52-year-old man with secondary diabetes mellitus

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History of Present Illness

- 52-year-old man
- History of alcohol abuse and chronic pancreatitis
- December 2007 underwent total pancreatectomy and islet cell transplantation at UIC for chronic pancreatitis, islet transplant failed
- Diabetes mellitus secondary to pancreatectomy

Past Medical History

- Chronic pancreatitis s/p pancreatectomy
- Malabsorption/Main nutrition
- Endocarditis
- Gastroparesis
- Bilateral peripheral neuropathy
- Chronic abdominal pain
- Chronic narcotic use

History

- Family History
  - No family history of diabetes mellitus or pancreatitis

- Social History
  - Previous alcohol abuse
  - Tobacco: 1 ppd for the last 30 years
  - Divorced with 4 children
  - One of his children lives with him
  - On disability

Diabetes Management

- Started on Animus pump in 2008 at UIC
- Referred to J of C Endocrine Clinic by gastroenterology in 2009
- Described weight loss (150 – 118 pounds since surgery), poor appetite and malabsorption since surgery
- Basal rate of 0.45 units Novolog/hour
- Multiple episodes of hypoglycemia when attempting to use insulin to carbohydrate ratio with meals
  - Correcting elevated blood sugar two hours after meals with a correction ratio of 1 unit of Novolog for every 90 mg/dL of blood glucose results in hyperglycemia but fewer episodes of hypoglycemia
  - Hemoglobin A1c of 8.4%

Recent Hospitalizations

- December 2011 admitted for initiation of TPN (Weight – 110 pounds, Height 5’11”)
  - 10% of calories by mouth
  - Tube feeds with Peptamen 1.5 at 75 mL/hr from 8pm – 8am (J-tube placed 1/2011)
  - Basal rate of 0.55 units Novolog/hour when he is off tube feeds
  - Basal rate of 0.70 units Novolog/hour when tube feeds are on
Hospital Course
- Per GI Note, over the past 3 weeks the patient reports
  - feeling weaker
  - lower leg swelling
  - feeling cold all the time
  - constant abdominal pain
- Plan restart TPN

Hospital Course
- Pt did not bring pump
- Started on Lantus as basal insulin and then NPH q8h for continuous tube feeds
- Initially blood sugars well-controlled
- Patient found to have E. faecalis bacteremia, mitral valve vegetations with severe regurgitation

Readmitted 12 days later
- Presented for follow-up cardiology appointment with son
- Patient noted to be disoriented
- Insulin pump and PICC line were no longer in place since the day prior to admission
- Noted to be confused

Laboratory Studies

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Hgb</td>
<td>121 g/L</td>
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<tr>
<td>WBC</td>
<td>7,800/μL</td>
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<tr>
<td>Platelets</td>
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<tr>
<td>A1c</td>
<td>8.9%</td>
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<tr>
<td>Creatinine</td>
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<tr>
<td>Sodium</td>
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<td>Potassium</td>
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<tr>
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<tr>
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<tr>
<td>HDL</td>
<td>10.1 mg/dL</td>
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<tr>
<td>LDL</td>
<td>160 mg/dL</td>
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</table>

- Beta-hydroxybutyrate = 6.57 mmol/L
- Hgb A1c = 8.9%
- Calculated Anion Gap = 34
- Lactic acid = 1.1 mEq/L
- Alcohol < 25 mg/dL

Human islet of Langerhans
Increased peripheral exogenous insulin sensitivity

- 14 patients with diabetes secondary to chronic pancreatitis or pancreas atrophy
- 10 patients with type 1 diabetes
- 25 normal controls

Patients with pancreas-atrophic diabetes had higher 128-hour insulin sensitivity compared to patients with type 1 diabetes with same degree of hyperinsulinemia and normal subjects.

The increase in insulin sensitivity is likely due to an increase in insulin sensitivity.

These data, in the absence of any sign of major remitting and relapsing disease, suggest that the increase in insulin sensitivity, which is not accompanied by an increase in the C-peptide levels, is likely due to an increase in insulin sensitivity.

Further research will be needed to understand the mechanisms involved.

Patients with pancreas-atrophic diabetes had enhanced tissue sensitivity to exogenous insulin measured with the glucose clamp compared with patients with type 1 diabetes.

Decreased frequency of DKA

- Case Series Study of all patients who underwent total pancreatectomy at Mayo Clinic from 01/01/1985 - 12/31/2006
  - 141 cases
  - In 2007, 59 patients were presumed alive, 47 responded to the survey
    - Mean insulin requirement was 0.5 units/kg/day
    - 76% (37/47) experienced episodic hypoglycemia
    - 41% (19/47) experienced severe hypoglycemia
    - 4% (2/47) developed DKA

Glucagon Deficiency

- Decrease in glucagon when fasting promotes a hypoglycemic state with only a slight excess of exogenous insulin.

Glucagon decreases activity of acetyl-coenzyme A carboxylase and promotes ketone body formation.

Factors for ketone body formation:
- Sufficient substrate in the form of free fatty acids
- Shift in hepatic handling of free fatty acids from triglyceride synthesis (i.e., esterification) to oxidation
**Return to Patient**

- Discharged to Skilled Nursing Facility to complete intravenous antibiotics
- Continued on basal/bolus insulin regimen
- Follow-up appointment scheduled for this month

**Take Home Points**

- Diabetes Mellitus secondary to pancreatectomy
  - Insulin sensitive at the periphery
  - Greater risk for hypoglycemia
  - May be less likely to develop DKA but still at risk

**References**


**References**