



REGIONAL LOCAL HEALTH NETWORKS

Protocol (clinical)

Title: Hyperglycaemic Hyperosmolar State Management in Adults with Type 2 Diabetes

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Summary This protocol outlines responsibilities and actions required by medical practitioners, nurses and midwives to ensure the safety and quality of patient care.

Policy/procedure reference This protocol supports the SA Health Recognising and Responding to Clinical Deterioration Policy Directive and Guideline, Diabetes Service Plan and Diabetes Inpatient Model of Care.

Keywords Clinical, protocol, medical, nursing, midwifery, emergency, safety, quality, standards, insulin, infusion.

Document history Is this a new LHN protocol? **N**
Does this protocol *amend or update* an existing protocol? **Y**
Hyperglycaemic Hyperosmolar State Management in Adults with Type 2 Diabetes Protocol
Objective No. 2020-02597
Does this protocol *replace* an existing document? **N**

Applies to This protocol applies to all hospital medical practitioners, nursing and midwifery staff.

Objective file number 2020-02597

Version control and change history

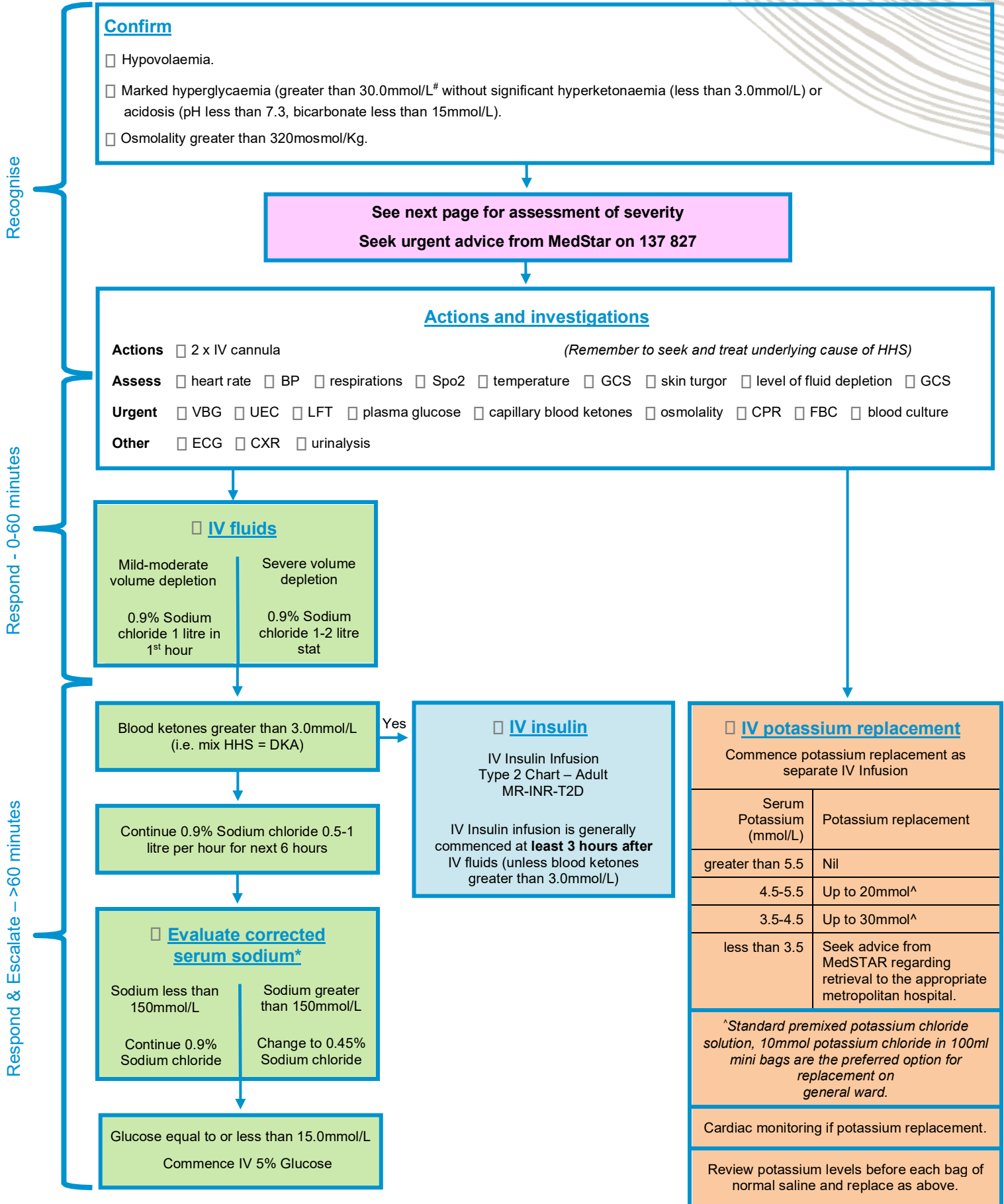
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DO NOT USE FOR
DIABETIC
KETOACIDOSIS

Hyperglycaemic Hyperosmolar State Protocol in Adults with Type 2 Diabetes - Flowchart



[#] ePOC blood glucose limitation: result will be 'HI' if blood glucose greater than 38.0mmol/L.

