

Characteristics of Inpatients with Diabetic Ulcers in Margono Soekarjo County Hospital, Indonesia: A Retrospective Study

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ABSTRACT

Introduction: Diabetic ulcers, common complications of poorly managed diabetes mellitus, significantly impact physical well-being, afflicting 25% of diabetes patients. We conducted a retrospective study at Margono Soekarjo County Hospital in Indonesia to comprehensively describe demographic and clinical characteristics, aiming to inform prevention, management, and patient-centered care strategies.

Methods: Using secondary data and a cross-sectional approach, we collected information from inpatients with diabetic ulcers at Margono Soekarjo County Hospital in 2020-2021, profiling age, gender, education, occupation, blood sugar levels, and ulcer sites.

Results: Most inpatients were female (56.1%), aged over 60 (46.1%), with primary school education (33.9%). The majority had blood glucose levels >200 mg/dl (58.6%), and foot ulcers were predominant (91.8%).

Discussion: Diabetic ulcers, affecting 25% of diabetes patients, result from poorly managed diabetes and significantly impact physical well-being. Our findings align with global trends, highlighting disparities in education and employment that affect healthcare access.

Conclusion: Addressing these disparities and improving blood glucose management is crucial to mitigate the diabetes burden. Our study underscores the need for tailored public health strategies in Indonesia with potential global relevance.

KEYWORDS: Diabetes mellitus, diabetic ulcers, demographic characteristics, clinical characteristics, epidemiology, blood sugar level, ulcer sites, patient-centered care strategies

ARTICLE DETAILS

Published On:
09 October 2023

Available on:
<https://ijmscr.org/>

INTRODUCTION

The International Diabetes Federation (IDF) states that globally in 2019 there were 463 million people in the world with diabetes mellitus (DM).¹ Poorly managed diabetes mellitus often leads to complications, one of common complications is the diabetic ulcer. The resulting neuropathy in diabetes mellitus (DM) patients with manifestation of diminished sensory and motoric weakness of the lower extremities is the trigger that makes diabetes mellitus (DM) patients have higher risks for diabetic foot ulcers and even amputations. Data from Indonesian Endocrinology Society (PERKENI) suggested diabetic foot ulcers due to diabetic neuropathy often occur on the sole of the feet as they are the anatomical areas which experience physical contacts and receive the heaviest pressure during weight bearing.²

One study revealed the prevalence of diabetic ulcers in Indonesia reached 15% of the total number of diabetics

patients.³ Research at Cipto Mangunkusumo National General Hospital in 2014 showed the mortality rate and amputation rate in diabetic ulcer patients were 16% and 25% respectively with 14.3% would die one year after amputation and 37% would die 3 years after amputation. Internal data from our Margono Soekarjo County Hospital, Indonesia showed that 389 hospitalized patients and 521 outpatients were diagnosed with diabetic ulcers in a 2-year span from Januari 2020 to December 2021.

As diabetic ulcers represent a significant burden on healthcare systems worldwide, understanding the profile of affected individuals is crucial for effective management and prevention strategies. Considering that matter, we conducted this retrospective study aiming to comprehensively describe the demographic and clinical characteristics of inpatients diagnosed with diabetic ulcers in Margono Soekarjo County Hospital as one of the referral hospital in Indonesia. By

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examining specific factors such as age, sex, occupation, blood sugar levels, and the sites of the ulcers, our goal is to provide a detailed profiling of the population. This study also seeks to contribute valuable insights into the epidemiology and clinical presentation of diabetic ulcers in local-regional area of our hospital, ultimately informing more effective prevention, management, and patient centered care strategies for individuals suffering from this debilitating complication of diabetes mellitus

METHODS

This study is a retrospective descriptive study using secondary data from patient medical record and a cross sectional approach. We collected data from inpatients with

diabetic ulcers at Margono Soekarjo County Hospital, Indonesia in one-year span from 2020 to 2021. We profiled the characteristics in this study include age, gender, education, occupation, blood sugar level and sites of ulceration. Univariate analysis analyzes the data to determine the characteristics of the respondents.

RESULTS

We collected data from 319 inpatients with diabetic ulcers at Margono Soekarjo County Hospital, Indonesia in one-year span from 2020 to 2021, and we studied their characteristics include age, gender, education, occupation, blood sugar level and sites of ulceration.

