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**CLINICAL CHARACTERISTICS AND CLINICAL SIGNIFICANCE OF ARRHYTHMIAS
IN WOMEN OF REPRODUCTIVE AGE WITH IRON DEFICIENCY ANEMIA**



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Annotation: Iron deficiency anemia is one of the most common hematological conditions among women of reproductive age and may be associated with various functional changes in the cardiovascular system, including palpitations, tachycardia, reduced exercise tolerance and cardiac rhythm disturbances. A decrease in hemoglobin levels reduces the oxygen-carrying capacity of the blood and may increase compensatory cardiovascular workload. The aim of this study was to assess the clinical characteristics and clinical significance of arrhythmias in women of reproductive age with iron deficiency anemia. Particular attention was given to the relationship between anemia severity, iron status and cardiovascular manifestations, as well as electrocardiographic changes and rhythm disturbances. The findings indicate that comprehensive assessment of hematological parameters together with cardiovascular evaluation may contribute to earlier detection of cardiac rhythm abnormalities. Electrocardiography and, when clinically indicated, Holter monitoring may provide additional diagnostic information in patients with recurrent palpitations and other cardiovascular symptoms. Early identification and correction of iron deficiency may help reduce cardiovascular manifestations and improve the functional status of affected women.

Keywords: Iron deficiency anemia, women of reproductive age, arrhythmia, cardiac rhythm disturbances, tachycardia, palpitations, hemoglobin, ferritin, electrocardiography, Holter monitoring, cardiovascular system.



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ОСОБЕННОСТИ ТЕЧЕНИЯ АРИТМИЙ И ИХ КЛИНИЧЕСКОЕ ЗНАЧЕНИЕ У ЖЕНЩИН ФЕРТИЛЬНОГО ВОЗРАСТА, СТРАДАЮЩИХ ЖЕЛЕЗОДЕФИЦИТНОЙ АНЕМИЕЙ

Аннотация: Железодефицитная анемия является одним из наиболее распространенных гематологических состояний среди женщин фертильного возраста и может сопровождаться различными функциональными изменениями со стороны сердечно-сосудистой системы, включая ощущение сердцебиения, тахикардию, снижение толерантности к физической нагрузке и нарушения сердечного ритма. Снижение уровня гемоглобина приводит к уменьшению кислородотранспортной способности крови и может повышать компенсаторную нагрузку на сердечно-сосудистую систему. Целью настоящего исследования являлась оценка клинических особенностей и клинического значения аритмий у женщин фертильного возраста с железодефицитной анемией. Особое внимание уделялось взаимосвязи между степенью анемии, показателями обмена железа и сердечно-сосудистыми проявлениями, а также электрокардиографическими изменениями и нарушениями ритма. Полученные результаты показывают, что комплексная оценка гематологических показателей совместно с исследованием сердечно-сосудистой системы может способствовать более раннему выявлению нарушений сердечного ритма. Электрокардиография, а при необходимости холтеровское мониторирование могут иметь дополнительное диагностическое значение у пациенток с повторяющимися эпизодами сердцебиения и другими сердечно-сосудистыми симптомами. Своевременное выявление и коррекция дефицита железа могут способствовать уменьшению сердечно-сосудистых проявлений и улучшению функционального состояния пациенток.

Ключевые слова: Железодефицитная анемия, женщины фертильного возраста, аритмия, нарушения сердечного ритма, тахикардия, сердцебиение, гемоглобин, ферритин, электрокардиография, холтеровское мониторирование, сердечно-сосудистая система.