Assessment of severity

Seek urgent advice from MedStar on 137 827 if any of the listed criteria below is noted

Recommend transfer to an appropriate regional HDU or metropolitan ICU

- | | |
|--|---|
| <ul style="list-style-type: none"> > Osmolality: greater than 350mosmol/kg > Sodium: greater than 160mmol/L (must calculate corrected sodium[^]) > Venous/arterial pH: less than 7.1 > Hypokalaemia: (less than 3.5mmol/L) or hyperkalaemia: (greater than 6.0mmol/L) > Glasgow Coma Scale (GCS): less than 12 or abnormal AVPU* scale > Oxygen saturation: less than 92% on air (assuming normal baseline respiratory function). | <ul style="list-style-type: none"> > Systolic blood pressure: less than 90mmHg > Pulse: greater than 100 or less than 60bpm > Urine output: less than 0.5ml/kg/hour > Serum creatinine: greater than 200µmol/L > Microvascular event: myocardial infarction or stroke > Hypothermia > Other serious co-morbidity: end stage kidney disease, heart failure or conditions that would warrant admission to HDU in their own right. |
|--|---|

[^] Corrected sodium concentration (mmol/L) = measured sodium (mmol/L) + (0.3 x [serum glucose {mmol/L} – 5.5]) eTG March 2021

* AVPU – Alert / Voice / Pain / Unresponsive

Ongoing local management. Assess your site to manage this medical emergency based on staff availability, qualification, experience and competency. The following criteria must be met:

- | | Yes | No |
|---|--------------------------|--------------------------|
| 1) Availability of medical staff who are competent in managing HHS and can review the person frequently, and at short notice. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2) Availability of nursing staff who can provide 1:1 or 1:2 nursing care. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3) Availability of relevant point of care testing. | <input type="checkbox"/> | <input type="checkbox"/> |

1. Introduction

Hyperglycaemic Hyperosmolar State (HHS) is a life-threatening complication of type 2 diabetes. HHS is associated with significant morbidity and much higher mortality than diabetic ketoacidosis (DKA). **HHS is a medical emergency and must be diagnosed promptly and managed intensively.**

In addition to the significant metabolic derangements due to hyperglycaemia and dehydration, these persons are often older (65+ years of age), have additional medical or surgical co-morbidities and an underlying infection, inadequate insulin or noncompliance. The chronic comorbidities and acute illness must appropriately managed. The clinical presentation of HHS may represent as;

- > a new diagnosis of type 2 diabetes **OR**
- > an acute complication of hyperglycaemia in pre-existing type 2 diabetes.

Seek urgent advice from MedSTAR on 137827

Most cases will mandate retrieval by MedSTAR to the appropriate metropolitan hospital. Less severe cases (see *page 6*) may be managed at a regional hospital if resources are available.

Obstetrics. The incidence of type 2 diabetes is increasing in the younger population. Although rare, HHS has the potential for dire consequences for both mother and foetus. Treatment of HHS and intravenous fluid resuscitation requires immediate consultation with MedSTAR.

Paediatrics. This protocol is not to be used for children or young people under 18 years of age. Treatment of HHS and intravenous fluid resuscitation requires immediate consultation with MedSTAR with reference to the South Australian Paediatric Clinical Practice Guideline for Hyperglycaemia Hyperosmolar State in Children and Adolescents (*in development*).

The aim of HHS treatment is:

- > diagnosis and treatment of any underlying cause and to gradually and safely
- > normalise the osmolality
- > replace fluid and correct dehydration without causing fluid overload
- > replace electrolyte losses, mainly potassium
- > normalisation of blood glucose (BG).

1.1 Diagnosis

DEFINITION AND DIAGNOSIS OF HHS

1. Hypovolaemia
2. Marked hyperglycaemia (greater than 30.0mmol/L without significant hyperketonaemia (less than 3.0mmol/L) or acidosis (pH less than 7.3, bicarbonate less than 15.0mmol/L)
3. Osmolality greater than 320mosmol/Kg

Note: A mixed picture of Hyperglycaemic Hyperosmolar State and Diabetic Ketoacidosis may occur.

