regimens of antimycobacterial drugs that are also effective against *M. avium* complex (*4*).

In 2 studies that evaluated the effect of adjunctive IL-2 therapy in addition to ART for previously treatment-naive patients with HIV infection, baseline median numbers of circulating CD4+ cells increased significantly, but expansion of CD4+ T cells was not associated with the reduction in the risk for opportunistic diseases or death (*8*). In contrast to these results, in a study of HIV-positive patients who had low circulating CD4+ T cell counts, the participants experienced fewer AIDS-defining events and fewer deaths occurred when they were treated with adjunctive IL-2 immunotherapy (*9*).

This case report provides lessons for the understanding of mycobacterial diseases. First, despite massive infiltration of duodenal mucosa, mesenterial lymph nodes, and bone marrow, the lack of inflammatory responses in this patient prevented tissue destruction. Second, in the absence of a sufficient immune response and an increase in the number of circulating CD4+ T cells, antimycobacterial therapy without adjunctive immunotherapy did not clear the systemic bacterial infection.

Host responses to pathogens are not always beneficial. Intense immune reactions experienced during episodes of sepsis or HIV immune reconstitution inflammatory syndrome are frequently associated with patient death. Alternately, in the absence of inflammatory responses to pathogens, the patient is unprotected, and even microbiota that are harmless to an immunocompetent person can adversely invade. In an optimal immune response setting, a balance between proinflammatory and anti-inflammatory factors in response to pathogens is maintained (*10*).

C.L. is funded by the German Center for Infection Research (DZIF).

References

1. Griffith DE, Aksamit T, Brown-Elliott BA, Catanzaro A, Daley C, Gordin F, et al. An official ATS/IDSA statement: diagnosis, treatment, and prevention of nontuberculous mycobacterial diseases. Am J Respir Crit Care Med. 2007;175:367–416. http://dx.doi.org/10.1164/rccm.200604-571ST
2. Hartwig NG, Warris A, van de Vosse E, van der Zanden AG, Schülin-Casonato T, van Ingren J, et al. "Mycobacterium tilburgii" infection in two immunocompromised children: importance of molecular tools in culture-negative mycobacterial disease diagnosis. J Clin Microbiol. 2011;49:4409–11. http://dx.doi.org/10.1128/JCM.05460-11
3. Wagner D, Vos MC, Buiting AGM. "Mycobacterium tilburgii" infections. Emerg Infect Dis. 2006;12:532–4. http://dx.doi.org/10.3201/eid1203.051139
4. Temmerman S, Vandekerckhove L, Sermijn E, Vogelaers D, Claeys G, Vaneerchoutte M, et al. Disseminated infection with *Mycobacterium tilburgii* in a male immunocompromised patient. J Clin Microbiol. 2014;52:1777–9. http://dx.doi.org/10.1128/JCM.03148-13
5. Palmore TN, Shea YR, Conville PS, Witebsky FG, Anderson VL, Rupp Hodge IP, et al. "*Mycobacterium tilburgii*," a newly described, uncultivated opportunistic pathogen. J Clin Microbiol. 2009;47:1585–7. http://dx.doi.org/10.1128/JCM.02385-08
6. Schepers K, Schandené L, Bustamante J, Van Vooren J-P, de Suremain M, Casanova J-L, et al. IL-12Rβ1 deficiency and disseminated *Mycobacterium tilburgii* disease. J Clin Immunol. 2013;33:1285–8.
7. Kolditz M, Halank M, Spornraft–Ragaller P, Schmidt H, Höffken G. Localized pulmonary infection associated with *Mycobacterium tilburgii* in an HIV-infected patient. Infection. 2005 2005/08/01;33(4):278–81.
8. INSIGHT-ESPRIT Study Group, SILCAAT Scientific Committee; Abrams D, Levy Y, Losso MH, Babiker A, Collins G, Cooper DA, et al. Interleukin-2 therapy in patients with HIV infection. N Engl J Med. 2009;361:1548–59. http://dx.doi.org/10.1056/NEJMoa0903175
9. Fontas E, Kousignian I, Pradier C, Poizot-Martin I, Durier C, Weiss L, et al. IL-2 therapy: potential impact of the CD4 cell count at initiation on clinical efficacy—results from the ANRS CO4 cohort. J Antimicrob Chemother. 2010;65:2215–23. http://dx.doi.org/10.1093/jac/dkq296
10. Kaufmann SH, Lange C, Rao M, Balaji KN, Lotze M, Schito M, et al. Progress in tuberculosis vaccine development and host-directed therapies—a state of the art review. Lancet Respir Med. 2014;2:301–20. http://dx.doi.org/10.1016/S2213-2600(14)70033-5

Address for correspondence: Christoph Lange, Division of Clinical Infectious Diseases, German Center for Infection Research, Clinical Tuberculosis Unit, Research Center Borstel, Parkallee 35, 23845 Borstel, Germany; email: clange@fz-borstel.de

