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Experience of Carotid Endarterectomy and its Complications Under Superficial Cervical Block in Conscious Patients in a Tertiary Care Hospital

Aftab Ahmad Khan, Muhammad Jamil, Khurram Shoaib Khan, Shazadi Ambreen*

Department of Vascular Surgery, Combined Military Hospital Rawalpindi/National University of Medical Sciences (NUMS) Pakistan, *Department of Physiology, Shifa Tameer-e-Millat University Islamabad Pakistan

ABSTRACT

Objectives: To determine the frequency of post-operative complications of carotid endarterectomy conducted under superficial cervical block.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Vascular Surgery, Combined Military Hospital, Rawalpindi, Pakistan Sep 2019 to Feb 2021.

Methodology: A total of 70 patients who reported to the Vascular Surgery Department, Combined Military Hospital, Rawalpindi Pakistan with an indication for carotid endarterectomy who met the sample selection criteria were included in this study. All patients underwent carotid endarterectomy and were followed up for subcutaneous and subplatysmal hematoma formation, the development of Neuropraxia, stroke and bleeding which required exploration for 4 weeks. Data was analyzed by SPSS 26.0.

Results: A total number of 10(14.3%) developed complications while 60(85.7%) surgeries were uneventful. Out of the total complications, hematomas accounted for 4(40%) of cases, while Neuropraxia and contralateral stroke accounted for 2(20%) of the cases each. Of the remaining two cases one developed myocardial infarction (MI) treated by cardiologist and discharged 5th postoperative day while the other required exploration for persistent hemorrhage.

Conclusion: Carotid endarterectomy under superficial cervical nerve block is a safe and effective procedure, with good outcomes.

Keywords: Carotid Endarterectomy, Post-operative Complications, Superficial Cervical Block.

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INTRODUCTION

Atherosclerosis causes sub-intimal atheroma which lead to arterial occlusion followed by thrombosis resulting in cerebral infarction if it embolizes. The burden of stroke and resulting disability is enormous, with an incidence of 95/100,000 in Pakistan.[1] It is estimated that approximately half to three quarters of all patients with stroke have carotid artery disease.[2] Carotid endarterectomy (CEA) may be employed for the management of both asymptomatic and symptomatic carotid artery stenosis. Patient selection is based on the percentage of stenosis as identified by Duplex ultrasonography and confirmed by computed tomography (CT) angiography. Patients are divided into four groups on the basis of these tests: patients with carotid stenosis <50 (%), those with 50-69(%) stenosis, and those with 70-99(%) stenosis and patients with total occlusion.[3]

CEA has been shown to be three times more effective in patients with 70-99(%) stenosis when compared to medical management. For patients with 50-69(%) stenosis, the risk/benefit ratio is weighed in each individual case. Patients with less than 50(%) stenosis do not get any benefit from CEA when compared to medical management alone. CEA can be performed under general or regional anesthesia (superficial cervical block plus local anesthesia).[4] The advantage of doing it under superficial cervical block is per-operative neurological monitoring in awake patients. If patients develops per-operative neurological symptoms on cross clamping, a temporary shunt may be used to maintain cerebral blood flow. Complications of the procedure include hematoma at surgical site, bleeding requiring exploration to secure hemostasis and to prevent airway compromise, peri-operative stroke which can be temporary or permanent and reperfusion associated cerebral edema. There is also a risk of developing myocardial infarction. .The cranial

Correspondence: Dr Aftab Ahmad Khan, Department of Vascular Surgery, Combined Military Hospital Rawalpindi Pakistan

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nerves at risk are vagus nerve 3.99 % hypoglossal nerve 3.79 % marginal mandibular nerve 1.58 % glossopharyngeal nerve 0.22 % and spinal accessory nerve 0.21 %.[5] The GALA trial (General anesthesia versus local anesthesia) in 2013 found no difference in perioperative stroke, MI, or death among patients receiving regional and general anesthesia. Thus, the benefits of local anesthesia / superficial cervical block include cost effectiveness and clinical peri-operative neurologic monitoring, with a similar result.[6]

The aim of this study was to evaluate our experience of performing carotid endarterectomy under superficial cervical block in order to understand the incidence of complications encountered in our vascular surgery unit during carotid endarterectomy and to compare it with internationally reported data.

METHODOLOGY

We conducted a cross-sectional study from September 2019 to February 2021 in the Department of Vascular Surgery, Combined Military Hospital, and Rawalpindi with a sample of 70 patients who gave informed consent. Cases were selected via non-probability consecutive sampling. Approval was obtained from Ethical Committee/Institutional Review Board letter number 140/3/21.

Inclusion Criteria: Patients of all ages and both gender with asymptomatic and symptomatic carotid artery stenosis undergoing carotid endarterectomy were included in the study.