Table 1. Characteristics of Diabetic Ulcer Inpatients (Age and Gender)

Variables	Total	%
Gender		
Male	140	43.9
Female	179	56.1
Total	319	100
Age		
>60 years	147	46.1
51-60 years	128	40.1
41-50 years	35	11.0
<40 years	9	2.8
Total	319	100

Our study found the majority of the inpatients with diabetic ulcers was female (179 patients, 56.1%), and the largest proportion of the inpatients with diabetic ulcers came from

the age group older than 60 year old (147 patients, 46.1%), followed closely by ones in the age group of 51-60 year old (128 patients, 40.1%).

Table 2. Characteristic of Diabetic Ulcer Respondents based on Their Level of Education

Variable	Total	%
Level of Education		
No formal education	57	17.9
Elementary school	108	33.9
Junior high school	34	10.7
Senior high school	70	21.9
Bachelor degree	43	13.5
Master degree	7	2.2
Total	319	100

Our study found the largest proportion of the inpatients with diabetic ulcers came from the lower level of education in

which patients who passed elementary schools (108 patients, 33.9%) were the dominant ones.

Table 3. Characteristic of Diabetic Ulcer Respondents Based on Daily Occupation

Variable	Total	%
Occupation		
Unemployed	81	25.4
Housewife	58	18.2
Retired	23	7.2
Self Businessman/-woman	56	17.6
Civil Servant	25	7.8

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Teacher	16	5.0
Employee	25	7.8
Labor	14	4.4
Farmer	17	5.3
Army	2	0.6
More	2	0.6
Total	319	100

Our study found the largest proportion of the inpatients with diabetic ulcers were unemployed (81 patients, 25.4%), followed by housewives (58 patients, 18.2%) and self-

workers (56 patients, 17.6%). Other occupations had a percentage of less than 10%.

Table 4. Characteristic of Diabetic Ulcer Respondents based on blood sugar level

Variable	Total	%
Blood Sugar Level		
Category I (<200 mg/dL)	132	41.4
Category II (≥200 mg/dL)	187	58.6
Total	319	100

In reference to the blood sugar level classification established by Indonesian Endocrinology Society (Perkeni), we found out that the majority of the inpatients with diabetic ulcers had

higher blood sugar level than 200 milligrams per decilitre (187 patients, 58.6%).

Table 5. Characteristic of Diabetic Ulcer Respondents based on Their Sites of Ulceration

Variables	Total	%
Sites of Ulceration		
Foot	293	91.9
Toes	34	10.6
Dorsal of the foot	5	1.6
The sole of the foot	12	3.8
Other/non-specific part of foot	242	75.9
Hand	15	4.7
Fingers	4	1.3
Other/non-specific part of hand	11	3.4
Others	11	3.4
Total	319	100

Our study confirmed that diabetic foot ulcers were the dominant types of diabetic ulcers (293 patients, 91.9%). Although specific foot part or area like toes (34 patients, 10.6%) and sole of the foot (12 patients, 3.8%) contributed large proportions of the inpatients with diabetic ulcers, unspecified locations of the foot like the side parts (outer side or inner side), posterior parts and ankles contributed the largest proportion in total (242 patients, 75.9%). Interestingly, 11 patients (3.4%) suffered from diabetic ulcers on other locations than hands and feet.

DISCUSSION

Diabetic ulcers, a complication stemming from diabetes mellitus (DM), instigate multifaceted alterations and disruptions across the physical, psychological, social, and economic domains of afflicted individuals. This ailment exerts a profound impact on physical well-being, manifesting as deformities in foot morphology, persistent pain, malodorous discharges from foot infections, and, in severe

instances, necessitating amputation. Notably, diabetic ulcers afflict 25% of the diabetes mellitus patient populace, precipitated by the deleterious effects of heightened blood glucose levels on nerves and vasculature, thereby compromising circulatory function. Furthermore, as elucidated by Setiawan and colleagues, the etiology of ulcers in DM patients hinges upon neuropathic and/or ischemic origins, coupled with infectious complications.⁴

