Journal of Scientific and Innovative Research 2014; 3(5): 478-481
Available online at: www.jsirjournal.com

Research Article

ISSN 2320-4818
JSIR 2014; 3(5): 478-481

Received: 19-09-2014
Accepted: 20-10-2014

Rajesh Kamtikar
MS General surgery, Assistant professor, Department of Surgery, Bidar Institute of Medical Sciences, Bidar, 585401, India

Nagaraj Mitra
MS General surgery, Senior resident, Department of Surgery, Bidar Institute of Medical Sciences, Bidar, 585401, India

Correspondence:
Dr. Rajesh Kamtikar
MS General surgery, Assistant professor, Department of Surgery, Bidar Institute of Medical Sciences, Bidar, 585401, India
E-mail: tegn@rediffmail.com

Clinico microbiological profile of *Pseudomonas aeruginosa* isolated from diabetic foot ulcer

Rajesh Kamtikar, Nagaraj Mitra*

Abstract

Diabetes mellitus is a major health problem, rapidly expanding worldwide. In India, it is projected that around 80 million will be affected by DM. Asia contributes to >60% of the world's population with diabetes, of which two nations; India and China contribute the largest. In developing countries like India, diabetic foot ulcerations and infections are one of the most common causes of hospitalization and often resulting in amputation, osteomyelitis, mortality and morbidity. Infection is most often a consequence of foot ulceration, which typically follows trauma to a neuropathic foot. The present study was conducted to know the prevalence and sensitivity pattern of *P. aeruginosa* from diabetic foot infections and to assess their susceptibility to the commonly used antibiotics. This was a retrospective study conducted at a tertiary care hospital in South India conducted from January 2013 to August 2013. Culture materials from all the wounds were obtained, either by washing the wound with sterile physiological saline and then making a puncture-aspiration from the base of the wound or by applying a sterile cotton swab to the wound. A total of 77 patients were included in the study. 104 bacteria were isolated from 77 patients. Out of 104 bacteria, 39 (37.5%) were *P. aeruginosa*. Infection was polymicrobial is some cases and Gram negative bacteria were the most common organisms isolated. *P. aeruginosa* showed resistnce to most commonly used antibiotics, highest resistance was seen with Ciprofloxacin and Ofloxacin and least with Aztreonam an Imipenem. Other studies have reported similar findings. The major concern is emergence of resistance to third and fourth generation of Cephalosporins and even more alarming is Carbapenem resistance surfacing nowadays. The increasing prevalence of multi drug resistance in *P. aeruginosa* is a cause for concern. The selection of the antibiotic treatment should be based on the predominant organisms which are isolated and their antimicrobial susceptibility patterns.

Keywords: Diabetic foot infection, Gram neative organism, *Pseudomonas aeruginosa*, Antibiogram.

Introduction

Diabetes mellitus (DM) is a major health problem, rapidly expanding worldwide.[1] In India, it is projected that around 80 million will be affected by DM.[1] Asia contributes to >60% of world's population with diabetes[2] of which two nations; India and China contribute the largest. In developing countries like India, diabetic foot ulcerations and infections are one of the most common causes of hospitalization and often resulting in amputation, osteomyelitis, mortality and morbidity.[3-6] Lifetime risk of a person with diabetes for developing a foot ulcer could be up to 25%.[7]

Infection is most often a consequence of foot ulceration, which typically follows trauma to a neuropathic foot.[8] Diabetes associated problems are the second most common cause of lower limb amputations in India.[7] In recent years, there has been an increase in the incidence of multidrug resistant organisms, which could increase the duration of the hospital stay, the cost, and the morbidity and the mortality.[9] Most of the diabetic foot infections (DFIs) are polymicrobial in nature and the organisms isolated are frequently mixed organisms.[10-12] But the spectrum of organisms depends on other factors such as microbial flora of the lower limb, metabolic factors, foot hygiene and the use of antibiotics.[12]

