Case Report

A case of multiple splenic abscesses due to *Enterococcus hirae*

Wadha Alfouzan,^{1,2} Saud Al-Sheridah,¹ Ammar Al-Jabban,¹ Rita Dhar,³ Abdul Rahman Al-Mutairi⁴ and Edet Udo²

Correspondence

Wadha A. Alfouzan
alfouzan.w@hsc.edu.kw

¹Microbiology Unit, Department of Laboratories, Farwania Hospital, Kuwait

²Department of Microbiology, Faculty of Medicine, Kuwait University, Kuwait

³Microbiology Unit, Department of Microbiology, Maternity Hospital, Kuwait

⁴Department of Surgery, Farwania Hospital, Kuwait

Introduction: *Enterococci* are prevalent human pathogens that display increasing resistance to antimicrobial agents. Twelve species pathogenic for humans have been described to date, including the most common human isolates, *Enterococcus faecalis* and *Enterococcus faecium*. *Enterococcus hirae* is a known member of the intestinal flora of several domestic animal species but rarely encountered in humans.

Case presentation: We report a case of multiple splenic abscesses caused by *E. hirae* in an adult patient diagnosed with type 2 diabetes mellitus. The patient responded to combined therapy with antibiotics plus splenectomy.

Conclusion: Only 9 human infections due to *E. hirae* have been reported in the literature. To our knowledge, this is the first reported case of splenic abscess and septicemia caused by *E. hirae*.

Keywords: enterococci; *Enterococcus hirae*; splenic abscess; splenectomy.

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Introduction

Splenic abscess is an uncommon infection that manifests as a single or multiple abscesses, detected in 0.14 % to 0.7 % autopsy studies (Chang *et al.*, 2006). However, increasing incidence is reported, possibly because of enhanced diagnosis as a result of developments in imaging studies. The risk factor for splenic abscess is endocarditis, as it typically results from seeding from pre-existing endocarditis or in some instances, seeding from other infected organs (Ooi & Leong, 1997). Earlier, the incidence of splenic abscess as a complication of infective endocarditis was reported in 4.8 % of patients (Robinson *et al.*, 1992).

Clinical features of splenic abscess include recurrent or persistent fever and left upper quadrant pain with or without splenomegaly (Robinson *et al.*, 1992). However, these features are not evident in all patients, and some may present with other non-specific symptoms, such as chills and constitutional symptoms observed in 40 % and 36 % of patients, respectively, by Westh *et al.* (1990).

Splenic abscesses can be diagnosed via computed tomography scan of the abdomen (CT-Abdomen) but are often confused with splenic infarction, which is associated with similar risk factors (Robinson *et al.*, 1992; Westh *et al.*,

1990). Previous reports focusing on the etiology of splenic abscess have described a wide variety of pathogens that differ according to geographical distribution and the time-period of the studies conducted (Robinson *et al.*, 1992; Westh *et al.*, 1990). The most commonly reported pathogens include *Staphylococci*, *Streptococci*, *Escherichia coli*, and *Salmonella* spp. *Mycobacterium tuberculosis* was reported to be the cause in 0.8 % to 7.8 % of cases, but occurred more frequently in high-prevalence areas (Robinson *et al.*, 1992). Fungi, especially *Candida* spp., have also been frequently identified as a cause of splenic abscess, especially with the increasing numbers of immunocompromised patient populations (Johnson & Raff, 1984).

The treatment of choice for splenic abscesses involves both surgical and medical options. Medical therapy entails providing targeted antimicrobial therapy tailored to the infective organism (Ooi & Leong, 1997; Chang *et al.*, 2006), while the gold standard surgical management is splenectomy (Johnson & Raff, 1984). Percutaneous aspiration of splenic abscesses has shown moderate success in reported cases, and therefore should not replace splenectomy as the standard measure. The optimal duration of antimicrobial therapy for splenic abscesses is yet to be established, since insufficient trials have been performed to determine the most favourable agents and duration of therapy (Chang *et al.*, 2006).

Abbreviations: LUQ, left upper quadrant; pip/taz, piperacillin/tazobactam; PCD, percutaneous drainage

To our knowledge, only 9 human infections due to *E. hirae* have been documented to date. The current case, an immunocompetent patient displaying splenic abscesses with sepsis, represents the first case of infection by this organism leading to such clinical syndromes.

Case report

A 48-year-old woman was admitted in November 2012 to the Emergency Department of Farwania Hospital, presenting with 1-month history of mild left upper quadrant (LUQ) abdominal pain, productive cough and fever. The patient did not complain of any changes in bowel habits, haemoptysis, night sweats or weight loss. She had a history of insulin-dependent type 2 diabetes mellitus and had undergone tubal ligation 17 years beforehand. The patient denied any recent contact with animals. On physical examination, temperature was 40 °C, heart rate was 112 bpm and blood pressure was 110/70 mmHg, with oxygen saturation of 94 % in room air. An abdominal examination revealed LUQ tenderness, but no guarding or rigidity. There was no sign of hepatomegaly or splenomegaly. On chest auscultation, breath sounds appeared diminished in the left lower zone without crackles or wheeze. Heart sounds were normal with no murmurs or added sounds. Neurological examination revealed normal results.

