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Short communication

Carotid Endarterectomy: Anesthetic Goals and Monitoring

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DESCRIPTION

Carotid Endarterectomy (CEA) remains a cornerstone surgical intervention for the prevention of ischemic stroke in patients with significant carotid artery stenosis. The procedure, although highly effective, is associated with considerable perioperative risk due to the potential for cerebral ischemia, hemodynamic instability, and cardiac complications. Anesthetic management plays a critical role in optimizing patient outcomes by ensuring cerebral perfusion, maintaining cardiovascular stability, and enabling rapid identification and intervention in response to intraoperative events. A focused understanding of anesthetic goals and monitoring strategies is therefore essential for clinicians involved in CEA.

The primary anesthetic goal in carotid endarterectomy is the maintenance of adequate cerebral perfusion throughout the procedure. Patients undergoing CEA often have compromised cerebrovascular reserve due to pre-existing atherosclerotic disease; thus, even transient hypotension or hypertension can precipitate ischemic events or hyper perfusion injury. Anesthesiologists aim to maintain blood pressure within 10%-20% of baseline values, avoiding sudden fluctuations that may jeopardize cerebral oxygen delivery. Hemodynamic stability is particularly important during carotid cross-clamping, which may transiently reduce ipsilateral cerebral blood flow. Strategies to mitigate ischemia include careful titration of anesthetic agents, judicious use of vasoactive medications, and, in selected patients, intraoperative shunt placement to maintain perfusion distal to the stenotic segment [1-3].

Another critical goal is the optimization of oxygenation and ventilation. Hypoxia and hypercapnia can exacerbate cerebral ischemia, whereas hypocapnia can lead to cerebral vasoconstriction, reducing blood flow to vulnerable brain regions. Anesthetic management must therefore ensure adequate oxygen delivery, normocapnia, and stable acid-base status throughout the procedure. Additionally, anesthetic depth must be carefully balanced; excessive sedation may depress cardiovascular function and compromise perfusion, while insufficient anesthesia may increase sympathetic responses and hemodynamic variability.

Monitoring strategies in carotid endarterectomy are central to the detection of cerebral ischemia and other complications. Standard monitors, including electrocardiography, pulse oximetry, noninvasive blood pressure, and capnography, provide essential baseline physiological information. However, due to the high stakes of cerebral perfusion, more advanced monitoring modalities are often employed. Intraoperative Electroencephalography (EEG) or processed EEG, transcranial Doppler ultrasonography, Near-Infrared Spectroscopy (NIRS), and Somatosensory Evoked Potentials (SSEPs) can detect changes in cerebral perfusion in real time, guiding anesthetic and surgical interventions. These modalities are particularly valuable during carotid clamping, enabling prompt response to ischemic events and potentially reducing perioperative stroke risk [4-6].

The choice between general anesthesia and regional techniques, such as cervical plexus block with sedation, further influences anesthetic goals and monitoring. Regional anesthesia allows for continuous neurological assessment through patient cooperation, offering immediate detection of cerebral ischemia without reliance on indirect monitoring. However, general anesthesia provides a controlled environment for hemodynamically unstable patients and those requiring prolonged surgical exposure. Regardless of technique, vigilant intraoperative monitoring and communication between anesthesiologist and surgeon are essential to anticipate and manage rapid physiological changes.

Postoperative monitoring is equally critical. Patients are at risk for hyperperfusion syndrome, cerebral edema, and cardiac events in the immediate postoperative period. Close observation in a high-dependency or intensive care setting allows timely detection and management of complications. Blood pressure control, pain management, and neurological assessment remain central to postoperative care and functional recovery [7-8].

The anesthetic management of carotid endarterectomy centers on the dual goals of maintaining cerebral perfusion and achieving hemodynamic stability. Meticulous planning, selection of appropriate anesthetic technique, and utilization of advanced monitoring modalities are critical for minimizing perioperative stroke risk and optimizing patient outcomes. As surgical

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techniques and monitoring technologies continue to evolve, a proactive, patient-centered approach remains essential, emphasizing the importance of collaboration between anesthesiologists and surgeons in ensuring safe and effective care for patients undergoing carotid endarterectomy [9-10].

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