

Original Research Article

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## A Clinico Microbiological Study of Diabetic Foot Ulcers

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### ABSTRACT

Infection complicates the pathological picture of diabetic foot and plays a main role in development of moist gangrene. A total sample size of 100 patients with diabetic foot ulcer was included in this cross sectional study. A detailed history was obtained and assessment of clinical symptoms and signs were made. Discharge from the lesions, pus aspirates from the abscesses and debrided necrotic materials were collected. Aerobic culture anaerobic culture and antibiotic susceptibility testing was done. Males were the predominant group in this study 66% as compared to females 34%. Most of the patients (98%) had type 2 Diabetes Mellitus. Around 50% of the patients had Diabetes Mellitus for less than 5 years and the rest had Diabetes Mellitus for a period more than five years. Poor glycemic control was present in 90% cases and was a significant risk factor in relation to foot ulceration. Out of 100 samples 95 samples were culture positive. From the 95 culture positive patients 130 isolates were isolated as average 1.36 isolates per patient. The majority of the patients were infected with aerobes only. (89%) Both aerobic and anaerobic organism could be isolated in the remaining patients. (11%) Gram positive organisms were isolated in 53 patients. *Staphylococcus aerues* was the commonest isolate. Resistance to cotrimoxazole, cefotaxime, gentamycin was noticed among the gram negative bacteria.

#### Keywords

Microbiological,  
Cotrimoxazole,  
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### Introduction

Diabetes mellitus is recognized as an epidemic in the Asian sub-continent affecting nearly 25 millions in India alone<sup>1</sup>. Foot disorders are a leading cause of hospitalization for patients with diabetes<sup>2</sup>. Ulceration of the foot is the precursor to approximately 85% of all diabetic amputations and it is estimated that 14.20% of patients with foot ulcers will have to undergo amputation.

The triad of problem leading on the diabetic foot is neuropathy, vascular changes and infections, which constitute the diabetic foot

syndrome<sup>3</sup>. Infection complicates the pathological picture of diabetic foot and plays a main role in development of moist gangrene. This study was done to detect the prevalence of diabetic foot, to know the risk factors for developing diabetic foot ulcers, microbial profile in diabetic wound, common susceptibility pattern to antibiotics and presence of multiple drug resistant organisms in diabetic foot.

### Materials and Methods

A total sample size of 100 patients with diabetic foot ulcer (Both Outpatients and

Inpatients) who were treated at Government Medical College Hospital Thoothukudi were included in this cross sectional study. A detailed history was obtained and assessment of clinical symptoms and signs were made.

Grading of foot lesions was as follows depending on the severity of lesions<sup>3</sup>

### **Wagner ulcer classification systems**

Grade: 0: No open lesions; may have deformity or cellulites

Grade: 1: Superficial diabetic ulcer (Partial or full thickness)

Grade: 2: ulcer extension to ligament, tendon, joint capsule or deep fascia without abscess or osteomyelitis

Grade: 3: Deep ulcer with abscess, osteomyelitis or joint sepsis

Grade: 4: Gangrene localized to portion to forefoot or heel

Grade: 5: Extensive gangrenous involvement

Osteomyelitis diagnosed on suggestive changes in the radiographs and bone scans. All cases were monitored until discharge from the hospital

Discharge from the lesions were collected with sterile swabs after the surface of the wound had been washed vigorously by saline, pus aspirates from the abscesses and debrided necrotic materials were collected.

### **Microbiological Methods**

A gram stained direct smear of the specimen was examined. The specimen were cultured on blood agar and Mac Conkey agar for aerobic culture and incubated at 37 C overnight. The

bacterial isolates were identified by conventional biochemical tests.

### **Susceptibility testing**

Anti-microbial susceptibility testing of isolates was performed by the standard disc diffusion method as recommended by the Clinical Laboratory Standards Institute

### **Anaerobic culture**

Tissue bits, were inoculated into Robertson's Cooked Meat Media at the bed side, then the subculture was done on to blood agar plate, neomycin blood agar plate and kept in an anaerobic jar. Anaerobiasis maintained using gaspak (commercially purchased from Himedia). After incubation for 48 hours Bacteroides was confirmed by subculturing on to bacteroides bile esculin agar and observing the growth. Organism was identified by gram stain, microscopic and colony morphology and results of aerotolerance tests. The plates were incubated for another 48 hours to identify slow growing organisms. RCM was incubated at 37°C and observed for 7 days.

### **Results and Discussion**

Pus samples were collected from 100 patients with diabetic foot ulcers Males were the predominant group in this study 66% as compared to females 34%. This might be due to reduced immunity in old age and the increased duration of diabetes mellitus.

Most of the patients (98%) had type 2 Diabetes Mellitus,

Around 50% of the patients had Diabetes Mellitus for less than 5 years and the rest had Diabetes Mellitus for a period more than five years. This could be because most of the patients were in the lower socio economic group and were illiterates having low level of

awareness regarding diabetes. Many of them had their blood sugar checked at the time of admission for a non-healing ulcer.

