**Pheochromocytoma Induced Hyperglycemia Leading to Misdiagnosis of Type 1 Diabetes Mellitus**


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**Introduction**

There are few documented cases describing the effects of metyrosine treatment and surgical adrenalectomy on glucose levels with patients requiring insulin therapy preoperatively.

**Case Presentation**

A 31 y/o male with past medical history of type 1 diabetes mellitus presented with symptoms of episodic headache, blurry vision, palpitations, diaphoresis, and chest pain. His blood pressure was 220/120 mmHg on admission.

Fractionated 24 hour urine collection showed extremely elevated catecholamines and metanephrines (Table 1). MRI of abdomen/pelvis revealed bilateral adrenal masses (left 6.5x6.0x5.7cm, right 8.3x8.4x7.8cm, Figure 1) consistent with pheochromocytoma. Other significant findings included hypercalcemia (11mg/dL), elevated intact PTH (122pg/mL), and a nodular thyroid. Fine needle aspiration showed medullary thyroid cancer, and positive RET proto-oncogene confirmed the diagnoses of MEN 2A syndrome.

The patient gave a history of type 1 diabetes mellitus diagnosed 3 years prior to admission. His insulin regimen was glargine 45 units daily and aspart 15 units with meals, GAD-65 autoantibody was negative, Hemoglobin A1c was 6.7%.

In preparation for bilateral adrenalectomy, he was started on alpha blockade with phenoxybenzamine and metyrosine 250mg QID which was uptitrated to 750mg QID over 11 days. After metyrosine initiation, his blood glucose levels improved necessitating significant reductions in exogenous insulin dose. The day prior to adrenalectomy, glargine dose was 20 units daily and aspart was 5-10 units with meals.

After bilateral adrenalectomy, glucose levels were observed hourly with the lowest reading of 58mg/dL, occurring 3 hours postoperatively. There were no further episodes of hypoglycemia. Despite being maintained on steroid replacement therapy, he remained euglycemic and did not require any further insulin treatment.

**References**


**Urine Catecholamines and Metanephrines (mcg/24hr)**

<table>
<thead>
<tr>
<th>Catecholamines</th>
<th>Preoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dopamine</td>
<td>52-480</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>2-24</td>
</tr>
<tr>
<td>Norepinephrine</td>
<td>15-100</td>
</tr>
<tr>
<td>Metanephrine</td>
<td>45-290</td>
</tr>
<tr>
<td>Normetanephrine</td>
<td>82-500</td>
</tr>
</tbody>
</table>

**Table 1. Preoperative 24 hour fractionated urine catecholamine levels in mcg/24hr**

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**Discussion**

Catecholamines suppress insulin secretion, attenuate peripheral glucose utilization and increase glucagon production and gluconeogenesis. Catecholamine excess as a secondary cause of hyperglycemia should be considered in patients with pheochromocytoma.

Metyrosine is an inhibitor of tyrosine hydroxylase, the enzyme required for catecholamine synthesis.1 It is useful for pre-operative preparation in patients to reduce high catecholamine burden, and may help to lower the risk of peri-operative complications.2 Two days after metyrosine was started, glucose control improved and a 50% reduction in the insulin dose was required during the preoperative period (Figure 2). There was a 15% decline in average glucose readings, and improvements in postprandial glucose excursions.

Phenoxybenzamine, which has been shown to release insulin by α-adrenergic receptor antagonism,2 was initiated 12 days prior to the metyrosine, but no significant effect on average glucose values or insulin dosing was noted during that time. The question of a misdiagnosis of type 1 diabetes was suspected after noting the improvement in glucose control with metyrosine and the negative type 1 antibody testing. Postoperatively, plasma metanephrines were low (metanephrine 10pg/mL normetanephrine 50pg/mL), and the patient remained euglycemic and off insulin 3 months after surgery.

Pheochromocytoma resection can result in post-operative hypoglycemia, due to rebound hyperinsulinemia as the β-cells are released from the inhibition by high catecholamines, and from the reduction in adrenaline stimulation of hepatic glucose output.4 Our patient had the additional risk of hypoglycemia postoperatively due to the use of a long acting insulin analogue, but this resulted in only one mild hypoglycemic event. Hypoglycemia may have been attenuated by the addition of the necessary glucocorticoid replacement after bilateral adrenalectomy.

**Conclusion**

Catecholamine excess may result in hyperglycemia and necessitate insulin treatment. Pre-operative use of metyrosine can decrease insulin requirement as it alleviates the catecholamine burden. The critical feature of this case is to recognize that younger patients can be misdiagnosed with type 1 diabetes due to supraphysiological catecholamine production from pheochromocytoma. Close monitoring of hyperglycemic patients is required to avoid hypoglycemia during both pre-operative preparation with metyrosine and in the post-adrenalectomy period.

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**Figure 1. MRI of Abdomen and Pelvis of patient with enlarged bilateral adrenal glands.**

**Figure 2. Graph of glucose levels (mg/dL) and insulin (Units) dosing over each day. Circles represent first day of metyrosine dosing. Arrow showing day of bilateral adrenalectomy.**

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