Sevoflurane and Orthopedic Surgery Related Cognitive Damage via the Activiation of Glia Cells in Hippocampus of Aged Rats

AUTHORS: Yang Mei-hua, Hu Nan, Wang Miao-miao, Wang Hai-yun, Yu Yong-hao, Wang Guo-lin

Department of Anesthesiology, Tianjin Medical University General Hospital, Tianjin Research Institute of Anesthesiology, Tianjin 300052, China

FUNDINGS: The study was supported by research grants from the National Natural Science Foundation of China (81371245, 81071059, 81100984), the Science and Technology Supported Key Project of Tianjin (12ZCZDSY03000)

Background: Many recent studies have suggested that old people with exposure to anesthesia and surgery can increase the risk of cognitive impairment and glia cells are involved in cognitive processes and neuropsychiatric disorders. Therefore，we established an rat model of surgery and sevoflurane anesthesia, aiming to probe the role of glia cell in sevoflurane related cognitive impairment.

Methods: Twenty-months old Wistar rats were randomly divided into six groups(n = 16): control group (received normal saline), propofol group（received propofol 0.5～0.7 mg·kg^{-1}·min^{-1} 2 h）, surgical group with propofol (do ditto), and sevoflurane inhalation of 1.0 MAC、1.3 MAC、1.5 MAC for 2 h. The cognitive function was estimated by Y- maze and fear conditioning test； The morphology and the expression of CD68 and GFAP of microglia and astrocytes in hippocampus were evaluated by immunofluorescence and the expression of IL-6 and TNF-α was estimated by western blot on day 1、3 and 7 after exposure.

Result： In this study, our results indicate that the orthopedic surgery could impaire cognitive function of the aged rats and compared with the group of surgery and propofol, the group of 1.5 MAC sevoflurane inhalation could enhance the cognitive deficits effect, the number of arm visits at day 1 and 3、the duration of novel arm visits and the contextual percent freezing time at day 1 and the cued percent freezing time were decreased at day 1、3 and 7 of group with 1.5 MAC sevoflurane inhalation. The expression of CD68、GFAP、IL-6 and TNF-α in hippocampus with 1.5 MAC sevoflurane inhalation were increased on day 1、3 and 7 after sevoflurane exposure. The morphology of microglia and astrocytes of the group with 1.5MAC sevoflurane had some change，such as the transformation of resting ramified microglia form into amoeboid form（figure 1).

Conclusion： These results suggest that 1.5 MAC sevoflurane aggravated the cognitive impairment effect of orthopedic surgery via altering IL-6 and TNF-α released by glia cells.

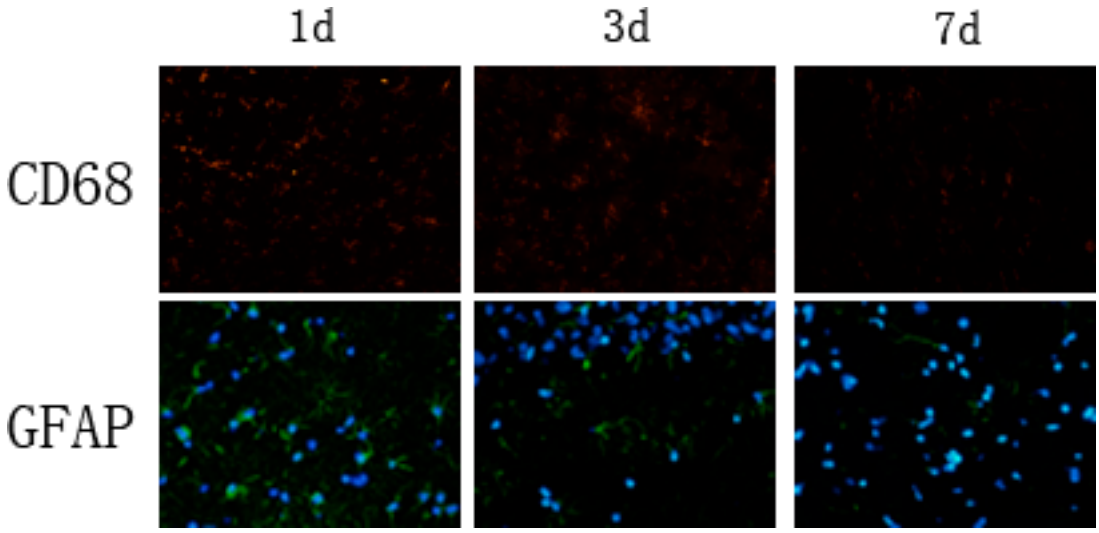

Figure1. The morphological change of microglia (CD68 positive, red) and astroglia cell(GFAP positive, green) at different times after exposure(×400).