SUMMARY

BACKGROUND / STUDY OBJECTIVES

Diabetes mellitus (DM) is an important non-communicable disease with a rising prevalence. DM adversely affects cardiovascular performance, and the presence of a co-morbid condition such as cardiac autonomic neuropathy (CAN) further worsens this. It was therefore considered necessary to compare the cardiovascular performance of diabetic patients who had cardiac autonomic neuropathy (DM with CAN) with the performance of diabetic patients who did not have cardiac autonomic neuropathy (DM without CAN).

SUBJECTS AND METHODS

It was a hospital-based case/control study.

Sixty-eight consecutive type 2 diabetic patients who satisfied the inclusion criteria and who were able to complete the cardiac autonomic function test were recruited from the diabetes clinic. They were grouped into those without CAN (23 males, 28 females), and those with CAN (7 males, 10 females). Fifty-one age and sex matched non-diabetic subjects were used as controls. The study subjects were subjected to graded intermittent treadmill exercise. No serious adverse event occurred during the study.

Measurements: Pre-exercise and exercise blood pressures (BPs) and heart rates (HRs).

RESULTS

Compared to controls, the mean maximal workload (METs) was reduced in DM without CAN, and further reduced in DM with CAN (controls: 6.98 ± 1.2; DM without CAN: 6.07 ± 1.1; DM with CAN: 4.47 ± 0.87, p = 0.00).

DM with CAN had a higher mean pre-exercise heart rate (beats/minute, or beats/min) than controls (87.76 ± 13.19 versus 77.17 ± 10.02, p = 0.01) and a higher proportion of persons with resting tachycardia than controls (29.4% versus 3.9%, p = 0.00). Maximal heart rate (beats/min) was reduced in DM without CAN,
and further reduced in DM with CAN (controls: 166 ± 21.50; DM without CAN: 154.31 ± 15.52; DM with CAN: 121.41 ± 10.90, p = 0.00). Heart rate reserve was reduced in the same order (p = 0.00).

Maximal systolic blood pressure (SBP) and rest-maximal change in SBP (mmHg) were reduced in DM with CAN. DM without CAN had a higher mean submaximal SBP than controls. Increment in heart rate per MET, and increment in SBP per MET were reduced in DM with CAN.

Heart rate, SBP, but not diastolic blood pressure (DBP), had strong positive linear correlation with workload in the three groups.

DM without CAN had a higher proportion of subjects with hypertensive response than controls (37.3% versus 19.6%, p=0.01).

Compared to controls, workload-corrected rate pressure product (RPP, mmHg beats min⁻¹ MET⁻¹) was high in DM without CAN, and low in DM with CAN (controls: 4365.84 ± 734.74; DM without CAN: 4797.28 ± 778.94; DM with CAN: 3459.65 ± 499.27, p=0.00).

CONCLUSION

1. Cardiovascular performance to exercise was impaired in diabetic patients without CAN, and further impaired in diabetic patients with CAN.

2. The presence of CAN in DM was associated with a number of factors which were known predictors of increased cardiovascular morbidity and mortality. Such factors included high resting heart rate, low maximal heart rate and poor heart rate reserve. Low maximal heart rate and poor heart rate reserve were also present in diabetic patients without CAN.

3. Diabetic patients with CAN appeared to have impaired ability to increase their heart rates and SBPs adequately in response to appropriate physiological stress.

4. The higher hypertensive response in diabetic patients without CAN as compared to the control subjects, suggested that they were more prone to develop hypertension than age and sex matched non-diabetic subjects.

5. Workload-corrected rate pressure product appeared to be able to distinguish between diabetic patients with CAN and diabetic patients without CAN.
6. No serious adverse event occurred during the study, suggesting that supervised or guided exercise was safe in diabetic patients with and without CAN.