

Vitamin and Mineral Deficiencies

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Objectives

- Diagnose vitamin and mineral deficiencies
- Understand appropriate treatment



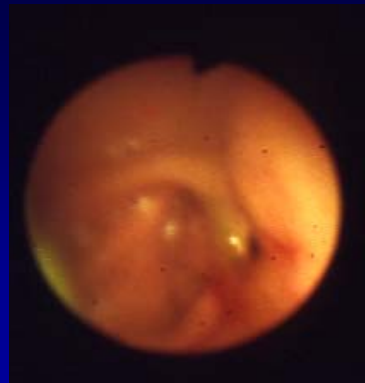
Déjà vu,
all over
again



Diagnose
that
Deficiency



- 56 year old alcoholic male admitted to the VAMC
- Epigastric pain, nausea, vomiting
- S/P Billroth I for PUD
- Beer only x 3 months





Next Test and Diagnosis?

- Serum Zn 10 ug/dl
- 3 days oral zinc and rash resolves
- 1 week later serum zinc 74 ug/dl



- Antioxidant.
- Catalytic role in zinc metalloenzymes, such as ADH.
- Structural role in zinc finger transcription factors, such as HNF-4 α , C/EBP and PPAR- α .
- Induction of metallothionein, which is a potent antioxidant.

McClain's Top 10 Manifestations of Zinc deficiency



- Skin lesions (acrodermatitis)
- Growth retardation
- Anorexia
- Poor wound healing
- Decreased night vision
- Hypogonadism
- Impaired immune function
- Diarrhea
- Depressed mental function
- Teratogenesis

Zinc Metabolism

- RDA – 11 mg males, 8 mg females
 - ~3 mg IV/day for TPN
 - Much higher needs with:
 - Diarrhea
 - Burns
 - Fistulae
 - Severe trauma
 - anabolism

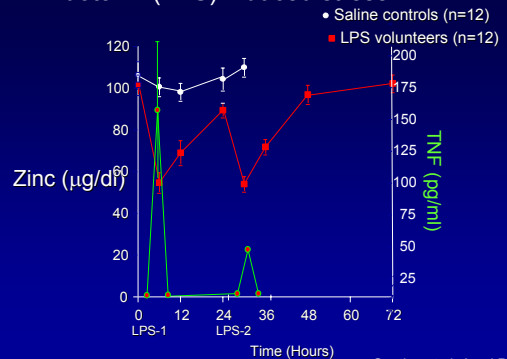
Zinc Status

- Serum zinc (↓ stress)
- Tissue (e.g., Leukocyte) zinc
- Reversal of signs of deficiency

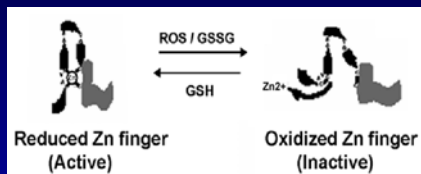
Stress, The Acute Phase Response, and Zinc

- ↓ serum zinc concentrations
- Internal redistribution of total body zinc
- ↑ zinc levels in liver
- ↑ urine zinc

Endotoxin (LPS) induced stress



Oxidative Stress negatively impacts zinc finger function

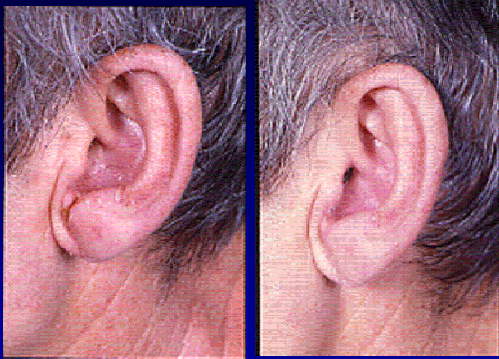


+ Zn finger : DNA binding

Skin Lesions (acrodermatitis)



Poor Wound
Healing



Diarrhea

- 48 year old with severe diarrhea
- Previous c.difficile colitis
- Serum Zn 22 ug/dl

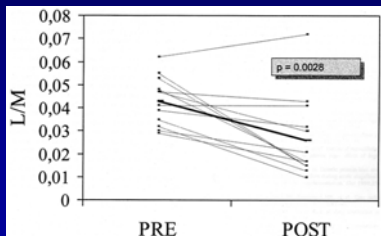


Zinc

Zinc supplementation tightens "leaky gut" in Crohn's disease.

