BMC Nephrology

CASE REPORT Open Access

# Rare skin color changes in an acute pancreatitis patient undergoing maintenance hemodialysis

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## Abstract

**Background** Skin conditions are common in patients on maintenance hemodialysis and those with pancreatitis. However, there is a lack of research on dermatological issues in patients who have both hemodialysis and pancreatitis concurrently.

**Case presentation** A 62-year-old male patient with a 4-year history of maintenance hemodialysis (MHD) presented with pain and was diagnosed with acute pancreatitis and gallbladder stones. Markedly elevated blood amylase, creatine kinase, and myoglobin were noted, alongside a purplish-red skin discoloration. Treatment included inhibition of digestive fluid secretion, anti-infection measures, blood purification, fasting, rehydration, and symptomatic care. Notably, continuous renal replacement therapy (CRRT) combined with hemoperfusion (HP) was employed. The patient's dialysis effluent initially appeared red. Upon examination of the patient's peripheral blood smear, red blood cell debris was not observed. The dialysis effluent (on Day 0) was analyzed, revealing no hemoglobin (0 g/L) but an elevated myoglobin concentration of 80.4 U/L. After the therapeutic intervention, the indicators, including the blood amylase, C-reactive protein, total bilirubin, creatine kinase, and myoglobin were improved. The patient experienced resolution of sternal and upper abdominal pain within two days. After four consecutive days of CRRT and HP treatment, the skin color returned to normal, alongside improved clarity of the dialysis effluent. Subsequently, the patient's method of blood purification was reverted to conventional hemodialysis. On the eighth day of hospitalization, the patient resumed normal diet and was discharged.

**Conclusions** In the case of the current patient with acute pancreatitis undergoing MHD, it is noteworthy to report the observation of a unique purplish-red skin discoloration. This phenomenon may be attributable to inflammation resulting from acute pancreatitis, and the retention of myoglobin within the body.

**Keywords** Acute pancreatitis, Creatine kinase, Myoglobin, Maintenance hemodialysis, Continuous renal replacement therapy, Hemoperfusion

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## Background

Globally, the yearly occurrence of acute pancreatitis varies, with reports indicating between 4.9 and 73.4 instances per 100,000 individuals [1]. Disorders of the pancreas often initially manifest with gastrointestinal symptoms. Jaundice and itching are common skin disease symptoms of pancreatic diseases, especially when bile drainage is obstructed [2]. Cutaneous manifestations in pancreatic disease are often overlooked during physical exams. A meta-analysis of observational studies revealed that the combined prevalence of acute pancreatitis among hemodialysis patients was 1.1% [3]. The likelihood of developing acute pancreatitis is higher in maintenance hemodialysis (MHD) patients compared to general population. This increased risk can be attributed not only to the usual risk factors present in the general population but also to specific issues associated with renal insufficiency and the dialysis procedure itself [1]. MHD Patients accompanied by pancreatitis exhibit clinical manifestations that are comparable to those in patients not on dialysis, characterized by the sudden onset of intense and persistent pain in the upper middle region of the abdomen [1]. Although dermatological problems frequently occur in individuals receiving MHD and those with pancreatitis, there is a notable lack of research on skin conditions affecting patients who are concurrently undergoing MHD and experiencing pancreatitis.

In individuals with chronic kidney disease, there is a marked elevation in serum myoglobin concentration, which correlates with the degree of renal dysfunction. The elevation in myoglobin levels may be attributed to enhanced release from muscle tissue, as well as a diminished excretory capacity of the kidneys [4, 5]. Among MHD patients, myoglobin concentrations may exceed twice the normal upper limit [4]. Rhabdomyolysis is a common cause of acute renal insufficiency in many cases [6, 7]. However, its occurrence in MHD patients is rare. When it does occur in this population, it is often associated with factors such as medication use, electrolyte imbalances, surgical procedures, and infections [8–12]. Rhabdomyolysis is rare in acute pancreatitis and is thought to be due to bacterial or viral infection, alcohol, or drug abuse [13]. Although the exact pathogenesis has not been clarified, pancreatitis provides the body with a harmful combination of digestive enzymes, inflammatory mediators, and cell debris that may be the cause of rhabdomyolysis [14]. The present study will conduct a preliminary exploration into whether elevated myoglobin levels contribute to changes in skin coloration in a patient undergoing concurrent MHD and experiencing acute pancreatitis.

