

# Comparative analysis of carotid artery stenting and carotid endarterectomy in clinical practice

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# Disclosure

Speaker name:

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I have the following potential conflicts of interest to report:

- Consulting
- Employment in industry
- Stockholder of a healthcare company
- Owner of a healthcare company
- Other(s)
  
- I do not have any potential conflict of interest**

**-Most carotid revascularization procedures in Russia are CEAs performed for the treatment of asymptomatic and symptomatic atherosclerotic disease. Nevertheless, CAS with “embolic protection” devices is also performed.**

**-In the Carotid Revascularization Endarterectomy versus Stenting Trial (CREST), no significant difference was found out between CEA and CAS with embolic protection for the treatment of atherosclerotic carotid stenosis regarding the composite end point of stroke, death or myocardial infarction.**

**-CREST included both symptomatic and asymptomatic patients, but unfortunately it did not focus on the symptomatic status. Thus it did not clear out if CAS with embolic protection is CEA equivalent for symptomatic patients.**

# Objective:

to evaluate immediate and long-term results of CEA and CAS with embolic protection in patients with severe carotid artery stenosis in clinical practice.

# MATERIALS AND METHODS

From 2008 till 2017 **2432** operations (**2355** patients) were performed: **1401** (57%) - group CEA and **1031** (42%) - group CAS.

Included patients were not older than 80.

They had a standard risk for complications from both procedures.

**627** patients (26% of 2355) were out of the contact in the follow-up period

Propensity score matching was used to compare the treatment results of both groups.

The follow-up period was **5 years**

End points were stroke, death and myocardial infarction

## Preoperative demographic and clinical data after propensity score matching in CEA and CAS groups

Characteristics	All cases	CEA	CAS	p
	N=1230 (100%)	N=615 (100%)	N=615 (100%)	
Female sex	270 (22.0%)	137 (22.3%)	133 (21.6%)	0.75
Age (years)	64.5 ( $\pm$ 7.9)	64.5 ( $\pm$ 7.6)	64.5 ( $\pm$ 8.2)	0.36
Ipsilateral carotid stenosis	75.5 ( $\pm$ 8.1)	75.5 ( $\pm$ 8.6)	75.4 ( $\pm$ 7.7)	0.50
Contralateral carotid stenosis	45.5 ( $\pm$ 23.9)	45.3 ( $\pm$ 22.8)	45.8 ( $\pm$ 25.1)	0.59
Coronary heart disease	1128 (91.7%)	562 (91.4%)	566 (92.0%)	0.68
Arterial hypertension	1174 (95.4%)	586 (95.3%)	588 (95.6%)	0.78
Chronic kidney disease	228 (18.5%)	117 (19.0%)	111 (18.0%)	0.66
Chronic renal failure	227 (18.5%)	119 (19.3%)	108 (17.6%)	0.42
Hyper-cholesterolemia	506 (41.1%)	256 (41.6%)	250 (40.7%)	0.73
Diabetes mellitus	294 (23.9%)	145 (23.6%)	149 (24.2%)	0.79
Smoking	1217 (98.9%)	608 (98.9%)	609 (99.0%)	0.78

## Results of symptomatic and asymptomatic patients treatment were evaluated separately

<b>Characteristics</b>	<b>All cases N=1230 (100%)</b>	<b>CEA N=615 (100%)</b>	<b>CAS N=615 (100%)</b>	<b>p</b>
Symptomatic cases	320 (26%)	160 (26%)	160 (26%)	NA
Asymptomatic cases	910 (74%)	455 (74%)	455 (74%)	NA

# Results for symptomatic cases after propensity score matching (30 days after procedure)

Complications	All cases N=320 (100%)	CEA N=160 (100%)	CAS N=160 (100%)	p
Deaths/strokes	18 (5.6%)	5 (3.1%)	13 (8.1%)	0.053
Deaths/strokes/ myocardial infarctions	18 (5.6%)	5 (3.1%)	13 (8.1%)	0.053
Deaths	2 (0.6%)	1 (0,63%)	1 (0,63%)	NA
<b>Strokes</b>	<b>16 (5%)</b>	<b>4 (2.5%)</b>	<b>12 (7.5%)</b>	<b>0.04</b>
Myocardial infarctions	0 (0%)	0 (0%)	0 (0%)	NA
Transient ischemic attacks	3 (0.9%)	0 (0%)	3 (1.9%)	0.25
Thromboses	1 (0.3%)	1 (0.63%)	0 (0%)	0.5
<b>Hematomas</b>	<b>6 (1.9%)</b>	<b>6(3.75%)</b>	<b>0 (0%)</b>	<b>0.04</b>
Cranial and cervical nerve injuries	6 (1.9%)	5 (3 %)	1 (0.63%)	0.22
Bleedings	3 (0.9%)	2 (1.25%)	1 (0.63%)	1.000

The differences in early strokes and number of neck hematomas were statistically significant, **p=0.04**.

