

**MANAGEMENT OF DIABETIC
HYPEROSMOLAR NON-KETOTIC SYNDROME
– GUIDELINES**

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

Plasma osmolality

$2 \times (\text{Na} + \text{K}) + \text{urea} + \text{glucose}$ (all mmol/l)
Normal range is 280 – 300 mosmol/kg

Immediate management

Initial Assessment

- Airway and breathing - correct hypoxaemia.
- IV access.
- monitor ECG, O₂ saturations, pulse, 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.
- Admits 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

500 mls saline over 2nd hour
 500 mls saline over 3rd hour
 500 mls saline over 4th hour

- 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 4.

Electrolyte replacement

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

Potassium replacement

No potassium in the first litre unless known to be < 3.0 mmol/l

Thereafter, replace potassium as below:

plasma potassium (mmol/l)	potassium added (mmol/hr)
< 3.5	40*
3.5 – 5.0	20
>5.0, or anuric	No supplements

* must be given in one litre of fluid; avoid infusion rates of KCL >10 mmol/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.

- If blood glucose falls below target (i.e. $<10\text{mmol/l}$) on 3 units/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 registrar.**

- 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**

- 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 anti coagulation 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 contraindicated).
- Nasogastric tube: if consciousness is impaired to avoid aspiration of gastric contents.
- Antibiotics: low threshold for use.

Subsequent Management – 4hours+

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 $U<U250\text{ml/hr}$ 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 $<20\text{mmol/l}$.
- Maintain IV insulin (minimum rate 2 unites/her) 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 to 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