Venous plasma glucose is recommended. The enterprise point of care (ePOC) system blood glucose will read 'HI' if the BG result is greater than 38.0mmol/L and the bedside Freestyle Optium Neo H blood glucose meter will read 'HI' if the BG is greater than 27.8mmol/L.

1.2 Assessment of severity

Seek urgent advice from MedSTAR on 137827 if any of the listed criteria below is noted
Recommend transfer to an appropriate regional HDU or metropolitan ICU
Commence and continue treatment until patient is medically handed over

- > Osmolality: greater than 350mosmol/kg
- > Sodium: greater than 160mmol/L (must calculate corrected sodium – see below)
- > Venous/arterial pH: less than 7.1
- > Hypokalaemia: (less than 3.5mmol/L) or hyperkalaemia: (greater than 6.0mmol/L)
- > Glasgow Coma Scale (GCS): less than 12 or abnormal AVPU* scale
- > Oxygen saturation: less than 92% on air (assuming normal baseline respiratory function)
- > Systolic blood pressure (BP): less than 90mmHg
- > Pulse: greater than 100 or less than 60bpm
- > Urine output: less than 0.5mL/kg/hour
- > Serum creatinine: greater than 200µmol/L
- > Microvascular event: myocardial infarction or stroke
- > Hypothermia
- > Other serious co-morbidity: end stage kidney disease, heart failure or conditions that would warrant admission to HDU in their own right.

*AVPU – Alert / Voice / Pain / Unresponsive

Corrected sodium concentration (mmol/L) = measured sodium (mmol/L) + (0.3 x [serum glucose {mmol/L} – 5.5])

eTG March 2021 Edition

1.3 Goal of treatment

The aim of HHS treatment is:

- > diagnosis and treatment of any underlying cause and to gradually and safely
- > normalise the osmolality
- > replace fluid and correct dehydration without causing fluid overload
- > replace electrolyte losses, mainly potassium
- > normalisation of BG.

Other goals include prevention of:

- > arterial or venous thrombosis
- > cerebral oedema/central pontine myelinolysis
- > foot ulceration and pressure injury.

1.4 Principles

This protocol is designed to be followed sequentially.

- > Measure or calculate osmolality using $2 \times \text{Sodium} + \text{Glucose} + \text{Urea}$ within 1 hour as baseline for monitoring treatment response. Initiate and ongoing monitoring *see page 9*.
- > IV 0.9% Sodium chloride solution is the preferred fluid to restore circulating volume and reverse dehydration. Only switch to 0.45% Sodium chloride solution if the osmolality is not declining despite adequate positive fluid balance.
- > Treatment targets
 - > An initial rise in sodium is expected and is not in itself an indication for hypotonic fluids, thereafter, the rate of fall of plasma sodium should not exceed 10.0mmol/L in 24 hours.
 - > The fall in BG should be no more than 3.0mmol/L/hr. IV insulin infusion should be commenced once the BG is no longer falling with IV fluids alone (usually after the first 3 hours of IV fluids) OR immediately if there is significant blood ketone levels (e.g. greater than 3.0mmol/L).
 - > Glucose toxicity can exist, and the BG can take some time to reduce. If BG is reduced too quickly, cerebral oedema or other significant neurologic impairment can occur.
- > Use the regional LHN *Intravenous Insulin Infusion Type 2 Diabetes Chart – Adult (MR-INF-T2D)*. Insulin neutral 100units/mL (Actrapid®) is the preferred insulin for IV infusion. (*Appendix A*)
- > Subcutaneous long acting insulin (e.g. insulin glargine 100unit/mL) **SHOULD** be continued.

**Seek urgent advice from MedStar on 137827
If being transferred, continue treatment until medical handover**

1.5 Nursing considerations

Level of nursing care and frequency of observations will be determined by the person's stability and treatment intensity (e.g. a person will need a 1:1 or 1:2 nursing ratio as hourly observations are needed, and an IV insulin infusion is used).

Nursing observations include;

- 1) Blood glucose: ePOC will read 'HI' if the BG is greater than 38.0mmol/L and bedside Freestyle Optium Neo H blood glucose meter will read 'HI' if the BG is greater than 27.8mmol/L.
- 2) Blood ketone: monitoring if ketones present.
- 3) Fluid balance record: to calculate and report deficit or positive fluid balance hourly (e.g. catheterisation and hourly measures).
- 4) Pulse oximetry.
- 5) Pulse, respiration and blood pressure.
- 6) Cardiac monitoring if hyperkalaemia or hypokalaemia. Continue to cardiac monitor if requiring IV potassium replacement.
- 7) Level of consciousness - Glasgow coma scale (GCS).
- 8) Two (2) intravenous access lines are required:
 - a. one for the IV insulin infusion, the other for IV hydration and potassium replacement if required
 - b. IV potassium chloride replacement via additional port on the IV hydration line (e.g. piggyback) as the IV potassium infusion must not be run via the IV insulin infusion line.
- 9) An infusion pump or other rate limiting device must always be used for both an IV insulin infusion and IV potassium chloride. Refer to regional LHN *Use of Intravenous Potassium Chloride Procedure*.
- 10) Use the regional LHN *Preventing and Managing Pressure Injuries Procedure* to undertake an accurate assessment and plan of any existing pressure injury and/or risk of developing a pressure injury.

