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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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ANALYSIS OF THE TYPES AND PATTERNS OF LIMB AMPUTATIONS RELATED TO DIABETIC FOOT CONDITIONS IN THE QASSIM REGION: A RETROSPECTIVE STUDY

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Abstract.

Background: Diabetic foot ulcers (DFUs) are a significant complication of diabetes, frequently leading to limb amputations. This study analyzes the patterns and types of amputations associated with DFUs in the Qassim region, Saudi Arabia, addressing a gap in regional data.

Methods: A retrospective study was conducted at the Sheikh Fahad Alawidah Diabetic Foot Center, Buraidah, Qassim, Saudi Arabia, including all patients diagnosed with DFUs who underwent amputations between January 2020 and September 2024. Data on demographics, diabetes-related characteristics, and amputation details were collected using a pre-designed checklist and analyzed using SPSS version 26. Below-knee and above-knee amputations were considered major, whereas toe and transmetatarsal amputations were considered minor.

Results: Among 241 patients, the majority were male 165 (68.5%) and over 60 years old 140 (58.1%). Most patients had type 2 diabetes 238 (98.8%). Regarding amputation patterns, 187 (77.6%) underwent minor amputations, 73 (30.3%) major amputations, and 19 (7.9%) had both types; overall, 168 (69.7%) had minor amputations only and 54 (22.4%) had major amputations only. Below-knee amputations 58 (79.5%) were the most common major procedures, while other toes amputations 97 (52.1%) predominated among minor amputations. Infection 128 (53.1%) and critical ischemia 73 (30.3%) were the leading causes of amputation. Significant associations were identified between amputation type and variables such as chronic diseases, ICU admission, and infection history. Multivariate logistic regression analysis further showed that ICU admission (OR = 6.15, $p < 0.001$), more than four hospital admissions (OR = 3.54, $p = 0.002$), chronic diseases (OR = 3.12, $p = 0.048$), diabetic nephropathy (OR = 2.87, $p = 0.033$), cardiovascular disease (OR = 2.41, $p = 0.016$), infection (OR = 2.76, $p = 0.006$), and previous surgery (OR = 2.11, $p = 0.021$) were independent predictors of major amputation. Higher white blood cell count (OR = 1.08, $p = 0.002$) and creatinine levels (OR = 1.04, $p = 0.008$) were also associated with increased risk, while higher hemoglobin levels were as-sociated with a lower risk (OR = 0.79, $p = 0.003$).

Conclusion: This study highlights the prevalence of minor amputations and the critical role of infections in DFU-related amputations in the Qassim region. Targeted prevention strategies and early intervention are essential to reduce the burden of amputations and improve patient outcomes.

Key words. Diabetes, Amputations, Qassim.

Introduction.

Diabetes is a major public health concern that is rapidly spreading to epidemic proportions over the world, making it one of the most serious global health emergencies of the twenty-first century [1]. The International Diabetes Federation (IDF) predicts that 537 million persons (aged 20 to 79) will have diabetes in 2021, with the figure rising to 643 million by 2030 [2]. Saudi Arabia is anticipated to be one of the top five countries in the world for type 2 diabetes mellitus (T2DM) prevalence by 2030 [3].

Diabetics are at a high risk of developing diabetic foot ulcers (DFU), and the majority of these cases require amputation within four years of diagnosis [4]. DFUs are 6.3% common worldwide, and they are more prevalent in male type 2 diabetes patients [5]. According to a comprehensive review, the mean prevalence of DFU in Saudi Arabia was 11.85% (4.7-19%), which was higher than in Egypt, Jordan, Bahrain, and Iraq. According to one study, the prevalence of DFU in Saudi Arabia was 1.8% in 2009- 2010 [6].

DFUs pose considerable health and socioeconomic issues, lowering patients' quality of life and inflicting a huge financial burden on both patients and their families [7]. In the United States, controlling diabetic foot (DF) illness costs between $9 and $13 billion each year, in addition to other diabetes-related expenses [8,9]. In Saudi Arabia, the total cost of caring for 99 patients with DFU was estimated to be 6,618,043.3 Saudi Riyals (equal to $1,764,632.68 USD), with an annual average of 6,684.9 SAR per patient (or $1,782.6 USD) [10]. Hospital admissions (45.6%), debridement treatments (14.5%), and ICU stays (10.4%) incurred the highest costs [10].

From January 1, 2009 to December 31, 2018, a retrospective study was undertaken in Bahir Dar, Northwest Ethiopia, on 387 patients [11]. Of these patients, 66 (17.05%) acquired DFUs, with a case rate of 4 per 100 person-years [11]. A greater BMI, diabetic retinopathy and diabetic nephropathy have all been associated with an increased risk of DFUs [11].

