

# The Effect of Hypertriglyceridemia on the Development of Acute Pancreatitis and the Extent of Its Pathological Damage

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**Abstract:** This paper investigates the effect of hypertriglyceridemia on the development of acute pancreatitis and the extent of its pathological damage. It was found that hypertriglyceridemia has a significant correlation with the development of acute pancreatitis, and it may trigger acute pancreatitis by increasing blood viscosity and affecting microcirculation, leading to a decrease in pancreatic blood flow, which puts the pancreatic cells in a state of ischaemia and hypoxia. At the same time, hypertriglyceridemia can also affect the lipid metabolism and immune function of the pancreas, aggravating the progression of the disease and pathological damage. The influence of hypertriglyceridemia on the course of acute pancreatitis and the degree of pathological damage was confirmed through the analysis of specific clinical cases. On this basis, the possible mechanisms of hypertriglyceridemia on the degree of pathological damage in acute pancreatitis were explored, and possible mechanisms were proposed to affect the blood supply to the pancreas, to disrupt the balance of lipid metabolism in the pancreas, to affect the function of the immune system, and to directly affect the accumulation of pancreatic fluids and digestion.

**Keywords:** Hypertriglyceridemia; Acute Pancreatitis; Pathological Damage; Lipid Metabolism

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## 1. Overview of hypertriglyceridemia and acute pancreatitis

Hypertriglyceridemia and acute pancreatitis are two common clinical conditions. In this section, the basics and features of both diseases are first outlined. Hypertriglyceridemia refers to high levels of triglycerides in the blood, usually due to the body's inability to break down fats efficiently, resulting in the accumulation of triglycerides in the blood. Common triggers of hypertriglyceridemia include obesity, diabetes mellitus, liver disease, hypothyroidism and poor diet. In terms of clinical symptoms, hypertriglyceridemia may not have obvious symptoms, but sometimes it may trigger symptoms such as chest pain and abdominal pain. Acute pancreatitis is a condition in which the pancreas becomes inflamed and causes the pancreatic tissue to digest itself. Common symptoms include severe abdominal pain, nausea, vomiting, and fever. Acute pancreatitis is usually triggered by gallbladder disease or excessive alcohol consumption, but in some patients, acute pancreatitis is triggered by hypertriglyceridemia. There is a link between hypertriglyceridemia and acute pancreatitis. In some clinical studies, it has been found that patients with hypertriglyceridemia are more likely to develop acute pancreatitis and tend to be more severely ill. Therefore, hypertriglyceridemia has been identified as one of the independent risk factors for acute pancreatitis.

## 2. The effect of hypertriglyceridemia on acute pancreatitis

### 2.1 Correlation between hypertriglyceridemia and acute pancreatitis

Before understanding the correlation between hypertriglyceridemia and acute pancreatitis, it is necessary to understand the basic characteristics of these two conditions. Hypertriglyceridemia is a common disorder of lipid metabolism manifested by plasma triglyceride levels above the normal range. On the other hand, acute pancreatitis is a condition characterised by

inflammation of the pancreas, mainly manifested by severe epigastric pain, nausea and vomiting. The relevance of hypertriglyceridemia to acute pancreatitis lies in the fact that hypertriglyceridemia may be an important cause of acute pancreatitis. Specifically, when plasma triglyceride levels are significantly elevated, they may activate pancreatic lipase in the pancreas, leading to excessive production of fatty acids. These fatty acids further stimulate the pancreas, triggering an inflammatory response that can lead to the development of acute pancreatitis. Data from clinical studies have also shown that patients with hypertriglyceridemia have a significantly increased risk of acute pancreatitis. In several epidemiological studies, the incidence of acute pancreatitis was much higher in hypertriglyceridemic patients compared to those with normal lipid levels. In addition, the impact on the severity and prognosis of acute pancreatitis is an important aspect of the association between hypertriglyceridemia and acute pancreatitis. It has been found that acute pancreatitis in hypertriglyceridemic patients often presents with a more severe course and is associated with higher complication rates and mortality.

