MANAGEMENT OF DIABETIC HYPEROSMOLAR NON-KETOTIC SYNDROME –GUIDELINES

- common in frail elderly
- high mortality (30%)
- may be previously undiagnosed diabetes, but can also develop in people with known type 2 diabetes
- significant hyperketonaemia, ketonuria and acidosis are usually absent
- acute intercurrent illness is common

Diagnosis

Typical features include:
- severe hyperglycaemia (> 50 mmol/l)
- hyperosmolarity (> 320 mosmol/kg) with profound dehydration and prerenal uraemia
- depression of the level of consciousness; coma is well recognised

<table>
<thead>
<tr>
<th>Plasma osmolality</th>
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<tbody>
<tr>
<td>2 x (Na + K) + urea + glucose (all mmol/l)</td>
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<tr>
<td>normal range is 280 – 300 mosmol/kg</td>
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Immediate management – Within the First Hour

Initial Assessment
- Airway and breathing - correct hypoxaemia.
- IV access.
- Monitor ECG, O₂ saturations, pulse rate, BP, respiratory rate, conscious level and fluid balance.
- Laboratory blood glucose, bedside BM, urea and electrolytes, serum bicarbonate, arterial blood gases.

Fluid Replacement
- Commence rehydration with 0.9% saline 1000 ml over one hour.

Intravenous Insulin
- Prepare intravenous insulin infusion (see below) and commence at 3 units/hr.
**Other Interventions/Actions**

- NG tube if impaired consciousness or protracted vomiting.
- Catheter if oliguric.
- Consider central line if clinically indicated.
- Admit patient to a high dependency area.
- **Call the metabolic/diabetes registrar.**

**Ongoing management – Hours 2-4**

**Reassess patient regularly and monitor vital signs**

**Intravenous fluids**

- Aim to rapidly restore circulating volume and then gradually correct interstitial and intracellular fluid deficits.
- Use isotonic saline (see example below) – infusion rates will vary between patients, remember risk of cardiac failure in elderly patients.
- If serum sodium exceeds 155 mmol/l, use 0.45% saline instead of isotonic. **Discuss with metabolic/diabetes registrar.**

<table>
<thead>
<tr>
<th>500 mls saline over 2\textsuperscript{nd} hour</th>
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<tbody>
<tr>
<td>500 mls saline over 3\textsuperscript{rd} hour</td>
</tr>
<tr>
<td>500 mls saline over 4\textsuperscript{th} hour</td>
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</tbody>
</table>

- If hypotension (SBP < 100 mmHg) or signs of poor organ perfusion are present, use colloid to restore circulating volume.
- Add in 10% dextrose once blood glucose $\leq$15 mmol/l. Infuse at 125-250 mls/hr. **Do not alternate saline and dextrose.**
- Measure U&Es and serum osmolality at the end of hour 2 and hour 4.
Electrolyte Replacement

- Target potassium concentration is 4.0-5.0 mmol/l.

<table>
<thead>
<tr>
<th>Potassium Replacement</th>
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<tbody>
<tr>
<td>No potassium in the first litre unless known to be &lt; 3.0 mmol/l</td>
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<tr>
<td>Thereafter, replace potassium as below:</td>
</tr>
<tr>
<td>plasma potassium (mmol/l)</td>
</tr>
<tr>
<td>&lt; 3.5</td>
</tr>
<tr>
<td>3.5– 5.0</td>
</tr>
<tr>
<td>&gt;5.0, or anuric</td>
</tr>
</tbody>
</table>
* must be given in one litre of fluid; avoid infusion rates of KCL >10mmol/hr

Blood Glucose and Insulin

- Hourly laboratory glucose
- Aim to ensure a gradual reduction in blood glucose over the first 12-24 hours. There is no specific evidence to avoid rapid rates of fall (e.g. >5mmol/hr), but there are some observational data to suggest that excessive rates of fall may be associated with cerebral oedema.
- The target blood glucose concentration for the end of the first day is 10-20mmol/l.
- Make up an infusion of 50 units of soluble insulin (e.g. Humulin S or Actrapid) in 50 mls 0.9% saline (1 unit/ml) and infuse using a syringe driver.

- 3 units/hr initially

If plasma glucose does not fall in the first hour, the rate of infusion needs increased - phone the metabolic registrar for advice

- If blood glucose falls below target (i.e.<10mmol/l) on 3units/hr, the insulin infusion can be reduced to a minimum of 1 unit/hr. Do not reduce the insulin infusion rate below this. If glucose continues to fall, increase the infusion
rate of dextrose or the concentration. Discuss with the metabolic/diabetes registrar.

- Remember that intravenous insulin has a half-life of 2.5 minutes. It is important that the insulin infusion is not interrupted.

**Consider Precipitating Factors:**
- FBC
- CXR
- ECG/MI screen
- urine gram stain and culture
- blood cultures and other infection screen

**Other measures**
- Urinary catheter: if cardiac failure, persistent hypotension, renal failure, no urine passed after 4 hours or impaired consciousness.
- CVP line: consider if elderly with concomitant illness, cardiac failure or renal failure.
- Thromboembolic complications are common, however full anticoagulation has been associated with a high risk of GI bleeding. Patients should receive DVT prophylaxis with LMWH, rather than unfractionated heparin and should have TED stockings (unless contra-indicated).
- Nasogastric tube: if consciousness is impaired to avoid aspiration of gastric contents.
- Antibiotics: low threshold for use.

**Subsequent Management – 4 hours+**

**Fluids and Electrolytes**
- Allow oral intake if swallowing safe and bowel sounds present.
- Measure U&Es twice daily, until within the normal reference range (or back to usual baseline for that patient).
- Continue with normal saline≤250ml/hour until U&Es back to baseline and the patient is eating.
- Continue potassium infusion until target is maintained.

**Insulin and Dextrose**
- A blood glucose meter can be used to monitor blood glucose concentration if the previous laboratory blood glucose is <20 mmol/l.
- Maintain IV insulin (minimum rate 2units/hr) and 10% dextrose infusion (250ml/hr) until biochemically stable and patient has eaten at least two meals. It is not necessarily the case that the patient will require subcutaneous insulin; the need for sc insulin or oral hypoglycaemic therapy should be discussed with the diabetes/metabolic registrar.
Continuing Care

- Ensure patient is reviewed by the diabetes team prior to discharge, so that the cause of the HONK can be elucidated, appropriate education be given and follow up arranged.
- Patient should not be discharged until biochemically normal, eating normally and established on appropriate therapy.
- Ensure that a copy of the discharge summary is sent to the diabetes team.

Protocol prepared by Vincent McAulay 10/2002
Updated by Mark Strachan 4/2004