PAEDIATRICS - WATER DEPRIVATION TEST

These are guidelines only, and it will be at the clinician’s discretion to apply different treatment depending on individual circumstances of patient

Indications for Test

Determination of urine concentrating ability in patients with polyuria and polydipsia.
Investigation of suspected diabetes insipidus (DI) and differentiation from primary polydipsia (psychogenic polydipsia).

Plasma and urine osmolality are measured during a period of water deprivation. If urine concentration is not achieved synthetic antidiuretic hormone (DDAVP) is administered to determine the renal tubular response to ADH in order to distinguish cranial (central) DI from nephrogenic DI.

Cautions

This is a potentially hazardous test and close medical supervision is required.
Fluid restriction should not take place overnight.
It must be possible to weigh the patient accurately throughout the test.
DDAVP should be obtained from Pharmacy in advance so that the DDAVP test may be commenced as soon as the water deprivation test ends.
The patient must not be allowed to become dehydrated.
Fluid intake post DDAVP test must be controlled to avoid water overload.

The test must be arranged in advance with the Chemical Pathology Laboratory and all specimens handled urgently.

All measurements must be charted and acted upon promptly.

STOP the test if:-

A diagnostic result is obtained, OR
weight loss exceeds 5% of initial weight, OR
patient shows signs of dehydration
plasma Na⁺ > 155 mmol/L or plasma osmolality >320 mosm/Kg.

Prior to undertaking a water deprivation test:

Establish polyuria by documenting 24 hour urine volume and fluid intake. If these are equal and appropriate for age (40 ml/kg/24 hours in older children and adults) the test is NOT NECESSARY.
Measure the osmolality of an early morning urine. If this is > 750 mosm/kg the test is NOT NECESSARY.
NB: Fluids must not be restricted at home prior to diagnosis.

Measure blood glucose, plasma calcium and potassium to exclude common cause of nephrogenic diabetes insipidus/polyuria.

If a water deprivation test is deemed necessary arrange a date and start time with a senior member of staff in Chemical Pathology to ensure samples are handled urgently.

**During test**

All urine passed during the test period must be collected into white topped universal containers and despatched to the Laboratory as hourly collections. If this proves difficult label the urine samples sequentially with the time of collection.

Blood samples when required : 1 ml Li Hep (Paed).

**Patient preparation**

Consider overnight admission prior to test. The patient might need to be admitted for a second night if following the test fluid intake needs to be monitored to avoid water overload. A light breakfast with minimal fluid (water) may be taken before the test starts. Weigh the patient accurately, to within 0.1 kg. Use the same scales throughout the test. An IV cannula must be inserted for blood sampling. Hydrocortisone cover should be commenced 48 hours prior to test, if patient is known to be cortisol deficient.

**Test procedure**

<table>
<thead>
<tr>
<th>Time</th>
<th>Events</th>
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<tbody>
<tr>
<td>08.30</td>
<td>Start test. Withhold fluids for up to 7 hours, with constant supervision. Empty bladder; measure urine osmolality and sodium concentration (U0).</td>
</tr>
<tr>
<td>09.30</td>
<td>Collect urine sample (U1) and blood sample (B1) measure Na$^+$ and osmolality on each sample.</td>
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<tr>
<td></td>
<td>Document patient weight, pulse, BP, urine volume and osmolality (U1).</td>
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<tr>
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<td>If U1 osmo &gt; 750 mosm/kg STOP TEST.</td>
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<tr>
<td></td>
<td>If B1 Na$^+$ &gt;148 mmol/L OR B1 OSM . 300 mosm/kg AND urine is inappropriately dilute (&lt;300 mosm/kg) diabetes insipidus confirmed. Proceed to DDAVP test.</td>
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</tbody>
</table>
10.30 Document patient weight, pulse, BP, urine volume and + osmolality (U2)

11.30 Document patient weight, pulse, BP, urine volume and + osmolality (U3).

Collect blood for Na⁺ and osmolality (B2)

12.30 Document patient weight, pulse, BP, urine volume and + osmolality (U4).

13.30 Document patient weight, pulse, BP, urine volume and + osmolality (U5).

Collect blood for Na⁺ and osmolality (B3)

14.30 Document patient weight, pulse, BP, urine volume and + osmolality (U6).

15.30 * Document patient weight, pulse, BP, urine volume and + osmolality (U7).

* Collect blood for Na⁺ and osmolality (B4)

*THESE SAMPLES AT THE END OF THE TEST ARE VITAL.

Test ends

Proceed to DDAVP test if indicated.

Stop test if at any time during WDT if

Any urine osmolality exceeds 750 mosm/kg (DDAVP test is not indicated) OR

Weight loss exceeds 5% of initial weight (DDAVP test may be indicated) OR

Serum osmolality rises (>300 mosm/kg) in the face of an inappropriately dilute urine (<300 mosm/kg). (DDAVP test is indicated) OR

The patient becomes clinically dehydrated. (DDAVP test may be indicated) OR

At 15.30 if these criteria have not been met. (DDAVP test may be indicated).

Interpretation

| Normal response | Urine osmolality >750 mosm/kg*
|                | U7 osm: B4 osm ratio >1.5
| Diabetes insipidus | U7 < 450 mosm/kg
|                  | ? central / ? nephrogenic
|                  | Proceed to DDAVP test directly.
| Psychogenic DI   | Normal response |
U7 450 - 750 mosm/kg*

DDAVP test is not indicated.

NB: False negative results may be obtained in the presence of concurrent cortisol deficiency but can be avoided by giving hydrocortisone cover.

* The urine osmolality value of 750 mosm/kg is derived from adults. In children no normative data exists. Values between 450 and 750 mosm/kg are frequently observed following water deprivation. In this range the diagnosis is probably one of psychogenic polydipsia and gradual fluid restriction under supervision may be indicated, with careful monitoring of plasma and urine osmolalities. Any patient with a history of prolonged polyuria of whatever cause will have some impairment of concentrating ability because of medullary solute washout.

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