Bacterial Wound Infections in Diabetic Patients and Their Therapeutic Implications

I alsaimary

Citation

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Abstract

Objective : To identify the bacterial pathogens associated with diabetic wounds and testing the antibiotic susceptibility of main antibiotics against predominant anaerobic bacterial types in comparison with some plant extracts.Methods : A total of 27 diabetic patients of each type; Insulin dependent (IDDM) and non-insulin dependent NIDDM and 30 non-diabetic patients with wound infection were introduce in the present study that was conducted between October – December 2007.Results : It has been found that wounds are highly infected by aerobic and anaerobic bacterial types; propionibacterium granulosum – as anaerobic bacteria- was a predominant pathogens in diabetic wound infections, in comparison with ps.aeruginosa which is predominant in non-diabetic wounds. Amoxycillin/ calvulanic acid was the best effective antibiotic which gave 20mm inhibition zone in comparison with other standard antibiotics, and aqueous extracts of Myrtus communis and Nerium oleander gave II and 10mm inhibition zone respectively.Conclusion : Three isolated pathogens have a greater percentage as made of isolation in diabetic wounds while double pathogens were greater in non-diabetic wounds. Amoxycillin/ calvulanic acid was the best effective antibiotic against common bacterial type , while aqueous extracts of Myrtus communis and Nerium oleander have the variable antibacterial activity .

INTRODUCTION

There is a general consensus among clinicians that diabetic patients are at increased risk of developing infection. (1)

This special vulnerability has been attributed to impaired leukocyte function associated vascular diseases, poor glucose control and altered host response. (2 & 3)

Onco infection occurs, it is difficult to treat since the clinical course of the infection is more fulminant and severe, and posses a greater threat to the glycemic status of the patient. (4 & 5)

With the advent of the new strategies and approaches in the prevention of these infections as with the introduction of new insulin preparation for good glycemic control, presumption in the altered patient behaviour may reduce the incidence of infections or alter the type of infection. (6 & 7)

There are several well accepted predisposing factors that place patients with diabetes at high risk for a lower-extremity amputation. The most common components in the causal pathway to limb loose include peripheral neuropathy, ulceration, infection and peripheral vascular disease. (8)

The development of wounds is a serious complication for patients with diabetes. Numerous factors related to diabetes can impair wound healing, including wound hypoxia (inadequate oxygen delivered to the wound) infection, nutrition deficiencies, and the disease itself. (9)

Fluctating blood sugar and hypoxia from poor circulation may impair the ability of white blood cells to destroy pathogenic bacteria and fungi, increasing infection risk. (10)

The aims of the present study were determine role of insulin and or/ antibiotics in wound infection of diabetic patients, identify the bacterial pathogens associated with diabetic wounds and testing the antibiotic susceptibility of main antibiotics against predominant anaerobic bacterial types in comparison with some plant extracts.

MATERIALS & METHODS

Patients: 27 diabetic patients were included in this study in both sexes (males and females), the patients arranged into two groups:

IDDM: Insulin dependent diabetic mellitus.

NIDDM: non-insulin dependent diabetes mellitus and 30 non diabetic patients with wound infection.

Sampling: A sterile swabs were taken from various location of wounds from diabetic patients then brain heart infusion added to swab for enrichment, and incubated for 2-4 hrs.

BACTERIOLOGICAL STUDY

Loop full of inoculated brain heart infusion cultured by streaking onto nutrient agar and blood agar (oxoid) and kept in anaerobic candle jar to supply anaerobic condition, another loopfull streaking onto same media in aerobic condition and incubated for 24-48 hrs in 37°c.

Classification and identification of aerobic and anaerobic bacterial types were done according to standard routine techniques proposed by Finegold & Baron (1986).[11]

ANTIBIOTICS AND PLANT EXTRACT

Six types of commercial antibiotics (HiMedia India) were used in therapeutic study these are : Pencillin G (P) (10U), Cephalothin (Ch) (30mcg), Tetracyclin (T) (30mcg), Gentamicin (G) (10mcg) Amoxycillin/ Clavulamic acid (AC) (20/10mcg) and ciprofloxacin (CF) (5mcg).

Two aqueous plant extract, in concentration 1000 mcg were used in this study from two plant genera:

Myrtus communis (Al-Yas in Arabic)

Nerium oleander (Al-Difflah in arabic).

Antibiotic susceptibility test was measured by agar diffusion method (disc test) to determine diameter of inhibition zones measured by (mm) by using Mueller-Hinton Agar (HiMedia).[11]

CONTROL PATIENT

(30) non-diabetic wound patients were introduce in this study in comparison with diabetic wound infections.

RESULTS

From 27 DM patient 11 and 3 were IDDM and NIDDM males respectively, while 7 and 6 IDDM and NIDDM females respectively.

In other hand (30) non Dm patient with wound infection are 18 males and 12 females (P< 0.05) Table (1).

Table (2) illustrated types of antibiotics and mode of administration attending to DM patients. It has been found that Ampiclox injection was given as greater therapy for 18 patients followed by pencilling injection and orally tetracycline that given to 16 (patients) followed by other antibiotics.

Also it has been noticed that the patient may be given two or three antibiotics as atherapy for wound infection.

Aerobic and anaerobic bacterial types isolated from both diabetic and non-diabetic wound infection were illustrated in Table (3). It has been found that propionibacterium granulosum as a anaerobic bacteria was a predominant pathogens in diabetic wound (17 cases) followed by staph. Saprophyticus- as aerobic bacteria) (12 cases). While ps.aeruginosa was a predominant pathogens isolated from non diabetic wound infection.

