Transitioning diabetic therapy beyond the hospital doors

Sady Castane, PharmD
West Kendall Baptist Hospital
PGY-1 Pharmacy Resident

Disclosure
The author of this presentation has nothing to disclose concerning possible financial or personal relationships with commercial entities that may have direct or indirect interest in the subject matter of this presentation.

Objectives
- Review cost effective treatment options for diabetes and their place in therapy
- Discuss clinical and financial considerations when transitioning a patient's hospital diabetes treatment to home
- Review diabetic discharge education points for an effective transition from the hospital to home
Diabetes treatment challenges

- Diabetes mellitus (DM) is a chronic disease requiring continuous medical care
- Transition of care from hospital to community may involve complicated changes in regimen
- Limited guidance on transitions of care in diabetic patients is available

Diabetes Epidemiology

- Ranked 7th leading cause of death in 2010
- In 2012, 9.3% of Americans were affected
  - 21 million diagnosed
  - 8.1 million undiagnosed (estimated)
- About 1.7 million are newly diagnosed every year

Economic Burden

- Direct medical cost: $176 billion
  - Increased emergency department visits and hospitalizations due to DM
- Indirect cost: $69 billion
- Medical expenses in diabetes are 2.3 times higher than non-DM patients
Complications

- Hyperglycemic crisis
- Heart attack
- Stroke
- Kidney disease
- Vascular disease
  - Amputations
  - Vision complications (including vision loss)
  - Neuropathy
- Hypoglycemia

Hospital Treatment Plan

- Begin discharge planning at time of hospital admission
- Provide appropriate glycemic control
- Modify treatment throughout hospitalization
- Tailor discharge treatment regimen according to patient specific factors:
  - A1c value upon admission
  - Level of skilled care provided at home
  - Patient ability and preference

Management for DM

- Multidisciplinary approach
  - Monitoring
  - Therapy assessment and modification
  - Preventive care for complications
- Comprehensive self-management education
  - Therapeutic lifestyle changes
  - Blood glucose monitoring
  - Hypoglycemia prevention and management
Glycemic Control

<table>
<thead>
<tr>
<th>A1c &lt; 7.5%</th>
<th>A1c ≥ 7.5%</th>
<th>A1c &gt; 9%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monotherapy</td>
<td>Dual / Triple Therapy</td>
<td>Symptoms</td>
</tr>
<tr>
<td>Metformin</td>
<td>Metformin or other 1st line agents</td>
<td>No</td>
</tr>
<tr>
<td>GLP-1 RA</td>
<td>GLP-1 RA</td>
<td>Yes</td>
</tr>
<tr>
<td>SGLT-2i</td>
<td>SGLT-2i</td>
<td>Dual Therapy or Triple Therapy</td>
</tr>
<tr>
<td>DPP-4i</td>
<td>DPP-4i</td>
<td></td>
</tr>
<tr>
<td>AGi</td>
<td>T2D</td>
<td></td>
</tr>
<tr>
<td>Thiazolidinedione</td>
<td>Basal insulin</td>
<td></td>
</tr>
<tr>
<td>SU/GLN</td>
<td>Colesevelam</td>
<td></td>
</tr>
<tr>
<td>No insulin required</td>
<td>Bromocaprine QR</td>
<td></td>
</tr>
<tr>
<td>AGi</td>
<td>SU/GLN</td>
<td></td>
</tr>
</tbody>
</table>

*Refer to appendix for abbreviations.

