**KRASIŃSKA-PŁACHTA, Aleksandra, BRĄZERT, Agata, MAMCZUR-ZAŁĘCKA, Joanna, BEGIER-KRASIŃSKA, Beata, KRASIŃSKI, Zbigniew & KOCIĘCKI, Jarosław. Recovery of visual function after endarterectomy - series of cases report. Journal of Education, Health and Sport. 2023;13(5):95-99. eISSN 2391-8306. DOI http://dx.doi.org/10.12775/JEHS.2023.13.05.013**
**https://apcz.umk.pl/JEHS/article/view/42708**
**https://zenodo.org/record/7718609**

**The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of December 21, 2021. No. 32343.**
**Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical Culture Sciences (Field of Medical sciences and health sciences); Health Sciences (Field of Medical Sciences and Health Sciences).**
**Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 21 grudnia 2021 r. Lp. 32343. Posiada Unikatowy Identyfikator Czasopisma: 201159.**
**Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).**

**The authors declare that there is no conflict of interests regarding the publication of this paper.**
**Received: 21.02.2023. Revised: 28.02.2023. Accepted: 09.03.2023. Published: 11.03.2023.**

# Recovery of visual function after endarterectomy - series of cases report

Aleksandra Krasińska-Płachta
Department of Ophthalmology, Poznan University of Medical Sciences
https://orcid.org/0000-0001-8934-2506

Agata Brązert
Department of Ophthalmology, Poznan University of Medical Sciences,
https://orcid.org/0000-0003-0181-245X

Joanna Mamczur-Załęcka
Department of Ophthalmology, Poznan University of Medical Sciences
https://orcid.org/0000-0001-7048-9217

Beata Begier-Krasińska
Department of Hypertensiology, Angiology and Internal Diseases, Poznań, Poland
https://orcid.org/0000-0002-3464-1645

Zbigniew Krasiński
University of Medical Sciences, Department of Vascular and Endovascular Surgery, Angiology and Phlebology, Poznań, Poland,
https://orcid.org/0000-0002-2798-1959

Jarosław Kocięcki
Department of Ophthalmology, Poznan University of Medical Sciences
https://orcid.org/0000-0001-7321-1835

## Abstract

Carotid arteriosclerosis is the main cause of the stroke but it can also lead to ophthalmic symptoms. In this article, we aim to present four patients. All of them had hemodynamically significant but asymptomatic unilateral carotid stenosis and underwent internal carotid endarterectomy. Postoperatively, their visual function improved. Mean deviation in perimetry and values of amplitudes in pattern visual evoked potentials increased. Two patients improved visual acuity; in the other two, it remained stable.

**Keywords: internal carotid artery, endarterectomy, visual field, electrophysiology**

## Introduction

Carotid arteriosclerosis can lead to stroke, and transient ischemic attack but also to ophthalmic symptoms [1–3]. In this article, we present a case series of four patients. All of them had hemodynamically significant but asymptomatic unilateral carotid stenosis and underwent internal carotid endarterectomy (ICE). Patients were recruited based on medical documentation. Each individual has been diagnosed and qualified for the surgery in the Department of Vascular Surgery of the Poznan University of Medical Sciences, Poland. Every patient had Doppler of internal carotid arteries (using multifrequency 7.5-MHz linear probe), before the surgery, done by a vascular surgeon. The Doppler Sonography was done using Mindray DC-8 ultrasound with 5-12 MHz linear transducers. Patient's eyes have been tested twice, before and after ICE in The Department of Ophthalmology of the Poznan University of Medical Sciences, Poland. We assessed their visual acuity (best-corrected visual acuity), intraocular pressure (with Goldman applanation tonometry), perimetry (using Medmont M700 automated perimeter), and pattern visual evoked potentials (PVEP) (using the RETI-port (Roland Consult) system (V1021.3.0.SBC03.05). Postoperatively, in all of them, there was an improvement in visual function. Mean deviation (MD) in perimetry and values of amplitudes in PVEP increased. Two patients improved visual acuity; in the other two, it remained stable.

## Report of cases

### Case 1

A 78-year-old woman, with hypertension and right internal carotid artery stenosis of 80% underwent an endarterectomy. Before the surgery her LogMAR best corrected visual acuity (BCVA) was 0.2 in the right eye and 0.7 in the left eye, the intraocular pressure (IOP) was normal (left eye: 12 mmHg, right eye: 14 mmHg), there were no changes of anterior and posterior segments and results of perimetry and pattern visual evoked potentials (PVEP) are presented in tables 1,2 and 3.
After the ICA (internal carotid artery) recanalization, the LogMAR BCVA in both eyes was 0.2, and IOP remained normal (13 mmHg in both). The perimetry parameters and PVEP are summed up in tables 1,2, and 3.

