of the counter-regulatory defence against hypoglycaemia and physiological GH secretion is inhibited by hyperglycaemia. In acromegaly, GH secretion is autonomous and does not suppress and may paradoxically rise with hyperglycaemia.

### Alerts

- Patients should follow a high carbohydrate diet for 3 full days prior to test. Example meal plan can be found here: <http://health.act.gov.au/sites/default/files/Glucose%20Tolerance%20Test%20for%20Non-Pregnancy-%20Diet.pdf>
- Patients should limit alcohol to one drink per day for 3 full days prior to test.
- Patients should not smoke for 24 hours prior to test.
- Patients should be advised to fast for 10-12 hours prior to this test but may drink small volumes of water.
- This test is unnecessary in patients with poorly controlled diabetes as Growth Hormone should already be suppressed with high serum glucose levels.

### Equipment

- As per venepuncture policy.
- As per IV therapy policy.
- 20/22G gauge x 11/4" Introcur Safety IV catheter
- 0.9% Sodium Chloride Solution for IV injection 10mL
- 10 ml syringe x 5
- Safeflow Extension Set
- Sterile Gloves
- PPE – goggles, gloves
- Vacurette Holdex
- Alcohol wipes
- Tourniquet
- Serum tubes x 5
- Fluoride tubes x 5
- Serum tubes x 5 for discard.
- Specimen bag
- As per capillary BGL policy.
- Patient Identification labels.
- 75 grams Glucose drink
- Pathology Order

### Procedure

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1. Arrange date and time of test with patient and provide pre test instructions as above.
2. Obtain Pathology Order from referring medical officer marked “Glucose Tolerance test with Growth Hormone – Glucose and Growth Hormone 0,30,60,90 and 120 minutes”
3. Confirm identity of patient using 3 identifying elements (name, date of birth, URN or address)
4. Explain the procedure to the patient and ensure patient comfort
5. Obtain and document verbal consent for the procedure
6. Ensure patient rests for 30 minutes prior to commencement of test
7. Obtain and document baseline observations including Blood pressure – lying and standing, pulse, respirations, Oxygen saturation, temperature and cBGL.
8. Obtain and document medical history, medications and allergies.
9. Insert IV cannula
10. Collect basal sample.
11. Attach primed Safeflow Extension Set
12. Administer oral 75 gram Glucose
13. Collect samples as per table below:

	0 minutes	30 minutes	60 minutes	90 minutes	120 minutes
Glucose	S	S	S	S	S
Growth Hormone	S	S	S	S	S

**S = Sample at this time point**

**Note:**

Flush cannula with 0.9% sodium chloride between sample collections and ensure 5ml drawback and discard.

14. Document sampling on Endocrine Test Form (Attachment A). A copy of the form can be printed from the Clinical Forms Register.
15. Obtain and document vital signs
16. Remove cannula
17. Ensure patient has follow-up appointment with referring Medical Officer
18. Discharge patient
19. Send samples, and a copy of the Endocrine Test Form to ACT Pathology

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## Section 6 – Saline Infusion Test (SIT)

### Purpose

The Saline Infusion Test is used as a confirmatory test in the diagnosis of Primary Aldosteronism. Recent studies have suggested that seated saline suppression test is more sensitive than recumbent saline suppression test in the diagnosis of primary aldosteronism, particularly in posture responsive aldosteronism.

### Alerts

- Potassium-sparing diuretics (spironolactone, eplerenone, amiloride, triamterene), potassium-wasting diuretics and liquorice-containing products should be stopped at least 6 weeks before the test
- Beta-adrenergic blockers, central  $\alpha$ -2 agonists (clonidine,  $\alpha$ -methyldopa), NSAIDs, ACE-inhibitors, angiotensin-receptor blockers, renin inhibitors, dihydropyridine calcium antagonists (e.g. amlodipine, nifedipine, lercanidipine) should be withheld at least 4 weeks before the test
- Medications with minimal effects on renin and aldosterone levels can be used to control hypertension if needed: non-dihydropyridine calcium antagonists (e.g. verapamil SR), hydralazine and prazosin. Withhold these medications on morning of test and administer at completion of test.
- Correct hypokalemia as best as possible. Ideally K<sup>+</sup> should be 4.0 mmol/L
- Relative contraindications: severe uncontrolled hypertension, congestive cardiac failure
- Bloods for Renin need to be delivered at room temperature immediately to pathology laboratory

