Explanation of Evidence Ratings

Inclusion Criteria
- Patients with diabetes mellitus type 1 or 2 requiring a surgical procedure
- Treated in PACU to be discharged home

Exclusion Criteria
- Admitted to hospital (use other page)
- DKA (use DKA Pathway)

Orders
- Anesthesiologist has ordered PACU insulin and diabetes management using Anesthesia Diabetes (Insulin) Perioperative Plan
- Advance diet as tolerated per home dietary restrictions (if requested for extended stay, order carb-counted meal)
- Consult endocrinologist for complex transition plans

Routine Monitoring
- Check BG upon arrival to PACU then every 30 minutes until child wakes from anesthesia, then hourly until discharge to home

HYPOglycemia Safety
- For glucose < 80 mg/dL, call provider and follow Diabetes: (Non-DKA) Hypoglycemia Management

HYPERglycemia Safety
- For glucose > 500 mg/dL x 1 or > 250 mg/dL x 2
  - Notify anesthesia provider
  - Check BOHB
  - If BOHB ≥0.6 mmol/L, consult endocrine

Glossary
BG: blood glucose
Basal insulin: long acting subcutaneous insulin given 1-2 times a day to provide a steady dose of insulin throughout the day
Bolus insulin: rapid-acting subcutaneous insulin used to treat blood glucose above target or to cover carbohydrates in food
BOHB: beta hydroxybutyrate, used to measure ketones

Discharge Criteria
- Patient is ready to resume home insulin
- Patient is able to tolerate oral intake

Insulin Pump
Patients arriving in PACU on insulin pump, or restarted:
- Patient/family verifies that insulin pump is infusing
- Until caregiver is managing insulin pump, order one time subcutaneous insulin dose.
- If BG >250 mg/dL and it has been at least 3 hours since last rapid-acting dose, correct with rapid-acting insulin
- Instruct patient/caregiver when to resume home routine insulin (change target insulin back to usual home setting)

Discharge Instructions
- Confirm with caregiver that insulin pump settings are accurate per home regimen
- Pamphlet Surgery and Diabetes (PE1855) (For SCH users only)
- Pamphlet Sick Day Management (PE288) (For SCH users only)
- Advance diet as tolerated per home dietary restrictions
- Call the diabetes nurses’ line at (206) 987-5452 or managing endocrine provider to review blood glucose within 48 hours after discharge.
- Call the endocrinologist on call at (206) 987-2000 or managing endocrine provider for urgent questions about blood glucose.

Glossary, Cont
Continuous IV insulin infusion: an insulin drip made by hospital pharmacy and administered via a hospital pump
Home insulin pump: provides a continuous subcutaneous infusion of insulin and bolus doses of insulin as programmed. Competent caregiver required for perioperative management.

PACU Phase 1 and 2
HYPOglycemia Safety
- For glucose < 80 mg/dL, call provider and follow Diabetes: (Non-DKA) Hypoglycemia Management

HYPERglycemia Safety
- For glucose > 500 mg/dL x 1 or > 250 mg/dL x 2
  - Notify anesthesia provider
  - Check BOHB
  - If BOHB ≥0.6 mmol/L, consult endocrine

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- Confirm with caregiver that insulin pump settings are accurate per home regimen
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- Call the endocrinologist on call at (206) 987-2000 or managing endocrine provider for urgent questions about blood glucose.
Anesthesia/PACU Perioperative Diabetes (Non-DKA): Discharge to Inpatient v5.1

**Inclusion Criteria**
- Patients with diabetes mellitus type 1 or 2 requiring a surgical procedure
- Treated in PACU to be admitted to hospital

**Exclusion Criteria**
- Discharged to home (use other page)
- DKA (use DKA Pathway)

**PACU Phase 1**

**HYPOglycemia Safety**
- For glucose < 80 mg/dL, call provider and follow Diabetes: (Non-DKA) Hypoglycemia Management

**HYPERglycemia Safety**
- For glucose > 500 mg/dL x 1 or > 250 mg/dL x 2
  - Notify anesthesia provider
  - Check BOHB
  - If BOHB ≥0.6 mmol/L, consult endocrine

---

**Orders**
- Anesthesiologist has ordered PACU insulin and diabetes management using Anesthesia Diabetes (Insulin) Perioperative Plan

