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Mid- and long-term results of external jugular vein patch plasty in carotid endarterectomy

Karotis endarterektomide eksternal juguler ven yama plastinin orta ve uzun dönem sonuçları

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ABSTRACT

Background: This study aims to report mid- and long-term results of external jugular vein patch plasty in carotid endarterectomy.

Methods: Twenty-three patients (14 males, 9 females, mean age 67.56 years; range 49 to 81 years) who underwent carotid endarterectomy with external jugular vein patch plasty within the past 12 years were routinely followed for neurological events and restenosis. After early control, duplex ultrasonography was added to the routine controls to detect restenosis.

Results: One patient died due to pneumonia and sepsis in the early period. Two patients died due to several causes which were not directly related to surgery in the late period. One patient had minor stroke; however, the operated carotid artery was not responsible for the event. Duplex ultrasonography showed mild to moderate restenoses in three asymptomatic patients (15%).

Conclusion: External jugular vein is a good alternative to saphenous vein and synthetic patching in multivascular atherosclerotic patients, in particular.

Keywords: Carotid endarterectomy; external jugular vein; patch plasty.

ÖZ

Amaç: Bu çalışmada karotis endarterektomide eksternal juguler ven yama plastinin orta ve uzun dönem sonuçları bildirildi.

Çalışma planı: Son 12 yıl içinde eksternal juguler ven yama plasti ile karotis endarterektomi yapılan 23 hasta (14 erkek, 9 kadın, ort. yaş 67.56 yıl; dağılım 49-81 yıl) nörolojik olaylar ve tekrar daralma açısından rutin olarak takip edildi. Erken kontrol sonrasında, rutin kontrole tekrar daralma saptanması için dupleks ultrasonografi eklendi.

Bulgular: Bir hasta pnömoni ve sepsis nedeni ile erken dönemde kaybedildi. Geç dönemde iki hasta doğrudan ameliyata bağlı olmayan çeşitli nedenlerle kaybedildi. Bir hastada minör inme gelişti; ancak ameliyat edilen karotis arter olaydan sorumlu değildi. Asemptomatik üç hastada (%15) dupleks ultrasonografi ile hafif ve orta derecede tekrar daralma saptandı.

Sonuç: Özellikle çok damarlı aterosklerotik hastalarda eksternal juguler ven, safen ven ve sentetik yama işlemlerine iyi bir alternatiftir.

Anahtar sözcükler: Karotis endarterektomi; eksternal juguler ven; yama plasti.

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Carotid endarterectomy (CEA) is a vital surgical procedure which reduces the incidence of stroke in patients with critical carotid artery stenosis. Although the procedural technique may vary according to the centers, the main goal of surgery is same: to reduce stroke.[1,2] It has been widely recognized that patch plasty in CEA diminishes ipsilateral stroke by preventing acute thrombosis in the early phase and restenosis in the late period.[3-5] That is why closure of the arteriotomy with a patch has become a routine part of CEA procedure in recent years. Saphenous vein and neck veins are the most frequently used autogenous patch materials.[6,7] Synthetic patches are made up of polyester, polytetrafluoroethylene, and polyurethane materials. Patch materials-related complications include bleeding, rupture, infection, and thrombosis.[8] In addition, autologous veins cost less than synthetic materials and can be more easily manipulated.[9] They also have endothelial surface which can prevent thrombosis. In contrast to synthetic materials, they are more resistant to infection; however, the risk for rupture is higher.[10] Neck veins such as external jugular vein (EJV) and common facial vein (CFV) should be considered as an alternative patch material in CEA operations in patients requiring multivascular reconstructions, as saphenous veins can be used in coronary artery bypass surgery and lower extremity arterial reconstructions. External jugular vein is also longer than the CFV. It has some merits when used in elderly, obese and diabetic patients, in particular, since its preparation does not need another incision as in the case of a saphenous vein.

PATIENTS AND METHODS

External jugular veins were used as patch materials to close arteriotomies in 23 patients (14 males, 9 females; mean age 67.56 years; range 49 to 81 years) who underwent CEA operations between January 2000 and October 2012. The mean body mass index was 26.65 kg/m^2. Critical carotid stenosis was defined by radiological examinations along with physical examination findings such as murmurs on the carotid arteries in eight asymptomatic patients. Five of the symptomatic patients had transient ischemic attack (TIA), six had hemiparesis, three had amaurosis fugax and one had hemiplegia (Table 1).

