

## *Corynebacterium kutscheri* Infection of Skin and Soft Tissue following Rat Bite<sup>▽</sup>

Natasha E. Holmes<sup>1</sup> and Tony M. Korman<sup>1,2\*</sup>

Department of Infectious Diseases, Monash Medical Centre, 246 Clayton Road, Clayton, Victoria 3168, Australia,<sup>1</sup> and Department of Medicine, Monash University, Clayton, Victoria 3168, Australia<sup>2</sup>

Received 19 March 2007/Returned for modification 26 June 2007/Accepted 24 July 2007

***Corynebacterium kutscheri* is a common bacterium isolated from the oral cavity of healthy mice and rats. We report the first well-documented case of *C. kutscheri* human infection which followed a rat bite. The microorganism was identified by conventional biochemical tests and confirmed by 16S rRNA gene sequence analysis.**

### CASE REPORT

A 7-month-old infant girl was admitted to the hospital with an infected right middle finger. Apart from premature birth at 32 weeks gestation, the patient had no other medical illness. Twelve days prior to admission, the patient had been bitten on the right hand by a rat. Following the bite, the patient developed swelling and erythema of the finger despite daily wound cleansing with saline. The patient initially presented to the emergency department, where an incision and drainage were performed; frank pus was noted, and a swab sent for microscopy and culture. The patient was treated with 200 mg amoxicillin–28.5 mg clavulanic acid orally twice a day, but purulent discharge and cellulitis persisted. The patient underwent deep debridement of the right middle finger, and no discrete collections were identified. The patient received intravenous doses of 400 mg ceftriaxone daily and 65 mg metronidazole three times a day for 5 days, followed by 160 mg amoxicillin–22.8 mg clavulanic acid orally twice a day for 15 days and made a full clinical recovery.

The Gram stain of the initial swab from the incision and drainage revealed polymorphonuclear leukocytes, but no organisms were seen. Pure growth of slightly irregular gram-positive bacilli was noted on horse blood agar and chocolate agar after 24 h at 35°C in aerobic conditions and also when enriched with CO<sub>2</sub>. The colonies were fine and circular without hemolysis. Standard protocols for manual biochemical tests were followed in our laboratory and the reference laboratory. The catalase and nitrate reduction tests were positive. Hydrolyses of urea and esculin were also positive. Carbohydrate fermentation reactions occurred with glucose, maltose, sucrose, and pyrazinamidase, but not with mannitol and xylose. The CAMP test was negative. The penicillin MIC was 1.0 µg/ml, as determined by Etest (AB Biodisk, Solna, Sweden) (7). Using a BBL crystal Gram-positive identification system (Becton Dickinson and Company, MD) and API Coryne v3.0 (bioMérieux, Marcy-l'Étoile, France), the microorganism was identified as

*Corynebacterium kutscheri* with 99.9% confidence on both systems (biotypes 2760041527 and 7051325, respectively).

DNA was extracted using a Roche High Pure PCR template preparation kit with lysozyme (F. Hoffmann-La Roche, Basel, Switzerland). Sequence analysis was performed with 462 nucleotides at the 5' end of the 16S rRNA gene, and a GenBank BLAST search (National Center for Biotechnology, Bethesda, MD) was carried out. The patient's isolate had 100% sequence homology with the *Corynebacterium kutscheri* rRNA nucleotide sequence with GenBank accession number X82063 (data not shown) (12).

*C. kutscheri* was first isolated in mice in 1894 (9). It has since been described as a commensal bacterium in mice, rats, and voles and has been identified in the oral cavity, esophagus, colon, rectum, and submaxillary lymph nodes of these rodents (1, 9). It was first called pseudotuberculosis, as clinical disease with the organism resembled mouse tuberculosis, with pulmonary abscesses and caseating necrosis. Typically, *C. kutscheri* causes latent infection in healthy mice and rats but can cause severe illness when an animal is immunocompromised or nutritionally deficient (1, 3a, 9, 10). Illness is characterized by bacteremia with septic emboli and end-organ disease in the kidneys and livers of mice and the lungs of rats (3a, 9, 10).

Phylogenetically, *C. kutscheri* closely resembles other diphtheroids of clinical significance in humans (11), including *Corynebacterium diphtheriae*, *Corynebacterium pseudotuberculosis* (6), and *Corynebacterium ulcerans* (3). It has not been reported as a commensal in humans or an environmental pathogen. Human infection has been limited to two case reports, although there were no associations with rodent bites and the data supplied did not definitively establish an identification of the pathogen as *C. kutscheri*, as noted in the comprehensive review by Funke et al. (5). In the possible case of chorioamnionitis and funisitis described in Fitter et al. (4), the isolate did not reduce nitrate and only sucrose and urease reactions were listed. In the other case of septic arthritis, described in Messina et al. (8), there was no specific information about which carbohydrates were fermented.

