A unique anesthesia approach for carotid endarterectomy: Combination of general and regional anesthesia

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ABSTRACT

Carotid endarterectomy (CEA), a preventable surgery, reduces the future risks of cerebrovascular stroWke in patients with marked carotid stenosis. Peri-operative management of such patients is challenging due to associated major co-morbidities and high incidence of peri-operative stroke and myocardial infarction. Both general anesthesia (GA) and local regional anesthesia (LRA) can be used with their pros and cons. Most developing countries as well as some developed countries usually perform CEA under GA because of technical easiness. LRA usually comprises superficial, intermediate, deep cervical plexus block or a combination of these techniques. Deep block, particularly, is technically difficult and more complicated, whereas intermediate plexus block is technically easy and equally effective. We did CEA under a combination of GA and LRA using ropivacaine 0.375% with 1 mcg/kg dexmedetomidine (DEX) infiltration. In LRA, we gave combined superficial and intermediate cervical plexus block with infiltration at the incision site and along the lower border of mandible. We observed better hemodynamics in intraoperative as well as postoperative periods and an improved postoperative outcome of the patient. So, we concluded that combination of GA and LRA is a good anesthetic technique for CEA. Larger randomized prospective trials are needed to support our conclusion.

Key words: *Carotid endarterectomy, dexmedetomidine, intermediate cervical plexus block, superficial cervical plexus block*

INTRODUCTION

Carotid endarterectomy (CEA) is a preventive surgery. Early operation (≤2 weeks) in symptomatic patients is useful. Patients undergoing CEA with co-morbidities having a higher incidence of coronary disease and prone to intraoperative hemodynamics fluctuation.[1] So, anesthesiologists may encounter a high-risk patient with a minimum time for preoperative optimization. Both the intraoperative and postoperative periods are usually associated with major hemodynamic changes, leading to compromised cerebral or coronary circulation. The operation may be performed under local regional anesthesia (LRA) or general anesthesia (GA). Both the techniques have their own advantages and disadvantages, but without any difference in outcome.[2] Currently, operations in the neck are usually performed under GA, mainly because anesthesiologists are more comfortable with secured airway in GA over regional anesthesia (RA). However, RA has several advantages compared with GA, such as better postoperative analgesia, faster recovery, lower costs, and lower morbidity and mortality rates.[3] If LRA is the choice, CEA is typically approached via a combined superficial and deep cervical plexus (CP) block. LRA allows direct neurological monitoring in a conscious patient, but it is uncomfortable and stressful for the patient during surgery and is associated with technical complications, particularly with deep CP and cervical epidural block. Securing of airway and conversion into GA may be required at any point of time during the surgery. GA offers excellent operating conditions as well as some degree of neuroprotection during the period of cross-clamping of common carotid artery.[4] Here, we report a case of CEA done under a combination of GA and LRA using ropivacaine 0.375% with 1 mcg/kg dexmedetomidine (DEX) infiltration. We

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observed better hemodynamics in intraoperative as well as postoperative periods and an improved postoperative outcome of the patient. To the best of our knowledge, DEX infiltration with local anesthetic in CEA surgery has not been reported so far. We decided to report the case after obtaining written informed consent.

CASE REPORT

A 68- year-old male of weight 68 kg, who was a non-diabetic and a known hypertensive, and was taking telmisartan, atenolol, and amlodipine, presented to us. He had a history of coronary artery disease (CAD) for 3 years and was taking aspirin plus clopidogrel, isosorbide mononitrate, and atorvastatin. Carotid angiography showed 70% block in the right (Rt) side and 90% block in the left (Lt) side [Figure 1]. He presented with history of transient ischemic attack (TIA) 15 days ago, along with Rt-sided monoplegia of the upper limb. His general examination including vitals was unremarkable. Airway examination showed him to be edentulous, and other parameters were within normal limits. ECG showed left ventricular hypertrophy and inferior wall ischemia. Echocardiography revealed ejection fraction of 40-45% with mild diastolic dysfunction. He was premedicated with alprazolam and ranitidine, and all the drugs that he was taking, except telmisartan, were continued. In the operation theatre, all routine monitors including bispectral index (BIS) sensor were attached and arterial line was secured under LA. Baseline transcranial Doppler (TCD) was recorded. He was induced with fentanyl 100 mcg, propofol 80 mg, and vecuronium 6 mg. Anesthesia was maintained with sevoflurane in air/O_2 (35:65) plus vecuronium as a muscle relaxant, based on hemodynamics and BIS value. BP fluctuation was treated with phenylephrine and beta blocker/nitroglycerine as per the situation. Just after intubation, we performed ultrasound (Micromaxx Sonosite, Gurgaon, India)-guided intermediate and superficial CP nerve block with 5-10 MHz probe [Figure 2]. Then, before incision, the surgeon was asked to give the same drug along the incision line and parallel to the lower border of mandible [Figure 3]. Totally 25 ml of 0.375% ropivacine plus 75 mcg DEX was used in LRA. At the end of the operation, sevoflurane was stopped on completion of skin suturing. Patient was extubated safely following the criteria of extubation. Patient was monitored in the postoperative period for hemodynamics, saturation, ECG, analgesia, sedation, and neurological assessment up to 24 h. Patient was kept inside the neuro high-dependency unit up to 72 h after operation. We observed better hemodynamics intraoperatively with lesser fluctuation, less requirement of opioid analgesics, and stable heart rate (no tachycardia) and blood pressure. Also, there was lesser requirement of phenylephrine and hypotensive drugs and smooth emergence and recovery. In the postoperative period, we observed early neurological recovery, better postoperative hemodynamics, prolonged postoperative analgesia, and

