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ETIOLOGY, PATOLOPHYSIOLOGY OF ANEMIA

Djalolova Ozoda Kasimjanovna

Andijan State Medical Institute, Phd.

Abstract: Anemia of chronic diseases, also known as anemia of chronic inflammation, is a common complication that affects millions of individuals worldwide. It is a type of anemia that occurs in patients with chronic diseases such as kidney disease, rheumatoid arthritis, cancer, and chronic infections. Anemia of chronic diseases is characterized by a decreased production of red blood cells, which can lead to fatigue, weakness, and shortness of breath. In this article, we will discuss the pathophysiology, diagnostic challenges, and therapeutic approaches of anemia of chronic diseases.

Keywords: Anemia, chronic, elements, medical treatment, immunity, diagnoses.

Introduction: Anemia of continual ailments is a situation that accompanies a particular underlying disease, in which there is a reduce in hemoglobin, hematocrit and erythrocyte counts due to a complicated process, generally initiated by way of cell immunity mechanisms and pro-inflammatory cytokines and hepcidin. This is the 2d most frequent kind of anemia after iron deficiency anemia in the world. Its severity commonly correlates with the severity of the underlying disease. This disorder most regularly coexists with continual inflammation, autoimmune diseases, cancer, and kidney failure. Before beginning treatment, one ought to undertake in-depth diagnostics, which consists of now not solely evaluation of whole blood depend and biochemical parameters, however additionally severity of the underlying disease. The differential analysis of anemia of persistent illnesses is mainly based totally on the exclusion of different kinds of anemia, in precise iron deficiency. The important aspects of anemia of persistent ailments encompass slight to reasonable reducing of hemoglobin level, lowered proportion of reticulocyte count, low iron and transferrin concentration, however elevated ferritin. Due to the higher information of the Patho mechanism of persistent illnesses and most cancers biology, the prognosis of this anemia is continuously increasing with new biochemical indicators.

These include: the awareness of different hematopoietic elements (folic acid, nutrition B12), hepcidin, creatinine and erythropoietin. The fundamental shape of cure of anemia of persistent illnesses stays supplementation with iron, folic acid and diet B12 as nicely as a weight-reduction plan wealthy in the above-mentioned hematopoietic factors. The route of administration (oral, intramuscular or intravenous) requires cautious consideration of the advantages and feasible facet effects, and evaluation of the patient's medical status. New strategies of treating each the underlying disorder and anemia are elevating hopes. The novel strategies are related no longer solely with supplementing deficiencies, however additionally with the administration of capsules molecularly centered to unique proteins or receptors worried in the improvement of anemia of persistent diseases.

Literature review.

Anemia of chronic diseases (ACD) has emerged as a significant health concern, particularly in the context of various chronic inflammatory conditions. The literature surrounding ACD highlights its multifaceted nature, characterized by a complex interplay of inflammation, iron metabolism, and erythropoiesis. The foundational work by Agarwal et al (2009) underscores the relationship between chronic inflammatory states, such as periodontitis, and the development of anemia,

suggesting that ACD may arise from a variety of inflammatory stimuli beyond traditional expectations.

Following this, Domenica Cappellini et al (2017) delve deeper into the specific mechanisms of iron deficiency within chronic inflammatory diseases. They emphasize the need for clear diagnostic criteria to distinguish iron deficiency from anemia itself, particularly in the context of fluctuating hepcidin levels induced by proinflammatory cytokines. This article highlights the clinical challenges faced by healthcare providers in managing patients with concurrent chronic diseases and iron deficiency, revealing a critical gap in understanding how these conditions interact. Haagen Nielsen (2018) further elaborate on the implications of ACD in patients with inflammatory bowel disease (IBD), where anemia frequently correlates with disease severity. They illustrate how chronic inflammation exacerbates iron deficiency through mechanisms such as impaired absorption and increased hepcidin production, which collectively hinder effective erythropoiesis. The findings suggest that managing iron-deficiency anemia in IBD is crucial not only for improving patient quality of life but also for addressing potential systemic complications arising from untreated anemia. Begum and O. Latunde-Dada (2019) expand the discussion by examining ACD's prevalence across various chronic diseases, including chronic kidney disease and cancers. They provide a comprehensive analysis of how systemic inflammation disrupts iron homeostasis and erythropoiesis, leading to a significant burden of anemia on affected populations. Their work emphasizes the need for a multifactorial approach to understanding and treating ACD, given its diverse etiologies and the role of proinflammatory cytokines in modulating erythropoietin production and iron availability.

