Summer 8-6-2020

Pathophysiology of Diabetes Mellitus

Nancy Rozzo
Otterbein University, rozzo2@otterbein.edu

Pathophysiology of Diabetes Mellitus

Nancy Rozzo, RN, BSN

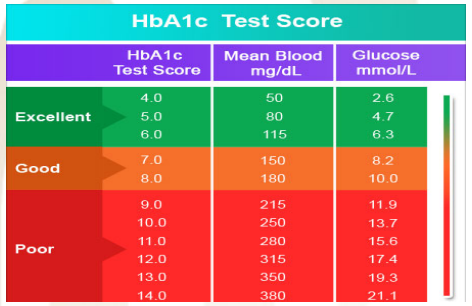
Otterbein University, Westerville, Ohio

Introduction

- Three main types of diabetes are: type 1, type 2, or gestational diabetes.
- Diabetes is the 7th leading cause of death in the United States (CDC, 2020).
- In the past twenty years, the number of people diagnosed with diabetes has doubled (CDC, 2020).
- In type 1 the body does not produce insulin and can occur with any age, race or gender.
- Type 2 diabetes is the most common type of diabetes. In type 2 diabetes the body does not produce enough insulin, or use it properly. Proper diet and exercise can typically manage it, but medications may be needed.
- Type 1 and type 2 diabetes can lead to diabetic ketoacidosis if patient has high blood glucose levels for long periods of time. This typically happens in individuals that are not aware they have diabetes.
- Gestational diabetes affects pregnant women, the cause is unknown and treatable.
- The goal for gestational diabetes is diagnosing early and treating quickly so that mother and baby are not affected.
- Managing blood glucose through diet and exercise can help reduce the amount of medication a patient may need to take to reduce blood glucose levels.
- Insulin and oral medication can help patients to reduce blood glucose levels.
- HbA1C helps provide a snapshot over a 2- 3 month period of how well blood glucose levels are controlled.

Signs/Symptoms

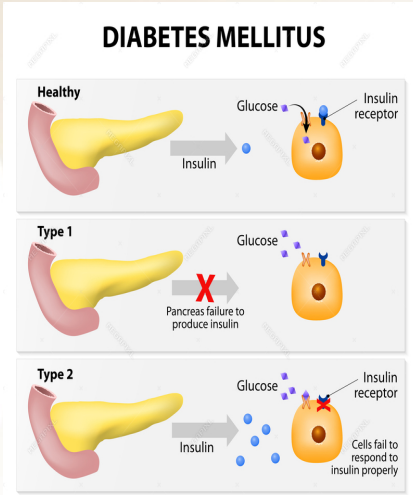
•According to the CDC (2020), 7.3 million adults aged 18 years or older were found to have undiagnosed diabetes. Common signs and symptoms of diabetes are:
•Urinating frequently
•Feeling very thirsty
•Feeling very hungry—even though you are eating
•Extreme fatigue
•Blurry vision
•Cuts/bruises that are slow to heal
•Weight loss—even though you are eating more (type 1)
•Tingling, pain, or numbness in the hands/feet (type 2)
•Gestational diabetes often have no symptoms.



(HbA1C Chart, 2020)