A cross-sectional study conducted in Tehran, Iran, from 2011 to 2020 examined 4676 patients with DFUs at Sina and Shariati hospitals [12]. Among these patients, 18.8% (882 people) had lower extremity amputations [12]. Toe amputation was the most common type of amputation, accounting for 35.8%, followed by Chopart amputation at 0.6% [12]. DFUs were primarily found in the forefoot (88.1%) and classified as ischemic wounds (57.8%), frequently resulting in toe amputations [12]. Bilateral DF problems were infrequent (0.7%), and Charcot arthropathy was the cause of amputation in less than 3% of cases [12].

A cross-sectional analysis of 62,681 people aged 25 and older, using data from the Saudi National Diabetes Registry (SNDR) database, found that the overall prevalence of DF complications was 3.3% [13]. Foot ulcers were seen in 2.05% of the population, with gangrene and amputations occurring at rates of 0.19% and 1.06%, respectively [13]. Foot problems increased with both age

Table 1. *Distribution of studied patients according to their demographic characters and year of amputation (No.: 241).*

Variable	No. (%)
Age (years)	
<30	1 (0.4)
30-40	2 (0.8)
41-50	23 (9.5)
51-60	75 (31.1)
>60	140 (58.1)
Gender	
Female	76 (31.5)
Male	165 (68.5)
Nationality	
Non-Saudi	14 (5.8)
Saudi	127 (94.2)
Year of amputation	
2020	28 (11.6)
2021	62 (25.7)
2022	51 (21.2)
2023	65 (27)
2024	35 (14.5)

and diabetes duration, especially in male patients [13]. Although T2DM individuals are more likely to have DF, those with type 1 diabetes have a higher incidence [13]. A cross-sectional analysis of 62,681 people aged 25 and older, using data from the Saudi National Diabetes Registry (SNDR) database, found that the overall prevalence of DF complications was 3.3% [13]. Foot ulcers were seen in 2.05% of the population, with gangrene and amputations occurring at rates of 0.19% and 1.06%, respectively [13]. Foot problems increased with both age and diabetes duration, especially in male patients [13]. Although T2DM individuals are more likely to have DF, those with type 1 diabetes have a higher incidence [13].

The specific patterns and types of amputations linked to DF conditions are not well understood in the Qassim region. Thus, the purpose of this study is to identify the precise patterns and types of amputations that are carried out on patients with DF in the Qassim region, Saudi Arabia.

Materials and Methods.

This retrospective study was conducted at the Sheikh Fahad Alawidah Diabetic Foot Center in Buraidah, Qassim, Saudi Arabia from January 2020 to September 2024.

The inclusion criteria were all patients diagnosed with diabetic foot and underwent amputation between January 2020 and September 2024, of both genders, all ages and with complete medical records. The exclusion criteria were patients with incomplete medical records.

A comprehensive sample was taken, where all patients diagnosed with diabetic foot and who underwent amputation between January 2020 and September 2024 were included. A total of 241 patients were included in the analysis.

A pre-designed checklist was prepared to collect data about: patients' demographics: (Age, Gender, Nationality), year of amputation, DM clinical data, chronic diseases, pattern of amputation: (type: Minor, major or both types of amputation), type, level and causes of amputation, history of wet or dry gangrene, site of admission, duration of hospital stay, ICU admission, number of admissions related to DM, presence of osteomyelitis, previous surgeries and laboratory data.

Ethical approval and informed consent statement: Ethical approval for the study was obtained from the Regional Research Ethics Committee, Qassim Province, Saudi Arabia (Approval number 607/46/648). The need for informed consent was waived due to the retrospective design of the study.

Data were statistically analyzed using the (SPSS) application version 26. To investigate the association between the variables, the Chi-squared test ($\chi 2$) was applied to qualitative data that was expressed as numbers and percentages. Quantitative data was expressed as mean and standard deviation (Mean ± SD), where the Kruskal Wallis tests was applied for non-parametric variables. Multivariate logistic regression analysis was performed to identify independent predictors (risk factors) of major amputation. A P-value of <.05 was considered as statistically significant.

Results.

Of the studied 241 patients, 140 (58.1%) had an age more than 60 years, 165 (68.5%) were males, and 127 (94.2%) had a Saudi nationality. Almost one quarter of amputations (65: 27%) were done in 2023 and 62 (25.7%) were done in 2021 (Table 1).

Table 2 demonstrates that most patients (238: 98.8%) had type 2 DM, 151 (62.7%) were on oral hypoglycemic agents, and 185 (76.8%) were on Insulin treatment. Most of patients (195: 80.9%) had chronic diseases with HTN (179: 91.7%), and CVD (132: 67.6%) the most common comorbidities.

