A malnourished cachectic alcoholic with AMS is picked up by EMS and has a glucose of 40 mg%. The ED physician gives the order for an amp of D50 and the patient arrives 20 minutes later. On arrival he receives 100 mg IV thiamine. The upstairs doctors point out how naive the ED Doc is because glucose before thiamine can rapidly cause Wernicke’s.

Are they right?

Can giving IV glucose before Thiamine cause acute Wernicke’s Encephalopathy?

**ACUTE WERNICKE’S ENCEPHALOPATHY PRECIPITAT ED BY GLUCOSE LOADING**

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Summary

Cases of acute Wernicke’s Encephalopathy in non-alcoholic, malnourished patients are described. In each case the administration of a glucose load precipitated a neurological crisis which was rapidly reversed by the administration of intravenous Thiamine. It is suggested that prophylactic Thiamine treatment therapy should be considered in the management of all malnourished patients, one of whom had a recent history of excessive alcohol intake, in which the administration of a glucose load precipitated a neurological crisis.

**Case 1**

A 37 year old female was admitted with a 3 day history of nausea and vomiting. She also complained of recent onset of dizziness and blurring of vision. She had been well until 6 months prior to this admission when she became anorectic. At the time she was 15 st (78 kg). Over the past 12 months she lost weight to 62 st (32 kg). At the time of admission her height was 160 cm and her weight was 52 kg. She was dehydrated and had a blood glucose of 44 mg%. She was treated with intravenous fluids and 500 ml of 5% dextrose was given. During this period she complained of severe headache and became disoriented. She was transferred to the ward and was treated with hydration which included the administration of 5 litres of Dextrose 5% over a 24 hour period. During this period, vomiting and diarrhoea persisted and both persisted and were absent. Following infusion of 2 litres of Dextrose 5%, she became disoriented. The patient was transferred to the ward and was treated with hydration which included the administration of 5 litres of Dextrose 5% over a 24 hour period. During this period, vomiting and diarrhoea persisted and both persisted and she became disoriented. The patient was transferred to the ward and was treated with hydration which included the administration of 5 litres of Dextrose 5% over a 24 hour period.
**Thiamine**

- Give 100 mg IV push
- IV is very safe
- Give to all malnourished and cachetic patients
- Give after hypoglycemic emergencies; NOT before

**Wernicke’s Encephalopathy**

**Classic Triad**

- Ataxia
- Ocular findings: nystagmus or lateral rectus palsy
- Encephalopathy

**Signs in Wernicke-Korsakoff Complex**

- Excellent Review
- More than just chronic alcoholics at risk
- Persistent neurologic dysfunction common
- Do not expect the triad
What 5 groups are at higher risk for Wernicke’s?

- Chronic Ethanol Abuse
- Chronic Severe Malnutrition
  - (HIV, Cancer, Prisoners, Refugees, etc.)
- Malabsorption Syndrome
  - (Short Gut Syndrome s/p gastric bypass, DM, etc.)
- Hyperemesis Gravidarum
- Anorexia Nervosa

Why does every hypoglycemic patient’s low blood glucose have to be ReExplained?

Hypoglycemia ReExPLAIND

| Re | Renal |
| Ex | Exogenous Insulin/antihyperglycemics |
| P  | Pituitary Insufficiency |
| L  | Liver |
| A  | Alcohol, Addison’s, Aspirin |
| I  | Infection, Insulinoma |
| N  | Neoplasm |
| D  | Drugs |

Hypoglycemia (Renal)

- Decreased insulinase
- Decreased excretion
- Decreased caloric intake
- Increased number of infection
Hypoglycemia in the very young or very old equals infection/sepsis until proven otherwise

One amp of D_{50} should raise serum glucose by about 200 mg/dl for up to 30 minutes.

If it doesn’t look for complicating factors like sepsis, insulin OD, oral agent OD, or ASA OD

D_{10} vs D_{50}

- D_{50} osmolarity = 2,525 mOsm
- pH = 3.2 – 6.5
- Hypertonic and acidic = ↑ phlebitis
- D_{10} = 505 mOsm
- Authors suggest using D_{10}

Can D_{10}W be substituted for D_{50}W?

