Case Report

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Clostridium fallax associated with sudden death in a 16-year-old boy

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Clostridial myonecrosis or gas gangrene occurs most frequently in contaminated wounds following trauma or surgery. It is caused by a wide variety of Clostridium species, the most common being Clostridium perfringens. Spontaneous, non-traumatic clostridial myonecrosis is uncommon and is usually associated with gastrointestinal and haematological malignancy, diabetes mellitus and peripheral vascular disease. The case of a previously healthy 16-year-old boy with acute onset of gastrointestinal symptoms, who died of bacterial sepsis without apparent preceding trauma, is presented here. Clostridium fallax was identified as the most probable causative agent. As far as is known, this is the first report of fatal sepsis in humans due to C. fallax, which has been described only rarely as a cause of gas oedema in animals.

Introduction

Clostridial infections often present as myonecrosis or gas gangrene, which are acute, rapidly progressing, necrotic, soft tissue infections that are typically associated with wound contamination following trauma or surgery. Causative agents are anaerobic, spore-forming, Gram-positive bacilli of the genus Clostridium that produce local and systemic toxins. Although over 150 species of the genus Clostridium have been recognized, Clostridium perfringens is the most frequently isolated species (95%), either alone or in combination with other pathogenic clostridia, such as Clostridium novyi (8%) or Clostridium septicum (4%) (Weinstein & Barza, 1973; Bakker, 1988). Uncommonly, spontaneous clostridial myonecrosis occurs without preceding trauma. This phenomenon has been associated with gastrointestinal and haematological malignancy, diabetes mellitus and vascular disease (Stevens et al., 1990; Burke & Opeskin, 1999). Other clostridia, such as Clostridium fallax, have occasionally been shown to cause gas oedema disease in animals (Coloe et al., 1983; Vatn et al., 2000). A MEDLINE search using the term ‘clostridium fallax’ revealed no cases of fatal C. fallax infection in humans.

Case report

Case history

A 16-year-old, male, white teenager from the USA, who had come to Germany 2 months before the incident to visit relatives, collapsed at his host’s home. The emergency medical service was called and arrived within a few minutes. Resuscitation efforts were started immediately and the patient was transferred to a hospital. Despite intensive-care measures, he died of circulatory failure shortly after arrival. His relatives reported that he had a 1 week history of a gastrointestinal disorder, but had not sought medical advice. Symptoms, such as nausea, emesis and diarrhoea, had started 1 week before, with acute abdominal distension, colic and anorexia. No other member of the household had been affected. The patient’s medical history was otherwise unremarkable, showing no evidence of any underlying serious disease or drug abuse.

Autopsy findings

Although the corpse had been kept at 4 °C until forensic autopsy, which was performed about 24 h post-mortem, the cadaver showed relevant signs of decomposition, with marbling and greenish discolouration of the skin. The mucous membranes of the intestine were high-grade putrefied and discoloured. The lining of the small intestine was haemorrhagic in several areas and multiple, small, erosive lesions were seen. Gastric contents, as well as the contents of the small and large intestine, were watery consistency, showing no evidence of abnormal gas formation, obvious injection marks or other superficial lesions, were not found.

Post-mortem toxicological findings

Samples of heart blood and urine, obtained at autopsy, were analysed by enzyme immunoassay and GC-mass spectro-
metry. Significant concentrations of toxic agents or substances with effects on the central nervous system could not be found. The concentration of ethanol in blood was 0.2 \text{mg}\text{ml}^{-1}.

**Histological findings**

Light microscopic examination of haematoxylin and eosin (H&E)-stained tissue samples from the stomach and bowel revealed distinct autolytic changes. Epithelial ulcerations and focal infiltrations of mononuclear inflammatory cells were found in the mucosa of the ileum (Fig. 1). Examination of Gram-stained specimens revealed accumulations of large, Gram-positive rods in these mucosal lesions, as well as in tissue sections from the left heart ventricle and the kidney (Fig. 2). Significant inflammatory reaction adjacent to these bacterial accumulations could not be detected.

**Post-mortem microbiological findings**

Specimens for post-mortem bacteriology were collected as recommended by Tsokos et al. (2002). Cultures of the intestinal content plated on selective media were negative for enteric pathogens, such as *Salmonella* spp., *Shigella* spp., *Campylobacter* spp. and *Yersinia enterocolitica*. Cultures of heart blood and spleen swabs grew large, convex, slightly irregular, translucent colonies after 48 h anaerobic incubation on non-selective media. Gram-staining revealed large, Gram-positive rods with sparse formation of endospores. No growth of bacteria that are usually regarded as post-mortal flora, such as other anaerobes, enterobacteria or staphylococci, occurred on any of the anaerobic or aerobic culture plates within 7 days. The strain was further characterized by PCR amplification and sequencing of 1438 bp of the 16S rRNA gene (GenBank accession no. AY208919), as described elsewhere (Relman et al., 1992). Sequence analysis clearly identified the isolate as *C. fallax* [99.6 % similarity to *C. fallax* ATCC 19400T (GenBank accession no. M59088); primer sequences and ambiguities were omitted].

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**Fig. 1.** Section from the ileum (top), showing focal infiltrations of mononuclear inflammatory cells (arrowheads) (H&E-stained, ×160), as well as (bottom) accumulations of Gram-positive, rod-shaped bacteria (arrow) (Gram-stained, ×410).

**Fig. 2.** Accumulations of Gram-positive, rod-shaped bacteria (Gram-stained, ×410) without significant inflammatory reaction in tissue sections from the left heart ventricle (top) and the kidney (bottom).
Biochemical identification by using the RAPID 32A system (bioMérieux) failed, as the resulting reaction pattern (4103, 4001, 10) was not in sufficient accordance with the pattern for *C. fallax* that was included in the database.

**Conclusions**

The isolation of *C. fallax* from two independent body sites, the absence of other bacteria in these cultures and the histological detection of clostridia-like bacteria in a variety of tissues indicated bacterial dissemination *in vivo* and a possible causative role of the isolate in the death of the patient.

*C. fallax* is generally regarded as a soil organism of little or no clinical significance and has also been described as part of the normal indigenous intestinal flora (Finegold *et al.*, 1983). Nevertheless, it has been reported that it can cause experimental and sporadic infections in animals (Weinberg *et al.*, 1937; Coloe *et al.*, 1983; Vatn *et al.*, 2000) and that it is able to produce a lethal toxin (Willis, 1977). Therefore, it can be regarded as a facultative pathogen for humans with predisposing conditions. Production of toxins may contribute to circulatory failure in these cases.

The micro-organisms could have entered the bloodstream either parenterally or via the gastrointestinal route. As no skin lesions or injection sites were detected, exogenous infection seems unlikely. It can be assumed that the intestinal mucosal lesions were the source of an endogenous infection, as described for other pathologies, such as gastrointestinal malignancy (Ray *et al.*, 1992).

In the absence of other morphological or toxicological findings, septicotoxic circulatory failure that is attributable to *C. fallax* bacteraemia, contracted through lesions of the intestinal mucosa following dysentery of unknown aetiology, is the most probable cause of death in the reported case.

This case highlights the need for vigilance in forensic pathology to consider bacterial sepsis, especially if unusually advanced signs of decomposition are present, despite a short post-mortem interval and appropriate storage of the subject. Microbiological investigation should include cultures for detection of anaerobic bacteria, such as clostridia.

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**References**