The amputation data are illustrated in (Table 3, Figure 1,2,3 and 4), It was found that 238 (98.8%) of patients underwent amputation, with 187 (77.6%) had minor amputation and 73 (30.3%) had major amputation. As for all amputations, 168 (69.7%) had minor amputation, 54 (22.4%) had major amputation, while 19 (7.9%) had both types of amputation. As for those who had minor amputation (n.: 187), the level of amputation was the

Table 2. *Distribution of studied patients according to DM clinical data, and chronic diseases (No.: 241).*

Variable	No. (%)
Diabetes type	
Type 1	3 (1.2)
Type 2	238 (98.8)
Use oral hypoglycemic agents	
No	90 (37.3)
Yes	151 (62.7)
Use Insulin treatment	
No	56 (23.2)
Yes	185 (76.8)
Chronic disease	
No	41 (17)
Yes	195 (80.9)
NA	5 (2.1)
If yes, specify: (No.: 195)	
CVD	132 (67.6)
HTN	179 (91.7)
Diabetic neuropathy	16 (8.2)
Diabetic nephropathy	15 (7.6)
CKD	65 (33.3)
Malignancy	3 (1.5)

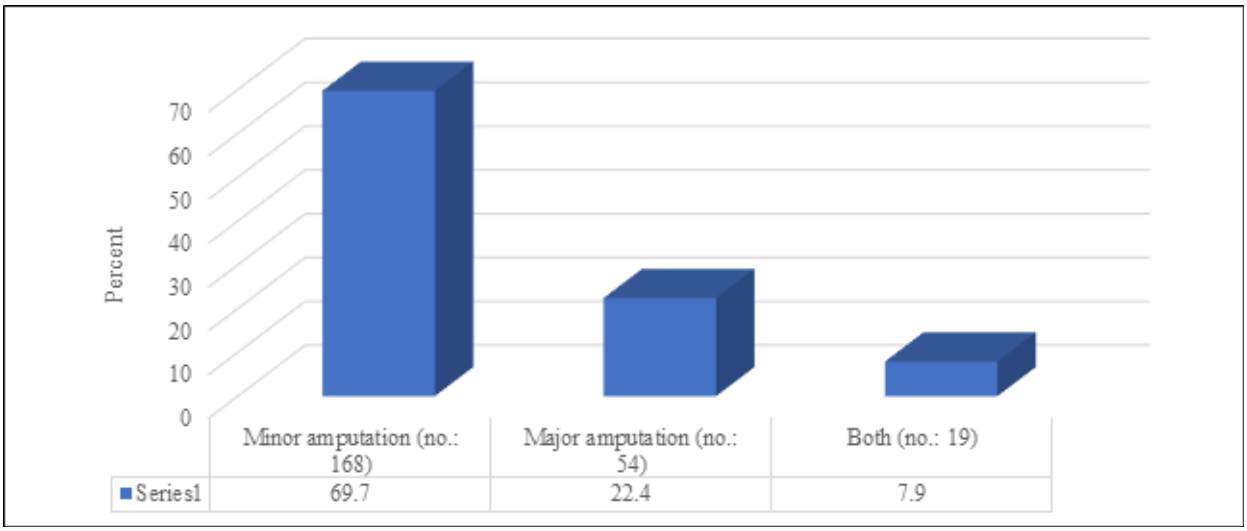

Figure 1. *Percentage distribution of types of all amputations among studied patients.*