Sturniolo GC, Di Leo V, Ferronato A, D'Odorico A, D'Inca R.
Inflamm Bowel Dis 2001 May;7(2):94-8

Intestinal Permeability before and after 8 weeks zinc therapy



- 82 y.o. male
- S/P CVA
- Nursing home x 4 years
- PEG with tube feeding x 4 years
- Decubitus –Rx with ZnSO₄ – 220 mg TID via PEG



• Labs

- Hb 14 ➡ 9 g/dl
- MCV 79
- Heme negative
- Hemolysis workup negative
- CRP 1.2 mg/dl
- UGI endo, colon negative
- No response to iron Rx

Next Test and Diagnosis?

- Serum copper – 27 ug/dl
- Discontinued zinc supplements and Hb increased to 13.6 g/dl with copper supplementation

Copper

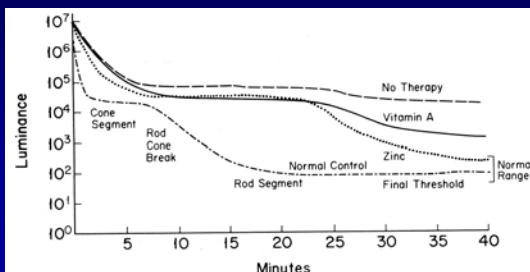
- Zinc induces metallothionein and IMPAIRS copper absorption; excess zinc may lead to deficiency
- Copper deficiency results in anemia NOT responsive to iron supplementation, neutropenia, and less often hypopigmentation, immune dysfunction and skeletal abnormalities
- Recent studies also demonstrate neurologic defects.

- 56 year old alcoholic cirrhotic male
- Auto accident at midnight
- Driving was erratic
- No EtOH x 1 year
- Blood EtOH - undetectable
- PE: +spiders



- Vit A ↓ (12 ug/dl)
- RBP ↓ (.9 mg/dl)
- Zinc ↓ (39 ug/dl)

Next Test and Diagnosis?



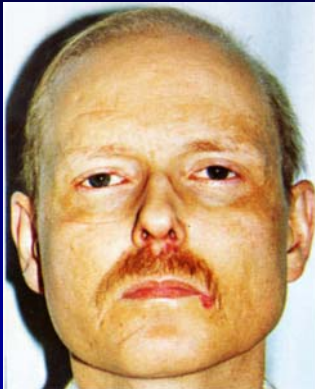
Vitamin A

- The major clinical manifestations of vitamin A deficiency include:
 - dry eyes or xerophthalmia,
 - abnormal dark adaptation,
 - thickening of the hair follicles or follicular hyperkeratosis.

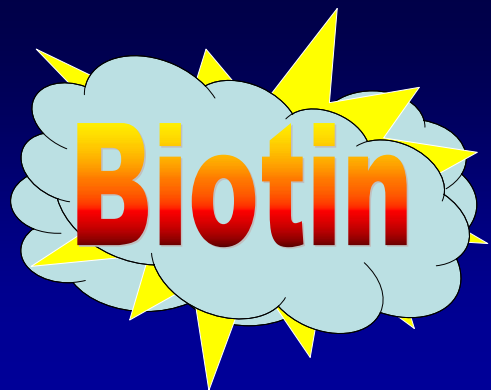
- 36 year old white male with Crohn's x 17 years
- Multiple surgeries, colostomy
- Short bowel, fistulae
- Home TPN – includes MVI and Intralipid™
- Chronic UTI – intermittent Rx



- Skin rash
- No response to Zn, lipids
- Lethargy
- Depression
- Paresthesias



Diagnosis?



- Biotin deficiency usually manifests itself as:
 - conjunctivitis,
 - dermatitis around the eyes, nose and mouth,
 - alopecia often with loss of normal hair coloring,
 - skin infections,
 - neurologic symptoms such as ataxia, hypotonia,
 - severe lethargy,
 - depression and
 - possibly parasthesia and hallucinations.

