

# Stenóza karotické tepny:

krok po kroku

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2. LF UK a FN MOTOL

Motto:  
„Neničte můj mozek, je to můj druhý  
nejoblíbenější orgán.“

Woody Allen



# Prevalence

- Karotická aterosklerosa je příčinou pětiny CMP.
- Prevalence je odhadována u subjektů nad 65 years 5% and 10%, méně než 1% má stenosu nad 80%.

Risk of neurological events in medically treated patients with carotid stenosis according to the year of enrollment to the study.



Ipsilateral stroke



Stroke + TIA

# Diagnostika

# Indikace

(pro neinvazivní vyšetření)

- **CMP nebo TIA**
- **Amaurosis fugax**
- Šelest
- Sledování asymptomatické stenózy nad 20%
- Kumulace rizikových faktorů
  - Hypertenze
  - DM
  - Nikotin
  - Hypercholesterolemie
  - ICHS a/nebo ICHDK – symptomatická ateroskleróza
  - Věk

S.KILLN

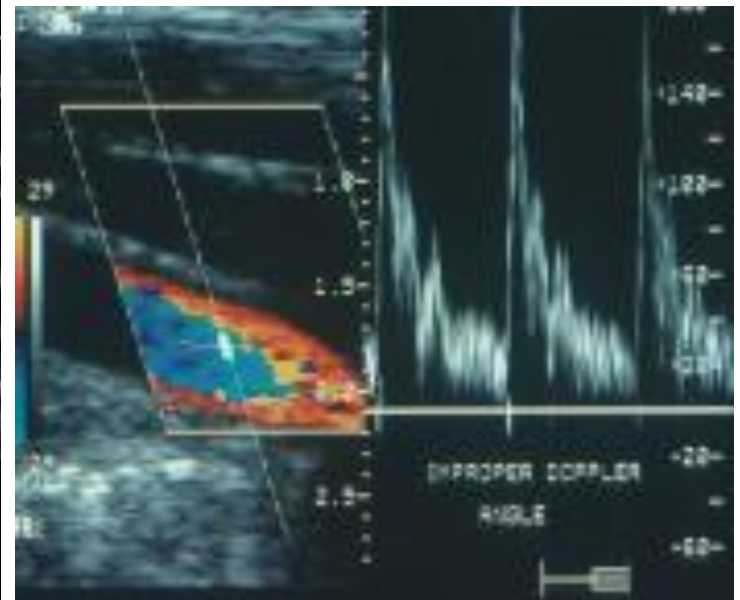
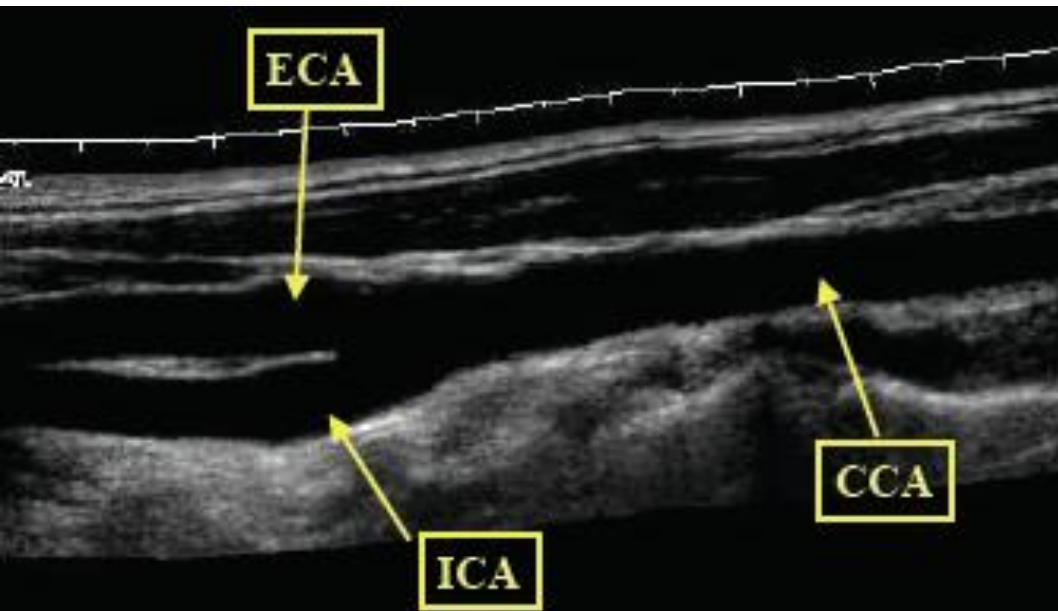
THE TIMES-PIAYUNE  
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DOUBLE  
CHEESEBURGER,  
LARGE FRIES,  
AND A JUMBO  
SHAKE

