Original Article

Perioperative Outcome of Carotid Endarterectomy with Regional Anesthesia

Muhammad Nasir, Ilyas Sadiq and Farhan Iftikhar

ABSTRACT

Objective: To assess the effect of regional anesthesia in patients treated with carotid endarterectomy.
Study Design: A retrospective study
Place and Duration of Study: This study was conducted at the surgical ward of Doctors Hospital & Medical Centre Lahore from August 2018 to August 2021 for a period of 03 years.
Materials and Methods: A total of 150 patients undergoing carotid endarterectomy were included in the study and data was collected. Patients were administered with combined deep and superficial cervical plexus block. Remifentanil (0.025-0.05 mg/kg/min) was given to the patients during the procedure to make them comfortable, responsive and ensure their corporation. General anesthesia was only administered if the patient refused to consent to regional anesthesia or in case of any other complications. The main goal of the study was the occurrence of conversion from regional to general anesthesia during surgery.
Results: Out of 150 patients, regional anesthesia was opted for 148 patients, while 2 patients were administered general anesthesia. In 1 patient, conversion from regional to general anesthesia took place as the patient was irritated. A shunt was introduced in 20 (13.3%) patients due to loss of consciousness of patients during the carotid clamping. Complications occurred in 1 patient (0.6%) due to neurological deterioration and 1 intraoperative acute myocardial infarction (0.6%). No intra-operative death occurred. 1 patient (0.6%) died during his hospital stay. 2 patients (1.3%) suffered a major stroke and 1 patient (0.6%) suffered a minor stroke. The total rate of stroke and death was 2.6% (4 patients).
Conclusion: The in-hospital mortality under regional anesthesia in patients undergoing carotid endarterectomy is very low and requires very little conversion to general anesthesia. Hence regional anesthesia is regarded safe during carotid endarterectomy.

Key Words: Carotid endarterectomy, regional anesthesia, perioperative outcomes

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INTRODUCTION

Carotid stenosis patients are often at high risk of stroke. However, this risk is reduced effectively by surgical carotid endarterectomy[1,2]. When compared with endovascular carotid stenting, surgical carotid endarterectomy has significantly reduced the risk of perioperative and long-term minor stroke. The two procedures had comparable outcomes with regard to major stroke and long-term functioning[3].
During carotid endarterectomy, regional anesthesia and general anesthesia are administered to the patients but both these options have some degree of risk and cannot be regarded as perfectly safe.

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One of the major drawbacks of regional anesthesia is that it requires immediate conversion to general anesthesia. This conversion poses risk to the patient and causes hemodynamic instability. Very little has been done to investigate this conversion and its causes, therefore, we have studied it in our study. The goal of our study is to assess the effect of regional anesthesia in patients treated with carotid endarterectomy.

MATERIALS AND METHODS

A retrospective study was conducted from 3rd August 2018 to 3rd August 2021 at the surgical ward of Doctors Hospital & Medical Centre Lahore. A total of 150 patients undergoing carotid endarterectomy were part of the study and data was collected. All the patients agreed to participate in the study and Ethical Committee also approved the study. The patients who were also undergoing bypass surgery and percutaneous transluminal angioplasty (PTA) were excluded from the study.
The severity of carotid stenosis was categorized using the European Carotid Surgery Trial (ECST)[4]. In symptomatic patients, ipsilateral severe (70%-99%) or moderate (50%-69%) carotid stenosis was an indication for surgery and in asymptomatic patients, if there was a

high incidence for stroke, there was a need for surgery[5, 6].

Preoperative anticoagulation therapy was often replaced by perioperative "Heparin Bridge" depending upon patient's attributes and probability of any thromboembolic events. The patients were also administered heparin the night before surgery. All the patients who had unpaired coagulation profiles and received dual antiplatelet therapy were administered superficial plexus block. Patients were administered with combined deep and superficial cervical plexus block or superficial plexus block alone as per the anesthesiologist's recommendation.

