the three groups, but the respiratory quotient during ergometer exercise of DM group was lower than those of N and HL groups significantly. Exercise therapy for about 1 month induced falls of serum concentrations of T-cho, triglyceride, and atherogenic index ((T-cho-HDL-cho)/HDL-cho), but no changes of serum concentrations of HDL-cho, phospholipid, and free fatty acid. In DM group, by exercise therapy for about 1 month, Hb-A_{1c} was decreased and the respiratory quotient during ergometer exercise for 30 minutes was increased significantly. These results were interpreted that exercise therapy has beneficial effects for patients with DM or HL, and that the improvement of glucose utilization during exercise of DM patients may be evaluated by measurement of the respiratory quotient during exercise.

-110- METABOLIC AND CIRCULATORY REGULATION DURING GRADED EXERCISE IN CHRONIC HEART FAILURE

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The metabolic processes and the circulatory regulation during exercise were studied in chronic heart failure (CHF). Thirteen patients of functional class II and III and 18 normal subjects underwent graded treadmill exercise test, measuring oxygen consumption ($\dot{V}O_2$), blood lactate and, in 6 cases, mixed venous oxygen content. The blood lactate curve showed tri-phasic pattern to $\dot{V}O_2$ increment in both groups, that is, phase I is the first period with small change of blood lactate, phase II the second period with continuous increase of lactate, and phase III the last period with rapid increase of lactate. During phase I, mixed venous oxygen content rapidly fell, then it was gradually decreasing during phase II and III. The values of $\dot{V}O_2$ at the onset of phase II and phase III, and $\dot{V}O_2$ max were significantly smaller in CHF than in control. However, the relative $\dot{V}O_2$ ratio to the observed $\dot{V}O_2$ max at the onset of phase II and phase III were same level in both groups, that is $41.6 \pm 10.0\%$ and $78.6 \pm 9.9\%$ in CHF, and $41.3 \pm 9.2\%$ and $78.0 \pm 8.8\%$ in control, respectively. It is considered that phase I consists of high aerobic circumstance owing to rapid increase of oxygen extraction, resulting in complete catabolization of produced lactate. During phase II, the produced lactate may exceed its catabolizing threshold. During phase III, the rapid lactate increment indicates a severe shortage of aerobic energy production to the total energy demand, and this may prove the advanced regulatory failure of blood flow to the working muscle. It is concluded that the metabolic processes and circulatory regulation during maximal graded exercise shows the tri-phasic change in both CHF and normal subjects. This phenomenon may be useful to investigate the physiologic basis of life activity in patients with CHF.

-111- VENTILATORY CHANGES IN PATIENTS WITH CHRONIC HEART FAILURE

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One minute incremental supine exercise test was performed in 30 cases, to evaluate the ventilatory changes. Cardiac output (C.O.) was calculated in every minutes with Fick Principle. Simultaneously, to evaluate anaerobic threshold (A.T.) and respiratory compensation threshold (R.C.T.), ventilatory parameters were measured.

In normal cases, the increase of CO (ΔCO) was proportional to the increase of arteriovenous O_2 difference (ΔavO_2D), and the $\Delta CO/\Delta avO_2D$ ratio showed the value of 1.05 ± 0.3 . By using this ratio, 25 patients of CHF were divided into two Groups: 12 patients showed normal valve GI and, 13 patients, under the valve of 0.7 GI. AT Point and RCT Point, detected by ventilatory changes, were noted in 9 cases (70%) in GII and 6 (50%) in GI. But the delay time of RCT from AT was different between 2 Groups. The mean delay time of GI showed 5 minutes and GII 1 minute. These findings demonstrate the impaired CO response during exercise might be noted non-invasively with the ventilatory parameter changes.

-112- DECREASE OF FINGER TEMPERATURE (FIT) DURING EXERCISE AS A FUNCTION OF THE INDIVIDUAL MAXIMAL POINT

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The purpose of the study was to evaluate the applicability of finger temperature monitoring as an indicator of peripheral vasoconstrictor response during maximal (MAX) exercise (Ex) testing. Ex testing with FIT monitoring by a thermistor on the mid-finger was done in 6 athletes (A), 16 normal (N), 8 mild cardiac (MIC) and 15 moderate cardiac (MOC) subjects using multi-stage protocol with a 3-min rest period between 3-min Ex stages. Intermittent Ex protocol was necessary to ensure reproducibility and to yield progressive FIT changes during Ex. Anaerobic threshold (AT) was determined by respiratory measurements. FIT change in parallel with finger blood flow changes (by plethymography). At the mild Ex stage FIT decreased initially, only to rise at the latter half of Ex. As Ex stage increased, FIT continued to decrease throughout the 3-min Ex period. Near or at the individual maximal stage FIT decreased linearly (LD). Sympathetic blockade abolished FIT decrease and an acute rise in norepinephrine was observed concomitantly with an acute decrease in FIT. Among 48 subjects, mean max $\dot{V}O_2$ (kg/min) was 63, 47, 31 and 15, and mean HR; 188, 195, 165 and 142, respectively in group A, N, MIC and MOC. LD was observed in more than 90% of cases at the work load, 1.6-fold of AT and within 90% of MAX. CONCLUSION: Progressive decrease of finger temperature during exercise testing was the result of sympathetic vasoconstriction and is an excellent non-invasive indicator of approaching maximal point in exercise.

-113- TREADMILL EXERCISE TESTING IN PATIENTS WITH DILATED CARDIOMYOPATHY

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