RESEARCH ARTICLE

Bacteriological Characterization of Diabetic and Non- Diabetic Wound Infections in Samawah City, Iraq

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Abstract

A total of 150 samples (75 diabetic and 75 non-diabetic) of different ages and both genders (86 male and 64 female) were collected from patients suffering from wound infections who attending the Samawah Hospital of AL-Muthanna governorates through the period of one year (December 2015 - December 2016). The isolation and identification methods of bacterial isolates were followed upon the morphological, cultural and biochemical characteristics in addition to the confirmative systems such as CHROMagar and Api 20 for differentiation among bacterial species. The phenotypic results showed that the isolation percentage of *Propionibacterium granulosum* as an anaerobic bacteria was 22(18.6%) as predominant pathogens in diabetic wound followed by *Staphylococcus aureus* as aerobic bacteria 17(14.4%). While *Pseudomonas aeruginosa* was 17(15.7%) a predominant pathogens isolated from non-diabetic wound infection. Isolated culture was treated with antibiotics and Amoxycillin was found as the best effective antibiotic which gave (16mm) inhibition zone in comparison with other standard antibiotics.

Key words: Bacterial isolation, diabetics, antibiotics. CHROMagar, APi 20, Wound Infections

Introduction

The diabetes is a chronic disorder that globally affects a large number of people and is one of the major public health problems (Sivanmaliappan et al, 2011). Approximately one-fourth of people with the diabetes will develop an ulcer during their lifetime and as many as half of these ulcers will become infected (Lipsky et al, 2004. Lavery et al, 2007). In people with diabetes and the foot ulcers, several factors such as inappropriate antibiotic treatment, the chronic nature of the wound and frequent hospital admission can influence the presence of multidrug-resistant microorganisms in their ulcers (Kandemir et al, 2007). Moreover, the specific organisms identified in diabetic infections can differ not only from patient to patient and hospital to hospital but also from one part of the country to another (El-Tahawy, 2000).

The aims of the present study were to determine the role of antibiotics in wound infection of diabetic patients and to identify the bacterial pathogens associated with the diabetic wounds and the antibiotic susceptibility testing of main antibiotics against predominant bacterial types.

Materials and methods

Collection of samples

The samples were collected from the Samawah Hospital through a period of (December 2015 to 2016). 150 samples included 75 samples diabetic patient's wound and 75 samples from non-diabetic patient's wound. The isolates were taken from skin wound from various parts of the body of the different ages of both male and female subjects.

Transport media swabs were used in the collection of samples to ensure the vitality of isolation.

Culture of samples

The 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. The Loop full of inoculated brain heart infusion cultured by streaking onto nutrient agar and blood agar and kept in anaerobic candle jar to supply anaerobic condition, another loop full streaking onto same media in the aerobic condition and incubated for 24-48hrs at 37^{o}C. Classification and identification of aerobic and the anaerobic bacterial types were done according to standard routine techniques proposed by Finegold and Baron (1986) as well as Chromagar medium used in the diagnosis of some bacterial species, especially *Staphylococcus aureus*.

Antibiotic Susceptibility testing

The susceptibility test was measured by agar diffusion method (disc test) to determine diameter of inhibition zones measured by (mm) using Mueller-Hinton Agar (Hi- Media) Fingold and Baron (1986).

Results and Discussion

In this study, a total of 150 wound swabs specimens were collected and examined from patients who suffered from diabetic and non- diabetic wounds. The total wound swabs with diabetic according to the gender groups were 49.4% and 50.6% for male and female respectively. While, the total wound swabs from non-diabetic patients according to the gender groups were 65.4% and 34.6% for male and female respectively as shown in table 1.

Samples	Diabetic patients	%	Non-Diabetic patients	%	Total
Male	37	49.4	49	65.4	86
Female	38	50.6	26	34.6	64
Total	75	100	75	100	150

Table1: *Numbers of Diabetic and Non-Diabetic Patients According To Gender.*

The prevalence of bacterial infections (aerobic and anaerobic) among diabetic and non-diabetic patients were determined and the most predominant bacterial types and their sensitivity pattern were explored in this study. The greater percentages of aerobic and anaerobic bacterial species were found in diabetic patients as compared to non-diabetic group.

The aerobic and anaerobic bacterial types isolated from both diabetic and non-diabetic wound infection is illustrated in table 2.

