

Cerebral protective effect of mild whole body hypothermia after ischemic stress in guinea pig hippocampus

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We researched the effect of mild (34°C) hypothermia on hippocampal region with 8 minutes of experimental cerebral ischemia in 11 hypothermic and 12 normothermic guinea pigs. Following light microscopic evaluation, neuronal damage was significantly less in hypothermic experimental group than that of controls. In conclusion, hypothermia had a beneficial effect on neuronal damage due to cerebral ischemia. [Turk J Med Res 1995; 13(2): 43-46]

Key Words: Hypothermia, Neuroprotection, Guinea pig

Hirsch et al (1962) firstly demonstrated the benefits of very low brain temperature to protect the cell from ischemic damage but the mechanism is unclear (1). In the previous studies, it was demonstrated that moderate and low-grade hypothermia had a protective effect (2,3). In the light of above studies, we compared the neuronal ischemic damage in normothermia and hypothermia on hippocampal region which is the most sensitive to ischemic episode in guinea pigs.

MATERIALS AND METHODS

Twenty-six adult guinea pigs were used; 11 of them were the hypothermic study group, 12 normothermic control group and 3 animals were used for the assessment of normal histologic structure.

The forebrain ischemia model (bilateral carotid artery occlusion in conjunction with systemic hypotension [<50 mmHg]) is identical to that used in the previous studies (4,5) and has been described (6,7). We subjected 12 guinea pigs to 8 minutes of forebrain ischemia with rectal temperature maintained at 37°C during and after ischemic episode. Ischemia was created by bilateral carotid artery clipping following general anesthesia with intraperitoneal ketamine of 44 mg/kg (Fig. 1). We subjected 11 other guinea pigs to 8 minutes of normothermic cerebral ischemia, but im-

mediately after the ischemic episode rectal temperature was lowered to 34°C and maintained at that level for 2 hours. Rectal temperature was controlled using a feed-back regulated water heating blanket. Hypothermia was instituted by spraying alcohol on the guinea pig's skin while a fan circulated room air (approximately 22°C) around the animal. Rectal temperature was not permitted to fall below 34°C. After 2 hours of hypothermia the guinea pigs were slowly warmed (over approximately 15 minutes) to 37°C. In both groups, the rats were returned to their cages 2-3 hours after the ischemic event.

Seven days after the ischemic insult, each rat was anesthetized with 44 mg/kg ketamine. The animal was transcardially perfused with 10% neutral buffered formalin following vascular washout with saline. Immediately after perfusion, the head was immersed in neutral buffered formalin for 1 hour; the brain was then removed and immersed in neutral buffered formalin for 1 week. The brain was cut into 3 mm coronal slices with a rodent brain matrix allowing anatomically reproducible slices for each guinea pig. After the hippocampus was removed, each slice was processed and embedded in paraffin for histologic evaluation. Six micron-thick sections were stained with hematoxylin and eosin and examined for differential counts of normal and necrotic neurons. Irreversibly injured or necrotic neurons were identified by criteria of Garcia et al (8). These criteria include marked changes in volume, shape, and stainability (eosinophilia) of the perikaryon and, above all, either nuclear pyknosis or nuclear deformity, as discussed extensively elsewhere (9). For quantification of ischemic neuronal injury, necrotic neurons were counted for all areas of hip-

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