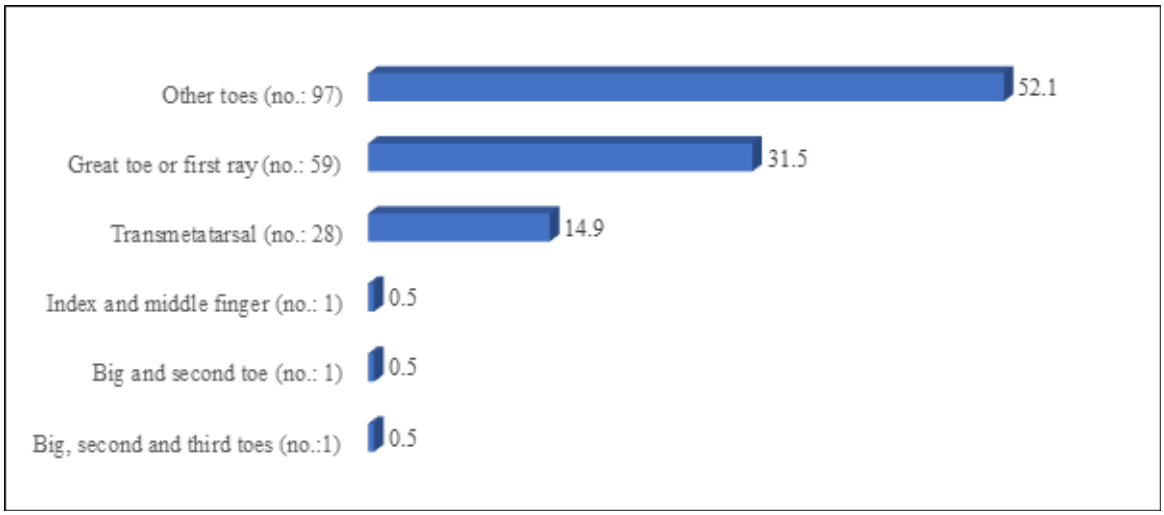

Figure 2. *Percentage distribution of levels of minor amputation (no.: 187).*

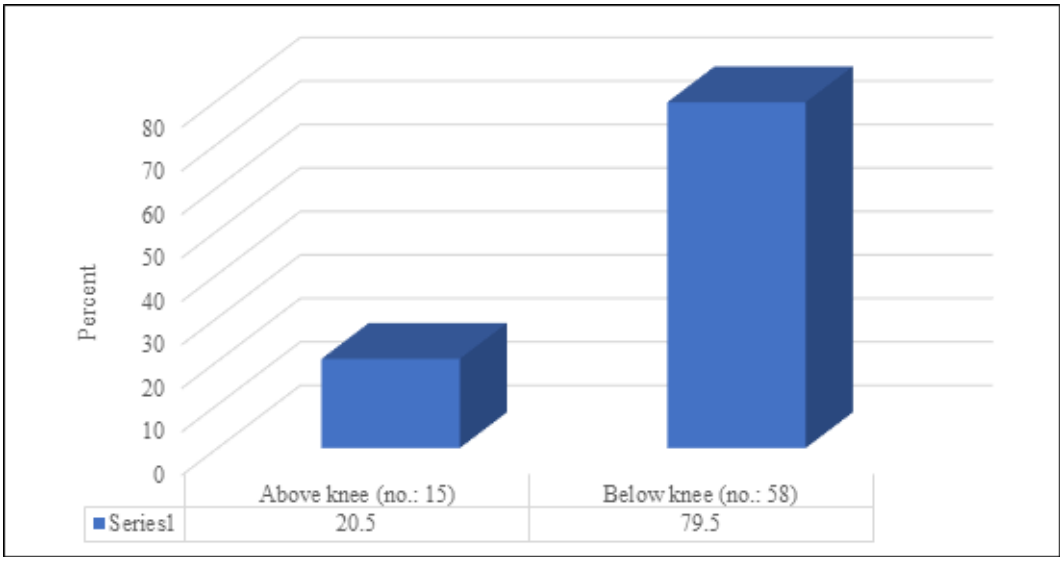

Figure 3. *Percentage distribution of levels of major amputation (no.: 73).*

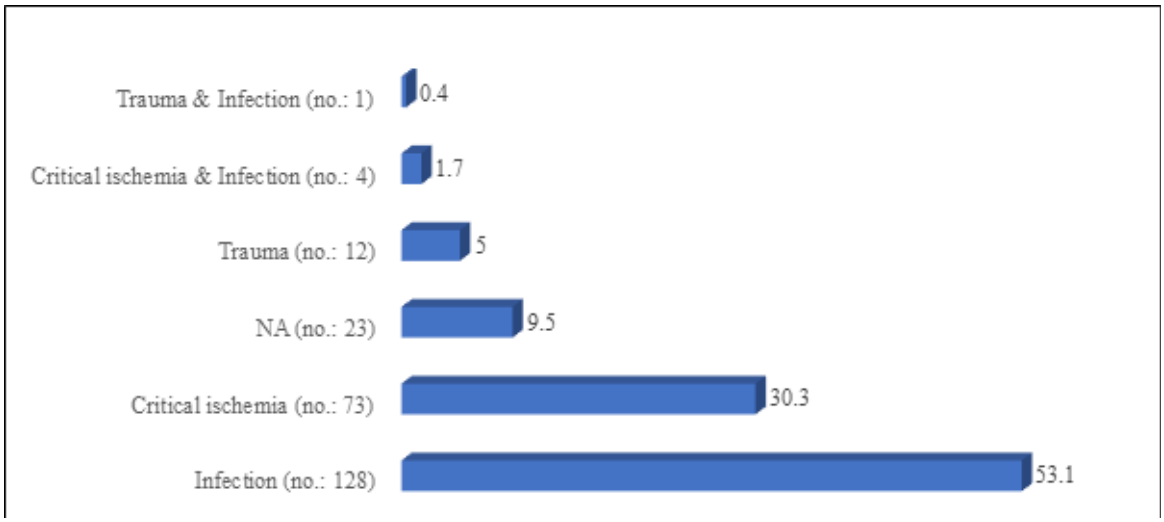

Figure 4. *Percentage distribution of causes of amputation.*

Table 3. *Amputation data: type, level and causes and history of wet or dry gangrene (No.: 241).*