Of the patients, 19 had 70 to 95% carotid stenosis as confirmed by duplex ultrasonography. Eight of these patients had 70 to 99% stenosis as evidenced by magnetic resonance angiography. In another eight patients, four had previous a duplex diagnosis and carotid stenosis of 80 to 99% was shown by digital subtraction angiography. In addition, radiological examinations demonstrated that 22 patients had calcifications, three had plaque ulcers, and three had a thrombus.

Four of the patients were operated for bilateral carotid stenosis. Three of these patients underwent a second operation for the contralateral side four to seven days after the first operation. One of the patients was operated for the contralateral side seven years after the first operation, as severe stenosis was defined on routine controls. Fifteen of the rest of the patients were operated for the left side and four patients for the right side. All patients were operated by a single surgeon. All patients received acetylsalicylate 100 mg/day before and after the operation.

All patients were operated under the general anesthesia. Two legs were prepared for saphenous vein to prevent waste of time if EJV was not suitable for patching. An incision was made anterior to the sternocleidomastoid muscle. After platysma was passed, EJV was explored and a 5 cm segment was prepared (Figure 1). It was used, unless its diameter was less than 4 mm. Then, it was everted with a fine penset to expose the endothelial surface with blood flow after patching and put in heparinized isotonique (10 U/mL). Common carotid artery (CCA), internal carotid artery (ICA), and external carotid artery (ECA) were prepared and controlled with silicon loops. Arteriotomy was made from CCA to the ICA three minutes after systemic heparinization (100 U/kg). Then, an outlying shunt was inserted from the CCA to the ICA. Following endarterectomy and distal intimal fixation with a 7/0 polypropylene suture material, double layered everted EJV was continuously sutured to the arteriotomy with 6/0 polypropylene suturing beginning from the distal end (Figure 2). Before arteriotomy was closed, the outlying shunt was immediately extirpated and residual air was evacuated. The first blood flow from the CCA was diverted to the ECA and then the ICA was opened. After bleeding control, incisions were closed in a routine way and a silicon drain was inserted.

Table 1. Comorbidities

Comorbidities	n	%
Coronary heart disease	9	39.13
Diabetes mellitus	8	34.78
Hypertension	14	60.86
Peripheral arterial disease	1	4.34
Hyperlipidemia	13	56.52
Atrial fibrillation	2	8.68

The mean follow-up after CEA operation was 70±43 (range, 11 to 147) months. All patients were evaluated for neurological and monocular symptoms at one week, one month and every six months after discharge. Operated carotid arteries were controlled with duplex ultrasonography at one week and six months. After 12 months, follow-up examination and duplex ultrasonography was performed annually. The duplex scan criteria of 16 to 49% stenosis of ICA were peak systolic velocity (PSV) less than 140 cm/sec and end-diastolic velocity (EDV) less than 140 cm/sec. For 50 to 79% stenosis of ICA, PSV 140 cm/sec or more and EDV less than 140 cm/sec and for 80-99% ICA stenosis, PSV more than 140 cm/sec and EDV more than 140 cm/sec were predefined measurements.[11]

RESULTS

There was no mortality except one patient who died from pneumonia and sepsis and there was no neurological deficit in patients in the early postoperative period. Other patients were followed in the clinical setting for a mean 4 days (range, 3 to 45 days) after one day stay in the intensive care unit. There was no infection, pseudoaneurysm, or patch rupture. One patient had minor incisional hematoma which did not required revision. Clopidogrel 75 mg was added to the acetylsalicylate treatment in three patients who had also peripheral arterial disease, whereas warfarin was given to two patients with atrial fibrillation.

In the late period, there was no EJV patch aneurysm (Figure 3). One of the patients died from leukemia two years after the operation. Another patient died due to myocardial infarction one year after the operation. A 70-year-old male patient had ipsilateral minor stroke two years after the operation. As duplex ultrasonography showed no more than 50% stenosis and distal occlusion was defined on a watershed area of the middle cerebral artery by magnetic resonance angiography, he was treated conservatively. Of surviving asymptomatic 20 patients, we also found ICA stenosis less than 50% in one patient and 50 to 79% ICA stenosis in an 80-year-old male patient in the soonest duplex ultrasonography.

DISCUSSION

It has been an ingrained approach since 1996 that arteriotomy should be closed with a patch, if diameter of the ICA is less than 6 mm or if it is greater it can be closed primarily, as reported by Golledge et al.[12] The aforementioned authors showed that serious stenosis might develop 24 months after surgery in endarterectomized carotid arteries which were less than 6 mm in diameter and no patch was used in

Figure 1. External jugular vein pointed with a pick-up in the operative field after its major branches were ligated and cut during carotid endarterectomy.

