Consensus Guideline for the Management of Diabetes during COVID-19 Pandemic

Foreword

Professor Than Than Aye
M.B.,B.S, M.Med.Sc (Int.Med.), D.T.M & H (London), MRCP (UK)
Dr.Med.Sc (Gen.Med.), FRCP (Edin), FRCP (London)
Emeritus Professor, University of Medicine 2, Yangon
Former Professor and Head, Department of Medicine
North Okkalapa Teaching and General Hospital, University of Medicine 2, Yangon
Patron of Myanmar Society of Endocrinology and Metabolism (MSEM)

Diabetes and high blood glucose levels are associated with increased complications, respiratory failure and mortality in hospitalized patients with COVID-19. Glycemic control is important in the treatment of COVID-19 patients. Although there are guidelines which cover comprehensive measures for prevention, control and management in general, specific measures for management of diabetes and hyperglycemia are still challenging. With the purpose of bridging the gap, Myanmar Society for Endocrinology and Metabolism (MSEM) and Myanmar Diabetes Association (MMDA) have developed consensus among endocrinologists and internists to formulate the guidelines for management of diabetes during COVID-19 pandemic. It is our hope that this Consensus Guideline for the management of diabetes during COVID-19 pandemic will serve several useful purposes. Our primary goal is to improve the care of patients with diabetes who are managed in quarantine or isolation areas and COVID-19 confirmed cases. This guideline is meant for the period of COVID-19 pandemic to get optimal outcomes for diabetes patients as well as to minimize the risk for health care persons. It is hoped that the guideline will provide guidance for general physicians, endocrinologists, infectious disease specialists and all the health care persons who is taking care of COVI-19 suspect and confirmed cases.

We wish to thank Professor Tint Swe Latt (President of Myanmar Diabetes Association), Professor Khin Saw Than (Professor/Head of Department of Diabetes and Endocrinology, University of Medicine 1, Yangon), Professor Ko Ko (Professor/Head of Department of Diabetes and Endocrinology, University of Medicine 2, Yangon), Professor Aye Aye Aung (Professor/Head of Department of Diabetes and Endocrinology, University of Medicine, Mandalay), Colonel Daw Theingi Kyaw (Department of Endocrinology and Metabolic Diseases, Defence Services Medical Academy) and members of Myanmar Society of Endocrinology and Metabolism who volunteered countless hours of their time developing this guideline.

Professor Than Than Aye

INTRODUCTION

Professor Tint Swe Latt
M.B.,B.S, M.Med.Sc (Internal Medicine), Dr.Med.Sc (General Medicine)
MRCP (UK), FRCP (Edinburgh), Dip.Med.Sc (Medical Education)
Emeritus Professor, University of Medicine 2, Yangon
President of Myanmar Diabetes Association (MMDA)

Pneumonia of unknown cause detected in Wuhan, China was first reported to World Health Organization (WHO) Country Office in China on 31 December 2019. On 11 February 2020, WHO announced a name for the new coronavirus disease: COVID-19. As the disease spread to the other parts of the world, WHO initially declared it as public health emergency of international concern on 30 January 2020. Soon after the number of cases outside China increased 13-fold and the number of countries with cases increased threefold, the WHO declared the novel COVID-19 outbreak a global pandemic on 11 March 2020.

The WHO-CHINA Joint mission on COVID-19 reported that approximately 80% of laboratory confirmed patients have mild to moderate disease, 13.8% have severe disease and 6.1% are critical. The report also mentioned that the individual at highest risk for severe disease and death are people aged over 60 years and those with underlying conditions such as hypertension, diabetes, cardiovascular disease, chronic respiratory disease and cancer.

Experiences from China, Italy, UK and USA have shown that diabetes is one of the common risk factors for severe COVID 19 infection and its death. Although the presence of diabetes itself did not increase the prevalence of COVID -19 infection, poor glycemic control with hyperglycemia is a risk factor for both severity and mortality in patients with COVID-19.

COVID-19 can affect the patients with diabetes in several ways. It can make hyperglycemia get worse during the infection under the influence of stress hormones and also due to adverse affect of medications used during the illness. Not only increasing the insulin doses in the patients with diabetes who were using insulin for their glycemic control, but also those with OAD also become out of control in their glycemic control and become requiring for insulin for their glycemic control. COVID-19 can also cause stress hyperglycemia in those patients without diabetes making them requiring insulin therapy for effective control of infection and its complications. COVID-19 can also unmask the diabetes in those patients with pre-diabetes previously.

Obviously, timely blood glucose management for the outbreak of COVID-19 is urgently needed. Experts from all over the world unanimously recommend achieving good glycemic control in diabetes patients not only to prevent them from severe COVID-19 but also reduce the mortality in those patients with severe infection.

Although various professional associations all over the world has recommended various guidelines for glycemic management during COVID-19 pandemic, we still need to develop our own guideline using our available resources and also to meet with our local strategy and practice of prevention and control of COVID-19 pandemic.

