

Adult Hyperosmolar Hyperglycaemic State (Previously HONK, HONC) Treatment Pathway L&D Hospital Hospital Number _____ Surname _____ First Name _____ Use Patient Label Date of Birth _____ NHS Number _____		<input type="checkbox"/> Hourly blood glucose <input type="checkbox"/> Monitor patient's GCS <input type="checkbox"/> Urinary catheter & monitor strict fluid balance <input type="checkbox"/> Pressure area protection especially heels <input type="checkbox"/> HHS Monitoring Profile: 2 hourly for 8 hours, then 4 hourly for next 8-24 hours.							
Step 1 <input type="checkbox"/> Clinical suspicion of HHS		Step 7 - Insulin and glucose <input type="checkbox"/> Following initiation of 0.9% NaCl, start intravenous insulin infusion (If K+ <3.5, withhold insulin infusion & replace K+ as per step 9) <input type="checkbox"/> Use fixed rate of 0.05unit/kg/hr (maximum rate = 3units/hr) <input type="checkbox"/> Continue patient's usual long acting SC insulin (Levemir, Lantus, Tresiba, Humulin I, Insulatard & Insuman Basal). Omit other types of insulin							
Step 2 - Making a diagnosis A) Hypovolaemia (Dehydration) B) Glucose ≥ 30 mmol/L C) *Serum osmolality > 320 mOsm/Kg D) pH > 7.3 or bicarbonate > 15 mmol/L E) Blood ketones < 3 mmol/L or urine ketones ≤ 2 NB: A mixed picture of HHS & DKA may occur. In this case, use DKA protocol until pH > 7.3 & urine ketones ≤ 2		• Blood glucose should fall at a rate of 5mmol/L/hour • If blood glucose falls < 5 mmol/L/hour, check fluid balance (aim for positive fluid balance of 2-3 Litres by 6 hours, 3-6 litres by 12 hours) ❖ If positive balance inadequate, increase rate of 0.9% NaCl. ❖ If positive balance adequate, increase insulin rate to 0.1unit/kg/hr (maximum rate = 6units/hr) • When blood glucose < 14 mmol/L, add 5% glucose at 125ml/hr							
*Measure or calculate osmolality • Osmolality = $2 \times [\text{Sodium}] + [\text{Glucose}] + [\text{Urea}]$ • <u>Normal range = 275-295 mOsm/Kg</u> Aims of treatment • <u>Normalise the osmolality</u> • <u>Replace fluid and electrolyte losses</u> • <u>Normalise blood glucose & avoid hypoglycaemia</u>		Step 8 - Fluids Na+ level is expected to rise initially, due to drop in glucose level <input type="checkbox"/> Prescribe further IV fluids. Use 0.9% NaCl <input type="checkbox"/> Do not use 0.45% NaCl unless the osmolality is not falling or is rising (see below [#])							
Step 3 - Initial fluid <input type="checkbox"/> Commence 1 litre 0.9% NaCl over 1 hour (caution in elderly or risk of fluid overload). If systolic BP < 90 mmHg give 500ml 0.9% NaCl stat prior to that.		• Fluid deficit is typically 7-15 Litres for a 70 kg patient. • Aim for positive fluid balance of 2-3 Litres by 6 hours, 3-6 litres by 12 hours, the rest over next 24-48 hours • Frequency of IV fluids needs to be assessed by a senior doctor (SpR or above) according to age, co-morbidities, risk of fluid overload and degree of dehydration +/- AKI • Osmolality should fall at a rate of 3-8 mOsm/kg/hour • [#] If osmolality declines at < 3 mOsm/kg/hour or increasing, check fluid balance: ❖ If positive fluid balance inadequate, increase rate of 0.9% NaCl ❖ If positive fluid balance adequate, switch to 0.45% NaCl. • If osmolality falling > 8 mOsm/Kg/hr, decrease rate of 0.9% NaCl and decrease rate if on high dose insulin (0.1unit/kg/hr) • Fall of sodium should be < 10 mmol/L in 24 hours							
Step 4 - Initial management and tests <input type="checkbox"/> Prophylactic LMWH STAT (if not contraindicated) <input type="checkbox"/> Venous/Arterial blood gas <input type="checkbox"/> HHS Diagnosis Profile (Look in ICE. Include U&E, Urea, Glucose, serum osmolality, Beta-hydroxybutyrate) <input type="checkbox"/> FBC/LFT/CRP <input type="checkbox"/> ECG <input type="checkbox"/> CXR <input type="checkbox"/> Urine dipstick & culture <input type="checkbox"/> Consider CT head, CK, troponin, amylase or blood culture if indicated		Step 9 - Potassium <input type="checkbox"/> Maintain K+ in normal range. Replace as following							
Step 5 - Clinical assessment • History & examination (GCS, hydration status, fluid overload risk & feet) • Seek and treat precipitating cause • Level 2/HDU Criteria: Consider if ❖ Serum Osmolality > 350 mOsm/Kg ❖ Sodium > 160 mmol/L ❖ Venous/Arterial pH < 7.1 ❖ K+ (admission) < 3.5 or > 6 mmol/L ❖ GCS $< 12/15$ or abnormal AVPU ❖ SpO ₂ $< 92\%$ (with normal baseline respiratory function) ❖ Systolic BP < 90 mmHg ❖ Pulse < 60 or > 100 bpm ❖ Urine output < 0.5 ml/kg/hr ❖ Serum creatinine > 200 micromol/L ❖ Hypothermia ❖ Macrovascular event (MI/stroke) ❖ Other serious co-morbidity		<table border="1"> <tr> <td>K > 5.5</td> <td>K 3.5-5.5</td> <td>K < 3.5</td> </tr> <tr> <td>Nil</td> <td>Add 40mmol KCL/litre</td> <td>Add 40mmol KCL/litre. Withhold insulin infusion</td> </tr> </table>		K > 5.5	K 3.5-5.5	K < 3.5	Nil	Add 40mmol KCL/litre	Add 40mmol KCL/litre. Withhold insulin infusion
K > 5.5	K 3.5-5.5	K < 3.5							
Nil	Add 40mmol KCL/litre	Add 40mmol KCL/litre. Withhold insulin infusion							
		Step 10 - Ongoing support <input type="checkbox"/> Continue regular review <input type="checkbox"/> Continue to treat precipitating cause <input type="checkbox"/> Continue daily prophylactic LMWH <input type="checkbox"/> Check for complications: Cerebral oedema, fluid overload, venous thromboembolism etc <input type="checkbox"/> Daily foot check. <input type="checkbox"/> Inform diabetes team. HHS may take up to 72 hours to fully resolve							



