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Comparison of primary suturing and dacron patch in carotid endarterectomy

Karotis endarterektomide dacron yama ve primer kapatma yöntemlerinin karşılaştırılması

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Abstract

Purpose: In carotid artery atherosclerotic disease; indications for intervention are accepted to be over 75% stenosis for asymptomatic patients and over 50% for symptomatic patients. Preferred surgical treatment is carotid endarterectomy. In this study, we compared clinical outcomes and ultrasonographic findings in two different surgical techniques of arteriotomy closure. The first technique consisted of primary suturing and the second is patch angioplasty with a dacron patch. In 6 month follow-up period clinical examinations and dupplex ultrasonography were performed and analyzed statistically.

Material and methods: 60 patients who underwent carotid endarterectomy for carotid artery disease between January 2017 and December 2020 were enrolled in the study. Data were obtained from hospital database and evaluated statistically. 30 arteriotomy incisions were closed primarily and 30 with dacron patch angioplasty. As surgical indication 50% stenosis in symptomatic patients and 70% stenosis in asymptomatic were determined. Postoperative complications were evaluated. After discharge one-week, two-month, six-month clinical examitanions were performed and in six-month follow up dupplex ultrasonography was performed by an independent radiology specialist, and these results were compared statistically.

Results: When the patients were evaluated in terms of postoperative complications, clinical follow-up after discharge, and 6-month Doppler ultrasonography, no significant differences were detected.

Conclusion: No statistically significant difference was found among techniques primary suturing and dacron patch angioplasty for stroke, occlusion and re-stenosis rates. According to short term results both techniques may be feasible for arteriotomy closure during carotid endarterectomy.

Key words: Carotid endarterectomy, stroke, primary suturing, dacron patch angioplasty.

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Öz

Amaç: Karotis arter hastalığında asemptomatik hasta için %75 ve üzeri darlıkta, semptomatik hasta için %50 ve üzeri darlıkta operasyon önerilir. Cerrahi olarak ise karotis endarterektomi yapılır. Yazımızda karotis endarterektomide primer kapatılan ve dacron yama ile kapatılan hastalardaki, postoperatif komlikasyonlar yönünden ve 6 aylık takipler açısından sonuçlarımızı değerlendirdik.

Gereç ve yöntem: 2017 ve 2020 yılları arasında karotis endarterektomi yapılan yapılan 60 hasta (38 erkek, 22 kadın) retrospektif olarak değerlendirildi. Çalışmaya alınan vakaların tamamı tek taraflı opere edilmiş olup, ameliyatların hepsi genel anestezi eşliğinde yapılmıştır. 30 hastanın karotis arteriotomisi primer kapatılmış, diğer 30 hastanın arteriotomileri dacron yama ile kapatılmıştır. Hastalarda ameliyat kriteri olarak semptomatik hastalarda %50 ve üzeri darlık, asmeptomatik hastalarda %75 ve üzeri darlık kabul edilmiştir. Hastalarda postoperatif komplikasyonlara bakıldı. Taburculuk sonrası 1. hafta, 2. ay ve 6. aydaki kontrollerde klinik olarak değerlendirildi. 6. ayda bağımsız bir radyolog tarafından yapılan doppler ultrasonografi sonuçlarındaki stenoz oranlarına bakıldı.

Bulgular: Hastalar da postoperatif komlikasyonlar, taburculuk sonrası klinik takiplerinde ve 6. ay doppler ultrasonografileri darlık açısından değerlendirildiğinde anlamlı farklılıklar tespit edilmedi.

Sonuç: Karotis endarterektomide primer kapatma ve dacron yama ile kapatma yöntemlerinde postop restenoz açısından anlamlı istatiksel farklılıklar tespit edilmedi. Mevcut çalışmamızda iki kapatma yönteminde güvenle tercih edilebileceği düşünülmektedir. Tabi ki daha büyük ölçekli çalışmalarda farklı sonuçlar çıkabileceği de unutulmamalıdır.

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Anahtar kelimeler: Karotis endarterektomi, inme, birincil dikiş, dakron yama anjiyoplasti.

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Introduction

Carotid Artery Disease (CAD) is a commonly encountered disease because of the neurologic symptoms. In guidelines; 5 year stroke rates and mortalities are shown to be 10.9% even with maximal medical treatment [1]. But in symptomatic patients these rates are even higher [2, 3]. In CAD in addition to medical treatments; carotid endarterectomy (CEA) and interventional radiologic carotid artery stenting (CAS) are the options for treatment [4]. But the gold standard treatment method in carotid artery stenosis is still carotid endarterectomy. Patients with high comorbidity and mortality and stenting and endovascular treatment modalities are good alternatives to endarterectomy, but no significant difference was demonstrated in closure technique subclasses [5].

