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Carotid endarterectomy; A new center, two years results

Abstract

Aim: We aimed to evaluate the demographic characteristics and early postoperative complications of patients who underwent conventional carotid endarterectomy (CEA) in a secondary level hospital retrospectively.

Material and Methods: Forty-six patients who operated by a single surgeon at Sinop Atatürk State Hospital between January 2015 to December 2016 were included in the current study. Data regarding to demographic characteristics, symptoms, distribution of lesions, diagnostic methods, operation technique and early complications have been collected from handwritten and electronic clinical records.

Results: The mean age was found as 70.9±9.7. Thirty patients were male. The most common risk factors were hypertension (93.5%), hyperlipidemia (50%), cigarette (41.3%) and diabetes (34.8%). Conventional CEA (CCEA) was performed to all patients. Patch plasty was applied to only one patient. According to the internal carotid artery stump pressure, T shunt was performed to 17.4% of patients. One patient died in early postoperative period because of myocardial infarction. In four patients; transient dysphagia, in three patients; hematoma requiring revision, in one patient; uncontrolled hypertension, and in one patients wound infection occurred. Furthermore, delirium occurred in one patient.

Conclusion: Our experience CEA are compatible with the literature. Our results have supported that CCEA with measurement of carotid arter stump pressure are reliable surgical procedure for patients with carotid artery stenosis. Cardiac complications are rare but it can be mortal. Minor surgical complications are more common than death and stroke risk. However, close follow-up can prevent serious complications.

Keywords: Carotid endarterectomy, Early postoperative complications, Carotid artery stenosis

INTRODUCTION

Carotid artery stenosis is one of the most important causes of stroke, one in five of all strokes develop in this manner (1). Carotid endarterectomy (CEA) is a common and reliable procedure for the treatment of carotid artery stenosis (2). The main objective of the CEA is to prevent or at least reduce the risk of stroke (3).

The surgery itself, however, carries a risk of stroke. The incidence of major complications such as death and stroke in symptomatic patients is approximately 6%, and approximately 3% in asymptomatic patients (2-4). There is less information about the rates of minor surgical complications. However, it is believed to be more common (5). In recent years, new revascularization techniques in endovascular procedures have

been introduced in highrisk patients for surgery and comparative studies have been published. However, even in these patients, CEA remains a standard therapy (6).

We aimed to evaluate that early medical and surgical complications of CCEA in patients operated at a cardiovascular surgery clinic of a new center, retrospectively.

MATERIAL AND METHODS

A total of 46 CEA cases performed by a single surgeon at Sinop Atatürk State Hospital Cardiovascular Surgery between 2015-2016 were evaluated retrospectively. Diagnostic methods were recorded in terms of symptoms, operative methods, complications and mortality. Ethical approval of the study was obtained from Ondokuz Mayıs University Clinical Research Ethics Committee

(Reference Number: OMU KAEK 2017/32).

Patients were diagnosed with carotid doppler ultrasonography (USG) and computerized tomography angiography (CT angio). One patient was treated with both doppler USG, CT angio and magnetic resonance angiography (MR angio). Two patients did not undergo angiography. They were diagnosed only using doppler USG. The doppler USG of these patients were repeated by the preoperative surgeon. One of them was operated to protect from contrast nephropathy as he had compensated chronic renal failure (CRF), and the other was an emergency operation due to a moving thrombus.

Grading of carotid artery stenosis of the patients included in current study was classified according to NASCET (North America Symptomatic Carotid Endarterectomy Trial) criteria [7]. We had no asymptomatic patient. Patients with > 70% of stenosis and a doppler USG with moving thrombus and/or ulcer plaque were operated after consultation with a neurologist. There was no restriction of age. All patients were consulted by cardiologist and pulmonary medicine specialist. Two patients had been transferred to the nearest coronary angiography unit. One of these patients underwent CCEA one week after percutaneous transluminal coronary angioplasty (PTCA)+stent had been treated, while being treated with clopidogrel 75 mg 1x1. Antiagregant therapy was performed on all other patients were discontinued 3 days prior to the operation and 100 anti-Xa IU/kg enoxaparin sodium was administered 12 hours apart until the operation day. Patients with critical carotid lesions on both sides were operated on before the lateralization of the patients.

