# Hyperglycaemic Hyperosmolar State

## *Executive summary*

## Introduction

Hyperglycaemic hyperosmolar state (HHS) is a medical emergency that should be referred to a doctor immediately. It is a hyperglycaemic complication of type II diabetes mellitus patients, typically seen in middle-age to elderly type II diabetics.

## Target users

* Nurses
* Doctors

## Target area of use

* Gate clinic
* Outpatient department
* Ward

## Key areas of focus / New additions / Changes

This guideline outlines the recognition and acute management of HHS.

## Limitations

Management of diabetes mellitus after the emergency is over is covered by a separate guideline (MeG-CLS-004).

## Presenting symptoms and signs

Patient is usually a known diabetic. He / She may present with

* Hypovolemia
* Marked hyperglycemia of 30 mmol/L or more
* Absence of ketones in urine (or 1+)
* No acidosis (bicarbonate greater than 15 mEq/L)
* Osmolality usually 320 mOsmol/kg or more

N.B. A mixed picture of HHS and DKA may occur.

Other symptoms may include;

* Weakness
* Weight loss
* Polyuria & polydipsia
* Signs of dehydration
* Lethargy and confusion
* Convulsions and coma

## Immediate action

**This is a medical emergency – a doctor should be called and the patient should be transferred to the ward as soon as possible.**

* Call for help (senior nurses, other physicians)
* Check Airway, Breathing and Circulation status. Ensure the patient is alive!
* Get two Intravenous access with the widest cannula possible for the adult (try sizes 18 [green cannula] & 16 [grey cannula])
* If shocked, give 1 Litre of 0.9% Saline. Give this over 30 minutes. Reassess thereafter. Repeat if necessary.

Check the following before the doctor arrives;

* Vital Signs (PR, BP, RR, Temp, SpO2 , weight & height if possible)
* Blood sugar
* Urine dipstick

## Medical Assessment

### Examination findings

May include: tachycardia, tachypnea, hypotension, fever (if infection is present), orthostatic hypotension, altered mental status, confusion, lethargy, coma, signs of dehydration.

### Differential Diagnosis

* CNS infection
* Hypoglycemia
* Sepsis
* Uremia
* Severe dehydration
* Hyponatremia

### Investigations

* FBC, U&Es, Cr, LFTs, serum blood sugar, Urinalysis and Urine microscopy, culture & sensitivity.
* ECG & Renal US (underlying chronic kidney disease or heart failure is common in HHS)

The diagnosis is confirmed if:

* Hyperglycemia 30 mmol/L or more
* Serum bicarbonate > 15 mEq/L
* Serum osmolality > 310 mOsm/kg – ideally measured – to calculate it = 2Na + 2K + glucose + urea
* Normal anion gap < 14 mEq/L – to calculate it = Na - (Cl + HCO3)
* No acidosis - blood pH > 7.3 (not available to us)

### Management

If the patient is not already there, send to the ward immediately for admission.

**Fluids**: IV fluid rehydration with 0.9% Normal Saline; Give 4-6 Litres of fluid in the first 8-10 hrs (1 Litre stat, then 1 Litre in 1 hour, 1 Litre in 2 hours, 1 Litre in 2 hours, 1 Litre in 4 hours), then continue with 1 Litre 4 hourly.

Only switch to 0.45% sodium chloride solution if the osmolality is not declining despite adequate positive fluid balance. An initial rise in sodium is expected and is not itself an indication for hypotonic fluids. The rate of fall of plasma sodium should not exceed 10mmol/L in 24 hours.

Change to 5% dextrose saline once the blood sugar is < 14 mmol/L.

**Insulin therapy** should be delayed as fluid replacement alone can reduce hyperglycemia considerably by correcting the hypovolemia.

Low dose IV insulin (0.05 units/kg/hr) should only be commenced once the blood glucose is no longer falling with IV fluids alone OR immediately if there is significant ketonaemia (urine ketones greater than 2+).

The fall in blood glucose should be no more than 5 mmol/L/hr

Once the patient is stabilized and the blood glucose falls to around 13.9 mmol/L, insulin can be given subcutaneously.

**Potassium replacement**: Add K to fluids if the patient is on insulin infusion and has started passing urine. Typical deficit is 3-5 mmol/kg. Plasma Kfalls with insulin administration.

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| **Serum KLevel (mmol/L)** | **KCl amount to add per Litre of Fluid** |
| K> 5.5 | No need to add KCL |
| K < 5.5 | Add **20mmol** of KCl |
| K < 4.0 | Add **30mmol** of KCl |
| K < 3.0 | Add **40mmol** of KCl |

**Other issues and ongoing monitoring:**

* Check serum K, HCO3 & glucose every 6 hours.
* Do hourly temperature, BP, neurological observation (Glasgow Coma score), fluid balance and bedside BM.
* If the patient has not passed urine by one hour into resuscitation, consider passing a urinary catheter. Aim for a urinary output of > 0.5 ml/kg/hour.
* Consider NG tube if vomiting or drowsy.

Find and treat the cause of the HHS e.g. infection or other inter-current illness, poor adherence to medications for previously known patients. Investigate as appropriate e.g. Chest X-ray, FBC, blood culture for suspected Pneumonia.

See guideline on Diabetes Mellitus for ongoing care of these patients once the emergency is over.

## Key Issues for Nursing care

* Always check the blood sugar in unconscious or very sick patients and do urinalysis if the blood sugar is high.
* Refer patients with high blood glucose, significant urine dipstick findings and/or very sick patients to the doctor.
* Nurse unconscious patients and monitor them closely as instructed by the doctor.

## References

Nyenwe EA et al. Evidence-based management of hyperglycemic emergencies in diabetes mellitus. Diabetes Res Clin Pract. 2011 Dec;94(3):340-51.[PMID:21978840]

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| **Written by:** | Name: Musa Jallow | Date: 5 June 2018 |
| **Reviewed by:** | Name: Babatunde Awokola | Date: 12 July 2018 |
| **Version:** | **Change history:** | **Review due date:** |
| 1.0 | New document | 31 July 2020 |
| 1.1 | Executive summary added | 31 July 2020 |
| Review Comments (*if applicable)* |  |  |