Prone Position, Intraoperative Cerebral Oxygenation Monitoring and Postoperative Cognitive Dysfunction

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Introduction. Prone position (PP) is required to provide operative access during spinal neurosurgery. PP causing a variety of physiological changes in human body can also affect cerebral blood flow, influencing the amount of oxygen delivered to cerebral tissue. Perioperative cerebral hypoxia is one of the pivotal postoperative cognitive dysfunction causes leading to long-term consequences. Non-invasive regional cerebral oximetry devices used intraoperatively measure real time continuous regional cerebral oxygenation ($rScO_2$) and help to obviate harmful events.

Aim, Materials and Methods. The aim of our study was to investigate whether patients undergoing spinal neurosurgery in prone position experience intraoperative $rScO_2$ changes and link to postoperative cognitive dysfunction and compare cognitive outcome results to spinal neurosurgery patients who do not receive intraoperative $rScO_2$ monitoring.

In total, 48 patients were included in prospective observational study. Patients were randomised in two groups – the study group (n = 38, medium age 55 ± 15) and the control group (n = 10, medium age 56 ± 11). All patients were scheduled for spinal neurosurgery in prone position under standardised general anaesthesia. Cognitive function was assessed in both groups using Montreal Cognitive Assessment (MoCA) scale before surgery and 48 hours after. MoCA scores range between 0 and 30. A score 26 is considered to be normal. In the study group intraoperative $rScO_2$ monitoring was applied using non-invasive near infrared spectroscopy INVOS 4100 device. In control group, $rScO_2$ monitoring was not applied. Intraoperative MAP, HR, $EtCO_2$, SpO_2 were fixed every 5 min in both groups. Preoperative Hb level, intraoperative blood loss, duration of the operation were also recorded.

Results. The medium $rScO_2$ values throughout surgery in the study group was as follows – $rScO_2$ lying supine during induction of anaesthesia above the right cerebral hemisphere (R) = 72 ± 9 %, above left (L) = 72 ± 9 %. In prone position $rScO_2$ was R = 73 ± 9 %, L = 73 ± 8 %. Lying supine at the end of the surgery $rScO_2$ was R = 73 ± 9 %, L = 73 ± 7 %.

Medium MAP (mmHg) was 87 ± 5 in the study group and 90 ± 5 in the control group.

Medium duration of operation (min) in the study group was 105 ± 37, in the control group – 126 ± 44. Medium blood loss (ml) was 289 ± 310 in the study group, 195 ± 149 in the control group. Medium Hb level (mg/dl) was 13 ± 2 in the study group, 13 ± 1 in the control group.

Medium MoCA score before surgery was 24 ± 3 points in the study group, 23 ± 4 points in the control group. MoCA 48 hours after surgery was 25 ± 3 points in the study group, 23 ± 3 points in the control group. In our study group, two patients showed MoCA decrease by one point and four points, respectively. In the control group, six of ten patients showed MoCA decrease by 1–2 points.

Patients with MoCA postoperative decrease form the study group presented similar intraoperative $rScO_2$ values as those without.

Conclusions. Significant intraoperative $rScO_2$ changes in patients undergoing spinal neurosurgery in prone position were not observed. The medium MoCA scores were similar in both groups – those who received and who did not receive intraoperative $rScO_2$ monitoring. Individually mild MoCA score decrease was observed more often in patients who did not receive intraoperative $rScO_2$ monitoring.

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