Chapter 57: Caring for Clients With Diabetes Mellitus

Pancreas: Anatomy and Physiology

- Below the stomach with head of gland close to the duodenum
- Islets of Langerhans
  - Insulin: Beta cells
    - Carries glucose into cells
    - Promotes liver’s storage of glucose as glycogen
    - Inhibits breakdown of glycogen into glucose
  - Glucagon: Alpha cells
    - Stimulates breakdown of glycogen into glucose in the liver
Type 1 Diabetes Mellitus

- Insulin-dependent diabetes mellitus (IDDM)
  - AKA: Juvenile diabetes
  - No insulin is produced
  - Blood glucose level ↑
  - Body breaks down fat (lipolysis) and protein for cellular energy
  - Ketones accumulate in blood resulting in ketoacidosis

Type 2 Diabetes Mellitus

- Non-insulin-dependent diabetes mellitus (NIDDM)
- Insulin resistance:
  - Blood glucose remains ↑
  - Increased conversion of glycogen to glucose by the liver
- Linked to obesity, esp. intra-abdominal obesity
- Beta cells respond to ↑ blood glucose by producing more insulin
  - Overstimulation exhausts insulin production and eventually insufficient insulin is produced

Diabetes Mellitus

- Prediabetes Mellitus
  - Can lead to
    - Type 2 diabetes
    - Heart disease
    - Stroke
    - Impaired fasting glucose (IFG)
      - 100 to 125 mg/dL
    - Impaired glucose tolerance (IGT)
      - 140 to 199 mg/dL
What kind of disorder is Diabetes Mellitus?
A. Metabolic
B. Psychiatric
C. Renal
D. Neurologic

Diabetes Mellitus affects the metabolism of:
A. Carbohydrates
B. Fats
C. Proteins
D. All of the above

Diabetes Mellitus
S/S
Classic symptoms:
- Polyuria
- Polydipsia
- Polyphagia
Diabetes Mellitus

S/S
- Weight loss
- Weakness
- Thirst
- Fatigue
- Dehydration
- Blurred vision
- Infections: Skin, urinary tract, vaginal

Why do patients with Diabetes Mellitus have an increased incidence of skin, urinary, and vaginal infections?

Diabetes Mellitus

Diagnostics:
- Blood: see table 57-1
- Urine: glucose & ketones
- Hemoglobin A1c test

Medical Management:
Dependent upon type of DM & insulin prod
- Diet/exercise/weight loss
- Insulin
- Oral antidiabetic agents
- Pancreas/islet cell transplantation
HgA1c reflects the amount of glucose stored over _______ days.

Normal HgA1c is < _____

**Diabetes Mellitus**

**Diet/Weight loss/Exercise:**
- Specially prepared diets with exchanges and calorie counts
- Moderate wt loss improves insulin use
- Exercise
  - Lowers blood sugar
  - Improves blood circulation
  - Pt. need to exercise consistently, not sporadically

**Diabetes Mellitus**

**Insulin:**
- Human: more commonly used
  - Fewer allergic reactions
  - More effectively used
- Beef/pork
  - See table 57-2 for Insulin preparations
  - Onset: when the insulin first begins to act in the body
  - Peak: time when insulin is exerting maximum action
  - Duration: time insulin remain in effect
When combining Regular and NPH insulin in the same syringe:
A. Draw-up the NPH first
B. Never mix the two insulins
C. Remember to administer IM
D. Draw-up the Regular first

Diabetes Mellitus

Administration:
- Prescribed in units
- Route: sub Q or IV (regular only)
  - Abdomen is preferred site
- Site rotation to avoid lipoatrophy and lipohypertrophy
- Insulin pen
- Jet injector
- Insulin pump

Figure 57-8 Absorption of Insulin through a needle vs. Jet Injector

Diabetes Mellitus

Oral Antidiabetic Agents
For patients with Type 2 who:
- Fasting blood glucose level<200 mg/dl
- Insulin requirement of <40 units/day
- No ketoacidosis
- No renal/hepatic disease
Diabetes Mellitus

Oral antidiabetic agents-type 2

- Sulfonylureas and meglitinides
  - "Insulin releasers"
  - Stimulate pancreas to secrete insulin
- Biguanides and thiazolidinediones
  - "Insulin sensitizers"
  - Help tissues use insulin more efficiently
- Alpha-glucosidase inhibitors
  - Slows breakdown of complex carbs into glucose in intestines
  - Glucose is absorbed more slowly from small intestine

True or False

Oral antidiabetic agents are also called oral insulin.