Our study has unveiled a prevailing trend among respondents, with the majority of inpatients with diabetic ulcers exceeding 60 years of age (comprising 46.1% of the sample) and being predominantly female (constituting 56.1% of the cohort). This observation aligns harmoniously with prior research conducted by Madanchi and colleagues, as well as Llanes and colleagues, which corroborated a dominant age distribution among diabetic ulcer patients within the fifth and sixth decades of life.^{5,6} The World Health Organization (WHO) states that a person who has reached the age of 30 will experience an increase in blood sugar by 1 to 2 milligrams

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per deciliter. Moreover, as age advances, the susceptibility to elevated blood glucose levels and impaired glucose tolerance amplifies. This escalation can be attributed, in part, to the deteriorating functionality of organs such as pancreatic cells, leading to perturbations in insulin hormone production and consequent elevations in blood glucose concentrations.⁷

A groundbreaking investigation led by Witanto and a team of researchers at Immanuel Hospital, Bandung discerned a striking gender distribution among diabetic ulcer patients, with 63% being female and 37% male.⁸ Remarkably, their findings diverge substantially from the research conducted by Decroli and colleagues at M. Djamil Hospital, Padang in which the gender distribution exhibited an astonishing 71% male and 29% female prevalence.⁹ This incongruity underscores a compelling phenomenon: a pronounced predilection for diabetes mellitus among women, a phenomenon closely linked to the fact that the majority of diabetic ulcers manifesting in individuals aged 56-65, closely followed by those aged 46-55.¹⁰ This conspicuous age-related trend may also, in part, be attributed to the physiological implications of menopause in women, which in turn exerts a discernible impact on blood glucose regulation.⁷ Related to the strikingly different findings of Decroli and colleagues, we assume that, diabetic men were more susceptible to traumatic woundings due to their higher intensity of physical activity. Our study also highlighted a predominant proportion of respondents who completed only elementary school as their highest level of education, comprising 33.9% of the sample. This finding aligns with prior investigations, such as studies by Husen and Basri in Ternate, Indonesia which similarly observed a majority of diabetic ulcer patients possessing elementary school education.¹¹ Nonetheless, it is noteworthy that a 2014 study conducted by Sentana and colleagues at West Nusa Tenggara Provincial Hospital reported a contrasting trend, revealing that the majority of respondents in their cohort had attained a senior high school education level.¹² The influence of education on fostering a health-conscious lifestyle cannot be understated, particularly in terms of motivating individuals to enhance their health status. A higher educational attainment is expected to facilitate better access to information, including crucial insights related to disease prevention, treatment, and overall health knowledge.² A research by Yosmar and colleagues further supports this assertion, underscoring the role of education as a significant factor linked to diabetes mellitus, given its impact on an individual's knowledge base and decision-making capacity when addressing their health concerns.¹³ A prominent observation in our study showed the majority of respondents (25.4%) were unemployed. This observation aligns with research findings of Sentana and colleagues,¹² where a substantial 57.5% of diabetic ulcer patients were found to be non-working individuals. Occupation emerges as a pivotal social determinant impacting not only healthcare utilization but also the extent of health-related information

assimilation, thus intricately linked to healthcare consultation outcomes.¹⁴ The repercussions of low income on the capacity to finance diabetic treatment further exacerbate the health challenges posed by diabetes mellitus. The inactive employment status of patients may also compound the severity of diabetes and heighten the susceptibility to diabetic ulcers due to its deleterious effect on physical activity and the routine body movements pivotal for facilitating blood sugar absorption by cellular mechanisms.¹⁵ Moreover, research by Setiawan and colleagues underscores a linear relationship, demonstrating that a substantial proportion of individuals afflicted with foot ulcers endure a notably diminished quality of life.⁴

Our study also found a predominant presence of blood sugar levels falling within the higher-than-200-milligrams-per-deciliter range, constituting 58.6% of the observed cohort. This is in sync with previous investigation by Syaufika and Karimi in which a noteworthy prevalence of poor fasting sugar levels among diabetic ulcer patients accounting for a staggering 93.93% with levels surpassing 126 milligrams per deciliter or higher.³ It is imperative to acknowledge the diurnal fluctuation of glucose levels within the human body, which are intricately influenced by daily activities and dietary intake. The restorative normalization of blood sugar levels typically ensues within a 2-hour window after meal, with established norms ranging between 80 to 80 milligrams per deciliter. Prolonged periods of elevated blood glucose, however, can culminate in vasodilation, resulting in diminished blood flow to peripheral nerves, rendering diabetic ulcer patients susceptible to unnoticed injuries in this context, as expounded upon in the work of reference.¹⁶

