Prevalence of Diabetes Mellitus (DM) in the United States, all ages.

- Total: 25.8 million people or 8.3% of the population have diabetes.
- Diagnosed: 18.8 million people
- Undiagnosed: 7 million people

(23.6 million / 7.8% CDC 2007)

Diabetes & Pathophysiology

- Leading cause of End Stage Renal Disease (ESRD)
- 56,000 lower-limb amputations/year
- Leading cause of adult blindness:
  12-24,000 cases/year
Diabetes: Estimated Economic Impact in the U.S. in 2007
• Total $174 billion (direct medical $116 billion). People diagnosed with Diabetes incurred costs that were 2.3 X higher than what would be in the absence of the disease.
• Indirect costs: $58 billion (disability, work loss, premature mortality)

The Healthy Pancreas & Liver
• High Blood Sugar: Pancreas releases Insulin, cells uptake glucose. The Liver converts glucose to glycogen for storage. Results in lower blood glucose level.
• Low Blood Sugar: Pancreas releases glucagon (antagonist to Insulin) which causes Liver to convert the stored glycogen to glucose (glyconeogenesis). Thus blood glucose level rises.

Diabetes Mellitus
• Type I (5-10% of diabetic population): lack of Insulin secretion due to autoimmune destruction of Beta Cells (genetic, immunological & environmental factors).
• Treatment:
  – Insulin Therapy
  – Dietary Restrictions
  – Exercise

* Pearson Education, Inc. 2011
Diabetes Mellitus

• **Type II** (90-95% of diabetic population): Insulin receptors in the target cells have become insensitive or resistant to the hormone. Also, in response, hypersecretion of insulin by the Pancreas, leading to beta cell exhaustion and death.

• Treatment:
  – Oral Hyperglycemic Medications
  – Lifestyle Modifications

Impact Upon Health

Poorly managed or uncontrolled Type I & II Diabetes can affect many parts of the body and can lead to serious acute and chronic complications such as heart disease, CVA, blindness, kidney damage, and amputation.

Case Study

• Mrs. S. is a 49 y.o. Hispanic female with a history of Type 2 DM who was brought into the ED via ambulance for decreased level of consciousness. Mrs. S. has been despondent over the passing of her husband 3 weeks ago and has not been eating regularly, yet continued taking her diabetic medications. Her sister found her this morning at home unresponsive and called 911. At the scene, ParaMedics found her FSBs to be 27. IV access was obtained and 2 ampules (AMPS) of Dextrose 50% IV given, cardiac monitor & supple-mental O2 initiated, and then she was transported to the ED.
Case Study Cont’ed

• Mrs. S. was stabilized in the ED, and after 6 hours is now being admitted to the Med/Surg Floor. The nurse taking report is told the patients FSBS’s have been 74 at 1300, 86 at 1400, and 135 at 1500. She has received a total of 4 AMPS of Dextrose 50% IV, and 1 liter IV of Dextrose 5% in Lactated Ringers Solution. She is awake and alert and has been taking Clear Liquid fluids without difficulty.

Neuman Systems Model

• To what depth did the seriously low blood sugar penetrate Mrs. S.’s system/core?
• What level of prevention was initially instituted?

Medication Review

• The Nurse learns that Mrs. S. takes the drug Metaglip at home. (Combination of glipizide (Glucotrol) and metformin (Glucophage). Her normal dosage is 5/500mg PO BID. Her last dose was at bed time yesterday. Her last Hgb A1C two months ago was 6.7%.
Hgb A1C

• When hyperglycemia is prolonged, the RBC becomes saturated for its life span with glucose. This lab test gives an average value of blood glucose levels over the last 3 months. Optimal range is <7% for diabetics, 7-7.5% good control, 7.6-8.9% fair, >8.9% poor diabetic control. (4-6% is for non-diabetic patients).

  Corbett, J., 2004

Glipizide (Glucotrol)

• Action: This 2nd Generation Sulfonylurea stimulates the release of insulin from pancreatic islet cells and increases the sensitivity of insulin receptors on target cells.

• Adverse Effects:
  – Common: Nausea, heartburn, dizziness, H/A, drowsiness
  – Serious: Hypoglycemia (tremors, sweating, palpitations) cholestatic jaundice, blood dyscrasias
  – Other: Wt. gain, hepatotoxicity, disulfiram-like reaction with alcohol (flushing, palpitations, and nausea).

  Pearson Education, Inc. 2011

Metformin (Glucophage)

• Action: This Biguanide oral hypoglycemic, (the only drug in this class) decreases the hepatic conversion of glycogen to glucose (gluconeogenesis) and reduces insulin resistance. It does not promote insulin release from the pancreas and does not cause wt. gain or hypoglycemia.

