

Hyperglycaemic Hyperosmolar State Care Pathway 1

Name:
Date of Birth: DD / MM / YYYY
CHI: (or addressograph label)

Date: DD / MM / YYYY	Adverse features for senior physician review and/or consideration of medical high dependency: Osmolality >350mOsm/kg, sodium >160mmol/L, H+ >80mmol/L, hypo- or hyperkalaemia, systolic BP <90mmHg, heart rate >100 or <60bpm, urine output <0.5ml/kg/hr, creatinine >200umol/L, hypothermia, acute coronary syndrome or stroke, pregnancy, other serious co-morbidity
Time:	

Investigations

	Check if done
Check U&Es, FBC, bicarbonate, laboratory (not capillary) blood glucose	
Check venous blood gas	
Check urine ketones (or capillary ketones)	
Other interventions to consider	
ECG or cardiac monitor	Record GCS score
Blood cultures	MSSU
CXR	Urinary catheter

Diagnosis

	Results	Criteria	
Laboratory Glucose		More than 30mmol/L	Consider DKA if one of these criteria not met
Calculate serum osmolality: $2 \times (\text{Na}) + \text{glucose} + \text{urea}$		More than 320mOsm/kg	
Venous blood gas H+		Less than 50mmol/L	
Venous bicarbonate		More than 15mmol/L	
Urine ketones (or capillary ketones)		Less than 2+ in urine or less than 3mmol/L	

Management - Part 1 - Immediate to 6 hours

Immediate Management: 0-60 minutes	Check if done
Commence 1L sodium chloride 0.9% over 1hour (caution if heart failure) or faster if systolic BP <90mmHg	
Only start insulin if ketonaemic (>3mmol/L) or ketonuria 2+ or more	
Examine for source of sepsis or evidence of vascular event	
Mental state assessment	
Ensure foot protection	
Commence DVT prophylaxis (reduced dose if renal impairment)	
Continue oral diabetes medications and long acting insulin (if appropriate and caution if renal impairment)	
Ongoing Management: 60 minutes to 6 hours	
Commence insulin at 3units/hour ONLY IF glucose falling at less than 5mmol/hr on fluids	
Ensure hourly finger prick blood glucose	
Ensure U&Es, laboratory glucose and osmolality measured at 2hours then 4hourly thereafter	
Continue sodium chloride 0.9% at a rate of 0.5-1.0L/hr depending on status and improvement of osmolality	
Ensure potassium replacement	
Once insulin commenced, commence dextrose 10% at a rate of 125mL/hour if glucose less than 14mmol/L	

Monitoring - Aim to reduce osmolality by 3-8mOsm/kg/hour

Time	0hours	2hours	4hours	8hours	16hours	20hours	24hours
Actual Time							
Glucose							
Sodium							
Potassium							
Urea							
Creatinine							
Osmolality							

Fluids – Initial Management to 6 hours

Fluids (potassium) prescription sheet								
	Date	Fluid Additive	Vol (ml) Dose	Duration	Signature	Serial No Batch No	Time begun	Given by
AA		Sodium chloride 0.9%	500ml	30mins				
AB		Sodium chloride 0.9%	500ml	30mins				
AC		Sodium chloride 0.9%	500ml					
AD		Sodium chloride 0.9%	500ml					
AE		Sodium chloride 0.9%	500ml					
AF		Sodium chloride 0.9%	500ml					
AG		Sodium chloride 0.9%	500ml					
AH		Sodium chloride 0.9%	500ml					
AI		Sodium chloride 0.9%	500ml					
AJ								
AK								
AL								
AM								
AN								
AO								
AP								

After 6 hours move to Management – Part 2

Fluid Replacement	Potassium Replacement
<ul style="list-style-type: none"> • Aim to achieve 2-3L positive fluid balance by 6hours • If Na increasing but osmolality declining – CONTINUE sodium chloride 0.9% • If Na increasing AND osmolality INCREASING (or less than 3mOsm/kg/hour improvement), review fluid balance. If inadequate, CONSIDER increasing rate of infusion of sodium chloride 0.9% • If osmolality increasing and fluid balance adequate, CONSIDER switching to sodium chloride 0.45% at same rate • If osmolality falling at more than 8mOsm/kg/hour CONSIDER reducing infusion rate of IV fluids and/or insulin if commenced 	<ul style="list-style-type: none"> • Over 5.5mmol/L – no replacement • 3.5-5.5mmol/L – 40mmol replacement • Below 3.5mmol/L – senior review as additional potassium required

If on IV insulin, once Blood Glucose <14mmol/L start dextrose 10% AND CONTINUE sodium chloride 0.9%								
	Date	Fluid	Vol (ml)	Duration	Signature	Serial No Batch No	Time begun	Given by
AQ		Dextrose 10%	500ml	4hours				
AR		Dextrose 10%	500ml	4hours				
AS								
AT								

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Management - Part 2 - 6 hours to resolution

Ongoing Management: 6-12hours	Check if done
Continue monitoring blood glucose, sodium and calculated osmolality	
Assess for complications of treatment i.e. fluid overload, cerebral oedema, deteriorating conscious level	
Continue treatment of underlying cause	
Aim to keep blood glucose 10-15mmol/L	

