

Original Article

Unmet Needs in Diabetic Distal Symmetric Polyneuropathy: A Cross-sectional Analysis from a Tertiary Care Diabetes Centre in Sri Lanka

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Abstract

Background:

Distal symmetric polyneuropathy (DSPN) is the commonest type of neuropathy among people living with diabetes. We aimed to describe the clinical manifestations, foot complications, quality of life and self-care practices among adults with diabetic DSPN.

Methods:

We conducted a cross-sectional study in the Diabetes Clinic of National Hospital Colombo, Sri Lanka in 2022. Adults with diabetes and symptoms and/or signs of DSPN were recruited by consecutive sampling at Annual Diabetes End-organ Screening. Demographic and clinical data were collected via patient interviews and review of medical records. Quality of life (QoL) was determined using the SF-36 questionnaire.

Results:

Among 201 patients with diabetic DSPN (mean age 61 years [SD 10], men 39%, median duration of diabetes 15 years [IQR 8-25], loss of protective sensation in 99%), 65% had one or more DSPN-related foot complications (deformity 12%, pre-ulcer 59%, past or present ulcer 13%, lower limb amputation 5%). Peripheral arterial disease ($B=1.88$, $SE=0.67$, $p=0.005$) and body mass index ($B=0.1$, $SE=0.05$, $p=0.027$) were independent predictors DSPN-related foot complications. 129 (64%) reported burning pain in feet. Among them, only 27% received pharmacological treatment and amongst those treated, only 24% achieved symptom relief. QoL scores were lowest in physical function (45 [IQR 30-80]) and bodily pain (63 [IQR 45-78]) domains and scores were lower among those with burning pain, compared to those without. Self-care practices were suboptimal (daily foot inspection 78%, footwear both indoors and outdoors 36%, use of diabetic footwear 7%).

Conclusion:

Among Sri Lankan adults living with diabetes and DSPN, 65% had one or more foot complications while 64% had burning pain in feet, which was not treated or inadequately treated in the majority. DSPN was associated with reduced QoL score. Foot-related self-care practices remain suboptimal even amongst those with DSPN and foot complications.

Keywords: Diabetic foot syndrome, foot care, diabetes complications, diabetes self-management, patient education

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Introduction

Prevalence of diabetes in Sri Lanka has risen exponentially in the recent past. In 2006, approximately one in five adults in Sri Lanka had either diabetes or pre-diabetes, and one-third of those with diabetes were undiagnosed [1]. More recently, the Colombo Urban Study demonstrated that the prevalence of diabetes and prediabetes has risen to 57.9% in the urban population [2]. Diabetic peripheral neuropathy (DPN) is a common complication among Sri Lankan adults with diabetes [3,4] and contributes to considerable morbidity. Early identification through screening is crucial, given that

50% of cases are asymptomatic. Diabetic neuropathies are classified into three categories: diffuse neuropathy (the typical form), mononeuropathy, and radiculopathy or polyradiculopathy (atypical forms). Distal symmetric polyneuropathy (DSPN) stands out as the most common type, with mixed small and large fibre neuropathy being the most prevalent subtype. DSPN, a component of diffuse neuropathy, accounts for about 75% of diabetic neuropathy cases [5], with a lifetime risk of 50% [6]. DSPN is implicated in Charcot's arthropathy, foot ulceration [7,8] and increased risk of falls in the elderly.

Diabetic foot and its associated complications are the leading cause of non-traumatic foot amputations. Foot

ulcers precede foot amputations in 84% of diabetic patients^[7]. The lifetime risk of diabetic foot ulcerations can be as high as 34%, with foot amputation rates secondary to diabetic foot ulcers reaching 20%^[9]. Patients with diabetic foot ulcers or Charcot's neuropathic arthropathy have a reduced life expectancy compared to the general population. Following transtibial amputations, contralateral foot problems develop in 34% of patients, with 10% requiring amputation of the other foot as well^[10]. Furthermore, diabetic foot complications have a significant impact on quality of life of patients living with diabetes. Managing diabetic foot-related complications entails prolonged hospital stays and places a significant burden on healthcare systems.

Diabetic neuropathy presents a complex clinical scenario in the Sri Lankan context, where factors such as limited access to specialized care, disparities in healthcare infrastructure, and socio-economic constraints converge to impede optimal management outcomes. While efforts have been made to enhance diabetes care in Sri Lanka, data on complications of DSPN among people living with diabetes, their quality of life and treatment outcomes are scarce.

