Provincial Clinical Knowledge Topic
Basal Bolus Insulin Therapy, Adult – Inpatient
V 1.0

Revision History

Version	Date of Revision	Description of Revision	Revised By

Important Information Before You Begin

The recommendations contained in this knowledge topic have been provincially adjudicated and are based on best practice and available evidence. Clinicians applying these recommendations should, in consultation with the patient, use independent medical judgment in the context of individual clinical circumstances to direct care. This knowledge topic will be reviewed periodically and updated as best practice evidence and practice change.

The information in this topic strives to adhere to Institute for Safe Medication Practices (ISMP) safety standards and align with Quality and Safety initiatives and accreditation requirements such as the Required Organizational Practices. Some examples of these initiatives or groups are: Health Quality Council Alberta (HQCA), Choosing Wisely campaign, Safer Healthcare Now campaign etc.

Please read the following resources prior to reviewing this Clinical Knowledge Topic:

- How to BBIT: An Educational Resource for Prescribers. AHS Adult Subcutaneous Basal Bolus Insulin Therapy (BBIT)
- Basal Bolus Insulin Therapy Website (www.bbit.ca)

Decision Making

Algorithm for Diabetes Management in Hospital

Blood Glucose Targets in Hospital: **5.0-10.0 mmol/L** for most non-critically ill adults

Patient:

- Is well controlled at home **and** blood glucose targets are ***safely*** being met with current anti-hyperglycemic agents including: oral and/or non-insulin injectable and/or insulin doses

→ Continue home dosing of oral agents and/or insulin doses

→ Reassess Daily

If targets not being met, consider titrating doses of home therapies or starting BBIT

Patient meets one or more of the following criteria:

- Is poorly controlled at home
- Requires oral and/or non-insulin injectable agents to be held
- Is not achieving glycemic targets in hospital
- Has a new diagnosis of Diabetes Mellitus

→ Use Basal Bolus Insulin Therapy

→ Use **LOWER** TDD* IF one or more of the following:

Type 1 DM*, Slim Type 2 DM*
History of hypoglycemia unawareness
Reduced renal function (eGFR less than 30 mL/min)
Age greater than 70 with moderate/severe frailty
Liver failure

→ Use **HIGHER** TDD* IF one or more of the following:

Insulin resistance
Overweight Type 2 DM
Steroid treatment
Infection

→ Reassess Daily

If targets not being met, titration of insulin doses required

→ **Titration Algorithm**

If **Breakfast** BG* is:		If **Lunch** BG is:		If **Supper** BG is:		If **Bedtime** BG is:		If **Overnight** BG is:
LOW (below 5.0mmol/L)	HIGH (above 10.0mmol/L)	LOW (below 5.0mmol/L)	HIGH (above 10.0mmol/L)	LOW (below 5.0mmol/L)	HIGH (above 10.0mmol/L)	LOW (below 5.0mmol/L)	HIGH (above 10.0mmol/L)	LOW (below 5.0mmol/L)
Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Bedtime BASAL		**Breakfast** BOLUS		**Lunch** BOLUS or **Breakfast** BASAL		**Supper** BOLUS		**Bedtime** BASAL
If ALL BG are HIGH (greater than 10.0 mmol/L), Calculate TDD from last 24 hours, Increase TDD by 10-20% and Recalculate all Basal, Bolus and Correction Doses								
If **HYPER**GLYCEMIA **OR HYPO**GLYCEMIA**:** Discuss with patient and/or care provider to determine if change in activity or oral intake was the cause. If yes, monitor carefully. If otherwise unexplained, increase or decrease doses by 10-20% as per Titration Table above.								

