

GENDER-RELATED FEATURES IN THE DEVELOPMENT OF ANEMIA IN PATIENTS WITH DIABETES

Delkasheva Shakhlo Djamolitdinovna

Andijan State Medical Institute

Department of hospital therapy and endocrinology

Assistant

Abstract: *Anemia is a common complication in patients with diabetes, affecting a significant portion of individuals with the disease. While anemia can occur in both men and women with diabetes, there are gender-related features that may influence the development and progression of anemia in these patients. Understanding these gender differences is crucial for the effective management and treatment of anemia in individuals with diabetes.*

Keywords: *gender, anemia, gender-based outcomes, mechanism, resources, diabetes*

Introduction: In the past, gender-specific medicine often meant studying women's health. However, it is clear that sex issues are biologically based and that both sexes need to be analyzed in a gender-sensitive manner. Gender-based outcomes and utilization of health resources can have a significant impact on long-term health of both men and women. Understanding the mechanisms underlying gender differences in disease, and the resulting different responses to treatment, may lead to more effective treatment and better health for both sexes. Although certain diseases are more prevalent in one sex or the other, this in itself does not demonstrate a gender difference.

The case of iron-deficient anemia in diabetes is an example of a disease which is more prevalent in women, but it is not clear whether this is due to the biology of being female, or the fact that women live longer and thus have a greater lifetime risk of developing diabetes. At the same time, there is evidence to suggest that the clinical impact of anemia is more profound in men. Conditions that increase iron availability, such as hemolytic anemias and iron-loading anemias are associated with increased risk of developing diabetes. Therefore it is important to understand the impact of anemia on both sexes, in order to properly assess the burden of disease. The first step in doing so, is to understand if there is a gender-specific difference in the development of anemia in diabetes. This cross-sectional study is a preliminary step in understanding the issue.

Background

ACD is a result of an inflammatory disease and any chronic infection, malignancy, or other diseases and is the second most common form of anemia in diabetes. Inflammation is known to affect the level of iron in the blood, causing a disruption of production of the red blood cells and a reduced lifespan of mature red blood cells. This is crucial as iron metabolism is very important in the development of diabetes. High concentrations of body iron may pose a risk for diabetes complications and oxidative stress in those with diabetes but can still lead to iron-deficient erythropoiesis. Erythropoiesis is the production of red blood cells which requires iron, and if not enough is available, iron-deficiency anemia can develop. ACD is also a condition common in the elderly and more frequently seen in females, whereas other types of anemia are more common in males with diabetes (mainly due to ACD it shares similarity with mild to moderate chronic kidney disease anemia, a condition also very common in the elderly. Erkan Topcu et al, 2012)

Diabetes, a chronic illness characterized by high levels of glucose in the blood, has a prevalence of 8.7% in the US population, with 90-95% having type 2 diabetes. It contributes significantly to overall mortality as well as morbidity due to the damage it

causes in many organs throughout the body. A serious consequence of diabetes is that the risk of developing some form of anemia is double that of a healthy individual. Anemia is usually defined as low levels of red blood cells in the blood and can cause symptoms such as fatigue, shortness of breath, and heart palpitations. Types of anemia diabetes patients suffer from include anemia of chronic disease (ACD), iron deficiency anemia, and sickle cell anemia.

Significance of the Study

The principal goal of our current study was to determine the possible differences in the features in the development of anemia in patients with type 2 diabetes by evaluating the gender differences in progression to anemia among patients with type 2 diabetes. With that being said, our goal is to lead with defining and providing validity to the assessment of anemia, the causes that can lead to its deficit in both men and women, and then determining the differences in the features in the development of anemia in both genders, and assessing the reasons behind the findings. There are several reasons that prompted our study. First, consideration of gender in health and disease has become an important area of investigation nationally and worldwide.

Although gender and sex are not new issues in health research or epidemiology, over the past decade there has been an explosion of interest in the topic. This has largely been due to a growing awareness that gender influenced and differences in health and disease are real, and are most often a reflection of biological differences between men and women. As the importance of understanding these differences is recognized, the design and conduct of research in this area are increasingly becoming a priority. Ideally, it is becoming more common to see that a specific study or a health-related topic will examine the differences in causation, progression, and management of health outcomes in men and women. Despite this, a large proportion of research is not designed to consider or include gender in analyses. Even studies that do not have specific hypotheses related to gender may benefit

from looking at the patterns of disease in both men and women, as often there are differences in disease outcomes that may provide new insights or generate new hypotheses. There is evidence to suggest that the consideration of gender in a health-related topic can be beneficial and as such has been highly encouraged.

