IJIMM, Volume 2, Issue 6, 2024 ISSN: 2995-5319
http://medicaljournals.eu/index.php/IJIMM/issue/view/3
INTERNATIONAL JOURNAL OF INTEGRATIVE AND MODERN MEDICINE

Changes in the Pancreas in Metabolic Syndrome

Ergashev Sukhrob Tahir ugli, Radjabov Bekzod Madirim ugli, Gulmanov Ilyich Dzhumabaevich
Tashkent Medical Academy

Abstract: Changes in the pancreas (PG) in metabolic syndrome are mainly a diffuse process. Steatosis of the pancreas, as a rule, is combined with sluggish inflammation of the organ under the influence of various pancreatogenic factors (such as alcohol, taking medications, a history of cholelithiasis, etc.). It should be noted that the development of pancreatic steatosis most often occurs against the background of the presence of metabolic syndrome. The trigger for the progression of pancreatic pathology in MS is inflammation, which is closely associated with fatty infiltration of the organ against the background of obesity. Thus, changes in the pancreas characteristic of MS are not only secondary to its background, but also contribute to the progression of this syndrome and the development of complications, closing the pathogenetic circle.

Keywords: pancreas, metabolic syndrome, steatosis, diabetes mellitus, obesity.

Relevance. Patients with metabolic syndrome (MS) experience pronounced changes in the exocrine function of the pancreas (PG). The trigger for the progression of pancreatic pathology in MS is inflammation, which is closely associated with fatty infiltration of the organ against the background of obesity. Changes in the pancreas characteristic of MS are not only secondary to its background, but also contribute to the progression of this syndrome and the development of complications, closing the pathogenetic circle. The history of studying changes in the pancreas in obesity goes back about 100 years, when in the 1930s J. Schaefer and R. Ogilvie conducted comparative studies between pancreas mass and total human body weight. They showed that obese people had greater pancreatic mass than people with normal body weight [11, 12]. Subsequently, with the advent of radiological research methods, a high correlation was revealed between pancreatic steatosis, excess body weight and type 2 diabetes [13]. Modern experimental studies on experimental animals (mice, rats) that received a special diet rich in fats have shown a significant connection between diet and pancreatic steatosis with the subsequent development of b-cell dysfunction and the formation of type 2 diabetes [14, 15]. In obese experimental animals, the pancreas contained more total pancreatic fat, triglycerides, free fatty acids (FFA), but significantly less phospholipids and cholesterol compared to mice with unchanged body weight. Due to the fact that FFAs are a substrate of lipid peroxidation, thereby contributing to the disruption of the integrity of the cell membranes of pancreatic cells, while simultaneously increasing the production of pro-inflammatory cytokines (tumor necrosis factor a, interleukin-6, interleukin-8), these researchers assumed that the identified the differences may be due to the proinflammatory activity of adipose tissue. Thus, for the first time these authors proposed the term “non-alcoholic steatopancreatitis”. There are experimental data on the effect of endotoxemia on the development of pancreatic steatosis with the formation of type 2 diabetes [11].

In a study by E-J. van Geenen et al. [17] demonstrated a direct relationship between non-alcoholic fatty liver disease (NAFLD) and pancreas. The authors concluded that intralobular and total pancreatic obesity (steatosis) significantly depended on the activity of steatohepatitis. Disorders of lipid metabolism are manifested by atherogenic dyslipidemia, in which there is a significant increase in the concentration of FFAs in the pancreatic parenchyma, which, in turn, leads to both a decrease in insulin activity and b-cell dysfunction and, mainly, their apoptosis, this is confirmed by a number of studies [8 , 9]. A number of researchers are still studying in experiments other causes of the development of insulin resistance (IR), which is one of the main factors in the development of MS and pancreatic steatosis (which include agents that enhance the inflammatory response, such as the transcription factor - NFkB and its activator - IKK-b) [10], selenoprotein P [2], adipokines (leptin, apelin, omentin, etc.) [13].

