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Evaluation the levels of some Mineral Elements in Patients with Stroke

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Abstract

Aim of this study was estimate the levels of some trace elements in patients with stroke compared with the co.ntrol group, where collected 40 blood samples [18 females and 22 males] for patients with stroke, and the results were compared with the control group for healthy people that included 50 blood samples [24 females and 26 males]: In all groups trace elements [zinc(Zn) , copper(Cu), magnesium(Mg), manganese (Mn), iron(Fe), cobalt(Co) and chromium(Cr)] were measured Compared to control, patients with stroke have significantly decreased in the levels of zinc, magnesium, manganese and chromium for both sexes, while there was a significant increase in the levels of copper, iron and chromium in the patients group compared with the control group, for both sexes as well.

Keywords: stroke, trace elements, zinc, copper, magnesium, cobalt, chromium.

1. Introduction

Stroke is a neurological disorder characterized by blockage of blood vessels, leading to clots in the brain, cutting off blood flow, blocking the arteries and causing rupture of blood vessels, which leads to bleeding, and the rupture of the arteries leading to the brain during a stroke causes sudden death of brain cells due to lack of oxygen, Stroke can also lead to depression and dementia for patients who recover [1,2]. Stroke ranks second among the fatal diseases, and the incidence of stroke increases with age and is affected by genetics and environmental factors in addition to the main risk factors for the disease, namely diabetes, high blood pressure, coronary artery disease hypercholesterolemia, valvular heart disease and cigarette smoking [3,4]. The absence of specific biological markers poses a problem in the diagnosis and treatment of stroke, and trace elements are important components of biological structures and may be toxic at levels higher than the amounts required for biological functions [5].At the moment, it has begun to resort to trace elements in the diagnosis and treatment of stroke because they are necessary to maintain the metabolism of neurons and glial cells. In addition, some elements facilitate the process of binding molecules to receptor sites on cell membranes and change the structure of the membranes or the ionic nature of the membranes to prevent or allow certain molecules to enter the cell or leave it and stimulate gene expression, which leads to the formation of proteins involved in biological processes [6,7]. For example, zinc and copper are a necessary and important component of many enzymes that are important in the function of the central nervous system [6, 8].

2. Aim of the study:

The study aims to measure some trace element and their relationship to patients with Stroke.

3. .Materials and methods

In this study, 40 blood samples were collected from people with stroke, Their ages range between (50-75) years , divided into 18 females and 22 males, the samples were taken from the Al-Salam hospital in Mosul, Iraq after checking the patient and diagnosis with stroke by the specialist doctor ,Samples collected six months. Also, 50 blood samples were collected from healthy people (24 females and 26 males) and considered as a control group . The collected blood serum were separated and kept in plastic tubes in a freezer at (-10°c). After diluting the sample, the elements [Zinc, Copper, magnesium, Manganese, Iron, cobalt, chrome] in the blood serum were estimated using atomic absorption spectrometry (from the American company analyze) at different wavelengths [9].

4. Statistical Analysis

All data expressed as Mean ±SD using SPSS 20.0 version paired sample T-test.

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5. Results and Discussion

The results in Table [1] and Table [2] showed that there were a significant decrease in the levels of zinc and manganese in patients with stroke of both sexes [p≤0.001] compared to the control group and this agreement with [10]. From the results of the current study and other studies, it was found that the levels of trace elements have a direct physiological or physical effect on the brain and that the elements must cross the blood-brain barrier to act on neurons and glial cells [11]. Zinc is one of the important minerals necessary for a healthy immune system and has an important role in many brain functions because it acts as a cofactor in many enzymes and participates Superoxide-dismutase and Zn-thionin to reduce the process of oxidative stress [11] Zinc deficiency leads to severe damage to the endothelial protective function and causes or enhances the cytokine-mediated inflammatory process [12,13]. It is also believed that low zinc level has a role in neuronal damage in addition to its role in Alzheimer's disease [10,14].

