Basal-Bolus Insulin Therapy: Pattern Analysis Handout

Multiple Daily Injection (MDI) Therapy Overview

Purpose: Reduce hyperglycemia while avoiding hypoglycemia to prevent diabetes complications

Key Points:

- A1C is the gold standard for monitoring glycemic control
- A1C explains less than 25% of variation in complication risk
- A1C doesn't provide information about day-to-day glucose changes
- SMBG is a key adjunct to A1C monitoring

Benefits of Self-Monitoring Blood Glucose (SMBG)

SMBG provides critical information that A1C cannot:

- Distinguishes among fasting, preprandial, and postprandial hyperglycemia
- Detects glycemic excursions
- Identifies and monitors resolution of hypoglycemia
- Provides feedback about effects of food, activity, and insulin on glucose control

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Pattern Analysis: 4-Step Process

Step 1: Establish Glucose Targets

Set individualized targets based on patient characteristics:

Healthy Adults (good function, low treatment risks):

- A1C: <7.0-7.5%
- Fasting/preprandial glucose: 80-130 mg/dL
- Bedtime glucose: 80-180 mg/dL

Complex/Intermediate Health:

- A1C: <8.0%
- Fasting/preprandial glucose: 90-150 mg/dL
- Bedtime glucose: 100-180 mg/dL

Very Complex/Poor Health:

- Avoid reliance on A1C
- Focus on avoiding hypoglycemia and symptomatic hyperglycemia
- Fasting/preprandial glucose: 100-180 mg/dL
- Bedtime glucose: 110-200 mg/dL

Step 2: Obtain Comprehensive Data

Collect information on:

1. **Glucose levels** - Multiple daily readings
2. **Carbohydrate intake** - Timing and amounts
3. **Insulin administration** - Type, dosage, timing
4. **Activity levels** - Physical activity patterns
5. **Physical/emotional stress** - Factors affecting glucose

Step 3: Analyze Patterns

Look for:

- **BG lows** - Frequency, timing, potential causes
- **BG excursions** - Patterns of highs and lows
- **Aggravating/precipitating factors** - What influences glucose swings
- **BG ranges** - Variability throughout the day

Step 4: Implement Changes and Monitor

- Make appropriate insulin adjustments
- Perform ongoing SMBG to assess impact
- Fine-tune based on results

Patient Requirements for Successful Pattern Analysis

Patients must be able to:

- **Perform SMBG** accurately and consistently
- **Understand and record** food intake, physical activity, insulin use, and other factors that influence BG
- **Record stress factors** and psychological influences on BG
- **Interpret BG results** and identify acute/chronic glycemic control issues
- **Accept importance** of relying on SMBG readings rather than subjective feelings

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Common Morning BG Patterns

Somogyi Effect

- Hypoglycemia during sleep (around 2-3 AM)
- Rebound hyperglycemia in morning
- Pattern: BG drops low overnight, then spikes high

Dawn Phenomenon

- Natural rise in BG in early morning hours (4-8 AM)
- Due to hormonal changes (growth hormone, cortisol)
- Gradual, steady increase without preceding low

Bedtime Snack Effect

- Elevated morning BG due to uncovered carbohydrate intake
- Most common cause of morning BG fluctuations
- Address with portion control or snack coverage

Insulin Adjustment Principles

Basal-Bolus Balance

- **Target ratio**: Approximately 50% basal, 50% bolus

- **Adjustment rule**: Modify only basal OR bolus at one visit, not both
- **Overbasalization warning**: Watch for basal insulin >60% of total daily dose

Basal Insulin Adjustments

- **If fasting BG consistently high**: Increase basal insulin
- **If fasting BG consistently low**: Decrease basal insulin
- **Compare bedtime to morning BG**: Look for overnight trends

Bolus Insulin Adjustments

- **Pre-meal high BG**: Increase corresponding meal bolus
- **Post-meal high BG**: May need bolus increase or timing adjustment
- **Between-meal low BG**: May need to reduce previous meal bolus

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Correction Factor Integration

Calculate Correction Factor: 1800 ÷ Total Daily Dose (TDD)

Example: If TDD = 72 units

- Correction factor = 1800 ÷ 72 = 25
- Each unit of insulin lowers BG by ~25 mg/dL

Correction Scale Example (CF 1:25):

- BG 150-175 mg/dL = 1 unit correction
- BG 176-200 mg/dL = 2 units correction
- BG 201-225 mg/dL = 3 units correction
- BG >300 mg/dL = Call provider

Case Study Applications

When to Increase Basal Insulin

- Fasting BG consistently above target
- BG rises overnight from bedtime to morning

- Good meal coverage but elevated baseline

When to Increase Bolus Insulin

- Pre-meal BG at target but next meal BG elevated
- Consistent pattern of post-meal hyperglycemia
- A1C above target despite good fasting control

When to Add Correction Insulin

- Occasional BG excursions above target
- Need for fine-tuning between scheduled doses
- Pattern shows need for personalized adjustments

Red Flags: Overbasalization

Definition: Titrating basal insulin beyond appropriate dose to achieve glycemic targets

How to Identify:

- Basal insulin dose >0.5 units/kg/day
- Postmeal blood glucose >180 mg/dL despite target fasting glucose
- A1C not at goal despite target fasting BG achieved
- Large difference (≥50 mg/dL) between morning and pre-lunch BG

Follow-up Recommendations

Patient Education Priorities

1. **SMBG technique** and consistent monitoring
2. **Food diary** maintenance for pattern recognition
3. **CDCES referral** for comprehensive diabetes education
4. **Barrier identification** for self-management challenges

Provider Follow-up

1. **2-week check-in** after insulin adjustments

2. **Review BG logs** for pattern confirmation
3. **Fine-tune doses** based on real-world data
4. **Reassess targets** based on patient response

Key Takeaways

- **Pattern analysis addresses root causes** of glycemic issues, not just individual high readings
- **SMBG data is essential** for making informed insulin adjustments
- **Individualized targets** based on patient health status and risk factors
- **Systematic approach** prevents over-treatment and reduces hypoglycemia risk
- **Patient engagement** and education are critical for success
- **Regular monitoring and adjustment** optimize long-term outcomes

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This handout is based on the ECHO Session 2 presentation on Basal-Bolus Insulin Therapy by Kelley Newlin, DNSc, RN, APN, FAAN, presented September 10, 2025, in collaboration with the Weitzman Institute and UConn School of Nursing.