Results and Discussions.

Erythropoiesis is a multi-stage method of multiplication and erythrocyte differentiation from hematopoietic stem cells, which generally takes vicinity in the bone marrow of flat bones and the epiphyses of human lengthy bones. A special characteristic of stem cells is their capacity to self-renewal and differentiation. From the hematopoietic stem cell, a myelopoietic stem telephone is formed, which as a result undergoes a transformation to the erythropoietic progenitor cell. It matures via successive divisions and turns into a precursor cell, demonstrating at this stage some traits of the remaining cell. Further maturation happens via altering the nature of the cell nucleus from basophilic to acidophilic, up to its loss in order to reduce metabolism and inhibit the opportunity of division. Mature, enucleated erythrocytes are launched into the blood thru the selective bone marrow barrier, fashioned by means of endothelial cells of the marrow vessels. Under pathological conditions, erythropoiesis can take place in the liver and spleen. Consequently, immature types of erythrocytes show up in the peripheral blood, inclusive of reticulocytes and erythroblasts containing the cellphone nucleus.

Erythropoiesis is difficulty to each nearby and systemic regulation. Although erythrocyte maturation is tightly programmed in the genome of hematopoietic stem cells, there are a wide variety of elements that alter the process. These encompass adhesion molecules, cytokines, ligands and receptors binding them, tyrosine kinases activating transcription elements in the telephone nucleus. Adhesive molecules are accountable for the adhesion of blood cells to the medium, whilst hematopoietic cytokines decide their survival and multiplication. Normal cells require regular cytokine stimulation, in view that the lack of such sign reasons course of the telephone to the apoptosis pathway. Proper cytokine grant is the primary mechanism that regulates phone homeostasis and ensures balance in the shape and variety of particular blood cells at a given site. The thing that regulates erythropoiesis at the systemic degree is glycoprotein peptide hormone secreted with the aid of the liver (20%) and, to an increased extent, by means of

kind I peritubular cells of the interstitial tissue of the kidney cortex (80%), known as erythropoietin. It stimulates a range of ranges of erythropoiesis due to binding to transmembrane EPO-R receptors, existing usually on precursor cells of the erythropoietic lineal, i.e., proerythroblasts. After ligand attachment, it creates a homodimer receptor and then prompts tyrosine kinases JAK (Janus-activated kinase) and different transcription factors. It is cited that the quantity of erythropoietin receptors is inversely proportional to the diploma of erythrocyte maturity. They are no longer located in the phone membrane of reticulocytes and erythrocytes. Conversely, the expression of this receptor in neoplastic cells seems to be a demanding phenomenon. This hampers the administration of recombinant erythropoietin in sufferers with malignant neoplasm, which in this scenario can promote tumor cell growth. The state of affairs triggering the launch of erythropoietin is hypoxia of tissues of a range of origins (heart and lung diseases, smoking or being at excessive altitudes).

Iron is one of the most essential microelements of the physique imperative for the synthesis of hemoglobin. In addition to its principal constructing function, it additionally has a regulatory role. As an issue of heme and cytochrome enzymes, it allows mobile breathing thru electrons switch in the electron transport chain, helps antioxidative methods and DNA synthesis (RNA reductase is an iron-dependent enzyme wished for DNA replication).

The human physique makes use of 20–25 mg of iron day by day for hemoglobin synthesis. Most of this thing comes from the herbal degradation of erythrocytes due to their injury or aging. However, there are conditions in which its immoderate accumulation in the physique occurs. It may additionally end result from the immoderate absorption of this aspect from the gastrointestinal tract (hemochromatosis), its immoderate furnish with meals or from flawed iron metabolism (shortage for erythropoiesis or immoderate launch from the liver or crimson blood cells). Currently, the capacity of free iron to provoke oxidative stress is extensively discussed, consisting mostly of the manufacturing of free radicals, which include reactive oxygen species, which harm nucleic acids, lipids and proteins contributing to carcinogenesis.

Conclusion.

Anemia of chronic diseases is a complex and multifaceted clinical entity that affects a substantial proportion of patients with chronic diseases. Understanding the pathophysiology of ACD is essential to develop effective treatment strategies and to improve the quality of life of affected patients. A comprehensive approach that includes iron therapy, ESAs, targeted therapy, and nutritional support can be effective in managing ACD. Ongoing research will continue to uncover novel diagnostic biomarkers, target pathways, and regenerative factors that will ultimately lead to improved treatment options for this debilitating condition.

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