Material and Methods

Subjects: This was a retrospective study conducted in a tertiary care hospital in South India conducted from January 2013 to August 2013. A DFU was defined as a full-thickness wound below the ankle in a diabetic patient, irrespective of duration.[15] The extent of the infection on admission was assessed based on Wagner's classification.[16]

Processing of specimens: Superficial ulcers of Wagner's grade 1, were excluded from the study in order to eliminate the possibility of isolating colonizing bacteria. Culture materials from all the wounds were obtained, either by washing the wound with sterile physiological saline and then making a puncture-aspiration from the base of the wound or by applying a sterile cotton swab to the wound.[19]

The isolation and identification was carried out by the procedures suggested by Valentina and Lalitha.[17] Antibiogram was performed using Kirby-Bauer method, as recommended by the Clinical and Laboratory Standard Institute.[18] The following antibiotics were used- Piperacillin (100 µg), Piperacillin+tazobactum (100/10 µg), Ciprofloxacin (5 µg), Ofloxacin (5 µg), Ceftazidime (30 µg), Cefotaxime (30 µg), Cefoperozone (75 µg), Amikacin (30 µg), Aztreonam (30 µg) and Imipenem (10 µg) (Hi-Media, Mumbai). *P. aeruginosa* ATCC 27853 was used as the control strain.

Results

A total of 77 patients were included in the study. 104 bacteria were isolated from 77 patients. Out of 104 bacteria, 39 (37.5%) were *P. aeruginosa*. The demographic data of the patients is shown in table 1.

Table 1: Characteristics of diabetic foot specimens

Variable	Frequency (%)
Age(mean± SD)	52.12±9.2
Male	52 (67.5%)
Female	25 (32.4%)
Duration of diabetes mellitus	
>2 years	63 (81.8%)
< 2 years	14 (18.1%)
Diabetic medication	
Oral antidiabetic	39 (50.6%)
Insulin	24 (31.1%)
Oral antidiabetic+insulin	14 (18.1%)
Duration of foot infections	
>30 days	41 (53.2%)
<30 days	36 (46.7%)
History of amputation	
Present	12 (15.5%)
Absent	65 (84.4%)
Wagner's classification	
WI	0 (0)
WII	7 (9.09%)
WIII	32 (41.5%)
WIV	20 (25.9%)
WV	18 (23.3%)

The characteristics of diabetic foot specimens is shown in table 2

Table 2: Characteristics of diabetic foot specimens

Variable	Frequency (%)
Total number of specimens	77
Total number of bacteria isolated	104
No of patients with positive culture	68 (88.3)
No of positive cultures with	
One isolate	68 (88.3)
Two isolates	23 (29.8)
Three isolates	12 (15.5)
Gram positive bacteria	38 (36.5)
Gram negative bacteria	66 (63.4)

Infection was polymicrobial is some cases and Gram negative bacteria were the most common organisms isolated. Among the Gram negative bacteria 39 were *P. aeruginosa*. The antibiogram of *P. aeruginosa* is shown in table 3.

Table 3: Antibiogram of *P. aeruginosa* (% resistance)

Antibiotic	Number	Percentage
Piperacillin	25	64.1
Piperacillin+tazobactum	5	12.8
Ciprofloxacin	31	79.4
Ofloxacin	29	74.5
Ceftazidime	24	61.5
Cefotaxime	15	38.4
Cefoperozone	20	51.2
Amikacin	25	64.1
Aztreonam	2	5. 1
Imipenem	0	0

Discussion

This study presents a comprehensive clinical and microbiological profile of infected diabetic foot ulcers. With the rise in the prevalence of diabetes mellitus there is increasing problem of infections among diabetic patients especially the diabetic foot infection which according to some studies accounts for 20% of hospital admissions.[19] Patterns of microbial infection are not consistent in patients with diabetic foot infections and therefore repeated evaluation of microbial characteristics and their antibiotic sensitivity is necessary for selection of appropriate antibiotics. Complications usually begin with an unrecognized foot ulcer in a patient with an insensate foot which gets infected, leading to significant morbidity and lower extremity amputations.[20]

