

Case Report

## *Serratia marcescens* Diabetic Foot: A Case Report and Review of Literature

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### ABSTRACT

**Introduction-** *Serratia marcescens* is a gram negative bacilli which was not recognised as a pathogen until the 1960's. It has been observed to be increasingly associated with nosocomial and opportunistic infections. This case report highlights the increased predisposition of a diabetic patient to *Serratia* infection while hospitalisation.

**Case History-** A 56 year old, female patient with a history of Diabetes mellitus type II for the past 20 years was admitted to a tertiary care hospital with the complaints of wound on the dorsum of the right foot along with discharge of pus, redness of the foot and decreased mobility for 10 days. Pathological and biochemistry examination of the blood was done along with collection of two pus swabs were collected and processed by standard microbiological procedures to identify the bacterial isolate to be *Serratia marcescens*. Antimicrobial susceptibility testing was performed and the multidrug resistant isolate was found to be susceptible to carbapenems. Patient was successfully treated using imipenem intravascular infusion.

**Conclusion-** In conclusion, infections in immunocompromised patients with underlying chronic comorbidities with history of hospitalization must be diagnosed with high index of suspicion of *Serratia* owing to its underlying characteristic of non-pigment production in pathogenic hospital acquired strains. Owing to the multidrug resistance and intrinsic AmpC production of *Serratia*, such infections must be promptly recognised and appropriately treated based on multidisciplinary treatment approach aiming at a good patient outcome.

**Key words-** *Serratia marcescens*, Diabetic foot, Opportunistic Infection, ESBL, AmpC

### INTRODUCTION

*Serratia marcescens* is a gram negative bacilli which was not recognised as a pathogen until the 1960's. [1] It is a member of the family Enterobacteriaceae. It possesses a characteristic red pigment which was previously used as a biological marker. [2] It has been observed to be increasingly associated with nosocomial and opportunistic infections. [2] A predisposition to *Serratia* infections has been observed due to surgery, renal failure, prior antimicrobial usage, immunocompromised status,

indwelling catheterization and underlying chronic debilitating diseases such as diabetes. [3]

Diabetic foot is a dreadful complication of Diabetes mellitus. It is a neuropathy which leads to decreased quality of life and increased morbidity. This may even lead to the loss of a limb in chronic untreated cases. [4] This case report highlights the increased predisposition of a diabetic patient to *Serratia* infection while hospitalisation.

## CASE HISTORY

A 56 year old, female patient with a history of Diabetes mellitus type II for the past 20 years was admitted to a tertiary care hospital with the complaints of wound on the dorsum of the right foot along with discharge of pus, redness of the foot and decreased mobility for 10 days. On examination, the foot was tender, warm and had a significant swelling along with an ulcer. The patient had a history of prior hospitalisation for similar complaints 2 months back when she noticed an ulcerated lesion on the toes and underwent amputation of the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> toe. The patient was a known case of Diabetes mellitus type II and hypertension since the last 20 years and on irregular medication.

Blood examinations revealed haemoglobin levels of 10.5g/dl, total leucocyte count of 8600/mm<sup>3</sup> and differential leucocyte count of 66/30/02/02/0 (neutrophils/ lymphocytes/ monocytes/eosinophils/basophils). The platelet count was found to be 2.86 lac/mm<sup>3</sup>. The bleeding time and clotting time were 2 minutes 10 seconds and 4 minutes 50 seconds respectively.

The glycosylated hemoglobin levels (HbA1C) was 9.8% indicating a fair to poor control of diabetes. The serum urea levels were 42mg/dl, serum creatinine levels were 1mg/dl, serum uric acid level was 6.2 mg/dl, total serum bilirubin was found to be 0.71 mg/dl, SGOT of 34 IU/L, SGPT 39.1IU/L and Serum alkaline phosphatase 98IU/L. the Serum sodium levels were 136mmol/L and Serum potassium levels

were 5.1mmol/L. The fasting blood sugar level was found to be 286mg/dl. Urine ketones were found to be negative. Wound debridement of the wound on the dorsum of the foot was done and two pus swabs were collected. The swabs were processed using standard microbiological procedures. [5]

Direct gram staining was performed from one swab which showed the presence of 3-4 polymorphonuclear cells per oil immersion field along with a few gram negative bacilli. The other swab was inoculated on nutrient agar, nutrient broth, 5% sheep blood agar and MacConkey's agar. They were incubated aerobically at 37C for 24 hours. After 24 hours, the nutrient agar plate showed large red moist colonies, the 5% blood agar plate showed red, opaque and moist colonies with no haemolysis while the MacConkey agar showed the growth of late lactose fermenting red coloured colonies which were opaque and moist. Gram staining was performed from the colonies which showed gram negative bacilli. Biochemical identification tests including triple sugar iron, Simmons citrate utilization test, Methyl red test, Voges Proskauer, indole and gelatin liquefaction tests were used to identify the organism as *Serratia marcescens*. The patient was treated using IV antibiotic sulbactam cefoperazone empirically and the blood sugar levels were closely monitored. A repeat sample of pus was sent 3 days after starting the patient empirically on sulbactam cefoperazone from which same organism was isolated with similar antimicrobial resistance pattern.



