Alqalam Journal of Medical and Applied Sciences. 2025;8(3):1765-1770
https://doi.org/10.54361/ajmas.258371

Original article

Prevalence, Risk Factors, and Psychological Impact of Amputations and Charcot Foot in Diabetic Patients: A Libyan Cross-Sectional Study

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Abstract
Diabetic foot complications impose a severe burden in resource-limited settings, yet comprehensive data from Libya remains scarce. This study assessed the prevalence of lower extremity amputations (LEA) and Charcot neuroarthropathy (CN), their risk factors, and psychological impact among diabetic patients in Tripoli, Libya. A cross-sectional study was conducted across five major healthcare facilities (October 2024–April 2025). A convenience sample of 149 adults with diabetes completed a structured 26-item questionnaire capturing demographics, clinical profiles, foot care practices, comorbidities, and psychosocial effects. Data were analyzed using descriptive statistics, Chi-square tests using SPSS version 26. The prevalence of LEA was 52% (n=78), with significant male predominance (55% vs. 45%, $p<0.05$). CN was identified in 19% (n=28). Hypertension (41%) was the leading comorbidity and significantly associated with amputation ($p<0.05$). Foot ulcers/infections were the primary amputation etiology (44%, $p<0.001$), predominantly requiring transmetatarsal procedures (37%). Key modifiable risk factors included inadequate foot hygiene (irregular inter-toe drying: $x^2=38.645$, $p<0.001$), non-therapeutic footwear ($x^2=65.801$, $p<0.001$), prolonged standing (49%, $p<0.05$), and smoking ($x^2=21.955$, $p<0.001$). Amputation caused severe psychosocial disruption: 64% reported impaired social life and 68% professional limitations ($p<0.001$). LEA and CN represent critical public health challenges in Libya, driven by modifiable behaviors and occupational exposures. The profound psychosocial burden underscores the urgent need for culturally adapted foot protection programs integrating education, therapeutic footwear, occupational adjustments, and psychological support.
Keywords: Lower Extremity Amputation, Charcot Neuroarthropathy, Diabetic Foot Disease, Psychosocial Impact, Libya

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia, posing a significant and growing global health burden [1]. Its long-term microvascular and macrovascular complications profoundly impair quality of life and drive increased morbidity and mortality [2]. Among these complications, diabetic foot disease (DFD) encompassing ulcers, infections, Charcot neuroarthropathy (CN), and lower extremity amputations (LEA) represents one of the most severe, debilitating, and economically costly sequelae [3,4]. Peripheral neuropathy, peripheral arterial disease (PAD), and impaired immunity synergistically elevate the risk of foot ulcers, with lifetime incidence estimates ranging from 15% to 34% globally [5,6]. Critically, diabetic foot ulcers (DFUs) precede approximately 85% of non-traumatic LEAs [7].
Risk is modulated by diabetes type and duration, glycemic control, and modifiable factors like smoking, which accelerates atherosclerosis and impairs microcirculation. This critically delays wound healing and increases amputation risk [8–10]. Charcot foot, a destructive neuroarthropathy characterized by inflammation, joint dislocation, and deformity, further complicates DFD management. Often misdiagnosed in its early inflammatory phase (presenting as warmth, redness, and swelling), delayed recognition leads to profound deformities, ulceration, and heightened amputation risk [11–13]. Comorbidities such as hypertension, dyslipidemia, and cardiovascular disease exacerbate risks by impairing perfusion and tissue oxygenation [14,15].
Beyond the physical toll, DFD complications inflict severe psychological distress. Foot ulcers, deformities, and particularly amputations are strongly associated with heightened depression, anxiety, social isolation, body image disturbance, and even suicidal ideation, underscoring the need for integrated mental health support [16–18]. While preventive strategies (e.g., foot self-care, appropriate footwear, early intervention) are established [19], the burden of severe outcomes like LEA and CN varies significantly by region and healthcare context.
Despite the recognized global burden, comprehensive epidemiological data on the prevalence of LEA and CN, their associated risk factors (including comorbidities and foot care practices), and their psychological impact among diabetic patients in Libya, particularly in Tripoli remain markedly scarce [20]. Addressing this critical knowledge gap is essential for targeted prevention and resource allocation strategies. Therefore, this cross-sectional study aims to determine the prevalence of lower extremity amputations and Charcot foot among diabetic patients in Tripoli, Libya; evaluate associations between comorbidities, foot care practices, and complication risk; and assess the psychological effects of foot amputations in this population.