• Adverse Effects:
  – Common: Flatulence, nausea/diarrhea, anorexia, abd. pain, bitter/metallic taste
  – Serious: lactic acidosis (rarely)

  Pearson Education, Inc. 2011
Insulin Sliding Scale

• Admission orders for Mrs. S. include Regular Insulin Sliding Scale Orders. These orders require checking the finger stick blood sugar (FSBS) level before each meal and at bedtime, a 2000 calorie American Diabetes Association (ADA) diet, and insulin orders as follows:

* Insulin Sliding Scale

- Regular Insulin (Humulin R) coverage:
  - FSBS 0-80: give 4 oz O.J. PO or 1/2 AMP D50% IV and repeat FSBS in 30 min, if FSBS <80 2nd time repeat above and call Provider.
  - 81-150: 0 units Humulin R SubQ
  - FSBS 151-250: 4 units Humulin R SubQ
  - FSBS 251-350: 8 units Humulin R SubQ
  - FSBS 351-450: 12 units SubQ and call Provider
  - FSBS > 450: Call Provider

- Alerts:
  - Hypoglycemia may occur quickly if client is not eating or blood sugar is low
  - Only type of insulin that is given IV
  - Rotate injection sites
  - Administer 30 minutes before meals
  - Pregnancy Category B
  - Monitor Serum K+ levels

Pearson Education, Inc. 2011
Adverse Effects

- Most Serious is Hypoglycemia, due to:
  - Too much insulin
  - Improper timing of insulin with food intake
  - Skipping a meal
  - Heavy exercise

* Pearson Education, Inc. 2008

Fundamental Principal

- The right amount of insulin must be available to cells when glucose is available in the blood.
- Administering too much insulin or when little or no glucose is available can cause coma and death.

Signs/Symptoms of Hypoglycemia:

Tachycardia, confusion, nausea, paleness, tremors, irritability, H/A, light-headedness, anxious, sweating, drowsiness or decreased level of consciousness

**Severe** Hypoglycemia:

convulsions, coma, death
Ketosis

- In the absence of Insulin, Ketones form and accumulate in response to inadequate carbohydrate metabolism and accelerated lipid (fatty acid) metabolism. This results in lower systemic pH, ketonuria, increased respiratory rate and a fruity odor on the breath. Untreated, can lead to ketoacidosis (DKA), coma and death. More common in Type I DM.
  - Mosby’s Medical & Nursing Dictionary 1983
  - Pathophysiology, Copstead, L., Banasik, J., 3rd Ed., 2005

Hyperosmolar Hyperglycemic State (HHS)

- HHS (formerly called Hyperosmolar Nonketotic Hyperglycemic Coma), manifests as severe hyperglycemia and dehydration with little or no ketosis. Most common with elderly institutionalized patients who are Type II DM and are unable to recognize or appropriately respond to thirst. Can be life threatening.

  - Pathophysiology, Copstead, L., Banasik, J., 3rd Ed., 2005
  - Pearson Education, Inc 2011

HHS

- Cause: Insufficient amounts of circulating insulin
- Signs/Symptoms: gradual onset; flushed, dry and warm skin. Polyuria, polyphagia, polydipsia, drowsiness, glycosuria, ketonuria, acetone breath. Blood sugar may rise above 600 mg/dl
- Treatment: fluid replacement, correct electrolyte imbalance, low dose IV insulin
- Outcome: 20-40% mortality rate

  - Pearson Education, Inc 2011
Potential/Actual Nursing Diagnosis for Mrs. S.

- Injury (hypoglycemia), Risk for, related to adverse effects of drug therapy
- Imbalanced Nutrition, Risk for, related to adverse effects of drug therapy, poor appetite related to recent loss of spouse.
- Ineffective Therapeutic Regimen Management related to Knowledge, Deficient
- Altered Compliance/Noncompliance related to inappropriate dosing of oral diabetic medications.

Planning: Client Goals & Expected Outcomes

- The Client (Family/S.O.’s) will:
  - Immediately report irritability, dizziness, diaphoresis, hunger, behavior changes, changes in level of consciousness (LOC)
  - Demonstrate understanding of necessary life-style modifications for successful drug therapy
  - Demonstrate understanding of drug action and side effects

Implementation

- Check FSBS AC & HS, & PRN fever, N/V/D, tachycardia, confusion, sweating, drowsiness
- If FSBS > 300, Check urine for Ketones, to avoid Ketoacidosis
- Monitor VS, % of meals eaten, (Daily weights prn)
- Provide simple sugars at first signs of Hypoglycemia
- Explore coping mechanisms and supportive aids and services

Pearson Education, Inc. 2011

Pearson Education, Inc. 2008
Nurse Evaluation of Drug Therapy

Confirm that client goals and expected outcomes have been met
   - the client states need to immediately report irritability, dizziness, diaphoresis, hunger, behavior changes, changes in LOC
   - The client verbalizes the need to make necessary life-style modifications for successful drug therapy
   - The client demonstrates an understanding of drug action by describing side effects and precautions
     • Pearson Education, Inc. 2008

Next Morning

• Mrs. S. has ordered her breakfast and the nurse asks her if she feels hungry or is nauseated. She denies nausea but has no appetite. The nurse explains that it is important to be well nourished and it good she has ordered her breakfast already. The nurse reinforces the need to eat after taking diabetic medications to insure the blood sugar remains WNL to avoid injury.

