

# Perioperative and Early Postoperative Neurological Deficit in Older Patients during Carotid Artery Thrombendarterectomy

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## ABSTRACT

*Cerebrovascular accidents, strokes in particular, are among the most frequent causes of death today in developed countries<sup>1-3</sup>. In the last two decades, stroke was the second most frequent cause of death in Primorsko-Goranska Region in Croatia. In older patients, individuals older than 65 years of age have an increased risk of stroke, mainly because the degree of carotid artery stenosis increases with age. The most frequent complication of the high percent stenosis of the carotid arteries is thrombosis in the area of atherosclerotic changes of blood vessels<sup>1-5</sup>. With the increase in the age of the population, there is also an increase in the number of risk factors of cerebrovascular accident. Doppler ultrasound sonography and Multi Slice CT scans have the most prominent role in the early detection of atherosclerotic changes and in the assessment of the degree of carotid artery narrowing. Today, in Croatia as well as worldwide, thrombendarterectomy holds the most important place in stroke prevention. Between 2006 and 2009, 209 patients underwent surgical intervention at the Clinical Hospital Center in Rijeka for high degree of carotid artery narrowing. In the group younger than 65 years of age, which consisted of 53 patients, a neurological deficit was noted in 4 patients (7.54%) in the perioperative and early postoperative course. In the group of individuals older than 65 years of age, which consisted of 156 patients, a neurological deficit was noted in 9 patients (5.76%). There was no significant statistical difference in the incidence of neurological deficit, nor in the mortality in individuals older than 65 years of age during carotid arteries thrombendarterectomy.*

**Key words:** carotid artery narrowing, thrombendarterectomy, stroke

## Introduction

Stroke is today the third leading cause of death in developed countries<sup>1</sup>. There are roughly 500.000 victims of first-ever or recurrent stroke each year in the United States, and stroke itself is the cause of death for 150.000 patients each year<sup>2-4</sup>.

Cerebrovascular diseases were the second most common causes of death in the Primorsko-Goranska Region during the last two decades. More than 94% of the individuals who died as a consequence of a stroke were patients older than 60 years of age.

Thrombosis in cerebral and an extracerebral blood vessels affected by atherosclerotic changes is the most frequent complication and extremely frequent cause of

death in western countries. The most frequent site for the development of atherosclerotic changes in extracranial blood vessels is the carotid artery, its bifurcation to be more precise.

The risk of ischemic attacks increases many times with age (individuals older than 65 yrs.) and in men with a family history of ischemic attacks in those with arterial hypertension and heart diseases<sup>5-7</sup>. Additional risk factors are: diabetes, smoking, dyslipidemia and overweight<sup>8,9</sup>. A precise assessment of the degree of atherosclerotic changes, i.e. of the percentage of carotid artery narrowing is extremely important in the stroke prevention algorithm. The high resolution Doppler ultrasound

sonography, followed by three-dimensional Multi Slice carotidography or MRI are the most important diagnostic procedures in the detection and assessment of the degree of carotid stenosis, and in the evaluation of the atherosclerotic plaque itself<sup>5</sup>.

Stroke is most frequently caused by complications due to atherosclerotic changes of the bifurcation of the carotid artery. The degree of carotid artery narrowing is an extremely important factor of prediction of stroke incidence<sup>10</sup>.

Stroke prevention consists in the reduction and decrease in risk factors. The most important modifiable risk factors are hypertension and glucose level in patients with diabetes, and the treatment of heart problems. The drugs which are most frequently used in the prevention of stroke are those in the group of antiagregans (Aspirin) and antithrombotics (Klopidogrel)<sup>11,12</sup>.

The most effective stroke prevention in patients with high degree of carotid artery stenosis is the dilatation of carotid bifurcation stenosis by means of stent placement, or the surgical carotid arteries thrombendarterectomy<sup>13</sup>.

## Materials and Methods

This study included 209 patients who underwent thrombendarterectomy in the period between 2006 and 2008.