Myanmar has been vigilantly as well as diligently trying to control the COVID-19 since the inception of outbreak in China. Effort to control the infection is spearheaded by the State Counsellor of the country, who ardently follows the progress of the control measures on daily basic. Ministry of Health and Sports (MOHS) has developed the guidelines for prevention and control of COVID-19 mainly based on the recommendations by WHO. People with history of travel to the area of COVID-19 outbreak (or) those in close contact with COVID-19 patients are categorized as Category A, and people having contact history with fever and cough and those with signs and symptoms of severe respiratory infections are categorized as Category B and C respectively. While those from Category A are kept under surveillance in facility quarantine or community quarantine centers, those from Category B and C who are also called as Patients Under Investigations (PUI) are managed in special wards for isolation in designated hospitals and testing for COVID-19 infection is undertaken according to the guidelines by MOHS. Confirmed patients with positive COVID-19 test by RT-PCR are managed in the specially designated hospitals for COVID-19 infections by specialists in infectious diseases or general physicians.

Although the guidelines from MOHS covered comprehensive measures for prevention, control and management in general, it does not include specific measures for management of diabetes and hyperglycemia. To fill the apparent gap, Myanmar Society for Endocrinology and Metabolism (MSEM) and Myanmar Diabetes Association (MMDA) have developed consensus among endocrinologists and internists to formulate the guidelines for management of diabetes during COVID-19 pandemic. It is aimed to facilitate to achieving better outcome for the patients with hyperglycemia in all categories of working definition for COVID-19 while minimizing the workload and contact with probable and confirmed patients with COVID-19 for the attending health care providers to prevent contracting infection among them.

Professor Tint Swe Latt

Contents

Guideline Developing Committee and Advisory Group for the Management of Diabetes during COVID-19 Pandemic

Committee Members

1 . **Professor Aye Aye Aung and Team**

Department of Diabetes and Endocrinology

University of Medicine, Mandalay

2 . **Professor Khin Saw Than and Team**

Department of Diabetes and Endocrinology

University of Medicine 1, Yangon

3 . **Professor Ko Ko and Team**

Department of Diabetes and Endocrinology

University of Medicine 2, Yangon

4. **Colonel Theingi Kyaw and Team**

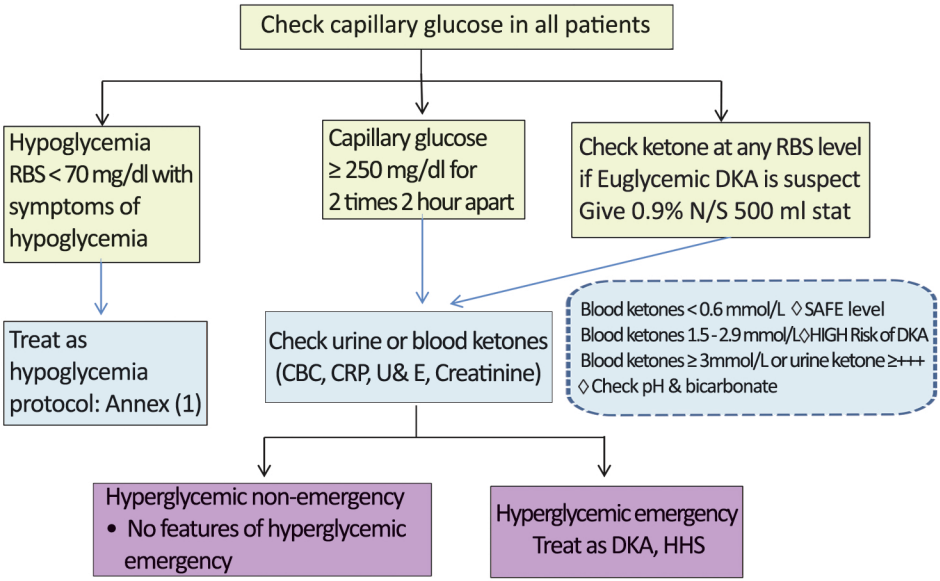
Department of Endocrinology and Metabolic Diseases

Defence Services Medical Academy

Advisory Group

1. **Professor Tint Swe Latt**
   President of Myanmar Diabetes Association (MMDA)
2. **Professor Than Than Aye**
   Patron of Myanmar Society of Endocrinology and Metabolism (MSEM)
3. **Professor Zaw Lynn Aung**
   Department of Medicine
   University of Medicine 1, Yangon
4. **Professor Yan Lynn Myint**
   Department of Medicine
   University of Medicine, Mandalay
5. **Professor Thin Thin Nwe**
   Department of Medicine
   University of Medicine 2, Yangon
6. **Professor Nyo Nyo Wah**
   Department of Medicine
   University of Medicine, Magway
7. **Colonel Khin Phyu Pyar**
   Department of Medicine
   Defence Services Medical Academy
8. **Professor Hlaing Mya Win**
   Department of Medicine
   University of Medicine 1, Yangon
9. **Professor Moe Moe San**
   Department of Tropical and Infectious Diseases
   University of Medicine 1, Yangon
10. **Professor Sabai Phyu**
    Department of Tropical and Infectious Diseases
    University of Medicine 2, Yangon
11. **Professor Win May Thein**
    Department of Tropical and Infectious Diseases
    University of Medicine, Mandalay

(1) Glycemic management of PUI cases on admission
Glycemic management of PUI at isolation ward



Glucose can be normal in SGLT-2 inhibitor associated DKA & pregnancy associated DKA

If clinical suspicion of DKA is high, check ketone at any RBS level (eg. Euglycemic DKA).