1.6 Treatment Plan – Part A

Within first hour: Immediate management: 0 to 60 minutes (continuous on-site medical supervision is necessary).

Time = 0 when IV fluids are commenced. Any problem with IV access, seek urgent advice from MedSTAR on 137827.

The aim of this time period is to:

Assess and decide if transfer is required or the person can be managed locally.

- 1) Commence IV 0.9% Sodium chloride – 1 litre to run over 1 hour
 - > consider more rapid replacement if systolic BP less than 90mmHg, give 500mL over 15 minutes
 - > caution in the person greater than 65 years of age or known heart failure, as rapid rehydration may precipitate heart failure or insufficient hydration may fail to reverse acute kidney injury.
 - > **ONLY** commence IV insulin infusion if there are significant blood ketones (greater than 3.0mmol/L). Use the regional LHN *Intravenous Insulin Infusion Type 2 Diabetes Chart – Adult (MR-INF-T2D)*. For regional LHN hospitals using electronic medical records (EMR) order sets, further information is available at [Ordering Adult Insulin Infusions](#)
- 2) Establish monitoring regime:
 - > venous plasma BG on admission then 6-8 hourly; hourly venous plasma glucose or capillary (ePOC system will read 'HI' if BG is greater than 38.0mmol/L and Freestyle Optium Neo H blood glucose bedside meter will read 'HI' if BG is if greater than 27.8mmol/L)
 - > hourly sodium, potassium, urea and calculated osmolality (2x Sodium + Glucose + Urea) for the first 6 hours, then 2 hourly if, fall of osmolality by 3-8mosmol/kg/h
 - > urea and electrolytes hourly for first 6 hours
 - > insert urinary catheter, monitor hourly urine output and calculate fluid balance
 - > venous blood gas 6-8 hourly
 - > blood ketones and lactate 12 hourly
 - > maintain continuous pulse oximetry
 - > ECG on admission and continuous cardiac monitoring if requiring IV potassium replacement.
- 3) Investigations:
 - > full blood count daily
 - > blood cultures as clinically indicated
 - > CXR on admission
 - > urinalysis and culture on admission
 - > CRP (infection suspected) daily.
- 4) Commence DVT prophylaxis (e.g. enoxaparin sodium - clexane®).
- 5) Continue regional LHN *Preventing and Managing Pressure Injuries* Procedure (e.g. existing pressure injury and/or risk of developing a pressure injury plan including daily foot checks).
- 6) Assess for precipitating causes (septic/vascular event or recent changes to medication) and treat (consider IV antibiotics if sepsis identified or suspected).
- 6) If prescribed a sodium-glucose co-transporter 2 inhibitor (SGLT2i), cease immediately and do not recommence until assessment post discharge.

If patient not responding, seek urgent advice from MedSTAR on 137827

If being transferred, continue treatment until medical handover

1.7 Treatment Plan – Part B

60 minutes to 6 hours (continuous on-site medical supervision is necessary)

The aim of this time period is to:

- 1) Achieve a gradual decline in osmolality (3-8mosmol/kg/hour)
 - > using 0.9% normal saline aim to give a further 0.5 – 1 L per hour depending on clinical assessment of dehydration and/or risk of precipitating heart failure, the target fluid balance is to achieve positive fluid balance of 2-3 litres by 6 hours)
 - > measure glucose, urea and electrolytes hourly and calculate osmolality:
 - > if plasma sodium increasing but osmolality declining at appropriate rate, continue 0.9% Sodium chloride
 - > if plasma sodium increasing AND osmolality increasing (or declining at less than 3mosmol/kg/h), switch to 0.45% Sodium chloride at same rate
 - > if osmolality falling at rate exceeding 8mosmol/kg/h consider reducing infusion rate of IV fluids and/or insulin (if already commenced)
 - > consider using arterial or CVC blood for hourly glucose testing to reduce finger trauma.
- 2) BG is expected to fall by 2.5 - 3.0mmol/L per hour. If BG is not falling at this rate, check fluid balance:
 - > if positive balance inadequate, increase rate of IV infusion of 0.9% Sodium chloride
 - > if positive fluid balance adequate, commence regional LHN *Intravenous Insulin Infusion Type 2 Diabetes Chart – Adult (MR-INF-T2D)*.

