

FIONA STANLEY HOSPITAL ADULT HYPEROSMOLAR HYPERGLYCAEMIC STATE HSS MANAGEMENT RECORD INSULIN AND INTRAVENOUS FLUID PRESCRIPTION CHART AND MONITORING RECORD		SURNAME		UMRN	
WARD _____		GIVEN NAMES		DOB	GENDER
DOCTOR _____		ADDRESS		POSTCODE	
				TELEPHONE	

LINE 1: Intravenous 0.9% Sodium Chloride (With potassium as per instruction above)						LINE 2: Intravenous 10% DEXTROSE (When blood glucose <14mmol/L. Continue but adjust saline)													
Date	Time	Fluid *	Additives/ Batch No	Volume	Rate mL/hr	Ordered By (Dr Sign)	Given by	Checked by	Pharmacist	Date	Time	Fluid	Additives/ Batch No	Volume	Rate mL/hr	Ordered By (Dr Sign)	Given by	Checked by	Pharmacist
		Sodium Chloride 0.9%	NIL	1L	1000mLs/hour							Dextrose 10%	NIL	500 mL	125 mL/hr				

Observation	0 to 6 hours							6 to 12 hours							12-24 hours										
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Glucose (mmol/L)																									
Creatinine (umol/L)																									
Potassium (mmol/L)																									
Sodium (mmol/L)																									
Osmolality [2Na++glucose+urea]																									
Patients volume status (hypo, hyper or euvoaemic)																									

FIONA STANLEY HOSPITAL ADULT HYPEROSMOLAR HYPERGLYCAEMIC STATE (HHS - FORMERLY KNOWN AS HONK) GUIDELINES AND MANAGEMENT RECORD		SURNAME		UMRN	
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ENTRY CRITERIA: (Tick boxes if criteria present, if none re-consider diagnosis).
Does patient have characteristic features of:-

Hypovolaemia

Marked Hyperglycaemia (>30 mmol/L)

Increased serum osmolality (>320 mosmol/kg) [2Na++glucose+urea]

If Type 1 diabetes OR hyperglycaemia with Acidosis (pH < 7.3; HCO3 <15) AND Ketones (Capillary ketones >3 mmol/L) **THEN FOLLOW DKA PROTOCOL**

- New principles of management of HHS**
1. Correct hypovolaemia first using 0.9% sodium chloride solution for resuscitation. Do not use Hartmann's or colloid. **Expect an initial rise in sodium.**
 2. Monitor electrolytes as high risk of abnormalities and cerebral oedema.
 3. **Treat Hyperglycaemia with intravenous fluids only.** Only commence insulin when blood glucose is no longer falling with IV fluids. **Or if significant ketonaemia > 1mmol/L**
 4. Secondary risk prevention. (Assess foot risk score on admission)

- Consider critical care admission and senior review if one or more of the following are present:**
- | | |
|------------------------------|-------------------------------------|
| 1. Osmolality >350 mosmol/kg | 6. Hypo/hyperkalaemia |
| 2. BP <90mmHg | 7. Urine output < 0.5 ml/kg/hr |
| 3. Na >160 mmol/L | 8. GCS < 12 or abnormal AVPU score |
| 4. Pulse <60 or >100 bpm | 9. O ₂ sats < 92% on air |
| 5. pH < 7.1. | 10. Other serious co-morbidity |

ESSENTIAL INITIAL RESULTS AND ASSESSMENT OF SEVERITY

Blood ketones _____ mmol/L Blood glucose _____ mmol/L

Venous bicarbonate _____ mmol/L Venous (or arterial) pH _____

Potassium _____ mmol/L [Beware initial low K⁺, if low (<3.5 mmol/L) call for senior advice immediately]

Serum Osmolality _____ mosmol/kg Creatinine _____ umol/L

Blood pressure _____ mmHg GCS _____



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Intravenous fluid Assess severity of dehydration and use 0.9% saline (+/- K+) for fluid replacement **WITHOUT** insulin initially. (This alone will lower blood glucose which will reduce osmolality).