Recent studies proves that gold standard treatment of CAD is still CEA [6]. CAS can be the alternative treatment in selected patients and stenosis without thrombi [7, 8].Main reason behind carotid stenosis is atherosclerosis in 90% of cases. Symptoms may vary according to the zone of stenosis. The most common zones of stenosis is the carotid bifurcation and proximal segment of internal carotid artery [9]. Clinical outcomes are caused by stenosis percentage and ischemia. Stroke, syncope, vertigo, transient ischemic attack are the common presentations of CAD.

Material and method

In our study, 60 patients who underwent carotid endarterectomy for carotid artery disease between January 2017 and December 2020 were evaluated retrospectively. Data was collected from a predetermined database. 60 patients (38 male, 22 female) were enrolled. The age varies from 48-83 years old and mean age of 65.5. Patient demographics are shown in the Table 1.

Table 1. Patient demographics

		Min-Max	Median	Mean±SD/n-%
Age		48.0 - 83.0	68.0	67.2 ± 9.3
Gender	Female			22 36.7%
	Male			38 63.3%
Smoking				31 51.7%
HT				32 53.3%
DM				39 65.0%
HL				31 51.7%
Previous Cerebrovascular Event				48 80.0%
Preoperative Stenosis	50-69%			32 53.3%
	≥60%			28 46.7%
Postoperative HT				52 86.7%
Postoperative Complication	(-)			54 90.0%
	(+)			6 10.0%
	Haematoma			2 3.3%
	Contralateral Weakness			2 3.3%
	Hemiplegia			1 1.7%
	Hoarseness			1 1.7%
6th Month Dupplex Ultrasonography	No Stenosis			56 93,3%
	40% Stenosis			1 1.7%
	50-69% Stenosis			3 5.0%

48 patients had a history of previous cerebrovascular events and 32 of these patients had 50-69% stenosis. All other patients had stenosis over 70%. Totally occluded carotid arteries were not operated and not included to the study. Stenosis percentages were shown in the Table 2. Stenosis rates were determined by dupplex ultrasonography and were verified by contrast enhanced computer tomography.

Surgical technique and medication

All patients were hospitalized 2 days preoperatively. Routine Cardiology, Pulmonology, and Anesthesiology consultations were performed. All operations were performed under general anesthesia. Carotid artery was explored and controlled with vascular tapes. 5000 IU unfractionated heparin was administered intravenously. Vascular clamps were placed in internal carotid, common carotid and external carotid arteries. Clamping time was 16-22 minutes (mean 19 minutes). After performing endarterectomy half of the arteries were sutured primarily (Figure 1) and half were closed with dacron patch angioplasty (Figure 2). After haemostasis hemovac drains were placed. Patients were taken to the ICU unit. As a postoperative medication, all patients received 100 mg acetylsalicylic acid once daily and 4000 IU enoxaparin sodium once daily and were discharged with the same treatment. At 1st week follow up enoxaparin was discontinued. At the 6th month follow up dupplex ultrasonography was performed by an independent radiology specialist.

