

ORIGINAL ARTICLE

Carotid Endarterectomies in Latvia

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Summary

Introduction. Carotid endarterectomy (CEA) is a treatment of choice for significant carotid stenosis, and it has an important role in stroke prophylaxis, that is proved in many trials all over the world.

Aim of the study. To evaluate preoperative diagnostic methods, risk factors and co-morbidities, operation results for patients undergoing CEA in Latvia.

To analyze used anaesthesia and operation technique in CEA in Latvia.

To reflect carotid endarterectomy results that depends from chosen operation technique.

Materials and methods. 317 patients were included in the retrospective study from January 1st till December 31st, 2008. Patient charts were evaluated for information about history of disease and other comorbidities, preoperative investigation, operation and early postoperative period followed by protocol. All patients were divided into three groups depending on type of endarterectomy (CEA with primary suture, with patch or eversion CEA).

Results. In 59% cases carotid disease were asymptomatic. Computer tomography angiography (CTA) and duplex ultrasound were the most common diagnostic methods to evaluate carotid stenosis. 339 carotid endarterectomies were performed, where CEA with primary suture was used in 56.2% of cases (group1). There were no significant differences in patient atherosclerotic risks factors, comorbidities, preoperative investigation methods, time of surgery and complications rate between the groups.

Conclusions. In Latvia carotid endarterectomy is carried out mostly in classical conventional techniques and arteriotomy is being closed with a primary suture.

Key words: carotid endarterectomy (CEA).

INTRODUCTION

Ishaemic stroke is one of the main causes of death in the world, and the leading cause of morbidity in many countries. Mortality rate from stroke is 10-30% and there is a high risk for recurrent stroke or transient ischaemic attack, and coronary syndrome as well for survivors (1, 2).

In 2007 there were 222 cases of death on 100 000 persons from cerebrovascular events in Latvia (3).

Atherosclerosis of brachiocephalic arteries, especially internal carotid artery is the main cause of ischaemic stroke.

Carotid endarterectomy is a conventional surgical method, which was established in 1954, and widely used at present. CAE is evacuation of atherosclerotic plaque with intima of vessel in carotid bifurcation and in segmental proximal part of internal carotid artery (4).

There were two large clinical trials in Europe and North America, which approved, that CAE has a significant benefit in ischaemic stroke prophylaxis. In 1991 published NASCET (North American Symptomatic Carotid Trial) and ESCT (European Carotid Surgery Trial) results showed, that CAE is more effective in reducing recurrent cerebrovascular events than conservative treatment for symptomatic carotid patients. NASCET trial results reflected, that after 2 year follow-up relative

risk reduction was 81% in carotid endarterectomy group in comparison with medical therapy. Very similar results were found in European ESCT trial. After 3 year follow-up risk for stroke was 2.8% in carotid endarterectomy group vs 16.8% in medical treatment group, respectively there were sixfold reduction of risk. Comparing to previously mentioned trials, Veterans Affairs Symptomatic Trial (VAST) showed a significant reduction of risk in CAE group in symptomatic patients as well. After one year follow-up risk for cerebrovascular events was 7.7% in endarterectomy group vs. 19.4 in conservative treated patients (4, 5, 6).

Similar trials were done for asymptomatic carotid artery disease as well. In return Veterans Affairs Asymptomatic Trial (VAAT) was one of the first trials that demonstrated stroke reduction for patients, who received prophylactic carotid endarterectomy. ACAS (Asymptomatic Carotid Atherosclerosis Study) trial showed, that perioperative risk for stroke was 5.1% in cases of surgery group vs. 11% in non-surgical group, that means operation reduces relative stroke risk for 53%. In other asymptomatic carotid trial - Asymptomatic Carotid Surgery Trial (ACST) risk of fatal stroke, fatal and disabling stroke and all strokes were assessed. The study reflected in 5 year follow-up, that risk for fatal stroke were 2.1% in carotid endarterectomy group vs 4.2% in conservative

group, for fatal and disabling stroke 3.5% vs 6.1% and all strokes were 6.4% vs 11.8%. ACST demonstrated that stroke risk for women reduces after longer time after CAE, while in men population a significant benefit from surgery is observed faster. In ACAS trial there were no significant benefit from CAE for women proven (7, 8, 9, 10).

