



Clinical Guidance on Diabetes Management at COVID-19 Patient Management Facility

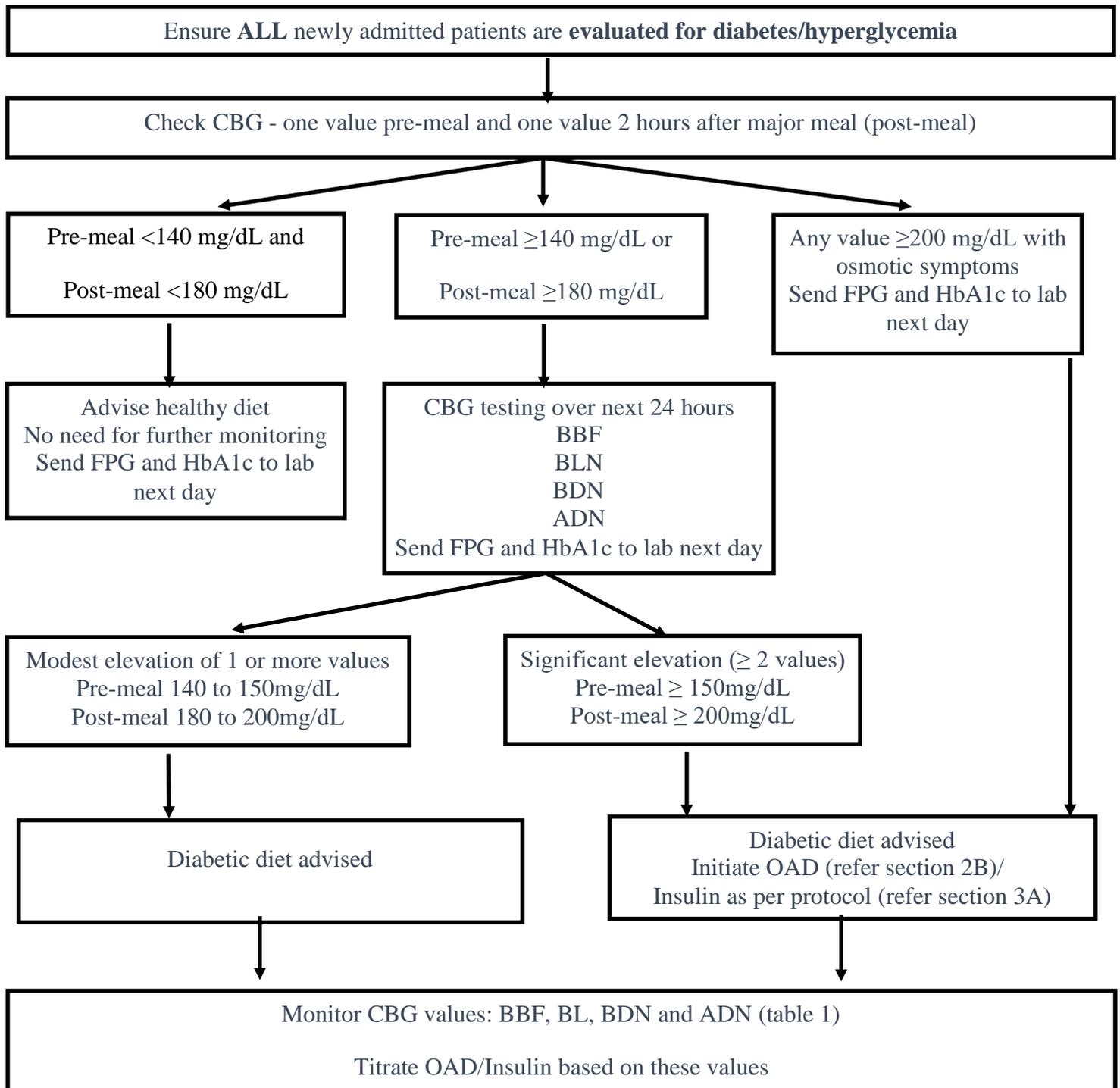
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Important points:

- **Screen every patient for hyperglycemia at admission with at least 2 capillary blood glucose (CBG) values (1 pre-meal and 1 post-meal value) by a glucometer.**
- **Every patient with diabetes should be started on a diabetic diet. Kindly ensure that the patient strictly adhere to the timing and quantity advised in the diet chart.**