All patients underwent the surgical intervention for high degree of carotid artery stenosis. The thrombendarterectomy was carried out in open treatment of the carotid arteries with full heparinization and using regional anesthesia known as »cervical block« in patients with full consciousness.

The neurological status of the patient was monitored during the whole intervention by direct verbal contact and by checking the pupillary reflex and motor functions on the contralateral side of the body, as well as by continuous monitoring of heart rate and arterial pressure.

During the intervention, immediately before thrombendarterectomy, on all patients the carotid arteries were clamped for at least three minutes. If a neurological or motor deficit occurred during the probationary period of clamping, the intervention was performed with the help of artificial carotid shunting.

In the early operative stage, the heart rate and the arterial pressure, as well as the neurological and motoric status are continuously monitored.

The comparison of the incidence of stroke or neurological deficit was carried out during the surgical intervention and in the early postoperative course was by dividing the patients into two groups: one group was made of individuals younger than 65 years and the other of those older than 65 years of age.

Out of the total number of 209 patients, a group younger than 65 years of age consisted of 53 patients (25.35%), and a group older than 65 years consisted of 156 patients (74.64%).

In the age group under 65 years, the youngest patient was 47 years old while the median age of this group was 59.9 years. In the group of patients over 65 years, the oldest patient was 86 years old while the median age of this group was 72.8 years. The gender representation in the younger age group was 39 men (73.58%) and 14 women (26.41%).

In the older age group there were 125 men (80.12%) and 31 women (19.87%). Both groups of patients underwent thrombendarterectomy of high percent carotid artery stenosis on the side with a higher percentage of stenotic process.

In the younger age group, 40 patients (75.47%) underwent the surgical intervention, with normal hemodynamic parameters on the contralateral side and with a stenotic process of the carotid artery below 50%. In 13 patients (24.52%) before the intervention was ascertained a contralateral carotid artery stenosis greater than 50% or an occlusive process of the carotid artery.

In the group over 65 years, 95 patients (60.89%) underwent surgery with normal hemodynamic parameters on the contraleteral side and with a stenotic process below 50%. In 68 patients (39.1%) was noted a preoperative contralateral carotid artery stenosis greater than 50% or an occlusive process.

Comorbidity was noted in both groups of patients in equal ratio and it consisted of hypertonia, diabetes mellitus, family predisposition, heart diseases and lipidemia.

## Statistical analysis

In this study, a standard computerized template was used. Statistica 6.1 analysis (StatSoft, Inc., Tulsa, USA) was used in the calculation of the statistical relevance –  $p < 0.05$ .

## Results

In the younger age group (N=53), during thrombendarterectomy and in the early postoperative course, a neurological deficit or a cerebrovascular insult occurred in 4 patients (7.54%) (Figure 1).

In all of them, Multi Slice CT showed various degrees of recent ischemic changes in the brain and a carotid artery rethrombosis was noted in one patient.

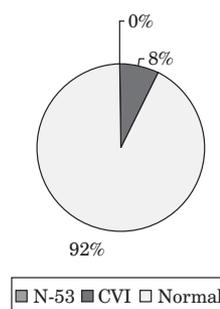


Fig.1. N –53 – Incidence of cerebrovascular insult in surgical patients.

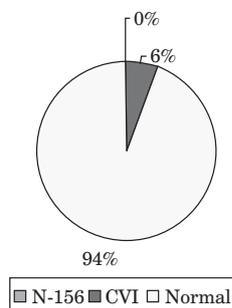


Fig. 2. N – 156 – Incidence of cerebrovascular insult in surgical patients

Two patients had a full recovery during the early postoperative course.

One patient was left with paresis of the contralateral hand with normal neurological status (1.88%), while the patient who also developed an early carotid artery rethrombosis, and therefore immediately underwent a surgical reintervention, died during the first postoperative day with wide ischemic changes on the brain (1.88%).

In the older age group made of patients over 65 years (N-156), during carotid arteries thrombendarterectomy or during the early postoperative course, 9 patients (5.76%) developed a neurological deficit, or a cerebrovascular insult (Figure 2).