Glycemic management of PUI according to severity of hyperglycemia (Hyperglycemic non-emergency)

Glycemic status	Management action
Moderate hyperglycemia **cBG < 350 mg/dl** **(Non ICU setting)**	Continue original regime (or) Basal insulin* plus OAD (Preferred DPP4 inhibitor) Add SU if not reach target in patients with low risk of hypoglycemia Insulin therapy if BG is not controlled
Severe hyperglycemia **cBG ≥350 mg/dl** **(Non ICU setting)**	Preferably Basal bolus*** Alternative -Premixed twice daily
cBG ≥180 mg/dl x ≥ 2 times **(ICU setting or NPO)**	VRIII (or) Basal correction regime

Consideration of anti-diabetic drugs in COVID-19 suspect/confirmed patients with Type 2 Diabetes

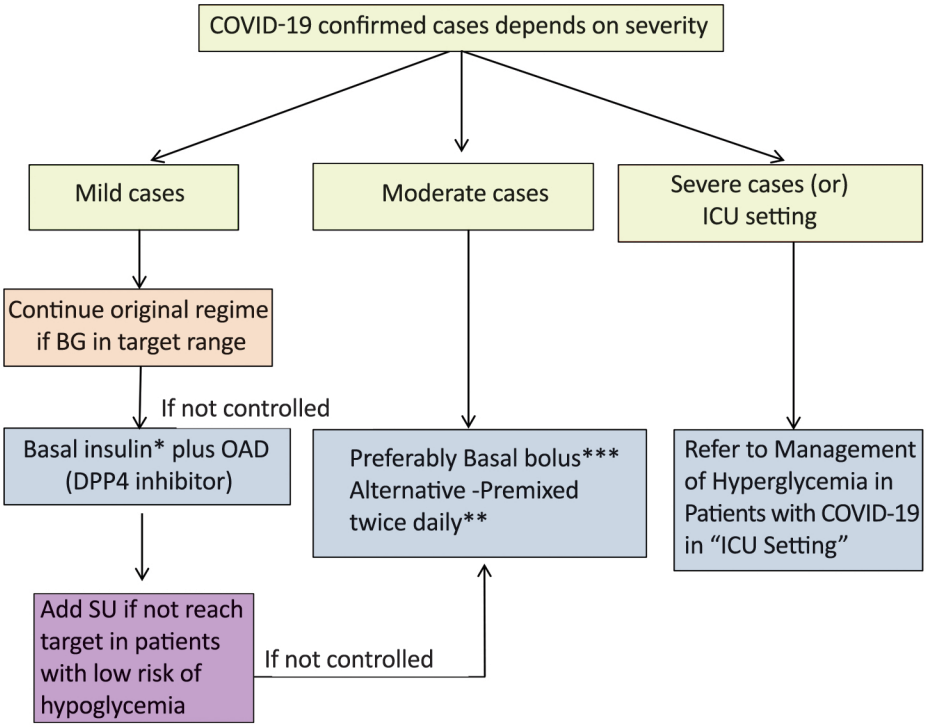
Metformin	Dehydration and lactic acidosis will probably occur if patients are dehydrated, so patients should stop taking the drug during illness, renal function should be carefully monitored
SGLT2- inhibitors	Risk of dehydration and diabetic ketoacidosis during illness, patients should stop taking the drugs and follow sick day rules Patients should avoid initiating therapy during respiratory illness
DPP-4 inhibitors	These drugs are generally well tolerated and can be continued
Sulfonylurea	Increase the risk of hypoglycemia in hospitalized subjects with severe medical illness
GLP -1 receptor agonists	Dehydration is likely to lead to a serious illness so patients should be closely monitored

(2) Glycemic management of COVID-19 confirmed case at designated hospital

Categorization of severity of COVID-19 infection

Category	Case definition
Mild illness	Fever, fatigue, cough (with or without sputum production), anorexia, malaise, muscle pain, sore throat, dyspnea, nasal congestion, or headache. (diarrhoea, nausea, and vomiting)
Moderate	Adult with pneumonia but no signs of severe pneumonia and no need for supplemental oxygen
Severe pneumonia, with or without ARDS and sepsis	Fever or suspected respiratory infection, plus one of the following: respiratory rate > 30 breaths/min; severe respiratory distress; or SpO2 ≤ 93% on room air

Glycemic management of COVID-19 confirmed case according to severity of infection



Blood glucose target - 7.8 – 10 mmol/L (140 –180 mg/dL)

2 (a) Insulin regimen in non-ICU setting

Meal pattern	Insulin regimen
Regular meal	basal insulin plus OAD or twice daily premixed insulin or basal bolus insulin (SC rapid- or short- acting insulin before meals and basal insulin)
Continuous enteral/ parenteral nutrition	basal insulin with correction regimen (preferred)
Bolus enteral nutrition	basal bolus regimen (preferred)
Nothing by mouth	VRIII (or) basal insulin with correction regimen (preferred)
If oral intake is poor, a safer procedure is to administer the rapid-acting insulin immediately after meal	