### Equipment

- 20/22G gauge Introcan Safety IV catheter
- 0.9% Sodium Chloride Solution for IV injection 10mL
- 10 ml syringe
- Safeflow Extension Set
- Tourniquet
- Sterile Gloves
- PPE – goggles, gloves
- Vacuette Holdex x 2
- Alcohol wipes
- Lithium Heparin tubes x 2
- EDTA collection tube x 2
- Serum tubes x 2 for discard.
- 0.9% Sodium Chloride Solution for IV injection 10mL
- Specimen bag
- Patient Identification labels and bands
- IV Fluid Chart for N/Saline 2 litres over 2 hours
- Fluid Balance Chart (in the patient’s clinical record)

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- General Observation Chart (in the patient's clinical record)
- Braun Infusomat Spaceline IV infusion set
- Braun Infusion Pump
- Sphygmomanometer

### Pre-Test

- Arrange date and time of test with the patient.
- Advise patient about withholding medications as per Alert above
- Educate patient about procedure. Patients should present to the endocrine department between 8 am and 9.30 am. No requirement to fast.

### Procedure

1. Admit patient (Day Stay inpatient Medical admission)
2. Confirm identity of patient using 3 identifying elements (name, date of birth, URN or address) and apply identification/allergy bands
3. Explain the procedure to the patient and ensure patient comfort
4. Obtain and document written consent for the procedure
5. Obtain and document baseline observations including Blood pressure – lying and standing, pulse, respirations, Oxygen saturation, temperature, cBGL, weight, allergies and fasting commencement time.
6. Place patient in the chair and keep in seated position for the full duration of the test (feet touching the floor)
7. Insert an 18-22 gauge cannula in the cubital fossa of one arm. Cannula will be used first for drawing of baseline blood samples, then the infusion and lastly the 240 minutes drawing of blood.
8. Send venous blood gas to lab for urgent K+ measurement. Ideally K+ should be 4.0 mmol/L. Results can be obtained on the spot.
9. After 15 minutes in the seated position, take bloods from cannula for UEC, plasma renin concentration, plasma aldosterone and cortisol; measure baseline blood pressure.
10. Start infusion of 2 litres NaCl 0.9 % at a rate of 500 mL per hour (total infusion duration 4 hours)
11. Measure blood pressure after every 500 ml of infusion
12. When the infusion has finished, take bloods for UEC, renin, aldosterone and cortisol.
13. Measure post-test blood pressure
14. Remove cannula
15. End of test

### Interpretation:

- Post infusion plasma aldosterone > 165 pmol/L): PA very probable
- Post infusion plasma aldosterone < 165 pmol/L): PA very unlikely

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## Section 7 – Clonidine Suppression Test

### Purpose

The Clonidine Suppression Test is performed to investigate presence of pheochromocytoma.

### Alerts

- The test should be performed with the patient recumbent and in a quiet room with no disturbances for the duration of the test.
- Clonidine suppression tests should **not** be performed in hypovolemic patients because of the risk of a marked reduction in blood pressure, or in patients with normal plasma catecholamine values because the results are often inaccurate.

### Equipment

- As per venepuncture policy.
- As per IV cannulation policy.
- 20 gauge x 11/4" Introcur Safety IV catheter
- 0.9% Sodium Chloride Solution for IV injection 10mL
- 10 ml syringe
- Safeflow Extension Set
- Tourniquet
- Sterile Gloves
- PPE – goggles, gloves
- Vacuette Holdex
- Alcohol wipes
- Serum tubes x 2 for discard.
- 0.9% Sodium Chloride Solution for IV injection 10mL
- Specimen bag
- 0.9% sodium chloride x 1 litre
- Patient Identification labels and bands
- 10ml Lithium Heparin Tube with Sodium Metabisulphate added (obtain from Clinical Chemistry extn: 42809
- Ice for Metanephrine samples
- Progress Notes, Fluid Balance Chart, Mews Chart
- Medication orders Clonidine 300 micrograms (150 micrograms x 2 tablets)
- Clonidine 300 micrograms tablets (150 micrograms x 2 tablets)
- Fluid orders for 0.9% sodium chloride if needed for hypotension

### Procedure

#### Pre-Test

- Arrange date and time of test with the patient. Patient may be drowsy following test and should arrange transportation.
- Instruct patient to fast from 12 midnight prior to the test.

