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## Research article

### A DESCRIPTIVE STUDY ON PREVALENCE OF BACTERIAL PATHOGENS IN DIABETIC ULCER AND INTERVENTIONAL COMPONENT FOR THE PREVENTION OF FOOT ULCERS

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#### ABSTRACT

Diabetes is considered to have reached epidemic proportions worldwide. The most distressing complication of diabetes is foot ulcer and is the major cause of lower limb amputation. Hence, they require a prolonged hospital stay to combat more serious complications like gangrene and lower limb amputation. Early detection and prompt treatment help in alleviating the ulceration. **Methods:** The present study was conducted among 50 diabetes patients. Study subjects were selected using non probability purposive sampling technique. Pus samples were collected by using sterile swabs in a sterile manner from the ulcerated area. The wounds are washed vigorously with normal saline solution before collection of specimen. The specimens were transported immediately to the laboratory for culture. The clinical specimens were first screened microscopically by Gram's stain, and then cultured on blood agar (aerobically and an aerobically), MacConkey agar and Robertson cooked meat broth for 48 hours at 37°C in 5-10 percent CO<sub>2</sub> and bacteria's were isolated. **Results:** The socio demographic profile of the present study reveals that males were predominant among the study population. Type II diabetes was more common, majority of study subjects are suffering from diabetes for more than 5 years and are treated with oral hypoglycemic drugs. The wound size was ≤ 2cms in majority of study subjects. The bacteriological profile of diabetic ulcer reveals that a majority of 23 (46%) had growth of *Staphylococcus aureus* and 19 (38%) had growth of *klebsiella* and a minimum of 6 (12%) and 2 (4%) had grown of *Pseudomonas* and *Staphylococcus albus*. **Conclusion:** Early detection of these bacterial pathogens helps to minimize the disease progress.

**Key words:** Foot ulcer, Gram stain's, Mac Conkey agar, Robertson cooked meat broth

#### INTRODUCTION

Diabetes is a chronic disorder that leads to serious damage to many body systems. Globally, it is estimated that 285 million people as of 2010 had diabetes, out of which 90% of the cases constituting Type II. A total of 366 million people have diabetes in 2011. The International diabetes federation estimates that 381 million people had diabetes in 2013<sup>1</sup>. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and

4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030<sup>2</sup>. In India the prevalence of diabetes is more pronounced in urban areas, and is roughly double than those in rural areas<sup>2-4</sup>. Also, the prevalence is higher in men <60 years of age and in women at older ages due to demographic changes<sup>5</sup>. One of the horrendous manifestations of diabetes on any patient is diabetic foot ulcer which means an

open sore or wound occurs on the bottom of the foot resulting in ulcerations, infections, and gangrene. The critical triad most commonly seen among patients with diabetic foot ulcers includes peripheral sensory neuropathy, deformity, and trauma. Annually the incidence of foot ulceration is 1.0-4.1% and prevalence is 4-10%. The principle causative factors are peripheral neuropathy, vascular compromise, ulceration and infections. Foot infections are a common and serious problem in person with diabetes<sup>3</sup>. Patients with diabetic foot infections most commonly end up in serious complications of gangrene formation and amputation. Most Diabetic foot infections are poly microbial with aerobic gram positive cocci and especially staphylococcus, the most common causative organisms<sup>4</sup>. Delay in wound healing, Inadequate treatment of foot infection and bacterial resistance often end up in limb loss and the treatment for complicated lesions becomes challenging and rewarding, hence appropriate treatment for diabetic foot ulcer remains underestimated. Hence, the present study reveals the prevalence of pathogens in diabetic foot ulcer among patients in Type II diabetes mellitus. The authors recommend a program called **SAFE** – Self Awareness & Foot Examination, if followed meticulously, will prevent foot ulcers in diabetic patients.

Hence the researcher did a descriptive study to identify the prevalence of bacterial pathogens in diabetic ulcer and interventional component for the prevention of foot ulcers in selected hospitals at Kanyakumari District. The main objectives are to determine the common pathogens isolated from diabetic ulcer and to recommend strategies for prevention – SAFE programme.