It should be noted that pancreatogenic factors also include alcohol and cholelithiasis, which can also lead to the development of pancreatic steatosis [4]. Thus, we can assume completely different ways of developing fatty degeneration (steatosis) of the pancreas, which, in turn, proves its polyetiology (from banal excess nutrition associated with the patient's eating behavior to disorders at the gene level); rice. 9. Most researchers agree on one thing: the clinical and functional state of the pancreas in MS is a dysmetabolic pancreatopathy (steatosis, lipogenic pancreatitis, non-alcoholic fatty pancreatic disease), which consists in the diffuse development of adipose tissue in all parts of the organ and is combined with low-grade inflammation against the background obesity/MS [12, 14].

According to some researchers [15], there is a clear relationship between excessive consumption of high-calorie foods containing fats and pancreatic steatosis. These are the so-called external factors leading to obesity. Along with this, there is also a genetic predisposition to obesity or the development of insulin resistance (IR). There is still no consensus in the literature about the root cause of the cascade of metabolic disorders. Thus, according to some authors, the primary is a hereditary predisposition to obesity and IR, which is realized in conditions of low physical activity, excess nutrition and leads to compensatory hyperinsulinemia [7]. In turn, hyperinsulinemia blocks insulin receptors, and as a result, exogenous carbohydrates and fats are deposited to a greater extent in adipose tissue, and lipolytic processes slow down. Obesity progresses, and thus a vicious circle is completed. Constant hyperinsulinemia depletes the β-cell apparatus of the pancreas, which sooner or later leads to impaired glucose tolerance (IGT), and then to the development of diabetes mellitus (DM). Disorders of lipid metabolism are manifested by atherogenic dyslipidemia, in which there is a significant increase in the concentration of FFAs in the pancreatic parenchyma, which in turn leads to both a decrease in insulin activity and β-cell dysfunction and mainly to their apoptosis, which is confirmed by a number of studies [2; 8]. In addition, high levels of FFA in the blood promote increased formation of nitric oxide, which, in turn, leads to apoptosis of β-cells. An increase in the activity of free radical lipid oxidation (LPO), which is also toxic to pancreatic cells, leads to the progression of damage to the pancreas with disruption of its intra- and exocrine functions. It should be noted that the increase in pancreatic adiposity is associated not only with an increase in FFA, but also with other cytokines such as interleukin-6, leptin, adiponectin and tumor necrosis factor α (TNF-α). Moreover, the latter has direct cytotoxic effects on β-cells, especially in combination with other cytotoxins [1]. Along with this, atherogenic dyslipidemia is also the cause of the development of hyperlipidemic pancreatitis, which is based on vascular fat embolism in combination with a massive effect on the tissues of fatty acids, but, as a rule, this is acute pancreatitis. The results of studies of morphological changes and the functional state of the pancreas are presented in many experimental works [7; 12]. One of the postulates of these theories is that triglycerides are hydrolyzed by pancreatic lipase and FFAs accumulate in the pancreas. In turn, FFAs both affect the cells of the pancreas and damage the capillaries of the pancreas. As a result of ischemia, an acidic environment (acidosis) is created, which increases the toxicity of FFA. The authors also point out another important point - increased blood viscosity due to a high level of chylomicrons, which can cause disruption of microcirculation in the pancreas and its ischemia. These experimental studies on experimental animals (mice, rats) receiving a special diet rich in fats showed a significant relationship between diet and pancreatic steatosis with the subsequent development of β-cell dysfunction and the formation of type 2 diabetes [7].

