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The Features of Trace Elements Metabolism in Patients with Chronic Atrophic Gastritis

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The modern trials showed that chronic gastritis should be considered not only as a local lesion of gastric mucosa , but also as a general disease of the body, which raised all kinds of metabolism. There are occasional reports that the level of essential trace elements - Cu, Zn, Fe, Se, Mg, Mn, Co, Si (which are regarded as potentially necessary) in chronic gastritis are reduced, and their competitors conditionally toxic elements (Bi, Ni, Mo, Pb, As, Al) are increased. We examined of 126 patients with chronic atrophic gastritis (HAG): in 97 individuals we've diagnosed of chronic multifocal atrophic gastritis (CAMG) and in 29 patients - chronic autoimmune atrophic gastritis (CAG). Trace elements (iron, copper, zinc) in serum were determined by atomic absorption spectrophotometry (atomic absorbtion spectrophotometer C-320). Intensity of lipid peroxidation was assessed by the level of diene conjugates (DC) and active products of thiobarbituric acid (TBA). Status of antioxidant protection (AOP) identified by method of quantitative determination of catalase (C), plasma iron saturation of transferrin (IST), the activity of ceruloplasmin (CA) and carbonic anhydrase (CA). Our trial showed that in patients with chronic atrophic gastritis is present of an imbalance of trace element composition in blood, which is characterized by a significant decrease in levels of iron and zinc and copper downward trend.

Keyword: Chronic Atrophic Gastritis, Trace Elements, Antioxidant Protection.

1. Introduction

The data of modern trials showed that chronic gastritis should be considered not only as a local lesion of gastric mucosa , but also as a general disease of the body, which raised all kinds of metabolism [2]. There are occasional reports that the level of essential trace elements - Cu, Zn, Fe, Se, Mg, Mn, Co, Si (which are regarded as potentially necessary) in chronic gastritis are reduced, and their competitors conditionally toxic elements (Bi, Ni, Mo, Pb, As, Al) are increased [8]. Particular attention is paid to the role of the metals (especially with variable valence) in the reactions of lipid peroxidation. In recent years, among the trace elements zinc attracts attention. Zinc ions affect of the morphofunctional status and cell regeneration of gastroduodenal mucosa, may inhibit of the enzymatic activity of pepsin, and determine of the trophic activity of gastric mucosa and increase of the protective properties of the gel wall [3]. Violation of the complex process of Zn metabolism in the body takes place at different levels - during absorption in the small intestine and transport through enterocytes, penetration and intracellular inclusion in the structural formation. Zinc is absorbed partly by participation of special protein, produced in the lining of the intestine, kidney and liver [5]. Sharing feature of this trace element is that its absorption is normal consistent with human body demand, and the small intestine rapidly react to it. The diagnosis of "zinc- deficient condition" is

assigned when a decrease in its concentration below 13 mmol/l, and a further reduction has an unfavorable prognostic signs. Imbalances of trace elements, especially metals d-sublevel (Cu), may play a role in initiating of the formation of reactive oxygen species [7]. Deficiency of copper can be doubled enhance lipid peroxidation while reducing the activity of superoxide dismutase, catalase and glutathione peroxidase. The oxidation of Fe^{+2} to Fe^{+3} ensured by C^{-} containing enzyme "ceruloplasmin" due its ferrooxidative activity, then Fe^{+3} keen transferrin , which is important to prevent of activation of lipid peroxidation Fe^{+2}. Iron ions are an integral part of iron-porfirine compounds, which are representative by enzymes of antioxidant defense system (AOS): catalase, peroxidase, transferrin. Iron deficiency contributes of pathological membrane changes due to activation of lipid peroxidation, resulting in disrupted cell integrity. The higher concentrations of iron ions inhibit of oxidation.

The aim of study is to determine of the blood levels of minerals Fe, Zn, Cu in patients with chronic atrophic gastritis and its impact on the clinical course of the disease and the relationship to changes in the system LPO - AOP.