YOU WANT  
ANGIOPLASTY  
WITH THAT?



# DUS

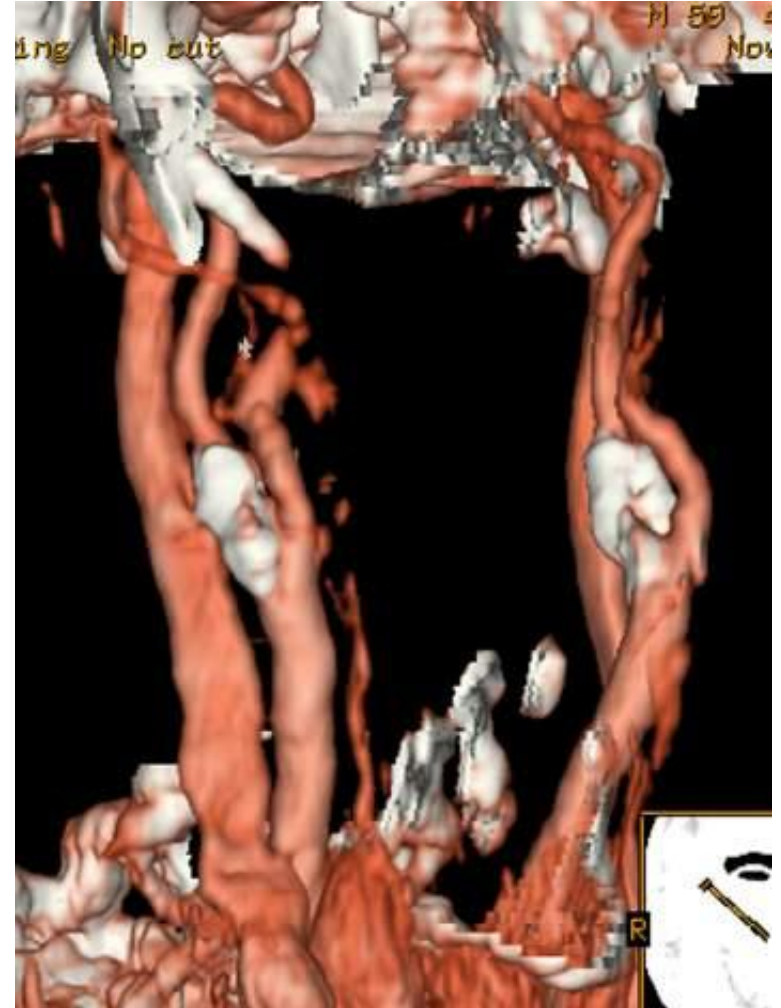
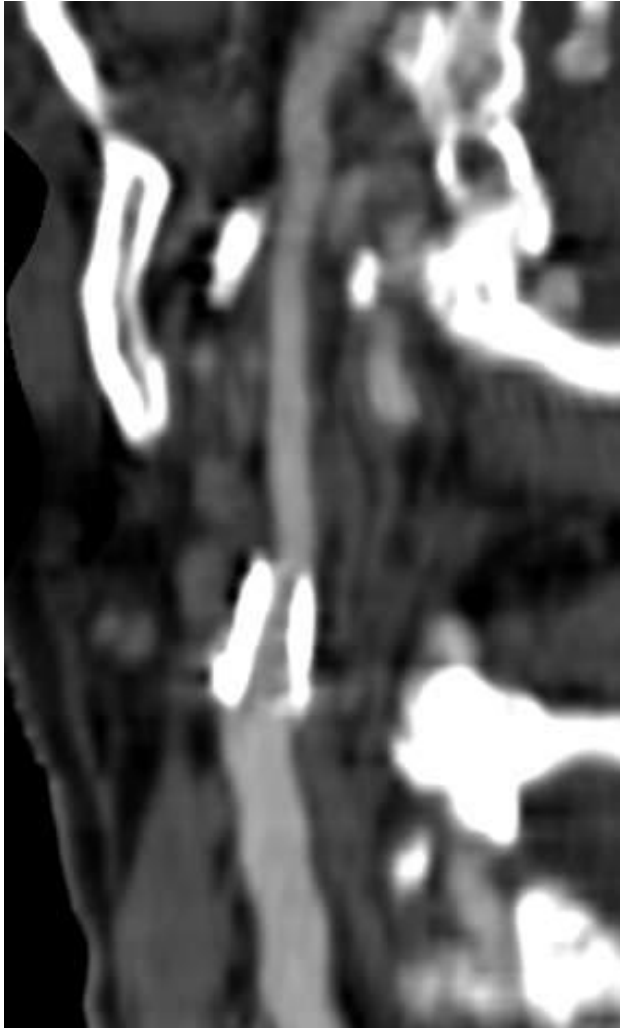


