ต้นฉบับ หน้าขาดหาย

Spectral analysis of RR interval variability and neural cardiac control at rest

The HF power of the RR interval variability of the ETA group, expressed in absolute value, was significantly higher than that in RTA and SS group. From numbers of studies in dictated that HF power of the RR interval variability is mainly determined by the vagal tone (Furlan et al, 1993), so this finding suggests an enhanced parasympathetic control of heart rate with endurance training, in agreement with the observations of others who used different (Kamath et al, 1991) or similar techniques (Pagani et al, 1988) with less parasympathetic control system in RTA and SS group.

The LF power of RR interval variability of the ETA group, expressed in absolute value, was higher than that in SS group, however, no significant difference is found, compared to RTA group. As LF is influenced by sympathetic and parasympathetic activity, the LF power of RR interval variability in ETA group is rather high compared to other groups because of higher parasympathetic performance in ETA group than in the rest of two groups. These results are agree to Piug et al study in 1993, which find that LF power of the athletes is higher than that of non-athletes. Although LF power is believed to be a reflection of both sympathetic and parasympathetic inputs, several investigators have attempted to use the absolute LF power as a measure of sympathetic tone. This most likely represents an oversimplification of the use HRV. Hopf et al (1995) studied a series of 10 subjects with thoracic epidermal anesthesia while supine and during head-up tilt. Head-up tilt, a sympathetic stresses, did not result in a change in absolute or fractional LF power, further demonstrating that the LF band does not specifically reflect cardiac sympathetic modulation. Because of issues related to the specificity of the frequency bands and lack of concordance between absolute autonomic tone and power, multiple investigators have proposed that heart rate variability measures can be use to assess relative change in autonomic tone, or the "balance" between sympathetic and parasympathetic activity. One method of assessing sympathovagal balance has been used to the LF/HF ratio power, with increasing values indicating a shift toward sympathetic predominance (Lee, 1996). For example, sympathetic nervous system activation secondary to upright tilt and the administration of vasodilating drugs is associate with the increases in the LF/HF ratio (Vybiral et al, 1989). In addition, it is found from the experiment on human that mental stress has also been shown to be associate with the increases in the LF/HF ratio (Pagani et al, 1991). Sympathetic stressors can decrease total variance, but the relative proportion of the HRV power spectrum in LF band may increase relative to the other frequencies. Therefore, the use of the ratio to assess sympathovagal "balance" may be more appropriate than using absolute values.

The result demonstrates that LF/HF ratio at rest alone of ETA group is significantly lower than that of RTA and SS group, but no significant difference is found between RTA and SS group. This indicates that sympathetic performance at rest in RTA and SS group is higher than ETA group results in higher HR found in RTA and SS comparing to ETA group.

Power spectral analysis of RR interval variability and neural cardiac control during the exercise at 50% VO2max

This study shows that, while exercise produced a significant increase in the ratio of low to hight frequency peak, and decreased of the high and low freqeuncy (absolute value) component when compared with the resting. The combination of an increase in LF/HF ratio and a decrease in high and low freqeuncy components with during exercise is consistent with deactivation of afferent nerve impulses from sinoaortic baroreceptors. As a dynamic nagative feedback system, the oscillatory activity in the cardiac medullary centers would normally tilt toward increased tonic sympathetic stimulation of the peripheral vessels and concomitant withdrawal of parasympathetic out put to the heart (Kamath et al, 1991).

The results of the present study are supported indirectly by evidence elsewhere. For instance, in an article by Bartoli et al in 1985, demonstrated a lowing of both high and low freqeuncy power of RR interval power spectrum during exercise. Maciel et al in 1986, studied the effects of sympathetic and parasympathetic responses to dynamic exercise in 23 normal male subjects. They found that the tachycardia of exercise is mediated by a biphasic response brought about by early rapid vagal withdrawal and a more delayed rise in sympathetic stimulation.

Considering the responses of ANS during the exercise at 50% of VO2max, the performance adjustment of sympathetic nervous system of ETA group is lower than RTA and SS group. This may be the result of the endurance-exercised training, which causes the change both in the structure and the performance of cardiovascular system includes; enlargement of the cardiac chamber size, decreases intrinsic heart rate and the alteration in beta-adrenergic density.

In addition, the result has shown that the high VO_2max groups also has high HF power during the rest as found in ETA group. These results showed in Figure 16 demonstrate the scattering of HF power during the rest and VO2max out of the three groups. These findings support the study result of Goldsmith and his colleagues in 1997 reporting that the group with high VO2max correlates with high HF power during the rest.

Previous studies have reported that the person whose the performance during the rest of parasympathetic nervous system controlling heart rate is dominant over sympathetic nervous system will have more ventricular fibrillation threshold or less risk of heart disease than. Those with the performance of sympathetic nervous system is dominant (Schwartz et al, 1984). Together from recent reports and this study demonstrate that endurance-exercised training will result in enhancing cardiovascular performance; VO_2max increases, decreases HR at rest, blood pressure decreases, and the risk of cardiovascular diseases may be lower. It can be seen from this study that endurance-exercised training are not only good for cardiovascular system, but also enhances the performance of parasympathetic nervous system. This results in lowering the heart rate and the body relaxes more.

CONCLUSION

In conclusion, these findings suggest that the endurance exercise training results in enhancing the performance of parasympathetic nervous system controlling heart rate better than the resistance-exercise training. Moreover, the result of this study can be used to givee the recommendation on exercise programming for health, which is expected to enhance the performance efficiency of parasympathetic nervous system controlling cardiovascular system. In addition, the technique of ANS performance assessment used in this study can also be used as the easy, convenient and save choice for assessing the autonomic function of cardiovascular system. Furthermore, these techniques may be useful to assess the stress level (Pagani et al,1991) or assess for over-training state of the athletes (Hedelin et al, 2000) and, consequently, further improve the appropriate training programs.