**Routine Monitoring**
- Check BG upon arrival to PACU, then every 30 minutes until child wakes from anesthesia, then hourly for 4 hours after

---

**Continuous IV insulin infusion running?**

**YES**

**On Continuous IV Insulin Infusion**
1. Continue IV insulin infusion and admit to ICU - OR -
2. Convert to basal-bolus insulin injections
   - Anesthesiologist adjusts insulin infusion/glucose to maintain target BG 150 mg/dL
   - Inpatient provider orders basal-bolus insulin; stop continuous insulin infusion in PACU
   - Check BG within 30 minutes of stopping insulin infusion - OR -
3. For patient on home pump, may convert to home insulin pump
   - Competent caregiver required to be present at bedside
   - Anesthesiologist adjusts insulin infusion/glucose to maintain target BG 150 mg/dL
   - Inpatient provider ordering insulin enters insulin pump orders in the presence of caregiver and nurse if available
   - After recovery from anesthesia AND after orders are entered, patient/family restarts insulin pump, stop continuous insulin infusion in PACU
   - Check BG within 30 minutes of stopping insulin infusion

**NO**

**Home insulin regimen?**

**CONTINUE**

**Continue Basal-Bolus Insulin**
- In PACU
  - Order one time insulin dose based on home regimen. Use Humalog if home insulin type is not known.
  - If BG >250 mg/dL and it has been at least 3 hours since last rapid-acting dose, correct with rapid-acting insulin

**Orders for Admission**
- Inpatient provider entering insulin enters insulin pump orders in the presence of caregiver and nurse if available

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**Pump**

**Continue Home Insulin Pump**
- Caregiver verifies that insulin pump is infusing
- Until caregiver is managing insulin pump, correct with subcutaneous rapid-acting insulin if it has been at least 3 hours since last rapid-acting dose.

**Orders for Admission**
- Inpatient provider ordering insulin enters insulin pump orders in the presence of caregiver and nurse if available

---

**Glossary**
BG: blood glucose
Basal insulin: long acting subcutaneous insulin given 1-2 times a day to provide a steady dose of insulin throughout the day
Bolus insulin: rapid-acting subcutaneous insulin used to treat blood glucose above target or to cover carbohydrates in food
BOHB: beta hydroxybutyrate, used to measure ketones

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**Summary of Version Changes**

**Exclusion Criteria**
- Discharged to home (use other page)
- DKA (use DKA Pathway)

---

**Approval & Citation**

**Explanation of Evidence Ratings**

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Inclusion Criteria
- Glucose LESS THAN 80 mg/dL
- Patient receiving subcutaneous insulin (by pump or injection) or insulin in parenteral nutrition

Exclusion Criteria
- Patient on IV continuous insulin infusions (including diabetic ketoacidosis (DKA))
- Patient on IV continuous insulin infusions (including diabetic ketoacidosis (DKA))

Signs of hypoglycemia: pallor, sweating, shaking, irritability, confusion, or seizures

Blood glucose less than 80 mg/dL identified

Patient safe to have simple carbohydrates administered orally or by feeding tube?

Loss of consciousness or seizure with glucose < 60 mg/dL?

NO

YES

Treat hypoglycemia (oral)
Hold meal tray
Give simple carbohydrates
Age ≤ 5 years: 10 g (2.7 oz = 81 mL fruit juice)
Age > 5 years: 15 g (4 oz fruit juice)
Check glucose 15 minutes post intervention
If more than one hour until next meal give 10-15 carb snack without insulin coverage

Treat hypoglycemia (IV, IM)
IV access
Administer D10W bolus
Check glucose 15 minutes post intervention
Blood glucose 80 mg/dL or greater
Resume routine monitoring per physician order
Cover carbohydrates in meal. Do not correct glucose value after hypoglycemia treatment.

No IV access
Administer IM glucagon (may give up to 2 doses per episode)
Check glucose 15 minutes post intervention
Glucose < 80 mg/dL, consider placing IV
Blood glucose 80 mg/dL or greater

Contact provider for plan. Provider decides to treat?

