Kluyvera Mediastinitis following Open-Heart Surgery: a Case Report

JUAN SIERRA-MADERO,1,2 KATHLEEN PRATT,2 GERALDINE S. HALL,2 ROBERT W. STEWART,3 JOHN J. SCERBO,4 AND DAVID L. LONGWORTH4*

Department of Infectious Disease,1 Microbiology,2 and Cardiothoracic Surgery3 and Division of Medicine,4 The Cleveland Clinic Foundation, 9500 Euclid Avenue, Cleveland, Ohio 44195

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Reports of serious infections caused by Kluyvera spp. have been rare. A case of Kluyvera sp. mediastinitis and bacteremia in a man after open-heart surgery is described. The clinical significance of Kluyvera sp. isolates was debated in early descriptions of the organism. More recent reports, as well as the present case, suggest that the pathogenic potential of this organism is being increasingly recognized by clinicians and microbiologists.

The genus Kluyvera is a recently defined group of organisms in the family Enterobacteriaceae which was previously identified as Enteric Group 8 (5). Kluyvera spp. have been considered infrequent opportunistic pathogens. The most common source of human isolates has been the respiratory tract, but Kluyvera spp. have been isolated from blood, stool, urine, nasopharynx, and bile specimens, wounds, and intravascular devices (2-9; A. Aevaliotis, A. M. Belle, J. P. Chanione, et al., Clin. Microbiol. Newsl. 7:51, 1985). In most instances, the pathogenic significance of these organisms has been uncertain (5). Scattered reports describing serious systemic infections with Kluyvera spp. have appeared. These infections have involved the urinary tract (8), the gallbladder (7), and the gastrointestinal tract (3). Catheter-related bacteremia has also been described (9). We report a patient with Kluyvera sp. mediastinitis and bacteremia following open-heart surgery.

A 74-year-old man was admitted to The Cleveland Clinic Foundation on 2 July 1989 with unstable angina. His medical history was remarkable for insulin-requiring adult onset diabetes mellitus, hypertension, gout, and end-stage renal disease requiring chronic hemodialysis. Cardiac catheterization disclosed triple-vessel coronary atherosclerosis, moderate left ventricular dysfunction, and moderately severe aortic stenosis. Only 7 July 1989, the patient underwent a five-vessel saphenous vein coronary artery bypass and aortic valve debridement. Postoperatively he developed acute aortic insufficiency which required aortic valve replacement on 8 July 1989. This was complicated by postoperative bleeding which necessitated mediastinal exploration later that day. Thereafter the patient was maintained on cefamandole for 10 days after surgery. On 21 July 1989, drainage from the sternal wound was noted. The patient was afebrile, and his leukocyte count was 16,000/mm³. Superficial sternal debridement was performed, and vancomycin and gentamicin were administered. Gram stain of the wound drainage disclosed gram-negative bacilli, and cultures of the wound and expectorated sputum grew a Kluyvera sp. within 24 h. Two separate blood cultures, one drawn through a central venous pressure line and the other through an arterial line, yielded a Kluyvera sp. In both instances, the organism grew in the Isolator tube (Dupont, Wilmington, Del.) and a tryptic soy broth bottle within 24 h of collection.

The organism was identified as a Kluyvera sp. by Vitek AMS (Vitek Systems, Hazelwood, Mo.) and by API (Analytab, Inc.). Identification to the species level was attempted in our laboratory and at the Centers for Disease Control, Atlanta, Ga. (J. J. Farmer). The organism was ascorbate positive and grew in cefsulodin-Irgasan-novobiocin medium. Fermentation of glucose at 5°C occurred in 17 days. These results are not conclusive for either Kluyvera ascorbata or K. cryocrescens, and the organism may represent a new species of the genus Kluyvera (Table 1). In addition, the organism was positive for catalase; methyl red; growth in KCN; ornithine decarboxylase; lysine decarboxylase; utilization of malonate, tartrate, and muate; esculin hydrolysis; and nitrate reduction. It was motile at 35°C. Fermentation test results were positive for glucose (with gas production), lactose, mannitol, salicin, sorbitol, arabinose, raffinose, rhamnose, maltose, xylose, trehalose, cellulbiose, melibiose, and mannose and negative for adonitol, glycerol, dulcitol, inositol, and erythritol. The isolate did not liquefy gelatin and was negative for the production of indole, oxidase, hydrogen sulfide, urease, arginine dihydrolase, phenylalanine deaminase, and DNase (25°C) and for sodium acetate utilization.

Susceptibility testing by means of broth microdilution (trays prepared in-house) revealed susceptibility to gentamicin, tobramycin, ceftizoxime, cefazidime, ciprofloxacin, and imipenem. The organism was resistant to ampicillin, cefamandole, cephalothin, ticarcillin-clavulanic acid, piperacillin, and aztreonam.