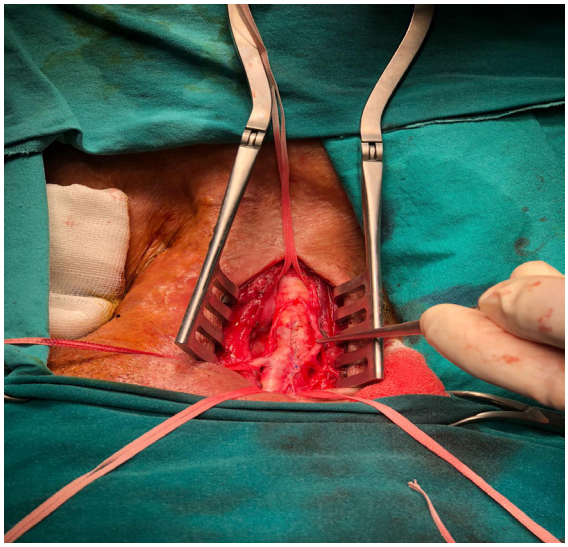

Figure 1. Primary suturing closure technique

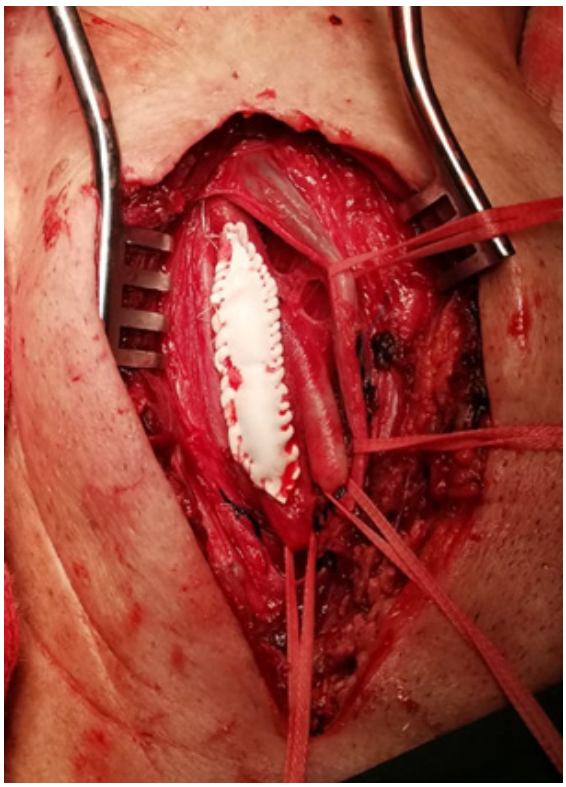

Figure 2. Dacron patch angioplasty closure technique

Statistical methods

Statistical analysis of the descriptive data was presented as mean, standard deviation, median, minimum value (min), maximum value (max), frequency, and percentage. The normality of the numeric variables was checked by using the Kolmogorov-Smirnov test. Continuous independent variables were analysed by the Mann-Whitney U test. Categorical variable analysis was performed by chi-squared test and when chi-squared test was not suitable Fischer test was performed. SPSS 27.0 computer software was used to perform statistical analysis.

The study was approved by the Nigde Omer Halisdemir University Non-Interventional Clinical Research Ethics Committee with its decision.

Results

This study aims to compare results of surgical techniques; primary suturing and carotid dacron patch angioplasty for arteriotomy closure in patients who underwent CEA. The demographic characteristics of the patients were summarized in Table 1. No statistically

Table 2. Comperation of arteriotomy closure techniques

		Primary Suturing		Dacron Patch		*P*	
		Mean±SD/n-%	Median	Mean±SD/n-%	Median		
Age		66.6 ± 9.4	67.5	67.8 ± 9.4	68,5	0,657	m
Gender	Female	11 36.7%		11 36.7%		1,000	X^2
	Male	19 63.3%		19 63.3%			
Smoking		16 53.3%		15 50.0%		0,605	X^2
HT		15 50.0%		17 56.7%		0,176	X^2
DM		22 73.3%		17 56.7%		0,796	X^2
HL		18 60.0%		13 43.3%		0,196	X^2
Previous Cerebrovascular Event		24 80.0%		24 80.0%		1,000	X^2
Preoperative Stenosis	50-69%	16 53.3%		16 53.3%		1,000	X^2
	≥60%	14 46.7%		14 46.7%			
Postoperative HT		24 80.0%		28 93.3%		0,129	X^2
Postoperative Complication	(-)	26 86.7%		28 93.3%		0,670	X^2
	(+)	4 13.3%		2 6.7%			
	Haematoma	1 3.3%		1 3.3%			
	Contralateral Weakness	2 6.7%		0 0.0%			
	Hemiplegia	0 0.0%		1 3.3%			
	Hoarseness	1 3.3%		0 0.0%			
6th Month Dupplex Ultrasonography	No Stenosis	27 90.0%		29 96.7%		0,611	X^2
	40% Stenosis	0 0.0%		1 3.3%			
	50-69% Stenosis	3 10.0%		0 0.0%			

Mann-whitney u test/X^2, Chi-squared test

significant difference was found between two groups. Patient ages and genders showed no significant difference ($p>0.05$). Also no statistically significant difference was observed in Postoperative HT, Postoperative Complication and also in 6th month dupplex ultrasonographic findings ($p>0.05$). Statistical analysis p values, mean±SD values and median values were shown in Table 2.

All patients were extubated in postoperative first 4 hours. 52 patients required antihypertensive medication due to postoperative hypertension. In two patients which were in the primary suturing group experienced contralateral muscle weakness. This weakness resolved by steroid treatment within six hours. One patient in the primary suturing group experienced hoarseness and this symptom regressed in postoperative third day, in first week follow up there were no signs of hoarseness. One patient in the dacron patch angioplasty group experienced hemiplegia at postoperative eighth hour, difficulty in breathing and had to entubated again. In radiologic images of brain diffusion magnetic resonance pathological findings were not present. After consulting neurologist medical treatment was arranged. When patinet was re evaluated after 48 hours there were no pathological findings and hemiplegia was healed. Patient was extubated and discharged at seventh postoperative day. Two patients; one in primary suturing group and one in dacron patch angioplasty group underwent reexploration due to hematoma in surgical site.

