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Case Report

Massive gas gangrene secondary to occult colon carcinoma

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ABSTRACT

Gas gangrene is a rare but often fatal soft-tissue infection. Because it is uncommon and the classic symptom of crepitus does not appear until the infection is advanced, prompt diagnosis requires a high index of suspicion. We present a case report of a middle-aged man who presented with acute onset lower-extremity pain that was initially thought to be due to deep vein thrombosis. After undergoing workup for pulmonary embolism, he was found to have massive gas gangrene of the lower extremity secondary to an occult colon adenocarcinoma and died within hours of presentation from multisystem organ failure.

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Case report

A 44-year-old man presented to the emergency department with complaints of 8 hours of progressive right lower-extremity pain. The patient's medical history was notable for untreated atrial fibrillation and ulcerative colitis (ongoing treatment with mesalamine). On arrival to the hospital, the patient was agitated and unable to get comfortable on the stretcher because of his severe right lower-extremity pain. He was diaphoretic, tachycardic, and hypertensive but afebrile at the time of admission. Physical examination revealed an edematous, pulseless, and insensate right lower extremity. No crepitus was noted on the initial examination. The primary concern was for deep vein thrombosis, which prompted a workup for pulmonary embolism and a stat

computed tomography (CT) pulmonary angiogram was ordered.

En route to the scanner, the patient was noted to have right lower-extremity crepitus. The chest CT was subsequently extended down to include the abdomen, pelvis, and lower extremities; and general surgery was consulted. The CT demonstrated a large amount of intramuscular and intrafascial air in the proximal right thigh, tracking up into the pelvis and the abdomen (Fig. 1A and B). Axial CT images at the level of the midabdomen demonstrated an area of colonic wall thickening and a contained perforation (Fig. 1C). Given these findings, a decision was made to urgently take the patient to the operating room. En route to and on arrival in the operating room, he had 3 episodes of cardiac arrest but was successfully resuscitated and stabilized such that

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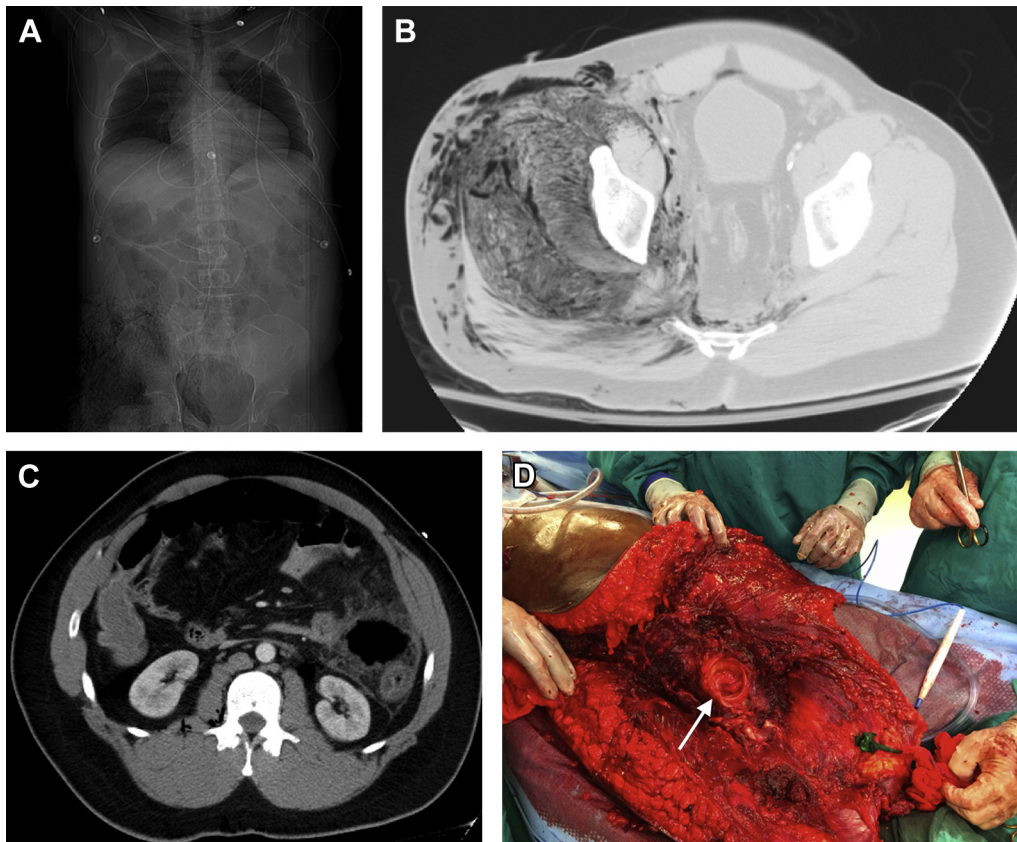


