Cognitive Function Is Not Associated With Recurrent Foot Ulcers in Patients With Diabetes and Neuropathy

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OBJECTIVE — To study whether there is an association between cognitive impairment and the relapse rate of foot ulcers in diabetic patients and those with previous foot ulcers.

RESEARCH DESIGN AND METHODS — This single-center prospective study assessed the association of cognitive function and risk for ulcer relapse in 59 patients with diabetes (mean age 65.1 years, diabetes duration 16.5 years, and A1C 7.4%), peripheral neuropathy, and a history of foot ulceration. Premorbid and current cognitive functions were measured (multiple-choice vocabulary test [Lehrl], number-symbol test, mosaic test [HAWIE-R], and trail-making tests A and B [Reitan]). Prevalence of depression was evaluated retrospectively (diagnoses in patient files or use of antidepressive medication). Patients were re-examined after 1 year.

RESULTS — Three patients (5%) died during follow-up (one of sepsis and two of heart problems). The remaining 56 patients (48%) developed 27 new foot ulcerations (78% superficial ulcerations [Wagner stage 1]). Characteristics of patients with and without ulcer relapse were not different. In a binary logistic regression analysis, cognitive function is not predictive of foot ulceration.

CONCLUSIONS — Cognitive function is not an important determinant of foot ulceration.

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RESULTS — Characteristics of the study patients (39 male, 17 female, all Caucasian) were as follows: age 65.1 ± 8.9 years, diabetes duration 16.5 ± 9.1 years, A1C 7.38 ± 1.30%, blood pressure 149.5 ± 25.3/77.5 ± 13.0 mmHg, number of antihypertensive drugs 2.5 ± 1.1 (span 0–6), BMI 31.6 ± 4.9 kg/m², and number of previous ulcers 2.9 ± 2.4 (median 2.0, span 1–9). Prevalence of severe neuropathy (neuropathy disability score >7) was present in 75% of patients (n = 44), and 15% (n = 9) suffered from diabetic osteoarthropathy. Orthopedic footwear was used by 78% (n = 46), and specialized foot care by 80% (n = 47). Peripheral artery disease was present in 53% (n = 31), and other macrovascular problems (past myocardial infarct, cardiovascular disease, or stroke) in 58% (n = 34). Insulin therapy was used by 90% (n = 47), and statins by 49% (n = 29). Low social status (without professional education and jobless) was recorded for 4% (n = 2), retirement for 76% (n = 45), and living with relatives for 81% (n = 48). Smoker or ex-smoker was recorded for 64% (n = 38), and drinking two or more alcohol equivalents per day was 15% (n = 9). Those suffering from nephropathy were 71% (n = 42), from retinopathy 51% (n = 30), and from both microvascular complications 39% (n = 23). A diagnosis of depression and/or antidepressive drugs was prevalent in 14% (n = 8).

The results of neuropsychological testing are as follows: (results in IQ points) PCF, 102.0 ± 8.7; CCF, 89.7 ± 11.1; number-symbol test, 93.3 ± 12.3; mosaic test, 94.6 ± 14.1; and trail-making test, 67.5 ± 13.5. After 12 months, three patients had died (sepsis, heart insufficiency, or sudden cardiac death). New foot lesions occurred in 27 patients (48%); 3 (5%) underwent a minor amputation (two toes and one forefoot).

The remaining 56 patients with and without ulcer relapse were not different for neuropsychological testing or other characteristics (results in Table 1). Cognitive function was not predictive for ulcer relapse in the binary logistic regression analysis using ulcer relapse as a dependent variable (odds ratio [95% CI] PCF 0.99 [0.94–1.06], CCF 0.99 [0.94–1.04], loss of cognitive function 1.01 [0.96–1.06], multiple-choice vocabulary test 0.99 [0.96–1.02], number-symbol test 0.98 [0.94–1.02], mosaic test 0.99 [0.96–1.04], trail-making test 1.0 [0.97–1.05]). Adjusting for age, diabetes duration, and depression did not alter the results.

CONCLUSIONS — In this study, no difference of cognitive function was found in patients with and without ulcer relapse. Therefore, a failure of patient education to prevent recurrent foot ulcers cannot be attributed to reduced cognitive function.

Patient characteristics were not different for ulcer relapse and nonrelapse patients. This is important because numerous confounders (e.g., age, A1C, diabetes duration, blood pressure, smoking, and alcohol intake) are reported to be associated with decreased cognitive function (11) and foot problems (3). For the study, 48% of patients developed a new ulceration, which is in keeping with other reported rates (2,12).

Depression is a major differential diagnosis for cognitive dysfunction (13) and has been shown to have a 30% prevalence among diabetic patients with neuropathy (14,15). Results of our study are limited in that the study did not screen for depression. Although an association of depression with micro- and macrovascular complications and mortality is described (14,15), a direct association of
depression with the occurrence of diabetic foot ulcers was not reported (13–15). In a post hoc analyses using diagnosis of depression or use of an antidepressant medication as an indicator for depression, these patients were evenly distributed in the ulcer-relapse and non-ulcer-relapse groups. Nevertheless, the prevalence of depression is likely to be underestimated, which possibly affects the results. In conclusion, this study does not support the commonly held belief that cognitive dysfunction is an important determinant of foot ulceration.

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