# Hodnocení stenosisy ICA dle DUS

| Stenosis (%) | PSV (cm/s)          | EDV (cm/s)                   | PSV <sub>ICA</sub> /PSV <sub>CCA</sub> |
|--------------|---------------------|------------------------------|--|
| 0-29         | PSV ≤ 100           | EDV < 40                     |  |
| 30-49        | 110 < PSV < 130     | EDV < 40                     |  |
| 50-59        | PSV > 130           | EDV < 40                     | PSV ratio < 3,2                        |
| 60-69        | PSV > 130           | 40 < EDV < 110               | 3,2 ≤ PSV ratio < 4                    |
| <b>70-79</b> | <b>PSV &gt; 210</b> | <b>110 &lt; EDV &lt; 140</b> | <b>PSV ratio ≥ 4</b>                   |
| <b>80-95</b> | <b>PSV &gt; 210</b> | <b>EDV &gt; 140</b>          | <b>PSV ratio ≥ 4</b>                   |
| 96-99        | String flow         |                              |  |
| 100          | Absence of flow     |                              |  |



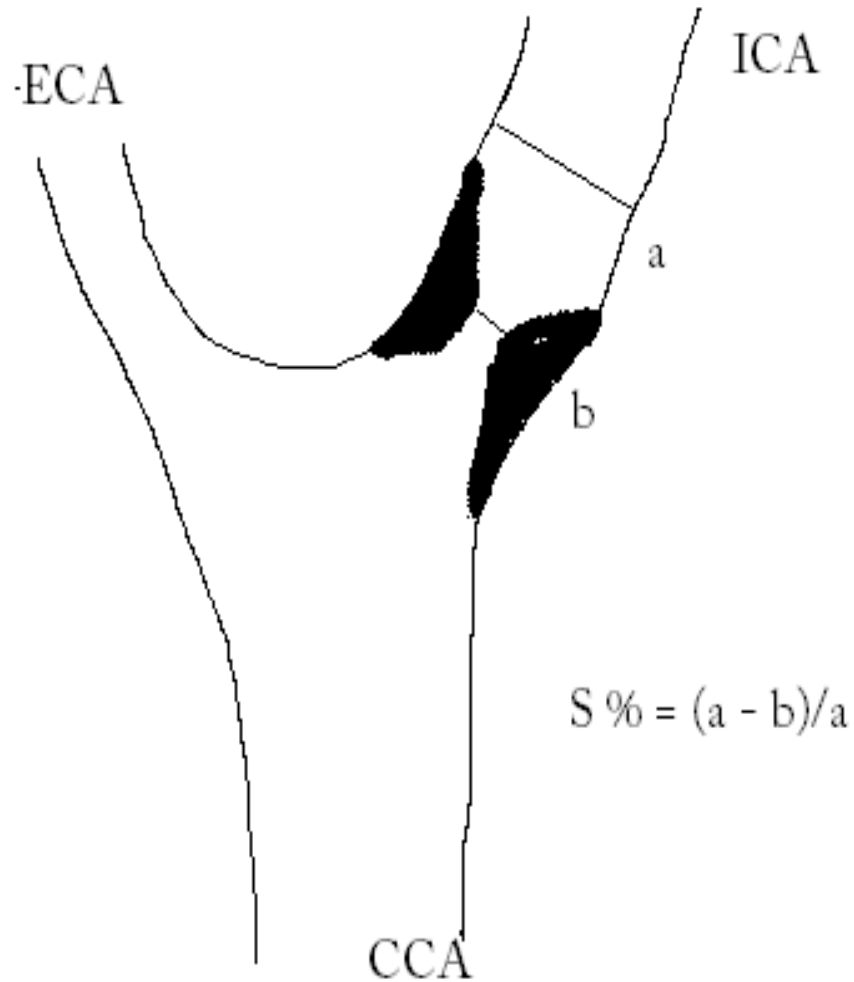
# CT angio



# MR angiografie



# Měření významnosti stenosisy dle NASCET



# Indikace k léčbě

# Indikace

Symptomatic patients

## Asymptomatic patients

Symptomatic patients  
with a stenosis of the  
internal carotid artery  
with a diameter of  
more than 70% stenosis  
of the internal carotid  
artery. It is reasonable to  
perform CEA or CAS in  
asymptomatic patients  
who have more than 70%  
stenosis of the internal  
carotid artery if the risk  
of perioperative stroke,  
MI, and death is low.

It is reasonable to perform CEA or CAS in asymptomatic patients who have more than 70% stenosis of the internal carotid artery if the risk of perioperative stroke, MI, and death is low.