***Legend:**
Blood Glucose (BG), Total Daily Dose (TDD), Diabetes Mellitus (DM)

Basal Bolus Insulin Therapy (BBIT) Order Set

Order Set Component

Order Set Restrictions: Exclude Pediatrics
Order Set Keywords: BBIT, Insulin – Basal Bolus Insulin Therapy
Order Set Requirements: Weight

Guidance:

- Use home dosing of oral/injectable antihyperglycemic agents and/or insulin if safe and blood glucose targets are being met.
- Basal Bolus Insulin Therapy (BBIT) should be used if the patient has a new diagnosis of diabetes that requires insulin, is poorly controlled at home, requires oral/injectable antihyperglycemic agents to be held, or is not achieving glycemic targets in hospital.
- BBIT is recommended even if therapy is expected to be temporary, peri-procedural, or for patients not previously requiring insulin. Diabetic therapy will be optimized to suit patient needs prior to discharge.
- Review glucose record daily. If targets of 5.0 -10.0 mmol/L are not achieved, consider the causes and adjust insulin doses where appropriate.
- For more details: see How to BBIT document on http://www.bbit.ca/

Refer to AHS Basal Bolus Insulin Therapy (BBIT) Order set. If NCR required, order form number 19885.

Discontinue all previous insulin and blood glucose monitoring orders

Point of Care Testing (POCT)

- ☑ Blood Glucose Monitoring – POCT 4 times per day (15 - 30 minutes before scheduled meals and at bedtime) **and** PRN for suspected hypoglycemia
- ☐ Blood Glucose Monitoring – POCT at 0200h x _____ days
- ☐ Blood Glucose Monitoring – POCT 2 hours after meal time
- ☐ Blood Glucose Monitoring – POCT Other (specify) _____

Clinical Communication

Refer to AHS Glycemic Management Policy

- ☑ Clinical Communication – If blood glucose less than 4.0 mmol/L initiate Hypoglycemia Procedure. Do Not Hold Insulin without prescriber order
- ☑ Clinical Communication – If blood glucose greater than 18.0 mmol/L initiate Hyperglycemia Procedure and call prescriber

Medications

Total Daily Dose (TDD)

Total number of all units of basal + bolus + correction insulin used in 24 hour period

Authorized Prescriber to use as guide for Basal, Bolus & Correction Calculations- TDD Calculation instruction

Calculated TDD for this order: _____

Basal Insulin

*Recommended Basal Insulin: Use Home dose **or** ½ Calculated TDD (given initially as two doses, divided equally between breakfast and bedtime; glargine may be given once daily).*

Basal Insulin Type

Choose ONE

☐ glargine (Lantus®)
☐ detemir (Levemir®)
☐ insulin NPH (HumuLIN® N)

Basal – Daily Dose

☐ insulin basal _____ unit(s) SUBCUTANEOUSLY daily at Bedtime *(preferred option)*
☐ insulin basal _____ unit(s) SUBCUTANEOUSLY daily at _____ time (*hh:mm*)

Basal – BID Dose

☐ insulin basal _____ unit(s) SUBCUTANEOUSLY with Breakfast
☐ insulin basal _____ unit(s) SUBCUTANEOUSLY at Bedtime

OR

☐ insulin basal _____ unit(s) SUBCUTANEOUSLY at _____ time (*hh:mm*)
☐ insulin basal _____ unit(s) SUBCUTANEOUSLY at _____ time (*hh:mm*)

Bolus and Correction Insulin Type

Choose ONE

Use the same insulin (rapid or short-acting) for bolus and correction

☐ lispro (HumaLOG®) SUBCUTANEOUSLY with meal
☐ aspart (Novorapid®) SUBCUTANEOUSLY with meal
☐ insulin regular (HumuLIN® R) SUBCUTANEOUSLY 30 mins before meal

Bolus Insulin

Recommended Bolus Insulin PER MEAL (1/2 Calculated TDD divided into 3 equal meal doses)

Use Home dose (consider reduction of 25-50% if reduced dietary intake) or ½ TDD divided initially into 3 equal doses

☑ Hold bolus insulin if no caloric intake, NPO or enteral or parenteral feeds stopped. Continue basal and correction insulin
☐ Patient may determine and administer own dose and report dose to nurse (Order insulin type and acceptable dose range)

Bolus Insulin – Dose Per Meal

☐ insulin bolus _____ unit(s) SUBCUTANEOUSLY with Breakfast or enteral feed at _____ time (*hh:mm*)
☐ insulin bolus _____ unit(s) SUBCUTANEOUSLY with Lunch or enteral feed at _____ time (*hh:mm*)
☐ insulin bolus _____ unit(s) SUBCUTANEOUSLY with Supper or enteral feed at _____ time (*hh:mm*)
☐ insulin bolus _____ unit(s) SUBCUTANEOUSLY with other _____ at _____ time *(hh:mm)*

