

## A Prospective Cohort Study on Diabetic Foot Infections with Emphasis on Identifiable Risk Factors in Patients Attending Tertiary Care Centre

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### Abstract

**Background:** Foot infections are one of the most commonly observed complications in diabetic patients and are associated with high morbidity and risk of lower extremity amputation. Foot infections account for about 20% of all hospitalizations in people with diabetes and at least 50% of all non-traumatic lower-limb amputations performed annually.

**Objective:** To identify the risk factors in patients with diabetic foot infections attending tertiary care centre.

**Method:** It is a longitudinal prospective study in which patients attending the tertiary care centre with diabetic foot infections meeting the inclusion criteria were enrolled after obtaining the informed consent form.

**Results and discussion:** The results of this study revealed that the overall prevalence of DFI was seen more in males (61.42%) when compared to females (38.57%). The results also showed that the risk of DFI was more with trauma(44.28%) followed by the long duration of DM (28.57%) > wound (15.71%) > uncontrolled DM & prior foot ulcer (5.7%) which indicates a lack of awareness, longer duration of DM, poor glycemic control were the main risk factors causing diabetic foot problems. **Conclusion:** The results suggest that lack of awareness, poor glycemic control, and long duration of diabetes were the main risk factors causing DFI. Therefore, efforts to prevent infections should be targeted at people with traumatic foot wounds especially those that are chronic and recurrent. Foot care education would be the foremost important way of dealing with this serious problem.

**Keywords:** Morbidity, lower-extremity amputation, trauma, glycemic control.

### INTRODUCTION:

Diabetes mellitus (DM) is a group of heterogeneous disorders in which carbohydrate metabolism is reduced while those of proteins and lipids are increased. Hyperglycemia is a common endpoint for all types of DM [1]. The underlying cause of diabetes is the defective production or action of insulin, a hormone that controls glucose, fat, and amino-acid metabolism [2]. The pathological changes include thickening of the capillary basement membrane and an increase in cellular proliferation resulting in vascular complications like narrowing of the lumen, early atherosclerosis, sclerosis of capillaries of the glomerulus, neuropathy retinopathy, and peripheral vascular insufficiency [3]. Diabetes is the third leading cause of death, the second leading cause of blindness as well as renal failure. Various complications often develop as a consequence of the metabolic derangements in DM over many years if there is poor glycemic control. As a result, there may be microvascular complications (neuropathy, retinopathy, and nephropathy) as well as macrovascular complications such as atherosclerosis and diabetic dyslipidemia (elevated LDL & TGs). Foot infections are more common in diabetics and are associated with high morbidity and risk of lower extremity amputation [4]. Diabetic foot infections are classified as mild, moderate, and severe. Gram-

positive bacteria, such as *Staphylococcus aureus* and beta-hemolytic streptococci, are the most common pathogens in previously untreated mild and moderate infection. Chronic, severe, or previously treated infections were mostly polymicrobial [5]. Diabetic foot infections range from superficial paronychia to deep infection involving bone based on severity. Types of infection include diabetic foot ulcers, cellulitis, abscesses, gangrene, and necrotizing fasciitis [6]. Foot infections account for about 20% of all hospitalizations in people with diabetes and at least 50% of all non-traumatic lower-limb amputations performed annually. As many, 25% of all diabetics are expected to develop severe foot problems at some point in their lifetime [7]. Infections in diabetics are generally more severe and more difficult to treat than infections in non-diabetics [8]. This is due to impaired microvascular circulation, neuropathy, lack of awareness, anatomical alterations, and impaired immune capacity in diabetic patients [9].

### MATERIAL AND METHODS:

The present research work was conducted at Malla Reddy Narayana Multispecialty Hospital, Suraram. It is a longitudinal prospective study in which patients with diabetic foot infections meeting the inclusion criteria were enrolled only

after obtaining informed consent. Laboratory reports like FBS, RBS, PPBS, HbA1c, and other parameters will be recorded in the patients. All the relevant and necessary data was collected in the data collection form.

**Inclusion and Exclusion Criteria:**

**Inclusion Criteria:**

- ✓ Patients who are diagnosed with diabetic foot infections.
- ✓ Patients of age group 18-80 years.
- ✓ Patients with either gender.
- ✓ Radiological investigations suggesting diabetic foot infections.
- ✓ Patients with either type of diabetes.