Fig. 1 – A 44-year-old man who presented to the emergency department with complaints of 8 hours of progressive right lower-extremity pain. (A) Scout topogram from contrast-enhanced computed tomography (CT) of the abdomen and the pelvis demonstrating intramuscular gas tracking up from the right thigh. (B) Axial image of contrast-enhanced CT at the level of the proximal right thigh demonstrates extensive intramuscular and intrafascial gas. (C) Axial image of contrast-enhanced CT of the abdomen demonstrates an area of wall thickening and enhancement at the level of the descending colon with an adjacent area of contained perforation. (D) Intraoperative image after right hip disarticulation demonstrating the right acetabulum (white arrow) and the proximal thigh muscles.

surgery could begin. The plan was for general surgery to perform an exploratory laparotomy followed by a fasciotomy with possible amputation or disarticulation by orthopedic surgery.

The general surgery service performed an exploratory laparotomy and found an area of pneumatosis and signs of a contained colonic perforation with induration and omental stranding around the descending colon. Given the need for expeditious care, a subtotal colectomy was performed. It was noted during the surgery that the retroperitoneum along the right side was also hemorrhagic and friable. Urology evaluated the scrotum and perineum, which appeared healthy. The patient was then repositioned for the orthopedic portion of the surgery. The patient's right lower extremity was noted to have numerous blisters extending to his groin. A large incision was made over the proximal right thigh down to fascia. On incision into the medial compartment of the patient's right thigh, there was audible hissing of gas as it was released. There were visible gas bubbles in the tissues and a foul-smelling odor. The muscle appeared necrotic, and there was no notable active bleeding in the extremity. The hip was disarticulated, and the extremity was placed in a pathology

specimen tray (Fig. 1D). Cultures of the devitalized tissues from the leg were sent to microbiology and the necrotic muscle of the posterior, medial, and anterior compartments of the thigh were subsequently debrided. The patient was then transferred to the intensive care unit on multiple vasopressors but succumbed to multiorgan failure a few hours later. Tissue cultures demonstrated the presence of *Clostridium septicum*. Pathology of the colectomy specimen demonstrated low-grade mucinous carcinoma with metastatic deposits in the omentum. These findings are compatible with gas gangrene, a type of necrotizing soft-tissue infection that rarely can occur in the setting of gastrointestinal malignancy.

Discussion

Gas gangrene, or Clostridial myonecrosis, is a rare life-threatening necrotizing soft-tissue infection. Known risk factors for necrotizing soft-tissue infections include immunosuppression, diabetes, cancer, and vascular disease. Gas gangrene usually occurs secondary to trauma or surgery, with only 16% of cases occurring spontaneously [1]. Although gas

gangrene is often polymicrobial, Clostridial myonecrosis is the most fulminant type of necrotizing soft-tissue infection [2].

Clostridium is an anaerobic, spore-forming, and gram-positive rod [3]. They are part of the normal flora of the skin and gastrointestinal tract. *Clostridium septicum* infection is rare and comprises a small subset of all Clostridium infections. Larson et al [4] reviewed all cases of Clostridium infection at their institution from 1966 to 1993. Among 241 cases of Clostridium, 32 cases (11.4%) were *Clostridium septicum* infection. Overall 50% of these patients had an associated malignancy (compared with 11% for other Clostridium infections). *Clostridium septicum* infection mortality rate was 56% compared with 26% for all Clostridium infections.

The association between *Clostridium septicum* infection and underlying malignancy was first reported in 1969 [5]. Since that time, numerous case reports have described non-traumatic *Clostridium septicum* infection in the setting of an underlying colorectal malignancy [6–9]. The proposed mechanism for spontaneous Clostridial myonecrosis in the setting of gastrointestinal malignancy is as follows: tissue damage occurs (ie, secondary to colorectal adenocarcinoma), resulting in hypoxia and allowing Clostridia to proliferate and produce exotoxins. The exotoxins increase capillary permeability, which allow the Clostridia to enter the systemic circulation. The infection spreads and typically affects muscle groups that are served by a single major artery (ie, an extremity) [3]. *Clostridium septicum* is able to invade healthy tissues as it is much more aerotolerant compared with other Clostridial species [10]. The infected muscles become ischemic and necrotic, which perpetuates Clostridial replication and toxin production. This will manifest clinically as edema and pain. As anaerobic fermentation continues, eventually enough gas will be produced to cause signs of crepitus.

In addition to malignancy, enterocolitis has also been identified as a risk factor for the development of gas gangrene [11–13]. It has been demonstrated that gastrointestinal inflammation causes hypoxia [14], and it may be the hypoxic environment that helps propagates spore formation and the spread of infection. So, the patient in this scenario had 2 predisposing factors to Clostridial myonecrosis: indolent colon cancer and inflammatory bowel disease.