Received: *05-06-2025* - ***Accepted***: *11-08-2025* - ***Published***: *20-08-2025*

Methods

A retrospective descriptive cross-sectional study was conducted at five major healthcare facilities in Tripoli, Libya (Tripoli University Hospital, Abu Salim Accident Hospital, Tripoli Central Hospital, Diabetes and Endocrinology Hospital, and Al Akhdar Hospital) between October 2024 and April 2025. A convenience sample of 149 adult diabetic patients (≥18 years) was recruited. Inclusion criteria required a confirmed diagnosis of Type 1 or Type 2 diabetes, regular attendance at participating centers, and the capacity to provide informed consent. Patients with non-diabetic foot pathologies, cognitive impairment, or refusal to participate were excluded.

Data collection employed a structured, self-administered 26-item questionnaire. The instrument captured seven domains: (1) Demographic characteristics (gender, age, education, occupation); (2) Clinical profile (diabetes type, duration, medication adherence, Charcot foot diagnosis, amputation history including reason and level); (3) Foot care practices (washing/examination frequency, inter-toe drying, moisturizer use, barefoot walking, footwear type); (4) Medical follow-up (healthcare-seeking for foot ulcers); (5) Lifestyle factors (smoking status/pack-years); (6) Comorbidities (hypertension, cardiovascular disease, chronic kidney disease); and (7) Psychosocial impact (professional limitations, emotional distress, social withdrawal, body image concerns using Likert scales). Charcot foot diagnoses were verified through medical records, where available.

Trained research assistants administered Arabic-language questionnaires during clinic visits after obtaining written informed consent. Participants required 15-20 minutes for completion, with clarifications provided as needed. Data underwent double-entry verification in Microsoft Excel 2010, followed by consistency checks and resolution of missing responses through participant re-contact.

Statistical analysis utilized IBM SPSS v26 and Excel. Descriptive statistics (frequencies, percentages, means ± SD) characterized the sample. Prevalence estimates for amputations and Charcot foot were calculated with 95% confidence intervals. Associations between risk factors (comorbidities, foot care practices) and outcomes were examined using Chi-square, with significance set at $p < 0.05$.

Results

Participant Demographics and Complication Prevalence

The study included 149 diabetic patients, predominantly male (59%, n=88) with a female minority (41%, n=61). Lower extremity amputation prevalence reached 52% (n=78), showing significant gender disparity with higher rates among males (55% vs. 45%; p<0.05). Charcot neuroarthropathy was identified in 19% (n=28) of participants, though no statistical association with amputation was observed (p>0.05) as shown in (Figure 1).