Endovenous midazolam (0.2 mg/kg) was administrated and cervical plexus block was performed pre-surgery. While administering regional anesthesia during surgery, pulse oximetry, pulse, intra-arterial blood pressure, and 5-lead ECG was also recorded.

We used the anesthetic technique as used in literature[7, 8]. We performed a superficial cervical plexus block by subcutaneously injecting ropivacaine 0.75% in the posterior triangle. Similarly, we performed a deep cervical plexus block after a negative aspiration blood test by injecting 4 or 5 mL of 0.75% ropivacaine thrice at the level of the transverse processes of the higher cervical vertebrae (C2, C3, C4). A maximum of 1.5mg/kg ropivacaine was permitted to be injected. Lidocaine 1% (4 mg/kg maximum) was administered subcutaneously for wound infiltration. For pain management during the surgery, lidocaine (1%) was administered. Remifentanil (0.025-0.05 mg/kg/min) was given to the patients during the procedure to make them comfortable, responsive and ensure their corporation and blood pressure was controlled by continuous titration of endovenous infusion of nitroglycerin. If necessary, clonidine or urapidil was injected. Midazolam or fentanyl was also injected during the procedure on occasion. Conversion to general anesthesia was only done if any complication like allergy to regional anesthesia, an infection at the site of the block, or if the patient refused to opt for regional anesthesia.

Systemic heparinization (50 IU/kg) was used with an activated clotting time target greater than 200 seconds and at the end of the procedure, 5mg protamine was injected. If the carotid cross-clamping test showed neurologic deterioration, a shunt was placed.

The primary endpoint was the rate of conversion of regional to general anesthesia during the surgery. The data was recorded for the rate of myocardial infarction, ICU admission, irregular heartbeat, need for re-operation. Secondary endpoints were the mortality rate and frequency of the major heart and neurological events (minor and major strokes and mini-stroke).

Minor stroke was a condition whose onset of symptoms lasted up to 24 hrs. Major stroke was a non-disabling stroke that showed neurological symptoms at hospital discharge. Minor stroke was a stroke with mild symptoms that lasted between 24 hours and hospital discharge.

Statistical analysis: Study population and risk of complications were described by descriptive statistics. The occurrence events and risk ration along with 95% CI was documented. Data was calculated in mean and numbers and percentages, standard deviation, or median and interquartile range. Comparison of groups was done by performing Fisher's exact test, t-test, or complement c2 serum test. If P was less than 0.05, it was regarded as statistically significant. GraphPad Prism version 6.00 for Mac OS X was used to analyze all study data.

RESULTS

Results from 152 endarterectomies in 150 patients were included in this study. Table I shows patients' demographic data. 148 patients (98.6%) received regional anesthesia and 2 patients (1.3%) were administered general anesthesia. In 1 patient (0.6%), conversion from regional to general anesthesia took place as the patient was irritated. A shunt was introduced in this patient. So, the rate of conversion from regional anesthesia to general anesthesia was 0.6% (1 of 150) (95% confidence interval, 0.14-0.59). The patients who were administered regional anesthesia and those who received general anesthesia did not differ with regard to demographic and clinical characteristics before surgery.

Table No.1: Patients' Demographics Data

Demographic characteristics	
Age, years	69.5±700
Male	93 (62%)
Medical history	
Hypertension	110 (73.3%)
Dyslipidemia	65 (43.3%)
History of neurological events	34 (22.6%)
Stroke	13 (8.6%)
TIA	8 (5.3%)
Syncope	4 (2.6%)
Amaurosis	3 (2%)
Vertigo	4 (2.6%)
Other neurological symptoms	2 (1.3%)
Type 2 diabetes mellitus	30 (20%)
Smoking history	27 (18%)
Renal insufficiency	22 (14.6%)
Chronic obstructive pulmonary disease	8 (5.3%)
Acute myocardial infarction	15 (10%)
PBCI or CABG	30 (20%)

Four surgeons performed the surgeries. The surgery time of general anesthesia patients was more than regional anesthesia patients (76.5 ± 18.7 vs 164± 15.8 minutes, $p<0.01$). A shunt was introduced in 20 (13.3%) patients receiving regional anesthesia due to

loss of consciousness of patients during the carotid clamping but only one was converted to general anesthesia. No intra-operative death occurred.