Section 1: Screening of hyperglycemia in every patient hospitalized with COVID-19 (at admission and on starting steroids)



*If BG level is more than 250 mg/dl, check urine/blood ketone levels → Consult endocrinologist/physician immediately if ketones are positive.
 *If Pre-meal BG level ≥300 mg/dl and post-meal BG level ≥400 mg/dl → consult endocrinologist/physician immediately irrespective of ketone levels (to start insulin infusion – section 4).
 *FPG ≥126 mg/dl and/or HbA1c ≥6.5% (lab values) establishes the diagnosis of Diabetes Mellitus

ADN: After dinner, BBF: Before breakfast, BDN: Before dinner, BL: Before lunch, FPG: Fasting plasma glucose, OAD: Oral antihyperglycemic drug

Section 2: Oral antihyperglycemic drugs (OAD)

2A: Treatment of known Diabetic patients who are on OAD at admission

- A. To continue existing OAD if all of the below mentioned criteria are fulfilled:
 - i. BG levels are controlled (Pre-meal <140 mg/dl and post-meal <180 mg/dl)
 - ii. Patient is conscious, oriented and accepting well orally
 - iii. COVID symptoms are mild
 - iv. KFT and LFT are normal
- B. If patient doesn't fulfil all of the above criteria – consult endocrinologist/physician [to start on basal + bolus Insulin (MSII) or IV insulin infusion, depending on BG levels – section 3B]

2B: To initiate OAD in patients detected to have diabetes at admission

(At admission – pre-meal BG: 150 to 180 mg/dl and/or post-meal BG 200 to 250 mg/dl)

- A. Consult Endocrinologist/physician at earliest to initiate or optimize OAD
- B. If there is an anticipated delay in consulting endocrinologist/physician, initiate on Tab Metformin 500mg BD and Tab Vildagliptin 50 mg BD, provided patient meets all the following criteria:
 - i. Pre-meal blood glucose is between 150 and 180 mg/dl **and/or** post-meal blood glucose is between 200 and 250 mg/dl
 - ii. Meets other criteria as mentioned above (Section 2A)
- C. If BG levels at admission are above the range mentioned (pre-meal ≥ 180 mg/dl or post-meal blood glucose ≥ 250 mg/dl) → start on insulin (Preferably consult endocrinologist or physician/ refer section 3A)

***BG monitoring in both section 2A and 2B: BBF, ABF, BL, AL, BDN and ADN (refer to table 1)**

Section 3: Basal bolus regimen

3A: To initiate insulin at diagnosis on admission

(At admission – pre-meal BG: ≥ 180 mg/dl or post-meal BG ≥ 250 mg/dl)

- A. **Total daily dose (TDD) = 0.4 units/kg/day** (In case of age > 65 yr, nephropathy or liver disease, use 0.2 units/kg/day)
- B. Total daily dose is divided equally into 4 doses (25% each): 3 doses are for bolus insulin (Regular insulin 30 min before breakfast, before lunch and before dinner) and 1 dose for basal insulin (Inj. NPH insulin at bed time/ 2 hours after dinner)

Example: 58 yr old male with weight 60 Kg presented with pre-meal BG of 184 mg/dl and post-meal BG of 302 mg/dl

Total daily dose = **0.4 units/kg/day** = $0.4 \times 60 = 24$ units per day Insulin

regimen to be prescribed for him:

Inj. Regular insulin 6 units SC 30min before breakfast, 6 units SC 30min before lunch and 6 units SC 30min before dinner

Inj. NPH insulin 6 units SC at bed time/ 2 hours after dinner

3B: If patient is on OAD and blood glucose levels are uncontrolled (Pre-meal BG ≥ 140 mg/dl or post-meal BG ≥ 180 mg/dl)

- A. If pre-meal BG value is 140 to 180 mg/dl and/or post-meal BG value is 180 to 250 mg/dl → consult endocrinologist/physician for optimization
- B. If pre-meal BG value ≥ 180 mg/dl and/or post-meal BG value ≥ 250 mg/dl despite being on OAD → add basal + bolus insulin using calculation mentioned above in section 3A (Kindly note that in this particular scenario OADs apart from Metformin and Gliptins need to be stopped). Consult endocrinologist/physician for optimization.