Investigations

Laboratory investigations revealed a white blood cell (WBC) count of $20 \times 10^9/L$ (83 % neutrophils; 13 % lymphocytes) and haemoglobin (6.6 g L^{-1}). Liver and renal function tests were normal, but the C-reactive protein (CRP) level was 212 mg L^{-1} (normal range less than 10 mg L^{-1}). Blood was drawn, and two sets of blood culture vials incubated in BACTEC 9240 blood culture system (BD Diagnostic Systems). Both aerobic and one of the anaerobic vials displayed positive signals after 12, 15, and 16 h, respectively. Gram staining of smears from the blood culture vials revealed gram-positive cocci in chains resembling streptococci. Bacterial growth was facultatively anaerobic, producing small, grey, alpha-haemolytic colonies on 5 % sheep blood agar. The isolate was identified as *Enterococcus* spp. with a negative catalase test reaction, and positive bile-aesculin and growth in 6.5 % salt broth tests. Moreover, the isolate reacted with Lancefield group D antisera (Streptex). Biochemical identification with VITEK 2 (bioMérieux) indicated *E. gallinarum* with 98 % probability while the Analytical Profile Index for streptococci (API Strept, bioMérieux) classified the strain as *E. durans* (81 % probability), leading to inconclusive identification. The strain was finally identified as *E. hirae* using the BD Phoenix Automated Microbiology System (BD Diagnostic Systems) with the sequence number 427610338643 and 99 % confidence value, and confirmed via 16S rDNA sequencing. DNA isolation and amplification

for 16S rDNA sequencing was performed using the MicroSeq® 500 16S rDNA sequencing kit (AB Applied Biosystems), according to the manufacturer's instructions. DNA sequencing was conducted with BigDye Terminator V1.1 Chemistry in a ABI 3130 $\times 1$ genetic analyzer (Applied Biosystems). Strain identity was established by querying the 16S rDNA bacterial gene database using MicroSeq ID Analysis software (AB Applied Biosystems).

Antimicrobial susceptibility testing (AST) was performed using the E-test to determine the minimum inhibitory concentration (MIC) using the Clinical Laboratories Standards Institute (CLSI) 2012 set breakpoints. The strain was susceptible to ampicillin (MIC, 0.25 mg L^{-1}), vancomycin (MIC, 0.5 mg L^{-1}), teicoplanin (MIC, 0.19 mg L^{-1}), linezolid (MIC, 0.05 mg L^{-1}) and tetracycline (MIC, 1.0 mg L^{-1}), but displayed resistance to ciprofloxacin (MIC, 2.0 mg L^{-1}). No high-level resistance to gentamicin was observed (MIC, 24 mg L^{-1}).

Abdominal ultrasonography (US) revealed cystic lesions in the spleen suggestive of two splenic abscesses, which were confirmed with a computed tomography (CT) scan (Fig. 1). Transthoracic echocardiography, followed by transoesophageal echocardiography, did not show evidence of infective endocarditis or other cardiac abnormalities. Empirical therapy with piperacillin/tazobactam (PTZ) 4.5 g q8h intravenously (IV), vancomycin 1 g q12h IV, and metronidazole 500 mg q8h IV was initiated, and splenectomy performed on day 2 of hospital stay. Pus from splenic abscess was submitted to the laboratory for microbiologic analysis. Examination of pus using gram-stained smear revealed pus cells and few gram-positive cocci in chains, while culture revealed growth of *E. hirae* similar to the blood culture isolate. Histopathological analysis of the spleen confirmed the presence of abscesses,

Fig. 1. Abdominal CT showing low-density lesions characteristic of splenic abscess in our patient

the larger of the two measuring 7.0 cm in diameter with central necrosis and rough wall.

Treatment

Following identification the isolate and availability of its antimicrobial susceptibility profile, vancomycin and metronidazole were discontinued and ampicillin 4.0 g q4h IV and linezolid 600 mg q12h IV added to the regimen with PTZ. Blood culture was repeated on day 7 of hospital stay, but no growth was evident after 5 days of incubation.

Outcome and follow-up

The patient improved clinically and became asymptomatic. All antibiotics were discontinued after two weeks of therapy. She received *Haemophilus influenzae* type b, quadrivalent meningococcal and pneumococcal polysaccharide vaccines before discharge from the hospital. A follow-up appointment at the surgical outpatient clinic a month later revealed good progress.

Discussion

Enterococcus hirae is a recognized animal pathogen, especially in psittacine birds, cats and rats (Devriese & Haesebrouck, 1991; Devriese *et al.*, 2002), which is associated with pre-existing colonic pathology in infected

animals (Nicklas *et al.*, 2010). To date, only 9 cases of human infections by *E. hirae* have been documented (Table 1), including spondylodiscitis (Canalejo *et al.*, 2008), native and prosthetic valve endocarditis, and septicaemia in a haemodialysis patient (Talarmin *et al.*, 2011). Our current report represents the tenth case.

