

Necrotising fasciitis caused by *Vibrio vulnificus* in the lower limb following exposure to seafood on the hand

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Vibrio vulnificus infection mainly manifests as primary bacteraemia or gastroenteritis following injection of the microorganism, and wound infection through direct inoculation. Injury from exposure to the microorganism and development of necrotising fasciitis at a remote site and sepsis are rare. This report is of a high-risk patient with haemoglobin H disease who developed necrotising fasciitis in the lower limb after exposure to seafood on the hand.

Introduction

Vibrio vulnificus infection in Hong Kong is more common in the summer months. The organism can lead to development of necrotising fasciitis, which is a soft-tissue infection with a high risk of fatality. Necrotising fasciitis occurs mostly in immunocompromised patients with diseases such as hepatic disease, diabetes mellitus, or thalassaemia. The microorganism usually invades the host through the gastro-intestinal tract or a wound. This report is of a rare case whereby development of necrotising fasciitis in the lower limb was due to invasion of the microorganism through a wound in the upper limb.

Case report

A 69-year-old man with a history of alpha thalassaemia trait haemoglobin H disease with splenomegaly, hypothyroidism, and congestive heart failure, presented in June 2010 with a 2-day history of left leg swelling and pain. He noted a lesion over his left leg with exquisite pain. His fingers had been injured by a crab while he was preparing a meal a few days before presentation.

On admission, he was febrile with a temperature of 40°C. There was no visible wound on his hands. A 5 x 5 cm erythematous patch with petechiae was found on his left calf (Fig). There was tenderness over the lesion, which extended beyond the apparent margin. No blisters and crepitus were found. The radiograph of his left leg showed soft tissue swelling, but no subcutaneous emphysema. A diagnosis of necrotising fasciitis was made. Intravenous antibiotics with penicillin G (2 megaunit every 6 hours), metronidazole (500 mg every 8 hours) and gentamicin (80 mg every 8 hours) were started promptly, while the patient was prepared for emergency surgical debridement. His condition deteriorated over the next hour, with the lesion spreading to the whole leg. Initial blood tests showed a mild degree of acute renal failure with a creatinine level of 201 µmol/L (reference range [RR], 53-106 µmol/L) and urea of 15.5 mmol/L (RR, 2.9-8.2 mmol/L). The white blood cell count was 9.5×10^9 /L (RR, 4.5-11.0 $\times 10^9$ /L), platelet count was 53×10^9 /L (RR, 150-450 $\times 10^9$ /L), and haemoglobin level was 91 g/L (RR, 140-175 g/L). A random blood sugar level was 7.6 mmol/L (RR, 3.9-6.1 mmol/L), C-reactive protein was elevated at 238 mg/L (RR, 0-80 mg/L) and the clotting profile was normal.

The diagnosis of necrotising fasciitis was confirmed intra-operatively. Dishwater-like fluid was found over the fascial plane. The underlying muscle was unhealthy with dusky appearance and non-contractile. There was extensive involvement of the whole lower limb down to the ankle region over both the medial and lateral sides. It was decided that high transtibial amputation was needed for complete excision of the infected tissue. The antibiotic regimen was switched to intravenous amoxicillin-clavulanate 1.2 g every 8 hours, and levofloxacin 500 mg daily postoperatively according to local guidelines on necrotising fasciitis following exposure to seawater or seafood. The wound was laid open after the amputation. The patient was admitted to the intensive care unit for close monitoring after the operation. He was hypotensive with tachycardia and was given intravenous dopamine infusion 40 mg per hour for the first 2 postoperative days. His condition gradually improved and he gradually stopped mechanical ventilation and inotropic agents on day 3.

Key words

Fasciitis, necrotizing; Gram-negative bacterial infections; Hemoglobin H; *Vibrio* infections; Wound infection

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一宗經手部接觸海鮮後因創傷弧菌引致下肢壞死性筋膜炎的病例

創傷弧菌 (*Vibrio vulnificus*) 感染可以透過注射引發原發性菌血症或腸胃炎，亦可經接種引致傷口感染。經由傷口感染創傷弧菌而在身體較遠位置出現壞死性筋膜炎及敗血症的病例相當罕見。本文報告一名高危的血紅蛋白H病患者，因手部被海產刺傷引致下肢的壞死性筋膜炎。

Both blood and wound swab results showed Gram-negative bacilli, which were subsequently identified as *V. vulnificus*, and was sensitive to gentamicin, ciprofloxacin, and augmentin. Antibiotic was switched to oral levofloxacin 500 mg daily. The pathology result also confirmed necrotising fasciitis.

The stump wound was healthy-looking after regular dressing changes. Repeated wound swabs showed no further growth of *V. vulnificus* and the wound was closed. The patient had an uneventful recovery and the wound healed well. He was referred for prosthesis fitting and rehabilitation.