A Total of 68 patients were infected with one microorganism and polymicrobial infections were present in 35 patients. Other studies poly microbial infection in the wounds was reported as high as 83.8% and 64.4% respectively.[14, 21] This difference could be due to different demographic characteristics, local pattern of antibiotic usage, absence of severe and deep wounds and the low virulence of micro-organisms isolated in our study. In our study,

Gram negative organism was the predominant pathogens which were in accordance with the findings of the study.[9, 14, 22] While other studies have found Gram positive organisms to be the predominant pathogens.[11, 13] This difference might be due to the same factors above.

The prevalence of *P. aeruginosa* in the present study was 37.5%. Other studies have reported prevalence ranging from 14 to 18%.[9, 13, 24] *P. aeruginosa* showed resistance to most commonly used antibiotics, highest resistance was seen with Ciprofloxacin and Ofloxacin and least with Aztreonam an Imipenem (table 3). Other studies have reported similar findings.[26, 27] The major concern is emergence of resistance to third‑ and fourth‑generation of cephalosporins and even more alarming is carbapenem‑resistance surfacing nowadays.[26,27] The carbapenems are often considered a "drug of choice" and are increasingly used in empirical therapy.[27] However, recent emergence of resistance to this group of antibiotic leaves little options for treating such life‑threatening infections as seen in our study group.

India has the largest number of diabetic individuals and appreciably poor economic conditions; the study on this intrinsic resistant organism in diabetic foot infections assumes significance. It is known that MDR infections are resistant to several antibiotics, and therefore, they have to be treated with extended spectrum antibiotics for longer durations. The detection of various resistance mechanisms by phenotypic methods are easy to interpret, reproducible, and inexpensive and can be included as routine testing protocol.

Conclusion

The increasing prevalence of multi drug resistance in *P. aeruginosa* is a cause for concern. The selection of the antibiotic treatment should be based on the predominant organisms which are isolated and their antimicrobial susceptibility patterns. Bacterial culture will help in treating the infection at the earliest and prevent from developing further complications like cellulitis. The routine reporting of resistant phenotypes in a target population would allow the surgeons to re‑valuate their empirical therapy polices.

Conflict of interest: None

References

1. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. Diabetes Res Clin Pract 2010;87(1):4–14.

2. Chan JC, Malik V, Jia W, Kadowaki T, Yajnik CS, Yoon KH, et al. Diabetes in Asia: Epidemiology, risk factors, and pathophysiology. JAMA 2009;301:2129-40.

3. Mohammad Z, Abida M, Jamal A. The clinico-bacteriology and the risk factors for diabetic foot infections with multidrug resistant microorganisms in north India. Biology and Medicine 2010; 2(4):22-34.

4. Peleg AY, Weerarathna T, McCarthy JS, Davis TM. Common infections in diabetes: Pathogenesis, management and relationship to glycaemic control. Diabetes Metab Res Rev 2007;23:3-13.

5. Lipsky BA, Tabak YP, Johannes RS, Vo L, Hyde L, Weigelt JA. Skin and soft tissue infections in hospitalized patients with diabetes: Culture isolates and risk factors associated with mortality, length of stay and cost. Diabetologia 2010;53:914-23.

6. Fincke BG, Miller DR, Christiansen CL, Turpin RS. Variation in antibiotic treatment for diabetic patients with serious foot infections: A retrospective observational study. BMC Health Serv Res 2010;10:193.

7. Singh N, Armstrong DG, Lipsky BA. Preventing foot ulcers in patients with diabetes. JAMA 2005;293:217-28.

8. Rao N, Lipsky BA. Optimising antimicrobial therapy in diabetic foot infections. Drugs 2007;67:195-214.

9) Shankar EM, Mohan V, Premalatha G, Srinivasan RS, Usha AR. Bacterial aetiology of diabetic foot infections in south India. Eur J Intern Med 2005;16:567-70.