Class II

# Asymptomatické versus symptomatické stenózy

## • **Asymptomatické stenózy:**

- indikační kriteria byla v minulosti značně nejasná a nejednotná
- Teprve výsledky ACAS – (*Asymptomatic Carotid Surgery Trial*) prokázaly, že chirurgicky léčení pacienti mají nižší riziko vzniku CMP (RRR 54% u stenózy nad 60%).
- Asymptomatické stenózy mají dobrou prognosu (2% riziko CMP/rok)

## • **Symptomatické stenózy:**

- *CMP, TIA, amaurosis fugax*
- Prospektivní studie prokázaly, že pacienti s významnou stenózou, kteří již prodělali TIA, mají 5-leté riziko CMP 30%-40%
- Efektivnost CEA prokazují dvě studie: (NASCET - North American Symptomatic Surgery Trials, ECST - European Carotid Surgery Trials)
- Vyplývá z nich, že operovaní pacienti se stenózou 70%-99% mají výrazně lepší prognózu ve srovnání s konzervativní léčbou

# CREST

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

## Stenting versus Endarterectomy for Treatment of Carotid-Artery Stenosis

Thomas G. Brott, M.D., Robert W. Hobson, II, M.D.,\* George Howard, Dr.P.H., Gary S. Roubin, M.D., Ph.D., Wayne M. Clark, M.D., William Brooks, M.D., Ariane Mackey, M.D., Michael D. Hill, M.D., Pierre P. Leimgruber, M.D., Alice J. Sheffet, Ph.D., Virginia J. Howard, Ph.D., Wesley S. Moore, M.D., Jenifer H. Voeks, Ph.D., L. Nelson Hopkins, M.D., Donald E. Cutlip, M.D., David J. Cohen, M.D., Jeffrey J. Popma, M.D., Robert D. Ferguson, M.D., Stanley N. Cohen, M.D., Joseph L. Blackshear, M.D., Frank L. Silver, M.D., J.P. Mohr, M.D., Brajesh K. Lal, M.D., and James F. Meschia, M.D.,  
for the CREST Investigators†