Exclusion Criteria: Patients who underwent combined carotid endarterectomy and coronary artery bypass surgery or carotid percutaneous transluminal angioplasty through neck surgical incision were excluded.

The sample size was calculated using the WHO sample size calculator keeping a confidence level of 95%, an absolute precision of 0.039, and an anticipated population proportion of 0.023.[7] All patients were evaluated with a thorough history and examination before the surgical procedure. Each patient received an ultrasound guided superficial cervical nerve block with 0.25(%) Bupivacaine: the mastoid process and Chassaignac's tubercle (anterior tubercle of transverse process of C6) were identified.[8] A line connecting these two anatomical landmarks was drawn. The midpoint of this line marked the location of superficial cervical plexus and it was the point of needle insertion for local anesthetic. After performing the block we waited for 10-15 minutes so that it becomes effective. Amoxicillin / Clavulanate 1.2 g intravenously was given as a prophylactic antibiotic 20 minutes before making the incision. All cases were operated upon by consultant vascular surgeon with fellow vascular surgery as assistant. Vertical incision on the anterior border of the sternocleidomastoid muscle was given. After gaining vascular control, anti-coagulation was given and the vascular clamps were applied. The sequence of clamping was internal carotid artery, followed by common carotid artery and then external carotid artery. The carotid artery was opened by anteriorly placed arteriotomy and the atheroma was removed with the feathering technique. At arteriotomy closure it was assessed whether to close the arteriotomy primarily or using a patch. Both are accepted techniques and depends upon surgeons' preference and institutional experience.[9-12] .We measured the diameter of internal carotid artery and closed the arteriotomy primarily if the diameter was > 4 mm. We closed primarily in 68 patients and by Dacron patch in 02 patients. Arteriotomy closure was performed without clinical narrowing and good per-operative flow. JAVID Shunt was used for per-operative neurological symptoms if required. Suction drain was placed in all patients and removed after 24 hours.

All patients were given anti-coagulation post-operatively and all patients were admitted in intensive care or high dependency unit for the first 24 hours post-operatively and subsequently shifted to inpatient floors for a further 24 hours. In the absence of any complication all were discharged on third post-operative day. Data was collected and entered into proformas. Data was analyzed using SPSS version 26.0. Mean±SD was calculated for quantitative variables like age. Qualitative variables like gender, presence of comorbidities, smoking addiction, functional status, development of complications, and type of complications developed and complications of surgery were recorded in terms of frequency and percentage.

RESULTS

A total of 70 patients were included in the study. Out of 70 patients 48(68.6%) were males and 22(31.4) patients were females. Our patients had a mean age of 67.24 ± 6.02 years, (p=0.68).46(65.7%) were smokers and remaining 24(34.4 %) were nonsmokers. All patients were having co morbid medical illness.19(27.1%) were diabetics, 29 (41.1%) were having both diabetes and hypertension and 22(31.4%) had coronary intervention for ischemic heart disease in addition to diabetes and hypertension.

40(57.1%) were independent and 30(42.9%) were partially dependent. (Table).

Table: Baseline characteristics of the Patients undergoing carotid Endarterectomy

Characteristics	n (percentage)
Gender	
Male	48(68.6)
Female	22(31.4)
Smoking	
Smokers	46(65.7)
Non smokers	24(34.4)
Co-morbid	
DM	19(27.1)
DM+HTN	29(41.4)
DM+HTN+CI	22(31.4)
Dependency	
Independent	40(57.1)
Partially dependent	30(42.9)

Surgery was uncomplicated in 60(85.7%) patients and complicated in 10(14.3%) patients.The complications observed in our study group were subcutaneous hematoma in 4(5.71%) patients, Neuropraxia of marginal mandibular nerve in 2(2.85%) patients, contralateral stroke in 2(2.85%) patients. One patient (1.42%) required exploration for bleeding and one patient (1.42%) developed myocardial infarction treated by cardiologist and improved (Figure).

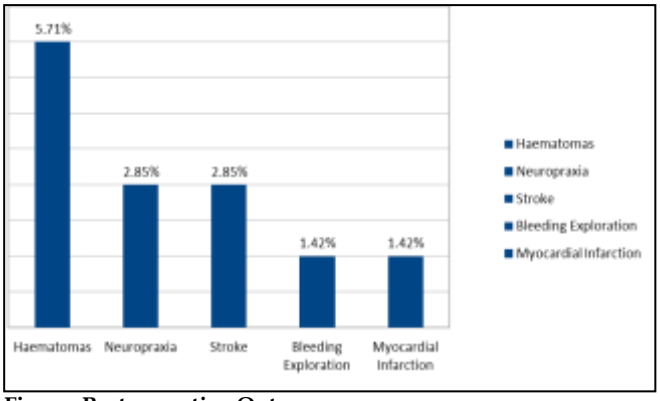

Figure: Post-operative Outcomes

DISCUSSION

Carotid endarterectomy is a safe procedure which is very commonly performed in vascular surgery unit. It has an increasing role in the prevention of cerebrovascular accidents. The associated complications of this procedure may be within an acceptable range if performed properly i.e. with the necessary preparation and precaution. Carotid artery stenosis is responsible for 20-30(%) of all ischemic strokes, which have significant morbidity and mortality.[13]