Our study revealed a conspicuous pattern, with the preponderance of diabetic ulcers manifesting primarily on the feet, as evidenced by 294 respondents (comprising 91.8% of the sample). This finding aligns seamlessly with prior research by Fitria and colleagues, underscoring the predilection of diabetes mellitus (DM) patients for developing ulcers on the feet, specifically the prominent toes and plantar surfaces, owing to heightened mechanical pressure dynamics.¹⁰ Augmenting this insight, investigative endeavors by Agustianingsih and colleagues revealed that blood circulation, which entails the orchestrated conveyance of blood propelled by the heart throughout the entire vascular system, including the peripheral extremities, is subject to the modulating influences of three pivotal factors: blood viscosity, vessel length, and vessel diameter. In the context of diabetes mellitus (DM), the accrual of hyperglycemia within the vascular milieu exerts a discernible impact on blood flow dynamics through the viscosity factor. Elevated blood viscosity disrupts the hemodynamic equilibrium throughout the systemic circulation, precipitating a notable decline in tissue perfusion, most notably discernible within the distal inferior extremities, anatomically situated furthest from the cardiac epicenter.¹⁷

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The lower incidence of diabetic ulcers or foot ulcers in developed countries, as compared to their developing counterparts like Indonesia, predominantly arises from the superior and expeditious therapeutic interventions employed. Common problems in developed countries such as prolonged delays in foot ulcer management and suboptimal treatment regimens substantially elevate the likelihood of severe diabetic ulcers culminating in amputation, a phenomenon more prevalent in developing nations than their developed counterparts.¹⁸

However, the prevalence of diabetic ulcers in developed countries continues to exhibit variations, primarily attributed to lifestyle factors. North America, the most industrialized region, exhibits the highest prevalence at 13%, while Oceania, particularly Australia, reports the lowest incidence at 3%. Developed European nations similarly display a relatively low prevalence rate of 5%. In terms of gender disparities, females manifest a lower prevalence when contrasted with males. Perhaps diabetic men are more susceptible to traumatic woundings due to their higher intensity of physical activity than women.

Characteristically, foot ulcer patients in developed regions across the Americas, Asia, Europe, and Oceania tend to be aged over 60, have a protracted history of diabetes with elevated blood glucose levels exceeding 200 milligrams per deciliter, and exhibit diminished body mass. Occupational profiles exhibit nominal influence, with lifestyle factors, such as smoking, emerging as significant determinants. The prevalence of foot ulcers in North America is notably attributed to smoking habits.

The prevalence of diabetes mellitus and its complications in most developed countries remains subdued due to the low cost of diabetes mellitus treatment as it is generally covered by the government.¹⁹ Conversely, a study conducted by Sriyani and colleagues concerning predictors of diabetic ulcers or foot ulcers in Srilanka, one of the developing nations, mirrors trends in developed countries, with a predominant patient demographic comprising individuals aged over 50, albeit with a slightly higher proportion of female patients. Education levels tend to be skewed towards junior high school and higher, with income levels playing a pivotal role, particularly among patients earning less than 15,000 Sri Lankan rupees or approximately USD 46.22.²⁰ This income factor significantly impedes individual capacity to manage his/her diabetes effectively, resulting in suboptimal care among individuals with lower incomes.

Consequently, employment status indirectly affects this dynamic. Similarly, Rigato and colleagues explained that the elevated prevalence of diabetic ulcers or diabetic foot ulcers in developing countries is rooted in diminished awareness of self-care practices, compounded by limited access to pertinent information facilitating diabetic foot ulcer mitigation and a subsequent neglect of foot health issues.¹