Picture1- Showing Antimicrobial sensitivity testing of *Serratia marcescens* using Kirby Bauer disc diffusion method.

Interpretation- Sensitive to Ciprofloxacin, Chloramphenicol, Imipenem, Meropenem, Aztreonam, Tigecycline and Tetracycline. Resistant to Ampicillin, Amikacin, Ceftazidime, Sulbactam, Ceftazidime and Cefoxitin.

Antimicrobial susceptibility testing was performed using antimicrobial discs of ampicillin, ciprofloxacin, ceftazidime, sulbactam ceftazidime, chloramphenicol, cefoxitin, amikacin, imipenem, meropenem, tigecycline, tetracycline and aztreonam. The antimicrobial susceptibility testing was interpreted using recent CLSI guidelines. [6]

Furthermore, Extended Spectrum Beta Lactamase production was tested by using CLSI disc diffusion method. Amp C detection was done using Amp C disc test.



Picture 2- Showing Extended Spectrum beta lactamase production using CLSI disc diffusion method and Amp C production by Amp C disc test showing heart shaped distortion.

Interpretation- The strain was resistant to Ceftazidime, Ceftazidime Clavulanate and Cefotaxime, Cefotaxime Clavulanate. The strain was confirmed to be AmpC producer.

The patient was then treated using IV antibiotic imipenem based on the results of antimicrobial susceptibility testing report and the blood sugar levels were controlled as well. The patient's condition improved and then she was shifted to oral antibiotics and discharged.

## DISCUSSION

*Serratia marcescens* was initially known as *Chromobacterium prodigiosum*. [2] It is distinctively recognised by the production of red pigment, prodigiosin; while it has been documented that most human pathogenic strains of *Serratia* do not produce the pigment. It is a non-lactose fermenting gram negative bacillus which is common inhabitant of various environmental sites including water, soil, plants and animals but is not a part of commensal flora in human beings therefore, most of the infections by *Serratia* are considered to be exogenously acquired. It is most commonly associated with medical exposure and hospital acquired infections. [7]

Furthermore, a predisposition to infection by *Serratia* has been observed in patients with underlying co-morbidities such as diabetes mellitus, immunocompromised state, chronic diseases, prolonged

antimicrobial therapy and hospitalization. The source of infection might be ulceration causing break of skin integrity, trauma or previous surgical site. In our case the predisposing factor was use of antimicrobial agents to which the organism was resistant, prolonged hospitalization, underlying history of poorly controlled diabetes and a diabetic foot ulcer.

Similar to other members of the family Enterobacteriaceae, *Serratia* also acquires resistance to various antimicrobial agents. Hospital acquired strains are often found to be AmpC producers and are difficult to treat. The strain obtained in this case was tested for the production of Extended Spectrum Beta Lactamase as per the CLSI guidelines by using the discs of ceftazidime, cefotaxime, ceftazidime clavulanate and cefotaxime clavulanate. [6] The strain was found to be resistant to all four of them on Kirby Bauers disc diffusion method. Then after, the strain was tested for the production of AmpC by using a disc of cefoxitin, 3-dimensional test and AmpC disc test. The results of all the three tests proved the AmpC production in this strain. Modified Hodge test was put up to check for the production of carbapenemase and was found to be negative. The results of

antimicrobial susceptibility testing showed sensitivity to ciprofloxacin, chloramphenicol, imipenem, meropenem, aztreonam, tigecycline and tetracycline. Ania et al have also reported carbapenems as the drug of choice for the treatment of *Serratia* infections. [8]

## CONCLUSION

In conclusion, infections in immunocompromised patients with underlying chronic co-morbidities with history of hospitalization must be diagnosed with high index of suspicion of *Serratia* owing to its underlying characteristic of non-pigment production in pathogenic hospital acquired strains. Owing to the multidrug resistance and intrinsic AmpC production of *Serratia*, such infections must be promptly recognised and appropriately treated based on multidisciplinary treatment approach aiming at a good patient outcome.

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