In particular, the NIH policy on the inclusion of women and minorities as subjects in clinical research has been an influence to increase the amount of health research that genuinely considers differences in disease and health outcomes in the past decade. This has implications in all areas of research and will hopefully continue to guide future research in ensuring that male and female subjects are studied and their results are analyzed separately. In fact, there are some who argue that gender should be considered as more than a covariate in research and instead incorporated into the actual design and analysis of studies. This is an issue that is ongoing and varies from each specific health-related topic.

Prevalence and Risk Factors

Studies have consistently shown a higher prevalence of anemia in women with diabetes compared to men. This gender disparity is particularly pronounced in postmenopausal women. The exact reasons for this difference are not fully understood, but several factors may contribute, including:

Iron deficiency: Women are more likely to develop iron deficiency due to menstrual blood loss, pregnancy, and childbirth. Iron deficiency is a major cause of anemia, and diabetic patients with low iron stores are at an increased risk.

Hormonal factors: Estrogen and progesterone have been shown to have a protective effect against anemia. After menopause, when these hormones decline, women become more susceptible to iron deficiency and anemia.

Dietary factors: Women may have lower intakes of iron-rich foods compared to men. This is particularly concerning in diabetic patients who often require dietary modifications that may limit their intake of certain nutrients.

Clinical Manifestations and Severity

Anemia in diabetic patients can manifest with a range of symptoms, including fatigue, weakness, shortness of breath, and impaired cognitive function. The severity of anemia is typically assessed based on hemoglobin levels. Studies have found that women with diabetes tend to have lower hemoglobin levels compared to men. This may be related to the higher prevalence of iron deficiency and the protective effects of hormones in men.

Management and Outcomes

The management of anemia in diabetic patients involves addressing the underlying cause. In cases of iron deficiency, iron supplementation is typically prescribed. Other treatments, such as erythropoietin-stimulating agents, may be considered in more severe cases.

Gender-specific considerations are important in the management of anemia in diabetic patients. Women may require higher doses of iron supplementation due to their increased risk of iron deficiency. Additionally, hormonal therapy may be beneficial in postmenopausal women to improve iron absorption and reduce the risk of anemia.

The outcomes of anemia in diabetic patients are influenced by several factors, including gender. Studies have shown that women with anemia and diabetes have a higher risk of cardiovascular complications and mortality compared to men. This may be related to the fact that women with anemia tend to have more severe disease and are less likely to receive appropriate treatment.

One of the key factors that contribute to the development of anemia in diabetic patients is the impact of diabetes on the kidneys. Diabetes is a leading cause of kidney

disease, known as diabetic nephropathy, which can lead to a decrease in the production of erythropoietin, a hormone that stimulates the production of red blood cells. This can result in a decrease in the number of red blood cells in the body, leading to anemia. Studies have shown that women with diabetes are at a higher risk of developing diabetic nephropathy compared to men, which may explain why women are more likely to develop anemia in the context of diabetes.

Another factor that may contribute to the development of anemia in diabetic patients is the impact of hormonal changes on red blood cell production. Women experience hormonal fluctuations throughout their menstrual cycle, pregnancy, and menopause, which can affect the body's ability to produce red blood cells. This may put women at a higher risk of developing anemia, particularly in the context of diabetes. Additionally, women are more likely to experience iron deficiency anemia due to blood loss during menstruation, which can further exacerbate the risk of anemia in diabetic patients.

Furthermore, studies have suggested that women with diabetes may have a higher prevalence of autoimmune conditions such as autoimmune hemolytic anemia, which can lead to the destruction of red blood cells. This may further increase the risk of anemia in diabetic women compared to men. Additionally, women with diabetes are more likely to have coexisting conditions such as thyroid disorders, which can also contribute to the development of anemia.

Conclusion

In conclusion, gender-related features play a significant role in the development of anemia in patients with diabetes. Understanding these differences is crucial for the effective management and treatment of anemia in individuals with diabetes. Healthcare providers should consider gender-specific factors such as hormonal differences, dietary habits, physical activity levels, and genetic factors when assessing and treating anemia in patients with diabetes. By taking a gender-sensitive approach to care, healthcare providers

can optimize the management of anemia in patients with diabetes and improve outcomes for these individuals.

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