CASE REPORT

Left Carotid Endarterectomy under Ultrasound-guided Intermediate Cervical Plexus Block in a Patient with Bilateral Internal Carotid Artery Web

Sayani Samanta [1]*, Sailaja Kamabathula [1]

Abstract

Background: Carotid endarterectomy is a high-risk surgery reducing future risk of stroke. Carotid cross clamping may result in ipsilateral cerebral ischemia.

Methods: We are reporting here a case of young male patient with bilateral internal carotid artery web, presenting with symptoms of left middle cerebral artery infarct. Case was done under ultrasound-guided left intermediate cervical plexus block after proper preoperative counselling regarding intraoperative awake state.

Results: Surgery was done uneventfully without any patient and surgeon discomfort. Neuro assessment was easily done, and hemodynamic surges were avoided by our anesthetic technique. Patient had minimal analgesic requirements postoperatively.

Conclusion: Ultrasound-guided intermediate cervical plexus block is a safe and effective anesthetic technique with advantages of neuromonitoring in an awake patient and maintenance of adequate hemodynamics where facilities for complex neuromonitoring are not available.

Keywords: Ultrasound; Intermediate cervical plexus block; Carotid Web; Carotid endarterectomy.

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Introduction

The carotid web is a radiological description of shelf like intraluminal projection in a carotid artery bulb.[1] It is an arteriopathy having fibromuscular intraluminal in-growth, which can lead to stroke without traditional atherosclerotic risk factors, thus manifesting in young, healthy patients.[2] Strict neurologic and hemodynamic monitoring is imperative in the perioperative period to prevent postoperative complications.[3] Over the years, regional anesthesia (RA) has undergone modifications to improve outcomes. Intermediate cervical plexus block (CPB) was introduced in 2004 by Telford & Stoneham as a sub-investing fascial injection. In 2010, Choquet et al. tried to redefine it using ultrasound (US).[4] Clinical trials fail to establish the superiority of one anesthetic technique over another, while precise techniques of RA having targeted endpoints show noticeable benefits.

Case Report

We report a case of 42-year-old male presenting with a history of right sided weakness and speech difficulty. He had left middle cerebral artery territory infarct five months ago, after which thrombolysis and mechanical thrombectomy were done. Later, CT angiogram showed a bilateral proximal internal carotid artery (ICA) web. Since he was symptomatic on the left side, left carotid endarterectomy (CEA) was planned to prevent recurrent strokes. He was a chronic smoker with no other comorbidities. Examination revealed right hemiparesis (power 3/5) and dysarthria. Investigations were within normal limits, including a good biventricular function. He was on tablet aspirin, clopidogrel, piracetam and atorvastatin which were continued to prevent perioperative and future risk of stroke.

Keeping in mind his being a chronic smoker, need for hemodynamic stability and real-time neurological assessment perioperatively, patient was counselled for his cooperation during surgery under RA. In case of pain, apprehension or breathing difficulty, the plan was to institute general anesthesia (GA). After proper knowledge of the risks and benefits of each technique, the patient consented to RA.

On the day of surgery, he was asked to empty bladder preoperatively, surgical safety checklist was performed, standard monitors were attached, intravenous access and invasive radial arterial line were placed on the right hand. With the patient in supine

position and head turned to his right, US machine was placed ergonomically near patient's right shoulder and right side of chest. Block was performed standing beside patient's left shoulder and left side of neck to avoid any eye strain, with block area and displayed sonoanatomy on US in line of sight.

Block area and 6 – 13 megahertz probe were draped to maintain sterility. Standard block tray, 10cc and 5cc syringes, 2% Lignocaine, 0.375% Bupivacaine and 50 mm Stimuplex needle were arranged.

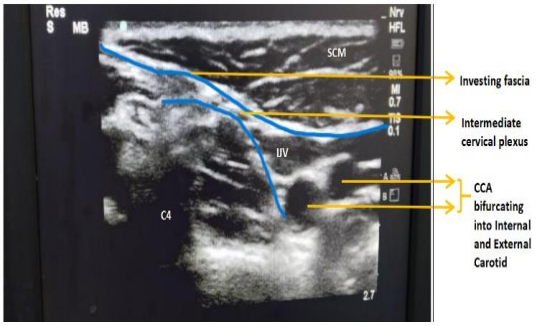
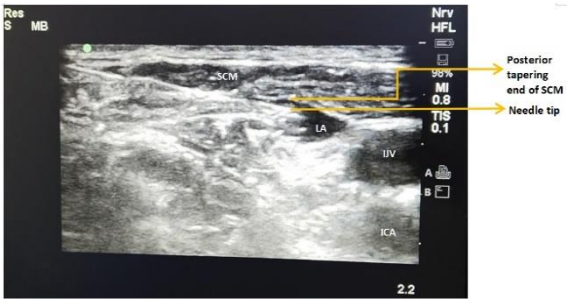


Figure 1a. Sonoanatomy of left intermediate CPB

Structures visualized: Sternocleidomastoid (SCM), common carotid artery (CCA) bifurcating into internal and external carotid branches, internal jugular vein (IJV), transverse process of 4th cervical vertebra (C4), intermediate cervical plexus, investing fascia.

