TABLE 1
EFFICACY OF THE ALCOHOL-BASED SANITIZER AGAINST FUNGI

| Fungal Species | ATCC No. | Exposure Time | $Log_{10}$ Reduction | % Reduction |
|---|---|---|---|---|
| *Aspergillus flavus* | 9643 | 15 | 5.02 | 99.9991 |
| | | 30 | > 5.57 | > 99.9997 |
| *A. niger* | 9642 | 15 | > 4.72 | > 99.9981 |
| | | 30 | > 4.72 | > 99.9981 |
| *Candida albicans* | 14053 | 15 | > 6.32 | > 99.9999 |
| | | 30 | > 6.32 | > 99.9999 |
| *C. tropicalis* | 13803 | 15 | > 6.42 | > 99.9999 |
| | | 30 | > 6.42 | > 99.9999 |
| *Epidermophyton floccosum* | 52063 | 15 | > 3.92 | > 99.9880 |
| | | 30 | > 3.92 | > 99.9880 |
| *Penicillium citrinum* | 9849 | 15 | 5.82 | 99.9999 |
| | | 30 | 5.05 | 99.9991 |
| *Trichophyton mentagrophytes* | 9533 | 15 | 5.93 | 99.9999 |
| | | 30 | > 5.93 | > 99.9999 |

ATCC = American Type Culture Collection.

TABLE 2
EFFICACY OF THE ALCOHOL-BASED SANITIZER AGAINST VIRUSES IN A 30-SECOND EVALUATION

| Viral Species | ATCC No. | $Log_{10}$ Reduction | % Reduction |
|---|---|---|---|
| Adenovirus type 2 | VR-846 | 1.32 | 95.2 |
| Parainfluenza virus type 2 | VR-92 | ≥ 4.39 | ≥ 99.996 |
| Parainfluenza virus type 3 | VR-93 | ≥ 4.14 | ≥ 99.993 |
| HIV type 1 | $HTLV\text{-}III_B$ | ≥ 4.14 | ≥ 99.993 |
| Hepatitis A virus | VR1073 | 1.25 | 94.4 |
| Influenza virus type $A_2$* | VR-544 | > 5.00 | > 99.999 |
| Rhinovirus type 16 | VR-1126 | ≥ 4.25 | > 99.994 |
| Rhinovirus type 14 | VR-284 | 2.25 | 99.94 |
| Rhinovirus type 37 | VR-1147 | 2.75 | 99.8 |
| Coxsackievirus $B_3$ | VR-30 | 2.75 | 99.8 |
| Herpes simplex virus type 1 | VR-733 | ≥ 5.00 | ≥ 99.999 |

ATCC = American Type Culture Collection.
*Hong Kong strain.

tericidal agent has been recognized for more than 60 years.[4] Recently, the recognition of low compliance with hand washing protocols and improper hand washing techniques has focused greater attention on the use of waterless, alcohol-based hand sanitizers as a primary tool for hand disinfection in the United States. The numerous advantages of alcohol-based sanitizers, such as rapid, broad-spectrum antibacterial activity, time savings, increased compliance with hand hygiene, and reduced infection rates, help to overcome the obstacles to effective hand hygiene. These products may replace soap and water as the leading recommended tools for hand disinfection in the 2002 Guideline for Hand Hygiene of the Centers for Disease Control and Prevention's Healthcare Infection Control Practices Advisory Committee (HICPAC). The results presented here extend the data on the antimicrobial efficacy of alcohol-based sanitizers to fungi and viruses and indicate that the alcohol-based sanitizer evaluated in these tests is highly effective in vitro against the fungal and viral species investigated.

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# Nosocomial Outbreak of *Kluyvera cryocrescens* Bacteremia

**To the Editor:**

Bacteremia caused by *Kluyvera cryocrescens* has been rarely reported. We report a nosocomial outbreak of *K. cryocrescens* bacteremia in four patients in a cardiovascular ward. Previous reports, as well as this study, suggest that *Kluyvera* is of clinical significance in humans.

To date, four different species, *Kluyvera ascorbata*, *Kluyvera cryocrescens*, *Kluyvera cochleae*, and *Kluyvera georgiana*, have been described and are classified in the family Enterobacteriaceae. In humans, sputum is the most common specimen yielding *Kluyvera;* the organism is rarely found in urine, stool, and blood or in the throat. Water, sewage, soil, milk, hospital sinks, and cows have been reported as environmental sources of *Kluyvera*.[1] Although a few reports have suggested that *Kluyvera* can cause severe disease, the clinical significance of the organism remains uncertain.[2,3] All previously reported *Kluyvera* infections were isolated cases; there have been no reports of outbreaks of infection caused by *K. cryocrescens*.

In this study, we report 4 cases of nosocomial *K. cryocrescens* bacteremia in our hospital. All 4 patients had 2 consecutive sets of blood cultures with positive results for *K. cry-*

https://doi.org/10.1086/503456 Published online by Cambridge University Press

*ocrescens*. They all had underlying coronary artery disease and a peripheral intravenous line with heparin lock. All developed a spiking fever and sepsis. Their white blood cell counts were within the normal range, except for 1 patient with 11,200/mm$^3$. Cefazolin and gentamicin were administered after blood cultures were drawn. All of the patients responded well to this regimen and were subsequently discharged from the hospital without sequelae (Table).