Two invasive treatment options for severe carotid artery stenosis are most used in medical community today – carotid endarterectomy and carotid stenting.

Indications for invasive treatment are based on five aspects: neurologic symptoms, degree of carotid stenosis, comorbidities, local and vascular anatomy features, morphology of the atheroma. The choice of invasive or conservative treatment is determined by neurologic symptoms of patients and degree of carotid stenosis. Comorbidities, local and vascular anatomy features and morphology of the atheroma are important aspects of the selection of the type of invasive treatment. The choice of the treatment is determined also by complication severity and incidence of treatment (11).

According to European Society of Vascular Society guidelines for invasive treatment of carotid stenosis indications for carotid endarterectomy is for symptomatic patients with stenosis 70-99% and contraindicated for symptomatic patients with less than 50% stenosis. For symptomatic patients perioperative stroke or death rate should be less than 6%.

For asymptomatic patients CAE is recommended for men with carotid stenosis 70-99%, if surgical risk is less than 3%. For women with asymptomatic carotid stenosis benefit from carotid endarterectomy is significantly less than for men. Therefore there are still many discussions about the choice of the method of treatment (11).

Recently the carotid stenting is becoming as a promising method to treat carotid stenosis. However European Society of Vascular Society collaborator group for treatment of carotid stenosis, concluded, that there is a need for more trials to find suitable treatment for carotid stenosis in special patient groups. Therefore today carotid stenting is used for patients with high surgical risk, but carotid endarterectomy is still a treatment of choice (11).

Carotid endarterectomy can be performed under local or general anaesthesia, both methods are safe (11). This been confirmed by GALA (General Anaesthesia vs. Local Anaesthesia) trial recently (12).

GALA Trial was the largest trial where the methods of anaesthesia were compared for 3526 patients undergoing CAE. Results showed, that there is no significant differences in operation results in general and local anaesthesia groups. GALA trial proved that surgical complications are less than in NASCET and ECST trials. It might be a sign that the results of carotid endarterectomy are improving. Vascular Surgery centers of Latvia took part in GALA trial as well (12).

Carotid endarterectomy can be performed in several techniques: carotid endarterectomy with primary suture, with synthetic or autologous patch or eversion endarterectomy.

There are some trials comparing carotid endarterectomy with primary suture and with patch. In groups of carotid endarterectomy with a patch there were significantly less perioperative stroke and death rates in early postoperative period, as well less restenosis risk in late postoperative period, but quality of those trials were poor, and results are not considered consistent. Studies, where eversion endarterectomy vs conventional endarterectomy with patch were compared showed no significant differences in perioperative stroke, death rates and in risk of restenosis. Today there are no recommendations in which technique carotid endarterectomy should be performed. Worldwide all techniques are used by the decision of the surgeon (13, 14).

Cerebral blood supply through carotid artery are temporally interrupted on time of CAE. Intraluminal shunts can be used to decrease the time of temporal occlusion. In trials, that compared operation results depending on the use of intraluminal shunts, there were no significant differences in both groups. There is no evidence of the benefit of routine use of intraluminal shunts (15).

Stroke and death are the most serious CAE complications. The number of cerebrovascular events was 6,5% in NASCET, of 5,8% in ECST and 5,5% in VAST trial. In asymptomatic carotid trials cerebrovascular events are more rare, for example, in ACAS trial only 1,1 %. Death makes 0,6% in NASCET and ECST trials in perioperative and early postoperative period, but 0,1% in ACAS trial (4, 5, 6, 8, 11).

Some cranial nerve disturbances have been reported after CAE. Temporal or permanent nerve disturbances develop in 2-15% of cases. *n. hypoglossus* and *n. facialis* are more often involved in damages (4).