Caveat: Bolus insulin (Inj. Regular insulin) may not always be needed for all 3 meals and can only be added to individual meals requiring prandial coverage (i.e., for meals with pre-meal to post-meal BG increment >40 mg/dl on a given day, regular insulin should be added before these meals on the next day), Example: at lunch on previous day BG levels were – BL 112 mg/dl and AL 204 mg/dl. Since increment is >40 mg/dl (92 mg/dl), Inj. Regular insulin has to be added before lunch on the next day.

- C. If FPG is ≥ 140 mg/dl and post-meal raise in BG level is normal (< 40 mg/dl), then one can add just basal insulin (Inj. NPH insulin bedtime/ 2 hours after dinner)/

3C: Patient is already on basal bolus regimen at admission

Continue existing regimen. Monitor blood glucose levels and review with BG log to an endocrinologist/physician.

3D: To switch to basal bolus regimen from insulin infusion

- A. Consult endocrinologist/ physician to switch to basal bolus regimen
- B. If there is an anticipated delay in consulting the endocrinologist/physician, follow the steps mentioned below to switch to basal bolus regimen:
- i. Calculate the total daily dose (TDD) based on insulin infusion requirements for the last 24 hours: **TDD** = 80% of the total daily insulin requirement on intravenous infusion in the last 24 hours.
 - ii. Once you have the TDD, calculate the doses of bolus insulin (Inj. Regular insulin) and basal insulin (Inj. NPH insulin) as described in section 3A (refer step B and example)
 - iii. Important pointers:
 - a. Do not switch from insulin infusion to basal bolus regimen until BG levels are controlled on insulin infusion, patient is orally accepting or on RT feeds and is hemodynamically stable
 - b. Insulin infusion has to be overlapped with basal bolus regimen for 60 minutes before stopping. Don't stop insulin infusion abruptly.

Example: A patient is on insulin infusion and his BG levels are adequately controlled for last 24 hours. He is taking orally well and vitals are stable. At **11 am his BG level is 132 mg/dl and we decide to switch to basal bolus regimen** from insulin infusion. We calculate the dose and plan to start Inj. Regular insulin 6 units SC BBF, 6 units SC BL and 6 units SC BDN and Inj. NPH insulin 6 units SC at bed time/ 2 hours after dinner. **We should not stop insulin infusion at 11 am, rather continue it till lunch. At 12.30 pm we give Inj. Regular insulin 6U SC (as calculated), patient takes lunch at 1:00 pm, insulin infusion is continued as per scale and finally stopped 1 hour later at 1.30 pm (after the overlap).**

***BG monitoring in section 3A to D: BBF, ABF, BL, AL, BDN and ADN (refer to table 1)**

Table 1: Capillary BG monitoring chart

(Kindly maintain exact same format of BG chart for every patient)

Date	BBF	ABF	BL	AL	BDN	ADN	#3am	Remarks
22/6/2020	224 (R8)	256	212 (R8)	262	198 (R8)	302 (N12)	192	
23/6/2020	172 (R8)	216	180 (R8)	211	368* (R10)	392 (N16)	164	*Had heavy snack at 6pm
24/6/2020	142 (R8)	179	132 (R8)	60*	154 (R10)	186 (N12)	108	*Didn't take lunch properly
25/6/2020	102 (R8)	149						

BBF: Before breakfast, ABF: After breakfast, BL: Before lunch, AL: After lunch, BDN: Before dinner, ADN: After dinner

R: Regular insulin, N: NPH insulin

Monitor 3 am blood glucose when fasting blood glucose is persistently out of target

Section 4: Intravenous insulin infusion

A. Indications for the use of intravenous insulin infusion

Advised when blood glucose is persistently above 180 mg/dl (2 or more values) under following situations:

1. Patient is NPO or has erratic diet (in time and content)
2. Diabetic Ketoacidosis (DKA)
3. Uncontrolled hyperglycemia despite MSII use or hyperglycaemia resistant to MSII (Insulin requirements > 2 units/kg)
4. Severe hyperglycemia at onset (Pre-meal BG level ≥ 300 mg/dl and post-meal BG level ≥ 400 mg/dl)
5. Critically ill like in sepsis and septic shock

B. Initiation of insulin infusion:

Insulin can be initiated at dose of 0.05-0.1 units/kg body weight/hour.

