A RETROSPECTIVE ANALYSIS OF THE CLINICAL PROFILES AND TREATMENT MODALITIES OF PATIENTS WITH DIABETIC FOOT ULCER AT A SECONDARY CARE HOSPITAL: A MULTI - DISCIPLINARY ACTIVITY

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ABSTRACT

Diabetic foot ulcer (DFU) is a serious complication of Diabetes Mellitus and a major cause of morbidity, hospitalization, and lower-limb amputation. This retrospective study analyzes the clinical profiles and treatment modalities of patients with diabetic foot ulcer managed at a secondary care hospital through a multidisciplinary approach. Medical records were reviewed to assess demographic characteristics, duration of diabetes, glycemic status, ulcer grading, microbial profile, and associated comorbidities. Treatment strategies including glycemic control, antibiotic therapy, wound debridement, dressing techniques, and surgical interventions were evaluated. The findings highlight that early diagnosis, appropriate antimicrobial therapy, regular wound care, and coordinated management by surgeons, physicians, microbiologists, and nursing staff significantly improved healing outcomes and reduced complications. The study emphasizes the importance of a structured multidisciplinary team in optimizing patient care and preventing limb loss in diabetic foot ulcer patients.

KEY WORDS

Diabetic foot ulcer, Diabetes Mellitus, Multidisciplinary approach, Wound management, Secondary care hospital, Retrospective study, Antibiotic therapy.

I. INTRODUCTION

One of the most serious consequences affecting people with diabetes in their lower extremities is Diabetic Foot Ulcers (DFUs) which have a complicated and protracted pathogenesis that includes vascular, neurological and infectious causes. The meta-analysis by Lihong Chen et al., which included 34 trials and 124,376 participants showed that DFU patients had high mortality rates: 13.1% at one year, 49.1% at five years and 76.9% at ten years. According to statistics gathered by David G. Armstrong and associates from publications released five years after 2007, the 5-year mortality rate for DFU was 30.5%. The healthcare expenses for DFU in the US in 2017 were equal to the direct expenditures of cancer in 2015 when compared to research-focused cancer. Not only is there proof that diabetic individuals with chronic kidney disease (CKD) have a higher chance of developing foot ulcers but some clinical research has also linked CKD to death in DFU patients in some cases. In patients with DFU, common risk factors for death include infection, amputation, chronic kidney disease and inadequate care. The only factors that were shown to be independently linked with death risk were moderate-to-severe CKD, age of onset larger than 69 years and eGFR less than 92. Valentina Guarnotta et al, collected DFU mortality among Sicilian Type 2 diabetic patients hospitalized between 2008-2013 and 2014-2019. **(Didangelos T et.al., 2021**)

DFU presents serious social, economic and health issues. Among diabetic patients, DFU is a leading source of morbidity and mortality. Severe infections extended hospital stays and frequently, amputations are the results of these ulcers. They cause socioeconomic challenges and hefty treatment expenditures. The occurrence of DFU is significantly influenced by lifestyle decisions and socioeconomic factors. Diabetes problems are more common in people with lower socioeconomic status because they have less access to health education and preventive care. The onset and progression of DFU are also influenced by lifestyle factors, such as smoking, poor blood glucose control and physical inactivity. Even with the abundance of therapy options, better diagnostic instruments and individualized treatment programs are still desperately needed. **(Pollak R et.al., 2025)**

Recent studies have shown that mesenchymal stem cells boost DFU repair, promote angiogenesis, speed up re-epithelialization and lower inflammation. This suggests that stem cell therapy is a viable approach to wound healing. In Malaysia, the prevalence of Diabetic Peripheral Neuropathy (DPN), one of the most prevalent complications of diabetes mellitus, is 50.7%. In many high-income countries, it is a major cause of nontraumatic lower extremity amputations and a critical factor that can result in the development of diabetic foot ulcers. The

primary clinical signs of DPN include lower limb discomfort, numbness, paresthesia and paralysis. Patients can also easily hurt their foot without realizing it, which can cause ulceration and ultimately necessitate amputation. Given the severity of the problems, DPN should be identified and treated as soon as feasible. However, there is no indication that the medication is effective. Numerous medical professionals have started researching the potential benefits of Traditional Chinese Medicine (TCM) for DPN treatment. According to TCM philosophy, moxibustion can enhance blood circulation, warm the meridian and regulate blood and all of which may aid in the treatment and prevention of DPN. External TCM treatments are frequently used in therapeutic settings. **(Ferreira JS et.al., 2024)**

