Liver Transplant INPATIENT Hyperglycemia Protocol
For use in the immediate post-transplant inpatient setting (1 page summary included on Pg.5)

- **All patients placed on regular insulin drip immediately post-OLT**
  - Use EPIC order set: GEN IP INSULIN INFUSION PROTOCOL
  - Discontinue any prior insulin and/or oral hypoglycemic agents

- **Transition off insulin drip**
  - SICU team will manage glucose during ICU phase of care. The following guidelines have not been adopted by the SICU physicians, but may be a basis for discussion if glucose management strategies differ.
    - When to transition:
      - If taking PO, or
      - Preparing for transfer to floor, or
      - Low daily insulin drip requirement (< 20 units/day)
      - In SICU greater than 72 hours with stable blood sugars
      - Prescriber discretion
    - How to initiate:
      - All insulin orders should be placed in EPIC within the order set called: BASAL, BOLUS, CORRECTION (BBC) INSULIN ORDERS
      - Extrapolate 24-hour insulin requirement from most recent 8 hours of infusion
      - If extrapolated 24-hour requirement:
        - <20 units: Order Correction insulin only
          - Select type of insulin and frequency of administration based on patients diet
            - NPO, continuous tube feeds: Regular insulin q6h
            - Eating: Humalog ACHS
            - Switch orders whenever diet is transitioned
          - Strength: LOW DOSE CORRECTION
        - ≥20 units: Order Basal (NPH) + Correction insulins
          - BASAL Insulin Orders
            - How to initiate:
              - Type of basal insulin is NPH
              - Amount of NPH to order
                - Total daily bolus dose = 40% of actual 24-hour insulin requirement
              - Administer in divided doses, AM dose > PM dose due to effect of steroids—e.g., 2/3 in the morning
(at breakfast or 0900), 1/3 in the evening (at dinner or 2100)

- **How to adjust:**
  - Assess blood sugars daily and adjust insulin regimen as necessary to achieve goal FSBG of 100-180 before meals and at bedtime
    - For blood sugars at goal:
      - Continue current regimen
    - For blood sugars > goal:
      - Assess amount of correction insulin used each day
      - If >5 units of correction, add approximately 40% of 24-hour correction requirement to NPH doses.
        - Adjust morning dose based on afternoon/evening FSBG readings
        - Adjust evening dose based on bedtime/morning readings.
    - For blood sugars < goal:
      - Decrease AM and/or PM NPH dose, as appropriate:
        - If AM sugars are low, decrease the evening dose
        - If PM sugars are low, decrease the morning dose
  - Consider discontinuing basal when requiring < 10 units/day
  - May transition basal insulin to glargine if patient used glargine or detemir prior to transplant
  - May add bolus with meals if patient is insulin-experienced and has significant post-prandial hyperglycemia
  - **CORRECTION Insulin Orders**
    - Select type of insulin and frequency of administration based on patient’s diet
      - NPO, continuous tube feeds: Regular insulin q6h
      - Eating: Humalog ACHS
      - Switch orders whenever diet is transitioned

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- Choose strength of correction scale based on actual 24-hour insulin requirements
  - < 40 units/day: LOW DOSE CORRECTION
  - 40-80 units/day: MEDIUM DOSE CORRECTION
  - > 80 units/day: HIGH DOSE CORRECTION

- BOLUS Insulin Orders
  - Not to be used routinely in insulin-naïve patients
  - For insulin-experienced patients, may begin to add bolus insulin (lispro) when patient has significant oral intake

- Discharge
  - All OLT recipients will receive diabetes education from the diabetes educators prior to discharge
    - Consult for diabetes educator should be ordered several days prior to expected discharge
      - Place consult order in EPIC: INPATIENT CONSULT TO DIABETES EDUCATOR
  - The diabetes educators and transplant coordinators will educate all patients
    - On the proper use of their glucometer, administration of insulin and their individual insulin regimen
    - How to check and record fingerstick blood glucose ac&hs
    - How to maintain a daily log which includes fingerstick results
    - To bring the daily log with them to all transplant clinic visits so the transplant team can assess
  - Discharge insulin regimen will be determined on day of discharge based on the prior 24-48 hours and will be individualized for each patient.
    - **Patients consistently (previous 24-48 hours) requiring Basal (NPH/glargine) + Correction insulin:**
      - Discharge on a Basal + Correction regimen
        - Basal (NPH):
          - Amount: re-evaluate dose prior to discharge and adjust as necessary to achieve goal FSBG of 100-180 before meals and at bedtime (refer to previous section for details)
          - Frequency of administration: with breakfast and at bedtime
            - Adjust morning NPH dose based on afternoon/evening FSBG readings.
            - Adjust evening NPH dose based on bedtime/morning FSBG readings.
        - Basal (glargine or detemir):
- Amount: re-evaluate dose prior to discharge and adjust as necessary to achieve goal AM glucose of 100-180
- Consider adding mealtime bolus if AM glucose at goal but hyperglycemic at other times of day
  - Correction:
    - Type: Humalog (Novolog substituted if insurance prefers)
    - Choose strength of correction based on actual 24-48 hour insulin requirements
      - < 40 units/day: LOW DOSE CORRECTION
      - 40-80 units/day: MEDIUM DOSE CORRECTION
      - > 80 units/day: HIGH DOSE CORRECTION

