Case Report

Gastrointestinal anthrax in coastal south India: a critical alert on a fatal masquerader

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Introduction: Anthrax remains endemic to some parts of southern India including Pondicherry. Among various forms of the infection, gastrointestinal anthrax appears to be the least common. Cases of inhalational anthrax causing sepsis and disseminated intravascular coagulation have been reported in the literature.

Case presentation: We report the first case, to the best of our knowledge, of gastrointestinal anthrax with sepsis and disseminated intravascular coagulation from India. The patient ate raw meat under the influence of alcohol, following which he developed fever and gastrointestinal bleeding. Later, he presented with ascites, intracerebral haemorrhage, haematuria and a deranged coagulation profile. Culture of his blood yielded *Bacillus anthracis*. He succumbed to the infection after 18 h of admission in the intensive care unit. The case was reported to the public health authorities for the necessary follow-up and preventive measures.

Conclusion: Gastrointestinal anthrax can have various non-specific clinical manifestations, making diagnosis difficult. Meticulous history taking, a high index of suspicion and prompt institution of antibiotics with or without surgical intervention is likely to improve outcomes.

Keywords: disseminated intravascular coagulation; gastrointestinal anthrax; sepsis.

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Introduction

Anthrax is a potentially fatal zoonotic disease found in both humans and animals. It is caused by *Bacillus anthracis*, a Gram-positive, non-motile, spore-forming, rod-like, aerobic bacterium. Humans can acquire infection either by handling the infected animal or its products such as hide or by consumption of undercooked meat. It can present in different forms – cutaneous, inhalational and gastrointestinal. Recently a new form, injection anthrax, has been reported among intravenous drug abusers with a high mortality rate (Booth *et al.*, 2014). Cutaneous anthrax is the most common manifestation. Inhalational anthrax is a serious form with high mortality, reported increasingly in the recent past as a consequence of bioterrorism in the USA (Borio *et al.*, 2001). Gastrointestinal manifestation is rare. Patients present with abdominal pain, vomiting, gastrointestinal bleed, ascites and, very rarely, disseminated intravascular coagulation (DIC) (Beatty *et al.*, 2003). Several cases of cutaneous anthrax leading to meningoencephalitis with 100 % mortality have been reported from Pondicherry (Kumar *et al.*, 2000a, b; Narayan *et al.*, 2009).

Although the incidence of anthrax has declined, sporadic cases continue to be reported. The fatality of the disease warrants effective immunization programmes for cattle and humans at risk, as well as public awareness campaigns, especially in developing countries like India where the disease is still endemic (Kumar *et al.*, 2000b).

Case report

A 50-year-old gentleman, a farmer by occupation with a long history of alcohol excess, presented to the emergency department with complaints of fever and malaena for 1 week. He had one episode of tonic clonic seizure on the day of admission. On examination the patient was febrile (39 °C), tachypnoeic and confused. His oxygen saturation was 90 % while breathing room air, with a Glasgow coma scale score of 6/15. He was admitted to the intensive care unit, intubated and mechanically ventilated. Systemic examination revealed a few bilateral basal crackles in the chest. His neurological examination was unremarkable. Abdomen examination revealed abdominal distension with shifting dullness suggestive of ascites. A nasogastric tube was inserted and coffee ground aspirate was found. There was no history of gastrointestinal bleeding or alcohol

Abbreviations: Abbreviation: DIC, disseminated intravascular coagulation.