Amputation	**3 (1.2)**
No	238 (98.8)
Yes	
Type of amputation	
Minor amputation	187 (77.6)
Major amputation	73 (30.3)
All amputations	
Minor amputation	168 (69.7)
Major amputation	54 (22.4)
Both	19 (7.9)
Level of minor amputation (no.: 187)	
Big, second and third toes	1 (0.5)
Big and second toe	1 (0.5)
Index and middle finger	1 (0.5)
Transmetatarsal	28 (14.9)
Great toe or first ray	59 (31.5)
Other toes	97 (52.1)
level of major amputation (no.: 73)	
Above knee	15 (20.5)
Below knee	58 (79.5)
Cause of amputation	
Infection	128 (53.1)
Critical ischemia	73 (30.3)
NA	23 (9.5)
Trauma	12 (5)
Critical ischemia & Infection	4 (1.7)
Trauma & Infection	1 (0.4)
History of dry gangrene	
No	167 (69.3)
Yes	74 (30.7)
History of wet gangrene	
No	143 (59.3)
Yes	98 (40.7)

Table 4. *Site of admission, duration of hospital stay, ICU admission, number of admissions related to DM, presence of osteomyelitis or previous surgeries and laboratory data (No.: 241).*

Variable	**No. (%)**
Site of admission	
ER	142 (58.9)
Outpatient	70 (29)
Referral	29 (12)
Duration of hospital stay	
<5 days	79 (32.8)
5-10 days	78 (32.4)
11-15 days	44 (18.3)
>15 days	40 (16.6)
ICU admission	
No	201 (83.4)
Yes	40 (16.6)
Number of admissions related to diabetes status	
1	133 (55.2)
2	41 (17)
3	18 (7.5)
4	9 (3.7)
>4	40 (16.6)
Presence of osteomyelitis	
No	177 (73.4)
Yes	64 (26.6)
History of previous surgeries	
No	146 (60.6)
Yes	95 (39.4)
HbA1C % (Mean ± SD)	9.41 (2.37)
WBCs 10^3/uL (Mean ± SD)	11.79 (7.23)
Creatinine umol/L (Mean ± SD)	142.49 (150.03)
Hb g/Dl (Mean ± SD)	11.19 (2.23)

great toe or first ray for 31.5%, Transmetatarsal for 28 (14.9%), while more than half (97: 52.1%) had other toes amputations. According to patients who under-went major amputation (n.: 73), 58 (79.5%) had below knee. The most common causes of amputation were infection (128: 53.1%) and critical ischemia (73: 30.3%). Among patients, 74 (30.7%) and 98 (40.7%) had dry and wet gangrene respectively.

Table 4 shows that 142 (58.9%) of patients were admitted through the ER, 79 (32.8%) had a hospital stay of less than 5 days, while78 (32.4%) had a duration of 5-10 days. Of them, 40 (16.6%) were admitted to the ICU, 133 (55.2%) had one admission related to DM, while 40 (16.6%) had more than 4 admissions. The prevalence of osteomyelitis was 64 (26.6%) and 95 (39.4%) had a history of previous surgery. The mean values of HbA1C %, WBCs 10^3/uL, Creatinine umol/L and Hb g/Dl are also illustrated in (Table 4).

The relationship between all amputation types (minor, major an both) and patients' demographics are illustrated in (Table 5). It was revealed that there were no significant relationships (p=>0.05).

Table 5. *Relationship between amputation type and patients' demographics and year of amputation (No.: 241).*

Variable	Amputation type			χ^2	CI	P-value
	Minor amputation No. (%)	Major amputation No. (%)	Both amputations No. (%)			
Age (years)						
<30	1 (0.6)	0 (0.0)	0 (0.0)	7.53	0.43-0.46	.48
30-40	2 (1.2)	0 (0.0)	0 (0.0)			
41-50	21 (12.5)	2 (3.7)	0 (0.0)			
51-60	51 (30.4)	17 (31.5)	7 (36.8)			
>60	93 (55.4)	35 (64.8)	12 (63.2)			
Gender						
Female	53 (31.5)	20 (37)	3 (15.8)	2.93	0.2-0.23	.23
Male	115 (68.5)	34 (63)	16 (84.2)			
Nationality						
Non-Saudi	10 (6)	2 (3.7)	2 (10.5)	1.21	0.66-0.68	.544
Saudi	158 (94)	52 (96.3)	17 (89.5)			
Year of amputation						
2020	23 (13.7)	5 (9.3)	0 (0.0)	5.26		.729
2021	42 (25)	16 (29.6)	4 (21.1)			
2022	34 (20.2)	11 (20.4)	6 (31.6)			
2023	46 (27.4)	13 (24.1)	6 (31.6)			
2024	23 (13.7)	9 (16.7)	3 (15.8)			

Table 6. *Relationship between amputation type and patients' demographics and year of amputation (No.: 241).*