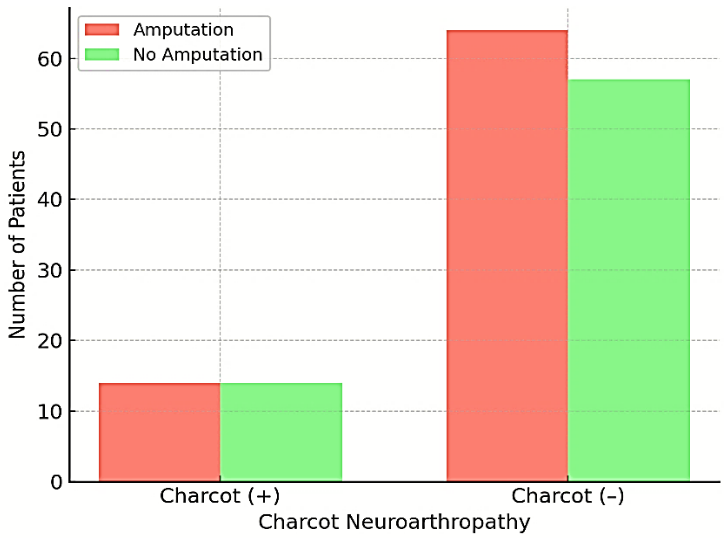

Figure 2: Charcot Neuroarthropathy and Amputation

Comorbidity Profile and Associations

Hypertension emerged as the most prevalent comorbidity (41%, n=58), followed by heart disease (27%, n=37), hyperlipidemia (21%, n=31), and thyroid disease (11%, n=17) as shown in (Figure 2). Hypertension demonstrated a significant association with amputation (p<0.05), while other comorbidities showed no statistical relationship (p>0.05).

Received*: 05-06-2025 -* ***Accepted****: 11-08-2025 -* ***Published****: 20-08-2025*

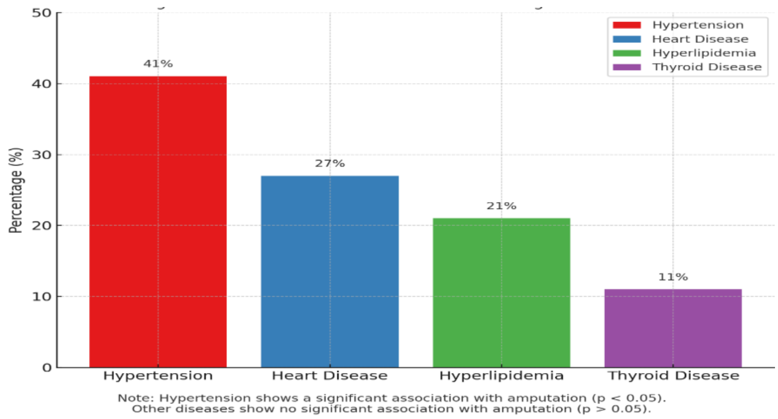

Figure 2: Prevalence of Chronic Diseases Among Diabetic Patients and Their Association with Amputation.

Amputation Characteristics and Etiology

Foot ulcers/infections constituted the primary amputation cause (44%, n=34, p<0.001), followed by fungal infections (40%, n=31), traumatic wounds (10%, n=8), and bone fractures (6%, n=5) as listed in (Figure 3). Amputation levels included transmetatarsal (37%, n=29), toe(s) (33%, n=26), foot (19%, n=15), and below-knee (10%, n=8) procedures as demonstrated in (Figure 4).

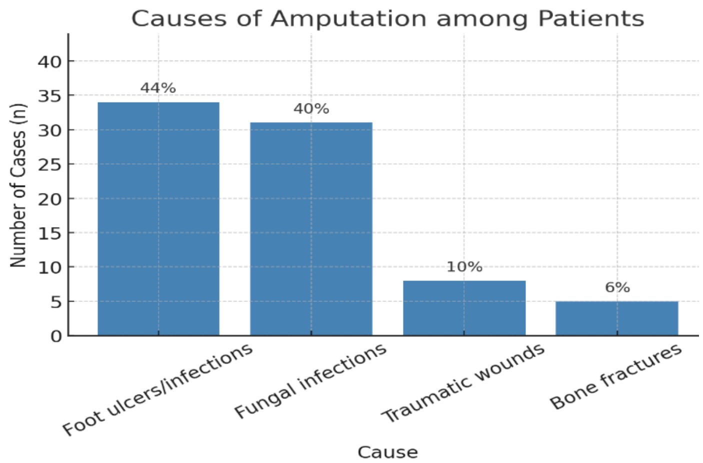

Figure 3. Causes of Amputation among Patients.

