CASE 100
Panting Panic

The Patient: Teresa Livermore, A Forty Nine Year Old Woman

Principal Complaint: Teresa Complains of light-headedness and "pins and needles" in her hands and around her lips. She also is having difficulty holding a pen and writing while filling out her grandson's insurance forms.

History: The feeling of lightheadedness and "pins and needles" began after Teresa arrived at the emergency room with her grandson, Dennis. She brought Dennis to the hospital because he had ingested an unknown number of aspirin tablets. Although her grandson appears to be fine, Theresa is quite anxious. She is having difficulty holding a pen and filling out the insurance forms for her grandson.

Teresa was hospitalized two months ago for depression and malnutrition. It was felt that this was related to the death of her husband one year ago. She is responding to treatment with antidepressants and counseling and has regained 25 of the 41 pounds she lost.

Her only daughter and grandson moved overseas shortly after her husband's death and this is their first visit to Teresa's house since then. Teresa is worried that her daughter may not trust her to baby-sit Dennis again.

Physical Findings: Physical exam reveals a thin, anxious 49 year old female. She is alert and oriented. She is 5'7" inches tall and weighs 124 pounds. Carpopedal spasms are noted in both hands. Except for a respiration rate of 25/ min. all other findings are within normal limits.
Laboratory Results:

<table>
<thead>
<tr>
<th></th>
<th>Teresa</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCO₂ (mmHg)</td>
<td>28</td>
<td>35-45</td>
</tr>
<tr>
<td>pH</td>
<td>7.52</td>
<td>7.35-7.45</td>
</tr>
</tbody>
</table>

**Treatment:** Teresa was asked to breathe slowly into a small paper bag placed around her nose and mouth to allow her to reinhale CO₂. Within 20 minutes her symptoms disappeared.

**Suggested Reading:**

http://www.tmc.tulane.edu/departments/anesthesiology/acid/acid.html

Marks 39-41 and 725 (sidebar)

Selected pKas:

Calcium citrate 3.14, 4.77, 6.39
**CASE 199**

**Antifreeze and Coke**

The Patient: Will Drink, a five year old boy

Principal Complaint: Accidental ingestion of ethylene glycol (automobile antifreeze).

History: A 5- year-old boy (Will Drink) is brought to the emergency room by his father, Bill. Bill believes that Will drank some antifreeze about one hour ago. According to Bill, he and Will had been in the garage. Bill had filled a soda can with antifreeze so he could pour it into the radiator more easily. He poured some into the radiator and put the can on the workbench while he looked for the radiator cap. When he turned around, Will was holding the can. Will denied drinking any, but about 1/2 hour later, Bill noticed that Will's speech was slurred and that he appeared to stagger when he walked. Bill called the Poison Control Center and they told him to take Will to the emergency room.

Physical Findings: Physical exam reveals a lethargic 5 year old white male. Nystagmus is noted in both eyes. His speech is slurred and he staggers when he walks. A faint sweet aromatic odor is detectable on his breath.

Laboratory Results: Serum ethylene glycol 8 mmol/L (50 mg/dL)
Serum ethanol undetectable
Serum osmolality is increased and the osmolar gap is elevated

Treatment: Will is treated with gastric lavage and activated charcoal. Ethanol treatment is initiated with 10 ml/kg of 10% ethanol IV until serum ethanol levels of 20 mmol/L are reached then a maintenance dose of 1.5 ml/kg/hr is continued until ethylene glycol levels are less than 1.5 mmol/L.

    Note: The half time for excretion of ethylene glycol is 3-8 hours. This is prolonged to 17 hours when ethanol is administered.

Suggested Reading:

Marks, Chapter 9, especially pages 117-123.
CASE 297
Too Much Aspirin

The Patient: Sharon Webb, a two year old girl

Principal Complaint: Sharon has consumed a bottle of baby aspirin.

History: The patient, Sharon, is brought to the emergency room by her grandmother, Doris Webb. Mrs. Webb had been caring for her granddaughter while her daughter worked. Earlier in the day Sharon had developed a slight fever which Mrs. Webb treated with two baby aspirin. She then put Sharon down for a nap. She went into the room to check on her about two hours later and found the child sitting in the crib playing with the empty bottle of aspirin. Mrs. Webb says she shook out all the bed covers, but she could only find one pill. The bottle had been new, so Mrs. Webb estimates that Sharon consumed almost the entire bottle (thirty six pills, each pill is 81 mg).