Oral Pharmacotherapy

<table>
<thead>
<tr>
<th>Class</th>
<th>Clinical Considerations</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biguanides</td>
<td>A1c reduction: 1% - 1.5%</td>
<td>Low</td>
</tr>
<tr>
<td>- Metformin</td>
<td>- Risk hypoglycemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Weight loss</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Gastrointestinal side effect</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Caution in renal impairment</td>
<td></td>
</tr>
<tr>
<td>Sulfonylureas (SU)</td>
<td>A1c reduction: 1% - 1.5%</td>
<td>Low</td>
</tr>
<tr>
<td>- Glyburide</td>
<td>- Hypoglycemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Weight gain</td>
<td></td>
</tr>
<tr>
<td>- Glipizide</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>- Glimepiride</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Thiazolidinedione (TZDs)</td>
<td>A1c reduction: 1% - 1.5%</td>
<td>Low</td>
</tr>
<tr>
<td>- Pioglitazone</td>
<td>- Risk hypoglycemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Weight gain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Edema/Heart failure</td>
<td></td>
</tr>
<tr>
<td>- Rosiglitazone</td>
<td>-</td>
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</tbody>
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</thead>
<tbody>
<tr>
<td>Meglitinides (GLN)</td>
<td>A1c reduction: 0.5% - 1%</td>
<td>Moderate</td>
</tr>
<tr>
<td>- Repaglinide</td>
<td>- Hypoglycemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Frequent dosing</td>
<td></td>
</tr>
<tr>
<td>- Nateglinide</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>α-glucosidase inhibitors (AGI)</td>
<td>A1c reduction: 0.5% - 1%</td>
<td>Moderate</td>
</tr>
<tr>
<td>- Acarbose</td>
<td>- No hypoglycemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Frequent dosing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Miglitol</td>
<td></td>
</tr>
<tr>
<td>Bile acid sequestrant</td>
<td>A1c reduction: 0.5% - 1%</td>
<td>High</td>
</tr>
<tr>
<td>- Colesevelam</td>
<td>- No hypoglycemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Triglycerides</td>
<td></td>
</tr>
<tr>
<td>Dopamine-2 agonist</td>
<td>A1c reduction: 0.5% - 1%</td>
<td>High</td>
</tr>
<tr>
<td>- Bromocaprine QR</td>
<td>- No hypoglycemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Gastrointestinal side effects</td>
<td></td>
</tr>
</tbody>
</table>
Oral Pharmacotherapy

<table>
<thead>
<tr>
<th>Class</th>
<th>Clinical Considerations</th>
<th>Cost</th>
</tr>
</thead>
</table>
| Dipeptidyl peptidase 4 inhibitor (DPP-4 inhibitors) | • Sitagliptin  
• Saxagliptin  
• Linagliptin  
• Alogliptin  
  - A1c reduction:0.5% - 1%  
  - No hypoglycemia  
  - May cause severe joint pain  
  - ↑ risk of pancreatitis | High  |
| Sodium-glucose co-transporter 2 inhibitor (SGLT2 inhibitors) | • Canagliflozin  
• Dapagliflozin  
• Empagliflozin  
  - A1c reduction: 0.5% - 1%  
  - No hypoglycemia  
  - Risk of ketoacidosis and serious urinary tract infections  
  - Volume depletion, hypotension, dizziness | High  |

Injectable Non-insulin Pharmacotherapy

<table>
<thead>
<tr>
<th>Class</th>
<th>Clinical Considerations</th>
<th>Cost</th>
</tr>
</thead>
</table>
| Glucagon like peptide 1 receptor agonist (GLP-1 RA) | • Exenatide  
• Liraglutide  
• Albiglutide  
• Dulaglutide  
  - A1c reduction:1% - 1.5%  
  - No hypoglycemia  
  - Gastrintestinal side effects  
  - Injectable | High  |
| Amylin mimetics                            | • Pramlintide  
  - A1c reduction:0.5% - 1%  
  - Hypoglycemia (insulin dose should be reduced)  
  - Frequent dosing  
  - Injectable | High  |

Indications for Insulin in Type 2 DM

- Severe hyperglycemia
- Inadequate glucose control with oral or injectable non-insulin agent combinations
- Advanced hepatic or renal disease
- Contraindications to oral agents (pregnancy)
- Hospitalized patients with hyperglycemia
Insulin Dosing