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- Instruct patient to withhold regular anti-hypertensive medication (especially  $\beta$  blockers) and Tricyclic antidepressants for at least two days prior to the test. If necessary, Prazosin can be used for blood pressure control.
- Obtain pathology order form marked "Clonidine Suppression test: noradrenaline, adrenaline and normetanephrine at 0 minutes and 3 hours"
- Book a consult room

### Test

1. The patient should attend the Endocrine Clinic at 08.30 after an overnight fast
2. Explain the procedure to the patient and ensure patient comfort
3. Confirm identity of patient using 3 identifying elements (name, date of birth, URN or address) and apply identification/allergy bands
4. Medical admission. Obtain and document medical history, medications and allergies.
5. Obtain and document written consent for the procedure
6. Ensure the patient rests for 30 minutes before procedure and is calm
7. Obtain and document baseline observations including Blood pressure – lying and standing, pulse, respirations, Oxygen saturation, temperature.
8. Insert intravenous cannula
9. Rest patient for 30 minutes before blood sample collection (see notes regarding collection of catecholamine samples).

#### **Alert: PLASMA CATECHOLAMINE COLLECTION**

Catecholamines, especially in plasma, are unstable. It is therefore essential to keep the blood specimen on ice at all times and transported immediately to ACT Pathology laboratory. Patient should not have eaten, drunk beverages (especially tea, coffee or cola drinks) or smoked at least three hours before sample collection.

10. Collect a blood sample for plasma adrenaline, noradrenaline and normetanephrine and place immediately on ice. (0 minutes) Ensuring adequate drawback and discard. Invert the tube once or twice and immediately place on ice.
11. Flush cannula with 0.9% sodium chloride 10mL
12. Obtain Blood Pressure reading (0 minutes)
13. Administer Oral clonidine 300 $\mu$ g (2 x 150 $\mu$ g tablets)
14. The patient lies quietly for 3 hours in a quiet, dark room undisturbed.
15. Collect second blood sample for plasma adrenaline, noradrenaline and normetanephrine 3 hours after clonidine was administered ensuring adequate drawback and discard. Invert the tube once or twice and immediately place on ice.
16. Obtain and document observations including Blood pressure, pulse, respirations, Oxygen saturation, and temperature.

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Blood sampling and BP as per chart below:

Sample and BP times	-30 minutes	0 Minutes	180 minutes
Adrenaline, Noradrenaline and Normetanephrine		S (On ice/ transport to lab immediately)	S (On ice/ transport to lab immediately)
Blood Pressure	BP	BP	BP

**S = Sample at this time point**

**Safety Alert**

1. The patient may be drowsy following the clonidine and should not drive immediately following the test.
2. 0.9% sodium chloride should be available for infusion if the patient becomes hypotensive.

17. If patient is stable discharge home.

**INTERPRETATION OF TEST**

The normal response to clonidine is to:

1. Suppress plasma normetanephrine by >40% and into the normal range.
2. Suppress plasma noradrenaline by >50% and into the normal range. (Less sensitive in patients with plasma noradrenaline levels of < 1 µg/L)
3. Concentrations remain increased in patients with pheochromocytoma

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**Section 8 – 72 hours fast for the diagnosis of Insulinoma in an adult population.**

**Purpose**

The purpose of this document is to provide guidelines for the inpatient investigation and diagnosis of suspected insulinoma via symptomatic and biochemical assessment over a 72 hour period.

**Scope**

This test should only be performed on patients admitted under an Endocrinologist and should ideally be performed on 6A. All other doctors are encouraged to discuss patients with suspected insulinoma with the endocrinologist on call prior to ordering investigations.

It is to be applied to patients presenting with hypoglycaemia of unknown aetiology who have been admitted to undergo a prolonged fast (over 72 hours) to help establish the cause, with insulinoma being a key differential diagnosis. The aim of the fast is to provoke the homeostatic response that keeps blood glucose concentrations from falling to concentrations that cause symptoms in the absence of food. A normal response prevents hypoglycaemia via increased release of specific hormones, including glucagon and epinephrine to prevent hypoglycaemia in a prolonged fast.