Regular Insulin

• The Nurse validates Mrs. S.s’ ID, and obtains a FSBS which is 161. Breakfast is due to arrive in ½ hour. The Nurse draws up 4 Units of Humulin R in an Insulin syringe, has another Nurse witness this and administers the medication SubQ to the Left Deltoid. The Nurse knows the Regular Insulin will be available in the blood in ½ hour to transport glucose into the cells, so he/she will insure the food arrives within that time frame.
QSEN: Safety

• Minimize risk of harm to patients and providers through both system effectiveness and individual performance

  Knowledge, Skills, Attitudes:
  – Culture of safety- value own role in preventing errors
  – Standardized practices: 2 nurses checking patient ID, medication, dose, timing, expiration date


Mrs. S.

• The nurse asks Mrs. S. if she would like her priest to visit her here in the hospital and she would. The nurse contacts Father A. who came in later that day. Mrs. S.’s sister, Beatrice, validates that Mrs. S. feels much relief after sharing her loss and grief with her priest and she plans to continue to talk with him.

  (Embodies QSEN Patient-centered Care)

Neuman Model

• Nurse proactive behavior demonstrates support of patient’s Psychological Variable (coping methods) and Reconstitution which strengthens the Lines of Resistance. This results in a higher level of Wellness.
Other Oral Hypoglycemic Drugs

• **Alpha-glucosidase Inhibitors** (acarbose or Precose)
  – Action: block enzymes in the small intestine which break down complex carbohydrates into monosaccharide’s, delaying glucose digestion
  – Adverse Effects: minimal, usually GI related (cramping, diarrhea, flatulence). Rarely Liver impairment
    • Pearson Education, Inc. 2011

Thiazolidinediones (Glitazones)

pioglitazone (Actos), rosiglitazone (Avandia)
Reduce blood sugar levels by decreasing insulin resistance and inhibiting hepatic glyconeogenesis.
• Optimal effect may take 3-4 months

Thiazolidinediones (Glitazones)

• Adverse effects: fluid retention, H/A, weight gain, hepatotoxicity (troglitazone (Rezulin) withdrawn in 2000)
• These drugs are contraindicated in clients with history of heart failure or pulmonary edema
• No hypoglycemia with this class of drug
Meglitinides

- nateglinide (Starlix), repaglinide (Prandin) act by stimulating insulin release from the Pancreatic Islet cells
- 2-4 hour duration
- Well tolerated, similar efficacy as sulfonylurea’s
- Adverse Effect: Hypoglycemia

Other Insulins

- **Insulin glargine** (Lantus), a recombinant human insulin analog. SubQ dosing once a day at HS, has a long acting constant hypoglycemic action with no peak effect. Not to be mixed with any other insulin.
- **NPH** (isophane): SubQ dosing, onset of action between 1-4 hours, peaks in 8-12 hours, duration 18-24 hours.
- **Insulin lispro** (Humalog) SubQ and infusion pump, onset of action is 10-15 minutes, peaks in 30-60 minutes, duration of 5 hours or less.

Insulin Protocols

- Always match the Units of the insulin syringe with the Units of the Insulin Vial (U100 syringe with U100 vial)
- Clear Insulin drawn up first into syringe, then cloudy-avoid mixing slow acting with fast acting insulin
- High risk medication—always a 2nd nurse double checks 1st nurse’s patient, dosing and orders
Fundamental Principal

• “The Right amount of Insulin must be available to the cells when glucose is available in the blood. Administration of Insulin when glucose is not available can lead to serious hypoglycemia and coma”. And death.

  • Pearson Education, Inc. 2011

Implementation & Education

• Mrs. S. has maintained her blood sugars within the 90-140 mg/dl range with the Insulin Sliding Scale coverage. She is eating properly and verbalizes how it is necessary to eat 3 meals a day and a snack at bed time to maintain a normal blood sugar. She also understands that at home if she becomes despondent and does not eat, she is not to take her Metaglip and will call her provider. She demonstrates good technique when checking her blood sugars.

Patient & Family Education

Upon discharge, Mrs. S. will stay at her sister Beatrices' home, where her daughter Nina and her two sons also live. Beatrice, Nina and Mrs. S. verbalize their understanding that Mrs. S. will immediately report loss of appetite, irritability, dizziness, diaphoresis, hunger, behavior changes, and changes in LOC. They will then check Mrs. S.’s blood sugar and have her eat some simple carbohydrate food/drink to correct hypoglycemia.
Education Continued

The client has verbalized the need to acknowledge her sense of loss and grief, and utilize her family, friends and religious supports. She will care for herself properly by adhering to the medication schedule, food and nutritional intake and moderate activity as tolerated. The client demonstrates an understanding of drug action by describing side effects and precautions.

Neuman Systems Model

While in the hospital, the education of Mrs. S. reflected which level of prevention?

Citations

• Pathophysiology, Copstead, L., Banasik, J., 3rd Ed., 2005