Eggerthella lenta bacteraemia in a patient with Caroli disease

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Introduction: Eggerthella lenta is an obligate anaerobic, non-spore-forming, Gram-positive rod found as a normal commensal of the human intestinal flora, which is capable of reducing digoxin into several metabolites. Disease caused by this micro-organism is unusual, although more frequent than reported.

Case presentation: A 74-year-old man presented to the emergency room and was admitted with a mild acute cholangitis syndrome. One anaerobic blood culture became positive after 5 days of incubation. After an additional 5 days, the usual aerobic subcultures were negative, whereas anaerobically incubated Columbia blood agar presented tiny smooth colonies. The isolate was capable of reducing digoxin and was identified as Eggerthella lenta. Adequate antibiotic treatment with meropenem had been started and the patient recovered fully.

Conclusion: We have described a patient with a potentially fatal bacteraemia with E. lenta that may have gone unnoticed. More case reports are necessary, not only to understand the pathogenicity and clinical course of infections by this neglected bacterium, but also to investigate its digoxin degradation and antimicrobial susceptibility variability.
The patient was admitted with a mild acute cholangitis syndrome. Magnetic resonance cholangiopancreatography and endoscopic retrograde cholangiopancreatography were performed, which demonstrated diffuse cholangiopathy consistent with acute cholangitis. The patient’s fever and symptoms subsided after 3 days of meropenem treatment, and after 7 days on meropenem, the patient recovered fully and was discharged.

Blood cultures were incubated in BacT/ALERT 3D (bioMérieux) and one anaerobic bottle became positive after 5 days of incubation. A Gram-stain revealed slender, pleomorphic, Gram-positive rods that even formed small chains mimicking a Streptococcus-like appearance. The usual aerobic subcultures were negative after 5 days, whereas anaerobically incubated Columbia blood agar presented tiny smooth colonies. This isolate was identified as *E. lenta* by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (Microflex LT; Bruker Daltonics) and Vitek 2 ANC ID card (bioMérieux). Antimicrobial susceptibility testing was performed by the E-test method on supplemented Brucella blood agar. The isolate was susceptible to imipenem, meropenem, metronidazole and clindamycin but resistant to cefuroxime, ceftriaxone and cefotaxime.

At the time of this episode, all bile duct abnormalities were attributed to cholangitis, and Caroli disease was not considered. A year later, the patient presented a new episode of acute cholangitis and an abdominal ultrasound showed pneumobilia and dilated bile ducts, chiefly in the left lobe of the liver, whilst magnetic resonance imaging showed multiple segmented cystic and fusiform dilatations of the left intrahepatic biliary tract. Thus, the patient was diagnosed with Caroli disease.

**Investigations**

In order to add evidence to our identification, we conducted an experiment to test the ability of the isolate to reduce digoxin by incubating it at an approximate concentration of $1.5 \times 10^6$ bacteria ml$^{-1}$ in tryptic soy broth (TSB) supplemented with approximately 2 ng digoxin ml$^{-1}$. TSB without the micro-organism was used as negative control, and both *E. lenta* and the control were incubated in an anaerobic atmosphere at 36 °C. After 4 days, a 10 % reduction in the level of digoxin was detected in the medium with *E. lenta* but not in the control. This reduction was 21 % after 7 days. Digoxin levels were measured with a micro-particle enzyme immunoassay (AxSYM Digoxin II; Abbott Laboratories).

**Discussion**

Bacteraemia by *E. lenta* occurs chiefly as a secondary translocation into blood from the gut in patients with underlying malignancies and gastrointestinal disorders such as inflammatory bowel disease or hepatobiliary disorders as discussed by Brook & Frazier (1993). Bacterial translocation is a physiological process through which indigenous enteric bacteria or their products cross the intestinal barrier and reach the mesenteric lymph nodes, establishing a crosstalk between the gut microbiota and the immune system in order to achieve a healthy equilibrium by means of an adequate T-cell response. A pathological bacterial translocation occurs when bacteria get to normally sterile tissues; bacterial overgrowth, increased intestinal permeability and immunological alterations are the principal factors involved in this process.

