A Case of Beriberi in the 21st Century

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Patient Presentation

- In 7/2015 ES a 59YO lady with a history of weight loss surgery was admitted to post-acute care after a six day hospital stay where she presented with a history of two weeks of nausea, vomiting, weakness, disorientation, and hallucinations; she was found to have volume contraction and transient AKI in the hospital. After hospital evaluation she was thought to have GI dysmotility from DM and opioids and improved with tapering of her opioids.

- On examination at the SNF she was inattentive, morbidly obese, unable to stand from a chair without assistance, and her physical exam was within normal limits except for lateral gaze nystagmus, and absence of knee and ankle reflexes.

- She had no recollection of the confusion, disorientation or hallucinations that her family reported she had experienced while hospitalized.

- A thiamine level of 52 (70-180) which had not been treated was in the hospital lab data, and she was started on thiamine injections upon admission to the SNF.

Causes of Poor Thiamine Intake

- Chronic alcoholism
- GI surgery (especially bariatric surgery)
- Anorexia nervosa or dieting
- Hyperemesis of pregnancy
- Prolonged IV feeding without proper supplementation
- Prolonged fasting or starvation, or unbalanced nutrition, especially with refeeding
- Systemic malignancy
- Transplantation (related to prolonged illness of recipient with poor nutrition, and hypoperfusion followed by reperfusion of transplanted organ)
- AIDS
Clinical Conditions Associated with Thiamine Deficiency

- DIURETIC USE—Thiamine is water soluble and is lost in urine in excess with diuretics.
- Intake of excessive thiaminase. Thiaminases are enzymes found in some plants and the raw flesh and viscera of certain fish and shellfish.
  > When ingested in significant amounts, thiaminase can induce thiamine deficiency even when there is sufficient thiamine in the diet.
- A proposed genetic insensitivity to a normal level of thiamine.
- Intake of excessive polyphenols in diet that cause altered absorption of thiamine.
  > Chronic intake of polyphenols can convert thiamine to an unabsorbable and inactive form.

Thiamine deficiency

- Thiamine is essential for glucose and amino acid metabolism, in a deficiency state there is an increase in plasma pyruvate levels and a decrease in cellular ATP.
- Beriberi (from the Sinhalese "I cannot") is an ancient term for a cluster of symptoms caused primarily by a nutritional deficit in vitamin B1 and historically has been divided into clinical syndromes based on the primary manifestation of the deficiency:
  > Neuritic or 'dry' beriberi
  > Cardiac or 'wet' beriberi
  > Gastrointestinal (GI) beriberi

Neuritic or 'Dry' beriberi

- Predominance of neurological manifestations such as confusion, apathy, delirium, amnesia, and mild neuropathy.
- Wernicke/Korsakoff syndrome. Wernicke encephalopathy (WE) is an acute syndrome, Korsakoff syndrome (KS) refers to a chronic neurologic condition that usually occurs as a consequence of WE.
- The classic triad of WE includes:
  > Encephalopathy with disorientation, indifference, impaired memory, impaired learning, and confabulation
  > Ocularmotor dysfunction with nystagmus, or ophthalmoplegia.
  > Ataxia, gait—probably a combination of polyneuropathy, cerebellar involvement, and vestibular dysfunction.
Cardiac or ‘Wet’ Beriberi

- Beriberi heart disease is due to particularly severe thiamine deficiency and more common in Asia where the diet consists of a high intake of polished rice which is deficient in thiamine content.
- With ‘beriberi heart’, there is high output cardiac failure.
- In the US, the presentation of cardiac beriberi is that of severe malnutrition, peripheral neuropathy with evidence of high output heart failure.
- Inconclusive studies have been done to evaluate routine administration of thiamine to all patients with CHF......with the recommendation of prospective double-blind studies being needed.

GI Beriberi

- In the 1940’s several separate experiments induced thiamine deficiency in humans.
- Almost all participants reported nausea, vomiting, and abdominal pain.
- These early observations of prominent GI symptoms with thiamine deficiency appear to have been overlooked until recently.
- In 2004, Donino ‘re-described’ GI beriberi with case studies of thiamine deficient patients exhibiting nausea, vomiting, abdominal pain and lactic acidosis that resolved quickly with administration of thiamine.

Recognition of Thiamine Deficiency

- WE is straightforward when an alcoholic presents with the classic triad but this is the exception rather than the rule.
- Autopsy studies show that in only 17% of patients proven to have pathological findings of WE had the classic triad of symptoms.
- In the 1986 autopsy series from Perth, the diagnosis of WE was made in ONLY 20% of the cases.
- In a 1989 autopsy series from Oslo, Norway 23% of cases of WE were in NON-alcoholics.
Recognition of Thiamine Deficiency

- The effectiveness of vitamin fortification of foods has caused complacency and the misconception among physicians that vitamin deficiency illnesses are only of historical interest and (other than B\textsubscript{12} deficiency) will not be encountered.

- The most common symptoms of WE are confusion, apathy, delirium, and neuropathy.

- WE can progress to coma and death if not recognized and treated, and treatment is both inexpensive and easy. A high index of suspicion MUST be cultivated in dealing with patients at risk, both with and \textit{without} a history of alcohol use.

Thiamine--How Much and Where can I Find It?

