

Pathogenetic Basis of Labor Disorders in Severe Iron Deficiency Anemia

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Abstract In severe iron deficiency anemia, depending on the body's reactivity, a decrease in heart rate variability is observed against the background of a decrease in the triangular index, parasympathetic, and humoral components. Spectral analysis of an increase in the sympathetic component with centralization of regulation revealed a shift in adaptive reactivity towards unsatisfactory adaptation and maladaptation. Accordingly, there is an increase in pro-oxidant activity and endogenous intoxication, and a decrease in protein stability. Against the background of this type of reactivity, a decrease in the duration of pregnancy, an acceleration of the first and second periods of labor, a decrease in fetal weight, an increase in the mass of the placenta and an increase in the duration of the third period of labor were revealed in maternity patients. In the postpartum period, there was a lag in uterine invasion and hematometry, as well as an increase in the number of Caesarean section operations.

Keywords Iron-deficiency anemia, Heart rate variability, Childbirth, Adaptation, Placenta, Fetus, Pro-oxidant, Antioxidant, Protein stability coefficient

1. Introduction

Currently, the number of pregnant women with iron deficiency anemia of various etiologies occupies one of the leading places in the world. According to WHO, this pathology affects about 2 billion people on earth, which corresponds to 30% of the total population. At the same time, among pregnant women, hemoglobin levels range from 21 to 80%, and serum iron levels range from 49 to 99% [11]. Iron deficiency anemia underlies the disruption of redox processes in the body of pregnant women, which is against the background of a lack of divalent iron (Fe^{++}) in the body of pregnant women in the composition of hemoglobin, myoglobin, respiratory chain of cells in the NAD, FAD, cytochrome a, b, c, impairs the transport of oxygen, carbon dioxide, and electrons [1,2]. Metabolic acidosis can develop in pregnant women due to this impaired oxygen and carbon dioxide is disrupted [7,9]. Which in turn promotes the expression of chemoreceptors and glomus receptors at the base of the aortic arch and carotid sinus, as well as the medulla oblongata [3]. The expression of receptors primarily promotes the activation of the sympathoadrenal system in pregnant women [13]. Activation of the sympathoadrenal system in a cascade mode promotes the release of hormones from the hypothalamus, adrenal glands, and pancreas and ensures the development of adaptation to this kind of hypoxia

[15]. Against the background of this kind of activation of ergotropic systems at the mitochondrial level, an increase in oxidative processes for the combustion of plastic materials and overload hypoxia are ensured [16]. In the respiratory chain, activation of the pro-oxidant system occurs against the background of overloading hypoxia, and lack of activity of the antioxidant system contributes to the formation of atomic oxygen (O), hydrogen peroxide (H_2O_2), and hydroxide (OH) [19,16]. These compounds act on the structural components of the body's cells and contribute to their destruction [5,8]. In this regard, the study of the pathogenetic foundations of women's labor disorders in severe iron deficiency anemia remains an urgent problem, since reactivity and adaptive capabilities to pregnancy and labor are sharply disrupted against the background of such changes in the mother's body.

This, in turn, can lead to irreversible complications.

The purpose of the study: to identify the mechanisms of labor disorders in severe iron deficiency anemia.

2. The Research Objective

1. To study the adaptive capabilities of maternity hospitals with severe iron deficiency anemia.
2. To study the pro-oxidant, antioxidant activity and indicators of endogenous intoxication of maternity women with severe iron deficiency anemia.
3. To study the periods of labor and uterine invasion in the postpartum period with severe iron deficiency anemia.

3. Materials and Methods of Research

We studied 30 maternity hospitals with normochromic type of blood supply and 30 with severe iron deficiency anemia. The reactivity of the maternity hospital was determined using the Neurolab-Biomysh device. The pro-oxidant activity was studied by malondialdehyde (MDA) [18]. Antioxidant activity was determined by the catalase index [10]. The indicators of endogenous intoxication and the coefficient of protein stability were also studied using the Gabrielyan method [6].

4. The Obtained Results and Their Discussion

When studying the reactivity of the women's body of women in labor with severe iron deficiency anemia, 5 (16%) women revealed normoadaptive reactivity with a shift towards the voltage of regulatory systems, that is, while the heart rate variability in spectral analysis revealed the preservation of the HF parasympathetic component within the normal range, and the VLF component of humoral regulation was reduced. At the same time, an increase in the LF-sympathetic component with centralization of regulation was revealed in comparison with the data of maternity hospitals with a normochromic type of blood supply (Image 1 and 2).

