

Diabetes Mellitus

- Mr. E, very big guy (260 lbs., 6'3")
- Recently has become weak and confused, difficulty in seeing.
- Wife reports
 - His father had diabetes
 - Drinking a lot at night, urinating frequently
 - Complains at night that his legs burn and tingle

Diabetes Mellitus

- Signs
 - Appeared dehydrated
 - Sunken eyes
 - Flat neck veins
 - Dry tongue
 - Skin tenting over sternum
 - BP 95/60
 - HR 110 b/min
 - Resp. Rate 20 b/min
 - Rectal Temp 102°F

Diabetes Mellitus

- Eye exam
 - No cataracts
 - Hemorrhages
 - Yellow exudates
- No murmurs or gallops
- Respiratory sounds normal
- Abdomen soft, no complaints of pain upon palpation
- Boils around hair line of neck and scalp (pus draining)

Diabetes Mellitus

- Admitted to ICU – ECG performed and blood drawn
 - ECG (1 am) – exhibits wide QRS and tall T wave (indicative of hyperkalemia)
 - Doctor administers 10 ml calcium gluconate (10% sol.)
 - Asked for a rapid response from the blood lab concerning potassium levels
 - Response
 - » Potassium level 6.9 (3.5 – 5)
 - » Glucose 1,390 mg/dl (60 – 100 mg/dl)
 - » Other blood results

Diabetes Mellitus

Time	Glucose	K ⁺	Na ⁺	Cl ⁻	BUN	Creatinine	WBC
Normal	60-100	3.5-5	136-145	98-106	10-20	0.7-1.4	4,500-11,00
1 AM	1,390	6.9	118	81	113	3.3	19,500
2 AM	1,344	5.2	125	87	108	3.2	
7 AM	950	5.1	132	105	102	2.9	

Diabetes Mellitus

- Doctor orders syringe with 20 units of regular insulin
 - Injected as a bolus, intravenously
 - To lower glucose and potassium levels
 - Administered 1 l 0.9% NaCl over a 1 hour period
 - To increase BP
 - Give antibiotics for an infection, most likely staph from boils (methicillin 1 g every 6 hours)
- Doctor received ABG's from respiratory therapist
 - pH = 7.34
 - PaCO₂ = 29
 - PaO₂ = 98
 - HCO₃⁻ = 15
- Doctor exclaims, diabetic ketoacidosis, well compensated, explaining Kussmal respirations

Diabetes Mellitus

- 1 Hour after calcium gluconate, insulin, saline administration
 - BP = 110/70
 - Serum K⁺ = 5.2 (still abnormal) – ECG reflected this
 - P wave almost absent
 - Tall T wave
 - QRS has narrowed
- Small doses of insulin given throughout the night (slowly adjusting glucose, why?)
 - By AM ECG normal
 - Near normal potassium levels, 5.1

Diabetes Mellitus

- Patient
 - Alert
 - Normal breathing
 - Glucose normal
 - Vision improved over days
 - Tingling and burning in legs remained
 - Orthostatic hypotension
 - Sent home
 - 1,800 cal diet – weight loss
 - Insulin
 - 25 units NPH/15 units regular in morning; 10 units NPH/5 units regular evening

Diabetes Mellitus

- Case Discussion

- Adult-onset (type II) diabetes mellitus

- Arrived at the hospital and was diagnosed the result of

- Ketoacidosis (compensated by Kussmal respirations)

- Very high levels of K^+ , hyperkalemia, abnormal ECG

- Administered calcium gluconate, binds with Na^+ channels and decreases depolarization until K^+ levels can be lowered

- Administered insulin which stimulates Na/K pump (moves K^+ into cells, especially muscle and liver)

Diabetes Mellitus

- BUN was high – Why?
 - Dehydration, reduced CO which reduced renal perfusion
 - BUN also could be the result of renal disease frequently seen in diabetics
- Causes of Diabetes – 5% of the population; two types, type I (requires insulin injections, IDDM or juvenile onset diabetes) and type II (typically doesn't require insulin, NIDDM or adult-onset; type II 4 x more common than type I)

Diabetes Mellitus

- Type I Diabetes Mellitus

- Usually detected during childhood, typically between the ages of 10 - 12
- Decrease in insulin the result of damage to beta cells in the islets of Langerhans
 - Usually the result of antibodies telling lymphocytes and other cells to kill these cells (could be inherited but not necessarily)

- Type II Diabetes Mellitus

- Usually over 40
- Target cells (i.e., muscle and adipose) become resistant to insulin, possibly the result of a decrease in receptors
- Pancreas produces insulin but not enough to overcome the resistance, a relative deficiency of insulin
 - Can be corrected via strict diet and use of oral hypoglycemic medications (sulfonylurea compounds [pancreas secretes more insulin, target cells become more responsive])
 - May require insulin during times of stress, i.e. infection Mr. E, can't be taken by mouth - why?

Diabetes Mellitus

- Contributing Factors to Type II Diabetes
 - Obesity
 - High carbohydrate diet
 - Pregnancy
 - Stress: surgery, infections
 - Excess: growth hormone, cortisol, somatostatin
 - Drugs: prednisone, thiazide diuretics (why?)
 - Aging

Diabetes Mellitus

- Diagnosing Diabetes
 - Symptoms
 - Polyuria (nocturia)
 - Polydipsia
 - Polyphagia – unlike other neurons, cells of the hypothalamic satiety center require insulin for glucose to enter – can result in obesity
 - Visual problems
 - Fatigue
 - Infections
 - Neuropathy

Diabetes Mellitus

– Diagnostic Studies

- Blood glucose – when fasting blood levels are 140 mg/dl or greater
- Glucose Tolerance Test
 - If fasting glucose < 140 but > 115, this test is done to confirm diabetes
 - Patient eat high carbo diet for 3 days, day of test drinks 75g of glucose
 - Blood sampled every 30 min. for 2 hours
 - » If normal, blood glucose will never exceed 200, and after 2 hours levels will be less than 140
- Urine Glucose
- Glycosylated Hemoglobin

Diabetes Mellitus

- Treatment
 - Education
 - What the disease is
 - How to measure glucose levels
 - Signs and Symptoms of too little or too much insulin
 - Exercise
 - Diet
 - Low carbohydrate, those ingested should be complex
 - Low calorie
 - Low saturated fats
 - Numerous small meals

Diabetes Mellitus

- Insulin and Oral Hypoglycemic Agents
 - Oral
 - Induce β cells to secrete insulin
 - Slows liver clearing of insulin
 - Reduces glucose synthesis by the liver
 - Different forms work in different amounts of time, for different times, and accentuate one of the above actions
 - Insulin
 - Required by all type I diabetics and 35% of type II
 - Three major forms
 - » Rapid Acting – Lantus, Lispro, Regular, Semilente
 - » Intermediate Acting – NPH and Lente
 - » Long Acting – Ultralente and Aspart
 - Continuous Subcutaneous Insulin Infusion (CSII)
 - Inhaled