Government of Western Australia
Department of Health

COVID-19 Guidelines for Management of Diabetes and Hyperglycaemia

1. Introduction

Diabetes and hyperglycaemia are risk factors for severe illness and mortality in COVID-19 disease. Infection with COVID-19 may cause unstable glucose levels in patients with a pre-existing diabetes due to counter-regulatory stress response, use of glucocorticoids (dexamethasone) and interruption to nutrition.

Individuals without pre-existing diabetes may develop newly detected hyperglycaemia (20-30%) due to counter-regulatory stress response and treatment with glucocorticoids.

Acute hyperglycaemia causes immune, cardiovascular and endothelial dysfunction, and is associated with worse outcomes in patients hospitalised with COVID-19.

This policy is aimed at providing guidance for the management of hyperglycaemia in ALL patients with COVID-19 infection regardless of whether they have pre-existing diabetes.

This guideline does not cover COVID-19 patients with Diabetic Ketoacidosis (DKA) or Hyperosmolar Hyperglycaemic State (HHS). For DKA and HHS management please refer to the local DKA and HHS guideline.

2. Abbreviations and Definitions

AKI	Acute Kidney Injury
BGL	Blood glucose level
CKD	Chronic Kidney Disease
DKA	Diabetic ketoacidosis
DM	Diabetes Mellitus
DNE	Diabetes Nurse Educator
DPP-4 inhibitors	Dipeptidyl peptidase 4 inhibitors e.g. Sitagliptin (Januvia®, Janumet®), linagliptin (Trajenta®, Trajentamet®)
eGFR	Estimated Glomerular Filtration Rate
GLP1-RA	Glucagon-like peptide 1 receptor agonists. e.g. dulaglutide (Trulicity®), semaglutide (Ozempic®)
HbA1c	Haemoglobin A1c (glycosylated haemoglobin)
HHS	Hyperglycaemia Hyperosmolar state
IV	Intravenous

QID	quater in die (four times a day)
SGLT2 inhibitors	Sodium-glucose co-transporter 2 inhibitors. e.g. Empagliflozin (Jardiance®, Jardiamet®, Glyxambi®), Dapagliflozin (Forxiga®, Xigduo®, Qtern®), ertugliflozin (Steglato®, Segluromet®, Steglujan®)
TDD	Total daily dose
TDS	ter die sumendum (three times a day)

3. Policy

3.1 Blood glucose and ketone monitoring recommendations for COVID-19 positive or suspected cases

COVID-19 positive patients	**Recommended BGL monitoring**
Patients with diabetes or hyperglycaemia	QID BGL's (pre-meals and before bed)
Patients without diabetes or hyperglycaemia but commenced on dexamethasone	QID BGL's (pre-meals and before bed) for 48 hrs then if BGL's remain less than 10mmol/L, reduce to BD BGL's (pre-breakfast and pre-dinner).
Patients without diabetes or hyperglycaemia or dexamethasone	Once daily blood glucose (pre-meal)
Concern regarding possible overnight hypoglycaemia	QID BGL's (pre-meals and before bed) and 0200hr BGL
Pregnant women with diabetes or hyperglycaemia	Pre-meals and post-meals
Ketone monitoring:	
Check ketone level in following circumstances: • On SGLT-2 inhibitor. • BGL >15.1 mmol/L. • Acidosis present, previous elevated capillary ketone level > 0.6 mmol/L (recheck within 2 hrs). • Nausea, vomiting, decreased oral intake >12 hrs. (NB if ketone level 0.3-0.6 mmol/L recheck within 4 hrs). • Pregnant women on admission and if BGL anytime >10mmol/L.	

3.2 On admission

1. All COVID-19 positive patients should have laboratory BGL measured.
2. Document in medical record if patient has diabetes- Type 1 vs Type 2 vs Type 3c (e.g. due to pancreatitis or pancreatectomy).

