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Disease State: Type 2 Diabetes

Etiology:

Risk Factors: physical inactivity, obesity (especially intra-abdominal), older age, previous history of gestational diabetes, impaired glucose tolerance, race and ethnicity, family history of diabetes; The exact cause of Type 2 Diabetes is still unknown, but both environmental and genetic factors are thought to be important; Three possible defects that may influence the development of Type 2 Diabetes: 1) An abnormal pattern of insulin secretion that is either excessive or inadequate, 2) Glucose uptake at the cellular level is decreased (insulin resistance) due to either a receptor or post-receptor defect, 3) Release of glucose by the liver may increase in the early morning hours

How the Condition is Diagnosed:

Fasting Blood Glucose (FBG): if >126 mg/dL on two or more occasions; **Post-Prandial Blood Test:** if blood sugar > 160 mg/dL 2 hours after eating; **Glucose Tolerance Test (GTT):** if at 120 min blood sugar is 205 mg/dL AND greater than 205 mg/dL at either 60 or 90 minutes (Adult), if >200 mg/dL at 60 or 90 minutes AND >170 mg/dL at 60 minutes, or if >140mg/dL at 120 minutes AND at 120 minutes (Child); **Glycosylated Hemoglobin A1c (HbA1c):** not used for diagnosis of disease so much as used for monitoring control of blood glucose once diagnosed; **Genetic testing** may identify those most at risk of developing diabetes (mostly Type 1, but to a small degree in Type 2)

Physiological Effects:

Type 2 Diabetes results in hyperglycemia d/t the peripheral cells' resistance to the circulating insulin; hyperglycemia leads to glucosuria which causes the classic symptoms of Diabetes: polyuria, polydipsia, and polyphagia, as well as dehydration; Long-term side effects include: retinopathy (central retinal vein occlusion or microcirculatory changes), nephropathy, atherosclerosis, and peripheral and autonomic neuropathy, peripheral neuropathy usually affects the hands and feet and may cause numbness, or pain, autonomic neuropathy may manifest itself in several ways including: gastroparesis, nocturnal diarrhea, impotence, and orthostatic hypotension, because hyperglycemia impairs the pt's resistance to infection uncontrolled diabetes may result in skin and urinary tract infections as glucose content of the epidermis and urine encourages bacterial growth, fungal infection such as oral and vaginal thrush also increases; Foot Ulcers and Joint Problems are important causes of morbidity in DM, the major cause is polyneuropathy as the sensory denervation impairs the perception of trauma, alterations in proprioception lead to abnormal pattern of wt bearing and sometimes to Charcot's Joints

Nutritional Implications of Disease State:

May lead to decreased renal function and infection

May lead to atherosclerosis and hypertension

May cause increased TG d/t fatty acid synthesis and decreased lipolysis

May cause increased TG storage d/t fatty acid synthesis and decreased lipolysis

Hypoglycemic agents may cause hypoglycemia and lactic acidosis

Hypoglycemic agents may cause an increase or decrease in appetite and wt gain

Hypoglycemic agents may cause nausea, vomiting, diarrhea, gas bloating

Anti-hypertensive agents may result in hyperkalemia, Acute Renal Failure, dry irritation cough

Lab Alterations Seen in Disease State:

| <u>Lab Test Alteration</u> | <u>Normal Value</u> | <u>Alteration</u> | <u>Cause of</u> |
|--|----------------------------|--------------------------|--|
| C-Peptides | 0.5-3.0 ng/mL | depressed or normal | Decrease in insulin production |
| Fasting Blood Glucose | 70-110 mg/dL | >126 mg/dL | Glucose not being cleared from blood d/t insulin resistance |
| HbA1c [glucose] | 3.5-8.5% (non-diabetic) | >8.5% | Increased [blood-glucose] causes increased glycosylation of proteins |
| Post-Prandial Blood Test being cleared | <160 mg/dL after 2 hours | >160 mg/dL | Glucose not from blood d/t insulin resistance |
| Genetic Testing | negative | positive | Testing for presence of "diabetes" gene, identifies those at greatest risk |
| Fructosamine Level chemical | NL | elevated | Fructosamine formed by rxn of glucose and plasma protein Reflects glucose control over past 1-3 weeks |

