

Review of acute management of Hyperosmolar Hyperglycaemic State in an acute hospital

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Background

Hyperosmolar Hyperglycaemic State (HHS) is a medical emergency, usually affecting older people with high associated mortality. Diagnosis should be prompt and treatment intensive whilst adjusting management for the complex multi-morbid patients in which it presents.

The aim of this audit was to review the diagnosis and management of HHS and compliance with the trust protocol.

Methods

A retrospective analysis was undertaken using electronic and paper records using the Joint British Diabetes Societies guidelines (2012) for audit standards.

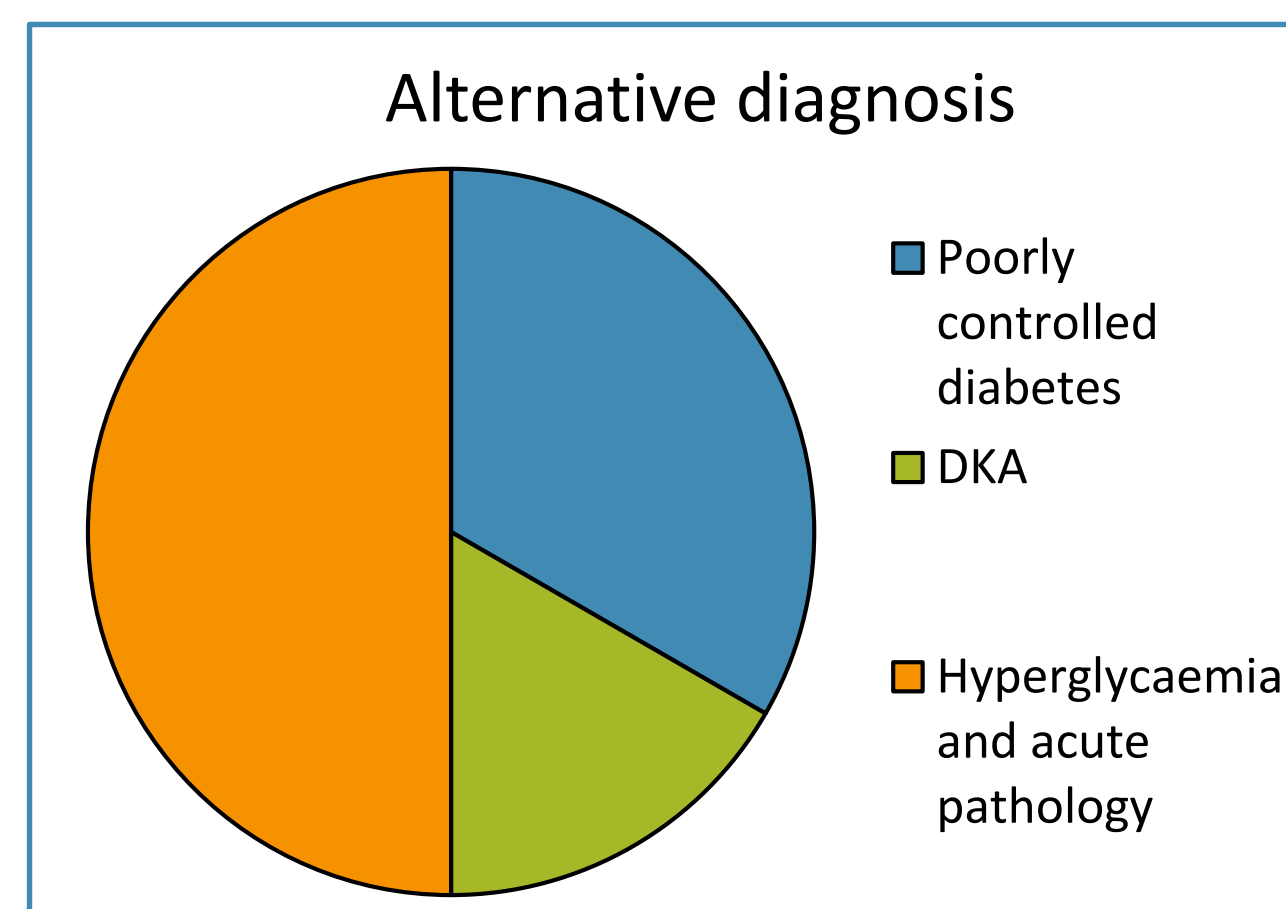
- (1)
- The calculation of osmolality
 - Escalation of care to HDU/Level 2 care
 - Intravenous fluid replacement with 0.9% sodium chloride, with potassium as required
 - Monitoring of glucose, sodium and osmolality to guide management
 - If significant ketonaemia is not present, to not start insulin
 - Assess for infection
 - Ensure VTE prophylaxis (or alternative) is given
 - Foot assessment and minimise risk of pressure damage

