Liver abscess caused by *Klebsiella pneumoniae* in a red-footed tortoise

Dear Editor,

*Klebsiella pneumoniae* is an important pathogen with worldwide distribution and can cause broad spectrum of infections, including pneumonia, septicemia, intra-abdominal infections, urinary tract infections, and meningitis in humans.\(^1\)\(^-\)\(^3\) It is emerging as the most common pathogen of human pyogenic liver abscess in Taiwan.\(^1\)\(^,\)\(^4\)

Similarly, bacterial infections are common in animals, including reptiles, and the frequent occurrence of urinary tract infection in turtles by *Klebsiella* was documented.\(^5\)

Although infections by *K. pneumoniae* from animals and human may be epidemiologically correlated, few studies were designed to establish the relevance.

*K. pneumoniae* liver abscess in reptiles, including turtles, has not been reported in the literature yet. Here, we described a red-footed tortoise that was hospitalized at the National Chung-Hsing University Veterinary Hospital in Central Taiwan and diagnosed with liver abscesses caused by *K. pneumoniae*. In addition, the presence of common virulence factors of *K. pneumoniae* strains causing human primary liver abscess was examined.

An adult female red-footed tortoise (*Chelonoidis carbonaria*), weighing 180 g, was presented with symptoms of lethargy and anorexia. Following a 1-day course of medical therapy, including gentamicin 4 mg/kg bw/q72hr, one part 5% dextrose with lactated Ringer’s solution (DLR), one part amino acid, and eight parts saline/2 mL injected subcutaneously, the turtle died and was necropsied. During the process of autopsy, a moderate amount of ascites was drained from the abdominal cavity. Grossly, small white spot lesions were observed in the swollen liver (Fig. 1A). Microscopically, in the liver, there was multifocal necrosis with a fine fibrous capsule, in which the activation and infiltration of neutrophils and Kupffer cells were noticed (Fig. 1B and C).

The culture of pus from liver abscess yielded *K. pneumoniae*, which was resistant to ampicillin, ciprofloxacin, and trimethoprim/sulfamethoxazole and was sensitive to the cephalosporins (cefazolin, cefotaxime, and cefepime).

![Figure 1. (A) Liver abscesses, presenting as multiple white spots in the liver of a red-footed tortoise. (B) Histopathological examination of the liver using hematoxylin and eosin stain. Multiple necrotizing lesions are demonstrated in liver tissue sections (20× magnification). (C) The lesions are characterized by multifocal necrosis rounded with a fine fibrous capsule and infiltrated by neutrophils and macrophages (400× magnification). Scale bars represent distances of 2.0 mm and 200 μm, respectively for B and C.](image-url)
and meropenem as demonstrated by disk diffusion assay. After being inoculated on 5% sheep blood agar plates and incubated overnight, this K. pneumoniae colony was tested negative for hypermucoviscosity as demonstrated by the string test (Tang et al., 2010). Capsule gene cluster (CPS) genotyping performed by the polymerase chain reaction (PCR) detection of K serotype—specific alleles at wzx loci using specific primers revealed negative for K1, K2, K20, K54, and K57 in the K. pneumoniae isolates. pLVPK-derived genetic loci were not detected as examined by PCR using genomic DNA as the template with specific primers for iutA, rmpA, silS, and iron. A case of liver abscess caused by hypomucoviscous K. pneumoniae in a red-footed tortoise is illustrated. Although K. pneumoniae is the most common pathogen of human liver abscess in Taiwan, there were no reports that K. pneumoniae was the microorganism responsible for the development of liver abscess in turtles. It was