Wound haematomas are rare and been reported in 1-3% of cases. Cardiovascular events like myocardial infarction develops around 1% for patients after CAE, in NASCET trial non-fatal myocardial infarctions were observed in 0,8% of cases and 0,4 % in ACAS trial (4, 5, 16).

In the same time perioperative CAE results have not been reported so far.

AIM OF THE STUDY

To evaluate preoperative diagnostic methods, risk factors and co-morbidities, operation results for patients undergoing CAE in Latvia.

To reflect carotid endarterectomy results depending from the chosen operation technique and anesthesia.

MATERIALS AND METHODS

The retrospective analysis of all patients operated in vascular surgery centers in Latvia from January 1st till December 31st, 2008 was performed. 317 consecutive patients undergoing 339 CAE at Pauls Stradins Clinical University Hospital and Riga Eastern Clinical University Hospital were included into study.

Severity of carotid stenosis was evaluated with duplex ultrasound (US) examination, computer tomography angiography (CTA), or digital subtraction angiography

(DSA), or magnetic resonance angiography (MRA). Following atherosclerosis risk factors were evaluated: arterial hypertension, diabetes mellitus and dyslipidemia. 80% of all patients were on statin therapy, 95% were on aspirin. Significant comorbidities were analyzed: coronary heart disease, chronic heart failure, peripheral artery occlusive disease and abdominal aortic aneurysm.

The following information about the operation was collected: duration of surgery, operation technique, type of anaesthesia, use of intraluminal shunt and active aspiration drainage.

Following postoperative complications were evaluated such as: stroke or transitor ischaemic attack, cranial nerve injuries (temporal and permanent), myocardial infarction, pulmonal thrombembolism, wound complications (haematoma and infection).

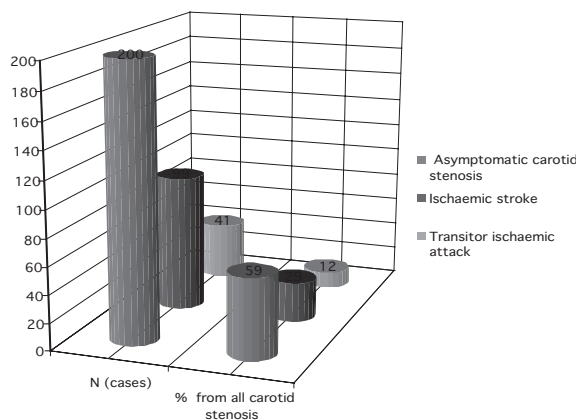
First 24 postoperative hours all patients were in intensive care unit, where they received prophylactic antibacterial therapy and correction of arterial hypertension, if indicated.

Chi-Square test was used to analyze the results, and p-values were evaluated.

RESULTS

The average age for patients was 67 years (45 - 85 years). From all patients 112 were women (35%) and 205 men (65%). All carotid artery stenosis were significant (70-99%) by international guidelines. 200 (59%) of patients were asymptomatic. Distribution of neurological symptomatology is depicted in Table 1.

Table 1. Distribution of neurological symptomatology for patients with symptomatic carotid stenosis



Distribution of asymptomatic carotid artery stenosis in all study groups is shown in Table 2.

Table 2. Asymptomatic carotid artery stenosis

Group	Asymptomatic carotid stenosis (cases; n)	% from all carotid stenosis in each group
1. group (CAE with primary suture)	93	59
2. group (CAE with a patch)	27	48
3. group (eversion CAE)	79	65

Arterial hypertension in 70% of cases was as a dominant atherosclerosis risk factor. In 32% of cases patients suffered from coronary artery disease and severe heart failure (NYHA class III and IV).

Atherosclerosis risk factors and comorbidities are summarized in Table 3 and 4.