## Case presentation

A 62-year-old man with a 4-year history of MHD was admitted to the department of nephrology on January 11, 2022. The day before admission, the patient experienced pain in the sternum and upper abdomen after completing the hemodialysis without any obvious cause. The suffocating chest pain, which could not be relieved after rest, lasted eight hours. One day after the onset, the patient visited our emergency department. Laboratory findings were hemoglobin was 120 g/L(Normal range, NM:130–175 g/L), and platelet count was $67\times10^9$/L (NM:125–$350\times10^9$/L), total bilirubin 219.9umol/L(NM: 5–21 umol/L), alanine aminotransferase enzyme 63U/L(NM:0-69U/L), blood amylase 1014U/L(NM:30-110U/L), creatinine 1064umol/L(NM:57–111 umol/L). Abdominal computed tomography revealed that the gallbladder was slightly larger with gallstones, the shadow in the peripancreatic fat gap was somewhat blurry.

On admission to hospital, physical examination showed that the skin was purplish-red (Fig. 1), and palpation unveiled mild tenderness in the upper abdomen and no rebound pain. Based on the patient's medical history and related examinations, the admission diagnosis was acute pancreatitis and gallbladder stones. The patient was provided with inhibition of digestive fluid secretion (somatostatin), anti-infection (ceftriaxone), blood purification (Fig. 2). In addition, dietary adjustment, rehydration, and symptomatic treatment was also prescribed. CRRT combined with HP therapy may help mitigate the inflammatory cascade in patients with acute pancreatitis [15]. Studies have confirmed that hemodialysis filtration and CRRT were effective modalities for reducing myoglobin levels in patients diagnosed with rhabdomyolysis [16, 17]. Therefore, in the early phase of the patient's hospitalization, the treatment modality was switched from MHD to CRRT combined with HP.

On the day of admission (Day 0), the effluent dialysis fluid following CRRT combined with HP exhibited a red hue. As the treatment progressed, there was a noticeable gradual lightening in the color of the effluent. Upon completion of the therapy, the effluent was observed to have a light brown appearance (Fig. 3). In response to the observation of a red hue in the dialysis effluent, an analysis was conducted to ascertain the presence of hemolysis by measuring the hemoglobin concentration within the dialysis waste liquid (on Day 0). The findings indicated a hemoglobin concentration of 0 g/L. Moreover, upon examination of the patient's peripheral blood smear, red blood cell debris was not observed. Subsequently, to determine whether the red discoloration of the dialysis effluent was attributable to myoglobin, an assessment of the myoglobin concentration in the dialysis waste liquid (on Day 0) was performed. The results of this assessment revealed a myoglobin concentration of 80.4U/L.