Variable	Amputation type			χ^2	CI	P-value
	Minor amputation No. (%)	Major amputation No. (%)	Both amputations No. (%)			
Diabetes type						
Type 1	3 (1.8)	0 (0.0)	0 (0.0)	1.32	0.66-0.69	.517
Type 2	165 (98.2)	54 (100)	19 (100)			
Use oral hypoglycemic agents						
No	49 (29.2)	30 (55.6)	11 (57.9)	15.88	0.01-0.02	**<.001**
Yes	119 (70.8)	24 (44.4)	8 (42.1)			
Use Insulin treatment						
No	38 (22.6)	12 (22.2)	6 (31.6)	0.8	0.71-0.73	.668
Yes	130 (77.4)	42 (77.8)	13 (68.4)			
Chronic disease						
No	38 (22.6)	3 (5.6)	0 (0.0)	13.47	0.09-0.01	**.009**
Yes	126 (75)	50 (92.6)	19 (100)			
NA	4 (2.4)	1 (1.9)	0 (0.0)			
If yes, specify: (No.: 195)						
CVD	85 (50)	38 (70.4)	10 (52.6)	6.88	0.02-0.03	**.032**
HTN	113 (67.3)	48 (88.9)	18 (94.7)	14.52	0.01-0.02	**.001**
Diabetic neuropathy	12 (7.1)	2 (3.7)	2 (10.5)	1.28	0.57-0.59	.527
Diabetic nephropathy	6 (3.6)	7 (13)	2 (10.5)	6.82	0.03-0.04	**.033**
CKD	41 (24.4)	21 (38.9)	3 (15.8)	5.66	0.04-0.06	.059
Malignancy	3 (1.8)	0 (0.0)	0 (0.0)	1.32	0.66-0.68	.517

N.B.: CI = Confidence interval.

Table 7. *Relationship between amputation type and its causes, gangrene, site of admission, duration of hospital stay, ICU admission, number of admissions related to DM, history of osteomyelitis or previous surgeries (No.: 241).*

Variable	Amputation type			χ^2	CI	P-value
	Minor amputation No. (%)	Major amputation No. (%)	Both amputations No. (%)			
Causes of amputation						
Critical ischemia	57 (33.9)	12 (22.2)	4 (21.1)	18.41	0.05-0.09	.002
Critical ischemia & Infection	1 (0.6)	3 (5.6)	0 (0.0)			
Infection	80 (47.6)	35 (64.8)	13 (68.4)			
Trauma	10 (6)	2 (3.7)	0 (0.0)			
Trauma & Infection	0 (0.0)	0 (0.0)	1 (5.3)			
NA	20 (11.9)	2 (3.7)	1 (5.3)			
History of Dry gangrene						
No	128 (76.2)	30 (55.6)	9 (47.4)	12.83	0.01-0.04	**.002**
Yes	40 (23.8)	24 (44.4)	10 (52.6)			
History of Wet gangrene						
No	102 (60.7)	31 (57.4)	10 (52.6)	0.56	0.75-0.78	.752
Yes	66 (39.3)	23 (42.6)	9 (47.4)			
Site of admission						
ER	95 (56.5)	37 (68.5)	10 (52.6)	3.19	0.5-0.53	.525
Outpatient	53 (31.5)	11 (20.4)	6 (31.6)			
Referral	20 (11.9)	6 (11.1)	3 (15.8)			
Duration of hospital stay						
<5 days	59 (35.1)	12 (22.2)	8 (42.1)	8.56	0.19-0.21	.2
5-10 days	54 (32.1)	20 (37)	4 (21.1)			
11-15 days	31 (18.5)	8 (14.8)	5 (26.3)			
>15 days	24 (14.3)	14 (25.9)	2 (10.5)			
ICU admission						
No	159 (94.6)	24 (44.4)	18 (94.7)	16.3	0.1-0.2	**<.001**
Yes	9 (5.4)	30 (55.6)	1 (5.3)			
Number of admissions related to diabetes status						
1	113 (67.3)	15 (27.8)	5 (26.3)	16.57	0.1-0.2	**<.001**
2	30 (17.9)	10 (18.5)	1 (5.3)			
3	10 (6)	5 (9.3)	3 (15.8)			
4	7 (4.2)	1 (1.9)	1 (5.3)			
>4	8 (4.8)	23 (42.6)	9 (47.4)			
Presence of osteomyelitis						
No	116 (59)	48 (88.9)	13 (68.4)	8.51	0.01-0.02	**.014**
Yes	52 (31)	6 (11.1)	6 (31.6)			
History of previous surgeries						
No	116 (59)	23 (42.6)	7 (36.8)	16.84	0.01-0.02	**<.001**
Yes	52 (31)	31 (57.4)	12 (63.2)			
HbA1C % (Mean ± SD)	9.46 ± 2.32	9.16 ± 2.25	9.58 ± 3.11	0.69*		.707
WBCs 10^3/uL (Mean ± SD)	10.68 ± 5.97	15.42 ± 9.93	11.32 ± 5.05	15.91*		<.001
Creatinine umol/L (Mean ± SD)	127.5 ± 136.3	200.77 ± 183.47	109.32 ± 123.34	10.02*		.007
Hb g/Dl (Mean ± SD)	11.58 ± 2.35	10.17 ± 1.74	10.58 ± 1.17	9.5**		<.001

