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An Unusual Case of Gas Gangrene in Intravenous Heroin Addict

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Abstract

BACKGROUND: Gas gangrene is a clostridium infection primarily of muscle tissue, most commonly caused by C. perfringens. Clinical diagnosis is usually made by local inspection of the wound: the infected tissue shows characteristic signs of tissue inflammation with blistered changes. The disease can starts suddenly, 4-6 hours after the injury, but most commonly the incubation period lasts 2-4 days. Without proper medical intervention, death occurs in 4-24 hours after the development of the first symptoms, but even with timely and adequate therapy, the lethality is very high (around 12%). Due to its fulminant course, in all cases with fatal outcomes, a forensic autopsy is an obligatory procedure. However, discovering the entrance gate and source of infection is not an easy task, especially in the absence of a traumatic injury.

CASE PRESENTATION: Male, 27 years old, an intravenous heroin addict for about 10 years, injured his left leg in a traffic accident. He only visited the doctor after 5 days. Upon examination, it was determined that there were no externally visible injuries and no fracture, and he was given a splint immobilization for an ankle luxation. Twelve days after the accident (or 7 days after the immobilization) his mother found him unconscious.

CONCLUSION: From medicolegal aspects, it's important to have in mind even the less frequent paths of infection, in order to give an expert professional opinion on origin and cause of death.

Introduction

Gas gangrene or clostridial myonecrosis are two supplementary terms used for the description of muscle tissue infection caused by the specific species of bacteria from the clostridium genus. *Clostridium butyricum* was the first clostridium species recognized by Louis Pasteur in the year 1861, but it took additional 30 years for the first written case report to emerge (period of 1882–1902) [1]. Clostridium is a genus of Gram-positive, rod-shaped bacteria with dimensions varying from 3 to 8 μm. Even though they are representatives of obligate anaerobes, some species are able to live in an aerobic environment as well by producing endospores in unfavorable conditions. They naturally inhabit ground or intestinal tracts of animals and humans and in the majority of cases, exist as harmless saprophytes; however, in specific conditions, they may cause serious illnesses. *Clostridium perfringens* is the main causative organism of gas gangrene, present in up to 80% of all cases [2].

Due to the fact that *C. perfringens* and their spores are predominantly in the ground or animal intestine, gas gangrene usually happens as a complication caused by trauma or surgical intervention. Throughout history, the most frequent incidence of gas gangrene has been noted during military conflicts. For instance, in World War I, statistics showed that gas gangrene occurred as a recovery complication in 6% of all open fractures and 1% of all open wounds. After devising and implementing adequate therapy, the incidence was drastically decreased, falling to 0.7% in World War II and 0.02% in Vietnam War [3]. In peacetime conditions, the incidence of gas gangrene is very rare, but it should not be underestimated [4]. If we only look at the USA, there are around 1000 cases of gas gangrene every year [5]. The majority of these cases originate as a complication of trauma, whether from injuries suffered in traffic, agricultural incidents, industrial accidents, gunshot wounds, or burns. In 30% of cases, it is a complication that appears in the post-operative period, especially after a colon and biliary tract surgery. The rest of the gas gangrene instances refer to spontaneous occurrences when the cause of infection remains unknown [3].

Case Report

Male, 27 years old, an intravenous heroin addict for about 10 years, injured his left leg in a traffic accident. He only visited the doctor after 5 days. Upon examination, it was determined that there were no externally visible injuries and no fracture, and he was given a splint immobilization for an ankle luxation. Twelve days after the accident (or 7 days after the immobilization) his mother found him unconscious.

The emergency services took him to the emergency room, where he was assessed as unconscious, febrile, with a temperature of 39.6°C, blood pressure of 206/110 mmHg, and heart rate of 160/min. An external exam revealed a swollen area on his left thigh, with blisters, redness, and crepitation on palpation, undoubtedly confirming necrotizing myositis, and leading to the diagnosis of gas gangrene. Despite the immediate high amputation of the left leg, the patient passed away only 4 h after admission.

During the forensic autopsy, it was discovered that body was well developed and well-nourished male. It was found a lot of linear and circular scars, no more than 1 cm in diameter, along with numerous tattoos, but needle marks characteristic of recent intravenous narcotics administration were not found.

High guillotine amputation was observed in the upper fifth region of his left leg, with skin in the area crackling upon palpation, swollen, greenish, and taut, with the presence of blisters and skin necrosis. Underlying muscle tissue looked weak, dim, and damp, completing clinical signs of gas gangrene.

Microscopic examination revealed uncharacteristic changes in organs such as interstitial myocardial fibrosis, pulmonary emphysema, fatty degeneration of hepatocytes with advanced fibrosis, and chronic inactive hepatitis B infection, all of which were strong indicators of long term narcotic abuse. Furthermore, toxicological testing revealed the presence of tramadol, metronidazole, diazepam, and nordiazepam in small quantities in blood and organs.

Microscopic examination of the left thigh tissue verified acute muscle cellulitis, tissue necrosis without leukocyte infiltration, and microbiological examinations confirmed the presence of bacteria of the clostridium species.

Based on the all analyzes performed, it was concluded that the death was caused by the gas infection of the subcutaneous and muscular tissue in the left leg and consequential invasion of the bacterial toxins into the patient's circulation.