When she picked Sharon up she noted that Sharon was hot and drenched in sweat. She immediately put Sharon into the car and drove to the hospital. This was about 30 minutes ago. During the drive Mrs. Webb says Sharon felt very hot and seemed to be breathing very rapidly.

Physical Findings: Physical exam reveals a lethargic, two year old, African American female. Temperature is 103.4 rectally. Body weight is 26 pounds. Her buccal mucosa and axilla are dry and there is decreased skin turgor. Heart rate is rapid and regular (110 bpm). Lungs are clear. The abdomen is soft with bowel sounds present. There is no urinary output.

Laboratory Results: Laboratory results show an elevated P_aCO_2 level.

Blood pH levels are 7.31 and blood salicylate levels are 170 mg/dl.

Suggested Reading: This case illustrates the integration of oxidative phosphorylation and intermediary metabolism. Chapters 21, 22, and 23 in Marks will be helpful.
CASE 397
Alcoholic Ankle

**The Patient:** Lynne Dearborn, a twenty seven year old woman

**Principal Complaint:** A painful swollen ankle and loss of consciousness after a fall down a flight of stairs.

**History:** Lynne Dearborn, a 27 year old white woman, is brought by her boyfriend to the emergency room of the local hospital on Friday evening at about 10:00 PM. Her boyfriend, Asa, says that Lynne fell down a flight of stairs as they were leaving the home of a friend. They had been attending a party that had started at about noon. Lynne had been drinking quite heavily and become so disoriented that Asa had decided that it would be better if they left the party and went home. According to Asa, Lynne fell down about seven steps and was unconscious when he got to her at the bottom of the stairs. He thinks that she regained consciousness in about one minute and then started complaining about her ankle hurting. Her ankle was starting to swell so Asa decided he'd better bring her to the hospital.

At the hospital Lynne is cooperative but very confused and disoriented. The following is an abstract of the admitting physician's notes.

The patient is a cooperative but disoriented, thin white female. Her boyfriend relates a history of heavy drinking over the past nine hours. He thinks she has probably had a bottle of champagne, a 6 pack of beer and several "zombies". She may also have had some punch that contained grain alcohol.

On further questioning, her boyfriend says that Lynne had been up most of the night studying for an anatomy exam. He is unsure if she ate dinner last night. He knows she was drinking coffee most of the night and doubts that she ate anything with the coffee since she is always dieting. She will frequently drink this much alcohol, especially on the weekends, but this is the first time she has ever fallen down a flight of stairs.

**Physical Findings:** The patient is a cooperative but disoriented, thin white female. She has a swollen right ankle and a contusion on her forehead. She is about 5'6" tall and weighs 110 pounds.

**Laboratory Results:** A blood sample taken on admission reveals a blood alcohol level of 0.27 and a blood glucose level of 50 mg/dl.

X-ray's of Lynne's ankle and skull are normal. A CAT scan of the head is also normal. With the exception of blood glucose, blood alcohol and a slightly elevated GGT, all other lab values are within normal limits.
Treatment: She is admitted to the hospital for observation. Hypoglycemia was noted in blood samples that were drawn over the next several hours.

Suggested Reading: Review the regulation of those biochemical pathways associated with hypoglycemia (low blood sugar). Try to relate the regulation of these pathways to significant findings in the patient's history.
CASE 497
Extreme Exercise

The Patient: Tim Racer, a twenty eight year old man

Principal Complaint: Confusion and exhaustion during marathon races.

History: Tim, a 28 year old male computer programmer comes to see you complaining of confusion and exhaustion during his last two marathons. He is wondering if he is anemic or has contracted some type of virus that is causing his running problems. He says he does pretty well until about mile twenty when he starts to feel exhausted. Tim even stopped running once and walked until one of his running partners caught up to him and urged him to keep running. He did start running again but almost did not finish the race because he was so disoriented that he was not sure where the finish line was. "I just kept running until the crowd stopped yelling at me."