Diabetes Mellitus

Medical Management:
- Pancreas transplantation
- Islet cell transplantation

Nursing Management:
- Physical exam: observe for physical changes
  - Skin: infection, temp, color
  - Pulses
  - Edema
  - Visual changes
  - Weakness/loss of sensation
- Monitor blood glucose levels ac & hs
Diabetes Mellitus
Client and Family Education

- Diet
- Meds, Insulin administration
  - Rotation of injection sites
  - One anatomic region preferred (abdomen)
- Blood glucose monitoring
- Skin care; foot care
- Exercise; weight reduction
- Drinking adequate water
- S/SX of hyperglycemia and hypoglycemia
  - How to correct hypoglycemia

Complications of Diabetes Mellitus

- Diabetic Ketoacidosis (DKA)
- Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNKS)
- Hypoglycemia

Diabetic Ketoacidosis (DKA)

- Type of metabolic acidosis
- Acute insulin deficiency or inability to use insulin secreted from pancreas

Causes:

- Uncontrolled or undiagnosed diabetes
  - Brittle diabetes
- Infection
- Noncompliance with medication regimen

Acidotic state; can result in coma & death
Diabetic Ketoacidosis (DKA)

S/S:
- Signs of dehydration:
  - Warm, flushed, dry skin
  - Thirst
- Signs of ketoacidosis:
  - Acetone breath odor (fruity)
  - Kussmaul's respirations
- Weakness
- Anorexia, vomiting, abdominal pain
- Drowsiness
- Pulse rapid/weak, BP-low
- BS elevated to 300-1000 or more

Kussmaul respirations are:

a. Deep, gasping
b. Shallow, rapid
c. Associated with exercise
d. Considered a usual breathing pattern

Diabetic Ketoacidosis (DKA)

Medical Management:
- Main goals
  - Reduce the elevated blood glucose
  - Correct fluid and electrolyte imbalances
  - Clear the urine and blood of ketones
- IV Insulin; glucose
- Isotonic fluid
- Potassium replacements
What would be administered to correct the blood sugar in DKA?

A. Dextrose 50% IV  
B. Regular insulin IV  
C. Orange juice PO  
D. Glucagon SL

Diabetic Ketoacidosis (DKA)

Nursing Management:
- Monitor IV  
- Obtain V/S  
- Monitor for fluid overload  
- Foley  
- Monitor labs-electrolytes/glucose  
- Monitor urine-ketones  
- Cardiac monitor

Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNKS)

Acute hyperglycemia without ketosis  

Causes:
- Serious illness  
- Undiagnosed diabetes  
  - Type 2  
- Medications that ↑ blood sugar  

Blood glucose >500
Why does ketosis not develop in patients with HHNKS?

Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNKS)

S/S:
- Hypotension
- Mental status changes
- Extreme thirst
- Dehydration: dry mucous membranes, poor skin turgor
- Tachycardia
- Fever
- Neurologic changes
- Electrolyte changes
  - ↓ Serum potassium & ↓ sodium
  - ↑ Serum osmolarity
  - Elevated blood glucose

Medical Management:
- Adm insulin
- Correct F/E imbalances

Nursing Management:
- Assess/monitor glucose & F/E
- Monitor hydration
- Monitor V/S
- Monitor cognitive status
**Hypoglycemia**

- Blood glucose level below 60 mg/dl.

**Causes:** for a patient with diabetes
- Not eating at all, still taking insulin or oral antidiabetics
- Not eating sufficient calories to compensate for glucose-lowering meds
- Exercising more than usual
- Alcohol consumption

**Hypoglycemia**

- Weakness
- Headache
- Nausea
- Excessive perspiration
- Personality/behavior changes
- Tremors
- Double vision
- Confusion
- Drowsiness
- Dizziness
- Nervousness
- Difficulty with coordination
- Hunger

One of the first signs of hypoglycemia is:

A. Flushed, dry skin
B. Kussmaul respirations
C. Thirst
D. Diaphoresis
Hypoglycemia

Diagnostics:
- Sx
- Hx
- Blood glucose levels

Medical/Nursing Management:
- Adm 15-20g of simple carbohydrate
  - Glucose gel in buccal cavity if unconscious
- Glucagon (SQ, IM, IV)
- 50% glucose IV (D50)

Hypoglycemia

Prevention:
- Timely provision of food in coordination with insulin administration.
- Monitor consumption of meals/snacks.
- Inform physician if N/V/D or refusal to eat occurs.
- Administer insulin at prescribed times.
- Avoid insulin errors, nurse-nurse dosage check

Chronic Complications of Diabetes Mellitus

Peripheral Neuropathy
- Motor
- Sensory
- Autonomic

Diabetic Nephropathy
Diabetic Retinopathy
Vascular Disturbances
Peripheral Neuropathy

Neuropathy = pathologic changes in nerves

Causes:
- Poor blood glucose control
- Decreased circulation to nerve tissue
- Increased with smoking

Onset is gradual

Motor Neuropathy

- Muscles weaken/atrophy
- Joint support weakened
- Feet widen with bone structure deformity
- Pressure areas tend to ulcerate
- May lead to amputation

Sensory Neuropathy

- Paresthesias: abnormal prickling, tingling, burning or needle-like pain in the feet, legs and hands
- Potential for total sensation loss.
**Autonomic Neuropathy**

- Gastroparesis: stomach atony
- Urinary retention—UTIs, incontinence
- Erectile dysfunction
- Orthostatic hypotention
- Decreased ability to sense CP, angina—delayed response to cardiac episodes

**Peripheral Neuropathy**

**Diagnostics:**
- Neuro exam
  - Tuning fork (vibration)
  - Nylon filament (touch)
  - Electromyography (nerve conduction)

**Medical/Nursing Management:**
- Diet, exercise and medication to control BS
- Pain mgmt. with non-narc analgesics, antidepressants, anticonvulsants.
- T.E.N.S. Unit
- Foot care: see box 57-1, p994

**Diabetic Nephropathy**

- Progressive decrease in renal function
- Consequence of glomerular deterioration & impaired filtration of blood
- Poor glucose control contributes
- HTN accelerates the onset/progression

**S/s:** none at early stages
- Feet/hand swelling
- Gradual BP increase
- Weak, tired
- Urine positive for albumin, ↑ BUN & creatinine
Diabetic Nephropathy

Medical Management
- Control blood glucose levels, hypertension
- Drug therapy
  - Capoten, Cozaar slow progression
- Dietary protein reduction
- Smoking cessation

Nursing Management
- Monitor blood glucose and hemoglobin A1c results
- Check for albuminuria
- Explain the therapeutic regimen

Diabetic Retinopathy

Pathological retinal changes of pts with DM
- Vascular changes in retina

Causes:
- Inadequate BS control

Types:
- Non proliferative (milder)
- Proliferative (leads to blindness)

Figure 57-11
Top: In the normal eye
Bottom: In diabetic retinopathy

Diabetic Retinopathy

S/S:
- Blurred vision
- No vision in spotty areas
- Floating debris
- Diminished visual field
- Exam: swelling near macula of eye, changes in blood vessels
Diabetic Retinopathy
Medical/Nursing Management

- Control blood glucose
- Ophthalmic eval
- Lisinopril to improve blood flow
- Laser photoagulation & vitrectomy for leaking blood vessels
- Teaching
  - Encourage therapeutic regimen for tight glucose control
  - Client education
    - Complications of diabetes
    - Regular ophthalmic examinations

Vascular Disturbances

- ↑ atherosclerotic and arteriosclerotic changes
- Thickening of arterial walls
- ↑ incidence of CAD

S/S:

- Pale, cool extremities
- Leg cramps
- Uncontrolled infection, skin ulcers, gangrene
- Chest discomfort, MI
- Hyperlipidemia, ↑ triglycerides

Vascular Disturbances

Medical/Nursing Management:

- Blood glucose control
- Low fat diet
- Exercise
- Lipid lowering meds
- Vasodilators
- Antiplatelet meds
- Smoking cessation
- Aggressive wound healing/prevention
- Amputation
A diabetic foot ulcer can result because of:
A. Peripheral neuropathy
B. Motor neuropathy
C. Sensory neuropathy
D. All of the above

References