In obese experimental animals, the pancreas contained more total pancreatic fat, triglycerides, FFA, but significantly less phospholipids and cholesterol compared to mice with unchanged body weight. Due to the fact that FFAs are a substrate of lipid peroxidation, thereby contributing to the disruption of the integrity of the cell membranes of pancreatic cells, while simultaneously increasing the production of proinflammatory cytokines (TNF-α, IL-6, IL-8), these researchers made the assumption that the identified the differences may be due to the proinflammatory activity of adipose tissue. In a study devoted to the genetic study of fatty degeneration of the pancreas, Y.T. Chang et al. [12] provide data on the presence of specific genes associated with hypertriglyceridemia. It was also noted that the mutation of these genes, as well as tumor necrosis factor polymorphism, are independent markers of the risk of developing hyperlipidemic pancreatitis in the Chinese population. According to some data, a

genetic mutation of the lipoprotein lipase gene is detected only in rare cases [13]. Thus, we can assume completely different ways of developing fatty degeneration (steatosis) of the pancreas, which, in turn, proves its polyetiology (from banal excess nutrition associated with the patient's eating behavior to disorders at the gene level) [1; 2].

Literature

1. Ахмедов В. А., Гаус О. В. Поражение органов гепатобилиарной системы и поджелудочной железы при ожирении //Терапевтический архив. – 2017. – Т. 89. – №. 1. – С. 128-133.
2. Бацков С. С., Пронина Г. А., Инжеваткин Д. И. Неалкогольная жировая болезнь поджелудочной железы как дигестивный маркер метаболического синдрома //Медико-биологические и социально-психологические проблемы безопасности в чрезвычайных ситуациях. – 2012. – №. 4. – С. 50-55.
3. Губергриц Н. Б. и др. Внешнесекреторная недостаточность поджелудочной железы при сахарном диабете: частота, патогенез, диагностика, лечение //Вестник Клуба панкреотологов. – 2019. – №. 3. – С. 7-22.
4. Гурова М. М., Гусева А. А., Новикова В. П. Состояние поджелудочной железы при ожирении у детей //Вопросы детской диетологии. – 2014. – Т. 12. – №. 2. – С. 7-12.
5. Даминова Л. Т., Муминова С. У. Сахарный диабет и экзокринная недостаточность поджелудочной железы (обзор литературы) //Международный эндокринологический журнал. – 2018. – Т. 14. – №. 1. – С. 55-58.
6. Дмитриев А. Н. Метаболический синдром и поджелудочная железа. Состояние экзокринной и инкреторной функции поджелудочной железы при различных типах гиперлипопротеинемий у пациентов с метаболическим синдромом //Экспериментальная и клиническая гастроэнтерология. – 2003. – №. 2. – С. 56-58.
7. Ефимова О. В. и др. Липиды, печень и поджелудочная железа на перекрестке эпидемий метаболического синдрома и ожирения //Атеросклероз. – 2021. – Т. 16. – №. 4. – С. 77-84.
8. Звенигородская Л. А., Хачатурян Н. Э. Функциональные и клинико-морфологические изменения поджелудочной железы при метаболическом синдроме //Consilium Medicum. – 2016. – Т. 18. – №. 8. – С. 51-58.
9. Косюра С. Д. и др. Поражение поджелудочной железы при ожирении //Лечебное дело. – 2016. – №. 3. – С. 100-104.
10. Пиманов С. И. Стеатоз поджелудочной железы-«белое пятно» панкреатологии //Медицинский совет. – 2014. – №. 11. – С. 22-26.
11. Самсонова Н. Г., Звенигородская Л. А. Поджелудочная железа и метаболический синдром //Экспериментальная и клиническая гастроэнтерология. – 2011. – №. 11. – С. 68-72.
12. Стародубова А. В. и др. Диагностика стеатоза поджелудочной железы у лиц с ожирением //Вестник Клуба панкреотологов. – 2019. – №. 4. – С. 30-33.
13. Христич Т. Н., Кендзерская Т. Б. Поджелудочная железа при метаболическом синдроме //Экспериментальная и клиническая гастроэнтерология. – 2010. – №. 8. – С. 83-91.
14. Фоминых Ю. А. и др. Коморбидность при метаболическом синдроме: решенные и нерешенные вопросы //Университетский терапевтический вестник. – 2019. – Т. 1. – №. 1. – С. 84-101.
15. Шестакова М. В. и др. Экзокринная недостаточность поджелудочной железы при сахарном диабете 1 и 2 типа //Сахарный диабет. – 2023. – Т. 26. – №. 2.