Figure 2. An intraoperative view showing the external jugular vein patch after endarterectomy.
* External jugular vein patch.

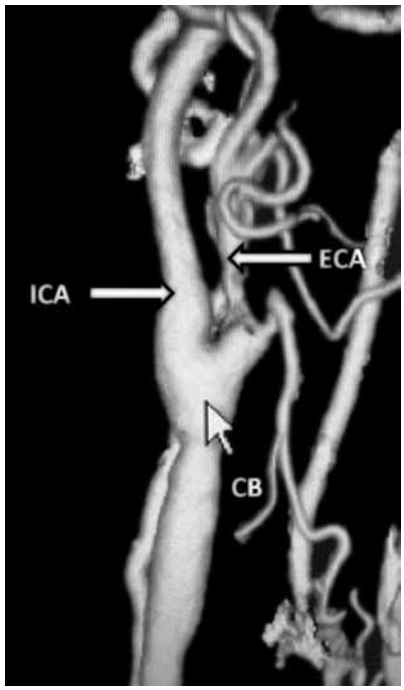

Figure 3. A computed tomography angiography image of a patient who underwent carotid endarterectomy with external jugular vein patching seven years ago. There is no aneurysmal dilatation of the patch extending the common carotid artery to the internal carotid artery.

ECA: External carotid artery; ICA: Internal carotid artery; CB: Carotid bulbus.

the arteriotomy closure. It was also demonstrated that the risk for stroke and death was remarkably reduced in patients whose arteriotomies were closed with a patch during CEA operation.[2] However, there is not any proved superiority of a patch material over another. Also, it has not been shown that any synthetic patch material (Dacron, PTFE) is more advantageous than another for stroke, death, and restenosis, except for one study. In that study analyzing 200 CEA operations, the authors concluded that PTFE patches reduced restenosis, stroke, and TIA after CEA operations, compared to the collagen impregnated Dacron patches.[2]

Furthermore, as autogenous patch materials such as saphenous vein, common facial vein (CFV), and EJV have an intimal surface, they can reduce the risk for thrombosis on the arteriotomy region and they are also more resistant to infection. However, some authors have suggested that synthetic patches such as Dacron, PTFE, and polyurethane are more robust and more resistant to the development of aneurysmal dilatation and ruptures.[13] In general, saphenous veins are used for coronary artery and peripheral arterial bypass graft surgery. Access to the EJV can be accomplished through the same incision during CEA, which possibly prevents incision-related morbidities in diabetic and obese patients, in particular.[14] The fact that there is no extra incision serves another advantage: namely, the operation can be performed under cervical blockage or local anesthesia.

In a series of 11 patients, Aslım et al.[15] showed that it was safe to use EJV as a patch material for local complications (i.e. bleeding, hematoma, edema, infection) during CEA.[15] No difference was found in non-randomized studies that compared patient groups in which saphenous veins or everted neck veins were used for patching in CEA operations for moderate and severe restenosis rate and stroke prevention.[7] It was reported that EJV was a safe and reliable material and the incidence of local complications and neurological deficits were similar to the PTFEs.[16] Long-term freedom from ipsilateral neurological events and severe restenosis was improved (up to 90%) in patients undergoing CEA, in which either a saphenous vein or cervical vein (CFV, EJV) was used for patching.[17] In our small series of patients, we observed no neurological event related to the EJV patch and found silent mild to moderate restenosis in 15% patients during follow-up. However, this method can be challenging in certain patients who have an arteriotomy length of >5 cm. As a cervical vein cannot be adequate to close arteriotomy, synthetic patchs should be available in the operation room and legs should be prepared for saphenous vein harvesting in these cases.

In the present study, we used two-layer EJV, as one-layer EJV is thin and weak for carotid patching. Despite its aforementioned advantages, its use requires some technical details. As EJV patch has two layers and it can be twisted, it should be sutured carefully at the distal and proximal ends, in particular, by passing sutures through the both layers. Meticulous hemostasis is also critical, since blood oozing between the layers of EJV may cause a patch hematoma. Doppler ultrasonography is helpful for the evaluation of the patch hematoma within the first week after the operation. In these cases, stent implantation to the patch hematoma segment of carotid artery may be a good choice.

In conclusion, external jugular vein patches with an intimal layer can reduce the risk for thrombosis and restenosis, and neurological events during the perioperative period, eventually. It also precludes

another incision for patch materials. The integrity of the saphenous vein is preserved by the help of this graft in patients with generalized atherosclerosis with coronary and peripheral atherosclerosis.

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