OPEN ACCESS

GAVIN PUBLISHERS

Journal of Tropical Medicine and Health

Research Article

Babiker RA, et al. J Trop Med Health 3: 140.
DOI: 10.29011/JTMH-140. 000040

Pseudomonas aeruginosa in Diabetic Foot Infections, Gadarif Diabetic Center, Sudan (2017-2018)

Rabie Ali Babiker[1*], Usama A Elsharief[2], Nadia A Mohammed[3]

[1]Department of Medical Microbiology, University of Gadarif, Sudan

[2]Department of Pathology, University of Gadarif, Sudan

[3]Department of histopathology and Cytology, University of kassala, Sudan

[*]**Corresponding author:** Rabie Ali Babiker, Department of Medical Microbiology, University of Gadarif, Sudan. Email: rabie197772@yahoo.com

Citation: Babiker RA, Elsharief UA, Mohammed NA (2019) *Pseudomonas aeruginosa* in Diabetic Foot Infections, Gadarif Diabetic Center, Sudan (2017-2018). J Trop Med Health 3: 140. DOI: 10.29011/JTMH-140. 000040

Received Date: 16 February, 2019; **Accepted Date:** 22 April, 2019; **Published Date:** 29 April, 2019

Abstract

Background: The infection of *Pseudomonas aeruginosa* in Diabetic Foot Infection (DFI), is increasing in Gadarif Diabetic Center, Sudan.

Aims: The objective of this study is to report on the frequency, antibiotic sensitivity of *P. aeruginosa* in patients with diabetic foot infection.

Methods: Prospectively, three hundred and fifteen swabs were obtained from diabetic foot infection wound, collected from diabetic foot infection patients who attended Gadarif Diabetic Center during the years (2017-2018). The isolation and identification of *P. aeruginosa* was done and antimicrobial susceptibility test of commonly used antibiotics (Piperacillin, Ceftazidime, Gentamicin, Ciprofloxacin and Doxycycline) against *P. aeruginosa* was performed.

Results: The present study included 315 bacterial wound swabs, there was 96.30% of bacterial isolates were *P. aruginosa.* The results of antimicrobial susceptibility test were found to be sensitive to Ciprofloxacin (81.84.4%) and followed by Ceftazidime (78.81.3%), piperacillin (69.71.9%), Gentamicin (66. 68.8%) and Doxycycline (12.12.5%).

Conclusion: The study agrees with previous studies in that, *P. aeruginosa* was an important causative agents responsible for diabetic foot infections in Gadarif Diabetic Center. Results of the antimicrobial sensitivity of *P. aeruginosa* isolates against commonly used antibiotics demonstrated the occurrence of resistance to various antipseudomonal agents (Ciproflopxacin, Piperacillin, Ceftazidime and Gentamicin).

Abbreviations:

ATCC	:	American Type Culture Collection
DFI	:	Diabetic Foot Infection
GDC	:	Gadarif Diabetic Centre
MR	:	Methyl Red
NCCLSs: Standards		National Committee for Clinical Laboratory
OF	:	Oxidative/Fermentative
VP	:	Voges-Proskauer

Introduction

P. aeruginosa is an important human opportunistic bacterium in the diabetic foot, it is a Gram-negative aerobic, rod-shaped non-fermenting bacterium with unipolar motility [1]. *P. aeruginosa* is often preliminarily identified by its pearlescent appearance and grape-like [2] or tortilla-like odour *in vitro*.

It can be responsible for a spectrum of presentations from superficial colonization of ulcers to extensive tissue damage, including osteomyelitis, septic arthritis and bacteraemia [3]. Definitive clinical identification of *P. aeruginosa* often includes identifying the production of pyocyanin and fluorescein, as well