At the same time, an increase in the MDA/catalase coefficient was revealed by 1.44 times ($P < 0.001$), the intoxication index of endogen MSM 254 by 1.4 times ($P < 0.001$), and a decrease in the protein resistance coefficient by 1.16 times ($P < 0.01$). Against the background of this type of reactivity of the body, activation of the pro-oxidant system, decreased activity of anti-oxidant activity and protein resistance, the duration of pregnancy was reduced, during labor the duration of the first and second periods was accelerated 1.23 times, and the third period of labor was prolonged 1.25 times ($P < 0.05$). In addition, a decrease in the fetal/placental

coefficient was revealed. On the third day after delivery, prolongation of the duration of uterine involution and hematometry were revealed. This process is explained by the predominance of the tone of the parasympathetic nervous system, the activity of the pro-oxidant system and a decrease in protein stability. Thus, the parasympathetic system, causing contractions of the muscles of the cervix, contributes to hematometry in the postpartum period. In addition, during the development of hematometry in severe iron deficiency anemia, protein stability decreases against the background of increased endogenous intoxication, as vascular resistance in the functional layer of the myometrium decreases [14,20].

In 8 (26%) women in labor with severe iron deficiency anemia, a state of unsatisfactory adaptation was revealed. At the same time, spectral analysis revealed a 1.24-fold decrease in the triangular index. Where there was a decrease in the activity of HF-parasympathetic, VLF - humoral components by 1.47 times, and an increase in the LF-sympathetic component by 1.28 times compared with the norm ($P < 0.001$) (Image 3 and 4). Against the background of this kind of reactivity, a further increase in the MDA/catalase coefficient was detected by 2.4 times ($P < 0.001$), and the endogenous intoxication index of MSM254 by 2.12 times ($P < 0.001$). At the same time, the protein stability coefficient decreased by 1.27 times ($P < 0.05$). Against the background of this kind of reactivity, the duration of pregnancy is shortened.

4 (50%) women underwent caesarean section, while the remaining 4 (50%) women gave birth naturally. At the same time, the acceleration of the first and second periods of labor was 3.1 and 2.4 times ($P < 0.001$), and the slowdown of the third period of labor was 2.3 times ($P < 0.05$). In this group, the fruit/placental index decreased by 1.4 times. On the third day, there was a 1.3-fold increase in uterine involution ($P < 0.001$) and hematometry. At the same time, the acceleration of the first and second periods of labor is explained by the predominance of the tone of the sympathetic nervous system over the parasympathetic innervation [14,12,1].

