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### Perioperative Management of the Patient with Diabetes Mellitus

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# Perioperative Management of the Patient with Diabetes Mellitus

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## Topic

- Diabetes Mellitus
- Diabetes Mellitus (DM) is "a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both" (McCance & Huether, 2018, p. 789).
  - The American Diabetes Association (ADA) classifies diabetes mellitus into four categories:
    - Type I: beta-cell destruction causing absolute insulin deficiency
    - Type II: ranges from insulin resistance with insulin secretion defect with insulin resistance
    - Other specific types
    - Gestational diabetes (McCance & Huether, 2018)
  - For the purpose of this poster, Type I & II will primarily be discussed.

## Why DM?

- Diabetes mellitus is an extremely prevalent co-morbidity in hospitals around the globe.
- In children, 1 in 300 under the age of 12 can be diagnosed with Type I Diabetes in the United States (McCance & Huether, 2018).
- In the U.S. it is estimated that approximately 10% of the population has diabetes mellitus (Khan, et al., 2021).
- According to the Center of Disease Control and Prevention [CDC] (2020), diabetes is the seventh leading cause of death in the United States. Additionally, the medical cost of diabetes, along with lost work wages, accounts for \$326 billion per year in the U.S. (CDC, 2020).
- "The American Diabetes Association conservatively estimates that 25% of hospitalized adults have diabetes mellitus, and that an estimated 25% to 50% of diabetic patients will require surgery" (Nagelhout & Elisha, 2018, p. 800)
- This topic was chosen because of the prevalence of DM as a co-morbidity and the need for understanding of the condition as an anesthesia provider.

## Signs & Symptoms

- Type I diabetes generally presents itself as wide fluctuations in blood glucose, weight loss, polyuria, polydipsia, fruity odor or breath, blurred vision and extreme fatigue (Graney, 2019).
- Type I diabetics may present to the hospital with extremely high glucose levels in diabetic ketoacidosis (DKA) (McCance & Huether, 2018).
- Signs and symptoms of DKA include: extreme thirst and increased urination (early), fast/deep breathing [Kussmaul breathing], dry skin and mouth, flushed face, fruity-smelling breath, headache, muscle-stiffness or aches, being very tired, nausea and vomiting and stomach pain (Diabetic Ketoacidosis, 2021).
- Clinical manifestations of Type II diabetes can be vague. The patient may be overweight, with dyslipidemia, elevated insulin levels, increased thirst & appetite, sores that don't heal and hypertension (McCance & Huether, 2018).
- Other signs and symptoms for Type II Diabetes may include: polyuria & polydipsia, fatigue, itchy skin (pruritis), recurrent infections, changes in vision or neuropathy symptoms (McCance & Huether, 2018).
- Signs of hypoglycemia, or low blood sugar, include tachycardia, shaking, sweating, nervousness or anxiety, irritability or confusion, dizziness or hunger (Low Blood Sugar (Hypoglycemia), 2021)

Figure 1. Pathophysiology of Type 2 Diabetes Mellitus. McCance & Huether, 2018, p. 795.

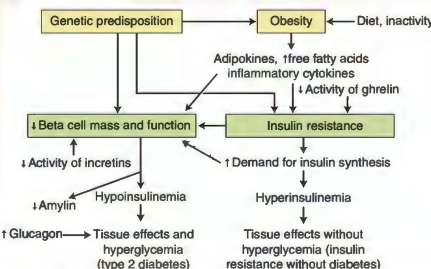


FIGURE 22-15 Pathophysiology of Type 2 Diabetes Mellitus.

## Underlying Pathophysiology

- Type I DM "affects the metabolism of fat, protein and carbohydrates" (McCance & Huether, 2018, p. 793).
- "It is caused by either a complete lack of insulin production, an inadequate amount of insulin secreted by the beta cells of the pancreas, tissue insensitivity to insulin, or insulin that is ineffective or destroyed before it can reach its target site" (Cornelius, 2016, p. 208)
- As excess glucose accumulates in the blood, it appears in the urine causing osmotic diuresis. Symptoms of polydipsia and polyuria can be seen. (McCance & Huether, 2018).
- This also causes wide fluctuations in blood glucose levels, protein & fat breakdown resulting in weight loss (McCance & Huether, 2018).
- When glucose is not regulated with exogenous insulin in Type I patients, extreme hyperglycemia can occur. This causes the "release of free fatty acids from adipocytes [and] increases [the] production of ketone bodies" (McCance & Huether, 2018, p. 793). Accumulation of these ketone bodies leads to a drop in pH and metabolic acidosis. This condition is termed Diabetic Ketoacidosis (DKA) and can be life threatening if left untreated (McCance & Huether, 2018).
- DKA may be "the first sign of diabetes in people who haven't yet been diagnosed" or caused by illness, missing insulin shots, a clogged insulin pump or wrong insulin dose (Diabetic Ketoacidosis, 2021).

## Significance of Pathophysiology

- Obesity is a major component of Type 2 Diabetes, present with 60-80% of those diagnosed. Obesity contributes to insulin resistance through adipokines (hormones produced in adipose tissue), elevated levels of free fatty acids, cholesterol and triglycerides, as well as inflammatory cytokines from intra-abdominal adipocytes (McCance & Huether, 2018).
- Severe disorders may occur in those whose diabetes has progressed without treatment. "Cardiovascular and atherosclerotic disease, including cerebrovascular disease and ischemic heart disease, is the major cause of death in patients with type 2 diabetes" (Cornelius, 2016, pp. 210-211).