Tim eats a high carbohydrate meal at 5:00 P.M. the day before the race. He never eats on the morning of the race, but drinks three glasses of water, two hours before the race and two glasses of water 5 to 10 minutes before the race. The race usually starts at noon. During the race, Tim tries to drink a cup of water every 20 minutes.

Tim has run 4 marathons. During the first two he felt quite good except for some trouble with abdominal cramps and diarrhea that developed late in the race. One of his friends suggested that his problem could be due to the high carbohydrate"sport drink" Tim was drinking during the race. He started drinking plain water and has not had abdominal cramps or diarrhea for the last two races.

Physical Findings: Physical exam reveals an alert, healthy, white male. All physical findings are within normal limits.

Laboratory Results: All laboratory results are within normal limits.

Training Diet: When questioned about his pre race training, Tim describes the following routine.

<table>
<thead>
<tr>
<th>Number of days before race</th>
<th>Exercise period</th>
<th>Training Diet: % carbohydrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>90 minutes</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>40 minutes</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>40 minutes</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>20 minutes</td>
<td>70</td>
</tr>
<tr>
<td>2</td>
<td>Rest day</td>
<td>70</td>
</tr>
<tr>
<td>1</td>
<td>Rest day</td>
<td>70</td>
</tr>
<tr>
<td>race</td>
<td></td>
<td>water</td>
</tr>
</tbody>
</table>
Normally he gains about 4 pounds during the last two days before the event.

**Suggested Reading:** Use this case to explore the relationships among metabolic fuels during exercise. Chapter 81 especially pages 480-482 in Marks will be helpful.
CASE 500
Fat-less Fuel

The Patient: Lofata Burne, a sixteen year old female

Principal Complaint: Extreme fatigue, nausea and vomiting. The patient is sweaty and limp.

History: A 16 year old female who has experienced, since the age of 14 months, recurrent episodes of profound fatigue associated with vomiting and increased perspiration. These episodes usually occur after an overnight fast. During more severe episodes, she has to be admitted to the hospital where she improved within hours of initiating a glucose infusion. These episodes only occurred if fasted for more than 8 hours. Because her mother gave her food late at night and woke her early in the morning for breakfast, Lofata's physical and mental development had progressed normally. On the day of admission, she had missed breakfast and by noon became extremely fatigued, nauseated, sweaty and limp. She was unable to hold any food in her stomach and was rushed to the hospital.

Physical Findings: Physical exam reveals a 16 year girl in obvious distress. Her skin is cold and clammy. Her abdomen is soft with bowel sounds present. Her liver is not palpably enlarged.

Laboratory Results:

<table>
<thead>
<tr>
<th></th>
<th>Admission</th>
<th>After treatment</th>
<th>Two hours post treatment</th>
<th>Normal Values (fasting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood glucose (mg/dl)</td>
<td>38</td>
<td>120</td>
<td>60</td>
<td>70-110</td>
</tr>
<tr>
<td>Fatty Acids (mg/dl)</td>
<td>600</td>
<td>625</td>
<td>750</td>
<td>190-420</td>
</tr>
<tr>
<td>Keto acids (mg/dl)</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3-2.0</td>
</tr>
<tr>
<td>Insulin (mU/ml)</td>
<td>3</td>
<td>100</td>
<td>5</td>
<td>6-26</td>
</tr>
</tbody>
</table>

Treatment: A bolus infusion of glucose is administered intravenously. The symptoms respond dramatically to this therapy. Blood glucose levels are monitored after treatment. Lofata refuses food and two hours after the initial treatment, blood glucose levels are at 60 mg/dl and the Lofata complains of feeling ill again. An intravenous glucose infusion is started at a rate that maintains blood glucose levels at 80mg/dl until Lofata begins to eat.

Suggested Reading: Chapter 23 in Marks.
The Patient: Nella Plasty, a forty four year old woman

Principal Complaint: Follow up care after angioplasty

History: The patient, Nella P. presents to your office for follow up care. Three weeks ago she experienced severe substernal chest pain while riding her bicycle. She was able to complete her ride but when the pain persisted at home, she went to the emergency room. She was treated with sublingual nitroglycerin and the pain disappeared. She was admitted and a cardiac catheterization with angioplasty was performed. Results from a treadmill stress test performed yesterday show no ischemic changes and her resting EKG is normal. The cardiologist noted that her homocysteine levels were elevated and asked her to follow up with her family physician.

