

Management is largely the same as for diabetic ketoacidosis (see guideline), but is associated with up to a 50% mortality. The patients are usually elderly and the condition is usually secondary to an underlying primary pathology. Refer to the DKA algorithm in the recent NICE guidelines.

The main causes of death are:

- aspiration of gastric contents (due to gastroparesis)
- cerebral oedema
- thromboembolic complications
- the underlying primary pathology

FIRSTLY ESTABLISH THE DIAGNOSIS

- Undiagnosed Type 2 DM or known cases of Type 2 DM
- Hyperglycaemia (blood glucose often > 28 mmol/l)
- Usually no ketones in the urine, although may be present in patient with vomiting (Particularly trace or 1+)
- No severe acidosis (pH >7.2 and HCO_3^- often normal)
- Hyperosmolality (serum osmolality >350 mosm/l)
- 50% of patients are hypernatraemic
- \pm decreased conscious level and mental confusion

CONSIDER PRECIPITATING EVENT

- In elderly patients, consider MI, chest infection, etc
- Usually underlying infection (URTI, diarrhoea and vomiting, UTI, etc, while temp and WCC unhelpful)
- Newly presenting patient
- Acute abdomen

INITIAL INVESTIGATIONS

- Glucose
- U and Es, (HCO_3^- if possible), amylase
- Infection screen (including CXR and blood cultures)
- Arterial blood gases
- Calculation of serum osmolality $\{= 2(\text{K}^+ + \text{Na}^+) + \text{urea} + \text{glucose (all in mmol/l)}\}$, and measurement by the laboratory
- Urinalysis
- CXR and ECG

INITIAL MANAGEMENT

- Site nasogastric tube (consider in all subjects mandatory if reduced conscious level: GCS <8)
- Intravenous access
- Insulin regime (see below)
- Fluid replacement (see below)
- Consider antibiotics
- Stop Metformin
- Low molecular weight heparin (or equivalent), and consider full heparinisation if serum osmolality >350 mosmol/l
- Catheterise if no urine output in first 3 - 4 hours of treatment, or if the patient is clinically shocked and/or has a reduced conscious level
- CVP line often required, particularly in those with IHD
- Monitor U and Es and glucose after 2 hours, and then at least 4 hourly until the patient is stable
- Protection of pressure areas, particularly heels (Spenco boots should be considered)

REMEMBER:

Average deficit to replace in 70 kg patient

- 200 - 300 mmol of K⁺ (often smaller amounts of K⁺ are required than in DKA)
- 6 - 12 litres of fluid (fluid requirements are likely to be greater than DKA but risks of cardiac failure are also greater)

THE MOST IMPORTANT ASPECT OF MANAGEMENT OF HONK IS REGULAR EXAMINATION AND RE-ASSESSMENT

INSULIN REPLACEMENT

Points to note:

- the half life of IV insulin is 3 - 5 minutes
- sustained low dose insulin infusion (0.1 U/kg/hr = 7 units/hr in 70 kg patient) will result in rapid and efficient metabolic recompensation with reduced risk of cerebral oedema

USUAL REGIME

- Give 10 units of Human Actrapid stat (IV or IM)
- Commence IV infusion (50 units of soluble insulin in 50 mls of N/Saline)

Suggested insulin infusion:

BM up to 4 mmol/l	0.5 units per hr
BM up to 4.1 - 7 mmol/l	1 unit per hr
BM up to 7.1 - 9 mmol/l	2 units per hr
BM up to 9.1 - 11 mmol/l	3 units per hr
BM up to 11.1 - 17 mmol/l	4 units per hr
BM up to > 17 mmol/l	6 units per hr

- Check the insulin infusion if there is any doubt (eg, has the cannula tissued?)
- For the first 12 hours, the BM should be done 1 hourly
- *Remember that capillary blood glucose testing can be unreliable in the dehydrated or hypothermic patient, and laboratory blood glucose is important as a cross reference*

REMEMBER WHEN STOPPING INSULIN INFUSION OVERLAP WITH S/C INSULIN OR ORAL HYPOGLYCAEMIC AGENTS BY AT LEAST 30 MINS

WATER AND SALT DEFICIT

- Fluid deficit is hypotonic but rapid replacement with hypotonic fluids precipitates cerebral oedema
- Average deficit 6 - 12 litres
- Aim to replace half the fluid deficit in the first 12 hours, the rest over the next 24 hours.

e.g. to replace 7 litres of fluid

500 ml N/Saline an hour for the first 4 hours

500 ml N/Saline 2 hourly for the next 4 hours

500 ml N/Saline 4 hourly for the next 4 hours = 3½ litres in 12 hours

Change to 5% dextrose once blood sugar around 15 mmol/l

- Applies to average size adult, in the elderly - particularly those with IHD - consider CVP line
- If the sodium concentration is >150 mmol/l, use 0.45% Saline (½ N/Saline)

POTASSIUM REPLACEMENT

- Initial potassium often high (particularly if renal impairment pre-exists, or if there is tissue catabolism)
- Insulin and fluid replacement often causes acute drop in K⁺, particularly within first 1 - 2 hours
- Need to replace about 200 mmol K⁺ in first 24 - 36 hours, usually at rate of 10 mmol/l per hour
- Check K⁺ after 2 hours of treatment

THE DIABETES TEAM

The Diabetes Team should be involved as soon as practically possible, and patients with HONK should be triaged to the wards with a diabetes specialty interest (Wards 38 and 30 at LRI, and Wards 3 and 4 at LGH).

TRANSFER TO SUBCUTANEOUS INSULIN OR ORAL HYPOGLYCAEMIC AGENTS

When the patient is able to eat and drink, transfer to subcutaneous (s/c) insulin, using 90% of the previous day's intravenous requirements in two equally split doses in patients not previously receiving insulin.

The starting insulin can be either a 30/70 fixed mixture (eg, Human Mixtard 30ge or Humulin M3 or one of the pre-mix analogue mixtures, e.g. NovoMix 30) or background insulin alone (eg, Human Insulatard, Humulin I or one of the new basal insulin analogues, i.e. glargine or Detemir), and a referral to the Diabetes Nurse Specialist should be made, although this should not delay the commencement of s/c insulin.

Patients with pre-existing insulin-treated DM should be usually be transferred back to their usual insulin and doses, although the Diabetes Team may consider making changes.

Some patients with HONK may be treated with oral hypoglycaemic therapy on recovery, but Metformin should not be used if there has been renal impairment associated, and thiazolidinediones (Pioglitazone or Rosiglitazone) should not be used if there is any evidence of cardiac failure, peripheral oedema or liver dysfunction.

In practice, oral hypoglycaemic therapy post HONK is usually a sulphonylurea (eg, Gliclazide or glimepiride) or prandial glucose regulator (eg, Repaglinide).

Nursing Interventions:

- ◆ Assess airway, breathing and circulation
- ◆ Observations – 1 hourly then 2 – 4 hourly once clinically indicated
 - Blood pressure
 - Pulse
 - Temperature
 - Respirations and type of respiratory effort
 - Oxygen saturations
 - BM stix recording – 1 hourly
- ◆ Neuro Obs if reduced conscious level – hourly
- ◆ Urinalysis
 - Dipstick urine for ketones
 - MSU if clinically indicated
- ◆ Patient may be confused – maintain safety, cot sides required
 - Orientate to time and place – reassure
- ◆ Strict fluid balance chart
- ◆ Administration of insulin as prescribed
- ◆ Administration of IV fluids as prescribed
- ◆ Referral to Diabetic team
- ◆ Catheterise as prescribed by medics