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CASE REPORT

# Implications of a blood sample with an extremely high lipid content in the emergency department: a case report

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## Abstract

Non-measurable blood test results are difficult to diagnose in emergency departments (EDs), especially since most emergency blood tests are performed in these settings. In this case, we present a 33-year-old male patient who consulted to the ED with worsening left flank pain and vomiting that started 6 hours before presentation. A comprehensive metabolic panel was not reported, as the test sample was high in lipids. On non-enhanced abdomen/pelvic computed tomography (CT), fluid collection around the pancreatic tail, without necrotic changes of parenchymal tissue suggested the possibility of acute pancreatitis. Blood investigations revealed a marked increase in triglyceride levels (8001 mg/dL). The patient was then admitted to the intensive care unit for severe hypertriglyceridemia-induced acute pancreatitis (HTG-induced AP), and later discharged home after treatment for seven days with insulin therapy and routine medication for hyperlipidemia. We present a case in which the laboratory comments of "not available for analysis" with regard to a blood sample have diagnostic implications.

## Keywords

Lipemic sample; Hypertriglyceridemia; Acute pancreatitis

## 1. Introduction

Blood tests are conducted in most patients who visit the emergency department (ED) with complaints of abdominal pain. In the ED, a complete blood count, comprehensive metabolic panel (aspartate aminotransferase [AST], alanine transaminase [ALT], amylase, lipase, creatinine, blood urea nitrogen [BUN], glucose, T-bilirubin), and coagulation panel are routinely performed. However, non-measurable blood test results are difficult to diagnose. In particular, most emergency blood tests are conducted in the ED; therefore, the process of diagnosis is challenging. The absence of accurate blood test results leads to an estimated diagnosis rather than a confirmed diagnosis.

Moreover, in an emergency environment, there is a risk that patients may miss the golden time for appropriate diagnosis and treatment due to a lack of examination results. In this study, we report a case of a patient visiting the ER with a lipidemic blood sample and evaluated the diagnostic process.

## 2. Case presentation

A 33-year-old male patient visited the ED with worsening left flank pain and vomiting that started 6 hours prior to presentation. The patient was overweight (body mass index, 31 kg/m$^2$). He was diagnosed with diabetes three years ago, and has been taking medication regularly. The patient has also been taking non-steroidal medication for a month for recurrent skin lesions His medical history included a 2-week diet low in carbohydrate and high fat (LCHF) because of obesity. On presentation, he was afebrile, with a blood pressure of 150/80 mmHg, pulse of 120 beats/min, respiratory rate of 22 beats/min, and oxygen saturation of 100% on room air. On physical examination, the abdomen was soft and flat. There was mild tenderness in the left lower quadrant area without guarding, and rebound tenderness was not observed. Costovertebral angle tenderness was identified in the left flank area. The bowel sounds were present and normal. We obtained blood tests, urinalysis, an abdominal/pelvic X-ray, and a chest X-ray, because we had in mind the possibility of acute gastroenteritis or ureteral stone (Fig. 1). The patient was treated conservatively. Initially, only a partial result was reported from the set of blood tests originally ordered. His white blood cell count (WBC) was 15,130 per cubic mililiter, red blood cell count (RBC) was 5.28 per cubic mililiter, hemoglobin was 15.6 g/dL, platelet count was 380,000 per cubic mililiter , urine analysis showed 1+ occult blood, 3+ ketones, and 3+ glucose. His comprehensive metabolic panel (including electrolytes) has not been reported since the test sample was high in lipids. Thus, it was recommended that his fasting blood samples be sent for analysis. Subsequently, a retest was conducted, and a lipid study was performed simultaneously. Abdomen/pelvic computer tomography (CT) was done due to the possibility of ureteral stones and the need for further evaluation of his fever. We consulted to radiologist on non-enhanced abdomen/pelvic CT study. Fluid collection around the pancreatic tail, without necrotic changes of parenchymal tissue, was noted, suggesting