C. Infusion preparation: 50 units regular insulin in 50ml NS (1unit/ml). Priming should be done before starting the infusion by flushing 20 ml of normal saline through intravenous tubing

D. Frequency of blood glucose monitoring:

2 hourly. Can be extended to 4 hourly, where requirement is low, glucose values are stable and in target.

E. Glycemic targets:

To achieve and maintain blood glucose of **140 to 180 mg/dl** for most individuals. Make BG target tighter to 110-180 mg/dl for those in whom it is safe to do so and relax to 220 mg/dl where even 140-180 mg/dl is unsafe.

F. Further titration of insulin infusion rate: Further titration of insulin infusion rates should be done based upon ambient blood glucose level, target blood glucose level and magnitude of blood glucose change in the previous hour. Other factors that should be accounted for are timing and content of meals, insulin sensitivity, and previous day's glycemic response.

A simple and popular formula: Infusion rate (units/hr) = BG level (mg/dl)/100 is good to calculate initial infusion rate. However, it should not be relied upon for titration because it does not account rate of BG change in the preceding hours.

Examples:

1. At an ongoing rate of 3 units/hr, BG decreased from 280 mg/dl 2-hour before to a current level of 250 mg/dl (drop of 15 mg/dl/hour). We expect the level to be 220 mg/dl (above target) after 2 hours at the current rate. So, the infusion rate should be increased.
2. At an ongoing rate of 1.8 units/hr, BG decreased from 185 mg/dl 2-hour before to a current level of 170 mg/dl (drop of 7.5 mg/dl/hour) and we expect the level to be 155 mg/dl (in target) after 2 hours at the current rate. So, we can continue the same infusion rate.
3. At an ongoing rate of 1.2 units/hr, blood glucose decreased from 144 mg/dl 2-hour before to a current level of 100 mg/dl (drop of 22 mg/dl/hour), and we expect the level to be 56 mg/dl after 2 hours at the current rate. So, the infusion rate should be decreased (set by 50% to 0.6 units/hr).
4. At an ongoing rate of 1.2 units/hr, BG decreased in the middle of night from 108 mg/dl 2-hour before to a current level of 60 mg/dl. In such a scenario, infusion should be discontinued, correction should be provided (50 ml of 50% dextrose in a sedated/unconscious patient, and 15-20 grams of oral glucose solution in a conscious patient) and blood glucose checked every 15-20 minutes till 2 or more values are >100 mg/dl, when the infusion can be restarted at 0.6 units/hr with close monitoring every 30-60 minutes.

G. Target rate of BG change: initially should be between 50-100 mg/dl/hour, till it reaches the target BG levels and maintains steady state. If the rate of glucose change is above 100 mg/dl or below 50 mg/dl, consider increasing and decreasing the infusion rates, respectively.

H. Coverage for meals: Just before taking the major meal increase the infusion rate by +2-4 units/hour over and above basal rate for next 2 hours.

Example: Patient is about to have lunch at 1pm. At 1 pm patient's BG level is 202 mg/dl and according to scale infusion rate is 2 U/hr, but we increase the infusion rate to 5 U/hr (2+3 U/hr) from 1pm to 3pm. 3pm onwards, again we maintain the basal infusion rate till the next meal. Increment in rate for meal coverage is subjected to change on the next day based on pre-meal to post-meal change in BG level on the previous day

I. Monitoring of serum potassium:

If patient is NPO – 6 hourly

If patient is accepting orally – 12 hourly

*Ensure minimal discontinuation of insulin infusion. For example, if insulin infusion is discontinued for patient's bath, it has to be restarted as soon as patient comes back with interruption less than 10 to 15 minutes.

Abbreviations:

1. CBG/BG – Capillary blood glucose/ Blood glucose
 2. OAD – Oral antihyperglycemic drugs
 3. MSII – Multiple Subcutaneous Insulin Injections
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- Gliptins: Sitagliptin, Teneligliptin, Vildagliptin, Linagliptin