Figure 1: Angiographic picture of carotid artery

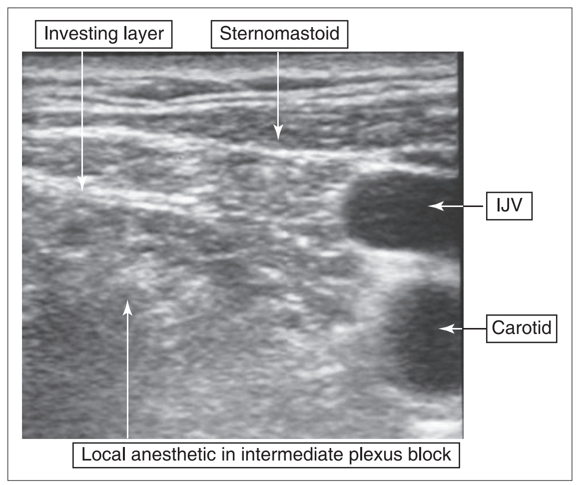

Figure 2: Ultrasonography neck showing intermediate plexus block with local anesthetic distribution

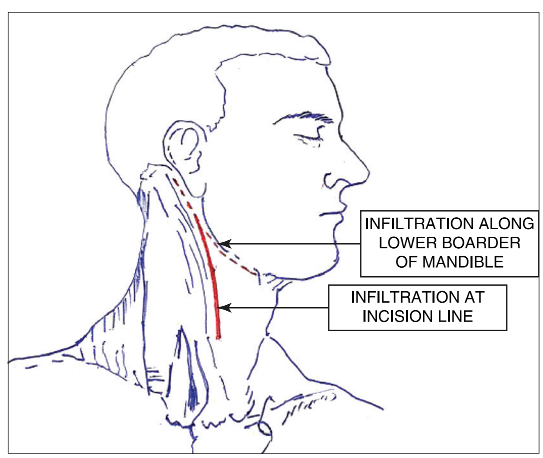

Figure 3: Incision line showing local anesthetic-dexmedetomedine infiltration

minimum requirement of rescue analgesia. Then, the patient was shifted to the ward and subsequently discharged on the 7th postoperative day.

DISCUSSION

Anesthesiologists should have a good knowledge of cerebral physiology and neck anatomy and a good understanding of the rapid pathophysiologic changes occurring during carotid artery manipulations for better management of and obtaining a good outcome in CEA. The major aims during GA for CEA are to preserve the cerebral circulation and oxygenation, provide cerebral protection, prevent myocardial ischemia, and prevent the patients from coughing and straining.

The goals of management of CEA are prevention and early detection of cerebral and myocardial ischemia, maintenance of hemodynamic stability, rapid recovery from anesthesia, and evaluation of neurological function. Cardiovascular fluctuation in hypertensive patients undergoing CEA is common.[1] The most feared and major peri-operative complications of CEA are cerebrovascular accident and myocardial infarction. Postoperative hypotension may compromise both myocardial and cerebral perfusion, and severe hypertension can produce cerebral hyperperfusion. In a study comparing CEA with carotid stenting, 13% of patients undergoing CEA had detectable cardiac troponin I release into the circulation.[5]

