REGIONAL LOCAL HEALTH NETWORKS

Protocol (clinical)

Title: Intravenous Insulin Infusion in adults with diabetes who are fasting, receiving perioperative or intrapartum care or who have hyperglycaemia

Author: Collette Hooper, Nurse Practitioner, Rural Support Service – Diabetes Service

Owner: Julianne O'Connor, Chief Clinical Advisor, Rural Support Service

Sponsor: Executive Director, Rural Support Service

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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 inpatient 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, diabetes, insulin, infusion.
Document history	Is this a new LHN protocol? Y Does this protocol *amend or update* an existing protocol? N 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	

Version control and change history

Version	Date	Amendment	Amended by:
1.0	10/08/2023	Original version	Collette Hooper, Nurse Practitioner

Table of contents

		page
1.	Introduction	3
1.1	Indication for an IV Insulin Infusion	3
1.2	Prescribing an IV Insulin Infusion	3
1.3	Preparation of an IV Insulin Infusion	5
1.4	Maintaining an IV Insulin Infusion	6
1.5	Documentation	7
1.6	Escalation	7
1.7	Cessation of IV insulin infusion and transition to alternative insulin or medication administration	8
1.8	Appendix A - regional LHN Intravenous Insulin Infusion Type 1 Diabetes Chart – Adult (MR-INF-T1D)	10
1.9	Appendix B - regional LHN Intravenous Insulin Infusion Type 2 Diabetes Chart – Adult (MR-INF-T2D)	12
2.	Linked Documents	14
3.	References	14
4.	Accreditation Standards	14
5.	Consultation	15

1. Introduction

Insulin is a high-risk medication. People with diabetes admitted to hospital and prescribed insulin are at risk of glucose variability, acute medical emergencies (e.g. hypoglycaemia, hyperglycaemia, diabetic ketoacidosis hyperosmolar hyperglycaemia state) and additional adverse outcomes, including death.

In the hospital setting, Intravenous (IV) insulin infusion is the preferred route of insulin delivery in adults with diabetes who are fasting, receiving perioperative or intrapartum care or who have hyperglycaemia.

IV insulin infusions offer rapid onset and short duration of action and can be titrated frequently to address insulin requirements and/or rapidly changing blood glucose levels.

Accurate monitoring and careful management of inpatients with diabetes prescribed IV insulin infusion will maximise benefit and minimise risk.

This Protocol outlines the requirements for the management of an IV insulin infusion in regional local health network (LHN) hospitals and is supported by the regional LHN *Work Instruction Intravenous Insulin Infusion Preparation and Setup*.

This protocol is not intended for:

- **use in medical emergencies** (e.g. diabetic ketoacidosis or hyperglycaemic hyperosmolar state management). Refer to the regional LHN Protocols for *Diabetic Ketoacidosis Management in Adults and Hyperglycaemic Hyperosmolar State Management Type 2 Adults*.
- **use for children or young people under 18 years of age**. Consultation must be sought from the paediatrician, specialist physician and/or endocrinologist.

1.1 Indications for IV Insulin Infusion

This protocol is indicated for use in the inpatient management of hyperglycaemia in the adult with diabetes who is:

- fasting
- perioperative
- pregnant and receiving intrapartum care

OR

- as part of the FeSS Sugar Protocol (Stroke management procedures and protocols clinical guideline).

This protocol is used in conjunction with the Intravenous Insulin Infusion Preparation and Setup Work Instruction and the:

- Intravenous Insulin Infusion Type 1 Diabetes Chart – Adult (MR-INF-T1D) *Appendix A* **OR**
- Intravenous Insulin Infusion Type 2 Diabetes Chart – Adult (MR-INF-T2D) *Appendix B*.

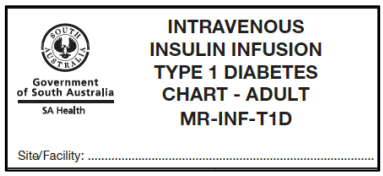
1.2 Prescribing an IV Insulin Infusion

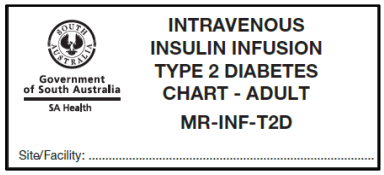
The Medical Practitioner is to:

1. Identify the correct IV insulin infusion chart to be used, either:
   - Intravenous Insulin Infusion Type 1 Diabetes Chart – Adult (MR-INF-T1D) *Appendix A*: new diagnosis or pre-existing type 1 diabetes