**Exclusion Criteria:**

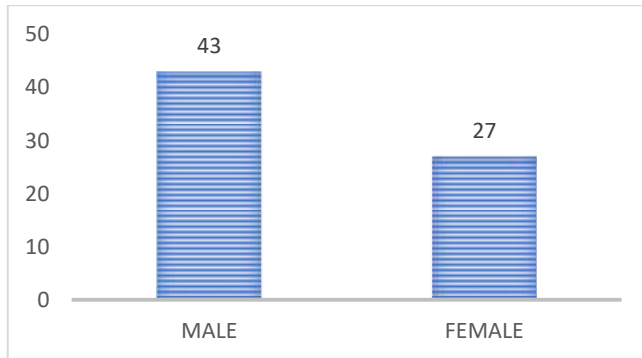
- ✓ Patients below 18 years of age.
- ✓ Unconscious patients.
- ✓ Pregnant women.

Data was entered in the Microsoft word excel sheet and analyzed.

**RESULTS AND DISCUSSION:**

**Results:**

**Distribution of patients based on gender:** A total of 70 patients with diabetic foot infections were enrolled for the study. The total number of males in the study was 43 (61.42%) while females were 27 (38.57%). A graphical representation of the data was shown in the figure-1.

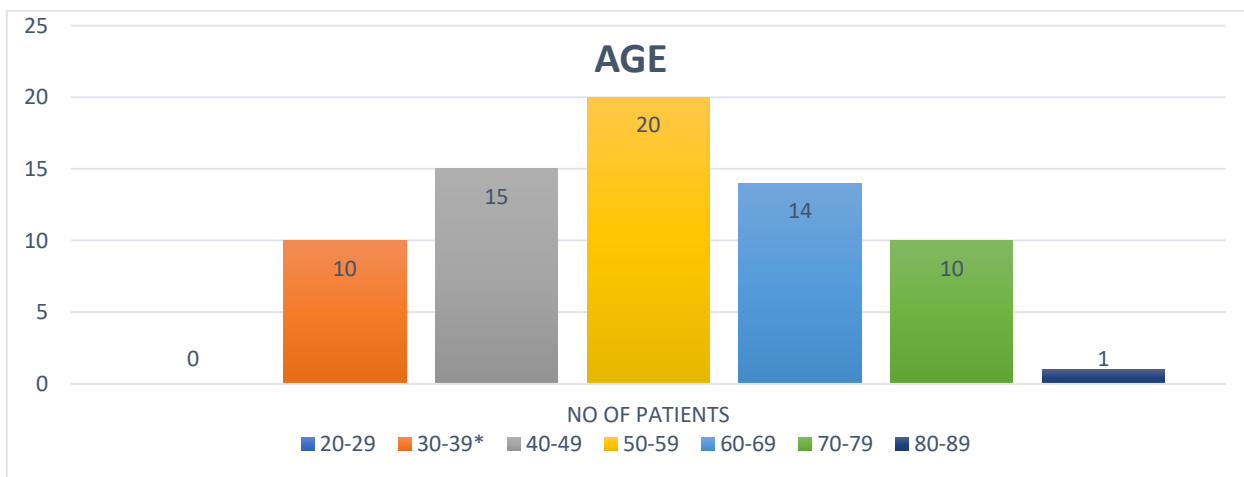


**Fig 1: Distribution of patients based on gender**

**Distribution of patients based on age:** Out of 70 patients, Diabetic foot infections are more prevalent in the age group (50-59) and less prevalent in the age group (20-29). Graphical representation of the data was shown in the figure-2 and results were shown in table-1.

**Table 1: Distribution of patients based on age**

Age in years	Subjects	Percentage
20-29	0	0.0%
30-39	10	14.28%
40-49	15	21.42%
50-59	20	28.57%
60-69	14	20.00%
70-79	10	14.28%
80-89	01	1.42%