Patients who had a stroke had not been kept waiting for a given period for their operations. They were operated on the first day after the preparations are completed. All the operations are performed under general anesthesia, depending on the developments in modern anesthesia techniques, we prefer to use general anesthesia, because of decreased patient anxiety and lower cerebral oxygen requirement. Patients were monitored by electrocardiography (ECG), invasive arterial pressure, capillary oxygen saturation and uroflowmeter. Surgical prophylaxis was started with pre-operative cefazolin sodium and discontinued on postoperative 3rd day. After incision, 100 units per kg of heparin was administered intravenously 5 minutes before the artery was returned. Before the placement of the clamp, 0.5 cc of 2% prilocain was administered to the lesion site adventitia with an insulin injector. Immediately after clamping the internal carotid artery (ICA), the patient's stump pressure was measured using invasively using the 21G needle and a T-shunt was placed at a mean pressure of < 40 mmHg. Following longitudinal arteriotomy of the common carotid artery (CCA) toward the ICA, endarterectomy was performed which was generally followed by primary suture closure. After conventional CEA, we performed a patch plasty (made with the patient's own saphenous vein) in one patient because of the inadequate carotid artery lumen diameter. An Imparato maneuver was applied to shorten the period of anastomosis. When the incision was closed, the arteriotomy line

was covered with surgicel and a silicone hemovac drain was placed. We didn't use protamine. All the patients were extubated in the operation room and had a neurological examination. They were transferred to intensive care unit in the presence of arterial blood pressure and ECG. The patients who were admitted to the unit on the first postoperative day and started on a liquid diet received 100 anti-Xa IU/kg enoxaparin sodium administered by subcutaneous injection for 12 hours. Clopidogrel 75 mg 1x1 and atorvastatin 40 mg 1x1 were administered orally on postoperative day 1. They were generally discharged on the fourth postoperative day. They had detailed neurological examination 10 days and 30 days after the surgery.

Statistical Method

Statistical analysis was performed using SPSS (version 24.0, Statistical Package for the Social Sciences Inc. Chicago, IL, USA). Numerical data are expressed as mean + standard deviation, nominal data are expressed as the number of subjects and the percentage of affected individuals.

RESULTS

The demographic and clinical characteristics of 46 patients who underwent CEA in 2015-2016 are presented in Table 1. The mean age of the patients was 70.9 ± 9.7 years and 65.2% of them were male. The most common risk factors were hypertension followed by hyperlipidemia, smoking, diabetes and ischemic heart disease.

The patients were referred to the neurology clinic. 52.2% of the patients had mild neurological findings such as vertigo, balance disorders, syncope. 37% had a history of stroke, and 10.9% had a history of TIA (transient ischemic attack). Right CCEA was performed in 21 (45.6%) patients while 24 (52.2%) patients had left CCEA. A small part of the study group (2.2%) underwent bilateral endarterectomy. Contralateral carotid artery was also present in 10.9% of patients with a total of > 70% narrowing. Contralateral ICA of 2 (4%) of the patients were occluded until the Willis polygon.

Conventional CEA was performed in all cases. During surgery, ICA stump pressure was measured and T shunt were placed to 8 patients when its pressure below 40 mm Hg. In only one of the 7 patients with contralateral occlusion and stenosis the pressure was below 40 mm Hg. Only one patient had patch plasty with saphenous patch.

No stroke or cerebral hemorrhage occurred in the patients in surgery and within one month after the operation. One patient developed post-op myocardial infarction on the third day and died. This patient underwent a post-operation revision on first day because of hematoma at the surgical site. A female patient had an uncontrollable hypertensive episode. She didn't respond to antihypertensive agents (glyceryl trinitrate 200 mcg/min + sodium nitroprusside 10 mcg/kg/min). She was re-anesthetized for 24 hours and she was gradually waken-up. There was no neurological sequelae. Four patients had dysphagia for about 3 weeks, and one patient had wound infection (improved with

local dressing). Three patients also had a hematoma requiring revision. One of these patients was a patient who continued to use clopidogrel. One of the patients also developed delirium dementia in the first post-op hours (Table 2). The patient was treated with haloperidol.

