

OVERVIEW

- DISCUSS VARIOUS TYPES OF DIABETES
- REVIEW IMPACT OF DIABETES ON HEALTHCARE SYSTEM
- REVIEW POTENTIAL COMPLICATIONS AND PREVENTION OF THEM
- DISCUSS HYPO & HYPERGLYCEMIA
- REVIEW DIABETIC KETOACIDOSIS
- CASE SCENARIOS

Clinical Review
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DIABETES

- DEFINITION:
A general term referring to a variety of disorders characterized by excessive urination
- TYPES:
 - Insipidus (central, nephrogenic)
 - Gestational (usually temporary)
 - Mellitus

Diabetes Insipidus

- A metabolic disorder which results in deficient quantities of antidiuretic hormone (ADH or vasopressin) being released or produced

Gestational Diabetes

- Onset or recognition occurs during the second or third trimester of pregnancy
- Usually disappears post-pregnancy
- Studies have shown that women who have gestational diabetes may have an increased likelihood of developing permanent diabetes as they grow older
- Impact on pregnant mother: more common...
 - UTI's
 - Caesarian section
 - Pre-eclampsia
 - Polyhydramnios
- Impact on developing fetus:
 - Macrosomia (large baby)
 - Hypoglycemia
 - jaundice

Diabetes Mellitus

- Type 1
 - Formerly called Juvenile-onset or IDDM
 - May occur at any age
 - Characterized by requirement for exogenous insulin
 - Results from damage to beta cells in pancreas so they can no longer produce insulin
 - Cause remains uncertain
- Type 2
 - Formerly called Adult-onset or NIDDM
 - May occur at any age
 - Characterized by inappropriate insulin secretion or insulin resistance (muscle, liver, fat cells do not use insulin properly)
 - Initially, the pancreas may produce more insulin until it eventually loses its ability to secrete enough insulin to meet the demands

Tests

- Fasting blood glucose
- Glucose tolerance test
- Insulin sensitivity test
- C-Peptide
 - Monitors insulin production by the beta cells
 - Determines if enough insulin is being produced, if there is insulin resistance, or if it is necessary to supplement oral medications with exogenous insulin
- Hemoglobin A1C
 - This blood test indicates how well blood glucose has been controlled over the past 3 months (the life-span of a red blood cell)
 - It gives a picture of the average amount of glucose in the blood over that time period
 - Results: normal 4-6%
diabetic > 6% (the closer to 6%, the better)



Statistics

- Over 2 million Canadians have diabetes
- WHO estimates over 300 million people will have diabetes by 2025
- Leading cause of new adult blindness
- Heart disease is 2 – 4 X more common with diabetes, 80% of diabetics will die as a result of heart disease or stroke
- Diabetics account for 28% of new cases of kidney disease in Canada
- >50% of non-traumatic limb amputations are due to diabetes
- Diabetes and its complications cost the Canadian healthcare system an estimated \$13.2 billion/year

Complications

1. Dental – periodontal disease
2. Eyes – blindness, retinopathy
3. Foot problems – ulcers, sores, circulation
4. Cardiovascular – hypertension, coronary artery disease, stroke
5. Renal – nephropathy
6. Neuropathy – 60-70% will develop this

Neuropathy

Affects nerves of:

1. Cardiovascular system -- often don't feel pain of angina or MI
2. Digestive system – gastroparesis, heartburn, N, V, D
3. Sexual dysfunction
4. Urinary tract – UTI's, incontinence
5. Sweat glands – may affect body's ability to regulate temperature
6. Hypoglycemic unawareness

Prevention

- Impeccable dental care
- Annual eye exams
- Control BP
- No smoking
- Foot care
- Exercise
- Weight management
- Medications – ACE inhibitors, beta-blockers, diuretics, cholesterol lowering agents
- Diet – monitor sugar, protein intake
- Control blood sugar *****

Types of Insulin

| <u>TYPE</u> | <u>NAME</u> | <u>ONSET</u> | <u>PEAK</u> | <u>DURATION</u> |
|---------------------|--------------------------|--------------|---------------|-----------------|
| Rapid-Acting | Humalog Novo Rapid | 5-15 min. | 30-90 min. | 3.5-4.5 hr |
| Short-Acting | Regular Toronto | 30-40 min. | 2-4 hr | 6-8 hr |
| Intermediate-acting | NPH (N) Lente (L) | 1-3 hr | 4-12 hr | 18-24 hr |
| Long-acting | Ultralente | 4-6 hr | 12-18 hr | 24-28 hr |
| Premixed (%R%N) | 30/70 (common) | 0.5-1 hr | 2-12 hr | 18-24 hr |

Injecting Insulin

- Angle of injection: (6-8mm needles)
 - 90 degree for most adults
 - 60 degree for very lean people or children
 - 45 degree for toddlers or very lean child
- Pinching skin is optional (depends on body fat)
- After injecting, keep needle in for approx. 5 seconds to ensure insulin does not backflow
- Inject at room temperature
 - Stings when injected cold
 - Absorption may be delayed when injected cold



Medications that Affect Blood Glucose

Hypoglycemic Effect

- Anticoagulants
- Salicylates
- Alcohol
- MAO inhibitors
- Allopurinol
- Beta-blockers
- Sulfonamides

Hyperglycemic Effect

- Corticosteroids
- Diuretics
- Epinephrine
- Oral contraceptives
- Estrogen/progesterone
- Antipsychotic (resistance)
- Beta-blockers

Signs and Symptoms

• Hypoglycemia

- Sweating
- Hunger
- Trembling
- Anxiety
- Confusion
- Blurred vision

• Hyperglycemia

- Polydipsia (increased thirst)
- Polyuria (increased urination)
- Polyphagia (increased appetite)
- Dry skin
- Fatigue
- Lethargy
- Blurred vision