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If Whipple’s triad is demonstrated (ie low plasma glucose AND symptoms of hypoglycaemia/neuroglycopenia AND resolution of symptoms with food) then confirmatory laboratory testing is performed. This includes insulin, c-peptide (to differentiate between exogenous and endogenous insulin), pro-insulin, beta-hydroxybutyrate (low in insulinoma due to antiketogenic effects of insulin), sulfonylurea and meglitinide screen.

This test must be done in the seemingly well patient, as those with underlying critical illness can confound the results (including cortisol deficiency and alcohol). The differentials in the seemingly well individual include insulinoma, functional beta cell disorders (Non-insulinoma pancreatogenous hypoglycaemia, post gastric bypass hypoglycaemia), insulin auto-immune hypoglycaemia (antibody to insulin, antibody to insulin receptor), and insulin secretagogue. Accidental, surreptitious, or malicious hypoglycaemia must also be considered.

**Equipment**

- Capillary blood glucose monitor
- Blood collection tubes: Sodium Fluoride- grey top, Lithium Heparin-light green top, Serum- gold top. (multiples of each)
- Vacutainers
- Needles
- Alcohol swabs
- Tourniquet
- Band-aids
- Pur-Zellin dry injection swab or cotton balls
- Pathology Order “72 hour Fast – plasma glucose, insulin antibodies (also collect insulin, C-peptide, proinsulin and beta-hydroxybutyrate but only test if plasma glucose <3.3mmol/l) 6<sup>th</sup> hourly then 1-2 hourly until formal laboratory plasma glucose <2.5mmol/l”

**Procedure – the 72 hour fast**

1. Prior to commencement of the fast
  - 3 days prior to commencement of test notify ACT Pathology on extension 42809 the date and time of test and patient details
  - Patient to be admitted and fast commenced in the morning on Monday or Tuesday ensuring fast does not end in evening or weekend, to allow in hours assessment at the completion of the 72 hours.
  - Patient to discontinue all non-essential medications and to ensure activity during waking hours.
  - Patient is permitted to consume beverages that are calorie and caffeine free.
2. Upon commencement of the fast
  - Record date and time of onset of fast, including the time of the last intake of calories.
  - Collect blood samples 6<sup>th</sup> hourly for measurements of glucose (2ml Sodium Fluoride tube- grey top), C-peptide, insulin, pro-insulin, beta-hydroxybutyrate (Serum tube sent to laboratory immediately) until BGL < 3.3mmol/L, then increase to every 1-2 hours. Although blood is collected 6<sup>th</sup> hourly, insulin, C-peptide, proinsulin and beta-

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hydroxybutyrate is only tested in those specimens in which the plasma glucose concentration is  $\leq 60$  mg/dL (3.3 mmol/L).

- 1 x insulin antibodies should be tested during the admission (not dependant on fasted state).
- Sulfonylurea blood sample (non gel Serum tube) should be collected on admission and again prior to end of fast. Bedside capillary testing should be used in conjunction with serum testing when frequency of testing is increased as there will be a delay in the results from the serum testing. However the fast should not be ended based on capillary testing alone.
- Careful questioning and testing for subtle symptoms or signs of hypoglycaemia should be conducted repeatedly when a patient's plasma is near or in the hypoglycaemic range.

3. Test end points and duration;

- The fast is ended when the plasma glucose concentration is  $< 2.5$  mmol/L, signs or symptoms of hypoglycaemia, 72 hours has elapsed, or when the plasma glucose concentration is less than 3.0 mmol/L AND Whipple's triad has been documented on a previous occasion.
- NB: if none of the above have been demonstrated, the patient should be asked to exercise vigorously (i.e. walk up several flights of steps) prior to the final blood test at 72 hours.