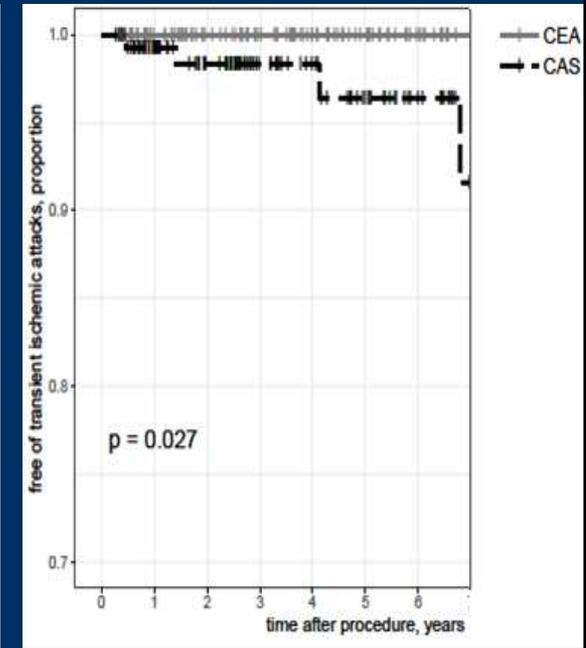
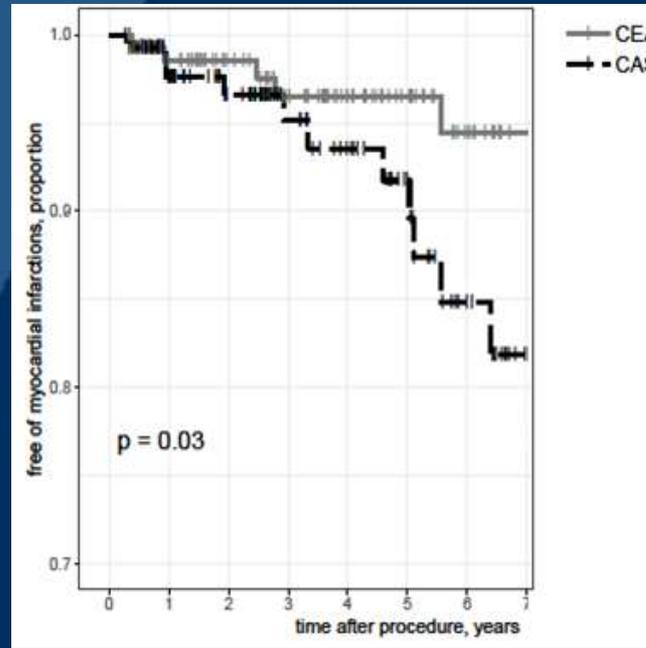
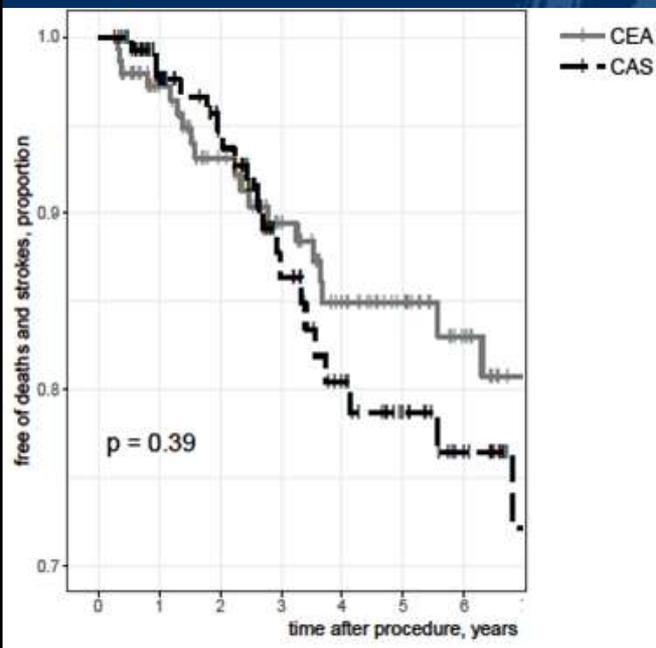
In the cases of neck hematomas blood transfusions were not carried out.