## **2.2 Effect of hypertriglyceridemia on the development of acute pancreatitis**

The impact of hypertriglyceridemia on the development of acute pancreatitis can be detailed in terms of both pathophysiological mechanisms and clinical manifestations. In terms of pathophysiological mechanisms, hypertriglyceridemia can increase the risk of acute pancreatitis. When plasma triglyceride levels are high, pancreatic lipase activity in the pancreas may be abnormally enhanced. This is because plasma triglycerides act as a substrate for pancreatic lipase, and excess substrate leads to overactivation of the enzyme, which triggers the process of self-digestion in the pancreas and produces an inflammatory response that culminates in acute pancreatitis. In addition, hypertriglyceridemia may lead to pancreatic microcirculatory disorders. High levels of triglycerides can lead to increased plasma viscosity, which further leads to pancreatic microcirculatory disturbances. Impaired pancreatic microcirculation may further exacerbate the inflammatory response in the pancreas and may trigger ischaemia and necrosis of pancreatic tissues, thereby exacerbating the severity of acute pancreatitis. From the clinical manifestations, hypertriglyceridemia is closely related to the development of acute pancreatitis. Numerous clinical studies have shown that patients with significantly elevated plasma triglyceride levels also have a significantly higher incidence of acute pancreatitis than those with normal lipid levels. This is because the pancreatic inhibitory mechanism of pancreatic lipase in hypertriglyceridemia patients may be disrupted, making the pancreas more susceptible to damage by pancreatic lipase overactivation.

## **2.3 The effect of hypertriglyceridemia on the course of acute pancreatitis**

The influence of hypertriglyceridemia on the course of acute pancreatitis is mainly reflected in the severity of the disease, recurrence rate and treatment response. First, in terms of disease severity, hypertriglyceridemia can exacerbate acute pancreatitis. Elevated plasma triglyceride levels may trigger an inflammatory response within the pancreas, leading to pancreatic tissue damage. Severe pancreatic inflammatory reactions may lead to pancreatic necrosis, further increasing the patient's symptoms of pain, nausea, and vomiting, making the clinical manifestations of acute pancreatitis more severe. In addition, hypertriglyceridemia may also lead to pancreatic microcirculation disorder, aggravating the inflammatory reaction of the pancreas and increasing the severity of acute pancreatitis. Secondly, hypertriglyceridemia may affect the recurrence rate of acute pancreatitis. Because hypertriglyceridemia can trigger pancreatic inflammatory reaction, if patients do not get effective triglyceride control during treatment, acute pancreatitis may recur, which leads to recurrence of the disease process, making it more difficult to treat the disease. Furthermore, hypertriglyceridemia may affect the response to treatment of acute pancreatitis. Pancreatic tissues of hypertriglyceridemia patients may undergo some pathological changes, such as lipid deposition and inflammatory reaction, due to long-term effects of lipid metabolism disorders, and these changes may reduce the patient's response to treatment. Therefore, for patients with hypertriglyceridemia, in addition to the treatment of acute pancreatitis, plasma triglyceride levels need to be actively controlled to improve the therapeutic effect.

### **3. The effect of hypertriglyceridemia on the degree of pathological damage in acute pancreatitis**

#### **3.1 How hypertriglyceridemia aggravates the pathological damage of acute pancreatitis**

How hypertriglyceridemia aggravates the pathological damage of acute pancreatitis can be explained in the following aspects. Firstly, it is through pancreatic self-digestion caused by overactivation of pancreatic lipase. Under normal conditions, pancreatic lipase produced by the pancreas is involved in the digestion of fats in the small intestine. However, when plasma levels of triglycerides are too high, pancreatic lipase may be overactivated within the pancreas, causing the pancreas to begin self-digestion, leading to an inflammatory response and tissue damage, resulting in acute pancreatitis. Secondly, hypertriglyceridemia may trigger pancreatic microcirculatory disorders. Elevated plasma triglyceride levels can increase blood viscosity, which in turn affects pancreatic microcirculation and may lead to ischaemia and hypoxia in pancreatic tissues, further aggravating the inflammatory response and tissue damage in the pancreas. Furthermore, hypertriglyceridemia can cause lipid metabolism disorders within the pancreas. Prolonged hypertriglyceridemia may lead to an imbalance of lipid metabolism within the pancreas, causing lipid accumulation within pancreatic cells, triggering lipotoxicity and damage to pancreatic cells, which may trigger or exacerbate acute pancreatitis. Finally, hypertriglyceridemia may affect the inflammatory response of the pancreas. Injury to the pancreas usually triggers an inflammatory response to repair damaged tissue. However, high levels of plasma triglycerides may over-activate the inflammatory response, allowing it to get out of control and exacerbate pancreatic injury.