Blood glucose monitoring

Meal pattern	Glucose monitoring
Patient eating regularly	Before meals **(3 times per day in basal bolus regime)**
Patient not eating (NBM)	every 6 hourly
Patients with good glycemic control	**twice a day** (To limit staff contact with the contagious COVID-19)

*Basal insulin dose - 0.2 unit / kg body weight once daily; Annex (2)

**Total daily dose (TDD) of insulin for premixed insulin - 0.5 unit / kg body weight (or) total of all insulin taken within a 24 hour period in insulin treated patients. (2/3 of TDD before breakfast, 1/3 before dinner) Annex (3)

*** Basal bolus regime;

- Starting dose = 0.5 unit/ kg body weight
- Conventional insulin – 40% (basal), 20% 20% 20% (bolus)
- Correction – since Day 1 and daily (For pre-meal blood sugar-Breakfast, Lunch, Dinner)
- Scheduled insulin– on Day 3 and every 2 to 3 days Basal bolus – (*Glargine/ NPH insulin can be given before dinner together with rapid acting insulin to reduce the frequency of injection to 3 times per day*)
- Correction insulin dose calculation = (BG - 140)/ Correction Factor (CF), where CF = 1700/total daily dose or 3000/ kg body weight (or) Use Correction insulin dose table; See Annex (4)

2 (b) Management of hyperglycemia in patients with COVID-19 in "ICU setting"

Check blood glucose in all patients on ICU admission. If RBS > 11.1 mmol/L (200 mg/dl), check blood or urine Ketone, electrolytes and ABG.

Being acutely unwell with suspected/confirmed COVID-19 requires adjustment to standard approaches to diabetes.

- People with COVID-19 infection appear to have a greater risk of hyperglycaemia with ketones including: people with type 2 diabetes (risk greater if on a SGLT-2 inhibitor) and people with newly diagnosed diabetes.
- COVID-19 disease precipitates atypical presentations of diabetes emergencies (mixed DKA and HHS).

- With severe illness on admission, fluid requirements may differ in those with DKA/HHS and evidence of "lung leak" or myocarditis. After restoring the circulating volume the rate of fluid replacement regimen may need to be adjusted where evidence of "lung leak" or myocarditis
- Significant insulin resistance seen in people with type 2 diabetes in ICU settings (people seen requiring up to 20 units/hr)

Management of hyperglycemic emergencies

2 (c) Criteria for diagnosis and management of hyperglycemic emergencies

Criteria	DKA	HHS
Blood glucose	>11 mmol/L (200 mg/dl)	≥30 mmol/L (540 mg/dl)
Ketones	Blood ≥3 mmol/L Urine ≥+2	
pH	< 7.3	≥7.3
Serum bicarbonate	< 15mEq/L	
Serum osmolality		>320 mOsm/kg

ABG = arterial blood gas

Management of DKA

Fluid	Insulin	Targets
Systolic BP < 90 mmHg infuse 500mls 0.9% saline bolus over 15 minutes. (Repeat if systolic BP < 90 mmHg) Standard rate of fluid replacement with 0.9% saline (Slower rate - aged 18-25 and over 70, pregnancy or who have cardiac or renal failure) If a more cautious approach is required in COVID-19 positive/ suspected, use starting point table; Annex (6), and aims to avoid excessive fluid replacement* when the glucose is < 14 mmol/L (250 mg/dL), 10% DW at 125 ml/ hour should be infused alongside	Fixed Rate Intravenous Insulin Infusion (FRIII); Infuse at a fixed rate of 0.1 unit/kg/hour BG is not falling by 3.0 mmol/ L/hr (54 mg/dL), increase the insulin infusion rate by 1.0 unit/hr hourly < 180 mg/dL; decreases insulin infusion to 2-3 units /hr Always start/continue long-acting Insulin when treating DKA	Fall in ketones - 0.5 mmol/l/hour Fall in capillary BG – 3 mmol/l/hr (55 mg/dl) Maintain serum K +between 4.5 -5.5 mmol/l Target blood glucose range until DKA has resolved = 6 - 14 mmol/l (108-250 mg/dl)

**Use clinical judgment, frequent senior review and consider a higher rate of fluid replacement if significantly hypovolaemic/AKI:*

- Insulin infusion preparation Annex (5)
- Monitor blood glucose 2-4 hourly & continue insulin infusion until DKA resolve.
- Check blood ketone daily until DKA resolution
- Potassium replacement is not recommended with initial liter of fluid. See Annex (8)
- Urine output should be present if potassium replacement is going to commence

Alternative insulin regimen

- If syringe pump is not available, alternative SC insulin regimen can be used in "Mild & Moderate" DKA Aiming for a reduction in ketones of at least 0.5 mmol/l/hour (2 mmol/l over 4 hours)
- Initial dose of 0.4 units/kg every 4 hours
- Reduce to 0.2 units/kg every 4 hours once glucose less than 14 mmol/l
- If ketones not falling as expected, increase rapid acting insulin dose to 0.5 units/kg every 4 hours
- Continue until ketones less than 0.6 mmol/l
- If using regular injectable long-acting insulin this should be continued. If not previously using basal insulin initiate a dose of 0.15 units/kg/day (different basal dose depending on insulin naive or previous insulin use)