Medications Commonly Used in Disease State:

| <u>Medication</u> | <u>Action</u> | <u>Nutritional Concerns</u> |
|--|----------------------------|---|
| <u>Insulin</u> Rapid-Acting (Humalog) | Replace endogenous insulin | quick acting, less risk of hypoglycemia |
| Short-Acting (Regular) | Replace endogenous insulin | risk of hypoglycemia |

| | | |
|--|---|--|
| Intermediate-Acting (NPH, LENTE) | Replace endogenous insulin | risk of hypoglycemia |
| Long-Acting (ULTRALENTE) | Replace endogenous insulin | risk of hypoglycemia |
| Premixed (70/30, 50/50) | Replace endogenous insulin | risk of hypoglycemia |
| <u>Oral Hypoglycemic/Sensitizing Agents</u> | | |
| Chromium Nicotinate | Sensitize insulin receptors | Cr may compete with Fe |
| on | via Glucose Tolerance Factor: Chromodulin | apotransferrin, but unlikely to cause Fe deficiency |
| Tolbutamide | stimulates insulin secretion increased sensitivity | risk of hypoglycemia |
| Chlorpropamide | stimulates insulin secretion increased sensitivity | risk of hypoglycemia increased appetite, wt gain anorexia, N/V/D, no alcohol |
| Gilpizide | stimulates insulin secretion increased sensitivity | risk of hypoglycemia wt gain, nausea, diarrhea, limit alcohol |
| Glyburide | stimulates insulin secretion increased sensitivity | risk of hypoglycemia dyspepsia, N/D, constipation wt gain, appetite disturbances |
| Metformin renal or | decreased hepatic-glucose | contraindicated with |
| | | hepatic disease or alcoholism, contraindicated during lactic acidosis and acute hospitalization |
| taste | production, may improve insulin | N/V/D, bloating, gas, metallic |
| | sensitivity in those who lose wt | |
| Acarbose with | alpha-glucosidase inhibitor | GI side effects common, take |
| | (delays CHO digestion/absorption) | food, gas, bloating, diarrhea |
| Troglitazone hepatotoxic | insulin sensitizer in skeletal muscle | potentially |
| | decreased hepatic-glucose production | |
| <u>Anti-hypertensive ACE Inhibitors</u> | Inhibits Angiotensin Converting | potential hyperkalemia, no |

| | | |
|---------------------|---|---|
| irritating | Enzyme and inhibits degradation concurrent NSAIDs, dry | |
| | Bradykinin | cough, can cause Acute Renal Failure in hypovolemic pt |
| Calcium Antagonists | Potent Peripheral Vasodilator | possible abnormal heart function dizziness, flushing, nausea heartburn, pedal edema |

Medical Treatment of Disease:

Exercise: important in controlling Type 2 Diabetes, results in increased insulin sensitivity possibly d/t exercise induced GLUT 2 transporter, when strong family history present reduction in body weight (through diet and exercise) can delay the onset of Type 2 Diabetes; at least 30 min of exercise is recommended for those with Type 2 Diabetes as is greater frequency (at least every other day), use of an oral hypoglycemic agent increases the risk of exercise induced hypoglycemia during or after exercise

Peritoneal dialysis if pt progresses to renal failure

See medications above

Surgical Treatment of Disease:

Hemodialysis if pt progresses to renal failure

Beta Cell Transplant (mostly Type 1, not yet perfected)

Roux-en-Y Gastric Bypass, Vertical Banded Gastroplasty, and Biliopancreatic Diversion (BPD) to treat morbid obesity associated with Type 2 Diabetes

Nutritional Treatment of Disease:

Weight management important, should maintain or achieve IBW; Energy; BEE x 1.2-1.3 depending on activity level; CHO: 50-60% but slightly lower could be better, complex CHO 45-50%, up to 5% as simple CHO OK, try for lower glycemic foods or mix to achieve a lower glycemic effect; Fiber: 40 g/d or 12 g/1000 kcal, need to increase fluid intake with increased fiber; Sugar Substitute Sweeteners: aspartame, saccharin, and sucralose do not contribute energy, fructose and sorbitol must be accounted for and their use may result in diarrhea; Protein: 0.8 g/kg BW (Adults), and 1.7 g/kg BW (Children), needs based on serum albumin during stress; Fat: $\leq 30\%$ of total kcal, P:S:M – 1:0.7:1.3- increasing MUFA's may help decrease blood-glucose and TG levels, Cholesterol ≤ 300 mg/d; Sodium: ≤ 3000 mg/d, but varies depending on pt; Alcohol: occasional use, negatively affects blood-sugar, negatively affects blood TG; pt should be taught how to use the Exchange Diet or Carbohydrate Counting to monitor CHO intake; Meals: should be planned out ahead of time, meals spread throughout the day work best to maintain blood glucose levels