The treatment of gas gangrene necessitates prompt administration of intravenous antibiotics followed by surgery to debride devitalized tissue. If the infection has crossed a joint, as in this case, disarticulation is required to attempt to prevent further spread. Many studies have also suggested augmentation with hyperbaric oxygen reduces morbidity and mortality [15–17]. However, *Clostridium septicum* is known to be aerotolerant, which may explain why in vitro data showed *Clostridium septicum* to be the most resistant of the Clostridium species to the bactericidal effects of hyperoxia [18].

Given that nearly half of all emergency department room visits involve imaging [19] and that the clinical symptoms of gas gangrene can be misleading, the radiologist may be the first to suggest the diagnosis. This patient had no history of trauma or surgery nor was he immunocompromised. He was afebrile and did not exhibit any signs of crepitus on examination. Yet in a matter of hours, he became profoundly

septic and ultimately succumbed to gas gangrene. Although uncommon, necrotizing soft-tissue infections require a high index of suspicion as early diagnosis and treatment are essential for survival.

REFERENCES

- [1] Perry BN, Floyd 3rd WE. Gas gangrene and necrotizing fasciitis in the upper extremity. *J Surg Orthop Adv* 2004;13(2):57–68.
- [2] Stevens DL, Bryant AE. The role of clostridial toxins in the pathogenesis of gas gangrene. *Clin Infect Dis* 2002;35(Suppl. 1):S93–100.
- [3] Wells CL, Wilkins TD. Clostridia: sporeforming anaerobic bacilli. In: Baron S, editor. *Medical Microbiology*. Galveston (TX): The University of Texas Medical Branch at Galveston; 1996.
- [4] Larson CM, Bublick MP, Jacobs DM, West MA. Malignancy, mortality, and medicosurgical management of *Clostridium septicum* infection. *Surgery* 1995;118(4):592–7. discussion 7–8.
- [5] Alpern RJ, Dowell Jr VR. *Clostridium septicum* infections and malignancy. *JAMA* 1969;209(3):385–8.
- [6] Hartel M, Kutup A, Gehl A, et al. Foudroyant Course of an Extensive *Clostridium septicum* Gas Gangrene in a Diabetic Patient with Occult Carcinoma of the Colon. *Case Rep Orthop* 2013;2013:216382.
- [7] Mao E, Clements A, Feller E. *Clostridium septicum* Sepsis and Colon Carcinoma: report of 4 cases. *Case Rep Med* 2011;2011:248453.
- [8] Pelletier JP, Plumbley JA, Rouse EA, Cina SJ. The role of *Clostridium septicum* in paraneoplastic sepsis. *Arch Pathol Lab Med* 2000;124(3):353–6.
- [9] Katlic MR, Derkac WM, Coleman WS. *Clostridium septicum* infection and malignancy. *Ann Surg* 1981;193(3):361–4.
- [10] Stevens DL, Musher DM, Watson DA, et al. Spontaneous, nontraumatic gangrene due to *Clostridium septicum*. *Rev Infect Dis* 1990;12(2):286–96.
- [11] Galbut DL, Gerber DL, Belgraier AH. Spontaneous necrotizing fasciitis: occurrence secondary to occult diverticulitis. *JAMA* 1977;238(21):2302.
- [12] Piedra T, Martín-Cuesta L, Arnáiz J, et al. Necrotizing fasciitis secondary to diverticulitis. *Emerg Radiol* 2007;13(6):345–8.
- [13] Secil M, Topacoglu H. Retroperitoneal necrotizing fasciitis secondary to colonic diverticulitis. *J Emerg Med* 2008;34(1):95–7.
- [14] Glover LE, Colgan SP. Hypoxia and metabolic factors that influence inflammatory bowel disease pathogenesis. *Gastroenterol* 2011;140(6):1748–55.
- [15] Korhonen K, Klossner J, Hirn M, Niinikoski J. Management of clostridial gas gangrene and the role of hyperbaric oxygen. *Ann Chir Gynaecol* 1998;88:139–42.
- [16] Eke N. Fournier's gangrene: a review of 1726 cases. *Brit J Surg* 2000;87(6):718–28.
- [17] Hirn M, Niinikoski J, Lehtonen O-P. Effect of hyperbaric oxygen and surgery on experimental multimicrobial gas gangrene. *Eur Surg Res* 1993;25(5):265–9.
- [18] Hill GB, Osterhout S. Experimental effects of hyperbaric oxygen on selected clostridial species. I. In-vitro studies. *J Infect Dis* 1972;125(1):17–25.
- [19] Niska R, Bhuiya F, Xu J. National Hospital Ambulatory Medical Care Survey: 2007 emergency department summary. *Natl Health Stat Report* 2010;(26):1–31.