

Results of carotid endarterectomy under regional anesthesia

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ABSTRACT

OBJECTIVE: The purpose of this study is to assess the efficacy of carotid endarterectomy (CEA) surgery under regional anesthesia and to report early mid-term results.

METHODS: Data for 42 patients who underwent CEA were reviewed retrospectively between January 2013 and June 2015. Of the patients, 60% (n=25) were male and 40% (n=17) were female. The mean age was 74.03 years. Early and midterm mortality, intraoperative stroke, and complication rates were calculated by reviewing patient's data at the end of 2 years.

RESULTS: The level of carotid stenosis was over 70% in 83% (n=35) of the patients. Seventeen percent (n=7) of the patients had 60% carotid stenosis. Forty patients received regional anesthesia and two patients received general anesthesia. The mean cross-clamp time was 13.08 min. The mean operation time was 53.09 min. No early post-operative deaths occurred. The midterm (24 months) mortality rate was 2% (n=1). Recurrent atheromatous plaque was found in 2% (n=1) of the patients.

CONCLUSION: Our study demonstrated that CEA surgery may be safely performed under regional anesthesia will acceptable low mortality and morbidity rate.

Keywords: Carotid; carotid stenosis; endarterectomy; regional anesthesia.

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An important reason of ischemic cerebrovascular accident (CVA) is extracranial carotid artery disease. In history, although suspect for carotid stenosis and thrombosis is earlier, the first successful carotid endarterectomy (CEA) operations were reported in 1950s. Today, there has been some development in the diagnosis and treatment of carotid artery disease due to evolution of technology and prolonged life expectancy. As definition and extent of the atherosclerosis have been understood, it has been seen that this systemic disease causes mild, moderate, and severe lesions at many vessels at the same time. It has been determined that carotid artery stenosis is in close relation with coronary artery disease (CAD) and peripheral artery disease (PAD).

Today, the mostly used modality for treatment is the CEA operation. Stent implantations are generally recommended in the presence of bilateral lesions and comorbid diseases. If the carotid artery stenosis is 70% or above, endarterectomy is recommended for all symptomatic patients [1, 2]. In the recent studies, based on the clinical and angiographic features, it is recommended to perform CEA in 2 weeks [3]. In the guidelines, the importance of the complication rate being under 3% underlined [4].

In this retrospective study, survival and complication rates have been investigated for 42 patients who went under CEA operation.



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MATERIALS AND METHODS

This retrospective study was created by review of 42 CEA patient records who were operated by the same surgical team between January 2013 and July 2015. Retrospectively analyzed after obtaining ethical approval (22.10.2019-58230125-771-E.48, Duzce State Hospital). Data collected from patient records as demographic characteristics included CAD, diabetes mellitus (DM), smoking habit, PAD, history of CVA, characteristics of carotid lesions, and previous operations. As exclusion criteria, the ischemic event in the past 14 days, bilateral stenosis of more than 70% and anatomically stenosis extending to the intracranial area were based on. Patients with unilateral stenosis of 70% or more and stenosis in the contralateral part <40% were included in the study.

Surgical procedure: Standard incision was done medial to the sternocleidomastoid muscle and 1 cc heparin was administered before the endarterectomy procedure. Operations were performed under regional anesthesia. Deep cervical plexus block was performed of cervical vertebrae by anesthesia. The incision to the artery was started at the level of common carotid (CC) artery through bifurcation and internal carotid artery. To prevent reflex sympathetic bradycardia, 1% lidocaine hydrochloride was injected into the carotid bulb. Before endarterectomy, a shunt was placed in the CC artery, if needed. Following cross-clamp, standard endarterectomy was performed for common and internal carotid artery. Arteriotomy incision was closed with continuous sutures. Systemic systolic pressure was maintained between 140 and 160 mmHg (Fig. 1).

Near-infrared spectroscopy (NIRS) was used as intraoperative cerebral monitoring systems. Pre- and post-operative magnetic resonance angiography (MRA), computerized tomography angiography (CTA), Doppler ultrasonography (USG) images of the patients, operation durations, general/local anesthesia, cross clamp durations, and post-operative follow-up data (CVA, bleeding, and nerve damage) were all collected from patient records.

All patients received dual antiaggregant treatment of 100 mg/day acetylsalicylic acid and 75 mg/day clopidogrel postoperatively. Post-operative follow-up included US scan at 6 Months and 1 years and then annually.

Ischemic accidents and mortality rates in the first 30 days following CEA were investigated as clinically

Highlight key points

- In CEA surgery, regional anesthetic helps lower mortality and morbidity.
- Awake patients and monitoring with intraoperative NIRS may reduce the risk/incidence of shunts during carotid endarterectomy.

