Bacterial infection of Diabetic foot ulcer

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Abstract

The study included 25 wound samples were collected from type 1 insulin dependent diabetes mellitus (IDDM), and type2 non-insulin dependent diabetes mellitus (NIDDM) foot patients admitted to daquq hospital of both sex and their ages between 41-75 years. The study aimed to screen the aerobic bacterial pathogens present in diabetic pus and to determine their antibiotic susceptibility against common standard antibiotics. Bacteriological diagnosis and antibiotic sensitivity profiles were carried out at two parts: The profile part swab was taken has been cultured in media of blood agar and MacConkey agar depend on biochemical tests and indicators. The results indicate that common pathogen isolates from the diabetic pus included *E. coli* followed by *Proteus mirabilis* and *Staphylococcus aureus*, and the peak proportion of diabetic foot ulcer (DFU) was recorded between 41-75 years in both sexes. The second step were included the performing antibiotic susceptibility according to Kirby-Bauer disc diffusion method on Mueller–Hinton agar using 11 different antibiotics. It was obvious that Nitrofurantoin, Ciprofloxacin and rifampicin is more active against *E. coli* followed by co-trimoxazole and gentamycin . Ofloxacin is more active against *Staphylococcus aureus* followed by gentamycin and Amipcillin .Amikacin, Nitrofurantoin and Co-Trimoxazole *is active against Proteus mirabilis* followed by gentamycin and erythromycin.

Key words: Diabetes mellitus, foot ulcers, infection, pathogen

Introduction

Foot ulcer is frequent complication of patients suffering with diabetes mellitus (DM), accounting for up to 20% of diabetes-related hospital admission [1, 2]. The ulcers become infected, and can develop in the skin, muscle or bone of the foot as a result of the nerve damage and poor circulation as a major causal factor for lower limp amputation[3]. Poorly controlled diabetes is prone to skin infections because elevated blood sugar reduces the effectiveness of bacteria fighting cells. Carbuncles boil, and other skin infections may be hazardous if not properly treated. Even small cut may progress to a deep, open sore, called an ulcer [4]. An average of 5-6 strains of organisms is often involved in the diabetic foot infections with a mixture of aerobic and anaerobic organisms [5]. Selection of an effective antimicrobial agent for microbial infection requires knowledge of the potential microbial pathogen [6]. Also antibiotic resistance to the commonly used antibiotics in now emerging as a result of misuse and abuse of particular antibiotics. Hence the treatment of infection in diabetic patients becomes difficult. Studies are required to assess the right kind of antibiotic to be used in diabetic infections. The aim of present study is to investigate the causative aerobic pathogens and the relation with type of diabetes mellitus patients, and profile of antimicrobial susceptibility.

Materials and Methods

Time and location

The study was carried out on 25 patients ,17 of them suffering from type 1(insulin dependent diabetes mellitus and 8 patients suffering from9 type2 (noninsulin dependent diabetes mellitus) foot ulcer attending to surgical unite in Daquq hospital from January 2009 to April 2010.

Sample collection and Identification of bacterial Isolates

Wound samples were collected using sterile cotton swabs (fresh pus). The pus sample was inoculated on blood agar and MacConkey agar plate. The streaked Plate was inoculated at 37ºC for 24hrs. Identification of isolates was done based on colony morphology, gram staining, catalase test, oxidase test, coagulase test and other biochemical tests [7, 8].

Antibiotic Sensitivity test

The organisms isolated were subjected to antibiotic susceptibility testing on Mueller-Hinton agar using Kirby–Bauer disc diffusion method [9], and evaluated according to recommended National Committee for Clinical Laboratory Standards (CLSI) guidelines [10].

Results and Discussion

Of the total 25 diabetic foot patients studied, 17 were male and 8 were female (Table-1), the high incidence of male to diabetic foot ulcers than female in both type 1 and type 2 diabetes mellitus (Table 2). This result is compatible with [12] who recorded males are more likely to undergo diabetic foot lesions than women this may be differences in biomechanics between male and female especially, decrease joint mobility and high foot pressure may predict the development of diabetic foot ulcers, also males with diabetes have nearly twice the odds of having insensate neuropathy as women with diabetes [11]. [12]

Age distribution in both NIDDM and IDDM foot patients

Table-3 show the maximum patients having diabetic foot infection in both NIDDM(n=17) and IDDM(n=8) belonged to age group of 40-49 years, this may be patients in these ages undergo repetitive mechanical force of gait during working than other ages.

Bacterial isolation

When an ulcer is present, there is clear entrance for invading bacteria. Infection can range from local infection of the ulcer to wet gangrene. From culture test of these swabs, aerobic bacteria in pure form were isolated in all the cases in which 14 (56%) were *E. coli*,

7(28%) were *Proteus mirabilis* and 4(16%) were *Staphylococcus aureus* the common organism isolated. The infection is usually polymicrobial in nature caused by gram positive and gram negative organisms. The presences of these organisms in septic complication of infected feet have been reported in various studies [13, 14] while (2,17) recorded *Staphylococcus aureus* and *Pseudomonas aeruginosa* the most common causes of diabetic foot infection.

Though previous studies (18, 19, and 20) showed that Gram-negative bacteria were the most common pathogens in infected diabetic feet.

Antibiotic susceptibility

The treatment of diabetic foot infections requires bactericidal antibiotics given in sufficiently large doses to provide adequate tissue levels. In certain circumstances the antimicrobial treatment may have to be initiated empirically to prevent systemic invasion by infecting organisms in an already debilitated patient while awaiting microbiological results[16].