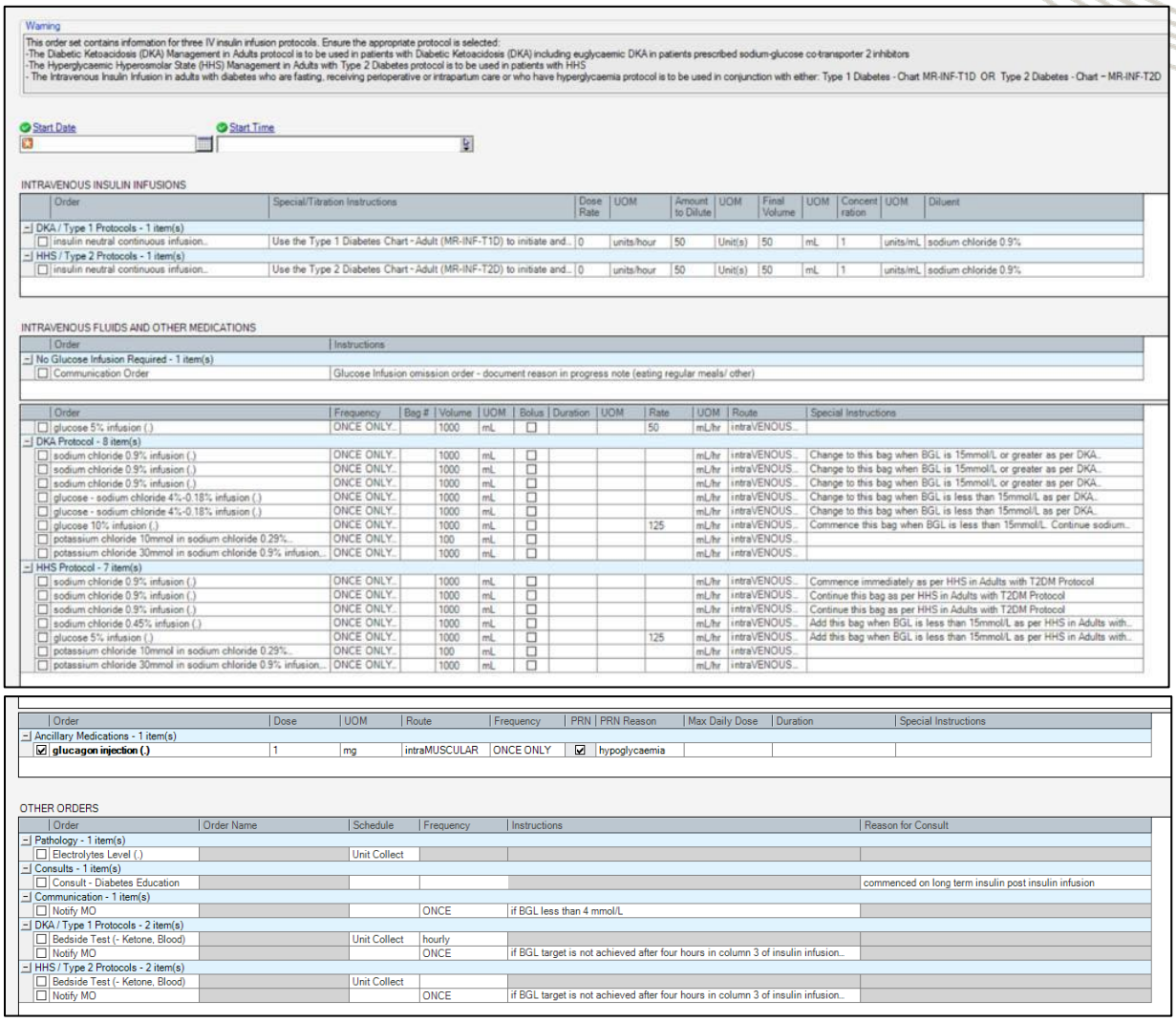
     OR

   - Intravenous Insulin Infusion Type 2 Diabetes Chart – Adult (MR-INF-T2D) *Appendix B*: new diagnosis or pre-existing type 2 diabetes.





2. Prescribe the IV insulin infusion by signing the top of the medication chart. For regional LHN hospitals using electronic medical records (EMR) order sets, further information is available at Ordering Adult Insulin Infusions. EMR example provided below:



Warning

This order set contains information for three IV insulin infusion protocols. Ensure the appropriate protocol is selected:
-The Diabetic Ketoacidosis (DKA) Management in Adults protocol is to be used in patients with Diabetic Ketoacidosis (DKA) including euglycaemic DKA in patients prescribed sodium-glucose co-transporter 2 inhibitors
-The Hyperglycaemic Hyperosmolar State (HHS) Management in Adults with Type 2 Diabetes protocol is to be used in patients with HHS
- The Intravenous Insulin Infusion in adults with diabetes who are fasting, receiving perioperative or intrapartum care or who have hyperglycaemia protocol is to be used in conjunction with either: Type 1 Diabetes - Chart MR-INF-T1D OR Type 2 Diabetes - Chart – MR-INF-T2D

Start Date | Start Time

INTRAVENOUS INSULIN INFUSIONS

Order	Special/Titration Instructions	Dose Rate	UOM	Amount to Dilute	UOM	Final Volume	UOM	Concentration	UOM	Diluent
DKA / Type 1 Protocols - 1 item(s)										
insulin neutral continuous infusion..	Use the Type 1 Diabetes Chart - Adult (MR-INF-T1D) to initiate and...	0	units/hour	50	Unit(s)	50	mL	1	units/mL	sodium chloride 0.9%
HHS / Type 2 Protocols - 1 item(s)										
insulin neutral continuous infusion..	Use the Type 2 Diabetes Chart - Adult (MR-INF-T2D) to initiate and...	0	units/hour	50	Unit(s)	50	mL	1	units/mL	sodium chloride 0.9%

INTRAVENOUS FLUIDS AND OTHER MEDICATIONS

Order	Instructions
No Glucose Infusion Required - 1 item(s)	
Communication Order	Glucose Infusion omission order - document reason in progress note (eating regular meals/ other)

