Frequency of different complication associated with diabetic foot and its bacteriology

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Objectives: To assesses the frequency of postoperative complication, microbial isolates of patients with diabetic foot infections and their antibiotic susceptibility pattern**. Methods:** This cross sectional study was carried out on 150 diabetic patients with infected diabetic foot. Patients were admitted for surgical intervention. Major variables of study were post-operative complications includes wound infection, stump dehiscence, septicemia and gas gangrene. Micro-organisms isolated type of antibiotic. SPSS version 23 was used for data analysis. **Result:** Majority of the patients between 40-50 years. Most of the patients 69.3% were males. The mean hospital stay was 14.41±2.92 days. Majority of the patients, 79.3% were >7 days of hospital stay. Wound infection was the most common post-operative complication i.e. 48.7%.**Conclusion:** Wound infection and gas gangrene are the main post operative complications of diabetic foot, Valgaris and Staphylococcus aureus were main responsible micro-organisms

Keywords: Diabetic foot, Becteriology, Complications

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INTRODUCTION

Diabetic foot is one of the most dreaded results of diabetes. It is responsible for the large number of hospitalization of diabetic patients[1]. Diabetic foot is described by several pathological complexities such as neuropathy, peripheral vascular disease, foot ulceration and infections, further developing into gangrene and even causing limb amputation. Diabetic patients have a 25% higherpossibility of having foot infection[2]. Also Diabetic infections are more risky and have higher probability of limb amputation than other infections. More than 1 million diabetic patients have need of limb amputation annually. The affliction of diabetic foot is inevitable to escalate with the passage of time[3].

The cases of type 2 diabetes is escalating to epidemic magnitudes globally while Egypt is leading the country with highest diabetic patients , 15% of their adult inhabitants (aged 10–79 years) has diabetes[4]. Therefore frequency of foot infections and amputations are very high, which is amount to 20% of diabetes-related hospital admittances. Leading reasons are as follows walking without shoes, insufficient diabetic care, low socioeconomic status, and illiteracy[5]. Diabetes patients usually got infected with gram-positive bacteria such as Staphylococcus aureus, Enterococcus, and gram-negative bacteria like Pseudomonas aeruginosa, Escherichia coli, Klebsiella species, Proteus Vulgaris and anaerobes[6]. They are also multi-drug resistant. Pathogenicmicro flora is often transferred involuntarily by medical staffs and

supplies and provisions used for treatment. Theexistence of infection is determined by the number of microbes residing in the lesions,while type of microbial strains and their pathogenicity influence healing process[7].

Day patients with slight infections can be cured by the administration of oral antibiotics which covers most of skin flora including streptococci and Staphylococcus aureus. Agents like, cephalexin, dicloxacillin, amoxicillin-clavulanate, or clindamycin are found effective in this scenario[8]. While methicillin-resistant S aureus (MRSA) infection can be dealt with by administration of thefollowing: clindamycin, trimethoprim-sulfamethoxazole,

minocycline, or linezolid.In case gram-negative aerobes and/or anaerobes are suspected, dual drug treatment with trimethoprim-sulfamethoxazole plus amoxicillin-clavulanate or clindamycin plus a fluoroquinolone such as levofloxacin or moxifloxacincanbe used[9].

There isabundantresearch available on microbiological study of diabetic foot infectionsand the related treatment from different parts of the world[10]. However, very little information is available about the association of post-operative complications of diabetic foot with variables such as age, gender, length of hospital stay,organism culture,antibiotics used and surgical management of diabetic foot. This study will provide us with useful knowledge about the relation between above mentioned variables and post-operative complications in diabetic foot patients, which can provide important insights for medical professionals and researchers.

Methodology

A cross sectional study was conducted at the Department of General Surgery, Nishter Hospital Multan, Pakistan, for the period of one year. For this study ethical approval was taken from the ethical committee of the hospital. All of the patients gave their consent for the collection of related data after detailed briefing was given to them about the study.

A total of 150 diabetic patients with infected diabetic foot were admitted for surgical intervention. The post-operative complications were recorded includes wound infection, stump dehiscence, septicemia and gas gangrene. Demographical data of the patients, their diagnosis and complexities were gathered. Clinical information such as bacterial culture and antibiotic treatment were taken from the files of all patients. All patients of either gender who presented with diabetic foot and required surgical intervention were included in the study. Patients with osteomyelitis, pregnant womenand patients with other comorbid conditions like, chronic venous insufficiency and HIV infection were excluded.Diabetic foot infections were categorized according to Wagner's Classification and the University of Texas Wound Classification System[11].

Samples of pus were taken upon the arrival at hospital on condition, that no antibiotics were administered in last two days. For infected wounds sample was obtained by swabbing at the base of wound. For the wounds which required surgical process swabbing was done intraoperative at depth of the lesions. Commercially available antiseptic swabs were used and straightway taken to the lab after sample was taken. All pus swabs were sent laboratory for culture and sensitivity. Proper antibiotics were administered according to their sensitivity results and metronidazole for Ecoli.

SPSS version 23 was used for analysis of data. Mean and standard deviation were calculated for numerical data like age, duration of hospital stay. Frequencies and percentages were calculated for categorical data like gender, micro-organisms isolated, type of antibiotic and complications (gas gangrene, wound infection, septicemia and Stump dehiscence). Test of significance was applied

to see the association among variables and p-value ≤ 0.05was taken as significant.