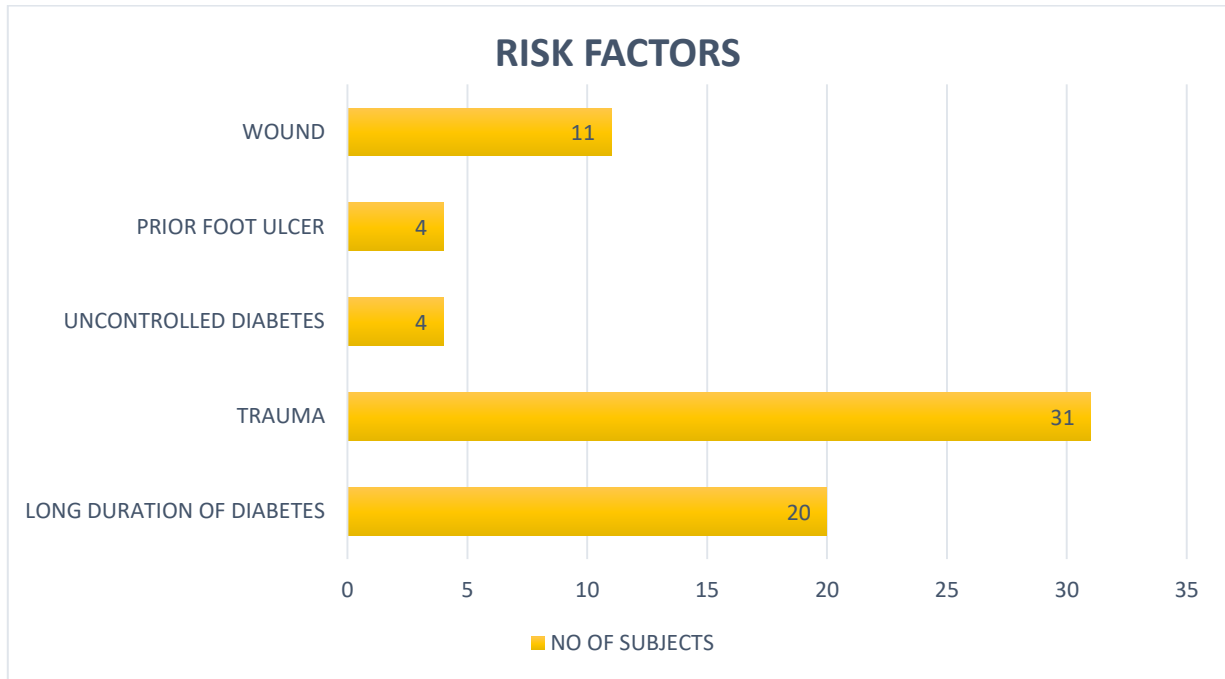
**Fig 2: Distribution of patients based on age**

**Distribution of patients based on type of diabetes mellitus:** Type 2 diabetes is most common in patients with diabetic foot infections. Results were shown in table-2.

**Table 2: Distribution of patients based on type of diabetes mellitus**

Type	Number of patients	Percentage
Type-1	9	12.85%
Type -2	61	87.14%

**Distribution of patients based on risk factors:** Interrelating risk factors and diabetic infections, the most common risk factor was trauma (44.28%). A graphical representation of the data was shown in the figure-3. Results were shown in table-3.