as its ability to grow at 42 ˚C [4,5]. *P. aerugenosa* is the most commonly isolated organism from diabetic ulcer [6]. In study from Malaysia culture of 86 diabetic septic foot patients revealed that *P. aeruginosa* (17.5%) [7] Dhanasekaran, et al. reported the prevalence of *Pseudomonas* species to be 18.79% from a diabetic centre in Chennai [8]. Fidelis Mbunda, et al. stated that *P. aeruginosa* (25.5%) was the most frequent gram negative bacteria isolated. *P. aeruginosa* is commonly resistant to antibiotics, and because of this it is a dangerous and dreaded pathogen. 44% of *P. aerugenosa* are multi drug resistant [6]. In the Mueller Hinton agar-based antibiogram resistogram pattern study of *P. aeruginosa* isolated from foot ulcers of diabetes patients, multidrug resistance for about 8 to 11 antibiotics was observed among 55.5% of the strains. No single antibiotic showed 100% sensitivity to all *P. aeruginosa* strains. Resistance was least with cefotaxime (16.6%), followed by an intermediate resistance of 66.7% observed for ciprofloxacin. Ciprofloxacin and cefotaxime were found to be better choices for diabetes patients with foot ulcers in this part of the region when compared to gentamicin, imipenem, piperacillin, and other third-generation cephalosporins [9].The objective of this study is to report on the frequency, antibiotic sensitivity, of *Pseudomonas aeruginosa* in Diabetic Foot Infection (DFI) in Gadarif Diabetics Center (GDC).

Patients and methods

This is a prospective observational analytic hospital based study in which all diabetic foot infections patients were questioned for personal in information, swabbed aseptically during a 2017-2018. The study was conducted in Gadarif Diabetic Center (GDC). Three hundred and fifteen (wound swabs) were collected from diabetic foot infections patients, transferred immediately to the laboratory for bacteriological examination.

Technical methods

Wound swabs were inoculated on three plates of Nutrient agar, MacConkey's agar and blood agar were incubated aerobically at 37 ˚C for 24-48 hours, those which did not show visible growth, were discarded. All plates were examined with the naked eye for colonial morphology, the result of presumptive colony was recorded. Pure growth was used to identify the causative agents. and Gram's stain was done to determine Gram reaction and bacterial morphology. All the isolated bacteria were examined by biochemical tests such as Catalase, MR, VP, indole, citrate, urease, oxidase, (OF) Oxidative/Fermentative test for further identification, the results were recorded.

Antimicrobial sensitivity

The bacterial isolates were subjected to a number of antibiotics by disc diffusion technique (Kirby-Bauer method). And the results were recorded according to National Committee for Clinical Laboratory Standards (NCCLSs), The same procedure was performed to the control organisms, American Type Culture Collection of *P. aeruginosa* (ATCC27853) was used as a standard control strain.

Results

A 315 swabs were obtained from Diabetic foot infections collected from Gadarif Diabetics Center (GDI) during 2017-2018. The swabs were cultured, purified by proper streaking on appropriate selective and differential culture media. The purified cultures of the isolates were then subjected to identification procedures which were based on the cultural characteristic, the microscopical examination and the biochemical characteristics. On the basis of the results of this identification test, it was found that (96; 30%) out of the total samples (315) were *P. aeruginosa*. (Figure 1).

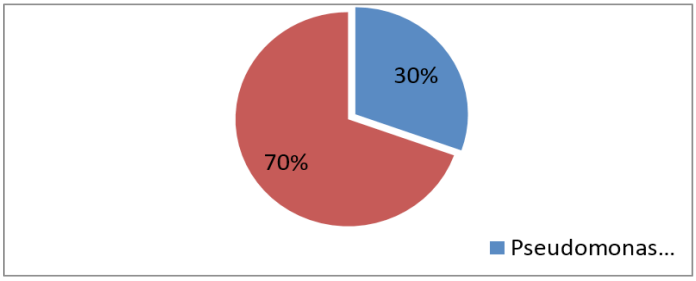

Figure 1: Percentage of *P. aeruginosa* in Diabetic foot infections.

The frequency distribution of Diabetic foot infections patients by *P. aeruginosa* isolation in relation to age and gender is shown in (Table1). The most frequent isolation of the *P. aeruginosa* was noted in the age group above 40 years (81.25 %,) followed by those in the age group of 18 less 40 years (17.71%), less 18 years (1.04%). We found the relationship between Diabetic foot infections and sex. The prevalence rate was higher in male (69.8%) patients compared with females (30.2%).

Age in years	M	F	Percentage
Less than 18	1	-	1.04
18 and less than 40	4	13	17.71
40 and above	62	16	81.25
Percentage	69.8%	30.2%	
Key: M= Male, F= Female			

Table 1: The frequency distribution of Diabetic foot infections patients by *P. aeruginosa* isolation in relation to age and gender.