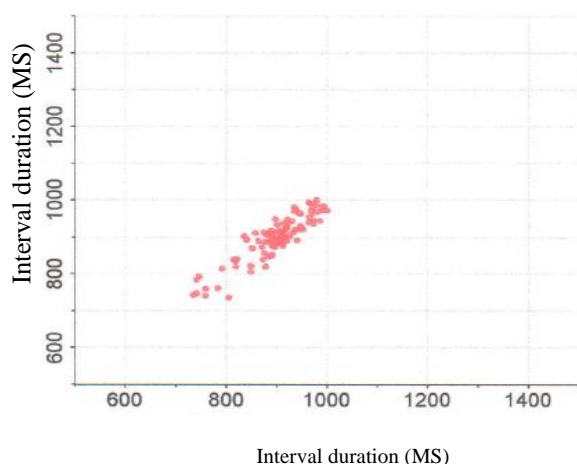


Image 1. The scatterogram

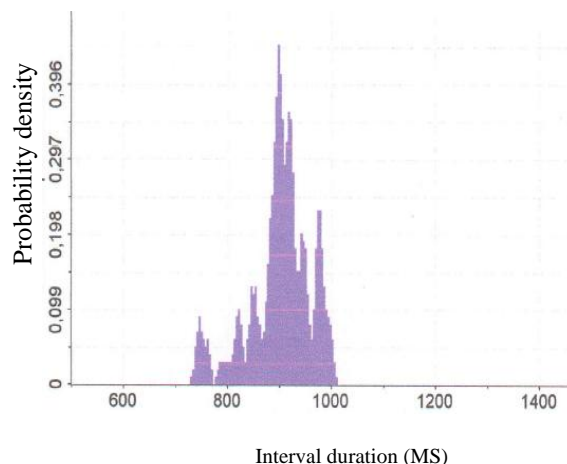


Image 2. Probability density

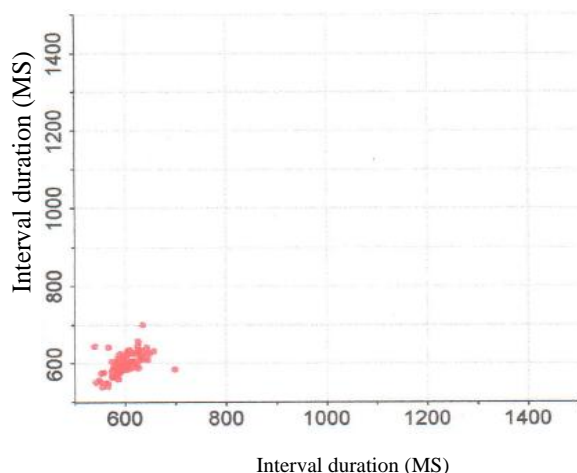


Image 3. The scatterogram

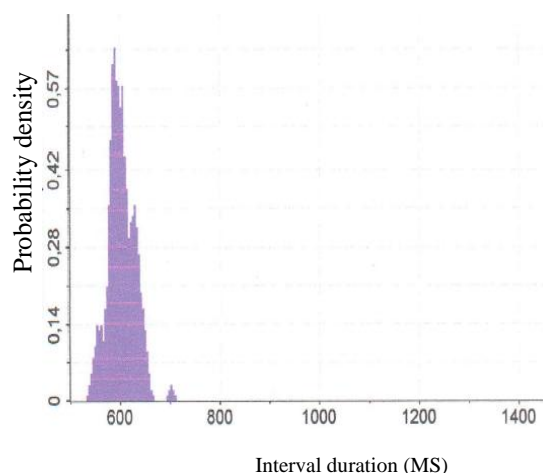


Image 4. Probability density

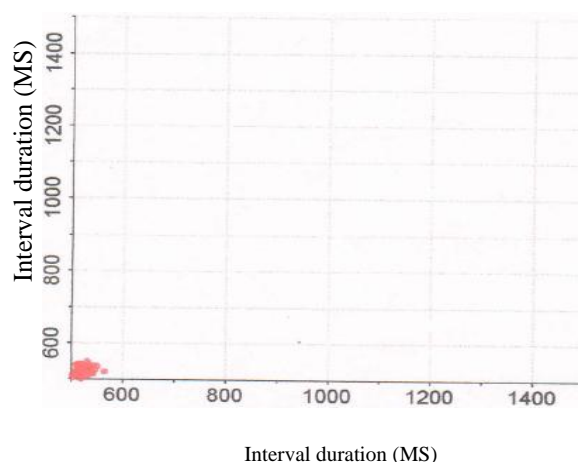


Image 5. The scatterogram

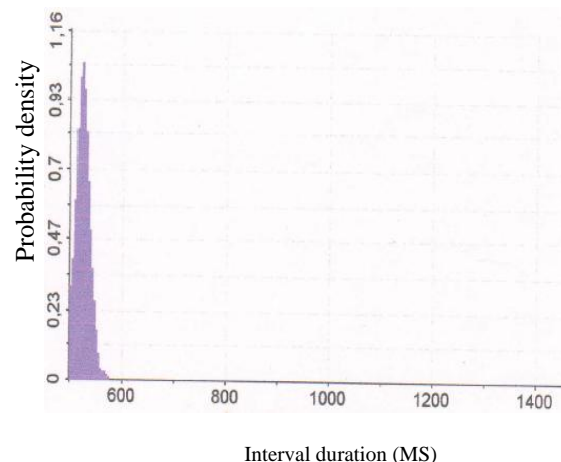


Image 6. Probability density

The remaining 18 (58%) women showed a state of unsatisfactory adaptation with a shift towards maladaptation. At the same time, spectral analysis revealed a sharp decrease in the triangular index by 2.1 times ($P < 0.001$), the functional activity index by 25.2 times ($P < 0.001$), HF parasympathetic by 2.3 times, VLF humoral component by 1.6 times and a further increase in the LF component of the sympathetic nervous system by 1.67 times and the centralization of sympathetic regulation by 3.7 times ($P < 0.001$) (Image 5 and 6).

In this group, the MDA/catalase coefficient is 3.2, and the indicators of endogenous intoxication of MSM254 continue to increase 2.6 times ($P < 0.001$). Where a decrease in the protein stability coefficient of 1.4 ($P < 0.05$) was revealed. At the same time, against the background of this kind of reactivity of the body, the duration of pregnancy was reduced to 10% ($P < 0.001$).

Among the women who gave birth, 12 (77.8%) underwent Caesarean section, the remaining 4 (22.2%) gave birth themselves. At the same time, the duration of the first and second periods of labor increased sharply by 3.6 and 4.2 times ($P < 0.05$), this process is explained by an increase in the tone of the sympathetic nervous system. [Semeleva E. V.,

Smirnova O. A. 2019; Pp.150-151.], and the third period of labor was extended by 3.8 times, in addition, a decrease in the fetal/placental coefficient by 1.4 times, a delay in uterine invasion by 20% ($P < 0.001$) and the development of hematometry were revealed. This process is explained by a sharp decrease in the adaptive capacity of maternity patients [5,20].