Ceftizoxime was added to the regimen, and vancomycin was discontinued. The patient remained afebrile, but purulent drainage from the wound persisted. On 24 July 1989, the patient underwent extensive sternal and mediastinal debridement with placement of mediastinal irrigation tubes. Irrigation with povidone-iodine (Betadine) was begun. Intraoperative cultures of purulent material within the mediastinum again yielded a Kluyvera sp. The isolate remained susceptible to ceftizoxime and gentamicin, and these antibiotics were continued. The patient remained afebrile and completed a 3-week course of ceftizoxime and gentamicin. Mediastinal irrigation with povidone-iodine was continued. After antibiotics were discontinued, however, cultured specimens of mediastinal drainage and a pleural effusion grew Candida albicans. An associated pneumonia was not identified, and the patient was believed to have fungal mediastinitis. He received 500 mg of amphotericin B over the subsequent 2 weeks. Although his infection responded to therapy, his course was complicated by recurrent upper gastrointestinal bleeding which required laparotomy with gastrectomy and vagotomy. Despite these procedures, bleeding recurred and...
was refractory to celiac artery embolization. The patient died on 6 September 1989, secondary to intractable gastrointestinal bleeding. Postmortem examination was performed and disclosed no evidence of residual mediastinitis.

In 1956, Asai and Okumura proposed the genus *Kluyvera* for a group of gram-negative bacteria with polar flagella which produced large amounts of alpha-ketoglutaric acid during the fermentation of glucose (1). In 1981, Farmer et al. compiled their experience with more than 100 isolates of a gram-negative, oxidase-negative fermentative bacterium that previously had been grouped under the name of Enteric Group 8 and recognized that the biochemical reactions were almost identical to those of the organisms defined by Asai and Okumura (5). Farmer and coworkers proposed the reclassification of the organism as a new genus within the family Enterobacteriaceae because of its unique biochemical characteristics.

The genus *Kluyvera* is composed of three species: *K. ascorbata*, the type species of the genus and the one most frequently isolated in clinical specimens (5); *K. cryocrescens*, an environmental isolate found in food, soil, and sewage but rarely present in clinical specimens (5); and *Kluyvera* sp. group 3, an infrequently isolated strain from any source, which appears to be distinct from the other two species as determined by DNA hybridization studies. Members of the genus *Kluyvera* are closely related to other members of the Enterobacteriaceae, such as Enterobacter spp. and Citrobacter spp. *Kluyvera* spp. differ, however, in their ability to utilize malonate and to ferment raffinose. Automated systems such as the Vitek AMS (Vitek Systems) and biochemical kit systems such as API (Analytab, Inc.) can identify the organisms to the genus level, but further testing is needed to differentiate the species.

Table 1 summarizes the biochemical characteristics that can be used to differentiate *K. cryocrescens* from *K. ascorbata* and describes the results of these tests for the present isolate. Results of the ascorbate test and glucose fermentation at 5°C have been described by Farmer et al. (5). Measurement of zones of inhibition around cephalothin and carbencillin disks remains a simple approach to the differentiation in most clinical laboratories. Isolates of the genus *Kluyvera* have been susceptible in vitro to aminoglycosides, broad-spectrum cephalosporins, imipenem, and aztreonam and resistant to narrow- and extended-spectrum cephalosporins and extended-spectrum penicillins (5). Our isolate showed a similar susceptibility pattern, except for resistance to aztreonam.

In the initial reports, the pathogenic significance of *Kluyvera* spp. was unclear (1, 5). Most of the isolates in the series of Farmer et al. were from respiratory specimens and probably represented colonization rather than infection. Only five isolates in that series were from blood, but clinical information on those cases was not provided (5). On the basis of those five isolates, plus another isolate (from gallbladder drainage fluid) considered significant by Braunstein and coworkers (2), Farmer et al. suggested that *Kluyvera* spp. are “infrequent opportunistic pathogens” (5). Since then, only six reports have appeared in the literature documenting *Kluyvera* spp. as pathogenic organisms in humans. Wong described a case of nosocomial *K. cryocrescens* bacteremia in a 17-month-old child in whom the source appeared to be a Broviac catheter (9). Luttrell and coworkers recently described a soft tissue infection with a *Kluyvera* sp. in a previously healthy woman (6). Tristram and Forbes reported a case of bacteremia and urinary tract infection (8), and Thaller et al. isolated *K. cryocrescens* from the gallbladder of a woman with acute cholecystitis (7). In addition, reports by Fainstein et al. (3) and Aevaliotis et al. (Clin. Microbiol. News., 1985) have associated *Kluyvera* spp. with diarrhea in a few patients.

Our case represents the first description of mediastinitis caused by this organism. The isolation of a *Kluyvera* sp. from the trachea suggests that colonization of the respiratory tract may have led to subsequent mediastinal infection and bacteremia. Our patient’s relatively indolent clinical course is consistent with other published reports. *Kluyvera* spp. are infrequently associated with human disease and appear to be mainly commensal organisms which rarely produce opportunistic infections. An increased awareness of these organisms by clinical microbiology laboratories will likely lead to a better understanding of the epidemiology and clinical presentation of *Kluyvera* infections.

**LITERATURE CITED**


