

Frequency of Methicillin Resistant Staphylococcus Aureus in Diabetic Foot Infections

Makil Shah¹, Mohammad Shoaib¹, Abdul Razaq², Mohammad Ashraf³ and Wasim Ahmad⁴

ABSTRACT

Objectives: The objective of the study was to determine the frequency of Methicillin resistant Staphylococcus aureus in diabetic foot infections.

Study Design: Descriptive / cross sectional study.

Place and Duration: This study was conducted at the Department of Surgery, Bannu Medical College Bannu from 03.06.2014 to 02-12-2015.

Materials and Methods: In this study, a total of 140 patients presenting with diabetic foot ulcers were recruited through consecutive sampling and subjected to detection of MRSA.

Results: The mean age of the patients was 42.2 ± 8.3 years. We had 51.4% males & 48.6% females in the study population. MRSA was detected in 23.6% of diabetic feet.

Conclusion: MRSA is a highly prevalent problem among our local population with diabetic foot and we recommend more research studies focusing on its risk factors so that preventive measures may be taken.

Key Words: Diabetes mellitus, Diabetic foot, Staphylococcus aureus, Methicillin Resistant Staphylococcus aureus

Citation of articles: Shah M, Shoaib M, Razaq A, Ashraf M, Ahmad W. Frequency of Methicillin Resistant Staph Aureus in Diabetic Foot Infections. *Med Forum* 2017;28(9):17-20.

INTRODUCTION

Diabetic foot infection is a clinical syndrome characterized by local findings of inflammation or purulence (sometimes accompanied by systemic manifestations of sepsis) occurring in site below the malleolus in a person with diabetes. Diabetes is a metabolic disorder affecting 371 million people worldwide. At present Pakistan has around 6.6 million people with diabetes; the number is anticipated to rise 11.4 million by year 2030.¹ Diabetic Foot infections are seen in up to 20% of diabetic patients and hence are the most commonly faced surgical problem.² Unless treated appropriately. It leads to amputation or disarticulation of varying levels, at least ones in such patient's lifetime. Worldwide, several studies have been conducted with respect to the bacteriology and antibiotic sensitivity pattern.² Staph aureus (S.aureus) is an enzyme "coagulase" positive species, which makes its colonies on human skin and nasopharynx.

¹. Department of Surgery / Medicine² / Pharmacology³, Bannu Medical College Bannu.

⁴. Department of Biotechnology, University of Science and Technology Bannu.

Correspondence: Makil Shah, Assistant Professor, Department of Surgery, Bannu Medical College Bannu.

Contact No: 0333-9749182

Email: vazim4847@gmail.com

Received: June 14, 2017;

Accepted: July 27, 2017

By doing this, it causes a variety of suppurative infections. Besides human skin structure infections, S. aureus may also causes some more somber infections such as phlebitis, pneumonia, meningitis, urinary tract infections, mastitis, diabetic foot infections and deep-seated infections, etc such as Osteomyelitis and endocarditis.³

The sole purpose of the Methicillin antibiotic was to introduce it in clinical practice in order to fight against infections that are resultant of penicillin resistant Staph species.

With time passage, a part of organisms acquired resistant to methicillin and the resistant strains were termed as "methicillin resistant Staph aureus" (MRSA). These resistant strains are needed to be treated with some different types of antibiotics. Since 1961, MRSA frequency has proved to be increased gradually and now hospital and community associated MRSA infections are a rising health apprehension around the globe.⁴

Nosocomial infections are majorly caused by MRSA with a lethal strain of Healthcare acquired methicillin-resistant S. aureus (HA-MRSA). It has urbanized confrontation to more than a few antibiotics. HA-MRSA infections might include surgical wound infections, UTIs, pneumonia, bloodstream and diabetic foot infections. HA-MRSA infections are treated with numerous antibiotics including trimethoprim-sulfamethoxazole, vancomycin, clindamycin etc as a first choice.⁵

Bacteria makes their colonies when there is some wound infection in the body. Proper infections are developed if the colonization gets association with many other factors including diminished blood supply, as in the diabetic foot infection, inherent virulence of specific bacteria like *S.aureus* along with host immune factors etc. All types of wound can get contaminated through various factors including surrounding skin, the local environment, and endogenous patient.⁵

Furthermore, the hospital stay, surgery techniques & extended or broad-spectrum antibiotic treatment of patient might causes bacterial colonization around wound or infection, or both, with opposing organisms including MRSA.⁶ The antibiotic-resistant bacteria pretense a chief apprehension to wound care because of their ability to resist many of the antibiotics used today to treat infections.⁷

MRSA infections are seen in both developed and developing countries. In Pakistan, MRSA has been established in health care settings and is emerging as a main nosocomial pathogen. Reports are there that shows that it has prevailed in local population with uneven frequencies having high incidence in the major cities of the country where its ratio is 61%.⁸ The data revealed that out of 52 *S. aureus* isolates, 19 (36.5%) were MRSA. Overall, *S. aureus* was found to be the main organism which contaminates wound infections.³ Since the various studies show varied frequencies of the MRSA in diabetic foot infections and have great discrepancies in these. The present study is designed to find out frequency of MRSA in local population to improve empiric antimicrobial therapy. As there is no local study available on the same topic. The frequency of MRSA may be high locally as the hygienic conditions are very different locally as compared to developed countries.

MATERIALS AND METHODS

This was a descriptive (Cross-sectional study) conducted at the surgical department Bannu medical college Bannu. Data collection was done through Consecutive (Non-probability) sampling from (03-06-2014 to 02-12-2015). Sample size was 140 using 36.5% MRSA in diabetic foot², 95% confidence level with 8% margin of error with the help of WHO software for sample size determination. Patients admitted for the treatment of the diabetic foot infection and meeting the inclusion criteria was briefed about the study and purpose of the study. Informed written consent was taken from all the patients. Before starting the study, approval was taken from hospital Ethical Review Committee (ERC). Swab of pus from the diabetic foot was taken from all the included patients in well hygienic condition. The sample was protected properly to avoid contamination by the trained laboratory technician. The sample was cultured for the bacteria on specific media (mannitol salt agar plate) in the hospital

laboratory under the supervision of senior microbiologist. The *S. aureus* cultured from the specimens was tested for the sensitivity to methicillin. The result was entered in preformed proforma for each patient separately. Strictly exclusion criteria was followed to control confounders and bias in the study results. The collected data was entered and analyzed by SPSS version 17. Mean and standard deviation was calculated for numerical variables like age. Frequencies and percentages was calculated for categorical variables like gender and MRSA. MRSA was stratified among age and gender to see effect modification .post stratification was done through chi-square test keeping p value ≤ 0.05 as significant. Result was presented in the form of table and graphs/ charts.

RESULTS

The study was conducted on 140 patients presenting with diabetic foot infections. The mean age of the sample was 42.2 ± 8.3 years. The range of age in our study was 25.50 years with minimum age of 29.50 years and maximum age of 55.00 years. On grouping the sample in different age groups, we observed that 10% of patients were in the age group up to 30.00 years, 29.3% were in the age group 30.01 to 40.00 years, 46.4% of patients were in the age group 40.01 to 50.00 years and 14.3% were in the age group 50.01 years & above.

Table No.1: Age-wise distribution of sample (n=140)

	n	Range	Minimum	Maximum	Mean	Std. Deviation
Age of Patient	140	25.50	29.50	55.00	42.2250	8.33346
Valid N (list-wise)	140					
Age Groups		Frequency		Percent		
	Up to 30.00 years		14		10.0	
	30.01 to 40.00 years		41		29.3	
	40.01 to 50.00 years		65		46.4	
	50.01 years & above		20		14.3	
	Total		140		100.0	

Table No.2: Gender-wise distribution of sample (n=140)

Gender		Frequency	Percent
	Male	72	51.4
	Female	68	48.6
	Total	140	100.0

Table No.3: Frequency of mrsa (n=140)

MRSA		Frequency	Percent
	Yes	33	23.6
	No	107	76.4
	Total	140	100.0

While distributing the patients with regards to gender, we observed that in our study 51.4% of the sample was male and 48.6% were female gender. From all the patients included in the study, swab was taken from the

diabetic foot ulcer and sent to hospital laboratory for the detection of MRSA. On report, MRSA was detected in 23.6% of patients.

DISCUSSION

Since its first report in 1961, MRSA became a most important pathogen causing diseases in the human.⁹ and the ever preliminary reported outburst of disease in 1968¹⁰. Reports (2003) from NNISS (National Nosocomial Infections Surveillance System) of the CDC showed that MRSA, on an average, responsible for 57% of *S. aureus* isolates causing nosocomial infection in ICUs¹¹. This prevalence is greater than the one that is reported for the years 1995–1999¹². Threat factors for MRSA colonization have been well explained¹³. Various factors are responsible for varying rates of colonization or infection with MRSA. These factors including geographic location, type of health facility and the explicit population which is being studied. 4%–8% MRSA prevalence or colonization in the ICU has been reported by some of the researchers^{14,15}. Similarly, the occurrence of MRSA colonization in the general population has been reported to be 0.18%–7.2%^{16,17} having an incidence of nosocomial attainment of up to 1.7%^{18,19}. Community-acquired colonization has just been explained as an important reservoir of MRSA, with a reported incidence of 1.3%–2%²⁰.

Lower extremity infections are a serious cause of morbidity in patients with diabetes mellitus. These infections are responsible for 20% of all hospital admissions in diabetic patients²¹. Diabetes is the major cause of non-traumatic limb amputation. Several immune defense mechanisms are defective in diabetic patients. Among these are a decrease in leukocyte chemotaxis, phagocytosis, and intracellular killing. Microbiologically, diabetic foot infections are generally polymicrobial. Among the most frequently isolated microorganisms from the lesions are *Staphylococcus aureus*, group B streptococci, Enterococci, anaerobic bacteria including *Bacteroides fragilis* and some enteric gram-negative organisms. The predominance of *S. aureus* is in agreement with the results reported by others

CONCLUSION

MRSA is a highly prevalent problem among our local population with diabetic foot and we recommend more research studies focusing on its risk factors so that preventive measures may be taken.

