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Pseudomonas oleovorans Sepsis in a Child: The First Reported Case in India

Lipika Gautam¹, Ramanpreet Kaur², Sunil Kumar², Arun Bansal³, Vikas Gautam^{2*}, Meenu Singh³, and Pallab Ray²

¹Department of Medical Microbiology, Government Medical College and Hospital (GMCH); ²Department of Medical Microbiology; and ³Department of Pediatrics, Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh, India.

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The members of the genus *Pseudomonas* are known opportunistic pathogens, and *Pseudomonas aeruginosa* is a notorious pathogen with protean manifestations (1). On the basis of 16S rRNA analysis, pseudomonads have been reorganized under various groups, each with several species. *Pseudomonas oleovorans* was first described by Lee and Chandler in 1941 (2) and taxonomically, it belongs to 16S rRNA group I (*P. aeruginosa* group). *P. oleovorans* is an environmental isolate rarely detected in clinical specimens. Gilardi in 1972 (3) reported the identification of this organism from many clinical specimens, but it was not considered pathogenic in any of these instances. Herein, we report a case of septicemia due to *P. oleovorans* in a patient with disseminated staphylococcal infection who was on prolonged mechanical ventilation.

In this case study, an 11-year-old girl was admitted to a pediatric emergency unit of a super-specialty tertiary care hospital with a 4-day history of swelling in the right gluteal region, fever, and respiratory distress. The patient also developed a small pustule in the right gluteal region that reached a size of 8 × 8 cm. The swelling was warm, tender, indurated and associated with pus discharge. Pus was collected after pustule incision and drainage, and the culture of the pus revealed methicillin-sensitive *Staphylococcus aureus* (MSSA). The patient developed signs and symptoms of sepsis and hypovolemic shock, with a heart rate of 160/min, respiratory rate of 40/min, and blood pressure of 90/50 mmHg, and she received hemodynamic support. Subsequently, she developed tachypnea and respiratory distress with bilateral crepts. There was decreased air entry on the right side of the chest and bronchial breathing. A chest radiograph revealed consolidation in the right and left lower lobes evident of right-sided pneumothorax and bilateral pneumonia. Blood culture was performed using the BACTEC 9240 system (Becton-Dickinson, NJ, USA) and revealed the presence of MSSA. Therefore, the patient was diagnosed with disseminated staphylococcal sepsis and was started on intravenous amikacin (400 mg once, daily), cloxacillin (1.2 g every 6 h), and rifampicin (200 mg once, daily). After 2 days of treatment, the patient continued to have fever, and a second blood sample was collected and cultured, revealing non-fermenting gram-negative bacilli

(NFGNB) with dry edges on blood agar and MacConkey agar. A third blood culture performed after 24 h revealed growth of morphologically identical, cytochrome oxidase-positive, and motile NFGNB. Biochemically, the culture was inert and did not produce acid from glucose. The organism was cultured at 42°C, hydrolyzed arginine, and reduced nitrates to nitrite. Negative test results were obtained for the production of lysine decarboxylase, ornithine decarboxylase, urease, and esculin. Furthermore, the isolate did not show the characteristic pigmentation or odor of *P. aeruginosa* (4).

Subsequently, the identification of the isolate was based on the protein profile using Matrix Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry (MALDI-TOF MS, Bruker Daltonics, Germany). Spectra were analyzed using MALDI Biotyper 3, and the isolate was identified as *P. oleovorans* with a high score of 2.2. Because it is a rarely isolated pathogen, its identification was confirmed by 16S rRNA gene sequencing (5). DNA extraction was performed using QIAamp DNA mini kit (Qiagen, Hilden, Germany) and the isolate was identified as *P. oleovorans*. Antimicrobial sensitivity testing was performed using the Kirby-Bauer disk diffusion method as per Clinical and Laboratory Standards Institute guidelines. The strain was found to be sensitive to ceftazidime, amikacin, piperacillin-tazobactam, and colistin, and resistant to tetracycline, levofloxacin, ciprofloxacin, and cotrimoxazole. The patient was started on ceftazidime (1 g i/v every 8 h) along with early antibiotic therapy for MSSA. Blood culture performed after 5 days of therapy was negative. The patient received intravenous ceftazidime and cloxacillin for 3 weeks; she was then shifted to oral cloxacillin (250 mg every 6 h). The patient made an uncomplicated recovery and was subsequently discharged after 4 weeks of admission.