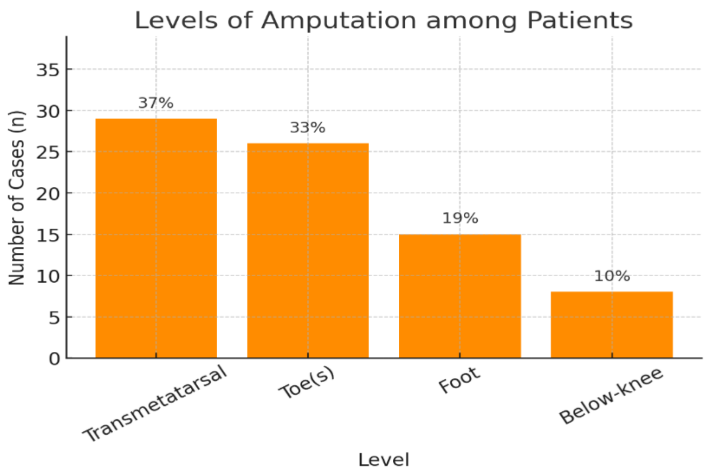

Figure 4. Levels of Amputation among Patients.

Risk Factor Analysis

Significant predictors of amputation included occupational factors (prolonged standing/walking: 49%, n=73, p<0.05), inadequate foot care practices (irregular drying: x^2=38.645, p<0.001; barefoot walking: x^2=13.604, p=0.003; non-therapeutic footwear: x^2=65.801, p<0.001), smoking (x^2=21.955, p<0.001), and type 2 diabetes

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https://doi.org/10.54361/ajmas.258371

(x^2=95.011, p<0.001) as listed in (Table 1). Non-significant factors included moisturizer use (x^2=1.528, p>0.05), medication adherence (x^2=2.638, p>0.05), and Charcot foot diagnosis.

Table 1. Amputation and its association with risk factors.

Question	Answer	N. of Cases	Percentage (%)	Pearson Chi-Square	P-value
Drying feet after washing them	Yes / No / Sometimes	30 / 64 / 55	20.13% / 42.95% / 36.91%	38.645 a	**P < 0.001***
Use moisturizing cream for feet	Yes / No / Sometimes	36 / 68 / 45	24.16% / 45.36% / 30.20%	1.528 a	P > 0.05
Walk barefoot?	Yes / No / Sometimes	58 / 53 / 38	38.92% / 35.57% / 25.50%	13.604 a	P < 0.003*
Choose comfortable shoes	Yes / No / Sometimes	57 / 51 / 41	38.25% / 34.22% / 27.51%	65.801 a	P < 0.001*
Smoking	Yes / No	60 / 89	40.27% / 59.73%	21.955 a	P < 0.001*
Take diabetes medication regularly	Yes / No	97 / 52	65.10% / 34.90%	2.638 a	P > 0.05
Type of diabetes	Type 1 / Type 2	26 / 123	17.45% / 82.55%	95.011 a	P < 0.001*

Duration-Outcome Relationship

Amputation likelihood significantly increased with diabetes duration (p<0.001), with the highest prevalence among those with 12-17 years' duration (50%, n=74), followed by >17 years (21%, n=31), 6-11 years (18%, n=27), and ≤5 years (11%, n=17).

Psychosocial Impact

Amputation profoundly affected psychosocial well-being, with significant disruption to social life (64%, n=50; x^2=20.045, p<0.001) and professional life (68%, n=53; x^2=22.886, p<0.001). Elevated levels of depression, anxiety, and body image disturbance were consistently reported (p<0.001 for all psychological metrics) as shown in (Table 2).

Table 2: Psychological effect of amputation.