Figure 2. Comparison of PFGE-XbaI profiles of Klebsiella pneumoniae isolate, CHKP0008, from the red-footed tortoise with those from clinical human cases and environmental isolates. Sixteen to 22 of the XbaI macro-restricted DNA fragments ranging in size from 75 kb to 1135 kb are resolved with high definition, and the dendrogram is generated by BioNumerics version 3.0 (Applied Maths, Sint-Martens-Latem, Belgium) for all the K. pneumoniae isolates. K1 and K2 typing is based on a polymerase chain reaction method. “Non” represents non-K1/K2 typed K. pneumoniae. Isolates from cases of tissue abscesses are green-boxed, and the isolate from the red-footed tortoise is red-boxed.
demonstrated in humans that hypermucoviscosity and CPS, especially K1 serotype, are related to the virulence and resistance to phagocytosis of <em>K. pneumoniae</em>.<sup>1,7</sup> PLVPK derivatives in clinical <em>K. pneumoniae</em> isolates are a possible virulence factor contributing to the development of liver abscess as the loss of PLVPK abolished the ability of <em>K. pneumoniae</em> to disseminate into extraintestinal sites and attenuated abscess formation in a mouse model.<sup>1</sup> This isolate from the diseased turtle did not have any of the above mentioned virulence factors, which is compatible with the fact that a number of non-K1/K2 <em>K. pneumoniae</em> isolates from human liver abscess did not have any known virulence factors. By comparing with 479 clinical <em>K. pneumoniae</em> isolates from human patients and six environmental isolates, the tortoise isolate was genetically related to abscess-forming, non-K1/K2 pathogenic human strains, as revealed by Pulsed Field Gel Electrophoresis (PFGE)-Xbol analysis (Fig. 2). This implies that not only the red-footed tortoise is presumably predisposed to the infections by <em>K. pneumoniae</em>, but also humans and turtles may share <em>K. pneumoniae</em> as a common pathogen causing abscess-forming diseases. As a result, other possibilities exist, including additional virulence factors of <em>K. pneumoniae</em>. Further investigation is needed to define the relationship of <em>K. pneumoniae</em> infections in the red-footed tortoise and humans in Taiwan.

In conclusion, clinical practitioners need to consider <em>K. pneumoniae</em> as the differential diagnosis of turtles presenting with cryptogenic liver abscess. Furthermore, the role of <em>K. pneumoniae</em> in pet turtles and other animals with a high prevalence of liver abscess and infections caused by <em>K. pneumoniae</em> in Taiwan is worth investigating.

**Conflicts of interest**

All authors declare no conflicts of interest.

**References**


Hui-Ling Tang  
Institute of Medical Research, China Medical University, Taichung, Taiwan, ROC

Department of Veterinary Medicine, College of Veterinary Medicine, National Chung-Hsing University, Taichung, Taiwan, ROC

Yi-Chyi Lai  
Department of Microbiology and Immunology, Chung Shan Medical University, Taichung, Taiwan, ROC

Chien-Shun Chioou  
Center for Research and Diagnostics, Centers for Disease Control, Taichung, Taiwan, ROC

Po-Yu Liu  
Department of Internal Medicine, Taichung Veterans General Hospital, Taichung, Taiwan, ROC

Department of Pharmacy, Tajen University, Pingtung, Taiwan, ROC

Ling-Ling Weng  
Department of Veterinary Medicine, College of Veterinary Medicine, National Chung-Hsing University, Taichung, Taiwan, ROC

Ken-Sheng Cheng  
Institute of Medical Research, China Medical University, Taichung, Taiwan, ROC

Kwong-Chung Tung**  
Department of Veterinary Medicine, College of Veterinary Medicine, National Chung-Hsing University, Taichung, Taiwan, ROC

Min-Chi Lu*  
Department of Microbiology and Immunology, Chung Shan Medical University, Taichung, Taiwan, ROC

Department of Medicine, Chung Shan Medical University Hospital, Taichung, Taiwan, ROC

*Corresponding author. Department of Microbiology and Immunology, Chung Shan Medical University, Number 110, Section 1, Chien-Kuo N. Road, Taichung 402, Taiwan, ROC.  
E-mail address: luminchi@outlook.com  
**Corresponding author. Department of Veterinary Medicine, College of Veterinary Medicine, National Chung Hsing University, 250 Kuo Kuang Road, Taichung, Taiwan, ROC.  
E-mail address: kctung1@dragon.nchu.edu.tw

17 October 2013