Note - Insulin infusion is only started after 3 hours of IV fluids (unless mixed HHS + DKA picture)

- 3) IV insulin infusion (regional LHN *Intravenous Insulin Infusion Protocol Type 2 Diabetes Chart – Adult (MR-INF-T2D)*)
 - a. if site-specific assessment does not meet criteria for safe staffing and IV insulin infusion is not feasible, subcutaneous insulin should be commenced with a stat dose of 0.1units/kg via deep subcutaneous injection. This dose can be repeated 2 hourly to achieve a fall in blood glucose of up to 3.0mmol/L.
 - b. Consult MedSTAR (or diabetes specialist) for additional IV insulin infusion adjustment if:
 - > column 3 is reached or a maximum level of 12units is being used in column 3

OR

 - > BG is falling at a rapid rate (e.g. greater than 5.0mmol/L or more in past hour).
Transfer to an appropriate HDU may be required.
 - c. additional subcutaneous rapid acting insulin is NOT recommended as the BG may decline too fast causing complications such as cerebral oedema.
- 4) Avoidance of hypoglycaemia:
 - a. review IV fluids
 - > if BG is greater than 15.0mmol/L, continue 0.9% Sodium chloride solution
 - > if BG is 15.0mmol or less, immediately commence
 - > **option 1** – 10% Glucose at 125mL per hour **AND** continue 0.9% Sodium chloride solution. This is the preferred option if BG level is less than 15.0mmol/L and bicarbonate is less than 12.0mmol/L or is not rising by 3.0mmol/L per hour

OR

 - > **option 2** – 5% Glucose at 125 ml/hr AND continue 0.9% Sodium chloride
 - b. aim for BG between 10.0 – 15.0mmol/L in first 24 hours.
- 5) Hourly vital signs and GCS monitoring.
- 6) Hourly fluid balance record (minimum urine output 0.5 mL/kg/hour).

7) Maintain potassium in the normal range:

- > hypokalaemia (less than 3.5mmol/L) or hyperkalaemia (greater than 6.0mmol/L) are life threatening conditions and require care in a regional HDU or metropolitan ICU.

Potassium level in first 24 hours (mmol/L)	Potassium replacement
Greater than 5.5	Nil
4.5 – 5.5	20mmol
3.5 – 4.5	30mmol
Less than 3.5	Seek urgent advice from MedSTAR on 137827 regarding transfer to appropriate HDU (e.g. may require replacement rate greater than 10mmol/hour)

- > 10mmol potassium chloride in 100mL mini bags is the preferred option for replacement. The maximum rate of potassium on a general ward is 10mmol/hr or 0.2mmol/kg/hr whichever is smaller.
- > Premix 30mmol potassium chloride in 1 litre 0.9% Sodium chloride for use in HDU only.

8) Review subcutaneous insulin needs:

- > if not already administered, commence daily subcutaneous long acting insulin at the usual time
- > administration of subcutaneous rapid acting insulin with IV insulin infusion without MedSTAR or diabetes specialist advice is NOT recommended. Glucose toxicity can exist in HHS and BG can take some time to reduce.

9) Continue DVT prophylaxis (e.g. enoxaparin sodium - clexane®).

10) Continue regional LHN *Preventing and Managing Pressure Injuries* Procedure (e.g. existing pressure injury and/or risk of developing a pressure injury plan including daily foot checks).

If patient not responding, seek urgent advice from MedSTAR on 137827

If being transferred, continue treatment until medical handover

1.8 Treatment Plan – Part C

6 to 12 hours

The aim of this time period is to:

- 1) Monitor clinical and biochemical parameters and take appropriate action (*as outlined in Part B*)
 - i. continue charting BG hourly; sodium and calculated osmolality 2 hourly if meeting criteria.
- 2) Continue IV fluid replacement to achieve positive fluid balance of 3-6 litres by 12 hours
 - ii. hourly fluid balance chart.
- 3) Assess for complications of treatment (e.g. fluid overload, cerebral oedema, central pontine myelinolysis, deteriorating conscious level).
- 4) Avoid hypoglycaemia
 - iii. aim to achieve and maintain BG between 10.0 – 15.0mmol/L in first 24 hours
 - iv. when BG is 15.0mmol/L, commence 5% Glucose at 125 mL per hour **AND CONTINUE** 0.9% Sodium chloride solution
 - v. do not cease IV insulin infusion before 24 hours.
- 5) Continue DVT prophylaxis (e.g. enoxaparin sodium - clexane®).
- 6) Continue regional LHN *Preventing and Managing Pressure Injuries* Procedure (e.g. existing pressure injury and/or risk of developing a pressure injury plan including daily foot checks).
- 7) Refer to the diabetes specialist nurse.
- 8) Refer to or consult with person's diabetes specialist to discuss discharge plan and post discharge follow up.