The probe was placed transversely over the midpoint of SCM and moved cranially until the bifurcation of CCA was seen (Figure 1a). At this level, C4 transverse process was also visible. Probe was moved backwards to see the posterior tapering end of SCM. Post local infiltration at the entry point, a 50 mm Stimuplex needle was introduced via an in-plane approach (Figure 1b) after flushing with local anaesthetic. 0.375% Bupivacaine 18 ml was injected slowly after negative aspiration while observing the needle tip in real-time and appropriate drug spread below the posterior border of SCM close to the carotid artery.

Figure 1b. Sonoanatomy during the



block.

Structures visualized: posterior tapering end of SCM, entire needle length and its tip, local anaesthetic (LA) spread, IJV, internal carotid artery (ICA).

Drapes kept away from the patient's face using a barrier to keep him comfortable. After 15 minutes, post-block adequacy was assessed by loss of cold perception and pinprick. 1 mg midazolam and 50 µg fentanyl were given intravenously to keep the patient calm and 2 l/min oxygen was connected via nasal prongs. Prophylactically, 1 gm paracetamol was given intravenously. The incision was uneventful and routine surgical steps were followed. Post carotid cross-clamping, neurological assessment at 0, 1, 3 and every 5 minutes thereafter was uneventful. Speech and cognition were assessed by number counting, whereas motor power was assessed by asking the patient to grip the right hand and lift the right leg. No shunting was needed, and primary closure was done with a total clamping time of 40 minutes. Hemodynamic stability was maintained throughout the surgery. Postoperatively, he was shifted to surgical intensive care unit (ICU) and oxygen was continued overnight.

He was pain free, alert and cooperative with stable hemodynamics, without any recent onset neurodeficit. Slurring of speech was the same as before surgery. The first dose of paracetamol 1gm intravenous injection was given 8 hours post-surgery and continued thrice daily for one day. Numeric Rating Score was 1-2/10 postoperatively. The next day, the patient was discharged directly from ICU. On follow up, neurological complications were nil.

Discussion

Carotid web was initially mentioned as a filling defect in 1968, later as a web like septum.[5] In cryptogenic recurrent ischemic strokes, this accounted for 9.4 – 37% of cases. The first successful surgery was reported by Ehrenfeld et al. in 1967.[1]

Anesthetic management for CEA comprises multiple approaches with or without sedation. The aim is to maintain airway, oxygenation and cardiovascular stability in a pain free patient while providing good operating conditions and allowing cerebral monitoring.[6]

Important anatomical considerations include understanding cervical plexus formation and disposition of cervical fascia in the neck. It is formed by ventral rami of the first four cervical nerves.[7]

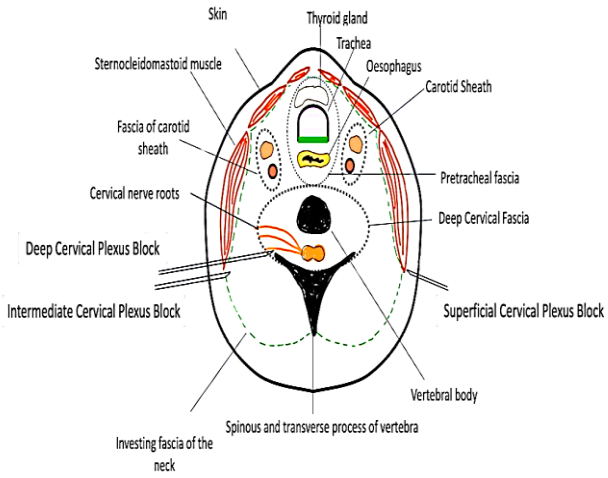


Figure 2. Fascial plane image showing different levels of CPB (Modified with permission from Singh SK)[8].

In 2003, Pandit et al. mentioned about sub investing fascial injection technique.[9] In 2007, they stated it as intermediate CPB, where needle tip pierces the investing fascia of neck deep to subcutaneous layer but stays superficial to prevertebral fascia (Figure 2).[10] In 2010, Choquet et al. documented that intermediate CPB targets posterior cervical space.

