



وزارة الصحة
Ministry of Health

GLYCEMIC CONTROL IN NONCRITICAL HOSPITALIZED ADULT PATIENTS PROTOCOL

Introduction

Among hospitalized adult patients, both hyperglycemia and hypoglycemia are associated with adverse outcomes, including death ⁽¹⁾. Therefore, careful management of inpatients with diabetes has direct and immediate benefits. In most instances, insulin is the preferred treatment for hyperglycemia in hospitalized Adult patients ⁽²⁾. However, the using of sliding scale approach alone for prolonged period is not recommended by the recent guidelines. **For this reason**, the General Administration of pharmaceutical Care (MOH Internal medicine clinical pharmacists' team) in collaboration with endocrinologists developed this protocol to guide the clinician during management of hospitalized non-critical diabetes adult patients.

Aim and scope:

To standardize the management of blood glucose level in hospitalized non-critical diabetic adult patients

Targeted population:

Hospitalized diabetic adult patients and adult patients with high blood glucose level. Not used for Intensive care unit patients, Diabetic ketoacidosis or Hyperosmolar Hyperglycemic State.

Targeted end users:

Physician, clinical pharmacist/pharmacist and nurses. The physician is responsible to prescribe and fill the form. Clinical pharmacist is responsible to review and continue the follow up of the form

Setup:

Hospitalized adult patients

Methodology:

The development of (Glycemic Control in Noncritical Hospitalized adult Patients) Protocol is initiated by internal medicine clinical pharmacists and endocrinologist at King Fahad Hospital - Jeddah as a response to the most clinical pharmacist interventions during 2019. The team reviewed and adopted the international guidelines, literature review ⁽¹⁻⁶⁾ and the MOH formulary to create this protocol. Then the panel of experts in the field of (internal medicine clinical pharmacists) reviewed and amended it. Finally, the guideline reviewed and by endocrinologist consultants from King Salman Hospital in Riyadh who were already implemented the same protocol since 2018 at KSH.

Conflict of interest:

This guideline developed based on valid scientific evidence, critical assessment of that evidence, and objective clinical judgment that relates the evidence to the needs of practitioners and patients. No financial relationships with pharmaceutical, medical device, and biotechnology companies.

Funding:

No fund was provided

Updating:

First version of this guideline created in 2020. The guideline will be updated annually if any changes or updates released by international/national guidelines, pharmacotherapy references or MOH formulary.