We aimed to describe the clinical characteristics of adults with diabetic distal symmetric polyneuropathy, prevalence of its foot-related complications, their quality of life and diabetes foot self-care practices

Methods

A cross-sectional study was conducted in the Diabetes Clinic of National Hospital Colombo, Sri Lanka over 4 months in Year 2022. Patients with diabetes (irrespective of type) attending annual diabetes screening programme and having symptoms of distal symmetric polyneuropathy (such as pain, dysesthesia) and/ or abnormal 4-point 10g monofilament test (impaired sensation at one or more sites) or impaired vibration sensation (vibration perception threshold less than 25 mV determined using biothesiometer) detected by a medical professional were invited to participate and recruited by consecutive sampling. Patients who did not have clinical features suggestive of diabetic polyneuropathy, and patients with gestational diabetes were excluded from the study. A trained member of the research team reviewed medical records and interviewed the patient to record demographic and clinical data. Self-administered SF-36 questionnaire was used to assess the health-related quality of life. Written informed consent was obtained from all participants. This study was approved by Ethics Review Committee of National Hospital of Sri Lanka.

Foot ulcers were classified according to IWGDF criteria^[11]. Foot deformity, pre-ulcer lesion, past or present diabetic foot ulcer or lower limb amputation related to diabetic foot complication were considered as diabetic DSPN related foot complications. To detect a 15% prevalence of diabetic foot ulcer syndrome^[12] with 5% precision at 95% confidence level, required sample size was estimated to be 196^[13].

Data were analysed though SPSS (IBM version 18) software. Continuous variables were tested for normality using Shapiro Wilk test and visual inspection of distribution graphs. Normally distributed continuous variables between groups were compared using independent sample t-test. Variables that were not normally distributed were compared using Mann-Whitney U test. Categorical variables were compared using Chi square test. We conducted a

multivariable logistic regression to determine predictors of diabetic DSPN-related foot complications. P value less than 0.05 was considered significant.

Results

Characteristics of the study population

We recruited 201 patients who met the eligibility criteria. Their clinical and demographic characteristics are summarized in table 1.

Clinical manifestations and complications of diabetic DSPN

Out of the study population, 12% were identified as having foot deformities (table 2). Hammer toe was the most prevalent, observed in 20 individuals (10%), followed by bunion affecting 4 individuals (2%). Pre-ulcer lesions were present in 59% of the patients. The most common was toe web infection, affecting 101 patients (50%), while cellulitis was observed in 2 patients (1%). Among the patients, active ulcers were detected in 9 individuals (5%). Among these, 7 patients (4%) had grade 1 ulcers, 1 patient (1%) had a grade 2 ulcer, and another patient (1%) had a grade 3 ulcer. Additionally, 15 patients (8%) had healed ulcers. Nine patients (5%) have had lower limb amputations. Among them, 6 patients had toe amputations and one each had forefoot, below-knee and above knee amputation. Only 35% had no pre-ulcer lesions or ulcers (active or healed) or amputations in both feet.

Table 2: Clinical manifestations and complications of diabetic distal symmetric polyneuropathy

Manifestation	Number (%)
Numbness of feet	168 (84)
Numbness of hands	77 (38)
Hyperesthesia of feet	65 (32)
Hyperesthesia of hands	6 (3)
Burning or aching pain of feet	129 (64)
Burning or aching pain of hands	24 (12)
Weakness of feet	4 (2)
Weakness of hands	0
Loss of protective sensation in feet	199 (99)
Loss of proprioception	15 (8)
Loss of vibration sensation	178 (89)
Loss of touch sensation (10g monofilament < 4/4)	133/181 (76)
Dry skin	197 (98)
Deformities	24 (12)
Hammer toes	20 (10)
Overlapping toes	2 (1)
Bunion	4 (2)
Arch deformity	0
Charcot	1 (1)
Pre-ulcer lesions	118 (59)
Callosities	28 (14)
Cones	0
In-grown toenail	3 (2)
Toe web infection	101 (50)
Cellulitis	2 (1)
Tissue loss	
Active ulcer	9 (5)
Past healed ulcer	15 (8)
No ulcer	177 (88)
Amputation	9 (5)

Diabetic foot related self-care practices

Table 3 summarises the diabetic foot related self-care practices in patients with diabetic neuropathy. Ten percent of patients reported to have never self-inspected their feet, 38% never applied moisturizer, over 90% used regular slippers, and two in three wore footwear only when outdoors.