The organisms recovered from blood specimens were identified as *K. cryocrescens* according to the methods previously reported.[1] Gram stain of colonies on sheep-blood agar revealed a large, gram-negative rod that was negative for oxidase. The isolates grew on MacConkey's agar and fermented lactose with the production of acid. The isolates were motile with positive reactions to catalase, ornithine decarboxylase, and o-nitrophenol-beta-D-galactopyranoside hydrolysis and fermentation of arabinase, mannitol, melibiose, raffinose, rhamnose, glucose, and sucrose. The following reactions were negative: inositol, adonitol, urea, $H_2S$, L-lysine, arginine decarboxylase, Voges-Proskauer, and tryptophan deaminase. Antimicrobial susceptibility was determined by disk diffusion tests according to the National Committee for Clinical Laboratory Standards (NCCLS).[4] All four *K. cryocrescens* isolates had identical antibiotic susceptibility patterns and were susceptible to gentamicin, ticarcillin, latamoxef, imipenem, norfloxacin, and ciprofloxacin; they were intermediately resistant to amikacin, cefoperazone, and cefuroxime.

An investigation was undertaken to determine the source of the outbreak. The same organism was not isolated from environmental samples and from the hands of the medical staff, based on automated ribotyping. Similarity coefficients were calculated based on both band position and relative banding intensity. Isolates were judged to have the same ribotype if the similarity coefficient between their patterns was 0.93 or greater. *Eco*RI-digested ribotyping was performed on 6 strains of *K. cryocrescens*, including 4 blood isolates from the patients, 1 clinical isolate from another teaching hospital, and 1 American Type Culture Collection (ATCC) 33435 standard isolate.

TABLE
CHARACTERISTICS OF THE PATIENTS INFECTED BY *KLUYVERA CRYOCRESCENS*

| Characteristic | Patient 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Age, y | 65 | 71 | 85 | 35 |
| Gender | F | F | F | M |
| Clinical features | | | | |
| Underlying disease | CAD & RHD | CAD | CAD, NIDDM | CAD |
| Possible risk factor | Peripheral intravenous route with heparin lock | Peripheral intravenous route with heparin lock | Peripheral intravenous route with heparin lock | Peripheral intravenous route with heparin lock |
| Symptoms and signs | Fever, chills, dyspnea, productive cough | Fever, chills, productive cough, nausea | Fever, chills | Fever, headache |
| White blood cell count (/mm$^3$) | 4,500 | 6,400 | 11,200 | 6,800 |
| Date of isolation | January 24, 1999 | January 23, 1999 | January 22, 1999 | January 24, 1999 |
| Treatment duration, d | 6 | 5 | 7 | 7 |
| Date of discharge | January 29, 1999 | January 27, 1999 | February 11, 1999 | January 30, 1999 |

CAD = coronary artery disease; RHD = rheumatic heart disease; NIDDM = non–insulin-dependent diabetes mellitus.

Ribotyping revealed that all *K. cryocrescens* from the 4 patients had an identical riboprofile, which differed from that of the other 2 strains tested. An outbreak of nosocomial *K. cryocrescens* bacteremia was thus confirmed by ribotyping.

*K. ascorbata* is the *Kluyvera* most frequently isolated in clinical specimens. *K. cryocrescens*, an environmental isolate found in soil and sewage, has been reported only occasionally in clinical specimens.[1] Microbiology tests used routinely for the family of Enterobacteriaceae are not useful for differentiating *K. ascorbata* from *K. cryocrescens*. The ascorbate test and glucose fermentation at 5°C are generally acceptable for differentiating between *K. ascorbata* and *K. cryocrescens*.[1]

Although Farmer et al.[1] suggested that *Kluyvera* species are an "infrequent opportunistic pathogen," peritonitis, cholecystitis, acute pyelonephritis, diarrhea, mediastinitis, urinary tract infection, and soft tissue infections caused by these organisms have been reported.[2,3,5] Nevertheless, serious infections associated with *K. cryocrescens* are rarely described. Although previous reports suggested that colonization with *Kluyvera* might lead to subsequent mediastinal infection and bacteremia,[2,3,5] there is no evidence that our patients had been colonized with *Kluyvera* before their episode of bacteremia.

All involved medical personnel were further investigated for the source of outbreak. No *Kluyvera* species were identified from skin swabs, gloves, tap water inside the ward, or diluent for heparin. The four patients had peripheral intravenous lines with heparin lock. A possible route of transmission of *K. cryocrescens* might be contaminated heparin. Unfortunately, no residual heparin was available for culture during the outbreak.

This is the first report of an outbreak of bacteremia caused by *K. cryocrescens*. The epidemiology, route of transmission, risk factors for disease, and pathogenetic mechanisms deserve further study. Therapeutic agents should be rationally selected to prevent the development of resistance.

*The authors thank Dr. Po-Ren Hsueh, National Taiwan University, for providing a clinical isolate of* K. cryocrescens.

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