Management of HHS

Fluid	Insulin	Targets
Use 0.9% NS for initial fluid replacement (1 L over 1 hr). After the 1st hr, the rate of IV fluid should be adjusted on the basis of the patient's hemodynamic and electrolyte status (standard 250 - 500 mL/hr) Adjust rate of NS to achieve a decline in blood glucose and plasma osmolality. when the glucose is < 14 mmol/l, 10%DW at 125 ml/hour should be infused alongside	Start once blood glucose is falling below 5 mmol/L/h (<90 mg/dL/h) in adequate fluid Fixed Rate Intravenous Insulin Infusion (FRIII); Infuse at a fixed rate of 0.05 unit/kg/hour Adjust insulin infusion rate by 1 U/hr to maintain blood glucose decline of < 5 mmol/L/hr (<90 mg/dL/hr),	Fall in plasma osmolality of 3-8 mOsmol/kg/hr Reduction in capillary BG – 4-6 mmol/L/hr (70-100 mg/dL/hr) Target blood glucose 10-15 mmol/L (180 - 270 mg/dl) during the first 24 hours

All patients should receive prophylactic low molecular weight heparin (LMWH) for the full duration of admission unless contraindicated.

Management of "uncontrolled hyperglycemia" in ICU setting

- All oral hypoglycemic agents must be stopped but basal insulin can be continued.
- ≥ 2 consecutive blood glucose is ≥ 10 mmol/L (180 mg/dL) 2 hours apart, initiate insulin therapy.

Target blood glucose range = 7.8 – 10 mmol/L (140 –180 mg/dL)

Individualized goals for blood glucose control should be recommended in the treatment.

	Target for fasting BG (mg/dl)	Target for 2HPP or RBS (mg/dl)
Mild COVID-19 patients	80- 110	110-140
Older patients with mild COVID -19 or in use of Glucocorticoid	110-140	140-180
In severe or critically ill cases of COVID-19	140-180	140-250

- Variable Rate IV Insulin Infusion (VRIII) is the most preferred method in the ICU; see Annex (7)
- Monitor BG 2-4 hourly
- Fluid therapy (substrate) run alongside VRIII - 5 to 10% dextrose water and 10 mmol of potassium chloride should always be run alongside the VRIII at a rate of 40 ml/hour or adjust the rate to meet the patient's fluid maintenance requirements If syringe pump is not available or frequent monitoring is not feasible, subcutaneous "Basal Correction regime" can be used as an alternative.

Calculation of basal correction regime

Age	eGFR	BG on Admission	Total Daily Dose of Insulin
≥ 70 yr	< 60 ml/min		0.2 to 0.3 U/kg
< 70 yr	> 60 ml/min	140–200 mg/dl	0.4U/kg /day
< 70 yr	eGFR > 60 ml/min	201–400 mg/dl	0.5 U/kg/day

50% of total daily dose should be basal insulin and correction dose; see Annex (3)
Check blood glucose every 4 - 6 hr if the target maintained for the consecutive 24 hr.
Prophylaxis of thromboembolism
In all patients with Diabetes in the ICU, Low molecular weight heparin (LMWH) is given unless pharmacological VTE prophylaxis is contraindicated.

Transition from IV insulin infusion to SC insulin

- Once the general condition is improved and the patient is able to eat, switch to Basal Bolus Correction regimen.
- From FRIII - Insulin-naïve patients TDD = patient's weight (kg) x 0.5 ~ 0.75 units. (Use 0.75 units/kg for more insulin resistant i.e. teens, obese)

From VRIII - TDD = estimated from the last 6 hr of the VRIII

- Divide the total dose of insulin administered in last 6 hr of the VRIII by 6. Multiply this by 20 (not 24, to reduce risk of hypoglycemia). 50% of the total insulin requirement is given as basal insulin (e.g., glargine) before evening meal and the remainder as regular or rapid-acting insulin, divided equally between breakfast, lunch and evening meal.
- Discontinue IV insulin at 1-2 h after administration of SC regular or rapid-acting insulin or IV insulin can be discontinued at least 2 hr after SC long acting basal insulin is administered.

(3) Management of patient with diabetes at facility quarantine (or home stay)

Diet and lifestyle

- To receive plenty of oral fluids to maintain good hydration
- To have nutritional plan with regular meals or 'little and often' if appetite is reduced
- To maintain a daily appropriate exercise

Observation of COVID-19 symptoms

- Call or see a health care professional immediately if they present with symptoms such as fever, cough, shortness of breath or wheezing, especially if they believe they may have been exposed to COVID-19 or live in or have recently traveled to an area with ongoing spread.

Glycemic management

- To receive their usual prescribed diabetes treatment
- To have regular twice daily capillary blood glucose testing with the aim to keep:
- HbA1c - <7%
- Fasting/Pre-prandial capillary plasma glucose 80 – 130 mg/dl
- Peak postprandial capillary plasma glucose <180 mg/dl

General advice

- Unhealthy habits of smoking, drinking and betel chewing should be avoided.
- Patients can keep in touch with their routine physicians via teleconsultations.