Table 1: Demographic and clinical characteristics of study participants

Characteristic	People with foot complications	People without foot complications	P value	Total population
Number (%)	130 (65)	71 (35)	-	188 (100)
Age in years, mean (SD)	61 (10)	60 (10)	0.519	61 (10)
Men, number (%)	49 (38)	29 (37)	0.762	78 (39)
Level of education, number (%)			0.660	
No formal education	1 (1)	1 (1)		2 (1.0)
Primary	50 (39)	27 (38)		77 (38)
Up to Ordinary level	49 (38)	21 (30)		70 (35)
Up to advanced level	26 (20)	18 (25)		44 (22)
Tertiary	4 (3)	4 (6)		8 (4)
Smoking status, number (%)			0.208	
Never smoked	114 (88)	64 (90)		178 (89)
Smoked in the past	8 (6)	6 (9)		14 (7)
Currently smoking	8 (6)	1 (1)		9 (5)
Alcohol consumption, number (%)			0.334	
Never used	106 (82)	52 (73)		158 (79)
Past user	11 (9)	7 (10)		18 (9)
Current user	13 (10)	12 (17)		25 (12)
Duration of diabetes in years, median (IQR)	15 (9-20)	12 (6-16)	0.015	15 (8-25)
Body mass index in kgm ⁻² , median (IQR)	25.6 (23.4-29.2)	24.9 (21.9-28.2)	0.068	25.3 (23.0-28.9)
HbA1c in percentage points, mean (SD)	8.9 (2.0)	9.4 (2.2)	0.103	9.3 (2.2)
eGFR in mL/min/1.73 m ² , median (IQR)	68 (48-91)	77 (52-95)	0.402	70 (49 – 92)
Diabetic retinopathy status, number (%)	60 (46)	22 (31)	0.051	82 (41)
Non-proliferative diabetic retinopathy	56 (43)	20 (29)	0.048	76 (38)
Proliferative diabetic retinopathy	3 (2)	1 (1)	1.000	4 (2)
Maculopathy	16 (12)	6 (9)	0.485	22 (11)
Diabetes medication use, number (%)				
Metformin	130 (100)	71 (100)	-	201 (100)
Sulfonylureas	62 (48)	41 (58)	0.187	103 (51)
Di-peptidyl peptidase-4 inhibitors	69 (53)	33 (47)	0.380	102 (51)
Pioglitazone	1 (1)	1 (1)	1.000	2 (1)
Sodium glucose co-transporter 2 inhibitors	3 (2)	3 (4)	0.668	6 (3)
Insulin	78 (68)	25 (35)	0.001	103 (51)
Metabolic co-morbidities				
MASLD / cirrhosis	2 (2)	4 (6)	0.357	6 (3)
Hypertension	57 (44)	30 (42)	0.395	87 (43)
Coronary artery disease	15 (12)	13 (18)	0.205	28 (14)
Stroke / transient ischaemic attack	2 (2)	1 (1)	0.999	3 (2)
Peripheral arterial disease	5 (4)	9 (13)	0.038	14 (7)

Percentages presented are column-wise. Comparison of continuous variables were with independent sample t-test for parametric variables and Mann-Whitney U test for non-parametric variables and comparison of categorical variables were with Chi square test.
 ** Only age and HbA1c were normally distributed.

Table 3: Diabetic foot-related self-care practices among people with diabetic distal symmetrical polyneuropathy

Foot care practice / question	People with foot complications	People without foot complications	Total sample
How often do you inspect your feet?			
Daily	101 (78)	55 (78)	156 (78)
4-6 times a week	8 (6)	2 (3)	10 (5)
2-3 times a week	4 (3)	2 (3)	6 (3)
Once a week	3 (2)	5 (7)	8 (4)
Once a month	1 (1)	0	1 (1)
Never	12 (9)	7 (10)	19 (10)
How often do you wash and clean your feet?			
Daily	122 (95)	67 (94)	189 (94)
4-6 times a week	5 (4)	1 (1)	6 (3)
2-3 times a week	1 (1)	1 (1)	2 (1)
Once a week	1 (1)	2 (3)	3 (2)
Once a month	0	0	0
Never	0	0	0
How often do you apply a moisturizer on your feet?			
Daily	65 (50)	29 (41)	94 (47)
4-6 times a week	7 (5)	4 (6)	11 (6)
2-3 times a week	7 (5)	5 (7)	12 (6)
Once a week	4 (3)	2 (3)	6 (3)
Never	46 (36)	31 (44)	77 (38)
Are the nails trimmed?			
Yes	108 (84)	62 (88)	170 (85)
What type of footwear do you use?			
Slippers	117 (91)	68 (96)	185 (92)
Regular shoes	0	2 (3)	2 (1)
Diabetic footwear	12 (9)	1 (1)	13 (7)
Orthotics	0	0	0
When do you wear footwear?			
Outdoors only	83 (64)	54 (76)	137 (68)
Both indoors and outdoors	46 (36)	17 (24)	63 (31)

Data presented are number (percentage)

Table 4: Quality of life scores among participants with and without complications of diabetic distal symmetric polyneuropathy [caveat-pain is not counted as a complication in this analysis]