## **MATERIAL AND METHODS**

The investigator selected non experimental descriptive research design on basis of problem and objectives to be accomplished. The population of the study was patients with diabetic ulcers with controlled blood sugar values. The study setting was selected hospitals at Kanyakumari district. The researcher used non probability purposive sampling technique and drawn 50 samples. Formal approval was obtained from the Institutional review board and Institutional ethical committee. Official permission was obtained from the Medical officer of selected

study settings. Both written and oral information about the study were given in local language to the study participants. They were requested to participate voluntarily in the study. The data collection procedure was carried out in the month of July 2013.

### **Inclusion criteria**

1. Patients of both male and female sex.
2. With history of diabetes for 5 yrs and above.
3. Patients with diabetic foot ulcer with controlled blood sugar values.
4. Patients willing to participate in the study.
5. Age 40 and above with known diabetes mellitus.
6. Patient who are conscious.

### **Exclusion criteria**

1. Patients with diabetic ulcer with elevated blood sugar values of more than 250 mg/dl.
2. Patients with complicated lesions.
3. Patients with Arterial occlusive disorders.

### **Isolation of bacteria from diabetic ulcer**

#### **Sampling**

Sample size was computed through power analysis. The estimated sample size was 48. Considering the attrition rate of 10%, the sample size was rounded to 50. Patients with diabetic wound, ulcer who fulfilled the Inclusion criteria were included in the present study. Both sexes were included with controlled blood sugar values. Samples were collected after the wounds are washed vigorously with normal saline solution. Using sterile swabs (Hi media), the fresh wound area from the margins and edges of an ulcer were wiped with the cotton swab. The wound swabs were then transported to the laboratory for culture. Then, using various differentials and selective media, the samples were cultured aerobically and an aerobically and bacterial pathogens were isolated using standard biochemical tests like Catalase coagulase oxidase test, Indole MR-VP test, Citrate test, TSI test.

**Staining:** This includes the microscopic appearance of a stained preparation of the wound swab using differential staining procedures is used. A gram stained film prepared from wound swabs and from culture were observed.

**Plating:** The collected swabs are subjected for observation by Gram staining and isolation by aerobic and anaerobic culturing using standard techniques and media.

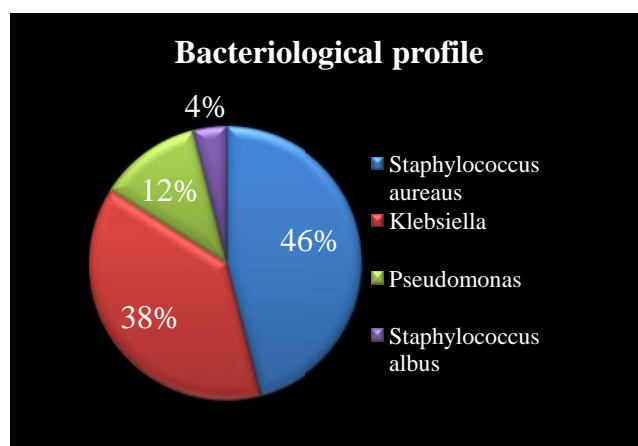
**Aerobic Isolation:** Collected swabs were streaked over appropriate media. The media used are nutrient agar, mac conkey agar, blood agar. The streaked plates were incubated at 37°C for 24 hours. After incubation, the plates were observed for growth and the isolated colonies were identified by morphological by gram staining. Bacterial pathogens were identified by conventional biochemical methods according to standard microbiological techniques [Kelly].

**Anaerobic Isolation:** Swabs with pus were inoculated in freshly prepared tubes of Robertson cooked meat broth. The top layer of the media is covered with melted paraffin wax, So that oxygen entering into the media is prevented. The top of the tube is cotton plugged and was again dipped in wax. The tubes were incubated in 37°C for 3 days in order to identify the growth of saccolytic, proteolytic anaerobes.