Sick day rules for patients with diabetes mellitus

- Monitor blood sugar level every 4-6 hours and blood or urine ketone in type 1 diabetic patients if feasible
- Drink at least 100 ml of water or sugar-free liquids every hour.
- If patient is on insulin therapy, advice for insulin dose adjustment if RBS> 200 mg/dl

Blood glucose	Insulin dose*
200-299 mg/dl	Add extra 2 units to each dose
300-399 mg/dl	Add extra 4 units to each dose
≥400 mg/dl	Add extra 6 units to each dose

- Blood ketones ≥1.5 mmol/L indicates high risk of diabetic ketoacidosis. Contact with health care person and consider urgent hospital assessment
- If patient is feeling unwell and BG persistently high, seek medical advice from health care provider.
- Beware of hypoglycemic symptoms.

Annexes

Annex (1) Treatment of hypoglycemia; Blood glucose less than 70 mg/dl (4mmol/L)

Conscious	Treat with eating or drinking 15-20g fast acting carbohydrate (5 Dextrose tablets/Fruit juice 200mls/ 4 tea spoonful sugar in warm water, honey or 160 ml of sugary cola) Recheck RBS after 15 minutes. Repeat for three times if RBS still <70 mg/dl repeat up to 3 times. When BG level is above 70 mg/dl, give 15- 20g of long acting carbohydrate (eg. Two biscuits / slice of bread / 200-300ml milk/an apple/a banana/ next meal if due)
Confused /unconscious or nil by mouth	80 ml 25% glucose or 200 ml 10% glucose or 40 ml 50% glucose over 10 minutes. Recheck glucose after 10 minutes and if still less than 70 mg/dl, repeat treatment once glucose >70 mg/dl give 10% glucose infusion at 100ml/hr until no longer NBM

Annex (2) Adjustment of basal insulin

***Basal insulin dose**	**10 units or 0.2** unit / kg body weight once daily NPH(conventional) or Glargine(analogue) or Detemir (analogue)
Monitoring and targets	**Monitor** pre-breakfast BG **Target** – pre-breakfast BG 100 – 140 mg/dl
Optimization	Adjust insulin doses after 3 consecutive BG values obtained (every 3 –7 days) • < 100 mg/dl (>1 value) ◊ reduce dose by 2 units • 100 – 140 mg/dl (all value) ◊ maintain current dose • >140 mg/dl (>1 value, no hypos) ◊ increase by 2 units
Caution	• Watch for nocturnal hypoglycemia. • If **hypoglycemia** is the limiting factor to achieve optimum dose, conventional intermediate-acting insulin may be **switched to basal insulin analogue**.

Annex (3) Adjustment of premixed insulin and premixed insulin analogue

****Premixed insulin dose**	**0.5** unit / kg body weight twice daily • 2/3 in the morning and 1/3 in the evening for conventional insulin • 50:50 of the dose for premixed insulin analogue
Monitoring and targets	**Monitor** pre-breakfast BG, pre-meals and bedtime **Target** – pre-breakfast BG 100 – 140 mg/dl, Pre-meal & Bedtime < 140 mg/dl
Optimization	Adjust insulin doses after 3 consecutive BG values obtained (every 3-7 days) • < 100 mg/dl (>1 value) ◊ reduce dose by 2-4 units • 100 – 140 mg/dl (all value) ◊ maintain current dose • >140 mg/dl (>1 value, no hypos) ◊ increase by 2 units θ Pre-breakfast BG determines pre-dinner premixed dose adjustment θ Pre-dinner BG determines pre-breakfast premixed dose adjustment.

Annex (4) Correction insulin dose table

Blood glucose (mg/dl)	Low dose scale (unit)	Moderated dose scale (unit)	High dose scale (unit)
	Lean or elderly patients or low basal or meal insulin doses.	Acutely ill or febrile or moderate basal or meal insulin doses.	Patients on steroids, TPN or tube feedings, or high basal or meal insulin doses
141-180	1	2	3
181-220	2	4	6
221-260	3	6	9
261-300	4	8	12
301-340	5	10	15
>340	6	12	18
The mealtime bolus insulin should be withheld when patients are not eating, but correction doses should still be given when needed to treat hyperglycemia.			

Correction insulin adjustment

If pre-meal plasma glucose are persistently above 140 mg/dl in the absence of hypoglycemia, increase insulin scale from the low dose scale to the moderate dose scale or from the moderate dose scale to high dose scale.

To avoid hypoglycemia, decrease regular or rapid-acting insulin from the high dose scale to the moderate dose scale or from moderate dose scale to the low dose scale when blood glucose < 100 mg/dl.

Annex (5) Insulin infusion preparation

Syringe pump - 50 Units soluble insulin (50ml with 0.9% sodium chloride = 1 unit/ 1ml)

If no syringe pump, soluble insulin 50U in 500 mL NS i.e. 1U insulin in 10 mL (20 drops/min is approximately equivalent to 6 Units/hr)

Annex (6) Fluid Management

If a more cautious approach is required in COVID-19 positive/suspected, after an initial fluid bolus of 250ml in 15 minutes, the table below is a starting point only, and aims to avoid excessive fluid replacement.