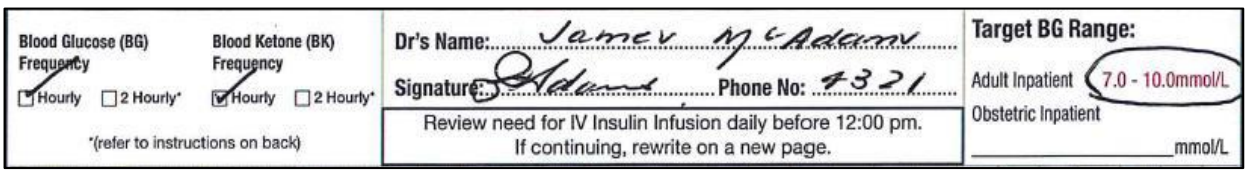
Order	Frequency	Bag #	Volume	UOM	Bolus	Duration	UOM	Rate	UOM	Route	Special Instructions
glucose 5% infusion (.)	ONCE ONLY..		1000	mL				50	mL/hr	intraVENOUS..	
DKA Protocol - 8 item(s)											
sodium chloride 0.9% infusion (.)	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	Change to this bag when BGL is 15mmol/L or greater as per DKA..
sodium chloride 0.9% infusion (.)	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	Change to this bag when BGL is 15mmol/L or greater as per DKA..
sodium chloride 0.9% infusion (.)	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	Change to this bag when BGL is 15mmol/L or greater as per DKA..
glucose - sodium chloride 4%-0.18% infusion (.)	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	Change to this bag when BGL is less than 15mmol/L as per DKA..
glucose - sodium chloride 4%-0.18% infusion (.)	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	Change to this bag when BGL is less than 15mmol/L as per DKA..
glucose 10% infusion (.)	ONCE ONLY..		1000	mL				125	mL/hr	intraVENOUS..	Commence this bag when BGL is less than 15mmol/L. Continue sodium..
potassium chloride 10mmol in sodium chloride 0.29%..	ONCE ONLY..		100	mL					mL/hr	intraVENOUS..	
potassium chloride 30mmol in sodium chloride 0.9% infusion...	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	
HHS Protocol - 7 item(s)											
sodium chloride 0.9% infusion (.)	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	Commence immediately as per HHS in Adults with T2DM Protocol
sodium chloride 0.9% infusion (.)	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	Continue this bag as per HHS in Adults with T2DM Protocol
sodium chloride 0.9% infusion (.)	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	Continue this bag as per HHS in Adults with T2DM Protocol
sodium chloride 0.45% infusion (.)	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	Add this bag when BGL is less than 15mmol/L as per HHS in Adults with..
glucose 5% infusion (.)	ONCE ONLY..		1000	mL				125	mL/hr	intraVENOUS..	Add this bag when BGL is less than 15mmol/L as per HHS in Adults with..
potassium chloride 10mmol in sodium chloride 0.29%..	ONCE ONLY..		100	mL					mL/hr	intraVENOUS..	
potassium chloride 30mmol in sodium chloride 0.9% infusion...	ONCE ONLY..		1000	mL					mL/hr	intraVENOUS..	

Order	Dose	UOM	Route	Frequency	PRN	PRN Reason	Max Daily Dose	Duration	Special Instructions
Ancillary Medications - 1 item(s)									
glucagon injection (.)	1	mg	intraMUSCULAR	ONCE ONLY	☑	hypoglycaemia			

OTHER ORDERS

Order	Order Name	Schedule	Frequency	Instructions	Reason for Consult
Pathology - 1 item(s)					
Electrolytes Level (.)		Unit Collect			
Consults - 1 item(s)					
Consult - Diabetes Education					commenced on long term insulin post insulin infusion
Communication - 1 item(s)					
Notify MO			ONCE	if BGL less than 4 mmol/L	
DKA / Type 1 Protocols - 2 item(s)					
Bedside Test (- Ketone, Blood)		Unit Collect	hourly		
Notify MO			ONCE	if BGL target is not achieved after four hours in column 3 of insulin infusion..	
HHS / Type 2 Protocols - 2 item(s)					
Bedside Test (- Ketone, Blood)		Unit Collect			
Notify MO			ONCE	if BGL target is not achieved after four hours in column 3 of insulin infusion..	

3. Identify target blood glucose (BG) range**.** The target BG range for an adult with diabetes during an IV insulin infusion is 7.0 – 10.0mmol/L.



Blood Glucose (BG) Frequency: ☐ Hourly ☐ 2 Hourly* | Blood Ketone (BK) Frequency: ☑ Hourly ☐ 2 Hourly*

*(refer to instructions on back)

Dr's Name: James Mc Adams

Signature: Adams Phone No: 4321

Review need for IV Insulin Infusion daily before 12:00 pm.
If continuing, rewrite on a new page.

Target BG Range:

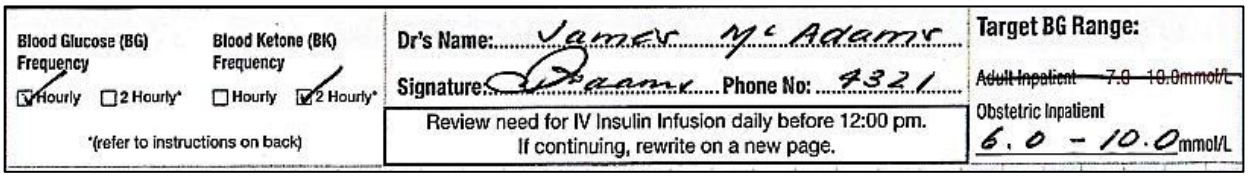
Adult Inpatient 7.0 - 10.0mmol/L

Obstetric Inpatient

_____ mmol/L

The Medical Practitioner is responsible for confirming if this target BG range is to be used or if a modified target BG range is required (e.g. for women with pre-existing diabetes in pregnancy, the BG target is generally 6.0 – 10.0mmol/L).

If a modified target BG range is to be used, the range must be documented.



Blood Glucose (BG) Frequency: ☑ Hourly ☐ 2 Hourly* | Blood Ketone (BK) Frequency: ☐ Hourly ☑ 2 Hourly*

*(refer to instructions on back)

Dr's Name: James Mc Adams

Signature: Adams Phone No: 4321

Review need for IV Insulin Infusion daily before 12:00 pm.
If continuing, rewrite on a new page.