In 5 patients, the Multi Slice CT showed recent ischemic changes of the brain in various degrees. In the remaining 4 patients no recent ischemic changes of the brain were noted.

Full recovery during the early postoperative course was registered in 7 patients.

One patient, who had a postoperative ischemic lesion of the brain, developed a contralateral hand paresis (0.64%), while one patient with postoperative ischemic change of the brain died during the second postoperative day (0.64%).

When comparing the perioperative and early postoperative incidence of neurological deficit between the group under 65 years (7.56%) and the group over 65 years of age (5.76%), there is no statistically relevant difference between the two groups ( $p < 0.05$ ).

Furthermore, when comparing the incidence of mortality in the above mentioned groups, between the group under 65 years (1.88%) and the group over 65 years of age (0.95%), there is no statistically relevant difference ( $p < 0.05$ ).

## REFERENCES

1. FEIGIN VL, Lancet, 365 (2005) 2160. — 2. BARNETT HJ, GUNTON RW, ELIASZIW M, JAMA, 283 (2000) 1429. — 3. NOWACZENKO M, SARZYNSKA-DLUGOSZ I, CZLONKOWSKA A, Neurol Neurochir Pol, 37 (2003) 27. — 4. OLIVIERO U, OREFICE G, COPPOLA G, Int

## Discussion and Conclusion

Nowadays, the incidence of stroke in developed countries is extremely high and the stroke risk increases many times with the increase of life expectancy in population.

Today, stroke prevention is the subject of discussion among many medical specialties<sup>12-18</sup>. Thanks to technological progress (Multi Slice CT) there has been a huge improvement in the diagnostics of degenerative changes in the blood vessels and in the precision during the assessment of the degree of carotid artery stenosis, which is a fundamental element in the prevention and treatment algorithm of cerebral accidents. Keeping risk factors under control, such as high blood pressure, diabetes, dyslipidemia and heart diseases, whose incidence also positively correlates with the increase in life expectancy, by administering antithrombotics (Klopidogre), is very important in the prevention of cerebral accidents.

The incidence of cerebral accidents and mortality due to complications is practically identical in Croatia and in the developed countries.

Nowadays, thrombendarterectomy has the most prominent place in stroke prevention both in younger individuals and in adults over 65 years of age.

Since the degree of carotid artery narrowing is directly proportional to age, carotid arteries thrombendarterectomy is an intervention for older people and it is irreplaceable for the prevention of cerebral accidents in patients of that age<sup>19-22</sup>.

Our results clearly show that carotid arteries thrombendarterectomy is an absolutely acceptable intervention for the prevention of stroke in patients over 65 years of age.

Our results demonstrate that in individuals over 65 years of age there is no increase in cerebrovascular accidents during the surgical intervention on carotid arteries, nor in the early postoperative course (5.76%) in comparison with patients under 65 years of age (7.54%).

The surgical intervention of carotid arteries thrombendarterectomy, mainly carried out in regional anesthesia called »cervical block« and with fully conscious patients, it is absolutely recommended and safe in older adults<sup>22-25</sup>.

In individuals older than 65 years of age, the mortality during the surgical intervention and in the early postoperative course is extremely low, which speaks in favor of the assumption that carotid arteries thrombendarterectomy is a successful surgical intervention in older patients.

Angiol, 21 (2002) 117. — 5. EL-BARGHOUTY N, NICOLAIDES A, BAHAL V, GEROUKAKOS G, ANDROULAKIS A, Eur J Vasc Endovasc Surg, 11 (1996) 470. — 6. Tsiskaridze A, DEVUYST G, DE FREITAS GR, VAN MELLE G, BOGOUSSLAWSKY J, Arch Neurol, 58 (2001) 605. — 7.

