

Case Report

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Fatal *Morganella morganii* bacteraemia in a diabetic patient with gas gangrene

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We report a case of a 60-year-old lady with a history of a heel ulcer that had not responded to antibiotic therapy. This progressed to involve the right leg, which was swollen and erythematous. Radiological imaging revealed the presence of gas within the fascial planes. Blood cultures on admission yielded *Morganella morganii*. Due to the extent of the gas gangrene and her co-morbidities the patient was not suitable for surgical intervention and was treated conservatively with antibiotics. She deteriorated and died within 72 h of presentation. Non-clostridial gas gangrene is relatively rare, and diagnosis is frequently delayed and often missed. Early aggressive surgical intervention combined with appropriate antibiotic therapy is essential. Bacterial species other than *Clostridium* should be considered in all cases of gas gangrene.

Introduction

Gas-forming infection, whether clostridial or non-clostridial in origin, is serious and often life-threatening (Bessman & Wagner, 1975; Bird *et al.*, 1977; Brightmore, 1971). The medical and surgical management of non-clostridial gas gangrene is significantly different from that of clostridial gas gangrene. Non-clostridial gas gangrene is a rare clinical condition and has a high mortality (Darke *et al.*, 1977). Urgent surgical intervention in addition to appropriate antibiotic therapy is essential.

Case report

A 60-year-old lady was admitted to Ayr Hospital with a 6 week history of a right heel ulcer, presumably from ill-fitting footwear. She was treated initially by her general practitioner with amoxicillin–clavulanic acid. The patient had a history of poorly controlled insulin-treated type 2 diabetes for the last 16 years. She also had several co-morbidities, including metastatic adenocarcinoma of the colon (not amenable to surgery or chemotherapy), atrial fibrillation, hypertension, dyslipidaemia, ischaemic heart disease, stage 3 chronic kidney disease, diabetic retinopathy, peripheral neuropathy, interstitial lung disease, iron deficiency anaemia and osteoporosis. She did not have any evidence of peripheral vascular disease or chronic venous insufficiency. She had no pets at home.

Examination revealed a 2.5 × 2.5 cm ulcer on the right heel and a grossly swollen erythematous right leg. The swelling and redness extended up to the right thigh. There was also an area of ulceration (5 × 3.5 cm) over the right calf

(Fig. 1). The patient stated that initially she had noticed an area of redness over the calf, which subsequently developed into bullae, before coalescing and subsequently ulcerating. The base of the ulcerated area was necrotic. On palpation of the affected limb there was no crepitus. Systemically the patient was generally unwell. She was febrile, tachycardic, hypotensive and had features of septic shock. Laboratory investigations showed a markedly elevated white cell count (30.9×10^9 cells l^{-1}), neutrophil count (28.4×10^9 cells l^{-1}) and C-reactive protein (288 mg l^{-1}). Urea (19.6 mmol l^{-1}) and creatinine levels (152 μ mol l^{-1}) were also raised. Liver function tests were normal prior to admission. There was a mild elevation of bilirubin (32 U l^{-1}) in keeping with sepsis. There was no evidence of urinary tract infection.

Chest X-ray revealed evidence of long standing interstitial lung disease and electrocardiography revealed evidence of ischaemic heart disease. Radiological imaging revealed the presence of gas within the fascial planes (muscles) of the right leg (Fig. 2). *Escherichia coli* and *Proteus* spp. were isolated from superficial swabs. Swabs were not obtained from deeper tissues. Two separate peripheral blood cultures taken on the day of admission yielded a non-lactose fermenting Gram-negative bacillus within 48 h of incubation. The identity of the organism was established with the help of a VITEK 2 GN colorimetric card that was read with VITEK 2 system software version VT2-R05.01. The probability of the isolate being *Morganella morganii* was 0.99. The organism was susceptible to ciprofloxacin, gentamicin, ceftriaxone and meropenem. Because of the possibility of inducible resistance, treatment with meropenem was advised. *Clostridium perfringens* was not isolated from any of the samples.



Fig. 1. Clinical image showing the ulcerated area of the right calf.

The patient was referred to the surgical and anaesthetic team. The pros and cons of surgery and general anaesthesia were discussed in detail by the multidisciplinary team and with both the patient and her family. Amputation was considered, but due to her co-morbidities and extent of disease it was felt that the likelihood of her surviving surgery was slim. The patient was managed conservatively with intravenous broad-spectrum antibiotics (2 g meropenem three times daily and 400 mg teicoplanin once daily, following an initial loading dose). She was kept comfortable and supportive care was provided. She deteriorated and died within 72 h of presentation.



