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Prevalence of iron deficiency anemia in hospitalized infants

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Abstract

Iron is vital, as it is essential for many metabolic processes, including oxygen transport, electron transport, DNA synthesis and repair. Iron balance in the body is regulated carefully so that iron losses are compensated by sufficient iron absorption. Iron deficiency is a common cause of anemia and is typically due to insufficient intake, poor absorption or overt or occult blood loss. The World Health Organization has recognized iron deficiency anemia as the most common nutritional deficiency in the world with 30% of the population being affected. This study was conducted to estimate the prevalence of iron deficiency anemia in 152 hospitalized infants between 1-12 months old. Iron deficiency anemia resulted highly prevalent in this age group, 45% of infants had Hemoglobin level <10g/dl. Despite nutrition, there are other social-economic factors that play a role in the high prevalence of iron deficiency anemia in infants. Conclusively it is stated that, as iron deficiency impairs neurologic development and growth in infants, an adequate clinical attention and evaluation should be directed towards it. Routine screening starting at 9 to 12 months is recommended to help preventing the development of anemia. It is also important adequate weaning and early introduction of iron-rich foods, 4-6 months of age.

Keywords: Iron; Anemia; Deficiency; Infants; Breastfeeding

1. Introduction

Iron is a vital element for human beings. It is essential for multiple cellular and tissue functions as oxygen transport, electron transport, mitochondrial function, energy production especially in skeletal and cardiac muscles, cell proliferation and DNA synthesis [1, 2, 3]. Iron balance in the body is regulated carefully so that iron losses are compensated by sufficient iron absorption. Although the amount of iron absorbed in daily bases is 1mg, the internal need for iron to keep the balance is much higher 20-25mg daily [4].

An erythrocyte has a lifespan of 120 days, so 0.8% so red blood cells are destroyed and replaced each day. Most of this iron passes through the plasma for reutilization, hemoglobin synthesis and other metabolic processes. Iron in excess is deposited in body stores as ferritin or hemosiderin [5, 3]. This regulation of iron balance concentration takes place in the small intestine by the absorptive mucosal cells.

Persistent fails in iron balance lead to iron deficiency anemia or hemosiderosis, both of which can cause adverse consequences. Diminished absorbable dietary iron or excessive loss of body iron can cause iron deficiency. Diminished absorption is more often due to insufficient intake of dietary iron in an absorbable form and rarely due to small bowel diseases (sprue, celiac disease, enteritis) or previous gastro-intestinal tract surgery [6, 2]. Hemorrhage is the most common cause of excessive loss of body iron, but it can also occur with hemoglobinuria due to intravascular hemolysis.

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Dietary iron can be found in two forms, heme and non-heme iron, both forms are absorbed non competitively into duodenal and jejunal mucosal cells. Many factors that alter the absorption of non-heme iron have little effect upon the absorption of heme iron, due to the differences in their chemical structures. Heme iron is easily absorbable and arises from hemoglobin and myoglobin in the form of animal meat, poultry and fish. Non-heme iron is mostly found in plant food but is not easily absorbable. In North America and Europe, one third of dietary iron is heme iron. Heme iron is not chelated and precipitated by numerous dietary constituents that make non-heme iron non-absorbable such as phytates, phosphates, tannates, oxalates and carbonates [7, 8]. Globulin degradation products, produced by pancreatic enzymes, maintain heme soluble and available for absorption.

Aim

This study aimed to find the prevalence of iron deficiency anemia in hospitalized infants.

2. Material and methods

This is a retrospective study. There are enrolled 152 infants aged 1-12 months old, hospitalized in the General Pediatric Ward in the University Hospital Center "Mother Teresa" in Tirana, Albania during 2018-2019.

Information is extracted from the medical records of the patients. The studied parameters are: red blood cells number, hemoglobin level, hematocrit level, mean corpuscular volume, feeding (breastfeeding or formula), mother school-education, number of children in the family, medical diagnose on admission.

3. Results

Of the 152 hospitalized infants included in the study 60% were males and 40% were females. 55% of them were between 1-6 months old and 45% were between 6-12 months old.

According to laboratory parameters 34% of infants had Red Blood Count (RBC) < 3,500,000 cells/mm^3, 44% of infants had Hematocrit (Hct) levels <30%, 40% of infants had Mean Corpuscular Volume (MCV) < 70μm^3, and 45% of infants had Hemoglobin (Hg) level < 10 g/dl (Tab.1).

Table 1 Laboratory parameters

Lab. parameter	RBC <3,500,000cells/mm^3	Hct < 30%	MCV <70μm^3	Hg <10g/dl
Percentage	34%	44%	40%	45%

A further division in Hemoglobin level revealed that 3% of infants had Hemoglobin level >12g/dl, 52% of infants had Hemoglobin level between 10-12g/dl, 34% of infants had Hemoglobin level between 9-10g/dl, 8% of infants had Hemoglobin level between 8-9 g/dl, and 3% of infants had Hemoglobin level <8g/dl (Graph.1).