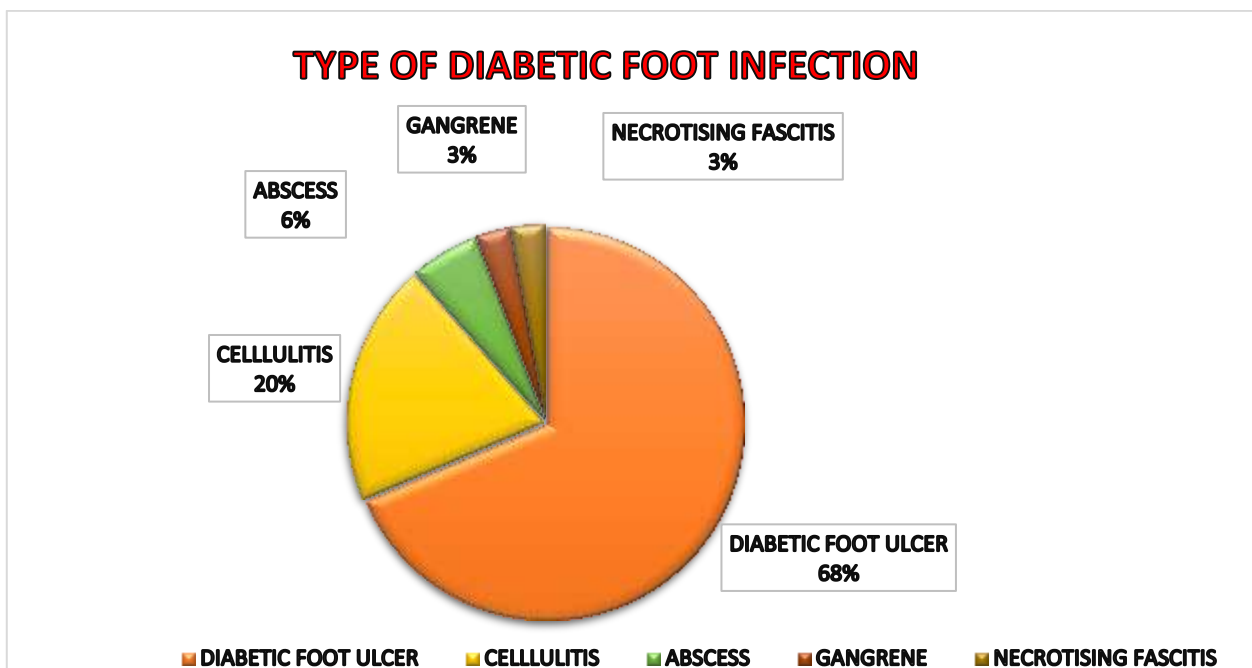


**Fig 3: Distribution of patients based on risk factors**

**Table 3: Distribution of patients based on risk factors**

Risk factor	Number of patients	Percentage
Trauma	31	44.28%
Long duration of diabetes	20	28.57%
Uncontrolled DM	4	5.7%
Prior foot ulcer	4	5.7%
Wound	11	15.71%

**Distribution of patients based on type of foot infection:** Most common type of foot infection affected in patients is diabetic foot ulcers. A graphical representation of the data was shown in the figure-4. Results were shown in table-4.

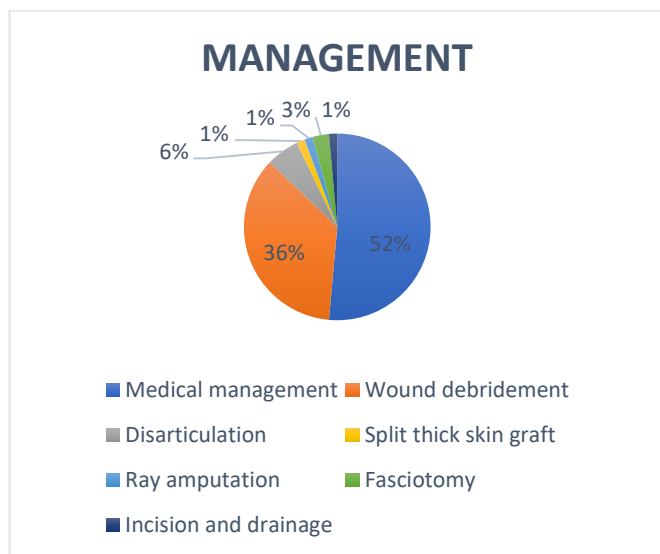


**Fig 4: Distribution of patients based on type of foot infection**

**Table 4: Distribution of patients based on type of foot infection**

Type of foot infection	Number of patients	Percentage
Diabetic foot Ulcers	48	68.57%
Abscess	4	5.7%
Cellulitis	14	20.00%
Gangrene	2	2.85%
Necrotizing fasciitis	2	2.85%

**Distribution of patients based on management of foot infections:** Medical management is preferred mostly for diabetic foot infections. A graphical representation of the data was shown in the figure-5. Results were shown in table-5.

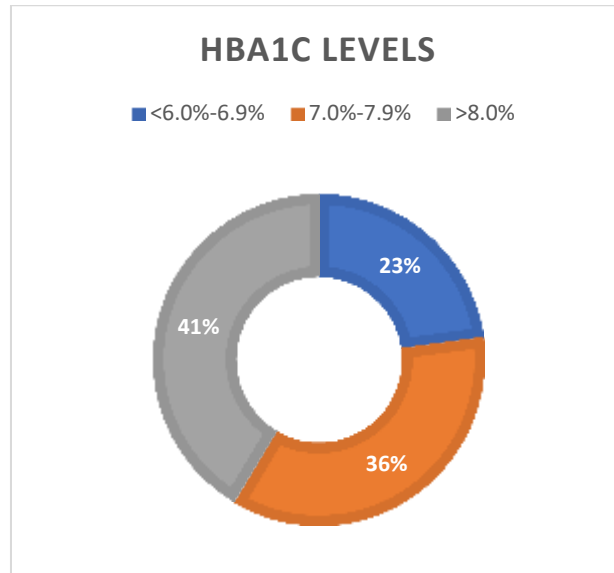


**Fig 5: Distribution of patients based on management of foot infections**

**Table 5: Distribution of patients based on management of foot infections**

Type of management	Number of patients	Percentage
Medical management	36	51.4%
Wound debridement	25	35.7%
Disarticulation	4	5.7%
Split thick skin graft	1	1.42%
Ray amputation	1	1.42%
Fasciotomy	2	2.85%
Incision and drainage	1	1.42%

**Distribution of patients based on HbA1C levels:** Out of 70 patients, 29 patients HbA1C levels were above 8.0% which indicates that patients with uncontrolled diabetes are at higher risk of developing diabetic foot infections. A graphical representation of the data was shown in the figure-6. Results were shown in table-6.