Fig. 2. Computed tomography scan showing the presence of gas within the right leg.

Discussion

Non-clostridial gas gangrene is relatively rare, and diagnosis is frequently delayed and often missed. Delay in the preliminary diagnosis and failure to undertake urgent aggressive surgical intervention is associated with a poor outcome. An early intervention of this type combined with appropriate antibiotic therapy is essential. Non-clostridial gas gangrene is often associated with trauma (Hubens *et al.*, 1989; Yasuda *et al.*, 1986). However, non-traumatic infection may occur in the absence of cutaneous wounds and tends to be more common in individuals suffering from diabetes mellitus, congestive heart failure, renal failure, nutritional deficiencies, and haematological and gastrointestinal malignancies or any other immunocompromised state. *M. morganii* is often associated with urinary tract and hepatobiliary infections (McDermott & Mylotte, 1984). Other risk factors include old age, the presence of concomitant bacteraemia, hospitalization, recent surgery and concurrent antibiotic use (Lee & Liu, 2006). The progress of non-clostridial gas gangrene is often deceptive with a slow initial phase followed by rapid progression with a risk of septicaemia (Kim *et al.*, 2007). Specific symptoms like local pain and swelling are less marked than that of clostridial gas gangrene. This initial lack of definite symptoms often leads to a delayed diagnosis and a poor outcome.

Non-clostridial gas gangrene is usually caused by a mixed infection, including infection by bacteria such as: *Enterococcus faecalis*, *Escherichia coli*, *Staphylococcus aureus*, group G streptococcus, *Klebsiella pneumoniae*, *Proteus vulgaris* and *Citrobacter diversus*. *M. morganii* bacteraemia has not previously been reported from a patient with non-clostridial gas gangrene. However, *Morganella* has been isolated from a patient with polymicrobial non-clostridial myonecrosis (Takahira *et al.*, 2002). There is only one report of isolation of *M. morganii* from a sacral pressure ulcer as part of a mixed pyogenic infection (Setsuko *et al.*, 2006).

In our patient, coliforms were isolated from superficial leg swabs, which could reflect polymicrobial sepsis. Polymicrobial infection plays an important role in pathogenesis. Facultative anaerobes such as coliforms reduce the redox potential in tissues thereby allowing obligate anaerobes to multiply. Anaerobes on the other hand inhibit phagocytosis (Styrt & Gorbach, 1989).

Morganella belongs to the family *Enterobacteriaceae*. It is present in the environment and is part of the normal flora of the colon. It is a motile Gram-negative bacillus and ferments glucose with the production of acid and gas (Janda *et al.*, 1996). Fermentation of glucose in tissues is thought to be the source of the gas in gangrenous infections (Chi *et al.*, 1995). *M. morganii* bacteraemia is relatively uncommon but has a high rate of mortality. Urinary tract infection is probably the most common infection caused by *M. morganii* in humans, but the organism has also been documented as causing pneu-

monia, empyema, wound infection, pericarditis, peritonitis, sepsis, arthropathy, endophthalmitis, meningitis, ecthyma gangrenosum-like eruptions and Fournier's gangrene (Bagel & Grossman, 1985; Cafferkey *et al.*, 1988; Cunningham *et al.*, 1997; Del Poso *et al.*, 1998; Isobe *et al.*, 1994; Mastroianni *et al.*, 1994; Sica *et al.*, 1995; García Reinoso *et al.*, 1990).

It is well documented that patients with colonic cancer are more likely to develop infective endocarditis due to *Streptococcus bovis*. *M. morganii* is part of the normal flora of the colon and our patient had an inoperable adenocarcinoma of the colon. It is not clear if this was related to the development of *Morganella* bacteraemia. However, bacteraemia followed by secondary seeding of a compromised tissue might have led to gangrenous infection.

Production of extended spectrum β -lactamases and induction of β -lactamases upon therapy has been widely reported in *Morganella* (Choi *et al.*, 2008). Carbapenems are therefore considered as the first-line antibiotics for the treatment of life-threatening infections due to *Morganella*. Unlike clostridial gas-gangrene, hyperbaric oxygen therapy in non-clostridial gas gangrene in diabetics is ineffective (Owada *et al.*, 1994).

In summary, bacterial species other than *Clostridium* should be considered in all cases of gas gangrene. Antibiotic therapy should be directed towards polymicrobial sepsis because of the life-threatening nature of this condition.

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