Pathophysiology

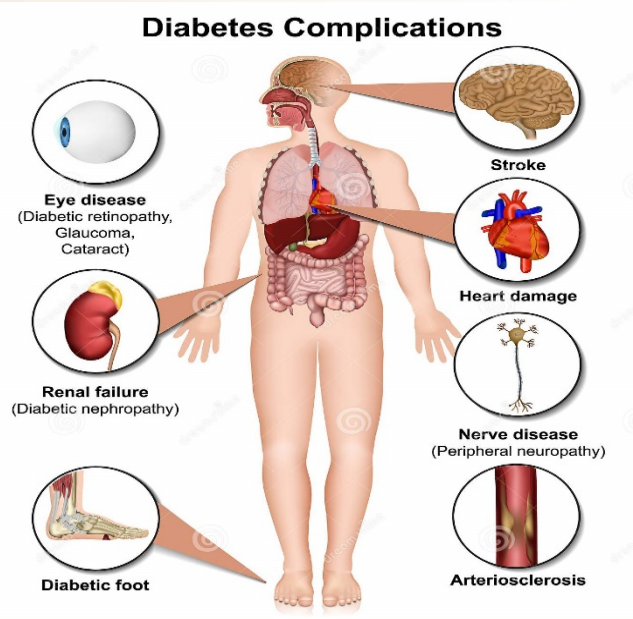
A healthy pancreas secretes digestive enzymes, glucagon, and insulin into the bloodstream to control the amount of glucose in the body. Insulin secreted lowers the glucose level in the body. In type 1 diabetes the pancreas fails to produce insulin. This can happen at any age and does not discriminate by race or gender. In type 2 diabetes the pancreas secretes insulin but the cells fail to respond to the insulin appropriately. As the body breaks down carbohydrates into blood sugar that is used for energy, insulin is needed to get blood glucose from the bloodstream to the body (ADA, 2020). A hemoglobin A1C will allow a 2-3-month snapshot to show if blood glucose levels have been well managed. According to the ADA (2020), those individuals whose levels are between 5.7 and less than 6.5% are prediabetic. Levels of 6.5% or higher, fall in the diabetic range. Medications such as insulin and oral medications can be prescribed to help reduce blood glucose levels. Type 1 diabetes requires insulin due to the body not making any. Insulin is given at specific times throughout the day and usually before meals. Some individuals may have an insulin pump that provides small doses of insulin at specific intervals. Type 2 diabetics may take oral and/or insulin to decrease blood glucose levels. Medications can be adjusted to receive optimal results in lowering blood glucose levels. Diet and exercise for type 2 diabetics is crucial and can assist to reduce blood glucose levels and reduce the use of medications.



(Diabetes Mellitus, 2020)

Significance of Pathophysiology

Currently, there are 34.2 million adults in the United States that have diabetes, and 1 in 5 of them do not know they have it (CDC, 2020). According to the World Health Organization (WHO, 2020), 422 million adults have diabetes worldwide. Type 2 diabetes is the most common type of diabetes. "Recent data from the National Diabetes Statistics Report (2017),indicates that 87.5% of adults with diabetes are overweight/obese, but the 18.4 million people who are overweight/obese and have diabetes only represent 13.8% of the total overweight/obese adult (>18 years) population identified in the United States in 2016" (Malone & Hanson, 2018). Managing proper diet and exercise is key to reducing the likelihood of a diabetes diagnosis and managing symptoms. Complications related to diabetes affect the blood vessels, eyes, nerves, heart, and kidneys. Cardiovascular complications are a leading cause of mortality in diabetic patients (Rethemiotaki, 2010). According to the American Heart Association (2020), those with high blood pressure have a major risk factor for cardiac disease. "Studies report a positive association between hypertension and insulin resistance. When patients have both hypertension and diabetes, which is a common combination, their risk for cardiovascular disease doubles" (AHA 2020). Most patients who have diabetes also have increased cholesterol levels, with increased LDL levels and decreased HDL levels. This can lead to diabetic dyslipidemia. Individuals with diabetes have a 2-3-fold increased risk of heart attack and stroke. Kidneys are affected due to high blood glucose, that damage cells that allow your kidneys to filter waste and function properly. Nerve damage, or neuropathy, is caused by high blood glucose levels for long periods of time that damage nerves throughout the body. This can happen in arms and legs and also affect other organs such as the heart and stomach. Retinopathy due to long term damage of small blood vessels in the eyes over time can lead to blurriness, floaters, dark areas of vision, and lastly, blindness (ADA, 2020).