**Interpretation of laboratory tests**

Signs or symptoms or both	Glucose (mmol/L)	Insulin (mU/L)	c-peptide (nmol/L)	Pro-insulin (pmol/L)	BH (mmol/L)	Circulating OHG agent	Antibody to insulin	Diagnostic interpretation
No	$< 3.0$	$< 3.0$	$< 0.2$	$< 5$	$> 2.7$	No	No	Normal
Yes	$< 3.0$	$\gg 3.0$	$< 0.2$	$< 5$	$\leq 2.7$	No	Negative	Exogenous insulin
Yes	$< 3.0$	$\geq 3.0$	$\geq 0.2$	$\geq 5$	$\leq 2.7$	No	Negative	Insulinoma, NIPHS, PGBH
Yes	$< 3.0$	$\geq 3.0$	$\geq 0.2$	$\geq 5$	$\leq 2.7$	Yes	Negative	OHG agent
Yes	$< 3.0$	$\gg 3.0$	$\gg 0.2$	$\gg 5$	$\leq 2.7$	No	Positive	Insulin autoimmune
Yes	$< 3.0$	$< 3.0$	$< 0.2$	$< 5$	$\leq 2.7$	No	Negative	IGF
Yes	$< 3.0$	$< 3.0$	$< 0.2$	$< 5$	$> 2.7$	No	Negative	Not insulin (or IGF) mediated

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**Section 9 – Dexamethasone Suppression Tests**

**Purpose**

The Dexamethasone Suppression Test is performed when overproduction of cortisol is suspected. The low-dose test is used as a screening test and can help differentiate healthy

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people from those who produce too much cortisol (Cushing’s Syndrome).

The high dose dexamethasone suppression tests assist in distinguishing patients with Cushing’s Disease (ACTH hypersecretion from pituitary) from patients with ectopic ACTH or cortisol production.

Five variations of this test are listed:

- Overnight Low Dose Dexamethasone Suppression Test.
- Two day Low Dose Dexamethasone Suppression Test.
- Overnight High Dose Dexamethasone Suppression Test.
- Two day High Dose Dexamethasone Suppression Test.
- Dexamethasone Suppression Test (Long).

**Alerts**

- The 1mg low-dose dexamethasone test should not be used as the sole criterion for excluding the diagnosis of Cushing's syndrome.
- Some medications (barbiturates, estrogens, corticosteroids, oral contraceptives, phenytoin, spironolactone, and tetracyclines) may interfere with test. Confirm with referring doctor if patient is to withhold medications.
- Contraindicated in patients with intercurrent acute illness, systemic infection.

**Equipment**

- Dexamethasone 1mg or 4mg tablets depending on which test is requested.
- Venepuncture equipment as per venepuncture policy
- Serum or Lithium Heparin pathology collection tube
- Specimen bag
- Pathology Order (in the patient’s clinical record)

**Procedure**

**Pre Test**

1. Obtain Pathology Order from referring medical officer marked “Dexamethasone Suppression Test- Cortisol 0800hrs”.
2. Obtain prescription (Canberra Hospital script) from referring doctor for Dexamethasone tablets
3. Obtain from pharmacy Dexamethasone tablets (dosage differs with test requested see tables below) and provide to patient.
4. Arrange date and time of test with patient and provide pre test instructions as per tables below.

**Day of Test**

1. Confirm identity of patient using 3 identifying elements (name, date of birth, URN or address)
2. Explain the procedure to the patient and ensure patient comfort
3. Collect blood for Cortisol sample via venepuncture at 0800hrs.

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4. Document on request form Dexamethasone dosage and time of administration.

<b>Test Requested</b>	<b>Patient Instructions</b>	<b>Dexamethasone Dosage</b>	<b>24 Hour Urine Free Cortisol and Creatinine Collection</b>	<b>Cortisol Sample collection</b>
<b>Overnight Low Dose Dexamethasone Test</b>	Day 1: Take Dexamethasone 1mg (2x 0.5mg tablets) orally between 2300-2400hrs on the night before sample collection.  Day 2: Present to unit or pathology collection centre at 0800 following morning	1mg orally taken between 2300-2400hrs night prior to sample collection (Day 1)	—	Day 2: 0800 cortisol sample on day following Dexamethasone dosage
<b>Two Day Low Dose Dexamethasone Test</b>	Days 1 and 2: Take Dexamethasone 0.5mg at 0800hrs, 1400hrs, 2000hrs and 0200hrs on the two days prior to sample collection.  Present to unit or pathology collection centre at 0800 on the third morning	0.5mg orally 6 <sup>th</sup> hourly (0800, 1400, 2000 and 0200) on the two days prior to sample collection	—	Day 3: 0800 cortisol sample (sample 6 hours post last dexamethasone dose.)
<b>Overnight High Dose Dexamethasone Test</b>	Day1: Take Dexamethasone 8mg (2x 4mg tablets) orally between 2300-2400hrs on the night before sample collection.  Present to unit or pathology collection centre at 0800 following morning	8mg orally between 2300-2400hrs night prior to sample collection	—	Day 2: 0800 cortisol sample (sample 6 hours post last dexamethasone dose.)

