



CORRELATING THE LENGTH OF THE INTERNAL CAROTID ARTERY PLAQUE TO THE TECHNIQUE OF ENDARTERECTOMY

Morphology

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ABSTRACT

The purpose of this article is to correlate the length of the internal carotid artery plaque to the technique of endarterectomy. In a prospective collaborative institutional database from 2007 to 2016 years a total of 250 patients (all of whom were selected according to the German S3 guideline) from department of general, visceral, and vascular surgery, university of Halle-Wittenberg, Germany and the vascular surgery department of LTD "Israeli Georgian medical research clinic helsicore", underwent ICA endarterectomy at either institutions. Our selection of the technique of the endarterectomy is made by considering the length of the atherosclerotic plaque defined by Scheberle. For a short atherosclerotic plaque we performed eversion endarterectomy (EEA) with cervical blockade (EEA + CB – Short). For atherosclerotic long plaque, conventional endarterectomy, using intracarotid straight shunt and Patch was undertaken. Under general anesthesia (GA). According to our data during the surgical treatment of internal carotid artery plaque, neurological complications related to eversion carotid endarterectomy with cervical block composed 0%. Those attributed to conventional endarterectomy with intracarotid shunt and patch under general anesthesia composed 1.45%. Thus in case of short atherosclerotic plaque of the internal carotid artery, eversion endarterectomy with cervical block, when the clinical requirements are met, seems to be an optimal choice. For the long atherosclerotic plaque of the internal carotid artery, conventional endarterectomy with the intracarotid shunt and patch-repair under general anesthesia is more suitable option.

KEYWORDS:

Internal carotid artery; Endarterectomy; General anesthesia; Cervical block

Introduction

The stenosis of the internal carotid artery (ICA), which is mainly caused by the atherosclerotic plaque, with its pathological sequelae, is a cardinal cause of disruptive perfusion to the brain. The degree of ICA stenosis is well established to be proportional to the incidence of ischemic strokes, thus overtly emphasizing its clinical significance. This pathology is widespread in the world, and as with the other cardiovascular diseases, has its predominance in the western hemisphere [1,2].

Duplex scanning of the ICA can provide a quantitative assay of the degree of stenosis as well as of the length of the plaque. In addition, more sophisticated diagnostics using digital angiography, Computed Tomography Angiography (CTA) or Magnetic Resonance Imaging (MRI) can also be implemented. In west European population the incidence rate of ischemic strokes commences at 20%, whereas in the united states atherosclerotic of the cervical carotid artery is responsible for at least 40% of ischemic strokes [3,4].

Nowadays carotid endarterectomy remains to be the safest method of preventing carotid associated ischemic strokes. The most frequently used methods of carotid endarterectomy are eversion endarterectomy (EEA) and conventional endarterectomy (CEA) [5]. Although the main question, what type of method is preferable in case of short atherosclerotic plaque and what type of method is preferable in case of long atherosclerotic plaque, is yet to be addressed.

There is no common opinion about correlating the length of the internal carotid artery plaque to the technique of endarterectomy. Our selection of the technique of the endarterectomy is made by considering the length of the atherosclerotic plaque defined by Scheberle.

Regardless of the surgical technique and anesthesia performed, various postoperative complications (stroke, transient ischemic attack, myocardial ischemia), commencing at 3% in asymptomatic and 6% in

symptomatic patients, were asserted through various multicenter studies [6,7]. In this study we aim to correlate a preferential surgical technique selection (eversion vs. conventional) in regard of the length of ICA plaque at hand.

Materials and methods

In a prospective collaborative institutional database from 2007 to 2016 years a total of 250 patients (all of whom were selected according to the German S3 guideline) from department of general, visceral, and vascular surgery, university of Halle-Wittenberg, Germany and the vascular surgery department of LTD "Israeli Georgian medical research clinic helsicore", underwent ICA endarterectomy at either institutions. Indications for surgery were: > 60% ICA stenosis (according to NASCET) proven by Duplexsonography in neurologically symptomatic patients, and > 70% (according to NASCET) ICA stenosis proven by Duplexsonography in neurologically asymptomatic patients.

The main criteria determining the choice of endarterectomy technique (either conventional or eversion), was the length of the atherosclerotic plaque measured by Duplexsonography. The definition of the length of the ICA plaque was in accordance with criteria mentioned above, with the short plaque (< 1cm) and a long plaque (> 1cm) [8,9].

For a short atherosclerotic plaque we performed eversion endarterectomy (EEA) with cervical blockade (EEA + CB – Short). Here intraoperative neuromonitoring was conducted through confirmatory squeaking in response to command given using a rubber shouter toy placed in the contralateral hand.

For atherosclerotic long plaque, conventional endarterectomy, using intracarotid straight shunt and Patch was undertaken. Under general anesthesia (GA) [10,11].

The patient pool was divided into two different categories according to the surgical technique: EEA for short plaque; CEA for long

atherosclerotic plaque.

The first group was comprised of 44 patients who had a short atherosclerotic plaque, and had surgery conducted in the eversion method with cervical blockade [12].

The second group was comprised of 206 patients, who had a long plaque and underwent CEA. These patients were intubated and had received GA.

