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Original Article

Our Carotid Endarterectomy Experiences with Regional Anesthesia

Rejyonel Anestezi Altında Karotis Endarterektomi Tecrübemiz

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ABSTRACT

Aim: Carotid endarterectomy is a standard revascularization option for carotid atherosclerosis. Regional anesthesia for carotid endarterectomy has become a preferred anesthesia technique in lots of centers. In this study, we present our carotid endarterectomy experiences with regional anesthesia.

Material and Methods: From 2019 to 2022, 271 patients who underwent carotid endarterectomy with regional anesthesia in two centers were included. Retrospectively, patient data, demographical characteristics, comorbidities, and radiological imaging features were enrolled by searching the hospital database. The primary endpoint was to describe the outcomes.

Results: Of the 271 participants, 202 were male, and 69 were female. The mean age was 65.3±10.2. General anesthesia was maintained for two patients due to inadequate patient collaboration. The average operation time was 52±8.9 minutes. The mean X-clamp time was 14±2.5 minutes, and the patient stayed in the intensive care unit for an average of 14±2 hours. The most common postoperative complication was bleeding (n=8). No cranial nerve damage was observed. There was no procedural death. Patients were discharged within an average of 5 days.

Conclusion: Regional anesthesia can be safely performed for carotid endarterectomy. Considering patient preference and compliance, regional anesthesia is the first option for carotid endarterectomy operations in our routine.

Keywords: carotid artery stenosis, carotid endarterectomy, regional anesthesia

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Öz

Amaç: Karotis endarterektomi, karotis aterosklerozu için standart bir revaskülarizasyon seçeneğidir. Karotis endarterektomi için bölgesel anestezi birçok merkezde tercih edilen bir anestezi tekniği haline gelmiştir.

Bu çalışmada, bölgesel anestezi ile karotis endarterektomi deneyimlerimizi sunuyoruz.

Gereç ve Yöntemler: Çalışmaya 2019-2022 yılları arasında iki merkezde rejyonel anestezi ile karotis endarerektomi uygulanan 271 hasta dahil edildi. Retrospektif olarak hasta verileri, demografik özellikler, komorbiditeler ve radyolojik görüntüleme özellikleri hastane veri tabanında taranarak kaydedildi. Birincil son nokta, sonuçları tanımlamaktı.

Bulgular: 271 katılımcının 202'si erkek, 69'u kadındı. Yaş ortalaması 65,3±10,2 idi. Yetersiz hasta kooperasyonu nedeniyle iki hastaya genel anestezi uygulandı. Ortalama operasyon süresi 52±8,9 dakika idi. Ortalama X-klemp süresi 14±2,5 dakika olan hasta ortalama 14±2 saat yoğun bakımda kaldı. Ameliyat sonrası en sık görülen komplikasyon kanamaydı (n=8). Kraniyal sinir hasarı gözlenmedi. Prosedürel bir ölüm olmadı. Hastalar ortalama 5 gün içinde taburcu edildi.

Sonuç: Karotis endarterektomi için rejyonel anestezi güvenle uygulanabilir. Hasta tercihi ve uyumu göz önüne alındığında rutinimizde karotis endarterektomi operasyonlarında rejyonel anestezi ilk seçeneğimizdir.

Anahtar Kelimeler: karotis arter stenozu, karotis endarterektomi, rejyonel anestezi

Introduction

In Europe, with a population of 715 million, 1.4 million people suffer a stroke yearly, and carotid artery atherosclerosis is one of the most important causes. The prevalence of extracranial carotid stenosis secondary to atherosclerosis in patients over 65 y/o ranges from 6% to 15%. Therefore, carotid endarterectomy (CEA) is the gold standard for the treatment(1, 2). The CEA procedure consists of painful steps, such as skin and subcutaneous tissue incisions and carotid artery exposure.

However, there are some difficulties in the neurological follow-up of the patient during general endotracheal anesthesia (GEA). These difficulties can be significantly overcome by preferring regional anesthesia (RA). Despite its negative aspects, such as requiring patient cooperation and some difficulties in pain control, RA is an excellent alternative to GEA due to its advantages, such as shortening the hospital stay and low risk of hemodynamic instability (3). However, the issue of which anesthesia method should be chosen in CEAs is still controversial.

In this retrospective study, we aimed to present the results of our CEA operations under RA.

Material and Methods

Between 2019-2022, 271 patients underwent CEA operations under RA in Ankara City Hospital and Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Education and Research Hospital. Local ethics committee approval and written informed consent from all patients were obtained. In addition, patient's demographic characteristics, radiological imaging, and perioperative data were obtained retrospectively from the hospital database.