INSULIN SUBCUTANEOUS: BASAL, BOLUS & CORRECTION (SLIDING SCALE) For Adult patients who are NPO, TPN, Eating meals, Bolus or Continuous tube feedings Not used for ICU patients, DKA, Hyperosmolar state		Patient information	
Initiate protocol for adult patients with known diabetes mellitus and anyone with two or more random (e.g: 6 hours apart) blood glucose readings > 180 mg per dL. (order Hb A1C if none obtained)			
GOAL OF THERAPY:			
To minimize the need to use correction insulin doses in the form of sliding scale also to provide insulin as regularly scheduled basal and bolus insulin for more efficient control of blood glucose		To maintain Capillary Blood Glucose (CBG): 140–180 mg/dL (7.8–10.0 mmol/L)	
MONITORING			
Measure CBG: <ul style="list-style-type: none"> Eating meals patients: before meals and at bedtime. Bolus tube feedings patients: before each feeding. NPO or Continuous tube feedings patients: every 4 hours (rapid insulin), every 6 hours (regular insulin). 		In case of high morning blood sugar measure CBG at 3:00 a.m. to distinguish between Somogyi effect and the dawn phenomenon.	
MEDICATIONS ⁽⁶⁾			
Discontinue all previous antihyperglycemic agents (injection/oral). <input type="checkbox"/> yes <input type="checkbox"/> no If yes, continue to calculate insulin dose		Calculate initial Total Daily Insulin (TDI) per a day <ul style="list-style-type: none"> 0.25 units per kg: Stage chronic kidney disease not on dialysis 0.3 units per kg: underweight (BMI < 18.5), older age (≥65 years), hemodialysis. 0.4 units per kg: normal weight (BMI between 18.5 and 24.9) 0.5 units per kg: overweight (BMI 25.0 to 29.9) ≥ 0.6 units per kg: obese (BMI ≥30); glucocorticoids; insulin resistance. 	
BASAL Insulin (Longer acting):			
Order 50 % of the TDI	Should be given even if NPO*	To consider reduce dose by 25% if NPO*/poor intake/glycemia well controlled	
Insulin GLARGINE (Lantus, Toujeo)		_____ units subcutaneous at _____.	
Insulin DETEMIR		_____ units subcutaneous Q24 or Q12 hours at _____.	
BOLUS Insulin (Shorter acting):			
Order 50 % of the TDI	HOLD IF NPO*, TPN**, low oral intake.	Divided equally before each meals/bolus feed.	If continuous feed every 4 hours (rapid insulin), every 6 hours (regular insulin).
Insulin REGULAR		_____ units SC 30 minutes BEFORE each meals/bolus feed or every 6 hours if continuous feed.	
Insulin LISPRO /ASPART / GLULISINE		_____ units SC WITH each meals/bolus feed or every 4 hours if continuous feed.	
TPN** patient: regular insulin may added to the solution, starting dose of 1 unit of human regular insulin for every 10 g dextrose.			
CORRECTION/SLIDING SCALE (Shorter acting): ⁽⁴⁾			
SHOULD be ordered and given even if NPO:	Eating meals patients: before meals and at bedtime (prefer rapid acting insulin). <ul style="list-style-type: none"> Insulin REGULAR SC 30 minutes before meals. Insulin LISPRO or ASPART or GLULISINE SC with meals. 	Bolus feed patients: before each feeding.	TPN, NPO or Continuous tube feedings patients: every 4 hours (rapid acting insulin), every 6 hours (regular insulin).

CBG (mg/dL)	Pre-meal: Sensitive (BMI <25 or TDI <50 units/d) Low dose	Pre-meal: Average (BMI 25-30 or TDI 50-90 units/d) Medium dose	Pre-meal: Resistant (BMI >30 or TDI >90 units/d) High dose	Bedtime (Eating meals patient)
<70	Follow hypoglycemia protocol			
70-150	Give scheduled insulin (no need for correctional dose)			
151-200	1 units	2 units	3 units	0 units
201-250	2 units	4 units	6 units	1 unit
251-300	3 units	6 units	9 units	2 units
301-350	4 units	8 units	12 units	3 units
351-400	5 units + call	10 units + call	15 units + call	3 units + call
>400	6 units + call	12 units + call	18 units + call	3 units + call

* For NPO (Nothing by mouth) patients: consider starting of IV fluid **TPN (Total parenteral nutrition) consult endocrinologist. SC (subcutaneous)

NOTES TO PRESCRIBER

- **A well education program should be conducted to all medical staff (physicians, pharmacists and nurses) to implement this protocol**
- **All adult diabetic patient/ patients with high blood glucose level should be managed according this protocol**
- If oral medications held during hospital stay or admission, there should be a protocol for resuming those 1–2 days before discharge with discontinuing of this protocol and keep regular blood glucose level monitoring

Basal insulin (longer acting insulin that targets hyperglycemia caused by body metabolism when not eating)

- Patients previously on insulin: should receive scheduled basal insulin at all times regardless of nutritional status.
- Patients with type 1 diabetes: should have basal insulin ordered at all times to avoid developing ketosis.
- Patients with Type 2 diabetes not previously on insulin can also be started on basal insulin if they are either:
 - Poorly controlled on admission (i.e. Hb A1C above 10%) OR
 - On two or more high doses of oral agents which are being held in hospital.
- Well controlled Type 2 diabetes eating meals: consider 25% dose reduction if glucose is well controlled and dietary intake reduced.

Bolus insulin (shorter acting insulin that targets hyperglycemia caused by meals)

- Patients should receive scheduled bolus insulin if taking approximately 80% of caloric requirement.
- REGULAR insulin should be administered subcutaneous 30 minutes BEFORE each meals/bolus feed or every 6 hours if continuous feed and Insulin LISPRO or ASPART or GLULISINE should be administered subcutaneous WITH each meals/bolus feed or every 4 hours if continuous feed.
- TPN receiving patient: human regular insulin may be added to the solution, starting dose of 1 unit of human regular insulin for every 10 g dextrose.