Weight (kg)	Rate of 0.9% Sodium Chloride infusion (ml/hr)	
	pH 7.1 OR less	Greater Than 7.1
Less than 50	100	90
50-60	115	100
61-70	130	115
71-80	140	125
81-90	150	135
91-100	165	145
> 100	170	155

Annex (7) Variable rate insulin regime (VRIII)

Capillary BG	Reduced Rate	Standard Rate	Increased Rate
<70 mg/dl	Inpatient hypoglycaemia policy	Inpatient hypoglycaemia policy	Inpatient hypoglycaemia policy
70 – 109 mg/dl	0 units	0 units	0 units
110 - 144 mg/dl	0.5 units	1 units	2 units
145 - 214 mg/dl	1 units	2 units	4 units
215 - 289 mg/dl	2 units	4 units	6 units
290 - 360 mg/dl	3 units	5 units	7 units
361 - 435 mg/dl	4 units	6 units	8 units
> 435 mg/dl	6 units	8 units	10 units

Reduced Rate – Insulin sensitive patient (i.e. < 24 IU/day)
Standard Rate – Use unless otherwise indicated
Increased Rate – Insulin resistant patient (i.e. >100 IU/day)

Annex (8) Potassium replacement

Potassium level	Potassium replacement
> 5.5mmol/l	No KCl
3.5 to 5.5 mmol/l	10mmol of KCL in 500 ml
< 3.5 mmol/l	20mmol of KCl in 500 ml
Check potassium level daily	

Annex (9) Types of insulin

	Conventional	Analogue
Basal insulin	NPH (Insultard, Insunova N, Wosulin N)	Glargine (Glaritus, Insunova G, Lantus), Detemir (Levemir)
Bolus insulin	Short acting (Actrapid, Insunova R, Wosulin R)	Rapid acting (Novorapid, Apidra)
Premixed insulin	(Mixtard 30, Insunova 30/70, Wosulin 30/70)	(Novomix 30)

References

1. ADA, American Diabetes Association (2020) the Standards of Medical Care in Diabetes-2020. *Diabetes Care*, 43, Supplement 1, pp. S1-212.

2. Association, A.D. (2019) 15. Diabetes Care in the Hospital: Standards of Medical Care in Diabetes-2019. *Diabetes Care*, 42 (Supplement 1), S173-S181.

3. A Covid-19 Response Action – Diabetes Management in Care Homes [Internet]. A National Stakeholders Covid-19 Response Group Interim Guidance. 2020 [cited 3-5-2020].Available from:https://abcd.care/sites/abcd.care/files/site_uploads/Resources/COVID-19/Covid-19-and-Diabetes-Care-Home-Guidance-28042020.pdf.

4. Banerjee, M., Chakraborty, S. & Pal, R., (2020) Diabetes self-management amid COVID-19 pandemic. *Diabetes Metab Syndr*, 14, pp.351-354.

5. Bornstein, S.R., Rubino, F., Khunti, K., et al. (2020) Practical Recommendations for The Management of Diabetes in Patients with COVID-19; *Lancet Diabetes Endocrinol* : S2213-8587(20)30152-2. doi:10.1016/S2213-8587(20)30152-2.

6. Barry Conrad, Enrique Caballer, Irl Hirsch, Shivani Agarwal, et al. (2020) ADACOVID-19 Webinar Series | American Diabetes Association. 5 January 2020. Available from:https://professional.diabetes. org/content-page/ada- covid-19-webinar-series [Accessed: 5 May 2020].

7. Concise advice on Inpatient Diabetes (COVID:Diabetes):FRONT DOOR GUIDANCE.DiABETES UK designed by: *Liecester Diabetes Centre*, Version 1.0, published online 9/4/2020.

8. Chen Y, Gong X, Wang L, Guo J. (2020) Effects of hypertension, diabetes and coronary heart disease on COVID-19 diseases severity: a systematic review and meta-analysis. *medRxiv* 2020; published online March 30; DOI:10.1101/2020.03.25.20043133 (preprint).

9. Chow N.(2020) Preliminary Estimates of the Prevalence of Selected Underlying Health Conditions Among Patients with Coronavirus Disease 2019 - United States, February 12-March 28, 2020. MMWR Morb Mortal Wkly Rep 2020;69:382-6.

10. Covid-19 report of MOHS, Ministry of Health and Sport, Myanmar 2020. Available: https://www.mohs.gov.mm.

11. Dhatariya, K., James, J., Kong, M. -F., Berrington, R., et al. (2020) Diabetes at the front door. A guideline for dealing with glucose related emergencies at the time of acute hospital admission from the Joint British Diabetes Society (JBDS) for Inpatient Care Group. *Diabetic Medicine*. dme.14304.

12. Dr Aled Roberts & Simone Penfold (2018) JBDS_Enteral_feeding_FINAL.pdf. (05), 32.

13. Dr Adrian Scott & Anne Claydon (2012) The management of the hyperosmolar hyperglycaemic state (HHS) in adults with diabetes. (06), 32.

14. Dr Ketan Dhatariya & Dr Mark Savage (2013) 2013_09_JBDS_IP_DKA_Adults_ Revised.pdf. (02), 44.

15. Drucker, D.J. (2020) Coronavirus Infections and Type 2 Diabetes—Shared Pathways with Therapeutic Implications. *Endocrine Reviews*. 41 (3), bnaa011.