ENSURE REFERRAL TO INPATIENT DIABETES TEAM AT EARLIEST OPPORTUNITY

Ongoing Management: 12hours to resolution	Check if done
Continue IV fluid replacement aiming to achieve replacement of estimated fluid losses within next 12 hours depending on initial degree of dehydration / body weight and MOST IMPORTANTLY response to treatment	
Continue keeping blood glucose 10-15mmol/L and adjust insulin infusion as appropriate	

Principles Of Treatment
<ul style="list-style-type: none"> • HHS is associated with a significantly higher morbidity and mortality than DKA and must be managed intensively • Fluid losses are estimated to be 10-22L in a person weighing 100kg • Rate of fall of sodium should not exceed 10mmol/L in 24hours • Complete normalization of biochemistry may take 72hours • Patients with HHS have a significantly higher risk of thromboembolism than in DKA and therefore all patients should receive prophylactic low molecular weight heparin for the duration of admission unless contra-indicated • There is also a high risk of pressure ulceration

Reference Targets

Time	6hour	12hour	24hour	48hour	>48hour
Sodium		Not more than 5mmol/L improvement	Not more than 10mmol/L improvement	Not more than 20mmol/L improvement	Not more than 10mmol/L improvement/day
Osmolality	18-42mOsm/kg improvement	36-96mOsm/kg improvement			
Insulin	Commence if glucose improving at less than 5mmol/L per hour with fluids Reduce rate if osmolality improving at more than 8mOsm/kg				
Fluid balance	2-3L positive balance	3-6L positive balance	Aim to replace remaining estimated losses		Neutral balance
Other	Ensure LMWH prescribed, pressure care, continuation of (appropriate) diabetes medications				

Monitoring - Aim to reduce osmolality by 3-8mOsm/kg/hour

Actual Time							
Glucose							
Sodium							
Potassium							
Urea							
Creatinine							
Osmolality							

Fluids – 6 hours to resolution

Fluids (potassium) prescription sheet								
	Date	Fluid Additive	Vol (ml) Dose	Duration	Signature	Serial No Batch No	Time begun	Given by
BA								
BB								
BC								
BD								
BE								
BF								
BG								
BH								
BI								
BJ								
BK								
BL								
BM								
BN								
BO								
BP								

Fluid Replacement	Potassium Replacement - first 24hours	Potassium Replacement - beyond 24 hours
<ul style="list-style-type: none"> • Continue IV fluid replacement to achieve positive fluid balance of 3-6L by 12hours • Beyond 12hours, aim for IV fluid replacement aiming for replacement of estimated fluid losses over next 12 hours – dependent on initial degree of dehydration and response of treatment so far • Continue IV fluids thereafter until eating and drinking normally 	<ul style="list-style-type: none"> • Over 5.5mmol/L - no replacement • 3.5-5.5mmol/L - 40mmol replacement • Below 3.5mmol/L - senior review as additional potassium required 	<ul style="list-style-type: none"> • Over 5.5mmol/L - no replacement • 3-5.5mmol/L - 10mmol replacement • Below 3.5mmol/L - 20mmol replacement

If on IV insulin, once Blood Glucose <14mmol/L start dextrose 10% AND CONTINUE sodium chloride 0.9%								
	Date	Fluid	Vol (ml)	Duration	Signature	Serial No Batch No	Time begun	Given by
BQ		Dextrose 10%	500ml	4hours				
BR		Dextrose 10%	500ml	4hours				
BS								
BT								



**HYPERGLYCAEMIC HYPEROSMOLAR STATE:
INSULIN ADMINISTRATION – ONLY START IF
GLUCOSE FALLING <5MMOL/HR (OR IF
KETONAEMIC)**

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Section 1 – Prescription Details

Insulin:	Total Amount of insulin:	Diluent:	Total volume in syringe:	Insulin concentration:	Route:	Type: Model: Serial No:
HUMAN ACTRAPID	50 UNITS	Sodium Chloride 0.9%	50mL	1unit/mL	Intravenous	

Section 2- Intravenous Insulin Prescription (To be completed by doctor)

Date	Insulin Rate	Type Of Insulin	Signature	Given By
Commence if glucose falling at less than 5mmol/hour with IV fluids				
	3 UNITS/HOUR	ACTRAPID		
Reduce rate if serum osmolality decreasing at more than 8mOsm/kg/hour				

Section 3 – Preparation and setting-up details (To be completed by doctor or nursing staff)

Date	Time	Prepared by	Checked by	Set by	Checked by

ONLY START INSULIN IF BLOOD GLUCOSE FALLING AT LESS THAN 5MMOL/HOUR

Section 4 - Administration check (To be completed 1 hourly by nursing staff)									
Date	Time	Volume Remaining	Total volume infused (cumulative)	Volume infused since last check	Blood glucose reading	Flow rate required (refer to prescription)	Set by	Checked by	Comments

Section 5 - Discontinuation (To be completed by doctor)

Signature: _____ Date: _____ Time: _____