### Case 2

A 66-year-old man with asymptomatic, right ICA stenosis of 60% underwent an endarterectomy
Before the surgical procedure, LogMAR BCVA was 0.0 for both eyes, IOP was normal (17 mmHg in both eyes), there were no anomalies in anterior and posterior segments and perimetry and PVEP results are presented in tables 1,2, and 3.
After the endarterectomy the results of the ophthalmic examination were: LogMAR BCVA 0.0 for both eyes, IOP was normal (16 mmHg in both eyes), perimetry and PVEP are shown in tables 1, 2, and 3.

### Case 3

A 65-year-old man with right ICA stenosis of 90 % underwent internal carotid endarterectomy. On the first ophthalmic examination, LogMAR BCVA was 0.0 for the right and 0.1 for the left eye, and the IOP in both eyes was normal (right eye: 10 mmHg, left eye: 12 mmHg). There were no pathological changes of anterior and posterior segments of the eyes. Perimetry and PVEP results are summed up in tables 1, 2, and 3.
After the surgery; LogMAR BCVA for both eyes was 0.0, and IOP was stable (right eye: 10 mmHg, left eye: 12 mmHg). The perimetry and PVEP parameters are presented in tables 1,2 and 3.

### Case 4

A 63-year-old woman with significant unilateral ICA stenosis, diabetes, and hypertension underwent an endarterectomy.

Before the surgical procedure, LogMAR BCVA was 0.0 in both eyes, and IOP was 16 mmHg for the left and right eye. The anterior and posterior segments were normal. Perimetry and PVEP results are shown in tables 1,2 and 3.
After internal carotid endarterectomy (ICE), LogMAR BCVA remained at 0.0 in both eyes, IOP was 13 mmHg in the right and 15 mmHg in the left eye. The results of perimetry and PVEP are summed up in tables 1,2 and 3.

**Table 1.** Mean deviation (MD) obtained in perimetry before and after internal carotid endarterectomy (ICE).

| | Before ICE | | After ICE | |
|---|---|---|---|---|
| | Left eye | Right eye | Left eye | Right eye |
| Case 1 | -5,36 | -3,72 | -0,79 | -0,60 |
| Case 2 | -4.60 | -5,65 | -4,60 | -4,20 |
| Case 3 | -4,88 | -3,74 | -3,62 | -2,96 |
| Case 4 | -2,97 | -4,89 | -2.90 | -3,22 |

**Table 2**. Left eye; pattern visual evoked potentials (PVEP) results of amplitudes of N75-P100, P100-N135, and PVEP 15 N75-P100, before and after internal carotid endarterectomy (ICE).

| Left eye | Before ICE | | | After ICE | | |
|---|---|---|---|---|---|---|
| | N75-P100 (µV) | P100-N135 (µV) | PVEP 15 N75-P100 (µV) | N75-P100 (µV) | P100-N135 (µV) | PVEP 15 N75-P100 (µV) |
| Case 1 | 3,95 | 3,87 | 3,76 | 5,40 | 6,89 | 11,3 |
| Case 2 | 4,93 | 9,85 | 4,56 | 7,90 | 10,30 | 4,60 |
| Case 3 | 4,76 | 5,69 | 1,61 | 18,00 | 22,90 | 9,9 |
| Case 4 | 9,23 | 8,95 | 10,70 | 9,23 | 16,50 | 14,20 |

**Table 3.** Right eye; pattern visual evoked potentials (PVEP) results of amplitudes of N75-P100, P100-N135, and PVEP 15 N75-P100, before and after internal carotid endarterectomy (ICE).

| Right eye | Before ICE | | | After ICE | | |
|---|---|---|---|---|---|---|
| | N75-P100 (µV) | P100-N135 (µV) | PVEP 15 N75-P100 (µV) | N75-P100 (µV) | P100-N135 (µV) | PVEP 15 N75-P100 (µV) |
| Case 1 | 1,50 | 2,27 | 3,12 | 5,06 | 7,89 | 6,82 |
| Case 2 | 3,75 | 4,80 | 4,39 | 7,40 | 10,30 | 5,00 |
| Case 3 | 5,33 | 8,17 | 2,95 | 13,60 | 21,30 | 19,50 |
| Case 4 | 11.61 | 8,31 | 11,11 | 11,70 | 9,50 | 14,50 |