*N.B.: CI = Confidence interval, * = Kruskal Wallis test, ** = ANOVA test.*

Table 8. *Multivariate logistic regression analysis of predictors (risk factors) of major amputation (No.: 241).*

Variable	Adjusted OR	95% CI	P-value
Age >60 years	1.32	0.72 – 2.41	0.365
Male gender	0.88	0.48 – 1.61	0.682
HbA1c (%)	0.96	0.84 – 1.10	0.579
CVD	2.41	1.18 – 4.92	**0.016**
Diabetic nephropathy	2.87	1.09 – 7.54	**0.033**
Chronic diseases (any)	3.12	1.01 – 9.61	**0.048**
Infection as cause	2.76	1.34 – 5.68	**0.006**
ICU admission	6.15	2.87 – 13.17	**<0.001**
WBCs (per 1×10^3/uL increase)	1.08	1.03 – 1.14	**0.002**
Creatinine (per 10 µmol/L increase)	1.04	1.01 – 1.07	**0.008**
Hb (g/dL)	0.79	0.68 – 0.92	**0.003**
>4 admissions (vs. 1 admission)	3.54	1.62 – 7.74	**0.002**
Previous surgery	2.11	1.12 – 3.98	0.021

Table 6 shows that the prevalence of having both types of amputation was significantly lower among patients on oral hypoglycemic agents (8: 42.1%), however it was significantly higher among those having chronic diseases (100%) (P=<.05). The prevalence of major amputation only was significantly higher among patients having CVD (38: 70.4%), or Diabetic nephropathy (13%) (P=<.05).

Table 7 shows that undergoing both types of amputations were higher among patients whose amputation cause was infection (13: 68.4%), and who had a history of history of dry gangrene (10: 52.6%) (P=<.05). At the same time, patients who had both amputation types had a significant higher percent of having more than four admissions related to DM (9: 47.4%), or had a history of previous surgery (12: 63.2%) (P=<.05). On the other hand, the prevalence of major amputations was significantly higher among patients who were admitted to the ICU (30: 55.6%), who had a higher mean WBCs (15.42 ± 9.93 10^3/uL) and who had a higher mean Creatinine level (200.77 ± 183.47 umol/L) (p=<0.05). While minor amputations were significantly higher among patients who had a higher mean Hb level (11.58 ± 2.35 g/Dl) (P=<.05). Table 7 shows that undergoing both types of amputations were higher among patients whose amputation cause was infection (13: 68.4%), and who had a history of history of dry gangrene (10: 52.6%) (P=<.05). At the same time, patients who had both amputation types had a significant higher percent of having more than four admissions related to DM (9: 47.4%), or had a history of previous surgery (12: 63.2%) (P=<.05). On the other hand, the prevalence of major amputations was significantly higher among patients who were admitted to the ICU (30: 55.6%), who had a higher mean WBCs (15.42 ± 9.93 10^3/uL) and who had a higher mean Creatinine level (200.77 ± 183.47 umol/L) (p=<0.05). While minor amputations were significantly higher among patients who had a higher mean Hb level (11.58 ± 2.35 g/Dl) (P=<.05).

Numerous independent predictors of major amputation were found using multivariate logistic regression analysis. The best predictor was ICU hospitalization (OR = 6.15, p < 0.001). Additionally, the risk was considerably higher for patients with more than four hospital admissions (OR = 3.54, p = 0.002). Major amputation was significantly predicted by the presence of chronic diseases (OR = 3.12, p = 0.048), diabetic nephropathy (OR = 2.87, p = 0.033), cardiovascular disease (OR = 2.41, p = 0.016), infection as a cause (OR = 2.76, p = 0.006), and history of prior surgery (OR = 2.11, p = 0.021). Additionally linked to greater risk were higher creatinine levels (OR = 1.04, p = 0.008) and higher white blood cell counts (OR = 1.08, p = 0.002). On the other hand, a lower risk of major amputation was linked to higher hemoglobin levels (OR = 0.79, p = 0.003).

Discussion.

Limb amputation is a common surgical intervention among patients with diabetic foot complications [14]. However, the amputation patterns remain insufficiently under-stood, particularly in certain regions of Saudi Arabia [15]. This study aims to address this gap by examining the specific types and patterns of limb amputations related to diabetic foot conditions in the Qassim Region.

This study found that 58.1% of the patients were older than 60 years old. In contrast, investigations conducted in Nigeria and India found that patients were younger [16, 17]. This issue may be related to the notable advancements in primary healthcare facilities and health services that have been spread out over Saudi Arabia in the past ten years.