Globally, clinicians have challenges in managing Diabetic Foot Ulcers (DFUs). Studies conducted in the real-world show that less than 50% of DFUs heal after 12 weeks, despite advancements in treatment. Although recurrence is regrettably typical in this population, clinical trials are still reviewing new treatments to encourage healing, because recurrence is so common, doctors now refer to the healed diabetic foot as being in "remission." Durability of closure is a crucial clinical trial endpoint: a sophisticated treatment with little therapeutic benefit and little commercial value if it does not provide a fair amount of time without ulcers. Topical oxygen therapy appears to alter wound biochemistry, perhaps leading to a more robust DFU closure, according to preclinical research. Digital healthcare solutions have the potential to streamline, organize and enhance the advised foot care regimen. In order to lower the high healthcare costs associated with treating Diabetic Foot Ulcers (DFUs) and to enhance the quality of life for patients with diabetes at risk of developing DFUs, interdisciplinary care annual structured foot screening and prompt prevention are required. Blood sugar monitoring, wound debridement, moist dressings, antibiotic medication and ulcer offloading are all part of traditional DFU management. These approaches, however usually fail, leaving patients with recurrent DFUs and negatively affecting their quality of life. **(Bus SA et.al., 2021)**

II. REVIEW OF LITERATURE

AUTHOR	YEAR	FINDINGS AND CONCLUSIONS
Xinyuan Qin, et al	2025	It has been shown that a no weight-bearing brace and an early postoperative mobilization program can improve functional capacity in surgical patients with diabetic foot ulcers.
Dirk Hochlenert, et al	2025	Plantar foot ulcers may heal more quickly using sensor-assisted wound care, which also keeps patient's mobile during the healing process.
Laya Hooshmand Gharabagh, et al	2025	The treatment regimen for patients with DFO may include oral NAC 600 mg twice daily to speed up antibiotic responses and the trend of decreasing infectious inflammatory markers during the therapy.
Mohd Yazid Bajuri, et al	2024	According to these findings, DFU patients' ulcers heal more effectively when using the ACC dressing as opposed to the silver-based dressing.
Ulla Hellstrand Tang, et al	2024	Using the Clinical Decision Support System, the medical staff discovered that the foot examination was organized and adhered to clinical recommendations. Even though additional enhancements like interaction with existing health record systems, were required, the electronic health record documentation was comprehensive
Shawn M Caggell, et al	2024	Compared to SoC alone, dACM enhanced the frequency, reduced the median time and raised the likelihood of CWC in a sufficiently powered DFU RCT. In DFUs, dACM showed positive results in a complicated patient group.
Yin Wu, PhD, et al	2023	For patients with chronic DFUs, negative pressure wound management is better than traditional moist dressings when it comes to preparing the wound bed before STSG surgery.

III. AIM & OBJECTIVES

AIM

To retrospectively analyze the clinical profile and treatment modalities of patients presenting with diabetic foot ulcers at a secondary care hospital.

OBJECTIVES

- ❖ To study the demographic characteristics (age, gender) of patients with diabetic foot ulcers.
- ❖ To assess the clinical presentation and severity of diabetic foot ulcers.
- ❖ To identify associated risk factors and comorbidities (e.g., duration of diabetes, glycemic control, neuropathy, peripheral vascular disease).
- ❖ To evaluate the types of treatment modalities employed (medical management, surgical interventions, wound care practices).
- ❖ To analyze outcomes such as healing rates, complications, and need for amputation.
- ❖ To assess the duration of hospital, stay and overall treatment outcomes.
- ❖ To identify patterns that may help improve early diagnosis and management of diabetic foot ulcers.

IV. MATERIALS AND METHODS

STUDY SITE: The study was conducted in the Department of Pharmacy Practice, Senghundhar College of Pharmacy and Monika Diabetes Center

STUDY METHODOLOGY: Retrospective cohort study

STUDY PHASE: Three months (Retrospectively collect 1 years of data)

STUDY PERIOD: The study was conducted from Nov 2025 - Dec 2025.

STUDY POPULATION: Comprehensive data on all cases of Diabetic Foot Ulcer in the past 1Year in Monika Diabetes Center will be collected.

STUDY CRITERIA

INCLUSION CRITERIA

- All type of Diabetic Foot Ulcer patients.
- All stages of Diabetic Foot Ulcer
- Both gender with age >25 years.

EXCLUSION CRITERIA

- Patients of age <20 years.
- Patients discontinued treatments.

VARIABLES

The variables in the collected data, which includes
- Age at diagnosis
- Sex
- Treatment type and duration
- Body mass index data
- Immunohistochemistry date and type
- Antibiotic therapy and its duration
- Compare the rate of fasting blood sugar level at 1st visit with the fasting blood sugar level at 2nd visit

- Compare the rate of post prandial blood sugar level at 1st visit with the post prandial blood sugar level at 2nd visit
- Compare the HBA1C & DFU grade data's
- Data of last follow-up

STUDY PROCEDURE

- Diabetic Foot Ulcer patients from the Monika Diabetes Centre were enrolled in the study.
- Detailed information on all Diabetic Foot Ulcer patients from the past One month was collected.
- There are two main groups of patients, based on whether they were treated with Antibiotic therapy and also treated with Antidiabetic therapy.
- A Microsoft Excel workbook was used to analyse the collected data statistically.
- SPSS version 20.0 and Graph Pad Prism version 8.0 were used for statistical analysis.
- According to the data distribution, parametric or non-parametric tests will be selected.
- The dichotomous variables were analysed using the Chi-square test or Fisher exact test.
- In order to determine patient health status, telecommunication was used.

V. DIAGNOSIS AND IMAGING

The detection of DFU uses image processing techniques to increase diagnostic accuracy and allow for the early and precise identification of ulcerations in diabetic patients. These methods examine and retrieve relevant data from medical pictures. DFU detection uses a range of imaging modalities, including conventional and Infrared (IR) pictures, to capture different aspects of blood flow patterns and tissue characteristics. By offering insights into temperature fluctuations and aiding in the assessment of inflammation and possible infection, infrared images improve the thorough examination of DFU for more effective diagnosis and treatment planning. Conventional images provide comprehensive visual details on the shape of the wound.
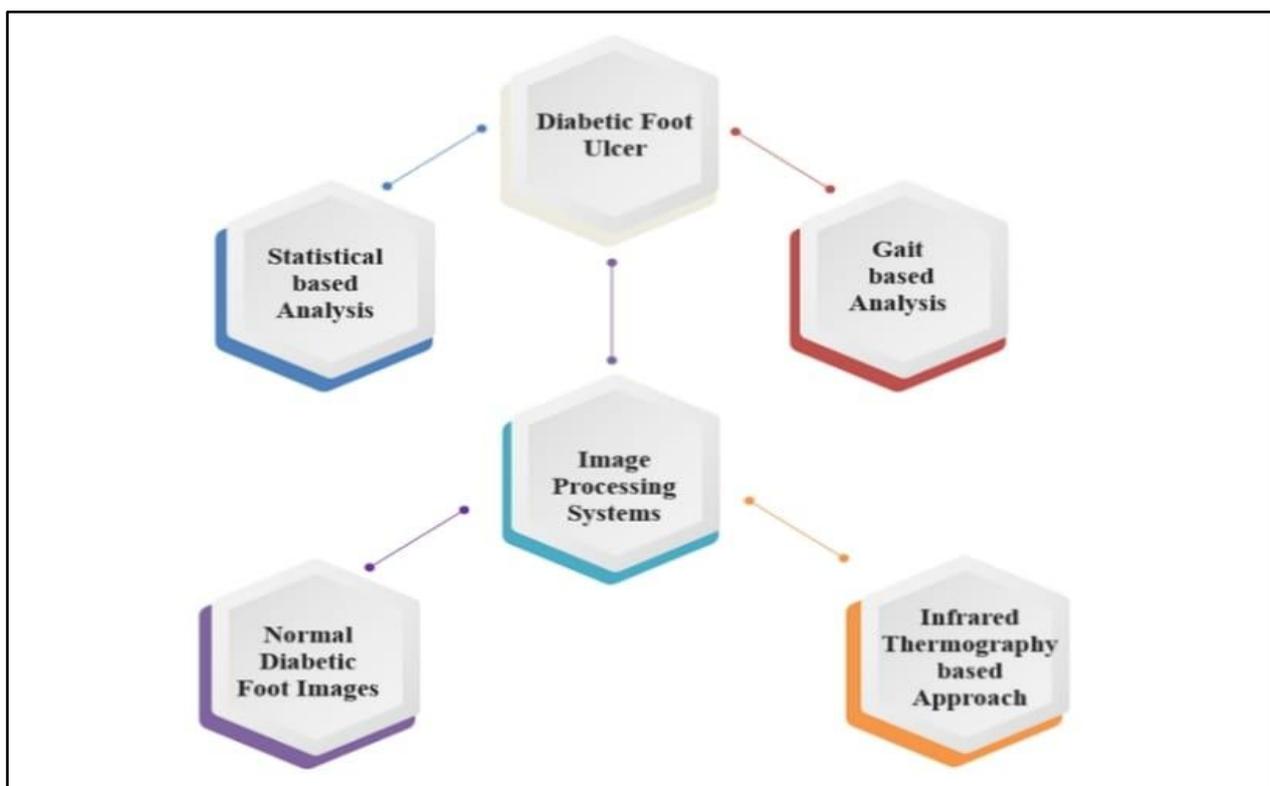

FIGURE-5.1: Overview of Diabetic Foot Ulcer Analysis Approaches.

VI. RESULTS

The study was conducted on out-patient of DIABETOLOGY department at Monika diabetes center, Erode. The total study population comprised 160 patients to collect the data were analyzed for following Parameter.

6.1 EVALUATION OF PATIENTS WITH AVERAGE VALUE OF FBS

From the table of 160 patients, the mean Fasting Blood Sugar (FBS) level at the first visit was 201 mg/dL, which decreased to 150 mg/dL at the second visit, indicating an improvement in glycemic control over the follow-up of two months period.

FBS @ 1ST VISIT	201
FBS @ 2ND VISIT	150

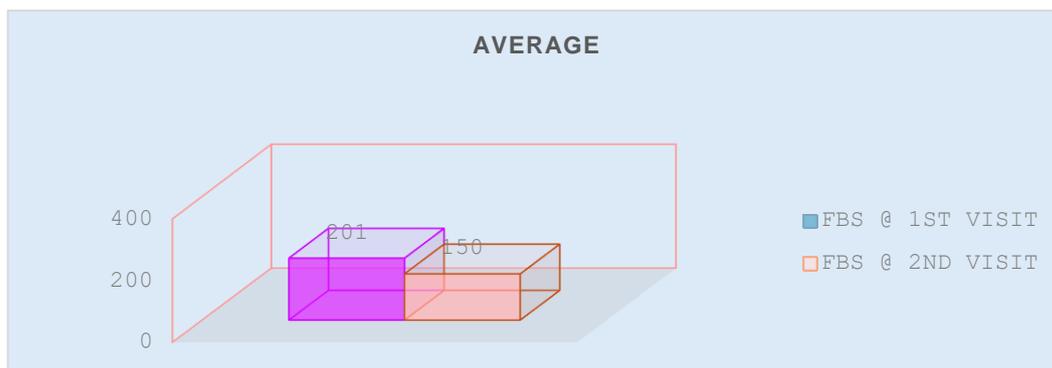TABLE-6.1: EVALUATION OF PATIENTS WITH AVERAGE VALUE OF FBS(n=160)

FIGURE-6.1: EVALUATION OF PATIENTS WITH AVERAGE VALUE OF FBS (n=160)

6.2 EVALUATION OF PATIENTS WITH AVERAGE VALUE OF PPBS

From the table of 160 patients, the mean Post-Prandial Blood Sugar (PPBS) level at the first visit was 254 mg/dL, which reduced to 186 mg/dL at the second visit, showing an improvement in post-meal glycemic control during follow-up of two months period.

PPBS @ 1ST VISIT	254
PPBS @ 2ND VISIT	186

TABLE-6.2: EVALUATION OF PATIENTS WITH AVERAGE VALUE OF PPBS (n=160)
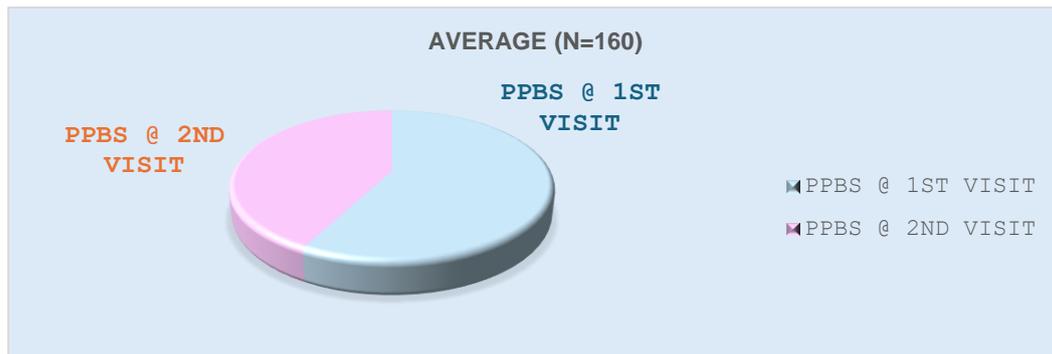
FIGURE-6.2: EVALUATION OF PATIENTS WITH AVERAGE VALUE OF PPBS (n=160)

COMPARISON VALUE OF OVERALL RESULT AS COMPARED TO 1ST VISIT

	FIRST VISIT	SECOND VISIT	P-VALUE	SIGNIFICANCE
AGE	60.8 ± 18.8	60.8 ± 18.8	1.000	NOT SIGNIFICANCE
BODY MASS INDEX	25.4 ± 5.6	24.3 ± 6.0	0.06	NOT SIGNIFICANCE
HBA1C	7.95 ± 0.36	6.37 ± 0.45	<0.001	HIGHLY SIGNIFICANCE
Duration of diabetic foot ulcer (month)	8.90 ± 2.06	8.833 ± 1.821	0.65	NOT SIGNIFICANCE
The velocity of walking (meters/min.)	63.20 ± 4.92	61.86 ± 5.56	0.023	SIGNIFICANT
Male/female (%)	0.58 ± 0.49	0.58 ± 0.49	1.000	NOT SIGNIFICANCE

Grades of ulcer (II or III or IV)	56.67 ± 43.33	49.5 ± 47.9	0.15	SIGNIFICANT
COMORBIDITIES (CVS, BP, HYPERLIPIDEMIA, DIABETIC NEUROPATHY & RETINOPATHY, ALLERGY)	45.9 ± 33.7	40.5 ± 36.0	0.18	SIGNIFICANT
FBS	13.7 ± 11.8	130.5 ± 14.7	0.002	SIGNIFICANT
PPBS	212 ± 33	180.2 ± 57.3	<0.001	HIGHLY SIGNIFICANCE

6.3 EVALUATION OF PATIENTS WITH DIABETIC FOOT ULCER GRADES @ 1ST VISIT

Among the 160 patients evaluated for diabetic foot ulcer (DFU), Grade III ulcers were the most common, accounting for 35% of cases. This was followed by Grade II ulcers in 29% of patients and Grade IV ulcers in 20%. Grade V ulcers were observed in 11% of the patients. The overall mean distribution of DFU grades was reported as 23.75, with the standard deviation of 9.09.

GRADES OF DFU	PERCENTAGE	MEAN ± SD
GRADE-II	29%	
GRADE-III	35%	23.75 ± 9.09
GRADE-IV	20%	
GRADE-V	11%	

TABLES-6.3: ASSESSMENT OF PATIENT WITH DFU GRADES @ 1ST VISIT (n=160)

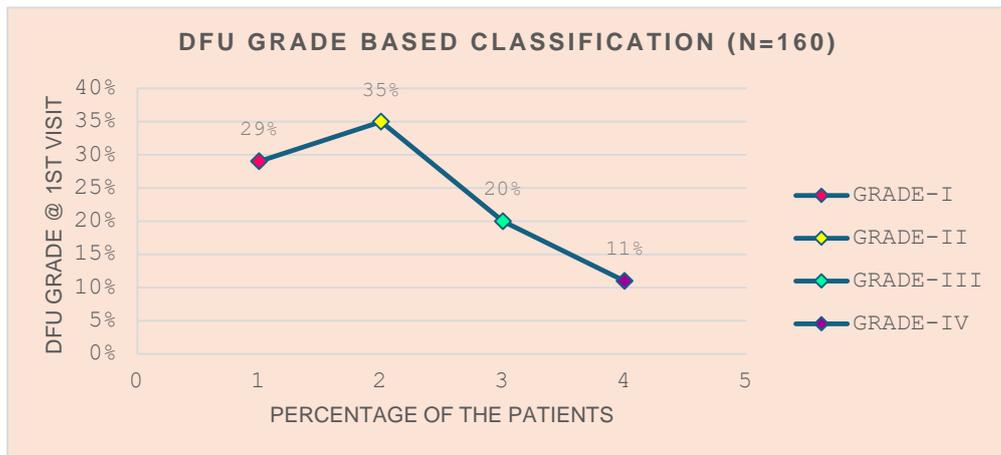**DFU GRADE BASED CLASSIFICATION (N=160)**

FIGURE-6.3: ASSESSMENT OF PATIENT WITH DFU GRADES @ 1ST VISIT (n=160)

6.4 EVALUATION OF PATIENTS WITH DIABETIC FOOT ULCER GRADES @ 2ND VISIT

Among the 160 diabetic patients evaluated, the majority had Grade II diabetic foot ulcer (42%), followed by Grade I (29%) and Grade III (15%). Grade IV and Grade V ulcers were observed in 9% and 5% of patients respectively. The mean diabetic foot ulcer grade was reported as 2.19, with the standard deviation of 1.10.

GRADES OF DFU	PERCENTAGE	MEAN ± SD
GRADE-I	29%	
GRADE-II	42%	
GRADE-III	15%	2.19 ± 1.10
GRADE-IV	9%	
GRADE-V	5%	

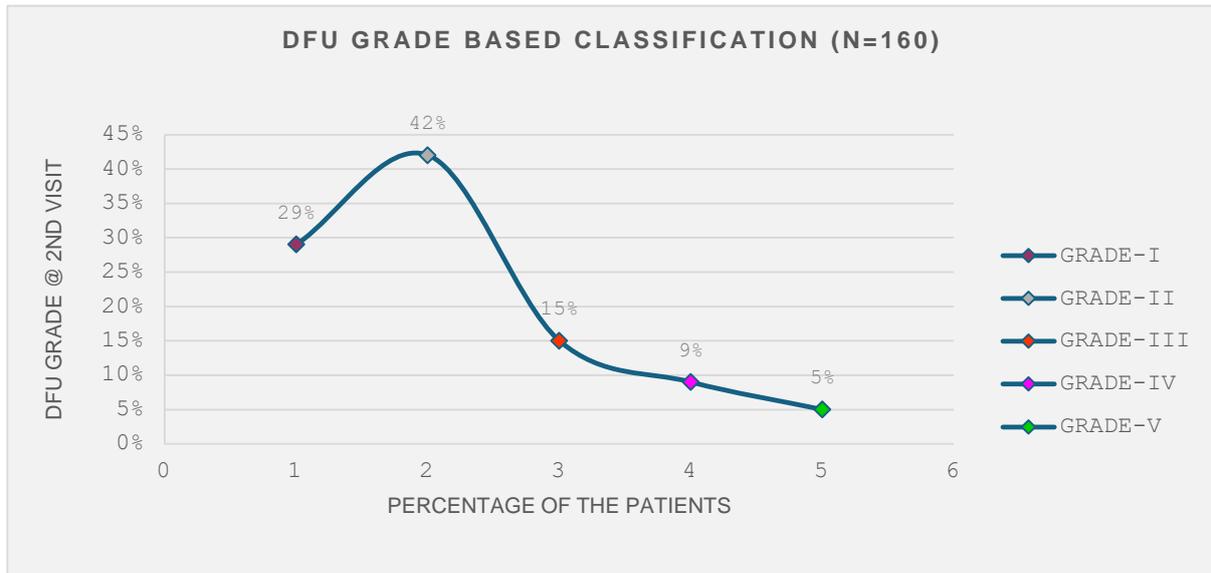TABLES-6.4: ASSESSMENT OF PATIENT WITH DFU GRADES @ 2ND VISIT (n=160)

FIGURE-6.4: ASSESSMENT OF PATIENT WITH DFU GRADES @ 2ND VISIT (n=160)

6.5 ANTI-DIABETIC DRUG BASED CLASSIFICATION

From the anti-diabetic drug–based classification of 160 patients, 39% were treated with insulin, 22% received sitagliptin and 11% were on teneligliptin. Regarding oral anti-diabetic medications, the most commonly prescribed regimen was metformin + glimepiride (50%), followed by glimepiride alone (10%), vildagliptin (11%) and teneligliptin + metformin (4%). Other drugs such as cilnidipine (3%), vildagliptin + metformin (3%), linagliptin (2%), dapagliflozin (2%), gliclazide (3%) and various combination therapies including linagliptin with metformin or SGLT2 inhibitors each accounted for 1–2% of prescriptions. The overall mean HbA1c level among patients receiving anti-diabetic therapy was reported as 8.25 and its standard deviation is 13.16.
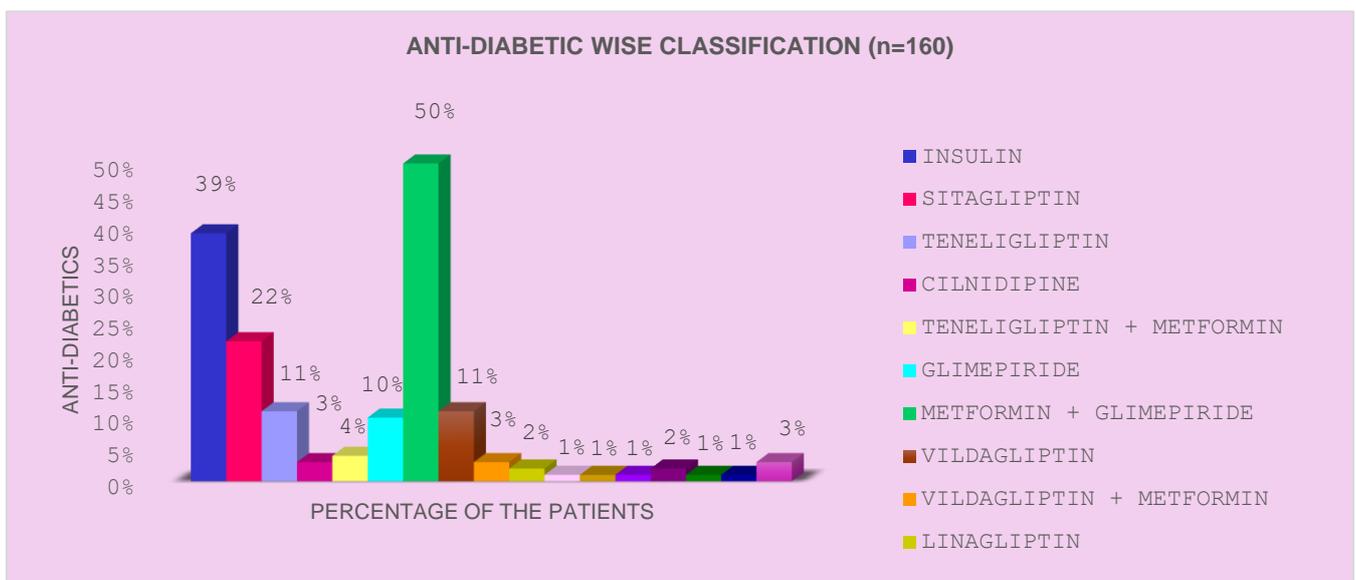

FIGURE-6.5: ANTI-DIABETIC DRUG BASED CLASSIFICATION (n=160)

6.6 CLASSIFICATION BASED ON ANTIBIOTICS

From the antibiotic-based classification of 160 patients, amoxicillin with potassium clavulanate was the most commonly prescribed antibiotic (64%), followed by Faropenem (15%), sultamicillin (7%), levofloxacin (6%) and cefixime with ofloxacin (6%). A smaller proportion of patients (2%) received doxycycline with lactic acid bacillus. The overall mean percentage distribution of antibiotic usage was reported as 26.67 and its standard deviation is 34.44.
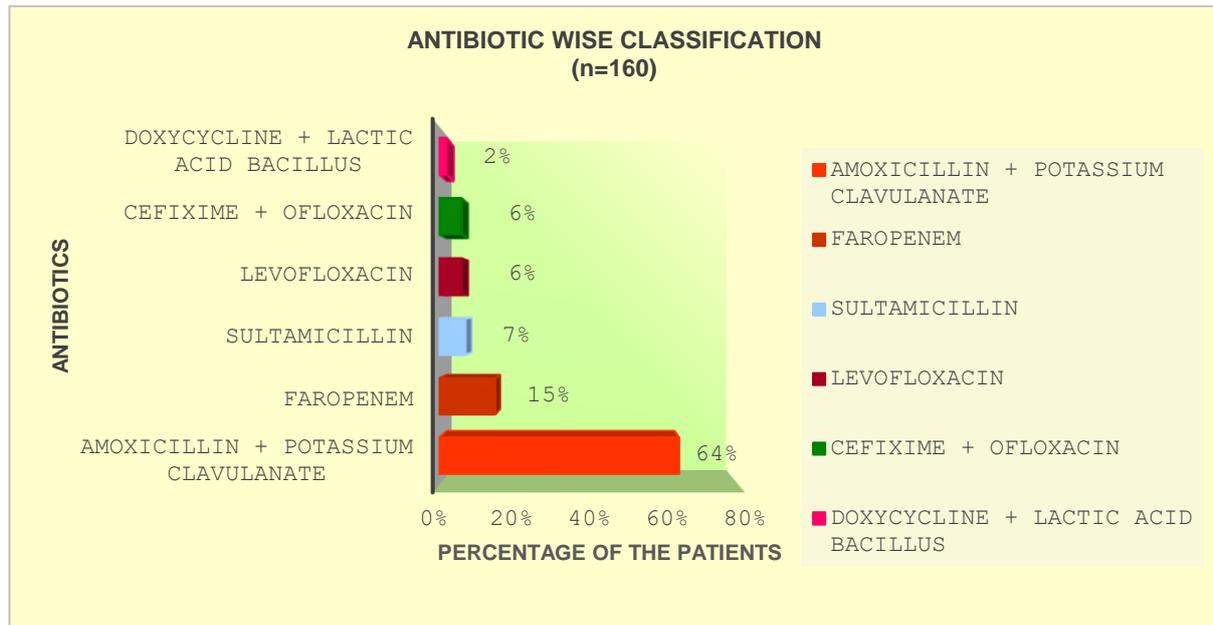