Bacterial translocation from the biliary tract to the bloodstream and lymphatic system may occur due to cholestasis, resulting in increased biliary pressure. Both bile stagnation and increased pressure have a deleterious effect on defensive barrier mechanisms, i.e. intercellular junctions controlling the blood–biliary barrier, Kupfer cells, the resident liver macrophages, and antibacterial products such as IgA and mucus excreted into the biliary tract. In addition, the continuous flushing that prevents bacterial colonization by microorganisms that grow in the presence of bile salts such as *E. lenta* is lost (Karsten et al., 1998; Sung et al., 1992).

Our patient had Caroli disease, a rare congenital disorder characterized by unilobar or bilobar segmental cystic dilatation of the intrahepatic bile ducts, predisposing to cholestasis, biliary lithiasis and recurrent cholangitis that can be complicated by liver abscesses and sepsis. Therefore, this congenital condition set the perfect scenario for bacterial translocation from the biliary tract. In addition, empirical treatment with cefuroxime favoured bacteraemia by *E. lenta* in this patient, as the isolate was resistant to this antimicrobial.

Monomicrobial bacteraemia by this micro-organism is also associated with clinically significant infections (Thota et al., 2011). Prior studies have demonstrated that infection by *E. lenta* is more frequent than reported (Lau et al., 2004a,b; Rodriguez-Cavallini et al., 2011; Shinagawa et al., 2011) and that bacteraemia is associated with significant mortality and morbidity, especially when there is no fever at presentation (Brook & Frazier, 1993; Venugopal et al., 2012). Our patient presented with cholangitis, bacteraemia by this micro-organism and a systemic inflammatory response syndrome that did not developed into a full-blown blood infection, most likely due to early treatment with meropenem. Thus, the prevalence and clinical features of *E. lenta* bacteraemia are probably underestimated and remain imprecise, chiefly due to culture difficulties, i.e. nutritional requirements, prior antimicrobial treatments or established incubation times, all of which can give rise to false-negative results.

Besides these ambiguities, studies have shown great variability in the antimicrobial susceptibility profile of *E. lenta*, leading to uncertainty regarding the most appropriate therapy (Lau et al., 2004a; Lee et al., 2012; Mosca et al., 1998). Mosca et al. (1998) described two antimicrobial susceptibility patterns in *E. lenta*: type A was resistant to cephalosporins, intermediate to clindamycin and susceptible to imipenem, piperacillin, metronidazole and ampicillin, but presented high MICs; type B was susceptible to all antimicrobials tested but presented high MICs to metronidazole.
Lee et al. (2012) presented different results; most of their isolates were susceptible to cefamandole but had high MICs, and 63% were resistant to clindamycin. Our isolate was different from these three patterns although closely related to type A of Mosca et al. (1998). This variability could be due to clonal geographical differences. In addition, although more research is needed, the high cephalosporin MICs observed could be explained by the presence of low-affinity penicillin-binding proteins to these antimicrobials.

All things considered, two issues should be emphasized in this case report: first, that the only positive blood culture grew after the recommended incubation time for automated blood cultures, i.e. 5 days (Lamy & Seifert, 2012); and secondly, that the digoxin degradation rate was very different from prior studies, i.e. a 21% reduction versus about 100% after 7 days (Robertson et al., 1986), possibly due to metabolic variability among E. lenta isolates, or to substrate competition caused by amino acids from the culture medium (Lu et al., 2014). Both circumstances pose questions about false-negative blood cultures, especially regarding fastidious, anaerobic bacteria, and about how much E. lenta digoxin reduction variability could affect patients under digoxin regimes.

A full-genome sequence of E. lenta has been described (Saunders et al., 2009; Yokoyama et al., 2011) and may be a means to better understand: (i) its virulence factors, such as antimicrobial resistance mechanisms; (ii) its metabolic pathways, as well as their regulation, bringing some light to the observed digoxin degradation variability; and (iii) the cell wall biogenesis, especially the properties of its penicillin-binding proteins and its affinity to β-lactams.

In conclusion, we have described a patient with potentially fatal E. lenta bacteremia secondary to acute cholangitis and underlying Caroli disease who responded to treatment with a carbapenem but could have passed unidentified. It is worth mentioning that a final identification was achieved 3 days after the patient was discharged. Finally, to the best of our knowledge, this is the first published case report of E. lenta bacteremia associated with Caroli disease, indicating that more case reports are necessary, not only to understand the pathogenicity and clinical course of infections by E. lenta but also to investigate its digoxin degradation and antimicrobial susceptibility variability.

**References**


