

## Regional Cervical Plexus Blockage for Carotid Endarterectomy in Patients with Cardiovascular Risk Factors

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### ABSTRACT

**Background:** Carotid artery disease is not rare in cardiac patients. Patients with cardiac risk factors and carotid stenosis are prone to neurological and cardiovascular complications. With cardiac risk factors, carotid endarterectomy operation becomes challenging. Regional anesthesia is an alternative option, so we aimed to investigate the operative results of carotid endarterectomy operations under regional anesthesia in patients with cardiac risk factors.

**Methods:** We aimed to analyze and compare outcomes of carotid endarterectomy under regional anesthesia with cardiovascular risk groups retrospectively. Between 2006 and 2014, we applied 129 carotid endarterectomy ± patch plasty to 126 patients under combined cervical plexus block anesthesia. Patients were divided into three groups (high, moderate, low) according to their cardiovascular risks. Neurological and cardiovascular events after carotid endarterectomy were compared.

**Results:** Cerebrovascular accident was seen in 7 patients (5.55%) but there was no significant difference between groups ( $P > .05$ ). Mortality rate was 4.76% ( $n = 6$ ); it was higher in the high risk group and was not statistically significant ( $P = .180$ ). Four patients required revision for bleeding (3.17%). We did not observe any postoperative surgical infection.

**Conclusion:** Carotid endarterectomy can be safely performed with regional cervical anesthesia in all cardiovascular risk groups. Comprehensive studies comparing general anesthesia and regional anesthesia are needed.

### INTRODUCTION

Carotid endarterectomy (CEA) is a standard surgical treatment for significant carotid artery stenosis. This operation can be performed via general anesthesia or regional cervical plexus blockage. Regional cervical plexus blockage is traditionally classified into two groups: deep and superficial [Pandit 2007]. Additionally, intermediate and

combined cervical plexus blockage procedures can be used for this purpose. When the carotid artery is clamped due to regional anesthesia, neurological monitoring including verbal communication, orientation evaluation, and motor function control is possible with this technique [Agrifoglio 1993; Anderson 1980].

Patients with carotid artery stenosis and concomitant cardiovascular risk factors who underwent CEA are prone to neurological and cardiovascular complications. It is well known that postoperative complications in these groups of patients are significantly lower in regional anesthesia groups in comparison with that of general anesthesia groups [Anderson 1980; Markovic 2012].

We routinely perform carotid endarterectomy operations via combined (superficial + deep) cervical plexus blockage. We aimed to evaluate the operative results of patients who underwent carotid endarterectomy operation via combined cervical plexus blockage according to their cardiovascular risks, and to evaluate the neurological and cardiovascular postoperative outcomes.

### MATERIALS AND METHODS

Between 2006-2014, 129 carotid endarterectomy ± patch plasty operations were performed in 126 patients. In three patients, carotid endarterectomy was performed bilaterally. Combined cervical plexus blockage was used in all patients by using bupivacaine and lidocaine. For patch plasty, we used saphenous vein, dacron, fabric, PTFE or carotid patch materials. Carotid shunt was used when the retrograde flow was not enough or if there was a significant stenosis/occlusion on the contralateral carotid artery, or if a neurological deficit was seen due to operation. Antiplatelet agents, statins, antihypertensive drugs and antibiotics were given to patients postoperatively as standard medications.

Patients were divided into three groups according to their cardiovascular risks: high, moderate and low. High risk group (Group I): Myocardial infarction (MI) in last six weeks, unstable angina pectoris and/or Canadian Cardiovascular Society (CCS) class III/IV, congestive heart failure and concomitant valvular heart disease. Moderate group (Group II): Ejection fraction (EF) 30-50%, MI in more than six weeks, stable angina pectoris and/or CCS class I/II and arrhythmia. Low risk group (Group III): No MI history and normal cardiac

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Table 1. Patient Demographics

	High risk (n = 35)	Moderate risk (n = 43)	Low risk (n = 48)	P
Age	63.72 ± 10.91	71.80 ± 6.44	65.32 ± 10.64	.621
Sex, male, n (%)	22 (62.8)	35 (81.4)	37 (77.1)	.906
Symptom, n (%)	6 (17.1)	22 (51.1)	42 (87.5)	.005*
DM, n (%)	6 (17.1)	15 (34.8)	10 (20.8)	.335
HT, n (%)	15 (42.8)	22 (51.1)	22 (45.8)	.582
COPD, n (%)	9 (25.7)	0 (0.0)	10 (20.8)	.650
Dyslipidemia, n (%)	14 (40.0)	7 (16.2)	4 (8.3)	.021**

DM indicates diabetes mellitus; HT, hypertension; COPD, chronic obstructive pulmonary disease.