Correction Insulin for Hyperglycemia

- ☑ Clinical Communication - Correction dose to be determined and administered with/before meal/enteral feed OR at scheduled mealtime if NPO. Bedtime correction not routinely recommended. Correction and bolus doses can be combined and administered as a single subcutaneous injection.
- ☑ Use Hypoglycemia Procedure if Blood Glucose less than 4.0 mmol/L

Choose ONE correction insulin (below) based on current Total Daily Dose (TDD)
Use the same insulin (rapid or short-acting) for bolus and correction

If TDD is 15-30 units

☐ insulin correction SUBCUTANEOUSLY TID with mealtime based on Blood Glucose reading

- 0 unit if Blood Glucose 4.1 – 10.0 mmol/L
- 1 unit if Blood Glucose 10.1 – 14.0 mmol/L
- 2 units if Blood Glucose 14.1 – 18.0 mmol/L

If TDD is 31-50 units

☐ insulin correction SUBCUTANEOUSLY TID with mealtime based on Blood Glucose reading

- 0 unit if Blood Glucose 4.1 – 9.0 mmol/L
- 1 unit if Blood Glucose 9.1 – 12.0 mmol/L
- 2 units if Blood Glucose 12.1 – 15.0 mmol/L
- 3 units if Blood Glucose 15.1 – 18.0 mmol/L

If TDD is 51-80 units

☐ insulin correction SUBCUTANEOUSLY TID with mealtime based on Blood Glucose reading

- 0 units if Blood Glucose 4.1 – 10.0 mmol/L
- 2 units if Blood Glucose 10.1 – 12.0 mmol/L
- 3 units if Blood Glucose 12.1 – 14.0 mmol/L
- 4 units if Blood Glucose 14.1 – 16.0 mmol/L
- 5 units if Blood Glucose 16.1 – 18.0 mmol/L

If TDD is 81 units or more

☐ insulin correction SUBCUTANEOUSLY TID with mealtime based on Blood Glucose reading

- 0 unit if Blood Glucose 4.1 – 9.0 mmol/L
- 2 units if Blood Glucose 9.1 – 11.0 mmol/L
- 4 units if Blood Glucose 11.1 – 13.0 mmol/L
- 6 units if Blood Glucose 13.1 – 15.0 mmol/L
- 8 units if Blood Glucose 15.1 – 17.0 mmol/L
- 10 units if Blood Glucose 17.1 – 18.0 mmol/L

Custom

☐ insulin correction SUBCUTANEOUSLY TID with mealtime based on Blood Glucose reading

- _____ units if Blood Glucose _____ – _____ mmol/L
- _____ units if Blood Glucose _____ – _____ mmol/L
- _____ units if Blood Glucose _____ – _____ mmol/L
- _____ units if Blood Glucose _____ – _____ mmol/L
- _____ units if Blood Glucose _____ – _____ mmol/L

Clinical Decision Support

CDS Calculator Requirements:

- Calculator to determine Total Daily Dose of insulin and then to automatically calculate insulin doses for basal, bolus, and chooses approximate correction insulin doses

Total Daily Dose (TDD)

- Calculator to determine total number of all units of basal, bolus, and correction insulin used in last 24 hour period
  - TDD (units) = basal + bolus + correction used in the last 24 hour period

- If TDD from previous day is not available, or weight based calculation required, then use calculator to determine TDD by weight. Use if patient has poor control or requires insulin (even transiently) in hospital to achieve targets of 5.0 -10.0 mmol/L

Use **LOWER TDD** IF one or more of the following: Type 1 DM, Slim Type 2 DM, History of hypoglycemia unawareness, Reduced renal function (eGFR less than 30 mL/min), Age greater than 70 with moderate/severe frailty or Liver failure	TDD = Weight (kg) x 0.3 to 0.5 units/kg/day
Use **HIGHER TDD** IF one or more of the following: Insulin resistance, Overweight Type 2 DM, Steroid treatment or Infection	TDD = Weight (kg) x 0.5 to1 units/kg/day

Basal Insulin Dose Calculator

- Calculator to determine scheduled basal insulin doses
  - Total Basal (units) = TDD x 0.5

