


BBIT: Basal-Bolus Insulin Treatment

Ordering and Implementing Basal Bolus Insulin Therapy in Hospital (paper based)

For those who prescribe and administer insulin

 PDF of presentation

Sept 21, 2016

Alberta Health Services

Basal Bolus Insulin Therapy (BBIT)
Adult Inpatient Order Set

1. Discontinue all previous insulin and bedside blood glucose monitoring orders

2. All adult subcutaneous insulin orders (except STAT orders) must be documented using this order set. Any change in insulin orders requires completion of a new BBIT order set. (Stroke out entire page, and initial when starting new order set)

3. Orders marked with **ID** are active by default, unless crossed out and initialed by prescriber. Boxed orders (**ID**) require prescriber check mark (**ID**) to be initiated

Blood Glucose (BG) Monitoring

4 times per day (15 - 30 minutes before meals and at bedtime), as well as PRN for suspected hypoglycemia and: 0200h x _____ days 2 hours after meals Other (specify) _____

If BG less than 4.0 mmol/L initiate Hypoglycemia Procedure

If BG greater than 18 mmol/L initiate Hyperglycemia Procedure and call MD

Total Daily Dose (TDD) See calculation instructions on reverse for Physician Signature only

Calculated TDD for the order: Physician use only for Basal. See if checked. _____

Basal Insulin

Checklist: 100% (use only to record dose only when at hospital and bedside. Always use for pre-meal dose)

Choose One Basal Insulin

Insulin (Lantus)¹ Insulin (Humalog)² Insulin (Novolog)³ Insulin (Humulin R)⁴

Units _____ Units _____ Units _____ Units _____

Time (hr:min) _____ Time (hr:min) _____ Time (hr:min) _____ Time (hr:min) _____

Basal and Correction Insulin Use the same insulin regimen as that being for Basal and correction

Choose One Basal/Correction Insulin

Insulin (Lantus)¹ Insulin (Humalog)² Insulin (Novolog)³ Insulin (Humulin R)⁴

Units _____ Units _____ Units _____ Units _____

Time (hr:min) _____ Time (hr:min) _____ Time (hr:min) _____ Time (hr:min) _____

Basal Insulin must be given (except correction of 24 BGs for insulin and/or 100% checked only on 2 repeat doses)

If BG is no orders, initiate, NPO or Insulin holds stopped continue Basal & Correction insulin. If indicated dietary holds, do NOT for reduction in basal dose

Patient may adjust own dose and report dose to nurse (Other insulin type and quantify acceptable dose range)

Units _____ Units _____ Units _____ Units _____

With Breakfast or basal at _____ With Lunch or basal at _____ With Dinner or basal at _____ With Other _____ at _____

Correction for Hypoglycemia Choose one insulin correct. See Daily Order (TDD)