For all patients (n = 250), whenever antiplatelet therapy was previously used, it was discontinued to the day of the planned surgery. A bolus 5000 units of unfractionated Heparin was given to all patients intraoperatively immediately before clamping. Before ending the surgery all the patients, who had received GA were checked by DSA (digital subtraction angiography). In addition, all patients, were postoperatively perfused with 600 U/hr unfractionated Heparin continuously for the first 24 hours, followed by dual coverage with Aspirin (100mg - 325mg) as an antiplatelet drug and a low molecular Heparin, until complete mobilization. Thereafter, patients were reverted back to sole antiplatelet therapy.

Statistical analysis

Data were statistically analyzed using SPSS 15.0 for Windows (SPSS INC, Chicago, IL, USA). Statistical significance was defined as P < 0.05. statistical significance was calculated using unpaired Student's t-test. All data presented as means with standard deviation (+/- SE).

Results

As depicted in Table 1, in the (EEA + CB – Short) group, out of the 44 patients eligible, one patient sustained myocardial infarction with positive outcome (2.27%; p < 0,05). No neurological or other complications were observed in the remaining patients. Thus strictly speaking, the complication rate directly linked to the Endarterectomy performed in this group was virtually none.

Table 1 : Stratification of technique of endarterectomy, type of anesthesia and length of stenosis to various neurological and non-neurological complications

		EEA + CB - Short	CEA + GA - Long
Number of Patients		44	206
Complications	Myocardial infarction	1	0
	Ischemic Stroke	0	1
	TIA	0	2
Percentage		2.27%	1.45%

EEA: Eversion endarterectomy; CEA: Conventional endarterectomy; CB: Cervical blockade; GA: General anesthesia; TIA: transient ischemic attack

Regarding the (CEA + GA – Long) group, 2 patients out of 206 had a fully reversible transient ischemic attack (TIA), and one patient had an ischemic stroke (1.45%, p < 0,05).

Discussion

In this series, an eversion endarterectomy (EEA) with cervical blockade (CB) (classic approach of Winnie), was the preferred method whenever a short ICA plaque was sonographically confirmed. This collaboration of surgical technique and type of anesthesia used, was justified by the lesser technical demand to conduct an eversion endarterectomy, hence reflecting on its shorter duration. The incision to closure duration for EEA was 45.2 min +/- 14.0 minutes VS 60.6 +/- 12.1 min for CEA (p < 0.001). This discrepancy in duration can be attributed to the smaller incision required, less mobilization needed for the ICA and a smaller suturing distance implemented for the circular anastomosis in comparison with the longitudinal incision with patching. Logically this is a major appeal for the procedure tolerability by the patient. In this group no patients developed any form of neurological deficits. Constant intraoperative contact with the patient, using a confirmatory squeaking toy in the contralateral hand, served as a neuromonitoring and assured non-disrupted brain perfusion. A clear indication for immediate intracarotid shunting would be a negative response on command. Here, conversion to general anesthesia and

CEA would be commenced. Fortunately, none of these patients had neurological deficits during clamping. Thus we didn't have to change the method of endarterectomy intraoperatively due to any technical difficulties.

Conventional endarterectomy (CEA) on the other hand is regarded to be more technically demanding, hence also time consuming. In this setting, intraoperative neuromonitoring must be assayed through more invasive methods. It is agreed upon by some authors [13], that when a prolonged closure of the internal carotid artery is observed and in order to decide the necessity of intracarotid shunt placement. Simultaneous monitoring of brain perfusion can be conducted through measurement of evoked potentials, EEG registration and perfusion pressure assay in the distal pool of the ipsilateral internal carotid artery (intracarotid tensiometry). In addition to being expensive, evoked potentials measurements and EEG registration depict neurological damage only after its occurrence. Whereas for intracarotid tensiometry, retrograde filling from collateral blood vessels might provide the false impression of adequate brain perfusion. To avoid this dilemma, we pursued intracarotid shunting routinely whenever general anesthesia was conducted.

In concordance with the well established data linking direct the closure of the ICA to luminal narrowing, with a re-stenosis incidence rate ranging from 1.0 - 14.0% [14], all patients undergoing a conventional endarterectomy in this series had Dacron patching. By implementing that, re-stenosis rates have been reported to fall 0.1 - 5.8% [15]. However, due to heightened risk regarding intra- and postoperative bleeding, advanced surgical proficiency is required.

Hence according to our data during the surgical treatment of internal carotid artery plaque, neurological complications related to eversion carotid endarterectomy with cervical block composed 0%, however there was one patient who sustained myocardial infarction with positive outcome. Those attributed to conventional endarterectomy with intracarotid shunt and patch under general anesthesia composed 1.45% (see table 1).

Conclusions

In case of short atherosclerotic plaque of the internal carotid artery, eversion endarterectomy with cervical block, when the clinical requirements are met, seems to be an optimal choice. For the long atherosclerotic plaque of the internal carotid artery, conventional endarterectomy with the intracarotid shunt and patch-repair under general anesthesia is more suitable option.

This type of selection of the patients preoperatively is convenient to the vascular surgeons, due to the optimal planning of the surgery, which contributes to decreasing the risk of intraoperative complications.

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