Table 1. Demographic and clinical characteristics of the study patients

Characteristics	N (%)
Mean age (years)	70.9 ±9.7
Age distribution	
<60	6(13.0%)
60-69	11(23.9%)
70-79	22(47.8%)
80≤	7(15.2%)
Gender	
Female	16(34.8%)
Male	30(65.2%)
Risk factors	
Hypertension	43(93.5%)
Hyperlipidemia	23(50.0%)
Smoking	19(41.3%)
DM	16(34.8%)
IHD	11(23.9%)
COBD	8(17.4%)
AF	7(15.2%)
CRF	6(13.0%)
PAD	4(8.7%)

DM:Diabetes mellitus,IHD:Ischemic heart disease, COBD:Chronic obstructive pulmonary disease, AF:Atrial fibrillation,CRF:Chronic renal failure, PAD:Peripheral artery disease.

Table 2. Perioperative complications within 30 days of carotid endarterectomy

Complication types	N (%)
Stroke	0(0.0%)
Cerebral hemorrhage	0(0.0%)
Myocardial infarction	1(2.2%)
Uncontrolled hypertension	1(2.2%)
Dysphagia(liquid)	3(6.5%)
Dysphagia(solid)	1(2.2%)
Wound infection	1(2.2%)
Delirium	1(2.2%)
Wound hematoma	3(6.5%)
Death	1(2.2%)

DISCUSSION

Carotid stenosis is among the most important causes of ischemic stroke and more frequently seen in elderly patients. We have studied the two-year data of our carotid endarterectomy results in Sinop, one of the two oldest cities in Turkey according to the median age data of the Turkish Statistical Institute (7). Hence, we

have retrospectively reviewed two-years data extracted from our carotid endarterectomy experience. We also particularly aimed to focus on early postoperative complications of CCEA in a group of patients with carotid artery stenosis. Studies showed that both eversion CEA and CCEA operations were safety methods with very rates low complication. Therefore, it is important that carotid surgery is performed by experienced surgeons with sufficient experience of the procedure, as emphasized in the guidelines (8,9).

In current study, mean age of the patients was higher as compared to two important studies [NASCET (North American Symptomatic Carotid Endarterectomy Trial) and ECST (Europe Carotid Surgery Trials)] (for our patients 70.8, NASCET 65.4, ECST 62.5 years). Also it is worthy of note that, most of the patients in our case series have neurological findings related to carotid artery stenosis (CAS). Despite the relatively older and symptomatic study population, we have seen comparable stroke and mortality rates within postoperative 30 days to the above mentioned studies (1.1% and 1.8% for NASCET and 1.3%+3.2% for ECST and 0+2.2% for our study). Post-op cranial nerve damage, wound infection and other minor complications were observed in our clinic at similar rates to other centers. The rates of cranial nerve damage were 8.6% in NASCET, 6.3% in ECST, 8.7% in our clinic; the rates of hematoma were 7.1% in NASCET, 6.5% in our clinic; the rates of wound infection were 2.1% in NASCET, and 2% in our study (n=1) (2, 10).

The timing of the surgery continues to be a matter of debate. We operated patients who were having stroke during the hyperacute period. Early operation of symptomatic patients may provide the greatest benefit when the stroke risk caused by ruptured plaques is considered (11, 12).