The first recorded CEA was performed by Michael DeBakey at Methodist hospital in Houston, Texas in 1953.[14] The landmark trial North American symptomatic carotid endarterectomy (NASCET) trial compared the benefits of CEA versus medical management. The risk of major stroke and death was 8(%) with surgical intervention and 19.1 (%) with medical therapy only while the risk of any stroke or death was 15.8(%) and 32.3(%) in surgical and medical groups, respectively. The internationally reported incidence of overall complications for CEA was < 3 (%) while the frequency of peri-operative CVA and death was 2-6.5(%)., while the mortality rate was 0.8(%) and 0.3(%) in a European and North American trial, respectively.[15] In asymptomatic carotid artery stenosis, 1.4(%) suffer ipsilateral stroke while this number is 3.2(%) in symptomatic individuals.[16] Bleeding requiring exploration is seen 1.8(%) and cranial nerve injury 1.8(%) in international data.[17]

The reported national data showed 0.6(%) mortality. Focal neurological deficit 1.8(%) subcutaneous neck hematoma 11.7(%).[18]

In our study group, males suffering from carotid artery stenosis were more common than females. Most of them were smokers or had recently quit smoking. The usual co-morbid medical illnesses were diabetes mellitus alone, diabetes mellitus plus hypertension and diabetes mellitus plus hypertension and previous cardiac intervention with frequencies of 27.1(%), 41.4(%) and 31.4(%), respectively. 45.71(%) of our patients were independent in their functional status while 54.28(%) were partially dependent. This is attributed to symptomatic patients who suffered either recurrent transient ischemic attack or strokes.

Neck hematoma results from pre-operative antiplatelet therapy, post-operative anti-coagulation or hypertension usually with a systolic blood pressure > 150 mmHg.[19] In our study, 4 patients 5.71(%) developed subcutaneous hematoma but none required re-intervention. These patients were initially observed in intensive care for expansion of hematoma and for airway compromise. None developed any dangerous effects and settled spontaneously. One patient developed deep tension hematoma 1.4(%) requiring exploration for impending airway compromise. Hematoma was the result of a venous ooze. It was evacuated and hemostasis secured. Post-operatively, the patient made a smooth recovery.

Nerve injuries are reported in 5-6(%) of cases, internationally.[20] In our study group, 2.85(%) (n=2) developed transient Neuropraxia which settled after 6-8 weeks, postoperatively. Both patients had a higher bifurcation of common carotid artery and Neuropraxia resulted from traction on marginal mandibular nerve. Myocardial infarction (MI) has a reported incidence of 0-2(%) in international literature.[21] 1.4(%) developed MI in our study group. One patient developed myocardial infarction on the first post-operative day and was treated by a cardiologist. This patient recovered well and was discharged on the 5th post-operative with out-patient follow-ups.

Post-operative stroke has an incidence of 0.25-3(%).[22] It usually results from blood loss, thrombosis at surgical site leading to embolism or prolonged clamp time resulting in cerebral vasospasm. Our study observed the incidence of contralateral stroke to be 2.85(%). These patients had arm and speech weakness and required neurological treatment and follow up. Shunts were used in 4 patients because of the development of neurological signs and symptoms. These patients did not exhibit postoperative neurological deficit. There was no permanent nerve injury seen in our study and no death occurred.

Our data suggests that carotid endarterectomy can be performed safely under superficial cervical block, obviating the need of general anesthesia and the complication rate is comparable with internationally reported data. Our study was limited by a small sample size and short study period, as well as a lack of comparison with general anesthesia.

CONCLUSION

Carotid endarterectomy is a relatively simple procedure with significant benefits in terms of morbidity and mortality. The procedure was previously performed under general anesthesia which may not be feasible in such patients who usually suffer from multiple comorbidities. The superficial cervical nerve block has been proven to be an effective alternative in such patients with results and complication rates comparable to procedures performed under general anesthesia. Effective, rational employment of the local anesthetic technique will help to broaden the patient base to whom this intervention can be offered, increasing the utility of this useful procedure.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AAK & MJ: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

KSK & SA: Data acquisition, data analysis, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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