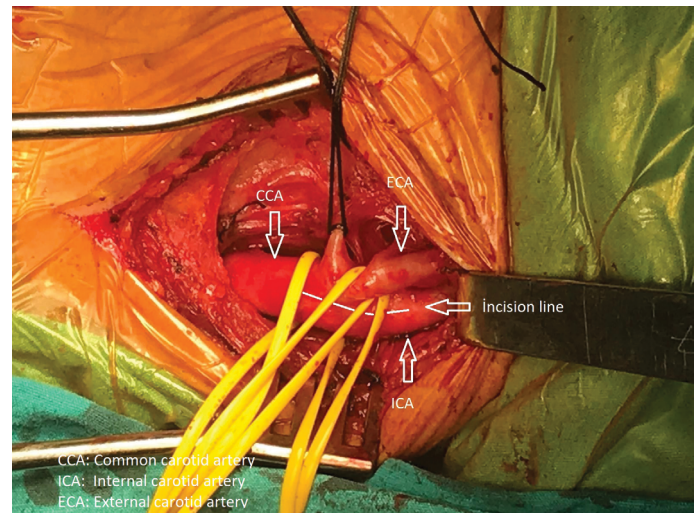


FIGURE 1. Perioperative image of carotid endarterectomy.

meaningful endpoint in the early stages. For the mid-term analysis (end of 2 years), recent accident, recently formed atheroma plaque and survival data results were reached. Stenosis more than 50% at the end of 2nd year of the operation was considered as atheroma plaque reformation. Stroke after CEA and atheroma plaque reformation were evaluated.

From the records, it was seen that two patients were lost in the 4th year of the operations due to the reasons which were not related to the operations. Remaining patients were still alive.

Statistics

Patient's data were evaluated using software SPSS 22 (IBM Corp, Armonk, NY, USA) program. The demographic characteristics of the patients, age, cross-clamp duration, average operation duration, CVA, and mortality rates in the 30 days of operation were collected. Descriptive analyses were presented using means and standard deviations for normally distributed variables. Frequencies and percentages were given for categorical and nominal variables. Survival rates were calculated at the end of 2nd year of operation. P-value of <0.05 was considered to show a statistically significant result.

TABLE 1. Demographics and results of patients who had CEA

Demographics (n=42)	Mean±SD	Percent
Age, mean (years)	74.03	
Sex		
Male		60
Female		40
HT		29
DM		19
History of CVA		21
CAD		12
PAD		12
Previous surgery (CAD+PAD)		10
Smoking habit		21
Carotid stenosis		
60%		17
70%		83
Results		
Cross-clamp time (min)	13.08	
Total operation time (min)	53.09	
Early death		0
Late death		1
Repeating plaque formation		1
Complication		1
Survival		99

CEA: Carotid endarterectomy; SD: Standard deviation; HT: Hypertension; DM: Diabetes mellitus; CVA: Cerebrovascular accident; CAD: Coronary artery disease; PAD: Peripheral artery disease.

RESULTS

Of the 42 patients who has undergone CEA, 57% (n=24) were male and 43% (n=18) were female. The mean±SD age was 74.3 years. Of all the patients, 12% (n=5) had CAD, 19% (n=8) had DM, 12% (n=5) had PAD, 29% (n=12) had hypertension (HT), 21% (n=9) were smokers, 21% (n=9) CVA history, 30% (n=13) had contralateral lesion, and 10% (n=4) had history of previous operation (cardiac and peripheral). For the diagnosis of carotid artery stenosis, 62% (n=19) had MRA, 12% (n=5) had CTA, and 26% (n=18) had digital subtraction angiography. All the patients had Doppler USG results.

The carotid stenosis of the 83% (n=35) patients was above 70%. In 17% (n=7) of the patients, stenosis was 60%. It was understood that the patients with the 60% lesion were the ones with the CVA history.

Sharp kinking of the internal carotid artery was present in three of the patients. Except 2 patients, operations were performed under regional anesthesia. During the operations, four of the patients needed shunt. In three of the patients, patch plasty were done by using veins. Since the ICA diameter decreased, patch plasty was applied to three patients. This procedure was done routinely to avoid the risk of future stenosis.

Pre-operative mean NIRS values on the right and left were 68 and 65, respectively. When compared with post-operative NIRS values, there was no significant difference ($p>0.05$)

Three patients had the history of coronary artery bypass grafting operation and one patient had the history of peripheral vascular surgery operation.

The mean±SD cross-clamp time was 13.08 min. The mean±SD operation time was 53.09 min. There was no post-operative early mortality. One of the patients developed weakness in the right arm. In five patients, temporary withdrawals were seen in the face and lips. One of the patients underwent reoperation due to bleeding. No neurologic deficit was observed.

When midterm results were evaluated (24 months), death was observed in one of the patients due to repeating CVA. Mortality rate was 2% (n=1) for midterm analysis. At the end of 24 months, reformation of atheroma plaque was seen in 2% (n=1) of the patients (Table 1).

DISCUSSION

Stroke is the second common cause of death among all mortality reasons. No early mortality in our 42 patients after CEA. Age ≥ 80 years are associated with high surgical risk and death. In young population, this rate is between 10% and 15% of all stroke patients [5]. In large randomized clinical trials, CEA is recommended as an effective treatment modality to prevent repeating neurological deficits and stroke in symptomatic and asymptomatic patients with the moderate and severe carotid artery stenosis [6, 7]. In our study on a limited number of patients, there was no serious neurological deficit. By minimizing the use of shunt, we closely monitored the neurological condition of the awake patient under local anesthesia and tried to prevent negative consequences.

