

Progress in the relationship between each components of metabolic syndrome and glutamate aminotransferase

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Abstract: Metabolic syndrome (metabolic syndrome, MS) reaction is systemic metabolic abnormalities, by many types of pathogenic factors together on the human body, blood pressure, blood fat, blood sugar, obesity, disorders, mainly with high uric acid and abnormal coagulation is given priority to, with coronary atherosclerosis, the occurrence of cardiovascular disease. Alanine aminotransferase (ALT) is widely distributed in human body, exists in most tissues and organs, mainly involved in the process of protein digestion and absorption of human body, in which the content of liver cell mitochondria is the highest, so it is used to measure liver function and is also one of the most sensitive indicators reflecting liver damage. Metabolic syndrome is defined as a chronic inflammatory disease, and ALT, as an inflammatory factor associated with metabolic diseases, has a long-term and persistent effect in patients, mainly involved in oxidative stress response, produce a series of immune response effects, leading to damage to hepatocytes, and eventually lead to the level of ALT in the blood of patients. In recent years, there are few relevant studies at home and abroad, but some studies directly confirm that ALT participates in the occurrence and development of MS and plays a certain role in it. Meanwhile, modern medicine suggests that serum ALT levels are also closely related with the MS components. Secondly, ALT can be used to measure and identify MS, so it is expected to be a new predictor of MS. Although there is no clear definition of MS in traditional Chinese medicine, some doctors can attribute the disease location to the liver, spleen and kidney, and the pathogenesis is mainly false and solid, and a large number of studies have found that dampness, heat, phlegm and blood stasis are the main pathological factors, and the clinical treatment is mainly to remove phlegm and remove blood stasis.

1. Introduction

Metabolic syndrome (metabolic syndrome, MS) reflects systemic metabolic abnormalities, which involve many types of pathogenic factors acting on the human body, resulting in disorders in blood pressure, blood lipid, blood sugar, obesity and other aspects, mainly with high uric acid and abnormal blood coagulation. Although there is no direct corresponding disease name in Chinese medicine, some doctors attribute MS to "obesity", "thirst", "thirst", "headache", "dizziness", "chest pain" and "illusion of spleen" according to their symptoms and the pathogenesis of each

component^[1]. In recent years, according to the relevant epidemiological investigation and research, the incidence of metabolic syndrome in China is increasing year by year, and the incidence of its various components is becoming more and more significant. Data show that the incidence of metabolic syndrome in China shows a trend of younger, and the annual positive rate is about 21.3%, the prevalence of women is significantly higher than that of men, and the prevalence of men and women is 19.2% and 27.0% respectively^[2,3]. There was statistical significance between gender and the incidence population. And with a significant association between the incidence of coronary atherosclerosis and cardiovascular disease and metabolic syndrome in non-MS patients^[4]. Tracing back to China's medicine, traditional Chinese medicine believes that the causes of metabolic syndrome are mainly congenital endowment, poor diet, emotional disorders, tired internal injury and old age, etc^[5]. Its pathological factors are mainly phlegm turbidity, blood stasis, dampness and heat, etc., the pathogenesis, and the disease involves liver, spleen, kidney and viscera^[6, 7]. The spleen is "innate", mainly transporting water and valley, and is related to the digestion and absorption of food and scattered "temper loose essence, belongs to the lung", participating in the metabolic process of the human body. Similarly, the spleen is the "source of sputum", and "all diseases are caused by sputum". At the same time, it can be used as the pathogenic factor of metabolic syndrome and become its pathological factor, and the two are interrelated and influence each other. Liver main drainage, liver gas dredging, smooth reach the whole body qi machine, promote the spleen and stomach transport and secretion of bile. The smooth and normal operation of the human body depends on the liver and spleen. If the air machine lift dysfunction, cause the air machine disorder, condensed into phlegm, wet and other pathological products. However, some studies have shown that the most common type of TCM constitution in the incidence of metabolic syndrome in China is phlegm and dampness^[8]. In addition, a large number of research data show that people with phlegm and dampness constitution are also accompanied by the occurrence of obesity, abnormal blood pressure, dyslipidemia, abnormal blood glucose, hyperuricemia and other diseases^[9]. No matter in modern medicine or traditional Chinese medicine research, the occurrence and development process of metabolic syndrome will cause different degrees of impact on the human body. Therefore, clinically, the early detection of MS, early prevention, early intervention is particularly important.

