

Prevention of Intra-operative Cerebral Ischemia during Carotid Endarterectomy, Loco-regional versus General Anesthesia

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Abstract

Carotid endarterectomy (CEA), as a prophylactic operation is becoming more popular. It is performed in patients who are at risk of stroke from dislodged atheromatous plaque at the carotid bifurcation. The major concern during CEA is the detection of cerebral hypoperfusion or ischemia during carotid cross clamping. Some studies have shown that the introduction of loco-regional anesthesia has lowered the incidence of major complications compared with general anesthesia since ischemia detection is easier in conscious patient.

Carotid endarterectomy (CEA) is commonly performed in patients who are at increased risk of primary or recurrence of cerebral vascular accident (CVA). This procedure can be done under general or loco-regional anesthesia. Major complications of this procedure include stroke, myocardial ischemia and death. The best intraoperative monitoring during CEA is controversial. Many consider a conscious patient as the best monitor.^{1,2}

The American Academy of Neurology has recently reviewed the indications for CEA in two groups of patients: symptomatic and asymptomatic. The first group includes patients who are having symptoms with active plaque giving rise to emboli that enter the cerebral circulation and cause transient ischemic attacks (TIAs), reversible ischemic neurological deficits or minor strokes; while the second group (asymptomatic patients) include those who have demonstrable disease at the carotid bifurcation but no history of a recent neurological event attributable to this lesion.³

CEA may be performed under loco-regional or general anesthesia. Each procedure has its advantages and disadvantages.⁴ The types of loco-regional anesthesia for CEA include deep, superficial, intermediate and combined cervical plexus block (CPB).² The major concern during CEA is cerebral ischemia especially during cross clamping. This represents a real problem in patients under general anesthesia.² Carotid shunting may offer a degree of cerebral protection during cross clamping but carries its own risks and has not been proven to reduce morbidity and mortality.⁴ The need for a carotid shunt may not be a straightforward

decision and this may be based on clinical judgment, the use of monitors of cerebral perfusion or awake neurological monitoring. Under general anesthesia (GA), different techniques have been used in the assessment of intra-operative cerebral perfusion, e.g. transcranial Doppler, stump pressure, electroencephalogram, somato-sensory evoked potential and others. For GA, many if not most, surgeons would place a shunt as there is no ideal monitor of cerebral perfusion in the patient receiving GA.^{2,4-6} Loco-regional anesthesia has an advantage over GA as continuous evaluation of the conscious patient's neurological status (speech, motor function, level of consciousness) is possible during carotid artery clamping. This serves as a good indicator for cerebral perfusion/ischemia.^{2,4,7} This allows for selective carotid shunting and consequently reduction of unnecessary shunts and associated complications such as CVA.^{2,4}

Practice varies widely among institutions and surgeons; some routinely insert shunts in all patients under GA, whereas others avoid their use altogether. Others are using selective shunting based on one or more monitors of cerebral function or blood flow.⁸⁻¹⁰ The use of intra-operative shunt is not free of complications. These complications can be classified into acute and long term complications. The acute complications include embolization of air or plaque, intimal tears and carotid dissection. Long term complications include restenosis. There is an associated risk of other local complications including haematoma, nerve injury and infection. With all these complications in mind, flow through the shunt may or may not be adequate to meet cerebral oxygen requirements.^{4,8,11}

Meta-analysis of 10 randomized trials comparing GA and loco-regional anesthesia, involving 4335 operations of which 3526 were from the single largest trial, was performed by Rerkasem K et al. This review provides evidence to support a policy that patients and surgeons can choose from either GA or loco-regional approach, depending on the clinical situation and their own preferences since the risk of stroke and death during, or soon after, surgery did not differ significantly between the two types of anaesthetic technique during carotid endarterectomy.⁷ Another trial by AbuRahma AF, concluded that the perioperative stroke/myocardial infarction and death rates were similar in CEA done under local anesthesia or general anesthesia.¹² The results of (Vassiliou T) clinical trial support the theory that the indication for insertion of intraluminal shunts was significantly reduced by loco-regional anesthesia

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(14% vs. 43%) due to the more reliable diagnosis of neurological complications.¹³ The use of loco-regional anesthesia by itself carries some complications including intrathecal or intravascular injection of local anesthesia, respiratory compromise related to phrenic nerve paralysis, and systemic local anesthetic toxicity if a deep CPB is employed.^{2,14} In this respect, Stoneham has shown that a superficial CPB alone is just as effective as a combined superficial and deep CPB in producing satisfactory intra-operative analgesia.¹⁵ Other authors have confirmed similar effectiveness and fewer side effects with a superficial block.^{16,17} So, superficial CPB can be considered as an alternative to combined CPB with similar effectiveness and less side effects.¹⁵⁻¹⁷

Bevilacqua et al. (Anesthesia and Analgesia, June 2009) and Marcucci G et al. (International Angiology, December 2009) studied a new technique of anesthesia in CEA which was considered as a third option in addition to general and loco-regional anesthesia. This mode depends on patient cooperation during general anesthesia for neurological monitoring. This technique uses general anesthesia with remifentanyl conscious sedation. These studies have demonstrated that this new technique is safe and satisfactory.^{18,19}

Regarding our center experience, we do most of CEA cases under combined superficial and deep CPB without complications and we reserve GA mainly in case of patients refusing CPB (our data to be published later). Recently, we started to use ultrasound as guidance for deep CPB. Our surgeons prefer to insert shunts routinely in all patients under GA. For loco-regional cases we use continuous clinical neurological monitoring allowing early and specific detection of cerebral hypoperfusion and the easy, prompt and safe intervention whenever required. We encountered only one case that developed signs of cerebral hypoperfusion after carotid cross clamping under combined CPB. The patient became restless, sweaty and had worsening of his speech and right side hand grip (left CEA). The surgeon was immediately informed and temporary vascular shunt was inserted. The patient had immediate improvement in his signs and symptoms with recovery back to baseline. A conventional CEA was then completed uneventfully under CPB. His recovery period was uneventful, and he was discharged home in his baseline condition.

Conclusion

Although there is no clear opinion regarding the best technique of anesthesia in CEA, however, based on a good number of clinical trials that we reviewed and on our own experience, we concluded that loco-regional anesthesia, especially with the use of ultrasound is a comparatively safer technique, allowing monitoring of the neurological status during arterial clamping.

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