Discussion

Gas gangrene is necrotizing soft tissue infection characterized by muscle necrosis and gas release. Most frequently, it occurs on the site of trauma injuries or surgical wounds. Microbiological examinations have shown that in more than 80% of cases, the bacterial flora was polymicrobial and that only in <5% it was provoked solely by the members of the Clostridium species [6]. The most common entrance gate for these organisms is a wound contaminated by earth or feces, with anaerobic conditions provided by hematoma created in the damaged tissue. The bacteria located at the entrance of the wound release toxins and create gas that compromises circulation. Alpha toxins cause vasoconstriction and induce platelet aggregation, resulting in decreased blood flow which maintains the ischemic necrotic process. Theta toxins, which induce cell lysis, further contribute to the spread of infection to the surrounding tissue [7].

According to literature, the incubation period can take just a few hours, most commonly, it lasts 2–4 days [8]. In contrast of this, in our case, the first symptoms showed up very late, 12 days after the injury, or 7 days after immobilization. After the onset of the first symptoms, other features of clinical manifestation were common. Disease onset is sudden, usually characterized by strong pain and skin color changes (from pale, in the early stages, over reddish and brown, to finally black). Blisters with serosanguinous, odorous fluid are formed. Immediately following, an intensely painful tumescence and crackling sound upon palpation can be noticed. The increase in the affected surface is noticeable within minutes, with the infected tissue completely destroyed. Systemic symptoms start early, with sweating, rapid heart rate, fever, and anxiety, that later progress to life-threatening conditions, such as septic shock, liver necrosis, hemolytic anemia, and kidney failure [8].

Since the disease had a rapid onset, clinical diagnosis is reached usually by examining the local manifestations or by diagnosing the systemic disorder and shock. Diagnostic process may include radiography testing (air bubbles in the subcutaneous tissue of the infected region), hematology tests (leukocytosis, eosinophilia, and hemolytic anemia), and histological examinations of the samples from the wound, but bacteremia is registered only in approximately 15% of all cases [1], [6]. In cases with fatal outcomes, post-mortal diagnosis can be set macroscopically after observing typical changes of the skin and organs: Purple to bronze skin color, with the presence of hemorrhagic blisters, and soft, spongy consistency of parenchymatous organs, such as liver, spleen, and kidneys. Patohistological findings in cases of gas gangrene are characterized by intense tissue necrosis and absence of leukocyte infiltration, which makes a sharp contrast to some other aerobic bacterial infections [9]. All of those changes were also registered in this particular case.

In the peacetime periods, gas gangrene was commonly related to trauma, as well as subjects with reduced immunity. Because of this, gas gangrene is commonly present alongside malignant diseases, malnutrition, obesity, and in some specific groups, like among patients on corticosteroid therapy, patients with diabetes or heroin addicts [6], [8], [10], [11], [12], [13], [14], [15], [16], [17]. In the cases with subcutaneous or intramuscular drug injections, there is a high probability of the bacteria being administered directly into the deep tissue, and since there the conditions are anaerobic,

it is ideal for clostridia proliferation [8]. Microbes can appear in heroin packs either by contamination during manufacturing and distribution or by unhygienic injection conditions [10]. Even though the majority of bacteria are destroyed by temperatures above 72°C, it was proven that clostridium spores are able to survive in heroin packs prepared for injection (mixed with citric acid and heated) [10]. Furthermore, these spores are resistant to different disinfectants, and sometimes it is not possible to make skin aseptic even in hospital conditions, especially when it was contaminated with feces [18]. Although the infection is in the majority of cases developed in the region of drug injection, sometimes gas gangrene may progress into a distant area [6], [9,] [11], [13], and the most frequently affected body regions are limbs, trunk, and groin. Even though in some 20% of gas gangrene cases, its direct transmission path is not established, the development of clostridium bacteria is noted in the regions of poor oxidized tissues, most commonly when patients are having poor circulation or some immobilization.

In the presented case, injured extremity with immobilization became an ideal place for the development of anaerobic bacteria because of joined preconditions: Edema due to the injury and poor circulation due to the immobilization. In such conditions, infected thrombus from the point of intravenous drug injection is the most common source of septic embolism [11]. However, in the described case, we did not find confirmation of intravenous drug injection and thus no source of septic embolus. In cases like this, it is possible that the bacteria passed through the damaged walls of the intestines into an abdominal soft tissue [13], [19], [20], [21]. In the presented case, the above-mentioned infection path could not be absolutely confirmed by autopsy, but it is the only possible explanation for the presence of anaerobic flora in the soft tissue of the left thigh.

Conclusion

Even if it occurs rarely, gas gangrene is not a disease from the past. Understanding its origin as well as early symptom recognition is of crucial importance in establishing the diagnosis and starting medical care. Before anything else, detailed and aggressive surgical treatment of the infected tissue is key to reducing mortality rates [6], [12], [22], [23]. Aside from all possible complications in the treatment process that are universal, drug addicts are characterized by their uncooperative approach to medical staff, which leads to delayed admission and response to health problems. Because of it, medical care starts in the advanced stage of the disease, which worsens the prognosis for recovery [12], [24]. From medicolegal aspects, it is important to know that discovering the entrance gate and source of infection is not an easy task, especially in the absence of traumatic injury. Because of all of it, close cooperation between medical examiner and physician is the precondition for establishing an adequate opinion on origin and cause of death.

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