Case report

Ventilator associated pneumonia caused by *Raoultella ornithinolytica* in two immunocompetent trauma patients

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**ABSTRACT**

Infections with *Raoultella ornithinolytica* have recently been reported more frequently in the medical literature. This pathogen has the potential to cause many types of infections, including pneumonia. Here, we report the first two cases of ventilator-associated pneumonia (VAP) in trauma patients caused by *Raoultella ornithinolytica*. Both of these infections were successfully treated with antibiotics based on susceptibilities and the patients were able to be transferred out of the intensive care unit.

1. Introduction

*Raoultella ornithinolytica* is an encapsulated Gram negative aerobic bacillus bacterium of the Enterobacteriaceae family. This bacterium was formerly known as *Klebsiella ornithinolytica* but was reclassified as *Raoultella* in 2001 based on new genetic approaches [1]. *R. ornithinolytica* previously was thought to rarely cause infection in humans; however, recently it has been reported in the literature as causing many different types of infections including bacteremia, cholangitis, urinary tract infection, pneumonia, skin infections, osteomyelitis, meningitis, cerebral abscess, mediastinitis, pericarditis, conjunctivitis, otitis, among other infections [2,3]. The increase in reporting of *R. ornithinolytica* is likely due to implementation of new identification techniques in the laboratory such as the matrix-assisted laser desorption/ionization-time of flight mass spectrometer (MALDI-TOF MS) as older techniques did not always differentiate between *Klebsiella* spp and *Raoultella* spp [2,4]. In the most comprehensive study to date, Seng et al. reported 112 cases of *R. ornithinolytica* infections over an eleven year period which included both community and hospital-acquired infections from different sources [2]. This study included 20 cases of pneumonia representing 18% of infections. Boattini et al. reported three cases of hospital-acquired and 3 cases of community-acquired pneumonia over a 5 year period [3]. Risk factors for infection include solid cancer, diabetes mellitus, immunodeficiency, post-invasive procedures, and post-urethra trauma [2]. Nevertheless, there have been no cases of ventilator associated pneumonia (VAP) caused by *R. ornithinolytica* in an immunocompetent trauma population. We present two cases of ventilator-associated pneumonia caused by *R. ornithinolytica*.

2. Case 1

A 39 year old male was admitted to the Elvis Presley Memorial Trauma Center due to injuries suffered from being struck as a pedestrian by motor vehicle. The patient was intubated in the field prior to admission. Injuries included subarachnoid hemorrhage, intraventricular hemorrhage, multiple facial fractures, right clavicle fracture, right hemotorax and pneumothorax, multiple rib fractures, Grade 3 liver laceration, bilateral L1 transverse process fracture, right L2-L4 transverse process fractures, and right axillary artery laceration. On hospital day 7, mechanical ventilation was weaned and the patient extubated. On hospital day 10, the patient developed a fever of 39.5 °C, increased respiratory secretions, and right-sided infiltrate seen on chest x-ray. His white blood cell count of 11,900/μL. The patient required reintubation due to persistent low oxygen saturation. Ventilator associated pneumonia (VAP) was suspected due to the patient being on the ventilator for seven days on admission and the patient underwent bronchoscopy with quantitative bronchoalveolar lavage (BAL) per trauma unit VAP protocol. Broad spectrum antibiotics were started with ceftazidime and vancomycin after the BAL was performed. Quantitative BAL results from the lung were *R. ornithinolytica* 6.5 × 10⁶ CFU/mL in the left lower lobe and 9.3 × 10⁶ CFU/mL in right lower lobe (susceptibilities in Table 1). *Enterococcus* species also grew in both BALs with 4 × 10⁵ CFU/mL in the left lower lobe and 4.5 × 10⁴ CFU/mL in the right lower lobe. Antibiotics were changed to piperacillin/tazobactam monotherapy on the fourth day to effectively cover both organisms. Repeat BAL was performed on the eighth day of antibiotics with no significant growth seen in the final results indicating clearance of pneumonia with no other signs or symptoms of infection. The patient...
was treated with a total of twelve days of antibiotics (4 days of ceftazidine and vancomycin, 8 days of piperacillin/tazobactam). The patient continued to improve and was transferred out of the intensive care unit (ICU) on day 24 of hospital stay and was discharged home after a hospital stay of 41 days.

3. Case 2

A 50 year old male was admitted to the trauma intensive care unit (ICU) due to injuries suffered from a motor vehicle crash with multiple fractures. The patient’s past medical history included atrial fibrillation. The mechanical ventilation was unable to be weaned due to bradycardia, immunodeficiency, and post-urethra trauma. The patient was intubated on admission with respiratory deplacement of a pacemaker, and chronic obstructive pulmonary disease. On day 3, the patient developed a fever of 38.7 °C, purulent sputum, and a chest x-ray that revealed unilateral opaque hemi-thorax left. His WBC was normal at 4.3/μL while C-reactive protein (CRP) was 27.9 mg/dL. VAP was suspected and the patient underwent bronchoscopy with quantitative BAL per trauma unit VAP protocol. BAL (CRP) was 0.25 (S) ≤ 1 (S) ≤ 0.25 (S) ≤ 0.5 (S)

Table 1

| Antibiotics                  | MIC (Susceptibility) |
|------------------------------|----------------------|
|                              | Patient#1 (RLL BAL) | Patient#1 (LLL BAL) | Patient#2 (LIL BAL) |
| Amikacin                     | ≤ 2 (S)              | ≤ 2 (S)              | ≤ 2 (S)              |
| Ampicillin/sulbactam         | ≥ 32 (R)             | ≥ 32 (R)             | ≥ 32 (R)             |
| Ceftazidime                  | ≤ 1 (S)              | ≤ 1 (S)              | ≤ 1 (S)              |
| Ceftriaxone                  | ≤ 20 (S)             | ≤ 20 (S)             | ≤ 20 (S)             |
| Ciprofloxacoxin              | ≤ 0.25 (S)           | ≤ 0.25 (S)           | ≤ 0.25 (S)           |
| Gentamicin                   | ≤ 1 (S)              | ≤ 1 (S)              | ≤ 1 (S)              |
| Imipenem                     | ≤ 0.25 (S)           | ≤ 0.25 (S)           | ≤ 0.5 (S)            |
| Piperacillin/tazobactam      | S                    | S                    | S                    |
| Tobramycin                   | ≤ 1 (S)              | ≤ 1 (S)              | ≤ 1 (S)              |
| Trimethoprim/sulfamethoxazole| ≥ 20 (S)             | ≥ 20 (S)             | ≥ 20 (S)             |

4. Discussion

These two cases describe the first reports of *R. ornithinolytica* as a probable cause of nosocomial infections. This organism should be treated by healthcare providers as a pathogen with the possibility of drug resistance. In this case series, we report the first two cases of *R. ornithinolytica* VAP in an immunocompetent trauma population that were successfully treated guided by antimicrobial susceptibilities.

5. Conclusion

*R. ornithinolytica* is a previously underreported, emerging cause of nosocomial infections. This organism should be treated by healthcare providers as a pathogen with the possibility of drug resistance. In this case series, we report the first two cases of *R. ornithinolytica* VAP in an immunocompetent trauma population that were successfully treated guided by antimicrobial susceptibilities.

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