Out of the 96 isolates of *P. aeruginosa* were found to be sensitive to Ciprofloxacin, Ceftazidime, Piperacillin, Gentamicin and Doycycline respectively (Figure 2).

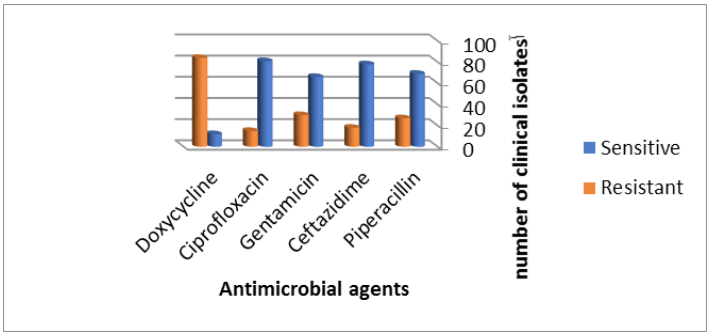

Figure 2: Sensitive & resistant of *P. aeruginosa* clinical isolates against used antibiotics according to the NCCLSS zone diameter standards protocol.

Standard control was tested against *P. aeruginosa* and the size of the inhibition zones were recorded so as to be compared with the test organisms (Figure 3).

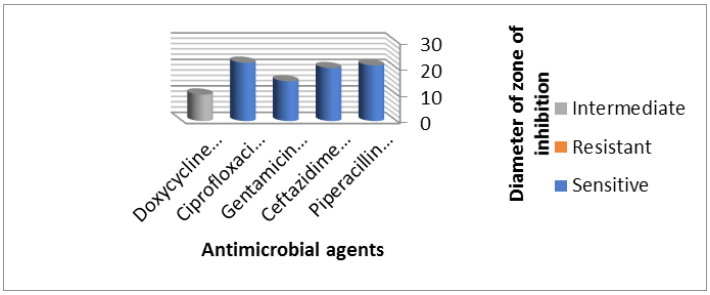

Figure 3: Sensitive & resistant *P. aeruginosa* (ATCC 27853) standard control strain against used antibiotics according to the NCCLS zone diameter standards.

Discussion

The appearance of Diabetic Foot Infection (DFI) in Gadarif Diabetic Center is a matter of great concern since 96/315 (30%) patients had developed by *P. aeruginosa* in the period during 2017. Another studies of (DFI) showed that *P. aeruginosa* is isolated in less than 10% of wounds in studies primarily from developed northern countries [10]. In a previous study showed that *P. aeruginosa* (16%) [11]. Other authors reported from diabetic ulcers, *p. aeruginosa* in 17.5% [12]. Pappu K, et al. who reported that 76% of the organisms which were isolated from (DFI) were gram negative bacilli, *Pseudomonas* being the predominant pathogen (23%) [13]. When factors such as age and sex of the patient were considered, we found the occurrence of *P. aeruginosa* to be higher in males (67, 69.8%) and in patients in the age group 40 years and above (78, 81.3%). In contrast with other study reported the presence of *P. aeruginosa* was not associated with the patient's age [14]. Increasing resistance to different anti-pseudomonal drugs particularly among hospital strains, has been reported world-wide [15] and this is a serious therapeutic problem in the management of disease due to these organisms. In this study, antimicrobial susceptibility patterns of *P. aeruginosa* isolates were determined against different antimicrobial agents. The isolates were found to be sensitive to Ciprofloxacin (81. 84.4%) and followed by Ceftazidime (78. 81.3%), piperacillin (69.71.9%), Gentamicin (66.68.8%) and Doxycycline (12.12.5%). Chander and Raza conducted a similar study on the clinical isolates of *P. aeruginosa* in Kathmandu, Nepal, they found that the isolates were sensitive to Ciprofloxacin (70.48.3%), piperacillin (65.44.8%) [16]). Another survey and evaluation of the British Society for Antimicrobial Chemotherapy disc susceptibility test which conducted in UK about Antimicrobial susceptibility of *Pseudomonas aeruginosa*: by Caroline, et al. found that *P. aeruginosa* was sensitive to Ciprofloxacin (91.9%), piperacillin (96.1%), ceftazidime (97.7%), gentamicin (88.9%) [17].