Figure 2. Multiorgan Causes and Consequences of Chronic Hyperglycemia in Type 2 Diabetes Mellitus. McCance & Huether, 2018, p. 795.

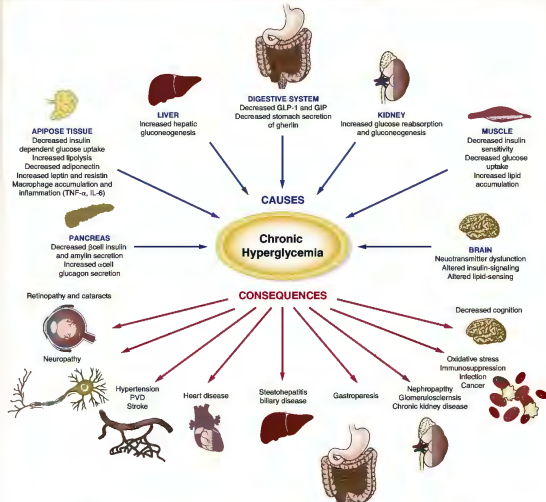


FIGURE 22-14 Multiorgan Causes and Common Consequences of Chronic Hyperglycemia in Type 2 Diabetes Mellitus. A, Interleukin; PVD, Peripheral vascular disease; TNF, Tumor necrosis factor.

## Implications for Nursing Care

- There are a plethora of risk factors associated with Type 2 Diabetes that nurses should make patients aware of:
  - Non-modifiable risk factors include: family history, race or ethnic background [diabetes is more prevalent in African-American, Asian-American, Latino-Hispanic American, Native American or of Pacific-Islander descent], age (most frequent over age 40) and gestational diabetes [those women with gestational diabetes are more likely to develop diabetes later in life] (Diabetes Risk Factors, 2021).
  - Modifiable Risk factors include: weight management, increasing physical activity, blood pressure management, control of cholesterol/lipid levels, smoking, diet, alcohol, stress management & sleep (Diabetes Risk Factors, 2021).
- Type 2 Diabetes can be managed with lifestyle modifications, including diet and exercise, and medications; however, Type 1 diabetes requires lifelong exogenous insulin (CDC, 2021).

## Diagnosis

- Diagnosis can be made through 3 tests:
  - Hemoglobin A1C** - can diagnose prediabetes and diabetes averaging a patient's blood sugar over 2-3 months. No fasting is required. An A1C of 5.7 - 6.4% diagnoses prediabetes and considers a person high risk for diabetes. A person is diagnosed with diabetes when their A1C is 6.5% or higher (Symptoms, Diagnosis and Monitoring of Diabetes, 2021).
  - The **Fasting Plasma Glucose Test** requires a patient to not eat or drink (except water) for 8 hours prior to the test. A fasting blood glucose of 100-125mg/dL is considered prediabetic and a fasting blood glucose greater than 126 mg/dL is considered diabetes mellitus (Symptoms, Diagnosis and Monitoring of Diabetes, 2021).
  - The final test is the **Oral Glucose Tolerance Test** which examines how well your body handles a certain amount of glucose. The healthcare provider draws blood 1 hour prior and 2 hours after receiving a large premeasured beverage containing glucose. A glucose measurement of 140-199mg/dL is considered prediabetes and a glucose of 200mg/dL is considered diabetes mellitus (Symptoms, Diagnosis and Monitoring of Diabetes, 2021).
- Once diagnosed, patients are given an at home blood glucose monitor to allow them to check their blood sugar throughout the day (Symptoms, Diagnosis and Monitoring of Diabetes, 2021).
- Diabetes cannot be cured but treatment is available.

## Perioperative Considerations

- Careful preoperative history and physical examination should be completed to minimize any surgical risks to the patient as well as preoperative labs, primarily blood sugar testing (Khan et al., 2021).
- Goals throughout surgery should include "avoidance of hypoglycemia, prevention of ketoacidosis, maintenance of fluid and electrolyte balance, and avoidance of marked hyperglycemia" (Khan et al., 2021).
- Prandial insulin (regular, lispro, aspart, and glulisine) should be stopped when patient is NPO for surgery to avoid hypoglycemia (Khan et al., 2021).
- Medical professionals should be aware that surgery and general anesthesia can cause a neuroendocrine stress response with release of counter regulatory hormones causing insulin resistance, increased lipolysis and hyperglycemia (Khan et al., 2021).

## Perioperative Considerations Cont.

- Lastly, providers should be aware that signs and symptoms of hyper- or hypoglycemia can be masked with general anesthesia and sedation (Khan et al., 2021).
- For short procedures, blood glucose should be checked preoperative and immediately postoperative. For long surgeries, blood sugar should be checked every 1-2 hours (Khan et al., 2021).

## Conclusions

- Diabetes is an extremely prevalent co-morbidity seen outpatient and inpatient by advanced nursing providers.
- This disorder can be modified by lifestyle changes with Type 2 Diabetes but requires life-long exogenous insulin with Type 1 Diabetes.
- Without treatment, hyperglycemia can cause several multiorgan system consequences (McCance & Huether, 2018)
- Signs and symptoms of hyper- and hypoglycemia may be hidden during surgery, so it is important to monitor blood sugar throughout the perioperative period.

## References & Additional Sources



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