Hyperosmolar Hyperglycaemic State (HHS) SUMMARY CLINICAL GUIDELINE

SEEK SENIOR REIVEW OR DIABETES TEAM INVOLVEMENT IF NOT IMPROVING

Reference No.: CG-T/2023/053

NHS
University Hospitals of Derby and Burton
NHS Foundation Trust

THE DIAGNOSTIC CRITERIA FOR HHS CAN BE DEFINED AS THE PRESENCE OF ALL OF THE FOLLOWING:

1) **High osmolality, often 320 mosmol/kg or more**
2) **High capillary blood glucose (CBG), usually 30mmol/L or more**
3) **Severely dehydrated and unwell**

If pH < 7.3 or ketones > 3mmol/L or urine ketones 2+ or more or venous HCO_3^-<15mmol/L **FOLLOW DKA GUIDELINE**

IMMEDIATE ACTIONS

- ABC assessment including all routine observations including GCS,
- Capillary blood glucose check and capillary ketone check
- Obtain urgent IV access and commence fluids (**as per Box A action 2**)
- Venous bloods obtained for U&E, bicarbonate, FBC and venous blood gas, blood cultures.
- Urinalysis for ketones (if capillary ketones not available)
- VTE prophylaxis - unless contraindicated
- **Calculate osmolality (2Na + glucose + urea)**

SEVERE HHS – NEEDS DISCUSSION WITH HDU/ICU

- Osmolality greater than 350mosmol/kg
- Sodium above 160mmol/L
- Venous/arterial pH below 7.1
- Hypokalaemia (<3.5mmol/L) or hyperkalaemia (>6mmol/L)
- GCS < 12 or abnormal AVPU
- SpO_2 < 92%
- Urine output < 0.5ml/kg/hr
- Serum creatinine > 200µmol/L
- Hypothermia
- Macrovascular events such as MI or stroke
- SBP < 90, pulse > 100/<60

Potassium chloride (KCl)

CONTINUOUS MONITORING OF K+ LEVELS IS ESSENTIAL
With VBG testing
(at 4,8,12, 24, 36 and 48hours)

Venous potassium level (mmol/L)	Potassium Chloride (KCl) replacement
> 5.3	NONE
3.5 – 5.3	10mmol/hr
< 3.5	senior advice

To be added to each Litre bag of NaCl according to the current measured K^+ level
Life threatening hypokalaemia can occur with insulin infusion.
If K^+ infusion is greater than 10mmol/hr cardiac monitoring is recommended. Senior advice should be sought if cardiac monitoring unavailable.

DO NOT GIVE KCL IF PATIENT IS ANURIC

****Long acting insulins that should be continued during treatment:**

Humilin I®	**Tresiba/Degludec®**
Insulatard®	**Toujeo®**
Insuman Basal®	**Levemir®**
Lantus®	**Semglee®**
Glargine®	**Absaglar ®**

IV FLUIDS

ASSESS VOLUME STATUS

Assess patient for **Bag 1** of fluids

PATIENT SHOCKED?
SBP < 90mmHg / HR > 100
1L 0.9% NaCl over 15 minutes
SBP still < 100 mmHg
Give another 500ml bolus NaCl

PATIENT NOT SHOCKED
HR/SBP – NORMAL RANGES

Continue Fluid resuscitation as follows

Note: caution in elderly, CCF, ESRF, adolescence, pregnancy

Bag 1 - 1L 0.9% NaCl +/- KCl over 2 hours

Bag 2 - 1L 0.9% NaCl +/- KCl over 2 -4 hours

At 6 hours, reassess patient in terms of HR, BP, JVP, chest auscultation. If appropriate, prescribe the following:

Bag 3 - 1L 0.9% NaCl +/- KCl over 4 -6 hours

AIM TO REPLACE 3-6 LITRES IN THE FIRST 12 HOURS

Bag 4 – 1L 0.9% NaCl +/- KCl over 6-8 hours

Bag 5 - 1L 0.9% NaCl +/- KCl over 8-10 hours

Adjust rate of the 0.9% NaCl to reduce the risk of fluid overload if concerned.

INSULIN

CHECK K^+ >3.5 mmol/L

No
Seek ITU/HDU advice

Yes

Blood ketones > 1

NO blood ketones

START FLUIDS ONLY
CONTINUE LONG ACTING S/C INSULIN**

ONLY START INSULIN IF BLOOD GLUCOSE FAILS TO FALL BY 5MMOL/HR DESPITE FLUID RESUCITATION

START FIXED RATE INSULIN ALONGSIDE FLUIDS
Use the 30units in 30ml prefilled syringe @ RDH
Use 50units Actrapid in 50ml NaCl @QHB
Start fixed rate insulin infusion at 0.05units/kg/hr
Maximum infusion rate 15units/hr
CONTINUE LONG ACTING S/C INSULIN**

If CBG falls > 5mmol/hr, reduce the rate of fluids as per the clinical picture

IF CAPILLARY BLOOD GLUCOSE < 14 mmol/L within the first 24 hours, Start IV 1L 10% glucose at 125ml/hr

Patient eating and drinking
Switch to patients subcutaneous insulin regime OR consider starting new insulin regimen *as appropriate*.
Stop fixed rate 30 minutes after administration of SC insulin (with meal)

Patient not eating and drinking or another indication for IV insulin (eg severe sepsis/ MI)
Switch to variable rate insulin

Refer early to diabetic specialist nurses
Consider starting long acting in new diabetics such as Semglee®/ Lantus® at 0.25 units/kg divided as twice as a day

IT MAY TAKE UP TO 72 HOURS FOR HHS TO RESOLVE. IF PATIENT NOT IMPROVING, SEEK DIABETIC SPECIALIST INPUT AT THE EARLIEST OPPORTUNITY. REFER EARLY TO DIABETES SPECIALIST NURSES

MONITORING

Monitoring should be performed as follows:
Osmolality – 4, 8, 12, 24, 36, 48 hours to monitor improvement
CBG/blood glucose – Hourly
Fluid balance – Hourly
NEWS – Hourly
VBG (venous) – 4, 8, 12, 24, 36, 48 hours
U&E – 4, 8, 12, 24, 36, 48 hours

AIMS

TARGETS

1) Aim to reduce osmolality by 3-8 mosmol/kg/hr
2) Aim to reduce CBG by 5mmol per hour
3) Aim to reduce sodium by 10mmol/24hr
4) Only consider using 0.45% sodium chloride if osmolality fails to drop WITH SPECIALIST INPUT

If numbers are not improving check the patency of lines and infusion pumps before considering increasing FRII

EXIT CRITERIA

RESOLUTION OF HHS

1. Resolution Of hyperglycaemia
2. Resolution of hyperosmolar state
3. If patient eating and drinking – restart normal diabetes medication. Insulin should be considered if not already on it
4. Triage to the diabetes ward