Results

One hundred and fifty patients were enrolled in this study, with mean age 14.41±2.92 years. Majority of the patients were between age 40-50 years. Most of the patients, (69.3%), were males. The mean hospital stay was 14.41±2.92 days. Majority of the patients, (79.3%),>7 days of hospital stay. Wound infection was the most common post-operative complication i.e. (48.7%). (Table. I).

The most common organism culture, (39.3%), was vulgaris. While, frequently used antibiotics was ciprofloxacin i.e. (62.7%). Debridement & non-stick dressingwas the most common surgical management of diabetic foot i.e. (36.0%). (Table. II).

Chi-square was applied to check the effect modification, it was seen that age (p=0.002), length of hospital stay (p=0.000), organism culture(p=0.000), antibiotics used(p=0.000) and surgical management of diabetic foot(p=0.000), were the effect modifiers of post-operative complication. (Table. III).

Table. I: Demographic and baseline characteristics of the patients

Variable	Mean±S.D	N (%)
Age (years)	14.41±2.92	
<40		25 (16.7)
40-50		93 (62.0)
41-60		20 (13.3)
>60		12 (8.0)
Gender		
Male		104 (69.3)
Female		46 (30.7)
Length of hospital stay	14.41±2.92	
<7 days		31 (20.7)
>7 days		119 (79.3)
Post-operative complication		
Wound infection		73 (48.7)
Septicemia		27 (18.0)
Gas gangrene		35 (23.3)
Stump dehiscence		15 (10.0)

Table. II: Micro-organisms

Variable	N (%)
Organism culture	
Staphylococcus aureus	41 (27.3)
Aeruginosa	31 (20.7)
Vulgaris	59 (39.3)
Ecoli	19 (12.7)
Antibiotics used	
Ciprofloxacin	94 (62.7)
Clindamycin	23 (15.3)
Amoxicillin plus clavulanic	33 (22.0)
Surgical management of diabetic foot	
Debridement & non-stick dressing	54 (36.0)
Debridement & skin grafting	24 (16.0)
Rays amputation	34 (22.7)
Local radical surgery	19 (12.7)
Proximal amputation	19 (12.7)

Discussion

Skin and bone infections are main complications of diabetic foot that may damage blood vessels and nerve supply associated with immune system issues[12]. In few cases infection involves tissues and bones later on develop small pockets and abscess. Furthermore, diabetes affects blood vessels and leads to cut off oxygen supply to the tissues those results in gas gangrene[13]. In our study we observed wound infection in 48.7% of cases, septicemia in 27% and gas gangrene in 23.3% of cases.

Our study shows that about 48.7% of patients presented with diabetic foot were polymicrobial and most common pathogen was gram negative in nature at the time isolation from infected debris. Gram negative bacteria were found sensitive from vancomycin and gram positive were sensitive to amikacin. A study was conducted by Raja et al[14] and reported that about 42% of cases were grown mixed pathogens (gram negative and gram positive. Another study by Wright-

Pascoe et al[15] reported that 80% of diabetic foot patients observed with polymicrobial organisms.

Table-3: Association of effect modifiers with outcome

Effect-modifier	Category	Post-operative complication				P-value
		Wound infection	Septicemia	Gas gangrene	Stump dehiscence	
Gender	Male	51	19	25	9	0.871
	Female	22	8	10	6	
Age (years)	<40	8	8	7	2	0.002
	40-50	39	15	27	12	
	41-60	14	4	1	1	
	>60	3	2	5	2	
Length of hospital stay (days)	<7	15	10	5	1	0.000
	>7	42	27	35	15	
Organism culture	Staphylococcus aureus	10	9	10	12	0.000
	Aeruginosa	4	9	9	9	
	Vulgaris	20	4	30	5	
	Ecoli	4	5	5	5	
Antibiotics used	Ciprofloxacin	66	17	6	5	0.000
	Clindamycin	5	6	9	3	
	Amoxicillin plus clavulanic	2	4	20	7	
Surgical management of diabetic foot	Debridement & non-stick dressing	36	10	3	5	0.000
	Debridement & skin grafting	5	1	10	8	
	Rays amputation	13	4	15	2	
	Local radical surgery	5	9	4	1	
	Proximal amputation	10	3	3	3	

Another study by Loan et al[16] on French population reported 87.2% of diabetic infections were due to polymicrobial organisms. Difference in percentages of monomicrobial and polymicrobial micro-organisms is may be due to superficial subcutaneous or clinically mild infections. Many Indian studies reported that gram negative bacteria were predominant pathogens that were isolated from diabetic wounds. In a study by Bansal et al[17] reported that reported 76% micro-organisms were gram negative and 24% were other common pathogens.

In another Indian study by Shankar et al[18] reported frequency of gram negative organisms was reported as 57.6% and 42.3% were other common pathogens. This difference may be environmental and climacteric or may hospital acquired because of poor fumigation and sterilization. In a study by Gadepalli et al[19] on Indian populations reported again 51.4% gram negative pathogens and other common pathogens in 33.3% of diabetic ulcer cases.

Deeper infections that involve deeper tissues usually diagnosed with gram negative organisms that were treated with clavunic acid, ampicillin, cefuroxime and sulbactum[20]. Sometime infection is more severe and involves bone and deep tissue, such type of infections can be treated with imipenem, meropenem and ceftazidime. Levofloxacin is also a appropriate drug which is sensitive in 98% of organisms[21].

Conclusion

Wound infection and gas gangrene are the main post operative complications of diabetic foot, Valgaris and Staphylococcus aureus were main responsible micro-organisms. Among antibiotics therapy Amikacin and vancomycine can cover gram positive and gram negative more effectively.

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