5. Conclusions

1. In severe iron deficiency anemia, depending on the reactivity of the body, a decrease in heart rate variability is observed, against the background of a decrease in the triangular index, parasympathetic, and humoral components, an increase in the sympathetic component with centralization of regulation revealed a shift in adaptive reactivity towards unsatisfactory adaptation and de-adaptation.
2. Accordingly, an increase in sympathetic reactivity, an increase in pro-oxidant activity and endogenous intoxication, a decrease in protein stability reveals a decrease in the duration of pregnancy, acceleration of

the first and second periods of labor, a decrease in fetal weight, an increase in placental mass, the duration of the third period of labor, a lag in uterine involution in the postpartum period and hematometry.

3. As the triangular index and the functional state index decrease, the maladaptive reaction in the mother's body and the rate of caesarean sections increase.

REFERENCES

- [1] Abramchenko V. V. Prostaglandins and antigestogens in obstetrics and gynecology. 2013. 207c.
- [2] Britti E., Delaspre F., Feldman A., Osborne M., Greif H., Tamarit J., Ros J. Frataxin-deficient neurons and mice models of Friedreich ataxia are improved by TAT-MTSCs-FXN treatment. *J. Cell. Mol. Med.* 2018 № 22.P. 834–848.
- [3] Bui Thi Huong Glutamatergic modulation of reflex regulation mechanisms of the cardiorespiratory system. // Dissertation St. Petersburg. 2013. 120c.
- [4] Dizdaroglu M., Coskun E., Jaruga P. Measurement of oxidatively induced DNA damage and its repair, by mass spectrometric techniques // *Free Radic Res.* 2015. Vol. 49. P. 525–548.
- [5] Dizdaroglu M., Coskun E., Jaruga P. Measurement of oxidatively induced DNA damage and its repair, by mass spectrometric techniques // *Free Radic Res.* 2015. Vol. 49. P. 525–548.
- [6] Gabrielyan N. I. Experience of using the indicator of average molecules in the blood for the diagnosis of nephrological diseases in children / N. I. Gabrielyan // *Laboratory business.* -1984. № 3. pp. 138-140.
- [7] Gayton A.K. Medical physiology. Translated from English / Edited by V.I. Kobrina. Moscow: Logosphere; 2008. 1296 p.
- [8] Hatherill M, Waggie Z, Purves L, et al. Mortality and the nature of metabolic acidosis in children with shock. *Intensive Care Med.* 2003. № 29(2) P. 286–291. doi: 10.1007/s00134-002-1585-y.
- [9] Jarylkasynova G.J, Iskandar R.M Epidemiological analysis of the prevalence of iron deficiency anemia in the republic of uzbekistan for 2007-2019 // *European Journal of Molecular & Clinical Medicine* 2020. 7 (10), p. 4- 27.
- [10] Korolyuk M. A., Ivanova L. I., Mayorova I. G., Tokarev V. E. Method for determining catalase activity. // *Laboratory work.* 1988. No. 8. pp. 16-19.
- [11] Kuo C и др. Biphasic changes in autonomic nervous activity during pregnancy // *Br. J. Anaesth.* 2010. T. 84, № 3. P. 323-329.
- [12] Malevich Yu.K. The use of prostaglandins for the induction of labor: methodological recommendations / Yu.K. Malevich, V.A. Shostak. - Minsk: Doctor of Design, 2019. - 32 p.
- [13] Nagibovich O.A., Ukhovskiy D.M., Zhekalov A.N. et al., Mechanisms of hypoxia in the Arctic zone of the Russian Federation. // *Bulletin of the Russian Military Medical Academy.* 2016 No. 2 (54) pp. 202-205.
- [14] Obukhova L.A. Autonomous innervation of organs: an educational and methodical manual // Novosibirsk State University. Novosibirsk, 2020. 34 p.
- [15] Prikhodko V.A., Elizarova N.O., Okovity S.V. Molecular mechanisms of hypoxia development and adaptation to it. Part I. *Pathology archive.* 2021; № 83(2): Pp. 52-61.
- [16] Rauchova H., Vokurkova M., Koudelova J. Hypoxia-induced lipid peroxidation in the brain during postnatal ontogenesis // *Physiol. Rev.* 2012. Vol. 61, Suppl. 1. S. 89–101.
- [17] Semeleva E. V., Smirnova O. A. The importance and prospects of the work of health centers // *Modern problems of healthcare and medical statistics.* 2019. No. 5. Pp. 150-151.
- [18] Stalnaya I.D., Garishvili T.G. Definition of MD. // *modern methods in biochemistry.* Moscow, 1977. pp. 66-68.
- [19] Uzbekov M.G. Lipid peroxidation and antioxidant systems in mental diseases. // *Social and clinical psychiatry.* 2014. Vol. 24, No. 4. pp. 97-103.
- [20] Zhilyakova O.V., Zakharova I.V., Nelidova N.E., Belugina O.S., Toropkina E.L., Belova N.G. The effect of anemia on the uteroplacental complex. // *Siberian Medical Journal.* 2010. Volume 25. No. 4. pp. 96-98.