If patient not responding, seek urgent advice from MedSTAR on 137827

If being transferred, continue treatment until medical handover

1.9 Treatment Plan – Part D

12 to 24 hours

The aim of this time period is to:

- 1) Ensure continuing improvement of clinical and biochemical parameters:
 - i. hourly BG monitoring if IV insulin infusion is running
 - ii. measure sodium and calculated osmolality - reduced to 4 hourly if improvement maintained (if not continue, 2 hourly)
 - iii. do not expect biochemistry to normalise by 24 hours (sodium and osmolality are likely to be raised)
 - iv. take appropriate action (*as outlined in Part B*).
- 2) Continue IV fluid replacement to achieve remaining replacement of estimated fluid losses within next 12 hours (3-6 litres) - this will be dependent on factors such as initial degree of dehydration, body weight and MOST IMPORTANTLY the response to treatment so far. Therefore:
 - v. maintain accurate fluid balance chart (1 hourly), plotting osmolality and make appropriate adjustments to fluid replacement rates.
- 3) Continue IV insulin infusion with or without 5%Glucose solution to maintain BG 10.0 – 15.0mmol/L
 - vi. do not cease IV insulin infusion before 24 hours
 - vii. adjust IV insulin infusion rate as per regional LHN *Intravenous Insulin Infusion Type 2 Diabetes Chart – Adult (MR-INF-T2D)*.
- 4) Assess for complications of treatment (e.g. fluid overload, cerebral oedema, central pontine myelinolysis, deteriorating conscious level).
- 5) Continue treatment of any underlying precipitant.
- 6) Continue DVT prophylaxis (e.g. enoxaparin sodium - clexane®).
- 7) Continue regional LHN *Preventing and Managing Pressure Injuries* Procedure (e.g. existing pressure injury and/or risk of developing a pressure injury plan including daily foot checks).

If patient not responding, seek urgent advise from MedSTAR on137827

If being transferred, continue treatment until medical handover

1.10 Treatment Plan – Part E

24 hours to Day 3

Expectation: person should steadily recover, beginning to eat and drink, and biochemistry back to normal.

- 1) Ensure that clinical and biochemical parameters are improving or have normalised:
 - viii. continue IV fluids until eating and drinking normally.
- 2) Convert to appropriate subcutaneous insulin when biochemically stable:
 - a. if the person has been on subcutaneous long acting insulin before admission, ensure the basal insulin has been recommenced, or commence basal insulin in insulin naive.
 - b. subcutaneous **basal insulin must be on board for at least 4 hours** before ceasing IV insulin infusion.
 - c. after 24 hours calculate the subcutaneous insulin requirements.
 - d. to transfer to subcutaneous basal bolus insulin:
 - i. calculate total insulin requirements (insulin used in last 6 hours x 4 = Total Daily Dose (TDD))
 - ii. 50% of TDD is prescribed as the basal insulin (long acting insulin) dose
 - iii. 50% of TDD is prescribed as in three equally divided doses with meals (rapid acting insulin).
 - e. if pre-mixed insulin (twice a day) is chosen:
 - i. two thirds (2/3) of TDD is given at breakfast and one third (1/3) is given at the evening meal.

- f. if co-formulation insulin (once a day) is chosen:
 - i. review pre-admission insulin dose and prescribe dose required.
- g. the fasting BG reflects adequacy of long acting insulin.
- 3) If previously prescribed a SGLT2i, do not recommence until assessment post discharge.
- 4) Continue BG monitoring QID as per the regional LHN [Blood Glucose and Blood Ketone Monitoring Chart \(MR59H\)](#). Subsequent insulin dose adjustments may be necessary based on capillary BG levels.
- 5) Encourage early mobilisation.
- 6) Daily urea and electrolytes.
- 7) Remove catheter when clinically appropriate.
- 8) Assess for signs of fluid overload or cerebral oedema.
- 9) Assess for evidence of continuing sepsis.
- 10) Continue DVT prophylaxis (e.g. enoxaparin sodium - clexane®).
- 11) Continue regional LHN *Preventing and Managing Pressure Injuries* Procedure (e.g. existing pressure injury and/or risk of developing a pressure injury plan including daily foot checks).

Trigger referral to diabetes specialist for post discharge follow up and review.

If patient not responding, seek urgent advice from MedSTAR on 137827
If being transferred, continue treatment until medical handover

1.11 After care

Most people will go home on subcutaneous insulin (the regime being determined by their circumstances).

In **pre-existing type 2 diabetes**, the usual diabetes medications should be reviewed. If previously prescribed a SGLT2i, do not recommence until assessment post discharge. Assess HbA1c to evaluate pre-admission glycaemic control and to identify any medication changes required for discharge.