TEMIR TANQISLIGI ANEMIYASI BILAN OG'RIGAN FERTIL YOSHDAGI AYOLLARDA ARITMIYALARNING KECHISH XUSUSIYATLARI VA ULARNING KLINIK AHAMIYATI

Annotatsiya: Temir tanqisligi anemiyasi fertil yoshdagi ayollar orasida keng tarqalgan gematologik holatlardan biri bo'lib, yurak-qon tomir tizimida turli funksional o'zgarishlar, jumladan, yurak urishini sezish, taxikardiya, jismoniy zo'riqishga chidamlilikning pasayishi va yurak ritmi buzilishlari bilan kechishi mumkin. Gemoglobin miqdorining kamayishi natijasida qonda kislorod tashish qobiliyatining pasayishi yurak-qon tomir tizimiga tushadigan kompensator yuklamani oshiradi. Mazkur tadqiqotning maqsadi fertil yoshdagi temir tanqisligi anemiyasi bilan og'rigan ayollarda aritmiyalarning klinik xususiyatlari va klinik ahamiyatini baholashdan iborat. Tadqiqotda anemiya darajasi, temir almashinuvi ko'rsatkichlari va yurak-qon tomir belgilarining o'zaro bog'liqligiga, shuningdek, elektrokardiografik va ritm buzilishlariga alohida e'tibor qaratildi. Olingan natijalar gematologik ko'rsatkichlarni yurak-qon tomir tizimini baholash bilan birgalikda olib borish ritm buzilishlarini erta aniqlashga yordam berishi mumkinligini ko'rsatadi. Elektrokardiografiya, zarur hollarda esa Holter monitoringidan foydalanish takroriy yurak urishi va boshqa yurak-qon tomir shikoyatlari mavjud bemorlarda qo'shimcha diagnostik ahamiyatga ega. Temir tanqisligini o'z vaqtida aniqlash va korreksiya qilish yurak-qon tomir belgilarini kamaytirish hamda bemorlarning funksional holatini yaxshilashga yordam berishi mumkin.

Kalit so'zlar: Temir tanqisligi anemiyasi, fertil yoshdagi ayollar, aritmiya, yurak ritmi buzilishi, taxikardiya, yurak urishi, gemoglobin, ferritin, elektrokardiografiya, Holter monitoringi, yurak-qon tomir tizimi.



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Introduction

Iron deficiency anemia is one of the most common hematological conditions among women of reproductive age. It is characterized by reduced iron stores and impaired hemoglobin synthesis, which can lead to decreased oxygen delivery to tissues. In women of reproductive age, iron deficiency is frequently associated with chronic blood loss during menstruation, increased physiological requirements for iron, insufficient dietary intake, and impaired intestinal absorption. Persistent iron deficiency may gradually affect the functional state of different organs and systems, including the cardiovascular system. The cardiovascular system may undergo significant functional changes in patients with iron deficiency anemia. A reduction in hemoglobin concentration decreases the oxygen-carrying capacity of the blood. In response, compensatory mechanisms are activated to maintain adequate tissue oxygenation. Increased heart rate, changes in cardiac output, and alterations in peripheral circulation may occur depending on the severity and duration of anemia. As a result, patients may experience palpitations, weakness, reduced exercise tolerance, shortness of breath, and other cardiovascular symptoms.

Arrhythmias require particular attention in patients with iron deficiency anemia. Reduced oxygen delivery and increased cardiovascular workload may influence autonomic regulation and cardiac electrical activity. Prolonged or severe anemia may place additional stress on the cardiovascular system and potentially contribute to disturbances in cardiac rhythm. However, the clinical presentation of arrhythmias is not identical in all patients and may depend on the severity and duration of anemia, general health status, and the presence of additional cardiovascular risk factors. The problem is particularly relevant among women of reproductive age because recurrent or prolonged iron deficiency may develop as a result of regular menstrual blood loss. Persistent depletion of iron stores may contribute to long-term anemia and increased cardiovascular workload. Therefore, assessment of these patients should not be limited to hemoglobin concentration alone. Evaluation of cardiac rhythm and the overall cardiovascular status may also be important, particularly in patients with symptoms such as palpitations, dizziness, weakness, or reduced tolerance to physical activity. Electrocardiography is an important diagnostic method for detecting cardiac rhythm abnormalities. When clinically indicated, Holter monitoring can provide additional information about changes in heart rhythm throughout the day and help identify premature beats and other arrhythmias that may not be detected during a standard electrocardiographic examination. Laboratory assessment of hemoglobin, serum ferritin, serum iron, and other hematological parameters can help determine the presence and severity of iron deficiency.

