Neuroglobin

Neuroglobin (NGB) is a globin, which is widely expressed in vertebrates central and peripheral nervous systems.

Neuroglobin (Ngb) has a high affinity for oxygen and helps prevent hypoxic-ischemic brain damage.

Serum Ngb levels were measured in 58 patients with aneurysmal subarachnoid hemorrhage and 27 controls using enzyme-linked immunosorbent assay. To continuously assess aSAH, they measured serum Ngb levels on days 1, 2, 3, 5 and 7 after aSAH. Clinical data were collected using the Hunt and Hess Stroke Scale, Glasgow Coma Scale (GCS), World Federation of Neurosurgical Societies grading and modified Fisher scale. Clinical outcomes included 6-month mortality and 6-month unfavorable outcomes (modified Rankin Scale (mRS) score of 3-6).

Serum Ngb levels increased after aSAH, peaked on day 2, and then gradually decreased, and serum Ngb levels on admission were higher in the patient group than in the control group (7.67 ± 2.56 ng/mL vs. 6.45 ± 0.88 ng/mL, $P < 0.05$). Multivariate logistic regression analysis indicated that serum Ngb levels on day 2 after aSAH were independently related to 6-month mortality (OR = 0.265, 95% CI = 0.094-0.747, $P < 0.05$) and 6-month unfavorable outcomes (OR = 1.919, 95% CI = 1.158-3.180, $P < 0.05$), and receiver operating characteristic (ROC) curve analysis showed that serum Ngb levels on day 2 predicted 6-month mortality and 6-month unfavorable outcomes with areas under the curve (AUCs) of 0.893 ($P < 0.05$; 95% CI, 0.812-0.974) and 0.818 ($P < 0.05$; 95% CI, 0.691-0.954), respectively, based on the best thresholds.

Serum Ngb levels on day 2 after aSAH were strongly associated with poor outcomes in aSAH, suggesting that Ngb may be a novel biomarker for predicting poor outcomes in aSAH [1)].

Shang et al. showed that the NGB expression level in neurons increased continuously from 2 h after injury, and reached a peak at 16 h ($p<0.01$), after which it decreased sharply. NGB that was overexpressed in mechanically injured B104 cells showed significant neuroprotective effects. Lactate dehydrogenase (LDH) activity decreased and cell survival rates increased ($p<0.01$, $n=5$). In the rat model of focal brain trauma, the NGB expression increased sharply at 1 h, after which it increased continuously until it reached a peak at 6 h, and then gradually decreased ($p<0.01$, $n=5$). Furthermore, moderate and severe injury resulted in significantly higher NGB levels than did mild injury ($p<0.01$, $n=5$). Our results indicate that NGB exerts significant neuroprotective effects after mechanical injury, and thus has important implications for the prognosis and cure of traumatic brain injury [2)].

NGB was upregulated in TBI and overexpressed rNGB had a significant neuroprotection in TBI. However, the mechanism remained unknown. A study suggested that rNGB overexpression may be a new strategy for treating of TBI [3)].

Neuroglobin level increased in serum after acute ischemic stroke (AIS) accompanied by increases in serum HIF1a, and was suggested as a predictor of stroke severity and poor prognosis [4].

Serum neuroglobin and Nogo-A levels could be suggested as biomarkers for predicting TBI severity and prognosis [5].

Neuroglobin (Ngb) overexpression is considered as an intrinsic neuroprotective response. Therefore, exogenous Ngb increased in brain tissues has become a promising therapeutic strategy for neurological diseases. Previous studies demonstrated that transactivator of transcription fusion protein transduction domain was able to mediate synthetic Ngb entrance into neurons, and then protected brain from hypoxia-ischemic injury. However, the role of recombinant Ngb on early brain injury following subarachnoid hemorrhage (SAH) has not been elucidated.

The objectives of a study were to investigate the expression of endogenous Ngb in brain using a rabbit model of SAH, and to verify whether TAT-Ngb fusion protein could be delivered into brain parenchyma, as well as to explore the neuroprotective effect of Ngb and its possible mechanisms.

Chen et al. found that Ngb expressions were up regulated in the transcript and protein levels in a similar time dependent manner after SAH as compared to the sham group. Moreover, TAT-Ngb fusion protein was successfully generated and transferred into brain neurons. Compared with the saline- and Ngb-treated group, neuronal viabilities and neurological outcomes were significantly improved 72 h post-SAH in the TAT-Ngb-treated group. Likewise, anti-apoptotic Bcl-2 protein was also elevated obviously. Conversely, pro-apoptotic factors including caspase 3, caspase 9 and Bax were greatly decreased after TAT-Ngb treatment. Our results suggest that Ngb plays a neuroprotective effect in rabbits suffering from SAH possibly through inhibiting the SAH-induced activation of mitochondria apoptotic pathway. Furthermore, TAT-mediated Ngb delivery into brain may be a promising therapeutic approach [6].

Cerebral hemorrhage significantly inhibited the spatial learning and memory ability of rats. The mechanism may be related to decreased cerebral expression of BDNF and neuroglobin (NGB) [7].

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