Intraoperative Management of Carotid Endarterectomy

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KEYWORDS

• Carotid endarterectomy • Carotid stenosis • Intraoperative management
• Neurophysiologic monitoring

KEY POINTS

- Carotid endarterectomy (CEA) is an effective and low-risk intervention for prevention of stroke in symptomatic and asymptomatic patients with severe carotid stenosis.
- CEA can be safely performed under either general anesthesia (GA) or locoregional anesthesia (LRA) (cervical plexus block) with similar mortality and morbidity.
- Neurologic monitoring (electroencephalography [EEG], stump pressure [SP] measurement, evoked potentials [EPs], transcranial Doppler [TCD], or cerebral oximetry) is advantageous when utilizing general anesthesia.
- Significant complications consist of strokes (mostly embolic), myocardial ischemia, and postoperative hypertension.
- In rare cases, hypertension progresses to cerebral hyperperfusion syndrome (CHS).

INTRODUCTION

First reports on the surgical treatment of cerebrovascular atherosclerosis date to the early 1950s.[1] Initial outcomes were not promising due to suboptimal surgical technique, which consisted of an end-to-end carotid anastomosis. With time, surgical technique has evolved and subsequent outcomes have improved.[2] Enthusiasm for CEA was revived after results of the first randomized trials were published in the 1990s. With more recent data, CEA has emerged as an effective measure for the prevention of stroke in patients with symptomatic and asymptomatic severe carotid artery stenosis.[3] In terms of the 5-year risk of ipsilateral ischemic stroke, randomized

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controlled trials examining CEA versus medical treatment have shown significant benefit to surgical intervention. The advantage of surgery is most significant in patients with greater than 70% internal carotid artery (ICA) stenosis and recent symptoms.[4]

Two large randomized trials, the North American Symptomatic Endarterectomy Trial and the European Carotid Surgery Trial, highlighted the benefit of surgical intervention. The combined results of these trials, as outlined in a meta-analysis, showed an absolute risk reduction for the combined outcome of death and subsequent stroke. Given the benefits that surgery offers beyond medical management, the number of CEA procedures continues to increase. This article explores the anesthetic management and considerations of patients undergoing CEA.

GENERAL VERSUS LOCOREGIONAL ANESTHESIA

Adequate surgical anesthesia for CEA can be achieved by both GA and LRA. A combination of deep and superficial cervical plexus blocks was historically used for this purpose; however, there are data to support that superficial block alone with supplemental wound infiltration and sedation[5] is equally effective. It is beyond the scope of this article to describe the technical aspects of performing regional anesthesia for CEA. This information is highlighted in an article by Guay[5] that describes the relevant aspects of performing regional anesthesia for CEA.

The most significant benefit of performing CEA under LRA is constant neurologic assessment of patients. This becomes crucial during the period of carotid cross-clamping, where cerebral circulation is potentially compromised. The onset of new neurologic symptoms should immediately alert the anesthesiologist and surgeon to possible ipsilateral brain hypoperfusion. These cerebral symptoms should prompt an adjustment in surgical technique, involving ipsilateral shunt insertion. Other real or perceived benefits of LRA include a reduction of postoperative respiratory complications secondary to the avoidance of endotracheal intubation. Additional benefits include a lower incidence of postoperative hypertension that may decrease the incidence of CHS[6,7] and the avoidance of the physiologic stress of induction and intubation, which may help minimize cardiac complications.

There are, however, many disadvantages when choosing LRA over GA. Most intraoperative strokes are the result of thromboembolism, not hypoperfusion, and occur during reperfusion.[8] The intraoperative placement of a shunt, which may occur during GA or LRA, does not diminish the incidence of thromboembolic stroke. In addition, should major neurologic deterioration or excessive sedation occur during LRA, establishing airway patency in an agitated or disinhibited patient under the surgical drapes can be difficult. Also, sudden movement of an awake patient during surgery is undesirable and dangerous. Moreover, as with any regional anesthetic, cervical plexus block may provide inadequate anesthesia or analgesia, necessitating an unplanned conversion to GA, or cause systemic toxicity (1.4% and 4.4%, respectively).[9]

Regardless, more patients with advanced systemic disease are referred for CEA and the avoidance of GA seems an attractive option. This view was encouraged by the results of studies claiming a reduced incidence of cardiovascular and respiratory complications in patients having general surgery procedures under neuraxial anesthesia.[10] Guay,[5] based on retrospective data, asserted that patients who had CEA performed under LRA had a decreased incidence of strokes, myocardial infarction (MI), death, respiratory impairment, and wound infection.

The General Anaesthesia Versus Local Anaesthesia for Carotid Surgery (GALA) study was a large, multicenter randomized controlled trial seeking to provide a definitive answer on which type of anesthesia is preferable for CEA. Its intended size was