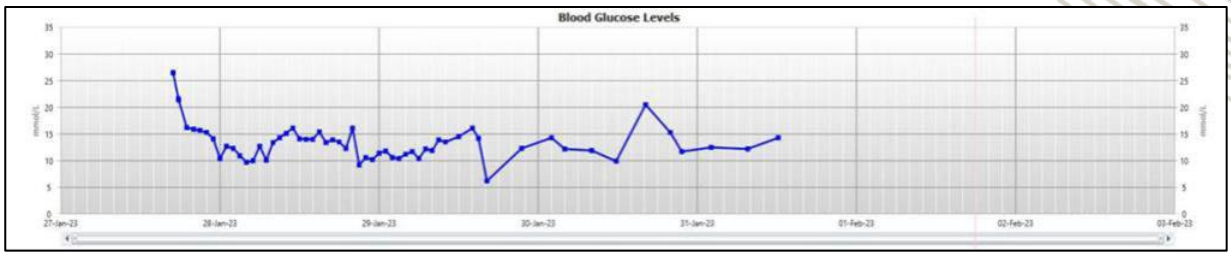
Target BG Range:

~~Adult Inpatient 7.0 - 10.0mmol/L~~

Obstetric Inpatient

6.0 - 10.0 mmol/L

For regional LHN hospitals using electronic medical records (EMR) order sets, further information is available at the BGL and Insulin Chart Window EMR example below:



4. Maintain previously prescribed basal insulin dose/s.
5. Cease previously prescribed rapid acting meal related doses and/or correction bolus insulin doses.
6. Review previously prescribed oral and/or non-insulin injectable medications and withhold if potential to worsen clinical state. Cease sodium-glucose co-transporter-2 (SGLT2) inhibitors immediately.
7. Plan daily review of the ongoing requirement for IV insulin infusion.
8. Assess preadmission HbA1c, refer to diabetes specialist nurse and consider previously prescribed diabetes medications in preparation of cessation of IV insulin infusion and for discharge planning.

1.3 Preparation of an IV Insulin Infusion

There is a need for a 1:1 or 1:2 nurse:patient ratio if an IV insulin infusion is used.

Nursing/midwifery observations include:

- 2 intravenous lines setup plus syringe pump for IV insulin infusion
- capillary blood glucose (BG) and blood ketone (BK) monitoring
- fluid balance record (e.g. catheterisation and hourly measures may be required) to calculate and report deficit or positive fluid balance.

Nursing/midwifery staff are to prepare the IV Insulin and Glucose Infusion:

- 50units insulin neutral 100units/mL (Actrapid®) in 49.5mL 0.9% Sodium chloride: concentration of 1 unit/mL via infuser pump. Refer to *IV Insulin Infusion Set Up Work Instruction*.
- Run IV Glucose Infusion as ordered.

Any additional IV fluids will depend on the patient's health status and will need to be assessed and ordered by the medical practitioner.
Nursing/midwifery staff are to start the IV insulin infusion rate according to COLUMN 1 (green).

Intravenous Insulin Hourly Rate Algorithm TYPE 1 DIABETES

Column 1	
BG mmol/L	Unit/hour
BG less than 4.0mmol/L is hypoglycaemia	
less than 5.0	Off
5.0 - 6.4	0.5
6.5 - 9.9	1.0
10.0 - 11.4	1.5
11.5 - 12.9	2.0
13.0 - 14.9	3.0
15.0 - 16.4	3.0
16.5 - 17.9	4.0
18.0 - 20.0	5.0
greater than 20.0	6.0

Column 2	
BG mmol/L	Unit/hour
BG less than 4.0mmol/L is hypoglycaemia	
less than 5.0	Off
5.0 - 6.4	1.0
6.5 - 9.9	2.0
10.0 - 11.4	3.0
11.5 - 12.9	4.0
13.0 - 14.9	5.0
15.0 - 16.4	6.0
16.5 - 17.9	7.0
18.0 - 20.0	8.0
greater than 20.0	12.0

Column 3	
BG mmol/L	Unit/hour
BG less than 4.0mmol/L is hypoglycaemia	
less than 5.0	Off
5.0 - 6.4	2.0
6.5 - 9.9	4.0
10.0 - 11.4	5.0
11.5 - 12.9	6.0
13.0 - 14.9	8.0
15.0 - 16.4	10.0
16.5 - 17.9	12.0
18.0 - 20.0	14.0
greater than 20.0	16.0

At commencement of the IV insulin infusion and with EACH syringe change, two (2) nurses/midwives to check and sign the nursing administration record as per example below:

NURSING ADMINISTRATION RECORD (IV Insulin Infusion)					
Insulin (units) and Sodium Chloride 0.9% (mL)	**Date/time commenced**	**Nurse 1**	**Nurse 2**	**Time stopped**	**Volume infused (mL)**
50units Insulin Neutral (Actrapid®) + 49.5mL Sodium Chloride 0.9%	17/01/23 0930	400ARR			
50units Insulin Neutral (Actrapid®) + 49.5mL Sodium Chloride 0.9%					
50units Insulin Neutral (Actrapid®) + 49.5mL Sodium Chloride 0.9%					

1.4 Maintaining an IV Insulin Infusion

Nursing/midwifery staff are to blood glucose (BG) monitor hourly for the duration of the IV insulin infusion unless otherwise stated by the medical practitioner.

When the BG test result is identified, consider if the test result is 'in' or 'outside' (e.g. above or below) target BG range.

Follow the instructions provided on the *IV Insulin Infusion Chart* to either remain in the same column or take action (e.g. moving up or moving down one column as required). Refer to instructions below and *Flow Chart*.

Moving up a Column is required if:

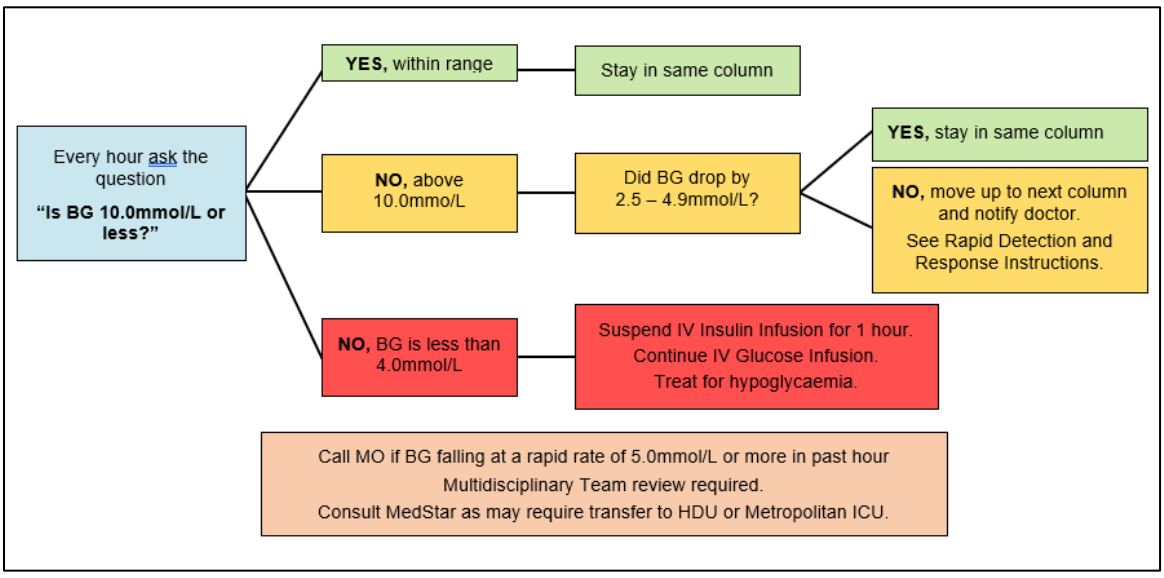
- the BG is greater than 10.0mmol/L **AND**
- the current BG test result did not drop by 2.9 – 4.9mmol/L within the last hour.

Moving down a Column is required if:

- the BG is less than 4.0mmol/L **OR** the IV insulin infusion has been suspended for one hour
- the BG is 15.0mmol/L or less **OR** BG falling at a rapid rate of 5.0mmol/L or more in past hour.

Continue IV Glucose infusion. Treat hypoglycaemia (less than 4.0mmol/L irrespective of symptoms) as per regional LHN Protocol *Treatment of hypoglycaemia in people with diabetes in the hospital*. If hypoglycaemia occurs while on Column 1, 2 OR 3, contact medical practitioner.

Flow Chart Instructions

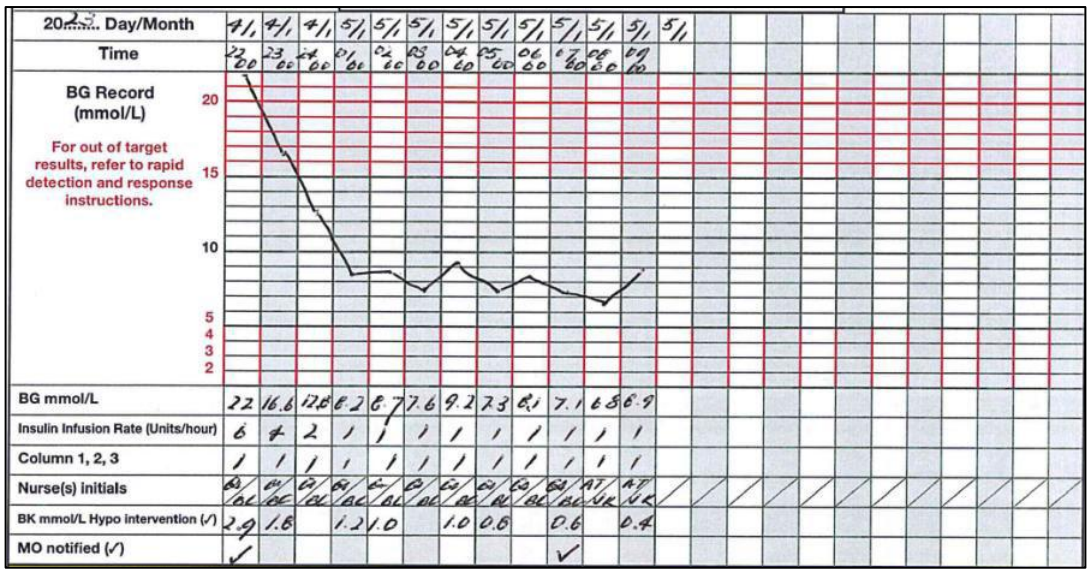


If the BG is within target range for 4-6 hours, monitoring may be reduced to 2 hourly. However, if IV insulin infusion rate is changed, resume hourly monitoring.

1.5 Documentation

Nursing/midwifery staff are to document the:

- date and time in the appropriate column.
- blood glucose (BG) is to be graphed with a dot (·) in the centre of the square which coincides with the BG level. For example, 16.1mmol/L or 16.8mmol/L is a dot in the middle of the box that corresponds to 16mmol/L. Connect to the previous dot with a straight line.
- numerical value of the BG in the designated row below the graph.
- IV insulin infusion rate. Please note: always begin in the green column (column 1).
- column being used to titrate the IV insulin infusion at that point in time (e.g. column 1, 2 or 3).
- initials of both nurses/midwives who checked the hourly rate independently.
- blood ketone (BK) if applicable.
- initiation of the regional LHN Protocol *Treatment of hypoglycaemia in people with diabetes in the hospital.*
- contact with the medical practitioner as per *Rapid Detection and Response Instructions* below.



1.6 Escalation

In the event of an out of target range blood glucose (BG) result, nursing/midwifery staff are to consult the **Rapid Detection and Response Instructions** and action recommendations.

Rapid Detection and Response Instructions	
Senior registered nurse (RN) review when: • 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.	Multi-disciplinary team (MDT) review when: • 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). **Consult MedStar as may require transfer to HDU or ICU**
Medical emergency response (MER) review when: • 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. **Consult MedStar as may require transfer to HDU or ICU**	

1.7 Cessation of IV Insulin Infusion and transition to alternative insulin or medication administration

The Medical Practitioner is responsible for determining when it is safe to transition off the IV insulin infusion to either:

- the regional LHN *Hyperglycaemia and Basal Bolus Insulin Chart (MR62A)* Protocol.
- pre-mixed insulin
- co-formulation insulin
- continuous subcutaneous insulin infusion (CSII) or insulin pump OR
- other diabetes medications.