- Thiamine is found in larger quantities in yeast, legumes, pork, whole grains (brown rice, quinoa, potatoes, liver, eggs, and cereals). Of note, milk products, most fruits, and vegetables are \textit{poor} sources of thiamine.

- In the US processed flour must be enriched with thiamine (as thiamine mononitrate along with niacin, ferrous iron, riboflavin and folic acid) to replace the thiamine lost in processing of the flour.

- Thiamine is water soluble and a normal person has a limited tissue store of about 10-20 days of thiamine.

- Unless a daily intake of at least 2 mg per day is maintained a deficiency state can develop in a relatively short period of time.

Thiamine Replacement...Easy and Cheap

- If thiamine deficiency is \textit{suspected} then thiamine should be administered percutaneously. Oral absorption of even large doses of thiamine in a thiamine-deficient patient is \textit{poor}, so the vitamin MUST be administered parenterally.

- If thiamine deficiency is \textit{suspected} then \textit{TREAT} with thiamine immediately, do \textit{NOT} wait on blood tests to confirm the diagnosis, let the response to therapy confirm the diagnosis.

- Dosing is recommended to be 500 mg IV over 30 minutes TD for 2 days, followed by 250 mg IV (or IM ideally) for 5 days in combination with other B vitamins (BTD).
Treatment with Thiamine

- **ALWAYS** remember that administration of glucose without thiamine in a thiamine deficient patient can PRECIPITATE or WORSEN Wernicke’s encephalopathy. It can be FATAL, perhaps an explanation of sudden death in refeeding starved POWs.

- The high dose for thiamine replacement therapy is based on incomplete absorption and utilization, and in the suspected genetically determined requirement of higher doses of thiamine.

- At the NH I use 200 mg of Thiamine IM tid for three days (SWAG) plus every patient admitted is placed on and continued on 100 mg daily of oral thiamine.

Table 2. Speech Therapy Testing

<table>
<thead>
<tr>
<th></th>
<th>At Admission</th>
<th>At Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Testing</td>
<td>23 of 30</td>
<td>26 of 30</td>
</tr>
<tr>
<td>Ability to Follow Multistep Directions</td>
<td>85%</td>
<td>95%</td>
</tr>
<tr>
<td>Recall of New Information</td>
<td>80%</td>
<td>85%</td>
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</tbody>
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* St. Louis University Mental Status Exam score  
* Montreal Cognitive Assessment score

Table 3. Occupational Therapy Testing

<table>
<thead>
<tr>
<th></th>
<th>At Admission</th>
<th>At Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Hand Grip Strength</td>
<td>26 lbs</td>
<td>55 lbs</td>
</tr>
<tr>
<td>Left Hand Grip Strength</td>
<td>12 lbs</td>
<td>52 lbs</td>
</tr>
<tr>
<td>Time Up and Go</td>
<td>67 seconds</td>
<td>8 seconds</td>
</tr>
<tr>
<td>Standing Function Research</td>
<td>4 in</td>
<td>15 in</td>
</tr>
<tr>
<td>ADL and Self Care</td>
<td>Moderate assistance required</td>
<td>Independent</td>
</tr>
</tbody>
</table>

* Abbreviations: ADL, activities of daily living
After Treatment with IM Thiamine

<table>
<thead>
<tr>
<th>Table 4. Physical Therapy Testing</th>
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<tbody>
<tr>
<td>At Admission</td>
</tr>
<tr>
<td>Transfers</td>
</tr>
<tr>
<td>Moderate assistance required</td>
</tr>
<tr>
<td>Ambulation</td>
</tr>
<tr>
<td>30 Second Chair Rise Test</td>
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Patient Profiles of My Thiamine Deficient Patients in the Past Year

- 66 YOF from Geri-Psy with 30 lb. wt. loss, aspiration, no appetite, PEG placed; antipsychotics stopped, appetite returned, no more paranoia.
- 66 YOF with gastric bypass and 195 lb. wt. loss, food tasted bad, unable to eat, PEG placed; bed bound for 1 month, ambulatory 250 ft.; appetite returned; SLUMS improved from 24/30 to 27/30 at D/C.
- 54 YOM with DM, no appetite for 6 months, poor appetite, weight loss, pressured speech, confabulation; SLUMS went from 13/30 to 21/30 in 1 week and went from the class clown to a model citizen.
- 78 YOM with severe Lewy Body dementia. He had a variable appetite and had undergone a rapid change from ambulating to being bed bound over a week period; after thiamine, he became verbal and was ambulating up to 10 steps.

TAKE HOME MESSAGE (FINALLY)

- We must be extremely vigilant and suspicious for thiamine deficiency and "If you think about the possibility of thiamine deficiency you should probably treat it." GGH.
- Think about how many patients you see that are:
  - Frail people with a poor appetite for days BEFORE they came to the hospital and then we subject them to the hospital routine and now in the post acute care unit where they HATE the food.
  - Eating poorly, weak, tired AND taking FUROSEMIDE.
  - All of the above, plus aphasia, forgetfulness, goofiness, or have some mental status change in the hospital... look for all the usual suspects, but while you are looking for them TREAT WITH PARENTERAL THIAMINE.
CHEEZY SLOGANS

- Nike...Just B
- Shakespeare...To B or not to B
- Today...B or W
- In a galaxy far far away...

OB, WANN