- BLASER T, HOFMANN K, BUERGER T, Stroke, 33 (2002) 1057. — 8. O'LEARY DH, POLAK JF, KRONMAL RA, MANOLIO TA, BURKE GL, WOLFSON SK, N Engl J Med, 340 (1999) 14. — 9. INOUE K, MATSUMOTO M, SHONO T, TOYOKAWA S, MORIKI A, J Stroke Cerebrovasc Dis 16 (2007) 14. 10. STORK S, VAN DEN BELD AW, VON SCHACKY C, Circulation, 110 (2004) 344. — 11. EZEKOWITZ JA, STRAUS SE, MAJUMDAR SR, MCALISTER FA, Am Fam Physician, 68 (2003) 2379. — 12. HALKES PH, VAN GIJN J, KAPPELLE LJ, KOUDESTAAL PJ, ALGRA A, Lancet, 367 (2006) 1665. — 13. EDERLE J, BROWN MM, Eur J Radiol, 60 (2006) 3. — 14. DHAMMOON M, TAI W, BODEN-ALBALA B, RUNEK T, PAIK MC, SACCO RL, ELKIND MSV, Stroke, 38 (2007) 1752. — 15. MEAD GE, LEWIS SC, WARDLAW JM, DENNIS MS, WARLOW CP, J Neurol, 249 (2002) 266. — 16. BOITEN J, Cerebrovasc Dis, 6 (1996) 281. — 17. TAMAKI T, SAWADA K, HAYASHI S, NODE Y, TERAMOTO A, J Clin Neurosci 13 (2006) 45. — 18. HALLIDAY A, MANSFIELD A, MARRO J, Lancet 363 (2004) 1491. — 19. RINGLEB PA, CHATELLIER G, HACKE W, J Vasc Surg, 47 (2008) 350. — 20. SMITH WS, SUNG G, STARKMAN S, Stroke, 36 (2005) 1432. — 21. VUKOVIC V, GALINOVIC I, LOVRENCIC-HUZJAN A, BUDISIC M, DEMARIN V, Coll Antropol, 33 (3) (2009) 977. — 22. BULAT C, ALFIREVIC I, KORDA ZA, PROTRKA N, NOVKOSKI M, PREDRIJEVAC M, Coll Antropol, 32(1) (2008) 209.

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## PERIOPERACIJSKI I RANI POSLIJEOPERACIJSKI NEUROLOŠKI DEFICIT U STARIJIM BOLESNIKA TIJEKOM TROMBENDARTEREKTOMIJE KAROTIDNE ARTERIJE

### SAŽETAK

Cerebrovaskularni inzulat spada među najčešće uzroke smrti u razvijenim zemljama<sup>1-3</sup>. U posljednja dva desetljeća, moždani udar je drugi najčešći uzrok smrti u Primorsko-goranskoj županiji u Hrvatskoj. Bolesnici stariji od 65 godina imaju povećan rizik od moždanog udara, uglavnom zbog stupnja stenoziranja karotidne arterije, koji se povećava s dobi. Najčešća komplikacija stenoziranja karotidnih arterija je tromboza u području aterosklerotskih promjena krvnih žila<sup>1-5</sup>. Uz povećanje dobi stanovništva, tu je i povećanje broja faktora rizika za cerebrovaskularne nesreće. Doppler ultrazvuk i Multi Slice CT imaju istaknutu ulogu u ranom otkrivanju aterosklerotskih promjena i u procjeni stupnja suženja karotidne arterije. Danas u Hrvatskoj, kao i širom svijeta trombendarterektomija zauzima najvažnije mjesto u prevenciji moždanog udara. Između 2006. i 2009. godine 209 bolesnika podvrgnuto je zkirurškom zahvatu u Kliničkom bolničkom centru u Rijeci zbog visokog stupnja suženja karotidnih arterija. U Skupini mlađih od 65 godina, koja se sastojala od 53 bolesnika, neurološki deficit je zabilježen u 4 bolesnika (7.54%) u perioperacijskom i ranom poslijeoperacijskom tijeku. U skupini osoba starijih od 65 godina, koja se sastojala od 156 bolesnika, neurološki deficit zabilježen je u 9 bolesnika (5.76%). Nije bilo značajne statističke razlike u incidenciji neurološkog deficit, kao ni u smrtnosti kod osoba starijih od 65 godina tijekom trombendarterektomije karotidnih arterija.