In the whole disease of the digestive system, there is still a great controversy about the pathogenesis of metabolic syndrome. The currently accepted doctrine is that STERM^[10] In the "common soil" doctrine,

The main factors causing the metabolic syndrome are insulin resistance, and the chronic chronic inflammatory state of the body. Hepatic insulin resistance may occur early in type 2 diabetes and become the initiating factor of metabolic diseases. ALT is largely present in the mitochondria of liver cells, and is an inflammatory factor, which is closely related with metabolic diseases, promotes inflammatory response, participates in oxidative stress, and is positively associated with the risk of metabolic diseases such as diabetes, hypertension and hyperlipemia^[11]. Similarly, the Olynyk JK^[12] As also mentioned in the study, ALT not only participates in the occurrence of MS, but also can predict the process of related components to a large extent. In recent years, the relationship between ALT and MS has a great impact, the association between ALT and MS in most of the studies, and ALT is expected to predict the occurrence of MS. This paper focuses on the correlation between ALT and metabolic syndrome and MS in traditional Chinese and western medicine.

2. Overview of ALT

Serum glutamate (alanine aminotransferase, ALT) is widely distributed in the human body, exists in most tissues and organs, mainly involved in the process of human protein digestion and

absorption, in which the content of liver cell mitochondria is the highest, so it is used to measure liver function and is also one of the most sensitive indicators reflecting liver damage^[13]. In the early days, researchers found that ALT levels increased significantly after cell necrosis and cell membrane permeability increased when hepatocytes were damaged by unknown causes. Therefore, there are the vast majority of studies using ALT levels in serum to assess the extent of liver function impairment^[14], Relatively accurate prediction of the stage of liver injury and of alcoholic liver disease^[15,16]In the middle of the diagnosis. The latest study found that the degree of liver fat deposition was positively correlated with ALT levels in patients with metabolic syndrome^[17], Also consistent with fat deposition at other sites, such as pancreatic fat deposition. Therefore, serum ALT can not only serve as the most sensitive indicator of hepatic fat accumulation, but also as an independent predictor of NAFLD, independently associated with multiple components of M etS including diabetes, insulin resistance and obesity, and serum ALT levels may be expected to be a new indicator for the prediction and diagnosis of MS^[18,19]. The pathological basis of metabolic syndrome is related to insulin resistance and chronic inflammation and oxidative stress, ALT is a kind of inflammatory factors associated with metabolic disease, activate the oxidative stress response in patients, participate in various stages of immune response, indirectly lead to liver ocyte damage, cell membrane permeability increases, eventually lead to higher serum levels of patients. At the same time, studies have confirmed that some inflammatory factors in the human body also come from excessive adipose tissue, including ALT, interleukin, etc., which stimulate the insulin signaling pathway, leading to insulin resistance in the body^[20], Induced the development of metabolic syndrome. Therefore, MS and ALT are correlated and interact with each other, and ALT not only participates in oxidative stress, occurs inflammatory response, and is expected to be an independent predictor of MS.

3. Glutamate transaminase with insulin resistance

IR depends on the combination of innate heritability and acquired environmental factors. Some previous studies have proved that the important inducing factors of IR pathogenesis are the increase of liver fat content and other visceral fat accumulation^[21]. Modern medical analysis, Due to the β cell function reduction, lead to reduced insulin secretion, even insulin function decline, produce excessive free fatty acids (FFA), aggravating the FFA content in the liver, and fatty liver formation, insulin resistance, exacerbated the lipid disorders, abnormal blood sugar, and blood pressure, form with IR as the core of the metabolic syndrome^[22]. The occurrence of insulin resistance is reported to induce increased ALT levels in the serum^[23]. At the same time, the liver fat infiltration, ALT levels are increased phenomenon, and cause insulin resistance^[24]. Due to the strong regenerative ability of the liver, when the fat accumulation in the liver cannot be properly metabolized, the ALT level increases and insulin resistance occurs, but there is no obvious symptoms of metabolic disorders. Meanwhile, excessive fat content accelerates the release of inflammatory factors similar to ALT from liver adipose tissue, further affecting the development and development of MS.

According to traditional Chinese medicine, the spleen is the foundation of the acquired, in the center, not only with the diet of water and grain, but also to coordinate the lung gas, irrigation the four sides, the fine micro material by temper cloth, cloth around the body, to fill the viscera rong body. If the spleen does not disperse sperm, the water essence can not be properly transferred in the lung to turbidity, and turbidity is manifested as insulin resistance. The physical types of obese people are mainly: phlegm dampness, dampness and heat quality and qi deficiency quality^[25]. According to Zhao Yao et al^[26], The IR of sputum was higher than that of dampness and significantly higher than that of the other two syndrome types.