P. oleovorans is an environmental isolate and has rarely been reported as a pathogen particularly in individuals with comorbidities and immunosuppression. More than four decades ago, Cowlishaw et al. (6) reported the first case of *P. oleovorans* meningitis in an 8-month-old infant who had contracted whooping cough at 4 months of age, followed by a chronic persistent cough; the infant received courses of antibiotic therapy. She survived after treatment with ampicillin, gentamicin, and chloramphenicol. Another case of peritoneal dialysis-associated peritonitis was recently reported by Hage et al. (7) in a 29-year-old woman with sickle-cell trait and end-stage renal disease. This patient made a significant recovery after treatment with parenteral meropenem and remained on continuous ambula-

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*Corresponding author: Mailing address: Department of Medical Microbiology PGIMER, Chandigarh, 160012, India. Fax: 91-17-227-55155, Email: r_vg@yahoo.co.uk

tory dialysis for more than a year without further complications. The present case involved sepsis due to *P. oleovorans* in a child with disseminated staphylococcal infection. The infection could have been nosocomially acquired because the child was on mechanical ventilation for a long period (8 days), and she was a candidate for opportunistic infection considering the disseminated infection, and compromised host defense mechanisms. When such patients are intubated, the risk of aspiration increases and can lead to invasive diseases. Furthermore, the repeated isolation of *P. oleovorans* from her blood samples along with the response to treatment indicated that this organism was the cause of septicemia. However, the exact source of infection due to *P. oleovorans* could not be traced because of the lack of inspection of hospital equipment and environmental surveillance.

We emphasize that *P. oleovorans* may be an important emerging non-*P. aeruginosa* pseudomonad or alternatively an under-diagnosed pathogen in patients maintained on long-term ventilator support. This organism is biochemically indistinguishable from non-pigment producing strains (up to 10%) of *P. aeruginosa* (1), further limiting its identification. Moreover, *P. oleovorans* imposes a problem with regard to conventional identification because most of the biochemical reactions are negative and only fructose is oxidized. *P. oleovorans* has been long known to be important in industrial microbiology. The present study, along with two earlier studies, shows its potential as a human pathogen. The small number of isolates precludes the characterization of the susceptibility profile of this pathogen. In addition, its phenotype is distinct from that of *P. aeruginosa*, and the rough and dry colonies can easily be mistaken for a contaminant microorganism unless efforts are made to identify them. The identified strain was susceptible to third generation cephalosporins. However, an environmental isolate containing *bla*_{VIM-2} has been recently reported to be associated with the generation of resistance mechanisms (8). Similar to the other members of the genus *Pseudomonas*, high-level antibiotic resistance mechanisms may exist in *P. oleovorans*. Although this organism was found to be susceptible to amikacin, it was isolated after amikacin therapy probably because of in-vitro and in-vivo disparity. Some non-fermenters, including the *Burkholderia cepacia* complex, have intrinsic resistance to aminoglycosides because of the lack of a self-promoted uptake system responsible for the permeability of these antibiotics. Although this uptake system is present in *P. aer-*

uginosa, it has not been studied in *P. oleovorans*. We believe that it may be responsible for this disparity (9).

The possibility of recovering this opportunistic pathogen should be considered if predisposing factors such as mechanical ventilation exist. Microbiologists and clinicians should be aware of emerging pathogenic species of *Pseudomonas*, and these clinical conditions may predispose the patients to bacterial infections; therefore, antibiotic susceptibility patterns should be addressed to provide a directed antibiotic therapy and avoid unnecessary antibiotic usage and the emergence of resistance. These environmental or opportunistic microbes can also serve as efficient agents of transfer of resistance to other *Pseudomonas* strains via horizontal gene transfer. Gene transfer has been well studied in *P. putida*, and a similar mechanism may be present in *P. oleovorans*. Therefore, the proper identification of these organisms is essential (10,11).

Conflict of interest None to declare.

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