ONLY Baseline Correction dose not routinely recommended

100 to 149 units 150 to 149 units 150 to 149 units or more Custom _____

| BG | Units | BG | Units | BG | Units | BG | Units |
|-------------|-------|-------------|-------|-------------|-------|---------------|-------|
| 4.0 - 5.9 | -1 | 6.0 - 6.9 | -2 | 7.0 - 7.9 | -3 | 8.0 - 8.9 | -4 |
| 9.0 - 9.9 | -5 | 10.0 - 10.9 | -6 | 11.0 - 11.9 | -7 | 12.0 - 12.9 | -8 |
| 13.0 - 13.9 | -9 | 14.0 - 14.9 | -10 | 15.0 - 15.9 | -11 | 16.0 - 16.9 | -12 |
| 17.0 - 17.9 | -13 | 18.0 - 18.9 | -14 | 19.0 - 19.9 | -15 | 20.0 - 20.9 | -16 |
| 21.0 - 21.9 | -17 | 22.0 - 22.9 | -18 | 23.0 - 23.9 | -19 | 24.0 - 24.9 | -20 |
| 25.0 - 25.9 | -21 | 26.0 - 26.9 | -22 | 27.0 - 27.9 | -23 | 28.0 - 28.9 | -24 |
| 29.0 - 29.9 | -25 | 30.0 - 30.9 | -26 | 31.0 - 31.9 | -27 | 32.0 - 32.9 | -28 |
| 33.0 - 33.9 | -29 | 34.0 - 34.9 | -30 | 35.0 - 35.9 | -31 | 36.0 - 36.9 | -32 |
| 37.0 - 37.9 | -33 | 38.0 - 38.9 | -34 | 39.0 - 39.9 | -35 | 40.0 - 40.9 | -36 |
| 41.0 - 41.9 | -37 | 42.0 - 42.9 | -38 | 43.0 - 43.9 | -39 | 44.0 - 44.9 | -40 |
| 45.0 - 45.9 | -41 | 46.0 - 46.9 | -42 | 47.0 - 47.9 | -43 | 48.0 - 48.9 | -44 |
| 49.0 - 49.9 | -45 | 50.0 - 50.9 | -46 | 51.0 - 51.9 | -47 | 52.0 - 52.9 | -48 |
| 53.0 - 53.9 | -49 | 54.0 - 54.9 | -50 | 55.0 - 55.9 | -51 | 56.0 - 56.9 | -52 |
| 57.0 - 57.9 | -53 | 58.0 - 58.9 | -54 | 59.0 - 59.9 | -55 | 60.0 - 60.9 | -56 |
| 61.0 - 61.9 | -57 | 62.0 - 62.9 | -58 | 63.0 - 63.9 | -59 | 64.0 - 64.9 | -60 |
| 65.0 - 65.9 | -61 | 66.0 - 66.9 | -62 | 67.0 - 67.9 | -63 | 68.0 - 68.9 | -64 |
| 69.0 - 69.9 | -65 | 70.0 - 70.9 | -66 | 71.0 - 71.9 | -67 | 72.0 - 72.9 | -68 |
| 73.0 - 73.9 | -69 | 74.0 - 74.9 | -70 | 75.0 - 75.9 | -71 | 76.0 - 76.9 | -72 |
| 77.0 - 77.9 | -73 | 78.0 - 78.9 | -74 | 79.0 - 79.9 | -75 | 80.0 - 80.9 | -76 |
| 81.0 - 81.9 | -77 | 82.0 - 82.9 | -78 | 83.0 - 83.9 | -79 | 84.0 - 84.9 | -80 |
| 85.0 - 85.9 | -81 | 86.0 - 86.9 | -82 | 87.0 - 87.9 | -83 | 88.0 - 88.9 | -84 |
| 89.0 - 89.9 | -85 | 90.0 - 90.9 | -86 | 91.0 - 91.9 | -87 | 92.0 - 92.9 | -88 |
| 93.0 - 93.9 | -89 | 94.0 - 94.9 | -90 | 95.0 - 95.9 | -91 | 96.0 - 96.9 | -92 |
| 97.0 - 97.9 | -93 | 98.0 - 98.9 | -94 | 99.0 - 99.9 | -95 | 100.0 - 100.9 | -96 |

Physician Name and Signature _____ Date (day-month-yr) _____ Time (hr:min) _____

Initials: _____ White _____ Green _____ Pharmacy _____

Basal, Bolus Insulin Treatment (BBIT)

Previous presentations:

- BBIT - rationale
- Key messages for in hospital management of diabetes, including targets 5-10 mmol/L

This presentation:

- Ordering BBIT in paper based order set (*using AHS form #19885*)
- Administering insulin per BBIT orders

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Ordering Basal Bolus Insulin

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Adult Inpatient Order Set

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3. Orders marked with **ID** are active by default, unless crossed out and initialed by prescriber. Boxed orders (**ID**) require prescriber check mark (**ID**) to be initiated

Blood Glucose (BG) Monitoring

Ordering Insulin: Example Patient

- 100kg pt, type 2 diabetes on insulin but can't recall doses... Instead of a sliding scale, order BBIT:

1. Long Acting Basal Insulin
 - glargine, detemir or Humulin N
2. Fixed Meal Bolus Insulin
 - aspart, lispro or Humulin R
3. Correction Scale Insulin
 - aspart, lispro or Humulin R