Bacterial species	Diabetic patients		Non-diabetic patients	
Aerobic	No.	%	No.	%
S. aureus	17	14.4	13	12
S. epidermids	4	3.3	7	6.4
S. xylosus	5	4.2	10	9.2
S. saprophyticus	9	7.6	12	11.11
P. aeruginosa	11	9.3	17	15.7
P. mirabilis	3	2.5	6	5.5
P. vulgaris	3	2.5	0	0
S. pyogenes	6	5	1	0.9
S. mutans	7	5.9	4	3.7
E. coli	5	4.2	9	8.3
Enterococcus spp.	4	3.3	2	1.8
K. pneumoniae	6	5	4	3.7
B. subtilis	1	0.8	0	0
Anaerobic				
P. acnes	12	10.16	7	6.4
P. granulosum	22	18.6	15	13.8
C. difficle	3	2.5	1	0.9
Total	118	100	108	100

Table2 : *Aerobic and anaerobic bacterial species isolated from diabetic and non-diabetic wound infections*

It has been found *Propionibacterium granulosum* as an anaerobic bacteria was a predominant pathogens in both grou with aggregate 22(18.6%) followed by *Staphylococcus aureus* as aerobic bacteria 17(14.4%) only in diabetic patient's wound. While *Pseudomonas aeruginosa* was 17(15.7%) a predominant pathogens isolated from non-diabetic wound infection.

The other aerobic bacteria isolated from Diabetic patients were *Propionibacterium acnes* 12(10.16%), *P. aeruginosa* 11(9.3%), *S. saprophyticus* 9(7.6%), *S. mutans* 7(5.9%), *S. pyogenes* and *K. pneumoniae* 6 (5%), *S. xylosus* and

E. coli 5(4.2%), *Staph. epidermids* and *Enterococcus* spp. 4(3.3%), *P. mirabilis, P. vulgaris* 3(2.5%) and *B. subtilis* 1(0.8%), among anaerobic isolates *P. acnes* 12(10.16%) and *C. difficle* 3*(*2.5%) were included. While, the anaerobic bacterial isolates from non-diabetic patients included *P. granulosum* 15(13.8%) and *P. acnes* 7(6.4%) among aerobic isolates *S. aureus* 13 (12%), *S. saprophyticus* 12(11.11%), S. *xylosus* 10(9.2%), *E. coli* 9(8.3%), *S. mutans* and *K. pneumonia* 4(3.7%), *Enterococcus spp*. 2(1.8%), *S. epidermids* 7(6.4%) *P. aeruginosa* 17(15.7%) *P. mirabilis* 6 (5.5%) and *S. pyogenes* 1(0.9%).

The study reveal high incidence of bacterial wound infections in diabetic patients as compared to non-diabetic patients. This finding approved by other studies such Pomposelli *et al*. (1998) which, indicate that high blood sugar can increase infection rate and the impair wound healing and wound inflammation. The poorly controlled diabetes adversely affects the ability of leukocytes to destroy invading bacteria and it prevent the harmful proliferation of usually benign bacteria present in the healthy body O Dell (1999).

It has been found that mode of double pathogens was 31(41%) predominant in diabetic wounds while three pathogens 22(29.4%) were predominant in non-diabetic wound followed by another modes of isolation (Table 3). This results were approach to Onche, *et al* (2004), while Alsaimary, (2010) results showed that Double, three and four pathogens were (25.9 %, 37%, 14.8%) from diabetic patients respectively and (20%, 26.6%, 36.6%) from non-diabetic patients respectively.

Mode of isolation	**Diabetic patients**		**Non-diabetic patients**	
	No.	%	No.	%
Single pathogen	23	30.6	21	28
Double pathogens	31	41.3	14	18.6
Three pathogens	10	13.3	22	29.4
More than three pathogens	7	9.4	11	14.6
No growth	4	5.4	7	9.4
Total	75	100	75	100

Table 3: *Modes of bacterial isolation from diabetic and non-diabetic wound infections.*

Antibiotic susceptibility test of ten antibiotics against anaerobes *P. granulosum*. It has been study that, Amoxycillin gave a greater inhibition zone (16 mm), while Cephalothin (14mm), Ciprofloxacin (13mm), Gentamicin (10 mm), Tetracyclin (9mm), Vancomycin (8mm), Penicillin (7mm),Rifampicin (6mm), Erythromycin (5mm) and Chloramphenicol (4mm). Within the limits of antibiotic inhibition zones (table 4). This results were approach to Alsaimary, (2010).

Antibacterial agent	**Concentration**	**Inhibition zone (mm)**
Penicillin	10 µ	7
Cephalothin	30 mcg	14
Tetracyclin	30 mcg	9
Gentamicin	10 mcg	10
Amoxicillin	10 mcg	16
Ciprofloxacin	5m cg	13
Erythromycin	30 mcg	5
Vancomycin	10 mcg	8
Chloramphenicol	10 mcg	4
Rifampicin	20 mcg	6

Table 4: *Antibiotics susceptibility test against P. granulosum isolated from diabetic wound infection.*

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

Conclusion

The accurately diagnose infection, a combination of clinical, laboratory and imaging investigations must be used. The various studies have defined the proper techniques for obtaining and the values of various tests. Determining which diagnostic procedures to order depends somewhat on the local expertise and availability. Among the simplest and most important of tests is probing the debrided wound at the base of an ulcer, this should be done on every wound to evaluate its depth and exclude osteomyelitis. If in doubt, it is better to treat potential

infection empirically while waiting for a definitive diagnosis than to delay treatment.

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