Case study

Pseudomonas mosselli: A case series on its potential as a rare opportunistic pathogen in immunocompromised patients

Abstract

Background

Pseudomonas mosselli is a Gram negative, rod-shaped, aerobic, non-sporing and motile bacterium co-existing in the soil with plants, protecting them from fungal and bacterial infections by producing diverse molecules and causing rare opportunistic infections in immunocompromised hosts. Most common presentations of respiratory infection caused by this isolate include fever, respiratory distress and purulent cough. Satisfactory antibiotic coverage and early diagnosis mostly leads to complete recovery of the patient.

Cases

Three cases have been included in our case series of which case 1 had type 2 diabetes mellitus, chronic kidney disease and hypertension and was also diagnosed SARS- CoV-2 positive by RT-PCR (Real time polymerase chain reaction), case 2 had Takosubo cardiomyopathy, an immunological disorder with impending heart failure and case 3 suffered from advanced renal failure due to rapidly progressive glomerulonephritis on weekly dialysis and steroid therapy. *Pseudomonas mosselii* from the respiratory samples of the patients admitted to a tertiary care centre were identified by the culture characteristics, biochemical reactions and species identification, performed by Matrix assisted laser desorption / ionization- time of flight- mass spectrometry (MALDI-TOF-MS).

Conclusion

Pseudomonas mosselii causes opportunistic infections in immunocompromised patients. Respiratory infections caused by it are highly drug susceptible and can be easily overcome by administration of appropriate antibiotic treatment followed by antibiotic susceptibility testing.

Keywords: *Pseudomonas aeruginosa, Pseudomonas putida, Pseudomonas mosselii,* Matrix assisted laser desorption / ionization- time of flight- mass spectrometry (MALDI-TOF-MS)

Introduction

Pseudomonas genus forms a group of Gram-negative, rod shaped, aerobic, non-sporing and motile bacteria [1]. They can survive in varying environments, varying from aquatic to terrestrial ecosystem to eukaryotic tissues. Varying physiological and metabolic activities are displayed by members of this genus against pathogens [2, 3]. *Pseudomonas mosselii* is a soil pathogen that protects plants from fungal and bacterial infections through production of varying metabolites and was first clinically isolated in France and deemed an opportunistic human pathogen [4, 5]. It was placed in *Pseudomonas putida* group by virtue of 16S rRNA analysis [6]. Dabboussi et al. (2002) described *P. mosselii* as a novel specie in 2002 due to low level DNA–DNA relatedness to other *Pseudomonas* strains, they used polyphasic taxonomic approach including 16S rDNA phylogeny, numerical analysis, DNA–DNA hybridization, thermal stability of DNA–DNA hybrids and siderotyping methodology to examine strains of *Pseudomonas fluorescens*, *Pseudomonas putida* and other *Pseudomonas species* to confirm it [4]. We present three cases of immunocompromised patients with respiratory distress of which case 1 tested positive for COVID-19 and suffered from severe covid pneumonia followed by secondary bacterial infection, case 2 suffered from Takosubo cardiomyopathy and impending heart failure and case 3 was a

known case of advanced renal failure due to glomerulonephritis. These patients' sputum samples revealed growth of a rare *Pseudomonas species* that were confirmed as *Pseudomonas mosselii* by Matrix assisted laser desorption/ionization- Time of flight- Mass spectrometry (MALDI-TOF MS).

Case reports

Case 1

A 74 year old male, case of type-2 diabetes mellitus, chronic kidney disease and hypertension, presented to a covid testing facility with chief complains of fever, sore throat and myalgia for a week. He tested positive for SARS-CoV-2 and was admitted to a covid facility at a tertiary care center on 19th April 2021, where he was administered steroids, oxygen therapy and other broad spectrum antibiotics despite which he developed moderate COVID-19 pneumonia. Being a chronic kidney disease patient, he needed regular haemodialysis sessions and was referred to the haemodialysis unit dedicated for covid 19 patients after 12 days of admission. His cough and respiratory distress was not relieved so a sputum sample was sent to the bacteriology section of the department of microbiology and a Grams' stained smear and culture was put up for the same on Mackonkey and blood agar. On Grams' stained smear, few epithelial cells, plenty pus cells and Gram negative bacilli were observed and the next day culture on Mackonkey agar showed non-lactose fermenting colonies with a fruity odour and blood agar showed transparent to grey colonies with haemolysis and was oxidase positive, suggestive of *Pseudomonas species*. The colonies were subjected to species identification by Matrix assisted laser desorption / ionization-time of flight- mass spectrometry (MALDI-TOF-MS) and were identified as *Pseudomonas mosselli*. When antibiotic sensitivity testing was performed by Kirby- Bauer disc diffusion method after preparing a McFarland of 10^5 microorganisms, it showed sensitivity to Amikacin,