Blood Glucose Monitoring

Blood Glucose (BG) Monitoring

4 times per day (15 - 30 minutes before meals and at bedtime), as well as PRN for suspected hypoglycemia and: 0200h x _____ days 2 hours after meals Other (specify) _____

If BG less than 4.0 mmol/L initiate Hypoglycemia Procedure

If BG greater than 18 mmol/L initiate Hyperglycemia Procedure and call MD

Calculating Total Daily Dose (TDD)

Total Daily Dose (TDD) See calculation instructions on reverse for Physician Guidance only

Calculated TDD for this order (Physician to use as guide for Basal, Bolus & Correction Calculations)

Total Daily Dose (TDD): total number of all units of basal + bolus + correction insulin used in 24 hour period

How to calculate TDD:

- If currently on BBIT in hospital and requires titration: **TDD = all insulin doses within past 24 hour period**
- If on Basal and Bolus insulin at home (with good control): **TDD = all insulin doses in a usual 24 hour period**
- If new start in hospital:

| | | |
|--------------------|---|---|
| Use LOWER TDD if: | Type 1 DM, aim Type 2 DM, history of hypoglycemia unawareness, reduced renal function (eGFR < 30 mL/min), liver failure, age >70, moderate/severe frailty | TDD=Weight (kg) x 0.3 to 0.5 Units/kg/day |
| Use HIGHER TDD if: | Insulin resistance, overweight Type 2 DM, steroid treatment, infection | TDD=Weight (kg) x 0.5 to 1 Units/kg/day |

Ordering Correction Insulin

Bolus and Correction Insulin Use the same insulin (rapid or short acting) for bolus and correction

Choose One Bolus/Correction Insulin

- lispro (Humalog®) sc with meal
- aspart (Novorapid®) sc with meal
- Humulin® R sc 30 min ac meal

Bolus Insulin Home dose (consider reduction of 25-50% for hospital diet), or 1/2 TDD divided initially into 3 equal doses

Hold if no caloric intake, NPO or bolus feeds stopped (continue Basal & Correction insulin). If reduced dietary intake, call MD for reduction in bolus dose.

Patient may adjust own dose and report dose to nurse (Order insulin type and specify acceptable dose range)

Units: With Breakfast or feed at time (hh:mm) With Lunch or feed at time (hh:mm) With Dinner or feed at time (hh:mm) With Other at time (hh:mm)

Correction for hyperglycemia: Choose one based on current Total Daily Dose (TDD)

Correction dose of insulin and Bolus dose to be combined and administered as a single sc injection with meal or feed ONLY. Bedtime Correction dose not routinely recommended.

| | | | | |
|-----------------|-----------------|-----------------|----------------------|----------|
| TDD 15-30 units | TDD 31-50 units | TDD 51-80 units | TDD 81 units or more | Comments |
| 80 Units | 80 Units | 80 Units | 80 Units | |
| 4 1:30 +0 | 4 1:30 +0 | 4 1:30 +0 | 4 1:30 +0 | |
| 10 1:14 +1 | 8 1:12 +1 | 10 1:12 +2 | 8 1:11 +2 | |
| 14 1:10 +2 | 12 1:08 +2 | 12 1:04 +3 | 11 1:03 +4 | |
| | 15 1:14 +3 | 14 1:10 +4 | 13 1:05 +5 | |
| | 18 1:10 +5 | 15 1:17 +6 | 17 1:10 +10 | |

Correction Insulin: additional rapid/short insulin administered to correct blood glucose if above target

- Selection based on TDD
- Is combined with the scheduled bolus insulin dose and administered as a single subcutaneous injection
- Use of bedtime Correction dose is not routinely recommended. MD may use discretion for STAT bedtime insulin dose if blood glucose over 18mmol/L.

