We describe a case of fatal lower limb necrotizing fasciitis in a 65-year-old man who was treated with broad-spectrum antibiotics, limb amputation and tissue debridement. The causative organism was identified by PCR as *Haemophilus influenzae* serotype f, which is a highly unusual cause of necrotizing fasciitis.

**Discussion**

Necrotizing soft tissue infections are rare infections that are associated with a high mortality and can affect any of the layers within the soft tissue compartment (dermis, subcutaneous tissue, superficial fascia, deep fascia or muscle). They were first described by Jones (1871) as ‘hospital gangrene’ and Wilson (1952) subsequently used the term necrotizing fasciitis, which is now recognized to describe rapidly progressive infection of the fascia and subcutaneous tissue, with thrombosis of the microcirculation.

Using bacteriological differentiation, two types of necrotizing fasciitis are described (Morton & Pasternack, 2005). In Type I, at least one anaerobic species is isolated in combination with other facultative anaerobes, including streptococci (other than group A) and members of the *Enterobacteriaceae*. In Type II, group A streptococci are deteriorated further requiring continuous veno-venous filtration and he developed multi-organ failure with worsening metabolic acidosis. In light of his deteriorating condition, meropenem was added to his antibiotic regime and he underwent further debridement of the left leg stump. Unfortunately, his condition continued to deteriorate despite intensive therapy and he died within 14 h of admission.

Blood cultures had been taken in A&E prior to the administration of antibiotics and further specimens received for culture included swabs of the blisters and surgically debrided deep tissue. *Haemophilus influenzae* was isolated from all of these specimens with no other organisms being detected. The organism did not possess a β-lactamase enzyme and was found to be susceptible to amoxicillin and cefuroxime. The reference laboratory (Colindale, UK) subsequently confirmed it to be serotype f using PCR. Following 5 days prolonged incubation, the tissue cultures and skin swabs remained negative for other organisms, including anaerobes.
isolated either alone or in combination with other species. However, no combination of bacterial species is either diagnostic or found in all cases (Anaya & Dellinger, 2007).

A case series of 89 patients with a diagnosis of necrotizing fasciitis reported that 54% of cases were polymicrobial, with streptococcal species, staphylococcal species, enterococci and members of the Enterobacteriaceae being common isolates. Of the remaining cases, 28% were monomicrobial and in 18%, no organism was isolated (Wong et al., 2003). More recently, a published series of 87 patients with necrotizing fasciitis reported monomicrobial infection in 59 patients (67.8%). Members of the Enterobacteriaceae accounted for approximately half of these cases with other organisms causing monomicrobial infection including β-haemolytic streptococci (primarily group A), Aeromonas species, Pseudomonas aeruginosa, Vibrio vulnificus and Acinetobacter baumannii. Mixed infection was documented in 17 patients and there was no organism identified in 11 patients (Liu et al., 2005). Both groups found that Bacteroides were the most commonly detected anaerobes.

Of note, H. influenzae was not isolated in any of the cases included in the studies described above and is rarely reported as a cause of necrotizing fasciitis. On review of the literature, there is one case report of an adult, who had insulin-dependent diabetes mellitus, who developed necrotizing fasciitis due to unencapsulated H. influenzae (Stumvoll & Fritsche, 1997). There are three reports of necrotizing fasciitis caused by haemophili in infants, with two of these occurring in association with evidence of pharyngeal infection and affecting the cervical region. In one of these cases, H. influenzae was isolated in association with three other pathogens, including two anaerobic species (Bush et al., 1984). The second case of cervical necrotizing fasciitis was caused by Haemophilus species other than H. influenzae and occurred in association with bacteraemia, pneumonia and meningitis in a 5-month-old infant (Cordeiro et al., 1997). The third reported case was of lower limb necrotizing fasciitis caused by monoinfection with H. influenzae serotype b (Collette et al., 1987).

There are six capsular types of H. influenzae, referred to as serotypes a–f, distinguishable from non-typable strains by the presence of one of six structurally and serologically distinct polysaccharide capsules. Prior to the introduction of the Hib vaccine, most invasive disease occurring as a consequence of H. influenzae was due to serotype b, affecting primarily children less than 2 years. In the post-vaccination era, there has been concern about the development of serotype replacement (Kapogiannis et al., 2005), with a simultaneous increase in the number of non-serotype b capsule H. influenzae being reported in Brazil, Portugal, Canada and Denmark (Tsang et al., 2006; Bruun et al., 2004). Tsang et al. (2006) examined 52 H. influenzae isolates from patients with invasive disease and found 26 of the isolates to be serotype a, 20 to be non-typable, three to be serotype b and one isolate each of serotypes c, d and f.

H. influenzae serotype f is an uncommon cause of invasive infection in adults. Slater et al. (1990) report five cases of adults with bacteraemia due to H. influenzae serotype f. Four of these cases occurred secondary to respiratory tract infections (three cases of pneumonia and one of epiglottitis) and the fifth, a patient with dysgammaglobulinaemia, had no obvious infective focus. Bruun et al. (2004) report 13 cases of invasive H. influenzae serotype f infection in adults, with eight of these occurring as a consequence of pneumonia or infective exacerbation of chronic obstructive pulmonary disease and one case each of meningitis.
epiglottitis, osteomyelitis, cholangitis and neutropenic bacteraemia with no clinical focus.

In conclusion, this case highlights a number of notable and unusual features. *H. influenzae* is an unusual cause of necrotizing fasciitis, and as far as we are aware, this is the first time that *H. influenzae* serotype f has been implicated in this clinical presentation. When invasive disease does occur as a consequence of *H. influenzae* infection, it predominantly affects children and is more frequently due to serotypes other than f. The background of excess alcohol consumption may have contributed to the severe infection that developed in this patient. He was jaundiced with hepatomegaly on admission and chronic liver disease is associated with an increased mortality due to necrotizing fasciitis. International epidemiological surveillance of encapsulated *H. influenzae* isolates would provide useful information with regard to Hib serotype replacement and would also reveal whether *H. influenzae* contributes to necrotizing soft tissue infections more frequently than has been previously recognized.

**References**