withdrawal seizure in the past. He was not diabetic or hypertensive. He had consumed around 150–200 ml alcohol two to three times a week for the last 25 years. His investigations revealed haemoglobin 12.3 gm dl^{-1} , white cell count $24.2 \times 10^9 \text{ l}^{-1}$ (neutrophils 60 %, lymphocytes 26 %, eosinophils 4 %), platelets $36 \times 10^9 \text{ l}^{-1}$, alanine transaminase 59 U l^{-1} , aspartate aminotransferase 101 U l^{-1} , prothrombin time 16.2 s, international normalised ratio 1.3 and activated partial thromboplastin time 37.6 s, and fibrin degradation product was positive. As the area is endemic for malaria and dengue, tests for malarial antigen and dengue antibodies were done and found to be negative. As he had a long history of alcohol excess, his human immunodeficiency virus, hepatitis B virus surface antigen and anti-hepatitis C virus status was determined and was found to be negative for all three. Arterial blood gas analysis was suggestive of metabolic acidosis. A chest radiograph and two-dimensional echocardiography were normal. A computed tomography scan of the brain showed multiple haemorrhages in the right cerebral hemisphere. Abdominal ultrasonography showed hepatomegaly with mild splenomegaly and moderate ascites. A provisional diagnosis of sepsis with DIC and decompensated chronic liver disease with hepatic encephalopathy was made. He was treated with transfusions of platelet concentrates and fresh frozen plasma, and intravenous ceftriaxone, metronidazole and oral rifaximin, pending blood and urine culture reports. Cerebral spinal fluid analysis was not done in view of coagulopathy. Blood was cultured using an automated Bact-T Alert system. Within a period of 6 h at the first indication of growth, a smear was done, which revealed long Gram-positive bacilli with a bamboo stick (box car) appearance (Fig. 1a). Colonies on blood agar had a typical grey wrinkled ('Medusa head') appearance and did not produce any haemolysis (Fig. 1b). The organism was identified as *B. anthracis* by standard tests. All laboratory procedures were done in a Biosafety Level 2 cabinet. Standard laboratory safety measures were followed for discarding the culture material. The patient's history was reviewed and it was discovered that he had eaten raw meat (beef) 1 week prior to admission. At 7 h post-admission, the patient deteriorated haemodynamically

with hypotension, oliguria and haematuria. His prothrombin time prolonged to 22.3 s and his partial thromboplastin time was 59.7 s. He developed severe metabolic acidosis. Inotropes were started. However, he died soon after (18 h after admission).

Discussion

Anthrax is endemic in Pondicherry (Kumar *et al.*, 2000a). Infection with *B. anthracis* involves three components: oedema factor, lethal factor and protective antigen for tissue damage and subsequent clinical outcome. Oedema factor and lethal factor combine together with protective antigen to form oedema toxins and lethal toxins, respectively (Dixon *et al.*, 1999). The protective antigen binds to the cell surface and allows oedema toxin and lethal toxin to enter the cell and inhibits the mitogen-activated protein kinase pathway. This leads to the inhibition of upstream signalling components that mediate NADPH oxidase assembly and thus suppresses human neutrophil-mediated innate immunity (Crawford *et al.*, 2006).

Humans can become infected by inhalation, ingestion or invasion through the skin. *B. anthracis* can cause various clinical manifestations such as cutaneous ulcers, pneumonia, meningoencephalitis, ascites, gastrointestinal bleeding and fever. DIC in the case of anthrax is rare and has been reported primarily in inhalational anthrax (Mina *et al.*, 2002; Stearns-Kurosawa *et al.*, 2006; Grinberg *et al.*, 2001).

A recent outbreak of injectional anthrax among intravenous drug abusers was reported in Scotland (Booth *et al.*, 2014). This is a new form of anthrax acquired by injecting contaminated heroin. In this outbreak, 47 patients had confirmed anthrax, of which 13 died. According to the report on this outbreak by the National Anthrax Outbreak Control Team, central nervous system symptoms or signs were recorded in 14 out of 42 patients (remaining 5 patient's data was incomplete). Few presented with agitation and low Glasgow coma scale scores. Seizures were noted in two patients who also had a past medical

Fig. 1. (a) Microscopic image of Gram-positive bacilli (bamboo stick/box car appearance) identified as *B. anthracis* from a Bact-T Alert blood culture. Magnification, $100\times$. (b). Sealed plate of blood agar showing growth of *B. anthracis* as non-haemolytic, grey, wrinkled colonies.

history of fits (National Anthrax Outbreak Control Team, 2011). Parcell *et al.* (2011) reported compartmental syndrome and necrotizing fasciitis in a case of injectional anthrax.