16. Grossman, L.D., BScPharm, R.R., Stone, J.A., Houlden, R.L., et al. (2018) Macrovascular and Microvascular Complications S162. 42, 342.

17. Guidelines.diabetes.ca. 2020. [online] Available at:(http://guidelines.diabetes.ca/docs/CPG-2018-full-EN.pdf) [Accessed 3 May 2020].

18. Guan W-jie, Ni Z-yi, Hu Y, et al.(2020) Clinical characteristics of corona virus disease 2019 in China. *N Engl J Med Overseas* Ed 2020.

19. Insulin Therapy in Clinical Practice, Myanmar, First Edition May 2019.

20. Joseph Tooley (2017) Insulin Infusion (Variable Rate) in *Critical Care*. (1), 10.

21. Karslioglu French, E., Donihi, A.C. & Korytkowski, M.T. (2019) Diabetic ketoacidosis and hyperosmolar hyperglycemic syndrome: review of acute decompensated diabetes in adult patients. BMJ. l1114.

22. Li B, Yang J, Zhao F, et al. (2020)Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China. Clin Res Cardiol 2020. doi:10.1007/s00392-020-01626-9. [Epub ahead of print: 11 Mar2020].

23. Misra, A., Nigam, P., Hills, A. P., Chadha, D. S., et al., (2012) Consensus physical activity guidelines for Asian Indians. Diabetes Technol Ther, 14, pp.83-98.

24. Misra, A., Sharma, R., Gulati, S., Joshi, S. R., et al., (2011) Consensus dietary guidelines for healthy living and prevention of obesity, the metabolic syndrome, diabetes, and related disorders in Asian Indians. Diabetes Technol Ther, 13, pp.683-694.

25. Management of diabetes in emergency department during coronavirus epidemic, NHS London/update 15/4/2020.

26. Moghissi, E.S., Korytkowski, M.T., DiNardo, M., Einhorn, D., et al. (2009)American Association of Clinical Endocrinologists and American Diabetes Association Consensus Statement on Inpatient Glycemic Control. *Diabetes Care*. 32 (6), 1119–1131.

27. Magaji, V. and Johnston, J. M., (2011) Inpatient Management of Hyperglycemia and Diabetes; *Clinical Diabetes*: 29 (1).

28. NHS. Sick day rules for patients on multiple daily injections (MDI): how to manage type 1 diabetes if you become unwell with corona virus2020:[1-5 pp.]. Available from: https://www.england.nhs.uk/london/wp-content/uploads/sites/8/2020/04/2.-Covid-19-Diabetes-Sick-Day-Rules-Type-1-MDI-06042020.pdf.

29. NHS. Sick day rules: how to manage type 2 diabetes if you become unwell with corona virus and what to do with you medication2020:[1-6 pp.]. Available from: https://www.england.nhs.uk/london/wp-content/uloads/sites/8/2020/04/3.-Covid-19-Type-2-Sick-Day-Rules-Crib-Sheet-06042020.pdf.

30. Professor Gerry Rayman, Dr Alistair Lumb, Dr Brian Kennon, Chris Cottrell, et al. (2020) Concise advice on Inpatient Diabetes (COVID:Diabetes): Front door guidance. (2),3.

31. Skamagas, M. (2013) Management of Diabetes and Hyperglycemia in Hospitalized Patients. In: Essentials of Hospital Medicine. *World Scientific.* 537– 551.

32. The Management of Blood Glucose Should be emphasized in the Treatment of COVID-19, Department of Endocrinology and Metabolism, West China Hospital, Sichuan University, Chengdu 610041, China.

33. Umpierrez, G.E., Hellman, R., Korytkowski, M.T., Kosiborod, M., et al. (2012) Management of Hyperglycemia in Hospitalized Patients in Non-Critical Care Setting: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism.* 97 (1), 16–38.

34. Wang, W., Lu, J., Gu, W., Zhang, Y., et al. (2020) Care for diabetes with COVID- 19: Advice from China. *Journal of Diabetes.* 12 (5), 417–419.

35. Webber, J. (2014) JBDS guideline for the use of VRIII in medical patients- a commentary. British Journal of Diabetes. 14 (4), 158-160.

36. WHO. Director-General's opening remarks at the media briefing on COVID-19, 2020. Available:https://www.who.int/dg/speeches/detail/who-diretor-general-s-opening-remarks-at-the-media-briefing-oncovid-19-11-march-2020.

37. Xue T, Li Q, Zhang Q, et al. (2020) Blood glucose levels in elderly subjects with type 2 diabetes during COVID-19 outbreak: a retrospective study in a single center. medRxiv 2020; published online April 2; DOI:10.1101/2020.03.31.20048579 (preprint). (Anon., n.d.)

38. Zhou, J. & Tan, J. (2020) Diabetes patients with COVID-19 need better blood glucose management in Wuhan, *China. Metabolism.* 107, 154216.

39. Zhou F, Yu T, Du R, et al.(2020) Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020; 395:1054–62.

Note ----------

i-sens