Discussion

Necrotising fasciitis is a severe soft-tissue infection involving the fascia, with a high mortality rate. The incidence of necrotising fasciitis in Hong Kong has been increasing.¹ Type 1 polymicrobial necrotising fasciitis involves a synergistic mixture of anaerobic, aerobic, and facultatively anaerobic bacteria. Type 2 monomicrobial necrotising fasciitis is caused by Gram-positive organisms, with the commonest being group A streptococcus.

Other species can also cause necrotising fasciitis, and *Vibrio* spp is one of the commonest



FIG. A 5 x 5 cm erythematous patch with petechiae over the patient's left calf, with the margin marked at admission. The erythematous patch rapidly spread to the whole leg after 1 hour

pathogens, particularly in warm coastal areas, including Hong Kong.² The bacterium is frequently found in oysters, crustaceans, and shellfish. *Vibrio vulnificus* is a naturally occurring, Gram-negative, halophilic, curved, rod-shaped bacterium. Infections associated with *Vibrio* spp tend to occur in coastal areas during the summer months, as they are found in water warmer than 20°C.³ Since the mean sea surface temperature is 26°C during the summer months in Hong Kong, it is not surprising that *V. vulnificus* infection is common in Hong Kong during the summer. In a local study, five of six *Vibrionaceae* infections causing necrotising fasciitis occurred during the summer months.⁴

Vibrio vulnificus produces three main manifestations, with 45% presenting as wound infection, 43% as primary septicaemia, and 5% as gastroenteritis; the remaining 7% include other conditions, such as pneumonia, osteomyelitis, meningitis, or infections of unknown origin.⁵ Primary septicaemia refers to bloodstream infections acquired from ingestion of the organism via the gastro-intestinal tract, resulting in systemic illness. Wound infection usually results from direct inoculation of the microorganism through exposure to seawater or marine species and tissue necrosis at the site of injury. Gastroenteritis is characterised by vomiting, diarrhoea or abdominal pain, and the microorganism is cultured from stool, but not from blood. Invasion by the microorganism of a wound resulting in bloodstream infections and cutaneous manifestations at a remote site as for this patient are rare.

Most patients with *V. vulnificus* infections have an underlying chronic illness, including chronic liver disease, diabetes mellitus, adrenal insufficiency, haemochromatosis, thalassaemia, chronic renal insufficiency, or other illness causing an immunocompromised state.^{6,7} Iron plays an important role in the pathogenesis of *V. vulnificus* infection.⁸ Patients with haemochromatosis, thalassaemia, and other syndromes causing chronic iron overload are susceptible to septicaemia caused by *V. vulnificus*. When the iron saturation level of transferrin is raised to a level above 50%, *V. vulnificus* can replicate rapidly in blood.⁹ The bacterium can create vulnibactin, a siderophore that can acquire iron from transferrin.¹⁰ Iron can accelerate the growth of bacteria and also reduce the activity of the immune cells.⁸ It has been shown that 74% of patients with haemoglobin H disease and splenomegaly have iron overload.¹¹ Therefore, this patient with haemoglobin H disease was more susceptible to necrotising fasciitis than most people who come into contact with this organism.

Vibrio vulnificus-mediated necrotising fasciitis typically presents with swelling, erythema and pain,

with pain being the most consistent symptom, as found in a local study.¹² Oedema and bullae formation are also clues to the diagnosis. Systemic illness that includes fever and hypotension may also be present in some patients.

Necrotising fasciitis is a surgical emergency. Early and aggressive debridement or amputation is essential for survival. Antibiotic treatment without adequate surgical debridement is ineffective due to thrombosis of the associated vessels. The mortality rate decreases from 23.0% to 4.9% if surgical debridement and fasciotomy are done within 24 hours of the onset of symptoms.¹³

Several regimens for antimicrobial treatment have been suggested. The antimicrobial sensitivity of *Vibrio* spp is different to that of group A streptococci.⁴ A combination of cefotaxime and minocycline has been shown to be better than a single antibiotic

regimen.¹⁴ Another study has also shown that single-agent fluoroquinolones are effective.¹⁵

Conclusions

Necrotising fasciitis caused by *V vulnificus*, although rare, should be kept in mind when assessing a susceptible patient with skin infection who has a recent history of contact with seawater or marine species, especially during the summer months in Hong Kong. While invasion via the gastro-intestinal route and direct inoculation over the wound are common, the focus of infection may not be apparent and may be in a remote location. Exquisite pain is the most consistent feature and a high index of suspicion is required to make the diagnosis. Prompt treatments, including surgical debridement and appropriate antibiotics, are essential.

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