3. Perform HbA1c for patients with known diabetes mellitus (any type) or known pre-diabetes or if hyperglycaemia on finger-prick and/or laboratory bloods (fasting BGL > 8.0 mmol/L and/or postprandial BGL >10.0 mmol/L).

For patients with known Diabetes Mellitus:

- Stop SGLT-2 inhibitors on admission.
- Stop metformin and GLP-1 RA if severe COVID-19, AKI or CKD, vomiting or ketoacidosis.
- If patient is usually on insulin before admission, continue usual insulin regimen and chart supplemental NovoRapid® insulin with meals.

3.3 Management of Hyperglycaemia

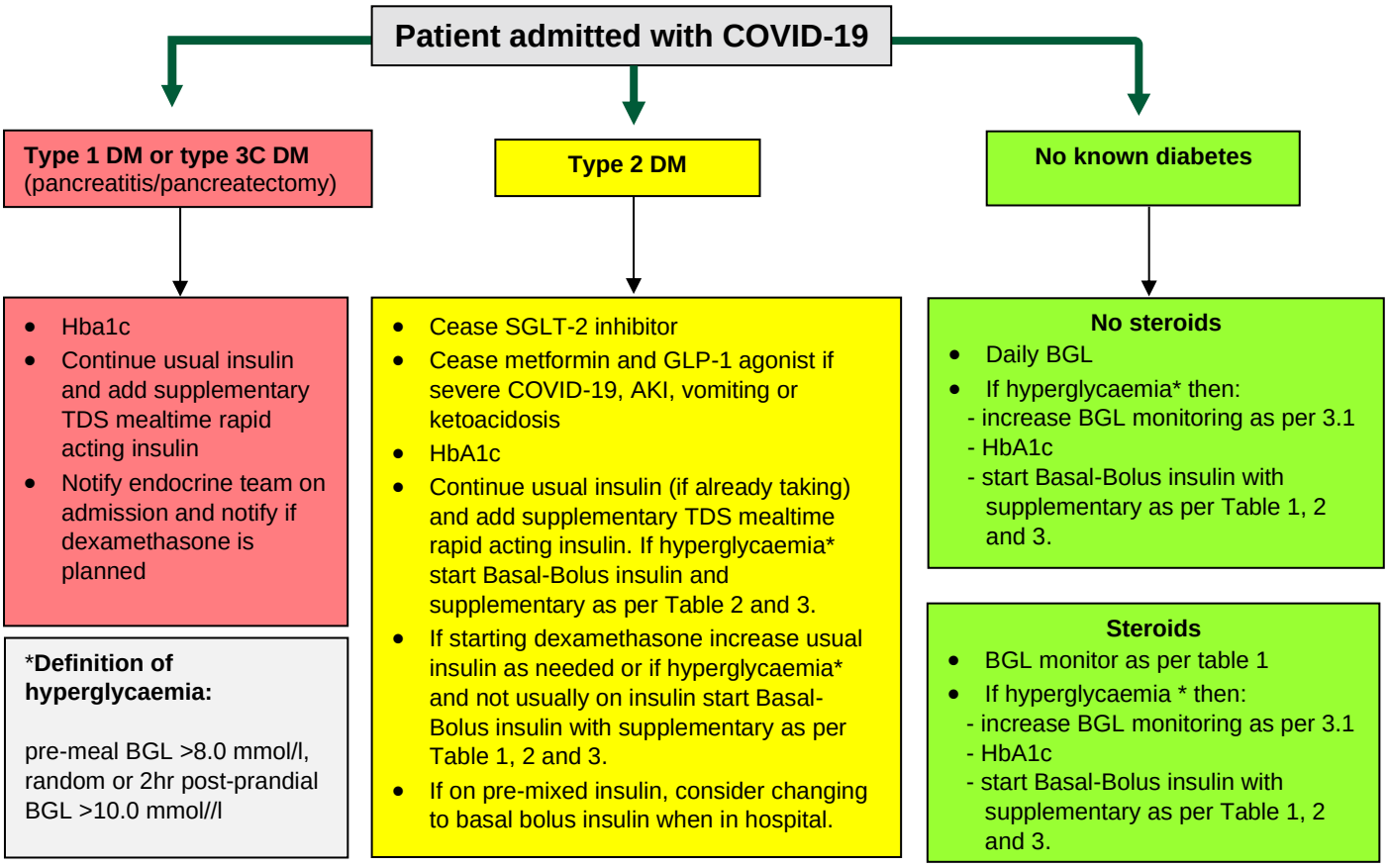

Table 1: Suggested starting insulin regimen and doses for hyperglycaemia for insulin naïve patients

Use the following guide to estimate the initiating insulin dose using ideal body weight. Chart basal bolus & supplemental insulin as outlined in Table 3.

Clinical Scenario	Total Daily Dose (TDD)	Insulin Type	Example: 80 kg patient
General situation	0.5 units/kg	½ basal (once daily) [Optisulin] ½ prandial (split into 3 meals) [NovoRapid] + supplemental scale	**TDD 40 units** Optisulin 20 units (mane or nocte) NovoRapid 6-7 units TDS with meals (if eating) NovoRapid supplemental insulin
Renal impairment (eGFR <30 ml/min or AKI), Liver impairment or age >70	0.25 units/kg	Insulin [NovoRapid]	**TDD 20 units** Optisulin 10 units daily NovoRapid 3-4 units TDS with meals (if eating) NovoRapid supplemental scale insulin

Table 2: Supplemental scale NovoRapid insulin

Based on patient's usual TDD or body weight (if insulin naïve), which is in addition to their basal bolus insulin. The NovoRapid insulin should be given TDS pre-meals.