The data set was compiled from the last 30 patients coded as HHS by the emergency department.

Results

30 patients were initially selected where 13 had an alternative diagnosis, creating a sample of 17 patients.

Of the non-HHS group 10 patients had no osmolality calculated. On review, the trust hyperglycaemia or DKA protocols would be more appropriate.



The cohort (n=17) was predominantly older females with known diabetes and a high comorbidity burden. 65% were female with an average age of 74.5 years.

| Comorbidities (Charlson comorbidity index) | Average: 7 points Range: 4 - 10 | 0% - 53% 10 year survival |
|--|--|---|
| Known Diabetes | 15 | 88% |
| On insulin | 6 | 40% |
| Frailty score (ED Scoring) | Average 6 Range 3 - 9 | Moderate frailty Encourage review of geriatric syndromes |

Diagnosis

Diagnosis was made at 2.07 hours from arrival with the majority satisfying the criteria of BM > 30 without significant ketonaemia, high osmolality and hypovolaemia.

| Criteria | Number | Percentage |
|------------------|--------|------------|
| BM > 30 | 13 | 77% |
| Ket < 3 | 16 | 94% |
| pH > 7.3 | 17 | 100% |
| Osmolality > 320 | 15 | 88% |

Osmolality was calculated in 88% at diagnosis. 71% had initial fluid resuscitation documented, but there was a paucity of ongoing fluid balance monitoring.

77% of patients had HbA1c measured pre-admission (mean 8.7%, mean 94 days prior). Only 24% had HbA1c checked on acute admission where all readings were greater than 8%.

Monitoring

The HHS management proforma was commenced in 12 of 17 but continued for only 5 patients with significant omissions, chiefly in fluid management. Not one patient has a repeat osmolality. Reasoning for intravenous insulin varied, 31% were used prematurely.

| | | | |
|-------------------|-------------------------------------|----------|-----|
| Insulin | Already use | 8 | 47% |
| | Basal doses continued while on FRII | 4 (of 5) | 80% |
| | Held mixed insulin while on FRII | 2 (of 3) | 66% |
| Commenced on FRII | | 13 | 76% |
| VTE prophylaxis | | 15 | 88% |
| IV antibiotics | | 10 | 59% |
| Foot review | | 8 | 47% |
| Place of care | - ACB (Level 1A) | 6 | 35% |
| | - Other ward then ACB | 5 | 29% |
| | - Non-ACB | 6 | 35% |

Outcomes

77% were managed on a monitored unit, but only 47% directly from ED. At the point of discharge insulin was commenced in 29% and increased in 24% where the HHS diagnosis was documented on the discharge letter in 65%. Half of the patients had a length of stay greater than 7 days (mean 10 days and range 1-48 days). There is significant associated mortality with death of 35% within 6 months of admission.