We believe that this report is the first definite case of *Corynebacterium kutscheri* causing infection in humans. Notably, in this case a soft tissue infection occurred in the context of a

\* Corresponding author. Mailing address: Department of Infectious Diseases, Monash Medical Centre, 246 Clayton Road, Clayton, Victoria 3168, Australia. Phone: 61 3 9594 4564. Fax: 61 3 9594 4533. E-mail: tony.korman@med.monash.edu.au.

<sup>▽</sup> Published ahead of print on 1 August 2007.

recent rat bite. *C. kutscheri* was identified using commercially available identification systems, and the identification was confirmed by 16S rRNA gene sequencing. Rat bite fever caused by *Streptobacillus moniliformis* or *Spirillum minus* (2) is well described, and *C. kutscheri* should be considered as another causative microorganism in the spectrum of rat bite-associated bacterial disease in humans.

We thank Kerrie Stevens at the Microbiological Diagnostic Unit (University of Melbourne, Parkville, Australia) for performing additional confirmatory tests with API Coryne v3.0 and 16S rRNA sequencing of the isolate.

The authors report no conflicts of interest.

#### REFERENCES

1. Amai, H., T. Akimoto, Y. Komukai, T. Sawada, M. Saito, and K. W. Takahashi. 2002. Detection of *Corynebacterium kutscheri* from the oral cavity of rats. *Exp. Anim.* **5**:99–102.
2. Dendle, C., I. J. Woolley, and T. M. Korman. 2005. Rat-bite fever septic arthritis: illustrative case and literature review. *Eur. J. Clin. Microbiol. Infect. Dis.* **25**:791–797.
3. De Zoysa, A., P. M. Hawkey, K. Engler, R. George, G. Mann, W. Reilly, D. Taylor, and A. Afstratiou. 2006. Characterization of toxigenic *Corynebacterium ulcerans* strains isolated from humans and domestic cats in the United Kingdom. *J. Clin. Microbiol.* **43**:4377–4381.
- 3a. Fauve, R. M., C. H. Pierce-Chase, and R. Dubos. 1964. Corynebacterial pseudotuberculosis in mice. II. Activation of natural and experimental latent infections. *J. Exp. Med.* **12**:283–304.
4. Fitter, W. F., D. J. De Sa, and H. Richardson. 1979. Chorioamnionitis and funisitis due to *Corynebacterium kutscheri*. *Arch. Dis. Child.* **55**:710–712.
5. Funke, G., A. von Graevenitz, J. E. Clarridge III, and K. A. Bernard. 1997. Clinical microbiology of coryneform bacteria. *Clin. Microbiol. Rev.* **10**:125–159.
6. Join-Lambert, O. F., M. Ouache, D. Canioni, J. L. Beretti, S. Blanche, P. Berche, and S. Kayal. 2006. *Corynebacterium pseudotuberculosis* necrotizing lymphadenitis in a twelve-year-old patient. *Pediatr. Infect. Dis. J.* **25**:848–851.
7. Martinez-Martinez, L., M. C. Ortega, and A. I. Suarez. 1995. Comparison of E-test with broth microdilution and disk diffusion for susceptibility testing of coryneform bacteria. *J. Clin. Microbiol.* **33**:1318–1321.
8. Messina, O. D., J. A. Maldonado-Cocco, A. Pescio, A. Farinati, and O. Garcia-Morteo. 1989. *Corynebacterium kutscheri* septic arthritis. *Arthritis Rheum.* **32**:1053.
9. National Research Council. 1991. Infectious diseases of mice and rats. National Academy Press, Washington, DC.
10. Pierce-Chase, C. H., R. M. Fauve, and R. Dubos. 1964. Corynebacterial pseudotuberculosis in mice. I. Comparative susceptibility of mouse strains to experimental infection with *Corynebacterium kutscheri*. *J. Exp. Med.* **12**:267–281.
11. Riegel, P., R. Mimy, D. De Briel, G. Prevost, F. Jehl, F. Bimet, R. Christen, and H. Monteil. 1995. *Corynebacterium argentoratense* sp. nov. from the human throat. *Int. J. Syst. Bacteriol.* **45**:533–537.
12. Ruimy, R., P. Riegel, P. Boiron, H. Monteil, and R. Christen. 1995. Phylogeny of the genus *Corynebacterium* deduced from analyses of small-subunit ribosomal DNA sequences. *Int. J. Syst. Bacteriol.* **45**:740–746.