Ceftazidime, Imipenem and Piperacillin-Tazobactam. The patient was started on Ceftazidime and his symptoms were relieved within 3 days.

Case 2

A 22 year old female, suffering from Takosubo cardiomyopathy with impending heart failure, presented to the department of emergency medicine on 22nd August 2021, with chief complains of on and off fever for two weeks which subsided with administration of oral antipyretics, productive cough and respiratory distress for 10 days and generalised edema for a week. She was managed conservatively and Bi-level positive air pressure (BIPAP) was used for respiratory distress, cause of chest pain could not be ruled out, she also presented with lower gastrointestinal bleed, joint pains, rashes and one unit blood was also transfused. On examination, she had pallor, cyanosis, clubbing and prominent edema. Her pulse rate was raised ranging from 120-130 per minute and respiratory rate was raised to 32 per minute with bilateral basal crepts. A COVID-19 Real Time- Polymerase Chain Reaction (RT-PCR) was performed owing to her symptoms but turned out to be negative. All other routine blood and radiological investigations were performed and a sputum sample was sent to the bacteriology section of the department of microbiology. Microscopic examination of the sample showed plenty pus cells and few long and thin gram negative bacilli, next day oxidase positive, translucent colonies were observed on blood agar surrounded by a zone of haemolysis, suggestive of *Pseudomonas species*. On MALDI-TOF-MS, the colonies were identified to be those of *Pseudomonas mosselli*. When antibiotic sensitivity testing was performed by Kirby- Bauer disc diffusion method, the microorganism showed sensitivity to Amikacin, Ceftazidime, Cefoperazone- Sulbactum, Imipenem and Piperacillin-Tazobactam. Adequate antibiotics were administered after sensitivity and her fever subsided

gradually over the course of 48 hours and respiratory symptoms where alleviated in 5 days of time.

Case 3

A 37 year old male, case of advanced renal failure presented to the department of Nephrology with chief complaints of edema, hypertension and active urinary sediments for a week and was admitted to the general ward on 8th October 2021. A kidney biopsy performed on admission, diagnosed him of having rapidly progressing glomerulonephritis (RPGN) and weekly dialysis was advised. Steroids were administered as histopathology reported IgA nephropathy. His total leukocyte count was around 22,000 cells/ cubic mm, suggestive of infection. He was advised to start Oseltamivir prophylaxis as a neighboring patient tested positive for H1N1 swine flu infection during course of hospital stay. After 10 days, he developed fever, respiratory distress and dry cough; but he tested negative for HINI swine flu. His sputum sample was sent for bacteriological culture and microscopy. Microscopic examination of the sputum sample showed moderate pus cells and few long and thin gram negative bacilli, next day oxidase positive, translucent colonies were observed on blood agar surrounded by a zone of haemolysis, suggestive of *Pseudomonas species*. On MALDI-TOF-MS, the colonies were identified as *Pseudomonas mosselli*. On antibiotic sensitivity testing by Kirby- Bauer disc diffusion method, it was sensitive to Amikacin, Ceftazidime, Cefoperazone- Sulbactum, Imipenem, meropenem and Piperacillin-Tazobactam. After clinicians had started empirical antibiotics, his fever and respiratory symptoms were alleviated in 3 days of time. On discharge, he was advised to take oral Cefuroxime Axetil 500 mg tables, twice a day for 5 days, steam inhalation and advised follow up in outpatient department after two weeks.