  

the possibility of acute pancreatitis (Fig. 2). The results of the repeat blood test were as follows: LDL cholesterol 169 mg/dL, total cholesterol 838 mg/dL, triglyceride 8001 mg/dL, HDL-cholesterol 19 mg/dL, lipase 259 IU/L, amylase 169 IU/L, glucose 162 mg/dL, AST not available, ALT 28 IU/L, ALP 87 IU/L, T-bilirubin not available, BUN 6.2 mg/dL, and creatinine 1.75 mg/dL. The patient was admitted to the intensive care unit for severe hypertriglyceridemia-induced acute pancreatitis (HTG-induced AP). Current guidelines have not yet defined first-line triglyceride (TG)-lowering therapies. Plasmapheresis can reduce serum TG levels effectively and quickly, but raises concerns about its cost-effectiveness, complications, and staffing requirements. Therefore, insulin therapy was used as the primary method. The patient was treated with insulin therapy as the primary method. An intravenous continuous infusion of regular human insulin was administered at a rate of 0.05 units/kg/h and up to 0.1 units/kg/h with concomitant dextrose 10% in water until HTG was reduced to less than 500 mg/dL for five days. The patient started oral medications on day 6 of the hospitalization: fenofibrate 480 mg twice daily, pravastatin 40 mg daily, and omega-3 fish oil 2 g twice daily by mouth for hyperlipidemia treatment. The patient was discharged after receiving conservative treatment for seven days. The patient was advised to begin taking fenofibrate, pravastatin and omega-3 fish oil until his follow-up appointment. This study was approved by the institutional review board of OOO, which waived the requirement of obtaining informed consent (IRB no: OOO 2021-03-006).

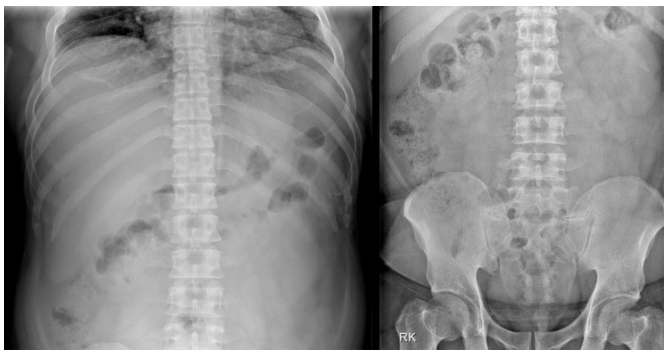

**FIGURE 1. Abdominal/pelvic x-ray shows no specific findings suggestive of acute gastroenteritis or ureter stone.**

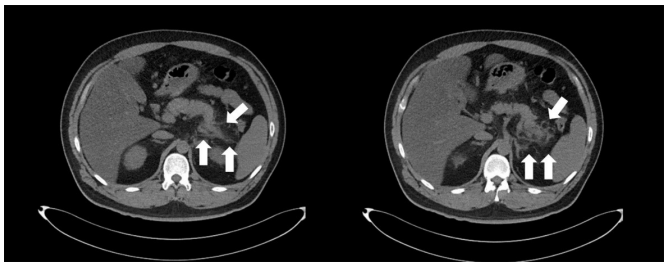

**FIGURE 2. Axial abdomen/pelvic computer tomography shows swelling of pancreatic tail portion with peripancreatic infiltration and fluid (white arrows).**

## 3. Discussion

A few laboratory samples are often rejected as "not available for analysis". While this may be due to incorrect processing, contamination, or artifacts, samples marked "not available for analysis sample" could be a manifestation of an actual underlying disease changing the characteristics of serum [1]. In the case of blood tests, lipidemic samples, icteric or hemolytic samples can be found to be non-measurable [1, 2]. To report the blood test results, separating the blood into plasma and blood cells is followed by measuring the absorbance of the plasma through the examination equipment. The lipidemic samples, icteric samples, and hemolytic samples cause interference in the measurement of absorbance that may impair outcomes. The Department of Laboratory Medicine has devised additional diagnostic methods to prevent such interferences [3].