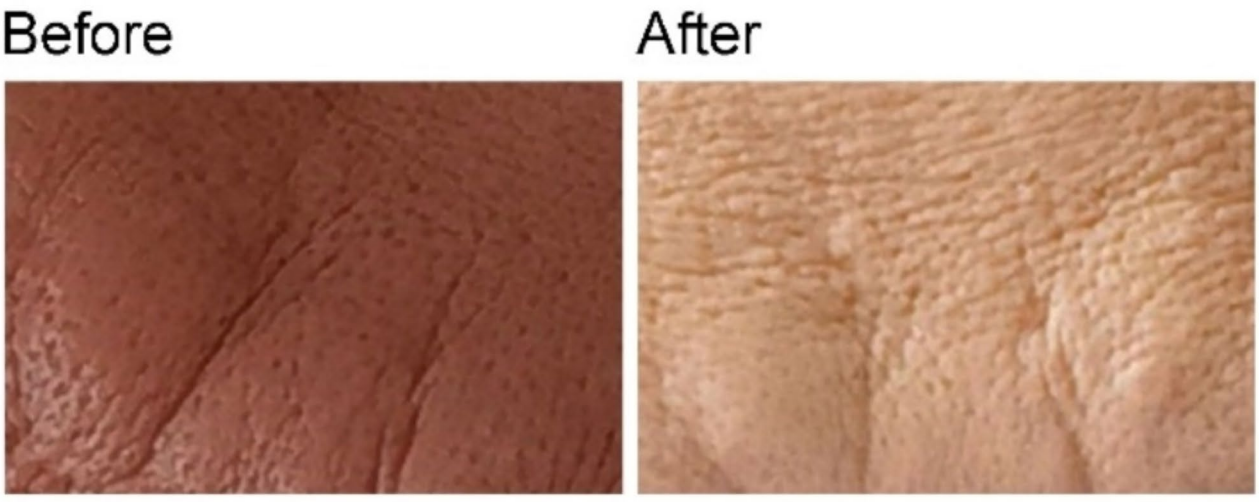


**Fig. 1** Images of the skin color of the patient before and after treatment

As shown in Fig. 2, after the aforementioned therapeutic intervention, the indicators, including the blood amylase, C-reactive protein, total bilirubin, creatine kinase, and myoglobin were improved. The patient experienced resolution of sternal and upper abdominal pain within two days. After four consecutive days of CRRT and HP treatment, the skin color returned to normal, alongside improved clarity of dialysis fluid. Subsequently, the patient's method of blood purification was reverted to conventional hemodialysis. In the case under discussion, the patient developed moderate anemia in the advanced stage of treatment. On the eighth day of hospitalization, the patient resumed normal diet and was discharged.

Post-discharge, the patient commenced a thrice-weekly MHD protocol. Six months later, he unfortunately expired due to acute respiratory distress syndrome precipitated by an acute pulmonary infection.

## Discussion and conclusions

MHD serves as the principal treatment approach for patients with end-stage renal disease. However, long-term MHD can lead to an array of complications [18]. Many patients on MHD experience skin-related symptoms, including pruritus, xerosis, variations in skin tone (pigmentation or pallor), nail complications, hair issues, and mucosal manifestation [19]. Management of these skin conditions involves a multidisciplinary approach, including optimal dialysis, topical treatments, systemic medications, and, in some cases, surgical intervention. The transient alterations in skin color observed in our patient diverged from those typically associated with MHD.

While bilirubin levels may be elevated in patients with end-stage renal disease (ESRD) due to decreased renal clearance, significant hyperbilirubinemia is more commonly associated with liver dysfunction or biliary obstruction [20]. The present patient demonstrated a marked elevation in serum total bilirubin levels during the initial phases. As the treatment progressed to a more advanced stage, the patient manifested a moderate anemic condition. However, the examination of the peripheral blood for the presence of fragmented red blood cells and the quantification of hemoglobin levels in the spent dialysate fluid from this patient did not provide evidence to support a diagnosis of hemolytic anemia. In addition, the development of anemia was after the improvement of several conditions, including pancreatitis and abnormal skin color. Upon the onset of moderate anemia, there was no observed elevation in the levels of total bilirubin, indirect bilirubin, or lactate dehydrogenase. In addition, the skin color of the patient was clearly different from that of jaundice. Given the clinical findings, the dermatological manifestations exhibited in this patient were deemed unlikely to be secondary to hemolytic pathology.

Weakness and myalgia are considered significant symptoms in patients with CKD or hemodialysis [21]. Thus, clinical symptoms (e.g. muscle pain, weakness) of the MHD patients would mask the diagnosis of rhabdomyolysis [11]. The patient in our case did not report significant weakness and myalgia, and his sternal and epigastric pain was considered to be due to pancreatitis. In MHD patients without urine, dark urine would not be observed. This MDH patient did not show the expected signs and symptoms of rhabdomyolysis. Additionally, his serum creatine kinase level did not elevate to the degree necessary to confirm a diagnosis of rhabdomyolysis per standard criteria [22]. However, a significant elevation in his serum myoglobin levels was observed. Additionally, the presence of myoglobin was confirmed in the waste bag from his dialysis treatment.