Nella is a computer programmer. She is happily married with two daughters, ages 12 and 16. She is an avid gardener enjoys many physical activities. She bicycles 4 to 5 miles, at least three times a week and walks a mile or two on the days she doesn't bicycle. She follows a high carbohydrate, low fat diet. She eats very little red meat and detests and vegetables. She does eat a small salad of iceberg lettuce and cucumbers for lunch every day. She does not smoke and only drinks an occasional glass of wine. Prior to her angina attack, she considered herself to be in great shape.

She has no history of any other illnesses and except for the birth of her children, has never been hospitalized. Both of her parents are in their 60's and in good health. Her grandmothers lived to ages 87 and 93.

Physical Findings: Physical exam shows an alert and oriented white woman. She is 66 inches tall and weighs 128 pounds.

Vital signs

<table>
<thead>
<tr>
<th>Temperature</th>
<th>98.5 F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiration</td>
<td>12/min</td>
</tr>
<tr>
<td>Pulse</td>
<td>60/min</td>
</tr>
<tr>
<td>BP</td>
<td>124/74 mmHg</td>
</tr>
</tbody>
</table>

Carotids are clear with no bruits; there is no jugular venous distention and no peripheral edema. Heart is regular in rate and rhythm without murmur or gallops. The remainder of the physical is noncontributory.
**Laboratory Results:**

<table>
<thead>
<tr>
<th></th>
<th>Nella P.</th>
<th>Normal values</th>
</tr>
</thead>
<tbody>
<tr>
<td>homocysteine</td>
<td>28 ( \text{\eta mol/ml} )</td>
<td>&lt;10 ( \text{\eta mol/ml} )</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>200 mg/dl</td>
<td>&lt;200 mg/dl</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>42 mg/dl</td>
<td>&gt;40 mg/dl</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>135 mg/dl</td>
<td>&lt;130 mg/dl</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>92 mg/dl</td>
<td>&lt;250 mg/dl</td>
</tr>
</tbody>
</table>

Lab values for the renal panel, liver panel and electrolytes are unremarkable.

**Medications:** She is taking aspirin 81 mg/day and atenolol 25 mg bid, both prescribed by the cardiologist. In addition she admits to taking 500 mg of vitamin C and 400 IU of vitamin E daily.

**Suggested Reading:** Review Chapters 39 and 40 in Marks. You will need to consult additional references.
The Patient: Arthur Hale, a twenty five year old man

Principal Complaint: Obesity, fatigue and weakness

History: Arthur Hale is a data entry clerk working at the University of New England in the admissions department. He is 25 years old and has been "fat for as long as I can remember". He is a friendly outgoing person. He majored in English in college and enjoys reading and movies. He frequently spends the entire day on Saturday in the movie theater watching three to four movies, one after the other. He is a member of a book discussion club that meets every Wednesday evening. He thought one of the new members of the club, Betty, was interested in him and he wanted to ask her to go out with him, but he felt too uncomfortable to do this because he was so fat. This was about a month ago at which time he weighed about 295 pounds.

Arthur was heavy throughout childhood but gained more rapidly during his high school and college years. He has a family history of both obesity and diabetes. His father and several aunts and uncles on his mother's side were diabetic. His maternal grandmother had a heart attack. At age 20, he weighed 260 pounds. His weight has been quite variable over the past 6 years ranging from a low of 215 pounds [(18 years old) following severe caloric restriction prior to high school graduation] to a high of 305 pounds [(22 years old) the summer after college graduation when he was living at home and couldn't find a job].

Arthur wanted to lose weight very rapidly this time, so he started a complete starvation regimen four weeks ago. He eats no food. He drinks water and takes vitamin and mineral supplements daily. He is now losing weight at the rate of about 2/3 of a pound per day (300 g/day). He has come to see you (the physician) because he is feeling tired and somewhat weak and Betty who majored in biochemistry in college suggested that this may be due to his diet.

Physical Findings: Physical exam reveals an obese male.