- 24 month trial of 871 pts, 100 ml D_{10}W
- Contra Costa EMS and Highland Hospital
- Average initial glucose was 37; repeat 91 mg %
- 23% required a second bolus
- 0.8% (< 1:100) required a third

D_{10} vs D_{50}

- Both raise glucose effectively
- D_{50} to 250 in 5 min; D_{10} to 100 in 10 min
- May need to repeat D_{10} in 1:4 patients
- D_{10} may be safer
- No definitive head to head large trial yet
The 5 Most Common “Endocrine” Complaints

- Refractory
- Weakness
- Arrhythmias
- Altered Mental Status
- Fluid and Electrolyte Abnormalities

What one word will help you the most to think Endocrine cause?

Refractory = Endocrine

Refractory Shock NOT due to Sepsis

- AMI
- PE
- Drugs
- Hypothermia
- Endocrine - Metabolic

A hypothermic patient presents to the ED.

How many therapies should you always consider?
### Hypothermia

**5 Therapies to Consider**

<table>
<thead>
<tr>
<th>Therapy</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heated O₂</td>
<td>Begin Therapy for Hypothermia</td>
</tr>
<tr>
<td>N.G.T</td>
<td>Narcotic OD, Hypoglycemia, Wernicke’s</td>
</tr>
<tr>
<td>Synthroid</td>
<td>Hypothyroid</td>
</tr>
<tr>
<td>Steroids</td>
<td>Hypoadrenal/Hypothyroid</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>Sepsis</td>
</tr>
</tbody>
</table>

### The most common cause of Hyperthyroidism in the ED is:

- **Graves Disease**

### Think Thyroid Disease “ED Crots”

- Anxious and multiple nonspecific complaints
- Young, healthy but “weak”
- Amenorrhea but negative pregnancy test
- Diarrhea but otherwise healthy
- Palpations in exercising “over-achiever”

### What 2 arrhythmias should always make you think of Hyperthyroidism?

- Atrial Fibrillation with Rapid Ventricular Response
- Refractory PSVT and/or PSVT that breaks but rapidly reoccurs S/P adenosine and/or cardioversion

### Activation of Graves Disease is usually due to:

- Discontinuing Medication
- Triggering Stress

### When you see a Hyper or Hypo Thyroid Crisis, think:

- Precipitating Cause!
When you see a Hyper or Hypothyroid Crisis, also think:

Adrenal

Hyperthyroidism
R/O Triggering Stress

- Infection
- Pregnancy
- Trauma
- Recent surgical procedures
- High emotional stress


THYROID STORM PRECIPITATED BY TRAUMA

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CASE REPORT

A 31 year-old woman was brought to the ED by ambulance after being assaulted with a pipe and struck in the head. She was awake and alert, but in obvious pain. She reported a loss of consciousness and was amnesic to further details of the assault. On examination of the head and neck, she complained of intense headache and neck pain. The patient reported no significant past medical history, and was not taking any medications (prescribed or not). Physical examination revealed tachycardia. A complete blood count and electrolytes were obtained via NTG. She was placed on IV fluids and admitted to the hospital. She recovered without sequelae.

TREATMENT OF HYPERTHYROIDISM

- ABC’s
- NGT
- Block peripheral action
- Block synthesis
- Avoid relative hypoadrenalism

TREATMENT OF HYPERTHYROIDISM

ABC, NGT

- Block peripheral action
- Beta Blockade
- Block synthesis
- PTU or Methimazole
- Avoid relative hypoadrenalism
- Steroids

Treatment of Hyperthyroidism

ABC, NGT

- Perform Opening Gambit
- Patients volume contracted
- High metabolism = Low Glucose Reserves
- Tachyarrhythmias common
- Treat the disease…. Not just the rhythm!
The Opening Gambit