<table>
<thead>
<tr>
<th>Basal</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C &lt; 8%</td>
<td>GLP-1 RA TDD: 0.2-0.3 unit/kg</td>
</tr>
<tr>
<td>0.1-0.2 unit/kg</td>
<td>TDD: 0.3-0.5 unit/kg</td>
</tr>
<tr>
<td>0.2-0.3 unit/kg</td>
<td>SGLT-2i 50% Basal</td>
</tr>
<tr>
<td>Titrated regimen every 2-3 days</td>
<td>DPP-4i 50% Prandial</td>
</tr>
<tr>
<td>Fixed: ↑ TDD by 2 units</td>
<td>Consider d/c or reducing SU after insulin started</td>
</tr>
<tr>
<td>Adjustable: FBG 140-180 mg/dL: ↑ 10-20% TDD</td>
<td>FBG 110-139 mg/dL: add 1 unit</td>
</tr>
<tr>
<td>FBG &lt;70 mg/dL: ↓ 10-20% TDD</td>
<td>BG&lt;70 mg/dL: ↓ 10-20% TDD after insulin started</td>
</tr>
<tr>
<td>BG&lt;40 mg/dL: ↓ 20-40% TDD</td>
<td>TDD = total daily dose</td>
</tr>
</tbody>
</table>

Insulin Prandial Therapy

### Class
- **Inhaled insulin**
  - Insulin human
    - Onset: Peak: 8-12 min
    - Duration: 180 min
- **Rapid acting analogs**
  - Lispro
    - Onset: Peak: 10-30 min
    - Duration: 3-6.5 h
  - Aspart
    - Onset: Peak: 10-30 min
    - Duration: 3-6.5 h
  - Glulisine
    - Onset: Peak: 10-30 min
    - Duration: 3-6.5 h
- **Short acting analogs**
  - Human regular
    - Onset: Peak: 1-5 h
    - Duration: 6-10 h

### Pharmacokinetics
- 5-15 min before meals or immediately after meals
- 30 min before meals

### Administration
- At the beginning of a meal

Insulin Basal Therapy

### Class
- **Intermediate-acting**
  - Human NPH
    - Onset: Peak: 1-2 h
    - Duration: 16-24 h
- **Basal insulin analogs**
  - Glargine
    - Onset: Peak: 1-3 h
    - Duration: 24 h
  - Detemir
    - Onset: Peak: None
    - Duration: 24 h
  - Degludec

### Pharmacokinetics
- Single dose: 30-60 min before breakfast (dinnertime if oral agent used)
- BID dosing: 30-60 min before breakfast and before dinner or bedtime
- Once daily: dinner or bedtime
- q12h or at breakfast and dinner or bedtime

### Administration
- Any time once a day
Insulin Basal/Prandial Therapy

<table>
<thead>
<tr>
<th>Class</th>
<th>Pharmacokinetics</th>
<th>Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed</td>
<td>• Onset: 10-60 min</td>
<td>• 15 min before breakfast and evening meal (30-60 min for NPH/human regular)</td>
</tr>
<tr>
<td></td>
<td>• Peak: 1-6.5 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Duration: up to 24 h</td>
<td></td>
</tr>
<tr>
<td>Lispro protamine/inspro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lispro 75/25, 50/50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspart protamine/aspart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70/30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH/human regular 70/30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Affordable Insulin

- ReliOn® - insulin manufactured for Walmart
  - ReliOn® Human Insulin R
  - ReliOn® Human Insulin N
  - ReliOn® Human Insulin 70/30
- Price: $24.88/vial
- Additional ReliOn® supplies include:
  - Insulin syringes
  - Pen needles
- Available without prescription

Insulin Conversion

- Basal insulin to NPH: 1 unit=1 unit
  - NPH once daily: AM or PM if combined with oral agent
  - NPH twice daily: ½ and ½ or 2/3 in the morning and 1/3 before dinner or at bedtime
- Rapid acting to short acting: 1 unit=1 unit
- Premixed protamine/rapid-acting analog (75/25, 70/30) to premixed NPH/regular insulin: 1 unit=1 unit
Insulin glargine (Basaglar)