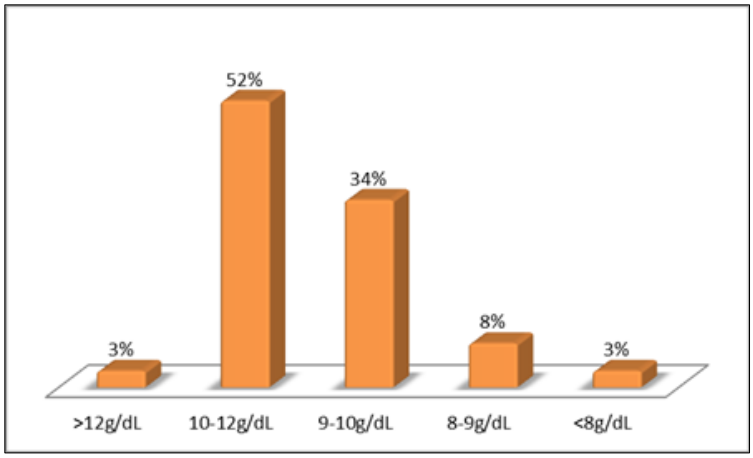

Figure 1 Hemoglobin levels

Regarding child feeding 78% of mothers breastfed their children and only 22% of them used formula milk. Regarding mother school-education 53% of them had only the basic education (8-9 years), 22% of them had middle school-education (12 years), and 25% of mothers had completed university. In 35% of cases the child in the study was the first child and in 65% of cases families had 2 or more children.

Medical diagnosis in admission were common infections of childhood. 55% of hospitalized infants had Bronchiolitis, 19% had Acute Diarrhea, 14% of infants had undetermined Viral Infection, 7% of infants had Urinary Tract Infection (UTI), and 5% of infants had Otitis Media Acute (OMA) (Graph.2).

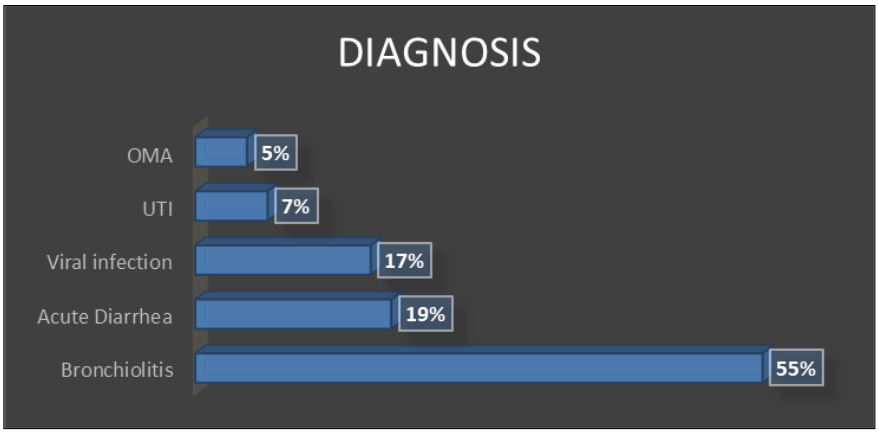

Figure 2 Medical diagnosis of hospitalized infants

4. Discussion

The most common pediatric anemia is dietary iron deficiency anemia, which is also the most common blood disease during infancy and childhood [9, 10]. Iron deficiency anemia develops when body stores of iron diminish at a point that are insufficient for a normal erythropoiesis, which is reflected in a reduction in red blood cell (RBC) number or hemoglobin (Hgb) concentration. Iron deficiency anemia is a prevalent disease, and iron deficiency is the most prevalent single deficiency in world-wide basis.

Healthy newborn infants have a total body iron of 250 mg (80 ppm), which is acquired through the trans-placental exchange during intrauterine life. The hemoglobin is high at birth in most newborns and normally declines, reaching the physiologic lowest point between 2 and 3 months of age in the term infant. During the first months of life breast feedings is protective against iron deficiency due to high bioavailability of iron in breast milk. After the first months of life, the increased erythropoiesis and the depletion of prenatal iron stores, increase the demand for iron intake, which is no longer satisfied be breast milk alone [11,12,13].

In Albania, which is a developing country, most of women in child-bearing age continue the tradition of breast feeding, which is legally protected. Most of mothers (78%) of the infants enrolled in the study feed their children with breast milk. Breast feeding is a perfect way of child nutrition for the first 4-6 months of life, but as the needs for iron are in increase, it is necessary to adequately wean in order to ensure iron-rich foods. This is the delicate point where other factors, social-economical ones, such as poor mother education or low income interfere and put infants at risk of developing iron deficiency. 53% of mothers enrolled in the study had the basic school education (8-9 years), and 65% of those had more than 1 child. These social-economic factors play a significant role in the high prevalence of iron deficiency anemia in the hospitalized infants. The prevalence of iron deficiency anemia in hospitalized infants in this study resulted considerably high with 45% of them having hemoglobin levels lower than 10g/dl. Another factor, responsible for the high prevalence of iron deficiency anemia in hospitalized infants, is the impaired immune function, inflicted by iron deficiency, that prone these patients to infections.

Iron deficiency anemia is a significant health concern. Infants are a high risk group of developing this medical condition. Because neurologic development and growth are impaired with iron deficiency, it is imperative that this condition receives adequate clinical attention and evaluation, as many children are un-diagnosed or remain under-treated. Even in Albania as in many other countries, there are implanted health-programs to help child-bearing women in promptly weaning their infants and properly including iron-rich foods. It is essential to understand that the prolongation of exclusive breast feeding and prevalent intake of milk, prevents the consumption of other iron-rich foods.

5. Conclusion

The prevalence of iron deficiency anemia is high in hospitalized infants. As iron deficiency impairs neurologic development and growth in infants, an adequate clinical attention and evaluation should be directed towards it. Routine screening starting at 9 to 12 months is recommended to help preventing the development of anemia. It is also important, adequate weaning and early introduction of iron-rich foods at 4-6 months of age.

Compliance with ethical standards

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Disclosure of conflict of interest

The author and co-authors of the manuscript declare no conflict of interest.

Statement of informed consent

Authors declare that the informed consent was obtained from the parents of all the children included in the study.

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