Where the admission represented a new diagnosis of type 2 diabetes, post insulin medication needs will need consideration.


All people should be reviewed by a diabetes specialist.

All people should receive appropriate diabetes specialist nurse consultation prior to discharge and follow up once discharged. The person's *Hyperglycaemia/Sick Day Action Plan* should be reviewed and reinforced.

The person's general practitioner should be provided with a discharge summary as soon as possible.

OFFICIAL: Sensitive//Medical in confidence

MR-INF-T2D NTRAVENOUS INSULIN INFUSION TYPE 2 DIABETES - ADULT

 <p>Government of South Australia SA Health</p>	<p>INTRAVENOUS INSULIN INFUSION TYPE 2 DIABETES CHART - ADULT</p> <p>MR-INF-T2D</p>	<p>Affix patient identification label in this box</p> <p>U.R. Number:</p> <p>Surname:</p> <p>Given Name:</p> <p>Second Given Name:</p> <p>D.O.B.: Sex/Gender:</p> <p>Visit No. (if applicable):</p>																								
<p>Site/Facility:</p>																										
<p>Indications for use</p> <ul style="list-style-type: none"> • Hyperglycaemic hyperosmolar state (HHS) in a new diagnosis or in pre-existing type 2 diabetes. • Surgical management of pre-existing type 2 diabetes. • Fasting or unable to tolerate food and fluids in pre-existing type 2 diabetes. • Peripartum management of pre-existing type 2 diabetes. • FeSS Sugar Protocol (Stroke management procedure & protocol guideline). <p>Not for use in;</p> <ul style="list-style-type: none"> • Paediatric patients: consultation with the MedSTAR paediatrician or paediatric service is recommended. 																										
<p>Blood glucose target & frequency</p> <ul style="list-style-type: none"> • Blood glucose (BG) target range during an IV Insulin Infusion is 7.0 – 10.0mmol/L for adult inpatients. • BG target for obstetric patients is determined by the consulting physician: generally 6.0 – 10.0mmol/L. • HHS: hourly BG monitoring is required for the duration of the IV Insulin Infusion. • Fasting: hourly BG monitoring is required for the duration of the IV Insulin Infusion. • Perioperative: hourly or 2hourly, refer to perioperative instructions. <p>Note: ePOC point of care system will read 'HI' if the BG result is greater than 38.0mmol/L and bedside Freestyle Optium Neo H blood glucose meter will read 'HI' if the BG is greater than 27.8mmol/L. Reducing a 'HI' BG level when exact BG level is unknown is not recommended without MedSTAR or diabetes specialist advice.</p>																										
<p>Blood ketone monitoring & frequency</p> <ul style="list-style-type: none"> • Hourly blood ketone (BK) monitoring while ketones are present, otherwise monitor QID. • Do not cease IV Insulin Infusion until BK are less than 0.6mmol/L and acidosis has resolved. 																										
<p>Rapid Detection and Response Instructions</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; background-color: #fff9c4;"> <p>Senior registered nurse (RN) review when:</p> <ul style="list-style-type: none"> • BG not returning to target at anticipated rate of 2.5 – 4.9mmol/L in last hour & column escalation is pending. • BG is greater than 20.0mmol/L in any column. • BG is less than 4.0mmol/L. • When IV Insulin Infusion has been switched off and when it is resumed. </td> <td style="width: 50%; background-color: #ffe0b2;"> <p>Multi-disciplinary team (MDT) review when:</p> <ul style="list-style-type: none"> • BK not decreasing at anticipated rate of 0.5mmol/L per hour. • BG is 15.0mmol/L or less, commence IV Glucose Infusion. • Moving up one column. • BG not decreasing at anticipated rate of 2.5 – 4.9mmol/L in last hour despite moving up one column or being in Column 3. • 12units/hour is being used in Column 3. • BG decreasing too fast (e.g. 5.0mmol/L or more in last hour). <p style="text-align: center;">Consult MedStar as may require transfer to HDU or ICU</p> </td> </tr> </table>			<p>Senior registered nurse (RN) review when:</p> <ul style="list-style-type: none"> • BG not returning to target at anticipated rate of 2.5 – 4.9mmol/L in last hour & column escalation is pending. • BG is greater than 20.0mmol/L in any column. • BG is less than 4.0mmol/L. • When IV Insulin Infusion has been switched off and when it is resumed. 	<p>Multi-disciplinary team (MDT) review when:</p> <ul style="list-style-type: none"> • BK not decreasing at anticipated rate of 0.5mmol/L per hour. • BG is 15.0mmol/L or less, commence IV Glucose Infusion. • Moving up one column. • BG not decreasing at anticipated rate of 2.5 – 4.9mmol/L in last hour despite moving up one column or being in Column 3. • 12units/hour is being used in Column 3. • BG decreasing too fast (e.g. 5.0mmol/L or more in last hour). <p style="text-align: center;">Consult MedStar as may require transfer to HDU or ICU</p>																						
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<p>Medical emergency response (MER) review when:</p> <ul style="list-style-type: none"> • BG is less than 4.0mmol/L and has not responded to the Hypoglycaemia Protocol oral treatment in 45 minutes. • Drowsy, confused, unsafe to swallow, unresponsive or unconscious. • Breathing rapidly or having difficulty breathing or complaining of severe abdominal pain. <p style="text-align: center;">Consult MedStar as may require transfer to HDU or ICU</p>																										
<p>Reviews</p> <p>Record intervention below and note corresponding letter in intervention row on page 1.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 65%;"></th> <th style="width: 15%;">Initial</th> <th style="width: 15%;">Designation</th> </tr> </thead> <tbody> <tr> <td>A</td> <td></td> <td></td> <td></td> </tr> <tr> <td>B</td> <td></td> <td></td> <td></td> </tr> <tr> <td>C</td> <td></td> <td></td> <td></td> </tr> <tr> <td>D</td> <td></td> <td></td> <td></td> </tr> <tr> <td>E</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>					Initial	Designation	A				B				C				D				E			
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B																										
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2. Linked documents (to be linked in approved documents)

