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Watch beyond hypotension

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In this month's the *Korean Journal of Anesthesiology*, an interesting paper focusing on the beach chair position (BCP) was published. Woo et al. [1] report that efforts to manage hypotension may not contribute to reducing cerebral desaturation events (CDEs) in the BCP under general anesthesia.

The BCP was introduced in the early 1980s for orthopedic shoulder arthroscopic procedures. Patients are seated at angles varying from 30 to 90° above the horizontal plane, with the head secured in a headrest. The BCP has significant advantages that injuries to the brachial plexus are reduced compared to those in the lateral decubitus position [2], and the surgeon has excellent access to the shoulder. The BCP gives the surgeon and the anesthesiologists the freedom to choose between regional and general anesthesia and allows easy conversion to an open procedure or general anesthesia if complications arise [2].

However, significant hemodynamic changes can occur when patients are placed in the BCP. Because of the pooling of blood in the lower body under general anesthesia, patients are particularly prone to hypotensive episodes. Under unanesthetized conditions, these effects are compensated for by an increase in systemic vascular resistance. This autonomic regulation is blocked by vasodilating anesthetics. Cerebral perfusion pressure decreases naturally in the sitting position and could further decrease under anesthesia because of vasodilation and impaired venous return. Therefore, hypotension has been considered a likely cause of ischemic brain injury in the upright position [3]. Recommendations for shoulder surgery in the BCP have been to monitor blood pressure carefully at the level of the brain, avoid and rapidly treat any hypotension or bradycardia, and position the head carefully to avoid extreme positions that may compromise cerebral vessels [4]. Incremental positioning and the use of intravenous fluids, vasopressors, and appropriate adjustments of anesthetic depth are recommended to reduce the degree and duration of hypotension, and elastic stockings and active leg compression devices are recommended to improve venous return [5].

Woo et al. [1] showed that the increase in venous return produced by compression stockings could correct hypotension but did not decrease CDEs. This indicates that blood pressure measurements alone might not be useful in predicting the occurrence of CDEs, and that other factors beyond blood pressure contribute to CDEs in the BCP. More advanced hemodynamic monitoring is required to define the etiology of CDEs in the BCP. We should consider other factors that come into play during surgery in the BCP, such as cardiac output, carbon dioxide concentration, cerebral metabolism, intravascular volume status, intraluminal atherosclerosis, and anatomical variables.

Cerebral autoregulation has been thought to maintain cerebral blood flow at a constant level over a range of mean arterial pressures (MAP), from 50 to 150 mmHg. The lower limit of autoregulation (LLA) has been thought to be an MAP value of 50 mmHg. However, this number was derived from animal studies, and the LLA may be higher in humans [6]. Moreover, an MAP of 50–60 mmHg eliminates any margin for error in case the blood pressure falls further, and neither the surgeon nor the anesthesiologist typically seems to consider the added effect of the BCP on cerebral perfusion.

Neurocognitive complications secondary to cerebral ischemia have been reported in patients who underwent arthroscopic shoulder surgery in the BCP under general anesthesia [7]. Appropriate management of cerebral oxygenation is thus one of the primary goals of anesthetic management during such procedures. It is important to monitor cerebral perfusion rather than blood pressure alone during surgery, especially in the BCP, and in this regard, near-infrared spectroscopy (NIRS) is useful as a noninvasive monitoring device. It potentially allows the early detection of a CDE and appropriate interventions to increase cerebral perfusion [8]. However, no gold standard limits exist, and the danger levels may change with alterations in patient position and carbon dioxide concentration. Therefore, if measured,

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trends in cerebral oxygen saturation are best interpreted during periods of constant ventilation and constant patient position [9,10].

Therefore, monitoring of cerebral oxygen saturation may be useful when patients are in steep head-up positions, including the BCP. However, there is a restriction on the use of NIRS in Korea because it is not allowed per the regulation setting criteria for providing reimbursed services of the National Health Insurance (NHI) Act.

I hope that the recent study of Woo et al. [1] will serve as an impetus to raise awareness of the importance of cerebral oxygenation monitoring and to change the relevant NHI regulation.

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