2. Materials and methods

Among the 126 examined patients with chronic atrophic gastritis (HAG) in 97 individuals (76.99 %) we've diagnosed of chronic multifocal atrophic gastritis (CAMG) and in 29 patients (23.01 %) - chronic autoimmune atrophic gastritis (CAG). Diagnosis was verified with compliance of the Sydney classification, modified in H'stoni (1996) [4]. The age of patients ranged from 19 to 73 years and the average was 53,3 ± 1,73 years old. Average time of HAMH was 8,66 ± 0,65 years, and for HAG - 7,89 ± 0,64 years. Trace elements (iron, copper, zinc) in serum were determined by atomic absorption spectrophotometry (atomic absorbtion spectrophotometer C-320). Intensity of lipid peroxidation was assessed by the level of diene conjugates (DC) and active products of thiobarbituric acid (TBA) [4]. Status of antioxidant protection (AOP) identified by method of quantitative determination of catalase (C), plasma iron saturation of transferrin (IST), the activity of ceruloplasmin (CA) and carbonic anhydrase (CA) [3].

Table 1: The contents of trace elements in blood of patients with chronic atrophic gastritis

Type of CG / TE	Control group, n=15	CAMG, n=97	CAG, n=29
Fe (mg%)	52,06±0,95	34,88±0,84 p<0,001	33,22±0,78 p<0,001 p_1>0,05
Cu (mcg%)	0,213±0,006	0,209±0,013 p>0,05	0,208±0,012 p>0,05 p_1>0,05
Zn (mcg%)	0,724±0,012	0,572±0,013 p<0,001	0,593±0,23 p<0,001 p_1>0,05

Remarks: 1.p – data probability compare control group;
2.p_1 - data probability compare groups of patients with 2 types of gastritis

3. Results of study and Discussion

The high toxicity of lipid peroxidation products along with decreased activity of antioxidant protection against violations of trace element results to damage of the integrity of cell membranes gastroduodenal tract, disintegrates reduction processes in the gastric mucosa, which served as a prerequisite for learning content

essential trace elements in blood of patients with chronic atrophic gastritis.

The data in Table 1 showed, that in the blood of patients with chronic atrophic gastritis revealed significant variations of trace elements. Severe imbalance of essential trace elements (TE) was typical for both types of chronic gastritis. Thus, in patients with CAMG and CAG we showed of significant decrease in iron content compared with controls (34,88 ± 0,84 mg%, p <0,001; 33,22 ± 0,78 mg%, p <0,001). We also observed of increase of the zinc content in both groups of patients (0,572 ± 0,013 mg%, p <0,001; 0,593 ± 0,23 mg%, p <0,001). We have seen a declining trend in copper content in the blood of all respondents, but these values were not significantly different from the control group.

The frequency of detection combined deficiency of two or three trace elements in blood encountered in this order: 37.30% - combined deficiency of all three trace micronutrients, in 26.98% cases - a combination of iron deficiency and zinc, 14.28% - zinc and copper (Fig. 1).

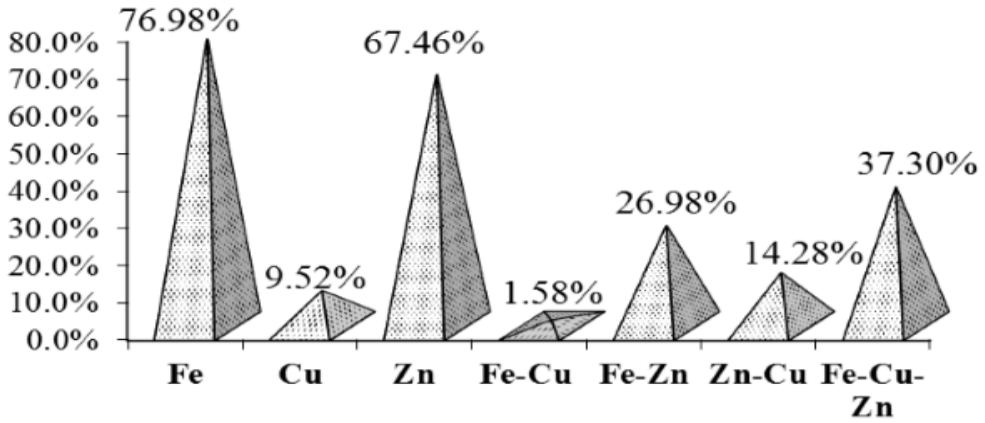

Fig. 1. Trace elements status in patients with chronic atrophic gastritis.

We established of dependence of the content of essential trace elements in blood from the duration of chronic atrophic gastritis (see Table 2). Significant reduction of iron in the blood was observed after the first year of the disease and the duration of CAG 1-5 years was 40,24 ± 1,06 mg%, p <0,01. With the extension of the duration of the disease iron levels rapidly decreased to 33,98 ± 1,87 mg%, p <0,001, (with a history more than 15 years).