BGL (mmol/L)	<26 units/day (or <50kg)	26 – 50 units/day (or 50.1-100 kg)	51-100 units/day (or 100.1-150kg)	>100 units/ day (or >150kg)
8.1 – 12	1	2	3	4
12.1 – 15	2	4	6	8
15.1 – 20	3	6	9	12
>20.0	4	8	12	16

Table 3: Titration of insulin

Use the following guide to estimate dose titration according to patient's BGL

Situation	Timing	Suggested Action
Hyperglycaemia	Within 4 hours following a meal	>10mmol/L increase that mealtime dose by 10% >15mmol/L increase that mealtime dose by 20%
	Not within 4 hours following a meal (i.e. fasting/overnight)	>10mmol/L increase basal insulin by 10% >15mmol/L increase basal insulin by 20%
Hypoglycaemia (<4mmol/L not explained by obvious cause such as missed meal)	Within 4 hours following a meal	<4 mmol/L decrease that mealtime dose by 10% <3 mmol/L decrease that mealtime dose by 20%
	Not within 4 hours following a meal (i.e. fasting/overnight)	<4 mmol/L decrease basal insulin by at least 10% <3 mmol/L decrease basal insulin by at least 20%

3.4 Management of elevated ketones

If Ketones >0.6 mmol/L:

- Ensure SGLT-2 inhibitor is ceased (should be stopped on admission).
- Perform venous blood gas.
- Recheck capillary ketone within 2 hours.

If Ketones >1.0 mmol/L:

- As per above and inform Endocrine team.
- Consider IV therapy if ketone >1 mmol/L (also discuss with COVID-19 team first as may need to avoid excess fluids).
- If evidence of ketoacidosis, discuss with endocrine and COVID-19 team – may need insulin glucose infusion +/- ICU transfer.