Acute pancreatitis (AP) is not infrequent in patients who are admitted to the emergency department with severe abdominal pain. The most common etiology of AP is biliary. Alcohol abuse is responsible for 20%–25% of cases in the United States [4]. HTG-induced AP is a less common condition responsible for approximately 3%–4% of all AP cases [5].

Most patients with acute pancreatitis presenting to the ED have triglyceride levels of less than 1500 mg/dL. This value does not interfere with blood tests. When a patient is diagnosed with AP caused by severe HTG, plasmapheresis may be considered [6].

### 3.1 AP with extremely high level of TG

Although many cases of HTG-induced AP have been published, there is still a lack of a true definition for this condition. In the previous literature, hypertriglyceridemia (HTG) $\geq$11.2 mmol/L (1000 mg/dL) has been classified as severe HTG. Most studies use TG levels $>$1000 mg/dL as the reference point for the diagnosis of severe HTG [7]. One study proposed that the cutoff TG level for diagnosing HTG should be changed to 500 mg/dL [6]. According to Carr *et al.* (2016) [8], the weighted mean TG level in HTG-induced AP was 2654 mg/dL (median 2622 mg/dL, standard deviation 2451 mg/dL). Thus, when compared with values reported in other studies, 8001 mg/dL represents a very high value.

### 3.2 High TG levels lead to underestimation of serum amylase

Hypertriglyceridemia interferes with amylase measurements. In patients with TG levels $>$500 mg/dL, amylase levels were found to be lower, similar to the level of 169 mg/dL reported in our patient. In fact, as TG levels decreased, higher amylase levels were observed. This suggests that diagnosing patients with HTG-induced AP may be difficult in the ED [9].

### 3.3 Blood samples high in lipids can interfere with other blood tests

Blood samples high in lipids can cause increased absorption of light, affecting tests that use spectrophotometric methods, the most common means by which lipids interfere with laboratory

tests [3, 10]. When the laboratory reports that a test result is "not available", as in the case of this patient, this may impede the diagnosis of AP in patients presenting to the ED. Creatinine levels can also be measured below the actual value of [11]. This discourages the use of enhanced abdominal pelvic computer tomography for diagnosis. Therefore, in the emergency room, more attention should be paid to blood test results labeled as "not available".

The research by Carr *et al*. [8], as with other studies, focused on the evaluation of treatment modalities, clinical characterization of HTG-AP, the relationship between hyperlipidemia and AP, diagnostic methodologies used in HTG-AP, specific genotypes in HTG-AP, and AP etiologies. Research on the interference of lipids in other blood tests has mainly been performed.

## 4. Conclusions

We present a case in which the laboratory comments of "not available for analysis" with regard to a blood sample have diagnostic implications. When the lipid content of a blood sample is high in a patient presenting with abdominal pain, HTG-induced AP should be suspected. Physicians need to know the limitations of amylase measurement. In this case, the patient's symptoms, together with radiological imaging of the pancreas, were largely sufficient to establish the diagnosis. In addition, it is necessary to check the lipid profile and to consider a non-enhanced CT scan of the abdomen/pelvis.

### AUTHOR CONTRIBUTIONS

DHK examined the patient, diagnosed the case. SHK wrote the first version. DHK approved the final version of the paper and edited it. DHK and SHK read the literature and participated in writing. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the institutional review board of Nowon Eulji Medical Center, which waived the requirement of obtaining informed consent (IRB No: EMCS 2021-03-006). The authors certify that they have obtained all appropriate patient consent forms. The patient has given consent for clinical information to be reported in the journal. The patient understands that name and initials will not be published and due efforts will be made to conceal the identity, but anonymity cannot be guaranteed.

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### CONFLICT OF INTEREST

The authors declare no conflict of interest.

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