Discussion

P. mosselii can be detected in the rhizospheric soil deeming it an environmental species [7, 8] and causes opportunistic infections in human. In our knowledge, only one case of *P. mosselii* has been reported to cause a prosthetic valve endocarditis [9]. Similarly rare *Pseudomonad* species from unknown natural sources act as opportunistic pathogens which mostly play a role as shuttles for acquired metallo- beta- lactamase (MBL) genes.

Rarely *Pseudomonad* isolates like *Pseudomonas mosselli* are isolated from clinical samples other than *Pseudomonas aeruginosa*. Dabboussi et al described it as a novel species in 2002 due to low level of DNA–DNA relatedness to other *Pseudomonas* strains [4].

Before classifying *Pseudomonas mosselii* as a separate species, these strains have most likely been misidentified as *Pseudomonas fluorescens*; which has been reported to cause respiratory infections and has been identified in human bronchoalveolar lavage fuid (BALF), sputum specimens or throat swabs but its previously suspected role in pneumonia pathogenesis is unclear [10-13]. However, clinical characteristics and antibiotic susceptibility pattern of *Pseudomonas fluorescens* and *P. mosselii* pneumonia have rarely been reported [12]. In our case reports, the possible source of infection of the bacteria in the hospital setting could either be soil contaminated hands of the health care workers or through contaminated water supply. Among all our cases, empirical treatment had already been started by the clinician before sending the sputum samples for culture and antibiotic sensitivity testing. Among the cases discussed, case 1 was positive for SARs-COV-2, receiving steroid therapy due to severe COVID pneumonia; type-2 diabetes mellitus, chronic kidney disease and hypertension, owing to severe immunosuppression may be a cause for succumbing to an opportunistic infection by

Pseudomonas mosselli after two weeks of hospitalization, the patient was empirically started on moxifloxacin and levofloxacin, as mentioned in Table 1, without sending a sample for culture or referring to the antibiogram which showed susceptibility to Ceftazidime, imipenem, meropenem and amikacin, thus an inappropriate drug regimen could not contain the infection and further starting ceftazidime led to relief of symptoms. However, case 2 was a Takosubo cardiomyopathy patient with impending heart failure having a presentation similar to that of an infectious disease in a young female who developed respiratory distress with pulmonary edema and purulent cough, sputum culture revealed growth of *Pseudomonas mosselli* after four days of hospitalization. He was already started on Levofloxacin (Table 1) on admission but due to timely communication with the clinicians our case was discharged after starting ceftazidime according to antibiotic susceptibility testing and was advised for follow up after two weeks. Case 3 was a patient of rapid progressive glomerulonephritis on weekly dialysis and steroid therapy, who developed respiratory distress during the course of hospital stay, the sputum culture revealed growth of *Pseudomonas mosselli* after two weeks of hospitalization. The clinicians had started amoxicillin-clavulinic acid, ceftazidime and cotrimoxazole prophylaxis (Table 1) not waiting for antibiotic sensitivity testing which further showed susceptibility to ceftazidime, suspecting an opportunistic infection.

Conclusion

Pseudomonas mosselii causes opportunistic infections in immunocompromised patients. Although, the infection caused by this isolate is less virulent in comparison to *Pseudomonas aeruginosa*, it causes enough morbidity to already immunocompromised patients. The respiratory infection can thus be easily overcome by administration of appropriate antibiotic treatment followed by antibiotic susceptibility testing.

References

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Table 1. Cases of *Pseudomonas mosselli* isolated from respiratory samples of patients admitted to a tertiary care center in Northern India

Case	Age /Sex	Underlying condition	Infecting organism	Culture specimen	Procalciton in assay	Treatment before antibiotic sensitivity testing	Outcome
1	74/M	Type 2 Diabetes mellitus	*Pseudomonas mosselli*	Sputum	0.16	Moxifloxacin and Ciprofloxacin	Alive
2	22/F	Takosubo cardiomyopathy	*Pseudomonas mosselli*	Sputum	63.60	Levofloxacin	Alive
3	37/M	Advanced renal failure on dialysis, Hypertension	*Pseudomonas mosselli*	Sputum	3.93	Amoxicillin-clavulinic acid, Ceftriaxzone and Cotrimoxazole	Alive