YES

NO

! Call a CODE BLUE
Notify

Next Expected Revision: May 2018

Blood glucose 80 mg/dL or greater

Return to Home
## Postoperative Inpatient Provider Ordering Insulin

<table>
<thead>
<tr>
<th>Patient is going to:</th>
<th>Who writes insulin orders</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surgical Service</strong></td>
<td></td>
</tr>
<tr>
<td>- Neurosurgery</td>
<td>Consulting endocrinologist writes insulin orders</td>
</tr>
<tr>
<td>- Oromaxofacial</td>
<td>APP Surgical Hospitalists (7-7709) in consultation with on-call endocrinologist</td>
</tr>
<tr>
<td>- Orthopedics</td>
<td>Medical Service writes insulin orders</td>
</tr>
<tr>
<td>- Otolaryngology</td>
<td>Medical Service</td>
</tr>
<tr>
<td>- Plastics</td>
<td></td>
</tr>
<tr>
<td>- Transplant</td>
<td></td>
</tr>
<tr>
<td>- Urology</td>
<td></td>
</tr>
<tr>
<td><strong>General Surgery</strong></td>
<td>Consulting endocrinologist writes insulin orders</td>
</tr>
<tr>
<td><strong>Cardiac Surgery</strong></td>
<td>Consulting endocrinologist writes insulin orders</td>
</tr>
<tr>
<td><strong>Medical Service</strong></td>
<td>Consulting endocrinologist writes insulin orders</td>
</tr>
</tbody>
</table>

Weekdays (M-F 7am-5pm) | Nights/Weekends
Anesthesia/PACU Perioperative Diabetes (Non-DKA) Pathway Citation

Approved by the CSW Diabetes Non DKA Perioperative Management Team (Post-Op/NPO) on March 2015

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Executive Approval:

Sr. VP, Chief Medical Officer Mark Del Beccaro, MD
Sr. VP, Chief Nursing Officer Susan Heath, MN, RN, CNAA


Summary of Version Changes

- **Version 1 (5/21/2013):** Go live
- **Version 1.1 (8/20/2013):** Sick Day Management added
- **Version 1.2 (8/22/2013):** ED wording changes, clarified sick day lab orders
- **Version 2.0 (2/10/2014):** Sick Day Management: added a yellow alert triangle to for a remind to initiate
- **Version 3.0 (7/30/2014):** Established Diagnosis: added guidance and recommendations for unreliable oral intake (Post-op, NPO) or vomiting
- **Version 3.1 (10/9/2014):** Established Diagnosis: added basal insulin to Unreliable Oral Intake or NPO for clarity
- **Version 4.0 (3/30/2015):** Perioperative Management added
- **Version 4.1 (10/25/2016):** Added warning triangle to hypoglycemia page
- **Version 5 (1/6/2017):** Rapid-acting insulin to be given at 0300 (removed instructions to give only if glucose >300mg/dL)
- **Version 5.1 (4/13/2018):** Added postoperative inpatient provider ordering insulin
Medical Disclaimer

Medicine is an ever-changing science. As new research and clinical experience broaden our knowledge, changes in treatment and drug therapy are required.

The authors have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication.

However, in view of the possibility of human error or changes in medical sciences, neither the authors nor Seattle Children’s Healthcare System nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for the results obtained from the use of such information.

Readers should confirm the information contained herein with other sources and are encouraged to consult with their health care provider before making any health care decision.
Literature Search
Studies were identified by searching electronic databases using search strategies developed and executed by a medical librarian, Susan Klawansky. Searches were performed in December 2012 in the following databases – on the Ovid platform: Medline and Cochrane Database of Systematic Reviews; elsewhere: Embase, Clinical Evidence, National Guideline Clearinghouse and TRIP. Retrieval was limited to 2007 (date of then-current ISPAD guideline) to date, humans, and English language. In Medline and Embase, appropriate Medical Subject Headings (MeSH) and Emtree headings were used respectively, along with text words, and the search strategy was adapted for other databases as appropriate. Concepts searched were type 1 diabetes mellitus and ketones, ketone bodies, keto acids, hyperglycemia, hospitalization, inpatients. All retrieval was further limited to certain publication types representing high order evidence. Additional articles have been identified by project team members and added to the retrieval.

Susan Klawansky, MLS, AHIP
May 16, 2013

Identification

Flow diagram adapted from Moher D et al. BMJ 2009;339:bmj.b2535
This pathway was developed primarily based on:


This supporting literature was also cited:


