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Pharmacotherapy Patterns of Diabetic Foot Ulcer Patients at Hayatabad Medical Complex, Peshawar, Pakistan: A Prospective Study

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Abstract: A two-month prospective study conducted at Hayatabad Medical Complex (HMC) Peshawar, Pakistan. In this study the pharmacotherapy patterns and drug-drug interaction (DDI) incidences were analyzed among 150 diabetic patients, of whom 50 presented with diabetic foot ulcer (DFU). Significant deviations from World Health Organization (WHO) core prescribing indicators were observed, particularly in the areas of polypharmacy and generic prescribing practices. The majority of DFU patients were from urban regions, with sedentary lifestyle factors identified as prominent contributors to DFU development. A higher incidence of DFU was noted among male patients with type 2 diabetes mellitus (T2DM) compared to female patients. Age distribution analysis revealed that patient ages ranged from 8 to 85 years, with 68% falling within the 41-60 age bracket, while only 2% were under 20 years of age. Among the all 391 pharmacotherapeutic agents prescribed, injectable medications constituted the majority (47.82%). Analysis of DDIs showed that 39.1% of prescribed medications were associated with drug interactions, with 72% of these classified as major interactions. The most frequently observed major DDIs involved combinations such as aspirin with Ramipril and Pregabalin with Losartan. These findings highlight the necessity for clinical pharmacists to review prescribing regimens to mitigate the risk of severe DDIs. The high prevalence of diabetes and DFU in this patient cohort is closely associated with lifestyle factors, insufficient health education, and lack of physical activity. These findings underline the urgent need for preventative strategies, including lifestyle modifications and public health education. Further investigation is recommended to enhance understanding of DFU risk factors and to develop improved prognostic and preventive frameworks.

Keywords: Diabetic foot ulcer (DFU); Pharmacotherapy patterns; Drug-drug interactions (DDIs); Diabetes management; Prescribing practices

1. Introduction

Diabetes mellitus (DM) is an endocrine metabolic disorder that arises from either autoimmune destruction of the pancreatic β-cells and thus causing insufficient insulin production or insulin action leading to insulin resistance (Delli & Lernmark, 2013). T1DM has an autoimmune basis and results from a complete lack of insulin. According to the American Diabetes Association, 90-95% of diabetes cases are T2DM, which is the most prevalent kind. Although insulin resistance is the main problem, it develops due to a relative insulin deficiency. Gestational diabetes was identified during pregnancy. Insulin resistance increases throughout pregnancy, increasing the need of more insulin. If resistance takes over, the pregnant woman becomes hyperglycemic. Numerous forms of diabetes and hyperglycemia that usually start before the age of 25 are linked to genetic abnormalities in β-cell functions. Mature-onset diabetes of the young (MODY) is the name given to this heterogeneous group, which has minimal or no abnormalities in insulin action (Baynes, 2015). 2-12% of all diabetes cases are caused by latent autoimmune diabetes in adults (LADA) (Naik & Palmer, 2003). Certain neurologic conditions, especially those with a high prevalence of autoantibodies against glutamic acid decarboxylase (GADAb), are more likely to cause autoimmune-mediated diabetes (Saiz et al., 1997). Neuroendocrinopathies occur in individuals who already have abnormalities in the secretion or utilization of insulin and produce diabetes by antagonistic interactions between insulin and

several hormones, including growth hormone, cortisol, glucagon, epinephrine, and others (Alam et al., 2014). Diabetic ketoacidosis (DKA) and non-ketotic hyperosmolar state (NKHS) are acute complications of diabetes (Marks, 2003). Nausea and vomiting are common symptoms of DKA. When DKA is severe, lethargy and central nervous system (CNS) depression might progress to a coma. Children are the most common patients to experience cerebral edema, an extremely serious complication (Kitabchi et al., 2015). NKHS is most frequently observed in elderly individuals with T2DM. Polyuria, orthostatic hypotension, and a range of neurological symptoms, such as altered mental state, lethargy, obtundation, seizure, and possibly coma, are among its most prominent features. Hyperglycemia from inadequate insulin production causes osmotic diuresis, which in turn causes a significant depletion in intravascular volume (Tripathi & Srivastava, 2006). The chronic diabetes complications include vascular and nonvascular. Vascular complications can be classified as either macrovascular (coronary artery disease, peripheral vascular disease, and cerebrovascular disease) or microvascular (retinopathy, neuropathy, and nephropathy). Among the nonvascular complications are problems like skin changes, sexual dysfunction, and gastroparesis. According to 2017 estimates from the International Diabetes Federation (IDF), more than 96,000 new cases of T1DM in children and adolescents under the age of 15 are diagnosed worldwide each year. Nearly 60% of all new cases occur in the top ten countries by number, which includes the United States, India, Brazil, China, the United Kingdom, the Russian Federation, Algeria, Saudi Arabia, Nigeria, and Germany. Globally, the prevalence of T1DM has been increasing at an average rate of about 3.0% per year. In 2017, it was predicted that 425 million people worldwide (about 9% of adults aged 20-79) had diabetes (IDF estimations). According to the data from the United States, the number of people with diabetes has nearly doubled, from 5.5 million in 1980 to 23.4 million in 2015. Globally, the number of adults with diabetes is expected to rise from 425 million (8.8%) in 2017 to 629 million (10.1%) in 2045. In addition, the prevalence of T2DM among young people (ages 10 to 19) increased by 4.8% on average each year between 2002 and 2012. However, compared to white youth (0.6%), the annual growth rate was significantly higher in certain ethnic groups, including Native Americans (8.9%), African Americans (6.3%), Hispanics (3.1%), and Asians/Pacific Islanders (8.5%) (Mayer-Davis et al., 2017). According to reports from 2011, the prevalence of diabetes among individuals in Pakistan between the ages of 25 and 70 was 11.9%, a 35% rise from 2005. In 2030, over 9.2 million Pakistanis are predicted to have diabetes (Aamir et al., 2019). The underlying pathology and patient presentation determine the commencement of treatment for hyperglycemia (Kitabchi et al., 2001). People with T1DM inevitably need insulin immediately (Katsarou et al., 2017). The selection of oral hypoglycemic medications, insulin, and regimens for T2DM is complicated and based on several considerations such as drug interactions, specific contraindications, cost, side effect profile, and drug efficacy. A period of modification in lifestyle is typically necessary for T2DM, and metformin medication is regarded as the first line of treatment (Baker et al., 2021). DFUs are injuries to all layers of the skin, necrosis, or gangrene that frequently develop on the soles of the feet in diabetics with peripheral neuropathy or peripheral artery disease (Jais, 2023). Bacterial invasion in feet results in infection and deterioration, particularly in the lower left distal region of the feet (Pal et al., 2024). Due to various predisposing factors like diabetic neuropathy, peripheral arterial disease, abnormalities of the bones, or infections, DFUs are significant microvascular diabetes-related lesions that, if left untreated, can result in very serious clinical conditions and eventually lower-limb amputation. Diabetes is the leading cause of lower limb amputations globally, and 15-25% of diabetic patients experience foot ulcers throughout their lifetime (Rümenapf et al., 2024). Based on prevalence data from 2015, the IDF predicts that specific DFUs manifest in 9.1 million to 26.1 million people worldwide each year (Chowdhury et al., 2024). Without surgery, the average recovery period lasts roughly 12 weeks. Infection is the most common cause of amputation, and patients with severe neuropathy usually have higher thresholds for mechanical pain than diabetics without it. Advanced age, peripheral arterial disease (PAD), and anemia (hemoglobin 11 g/dL) may also speed up the spread of infection (Sadriwala et al., 2018). According to the Wagner classification, the majority of patients had DFUs that were in their advanced stages, with 93% of the lesions being grades III-V (Khatoon et al., 2024). Edmon claims that DFUs are of two categories: neuropathic ulcers, which present with warm feet, adequate perfusion, palpable pulses, decreased perspiration, dry skin, and cracked skin, and neuroischemic ulcers, which are characterized by cooler feet, absent or weak pulses, smooth, hairy and thin skin, subcutaneous tissue atrophy, and intermittent claudication (McLeod et al., 2024). Closing the wound is the primary objective in the treatment of diabetic ulcers (Tang et al., 2024). Negative-pressure wound therapy (NPWT) is a common technique in wound care because it uses a suction device to collect large amounts of wound exudate, lessen the need to change dressings frequently, maintain the cleanliness of anatomically difficult wounds, and lessen odor. Additionally, it is hypothesized that by enhancing circulation, removing pathogenic materials, and eclipsing wound edges, vacuum forces promote wound healing (Pawar, 2019). Skin abnormalities in DFUs can be repaired with skin grafting and tissue replacement (Primous et al., 2024).

Keeping the above background in mind, the current prospective study was carried out in a tertiary care hospital in Peshawar, Khyber Pakhtunkhwa, Pakistan, aiming to assess the evaluation of prescribing patterns to DFU patients and study the most common DDIs noted in the therapy.

2. Methodology

2.1 Study Design

This research is a prospective study conducted in a tertiary care hospital in Peshawar, Khyber Pakhtunkhwa, Pakistan. The endocrinology ward of the hospital was selected where most of the patients suffering from DFUs received admission. For data collection regarding the evaluation of DFU pharmacotherapy patterns, a prospective study was conducted. To evaluate the pharmacotherapy patterns of DFUs, a total of 150 patients suffering from DM were selected and evaluated.

2.2 Inclusion Criteria

The inclusion criteria were based on the patient's diagnosis of DM. All inpatients admitted to the hospital's endocrinology ward who were suffering from DFUs and DM were included in the current study.

2.3 Exclusion Criteria

The exclusion criteria were based on the diagnosis and medical records of the patients. All patients who were not suffering from DFUs and DM were excluded from the study.

2.4 Ethical Approval

The study was approved by the Research Ethics Committee (REC) of Shaheed Benazir Bhutto University, Sheringal under reference number (Ref.no-SBBU/IEC/-22-27). Permission was also granted by the hospital director and the pharmacy manager to visit the concerned ward to collect data.

2.5 Statistical Data Analysis

The collected data was tabulated using an Excel sheet. Then the data was presented in the form of tables and graphs. The data was also assessed by applying statistical equations and the means and percentages were determined.

3. Results

3.1 Patient Demographic Distribution

A sample size of selected DFU patients (N=50) was analyzed for demographic distribution of 42%, 16%, 12%, 8%, 6%, and 6% for Peshawar, Karak, Afghanistan, Charsadda, Malakand, and Mardan, respectively. While Mohmand agency, Batagram, Kurram, and Kohat each represented 2% of the sample (Figure 1). It is assumed that the frequency of DFU from Peshawar may be due to a sedentary lifestyle and food.

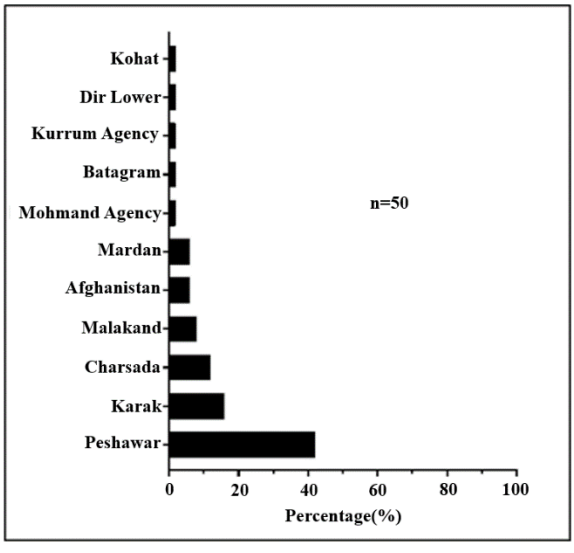

Figure 1. Patient demographic distribution

3.2 Gender-Based Distribution

A total of 50 prescriptions exhibited 34 males (68%) and 16 females (32%) for DFU (Figure 2). The gender-based distribution of DFU in patients with T2DM was found to be 88.23% in males and 81.25% in females. In contrast, T1DM was observed exclusively in the female population, accounting for 6.25% of the total sample.

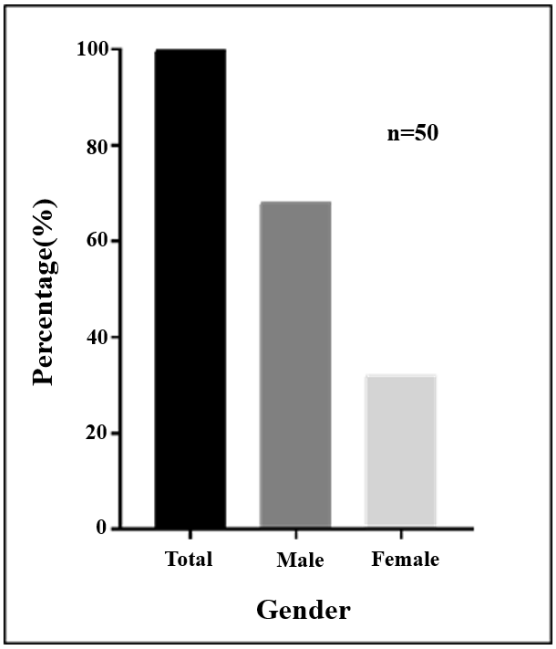

Figure 2. Gender-based distribution

3.3 Age-Based Distribution

Age-wise distribution of N=50 resulted in most patients in the age group of 41-60 years (n=34), while those in the age group of 61-80 years were n=11. The number of DFU patients in the age groups of 81-100 years and 21-40 years was n=2 and the least number of patients recorded was in the age range of 1-20 years (n=1), which was also a female patient.

A maximum age of 85 years was recorded for DFU while the minimum recorded age was 8 years (Figure 3).

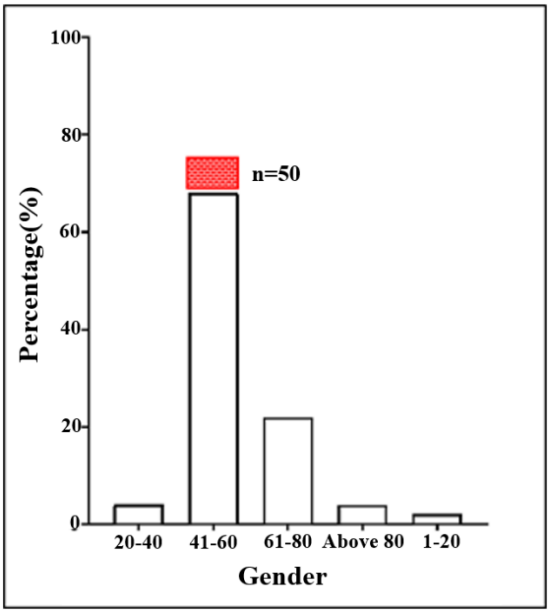

Figure 3. Age-based distribution

3.4 Distribution of Pharmacotherapy (N=50)

A total of 391 pharmacotherapeutic agents were prescribed representing a mean of 3.82 with a minimum of 1 to a maximum of 20 regimens per prescription. Frequencies of various dosage forms were calculated. The highest frequency of 187 for injection was obtained, followed by tablets, capsules, and suspension at 172, 17, and 12. The minimum frequencies of 2 and 1 were recorded for inhalation and ointment, respectively. The frequency for antibiotics was 52 which accounts for 13.299%, presenting a mean of 1.04%. Table 1 shows the pharmacotherapy. Figure 4 shows the dosage forms.

Table 1. Pharmacotherapy

Medication	Medication Generic	Generic Count	Brand Count
Inj Calcium Gluconate 10ml	Calcium Gluconate	2	2
Inj Insulin 8 Units	Insulin	64	1
Inj Provas 2ml	Paracetamol	3	1
Inj Acabel	Lornoxicam	1	1
Inj Tramal	Tramadol	3	4
Inj Gravinate	Dimenhydrinate	6	6
Inj Cefoperazone	Cefoperazone	1	1
Inj Risek 40mg	Omeprazole	11	6
Inj Meronem	Meropenem	14	3
Inj Humalin R	Insulin	64	1
Inj Lantus 20 Units	Insulin	64	1
Tab Nuberol Forte	Orphenadrine+paracetamol	9	8
Tab Concor	Bisoprolol	2	1
Tab Ascard 75mg	Aspirin	17	6
Tab Sustac	Glyceryl trinitrate	4	1
Cap Gabica 75mg	Pregabalin	10	8
Susp Colac	Lactulose	1	1
Inhaler Ventoline	Albuterol	2	2
Inj Meronem 500mg	Meropenem	14	10
Tab Getryl 3mg	Glimepiride	1	1
Tab Vilget	Rosuvastatin	27	1
Tab Rast 5mg	Metformin	8	1
Inj Nospa	Drotaverin hydrochloride	1	3
Inj Flagyl 100ml	Metronidazole	0	4
Inj Tenzo	Piperacillin+tazobactam	1	1
Inj Actrapid 10ml	Insulin	64	1
N/Saline	N/Saline	13	11
Tab Misar 40mg	Telmisartan	2	1
Inj Cefoperazone+Sulbactam 2gm	Cefoperazone+Sulbactam	1	1
Tab Rolip 100mg	Rosuvastatin	26	1
Synflex 500mg	Naproxen	1	2
Tab Ramipace 10mg	Ramipril	5	1
Tab Dap 10mg	Dapagliflozin	3	1
Tab Polymalt F	Polymalt F	1	1
Tab Aldactone 25mg	Spironolactone	4	3
Syp Laxoberon	Sodium Pico sulfate	8	3
Tab Tonoflex 100mg	Tramadol	9	8
Tab Ibert Folic	Ibert folic	2	2
Tab Morcet 10mg	Escitalopram	3	1
Tab Motilium 10mg	Domperidone	4	3
Ointment Kenalog	Oint (triamcinolone acetonide)	1	1
Cap Terbisil 250mg	Terbinafine	2	2
Tab Panadol 500mg	Paracetamol	4	2
Tab Tenormin 100mg	Atenolol	1	1
Inj Sulzone	Cefoperazone+Sulbactam	26	21
Bone One	Alfacalcidol	5	3
Tab Sustact 2.6mg	Glyceryl trinitrate	3	1
Tab Lophos	Calcium acetate	5	5
Total		391	

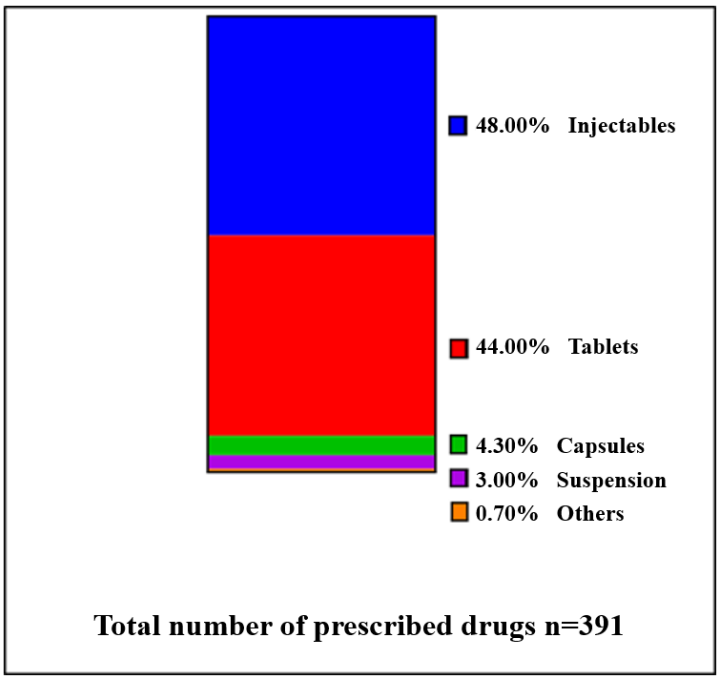

Figure 4. Distribution of dosage forms (n=391)

3.5 Frequency of Commonly Prescribed Drugs

Commonly prescribed medication exhibited peak value for insulin (n=65), followed by Rast (n=28) and Sulzone(n=26), respectively (Figure 5).

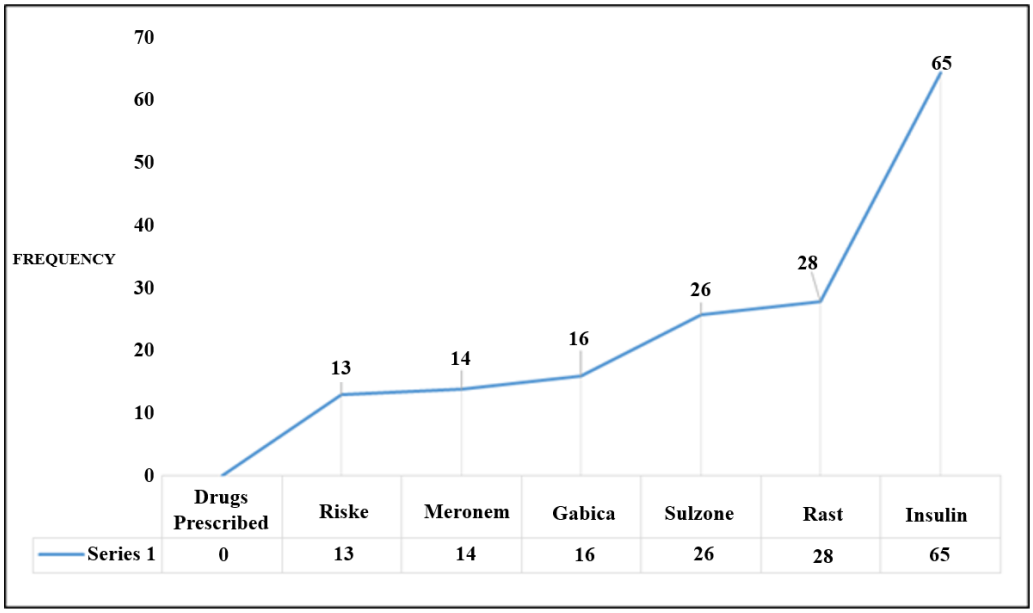

Figure 5. Frequency of commonly prescribed drugs (n=162)

3.6 Rationality for Pharmacotherapy Based on WHO Core Indicators

According to the WHO core indicators, generic prescription is 100%, average drugs per encounter is 1.6-1.8% (mean=1.7%), antibiotic encounter is 20-26.8% (mean=24.1%), and injection encounter is 13.4-24.1% (mean=18.75%). The obtained results (Figure 6) showed deviations in polypharmacy, number of drugs per encounter, generic, and injectable medications, while antibiotic encounter was less observed.

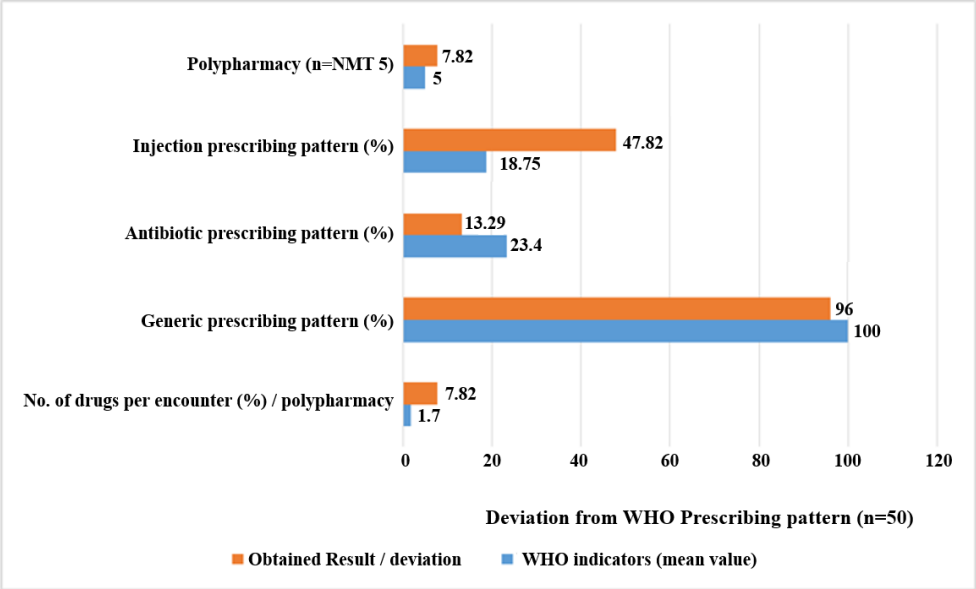

Figure 6. Comparative analysis of WHO prescribing patterns with pharmacotherapy

3.7 Drug-Drug Interactions (DDIs)

DDIs for all prescribed drug regimens (n=391) were analyzed by using online MEDSCAPE software. Initially, the descriptive statistics (Table 2) for DDIs were calculated for all drugs prescribed by using the EXCEL Data Analysis tool pack. A sum of 153 DDIs, a mean of 3.06, and a maximum of 20 were obtained, giving 39.1% DDIs, based on the drugs prescribed (n-391). To estimate the significance of gender-based DDIs, a t-test was performed in which 34 males and 16 females participated, resulting in 117 and 36 DDIs, respectively, further giving a p-value of 0.437138. This depicts that a p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant and hence it cannot be rejected. Therefore, the result is insignificant (Figure 7).

It was found that the most frequently prescribed non-steroidal anti-inflammatory drugs (NSAIDS), and antihypertensives exhibited more DDIs. When compared to female diabetic patients, the frequency of DDIs in male patients was higher (n=117, N=34). DDIs in females were 36 in 16 patients (n=36, N=16), which depicts that the result of DDIs in males and females is also not statistically significant.

DDIs were calculated from medscap.com. A mean of 3.06 with a standard deviation of 4.6088 exhibited strong DDIs. 28% of prescriptions were without DDIs, while 32% showed 3 to 20 DDIs per prescription (n=16). Intense DDIs were observed in prescriptions containing Remipril. This angiotensin-converting enzyme (ACE) inhibitor can cause severe DDIs with aspirin, pregabalin, and losartan. 40% of prescriptions were showing 1-2 major DDIs. Overall, 72% major DDIs were observed (Figure 8). Table 3 shows the regression analysis for factors influencing DDIs.

Table 2. DDIs (n=391, N=50)

Descriptive Statistics of DDIs (Using the MEDSCAPE Drug Interaction Checker)	
Mean per encounter	3.06
Standard error	0.651785616
Median	1
Mode	0
Standard deviation	4.608820293
Sample variance	21.24122449
Kurtosis	5.920425272
Skewness	2.473280776
Range	20
Minimum DDI	0
Maximum DDI	20
Sum	153
Count (total prescriptions)	50
Largest (1)	20
Smallest (1)	0
Confidence level (95.0%)	1.309812235

Note: N means the number of prescriptions, and n is the number of prescribed drug regimens.

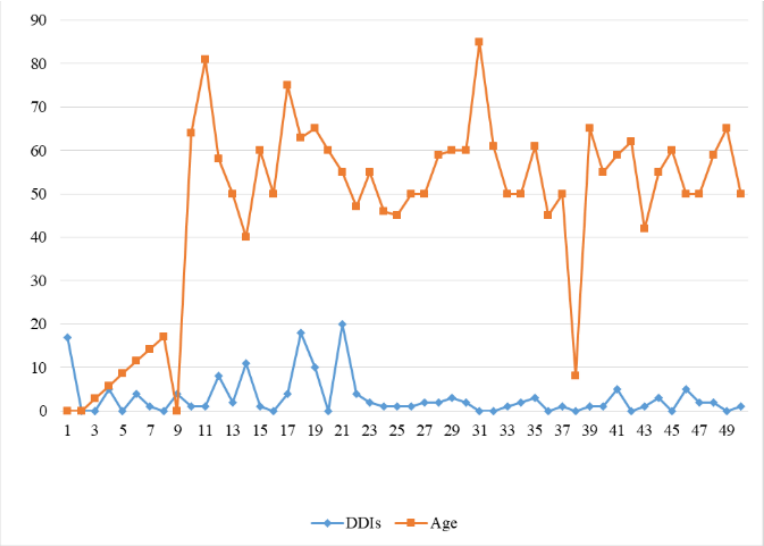

Figure 7. Estimation of age-based DDIs in 50 patients

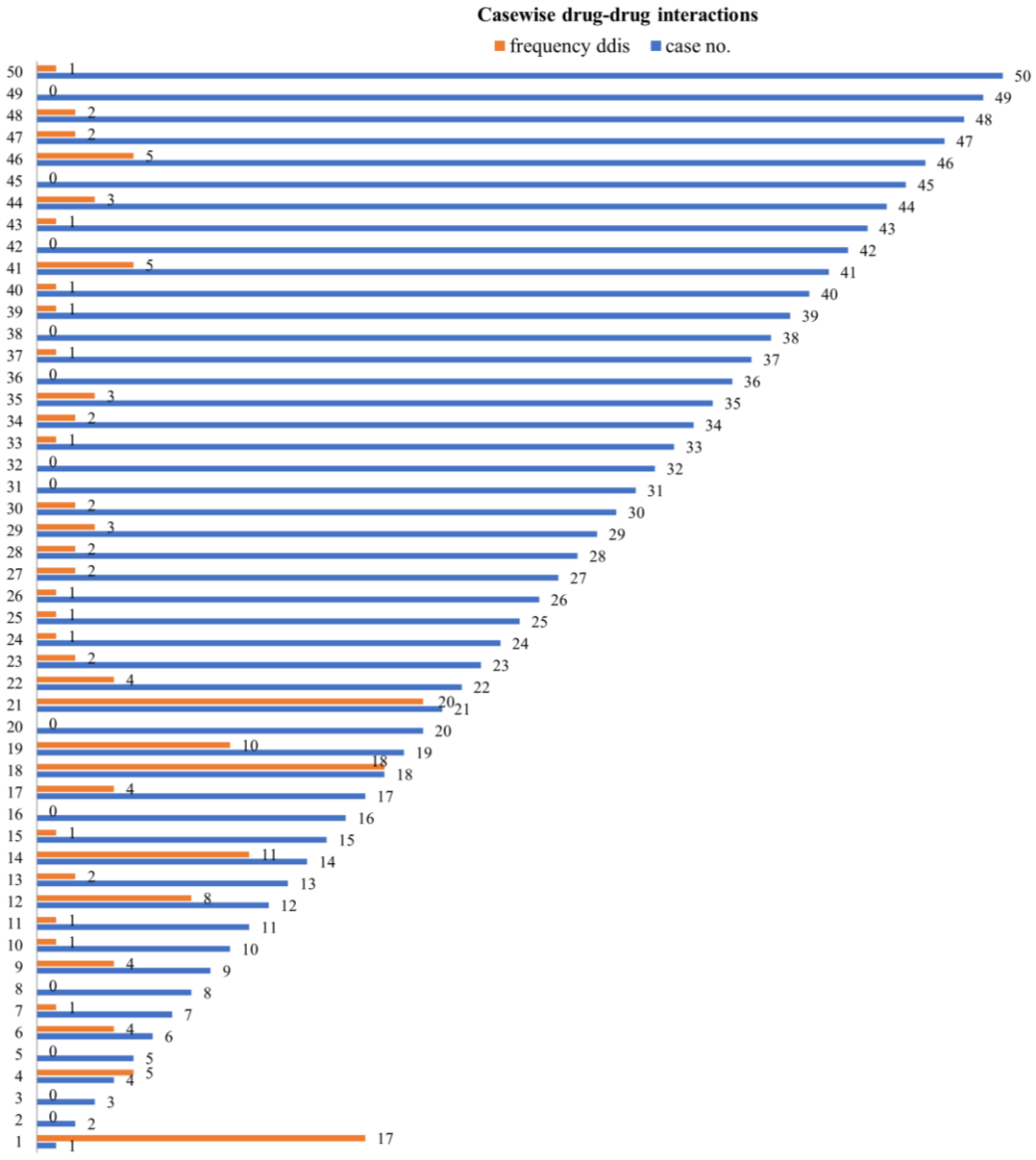

Figure 8. Case-wise DDIs in selected patients (n=50)

Table 3. Regression analysis for factors influencing DDIs

Variable	Coefficient (β)	Standard Error	t-Statistic	p-Value	95% Confidence Interval
Constant	0.500	0.450	1.111	0.275	[-0.400, 1.400]
Age	0.025	0.010	2.500	0.020*	[0.005, 0.045]
Gender (1=male)	0.100	0.200	0.500	0.620	[-0.300, 0.500]
Total medications	0.300	0.050	6.000	<0.001*	[0.200, 0.400]
Drug type (1=NSAIDs)	0.200	0.150	1.333	0.185	[-0.100, 0.500]

Regression analysis revealed a significant positive relationship (p=0.020) for age group, which suggests that for each additional year of age, the number of DDIs increases by an average of 0.025. Moreover, the coefficient for gender is not statistically significant (p=0.620), suggesting no substantial impact on DDIs. The total medication variable has a strong positive effect on DDIs, with a p-value<0.001, indicating that with each additional medication prescribed, the number of DDIs increases by 0.300 on average. Lastly, drug type is not statistically significant (p=0.185), indicating that the type of drug (specifically NSAIDs) does not significantly influence the number of DDIs within the given set of data.

4. Discussion

In this study we compared the results of the current studies with the previously reported studies, aiming to understand the pharmacotherapy of DFU. The total number of drugs that were prescribed to DFU patients was 391, and the average number of drugs prescribed per encounter is 7.82%, which is higher than the value recommended by WHO (1.6-1.8% per prescription). In addition, the drugs prescribed by their generic name were 4% overall, which is much lower than the value recommended by the WHO (100%). It was found that the percentage of antibiotics prescribed is 13.29%, which is lower than the value recommended by WHO (20-26.8%) and that of injectables is 47.82%, which is much higher than the value recommended by WHO (13.4-24%). Antihyperglycemic drugs has been prescribed widely, in which insulin was found to be widely used for DFU in this study (n=65). Since the beginning of the 20th century, insulin has been used to treat chronic wounds. Similarly, systemic insulin therapy improves wound healing in non-DM patients, decreases infections following surgical procedures in DM patients, and speeds up the healing of decubitus ulcers. In diabetics, topical insulin treatment increases skin wound healing at doses that have little effect on blood glucose levels. In addition to lowering blood sugar, insulin has additional potential benefits, including the preservation of organs for transplantation, wound healing solution, and total parenteral nutrition (Kajani et al., 2024). For treating DFU, insulin therapy is less expensive than growth factors or even stem cells (Hetta et al., 2024). Additionally, insulin is safe for human usage and only increases blood glucose levels which does not happen following topical application of modest doses to the skin (Bolli et al., 2022).

Antifibrinolytic agents were also found to be prescribed in this study among them Rast (rosuvastatin) has been widely prescribed (n=28) for such conditions. Rosuvastatin limits epithelialization and facilitates keratinocyte migration by suppressing the production of farnesyl pyrophosphate (FPP), an intermediary in the cholesterol manufacturing pathway that works on keratinocyte glucocorticoid receptors (GRs). Rosuvastatin has also been linked to cholesterol-independent effects, immunological response modulation, oxidative stress reduction, stimulation of fracture repair, and wound healing. By demonstrating restoration or preservation of sciatic nerve microcirculation, rosuvastatin has a beneficial effect on diabetic peripheral neuropathy, irrespective of its lipid-lowering action (Gulcan et al., 2007). Statin medications do have pleiotropic effects that could potentially influence DFU healing. By selectively competing and interfering with cholesterol biosynthesis, a subsequent decrease in low-density lipoprotein (LDL) cholesterol, an increase in HDL cholesterol and a decrease in total cholesterol and triglycerides can be observed (O'Dell et al., 2024). In this study, Sulzone was also found to be prescribed widely (n=26). As per previous studies Tazobactam was found to have significant anti-klebsiella effects (68.8%). The highest substantial antibacterial activity against staphylococcus aureus was shown by sulzone (Cefoperazone + sulbactam; 87.5%). Cefipime had the most effective rate against pseudomonas (66.6%), followed by Sulphamethazole (61.1%). Nitrofurantoin (43.5%) came in second place behind cefixime (61.5%) in terms of Escherichia coli (E. coli) activity. Pseudomonas and staphylococcus aureus infections were found in 18 and 8 individuals, respectively (Rajalekshmy & Rekha, 2023). Similarly, gabica (pregabalin) was found to be used in this study (n=16). Pregabalin is a GABAergic medication that is approved for usage in more than 120 countries and is primarily used to treat neuropathic pain. The mechanism of action of pregabalin is comparable to that of gabapentin, although it is 2-4 times more potent, necessitating a lower dose regimen. Due to the more linear pharmacokinetics similar to gabapentin, initial doses for neuropathic pain typically range from 75 to 150 mg per day, with relatively quick up-titration over several weeks to maximal tolerable levels (600 mg/day) (Dash et al., 2024). Among antibiotics, meronems (meropenem) was found to be used commonly (n=14). According to a different study on the effectiveness of meropenem on DFU, it was the most efficient antibiotic against all organisms, followed by amikacin and gentamycin. Cotrimoxazole was the antibiotic that encountered the most

resistance in DFUs, followed by cefuroxime and ceftriaxone. Over the past few decades, overuse of cephalosporin and cotrimoxazole has resulted in this rising resistance. Meropenem was found to have the best effects on the three most prevalent bacteria, staphylococcus aureus, E. coli, and Klebsiella, when the efficacy of antibiotics against the various species was taken into account. There was no variation in staphylococcus aureus frequency according to age or gender since it was common in all age groups and both sexes. Two-fifths of the 95 patients had hypertension, one-third were obese, and one-sixth were using cigratte smoking. Staphylococcus predominance negated any variation in organism prevalence concerning comorbidity states as previously reprted for diabetic foot ulcer (Andrianopoulou et al., 2024).

5. Limitations

However, this study has limitations. The physicians' suggestions were solely based on their clinical experience. Furthermore, other confounding factors were not investigated. The study was conducted within a single center and confined to one ward of a tertiary care hospital in a specified time, which may affect the study results.

6. Conclusion

This study reveals that the average number of prescriptions for DFU patients exceeds WHO recommendations, suggesting potential overuse of medications. It also shows a low use of generic based prescription of antidiabetic drugs and antibiotics, pointing to areas needing improvement in prescription practices. The high rate of injectable prescriptions compared to WHO standards indicates a need to reconsider the use of alternative therapies. The study highlights the effectiveness of meropenem against common pathogens and the rising resistance to Cotrimoxazole, underscoring the importance of targeted antimicrobial stewardship. Additionally, the use of rosuvastatin and pregabalin demonstrates the need to manage both neuropathic pain and wound healing. Demographic data shows that DFUs are more prevalent in men and individuals aged 41-60, guiding targeted prevention and education. The findings stress the need to adhere to standard treatment protocols while adjusting for local resistance patterns and emphasize continuous monitoring, education, and interdisciplinary collaboration to enhance DFU management.

Author Contributions

Conceptualization, A.U..; methodology, A.U.; software, A.U.; validation, AU, formal analysis, A.U; investigation, A.U.; resources, F.K.; data curation, F.K.; writing—original draft preparation, F.K.; writing—review and editing, BU.; visualization, A.U.; supervision, A.U; project administration. All authors have read and agreed to the published version of the manuscript.

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

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Conflicts of Interest

The authors declare no conflict of interest.

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