Manganese regulates many enzymes and is important for the normal development and function of the body. Imai and okabe noted in 2011 [15] a decrease in the level of manganese and Mn-Superoxide dismutase in stroke patients, and this supports our current study. It also appears from the results in Table [1] and Table [2] that there were a significant decrease in the levels of magnesium for both sexes [p≤0.01] and chromium at the probability level [p≤0.01], [p≤0.001] for males and females respectively, The reason for the low level of magnesium in stroke patients might be due to the relationship between magnesium and the disease [5] as it is known that magnesium blocks the glutamatergic N-methylene-D-Aspartate receptors in the nervous system during glutamate neurotoxicity such as acute stroke[16,17].Therefore, increasing the magnesium in the blood serum by taking magnesium therapy has a benefit for treating stroke [18,14]. As for chromium, it is one of the important and essential minerals in controlling blood sugar and lipid levels as the main component of the glucose tolerance factor. In addition, chromium deficiency is related to high blood pressure, heart disease and stroke [7]. While the results of our study showed that there is a significant increase in the level of copper [p≤0.001] for both sexes and this is agreement with Altamura in 2009 [19], As the copper is found in living organisms in its oxidized and reduced forms, in addition it is found throughout the skeletal system and in greater quantities in the brain and liver [7] and acts as an important stimulating cofactor for proteins necessary for growth and development of the body, however, increased levels of Cu in cells cause cytotoxicity [20]. There was also a significant increase in the iron level at the probability [p≤0.01], [p≤0.001] for males and females respectively, which might be due to the excess iron stored before the stroke [14,21] Also, a significant increase in the level of cobalt was observed at [p≤0.01] for males and [p≤0.001] for females. This might be associated with cobalt plays an important role in the biosynthesis of hemoglobin as a cofactor for vitamin B12 (cyanocobalamin), which has an important role in the maturation and completion of red blood cells, and that its increase has a negative effect associated with the risk of stroke. Because an increase in free oxygen radicals, which leads to a decrease in the level of antioxidants, especially glutathione, as well as a decrease in the effectiveness of antioxidant enzymes such as glutathione peroxidase, catalase and superoxide dismutase [22,23,24].

Table 1: Trace elements levels in males of both stroke patients and healthy control.

Parameters	Control (n= 26) Mean±SD	Patient (n=22) Mean±SD	P-value ≤
Zn (µg/dl)	80.56 ±6.44	48.78±7.69	.001
Cu (µg/dl)	111±10.68	164.22±4.02	.001
Fe (µg/dl)	99.33±6.65	154.56±38.42	.01
Mg (mgldl)	1.41 ± 0.12	1.26 ± 0.05	.01
Mn (µg/l)	0.83±0.04	0.512±0.07	.001
Co (µg/l)	0.22 ± 0.16.	0.34±0.027	.001
Cr (µg/l)	0.44±0.07	0.22± 0.05	.001

Table 2: Trace elements levels in Females of both stroke patients and healthy control.

Parameters	Control (n=24) Mean±SD	Patient (n=18) Mean±SD	p-value ≤
Zn (µg/dl)	90.33±3.71	57.11±5.54	.001
Cu (µg/dl)	90.11±5.04	169.78±4.41	.001
Fe (µg/dl)	106.78±9.52336	159.22±8.42	.001
Mg (mgldl)	1.86±0.19	1.52±0.19	.01
Mn (µg/l)	0.89±.02571	0.53±0.07	.001
Co (µg/l)	0.43±0.03	0.25±0.03	.001
Cr (µg/l)	0.34±0.03	0.23±.01364	.001

6. Conclusion

From the results obtained and the importance of trace elements in the biological activities of the body and their influence in many diseases, including stroke, it is necessary to maintain the normal ratio of the elements in the body, and in the case of their decrease than normal, it should be treated to avoid serious diseases, including stroke, diabetes, high blood pressure, and cardiovascular diseases.