**Fig 6: Distribution of patients based on HbA1C levels**

**Table 6: Distribution of patients based on HbA1C levels**

HbA1C Level	No of subjects
<6.0%-6.9% (Good)	16 (22.85%)
7.0%-7.9% (Poor)	25 (35.71%)
>8.0% (Uncontrolled)	29 (41.42%)

**DISCUSSION:**

Foot infections are one of the most common complications in diabetic patients, associated with increased morbidity and the possibility of lower extremity amputation. Diabetic foot infections are classified as mild, moderate, or severe. Gram-positive bacteria, such as Staphylococcus aureus and beta-hemolytic streptococci, are the most common pathogens in previously untreated mild and moderate infection. Chronic, severe, or previously treated infections were mostly polymicrobial. The severity of diabetic foot infections ranges from superficial paronychia to deep infection involving bone [10]. Types of infection include diabetic foot ulcers, cellulitis, abscesses, gangrene, and necrotizing fasciitis.

Foot infections account for about 20% of all hospitalizations in people with diabetes and at least 50% of all non-traumatic lower-limb amputations performed annually. As many, 25% of all diabetics are expected to develop severe foot problems at some point in their lifetime. Infections in diabetics are generally more severe and more difficult to treat than infections in non-diabetics. This is due to impaired microvascular circulation, neuropathy, lack of awareness of anatomical alterations, and impaired immune capacity in diabetic patients [11].

With a total of 70 patients, 61 patients with type 2 diabetes and 9 patients with type 1 diabetes met our inclusion criteria. The methodological quality of the study was satisfactory.

The results of this study showed that the overall prevalence of DFI was seen more in males (61.42%) when compared to females (38.57%). This is due to a sedentary lifestyle [12]. The male-female ratio was found to be 1.59:1.

Our study revealed that the prevalence of DFI was more common in the age group 50-59 (28.57%) and was increases with age i.e., 0% in the age group 20-29, 14.28% in the age group 30-39, 21.42% in the age group 40-49. This is due to weakened immune response and co-morbidity illness [12].

The results of our study showed that the most common type of DFI was diabetic foot ulcer (68.57%) preceded by cellulitis (20%) > abscess (5.7%) > gangrene & necrotizing fasciitis (2.85%). this shows that diabetic foot ulcer was the most common and serious complication of DFIs [13].

The results also showed that the risk of DFI was more with trauma(44.28%) followed by long duration of DM (28.57%) > wound (15.71%) > uncontrolled DM & prior foot ulcer (5.7%) which indicates a lack of awareness, longer duration of DM, poor glycemic control were the main risk factors causing diabetic foot problems [14][15]. This shows that foot care education would be the most important way of dealing with this major problem.

In our study glycemic control was good in 16 patients, poor in 25 patients, and was uncontrollable in 29 patients which indicate that patients with uncontrolled diabetes are at higher risk of developing diabetic foot infections.

Our study revealed that most of the patients with DFIs are treated with antibiotics (51.4%) followed by wound debridement (35.7%) > disarticulation (5.7%) > fasciotomy (2.85%) > split thick skin graft, ray amputation & incision and drainage (1.42%). These results are consistent with the findings from previous studies which include Gram-positive bacteria, such as Staphylococcus aureus and beta-hemolytic streptococci, which are the most common pathogens in previously untreated mild and moderate infection. Chronic, severe, or previously treated infections were mostly polymicrobial. Therefore, antibiotics generally clean up the infections in most people, and in case of any discharge, they may need to be drained with surgery.

## CONCLUSION:

According to the results of the proposed study, Foot infections occur relatively frequently in individuals with diabetes, almost always follow trauma which dramatically increases the risk of hospitalization. The results suggest that lack of awareness, poor glycemic control, and long duration of diabetes were the main risk factors causing DFI. Therefore, efforts to prevent foot infections should be targeted at people with traumatic wounds especially those that are chronic and recurrent.

This prospective study also confirmed that males are more prone to DFI especially in the age group 50-59. Therefore, more attention must be paid to elderly male diabetic patients with poor diabetes control. Foot care education would be the foremost important way of dealing with this serious problem.

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## CONFLICTS OF INTEREST:

None

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