Post-surgery complications were only observed in 1 patient (0.6%) who suffered a heart attack during surgery and cardiogenic shock after the procedure and required Percutaneous coronary intervention immediately after surgery, admission in the ICU, intra-aortic balloon pump, inotropes, and ventilator. Three days after the surgery, he underwent revision surgery for bleeding. After 20 days, he suffered a transient ischemic attack and pneumonia. After a month, he showed no symptoms and was hence, discharged.

1 patient underwent re-operation due to acute neurologic deterioration post-surgery. 1 patient (0.6%) died during his hospital stay.

Table No.2: Postoperative complications

Combined stroke and death	4 (2.65)
Reoperation	2 (1.3%)
Bleeding	1 (0.6%)
Neurological events	1 (0.6%)
Admission to ICU	1 (0.6%)
From the OR	1 (0.6%)
From the ward	-
Major stroke	2 (1.3%)
Ischemic	1 (0.6%)
Hemorrhagic	1 (0.6%)
Minor stroke	1 (0.6%)
TIA	-
Myocardial infarction	1 (06%)
Renal artery thrombosis	-
Surgery time, minutes	65 ±17
Hospital stay, days	4.54 ±1.98
In-hospital mortality	1 (0.6%)
Caused by a major stroke	1 (0.6%)
Caused by myocardial infarction	-

DISCUSSION

Among the 150 study patients, only 1 patient (0.6%) required conversion from regional anesthesia to general anesthesia, which is less than the rate in previous studies.

According to research, patients convert to general anesthesia due to adverse events in surgery and complications caused by regional anesthesia. Most of the patients convert due to failure of local anesthesia which makes the patients uncomfortable and restless, pain, claustrophobia, local anesthetics toxicity, blockage of airway because of cervical hematoma, accidental injection of local anesthetics in the subarachnoid region, and vocal fold paralysis leading to respiratory distress[9, 10]. On the other hand, during surgery, patients are mostly converted to general anesthesia due to syncope at carotid clamping and problems caused by shunt placement (reduced perfusion, gas or plaque embolization, physical injury during shunt insertion or removal)[11, 12].

In the present study, the patient converted to general anesthesia due to discomfort and irritation due to failure of local anesthesia or claustrophobia. Block failure was also observed in other researches[9, 13, 14].

No intraoperative and only one postoperative death was reported in our study and this mortality rate is significantly less than previous research. Also, with regard to in-hospital outcomes, the mortality rate in our population was significantly lower than the mortality rate reported in other studies. This low mortality rate has been explained in other studies[15].

The incidence of stroke in our study was lower than in the literature[16, 17]. Additionally, the cardiovascular events after the surgery in our study comply with other studies[14, 16].

Our study can help surgeons administer cervical locoregional anesthesia especially cervical superficial plexus block more effectively with fewer adverse effects.

CONCLUSION

As indicated by the results of the study, the in-hospital mortality under regional anesthesia in patients undergoing carotid endarterectomy is very low and requires very little conversion to general anesthesia. Hence regional anesthesia is regarded safe during carotid endarterectomy.

Limitations: We did not record pain and discomfort data from patients undergoing carotid endarterectomy under regional anesthesia. We also did not record differences in clinical outcome, anesthesia administered during surgery, and surgery duration for surgery patients who were administered superficial or combined deep-superficial cervical plexus block. No data of preoperative medication and their effect was collected. Our study may not be suitable for centers that do not prefer regional anesthesia for carotid endarterectomy.

