

**Abstract.** We investigated the effect of selective cerebral ultra-profound hypothermic blood flow occlusion on brain tissue and cell metabolism to ascertain the efficacy and safety of selective deep hypothermic technologies using proton magnetic resonance spectroscopy (\(^1\text{H}-\text{MRS}\)). The bilateral carotid artery was blocked at room temperature for 10 min. Other neck vessels were then blocked through cold perfusion of the internal carotid artery and reflux of the ipsilateral jugular vein. Thus, selective cerebral extracorporeal circulation was established. Brain temperature was reduced to 15.1° ± 0.9°C. After 60 min, cerebral blood flow recovered naturally. Routine magnetic resonance imaging
(MRI), diffusion-weighted imaging (DWI), and $^1$H-MRS examination of the bilateral frontal cortex and basal ganglia were performed prior to surgery and 4, 24, 72 h, 21 days after recovery. The formants and areas under the curve (AUC) of $N$-acetyl aspartate (NAA), choline (Cho), creatine/phosphocreatine (Cr/Cr2) were analyzed using $^1$H-MRS. The pre- and postoperative AUC of NAA and Cho at different time points were compared. Conventional MRI and DWI showed no abnormal signal changes in the brain parenchyma or right basal ganglia before and after surgery ($P > 0.05$). There was no significant difference in the ratio between NAA/(Cr+Cr2) and Cho/(Cr+Cr2) before and after surgery in the bilateral basal ganglia and frontoparietal regions of the cortex ($P > 0.05$). Quantitative $^1$H-MRS showed that selective deep cerebral hypothermia significantly improved the brain’s tolerance to ischemia and hypoxia. Our results could provide a better understanding of the efficacy and safety of selective deep hypothermia and blood flow occlusion.

**Key words:** Macaque monkey; Magnetic resonance spectroscopy; Hypothermia; Biochemical metabolism