CASE REPORT

A fatal metastasis of *Klebsiella pneumoniae* to the lungs

JH Frisbie

Research Service, Boston Healthcare Center and Harvard Medical School Medicine, Brigham and Womens Hospital, Boston, MA, USA

Background/Objective: To describe the relationship between a seemingly innocuous colonization in one organ and a fatal infection in another organ in a tetraplegic man.

Design: Case report.

Source: Veterans Administration Hospital, USA.

Methods/Results: A 61-year-old man, paralyzed at C7, American Spinal Injury Association Impairment Scale A for 31 years, presented with cough and negative sputum but urine positive for *Klebsiella pneumoniae*. After 2 days, he presented with sepsis and hypotension, received fluids and multiple antibiotics (blood and urine cultures taken after antibiotics were negative), and developed pulmonary failure 2 weeks after admission. Bronchial secretions obtained by bronchoscopy for mucous plugging revealed *K. pneumoniae*. The spectrum of antibiotic sensitivities for the organism from the initial urine and the later bronchial secretions was identical except for resistance to antibiotics administered between cultures. The subject developed an encephalopathy in association with respiratory acidosis, hyponatremia, hypoalbuminemia and renal failure and expired 36 days after presentation.

Conclusion: The urinary and respiratory tracts were infected with the same organism, leading to fatal sepsis in a chronically paralyzed tetraplegic man, suggesting migration between the two sites.

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Keywords: spinal cord injury; quadriplegia; *K. pneumoniae*; sepsis; metastatic infection; tetraplegia

Introduction

Vertebral osteomyelitis is an example of infection metastatic from skin or bladder in subjects with long-standing spinal cord injury.¹ Given the high prevalence of sepsis and pulmonary deaths in this population, a metastatic mechanism for pulmonary infection might sometimes be expected.² The following case suggests one such example.

Case report

A 61-year-old man, spinal cord injured at the C7 level, American Spinal Injury Association Impairment Scale A, for 31 years, was brought to a hospital because of a 'junky' cough. Sputum culture was negative; but urine culture grew *Klebsiella pneumoniae* and *Enterococcus faecalis* at >100 000 colonies ml⁻¹. He was treated with trimethoprim and sulfamethoxazole at this visit.

After 2 days, he was hospitalized because of confusion. Examination of the patient revealed no fever, pulse rate was 70–89 beats per minute, blood pressure was 77/45 mm Hg, respirations were 18 times per minute, hematocrit was 28%,

a white blood cell count was 17K μ l⁻¹, with 98% neutrophils and no band forms, serum creatinine was 1.9 mg% (baseline 0.7 mg%). The patient's weight was 122 lb. There was a past history of hemorrhoidal bleeding, respiratory infections and postural hypotension.

He was treated on an emergency basis with intravenous fluids, vasopressors and infusion of piperacillin with tazobactam. A 2:1 heart block developed and a temporary cardiac pacemaker, followed later by a permanent pacemaker, was inserted. Blood cultures 7 $\times$ and urine cultures 4 $\times$, all collected during antibiotic treatment, were negative.

The following day, the hematocrit was 25%, white blood cell count was 10K μ l⁻¹, serum creatinine was 0.7 mg% and urea was 16 mg%. The chest film was clear. No renal stone or abscess was found by ultrasound examination.

After a protracted course in which amikacin, cefazolin, ampicillin and sulbactam were administered, agitated confusion again developed. Temperature rose to 100.1°F, pulse rate to 144 and respiration to 32, and the blood pressure dropped to 68/30. Arterial pH was 7.16, PO₂ was 60 mm Hg and PCO₂ was 89 mm Hg. Computerized tomography of the chest had revealed mucous plugging, atelectasis and pleural effusion. The patient was intubated, mechanically ventilated and bronchoscoped. Thick secretions were removed, and their culture grew *K. pneumoniae*. Thoracentesis revealed a

Correspondence: Dr JH Frisbie, Spinal Cord Injury Service (128), Veterans Administration Hospital, 1400 VFW Parkway, West Roxbury, Boston, MA 02132, USA.

E-mail: jfrisbie@comcast.net

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transudate and no growth on culture. The patient lapsed into a vegetative state.

Antibiotics were changed and the blood pressure was supported by transfusion of whole blood and albumin. Pitting edema of the hands and ankles developed, and the patient's weight increased to 142 lb. Serum albumin dropped to 2.2 g%, serum sodium ranged from 126 to 132 mEq/l and serum creatinine rose progressively to 3.8 mg% and urea to 116 mg%. The subject then expired, 36 days after admission.

Comment

The subject died after a prolonged course of sepsis and progressive circulatory, renal and pulmonary failure ending in shock and massive extravasation of fluid. A urinary infection with *K. pneumoniae* was cultured 2 days before the presentation as sepsis. *K. pneumoniae* was cultured from the bronchial secretions 22 days later. The strain of these organisms appeared to be identical because the antibiotic sensitivities were similar, with the newly developed resistance to cephalosporins explained by intervening treatment with these drugs (see Table 1). Bacteremia, not confirmed by blood cultures drawn after antibiotics were administered, was implied by the hypotension and leukocytosis on hospitalization. Bacteremia may have emanated from the

urinary tract and eventually metastasized the lungs, manifesting as an infection of the bronchial tree, mucous plugging, atelectasis, pleural effusion and pulmonary insufficiency. In another case report in a neurologically intact subject, septic pulmonary embolism has been suggested as the mechanism for the metastasis of a urinary infection to the lung.³ Infections are a risk factor for pulmonary embolism, and the pelvic veins, draining the infected bladder, are a potential source.^{4,5}

K. pneumoniae, a normal part of the colonic flora, is a common pathogen in the bladder or the lungs, particularly in the chronically ill. The risk of significant pulmonary infection with this pathogen is attributable to its thick, complement-repelling capsule, similar to that of other pulmonary pathogens, for example, *S. pneumoniae*. The risk of sepsis is related to its endotoxin. It is also a common nosocomial pathogen and one of the most resistant to antibiotics. Prevention may depend on careful hygiene in skin and bowel care, challenging as it is in persons with spinal cord injury, and on minimizing in-patient hospital time.

Conclusion

Fatal sepsis developed in a tetraplegic man with a bladder infection due to *K. pneumoniae* that progressed to a pulmonary infection with the same organism. It is suggested that the lungs are susceptible to such a metastasis. The origin of pulmonary infections can be extra-pulmonary.

Table 1 Susceptibility patterns of *Klebsiella pneumoniae* cultured from urine and bronchial secretions

	Urine culture	Bronchial culture
Antibiotic	10/26/05	11/17/05
Amikacin	R	R
Ampicillin	R	R
Cefazolin	S	R
Tobramycin	I	R
Trimethoprim/Sulfa	R	R
Gentamicin	R	R
Imipenem	S	S
Ceftazidime	S	R
Cefepime	S	S
Levofloxacin	R	R
Cefotetan	S	S
Ceftriaxone	S	S
Sulbactam/Ampicillin	S	R
Cefuroxime	S	R
Piperacillin/Tazobactam	S	S
Gatifloxacin	R	R

Abbreviations: I, intermediate sensitivity; R, resistant; S, sensitive.

Sensitivities that changed are in bold face.

Interim antibiotics were trimethoprim/sulfamethoxazole, piperacillin/tazobactam, amoxicillin/clavulanic acid, cefepime/metronidazole, vancomycin, cefepime and midazolam.

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