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Test Requested	Patient Instructions	Dexamethasone Dosage	24 Hour Urine Free Cortisol and Creatinine Collection	Cortisol Sample collection
<b>Two Day High Dose Dexamethasone Suppression Test</b>	<p>Day 1 commence 24 hour urine collection at 0800 hrs.</p> <p>Days 2 and 3: Take 2mg Dexamethasone orally every 6 hours at 0800, 1400, 2000 and 0200 hrs.</p> <p>Day 4: Present to unit or pathology collection centre at 0800</p>	<p>2mg Dexamethasone orally every 6 hours at 0800, 1400, 2000 and 0200 hrs on Days 2 and 3</p>	<p>Day 1 commencing at 0800 and completing at 0800 Day 2.</p>	<p>Day 4: 0800 Cortisol and ACTH sample (sample 6 hours post last dexamethasone dose.)</p>

**Note:**

Serum Dexamethasone may also be requested but is a send away and not routinely attended.

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## Implementation

The guideline will be accessed via the Canberra Health Services Policy and Clinical Guidance Register. It is to be printed to be inserted into the clinical notes during the patient admission.

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## Related Policies, Procedures, Guidelines and Legislation

### Policies

- Nursing and Midwifery Continuing Competence Policy
- Waste Management Policy
- Consent and Treatment Policy

### Procedures

- Nursing and Midwifery Continuing Competency Procedure
- Aseptic Non Touch Technique

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**Legislation**

- *Workplace Safety Act 2009*
- CHS Code Of Conduct

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## Definition of Terms

- ATCH: adrenocorticotrophic hormone
- TCH: The Canberra Hospital
- ZES: Zollinger - Ellison Syndrome
- SIT: Saline Infusion Test
- GH: Growth Hormone
- IGF: Insulin-like Growth Factor 1
- Na+: Sodium
- BP: Blood Pressure
- Insulinoma
- Hypoglycaemia
- 72 hour fast
- Whipple's triad:
  - symptoms consistent with hypoglycaemia
  - low plasma glucose when symptoms are present
  - relief of symptoms after plasma glucose level is raised.

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## Search Terms

Short Synacthen Test, Diagnosis of Adrenal Insufficiency, Water Deprivation Test, Diabetes Insipidus, Primary Polydipsia, Insulinoma, Insulin Tolerance Test, Hypopituitarism, Acromegaly, Pheochromocytoma, Metanephrines, Primary Aldosteronism, Addison's Disease, Cushing's Disease, 72 Hour Fast.

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## Attachments

### Attachment A: Endocrine Test Form

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<i>Date Amended</i>	<i>Section Amended</i>	<i>Divisional Approval</i>	<i>Final Approval</i>
19/03/2020	Template and document updated to reflect current organisational structure	Policy Team Leader	Co-chair CHS Policy Committee
13/02/2023	Amendment to entire document related to DHR	Josie Russell-Brown, CHS DHR Readiness Lead - DoM	CHS Policy Team

*This document supersedes the following:*

<i>Document Number</i>	<i>Document Name</i>

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Do not refer to a paper based copy of this policy document. The most current version can be found on the CHS Policy Register



**Attachment A: Endocrine Test Form**



\* 4 0 2 9 0 \*

**The Canberra Hospital  
Endocrine Tests**

Date: \_\_\_/\_\_\_/\_\_\_ Weight: \_\_\_\_\_

Diagnosis: \_\_\_\_\_  
\_\_\_\_\_

Complete details or affix label

URN: \_\_\_\_\_

Surname: \_\_\_\_\_

Given name: \_\_\_\_\_

DOB: \_\_\_\_\_ Gender: \_\_\_\_\_

Type of Test: \_\_\_\_\_

Drugs Given: \_\_\_\_\_

Glucose: \_\_\_\_\_

Procedure: \_\_\_\_\_

Time (mins)	Cap BGL	Gluc	INS	LH	FSH	PRL	TSH	CORT	HGH	FT3	FT4	CTH

Endocrine Tests

Basal Samples: \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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