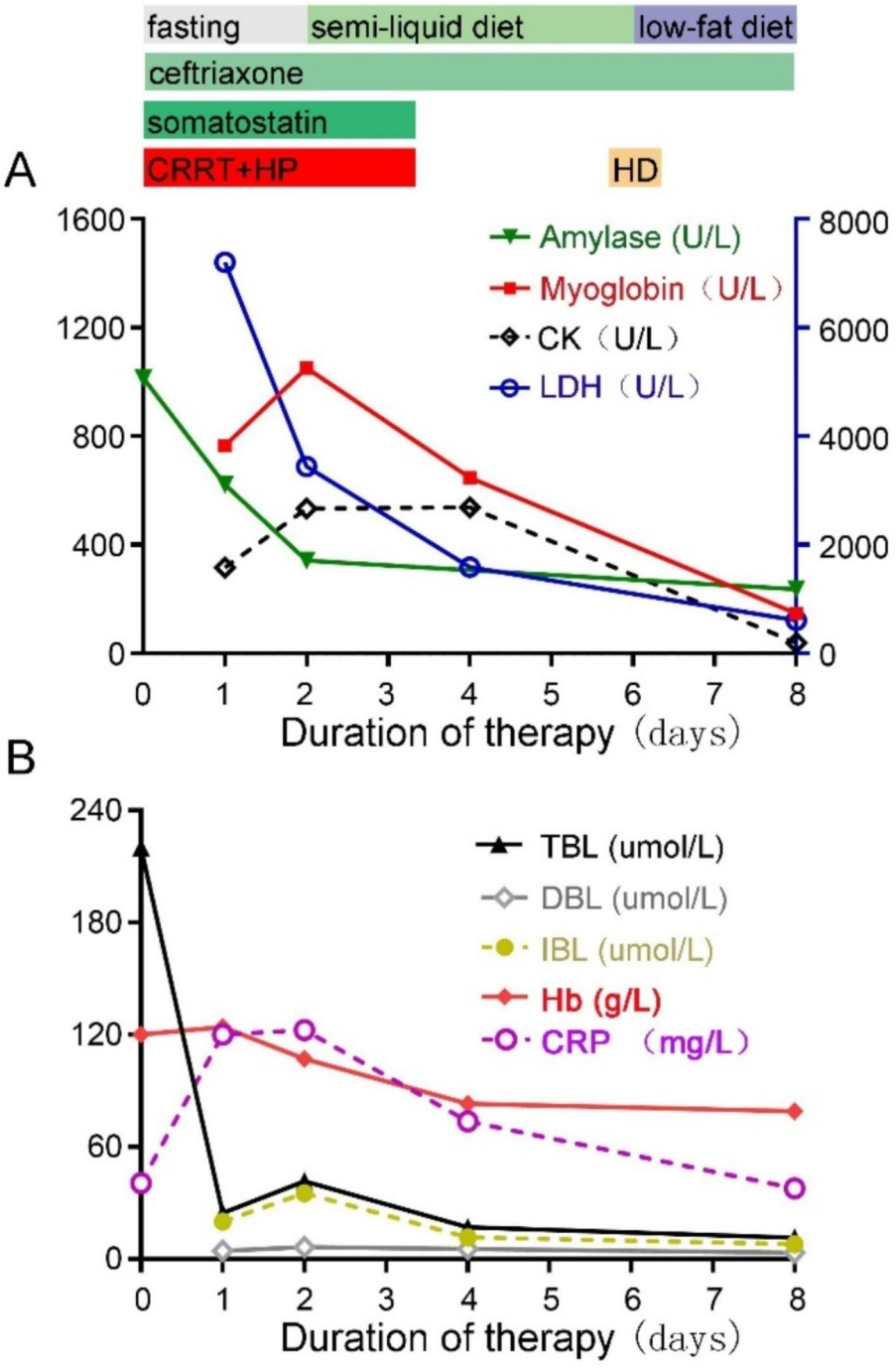


**Fig. 2** Alterations in hematological indicators throughout the therapeutic course. The right vertical axis represents the value of Lactate Dehydrogenase (LDH), whereas the left vertical axis denotes the values of additional parameters. CRRT: continuous renal replacement therapy. HP: hemoperfusion. HD: hemodialysis. LDH: lactic dehydrogenase. CK: creatine kinase. TBL: total bilirubin. DBL: direct bilirubin. IBL: indirect bilirubin. Hb: hemoglobin. CRP: C-reactive protein

To the best of our knowledge, this is the first report of purplish-red skin color in acute pancreatitis undergoing MHD. The patient's development of purplish-red skin in the early stage of this case may be related to the following potential factors. Firstly, acute pancreatitis is characterized by inflammatory response, which results not only in pancreas but also provokes alterations in remote organs. Inflammation is usually marked by classic signs like redness and warmth due to increased blood flow, and swelling from the leakage of fluid,