NEJM 2010

# CREST is the largest RCT comparing CAS vs CEA

- Largest, most rigorous, prospective randomized trial and shows the two therapies are safe and effective
- 108 US and 7 Canadian sites, 2502 pts.
- PE: stroke, MI, death; ipsilateral stroke up to 4 years

| Clinical Trial | # of Patients | # of Sites |
|----------------|---------------|------------|
| CREST          | 2,502         | 117        |
| ICSS           | 1,710         | 53         |
| SPACE*         | 1,183         | 35         |
| EVA-3S*        | 520           | 30         |
| SAPPHIRE*      | 334           | 29         |

\* Trials stopped prematurely



# Primary endpoint:

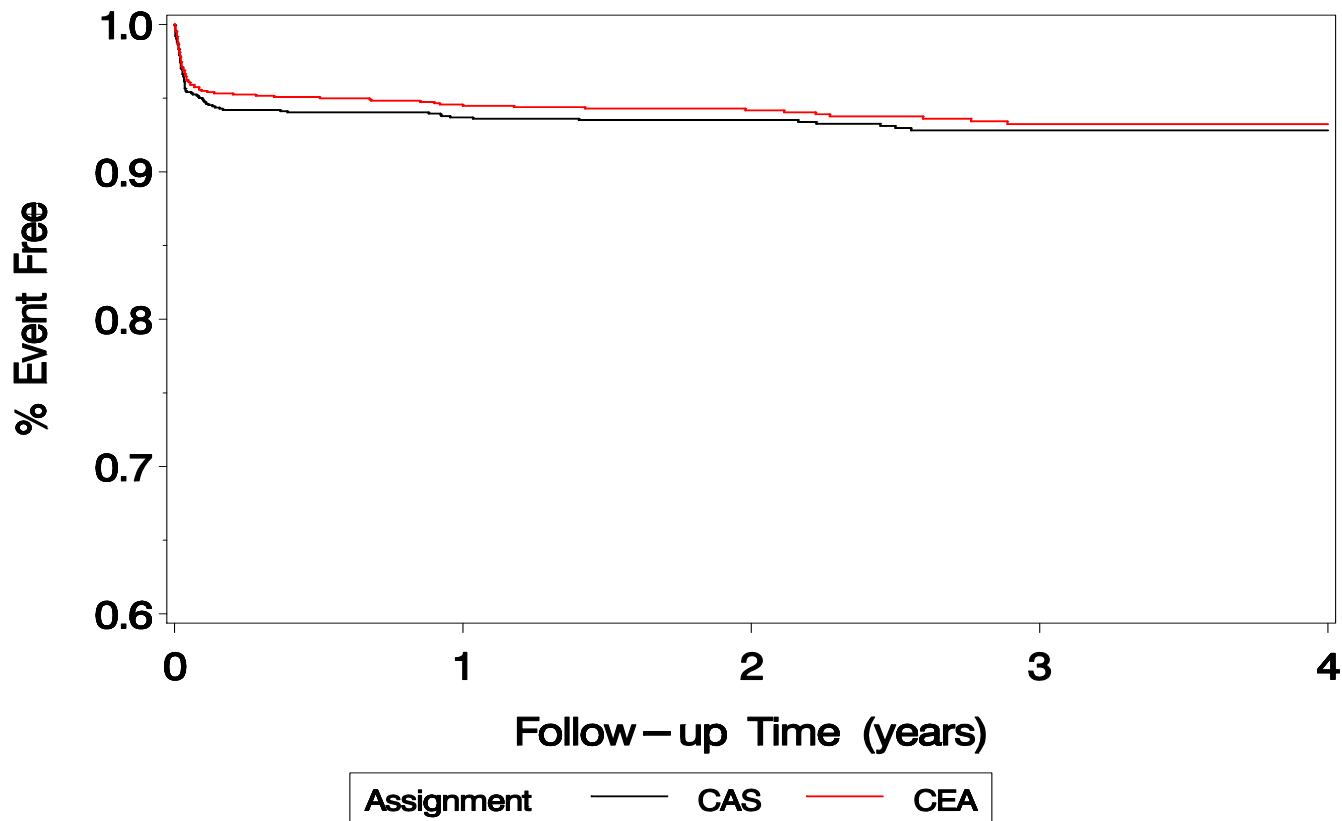
*Both stenting and surgery are equally safe and effective*

