Influence of blood glucose control on the progression of cardiac autonomic neuropathy in type 1 diabetes

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Background and aims : Cardiac autonomic neuropathy (CAN) is a frequent complication of diabetes mellitus. The present work aimed at analysing the influence of blood glucose control on the progression of indices of CAN in patients with type 1 diabetes mellitus.

Materials and methods : 48 (28 women and 20 men) patients with type 1 diabetes (mean ± SD : age : 41 ± 12 years; diabetes duration : 19 ± 10 years with a range from 3 to 38 years) were studied twice at a time interval of 43 ± 17 months (range : 16-91 months). Patients taking drugs interfering with cardiovascular regulation were excluded. CAN was assessed by calculating the baroreflex gain during a squatting test (1 min standing – 1 min squatting – 1 min standing) while continuous monitoring of heart rate and arterial blood pressure with a Finapres^{R} device. The baroreflex gain was calculated by plotting R-R cardiac intervals according to mean arterial blood pressure values during the transition active phase from squatting to standing. Overall blood glucose control was estimated by the mean value of several HbA_{1c} measurements between the two tests, and subjects were separated into two subgroups : HbA_{1c} levels $\leq$ 8 % in 21 patients (7.42 ± 0.60 %) *versus* > 8 % in 27 patients (9.44 ± 1.04 %).

Results : The baroreflex gain tended to be negatively related to the duration of diabetes at the initial evaluation ($r = - 0.174$; $n = 48$; $p < 0.10$). This index of CAN decreased from 4.00 ± 3.41 to 2.53 ± 1.46msec/mm Hg ($p = 0.008$) during the 43-month period separating the two orthostatic tests. The reduction in baroreflex gain was significant in patients with bad glucose control (from 3.89 to 2.13 msec/mm Hg, $p = 0.02$), but not in patients with acceptable control (from 4.16 to 3.05 msec/mm Hg, NS). While no significant differences were observed between the two groups at the initial evaluation, baroreflex gain became significantly lower in the poorly controlled group than in the better controlled group at the second evaluation ($p < 0.05$). A significant negative correlation was found between changes in baroreflex gain from test 1 to test 2 and mean HbA_{1c} levels ($r = - 0.304$; $n = 48$; $p < 0.01$), and between baroreflex gain at the second test and averaged HbA_{1c} during the period between the two tests ($r = - 0.409$; $n = 48$; $p < 0.001$). Interestingly, pulse pressure significantly increased from test 1 to test 2 in patients with poor metabolic control (from 47.3 to 57.6 mm Hg; $p < 0.001$), but not in patients with better metabolic control (from 50.4 to 56.6 mm Hg; NS).

Conclusion : In patients with long-standing (almost 20 years) type 1 diabetes, a period of 3-4 years with poor glucose control is sufficient to significantly decrease baroreflex gain, an index of cardiac autonomic neuropathy, and to increase pulse pressure, an index of arterial stiffness, two independent risk markers in patients with diabetes mellitus. These observations support the search of better metabolic control in patients with type 1 diabetes, with a minimum objective of HbA_{1c} levels below 7 %.