After discharge, patients were evaluated at one-week, two-month and six-month. In follow-up examinations no neurologic pathologies were found. As an additional examination at six-month follow-up all patients underwent dupplex ultrasonography. In 3 patients in primary suturing group 50-69% stenosis was observed, in one patient in dacron patch angioplasty group 40% stenosis was present. But none of the patients had clinical symptoms.

Discussion

CEA still is the most accepted treatment in preventing cerebrovascular events in both symptomatic and asymptomatic patients [10, 11]. There are some studies comparing primary suturing and dacron patch angioplasty. In COCHRANE study (Bond et al.[12]) shows that dacron patch angioplasty has statistically significant superiority over primary suturing comparing stroke rates [12-14]. Although randomized clinical trials claim that there is no superiority of the techniques over each other contrary to retrospective studies recent evidence shows that patch angioplasty decreases re-stenosis, occlusion and combined stroke and death rates [15]. Lazarides et al. [16] conducted a meta-analysis study with 4440 patients and compared 7 surgical closure techniques such as primary closure, eversion endarterectomy (EVE), dacron, vein patch, PTFE, bovine pericardium, polyurethane. EVE and patching with bovine pericardium or PTFE is associated with a lower incidence in both short-term and late undesired outcomes following CEA and seems to represent the best choice compared with other carotid closure techniques. And another meta-analysis of relatively small randomized controlled trials suggests that carotid patch angioplasty reduces the combined perioperative and long-term risk of stroke and the risk of restenosis, more data are needed [17]. When materials used for patch angioplasty (dacron, ptfe, saphena patch) there is no statistically significant difference between patch grafts. In our study we preferred dacron material for patch angioplasty.

Marsman et al. [18] studied carotid patients with 1280 patches and 1055 primary surgical closures in a meta-analysis study; the review showed no definite proof of a difference between carotid endarterectomy with patch angioplasty versus primary closure of the arterial wall on all-cause mortality, 30 days mortality, 30 days stroke, or any other serious adverse events. In our study, we compared primary suturing with dacron patch angioplasty in some of its aspects and anticipated patch angioplasty to be a better option for arteriotomy closure. We found no statistically significant difference between primary suturing and patch angioplasty techniques.

Some studies suggest that atrial fibrillation can be observed in 50% of the patients diagnosed with atherosclerotic carotid artery stenosis. Vascular pathologies are observed more often in patients with non valvular atrial fibrillation than in patients without any stroke or transient ischemic attack [19]. In this study none of the patients enrolled had atrial fibrillation. There is

still debate about timing of the surgery. Usually 4 to 6 weeks of delay in surgery is recomended after neurologic event. Because if surgery was performed before that recommended delay; non haemorrhagic infarct zone may turn into haemorrhagic zone. But recent studies show that new cerebrovascular events may happen during the time of this delay [20, 21]. But we respected this delay time when planning the time of surgery and did not experience any neurologic events during that time. Clamping of the carotid artery during endarterectomy may cause varying degrees of brain ischemia. Therefore, there are surgeons who advocate the use of shunts during endarterectomy [22]. However, we did not choose it in our cases because of the difficulty of using shunts and the risks of complications. CEA may be performed under general anesthesia or local anesthesia. When the methods of anesthesia were compared, techniques manifested no superiority over each other [23]. We preferred general anesthesia in our operations. No cardiac or pulmonary complications were encountered during or after anesthesia.

In conclusion, we compared primary suturing with dacron patch angioplasty in some of its aspects and anticipated patch angioplasty to be a better option for arteriotomy closure. We found no statistically significant difference between primary suturing and patch angioplasty techniques. It should be considered that statistical differences can be seen in studies conducted according to the number of patients, postoperative follow-up periods, and early and late complication follow-up processes.

Conflict of interest: No conflict of interest was declared by the authors.

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Ethics committee approval: The study was approved by the Nigde Omer Halisdemir University Non-Interventional Clinical Research Ethics Committe with its decision dated 24.02.2022 and numbered 2022/23.

Authors' contributions to the article

H.O. constructed the main idea and hypothesis of the study. F.S. developed the theory and arranged/edited the material and method section. A.N.A. and A.A.G.R. have done the evaluation of the data in the Results section. Discussion section of the article written by H.O. who also reviewed, corrected and approved. In addition, all authors discussed the entire study and approved the final version.