**Fig. 3** Images of the color change of waste liquid during blood purification treatment (on Day 1). The black arrow in the picture shows the waste liquid bag during the CRRT and HP treatment process of the patient on the second day after admission

plasma proteins, and leukocytes [23]. Owing to the rarity of skin redness among patients suffering from pancreatitis, it is insufficient to attribute the manifestation of skin redness solely to inflammation in this instance. Secondly, the abnormal skin color change observed in the early stage of the patient's hospitalization is likely related to an increased concentration of myoglobin in the blood. This hypothesis is supported by the observations detailed below: ① In the initial stage of dermatological disease abnormalities, elevated levels of myoglobin were detected in the patient's blood, and the presence of myoglobin was confirmed in the red dialysis residue. ② As the blood myoglobin concentration decreased, the color of the dialysis residue returned to normal. Concurrently, the patient's purplish-red skin color reverted to its normal appearance. These findings suggest a correlation between the elevated myoglobin levels and the patient's skin discoloration. While the patient's elevated creatine kinase level was insufficient to meet the diagnostic criteria for rhabdomyolysis, the serum myoglobin concentration was observed to be more than tenfold above the upper limit of the established reference range. We must consider the specificity of this case as a MHD patient without urine. Under normal circumstances, a healthy kidney will excrete countless compounds. When the concentration of myoglobin in the urine exceeds 300 mg/L, visible myoglobinuria is observed [24]. However, in MHD patients who experience anuria, myoglobin cannot be excreted via the urinary pathway and consequently accumulates within the body.

In this MHD case, the treatment strategy was employed predominantly for the management of acute pancreatitis and muscle injury. The initial approach to managing acute pancreatitis involved fluid resuscitation, vigilant monitoring, and the provision of optimal nutrition. Because myoglobin has a relatively high molecular weight, it is eliminated by ultrafiltration (convection clearance), but it is poorly to eliminate by dialysis (diffusion clearance) [25]. Hemoperfusion (HA330/380) can be efficiently used in sepsis, rhabdomyolysis, pancreatitis, liver failure and so on [26]. In our case, the substantially elevated myoglobin concentrations detected in the effluent following combined CRRT and HP provide objective evidence supporting the efficacy of this therapeutic modality for the treatment of muscle injury.

In the case of the current patient with acute pancreatitis undergoing MHD, it is noteworthy to report the observation of a unique purplish-red skin discoloration. Following the implementation of standard treatment protocols, supplemented with CRRT and hemoperfusion, a significant improvement was observed in the patient's condition. Notably, the abnormal skin color reverted to its normal state. This phenomenon may be attributable to inflammation resulting from acute pancreatitis, and the retention of myoglobin within the body. It should be pointed out that, the evidence is insufficient for definitive conclusions. Further research is needed to better understand dermatological manifestations in MHD patients with concurrent pancreatitis and muscle injury.

**Abbreviations**

| | |
|---|---|
| CRRT | Continuous renal replacement therapy |
| HP | Hemoperfusion |
| MHD | Maintenance hemodialysis |
| NM | Normal range |

**Acknowledgements**

We would like to thank the patient's family for giving consent. We would like to express our sincere gratitude to all the medical staff in the Renal Department for their assistance. In addition, we sincerely thank Dr. Li Ding from the Dermatology Department, Dr. Leiming Cai from the Department of Laboratory Medicine, and Dr. Hongjuan Lu from the Hematology Department for their kind help and support.

**Author contributions**
Zhen Wang and Lei Zhang were responsible for diagnosing and treating the patient. Zhen Wang, along with Jinghan Chen, gathered the patient's clinical data and laboratory test results. Zhen Wang authored the case report, which Jinghan Chen reviewed and approved as the final version. All authors have read and consented to the manuscript.

**Funding**
This work was made possible in part by funding from Shanghai Baoshan District Medical Key Specialty Project (BSZK-2023-BP03), Baoshan District Science Popularization Project of Shanghai (1-L007), and Medical and Health Project of Shanghai Baoshan Science and Technology Commission(2023-E-06).

**Data availability**
The data substantiating the conclusions of this study are not publicly available owing to considerations of sensitivity. However, they may be made accessible by the corresponding author given reasonable request.

## Declarations

**Ethics approval and consent to participate**
Not applicable.

**Consent for publication**
Formal consent for publication of clinical details and images was obtained in writing from the study patient.

**Competing interests**
The authors declare no competing interests.

Received: 13 February 2024 / Accepted: 29 August 2024
Published online: 03 September 2024

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