Table 3. Atherosclerosis risk factors for the patients undergoing CAE

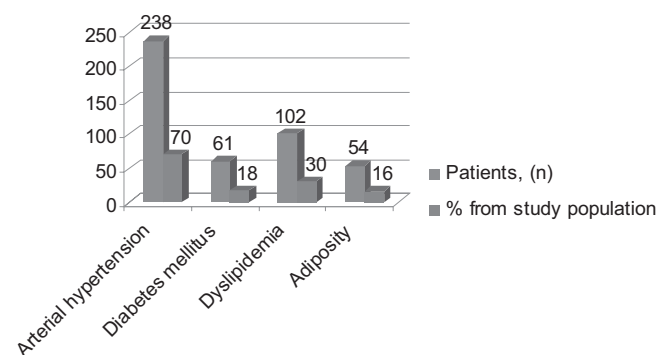
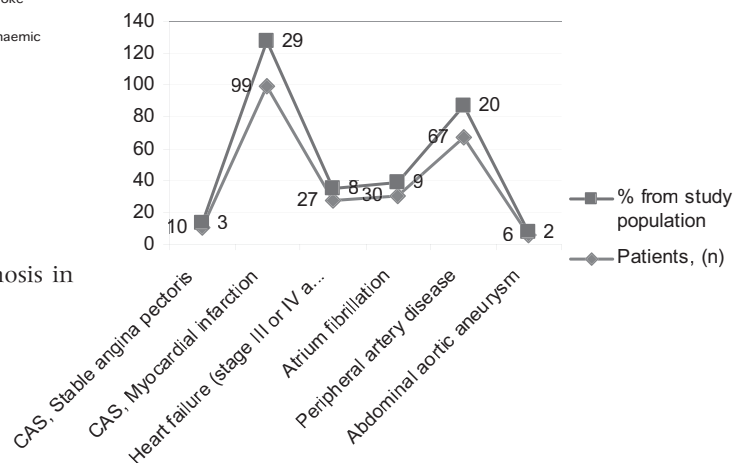


Table 4. Main comorbidities for study population undergoing CAE



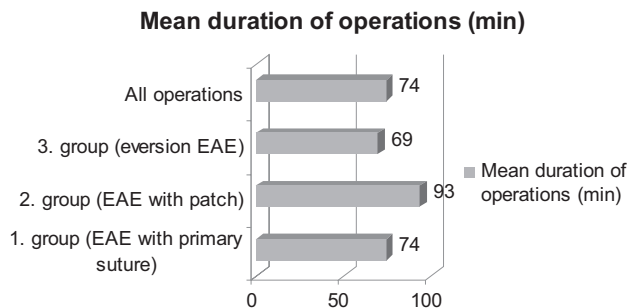
CTA was more often used investigation method for evaluation of carotid artery disease. In 43.6% of cases carotid arteries were investigated with CTA only. Significant role in carotid evaluation belonged to US, which in combination with CTA was used in 33,9% of cases, but it was seldom used as a single diagnostic tool (13,5%). DSA and MRA were rarely used as diagnostic methods for carotid arteries (Table 5).

Table 5 Choice of methods in preoperative investigation of carotid artery

Method	Cases (n)	%
US	46	13.5
CTA	148	43.6
US + CTA	115	33.9
US + DSA	11	3.2
CTA + DSA	6	1.7
US + MRA	7	2.0
Only DSA	4	1.1
US + CTA + DSA	2	1.0

In total 339 carotid endarterectomies were made in one year period in Latvia. 158 (46.3 %) of cases underwent conventional endarterectomy with primary suture (Group 1), 56 (16,5%) of cases were made in conventional endarterectomy with synthetic patch (Group 2) and 122 (36.9%) of cases received eversion endarterectomy (Group 3). Five carotid endarterectomies were made in conventional open endarterectomy with Y-type reconstruction of internal and external carotid artery. 334 surgeries were done under general anaesthesia and only 5 operations were performed under local anaesthesia (1.5%). The average duration of operation was 74 minutes (40 – 135 minutes). Operations were significantly longer in Group 2. Results of duration of operation are shown in Table 6.