The ulcers were either a non-healing ulcer followed by a trauma or began as a cellulitis initially, or were infections in a previous healed ulcer.

64% patients had Neuropathy, 24% had Nephropathy, 20% had Peripheral Vascular Disease, Osteomyelitis was present in 22% of subjects.

Poor glycemic control was present in 90% cases and was a significant risk factor in relation to foot ulceration.

53% patients had hypertension, this is similar to the study by Khalid *et al.*,<sup>4</sup> were 53 out of 116 patients included in the study had hypertension.

Awareness about risk factors regarding foot care was lacking and only 7% of patients were aware about the foot care.

The most common anatomical position of the ulcer was in the ball of the great toe (30%) followed by the sole of the foot 14%. It is mainly due to the high pressure over the ball of the great than other pressure points of the foot.

In the study conducted by Daivid G. Armstrong *et al.*,<sup>5</sup> 22% of diabetic foot ulcers were occurred in the ball of the great toe.

76% of the patients in this study had grade 2 diabetic ulcers, In the study by Rooh - Ulmugreem *et al.*,<sup>6</sup> the most of the patients had grade 3 ulcer while Llanes<sup>7</sup> and Balderas<sup>8</sup> have reported grade 2/3 and grade 2 ulcer respectively in their study.

In this study 58 cases had previous history of ulcer which is comparable to other studies Khalid *et al.*,<sup>4</sup> 18 cases had past history of amputation, 11% of the cases had necrotic ulcers, about 24% of case underwent surgical debridement and 22% underwent amputation. All the cases received appropriate wound dressing and medical management (Table 1 and 2).

**Table.1** Duration of the diabetes mellitus

Duration (in years)	No of cases
0-1 Years	14
1-2 Years	12
2-4 Years	18
4-6 Years	14
6-8 Years	8
8-10 Years	20
10-12 Years	4
>12 Years	10

**Table.2** Profile of isolated organisms from infected foot ulcers in diabetic patient’s specimens (n=130)

Organisms	No of Isolates	Percentage
<i>Staphylococcus aureus</i>	41	31.2
<i>Proteus</i> Species	26	21.0
<i>E. coli</i>	20	15.2
<i>Klebsiella</i> species	11	8.4
<i>Citrobactor</i> Species	2	1.5
<i>Pseudomonas aeruginosa</i>	2	1.5
<i>Diptheriods</i>	4	3.0
CONS	8	6.1
<i>Bacteroids</i>	9	6.8
<i>Peptostreptococci</i>	5	3.8
<i>Candida</i>	2	1.5

Out of 100 samples 95 samples were culture positive.

From the 95 culture positive patients 130 isolates were isolated as average 1.36 isolates per patient.

The majority of the patients were infected with aerobes only. (89%) Both aerobic and anaerobic organism could be isolated in the remaining patients. (11%) Fewer recovery of anaerobes because only few patients had gangrene.

In the study done by Unachukwu *et al.*,<sup>9</sup> Aerobes and anaerobes constituted 95.4% and 4.6% of the total bacterial isolates respectively.

Gram positive organisms were isolated in 53 patients. *Staphylococcus aerues* was the commonest isolate being recovered in 41%. This is similar to the other studies in Ali S *et al.*,<sup>10</sup>, Rooh – ul – Muqem *et al.*,<sup>6</sup>, other organisms isolated were *Proteus* sp (26), *E.coli* (20), *Kelbsiella* sp 11, *Citrobactor* and *Pseudomonas* 2 each, *Bacteroidssfagilis* was isolated in 9 cases and peptostreptococci in 5

cases.

Antibiotic sensitivity testing revealed that most *S. aureus* isolated were sensitive to amikacin and ciprofloxacin. They were resistant to cotrimoxazole, erythromycin and penicillin. MRSA was notices among 15 of them. Among the GNB *E-Coli* was uniformly sensitive to Amikacin, *Klebsiella* and *Proteus* – most of them sensitive to amikacin and ciprofloxacin. Resistance to cotrimoxazole, cefotaxime, gentamycin was notices among these bacteria, the prevalence of multidrug resistant organisms was around 76%. Patients with MDRO infected ulcer had significantly higher blood glucose levels than those with non MDRO infected ulcers.

15 of the *E. coli*, 10 among *Klebsiellae* and 17 isolates among *Proteus* were detected to be ESBL producers.

In the study Gadepalli *et al.*,<sup>11</sup> ESBL Production and methicillin resistance was noted in 44.7 and 56% of bacterial isolates respectively.

In conclusion, this study presents a comprehensive clinical and microbiological

survey of infected diabetic foot ulcer in hospitalized patients. Lack of awareness, poor glycemic control, long duration of diabetes and neuropathy were the main risk factors in the causation of diabetic foot ulcers. In this study gram positive aerobes were the predominant isolates.

The present study confirms that infection with Multiple Drug Resistant organisms is extremely common in hospitalized patients with diabetic foot ulcers.

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