Indonesia struggles with a persistently high prevalence of diabetes mellitus, holding the unsettling distinction of ranking sixth globally in this regard. The International Diabetes Federation (IDF) underscores an alarming trend, indicating a continuous ascent in diabetes incidence within Indonesia.²¹ According to the Basic Health Research conducted by the Ministry of Health, the diabetes landscape in Indonesia exhibited a prevalence rate of 6.9% in 2013, surging significantly to 8.5% in 2018. The estimation from Department of Health paint a staggering picture, projecting a total diabetic population of 16 million in Indonesia, with an ominous subset of 4 million individuals afflicted by diabetic ulcers. The socio-economic dynamics, particularly income disparities and educational attainments, emerge as pivotal factors amplifying the prevalence of diabetes-linked ulcerations. Notably, individuals with lower incomes and reduced educational attainment exhibit a heightened susceptibility, experiencing diabetes and concomitant foot ulcers at a rate 2 to 4 times greater, a phenomenon substantiated by multiple published studies.²²

One investigation delved into the distinctive attributes characterizing diabetic ulcer patients within the Indonesian population. This study revealed a preponderance of individuals aged 56 and above, comprising 57.3% of the cohort, and a conspicuous female majority, constituting 54% of the subjects. Notably, the predilection site of the ulcer was toward the lower extremity, particularly the foot. The vulnerability to diabetic ulcer complications exhibited an escalated proclivity among women in the menopausal phase. The hormonal decline during menopause, marked by estrogen depletion, engendered an augmented susceptibility to neuropathic incidents and diabetic ulceration. Additionally, the majority of patients hailed from economically disadvantaged backgrounds, where approximately 59% reported a total monthly income falling within the range of 1.5 to 3 million rupiah, coinciding with a lower educational attainment rate of 75% and a substantial portion, specifically 65%, being unemployed. Another study from Indonesia also examined the relationship between blood glucose levels and the degree of foot ulcers. The outcomes distinctly delineated a correlation, wherein 10% of subjects with grade 1 ulcers exhibited blood glucose levels below 200 milligrams per deciliter, contrasting with 40% and 50% of those with grade two and three ulcers, respectively, who manifested blood glucose levels surpassing or equal to 200 milligrams per deciliter.²³

The prevalence of diabetes in Central Java, particularly in the Banyumas region and generally in the southern parts of Central Java, has exhibited a notable upward trajectory in recent years. In 2018, the total count of diabetes cases in Central Java reached a substantial figure of 2,412,297. Notably, within the confines of Banyumas region, this incidence has displayed persistent annual increments. In 2017, diabetes mellitus accounted for 6.91% of all non-

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communicable diseases in the region, securing the sixth position in prevalence. Disaggregated data reveals that diabetes mellitus afflicted more women as opposed to men (755 to 604).²⁴ Data from the Kembaran I Public Health Center which served as one focal point of public health researches in Banyumas region, exhibited a pronounced predilection for elderly patients aged over 60, with females constituting 83% of the patient cohort. Remarkably, individuals with limited educational backgrounds, approximately 85.1%, exhibited the highest proclivity towards diabetes.²⁵ Those findings echo congruent trends observed in a parallel investigation conducted in another focal point of public health researches in Banyumas region, Jatilawang Public Health Center, wherein the prevalence of foot ulcers was predominantly observed among the older adults and elderly demographic, with women comprising 71.4% of the affected cohort. The majority of the diabetic patients in Jatilawang were unemployed, and a staggering 78.6% held no higher than elementary school qualifications, while a significant proportion demonstrated elevated blood glucose levels exceeding 200 mg/dl.²⁶

CONCLUSION

In summary, our retrospective analysis sheds light on the complex factors driving diabetic ulcers in Indonesia, with a focus on the Banyumas region. Diabetic ulcers, a severe complication of diabetes mellitus, have wide-ranging physical, psychological, social, and economic impacts, causing foot deformities, persistent pain, and even amputation.

Our findings align with global trends, revealing that diabetic ulcers primarily affect elderly individuals over 60, especially females. Education and employment status play significant roles, with many patients having limited education and being unemployed, affecting healthcare access and outcomes. Effective blood glucose management is crucial, as elevated levels can compromise circulation, making individuals more prone to ulcers, especially in their lower extremities. To address this growing issue, comprehensive public health strategies focused on diabetes prevention, health education, and improved healthcare access are essential, tailored to the unique demographics and socio-economic factors of the affected population in the Banyumas region, with potential implications for global healthcare strategies.

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