The impact of cardiopulmonary bypass on systemic interleukin-6 release, cerebral nuclear factor-kappa B expression, and neurocognitive outcome in rats.

Abstract:
Neurocognitive deficits after cardiac surgery with cardiopulmonary bypass (CPB) continue to affect patients’ quality of life, and an inflammatory reaction may be one of the contributors. We designed this experiment to study perioperative systemic interleukin-6 (IL-6) concentrations, cerebral expression of nuclear factor-kappa B (NF-kappaB), and neurocognitive outcome after CPB in young rats. The impact of oxygenator size on these outcomes was also assessed. Rats were randomly assigned to 1 of 4 groups: control (n = 7, nonanesthetized), sham-operated rats (n = 10, anesthetized, cannulated, and not connected to CPB), and 2 CPB groups, anesthetized, cannulated, and subjected to 90 min of CPB, using either a small-volume rat oxygenator (CPB/rat oxygenator, n = 10) or a neonate oxygenator (CPB/neonate oxygenator, n = 10). Systemic IL-6 was determined before, at the end of, and 2 h after CPB or at equivalent times. Hippocampal NF-kappaB expression was assessed on postoperative day 21 using immunohistochemistry. Neurocognitive performance was assessed with the modified hole-board test at baseline and for 21 postoperative days. Both CPB groups had increased systemic IL-6 levels compared with sham, with the neonate oxygenator causing a substantially
larger increase at 2 h after CPB compared with the rat oxygenator group (CPB/rat oxygenator: 220 pg/mL [16-415]; CPB/neonate oxygenator: 1400 pg/mL [592-5812]) (P< 0.05). Hippocampal NF-kappaB was increased in experimental groups compared with controls (10 +/- 4). CPB resulted in more NF-kappaB-positive neurons (271 +/- 57 CPB/neonate oxygenator and 269 +/- 72 CPB/rat oxygenator) compared with sham operation (173 +/- 24). Neurocognitive and behavioral performances were unaltered and comparable among all groups. Pronounced systemic inflammatory responses to experimental CPB associated with increased hippocampal expression of NF-kappaB were not accompanied by neurocognitive impairment. This suggests that other factors beyond CPB and inflammatory responses might contribute to adverse neurocognitive outcomes after cardiac surgery.