Diabetic Ketoacidosis (DKA)

- Most common with Type 1 diabetes (less common with type 2)
- Results from absolute or relative insulin deficiency
- Metabolic alterations:
 - Carbohydrate
 - Fat
 - Protein

DKA

Physical Findings

- Tachycardia
- Hypotension
- Tachypnea (Kussmaul's respiration, acetone breath)
- Abdominal pain, N, V, D
- Decrease LOC
- Signs & symptoms of dehydration

Pathophysiology

- osmotic diuresis leads to loss of fluids and electrolytes
- Metabolic acidosis due to accumulation of ketoacids
- Hyperkalemia due to potassium being displaced from the intracellular to the extracellular space in acidosis
*** remember that, despite initial high potassium on bloodwork (extracellular), a total body deficit exists

Dehydration

Clinical manifestations

- Skin
- Urine
- Temperature
- Hemodynamics

Labs

- Na+
- K+
- Serum osmolality
- Hgb, Hct, WBC's
- BUN, (and possibly Creat.)

DKA -- Interventions

- Treat dehydration with fluids, initially NS but, plan to change to dextrose-containing fluid as serum glucose decreases (eg. D5/0.45NS or 2/3 + 1/3)
- Correct acidosis -- bicarb is only recommended in severe acidosis (pH < 7.1)
- Monitor electrolytes (particularly K+, total CO2, anion gap), and pH (venous or arterial blood gas)
- As serum K+ begins to decrease, plan to change to IV fluids which contain potassium
- Administer insulin – most likely IV bolus and infusion

New Treatments on the Horizon

- Alternate methods of insulin administration:
 - inhaled insulin
 - insulin patch
 - insulin pills
 - buccal spray
 - implantable insulin pumps
 - artificial pancreas
- Islet cell transplantation
- Stem cell research

Case Scenarios

Paul is a 9 year old who has just been sent to your ER from the pediatrician's office with the diagnosis of Type 1 diabetes. His mother states that he is "acting weird", lethargic, c/o nausea and diarrhea. He has urinated 3 times in the past hour and has a fruity odour on his breath. His vitals are: T-36.9; P-142; R-38; BP-96/52. An IV is started and bloodwork is drawn.

Questions:

What type of IV fluid should be started?


1. D5W @ 50cc/h
2. 2/3 + 1/3 @ 75cc/h
3. NS with 40mEq KCl/L @ 100cc/h
4. NS @ 100cc/h

LAB RESULTS:

| | | |
|---------------|---------------|-----------|
| Na: 134 | glucose: 53.6 | pH: 7.2 |
| Cl: 93 | BUN: 12.1 | Hgb: 152 |
| K: 6.1 | Creat.: 159 | WBC: 14.1 |
| Total CO2: 10 | anion gap: 31 | |


After obtaining these results, what should your next nursing action be?

1. Call physician and prepare to give ½ amp NaHCO₃
2. Call physician and anticipate giving NS bolus and IV insulin
3. Call physician and anticipate administering 10 units NPH insulin
4. Tell mother that her child will probably be D/C'd home within the next hour



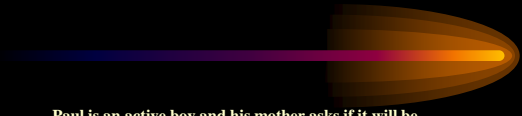
Paul is on an insulin infusion @ 3 units/h. In one hour, Paul's blood glucose is 18.5 mmol/L

- What is your concern?
- What do you expect his potassium to be?
- What IV fluids will most likely be hung?



Paul is stabilized in the Pediatric unit and the nurse is reviewing insulin administration with Paul and his mother. What is the best approach to use?

1. Ask Paul's mother when he will be able to begin self-injection
2. Have the nurse give the injections for several days
3. Have Paul practice giving the injection on his stuffed bear
4. Show the mother how to give the injections



Paul is an active boy and his mother asks if it will be alright for him to participate in sports, given his diagnosis. What is the best response for the nurse?

1. Suggest that he should not continue with any rigorous physical activity
2. Insist that one parent always be present while he is playing
3. Encourage Paul to participate in sports while adhering to his treatment plan
4. Advise the mother to discuss Paul's condition with the coach

A 42 year old woman with Type 2 diabetes is admitted to your medical floor with the diagnosis of r/o cholecystitis. She weighs 90kg and smokes 1 pack/day. When you ask her how she is feeling, she replies with vague complaints of epigastric discomfort and a generalized feeling of malaise.

1. Besides cholecystitis, what might you be suspicious of?
2. What tests and bloodwork might you be looking for? Why?

Sarah is a 22 year old York nursing student. She has had diabetes since she was 7 years old. She goes out to celebrate her graduation with a group of her classmates and drinks several beers. Into the early morning, you notice that Sarah is quite irritable, her skin is cold and clammy. When she is taken to the ER, which of the following nursing interventions should be a priority?

1. Obtaining a detailed description of Sarah's symptoms
2. Check what Sarah's last recorded glucose result was
3. Have Sarah drink fluids every hour until her glucose level returns to normal
4. Give Sarah a fast-acting carbohydrate solution
5. Tell Sarah that she should know better and will never be a good nurse

Resources

Canadian Diabetes Association: www.diabetes.ca
American Diabetes Association: <http://www.diabetes.org/home.jsp>
<http://diabetes.niddk.nih.gov/dm/pubs/overview/index.htm>
Royal Victoria Hospital Diabetes Education Centre

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