- \( \text{O}_2 \)
- \( \text{O}_2 \) Sat
- IV Access
- ECG Monitor
- 12 Lead ECG

Treatment of Hyperthyroidism
ABC, NGT

Begin \( \text{D}_5 \text{NSS} \) at 200 cc/hr

---

**Intake of Iodine**

**Synthesis of Thyroid Hormone** (Organification)

**Release of Active**

**Conversion of** \( T_4 \) to \( T_3 \)

**Stimulus effects on the body**

---

**Beta Blockers in Hyperthyroidism**

- As much as it takes but not too much
- Inderal 1mg Q5 minutes
- Esmolol 1/2 pts Wt in Kgs IV push then 1/10 of loading dose/min

\[ \text{e.g.: } 60 \text{ kg woman} = 60/2 = 30 \text{ mg IV push} = 3 \text{ mg/min} \]

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**Beta Blockers**

Beta Blockers block peripheral actions of Thyroid Hormone
And also decrease peripheral conversion of \( T_4 \rightarrow T_3 \)

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**PTU or Methimazole**

- Blocks \( T_3 \) and \( T_4 \) Formation
- Work Rapidly
- Must be given orally
- PTU decreases \( T_4 \rightarrow T_3 \) conversion
- Dose is:
  - PTU 200 mg Q4H
  - Methimazole 20 mg Q4H
PTU or Methimazole

Blocks the formation of Active Thyroid Hormone
PTU decreases $T_4 \rightarrow T_3$ conversion

Steroids in Hyperthyroidism

- Preserve Homeostasis
- Avoid Hypo Adrenal Crisis
- Decrease $T_4 \rightarrow T_3$ Conversion

Steroids

- Use in Thyroid Disease
- Use in Adrenal Disease
- Hydrocortisone 100 mg
- Decadron 6 mg
- Solumedrol 80 – 120 mgs

Steroids help decrease $T_4 \rightarrow T_3$ conversion
Steroids help borderline hypoadrenalism
Steroids supports organ function

Thyroid Storm
Thyrotoxic Crisis

- Agitation/AMS
- High fever
- Tachycardia > 140
- AFib with RVR
- Cardiovascular collapse
Treatment of Thyroid Storm

- ABC/NGT (O₂, D₅NSS)
- Titrate Beta Blocker
- Begin PTU or Methimazole
- Bolus with Steroids
- Administer Iodine

Iodine administration stimulates T₃ and T₄ formation

Treatment of Hyperthyroidism-Iodine

Large doses of iodine blocks release of active Thyroid Hormone and new Formation

*if PTU or Methimazole already onboard*

Wait 1 hour s/p PTU or Methimazole before Iodine administration

Iodine Therapy in Thyroid Storm

- SSKI (0.25 ml / 5 drops)
- Lugol’s Solution (0.5 ml / 10 drops)*
- Iodinated Contrast (1 gram inorganic I)

* Can also be given IV
Think Hypothyroidism

• Elderly with dementia
• CHF patient on diuretics with hyponatremia
• Hypertensive with repeat episodes of hypotension
• Fecal impaction, abdominal cramps, constipation
• Digitalis toxicity - even with decreasing dosage

Myxedema
A hypothyroid patient with

AMS
+
Significant Vital Sign Abnormalities
When should you consider myxedema?

Classic Myxedema Patients:
- AMI with shock, poor response to pressors
- Symptomatic bradycardia, poor response to atropine and/or TQ pace
- Hypothermia in the spring, summer or fall
- Hypothermia that won’t warm up
- AMS with sepsis

Myxedema
5 Vital Signs
- BP: Hypotensive
- P: Bradycardic
- RR: Hypercarbia
- Temp: Hypothermic
- O₂ sat: Hypoxic

Hypothyroid Patients
Hypoventilate!

Treatment of Hypothyroidism:
100 ugm (0.1 mg) of synthroid (T₄) daily.