## Results for asymptomatic cases after propensity score matching (30 days after procedure)

Complications	All cases N=910 (100%)	CEA N=455 (100%)	CAS N=455 (100%)	p
Deaths/strokes	28 (3%)	11 (2.4%)	17 (3.7%)	0.34
Deaths/strokes/ myocardial infarctions	36 (4%)	14 (3%)	22 (4.8%)	0.48
Deaths	10 (1.1%)	4 (0.9%)	6 (1.3%)	0.75
Strokes	18 (1.9%)	7 (1.5%)	11 (2.4%)	0.48
Myocardial infarctions	8 (0.9%)	3 (0.7%)	5 (1.1%)	0.72
Transient ischemic attacks	4 (0.4%)	1 (0.2%)	3 (0.7%)	0.62
Thromboses	9 (1%)	7 (1.5%)	2 (0.4%)	0.18
Hematomas	13 (1.4%)	9 (2%)	4 (0.9%)	0.26
<b>Cranial and cervical nerve injuries</b>	<b>13 (1.4%)</b>	<b>12 (2.6%)</b>	<b>1 (0.2%)</b>	<b>0.005</b>
Bleedings	11 (1.2%)	8 (1.8%)	3 (0.7%)	0.23

The differences in cranial and cervical nerve injuries were statistically significant , **p=0.005**