- Problems
 - No intake
 - Suppression of bacterial production
 - ↑GI losses

- Tennis partner is 58 year old male with Crohn's
- 8 previous surgeries/resections
- Active artist/photographer
- Onset of stiffness and cramps in hands
- Dx - osteoarthritis



- What Lab Test?
Serum Mg - .65 mmol/L
Responds to monthly IM
Mg⁺⁺



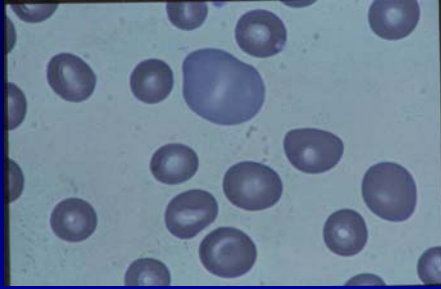
- Muscle cramps
- Weakness
- Cardiac arrhythmias

- 34 yo WF
- SB Crohn's x 2 years
- Presents with fatigue, SOB
- Private GI says she is a "complainer"
- Meds:
 - Pentasa 1 g QID
 - Zinc sulfate 220 mg daily



- H/H 10/30
- Differential:





Macrocytic anemia

Folate deficiency

- SOB worsens
- CT – Bilateral pulmonary emboli
- What laboratory test?

Serum homocysteine 38.2 μ M

- 24 yo F, BMI 46
- Gastric bypass
- 3 admissions for N/V



- 3 months post bypass
 - Headache
 - Slurred speech
 - Diplopia
 - Confusion
 - Coma

What Therapy?

- IV thiamine started
- ~80% resolution of symptoms

APGARS Neuropathy

- **Acute post gastric reduction surgery neuropathy.**
- **Bariatric Beriberi.**
- Painful symmetric sensorimotor lower extremity polyneuropathy often with weakness / \downarrow reflexes.
- Frequently misdiagnosed as Guillan-Barre syndrome.
- **Incidence:** 3.6% at 14 months, 4.6% at 20 months.
- **Operations:** gastric bypass > gastric banding.
- **Vitamins:** thiamine, B12, possibly others.

• Neurology 1987;37:196-200. Clin Nutr 1986;15:181-184. Obes Surg 2004 14(2):182-9. Muscle & Nerve 2006 33:166-176.

Wernicke's Encephalopathy

- Potentially reversible neurologic syndrome associated with **thiamine deficiency**
- **Classic Triad:** confusion, ataxia, ophthalmoplegia.
- **Other Signs:** hypothermia, tachycardia, hypotension.
- **Bariatric Surgery Incidence:** 0.4%.
- **Bariatric Risk factors:** persistent post-op vomiting, alcohol consumption, vitamin noncompliance, initial weight loss > 7 kg / month, APGAR5 neuropathy.
- Tests: serum thiamine, 24 hr. urine thiamine, RBC transketolase before and after thiamine diphosphate.
- Neurology 1987;37:196-200, Surgery 1979;86:648-654. Obesity/Bariatric Med 1977;6:185-187. Clin Nutr 2000;19:371-373.



- 38 yo female with bowel infarct
- Started on TPN by her surgeon
- 11 years later, Glucose increased, develops peripheral neuropathy
- What mineral is deficient?

Chromium

- 1957 extracted from pork kidney termed "glucose tolerance factor") corrected hyperglycemia in rats
- In patients with diabetes requiring TPN, chromium deficiency was indicated by increased insulin requirements
- Required for normal lipid and carbohydrate metabolism
- Other features
 - Poor wound healing
 - Neurologic - peripheral neuropathy, ataxia



- 40 yr old with short bowel
- Home TPN x 5 years
- Develops cardiomyopathy
- What trace metal is deficient?

Selenium Deficiency

- Main features
 - Congestive heart failure (Keshan syndrome)
 - Muscle weakness
- Issues
 - Related to soil content (mainland)
 - Not included in most MVI
 - Key component of glutathione peroxidase (anti-oxidant free radical scavenger)
 - Complements anti-oxidant properties of Vit E
- Diagnosis - clinical suspicion only
- Toxicity - Reported in U.S. from supplement 180 fold the amount labeled: nausea, emesis, hair loss, nail changes, mental status changes, and peripheral neuropathy



Last and Most Recent Case VA Offsite Question!

- 71 yo WF
- 3.5 years of numbness, weakness, leading to wheelchair dependence
- PE: unrevealing except for edentulous, wheelchair bound, decreased pinprick sensation to hips, leg weakness

Test and Diagnosis

- Serum copper 10 ug/dl
(↓ceruloplasmin, ↑zinc)
- Denture cream vs idiopathic copper deficiency

Conclusions

- Nutrient deficiencies are not infrequent, especially in GI diseases
- Appropriate recognition and treatment are necessary

Present Knowledge in Nutrition, Liver Disease: (55) 9 E, Vol, II, 2006

Thank you for playing...

**Diagnose
that
Deficiency**