Intravenous Insulin Infusion Type 2 Diabetes Chart – Adult (MR-INF-T2D) - Example
Intravenous Insulin Infusion in adults with diabetes who are fasting, receiving perioperative or intrapartum care or who have hyperglycaemia - Protocol
Preventing and Managing Pressure Injuries (sharepoint.com)
Regional LHN Proc Use IV Potassium Chloride (sharepoint.com)

3. References

Northern Adelaide Local Health Network (2019) Hyperglycaemic Hyperosmolar State Pathway. Northern Adelaide Local Health Network, Adelaide.

Joint British Diabetes Societies Inpatient Care Group (2012) [The Management of Hyperosmolar Hyperglycaemic State \(HHS\) in adults with diabetes](#). August. National Health Service Diabetes, United Kingdom.

Joint British Diabetes Societies Inpatient Care Group (2021) [The Management of Diabetic Ketoacidosis in Adults](#). June. National Health Service Diabetes, United Kingdom.

B Hirsch, MD, Michael Emmett, MD. *Diabetic ketoacidosis and hyperosmolar hyperglycemic state in adults: Treatment*. UpToDate accessed 02/03/2022 at <https://www.uptodate.com/contents/diabetic-ketoacidosis-and-hyperosmolar-hyperglycemic-state-in-adults-treatment#H14>

Angel NT.M., Ibeth FC.M., Antonio HP.J. (2021) Diabetic Ketoacidosis and Pregnancy. In: Montufar C., Hidalgo J., Gei A.F. (eds) *Obstetric Catastrophes*. Springer, Cham. Volume 269, pages 41-46. Available at https://doi.org/10.1007/978-3-030-70034-8_10.

Southern Adelaide Local Health Network (2020) Corrected sodium calculation.

Regional Health Hub - [Wound Management and Pressure Prevention](#)

4. Accreditation standards

National Safety and Quality Health Service Standards (2nd edition)

1	2	3	4	5	6	7	8
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Clinical Governance	Partnering with Consumers	Preventing & Controlling Healthcare Associated Infection	Medication Safety	Comprehensive Care	Communicating for Safety	Blood Management	Recognising & Responding to Acute Deterioration

5. Consultation

Version	Consultation
1.0	Northern Adelaide Local Health Network, Diabetes and Endocrine Service, CHSA Diabetes Specialist Nurse Network.
2.0	Northern Adelaide Local Health Network, Diabetes and Endocrine Service, CHSA Diabetes Specialist Nurse Network.
3.0	Northern Adelaide Local Health Network, Diabetes and Endocrine Service, regional LHN Diabetes Specialist Nurses, regional LHN visiting Physicians, regional LHN Clinical Pharmacists, Executive Directors of Medical Services, LCLHN Emergency Nurses.
4.0	Northern Adelaide Local Health Network, Diabetes and Endocrine Service, LCLHN Division of Medicine, regional LHN Diabetes Specialist Nurses, regional LHN visiting Physicians, regional LHN Clinical Pharmacists, Executive Directors of Medical Services, LCLHN Emergency Nurses.

This material is adapted from the Northern Adelaide Local Health Network Diabetes and Endocrine Service.

Regional Local Health Networks do not accept any responsibility for the use of this material outside the scope for which it has been designed. This information is not intended to replace professional judgement or experience.