Cessation of the IV insulin infusion is considered in the patient who:

- has no evidence of diabetic ketoacidosis and
- is able to eat or has commenced enteral feeds or total parenteral nutrition.

Preadmission HbA1c, referral to the diabetes specialist nurse and previously prescribed diabetes medications are to be considered for this transition and in preparation for discharge.

Ideally, the IV insulin infusion should be ceased after breakfast, with a dose of subcutaneous insulin (or other diabetes medications) given before breakfast. The following instructions are offered as a guide.

1. Switching from IV Insulin Infusion to the regional LHN *Hyperglycaemia Protocol: Basal Bolus Insulin Chart (MR62A)*.

Subcutaneous long acting insulin must be on board for at least 4 hours before discontinuing IV insulin infusion.

To commence subcutaneous insulin in a patient who was not previously known to have type 1 diabetes, calculate total daily insulin requirements (four times IV insulin infusion used in last 6 hours = Total Daily Dose (TDD).

i. 50% of TDD is prescribed as the basal insulin (long acting insulin) dose

ii. 50% of TDD is prescribed in three equally divided doses with meals (rapid-acting insulin).

For example

A total of 9units of IV insulin infusion used in the past 6 hours. 9 x 4 = TDD 36units
50% as subcutaneous basal insulin is 18units
50% as subcutaneous rapid acting insulin is 18units ÷ 3 = 6units TDS with meals.

Titrate to target BG range based on capillary BG.

2. Switching from IV Insulin Infusion to pre-mixed insulin

If pre-mixed insulin (twice/day) is chosen, two thirds (2/3) of the TDD is prescribed at breakfast and one third (1/3) of the TDD is prescribed with the evening meal.

If pre-mix insulin (once/day) is chosen, two thirds (2/3) of the TDD is prescribed at breakfast.

For example if BD is required

A total of 9units of IV insulin infusion used in the past 6 hours. 9 x 4 = TDD 36units
2/3rd as subcutaneous pre-mix insulin is 24units prescribed with breakfast
1/3rd as subcutaneous pre-mix insulin is 12units prescribed with the evening meal.

For example if once a day is required

A total of 9units of IV insulin infusion used in the past 6 hours. 9 x 4 = TDD 36units
2/3rd as subcutaneous pre-mix insulin is 24units prescribed with breakfast.

3. Switching from IV Insulin Infusion to co-formulation insulin

50% of TDD and one third (1/3) of 50% of TDD and prescribed with largest carbohydrate meal.

> **For example**
>
> A total of 9units of IV insulin infusion used in the past 6 hours. 9 x 4 = TDD 36units
> 2/3rd as subcutaneous co-formulation insulin is 24units prescribed with the largest carbohydrate meal.

4. Switching from IV Insulin Infusion to Continuous Subcutaneous Insulin Infusion (CSII) or insulin pump

An endocrinologist could be consulted for advice on transitioning to insulin pump therapy. However, in most instances, insulin pump therapy is recommended to be recommenced at the previous basal rate settings with the IV insulin infusion running concurrently.

IV insulin infusion rate will be titrated down based on BG levels.

If a meal is due during the 4 hours of transition, the insulin pump's advanced settings are to be used to calculate the meal-related bolus and correction bolus. The insulin pumps' advanced settings consider the pre meal BG test result, the BG target, insulin sensitivity factor, insulin:carbohydrate ratio and insulin action time (also known as 'insulin on board') to suggest a meal-related bolus dose to be delivered.

The suggested meal-related bolus dose can be self-administered or the suggested dose can be reduced and administered if concerns about postprandial hypoglycaemia.

The rregional LHN Protocol *Continuous Subcutaneous Insulin Infusion (CSII) in People with Diabetes in the Inpatient Setting* and *CSII Inpatient Rate Record (MR-CIR)* is to be used by the person with diabetes to document the meal-related bolus and correction bolus administered.

After at least 4 hours of subcutaneous basal insulin via the insulin pump **AND** if the person has tolerated food and fluid **AND** if the BK remains less than 0.6mmol/L, the IV insulin infusion can be discontinued.

After the IV insulin infusion is discontinued, maintain insulin pump therapy (using both basal and advanced settings at main meal times). Continue hourly BG monitoring for 2-4 hours then if stable, reduce BG monitoring frequency to QID. The BK should be rechecked in 1 hour and then as instructed by the medical officer.

5. Transitioning to other diabetes medications

The Medical Practitioner is to identify alternative diabetes medications (e.g. oral and glucagon-like peptide-1 (GLP-1) receptor agonists non-insulin injectables) that are safe for re-commencement.

SGLT2 inhibitors are not recommended to be recommenced in people with diabetes who have frequent bacterial or genitourinary yeast infections, low bone density and high risk for falls and fractures, foot ulceration, and factors predisposing to euglycaemic diabetic ketoacidosis (e.g. history of pancreatic insufficiency, drug or alcohol abuse or ketogenic diets).

1.8 Appendix A

For regional LHN hospitals using electronic medical records (EMR) order sets, further information is available at Ordering Adult Insulin Infusions

Type 1 Diabetes Chart – Adult (MR-INF-T1D)

OFFICIAL: Sensitive//Medical in confidence

Government of South Australia
SA Health

INTRAVENOUS INSULIN INFUSION TYPE 1 DIABETES CHART - ADULT MR-INF-T1D

Affix patient identification label in this box

U.R. Number: .....
Surname: .....
Given Name: .....
Second Given Name: .....
D.O.B.: ..... Sex/Gender: .....
Visit No. (if applicable): .....

Site/Facility: .....

Blood Glucose (BG) Frequency: ☐ Hourly ☐ 2 Hourly* | Blood Ketone (BK) Frequency: ☐ Hourly ☐ 2 Hourly*
*(refer to instructions on back)

Dr's Name: .....
Signature: ..... Phone No: .....
Review need for IV insulin infusion daily before 12:00 pm.
If continuing, rewrite on a new page.