Under US guidance, the drug is injected between SCM and levator scapulae along with perivascular carotid sheath infiltration to block pain fibres along sympathetic nerves. However, the later can have adverse effects related to cranial nerve palsy.[11]

Supplemental infiltration during skin incision is used to block cross innervation from the contralateral side, mandibular division of the trigeminal nerve and cervical branch of the facial nerve.[12]

Nash and colleagues proposed that investing fascia is permeable and subcutaneous injectate may spread to deeper tissues, which Ramachandran and colleagues supported.[13] Deep CPB is a paravertebral block with superior analgesia and muscle relaxation, but can result in ipsilateral phrenic nerve, recurrent laryngeal nerve and stellate ganglion block. Inadvertent intra-arterial and intrathecal injections are not unknown.[7] Intermediate CPB is advantageous due to its optimal analgesia, enabling patient satisfaction and minimal adverse effect profile. However, Leblanc et al. reported dysphonia in 12%, Horner's syndrome in 4% and swallowing difficulty in 2% of patients undergoing US guided intermediate CPB. With para carotid infiltration, hoarseness and dysphagia were frequent.[4] Facial nerve block can also result.

The cervical epidural technique has significant risks, which are unacceptable in the presence of newer, safer techniques. Despite the GALA trial (a randomised comparison of general and local anesthesia for patients undergoing CEA) showing equivocal results, debate continues to date.[7]

The most crucial advantage of RA is keeping patients awake, which is the gold

standard in cerebral monitoring. Other options include transcranial doppler, electroencephalogram, somatosensory evoked potential and near-infrared spectroscopy, which are required when the patient is under GA.

Cardiovascular instability can precipitate stroke or adverse cardiac events. With RA, overall hemodynamic changes are less perioperatively in view of preserved cerebral autoregulation in awake patients. Under RA following cross-clamping, if the patient becomes drowsy and unresponsive with airway loss, shunting is needed to maintain ipsilateral cerebral circulation. Under GA placing shunts and stump pressure monitoring are options.

In a nutshell, GA is suitable for anxious patients and those with altered mental status. Volatile anesthetics render neuroprotection and better control of arterial carbon dioxide and airway. Advantages of RA include real-time neuro assessment, better hemodynamic profile, lesser shunt insertion, decreased post operative pain and preserved cerebral autoregulation.12 Patient cooperation is essential under RA. Though patient satisfaction is better with GA,[14] complex neuromonitoring modalities are unavailable in every center, which restricts its use in all cases. As per the GALA trial, the incidence of stroke, myocardial infarction or death till 30 days after surgery was 4.8% and 4.5% in the GA and RA groups respectively. Quality of life and length of hospital stay showed no significant difference.[15] Cochrane Database of Systemic Reviews in 2021 and its update in 2022 also do not point to clear benefits of one over the other.[16]

Supplementary sedation prevents stress-related movement and adverse cardiac events in patients under RA. Conscious intravenous sedation enabling patient communication throughout the surgery is preferred. The ideal agent should not cause any hypoventilation, airway compromise or hemodynamic instability and should be titratable easily. Options are propofol target controlled infusion, dexmedetomidine infusion having additional analgesic effects and remifentanil infusion if available with close respiratory rate monitoring. However, hypotension may be an issue with these options.[17] Premedication with low dose midazolam (0.5 -1mg) and intermittent doses of fentanyl (25-50µg) are also helpful.

Summary

Cervical plexus blocks need the identification of multiple cervical fasciae in a compact space. Anesthesia for carotid endarterectomy is challenging and evolving constantly. The choice of anesthesia depends on anesthesiologist and surgeon references, individual skills, patient comorbidities and satisfaction level. Good perioperative outcome is the main target irrespective of anesthetic technique. International standards should be reviewed to update local guidelines. An awake patient is preferred in low to middle income countries due to non-availability and complexity of neurological monitoring techniques. Cadaveric studies demonstrate the disposition of cervical fascia, thereby helping understand these blocks. Protocols aimed at reducing perioperative complications, morbidity and mortality should be discussed in future studies.

Conclusion

Considering risk vs benefit of intermediate cervical plexus block, availability of ultrasound and keeping in mind resources available in our set up, we opted for ultrasound-guided intermediate cervical plexus block as the preferred anesthetic technique for carotid endarterectomy. The presence of ultrasound in most setups and increasing trend towards precise ultrasound guided blocks can assist in further increase in carotid endarterectomy cases done under regional anesthesia in a safe and effective manner.

Funding:

None.

Conflict of interest:

None.

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