Any death, stroke or MI within the perioperative period plus ipsilateral stroke out to 4 years.

| CAS  | CEA  | Hazard Ratio               | P-value |
|------|------|----------------------------|---------|
| 7.2% | 6.8% | HR:1.11; 95% CI: 0.81-1.51 | 0.51    |

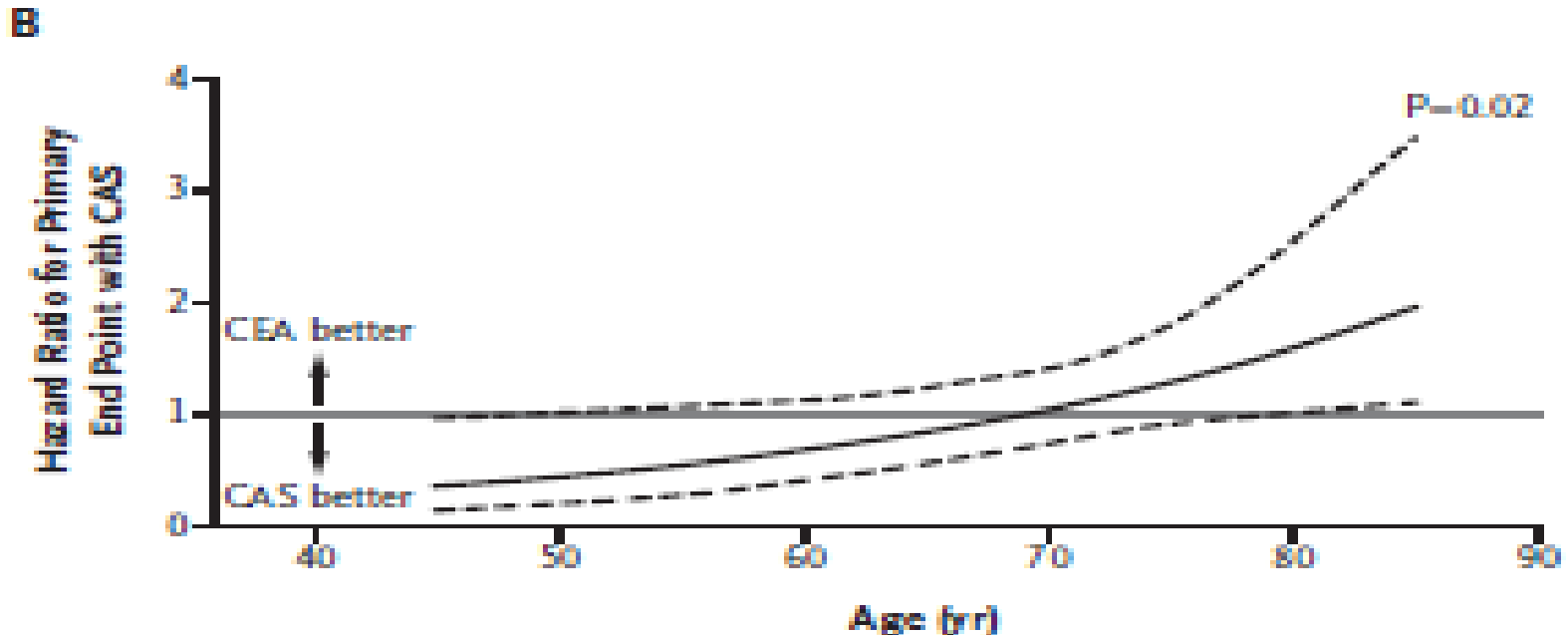
Primary Endpoint

ITT analysis



# Age and peri-procedural results

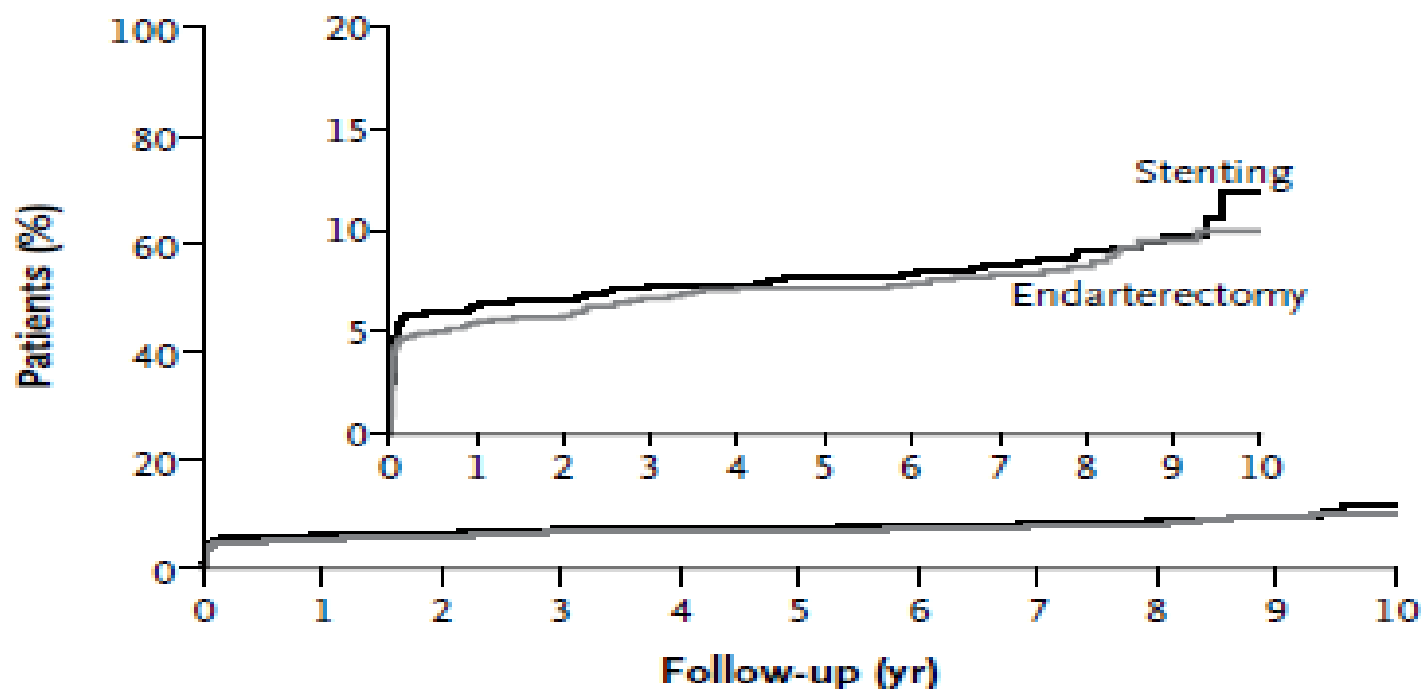
- Statement from NIH Press Release:  
“The study also found that the age of the patient made a difference. **At approximately age 69 and younger, CAS results were slightly better with a larger benefit for stenting the younger the age of the patient. For patients older than 70, surgical results were slightly superior to stenting with a larger benefit for surgery the older the age of the patient.**”



# Long-Term Results of Stenting versus Endarterectomy for Carotid-Artery Stenosis

CREST, NEJM 2016

Over 10 years of follow-up, we did not find a significant difference between patients who underwent stenting and those who underwent endarterectomy with respect to the risk of periprocedural stroke, myocardial infarction, or death and subsequent ipsilateral stroke. The rate of postprocedural ipsilateral stroke also did not differ between groups. (Funded by the National Institutes of Health and Abbott)