Ordering Basal Insulin

Basal Insulin

Home dose or 1/2 TDD (given initially as equal, twice daily doses at breakfast and bedtime; Glargine may be given once daily)

Choose One Basal Insulin

- glargine (Lantus®)
- detemir (Levemir®)
- Humulin® N

Units: With Breakfast or Time (hh:mm) At Bedtime or Time (hh:mm)

Basal Insulin: intermediate/long-acting insulin required to cover rising blood glucose between meals and overnight


How to calculate Basal Insulin

- If patient is well controlled on insulin at home, use pre-admission basal insulin doses and timing; otherwise:
- Total Basal = TDD x 0.5** (glargine (Lantus®) dosed once daily OR detemir (Levemir®) or Humulin® N dosed twice daily at breakfast and bedtime)
- At optimal doses, basal insulin should never cause hypoglycemia, even if the patient is not eating.
- All patients with Type 1 Diabetes require basal insulin, even when not eating, in order to prevent rapid development of diabetic ketoacidosis (DKA)
- No basal required if patient well controlled without basal at home and meeting hospital targets OR if receiving continuous enteral feeds and achieving targets on QID timed bolus plus correction insulin alone

Enteral Tube Feeds

carefully, if otherwise unexplained, adjust doses as per titration table above.

Enteral Tube Feeds / Parenteral Nutrition: Insulin requirements will vary depending on rate and carbohydrate content. For more details, see Educational Resource document on BBIT.ca website



11. Orders for Patients Requiring Insulin - on Parenteral Nutrition (PN)

- Consider consulting a dietician to determine the rate and carbohydrate content of the PN, as insulin requirements will vary depending on these two important parameters.
- There are several options for providing insulin while patient is receiving parenteral nutrition, with no single option being superior. Physicians need to be aware of the method of administration before completing orders, as IV insulin and insulin added to PN bag cannot be ordered using the AHS Basal Bolus Insulin Therapy (BBIT) Adult Inpatient Order Set (form 15855). Consider consulting Pharmacy for clarification and guidance with insulin dosing if required.

Ordering Bolus Insulin

Bolus and Correction Insulin Use the same insulin (rapid or short acting) for bolus and correction.

Choose One Bolus/Correction Insulin

- lispro (Humalog®) sc with meal
- aspart (Novorapid®) sc with meal
- Humulin® R sc 30 min ac meal

Bolus Insulin Home dose (consider reduction of 25-50% for hospital diet), or 1/2 TDD divided initially into 3 equal doses

Hold if no caloric intake, NPO or bolus feeds stopped (continue Basal & Correction insulin). If reduced dietary intake, call MD for reduction in bolus dose.

Patient may adjust own dose and report dose to nurse (Order insulin type and specify acceptable dose range)

Units: With Breakfast or feed at time (hh:mm) With Lunch or feed at time (hh:mm) With Dinner or feed at time (hh:mm) With Other at time (hh:mm)

Bolus Insulin: rapid/short insulin, required to cover rising blood glucose after meals caused by carbohydrate intake

How to calculate Bolus Insulin

- If patient is well controlled on insulin at home, use pre-admission bolus insulin doses. Consider reducing bolus doses by 25-50% if hospital diet less than home diet; otherwise:
- Total Bolus = TDD x 0.5 / 3** (3 equal doses with meals)
- Bolus insulin may be provided as lispro (Humalog®), aspart (Novorapid®), or Humulin® R.
- Blood glucose testing and bolus insulin administration are timed with feeding

Summary Example Patient

- 100kg pt, type 2 diabetes on insulin but can't recall doses

- Calculate TDD: $0.5 \times 100 \text{ kg} = 50$
- Basal Insulin: $TDD/2 \rightarrow 50/2 \rightarrow \text{TOTAL Basal } 25$
25 units glargine qhs, OR 12-13 units N /detemir with breakfast and hs
- Bolus Insulin: $TDD/2 \rightarrow \text{TOTAL Bolus } 25 \rightarrow 25/3 \text{ meals} \rightarrow 8$
8 units aspart/lispro with meals, or 8 units R 30 minutes ac meals
If patient NPO – NO FIXED BOLUS
- Correction Scale Insulin: Check off appropriate scale based on TDD

Slide 7

2 in text: basal, bolus and correction doses that follow
Julie McKeen, 10/18/2015

Titration

- Review blood glucose daily!!!
- Adjust insulin doses every 1-2 days as necessary to achieve target of 5-10 mmol/L!!