Target BG Range:
Adult inpatient 7.0 - 10.0mmol/L
Obstetric inpatient _____ mmol/L

20..... Day/Month																								
Time																								
BG Record (mmol/L) For out of target results, refer to rapid detection and response instructions. 20 / 15 / 10 / 5 4 3 2																								
BG mmol/L																								
Insulin Infusion Rate (Units/hour)																								
Column 1, 2, 3																								
Nurse(s) initials																								
BK mmol/L Hypo Intervention (✓)																								
MO notified (✓)																								

Intravenous Insulin Hourly Rate Algorithm TYPE 1 DIABETES

Column 1	
BG mmol/L	Unit/hour
BG less than 4.0mmol/L is hypoglycaemia	
less than 5.0	Off
5.0 - 6.4	0.5
6.5 - 9.9	1.0
10.0 - 11.4	1.5
11.5 - 12.9	2.0
13.0 - 14.9	3.0
15.0 - 16.4	3.0
16.5 - 17.9	4.0
18.0 - 20.0	5.0
greater than 20.0	6.0

Column 2	
BG mmol/L	Unit/hour
BG less than 4.0mmol/L is hypoglycaemia	
less than 5.0	Off
5.0 - 6.4	1.0
6.5 - 9.9	2.0
10.0 - 11.4	3.0
11.5 - 12.9	4.0
13.0 - 14.9	5.0
15.0 - 16.4	6.0
16.5 - 17.9	7.0
18.0 - 20.0	8.0
greater than 20.0	12.0

Column 3	
BG mmol/L	Unit/hour
BG less than 4.0mmol/L is hypoglycaemia	
less than 5.0	Off
5.0 - 6.4	2.0
6.5 - 9.9	4.0
10.0 - 11.4	5.0
11.5 - 12.9	6.0
13.0 - 14.9	8.0
15.0 - 16.4	10.0
16.5 - 17.9	12.0
18.0 - 20.0	14.0
greater than 20.0	16.0

Patients always begin in the green column - Column 1.

Moving up At each BG measurement ask the following two questions:
- Is the BG 10.0mmol/L or less?
- Did the BG drop by 2.5mmol/L - 4.9mmol/L in the last hour?

If the answer to **either question** is **YES** - remains in the current column.
If the answer to **both questions** is **NO** - moves up **one column**.
Call MO if BG falling at a rapid rate of 5.0mmol/L or more in past hour.

Moving Down If BG less than 4.0mmol/L OR insulin suspended OR BG is 15.0mmol/L or less OR BG falling at a rapid rate of 5.0mmol/L or more in past hour - moves down **one column**.

NURSING ADMINISTRATION RECORD (IV Insulin Infusion)

Insulin (units) and Sodium Chloride 0.9% (mL)	Date/time commenced	Nurse 1	Nurse 2	Time stopped	Volume infused (mL)
50units Insulin Neutral (Actrapid®) + 49.5mL Sodium Chloride 0.9%					
50units Insulin Neutral (Actrapid®) + 49.5mL Sodium Chloride 0.9%					
50units Insulin Neutral (Actrapid®) + 49.5mL Sodium Chloride 0.9%					

INTRAVENOUS INSULIN INFUSION TYPE 1 DIABETES - ADULT MR-INF-T1D

SA Health Revised May 2023

Adopted with permission from Northern Adelaide Local Health Network

Page 1 of 2

Government of South Australia
SA Health

INTRAVENOUS INSULIN INFUSION TYPE 1 DIABETES CHART - ADULT MR-INF-T1D

Affix patient identification label in this box

U.R. Number: .....
Surname: .....
Given Name: .....
Second Given Name: .....
D.O.B.: ..... Sex/Gender: .....
Visit No. (If applicable): .....

Site/Facility: .....

Indications for use

- Diabetic ketoacidosis (DKA) in a new diagnosis or in pre-existing type 1 diabetes.
- Euglycaemic DKA in pre-existing type 1 or type 2 diabetes prescribed a sodium-glucose co-transporter 2 inhibitor.
- Surgical management of pre-existing type 1 diabetes.
- Fasting or unable to tolerate food and fluids in pre-existing type 1 diabetes.
- Peripartum management of pre-existing type 1 diabetes.
- FeSS Sugar Protocol (Stroke management procedure & protocol guideline).

Not for use in:
- Paediatric patients: consultation with the MedSTAR paediatrician or paediatric service is recommended.

Blood glucose target & frequency

- 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.
- DKA: 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.

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.

Blood ketone monitoring & frequency

- 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.

Rapid Detection and Response Instructions

Senior registered nurse (RN) review when:
- 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.

Multi-disciplinary team (MDT) review when:
- 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).

Consult MedStar as may require transfer to HDU or ICU

Medical emergency response (MER) review when:
- 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.

Consult MedStar as may require transfer to HDU or ICU

Reviews

Record intervention below and note corresponding letter in intervention row on page 1.		Initial	Designation
A			
B			
C			
D			
E			

MR-INF-T1D INTRAVENOUS INSULIN INFUSION TYPE 1 DIABETES - ADULT

Page 2 of 2

1.9 Appendix B

For regional LHN hospitals using electronic medical records (EMR) order sets, further information is available at Ordering Adult Insulin Infusions

Type 2 Diabetes Chart – Adult (MR-INF-T2D)

OFFICIAL: Sensitive//Medical in confidence

Government of South Australia
SA Health

INTRAVENOUS INSULIN INFUSION TYPE 2 DIABETES CHART - ADULT
MR-INF-T2D

Affix patient identification label in this box

U.R. Number: .....
Surname: .....
Given Name: .....
Second Given Name: .....
D.O.B.: ..... Sex/Gender: .....
Visit No. (if applicable): .....

Site/Facility: .....

Blood Glucose (BG) Frequency ☐ Hourly ☐ 2 Hourly
Blood Ketone (BK) Frequency ☐ Hourly ☐ 2 Hourly
*(refer to instructions on back)

Dr's Name: .....
Signature: ..... Phone No: .....
Review need for IV Insulin Infusion daily before 12:00 pm.
If continuing, rewrite on a new page.