Also we can isolate pr. Acnes and cl.difficle from (9 and 7) diabetic wound respectively. P< 0.01

Table (4) described mode of isolation (How many bacterial types found in one case?)

It has been found that mode of three pathogens was predominant in (10) diabetic wounds while double pathogens was predominant in (11) non diabetic wound followed by another modes of isolation (P< 0.05)

Table (5)- illustrate antibiotic susceptibility test of six antibiotics and two plant extracts against anaerobes pr. granulosum.

It has been that Amoxycillin/ Clavulanic acid gave a greater inhibition zone (22mm) followed by another antibiotics, while aqueous extract of Myrtus communis and N. oleander gave (11 and 10 mm) against these bacteria within the limits of antibiotic inhibition zones.

Figure 1

Table 1: Numbers of diabetic patients according to sex and types of diabetes mellitus (DM) (P< 0.05)

Types of DM	Male No of cases (%)	Female No of cases (%)	Total
IDDM	11(61.1)	7(38.8)	18(66.6)
NIDDM	3(33.3)	6(66.6)	9(33.3)
Total	14(51.8)	13(48.0)	27
Non diabetic patient	18(60.0)	12(40.0)	30
Total	32(56.0)	25(43.8)	57

IDDM: Insulin-dependent DM

NIDDM: non insulin-dependent DM

Figure 2

Table 2: Types of antibiotics and mode of administration attending to DM patients with wound infection

Antibiotics	Mode of administration	No of cases %
Pencilling	Injection	16
Tetracyclin	Ointment	16
	Orally	5
Cephalexin or cephotaxime	Orally	6
	Injection	9
Gentamicin	Injection	15
Ampiclox	Injection	18

Figure 3

Table 3: Aerobic and anaerobic bacterial types isolated from diabetic wound infections and non-diabetic wound infection (P< 0.01)

Bacterial types	Diabetic patient		Non-diabetic patient	
	No.of cases	%	No.of cases	%
1. Aerobic				
Staph. aureus	4	4.59	7	7.52
Staph. xylosus	6	6.89	13	13.97
Staph. saprophyticus	12	13.79	16	17.2
Pseudomonas aeruginosa	9	10.34	20	21.5
Streptococcus pyogenes	4	4.59	0	-
Streptococcus mutans	8	9.19	5	5.37
Bacillus subtilis	2	2.29	0	-
Proteus mirabilis	4	4.59	6	6.45
Escherichia coli	3	3.44	8	8.6
Corynebacterium sp.	2	2.29	0	-
2. **Anaerobic**				
Propionibacterium acnes	9	10.34	2	2.15
Propionibacterium granulosum	17	19.54	6	6.45
Clostridium difficle	7	8.04	0	-

Figure 4

Table 4: Modes of isolation of bacterial types isolated from diabetic wound infection

Mode of isolation	Diabetic patients		Non-diabetic patients	
	No	%	No	%
Single pathogen	6	22.2	5	16.6
Double pathogens	4	14.8	11	36.6
Three pathogens	10	37	8	26.6
Over than three pathogens	7	25.9	6	20
Total	27		30	

Figure 5

Table 5: Antibiotics susceptibility test of six antibiotics and two plant extracts against isolated from diabetic wound infection

Antibacterial agent	Symbol	Conc.	Inhibition zone (mm)
Penicillin	(G)	10 µ	9
Cephalothin	(Ch)	30mcg	12
Tetracyclin	(T)	30mcg	10
Gentamicin	(G)	10mcg	12
Amoxicillin/ clavulanic acid	(AC)	20/10mcg	20
Ciprofloxacin	(CF)	5mcg	14
Aqueous extract of *Myrtus communis*		1000mcg	11
Nerium oleander		1000mcg	10

DISCUSSION

The prevalence of bacterial infections (aerobic and anaerobic) among IDDM and NIDDM diabetic patients, the most predominant bacterial types and the most common isolates and sensitivity pattern were carried out in this study.

It has been found that a greater percentage of aerobic and anaerobic bacterial infections/ pathogens from diabetic patients.

These findings are approved by another studies such as lycos(2007)[12] that explain this risk by abnormally high levels of blood sugar in the diabetic patient damage blood vessels, causing them to thicken and leak, over time, this makes the vessels less able to supply the body, especially the skin, with the blood if needs to remain healthy.

The resulting poor circulation leads to ulcers, especially those located in the feet . Those ulcers are slow to heal and often become deep and infected. [13 & 14]

Our study reveal high incidence of bacterial wound infections in diabetic patients in comparison with non diabetic patients. This finding approved by other studies, such as Pomposelli, et al.(1998)[15] which indicate that high blood sugar can increase infection rate and impair wound healing, and wound inflammation and infections can elevate blood sugar. Poorly controlled diabetes adversely affects the ability of leukocytes to destroy invading bacteria and to prevent the harmful proliferation of usually benign bacteria present in the healthy body [16]

Also Coulston (1998)[17] noticed that malnutrition further impairs wound healing in the diabetic patients. Hyperglycemia may result from several factors: inflammation and infections, the use of steroid medications,

and the feeding process. Feeding scheduale and medications may need to be adjusted for optimal blood sugar control.

Gordon (1999)[18] indicated that the systemic oral antibiotics should be initiated for all diabetic wounds, even chronic, if an active infection is felt to be invading beyond the point of local control, if there are no clinical signs of infection, oral antibiotics should be avoided by diabetic patients.

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Author Information

Ihsan edan abdulkareem alsaimary, Ph.D
ASSIST PROF, Department of Microbiology, University of Basrah