Studies reveal that stroke risk is between 2% and 5% in 1 year for serious asymptomatic patients. To determine surgery indication, neurological symptoms, carotid artery stenosis rate, carotid artery plaque mor-

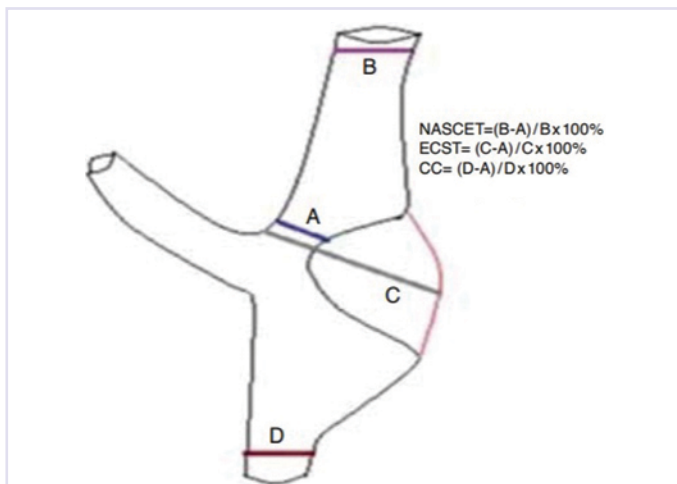


FIGURE 2. Measurement methods of carotid artery stenosis with Doppler USG.

phology, medical comorbidities, vascular, and local anatomical features should be taken into account [8].

In carotid artery disease, some of the patients refer to hospital with dizziness and balance problems. Remaining of the patients asymptomatic and they are recognized coincidentally, or they apply with CVA. Doppler USG is the first tool for diagnosis. Intima media thickness (IMT) can give an important idea for diagnosis. In ARIC study (Atherosclerosis Risk in Communities study), for the patients between 45 and 65 years of age, after excluding age, race, DM, hypercholesterolemia, HT, and smoking, strong correlation was determined between the risk of myocardial infarction risk and carotid IMT [9]. The methods that are used to measure carotid stenosis rate are European Carotid Surgery Trial, North American Symptomatic CEA Trial and CC methods. These methods are shown in Figure 2 [10].

Atherosclerosis is a common systemic disease. It is known that 50% of the patients with obstructive carotid artery disease who are candidates for CEA or interventional treatment methods, also have CAD [11]. Because of this, carotid artery disease or CAD should be investigated further for the patients having one of these diseases. It is important to perform detailed imaging techniques before coronary interventions and CEA. In our study, 12% of the patients were diagnosed for CAD. Four of the patients, we operated previously coronary or peripheral vascular surgery.

Restenosis rates following CEA is between 5% and 30%, it is seen more in the first 2 years. The reasons for restenosis are mainly, HT, smoking, dyslipidemia, in-

creased body mass index, gender, and age. The plaque reformation in first 2 years is usually related to intimal hyperplasia [12]. In our study, plaque restenosis (new plaque formation) was seen in only one patient.

Regional anesthesia renders CEA operations safer. It has been reported that regional anesthesia is related to less cardiopulmonary complications [13]. Although it is said that there is no difference between general anesthesia and local anesthesia, rate of neurological complications under general anesthesia was reported as 12.9% while this rate decreases to 2.8% under regional anesthesia [14]. It is not possible to check verbal and motor functions of the patient under general anesthesia. This increases the possibility of post-operative risk of embolic incidents and neurological sequelae. Except two of our patients, we had the opportunity of performing the operations under regional anesthesia so that we had the chance to check the patients' functions closely. Of the patients having contralateral lesions (13 patients), only four of them required shunt usage during operation. The use of intraoperative shunts during CEA under local anesthesia increases the risk of perioperative stroke. We applied shunt use in four of our patients due to the development of paralysis or numbness of the face and confusion. Patients being awake provided us to check their cognitive functions and for the other nine patients, we completed the operation without the need of shunt usage.

In our study, 83% of the patients had stenosis of more than 70%. But due to repeating CVA, 7 patients with stenosis of 60% were performed CEA. As mentioned above, this situation supports the recent studies saying that CEA should more extensively perform. Recent studies recommend broadening CEA indications in the guidelines [15].

Conclusion

This article showed that CEA surgery may be safely performed under regional anesthesia will acceptable low mortality and morbidity rate.

Limitations of Study

The inadequate number of patients is a limiting factor in our study. Another reason restricting the study is that it was not designed as randomized and prospective. The study is specific as it was conducted single-centered thus it is not suitable for generalization. Larger studies comparing local or general anesthesia for CEA should be conducted.

Ethics Committee Approval: The Duzce State Hospital Clinical Research Ethics Committee granted approval for this study (date: 22.10.2019, number: 58230125-771-E.48).

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Authorship Contributions: Concept – EI; Design – EI; Supervision – EI; Fundings – EI; Materials – EI; Data collection and/or processing – EI; Analysis and/or interpretation – ACD; Literature review – ACD; Writing – EI; Critical review – EI.

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