Bolus Insulin Dose Calculator

- Calculator to determine scheduled bolus insulin doses
  - Total Bolus (units) = TDD x 0.5 divided by 3 (three equal doses with meals or enteral feeds)

Correction Insulin Dose Calculator

- Calculator to determine correction insulin doses based on patient's TDD
    - Refer to Correction Insulin for Hyperglycemia order set component for correction doses based on TDD

Other CDS Requirements:

- Diabetes report showing blood glucose results in table format, and calculates the last 24 hours of blood glucose results as a diabetes score. This alerting any dangerous blood glucose.
- Automatic generic/trade population of insulin type into dose boxes
    - Basal Insulin Types auto populates into:
        - Basal – Daily Dose
        - Basal – BID Doses boxes
    - Bolus Insulin and Correction Insulin Types auto populates into:
        - Bolus Insulin – Dose Per Meal
        - Correction Insulin for Hyperglycemia

Analytics

Baseline Analytics – Outcome Measure #1, Order Set Usage

Name of Measure	Number of times Basal Bolus Insulin Therapy (BBIT) Order Set used.
Definition	Number of times Basal Bolus Insulin Therapy (BBIT) Order Set is used. Overall, by zone, by sites, by domain (ED, Inpatient, etc.), and by units. Will be required on an ongoing basis with the ability to filter by location, time period, domain, etc.
Rationale	Intended to measure how often the order set cited in the knowledge topic is being used, in what domain, and be for different lengths of time. May indicate areas with adoption issues or gaps in topic.

Baseline Analytics – Outcome Measure #2, Compliance to Clinical Standards

Name of Measure	Compliance to clinical standards of BBIT in the order set.
Definition	The elements of the CKT for which it is important to measure compliance against in the order set are: • BBIT use (basal + bolus + correction) • Use of alternative insulin orders • Blood glucose testing • Hyperglycemic frequency • Hypoglycemic frequency
Rationale	Measure compliance to specified clinical standards within the CKT. It is very important to note that the components of the BBIT order set are complex, and may be misrepresented by simply evaluating order set usage. Did users use all components – including blood glucose testing, basal, bolus, correction (if eating) or blood glucose testing, basal and correction (if patient is NPO). Or was the order set simply used to order their own "custom" correction scale (ie. A sliding scale).

Relevant Guidelines, Procedures, Protocols, and Polices

AHS Glycemic Management Policy – Adult

- Procedure: Treatment of Hypoglycemia - Adult HCS-206-01
- Procedure: Treatment of Hyperglycemia - Adult HCS-206-02
- Resource: Glycemic Management Policy Suite FAQ

Basal Bolus Insulin Therapy Website

Diabetes Canada Clinical Practice Guidelines

Guidelines for the Safe Management of Insulin Pump Therapy in Hospital Diabetes Obesity Nutrition SCN

Additional Readings

Informal Scoping Search: Association of Hyperglycemia with Harms In- Hospital

Insulin Safety & Diabetes Management Toolkit for Health Care Professionals

References

1. Basal Bolus Insulin Therapy. Basal Bolus Insulin Therapy Website. http://www.bbit.ca/
2. Basal-Bolus Versus Sliding-Scale Insulin Therapy in the Acute Care Hospital Setting: A Review of Comparative Clinical Effectiveness and Cost-Effectiveness. Canadian Agency for Drugs and Technologies in Health. https://www.cadth.ca/basal-bolus-versus-sliding-scale-insulin-therapy-acute-care-hospital-setting-review-comparative-0 . January 12, 2017
3. Diabetes Obesity Nutrition Strategic Clinical Network. *How to BBIT. An Educational Resource for Prescribers. AHS Adult Subcutaneous Basal Bolus Insulin Therapy. The Basic, New Concepts and Practical Pearls for Basal Bolus Insulin Therapy*. http://www.bbit.ca/assets/ahs-scn-don-how-to-bbit.pdf Updated April 25, 2017.
4. Houlden R, Capes, S, Clement M, Miller D. Canadian Diabetes Association 2013 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada: In-hospital Management of Diabetes. *Can J Diabetes* 2013;37(suppl 1):S77-S81.

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