Target BG Range:
Adult Inpatient 7.0 - 10.0mmol/L
Obstetric Inpatient _____ mmol/L

20..... Day/Month
Time

BG Record (mmol/L)
For out of target results, refer to rapid detection and response instructions.
20
15
10
5
4
3
2

BG mmol/L
Insulin Infusion Rate (Units/hour)
Column 1, 2, 3
Nurse(s) initials
BK mmol/L Hypo intervention (✓)
MO notified (✓)

Intravenous Insulin Hourly Rate Algorithm TYPE 2 DIABETES

Column 1	
BG mmol/L	Unit/hour
BG less than 4.0mmol/L is hypoglycaemia	
less than 6.4	Off
6.5 - 7.9	0.5
8.0 - 9.9	1.0
10.0 - 11.4	1.5
11.5 - 12.9	2.0
13.0 - 14.9	3.0
15.0 - 16.4	3.0
16.5 - 17.9	4.0
18.0 - 20.0	5.0
greater than 20.0	6.0

Column 2	
BG mmol/L	Unit/hour
BG less than 4.0mmol/L is hypoglycaemia	
less than 6.4	Off
6.5 - 7.9	1.0
8.0 - 9.9	2.0
10.0 - 11.4	3.0
11.5 - 12.9	4.0
13.0 - 14.9	5.0
15.0 - 16.4	6.0
16.5 - 17.9	7.0
18.0 - 20.0	8.0
greater than 20.0	12.0

Column 3	
BG mmol/L	Unit/hour
BG less than 4.0mmol/L is hypoglycaemia	
less than 6.4	Off
6.5 - 7.9	2.0
8.0 - 9.9	4.0
10.0 - 11.4	5.0
11.5 - 12.9	6.0
13.0 - 14.9	8.0
15.0 - 16.4	10.0
16.5 - 17.9	12.0
18.0 - 20.0	14.0
greater than 20.0	16.0

Patients always begin in the green column - Column 1.

Moving up At each BG measurement ask the following two questions:
- Is the BG 10.0mmol/L or less?
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If the answer to **either question** is **YES** - remains in the current column.
If the answer to **both questions** is **NO** - moves up **one column**.
Call MO if BG falling at a rapid rate of 5.0mmol/L or more in past hour.

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50units Insulin Neutral (Actrapid®) + 49.5mL Sodium Chloride 0.9%					

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

SA Health
Revised
May
2023

Adopted with permission from Northern Adelaide Local Health Network

Page 1 of 2

Government of South Australia
SA Health

INTRAVENOUS INSULIN INFUSION TYPE 2 DIABETES CHART - ADULT

MR-INF-T2D

Affix patient identification label in this box

U.R. Number: .....
Surname: .....
Given Name: .....
Second Given Name: .....
D.O.B.: ..... Sex/Gender: .....
Visit No. (if applicable): .....

Site/Facility: .....

Indications for use

- 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).

Not for use in;

- Paediatric patients: consultation with the MedSTAR paediatrician or paediatric service is recommended.

Blood glucose target & frequency

- 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.

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.

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- Hourly blood ketone (BK) monitoring while ketones are present, otherwise monitor QID.
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- 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.

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- 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).

Consult MedStar as may require transfer to HDU or ICU

Medical emergency response (MER) review when:

- 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.

Consult MedStar as may require transfer to HDU or ICU

Reviews

Record intervention below and note corresponding letter in intervention row on page 1.		Initial	Designation
A			
B			
C			
D			
E			

Page 2 of 2

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

2. Linked documents

Regional LHN Intravenous Insulin Infusion Preparation and Setup – Work Instruction
Regional LHN Intravenous Insulin Infusion Type 1 Diabetes Chart – Adult (MR-INF-T1D) - Example
Regional LHN Intravenous Insulin Infusion Type 2 Diabetes Chart – Adult (MR-INF-T2D) - Example
Regional LHN Diabetic Ketoacidosis Management in Adults - Protocol
Regional LHN Hyperglycaemic Hyperosmolar State Management Type 2 Adults - Protocol
Regional LHN Treatment of hypoglycaemia in people with diabetes in the hospital and community setting - Protocol
Regional LHN Continuous Subcutaneous Insulin Infusion (CSII) in People with Diabetes in the Inpatient Setting - Protocol
Regional LHN Continuous Subcutaneous Insulin Infusion (CSII) Inpatient Rate Record (MR-CIR) - Example
Regional LHN Treatment in Hyperglycaemia - Protocol and Basal Bolus Insulin Chart (MR62A)
Regional LHN Treatment in Hyperglycaemia Basal Bolus Insulin Chart (MR62A) - Example

3. References

Australian Diabetes Society and Australian and New Zealand College of Anaesthetists & Faculty of Pain Medicine (2022) *Perioperative Diabetes and Hyperglycaemia Guidelines (Adults).* Available at https://diabetessociety.com.au/downloads/20221113%20ADS%20ANZCA%20Perioperative%20Guideline%20Final%20Nov%202022.pdf
Northern Adelaide Local Health Network (2021) *Inpatient insulin management*. NALHN, Adelaide.
Southern Adelaide Local Health Network (2021) *Intravenous insulin infusion for the management of hyperglycaemia in non-pregnant adults (not for treatment of diabetic ketoacidosis)*, SALHN, Adelaide.
Southern Adelaide Local Health Network (2022) *Preadmission perioperative medication guidelines*, SALHN, Adelaide.
Central Adelaide Local Health Network (2022) *Hyperglycaemia Management – Actrapid Insulin and Glucose Infusion*, CALHN, Adelaide.
Central Adelaide Local Health Network (2021) *Diabetes inpatient management*, CALHN, Adelaide.

4. Accreditation standards

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

1	2	3	4	5	6	7	8
☒	☐	☐	☒	☒	☒	☐	☒
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, 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.