Author's Contribution:

Concept & Design of Study:	Makil Shah
Drafting:	Mohammad Shoaib
Data Analysis:	Abdul Razaq & Wasim Ahmad

Revisiting Critically:	Mohammad Ashraf
Final Approval of version:	Makil Shah & Mohammad Shoaib

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. R, Alvi SFD, Fawwad A, Basit A. Antibigram of *Pseudomonas aeruginosa* and Methicillin resistant *Staphylococcus aureus* in patients with diabetes. *Pak J Med Sci* 2014;3(04):814-18.
2. Banashankari GS, Rudresh HK, Harsha AH. Prevalence of gram negative bacteria in Diabetic foot - A Clinico-Microbiological Study. *Al Ameen J Med Sci* 2012;5(3):224-32.
3. Bano S, Tunio SA, Mal S, Jatt AT. Frequency of Methicillin resistant *Staphylococcus aureus* among Isolates of wound infections from Hyderabad. *Sindh Univ Res J* 2012;44(4):683-6.
4. Ippolito G, Leone S, Lauria FN, Nicastrì E, Wenzel RP. Methicillin-resistant *Staphylococcus aureus*: the superbug. *Int J Infect Dis* 2010;17: 88-93.
5. Siddiqui, Rahman A, Bernstein JM. Chronic wound infection: facts and controversies. *Clin Dermatol* 2010;28:519-26.
6. Baveja CP, Gumma VN, Jain M, Jha H. Foot ulcer caused by multidrug-resistant *Mycobacterium tuberculosis* in a diabetic patient. *J Med Microbiol* 2010;59:1247-9.
7. Percival SL, Thomas J, Linton S, Okel T, Corum L, Slone W. The antimicrobial efficacy of silver on antibiotic-resistant bacteria isolated from burn wounds. *Int Wound J* 2011;47:21-9.
8. Zafar, Stone AM, Ibrahim S, Parveen Z, Hasan Z, Khan E, et al. Prevalent genotypes of methicillin-resistant *Staphylococcus aureus*: report from Pakistan. *J Med Microbiol* 2011;60:56-62.
9. Jevons MP. Celbenin resistant staphylococci. *Br Med J* 1961;124-5.
10. Barrett FF, McGehee RF, Finland M. Methicillin resistant *Staphylococcus aureus* at Boston City Hospital: bacteriologic and epidemiologic observations. *N Engl J Med* 1968;279:441-8.
11. National Nosocomial Infections Surveillance (NNIS) System Report: data summary from January 1992 through June 2002, issued August 2003. *Am J Infect Control* 2003;31:481-98.
12. National Nosocomial Infections Surveillance (NNIS) System report, data summary from January 1992-June 2001, issued August 2001. *Am J Infect Control* 2001;29:404-21.
13. Boyce JM. Methicillin-resistant *Staphylococcus aureus*: detection, epidemiology, and control measures. *Infect Dis Clin North Am* 1989;3: 901-13.

14. Chaix C, Durand-Zaleski I, Alberti C, Brun-Buisson C. Control of endemic methicillin-resistant *Staphylococcus aureus*: a cost-benefit analysis in an intensive care unit. *JAMA* 1999;282:1745-51.
15. Grundmann H, Hori S, Winter B, Tami A, Austin D. Risk factors for the transmission of methicillin-resistant *Staphylococcus aureus* in an adult intensive care unit: fitting a model to the data. *J Infect Dis* 2002;185:481-8.
16. Barakate MS, Yang YX, Foo SH. An epidemiological survey of methicillin-resistant *Staphylococcus aureus* in a tertiary referral hospital. *J Hosp Infect* 2000;44:19-26.
17. Jernigan JA, Clemence MA, Scott GA, . Control of methicillin-resistant *Staphylococcus aureus* at a university hospital: one decade later. *Infect Control Hosp Epidemiol* 1995;16:686-96.
18. Cohen SH, Morita MM, Bradford M. A seven-year experience with methicillin-resistant *Staphylococcus aureus*. *Am J Med* 1991;91:233-7.
19. Herwaldt LA. Control of methicillin-resistant *Staphylococcus aureus* in the hospital setting. *Am J Med* 1999;106:11-8.
20. Fishbain JT, Lee JC, Nguyen HD. Nosocomial transmission of methicillin-resistant *Staphylococcus aureus*: a blinded study to establish baseline acquisition rates. *Infect Control Hosp Epidemiol* 2003;24:415-21.
21. Kenner J, O'Connor T, Piantanida N. Rates of carriage of methicillin-resistant and methicillin-susceptible *Staphylococcus aureus* in an outpatient population. *Infect Control Hosp Epidemiol* 2003;24:439-44.