**Discussion**

Carotid arteriosclerosis may lead to ophthalmic symptoms, as ophthalmic arteries come from the internal carotid artery and supply the eyes with blood. The embolus from the carotid artery can enter the ophthalmic artery causing transient monocular visual loss (TMVL), central retinal artery occlusion (CRAO), central retinal artery

branch occlusions (CRABO), anterior ischemic optic neuropathy (AION) or non-arteritic anterior ischemic optic neuropathy (NAION) [1–3]. Carotid arteriosclerosis can be treated with endarterectomy or angioplasty and stenting [4]. The function of the optic nerve can be assessed in perimetry and optic nerve electrophysiology [5]. Some research has shown that in patients with atherosclerosis, these parameters as well as visual acuity can be improved by recanalization of carotid arteries [5–8]. Similarly, in cases 1,3 and 4 (Table 1) MD binocularly increased after ICE indicating improvement in the visual field in both eyes after the surgery. In case 2, MD values remained stable for the left eye, however, they increased for the right eye. The visual acuity improved unilaterally in cases 1 and 3 (left eyes in both). In the rest examined eyes LogMAR BCVA remained unchanged at 0,0. Visual electrophysiology, especially pattern visual evoked potentials, enables to test of the cell function of the visual pathway (optic nerve and retina). Previous investigations on PVEP proved that the latency was slightly reduced but amplitude increased after CEA (carotid endarterectomy). These changes indicate an improvement in visual functions [9]. In all cases (1,2,3 and 4) one can notice an increase in amplitudes of N75-P100, P100-N135, and PVEP 15 N75-P100 in both eyes after ICA (Table 2 and 3), which testify to improvement of vision. What is more, previous studies found IOP to be significantly decreased after CEA [9,10]. However, in the presented cases one can't notice any significant difference.

**Conclusion**

Internal carotid arteriosclerosis can lead to vision deterioration. Surgical recanalization of the stenotic artery can help improve patients' vision; improve visual acuity, visual field (increase MD in perimetry), and function of the optic nerve (increase values of amplitudes in PVEP) [11,12].

**References**


1. Mendrinos E, Machinis TG, Pournaras CJ. Ocular Ischemic Syndrome. Surv Ophthalmol. 2010 Jan;55(1):2–34; DOI:10.1016/J.SURVOPHTHAL.2009.02.024.

2. Peeler C, Cestari DM. Non-Arteritic Anterior Ischemic Optic Neuropathy (NAION): A Review and Update on Animal Models. Semin Ophthalmol. 2016;31(1–2):99–106; DOI:10.3109/08820538.2015.1115248.

3. Arthur A, Alexander A, Bal S, Sivadasan A, Aaron S. Ophthalmic masquerades of the atherosclerotic carotids. Indian J Ophthalmol. 2014;62(4):472; DOI:10.4103/0301-4738.121183.

4. Sethi D, Gofur EM, Munakomi S. Anatomy, Head and Neck, Carotid Arteries. StatPearls Publishing; 2021.

5. Neroev VV, Kiseleva TN, Vlasov SK, Pak N v., Gavrilenko A v., Kuklin A v. Visual outcomes after carotid reconstructive surgery for ocular ischemia. Eye (Lond). 2012;26(10):1281–7; DOI:10.1038/EYE.2012.118.

6. Hamilton R, Bach M, Heinrich SP, Hoffmann MB, Odom JV, McCulloch DL, Thompson DA. ISCEV extended protocol for VEP methods of estimation of visual acuity. Documenta Ophthalmologica. 2021;142(1):17–24; DOI:10.1007/S10633-020-09780-1/FIGURES/1.

7. Kozobolis VP, Detorakis ET, Georgiadis GS, Achtaropoulos AA, Papas TT, Lazarides MK. Perimetric and retrobulbar blood flow changes following carotid endarterectomy. Graefe's Archive for Clinical and Experimental Ophthalmology. 2007;245(11):1639–45; DOI:10.1007/S00417-007-0589-2.

8. Qu L, Feng J, Zou S, Bai J, Hu Z, Guo M, Jing Z. Improved visual, acoustic, and neurocognitive functions after carotid endarterectomy in patients with minor stroke from severe carotid stenosis. J Vasc Surg. 2015;62(3):635-644.e2; DOI:10.1016/J.JVS.2015.04.401.

9. Yan J, Yang X, Wu J, Liu B, Jiao X, Li W, Guo M. Visual Outcome of Carotid Endarterectomy in Patients with Carotid Artery Stenosis. Ann Vasc Surg. 2019;58:347–56; DOI:10.1016/J.AVSG.2018.12.069.

10. Brovarone FV, Fea A, Gastaldi C, Magistro G, Favero C, Rabbia C, Boles Carenini A. Ocular functionality variations after endarterectomy. Acta Ophthalmol Scand Suppl. 1998;76(227):47–8; DOI:10.1111/j.1600-0420.1998.tb00883.x.

11. Krasińska-Płachta A, Brązert A, Mamczur-Załęcka J, Gabriel M, Suchodolski M, Begier–Krasińska B, Kocięcki J. Visual outcomes in carotid stenosis patients treated using endarterectomy, Pol Przegl Chir, 2023; 95 (4): 1-5; DOI: 10.5604/01.3001.0016.2123.

12. Krasińska-Płachta A, Brązert A, Mamczur-Załęcka J, Gabriel M, Begier–Krasińska B, Kocięcki J. Influence of endarterectomy on the function of the optic nerve – a review. Acta Angiol. 2023; 29 (1); DOI: 10.5603/AA.2023.0001.