The indications for the operation were by the ESVS 2017 guideline, and the indications were based on duplex ultrasonography and computerized tomographic angiography measurements. Risk factors include diabetes mellitus, hypertension, smoking, hyperlipidemia, preoperative Cerebrovascular accident (CVA) history, coronary artery disease, peripheral artery disease, and preoperative drugs such as acetylsalicylic acid, clopidogrel, statin, and anticoagulant were obtained from demographic data. Radiological findings were evaluated. Operative parameters such as operation time, x-clamp time, shunt, and patch usage were recorded.

Premedication (Midazolam, 0.03 mg/kg) was administered to the patients at a dose that would not interfere with their preoperative neurological evaluations. During the operation, all patients underwent complete monitoring (electrocardiography, pulse oximetry, invasive radial arterial pressure monitoring).

While RA was applied to 269 patients, GEA was used in only two patients due to insufficient cooperation with RA. Our RA technique was a superficial cervical block. Minimal sedation (with dexmedetomidine, remifentanil, and propofol) was administered to all patients at a dose that did not interfere with the neurological examination. In some patients, we applied local anesthesia during the skin incision.

Our surgical technique was endarterectomy and patch plasty or eversion CEA with the anterior approach. Neurological examination was performed at all stages of the operation, and near-infrared spectroscopy (NIRS) follow-up was performed.

In the postoperative period, the length of stay in the intensive care unit and hospital and complications were recorded.

SPSS v20.0 (SPSS Inc., Chicago, IL) was used for data analysis. Data were given as mean±SD and percentage.

Results

Postoperative demographic data and medical treatment are given in Table 1. 202 (74.5%) of the patients were male. The mean age was 65.3±8.5.

Table 1. Demographic Data and Medication

	Percent
Male to female ratio	74.5
Mean age	65.3
Acetylsalicylic acid	92
Clopidogrel	65
Statin	72
Oral anticoagulant	21

Regional anesthesia was used in 269 of a total of 271 surgical procedures. Two patients were switched from RA to general anesthesia due to their inability to adapt to surgical positions and difficulties in patient cooperation. There were no neurological events in these patients.

Risk factors are given in Table 2. The most common of these was hypertension (84.2%). Seventeen surgeons performed the eversion endarterectomies, but 80.9% of all interventions belonged to two surgeons. The carotid shunt was used in 32 patients (11.9%) due to insufficient collateral flow. Of these, 37.5% had complete occlusion in one of the carotid arteries. Fourteen patients (43.7%) had severe bilateral carotid stenosis. A shunt was placed immediately in patients who were found to have ischemia in neurological examination and NIRS after carotid sciatica. Twelve patients lost consciousness, ten had confusion, five had dysarthria, and five had contra-lateral motor movement loss.

Table 2: Comorbidities

	Percent
Hypertension	84.2
Coronary artery disease	67.4
Diabetes mellitus type 2	57
Active smokers	23.1
Hyperlipidemia	68.2
Preoperative Cerebrovascular Accident History	5.1
Peripheral Artery Disease	38.4

Twenty-five of the thirty-two patients who received perioperative NIRS showed a 20% decrease in NIRS. The mean carotid X-clamp time was 18 ±3 minutes. The operative time (12.5 ± 3 minutes) was significantly shorter in patients with primary repair compared to other techniques ($p < 0.001$).

In carotid artery intervention, 123 (46.2%) primary repair, 111 (41%) patch plasty with Dacron patch, 22 (8%) patch plasty with an autogenous vein graft, 10 (3.4%) eversion CEA and 5 (1%), four bovine carotid artery graft was used. Eight (2.9%) patients underwent revision due to bleeding.

In the postoperative period, minor neurological events (dysarthria, facial palsy, and motor loss in the tongue) were observed in 10 (3.7%) patients. Transient ischemic attack (TIA) was seen in 9 (3.3%) patients. CVA was observed in 6 (2.2%) patients postoperatively in the first thirty days (Table 3).

Table 3: Complication Rates

	Cases	
Complications	No.	Percent
Vocal cord paralysis	4	1.4
Hematoma requiring reoperation	8	2.9
12th nerve palsy	6	2.2
Transient ischemic attack	9	3.3
Stroke	6	2.2

11 (4.6%) patients had a fatal or non-fatal myocardial infarction (MI). The average length of stay in the intensive care unit was 14 hours, and the average hospital stay was five days. In-hospital mortality occurred in 10 (3.7%) patients. The first thirty-day mortality rate was 5.2%. Concurrent cardiac surgery was performed with CEA in 25.6% of the patients. These patients first performed CEA with RA and open-heart surgery with GEA.