Treatment of Myxedema
- Secure ABC’s: High FIO₂: Consider intubation
- Consider NGT: Beware hypoglycemia
- Thyroid Replacement: 400 ugm of Synthroid or 100 ugm T₃
- Steroids: 100 mg IV of hydrocortisone, or decadron
- R/O underlying disease: R/O AMI, sepsis, head trauma, UTI etc.
Hypothyroidism = Hyponatremia

Hypothyroid = Hypoadrenal

Adrenal Hormones

“Salt Water Energy Drink”
  • Aldosterone: Salt and Water Retention
  • Cortisol: Energy – Pressor Response

Consider Adrenal Insufficiency
  • Asthmatics (or history of steroid use)
  • HIV-AIDS (infiltrative disease with MAI)
  • Myxedema (or any endocrine disease)
  • Meningiococcemia and Fulminant Sepsis
  • Any “Refractory Shock Patient”
    - BP hypotensive
    - P bradycardic
    - Temp hypothermic

Consider Adrenal Insufficiency
  • In any Hyperkalemic patient without renal failure
  • In any Hypotensive patient not responding to volume or pressors
  • In any Hypothermic patient not rewarming

Treatment of Hypoadrenalism
  • Volume
  • Glucose
  • Sodium
  • Steroids
  • Diagnosis
Therapy of Adrenal Insufficiency

- Secure ABCs
  - O₂, Volume, Na (D₃NSS, 250-1000 cc/hr)
- NGT
  - Glucose (D₃NSS, 250-1000 cc/hr)
- Draw Red Top
  - Label time drawn

IV Therapy in Hypoadrenalism

- Patients need sodium
  - Volume at 250 - 1000 cc/hr
  - Bolus for shock
- Patients need glucose
  - Use D₃NSS
  - Not just NSS

Therapy of Adrenal Insufficiency

- Steroids
  - 6 mg Decadron
  - 250 ugm Corticotropin
- Find Cause
  - R/O infection, infarction
  - Redraw red top in 30-60 min

Diagnosing Addison’s Disease Cosyntropin Stimulation Test

- Draw red top tube *
- Give 6 mg Decadron
- And 250 ugm Corticotropin
- Draw second red top 30 – 60 min later *
- See if Cortisol level ↑ 20 (or doubles)
  * Label Times!!

Diagnosis of Hypoadrenalism

Failure of cortisol level to rise to 20 ugm/dl, or at least double.

Name that Endocrinopathy

1 Hypothyroid
2 Hyperthyroid
3 Hypoadrenalism
4 Wernicke’s
5 Hypoglycemia
A. A 48 year old male asthmatic suffers an inferior AMI and does not respond to pressors. Hypoadrenal
B. A 68 year old elderly female presents in coma due to hypoglycemia. She does not wake up after 2 amps of D50. Hypoadrenal…. Hypothyroid too?
C. A hypothermic alcoholic does not rewarm. Wernicke’s…. Hypoadrenal too?
D. A 28 year old woman presents in PSVT which keeps relapsing after therapy with adenosine, verapamil and 200 ws DC cardioversion. Hyperthyroid

E. Hyponatremic seizure. Hypothyroid
F. Sodium of 128. Hypothyroid, Hypoadrenal
G. Sick sinus syndrome. Hypothyroid

H. Weight loss. Hyperthyroid
I. Anorexia in healthy person. Hyperthyroid
J. Meningitis and WNL CSF. Thyroid Storm
K. AIDS. Hypoadrenal.. Wernicke’s Too?

L. Unresponsive Wernicke’s (coma, hypothermia, hypotension, bradycardia) Hypoadrenal
M. pCO2 of 45. Hypothyroid
N. Hyponatremia, hyperkalemia. Hypoadrenal

Q. Fecal impaction in NH patient. Hypothyroid
R. Coma with pinpoint pupils, bradycardia and hypotension. Wernicke’s
S. Persistent hypotension s/p major trauma no bleeding site found. Hypoadrenal

Summary
- Watch for Wernicke vulnerable
- Re-explained hypoglycemia
- Refractory = R/O endocrine
- Glu, BB, PTU, Steroids (I)
- Think Thyroid, Think Adrenal