\*In low risk group, being symptomatic is statistically significant.

\*\*Dyslipidemia is statistically higher in high risk group.

functions. All the patients in these three groups were evaluated postoperatively according to their neurological and cardiovascular status. Major stroke and minor cerebrovascular events and also cardiovascular complications were recorded.

SPSS (Statistical Package for the Social Sciences) version 15 was used for statistical analysis. Kolmogorov-Smirnov test was used for normality test. Parametric data was expressed as mean ± standard deviation. Hemodynamic parameters, cardiovascular and/or neurological complications were evaluated by chi-squared test.  $P < .05$  was statistically significant.

## RESULTS

Between 2006 and 2014, 129 carotid endarterectomy ± patch plasty operations were performed in 126 patients. Patients were divided into three groups according to cardiovascular risk factors. Demographic characteristics of the groups are shown in Table 1.

Bleeding requiring revision was seen in four patients (3.17%) but this was not statistically significant between groups. MI was seen in 5 patients (3.96%) and was higher in the high risk group ( $P > .05$ ). Cerebrovascular accident (CVA) was seen in 7 patients (5.55%) and there were no differences between groups. Six patients died after operations (4.76%) because of their comorbid diseases. Postoperative complications were higher in the high risk group but did not reach statistical significance (Table 2). There was no complication related to anesthesia and we did not need to change our method for general anesthesia.

## DISCUSSION

Carotid endarterectomy is accepted as a very effective operation for appropriate patients, and decreases the risk of stroke with strong evidence. It is also suitable for elderly patients with comorbid diseases. We prefer cervical blockage

Table 2. Postoperative Complications

	High risk (n = 35)	Moderate risk (n = 43)	Low risk (n = 48)	P
CVA, n (%)	2 (5.71)	4 (9.3)	1 (2.08)	.191
MI, n (%)	3 (8.57)	1 (2.32)	1 (0.74)	.148
Mortality, n (%)	3 (8.57)	2 (4.34)	1 (2.08)	.180
Hemorrhage, n (%)	2 (5.71)	0 (0.0)	2 (4.16)	.503

CVA indicates cerebrovascular accident; MI, myocardial infarction.

technique because it provides direct observation of the neurological functions due to operation. In some studies, cervical blockage technique has had better outcomes on general anesthesia regarding perioperative stroke, arrhythmia and perioperative MI [Markovic 2012]. It is possible to see a patient's neurological functions directly, it does not inhibit cerebral autoregulation mechanism, and it allows postoperative early mobilization that prevents the patient from respiratory problems and deep vein thrombosis. However, regional anesthesia also has an advantage in its cost-effectiveness. Postoperative major stroke rate was 5.55% in our study. It is higher in NASCET and ECST studies (2.9% and 2.5%) [Ferguson 1999; ECSTCG 1991] but this result did not reach statistical significance ( $P > .05$ ). Our results are similar to other studies in the literature [Pandit 2007; Mannova 2013; Barone 2010; Ecevit 2010]. We found a 4.76% mortality rate after CEA, 6.5% in NASCET, and 1.0% in ECST [Ferguson 1999; ECSTCG 1991]. Ecevit et al reported the mortality rate of 2.5% after CEA [Ecevit 2010]. High major stroke and mortality rates in our patients are probably related to comorbid factors (diabetes mellitus, hypertension, COPD, and dyslipidemia) [Table 1]. Although postoperative complications are higher in the high risk group, we did not find any significant differences between groups ( $P > .05$ ). Some studies similarly reported the safety of regional anesthesia procedures for CEA [Pandit 2007; Mannova 2013; Barone 2010; Ecevit 2010]. Intracerebral hemorrhage related to hyperperfusion is another serious complication that can be seen in 0.2%-0.6% [Ferguson 1999; ECSTCG 1991]. We did not detect any cerebral hemorrhage in our patient population.

## Conclusion

Combined cervical plexus blockage is a safe procedure for CEA with good results in all cardiovascular risk groups. More comprehensive studies are needed that include a larger number of patients; a comparison of general anesthesia and regional anesthesia for these patient populations is needed as well.

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