Patients consistently (previous 24-48 hours) requiring Correction insulin only:
- Assess amount of correction patient is requiring to determine discharge regimen
  - If requiring < 5 units/day of correction
    - Discharge on No insulin
    - Patient still requires education from diabetes educator
    - Patients should still check and record FSBG ac&hs
    - Patients should call if FSBG above 150 x 3 consecutive readings or any reading above 250
  - If requiring > 5 units/day of correction at any time over previous 24 – 48 hours
    - Discharge with LOW DOSE CORRECTION Humalog insulin. (Novolog substitution if insurance prefers.)

Patients consistently requiring no insulin while on regular diet, no history of DM:
- May consider discharging without FBSG checks (glucose on labs only)

<table>
<thead>
<tr>
<th>Correction insulin protocols:</th>
<th>100-149</th>
<th>150-199</th>
<th>200-249</th>
<th>250-299</th>
<th>300-349</th>
<th>&gt;350</th>
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<tbody>
<tr>
<td><strong>Low dose</strong></td>
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<tr>
<td>Before meals</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Bedtime</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td><strong>Medium dose</strong></td>
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<tr>
<td>Before meals</td>
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<tr>
<td>Bedtime</td>
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<td>2</td>
<td>3</td>
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<td>7</td>
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<tr>
<td><strong>High dose</strong></td>
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## LIVER TRANSPLANT INPATIENT HYPERGLYCEMIA PROTOCOL SUMMARY (See full protocol)

<table>
<thead>
<tr>
<th>OLT Patient Population</th>
<th>Criteria</th>
<th>Insulin Protocol</th>
<th>Protocol Details</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate post OLT</td>
<td>All patients</td>
<td>Insulin Drip</td>
<td>Regular</td>
<td>Continuous drip</td>
</tr>
</tbody>
</table>

### Transition to subcut insulin per SICU team when (one of):

1. Taking PO
2. Transfer to the floor
3. Low insulin drip req. (<20 units/day)
4. Long SICU stay with stable blood sugars
5. Prescriber discretion

<table>
<thead>
<tr>
<th>Criteria</th>
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<th>Protocol Details</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20 units</td>
<td>Correction</td>
<td>Select based on intake 1) NPO/continuous TF = Regular insulin q 6 hrs 2) PO = Humalog ACHS</td>
<td>LOW DOSE correction</td>
</tr>
<tr>
<td>&gt;20 units</td>
<td>Basal + Correction</td>
<td>Basal Protocol - NPH insulin BID preferred (AM dose&gt;PM dose, e.g., 2:1) - may transition to home basal where applicable - may add bolus for insulin-experienced pts Correction Protocol Select based on intake 1) NPO, continuous tube feeds = Regular insulin q 6 hrs 2) PO = Humalog ACHS</td>
<td>Basal Protocol Total daily bolus dose = 40% of actual 24-hour insulin requirement Correction Protocol Based on actual 24h insulin requirements: LOW = &lt;40 units/day MEDIUM = 40-80 units/day HIGH = &gt;80 units/day</td>
</tr>
</tbody>
</table>

### At Discharge

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Insulin Protocol</th>
<th>Protocol Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge insulin determined on day of discharge based on prior 24-48 hours</td>
<td>Basal + Correction</td>
<td>As above</td>
</tr>
<tr>
<td>Correction Only</td>
<td>Basal + Correction</td>
<td>As above</td>
</tr>
<tr>
<td>FSBG &gt; 200</td>
<td>Humalog (may substitute with Novolog if insurance prefers)</td>
<td>LOW DOSE correction</td>
</tr>
<tr>
<td>No FSBG &gt; 200</td>
<td>No INSULIN. Check FSBG ac&amp;hs. Call if above 150 x 3 consecutive readings or any reading above 250.</td>
<td>Per Endocrine NP, outpatient team discretion</td>
</tr>
</tbody>
</table>

Note: Use the following EPIC order sets: GEN IP INSULIN INFUSION PROTOCOL (insulin drip), BASAL, BOLUS, CORRECTION (BBC) for all other insulin protocols