Titration: for most patients, the recommended target is a blood glucose range of 5-10mmol/L.

| If Breakfast BG is: | | If Lunch BG is: | | If Supper BG is: | | If Bedtime BG is: | | If Overnight BG is: | |
|---------------------|---------------------|-------------------|---------------------|--------------------------------|---------------------|-------------------|---------------------|---------------------|---------------------|
| LOW (<5mmol/L) | HIGH (>10mmol/L) | LOW (<5mmol/L) | HIGH (>10mmol/L) | LOW (<5mmol/L) | HIGH (>10mmol/L) | LOW (<5mmol/L) | HIGH (>10mmol/L) | LOW (<5mmol/L) | HIGH (>10mmol/L) |
| Decrease | Increase | Decrease | Increase | Decrease | Increase | Decrease | Increase | Decrease | Increase |
| Bedtime BASAL | | Breakfast BOLUS | | Lunch BOLUS or Breakfast BASAL | | Supper BOLUS | | Bedtime BASAL | |

If ALL BG are HIGH (>10mmol/L), Calculate TDD from last 24 hours, increase TDD by 10-20%, and Recalculate all Basal, Bolus and Correction Doses

* If HYPOGLYCEMIA → Discuss with patient to determine if change in activity or intake was the cause. If yes, monitor carefully, if otherwise unexplained, adjust doses as per Titration Table above.

Example

- Example from above patient: ac dinner BG 3.9 mmol/L
 - Active insulin orders:
 - Detemir 12 units with breakfast and 13 qhs
 - Aspart 8 units ac meals
 - TDD 49 – so TDD 31-50 units correction scale is active
- What to do?
 - Treat hypoglycemia with 15 g carbohydrate, retest, if BG now normal, feed him dinner and give 8 units aspart
 - Treat hypoglycemia with 15 g carbohydrate, retest, if BG now normal, feed him dinner, HOLD aspart
 - Treat hypoglycemia with 15g carbohydrate, contact MD
 - Feed him dinner

Interpreting the Order set: For those who administer insulin

- The order set, will be providing:
 - Blood glucose monitoring qid
 - ac meals and hs at MINIMUM
 - Basal, Bolus and Correction doses for patients who are EATING
 - Basal and Correction doses for patients who are NPO

When to Notify Physician

- Immediately if:
 - Chemstrip under 2.5 mmol/L or hypoglycemia requiring assistance
 - Severe hyperglycemia (CBG >18 mmol/L)
 - Type 1 diabetic patient with CBG >14 mmol/L and positive ketones
- Within 24 hours if:
 - Mild hypoglycemia (any BG between 2.5- 4.0 mmol/L, not requiring assistance).
 - If reduced dietary intake, for consideration of reduced bolus doses.

Example

- Example from above patient: Fasting BG 12.6 mmol/L
 - Active insulin orders:
 - Detemir 12 units with breakfast and 13 qhs
 - Aspart 8 units ac meals
 - TDD 49 – so TDD 31-50 units correction scale is active
- Patient is about to eat breakfast

Correction for hyperglycemia: Choose one based on current Total Daily Dose (TDD)

Correction dose if required and bolus dose to be combined and administered as a single sc injection with meal or feed ONLY. Bedtime Correction dose not routinely recommended.

| TDD 15-30 units | | TDD 31-50 units | | TDD 51-80 units | | TDD 81 units or more | | Custom | |
|-----------------|-------|-----------------|-------|-----------------|-------|----------------------|-------|--------|-------|
| BG | Units | BG | Units | BG | Units | BG | Units | BG | Units |
| 4.1-10 | +0 | 4.1-9 | +0 | 4.1-10 | +0 | 4.1-9 | +0 | | |
| 10.1-14 | +1 | 9.1-12 | +1 | 10.1-12 | +2 | 9.1-11 | +2 | | |
| 14.1-18 | +2 | 12.1-15 | +2 | 12.1-14 | +3 | 11.1-13 | +4 | | |
| | | 15.1-18 | +3 | 14.1-16 | +4 | 13.1-15 | +6 | | |
| | | | | 16.1-18 | +5 | 15.1-17 | +8 | | |
| | | | | | | 17.1-18 | +10 | | |

Hypoglycemia Protocol:

- If patient exhibiting signs and symptoms of hypoglycemia:
 - Check blood glucose level immediately.
 - If blood glucose is less than 4 mmol/L, administer 15 g of a fast acting carbohydrate source (ONE of the following):
 - Four Dex-4 glucose tablets (if patient able to chew)
 - ½ cup (125 mL) of juice or regular pop
- Wait 15 minutes and retest CBG.
 - If blood glucose has increased above 4 mmol/L, provide a snack, if the next meal is more than 1 hour away.
 - If BG has not increased above 4 mmol/L, retreat using an additional 15 g of fast acting carbohydrate and repeat.
- Contact MD within 24 hours to notify of mild hypoglycemia

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- What to do?
 - A) Treat hypoglycemia with 15 g carbohydrate, retest, if BG now normal, feed him dinner and give 8 units aspart
 - B) Treat hypoglycemia with 15 g carbohydrate, retest, if BG now normal, feed him dinner, HOLD aspart
 - C) Treat hypoglycemia with 15g carbohydrate, contact MD
 - D) Feed him dinner
- Contact MD within 24 hours to notify of mild hypoglycemia

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Hyperglycemia

- Hyperglycemia is harmful and should not be ignored!
 - If BG is over 18 mmol/L, as per the hyperglycemia protocol, the physician should be notified immediately.
 - Ordering provider decides whether STAT order for additional correction or basal insulin should be provided to the patient
 - Correction scale ONLY APPLIES BEFORE MEALS, and should NOT routinely be provided at bedtime
 - If patient has type 1 diabetes, and blood glucose is over 14mmol/L, check urine for ketones, and if positive, contact ordering provider immediately

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Holding Insulin

- Our goal is to MAINTAIN a normal blood glucose, which will mean administering insulin even when a patient is meeting the CDA target of 5-10 mmol/L, particularly if the patient is about to eat a meal.
- Holding insulin ALWAYS requires an ORDER from the most responsible MD.

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Patient Safety

1. Most important aspect is communication!!
2. Type 1 diabetic patients ALWAYS need some insulin to prevent diabetic ketoacidosis
3. If patient NPO, they should NOT get their meal BOLUS (short acting) insulin. Patient will still receive their scheduled basal insulin and correction insulin if needed.
4. Designed to under-shoot for first few days to prevent hypoglycemia → requires aggressive titration
5. Chemstrips MUST be done qid (ac meals, qhs)
6. BBIT tool to aid, not replace, clinical judgment

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Example

- Example from above patient: hs BG 24.9mmol/L
 - Active insulin orders:
 - Detemir 12 units with breakfast and 13 qhs
 - Aspart 8 units ac meals
 - TDD 49 – so TDD 31-50 units correction scale is active
- What to do?


Correction for hyperglycemia: Choose one based on current Total Daily Dose (TDD)

Correction dose (if required) and BOLUS dose to be combined and administered as a single sc injection with meal or feed ONLY. Bedtime Correction dose not routinely recommended.

| TDD 15-30 units | | TDD 31-50 units | | TDD 51-80 units | | TDD 81 units or more | | Custom | |
|-----------------|-------|-----------------|-------|-----------------|-------|----------------------|-------|--------|-------|
| BG | Units | BG | Units | BG | Units | BG | Units | BG | Units |
| 4.1-10 | +0 | 4.1-9 | +0 | 4.1-10 | +0 | 4.1-9 | +0 | | |
| 10.1-14 | +1 | 9.1-12 | +1 | 10.1-12 | +2 | 9.1-11 | +2 | | |
| 14.1-18 | +2 | 12.1-15 | +2 | 12.1-14 | +3 | 11.1-13 | +4 | | |
| | | 15.1-18 | +3 | 4.1-16 | +4 | 13.1-15 | +6 | | |
| | | | | 16.1-18 | +5 | 15.1-17 | +8 | | |
| | | | | | | 17.1-18 | +10 | | |

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Questions??



www.bbit.ca

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