

Sweat function in the diabetic foot

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ABSTRACT

Background: Autonomic dysfunction, an early manifestation of diabetic neuropathy, presents with altered sweating patterns, leading to dryness and fissuring. We conducted a study to assess the sweat function in the diabetic foot and to determine the interrelation between the duration of diabetes, sensation, fissuring, and sweating. **Methods:** The sweat function was assessed in 30 diabetic patients, 28 of whom had fissuring of the feet, using Ninhydrin impregnated discs. **Results:** There was a significant association between fissuring and sensation, but not between the duration of diabetes and fissuring and between loss of sweating and fissuring. In 18 patients (60%) there was impairment or absence of sweating in the presence of normal sensation. **Conclusion:** Although fissuring increases with long-standing diabetes and sweating is reduced in diabetic patients with fissures on the foot, the correlation between these entities was not statistically significant. Since 60% patients had altered sweating in the presence of normal sensations, the sweat test can be used as an early indicator of diabetic neuropathy.

KEY WORDS: Ninhydrin sweat test, Fissures of the foot, Diabetic autonomic neuropathy

INTRODUCTION

The earliest manifestations of diabetic peripheral polyneuropathies are deficits of the autonomic system which alter sweating patterns.¹ Autonomic involvement increases with the duration and severity of hyperglycemia.¹ Anhidrosis over the feet promotes drying and fissuring.²

This study was conducted to determine the interrelation between the duration of diabetes, sensation, fissuring and sweating.

METHODS

The study included 30 patients, 12 males and 18

females, with type II diabetes mellitus of more than 5 years' duration. Their soles were tested for pain (using a pin) and temperature (with test tubes containing hot and cold water) sensations by the standard method³ and recorded as normal, impaired or absent sensation. Fissuring on the soles was graded as 0 (no fissure), 1 (minimal superficial fissures), 2 (fissuring in between grade 1 and grade 3) or 3 (deep fissures), as reported earlier.⁴

The Ninhydrin sweat test⁵ was performed on the sole (the test site) and the corresponding thigh (the control site). Briefly, filter paper punches soaked in 1% ninhydrin in acetone were transferred with dry forceps to the adhesive side of a scotch tape, which were then stuck to the test and control sites. The patient was asked to

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walk or stand in the sun to induce sweating and readings were taken after 30 minutes. Observations were based on the color change of the filter paper punch:⁵ Grade 0 – no color change, Grade 1 – just perceptible purple-blue color, Grade 2 – color change in between grade 1 and grade 3, and Grade 3 – intense purple-blue color.

RESULTS

The duration of diabetes ranged from 5 to 10 years (mean 7.7 ± 2.8 years). Its relation to fissuring is shown in Table 1.

Sweating was normal in 8 patients (26.66%), impaired in 13 (43.33%) and absent in 9 (30%). The relation between sweating and fissuring is shown in Table 2. Patients with grade 2 fissuring had impaired or absent sweating. The relation between sensations and sweating is shown in Table 3 and that between fissuring and sensations in Table 4. There was no correlation between loss of sweating and fissuring (rank correlation 0.240, $p=0.202$), sweating and sensation (rank

Table 1: Mean (SD) of duration of diabetes with grade of fissuring

Grade of fissuring	No. of patients	Mean (SD) of duration of diabetes (years)
0	2	8.5 (0.70)
1	20	7.6 (3.23)
2	8	7.7 (2.05)
Total	30	7.7 (2.81)

Table 2: Sweat patterns with grade of fissuring

Grade of fissuring	Sweating patterns (%)			
	Normal	Impaired	Lost	Total
0	0	2 (15.4)	0	2 (2.67)
1	8 (100)	6 (46.2)	6 (66.7)	20 (66.7)
2	0	5 (38.5)	3 (33.3)	8 (26.7)
Total	8 (100)	13 (100)	9 (100)	30 (100)

Table 3: Sweat patterns with sensation

Sensation	Sweating patterns			
	Normal (%)	Impaired (%)	Lost (%)	Total (%)
Normal	8 (100)	10 (76.9)	8 (88.9)	26 (86.7)
Impaired	0	2 (15.4)	0	2 (6.7)
Absent	0	1 (7.7)	1 (11.1)	2 (6.7)
Total	8 (100)	13 (100)	9 (100)	30 (100)

Table 4: Grade of fissuring with sensation

Grade of fissuring	Sweating patterns (%)			
	Normal (%)	Impaired (%)	Lost (%)	Total (%)
0	1 (3.9)	0	1 (50)	2 (6.7)
1	19 (73.7)	0	1 (50)	20 (66.7)
2	6 (23.7)	2 (100)	0	8 (26.7)
Total	26 (100)	2 (100)	2 (100)	30 (100)

correlation 0.116, $p=0.536$), and sensation and fissuring (rank correlation 0.033, $p=0.864$).

DISCUSSION

Although it has been reported that fissuring is more common in long-standing diabetics and that diabetic patients with fissures on the feet have reduced sweating, the differences we found in our study were not statistically significant. Diabetes is the most common cause of peripheral neuropathy and autonomic neuropathy manifests earlier than sensory neuropathy. Various tests to detect autonomic dysfunction include nuclear medicine scintigraphy, cystometry for gastrointestinal/genitourinary dysfunction, variations in ECG for cardiovascular dysfunction and sweat test for sudomotor dysfunction.⁶ We found that sweat function was affected even when the sensations were intact. Hence sweat testing can be used as an early indicator of diabetic neuropathy.

REFERENCES

1. O'Brien SP, Schwedler M, Kerstein M. Peripheral neuropathies in diabetes. *Surgl Clin* 1998;78:393-408.
2. Powers AC. Diabetes mellitus. In: Harrison's principles of internal medicine. 15th ed. Philadelphia: McGraw-Hill; 2001. p. 2126-7.
3. Jopling WH, McDougall AC. The disease. In: Handbook of leprosy. New Delhi: CBS Publishers and Distributors; 1996. p. 25.
4. Sivakumar M, Sivapriya N, Anil MC, Thomas VC, Srinivas CR. Prevalence and correlates of fissure foot in a rural area in Tamil Nadu. *Indian J Dermatol Venereol Leprol* 1999;65:26-7.
5. Nirmala M, Srinivas CR, Shanthakumari S. Ninyhydrin sweat test in the early detection of leprosy. *Int J Lepr* 2002;70: 125-6.
6. Ziegler D. Diagnosis and treatment of diabetic autonomic neuropathy. *Current Diabetes Reports* 2002;1:24-34.