Discussion

Carotid artery stenosis due to atherosclerosis is responsible for 20% of strokes, an important cause of mortality and morbidity. This condition is most commonly caused by cerebral embolism, which consists of ulcerated plaques in the carotid artery. Therefore, early treatment of severe carotid artery stenosis is important. The NASCET study demonstrated the superiority of surgical treatment over medical therapy in patients with symptomatic carotid artery stenosis (4). Again, similar results were obtained in the ECST study, and surgical treatment was recommended for appropriate patients (5). However, surgical intervention has some complications, especially during the perioperative stroke. Continuous perioperative neurologic monitoring can limit these complications. RA enables real-time

cerebral monitoring and is a good alternative to CEA. Also, some advantages of RA are low shunt placement rates and a safe method for X-clamp intolerance (3). Although GEA is the most preferred type of anesthesia in CEA operations today, RA is widely used in our clinic due to these advantages. There are many studies in the literature on surgical treatment strategies.

Similarly, the effect of anesthesia technique on the success of surgical treatment was also investigated. Whether general endotracheal and RA are superior to each other is the main subject of the studies(3). GEA is a comfortable technique for patients and surgeons. It can be preferred, especially in patients with high anxiety and in patients who cannot tolerate surgery and cannot cooperate. However, the most significant disadvantage of this anesthesia technique is the difficulty in monitoring the neurological status of the patients. However, the neurological examination is possible in awake patients. In addition, RA affects hemodynamic stability and is less costly (6). In addition, RA prevents complications associated with unnecessary shunt use and shortens hospital stays(7). GEA is a comfortable technique for patients and surgeons. It can be preferred, especially in patients with high anxiety and in patients who cannot tolerate surgery and cannot cooperate. However, the most significant disadvantage of this anesthesia technique is the difficulty in monitoring the neurological status of the patients. However, the neurological examination is possible in awake patients. In addition, RA affects hemodynamic stability and is less costly(6). In addition, RA prevents complications associated with unnecessary shunt use and shortens hospital stays(7).

On the contrary, the need for shunt and cerebral monitoring in GEA are disadvantages of this technique in CEA operations. The arguments that reasonable ventilation control, which can be considered an advantage, provides a safe airway, increase surgical comfort, and offer better cerebral protection are still debated (8). A comprehensive meta-analysis highlights that the risk of stroke, TIA, cardiac, pulmonary, and vascular complications, and 30-day mortality are higher in general anesthesia than in RA (9). Many factors have been suggested regarding the use of shunts in CEA operations. Electroencephalography (EEG) recordings showed that cerebral perfusion decreased by more than 70% in contralateral occlusions and carotid stenosis, and shunt use was recommended in these cases (10). In CEA surgeries performed under RA, being awake is the best method of monitoring the adequacy of brain perfusion (8). Therefore, RA is a technique that reduces unnecessary shunt use in CEA operations. A total of 32 shunts were used in our cases, and the use of the shunt was decided according to the perioperative neurological status. This resulted in a substantial reduction in strokes associated with shunts. Therefore, we think using RA techniques in our patient cohort reduces unnecessary shunt use.

Studies indicate that perioperative stroke or death risk is low in CEAs performed with RA (11, 12). However, other studies comparing general endotracheal and RA methods suggest no statistical difference. In these studies, the perioperative stroke risk in CEAs was reported to be 1.5-3% (13, 14). Our study found the 30-day CVA rate to be 2.5%.

Studies show that postoperative hypertension is reduced in patients who receive RA instead of general anesthesia (15). For example, hypertension was diagnosed in 84.2% of the patients in our cohort, and we observed that MI and mortality were reduced with RA thanks to blood pressure regulation in the intraoperative and postoperative periods.

The most crucial non-neurological complication in the postoperative period in CEA is MI. It is also the most common cause of postoperative death(16). Studies have reported that 30-80% of CEA patients have coronary artery disease. In our cohort, this rate was 67.4%. The incidence of less MI in CEAs performed with RA is consistent with our results (17). While MI was reported between 7-12% in patients who underwent CEA under GEA, it was 4.6% in our cases (18).

With RA, the postoperative recovery is faster, and the duration of intensive care and hospital stay is shorter(18). Therefore, in case of good patient cooperation with an experienced team, RA will be preferable to increase patient comfort and reduce the length of stay in hospital and intensive care units.

In our study, the average length of stay in the intensive care unit was less than one day, and the average hospital stay was five days. Although this period is shorter with GEA than with CEA, similar results have also been reported (7).

Conclusion

In conclusion, RA in CEA is a safe technique with acceptable complication rates. In addition, RA allows a healthier perioperative neurological follow-up. Although it contributes to shorter intensive care and hospital stays, a detailed preoperative evaluation and adequate patient enlightenment are essential for good patient cooperation.

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