A ten-year national executive strategy to control diabetes (2010-2020) and prevent the condition in the Saudi population was approved by the Ministry of Health (MOH). The foundation of the strategy is the complete involvement of all private facilities and the government in achieving its goals. Additionally, it aims to raise health awareness about diabetes and the variables that increase the risk of injury among members of the Saudi community [18]. Furthermore, the Saudi government has acknowledged the gravity of the diabetes epidemic and has taken a number of steps, such as Vision 2030, which focuses on enhancing public health and lowering the incidence of chronic illnesses like diabetes as part of the Kingdom's transformative plan. Moreover, Saudi Arabia had a national diabetes center devoted to diabetes prevention, teaching, and research [19].

The study revealed a high prevalence of minor amputations (77.6%) among patients with diabetic foot ulcers in the Qassim region. This finding aligns with results from other studies, such as Gong et al. in China, which reported a76.4% prevalence and Lo et al. in Singapore, which found 53% prevalence among similar patient populations [20,21]. These results highlight that minor amputations are a common intervention for diabetic

patients globally, underscoring the importance of early detection, preventive management, and comprehensive care in reducing the risk of amputation.

The great toe, or first ray, was the most commonly reported minor amputation (31.5%) among patients, consistent with findings from a Saudi study by Tashkandi et al., which identified toe amputation as the most frequent type among diabetic patients admitted to three major hospitals in Jeddah, Saudi Arabia [18]. Furthermore, below-the-knee amputation (58 cases, 79.5%) was the most commonly reported major amputation among diabetic patients in our study. This aligns with the findings of Wang et al., who observed that lower-extremity and transtibial amputations were the most common major amputations performed on diabetic foot ulcer (DFU) patients in Jeddah, Saudi Arabia, thereby highlighting the common patterns of both minor and major amputations among DFU patients [23].

The current study identified infection (128: 53.1%) and critical ischemia (73: 30.3%) as the most common causes of amputation among diabetic foot ulcer (DFU) patients. These findings are consistent with a Saudi study by Almohammadi et al., which re-ported infection as the leading cause of amputation, and with Musa et al., who identified ischemic ulcers as a significant contributing factor [24,25] Together, these studies highlight the major contributors to amputation and the clinical progression among DFU patient.

The study reported a significantly higher prevalence of both types of amputation among patients with chronic diseases, particularly those with cardiovascular disease (CVD) and diabetic nephropathy. This increased risk may be attributed to factors such as impaired immune function, vascular insufficiency, and delayed treatment, all of which contribute to poor wound healing in these groups. These findings underscore the importance of early intervention, including timely detection and management of high-risk patients, to improve outcomes in individuals with diabetic foot ulcers (DFUs).

The primary limitation of this study is its retrospective, single-center design, which may introduce selection bias, as records are often chosen based on relevance and data availability. Additionally, since data on amputation patterns among diabetic foot ulcer (DFU) patients were extracted from medical records, potential inaccuracies, incomplete documentation, and variability in clinical practices may have affected data quality. Furthermore, the study was conducted at a single facility, Sheikh Fahad Alawidah Diabetic Foot Center in Buraidah, Qassim region, Saudi Arabia, which limits the generalizability of the findings to other settings or populations. As a specialized referral center, the facility is more likely to receive patients with advanced or complicated DFU cases, which may overrepresent severe disease and higher amputation rates compared to the general diabetic population in the region. Therefore, the findings may not fully reflect the overall trend of DFU-related amputations in the broader Qassim region. Another limitation was lack of follow-up and outcome data.

Conclusion.

This retrospective analysis of 241 diabetic foot patients in the Qassim region reveals a predominant pattern of minor amputations (77.6%), with infection serving as the primary driver (53.1%) followed by critical ischemia (30.3%). The demographic profile shows an aging population with established type 2 diabetes, where below-knee amputations constitute the majority (79.5%) of major procedures, while toe amputations dominate minor interventions. Notably, patients with cardiovascular comorbidities and diabetic nephropathy demonstrated significantly higher rates of major amputations, and those requiring ICU admission showed elevated inflammatory markers and renal dysfunction, indicating more severe systemic involvement.

The findings underscore the critical need for a multifaceted prevention strategy targeting infection control and vascular assessment in diabetic foot care within the Qassim healthcare system. Early identification of high-risk patients—particularly those with cardiovascular disease, nephropathy, and recurrent admissions—combined with aggressive infection management protocols, may substantially reduce the progression from minor to major amputations. These regional patterns provide essential baseline data for developing targeted interventions and resource allocation strategies to address the growing burden of diabetic foot complications in Saudi Arabia's healthcare infra-structure.

Declarations.

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Informed Consent Statement: Patient consent was waived because the study is a retrospective study and used only de-identified, publicly available aggregate data with no possibility of individual identification.

Data Availability Statement: Dataset available on request from the authors. The raw data sup-porting the conclusions of this article will be made available by the authors on request.

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