Autopsy case of acute esophageal necrosis associated with fatal diabetic ketoacidosis

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Abstract: Acute esophageal necrosis is a rare disorder. Only a few autopsy cases have been reported so far. The case of a man in his 40s with acute esophageal necrosis who died of diabetic ketoacidosis, which is known to be a cause of acute esophageal necrosis, is reported. The victim showed a black colored esophagus. Its histology was consistent with that of acute esophageal necrosis. It was the clue to the cause of death being diabetic ketoacidosis, which was confirmed by marked elevation of β-hydroxybutyrate in the blood sample. The postmortem diagnosis of diabetic ketoacidosis is sometimes difficult, because it shows no specific findings on gross examination. The finding of acute esophageal necrosis may suggest the diagnosis of diabetic ketoacidosis.

Key Words: acute esophageal necrosis, autopsy, diabetic ketoacidosis, gastric erosion, hypothermia.

INTRODUCTION

Black esophagus was first reported in 1990 as “acute esophageal necrosis (AEN)” or “acute necrotizing esophagus” [1,2]. The prevalence of AEN is low, ranging from 0.008% to 0.28% on endoscopic observation [3-6]. Only a few autopsy cases have been reported (Table 1) [7-13].

AEN is characterized by diffuse and circumferential black colored mucosa in the lower part of the esophagus. Histological examination shows necrotic changes in the mucosa, possibly extending into the submucosa and muscularis propria, leukocytic infiltration. The change of the mucosal color stops abruptly at the gastroesophageal junction and does not invade to the gastric mucosa [2, 14].

AEN is caused by a combination of various mechanisms including ischemia, impaired mucosal barrier systems, and a backflow injury from gastric contents. The difference in the blood supply between the upper and lower parts of the esophagus is considered to be related to the ischemic mechanism. The upper part of the esophagus receives its blood supply from the superior and inferior thyroid arteries, branches of the subclavian and common carotid arteries. On the other hand, the lower part of the esophagus receives its blood supply from the esophageal branches of the descending aorta and splenic and left gastric arteries more distally [2, 14].

Various kinds of diseases are known to be associated with AEN. They include diabetes mellitus, malignancy, hypertension, chronic pulmonary disease, alcohol abuse, and trauma [2, 14].

An autopsy case with black esophagus, which led to a successful diagnosis of diabetic ketoacidosis (DKA), is described.

CASE REPORT

A man in his 40s was found dead in his house. He had a history of hypertension. He was suspected to have diabetes on previous medical examinations, but he had received no medications. He did not have a drinking habit.
Autopsy was performed about two days after the estimated time of death. His weight was 63.2 kg, and his height was 163 cm. The body mass index was 23.8 kg/m². No remarkable trauma was observed on his chest and abdomen.

The heart weighed 310 g and contained a large amount of dark-red blood mixed with fat-like and soft coagulated blood in the right cardiac cavities. The left cavity contained a small amount of dark-red blood. The coronary arteries showed no stenoses, the left and right lungs weighed 381 g and 552 g, respectively, and the edematous brain weighed 1589 g.

The esophagus showed a black appearance at its lower portion (Fig. 1). Neither varices nor ruptures were found in the esophagus. No hiatal hernia was evident in the esophagus. The gastric content was 300 mL of black colored liquids including a small amount of blood, and there were no gastric erosions.

Microscopic examination showed complete necrosis of the muscularis mucosa with inflammatory cells, possibly neutrophils, in the black esophagus (Figure 2). There were no abnormal histological findings of the heart, and the liver showed mild fatty liver and congestion. The kidneys were slightly congestive, and diabetic changes were not apparent.

Table 2 shows the results of postmortem biochemical examinations. The level of β-hydroxybutyrate was elevated to 15,744 µmol/L in the blood. Hemoglobin A1c was also elevated, at 18.3%. The glucose level was 1835 mg/dL in the urine.

A toxicological examination using INSTANT-VIEW® was negative. The concentration of alcohol in the femoral vein was 0.05 mg/dL.
DISCUSSION

Judging from the postmortem examination, the victim of the reported autopsy case of AEN died of DKA. Marked elevation of β-hydroxybutyrate is known to be useful for postmortem diagnosis of DKA. Kanetake et al. reported that a β-hydroxybutyrate concentration over 1000 μmol/L can be a basis for postmortem diagnosis for fatal ketoacidosis [15]. Iten and Meier also reported that DKA victims showed elevated β-hydroxybutyrate levels between 2290 and 37,800 μmol/L [16]. Moreover, the urinary glucose level remains stable in postmortem samples [17, 18]. Therefore, in this present case, DKA was associated with the cause of death.

Diabetes is known to be one of the most important risk factors for AEN [2, 4, 5, 19]. Since there are some reports indicating that AEN patients had DKA [19-23], DKA was most likely involved in the pathogenesis of AEN in the present case. In the most autopsy reports of AEN, black discoloration was found in the entire esophagus (Table 1). In our case it was detected in the lower part, consistent with ischemic mechanism of blood supply.

AEN was also reported in a case of hypothermia [24], and elevation of β-hydroxybutyrate has also been reported in those who died of cold exposure [25]. However, cold exposure as the cause of death in the present case was ruled out, because no difference in the color of the blood between the left and right cardiac cavities was observed in this case; a difference in the color of the blood is considered to be the most specific finding for death by cold exposure [26].

Three fatal DKA cases with gastric mucosal petechial hemorrhages, similar to Wischnewski-like lesions [27], observed in the gastric mucosa of victims who died by cold exposure, have been previously reported. Interestingly, one of the previous cases (Case 2 in the previous report [27]) showed a black colored esophagus (data not shown). Since Clark et al. postulated the idea that hypothermia and DKA have a common underlying pathophysiology, most likely a coagulopathy [28], the ischemic mechanism of coagulopathy may be involved in the pathophysiology in both Wischnewski-like lesions and AEN.

Victims who died of DKA are sometimes encountered at autopsy. Since they usually show no particular gross findings at autopsy, the diagnosis is sometimes difficult for forensic pathologists. Although

Figure 1. Gross findings of the esophagus. The esophagus shows a black appearance at its lower portion.

Figure 2. Histology of the lower part of the esophagus. The esophageal mucosa is completely necrotic to the muscularis mucosa. Inflammatory cells, possibly neutrophils, are infiltrated (Hematoxylin and eosin staining A; 40X, B; 100X).
only a small number of patients with DKA have AEN, we should pay attention to AEN as a possible marker for DKA.

Conflict of interest. The authors declare that there is no conflict of interest.

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References