Table 2: The trace elements contents in patients with different duration of chronic atrophic gastritis

TE / Duration	Fe (mg %)	Cu (mcg %)	Zn (mcg %)
Control	52,06±0,95	0,213±0,006	0,724±0,012
<1 year	48,84±1,28	0,237±0,011	0,548±0,021
	p>0,05	p<0,05	p<0,001
1-5 years	40,24±1,06	0,218±0,003	0,576±0,011
	p<0,01	p>0,05	p<0,001
5-10 years	36,28±1,46	0,209±0,017	0,675±0,009
	p<0,001	p>0,05	p<0,01
10-15 years	34,42±1,06	0,197±0,012	0,668±0,023
	p<0,001	p<0,05	p<0,01
>15 years	33,98±1,87	0,195±0,009	0,618±0,001
	p<0,001	p<0,05	p<0,01

Remarks: p – data probability compare control group

Examined of copper content in the blood, we observed that the minimum duration of CG (5 years) characterized by a significant increase in the level of copper to 0,237 ± 0,011 mg%, p <0,05, in the first year of the disease. Obviously, this is due to the participation of Cu not only in the process of AOS within ceruloplasmin, but in lipid peroxidation by the ability to change the valency. Significant reduction of copper was observed for the duration of the disease over 10 years.

The data of zinc homeostasis has been reducing its concentration 1.2 times in the first five years of the disease. Later was observed upward trend in Zn content in the blood, but it did not reach standard values. Reduced zinc levels may be explained of the frequency Helicobacter obsemination, because this trace element is a marker of high sensitivity to infection.

It is known that disturbance of absorption of biometals depends on the depth of inflammatory and destructive changes in the gastric mucosa, accompanied by changes in acid production process, and as a resulted into reducing of trace elements bioavailability. The level of iron in the blood progressively decreases with a reduction in the secretion of hydrochloric acid. Significant increase in the concentration of copper was diagnosed in patients with preserved acid-forming function (0,232 ± 0,019 mg %, p <0,05), and the likely reduction of Cu was observed in severe anacidic condition. Significant reduction of Zn inherent in all functional intervals, but to a lesser extent dependent on the ability of gastric acid-deficiency.

In order to establish the relationship between the content of essential micronutrients indices of lipid peroxidation and antioxidant we made of correlation analysis. Analyzing the results we revealed that among the contents of microelements in blood accurate dependencies installed. In our opinion, this can be explained by the lack of competition and vague antagonism between zinc and trace elements with variable valence in this disease. It is shown that the activation of lipid peroxidation occurs against lowering of metals, as evidenced by the existence of high power reverse correlation between concentration of diene conjugates and Fe, Zn, Cu (r = -0,312, p <0,01; r = -0,348, p <0,01; r = -0,322, p < 0,01).

Depletion of antioxidant protection depends from essential micronutrients deficiency. There was a high power direct correlation between the iron content in the blood and catalase levels (r = 0,428, p < 0.01) and the degree of saturation of transferrin by iron (r = 0,548, p < 0.001). Deficiency of Zn, apparently associated with increased synthesis of carbonic anhydrase: r = -0,628, p < 0.001. It is known that Helicobacter insemination increases of synthesis of carbonic anhydrase, which is Zn-content enzyme. We noted a high power direct correlation between the level of Cu and ceruloplasmin activity: r = 0,438, p < 0.01.

The results of our research suggested that in patients with chronic atrophic gastritis the dissociation of trace elements with variable valence is present. In particular we observed of decrease of the iron content in patients with CAMG and CAG an average of 1.5 times, while the copper content remained largely unchanged. In comparison with control group zinc content is reduced in patients in both groups for 1.3 times.

Also, the results indicate of the combined disorders of trace element homeostasis. More often is the zinc deficiency in combination with iron and copper deficiency or both micronutrients.

Thus, the presence of a high degree of Hp infection in patients with chronic gastritis significantly affect the performance of LPO and AOS, but is not the main trigger factor for gastric mucosa damage as a result of activation of lipid peroxidation.

4. Conclusion

Thus, in patients with chronic atrophic gastritis is present of an imbalance of trace element composition in blood, which is characterized by a significant decrease in levels of iron and zinc and copper downward trend.

For our opinion, the perspective direction of future investigation is revealing of imbalance of essential and potentially toxic trace elements in

patients with chronic atrophic gastritis and use of some medications with the aim of correction.

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