QoL domain	Total population	People with foot complications	People without complications	P value	People with burning pain	People without burning pain	P value
Physical function	45 (30-80)	45 (30-75)	55 (35-88)	0.115	40 (30-75)	65 (40-85)	0.040
Bodily pain	63 (45-78)	55 (45-78)	68 (45-78)	0.566	58 (45-78)	68 (45-78)	0.589
Vitality	80 (54-90)	80 (55-90)	80 (50-95)	0.490	75 (50-85)	80 (65-100)	0.009
Role-emotional	100 (100-100)	100 (100-100)	100 (100-100)	0.940	100 (100-100)	100 (100-100)	0.961
Role-physical	100 (0 – 100)	100 (0-100)	100 (25-100)	0.780	100 (0-100)	100 (100-100)	0.446
General health	85 (39-85)	85 (65-85)	75 (28-85)	0.055	85 (25-85)	85 (70-85)	0.085
Social function	75 (50-88)	75 (50-88)	75 (56-88)	0.351	75 (50-88)	75 (63-88)	0.258
Mental health	80 (56-89)	80 (56-86)	80 (58-92)	0.263	76 (52-84)	84 (68-100)	0.001

Data presented are median and IQR. Comparisons were made with Mann-Whitney U test

Quality of life

Quality of life scores assessed through SF-36 questionnaire are summarized in Table 4. Physical function and bodily pain were the most affected domains. No significant difference was found in the QoL domains between patients with and without foot complications. However, people with burning pain in feet and/or hands had lower scores in the domains on physical function, vitality and mental health, compared to those without burning pain.

Discussion

Our findings on the high prevalence of sensory symptoms and numbness are consistent with existing literature [14,15]. The low treatment rates and poor symptom improvement in our cohort align with previous reports of inadequate neuropathic pain management [16]. This could be attributed to patients not complaining on their neuropathic symptoms unless there is significant effect to their daily functioning. Additionally, the poor adherence to foot care practices and limited use of diabetic footwear mirror trends observed in similar studies from South Asia, where foot care adherence rates are also low [17,18]. Limited use of footwear can be related to the common practice of walking barefoot in these countries. Education sessions should be able to understand the cultural influence and educate patients without disrespecting patient's beliefs. Significant number of patients complained of upper limb symptoms in our cohort, where 38% had numbness and 12% complaining of pain. Upper limb symptoms, typically associated with advanced distal neuropathy or mononeuropathies. In a study conducted by Kender et al [19] demonstrated substantial prevalence of upper limb neuropathy in T2DM affecting 30.5% in their study population. This highlights the importance of routine screening of the upper limb for neuropathic involvement even though the usual focus would be lower limbs in most of the instances.

These findings underscore the urgent need for improved management and education strategies in diabetic neuropathy. Clinically, there should be a stronger emphasis on comprehensive sensory assessments, including upper limbs, during routine screenings. Despite being a tertiary care centre there is significant gap in patients' adherence to foot protective measures therefore, there is a critical need to enhance access to and education about diabetic footwear and proper foot care practices. Research should focus on identifying barriers to effective pain management and exploring more effective treatment protocols. Furthermore, public health initiatives must address the significant gaps in patient education to prevent foot complications and improve quality of life.

The strengths of our study include a comprehensive assessment of sensory symptoms and foot complications in a population with diabetic neuropathy, insights into the inadequacies of current treatment approaches and self-care practices and highlighting the often-overlooked issue of upper limb involvement in diabetic neuropathy. However, the study also has limitations: it was conducted in a tertiary care centre, potentially limiting the generalizability to the broader population of adults living with diabetes in Sri Lanka; selection bias due to the referral nature of the hospital likely skewed the sample towards more severe cases; the cross-sectional design preventing assessment of temporal progression of neuropathy and its predictors; reliance on routine investigation data and therefore limited exploration of other potential causes of peripheral neuropathy like B12 deficiency or hypothyroidism; and unavailability of standardized and validated questionnaire to quantify neuropathic symptoms like the Neuropathic Pain Questionnaire [20] or Michigan Neuropathic Screening Instrument [21]. Addressing these limitations in future studies could provide a more comprehensive understanding of diabetic neuropathy and enhance the development of targeted interventions.

Conclusion

Among adults with diabetic DSPN, two thirds have one or more foot-related complications including deformities in 12%, pre-ulcer lesions in 59% (including toe web infections in 50%), past or present foot ulcers in 13% and lower limb amputations in 5%. Burning pain affects two of three patients with diabetic DSPN, but only a third of them were on neuropathic analgesics and amongst them, only a quarter achieved symptom relief, exposing a significant unmet need in the care of patients with diabetic DSPN. Upper limb symptoms are common amongst patients with diabetic DSPN and should be evaluated on routine assessments. DSPN is associated with impaired QoL, particularly on physical function and bodily pain domains. Yet, foot self-care practices remain suboptimal, highlighting the need for better patient education and training on self-management and foot care.

Declarations

Conflicts of interest: none

Funding: none

Data availability:

Dataset available with corresponding author and can be provided upon request.

Ethics:

This study was approved by Ethics Review Committee of National Hospital, Colombo, Sri Lanka

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