The CP, formed by the anterior rami of the four upper cervical spinal nerves, lies on the scalenus medius and levator anguli scapulae muscles and deep into the sternocleidomastoid muscle, and gives off both superficial and deep branches (SCP and DCP). The superficial branches provide cutaneous innervation to the head and anterolateral neck, whereas the deep branches innervate the muscles of the anterior neck, the anterior and middle scalene, and the diaphragm.[6] In superficial CP block (SCPB), the local anesthetic is given subcutaneously along the posterior border of the sternocleidomastoid muscle, whereas in intermediate CP block (ICPB), it is injected deep into the investing cervical fascia and superficial to the pre-vertebral fascia.[7] SCPB is associated with low complications, but ineffectively blocks the neck muscles, whereas ICPB paralyzes the neck muscles with a low complication rate. Hemodynamic stability and preserved cerebral autoregulation are the main advantages of LRA in contrast to GA, especially in a high-risk patient[8] [Figure 4]. In deep CPB (DCPB), after identification of the transverse processes of the C2-C4 cervical vertebrae, the local anesthetic is administered directly into the cervical paravertebral space, either as one single or three separate injections. DCPB is associated with better analgesia, but is technically difficult and associated with more serious complications such as epidural, subarachnoid, or vertebral artery injection and phrenic nerve block, and is contraindicated in anticoagulated patients.[9] CEA may be performed under either an SCPB or a combined DCPB and SCPB. CEA can be done under cervical epidural anesthesia with good operating conditions, but is associated with a significant risk of major anesthetic complications.[10]

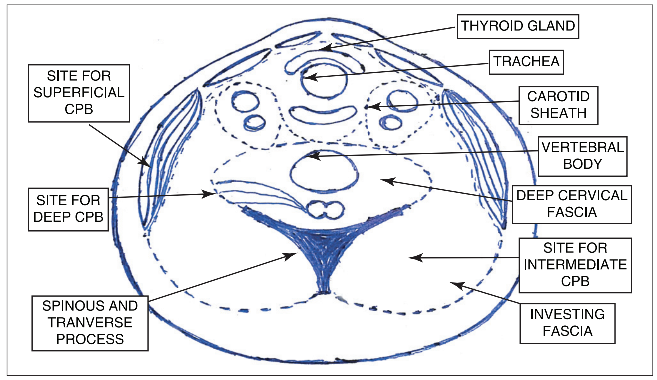

Figure 4: Neck cross section showing sites for superficial and intermediate plexus block

CEA may be performed under GA with intubation (preferred) or laryngeal mask airway (difficult airway access). Sevoflurane can help in rapid recovery, less vasodilation, and intact cerebral vascular reactivity to carbon dioxide when used alone. Propofol is comparable with sevoflurane.[11] Both volatile anesthetic agents and propofol may offer a degree of neuroprotection. Ultrasound-guided superficial, intermediate, and deep CPB has increased efficacy and safety in several disciplines.[12] Perisanidis *et al.* showed that ultrasound-guided intermediate and deep CPB is a feasible, effective, and safe method of RA for oral and maxillofacial surgical procedures.[13] Dinko *et al.* showed that intermediate catotid plexus block (ICB) is a safe and efficient RA technique, providing good hemodynamic stability with low neurological complication rate in high-risk patients (ASA III and IV).[14] Cheung *et al.* concluded that DEX seems to have an antihyperalgesic effect locally after bilateral third molar surgery.[15]

Yoshitomi *et al.* demonstrated that α-2 adrenoceptor agonists enhanced the local anesthetic action of lidocaine and suggested that DEX acts via α-2 adrenoceptors.[16]

In a randomized double-blind trial, DEX shortened the onset time and prolonged the duration of the block and postoperative analgesia when added to levobupivacaine for axillary brachial plexus block.[17] Addition of DEX to ropivacaine results in a dose-dependent increase in the duration of sensory and motor block.[18] DEX also helps to improve the block quality, prolong post-deflation analgesia, and decrease tourniquet pain when used as an additive to lignocaine in intravenous RA.[19]

DEX potentiates local anesthetics by binding to alfa 2 A subtype adrenergic receptors (α2A-AR) peripherally and enhances postoperative analgesia after intra-articular administration and direct infiltration in a dose of 1 mcg/kg as an adjunct to local anesthetics.[20]

In conclusion, we recommend a combination of GA and LRA using ropivacaine 0.375% with 1 mcg/kg DEX infiltration for CEA. Further prospective randomized trials are warranted to compare this new technique with the other available techniques.

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