

Up-regulation of Na⁺ expression in the area postrema of total sleep deprived rats by TOF-SIMS analysis

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摘要

Abstract

Area postrema (AP) is a circumventricular organ plays an important role in sodium homeostasis and cardiovascular regulation. Since sleep deficiency will cause cardiovascular dysfunction, the present study aims to determine whether sodium level would significantly alter in AP following total sleep deprivation (TSD). Sodium level was investigated in vivo by time-of-flight secondary ion mass spectrometry (TOF-SIMS). Clinical manifestation of cardiovascular function was demonstrated by mean arterial pressure (MAP) values. Results indicated that in normal rats, TOF-SIMS spectrum revealed a major peak of sodium ion counting as 5.61×10^5 at m/z 23. The sodium ions were homogeneous distributed in AP without specific localization. However, following TSD, the sodium intensity was relatively increased (6.73×10^5) and the signal for sodium image was strongly expressed throughout AP with definite spatial distribution. MAP of TSD rats is 138 ± 5 mmHg, which is significantly higher than that of normal ones (121 ± 3 mmHg). Regarding AP is an important area for sodium sensation and development of hypernatremic related sympatho-excitation; up-regulation of sodium expression following TSD suggests that high sodium level might over-activate AP, through complex neuronal networks involving in sympathetic regulation, which could lead to the formation of TSD relevant cardiovascular diseases.