Height: 5'10"

Weight: 273 pounds

BP: 134/88

All other findings within normal limits

Laboratory Results: Arthur has been measuring his blood glucose levels since he started his fast and reports that the level has increased from about 60 mg/dl at the end of the first
week to 65 mg/dl now. Both fatty acid and keto acid levels in the blood are elevated. He is excreting 5 grams of nitrogen per day.

**Energy Expenditure:** You have estimated Arthur's daily energy expenditure to be about 1500 kcal per day.

**Suggested Reading:** Focus on the metabolic changes induced by the diet with particular attention to protein metabolism. Chapters 31 and 42 in Marks will be helpful.


CASE 800
Fish Foul

The Patient: Stannard Teleost, a nineteen year old male

Principal Complaint: Strong body odor and halitosis.

History: Stannard Teleost comes to your office complaining of body odor and halitosis. He is home for Thanksgiving during his first semester of college. He tells you that he has had five different roommates since he started college in September. He has been in a single room for the last two weeks after the residence advisor took him aside and said that he had to live in a single until he could get his body odor under control. Stannard says he showers at least twice a day and brushes his teeth after every meal. He uses deodorant and cologne regularly.

Stannard's nickname in grammar school and high school had been "Fishy". When not at college, Stannard lives with his parents and younger sister in an apartment over a fish processing plant.

You note a distinct odor of rotting fish emanating from Stannard.

Physical Findings: Physical exam reveals an alert, healthy, white male. All physical findings are within normal limits except for a strong smell of rotting fish that is evident in his breath and sweat.

Laboratory Results: Urine contains elevated levels of trimethylamine. Other laboratory values are within normal limits.

Treatment: You prescribe metronidazole. Stannard's friends notice a distinct improvement when he returns to school. He has been invited by a group of friends to move with them to a house off campus next semester.

Suggested Reading: Try running a journal search at MD Consult. http://home.mdconsult.com/groups/uneweng1973.html You will need to register to use this site.
The Patient: Abe Tory, a thirteen year old boy

Principal Complaints: Abe is hospitalized with symptoms of dysarthria, ataxia, dystonia, increased daytime sleepiness, impaired short-term memory, and inadequate, confused behavior

History: Abe was born, after an uneventful pregnancy, to healthy nonconsanguineous parents. After normal childhood development, Abe's mother noticed increasing clumsiness at the age of 9 years. Four years later, Abe was overtly ataxic; his school performance and his handwriting had severely deteriorated. He was hospitalized with symptoms of dysarthria, ataxia, dystonia, increased daytime sleepiness, impaired short-term memory, and inadequate, confused behavior.

Physical Findings: Abe was disoriented toward place and time. His muscle tone was increased, and tendon reflexes could not be elicited; however, abdominal muscle reflexes were present. He exhibited a marked disturbance of all proprioceptive qualities and a positive Romberg's test. Cranial nerves and results of ophthalmic examination were normal. Cerebellar signs comprised intentional tremor, dysmetria, and dysdiadochokinesia. The IQ (Wechsler Intelligence Scales for Children-Revised) was below normal (total, 81; verbal, 81; performance, 82).

Laboratory Results: Visual and brain stem evoked potentials were normal. Peripheral motor and sensory nerve conduction velocities were marginally reduced. Plasma alpha-tocopherol was extremely low with a value of 0.6 mumol/L (normal values are 14-24 mumol/L). Plasma cholesterol was at the lower margin of the normal range and did not change in response to alpha-tocopherol supplementation. Creatine kinase was mildly elevated (133 U/L). Levels of vitamins A, D, and K, apolipoproteins, very long chain fatty acids and results of liver function tests were normal. The absorption of dietary alpha-tocopherol was normal.

DNA Studies: Genomic DNA was isolated from white blood cells according to standard procedures. A portion of the DNA that codes for a certain protein was sequenced. Part of the sequence is shown below compared to that of a normal individual. The sequence begins at the beginning of a codon.

<table>
<thead>
<tr>
<th>Normal Person</th>
<th>CAAATCACTCCATCCGTAGCCAAGAAGATTG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abe</td>
<td>CAAATCTCACTCCATCCGTAGCCAAGAAGATTG</td>
</tr>
</tbody>
</table>
Suggested Reading: Chapter 15 in Marks.

Try running a journal search at MD Consult.

You will need to register to use this site.