(Diabetes Complications, 2020)

Nursing Implications

- Teaching and implementing a proper diet and exercise plan are critical for both type 1 and type 2 individuals. This can decrease and eliminate the use of both insulin and oral medications.
- Diet and exercise can also reduce the risk of obesity which plays a major role in diabetes and can decrease cholesterol, HDL levels, and increase LDL levels to avoid diabetic dyslipidemia.
- Providing teaching and education are key to the importance of monitoring glucose levels.
- Teaching individuals how to recognize the signs and symptoms of low blood glucose and how to treat it if it occurs.
- Physical activity is a known benefit for any patient population, but in patients with diabetes, it can be a key component to managing their disease. The benefits of physical activity in patients with diabetes can blood glucose levels, body decrease mass index, and medication usage, which would then lower a patient's hemoglobin A1C (CDC, 2020).
- Maintain foot hygiene and seek care for ulcers if needed.
- Monitor for signs and symptoms of infection

Conclusions

•In conclusion diabetes among adults, 18 years and older, is prevalent worldwide and currently in the United States. Many individuals are not aware of the signs and symptoms and can be undiagnosed for years. Those diagnosed can decrease blood glucose levels with proper diet, exercise, and medications. There are many complications associated with diabetes and some can be prevented. Many patients with diabetes are overweight or obese. Diet and exercise not only decrease blood glucose levels and weight, but can also decrease cardiovascular complications. Exercise and diet can decrease cholesterol levels, decrease HDL, and increase LDL, which will decrease the likelihood of diabetic dyslipidemia. Careful monitoring of blood glucose is key to managing diabetes and to decrease complications such as kidney disease, retinopathy, neuropathy, and stroke. Medications include both insulin and oral medications to assist in lowering blood glucose levels. To properly manage diabetes, patient education, careful monitoring, and recognizing the signs and symptoms is crucial.

References

American Association of Diabetes Educators. (2020). An effective model of diabetes care and education: Revising the AADE7 self-care behaviors. The Diabetes Educator, 46(2), 139-160. doi:10.1177/0145721719894903

American Heart Association. (2020). Why are people with diabetes at increased risk for cvd? Retrieved from: https://www.heart.org/en/health-topics/diabetes/why-diabetes-matters/cardiovascular-disease--diabetes

Center for Disease Control and Prevention. (2020). Information for healthcare professionals. Retrieved from: https://www.cdc.gov/diabetes/prevention/info-hcp.html

Diabetes Complications. (2020). Retrieved from: https://www.dreamstime.com/medicalstocks_info

Diabetes Mellitus. (2020). Retrieved from: https://www.dreamstime.com/medicalstocks_info

Hemoglobin A1C Chart. (2020). Retrieved from: https://www.medindia.net/

Hill, J. (2019). The older person with diabetes: Considerations for care. British Journal of Community Nursing, 24(4), 160–164. https://doi.org/10.12968/bjcn.2019.24.4.160

Kime, N., Pringle, A., Zwolinsky, S., & Vishnubala, D. (2020). How prepared are healthcare professionals for delivering physical activity guidance to those with diabetes? A formative evaluation. BMC Health Services Research, 20(1), 8. https://doi.org/10.1186/s12913-019-4852-0

Malone J.& Hansen B.C. (2019). Does obesity cause type 2 diabetes mellitus (T2DM)? Or is it the opposite? Pediatr Diabetes,20,5-9.https://doi.org/10.1111/pedi. 12787

Olson, C., & Rosenberg, S. L. (2019). Effective teaching for newly diagnosed patients with type 2 diabetes. MedSurg Nursing, 28(5), 319–321. https://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=139018060&site=eds-live&scope=site.

Rethemiotaki, I. (2020). Diabetes mellitus and stroke - A cross sectional study of 2.5 million adults in the united states. Maedica - a Journal of Clinical Medicine, 15(1), 24–31. https://doi.org/10.26574/maedica.2020.15.1.24

Schnell, O., Crocker, J. B., & Weng, J. (2017). Impact of hba1c testing at point of care on diabetes management. Journal of Diabetes Science and Technology, 11(3), 611–617. https://doi.org/10.1177/1932296816678263

World Health Organization. (2020). Diabetes. Retrieved from: https://www.who.int/health-topics/diabetes#tab=tab_1

Additional References

OTTERBEIN UNIVERSITY