Fixed Rate Intravenous Insulin (See step 7)

Patient's Weight = kg (maximum rate = 3units/hr)

HUMAN ACTRAPID SOLUBLE INSULIN				Date		
Dose 50 units	Infusion Rate Units / hr	Route IV infusion	Start date	Time		
Additional Instructions In 50 ml 0.9% Sodium Chloride via syringe pump				Given By		
Signature	Valid period	Pharm	Nurse Initials			

Monitoring (See step 6)

Responsible team: Both medical and nursing team

Time (since admission)	Time (hh:mm)	Blood glucose (mmol/L)	Osmolality (mOsm/Kg)	Na+ (mmol/L)	K+ (mmol/L)	Urea (mmol/L)	Blood Ketone (if high initially)
Admission							
2hr							
4hr							
6hr							
8hr							
12hr							
16hr							
20hr							
24hr							

Intravenous fluid Prescription (See step 7, 8 and 9)

DATE	START TIME	ADDITIONS TO INFUSION		INFUSION FLUID		IV/SC	TIME TO RUN or mls/hr	Prescriber's Signature	Given By	Time Started	Time Finished	Amount Infused	Pharm
		DRUG (see K+ replacement protocol)	DOSE	TYPE/STRENGTH	VOLUME								
				0.9% Sodium Chloride	1000ml	IV	1 hour						
				0.9% Sodium Chloride	1000ml	IV	2 hours						
Review the patient, fluid balance, Potassium and the rate of change of osmolality before prescribing more fluids (see steps 7, 8 and 9)													
If glucose falls below 14 mmol/L, start 5% glucose solution at a rate of 125mls/hr ALONGSIDE the 0.9% sodium chloride													
				5% glucose	1000ml	IV	8 hours						

