

Active Diabetic Patients May Have Fewer Foot Ulcers

Study evaluated the variability of activity leading up to skin breakdown as compared with patients with no ulcers.

REVIEWED BY DAVID G. ARMSTRONG, DPM, MSC

Patients with diabetes who develop foot ulcers may have lower overall levels of activity as compared with their high-risk counterparts who do not develop ulceration. Researchers reported in *Diabetes Care* that the quality of that activity might be more variable.¹

Diabetic foot ulcers are one of the most common complications associated with the disease, affecting about 68 per 1,000 diabetic patients per year, according to David G. Armstrong, DPM, MSc, and colleagues. Dr. Armstrong, professor of surgery and director of the Center for Lower Extremity Ambulatory Research (CLEAR), Rosalind Franklin University of Medicine and Science, Chicago, reported that the pathologic process that leads to most foot ulcers is the same. "In the face of neuropathy pressure multiplied by repetitive moderate stress leads to inflammation and subsequent autolysis of soft tissue overlying bony prominences."

100 CONSECUTIVE PATIENTS

Dr. Armstrong and colleagues evaluated 100 consecutive patients with diabetes who were enrolled in an ongoing prospective longitudinal study. Ninety-five percent were male, the average age was 68.5 years \pm 10, and all had concomitant neuropathy, deformity, and/or history of lower-extremity ulceration/partial foot amputation (Table 1).

All patients were given a high-capacity computerized accelerometer/pedometer to measure activity level. They were followed every 2 to 3 months for regular foot care,

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and data was collected from their devices. Patients were followed for a minimum of 25 weeks or until ulceration.

During follow-up 8 patients ulcerated, all of which were on the patient's plantar forefoot. Researchers reported that the average daily activity was significantly lower in patients who ulcerated versus those who did not (809.0 ± 612.2 vs $1,394.5 \pm 868.5$, $P=.03$) (Figure 1).

"Interestingly, there was a large difference in variability between groups," Dr. Armstrong wrote. "The [coefficient of variation] CV was significantly greater in the ulceration compared with the no-ulcerations group (96.4 ± 50.3 vs. $44.7 \pm 15.4\%$, $P=.0001$) (Figure 2). Furthermore, in the 2 weeks preceding the ulcerative event, the CV increased even further ($115.4 \pm 43.0\%$, $P=.02$), but there was no significant difference in average daily activity during that period ($P=.5$) (Figure 3).

ACTIVITY AND ULCERS

The researchers said that they were surprised that patients who developed ulcers were less active than those who did not suffer ulceration. They added that many investigators — themselves included — have long postulated that the formula for neuropathic diabetic foot ulceration included pressure times cycles of repetitive stress.

"While this may still be the case, the data in the present study seem to suggest that there may also be a temporal component to the formula. In other words, the pattern of activity in individuals who ulcerated in the present study appeared to be characterized by periods of inactivity punctuated by relatively sudden pulses of activity taken over a short time frame," Dr. Armstrong and colleagues wrote.

The researchers hypothesized that perhaps skin in those

TABLE 1. STUDY POPULATION

Number of patients	100
Age (years)	68.5 \pm 10.0
% Male	95
Duration of diabetes (years)	13.7 \pm 9.3
Foot risk category 2 versus 3	68/32
BMI	30.0 \pm 3.0

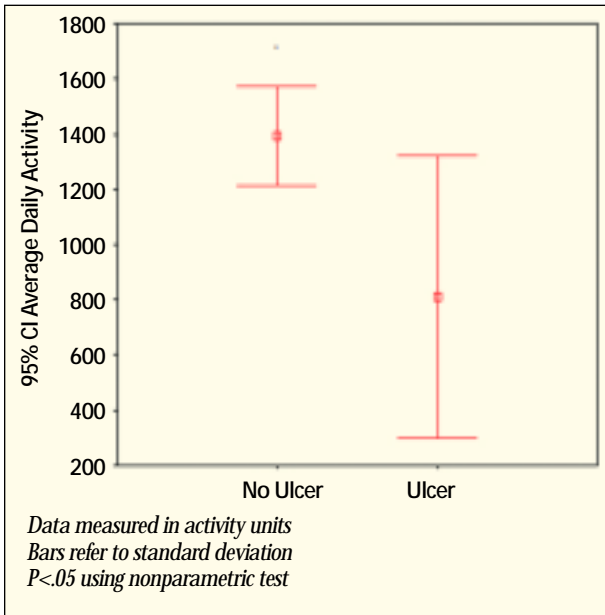


Figure 1. Activity of patients who ulcerated versus those who did not.