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8. References

1. Kuriakose,D. and and Xiao ,Z.(2020). Pathophysiology and Treatment of Stroke: Present Status and Future Perspectives. Int. J. Mol. Sci , 21, 7609.2-24.
2. Shakir, R. (2018)The struggle for stroke reclassification. Nat. Rev. Neurol., 14, 447–448.
3. Boehme, A.K. ,Esenwa ,Ch. and Elkind ,M.S.V.(2017). Stroke Risk Factors, Genetics, and Prevention.3,472-495.
4. Öztürk, K.H., Özgöz, A., İçduygu, F.M.,Soysal,Y.,Küsbeci,O.Y., İmirzalıoğlu,N.(2013).Prothrombotic gene polymorphisms in young patients with cerebrovascular accident. J. Clin. Anal. Med. 4, 273-276.
5. Pirincci, N., Gecit, I., Gunes, M., Kaba, M., Tanik, S., Yuksel, M.B., Arslan, H., Demir, H., (2013). Levels of serum trace elements in renal cell carcinoma cases. Asian Pac. J. Cancer Prev. 14, 499-502.
6. Zangieva, Z.K., Torshin, IIu., Gromova, O.A., Nikonov, A.A. (2013) . Trace elements in the nervous tissue and ischemic stroke. Zh. Nevrol. Psikhiatr. Im. S. S. Korsakova. 113, 30-36.
7. Mehri ,A. and Farzami Marjan, R.(2013). Trace Elements in Human Nutrition: A Review. Int j med invest.2(3):115-128.
8. Bernhardt , D. and Reilly, J.F. (2020). MINERALCOMMODITY SUMMARIES ,U.S.Geological Survey: 52 ,190.
9. Roman-Sliva ,D.A.,Rivera,L. and Morales,T.(2002).Determination of Trace elements in enviromental and biological samples using improved sample introduction flame atomic absorpation spectrometry (HHPN-AAS;HHPN-FF-AAS). Intern. J.. Anal. Chem., Environ . 83,4,327–341.
10. Gönüllüa, H., Karadaşa, S., Milanlioğlub, A.,Gönüllüc, E., Katıd, C.and Demire,H. (2013). Levels of serum trace elements in ischemic stroke patients. Journal of Experimental and Clinical Medicine 30 :301-304.
11. Grüngrei , K. , Gottstein , Th. and Reinhold ,D.(2020). Zinc Deficiency—An Independent Risk Factor in thePathogenesis of Haemorrhagic Stroke. Nutrients , 12, 3548:1-11.
12. Mammadova-Bach, E. and Braun, A.(2019). Zinc homeostasis in platelet-related diseases. Int. J. Mol. Sci., 20, 5228.
13. Zhang, J.; Cao, J.; Zhang, Y.; Li, H.; Zhang, H.; Huo, Y.; Li, J.; Liu, X.; Wang, X.; Qin, X.; et al.2019 Baseline plasma zinc and risk of first stroke in hypertensive patients. A nested case-control study. Stroke , 50, 3255–3258.
14. Moemeni ,H., Qujeq , D., Ahangar ,A.A., Hajian , K. and Parsian ,H.(2018). Evaluation of Serum Magnesium, Iron, Copper and Zinc Levels in Ischemic and Hemorrhagic Stroke Patients and Healthy Controls. JCBR ,2(1): 6-10.
15. Imai, N. and Okabe, T.,(2011) . Kinetics differ between copper-zinc and manganese superoxide dismutase activity with acute ischemic stroke. J. Stroke Cerebrovasc. Dis. 20, 75-78.
16. Yu, R.F., San Jose, M.C., Manzanilla, B.M. and Oris, M.Y.,(2002). Gan R.Sources and reasons for delays in the care of acute stroke patients. J. Neurol. Sci. 199, 49-54.
17. Nie, Z. L., Wang, Z. M., Zhou, B., Tang, Z. P.and Wang, S. K. (2013). Magnesium intake and incidence ofstroke: Meta-analysis of cohort studies. Nutrition,Metabolism and Cardiovascular Diseases, 23(3):169-176.
18. Goldman, R.S. and Finkbeiner, S.M. (1988) . Therapeutic use of magnesium sulfate in selected cases of cerebral ischemia and seizure. N. Engl. J. Med. 319, 1224-1225.
19. Altamura, C., Squitti, R., Pasqualetti, P., Gaudino, C., Palazzo, P and etal.(2009). Ceruloplasmin/Transferrin system is related to clinical status in acute stroke. Stroke. 40, 1282-1288.
20. Tapiero, H., Townsend, D.M. and Tew, K.D. (2003). Trace elements in human physiology and pathology. Copper. Biomed. Pharmacother. 57, 386- 398.
21. Millerot-Serrurot E, et al. (2008). Temporal changes in free iron levels after brain ischemia: Relevance to the timing of iron chelation therapy in stroke. Neuro chemistry International; 52(8): 1442-1448.
22. Wen,Y., Huang, S. , Zhang,Y and etal.(2019). Associations of multiple plasma metals with the risk of ischemic stroke: Acase-control study. Environment International, 125 . 125–134.

23. Atasoy, N., Mercan, U., Alacabey, İ. and Kul, A.R., (2011). Levels of heavy metals and certain macro elements in potable and tap water at Van city center. Hacettepe J. Biol. & Chem. 39, 391-396.
24. Moniz S., Hodgkinson S. and Yates P. 2017.Cardiac transplant due to metal toxicity associated with hip arthroplasty. Arth Tod., 3: 151-153.