1) Studies on the Peroxide Scavenging Potentials of Stroke-Prone Spontaneously Hypertensive Rats (SHRSP) and Wistar Kyoto Rats (WKY)

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We have reported that thiobarbituric acid reacting substances (TBARS) increased in the blood and the liver of SHRSP at time of stroke (I. Tomita et al.: Stroke 10: 323, 1979). This increase was accompanied by an concomitant elevation of lipids, especially triglycerides (TG) in the serum (M. Sano et al.: Lipid Peroxide Res. 3: 176, 1979). In the present study, the peroxide scavenging potentials of SHRSP and WKY were compared by measuring the expired gases (ethane and ethylene) after an intravenous administration of triglyceride peroxides (TGPO) prepared from trilinolenin or linseed oil. The activity changes of 2 enzymes, glutathione peroxidase (GSH-Px) and glutathione reductase (GR) were also examined in connection with the changes of TBARS.

A preliminary study was performed to elucidate the role of TGPO in relation to the development of the stroke in SHRSP.

Materials and methods

TGPO was prepared by UV irradiation of trilinolenin or linseed oil for 15 hrs at 25° and was purified through a silica-gel column. Linolenic acid peroxide (LNPO) was prepared according to the method of O'Brien et al. (Can. J. Biochem. 47: 485, 1969). Expired gases were analyzed by GLC (C. J. Dillard et al.: Lipids 12: 109, 1977). GSH-Px and GR activities were measured according to the methods of Hafemann et al. (J. Nutr. 104: 580, 1974) and Racker (Methods in Enzymology, Vol. 2 pp 722, Academic press Inc., 1955) respectively.

Results and discussion

When TGPO in hydrogenated castor oil was injected into the tail vein of SHRSP or WKY (612 or 650 n moles as malondialdehyde for the peroxides of trilinolenin or linseed oil respectively/100g of body weight), the expiration of ethane or ethylene was observed and reached to the maximum in 30 (ethylene) or 60 (ethane) min. In SHRSP, the expiration rates (p moles/100g body weight/min) of ethylene from the peroxides of linseed oil or trilinolenin were 36.0 and 10.1 respectively, while those of ethane (at 60 min) were 8.0 and 10.0 respectively.

The expiration of the gases could be seen even 6 hrs after the TGPO injection. The expiration pattern of the gases was different from that observed by the injection of LNPO in which the formation of the gases reached to the maximum in 30 min and decreased rapidly. It should be noted that the expiration rates of ethylene was significantly higher in WKY than in SHRSP; e.g. 97.6 p moles of ethylene was formed in WKY compared with 41.8 p moles in SHRSP 30 min after TGPO (linseed oil peroxide, 1.14 μ moles as malondialdehyde/100g body weight) injection.

The level of TBARS in the liver of both SHRSP and WKY 2 hrs after a TGPO injection (1.14 μ moles as malondialdehyde/100g body weight) increased significantly; 313% and 273% in SHRSP and WKY respectively, compared to the level of the control rats which did not receive TGPO.

In SHRSP (but not in WKY), a simultaneous and significant decrease of the activity of GR in the liver was observed (26.12 $\pm$ 1.27 units/mg protein to the control value 33.15 $\pm$ 2.36 units/mg protein, that is 21% decrease ($p < 0.01$)).

The activities of GSH-Px were not significantly changed by TGPO administration in both SHRSP and WKY.

These observations clearly suggest that TGPO can be decomposed less efficiently in SHRSP than in WKY, thereby producing a greater adverse effect on SHRSP than on WKY. A preliminary experiment indicates that TGPO (1.14 μ moles as malondialdehyde/100g body weight) could induce stroke lesions in SHRSP earlier than normal when it was injected into the tail vein at their 12 weeks of age.

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