- First “follow-on” insulin glargine approved by the FDA through an abbreviated pathway
- Manufactured by Eli-Lilly (will be available as KwikPen)
- Estimated availability in the U.S. is December 15, 2016
- Projected to be cheaper alternative to available insulin glargine
- Already available in Europe as Abasaglar

Discharge Medication Reconciliation

- Reassess home medication regimen and changes during hospitalization
- Consider insurance coverage and co-pays (agents & dosage forms)
- Review discharge prescriptions for clinical appropriateness

Discharge Education

- Review new or changed medications with patients and involve the family or caregivers
- Assess barriers to treatment adherence
- Inform patient of causes and symptoms of hyperglycemia and hypoglycemia
- Educate about DM related complications and co-morbidities
Patient Education
Assessment
- Implications of uncontrolled management of DM
- Appropriate injection technique if applicable
- Self-monitoring of blood glucose
- Blood glucose goals
- Recognition and treatment of hypo/hyperglycemia

Discharge Follow-up
- Clear communication with outpatient provider(s), including the patients’ pharmacist
- Outpatient follow up visit within 1 month is recommended for all patients that had a hyperglycemic event during hospitalization

Supplies/Prescriptions
- Oral medications
- Insulin and sliding scale instructions
- Syringes or pen needles
- Blood glucose meter and strips
- Lancets and lancing devices
- Oral glucose tablets, gels, or alternatives
- Glucagon emergency kit
- Urine ketone strips
Financial Assistance Resources

- Discount Prescription Programs
- Bureau of Primary Health Care
  - http://findahealthcenter.hrsa.gov
- State Children’s Health Insurance Program (SCHIP)
  - http://www.insurekidsnow.gov
- Partnership for Prescription Assistance
  - https://www.pparx.org/prescription_assistance_programs/diabetes_programs_supplies

Patient Case

38 y/o, female, wt:113 kg, ht:66 in, BMI: 40
CC: Hyperglycemia/UTI
HPI: Patient presents with burning sensation and discomfort on urination. She has been urinating more than usual, and drinking a lot of water. She hasn’t used insulin in the last 5 months because she felt she did not need it.
PMH: DM(dx ~4 years ago), Hypertension, Obesity
Medication: Insulin detemir 5 units HS, Lisinopril 20 mg QD, Metformin 500 mg TID, Simvastatin 10 mg HS
Labs on admission: Glucose random: 378 mg/dL, A1c: 12%, Scr:1.7 mg/dL

Patient Case

What is the best course of action regarding the diabetic regimen at discharge?
1. Leave home regimen as it is, her BG increased due to the infection
2. Discontinue Metformin, continue insulin detemir 5 units HS, and add Linagliptin 5mg QD
3. Discontinue Metformin, increase insulin detemir to 17 unit HS, add insulin aspart 6 units AC
T/F Question
The cost implication of self blood glucose monitoring is an integral factor to consider in the therapy transition

True

T/F Question
All patients must remain on basal/bolus insulin therapy after they leave the hospital.

False

T/F Question
Patient education is critical in ensuring a safe and effective transition to a home diabetic regimen

True
References

- "Drugs for Type 2 Diabetes." Pharmacist’s Letter/Prescriber’s Letter (2015).

Abbreviation Appendix

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>A1c</td>
<td>Glycated hemoglobin</td>
</tr>
<tr>
<td>AGI</td>
<td>Alpha glucosidase inhibitor</td>
</tr>
<tr>
<td>BG</td>
<td>Blood glucose</td>
</tr>
<tr>
<td>Bromocriptine QR</td>
<td>Bromocriptine quick release</td>
</tr>
<tr>
<td>DPP-4i</td>
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<td>FBG</td>
<td>Fasting blood glucose</td>
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