# Adverse events for symptomatic cases during the 5-year follow-up period



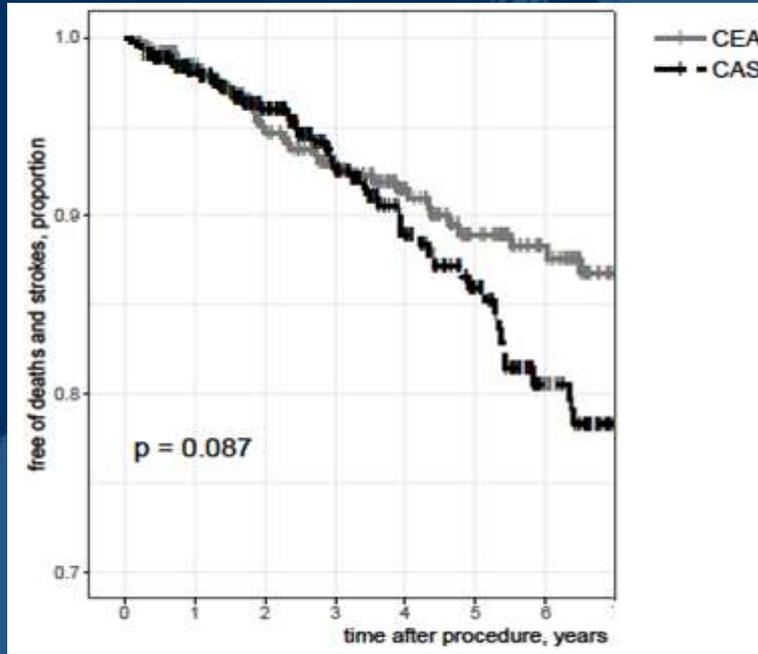
Freedom from death and stroke

Freedom from myocardial infarctions

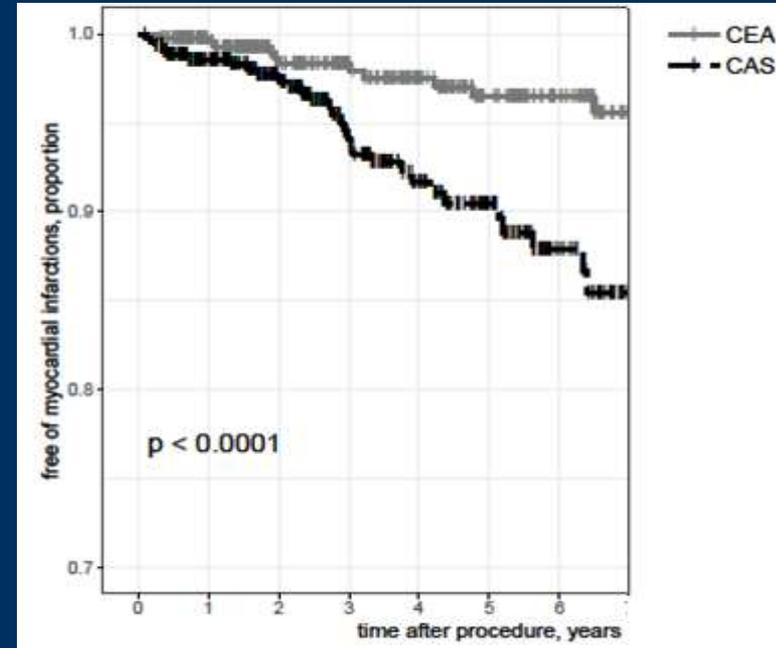
Freedom from TIA

Adverse events in 5 years	CEA (N=160)	CAS (N=160)	p
Deaths and strokes	20 (12.5%)	22(13.8%)	0.39
Deaths	10 (6.3%)	13 (8%)	0.52
Strokes	10 (6.25%)	9 (5.6%)	0.8
<b>Myocardial infarctions</b>	<b>4 (2.5%)</b>	<b>14 (8.7%)</b>	<b>0.03</b>
<b>Transient ischemic attacks</b>	<b>2 (1.3%)</b>	<b>9 (5.6%)</b>	<b>0.027</b>

# Adverse events for asymptomatic cases during the 5-year follow-up period



Freedom from death and stroke



Freedom from myocardial infarctions

## Adverse events in 5 years

	CEA N =455	CAS N=455	p
Deaths and strokes	49 (10.8%)	60 (13.2%)	0.08
Deaths	41 (9%)	50 (10.9%)	0.38
Strokes	8 (1.8%)	10 (2.2%)	0.81
<b>Myocardial infarctions</b>	<b>15 (3.3%)</b>	<b>42 (9.2%)</b>	<b>&lt;0.0001</b>
Transient ischemic attacks	3 (0.7%)	6 (1.3%)	0.31

## Preoperative symptomatic patients demographics and clinical data

Characteristics	All cases N=320	CEA N=160	CAS N=160	p
Coronary heart disease	288 (90%)	142 (88.7%)	146 (91%)	0.58
Class NYHA mean	1.8 ( $\pm 0.9$ )	1.8 ( $\pm 0.9$ )	1.8 ( $\pm 1.0$ )	0.81
Class NYHA 1	66 (20.6%)	31 (19%)	35 (21.9%)	0.67
Class NYHA 2	126 (39.4%)	71 (44.3%)	55 (34.4%)	0.08
Class NYHA 3	81 (25.3%)	35 (21.9%)	46 (28.8%)	0.19
<b>Coronary arteries stenting before operations</b>	<b>87 (27.2%)</b>	<b>53 (33.1%)</b>	<b>34 (21.3%)</b>	<b>0.02</b>
<b>Coronary artery bypass graft (CABG) before operations</b>	<b>47 (14.7%)</b>	<b>31 (19.4%)</b>	<b>16 (10%)</b>	<b>0.02</b>

## Preoperative asymptomatic patients demographics and clinical data

Characteristics	All cases N=910 (100%)	CEA N=455 (100%)	CAS N=455 (100%)	p
Coronary heart disease	843 (92.6%)	424 (93.2%)	419 (92%)	0.61
Class NYHA mean	1.9 ( $\pm 0.9$ )	1.9 ( $\pm 0.9$ )	2.0 ( $\pm 0.9$ )	0.49
<b>Class NYHA 1</b>	<b>130 (14.3%)</b>	<b>82 (18%)</b>	<b>48 (10.5%)</b>	<b>0.0018</b>
Class NYHA 2	446 (49%)	230 (50.5%)	216 (47.5%)	0.39
<b>Class NYHA 3</b>	<b>254 (27.9%)</b>	<b>113 (24.8%)</b>	<b>141 (31%)</b>	<b>0.046</b>
<b>Coronary arteries stenting before operations</b>	<b>346 (38%)</b>	<b>219 (48%)</b>	<b>127 (27.9%)</b>	<b>&lt;0.0001</b>
<b>Coronary artery bypass graft (CABG) before operations</b>	<b>196 (21.5%)</b>	<b>132 (29%)</b>	<b>64 (14%)</b>	<b>&lt;0.0001</b>

# Conclusions

- In the symptomatic subgroup, the 30-day rate of stroke was significantly higher in CAS group than in CEA group (7.5% vs. 2.5%,  $p=0.04$ ). In symptomatic patients, the use of CAS in routine practice should be limited.
- This study demonstrates that the rates of stroke and survival after CEA and CAS in patients 80 years of age or younger with asymptomatic and symptomatic severe carotid stenosis did not differ significantly over a period of 5 years.
- Longer follow-up is ideal and may reveal data that could alter our current conclusions, thus emphasizing the need for larger scale clinical trials to evaluate this approach.



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**Thank you for your attention !**