Relevance

The relevance of this topic is determined by the high prevalence of iron deficiency anemia among women of reproductive age and its potential influence on the cardiovascular system. Reduced hemoglobin concentration decreases oxygen delivery to tissues and may increase the workload of the heart. In some patients, these changes may be accompanied by palpitations and disturbances of cardiac rhythm. Early identification of arrhythmias is important because persistent rhythm abnormalities may negatively affect the patient's functional condition and quality of life. Therefore, studying the clinical characteristics of arrhythmias in women with iron deficiency anemia and evaluating their relationship with the severity of anemia may contribute to earlier diagnosis and more appropriate clinical management.

Aim

The aim of this study is to assess the clinical characteristics of arrhythmias in women of reproductive age with iron deficiency anemia and to determine their clinical significance in relation to the severity of anemia and cardiovascular functional changes.

Main part

Iron deficiency anemia is a common condition among women of reproductive age and develops when iron stores become insufficient to maintain normal hemoglobin synthesis. The main



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causes include chronic menstrual blood loss, inadequate dietary iron intake, increased physiological requirements, and impaired iron absorption. A persistent decrease in iron availability leads to reduced hemoglobin production and decreased oxygen-carrying capacity of the blood. As a result, tissues receive less oxygen and compensatory mechanisms are activated to maintain adequate oxygen delivery. The cardiovascular system plays an important role in this compensation because cardiac output may increase to maintain tissue perfusion. Patients may therefore experience weakness, fatigue, dizziness, shortness of breath, reduced exercise tolerance, and palpitations. The severity of clinical manifestations depends on the degree and duration of anemia, the rate of hemoglobin decline, and the presence of other diseases. Women with prolonged menstrual blood loss may develop recurrent iron depletion even when the initial symptoms are mild. Laboratory assessment commonly includes hemoglobin, red blood cell indices, serum ferritin, and other indicators of iron metabolism. Identification of iron deficiency before severe anemia develops is clinically important. Persistent iron deficiency may influence not only hematological parameters but also cardiovascular functional status.

The development of arrhythmias in patients with iron deficiency anemia may be associated with reduced oxygen delivery and compensatory cardiovascular responses. A decrease in hemoglobin concentration reduces the oxygen-carrying capacity of circulating blood, which may increase the workload of the heart. To compensate for reduced oxygen delivery, the heart may increase its rate and cardiac output. Persistent activation of compensatory mechanisms can influence autonomic regulation and myocardial function. Tachycardia is one of the most common cardiovascular responses to anemia, particularly when the hemoglobin level is significantly reduced. In some patients, increased sympathetic activity may contribute to sensations of palpitations and changes in cardiac rhythm. The relationship between iron deficiency and arrhythmias may also be influenced by the severity and duration of anemia. Additional factors such as electrolyte abnormalities, thyroid disorders, cardiovascular diseases, stress, and the use of certain medications may contribute to rhythm disturbances. Therefore, the presence of an arrhythmia in a patient with anemia should not automatically be attributed only to iron deficiency. A comprehensive clinical evaluation is required to identify other possible causes. Understanding these mechanisms is important for determining the clinical significance of rhythm abnormalities. Correction of iron deficiency and treatment of the underlying cause may reduce the cardiovascular burden associated with anemia.

Arrhythmias in women with iron deficiency anemia may have different clinical manifestations depending on the severity of anemia and the type of rhythm disturbance. Patients may report palpitations, rapid heartbeat, irregular heartbeat, weakness, dizziness, shortness of breath, or reduced tolerance to physical activity. In some cases, rhythm disturbances may be asymptomatic and detected only during electrocardiographic examination. Sinus tachycardia is a common response to reduced oxygen-carrying capacity and increased cardiovascular demand. Premature atrial or ventricular beats may also be detected in some patients, although their presence requires evaluation of other potential causes. The intensity of symptoms does not always correspond directly to the degree of anemia. Some patients with moderate anemia may experience significant palpitations, while others with more pronounced anemia may have relatively mild cardiovascular symptoms. The duration of iron deficiency may also influence the clinical presentation because chronic anemia allows compensatory mechanisms to remain active for a prolonged period. A detailed medical history should include information about menstrual blood loss, previous anemia, dietary habits, cardiovascular symptoms, and concomitant diseases. Physical examination should include assessment of heart rate, blood pressure, cardiac rhythm, and signs of cardiovascular stress. Electrocardiography can help determine the type of rhythm disturbance and identify other cardiac abnormalities. When symptoms are intermittent, ambulatory electrocardiographic monitoring may provide additional diagnostic information.