Gastrointestinal anthrax follows ingestion of grossly contaminated and undercooked meat. Following ingestion, anthrax bacilli are transported to the mesenteric lymph nodes. Subsequently, haemorrhagic mesenteric adenitis, ascites and septicaemia may occur. Most common pathological findings include soft hypertrophied lymph nodes in the ileocaecal region and oedema of the caecum and ascending colon. Non-specific symptoms and signs make the diagnosis of gastrointestinal anthrax difficult. The clinical presentation of gastrointestinal anthrax is divided into three phases. The first is the initial prodromal phase where the patient presents with fever, malaise and syncope. This is followed by the second progressive phase with abdominal pain, nausea, vomiting, abdominal distension, ascites and severe weakness. The third phase is the fulminant phase described as a sudden increase in abdominal girth and ascites, paroxysmal abdominal pain and shock (Lucey, 2012).

Commonest manifestation of intestinal anthrax is abdominal pain, vomiting, ascites and fever as reported by Hatami *et al.* (2010) and Ghodratollah *et al.* (2013). In both the case reports, patients presented with complaints of abdominal pain, vomiting, ascites and fever. In addition to these features, our patient had gastrointestinal bleeding and DIC. The largest case series of gastrointestinal anthrax to date has been reported from Iran by Beheshti *et al.* (2003). In this case series, they reported nine cases of gastrointestinal anthrax with a high mortality rate of 88 %. Of the nine cases, seven also had cutaneous anthrax. This highlights the fact that isolated gastrointestinal anthrax is rare. Moreover, in their study, they found that approximately 88 % had haematemesis whereas malaena was seen only in 33.3 %. Our patient had both these manifestations. The incidence of DIC in this series was 55 % (five out of nine patients). The course of gastrointestinal anthrax seems to be stormy, as evidenced by the death of six out of nine patients within 72 h of hospitalization. The same was observed in our patient who died within 18 h of admission. Cases of gastrointestinal anthrax have been reported from India, with the first case as early as 1985 (Bhat *et al.*, 1985; Sekhar *et al.*, 1990). However, none of these was complicated by DIC.

The main stay of treatment is specific antimicrobial therapy. Currently, ciprofloxacin or doxycycline is recommended as the first-line agent in combination with a second agent such as clindamycin, penicillin, meropenem or rifampin (Lane & Fauci, 2012). Of these, clindamycin is highly recommended due to its role in preventing toxin production (Bartlett, 2012). However, in the case of gastrointestinal anthrax, antimicrobial therapy alone may not suffice. Ghodratollah *et al.* (2013) reported five cases of gastrointestinal anthrax mimicking acute abdomen, where exploratory laparotomy and right hemicolectomy was performed in four patients. They achieved excellent

results, with 100 % survival of operated cases. In our case, although antibiotics were started, surgical intervention was deferred in view of the profound coagulopathy and shock.

The state has an Integrated Disease Surveillance Program, and all reportable communicable diseases are submitted to the health department. Following our notification, the public health team visited the village to create awareness among the population and vaccinated the cattle in the area.

Conclusion

Although believed to be eradicated from the western world, anthrax threatens to re-emerge in the form of injection anthrax and continues to be endemic in developing countries such as India. Gastrointestinal anthrax can mimic several conditions such as acute abdomen and gastrointestinal bleeding, making the diagnosis difficult. A carefully taken history of animal contact or ingestion of raw/undercooked meat and a high index of suspicion may lead to an early diagnosis. Prompt institution of appropriate antibiotics and surgical intervention are likely to improve the outcome in such cases. Clinicians and healthcare workers should refamiliarize themselves with this uncommon disease to reduce mortality. Effective immunization of animals is the other important control measure for anthrax.

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