Corynebacterium bovis Eye Infections, Washington, USA, 2013

Siu-Kei Chow, Uyen Bui, Jill E. Clarridge

Author affiliations: University of Washington, Seattle, Washington, USA (S.-K. Chow, J.E. Clarridge); Veterans Administration Puget Sound Health Care System, Seattle (U. Bui, J.E. Clarridge)

DOI: http://dx.doi.org/10.3201/eid2109.150520

To the Editor: *Corynebacterium bovis* is well known as a normal bovine microbiota and is a common cause of bovine mastitis (*1*). *C. bovis* infections in humans are rare, and identification of the organism by biochemical methods is challenging (*2*). Although 9 cases of *C. bovis* infections in humans have been reported (*3*–*6*), only the most recent case, which involved prosthetic joint infection, used 16S rRNA gene sequencing to identify the bacterium with certainty (*6*).

During February–July 2013, four adult patients (Table) were seen at Veterans Administration Puget Sound Health Care System in Seattle, Washington, USA, for eye swelling, pain, and purulent discharge. All 4 cases were

Table. Characteristics and test results for 4 isolates of *Corynebacterium bovis* from patients with eye infections, Washington, USA, 2013*

Characteristic	Isolates from this study				Reference strains		
	F7181	F7545	F7275	F7551	*C. bovis* type strain ATCC 7751	Animal isolates,† n = 115	Human isolates,† n = 6
Patient no.	1	2	3	4			
Age, y/sex	49/M	25/M	33/M	90/M			
Date isolated	2013 Feb 4	2013 Jul 2	2013 Feb 27	2013 Jul 12			
Location where specimen was collected	VAPSHCS urgent care	VAPSHCS urgent care	VAPSHCS ED	Bellevue clinic			
API Coryne test code	2001004	0001004	0001105	0001004			
Test results							
Production of							
Catalase	+	+	+	+	+	100	100
Urease	+	+	+	+	–	44–68	17
Pyrazinamidase	+	–	–	–	+	ND	ND
Acid production from							
Glucose	–	–	+	–	+	56–98	50
Galactose	–	–	–	–	+	11–31	33
Mannose	–	–	–	–	+	5–33	33
Lactose	–	–	–	–	+	11–26	17
Sucrose	–	–	+	–	ND	ND	ND
GenBank accession no.	KJ769199	KJ769200	KJ769201	KJ769202			
16S rRNA gene sequence identity to type strain ATCC 7751, %	100	100	100	100			
Length of 16S rRNA gene sequence, nt	465	424	465	436			

*Phenotypic characteristics of *C. bovis* isolates from this study (*2*) were obtained by using API Coryne system v3.0 and Vitek2 (bioMérieux, Marcy l'Etoile, France). +, positive; –, negative; ED, emergency department; ND, not determined; VAPSHCS, Veterans Administration Puget Sound Health Care System.
†% strains positive.

associated with isolation of *C. bovis* from essentially pure culture. We investigated these 4 cases after obtaining approval from the Puget Sound Veterans Administration Medical Center Institutional Review Board (MIRB #01012).

Patient 1 was a 49-year-old man with swelling of the right eyelid with discharge and pain after an episode of itching. Before this visit, the patient had 3 similar episodes and received incision and drainage of the eyelid. On examination, the inverted lower palpebrum revealed a purulent cyst (diameter 1–2 mm); pus was collected from the cyst for culture. The patient was prescribed tobramycin ophthalmic drops and amoxicillin/clavulanic acid. No follow-up information was available.

Patient 2 was a 25-year-old man with bilateral eye infection that started on the left eye a week before the patient sought care. The eye had redness, swelling, blurred vision with loss of acuity, and irritation. The right eye had the same symptoms on the day of visit. Examination found bilateral keratoconjunctivitis and a 3-mm cyst with drainage on the lower palpebrum. The patient was treated with ofloxacin ophthalmic drops for 4 months but did not improve. A specimen was then collected from his right eye for culture. In 2014, he was given a diagnosis of chronic conjunctivitis.

Patient 3 was a 33-year-old man with severe pain, erythema, and swelling on his left eyelid. His symptoms started 1 week before he sought care and included swelling, increased cyst size, and disturbed vision. The pustular exudate was aspirated and sent to the laboratory. The patient was prescribed erythromycin ointment and oral trimethoprim/sulfamethoxazole. The patient's eye had improved at 3 weeks.

Patient 4 was a 90-year-old man who fell at home 2 days before his visit. He landed on his cheek, causing an abrasion, and his eye was swollen shut a few hours after the fall. On the second day, his cheek was swollen and reddened, and yellowish purulent matter was present on the skin. A swab specimen was collected from the wound and sent for culture. The patient was treated with doxycycline for 14 days, and the wound healed by day 12.