4. ALT with obesity

The volume and number of adipose tissue of obese patients are higher compared with normal people, resulting in excessive fat in the body^[27]. Lipids not only constitute the structure of living organisms, but also play an important role in human body function, which is related to cell homeostasis, new morning metabolism and lipid metabolism^[28]. Obesity is not only an external change in body shape, but also internal endocrine disorders and a series of inflammatory responses of oxidative stress, are closely related to insulin resistance^[29]. An obesity-induced MS, chronic high intrahepatic free fatty acid (free fatty acids, FFA) stimulated by islet B cell dysfunction^[30], Aggravated lipid deposition in the liver, accompanied by hepatic insulin resistance, showed an abnormal elevation of ALT levels. In addition, a study of 4190 adolescents also found significantly higher ALT levels in central obese people^[31], And also appeared in different degrees of hepatocyte injury, appeared hepatic insulin resistance. Moreover, some studies have shown that the^[32], In obese people with normal ALT levels, the main feature is a five times higher risk of metabolic abnormalities than the normal control population. Therefore, it can be speculated that ALT may predict the occurrence and development of MS by reflecting hepatic fat accumulation and insulin resistance.

"Su Wen · Bi theory" mentioned: " the diet is doubled, the stomach is hurt."Diet, excessive intake of water valley, beyond the load of viscera, and spleen and stomach, spleen and stomach cannot complete the normal cloth water valley and water in the body, cause wet turbidity accumulation, brewing into phlegm, gathered on the skin surface, phlegm body bloated, spleen like dry evil dampness, phlegm wet trapped, spleen and stomach, weak, and cannot digest water valley, the more phlegm wet accumulation. Zhang Xiaomei et al^[33]By studying the relationship between abdominal obesity and systemic obesity and TCM constitution, it is found that the main constitution types of abdominal obesity and systemic obesity were phlegm dampness.

5. GALT and diabetes mellitus

Diabetic patients with liver lipid precipitation may cause hyperglycemia due to insulin resistance, aggravate the abnormality of tricarboxylic acid cycle, damage mitochondria, increase the content of peroxidase, and cause liver damage, resulting in a large number of ALT release into the blood. Other studies have also confirmed that patients with diabetes have significantly increased serum ALT levels compared with normal people^[34], And a survey study of Filipino women^[35], Only ALT levels were independently associated with an elevated prevalence of diabetes, suggesting that ALT may be a better biomarker of diabetes prediction in Filipino women. Therefore, the occurrence of diabetes mellitus is associated with ALT. Cao Ling defect^[36]The study confirmed that, Chronic inflammatory stimulation of ALT may cause diabetes combined with diabetic nephropathy. At present, fat deposition caused by ALT elevation and chronic oxidative stress are regarded as the mechanism of the relationship between serum ALT and diabetes^[37]. ALT, as an inflammatory factor, exacerbates the destruction of liver adipose tissue, causes insulin resistance, and causes elevated blood sugar content. Moreover, it has been documented that ALT isoenzymes can affect normal glucose metabolism and then induce insulin resistance.

On Strange Diseases said, "The overflow of the five qi is called an illusion of spleen. Fu five taste entrance, hidden in the stomach, the spleen for its essence, body fluid in the spleen, so the population sweet also... the sweet is full, so its gas overflow, into thirst ". The clinical symptoms of thirst elimination are similar to those of modern medical diabetes. According to traditional Chinese medicine, the liver hides blood, the basic pathogenesis of diabetes is liver dysfunction, and blood sugar is produced by consuming grains, vegetables, digestion, transforming simple sugars into the

blood. This process is consistent with "Lingshu • Qi" "in the coke by gas and juice, change and red, is called blood". Therefore, blood sugar is an important part of the blood mentioned in traditional Chinese medicine.

At present, there is a lack of association between ALT and diabetes TCM syndrome types, and in the future, multidisciplinary cooperation is needed to explore the correlation between ALT and metabolic syndrome and their various components.

6. GALT is associated with hypertension

According to the outline of "China Cardiovascular Disease Report 2018", the number of hypertension patients in China is about 245 million, which is not only a huge number, but also still in a growing trend^[38]. The study by Jia et al^[39] showed that ALT levels were significantly increased in the affected population with hypertension, and its incidence was significantly higher than that in the normal population. One of the important risk factors for prehypertension is insulin resistance, and ALT is a related inflammatory factor, which stimulates the oxidative stress process in human body, causes abnormal glucose and lipid metabolism, leading to the formation of atherosclerosis, and increases hypertension. Hong^[40] Some studies suggest that the potential predictor of hypertension in elderly China is ALT level; the correlation analysis of blood pressure in adolescence shows that the increasing trend of mean blood pressure increases with the increase of ALT level. At the same time, sympathetic excessive excitation, insulin resistance associated with hyperinsulinemia, stimulate the sympathetic nerve to secrete norepinephrine, increase vascular resistance, and cause elevated blood pressure^[41]. Lu Peipei^[42] The study also showed that the ALT level was proportional to the incidence of hypertension, and the level of serum ALT could even be used as an independent risk factor for hypertension.