The diagnosis of arrhythmias in women with iron deficiency anemia requires a combination of clinical, laboratory, and instrumental methods. A standard electrocardiogram is an important initial



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diagnostic method because it provides information about heart rate, rhythm, conduction, and electrical activity. However, a short electrocardiographic recording may not detect intermittent rhythm disturbances. In such cases, Holter monitoring can provide continuous recording of cardiac electrical activity over an extended period and may help identify episodes of tachycardia, premature beats, or other rhythm abnormalities. Laboratory evaluation should include assessment of hemoglobin and iron status, particularly serum ferritin, when iron deficiency is suspected. Additional laboratory tests may be required to exclude other causes of arrhythmia, including electrolyte disturbances and thyroid dysfunction. Echocardiography may be useful when there are clinical indications of structural heart disease or impaired cardiac function. Assessment of blood pressure and heart rate during physical activity can provide additional information about cardiovascular response. The results of these examinations should be interpreted together rather than separately. Establishing the severity of iron deficiency and determining the type of arrhythmia are important for selecting an appropriate management strategy. In patients with persistent or clinically significant rhythm disturbances, cardiological assessment may be necessary. Timely diagnosis is particularly important in patients with severe anemia, recurrent palpitations, syncope, chest discomfort, or significant exercise intolerance. A comprehensive diagnostic approach allows clinicians to distinguish anemia-related cardiovascular responses from primary cardiac disorders.

The clinical significance of arrhythmias in women with iron deficiency anemia depends on the type of rhythm disturbance, its frequency, associated symptoms, and the presence of other cardiovascular risk factors. In many cases, cardiovascular manifestations are related to the body's compensatory response to reduced oxygen delivery. Therefore, correction of iron deficiency and treatment of its underlying cause are important components of management. Iron therapy may be recommended according to the severity of iron deficiency, laboratory findings, the cause of iron loss, and the patient's clinical condition. In women with chronic menstrual blood loss, identifying and managing excessive menstrual bleeding is particularly important for preventing recurrent iron deficiency. Dietary improvement and adequate intake of iron-containing foods may support the correction of iron deficiency. If an arrhythmia is clinically significant, additional cardiological management may be required depending on its type and cause. Treatment should not focus only on the rhythm abnormality without addressing the underlying anemia. Regular monitoring of hemoglobin and iron stores can help evaluate the response to treatment and prevent recurrence. Patients with persistent palpitations or other cardiovascular symptoms may require repeated electrocardiography or ambulatory monitoring. Prevention also includes early detection of iron deficiency before severe anemia develops. Women of reproductive age with recurrent blood loss should receive appropriate clinical and laboratory assessment when symptoms are present. A coordinated approach involving primary care physicians, hematologists, gynecologists, and cardiologists may be beneficial in complex cases. Early treatment of iron deficiency can reduce cardiovascular stress and improve exercise tolerance and quality of life.

Results

The study included 30 women of reproductive age with iron deficiency anemia. Clinical assessment showed that weakness and increased fatigue were the most common complaints, observed in 24 patients (80.0%). Palpitations were reported by 19 patients (63.3%), while reduced exercise tolerance was noted in 18 patients (60.0%). Shortness of breath during physical activity was observed in 15 patients (50.0%), and dizziness was reported by 13 patients (43.3%). According to the severity of anemia, 17 patients (56.7%) had moderate iron deficiency anemia, while 13 patients (43.3%) had a more pronounced degree of anemia. Electrocardiographic examination revealed sinus tachycardia in 14 patients (46.7%), premature atrial beats in 4 patients (13.3%), and premature ventricular beats in 3 patients (10.0%). In 9 patients (30.0%), no clinically significant rhythm abnormalities were detected during standard electrocardiography. Among patients with more pronounced anemia, palpitations and tachycardia were observed more frequently than in patients with less severe anemia.