3.5 Indications for contacting endocrine team

- Type 1 DM
- Type 3c diabetes (Diabetes due to pancreatic insufficiency)
- Any diabetes in pregnancy (gestational diabetes, Type 1 or Type 2 DM in pregnancy)
- Patient without history of diabetes but HbA1c >6.5% prior to dexamethasone

- Patient with capillary ketone >1.0 mmol/L, difficult to control BGL (e.g. persistent hyperglycaemia or recurrent hypoglycaemia) despite use of this policy, or despite insulin – glucose infusion being used
- Patient with known diabetes or hyperglycaemia during admission and nil by mouth/not tolerating oral intake.

3.6 Indications for contacting Diabetes Nurse Educator

- New insulin for patients with or without diabetes
- Pre-existing diabetes patient who requires education e.g. patient unable to self-administer insulin or as otherwise requested by the endocrine team.

NOTE: Diabetes nurse educators require >=1 working day to educate a patient to start and safely administer insulin. This usually takes 2 working days for the elderly, those with poor English language skills or who are looked after by a carer or have cognitive impairment. Please plan Diabetes nurse educator referrals accordingly

3.7 Discharge planning

- Resume metformin and/or GLP1RA if AKI or severe COVID-19 has resolved and eating and drinking well.
- Inform patients and their usual clinician to plan to resume SGLT-2 inhibitor and/or GLP1RA 1-week post-discharge or 1 week after dexamethasone cessation (whichever is later)
    - COVID-19 patients newly started on insulin and following successful education to self-administer insulin by DNEs who are without hypoglycaemia (BGLs <=4mmol/L) or refractory hyperglycaemia (persistently >=14mmol/L) are suitable from a discharge planning perspective.
- Patients newly commenced on insulin during admission need the following documented on the discharge summary:
    - If admission HbA1c <8.5%: advise patient to cease insulin 1 day after dexamethasone ceased, and to then promptly follow-up with usual GP.
    - If admission HbA1c >8.5%: advise patient to reduce insulin doses to 1/3 (33%) of current doses 1 day after dexamethasone ceased, and to promptly follow-up with usual GP.
- Higher risk COVID-19 Diabetes patients should be referred to the local Endocrinology Specialist or Hospital Endocrine Team so they can facilitate Post-discharge follow-up
- Hyperglycaemia or diabetes in pregnancy: will require follow-up in High Risk Antenatal clinic
- Those with difficult to treat Diabetes Mellitus (recurrent hypoglycaemia (<=4mmol/L), refractory hyperglycaemia (persistently >=14mmol/L), HbA1c >=9% on admission.

4. Acknowledgements

These guidelines are based on current available knowledge of coronaviruses and may change as more evidence becomes available specifically regarding COVID-19.

The Department of Health wishes to acknowledge the expertise provided by the following groups

- COVID-19 Endocrinology Clinical Working Group
- Fiona Stanley Fremantle Hospitals Group Drugs and Therapeutics Committee
- Sir Charles Gairdner Hospital Endocrinology and Diabetes Department

Version Control			
Version	**Date**	**Reviewed by**	**Changes**
1.0	10/03/2022	SHICC Health Operations - COVID-19 Endocrinology Clinical Working Group	New guideline
1.1	30/05/2022	SHICC Health Operations - COVID-19 Endocrinology Clinical Working Group	Terminology changes and review

5. References

1. Liverpool Hospital COVID-19 and Diabetes and Hyperglycaemia Protocol. Version 1.1 Diabetes and Endocrine Service, Liverpool Hospital, 16 September 2021
2. New South Wales NSW Diabetes Hyperglycaemia Management Protocol. Version 1.1 Department of Health, 23 February 2021
3. Diabetes and Glycaemic management: Secondary COVID-19 Clinical Practice Guideline. Document Number COV02.02.05 Version 3.0, The Royal Melbourne Hospital, 14 October 2021
4. Randomized study of basal-bolus insulin therapy in the inpatient management of patients with type 2 diabetes (RABBIT 2 trial). GE Umpierrez. Diabetes Care 2007 Sep;30(9):2181-6

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This document can be made available in alternative formats on request for a person with disability.