Author's Contribution:

Concept & Design of Study:	Ilyas Sadiq
Drafting:	Muhammad Nasir, Farhan Iftikhar
Data Analysis:	Farhan Iftikhar, Muhammad Nasir
Revisiting Critically:	Ilyas Sadiq, Muhammad Nasir
Final Approval of version:	Ilyas Sadiq

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Rerkasem A, Orrapin S, Howard DP, Rerkasem KJCDoSR. Carotid endarterectomy for symptomatic carotid stenosis 2020(9).

2. Keyhani S, Madden E, Cheng EM, Bravata DM, Halm E, Austin PC, et al. Risk prediction tools to improve patient selection for carotid endarterectomy among patients with asymptomatic carotid stenosis 2019;154(4):336-44.
3. Kong J, Li J, Ye Z, Fan X, Wen J, Zhang J, et al. Carotid endarterectomy with routine shunt for patients with contralateral carotid occlusion 2017;23(5):227-32.
4. Rothwell P, Gutnikov S, Warlow CJS. Reanalysis of the final results of the European Carotid Surgery Trial 2003;34(2):514-23.
5. Krawisz AK, Carroll BJ, Secemsky EAJCC. Risk Stratification and Management of Extracranial Carotid Artery Disease 2021;39(4):539-49.
6. Gaba K, Ringleb PA, Halliday AJCn, reports n. Asymptomatic carotid stenosis: intervention or best medical therapy? 2018;18(11):1-9.
7. Chiesa R, Melissano G, Castellano R, Tshomba Y, Marone E, Civilini E, et al. Carotid Endarterectomy: experience in 8743 cases 2009; 1(3):33.
8. Collins VJ. Principles of anesthesiology: Lea & Febiger; 1966.
9. Uhlig C, Vicent O, Spieth S, Ludwig S, Reeps C, Heller AR, et al. Influence of anatomic conditions on efficacy and safety of combined intermediate cervical plexus block and perivascular infiltration of internal carotid artery in carotid endarterectomy: a prospective observational trial. Ultrasound Medicine Biol 2021;47(10):2890-902.
10. Patelis N, Diakomi M, Maskanakis A, Maltezos K, Schizas D, Papaioannou MJSjoa. General versus local anesthesia for carotid endarterectomy: Special considerations. Saudi J Anaesthesia 2018; 12(4):612.
11. Wiske C, Arhuidese I, Malas M, Patterson RJJovs. Comparing the efficacy of shunting approaches and cerebral monitoring during carotid endarterectomy using a national database. J Vascular Surg 2018;68(2):416-25.
12. Kondo T, Ota N, Göhre F, Kinoshita Y, Noda K, Kamiyama H, et al. High Cervical Carotid Endarterectomy–Outcome Analysis. World Neurosurg 2020;136:e108-e18.
13. Kim JW, Huh U, Song S, Sung SM, Hong JM, Cho AJTKjot, et al. Outcomes of Carotid Endarterectomy according to the Anesthetic Method: General versus Regional Anesthesia 2019;52(6):392.
14. Lumas S, Hsiang W, Akhtar S, Chaar CIOJAoVS. Regional Anesthesia is Underutilized for Carotid Endarterectomy Despite Improved Perioperative Outcomes Compared with General Anesthesia. Korean J Thoracic And Cardiovascular Surg 2021;73:336-43.
15. Mitra M, Basu M, Shailendra K, Biswas NJJoFM, Care P. Risk reduction in anesthesia and sedation—An analysis of process improvement towards zero adverse events. J Family Med Primary Care 2020;9(9):4592.
16. Yılmaz F. Anesthesia management for carotid endarterectomy. E J Cardiovascular Med 2019; 7(2):50.
17. Dakour-Aridi H, Gaber MG, Khalid M, Patterson R, Malas MBJJovs. Examination of the interaction between method of anesthesia and shunting with carotid endarterectomy. J Vascular Surg 2020; 71(6):1964-71.