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Holter monitoring was performed in patients with intermittent symptoms and detected additional rhythm disturbances in 5 patients (16.7%) who had no significant abnormalities on standard electrocardiography. Laboratory assessment showed reduced hemoglobin levels in all patients, while decreased serum ferritin indicated depleted iron stores. The results demonstrated that cardiovascular symptoms were more frequent among patients with lower hemoglobin and ferritin levels. After correction of iron deficiency, a reduction in palpitations and improvement in exercise tolerance were observed in the clinical follow-up assessment. These findings indicate that iron deficiency anemia may be associated with functional cardiovascular changes and rhythm disturbances in women of reproductive age. At the same time, arrhythmias should be evaluated together with other possible cardiovascular, metabolic, and endocrine factors. The results support the importance of combining hematological assessment with electrocardiographic monitoring, particularly in patients with severe anemia and recurrent cardiovascular symptoms.

Discussion

Iron deficiency anemia may have an important influence on cardiovascular function in women of reproductive age. Reduced hemoglobin availability decreases the oxygen-carrying capacity of blood and may consequently increase the workload of the cardiovascular system. In response to reduced tissue oxygen delivery, compensatory mechanisms such as increased cardiac output and sympathetic activation may develop. These mechanisms can contribute to the appearance of palpitations, increased heart rate and other cardiovascular symptoms. The relationship between iron deficiency and cardiac rhythm disturbances is therefore clinically important, particularly in patients with persistent or severe anemia. The development of rhythm disturbances in iron deficiency anemia may involve several interconnected mechanisms. Tissue hypoxia, increased sympathetic activity, changes in myocardial oxygen demand and impaired physical tolerance may influence cardiac electrical stability. In addition, iron deficiency itself may have biological effects beyond its role in hemoglobin synthesis, since iron is involved in cellular energy metabolism and normal myocardial function. These mechanisms may partly explain why cardiovascular symptoms can occur even before severe clinical complications of anemia develop.

Women of reproductive age represent a clinically important group because iron deficiency may be associated with increased physiological iron requirements and recurrent blood loss. Menstrual blood loss is one of the important factors contributing to iron depletion in this population. If iron deficiency persists for a prolonged period, compensatory cardiovascular responses may become more pronounced and may negatively affect quality of life and physical capacity. Therefore, assessment of iron status should be considered an important component of the clinical evaluation of women presenting with unexplained palpitations or exercise intolerance. Electrocardiographic assessment remains an important method for evaluating patients with suspected rhythm disturbances. However, intermittent arrhythmias may not always be detected during a short standard ECG examination. In such cases, ambulatory Holter monitoring can provide additional information by recording cardiac rhythm over a longer period. A combined assessment of clinical symptoms, hematological parameters and cardiac rhythm may therefore provide a more comprehensive understanding of the relationship between iron deficiency and cardiovascular manifestations.

Conclusion

Iron deficiency anemia in women of reproductive age is associated with clinically important cardiovascular manifestations, including palpitations, increased heart rate and reduced exercise tolerance. Reduced oxygen-carrying capacity and compensatory cardiovascular responses may contribute to the development of cardiac rhythm disturbances. Comprehensive assessment of patients with iron deficiency anemia should therefore include evaluation of both hematological status and cardiovascular function. Standard electrocardiography can provide important diagnostic information, while Holter monitoring may be useful when rhythm disturbances are intermittent or not detected during routine ECG examination. Identification and correction of iron deficiency, together with



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appropriate evaluation of possible underlying causes, may contribute to improvement of cardiovascular symptoms and prevention of further complications. Overall, early recognition of cardiovascular manifestations in women with iron deficiency anemia is important for timely diagnosis, individualized management and improved clinical outcomes

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