(2) ADULT HYPEROSMOLAR HYPERGLYCAEMIC STATE (HHS) PRESCRIPTION CHART

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Establish diagnosis of HHS

- High blood sugars > 30mmol without significant ketonaemia (blood ketones <3mmol/L or ketonuria < 2+) or acidosis (pH > 7.3)
- High Osmolality > 320mosmol/kg (calculated serum osmolality = 2Na⁺ + glucose + urea)
- Hypovolaemia

If Type 1 diabetes or hyperglycaemia with acidosis (pH < 7.3 or bicarbonate < 15) AND ketones present (blood ketones > 3mmol/L or ketonuria > 2+) FOLLOW DIABETIC KETOACIDOSIS (DKA) PROTOCOL

For more information refer to UHL guidelines on HHS management. Abridged version available on page 2 of this chart. Monitoring chart on page 3

Date Ward Patient's weight (kg)

Consultant

1) INTRAVENOUS FLUIDS should be commenced via a large IV cannula (green or grey). If there is a problem with intravenous access critical care support should be requested immediately. Be aware of any fluids that may have already been given in the ambulance or ED.

| Sodium chloride | Rate mL/hour (circle as appropriate) | Prescriber PRINT NAME | Administered by | 2nd Nurse check | Time & date commenced | |
|---|--|--|-----------------------|-----------------|-----------------------|-----------------------|
| 1st Litre over 1hr | Sodium chloride 0.9% 500ml/30mins 1000/other * | | | | | |
| Rate depends on clinical assessment of dehydration/risk of precipitating heart failure and fluid balance (target is to achieve positive fluid balance of 2-3L by 6 hours). Review regularly and use clinical judgement, seek senior advice if unsure) | | | | | | |
| STANDARD INFUSION RATE; AMEND ACCORDING TO PATIENT FLUID STATUS | Rate mL/hour (circle as appropriate) | Potassium Check potassium & correct as appropriate (circle as appropriate) | Prescriber PRINT NAME | Administered by | 2nd Nurse check | Time & date commenced |
| 2nd Litre over 1hr | Sodium chloride 0.9% 500ml/30mins 1000/ other..... | Nil/20mmol in 500ml other..... | | | | |
| 3rd Litre over 4hrs | Sodium chloride 0.9% 500ml/2hrs 250/ other..... | Nil/20mmol in 500ml other..... | | | | |
| 4th Litre over 4hrs | Sodium chloride 0.9% 500ml/2hrs 250/ other..... | Nil/20mmol in 500ml other..... | | | | |
| 5th Litre | Sodium chloride 0.9% 500ml/2hrs 250/ | Nil/20mmol in | | | | |

Conclusions

Early diagnosis and recognition of HHS including rigorous adherence to protocols are key in minimising morbidity and mortality. This audit showed that initial management was satisfactory however on-going adherence to protocol was poor as was the prognosis for this group of patients.

Further action is required to raise awareness of HHS diagnostic criteria and the importance of on-going active management. Technology could be used to prompt the calculation of osmolality in hyperglycaemic admissions and at intervals if HHS is confirmed. There also should be a robust follow-up pathway at discharge.

Recommendations

- Develop an electronic prompt to review the deteriorating hyperglycaemic patient and calculate osmolality alongside pH and ketones
- Encourage documentation of repeated osmolality to guide management decisions
- Active education, audit presentation and improve familiarity of acute medical staff with the HHS protocol
- All patients with HHS diagnosis should have an early discharge review and managed on ACB (1a level) unless agreed with the diabetes team
- Recognise the associated poor prognosis and to prioritise treatment on quality of life and early escalation discussions

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References

- 1) Joint British Diabetes Societies Inpatient Care Group. (2012). *The management of the hyperosmolar hyperglycaemic state (HHS) in adults with diabetes*. NHS.
- 2) [https://secure.library.leicestershospitals.nhs.uk/PAGL/Shared%20Documents/Hyperosmolar%20Hyperglycaemic%20State%20\(HHS\)%20in%20Adults%20UHL%20Guideline.pdf](https://secure.library.leicestershospitals.nhs.uk/PAGL/Shared%20Documents/Hyperosmolar%20Hyperglycaemic%20State%20(HHS)%20in%20Adults%20UHL%20Guideline.pdf)