FIGURE-6.6: CLASSIFICATION BASED ON ANTIBIOTICS (n=160)

VII. DISCUSSION

Through this study, 160 DFU Patients enrolled in Monika Diabetic center were analyzed by Previous studies conducted by Diabetologist, such as a study by Dr. Thangavelu E. et al., reported that antibiotic therapy continues to play a significant role in the overall management of DFU infections, highlighting the need for rational antibiotic use.

This Retrospective study aimed to evaluate the treatment modalities of patients with diabetic foot ulcer at a secondary care hospital: a multi - disciplinary activity. The results of this study provide to alters the pressure–time integral and the plantar pressure distribution, which may aid in the healing of diabetic foot ulcers. **(Alsaigh, S. H, et al., 2022)**

The study found that the most commonly prescribed antibiotics were those effective against gram-positive and gram-negative bacteria, such as amoxicillin-Potassium clavulanate and Faropenem. This is consistent with previous studies, which have reported that these antibiotics are frequently prescribed in Diabetic foot ulcer departments. **(Anbarasi, L. J., et al., 2024)**

However, the study also found that there was a significant proportion of patients who received antibiotic for conditions that did not require antibiotic therapy, such as multi-drug-resistant infections. This is consistent with previous studies, which have reported that antibiotics are often overprescribed in inpatient and outpatient settings. **(Pollak, R., et al., 2025)**

The findings of this study underscore the significance of Adverse Drug Reactions (ADRs) as a major concern in the Diabetology inpatient & outpatient department. The high prevalence of ADRs, with 37% of patients experiencing at least one ADR, highlights the need for healthcare providers to be vigilant in monitoring patients for potential ADRs. **(Spicer, M. T., et al., 2022)**

A comparison of glycemic parameters revealed that both Fasting blood sugar (FBS) and postprandial blood sugar (PPBS) levels showed a noticeable decrease during the second visit when compared to the first visit, indicating improved glycemic control following treatment and clinical interventions, this is consistent with previous studies. **(Didangelos, T., et al., 2021)**

This is consistent with previous studies, when compared to the first visit, the grades of diabetic foot ulcers showed a significant reduction during the second visit, which may be attributed to effective patient counselling, appropriate management and a multi-disciplinary activity based on individual patients. **(Loera-Valencia, R., et al., 2022)**

VIII. CONCLUSION

The present study highlights that Diabetic Foot Ulcer (DFU) remains a major complication among diabetic patients, particularly in older adults with multiple comorbidities such as hypertension, neuropathy and cardiovascular disease. Poor glycemic control, elevated HbA1c levels and high prevalence of Stage-2 hypertension were significant contributing factors. However, follow-up data showed notable improvement in FBS and PPBS values, indicating better glycemic management with appropriate pharmacological and supportive therapy. Combination drug therapy, antibiotic management and adjunct treatments played a crucial role in infection control and wound healing. Despite therapeutic advancements, the high incidence of Grade II and III ulcers emphasize the need for early screening, strict glycemic control, patient education and multidisciplinary care. Effective monitoring, rational drug use and lifestyle modification are essential to reduce complications, prevent amputations and improve overall quality of life in DFU patients.

IX. LIMITATION OF THE STUDY

- The study was conducted in a single secondary care center, which limits generalizability to other hospitals or regions.

- The sample size was relatively small (n = 160), which may reduce statistical power.

- It was a retrospective observational study, so causal relationships between treatment and outcomes cannot be firmly established.

- The follow-up period was short (approximately two months), which is insufficient to assess long-term ulcer healing, recurrence, or amputation rates.

- There was no control or comparison group, making it difficult to evaluate the true effectiveness of specific treatment modalities.

- Lifestyle factors such as diet adherence, foot care practices and socioeconomic status were not deeply evaluated.

- Ulcer severity grading outcomes at long-term follow-up were not fully assessed.

- Patient adherence to medications and wound care was not objectively measured.

- Advanced wound healing modalities were described in literature review but not comparatively evaluated in this patient cohort.

- The study population mainly included adults and older adults, limiting applicability to younger diabetic populations.

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