Phenotypic identification of *E. hirae* by semi-automated and other biochemical systems is usually difficult, perhaps owing to its common properties with *E. durans* (Canalejo *et al.*, 2008; Devriese *et al.*, 2002; Gilad *et al.*, 1998; Poyart *et al.*, 2002; Talarmin *et al.*, 2011). Molecular studies have shown that *E. hirae* and *E. durans* are genotypically very similar and differentiated based on detection of *mur-2* and *mur-2_{ed}*, respectively (Arias *et al.*, 2006; Talarmin *et al.*, 2011).

Splenic abscess is an uncommon clinical condition, previously documented at a rate of 0.14 % to 0.7 % in autopsy studies (Lee *et al.*, 2011) and reported more frequently in recent literature. Splenic abscesses are generally evident in patients with endocarditis where seeding of the incriminating organism occurs in the spleen, as well as those with obliterated immune systems, such as cases of neoplasia, trauma, and diabetes mellitus. Although our patient was free of cardiac lesions, she was a diabetic on insulin therapy. A recent surge in cases of splenic abscesses may be explained by the increase in the immunocompromised population and improved diagnostic imaging techniques, such as US and CT (Chang *et al.*, 2006; Lee *et al.*, 2011). The causative agents in most series have been identified as *Streptococci*, *Escherichia coli* and

Table 1. Reported cases of human infections due to *E. hirae*

Reference	Year	Age/sex	Diagnosis	Risk factor	Clinical sample	Treatment	Outcome
Gilad <i>et al.</i>	1998	49/M	Septicaemia	End stage renal disease, Haemodialysis	blood	VAN	Cured
Park <i>et al.</i>	2000	21/F	Acute pyelonephritis	None	Blood, urine	AMP	Cured
Poyart <i>et al.</i>	2002	72/M	Native valve Endocarditis	Coronary artery disease	Blood	AMP, GEN, RIF, VAN	Relapse, aortic valve replacement
Canalejo <i>et al.</i>	2008	55/M	Spondylodiscitis	DM	Blood	Discectomy, AMP, GEN, LVX	Cured
Kim <i>et al.</i>	2009	57/F	Acute pyelonephritis	Rheumatoid arthritis	Blood, urine	CIP, CRO, AMC	Cured
Talarmin <i>et al.</i>	2011	78/F	Infective endocarditis	DM Bioprosthetic valve	Blood	AMX, GEN	Relapse, RIF added
Chan <i>et al.</i>	2012	62/F	Acute pyelonephritis	None	Blood, Urine	CFZ, GEN, AMP	Cured
Chan <i>et al.</i>	2012	83/F	Acute cholangitis	CHF, valvular heart disease	Blood	CMZ	Cured
Sim <i>et al.</i>	2012	61/M	Bacterial peritonitis	Cirrhosis DM	Blood, Ascitic fluid	AMP	Cured
This case	2013	48/F	Splenic abscess septicemia	DM	Blood, pus	Splenectomy, AMP, PTZ, LZD	Cured

'Clinical sample' represents samples yielding growth of *E. hirae* on culture.

AMC, amoxicillin-clavulanic acid; AMP, ampicillin; AMX, amoxicillin; CFZ, cefazolin; CHF, Congestive heart failure; CIP, ciprofloxacin; CMZ, cefmetazole; CRO, ceftriaxone; DM, diabetes mellitus type 2; GEN, gentamicin; LVX, levofloxacin; LZD, linezolid; PTZ, piperacillin-tazobactam; RIF, rifampin; VAN, vancomycin

Klebsiella pneumoniae, *Mycobacterium tuberculosis* and *Salmonella typhi* have also been reported, highlighting geographical and population variations. To our knowledge, this is the first case of splenic abscess caused by *E. hirae* reported in the literature.

Treatment modalities entail antimicrobial therapy, percutaneous drainage (PCD) and splenectomy. However, no gold standard treatment for splenic abscess is currently available (Talarmin *et al.*, 2011). Nevertheless, the mortality rate does not appear to differ among the three groups and is usually related to the underlying condition of the patient. Since our patient was diagnosed with multiple abscesses in the spleen, PCD was not an option, and considering her clinical condition, splenectomy was performed and parenteral antibiotics added to the treatment because of systemic infection. There is a paucity of data regarding the antimicrobial susceptibility profile of *E. hirae*, but ampicillin and high-level resistance to gentamicin have been reported (Canalejo *et al.*, 2008).

In conclusion, *E. hirae* is a rare human pathogen accounting for <1 to 3 % of all enterococcal species isolated from clinical samples (Canalejo *et al.*, 2008). The source of infection remains dubious. Since knowledge of the antimicrobial susceptibility profile of *E. hirae* is limited, it is advisable that treatment is guided by antibiotic susceptibility testing and applied to patients on an individual basis.

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