Table 6. Mean duration of CAE surgery



Intraluminal shunts were used in more than half of operations (55 %), comparatively rarely intraluminal shunts were used in eversion CAE group (Table 7.). Active aspiration drainage up to 88% in Group 1 and 59% in group 2 was used after wound closure.

Table 7. The use of intraluminal shunts and active wound drainage in operations (p<0.05%)

Groups	The use of intraluminal shunts (i/a) (n)	The use of intraluminal shunts (% from the number of operations in the group)	Active wound drainages (n)	Active wound drainages (% from the number of operations in the group)
1. group (EAE with a primary stitch)	106	67	139	88
2. group (EAE with a patch)	43	77	33	59
3. group (eversions EAE)	35	29	96	79
All operations	187	55	268	79

Early postoperation complications, that are linked with new cerebrovascular events were observed in 4.0% from all operations. Ischaemic stroke was the most often cerebrovascular complication. There were no death in perioperative period. Postoperative cerebral complications are summerised in Table 8 and 9.

Table 8. Early postoperative complications due to new cerebrovascular events for all patients (p<0, 05%)

Group	Ischaemic stroke (%)	Haemorrhagic stroke, (%)	Transient ischaemic attack, (%)
1. group (CAE with a primary stitch)	3 (1.9)	0	2 (1.3)
2. group (CAE with a patc)	2 (3.6)	0	1 (1.8)
3. group (eversion CAE)	2 (1.6)	1 (0.81)	1 (0.8)
All operations	7 (2.0)	1 (0.29)	4 (1.8)

Table 9. Early post-operative complications due to new cerebrovascular events for symptomatic and asymptomatic carotid stenosis (p<0,05%)

Group	Ischaemic stroke (%)	Haemorrhagic stroke, (%)	Transient ischaemic attack, (%)
Asymptomatic carotid stenosis	1 (0.29)	1 (0.29)	2 (0.6)
Symtomatic carotid stenosis	6 (1.8)	0	2 (0.6)

There were no wound infection or pulmonary artery embolism been observed after CAE. Wound haematoma was the most reported from the all non-neurological complications (2.9%). Postoperative complications that are not connected with cerebrovascular events are summarized in table 10.

Table 10. Non-cerebral post-operation complications after CAE (p<0, 05%)

Group	Wound haematoma (%)	Miocardial infarction (%)	Cranial nerve injury (%)
1. group (EAE with a primary stich)	8	3	1
2. group (EAE with a patch)	1	1	0
3. group (eversion EAE)	1	1	1
All operations	10 (2,9)	5 (1.5)	2 (0.6)

DISCUSSION

Results of carotid endarterectomy in Latvia are similar to results of large randomized trials published recently. 59% of Latvian patients undergoing CAE are asymptomatic, that is similar to North American practice of treatment carotid stenosis, higher than reported in European countries. CTA is more often used as a only diagnostic tool compare with ultrasound evaluation in Latvia, while this is opposite with North American and most of the European reports. Perioperative complication rate in Latvia is well below the international guidelines targeted. Cerebrovascular complication rate is 4.09% (both symptomatic and asymptomatic patients), that is due to satisfied carotid treatment practice, however, there is space for improvement.

There were no statistically significant differences in atherosclerotic risks factors, comorbidities, preoperative investigation methods, operation time, complication rate in all groups. Our results do not show any benefit between groups and current patient selection seems proper.

Unfortunately this report do not includes carotid artery PTA and stenting procedures becoming more frequent last years. To get more objective data about carotid invasive treatment in Latvia prospective comparison would be very helpful.

CONCLUSIONS

CTA prevales as a preoperative diagnostic method to evaluate carotid artery stenosis in Latvia.

Carotid endarterectomy is carried out mostly in classical conventional techniques and arteriotomy is being closed with a primary suture in most of the cases.

We conclude that vascular surgeons of Latvia are performing carotid surgery safely with internationally recognizable results within the complication limits.

Conflict of interest: None

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