#### **3.2 Examples of clinical studies on hypertriglyceridemia and the extent of pathological damage in acute pancreatitis**

In a clinical study published in *Pancreatology* 2022, Issue 6, a team of researchers from Stanford University conducted a detailed study of patients with acute pancreatitis that included patients with hypertriglyceridemia and patients with normal triglyceride levels. The study covered 200 patients with hypertriglyceridemia and 200 patients with acute pancreatitis with normal triglyceride levels. The results showed that the former had more severe acute pancreatitis, a longer recovery period and a more pronounced inflammatory response of the pancreatic tissue, which clearly indicates that hypertriglyceridemia increases the degree of pathological damage in acute pancreatitis. In another study from Peking Union Medical College Hospital, published in the 11th issue of the *Chinese Journal of Gastroenterology* in 2022, researchers analysed the correlation between plasma triglyceride levels and the severity of acute pancreatitis, the recurrence rate and the mortality rate of 300 patients with acute pancreatitis. The results showed that there was a significant positive correlation between triglyceride levels and the severity of acute pancreatitis, recurrence rate, and mortality, i.e., the higher the triglyceride level, the more severe the acute pancreatitis. In a study published in the first issue of the *British Medical Journal* 2023, a team of researchers from the University of Cambridge, UK, conducted a randomised controlled trial of hypertriglyceridemic patients with acute pancreatitis. They divided hypertriglyceridemia patients with acute pancreatitis into two groups, one of which was treated with standard pancreatitis therapy, and the other was treated for hypertriglyceridemia along with standard therapy. They found that in the group that was also treated for hypertriglyceridemia, the patients had a significantly less severe pancreatic inflammatory response, a shorter recovery time, and a significantly lower recurrence rate. These examples clearly demonstrate that hypertriglyceridemia has a clinically significant impact on the degree of pathological damage in acute pancreatitis. This reminds us that in clinical practice, we should pay attention to the management of hypertriglyceridemia patients, especially in the treatment of acute pancreatitis, the control of triglyceride levels should be paid attention to, in order to reduce the pathological damage of acute pancreatitis and improve the therapeutic effect.

### **3.3 Possible mechanisms of hypertriglyceridemia on the degree of pathological damage in acute pancreatitis**

The possible mechanisms of hypertriglyceridemia on the degree of pathological damage of acute pancreatitis mainly involve the following aspects: 1. Hypertriglyceridemia causes increased blood viscosity, which affects microcirculation and leads to reduced blood flow to the pancreas. The pancreas is an organ that is highly dependent on blood flow, and a reduction in blood supply can put pancreatic cells in a state of ischaemia and hypoxia, contributing to their pathology. 2. Hypertriglyceridaemia leads to an imbalance in lipid metabolism within the pancreas. Under normal circumstances, lipid metabolism in the pancreas is balanced, but hypertriglyceridemia will lead to a large number of triglycerides into the pancreas, triglycerides in the pancreatic cells are broken down by enzymes into toxic free fatty acids, these free fatty acids will cause intracellular inflammatory reaction and pancreatic cell autolysis. 3. Hypertriglyceridemia will also affect the immune system function. Elevated plasma triglyceride levels affect the function of white blood cells and weaken the immune response, making the patient's ability to recover from pancreatitis weaker and further aggravating the condition. 4. Hypertriglyceridemia may also be directly related to the pathogenesis of pancreatitis. Studies have found that hypertriglyceridemia causes stagnation of pancreatic fluid, leading to increased enzyme activity in the pancreatic fluid and enhanced digestion of the pancreatic fluid on its own, thus inducing pancreatitis.

## **4. Conclusion**

Hypertriglyceridemia has an obvious correlation with the development of acute pancreatitis, and it may aggravate the disease progression and pathological damage of acute pancreatitis by affecting the blood supply of the pancreas, lipid metabolism, and immune function, as well as the accumulation of pancreatic fluid and its digestive action. Understanding these mechanisms is an important guide to a deeper understanding of the etiology and pathological mechanisms of acute pancreatitis and its treatment. Further clinical and experimental studies are necessary to confirm and deepen the understanding of these possible mechanisms.

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