The aerobic cultures of 3 eye and 1 cheek wound specimens from these patients grew gram-positive bacilli (Table). The organism was initially identified by the API Coryne system (biomérieux, Marcy l'Etoile, France) as *C. urealyticum* or *Corynebacterium* group F-1. However, given the difficulty of phenotypic identification and the lack of literature to support eye infections associated with *C. urealyticum*, we performed 16S rRNA gene sequence analysis of the first ≈500 bp to confirm the identity. Using the MicroSeq 500 database version 0023b (Applied Biosystems, Foster City, CA, USA), we identified all 4 isolates as *C. bovis* (100% identical to ATCC 7715; sequence length

424–465 nt). According to the MicroSeq 500 and GenBank databases, the next 2 closest matches were *C. confusum* (96.1% similarity) and *C. macginleyi* (95.9% similarity), making the identification unambiguous.

C. bovis has not been described as part of the human microbiota, nor has it been associated with eye infections, in contrast to other *Corynebacterium* spp. known to colonize the human conjunctiva and skin (*7*) and cause eye infections (*8,9*). We found *C. bovis* associated with each of these eye and facial soft-tissue infections, but whether this lipophilic organism colonizes in the oily glands of eyelids in healthy individuals is unclear. What is certain is that *C. bovis* can exist on the human facial skin, has pathogenic potential, and is difficult to identify.

Because human and animal strains of *C. bovis* vary in biochemical properties (*2*), phenotypic identification is unreliable. All our isolates were urease positive, contrary to most isolates reported in the literature (*2*). This phenotype may result in underreporting of the organism because it is not described in some databases (*10*). An epidemiologic investigation revealed no overlap among any of the specimens regarding date of collection, clinic location where patients were seen, or date of clinical work-up. From results of our investigation, we believe that cross-contamination was unlikely and that these cases are probably independent of each other.

The pathogenicity of *Corynebacterium* spp. can be easily overlooked, especially because some species are common skin colonizers. Speciation should be prompted when *Corynebacterium* spp. are isolated in large quantity or from a pure culture. Unexpected phenotypic identifications such as *C. urealyticum* from eye specimens should be confirmed with 16S rRNA gene sequencing.

Acknowledgments

We thank the personnel of the microbiology laboratory at Veterans Administration Puget Sound Health Care System for their support.

References

1. Ajitkumar P, Barkema HW, De Buck J. Rapid identification of bovine mastitis pathogens by high-resolution melt analysis of 16S rDNA sequences. Vet Microbiol. 2012;155:332–40. http://dx.doi.org/10.1016/j.vetmic.2011.08.033
2. Brooks BW, Barnum DA. Characterization of strains of *Corynebacterium bovis*. Can J Comp Med. 1984;48:230–2.
3. Vale JA, Scott GW. *Corynebacterium bovis* as a cause of human disease. Lancet. 1977;2:682–4. http://dx.doi.org/10.1016/S0140-6736(77)90495-0
4. Dalal A, Urban C. *Corynebacterium bovis* line related septicemia: a case report and review of the literature. Scand J Infect Dis. 2008;40:575–7. http://dx.doi.org/10.1080/00365540701772448
5. Bolton WK, Sande MA, Normansell DE, Sturgill BC, Westervelt JB Jr. Ventriculojugular shunt nephritis with *Corynebacterium bovis*. Successful therapy with antibiotics. Am J Med. 1975;59:417–23. http://dx.doi.org/10.1016/0002-9343(75)90401-5
6. Achermann Y, Trampuz A. *Corynebacterium bovis* shoulder prosthetic joint infection: the first reported case. Diagn Microbiol Infect Dis. 2009;64:213–5. http://dx.doi.org/10.1016/j.diagmicrobio.2009.02.003
7. von Graevenitz A, Schumacher U, Bernauer W. The corynebacterial flora of the normal human conjunctiva is lipophilic. Curr Microbiol. 2001;42:372–4. http://dx.doi.org/10.1007/s002840010232
8. Arsan AK, Sizmaz S, Ozkan SB, Duman S. *Corynebacterium minutissimum* endophthalmitis: management with antibiotic irrigation of the capsular bag. Int Ophthalmol. 1995–1996;19:313–6. http://dx.doi.org/10.1007/BF00130928
9. Suzuki T, Iihara H, Uno T, Hara Y, Ohkusu K, Hata H, et al. Suture-related keratitis caused by *Corynebacterium macginleyi*. J Clin Microbiol. 2007;45:3833–6. http://dx.doi.org/10.1128/JCM.01212-07
10. Funke G, Bernard KA. Coryneform gram-positive rods. In: Versalovic J, Carroll KC, Funke G, Jorgensen JH, Landry ML, Warnock DW, editors. Manual of clinical microbiology. 10 ed. Washington (DC): American Society for Microbiology; 2011. p. 413–42.

Address for correspondence: Jill E. Clarridge, Veterans Administration Puget Sound Health Care System, Pathology and Laboratory Medicine Service 113, 1660 S Columbian Way, Seattle, WA 98108, USA; email: jill.clarridge@va.gov