Conclusion

The present study agrees with previous studies in that, *P. aeruginosa* was an important causative agents responsible for diabetic foot infection in Gadarif diabetic center. The most frequent isolation of the *P. aeruginosa* was noted in the age group above 40 years. The prevalence rate was higher in male patients compared with females. Results of the antimicrobial sensitivity of *P. aeruginosa* isolates against commonly used antibiotics demonstrated the occurrence of resistance to various antipseudomonal agents (Ciproflopxacin, Piperacillin, Ceftazidime and Gentamicin).

References

1. Martínez C, Pons E, Prats G, León J (2004) Salicylic acid regulates flowering time and links defence responses and reproductive development. Plant J 37: 209-217.
2. Cox CD, Parker J (1979) Use of 2-aminoacetophenone production in identification of *P. aeruginosa*. J Clin Microbiol 9: 479-484.
3. Edmonds M (2009) The treatment of diabetic foot infections: focus on ertapenem. Vasc Health Risk Manag 5: 949-963.
4. (1984) Classics in infectious diseases. On the blue and green coloration that appears on bandages. By Carle Gessard (1850-1925). Rev Infect Dis 6: S775-S776.
5. Iglewski BH (1996) Pseudomonas. In: Baron S (ed.) Baron's Medical Microbiology. (4th edn), Univ of Texas Medical Branch.
6. Driver VR, Fabbi M, Lavery LA, Gibbons G (2010) The costs of diabetic foot: the economic case for the limb salvage team. J Vasc Surg 52: 17S-22S.
7. Mutluoglu M, Uzun G, Yildiz S (2010) Hyperbaric oxygen therapy in the treatment of diabetic foot ulcers--prudent or problematic: a case report. Ostomy Wound Manage 56: 32-35.
8. Dhanasekaran G, Sastry NG, Mohan V (2003) Microbial pattern of soft-tissue infections in diabetic patients in South India. Asian Journal of Diabetology 5: 8-10.

9. Sivanmaliappan TS, Sevanan M (2011) Antimicrobial Susceptibility Patterns of *Pseudomonas aeruginosa* from Diabetes Patients with Foot Ulcers. Int J Microbiol 2011: 605195.

10. Lipsky BA, Armstrong DG, Citron DM, Tice AD, Morgenstern DE, et al. (2005) Ertapenem versus piperacillin/tazobactam for diabetic foot infections (SIDESTEP): prospective, randomized, controlled, double blinded, multicenter trial. Lancet 366:1695-1703.

11. Ahmed EO (2003) Bacteriology of diabetic foot infection. A thesis submitted in partial fulfillment for the requirements of the degree of clinical MD in General Surgery. University of Khartoum.

12. Sharma VK, Khadka PB, Joshi A, Sharma R (2006) Common pathogens isolated in diabetic foot infection in Bir Hospital. Kathmandu Univ Med J (KUMJ) 4: 295-301.

13. Pappu AK, Sinha A, Johnson A (2011) Microbiological profile of diabetic foot ulcer. Calicut Med Journal e1-4.

14. Young H, Knepper B, Hernandez W, Shor A, Bruntz M, et al. (2015) *Pseudomonas aeruginosa*: an uncommon cause of diabetic foot infection. J Am Podiatr Med Assoc 105: 125-129.

15. Orrett FA (2004) Antimicrobial susceptibility survey of *Pseudomonas aeruginosa* strains isolated from clinical sources. J Natl Med Assoc 96: 1065-1069.

16. Chander A, Raza M (2013) Antimicrobial susceptibility patterns of *Pseudomonas aeruginosa* clinical isolates at tertiary care hospital in Kathmandu, Nepal. Asian J Pharm Clin Res 6: 235-238.

17. Henwood CJ, Livermore DM, James D, Warner M, The *Pseudomonas* Study Group (2001) Antimicrobial susceptibility of *Pseudomonas aeruginosa*: result of a UK survey and evaluation of the British Society for Antimicrobial chemotherapy disc susceptibility test. Journal of Antimicrobial Chemotherapy 47: 789-799.