Studies on the Antioxidative Potential of Tissues and Blood in Spontaneously Hypertensive Rats (SHR), Stroke-prone-SHR (SHRSP) and Normotensive Wistar Kyoto Rat (WKR)

Isao Tomita, Mitsuaki Sano, Shigeo Serizawa, Tomoko Takata, and Masako Furukawa

Following the previous examinations on lipid peroxide (LPO) and related enzyme activities in male SHR and SHRSP (Jap Heart J 18: 608, 1977), further studies were conducted with both male and female SHR, SHRSP, and WKR.

LPO in tissue homogenate or serum pretreated with sodium dodecyl sulfate (SDS) was measured by colorimetric (OD532nm) and/or fluorometric (Ex515nm, Em555nm) method according to Masugi et al. (Vitamins 51: 21, 1977) and Yagi (Biochem Med 15: 212, 1976) respectively. The amount of DPPH or DTNB reacting substances and the activities of superoxide dismutase (SOD) and glutathione peroxidase (GSHpx) in the tissues were determined by the method previously described. SOD in blood was determined with the supernatant which was obtained by adding the mixture of CHCl3, EtOH to erythrocyte hemolyzate followed by centrifugation and dialysis for 24 hrs.

1) Biochemical changes in relation to LPO with age

The level of LPO in liver was unchanged with age in both male and female rats. LPO in brain, however, increased with age; the values (n moles of malondialdehyde formed/mg prot), for example, were 1.12±0.05 (Mean±S. E., n=12) at 2 months and 1.36±0.07 (15) at 7 months (P<0.02) for male SHRSP and 1.17±0.06 (6) at 2 months, 1.46±0.09 (8) at 7 months (P<0.05) for female SHRSP. A slight and slow increase of LPO with age was also observed in both male SHR (P<0.001 at 12 months) and WKR (P<0.05 at 12 months). There was no increase in LPO level in female WKR. Examination of the serum produced the results analogous to those for brain; 7.24±0.76 (19) n moles of malondialdehyde/mg prot. at the age of 2 months increased to 8.33±0.69 (15) and 12.64±0.58 (4) (P<0.001) at 7 and 12 months respectively in male SHRSP and 7.19±0.55 (6) at 2 months reached to 8.82±0.56 (11) at 12 months in female SHRSP. It should be noted that the LPO level in serum at the age of 7 months was higher than that at 12 months in female SHRSP, SHR, and WKR.

The values of 12 months were not significantly different from those of 2 months. The fact that the LPO level in serum was suppressed at the later stage in female and not in male rats might be related to lower incidence of stroke in female than those in male rats.

The amount of DPPH reacting substances (DPPHRS) in both brain and liver
of SHRSP, SHR, and WKR (male and female) decreased with age. This decrease was the least in the brain of SHRSP which, on the contrary, showed a significant increase of LPO with age as mentioned above. A smaller decrease of DPPHRS in the brain of SHRSP than that in SHR and WKR is probably due to a larger inductive increase of SH (especially protein bound SH) formation in SHRSP than in SHR and WKR. The increase of SH is thus closely related to the accumulation of LPO and the relative coefficient was 0.55 (18) (P<0.02) in case of the brain of SHRSP.

The activity of SOD decreased with age except in the case of the brain of male rat. No significant change with age was observed in the brain of SHRSP, SHR, and WKR (both male and female) though the brain of 7 months old male SHRSP was an exception (increase of GSHpx, P<0.01).

2) Biochemical changes in relation to LPO during the evolution of the hypertensive process

In 2 blood samples of male SHRSP with stroke lesion, significantly high level of LPO (29.16 and 20.49 n moles of malon dialdehyde/ml blood) was observed. LPO levels of male SHRSP and WKR at 7 months in age were 11.83±0.51 (8) and 12.88±0.85 (7) respectively. In accord with the high LPO level, the activities of GSHpx (Unit/ml erythrocyte) in the above 2 stroke SHRSP were 132.0×10^2 and 119.2×10^2 which are different from the values of male (236.1±14.7×10^2) (8) and female (220.5±10.6×10^2) (8) SHRSP of the same 7 months in age. SOD activities (Unit/mg prot.) of 2 stroke SHRSP (178.8, 220.0) were also significantly different from those of male (263.0±27.96) (8) and female (265.82±22.98) (9) SHRSP. The values were 309.71±28.98 (5) and 291.84±25.97 (12) for male and female WKR respectively. Further investigations are now in progress to establish the relation between LPO and the enzyme activities during the process until the happening of stroke.

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