## RESULTS

**Table 1: Socio demographic profile of study subjects**

S.No	Variables	Frequency	%
1.	Age in years		
	31-40	-	-
	41-50	10	20
	51-60	10	20
	61 & above	30	60
2.	Sex		
	Male	40	80
	Female	10	20
3.	Type of diabetes mellitus	2	4
	Type I	48	96
	Type II		
4.	Duration of illness		
	≤5 years	20	40
	6-10 years	30	60
	11-15 years	-	-
	≥ 15 years	-	-
5.	Blood sugar controlled with		
	Oral hypoglycemic	45	90
	Insulin	2	4
	Alternative treatment	-	-
	Others	3	6
6.	Size of the ulcer		
	≤ 2 cms	35	70
	2- 5 cms	15	30
	5- 10 cms	-	-
	10 cms & above	-	-
7.	Random blood sugar		
	< 200 mg/dl	24	48
	>200 mg/dl	26	52



**Fig 1 - Bacteriological profile of diabetic ulcer**

## DISCUSSION

**Table 1** reveals the socio demographic profile of patients with diabetic ulcer. Among them majority of 30(60%) were in the age group of more than 60 years and males were found predominant in the study population, Also, 48(96%) were having Type II diabetes. Similar findings were obtained in other studies stating Type II was more predominant than other types.<sup>5</sup> The majority 30 (60%) of diabetic ulcers in this study were seen in patients who have been known to be suffering from diabetes for longer than 5 years. It is predominant that a majority of the 45 (90%) of diabetes patients in this study is under oral hypoglycemic therapy. Also, majority 35 (70%) of the study group had the ulcer size of ≤ 2 cms. Regarding the blood sugar value of study participants 24 (48%) had less than 200 mg/dl and 26 (52%) had more than 200 mg/dl.

**Figure 1** reveals the bacteriological profile of diabetic ulcer of the study population. Majority of 23 (46%) of diabetic ulcers had growth of *staphylococcus aureus*, 19 (38%) had growth of *Klebsiella*, minimum 6 (12%) of diabetic ulcer had pseudomonas growth and least of 2 (4%) had growth of staphylococcus albus in the diabetic ulcer. *Staphylococcus aureus*, the predominant bacterium in wound infection, which is similar to the finding made by Banashankari et al. (2012)<sup>6</sup>. The frequently reported organisms such as *Klebsiella* species and *Pseudomonas* species were also common in the present study. No evidence of anaerobic bacteria is observed in the present study. However, it was also evident in other studies that Gram-negative bacteria, Gram-positive bacteria and few fungal species are

reported as more common microbes present in diabetic foot infection<sup>7</sup>.

## CONCLUSION

Commonest bacterial pathogen isolated in this study was *Staphylococcus aureus*, *Klebsiella*, and *Pseudomonas*. This study will serve as a valuable reference material for future investigators. Large scale studies can be conducted. Early detection of bacterial pathogen helps to minimize the disease progress.

### Safe – programme

**Prevention is better than cure.** Emphasizing this principle, the author proposes a daily procedure for the patient, called “**self awareness & foot examination – safe**”.

Self awareness for a diabetic patient about foot care helps in the following types of prevention.

**Primordial prevention:** Even before the risk factors set in we should educate how to avoid such risks, which will cause injuries. The patient is taught to examine his foot every day for about 10 minutes, in broad daylight, and check for any injury, callosities, red, inflamed spots, examine in between the toes for any colour changes, infections. He should also be taught to take care of his toenails, cut them only after soaking the feet in warm water for about 5 minutes. Test for sensory loss in feet, will be done by health care providers specially trained in this, and the patient should seek their help to protect injuries to feet. Oral intake of Vitamin B complex, especially Pyridoxine, 10mg per day, is very helpful in controlling peripheral neuropathy.

**Primary prevention:** The patient should use proper footwear, preferably without any buckles, metals, and the inner sole should be made up of Micro Cellular Rubber. The patient can wear soft footwear in the house and also the outside foot wear should have a strong bottom layer which will prevent thorn pricks and other injuries.

**Secondary prevention:** The patient should seek medical advice and attention even for even minor injuries and should not manage the injuries by self.

**Tertiary prevention:** Medical/ Surgical management and rehabilitation services should be sought by the patient in appropriate time and the Government and private health care systems are well established for such health care services, especially under the

National Diabetes, Hypertension and Cardio Vascular Diseases Control Programme.

**Limitations:** The investigator had difficulties in sample selection.

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**Conflict of Interest: Nil**

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