The question	The answer	N. Of cases	Percentage%	Pearson Chi-Square P-value
Effect of amputation on social life	Yes / No	50 /28	64.10% / 35.897%	20.045 ^{a} P<0.001
Effect of amputation on professional life	Yes / No	53 / 25	67.95% / 32.05%	22.886 ^{a} P<0.001

Discussion

This study reveals a substantial burden of lower extremity complications among diabetic patients in Tripoli, Libya. The high prevalence of lower extremity amputation (52%) demonstrates a critical public health concern, exceeding rates reported in regional studies such as Sudan (38%) and Benghazi, Libya (44%) [21,22]. A significant gender disparity was observed, with males experiencing higher amputation rates (55% vs 45%; p<0.05), aligning with demographic patterns in Saudi Arabia where males constituted 56% of diabetic cases [23]. Charcot neuroarthropathy was identified in 19% of participants, a finding consistent with Tunisian data (13%) [24], though no statistical association with amputation was established (p>0.05). Hypertension emerged as the predominant comorbidity (41%), corroborating global patterns [25]. Crucially, hypertension demonstrated a significant association with amputation risk (p<0.05), highlighting its role in

Received*: 05-06-2025 -* ***Accepted****: 11-08-2025 -* ***Published****: 20-08-2025*

adverse diabetic outcomes [26]. Foot ulcers/infections constituted the primary amputation etiology (44%, $p<0.001$), mirroring findings from Iraq, where infections accounted for 49% of amputations [27]. Transmetatarsal amputations represented the most frequent procedure (37%), consistent with level distributions observed in Morocco (52%) [28].
Several modifiable risk factors demonstrated significant associations with amputation. Occupational exposure involving prolonged standing/walking (49%, $p<0.05$), inadequate foot care practices (irregular inter-toe drying: $x^2=38.645$, $p<0.001$; barefoot walking: $x^2=13.604$, $p=0.003$), and non-therapeutic footwear ($x^2=65.801$, $p<0.001$) were strongly predictive [29]. Smoking ($x^2=21.955$, $p<0.001$) and Type 2 diabetes diagnosis ($x^2=95.011$, $p<0.001$) further amplified risk, aligning with Sudanese research on behavioral contributors [30]. Conversely, foot moisturizing, medication adherence, and Charcot foot diagnosis showed no significant association ($p>0.05$), contrasting with Indian studies emphasizing their protective roles [31].
Diabetes duration exhibited a dose-response relationship with amputation likelihood ($p<0.001$), peaking at 50% among those with 12-17 years' duration. This finding supports Egyptian research documenting escalated complication risks beyond 10 years' disease duration [32]. Psychosocial impacts were profound, with significant disruptions to social life (64%) and professional life (68%) ($p<0.001$ for both), corroborating Saudi and Nigerian studies on post-amputation socioeconomic consequences [33,34]. Elevated depression, anxiety, and body image disturbances further underscored the multidimensional disability associated with this complication [35].
These findings collectively emphasize the urgent need for structured foot protection programs targeting modifiable behaviors (footwear, hygiene, smoking cessation) and occupational adaptations in Libya's diabetic population, particularly for males with extended disease duration and comorbid hypertension [36].

Conclusion
This study highlights a substantial burden of diabetic foot complications among patients in Tripoli, Libya, with amputations and Charcot neuroarthropathy representing significant clinical challenges. Modifiable behavioral factors, particularly suboptimal foot hygiene practices, inadequate footwear, occupational exposures, and smoking, emerged as critical preventable drivers of adverse outcomes. A notable gender disparity underscores heightened vulnerability among male patients. These complications inflicted profound psychosocial consequences, disrupting social integration and professional engagement while exacerbating psychological distress. Urgent implementation of culturally adapted foot protection programs is warranted, emphasizing structured education, therapeutic footwear provision, occupational modifications, and integrated mental health support. Prioritizing these interventions will address preventable disability and alleviate the multidimensional impact of diabetic foot disease in this resource-limited setting.

Acknowledgments
The authors extend their sincere gratitude to the administration and staff of the participating healthcare facilities in Tripoli (Tripoli University Hospital, Abu Salim Accident Hospital, Tripoli Central Hospital, Diabetes and Endocrinology Hospital, and Al Akhdar Hospital) for facilitating data collection.

Conflicts of Interest
The authors declare no conflicts of interest.

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Received: 05-06-2025 - **Accepted**: 11-08-2025 - **Published**: 20-08-2025

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***Received**: 05-06-2025 - **Accepted**: 11-08-2025 - **Published**: 20-08-2025*