Water Deprivation Test for Suspected Diabetes Insipidus in Children

This test is potentially very dangerous and must be undertaken with great care.

The test is presented across two pages overleaf.
Water Deprivation Test for Suspected Diabetes Insipidus in Children

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.

**Indication**

Investigation of suspected cranial or nephrogenic diabetes insipidus (Diabetes Insipidus) and primary polydipsia.

**Contraindications**

Other causes of polydipsia & polyuria eg diabetes mellitus, hypoadrenalism, hypercalcaemia, hypokalaemia, hypothyroidism, urinary infections, chronic renal failure and therapy with carbamazepine, chlorpropamide or lithium therapy.

If there is evidence for the ability to concentrate urine eg spot urine osmolality > 750 mOsm/kg.

**Principle of the Test**

Water restriction in the normal individual results in secretion of AVP by the posterior pituitary in order to reclaim water from the distal renal tubules. Failure of this mechanism results in a rise in plasma osmolality due to water loss, and a dilute urine of low osmolality. The two causes are a) a failure of AVP secretion and b) insensitivity of the renal tubules to AVP and they may be distinguished by the administration of DDAVP (synthetic AVP).

**Side Effects**

Patients with DI may become severely water depleted during the test and MUST be carefully monitored throughout the procedure.

**Preparation**

DO NOT RESTRICT FLUIDS UNTIL THE TEST COMMENCES.

**Requirements**

Accurate weighing scales for weighing the patient.

Volumetric flasks (200 mL) for measuring hourly urine volumes.

**Preparation**

Admit at just prior to 8am from home to the Day Care unit.

*The child should have their normal drinks and diet prior to and up to the test commencing.*

*Record all measurements and results in table (p2)*

1. Weigh child at 8am

2. Calculate 5% weight loss, subtract from actual weight and document in sheet

3. Take baseline ACTH, cortisol, TFTs, LFTs, and IGF-I (- these may not always be required)

   Measure urine and plasma U+E and osmolality and start fluid deprivation

4. Weigh child hourly and take hourly obs (heart rate, BP). If 5% weight loss is achieved then the test should be stopped and to proceed to DDAVP test - see next page.

5. Every 2 hours monitor blood and urine osmolality and electrolytes AND/OR collect every urine for osmo whenever passed.

6. Do not fast longer than 7 hours - however the test may be continued depending on the available results AND at the discretion of the consultant in charge.

7. Terminate test if
   a. any urine osmo is greater than 700mmol/l - this is a normal result
   b. there is fall in weight of greater than 5%
Water Deprivation Test for Suspected Diabetes Insipidus in Children (cont)

Baseline Weight...............................kg

5% weight loss...............................kg

Blood Pressure..............................

<table>
<thead>
<tr>
<th>Time</th>
<th>Time (h) since start</th>
<th>Weight (kg)</th>
<th>Weight loss</th>
<th>Urine volume (mls)</th>
<th>Plasma Na (2 hourly)</th>
<th>Plasma Osmo (2 hourly)</th>
<th>Urine Osmo (every urine passed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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</tbody>
</table>

Total Weight loss..........................(kg)

Total Urine volume..........................(mls)

**DDAVP test**

**SEEK ADVICE IF PROCEEDING TO A TEST DOSE OF DDAVP**

8) Stop fluid restriction and proceed to DDAVP test if:
   a) There is a fall in weight of more than 5%
   b) Plasma osmolality > 300mOsm/kg with inappropriately low urine osmolarity
   c) Clinically dehydrated

9) Methodology for DDAVP test (Caution - beware water intoxication after fluid deprivation stopped)
   a) administer intramuscular DDAVP at a doses below (ref Brook & Hindmarsh)
      DDAVP 0.1micrograms by i.m injection (<2 years)
      DDAVP 0.2micrograms by i.m injection (2-8 yrs)
      DDAVP 0.3micrograms by i.m injection (8-14yrs)
      DDAVP 0.4micrograms by i.m injection (>14 years)
   b) Fluid restriction should have been stopped, allow a light diet. Restrict infants to half normal fluid intake and limit older children to 500mls for 8 hours post DDAVP. The aim is to correct any electrolyte abnormalities slowly and avoid water intoxication.

10) Measure urine and plasma U+E osmo 2 & 4 hourly after DDAVP (record in table below)

11) Do not allow off ward until U+E, plasma and urine osmolality have normalised. This will happen if the kidneys are functioning adequately. Ensure parents understand the importance of slow introduction of fluids post DDAVP until effects wear off in approximately 8 hours’ time. Depending on the outcome of the results and clinical response it may be necessary to admit the child for closer observation.
Interpretation Table

<table>
<thead>
<tr>
<th>Post-dehydration osmolality (mOsm/kg)</th>
<th>Post DDAVP osmolality (mOsm/kg)</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>plasma urine</td>
<td>urine</td>
<td>normal</td>
</tr>
<tr>
<td>283-293 &gt; 750</td>
<td>&gt; 750</td>
<td>nephrogenic diabetes insipidus</td>
</tr>
<tr>
<td>&gt; 293 &lt; 300</td>
<td>&lt; 300</td>
<td>cranial diabetes insipidus</td>
</tr>
<tr>
<td>&gt; 293 &lt; 300</td>
<td>&gt; 750</td>
<td>chronic polydipsia</td>
</tr>
<tr>
<td>&lt; 293 300-750</td>
<td>&lt; 750</td>
<td>partial nephrogenic DI or primary polydipsia</td>
</tr>
<tr>
<td>&gt; 293 300-750</td>
<td>&gt; 750</td>
<td>partial cranial DI</td>
</tr>
</tbody>
</table>

In habitual water drinking the plasma osmo should not change significantly, but the renal concentrating ability may not reach 750mosm/kg