- Aim to achieve positive fluid balance of 3-6 litres within first 12 hours and 100% of estimated fluid losses by 24 hours.
- Typically fluid losses approximate 110 – 220 ml/kg (i.e. 10-22 L for 100kg patient).
- Provided osmolality decreasing appropriately continue 0.9% saline (**even if plasma Na+ increasing**)
- All fluid after the 1st bag should contain KCl, unless urine output is < 0.5ml/kg/hr or serum potassium remains in excess of 5.5mmol/L
- Caution** is needed, particularly in the elderly, where too rapid rehydration may precipitate heart failure.

Example fluid regimen:
(can speed up initial fluids as clinically indicated)

1st bag	0.9% sodium chloride	1000ml over 1 hour
2nd bag	sodium chloride 1L with 40mmol potassium chloride	1000ml over next 2 hours
3rd bag	sodium chloride 1L with 40mmol potassium chloride	1000ml over next 4 hours
4th bag	sodium chloride 1L with 40mmol potassium chloride	1000ml over next 4 hours
5th bag	sodium chloride 1L with 40mmol potassium chloride	1000ml over next 6 hours

Potassium

- Initial potassium is often high particularly if renal impairment.
Caution if Urine output less than 0.5ml/kg/hr
- Insulin and fluid replacement often cause acute drop in K+, particularly within first 1-2 hours.

PARAMETERS	ACTION
If K+ >5.5mmol/L	Nil replacement required
If K+ 3.5-5.5mmol/L	20-40mmol/hr (premixed bags only)
If K+ <3.5mmol/L	Senior clinician review/ICU K+ protocol

Rate of infusion through peripheral lines should be no more than 20mmol/KCL per hour. If this is required then the **patient must be on a cardiac monitor (also on monitor if K+ >5.5mmol/L or <3.0mmol/L).**

Insulin

Only start low dose IV insulin (0.05 units/kg/hr ie 80kg = 4units/hr) if:

- Significant ketonaemia (bedside capillary >1 mmol/L)

OR

- Blood glucose falling at rate of less than 5 mmol/hr despite adequate fluid replacement.

Mix 50 units of Actrapid insulin in 50mls of 0.9% sodium chloride

Once commenced if blood glucose falling less than 5 mmol/L per hour with adequate fluid balance increase insulin rate to 0.1 units/kg/hr

Beware of hypoglycaemia

Aim to keep blood glucose 10-15 mmol/L in first 24 hours

Once blood glucose falls below 14 mmol/L commence 10% Glucose at 125 ml/hr **AND CONTINUE 0.9% sodium chloride solution**

Patients should always continue their usual long-acting insulin at the usual dose.

DO NOT WRITE IN MARGIN

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Monitoring

Check every hour for first 6 hours then 2 hourly if satisfactory response:

- Repeat Na+, K+, Urea and Blood Glucose
- Calculated serum osmolality [2Na++glucose+urea] and plot on chart (see end of protocol).
- Assessment for complications of treatment e.g. fluid overload, cerebral oedema or central pontinemyelinosi (as indicated by a deteriorating conscious level)

If osmolality increasing (or falling at rate <3 mosmol/kg/hr) and Na+ increasing check fluid balance:

- If inadequate increase rate of infusion of 0.9% saline
- If adequate consider changing to 0.45% saline infused at same rate

If osmolality falling at rate > 8 mosmol/kg/hr consider:

- Reducing rate of IV fluids
- Reduce rate of insulin infusion (if commenced)

At all times, if the patient is not improving, senior advice should be sought.

Other considerations

- Identify and treat underlying precipitant, eg infection, Myocardial Infarction etc.
- Commence prophylactic anticoagulation as high risk of venous thromboembolism
- Assess foot risk score – assume high risk if patient obtunded or uncooperative
 - Ensure heels are off-loaded
 - Ensure daily foot checks

Ongoing management

- Convert to subcutaneous insulin when biochemically stable and the patient is **ready and able to eat and drink.**
- Transfer to subcutaneous insulin, using 75% of the previous day's intravenous requirements.
- The starting insulin can be a pre-mix analogue e.g. NovoMix 30 or background basal insulin analogues i.e. Lantus.
- Patients with pre-existing insulin-treated DM should be transferred back to their usual insulin and doses unless good reason not to.
- Contact diabetes team for education and follow up at discharge.