Conventional CEA was performed in the operation and patch was used in 1 patient. Patch use has been claimed to reduce long-term risk of recurrent stenosis (13-15). However, there are also publications showing that the outcome of patch use is not different in terms of restenosis formation (16). Although rarely seen, synthetic graft infection may require graft removal, which may be mortal (17). Saphenous patch can prevent this complication (18). Use of the patch can cause an increase in the stroke rate by extending the clamp duration. Imparato maneuver can shorten this period (19). The presence of a double suture line can increase complications such as thrombosis, hematoma and rupture. Despite all these theoretical possibilities, studies have shown that the use of patch leads to less complications than to primary closure (13, 14). In this study, we preferred CCEA over eversion endarterectomy for technical reasons in all patients. Compared to primary artery closure, patch angioplasty has fewer strokes and lower restenosis rates. Therefore, patchplasty is now the standard of practice for patients undergoing CCEA. A recent retrospective study by Huizing et al. (20) showed that patch angioplasty was associated with lower rates of restenosis and perioperative stroke. The plaque causes aneurysmatic appearance

by pushing the muscular layer out of the lumen, while causing the stenosis by pushing the endothelium lumen of the vessel during formation. This mild aneurysmatic segment that occurs when the plaque is removed can be removed by primer closure and can maintain the vessel flow laminar. Persistence of patch use in cases with non-narrowing of the vessel diameter may causes an aneurysmatic segment and cause a swirling flow. This may be the cause of thrombosis. We determined the patch requirement according to the sustained laminar flow.

Usually, one of the two surgical technique are preferred for treatment of patients had narrowed carotid artery: eversion carotid endarterectomy (ECEA) or CCEA. A direct comparison of outcomes of the two surgical procedure have recently been reported by Joseph Schneider et al. Bleeding within early postoperative period was most frequently seen in patients treated with ECEA as compared to patients had CCEA (21). However, neither immediate perioperative ipsilateral neurologic events nor any ipsilateral stroke were different for each technique. There is strong evidence that the eversion technique reduces late restenosis in comparative studies of conventional and eversion methods (22). But technically it is a possibility that the thin layer of the plaque on the high plaques extending to the cranial cannot be terminated by cutting properly and may cause dissection. We preferred the conventional method, considering that this layer of the plaque could be cut properly and sutured to the vein wall and this could be safer. The experience of the surgeon in this direction was a priority.

Surgeons who selectively use the intraluminal shunt to achieve cerebral blood flow during endarterectomy may be able to make decisions based on past cerebrovascular disease, contralateral occlusion, carotid stump pressure, transcranial doppler, decrease in cerebral perfusion in the infrared spectroscopy, changes in electroencephalography (EEG), and neurological examination failure under local anesthesia (10,23). We decided in our case based on stump pressure. This is because both the technique is easily accessible and safe, and our experience is effective. Only one of the patients with contralateral occlusion and stenosis had a stump pressure below 40 mm Hg. In others, the reason for not having a low pressure may be that the vertebral arteries provide adequate perfusion to the Willis Polygon. We therefore conclude that contralateral occlusion is not a reliable choice for T-shunt placement. Follow-up of neurological examination in patients with local anesthesia; coadaptation of the patient, the surgeon, and the anesthetist should be at a high level. In general, insertion of carotid shunt even though decreases the cerebral ischemic time, it does not provide any additional benefit of decreasing perioperative stroke when compared to non shunting (24).

There are publications that local anesthesia may not have a superiority in developing cardiac risk and stroke and potentially reduce complications (25,26). We preferred general anesthesia because of our experience. Thus, the positioning could have been done easily and the surgeon's attention was not affected.

Small complications were also included in our study. If these complications cannot be followed up well, they can cause stroke and death (5). A hematoma can cause hypoxia with airway pressure. Or if the administration of antiagregant is delayed because of hematoma progression, it may provide the ground for stroke. Therefore, the surgeon's scenario against all developments and post-operative follow-up algorithm should be available.

CEA is currently considered to be the standard treatment for carotid stenosis (27). Carotid artery stent may be an option in patients with high-risk, high-bifurcation or previously operated cases (28). In this regard, we expect the results of the ACST-2 study to illuminate us.

Early surgical outcomes of our clinic are compatible with the literature. As the number of cases increases, our updating efforts will continue. There are some suggestions on how to study the technical differences and operational methods, but no definite result is obtained. We applied conventional endarterectomy under general anesthesia with selective patch and shunt use. We believe that the technique should be determined by considering the experience of the surgeon and the anesthetist and the characteristics of the patient.

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