Traditional Chinese medicine believes that phlegm and blood stasis are not only pathological products, but also the pathogenic factors of blood operation. Modern doctors believe that the pathogenesis of phlegm and blood stasis is similar to the formation process of atherosclerosis^[43]. Zhao Qi^[44] The study confirmed that the serum ALT level of sputum stasis syndrome was higher than that of other syndrome types, and the increase of damp heat syndrome was most obvious^[45].

7. Gluine aminotransferase and dyslipidemia

Hyperhyperacylglycerolemia and / or LDL cholesterolemia are the main manifestation of dyslipidemia in the metabolic syndrome. In previous studies, the incidence of lipid metabolic disorders was associated with increased serum ALT levels^[46] and was independently associated with higher serum low-density lipoprotein cholesterol (LDL-L), non-high-density lipoprotein cholesterol (HDL-C), and lower high-density lipoprotein cholesterol levels (HDL-C)^[47]. Lin Caixia, et al., studies also showed that^[48], The prevalence of abnormal lipid metabolism increased significantly with increasing ALT levels. Because the triglycerides in blood lipids decompose into glycerol and fatty acids, and fatty acids can release a large number of inflammatory factors, causing liver inflammation, leading to the destruction of liver cells, and causing the increase of ALT in the blood^[49], Then affect the sensitivity of the liver to insulin, causing insulin resistance, leading to the body sugar and lipid metabolism disorders.

The main TCM syndrome of dyslipidemia are phlegm turbidity block, qi stagnation and blood stasis and Yin deficiency and Yang hyperactivity^[50]. According to traditional Chinese medicine, the spleen and stomach live in the center, receive the rotten diet, and the fine substances in the water and valley are scattered around the body. If the diet is not broken, hurt the spleen and stomach, the production of phlegm turbidity, blood stasis and other pathological products, gathered in the body. Dyslipidemia is mostly related to the spleen, and the treatment is also mainly to invigorate the

spleen, exercise qi dryness and dampness. Lei Yan et al^[51] Confirmed that ALT has a close connection with TCM sputum syndrome. The results of these studies suggest that we can treat dyslipidemia from the spleen theory. Studies have shown that^[52], The treatment of dyslipidemia to invigorate the spleen and expectorant drugs, Zhou Ziyang^[53] And other findings found that dyslipidemia to remove phlegm and blood stasis drugs.

8. The TCM value of glutamate transaminase

Some studies have pointed out that ALT is not only related to the fat deposition in the liver, but also positively associated with the accumulation of pancreatic fat^[54]. And at the same time, Lee^[55] have found that the key factors of insulin resistance and metabolic syndrome are pancreatic fat infiltration..... According to traditional Chinese medicine, the spleen and pancreas are the same origin, which is discussed in "cover is the accessory of the spleen, in the book of traditional Chinese medicine, named paste" can be seen that the pancreas is "ointment", is the accessory of the spleen, and the secretion function of pancreatic islet also belongs to the category of "spleen main transport"^[56]. The transport of the spleen is normal; if the spleen fails, the metabolism of gas, blood and body fluid will be disturbed, leading to abnormal insulin secretion and even insulin resistance. The liver is the official of the general, the main drainage, has the function of regulating the whole body qi machine, which can not only promote the operation of blood transfusion, but also enhance the rise and fall of the qi of the spleen and stomach. Liver qi regulation, the spleen and stomach drop, energy metabolism in the body is normal, can be transformed into fine microsubstances to nourish the whole body; liver loss, temper is abnormal, reverse condensed into phlegm wet, further aggravating the disorder of energy material metabolism^[57]. Kidney is the congenital, main essence, growth and development and reproduction. Kidney and thirst are closely related, liver, spleen and kidney work together, eventually leading to the occurrence of metabolic syndrome.

9. Conclusion

At present, serum ALT is not only the most sensitive indicator of hepatic fat accumulation and NAFLD, but also can independently predict NAFLD, and is also closely related to pancreatic fat deposition. Also independently associated with multiple components of M etS including diabetes, insulin resistance and obesity. Studies show a positive correlation between ALT and insulin resistance, thus similarly predicting obesity, hypertension, diabetes, and dyslipidemia. Conversely, the latter can affect the elevated ALT levels. Motherland medicine, through the study of ALT levels and metabolic syndrome components of the relationship between the TCM constitution, the results found that insulin resistance is mainly phlegm dampness, abdominal obesity and systemic obesity, the main type of constitution for phlegm dampness, high blood pressure population of serum ALT levels than other syndrome, and hot and heat contains evidence increased is the most obvious, and dyslipidemia is given priority to with phlegm remove blood stasis drugs.

However, the heterogeneous population distribution of ALT and MS and its components revealed multiple mechanisms and chronic inflammation caused by IR and oxidative stress.

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