Correction /sliding scale – selection of low, medium or high insulin dose

- The sliding scale insulin is designed to be given occasionally in addition to the scheduled bolus dose to correct for unexpected hyperglycemia; it should not be given routinely.
- Add up all insulin over 24 hours from all components of pre-admission regimen and choose the appropriate dose scale according to the 24hour insulin use. Consider starting at low dose for patients at high risk of hypoglycemia such as patients with renal dysfunction, or hypoglycemia unawareness, insulin naïve patients and the elderly.

Daily review of blood glucose results:

- Basal insulin: assess basal insulin daily and adjust as needed every 1 to 3 days by targeting the morning (pre-breakfast) glucose.
- Bolus insulin: assess nutritional insulin doses daily and adjust as needed every 1 to 3 days by targeting glucose level at next CBG.

- Correction /sliding scale insulin: If correction insulin is being given frequently, the basal and nutritional insulin doses should be reassessed.
- During initiation of the insulin regimen, the basal dose for the next day can also be increased by carefully adding 50% of correction doses used the previous day (do not include the nutritional component), and moving to high, medium, or low based on response to correction doses.

Insulin Conversion Chart:

GLARGINE Lantus (Gla-100)	Once daily NPH = Once daily GLARGINE Lantus (Gla-100) = Once daily DETEMIR
GLARGINE Toujeo(Gla-300)	NPH 20 units once daily = GLARGINE Lantus (Gla-100) 20 units once daily = DETEMIR 20 units once daily.
DETEMIR	Twice daily NPH = Twice daily DETEMIR = Once daily GLARGINE Toujeo(Gla-300) = 80% of once daily GLARGINE Lantus (Gla-100)
NPH	NPH 10 unit BID = DETEMIR 10 unit BID = GLARGINE Toujeo(Gla-300) 20 units once daily = GLARGINE Lantus (Gla-100) 16 units once daily.
	From GLARGINE Lantus (Gla-100) to GLARGINE Toujeo(Gla-300): **at the beginning start with same dose of Gla 100 but then may need a higher dose of Gla-300.
ASPART = LISPRO = GLULISINE = REGULAR	ASPART 5 units TID = LISPRO 5 units TID = GLULISINE 5 units TID = REGULAR 5 units TID
Premixed to premixed	Convert unit-per-unit.

Capillary Blood Glucose (CBG), Total Daily Insulin (TDI), Nothing by mouth (NPO), Three times a day (TID), Body mass index (BMI).

** They are not bioequivalent and are, therefore, not interchangeable without dose adjustment

Physician name:

Stamp:

References:

- 1- Clement S, Braithwaite SS, Magee MF, et al. Diabetes in Hospitals Writing Committee Management of diabetes and hyperglycemia in hospitals [published corrections appear in Diabetes Care 2004;27:856 and Diabetes Care 2004;27:1255]. Diabetes Care 2004;27:553–591
- 2- Moghissi ES, Korytkowski MT, DiNardo M, et al.; American Association of Clinical Endocrinologists; American Diabetes Association. American Association of Clinical Endocrinologists and American Diabetes Association consensus statement on inpatient glycemic control. Diabetes Care 2009;32:1119–1131
- 3- American Diabetes Association (ADA). Standards of medical care in diabetes – 2020: Volume 43 | Supplement 1
- 4- Robert J Rushakoff, MD. Inpatient Diabetes Management - Endotext - NCBI Bookshelf January 7, 2019.
- 5- PHARMACIST'S LETTER / PRESCRIBER'S LETTER October 2009 ~ Volume 25 ~ Number 251005
- 6- CHARLES KODNER, MD; et al. Glycemic Control in Hospitalized Patients Not in Intensive Care: Beyond Sliding-Scale Insulin Am Fam Physician. November 15, 2017. Volume 96, Number 10