Table-4 showed *E. coli* high degree of sensitivity to rifampicin, ciprofloxacin and nitrofurantoin. From this study the Gentamycin antibiotic indicated highest antibacterial activity to isolate *E. coli* 85.7%, *P. mirabilis* 42.8 % and *Staph. aureus* 75%, while nalidixic acid antibiotic resistance for isolated *E. coli* 100%, *P. mirabilis* (71.4%). This may be diabetic patients with foot ulcers are subjected to several factors that may be associated with multidrug resistance treatment, chronic course of the wound and chronic course admission [15]. Other studies [14] recorded that piperacillin was showed effect on most pathogenic organism and [2] recorded vancomycin the most effective antibiotic against positive organisms.

Table-1: Association between diabetic foot infection and sex

Gender	N=25	%
male	17	72%
female	8	28%
total	25	100%

Table -2: Relationship between gender and type of diabetic foot infection

gender	NIDDM Patient (n = 17)Type 2		IDDM Patient (n = 8) Type 1	
	N	%	N	%
male	12	70.58	5	62.5
female	5	29.42	3	37.5
total	17	100	8	100

Table -3: Age distribution in both NIDDM and IDDM foot patients

Type of diabetes	Age /year				
	40-49	50-59	60-69	70-79	Total
IDDM	3 (37.5%)	3 (37.5%)	2 (25%)	0 (0.0%)	8 (100%)
NIDDM	8 (47.1%)	4 (23.53%)	4 (23.53%)	1 (5.9%)	17 (100%)
Total	11 (44%)	7 (28%)	6 (24%)	1 (4%)	25 (100%)

Table -4: Aerobic bacteria isolates

Culture isolate	N	%
E. coli	14	56%
Proteus mirabilis	7	28%
Staphylococcus aureus	4	16%
Total	25	100%

Table -5: Antibiotic susceptibility of bacterial isolate (N=25)

	Bacterial isolates / Antibiotics	*E. coli* (n=14)		*P. mirabilis* (n=7)		*Staph. aureus* (n=4)	
		S	R	S	R	S	R
1	Gentamycin	12 (85.7%)	2 (14.3%)	3 (42.9%)	4 (57.1%)	3 (75%)	1 (25%)
2	Nalidixic Acid	0 (0.0%)	14 (100%)	2(28.6%)	5 (71.4%)	ND	ND
3	Co-Trimoxazole	13 (92.9%)	1 (7.1%)	4(57.1%)	3 (42.9%)	ND	ND
4	Nitrofurantoin	14 (100%)	0 (0.0%)	4(57.1%)	3 (42.9%)	ND	ND
5	Rifampicin	14 (100%)	0 (0.0%)	ND	ND	ND	ND
6	Ampicillin	0 (0.0%)	14 (100%)	0(0.0%)	7 (100%)	3 (75%)	1 (25%)
7	Amikacin	0 (0.0%)	14 (100%)	4(57.1%)	3 (42.9%)	1 (25%)	3 (75%)
8	Cefixime	3 (21.4%)	11 (78.6%)	0(0.0%)	7 (100%)	ND	ND
9	Ciprofloxacin	14 (100%)	0 (0.0%)	0(0.0%)	7 (100%)	ND	ND
10	Ofloxacin	ND	ND	ND	ND	4(100%)	0 (0.0%)
11	Erythromycin	ND	ND	3 (42.9)	4 (57.1%)	0(0.0%)	4 (100%)

ND=non done

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الاصابة الجرثومية لقرحة القدم في المرضى المصابين بداء السكري

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الخلاصة

شملت الدراسة 25 مريضا بداء السكري من النوع الاول والثاني الوافدين الى مستشفى الداقوق الذين يعانون من تقرحات في القدم ، وكان اعمارهم يتراوح بين 41 – 75 سنة ومن كلا الجنسين. هدفت الدراسة الى عمل مسحة لدراسة البكتريا المرضية الهوائية الموجودة في التقرحات العائدة لمرض السكري ولتحديد استجابتها لبعض المضادات الحيوية. التشخيص لبكتريولوجي والحساسية للمضادات الحيوية تم دراستها في قسمين. القسم الاول المسحة المأخوذة قد تم زراعتها على وسط Blood agar وMacConkey اعتمادا على الفحوصات الكيميائية وبعض المؤشرات كانت النتائج تشير الى ان البكتريا التي تم عزلها كانت E.coli , Proteus mirabilis , Staphylococcus aureus وسجلت اعلى نسبة في الاشخاص تتراوح اعمارهم بين 41-75 عاما ومن كلا الجنسين, القسم الثاني هو دراسة حساسية هذه البكتريا المعزولة بطريقة Kirby- Bauer disc diffusion methodعلى وسط مولر هنتون الصلب باستعمال 11مضادا حيويا مختلفة. لوحظ ان المضادات نايتروفيرانيتون ,السبروفلوكساسين, الريفامبسين فعال جدا ضدE. coli ويتبعها ترايمكسسول وجنتامايسين . وكان مضاد اوفلوكساسين فعال جدا ضدStaphylococcus aureus يتبعها جنتامايسين وامبسلين. نايتروفيرانيتون,اميكاسين و ترايمكسسول فعال جدا ضد Proteus mirabilis ويتبعها جنتامايسين وارثرومايسين.

كلمات مفتاحية: مرض السكري ,قرحة القدم ,إصابة ,ممرض .