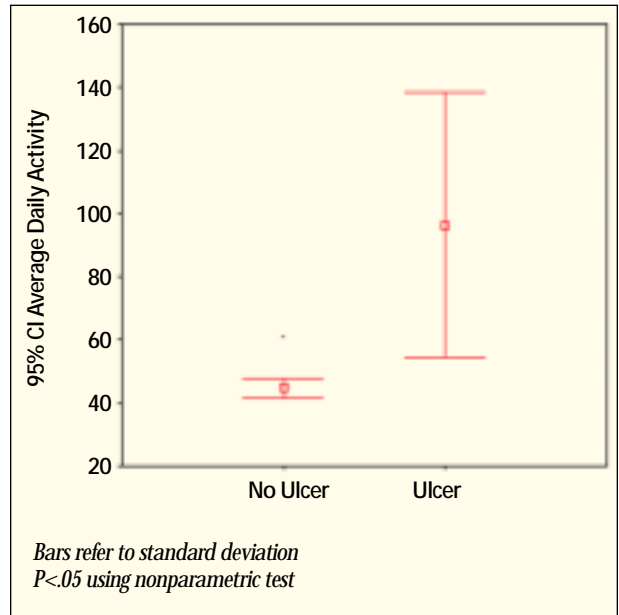


Figure 2. The difference in activity level between the ulcer and no-ulcer groups.

most at risk is least able to withstand repetitive stress, and it may be that skin that is not stressed consistently has an even higher risk of being damaged. The nonenzymatic glycosylation of tissue proteins compromises matrix reorganization of skin and soft tissue.

Studies by Klaesner² et al, and Maluf and Mueller³ have attempted to quantify this characteristic. Those researchers

concluded, “changes in weight-bearing activity following plantar tissue injury in patients with diabetes may influence tissue adaptation and the risk of ulcer recurrence.”

This research taken together with the current study may offer a unique opportunity for prevention by way of modulating the peaks and valleys of activity. By using some form of feedback in these high-risk patients, ulceration may be reduced. Dr. Armstrong and colleagues suggested the use of intelligent activity monitors designed to identify harmful variations in activity and then notify the patient and the patient’s health care provider.

“It could empower patients and their health care providers to modify activity,” Dr. Armstrong said in an interview. “We could essentially smooth the peaks and valleys of activity, ‘dosing’ activity like we dose drugs. If we could do that, then we think we can prevent a lot of foot sores, and keep a lot more legs on a lot more patients.” ■

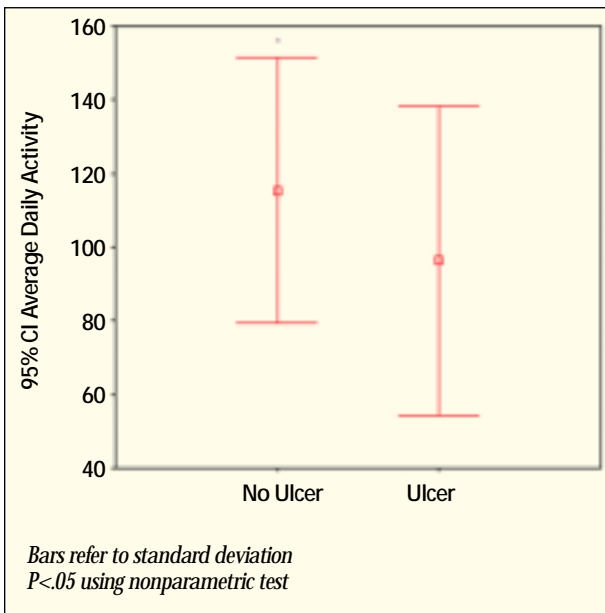


Figure 3. Variability of activity in ulcerated patients immediately before ulceration.

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