10. Pathare NA, Bal A, Talalkar GV, Antani DU. Diabetic foot infections: A study of microorganisms associated with the different Wagner Grades. Indian J Pathol Microbiol 1998;41:437-41.

11. Viswanathan V, Jasmine JJ, Snehalatha C, Ramachandran A. Prevalence of pathogens in diabetic foot infection in South India type 2 diabetic patients. J Assoc Physicians India 2002;50:1013-6.

12. Chincholikar DA, Pal RB. Study of fungal and bacteriological infections of the diabetic foot. Indian J Pathol Microbiol 2002;45:15-22.

13) G. Dhanasekaran, N. G. Sastry, and V. Mohan, "Microbial pattern of soft-tissue infections in diabetic patients in South India," Asian Journal of Diabetology 2003;5(6):8-10

14. Citron DM, Goldstein EJC, Merriam VC, Lipsky BA. Bacteriology of moderate to severe diabetic foot infections and invitro activity of antimicrobial agents. J Clin Microbiol 2007;45(9):2819–28.

15. Schaper NC. Diabetic foot ulcer classification system for research purposes: a progress report on criteria for including patients in research studies. Diabetes Metab Res Rev 2004;20(Suppl. 1):S90–5.

16. Wagner FW. The dysvascular foot: asystem of diagnosis and treatment. Foot ankle 1981;2:64-122.

17. G. Valentina andM. K. Lalitha, "Isolation and identification of bacteria from pus (including drainage tube, catheter, ear, eye and genital swabs)," in Mysers, Koshi's Manual of Diagnostic Procedures in Medical Microbiology and Immunology/Serology, R. M. Myers and G. Koshi, Eds., pp. 38–49, CMC, Vellore, India, 1989.

18. Clinical Laboratories Standards Institute (CLSI). Performance of standards for antimicrobial disk susceptibility tests; approved standards. 10th ed. Wayne, PA: CLSI;2009. vol 29. M02-A10.

19. Shankar EM, Mohan V, Premalatha G, Srinivasan RS, Usha AR. Bacterial etiology of diabetic foot infections in South India. European Journal of Internal Medicine 2005;16:567-70.

20. Van Baal JG, Harding KG, Lipsky BA. Foot infections in diabetic patients: an overview of the problem. Clin Infect Dis 2004;39:S71-S72.

21. Anandi C, Alaguraja D, Natarajan V, Ramanathan M, Subramaniam CS, Thulasiram M, et al. Bactriology of diabetic foot lesions. Indian J Med Microbiol 2004;22(3):175-8.

22. Raja NS. Microbiology of the diabetic foot infections in a teaching hospital in Malaysia: a retrospective study of 194 cases. J Microbiol Immunol Infect 2007;40(1):39-44.

23. Sharma VK, Khakda PB, Joshi A, Sharma R. The common pathogens which were isolated from diabetic foot infections in Bir hospital. Kathmandu Univ Med J 2006;4(3):295-301.

24. Sivanmaliappan TS, Sevanan M. Antimicrobial susceptibility patterns of *Pseudomonas aeruginosa* from Diabetes Patients with Foot Ulcers. Int J Microbiol 2011;2011:605195.

25. Shanmugam P, Susan S L. The bacteriology of diabetic foot ulcers, with a special reference to multidrug resistant strains. J Clin Diagn Res 2013;7:441-5.

26. Lee JH, Bae IK, Lee SH. New definitions of extended‐spectrum β‐lactamase conferring worldwide emerging antibiotic resistance. Med Res Rev 2012;32:216‐32.

27. Shahid M, Singhai M, Malik A, et al. In vitro efficacy of ceftriaxone/sulbactam against *Escherichia coli* isolates producing CTX‐M‐15 extended‐spectrum beta‐lactamase. J Antimicrob Chemother 2007;60:187-8.