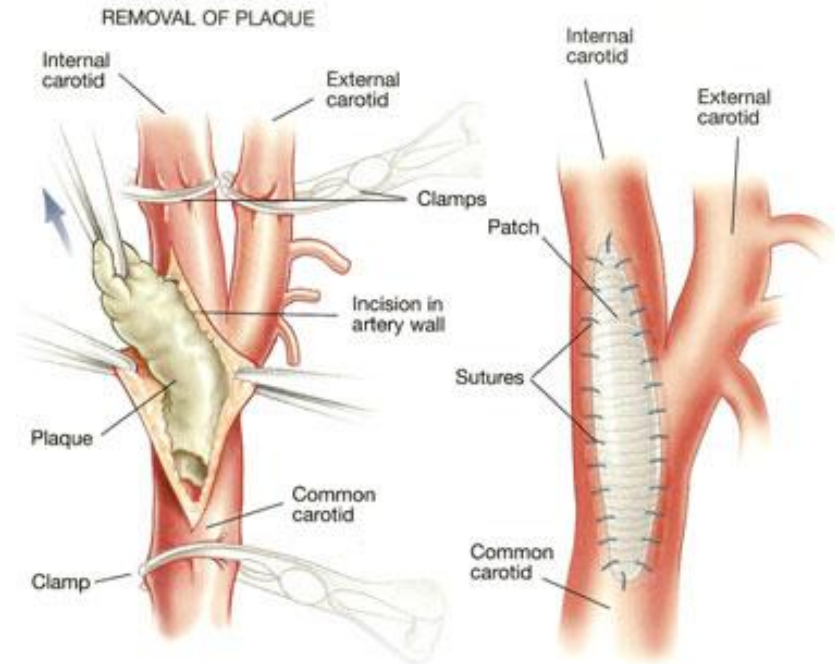
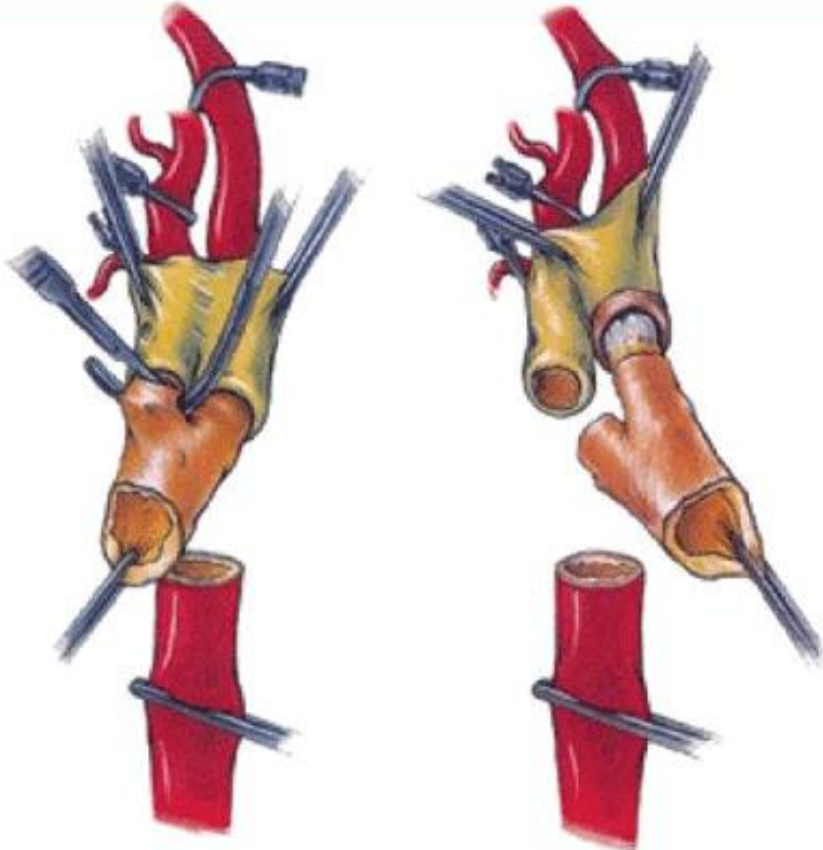


# Key Learnings

- CREST represents the largest, most rigorous, prospective randomized trial and shows **both stenting and surgery are safe and effective.**
- It is the standard by which these therapies should be measured.
- This study represents the highest level of medical evidence.
- Both treatment groups had very low event rates confirming safety and efficacy.
- No data for modern conservative therapy.

# Endarterectomy

Medscape® www.medscape.com

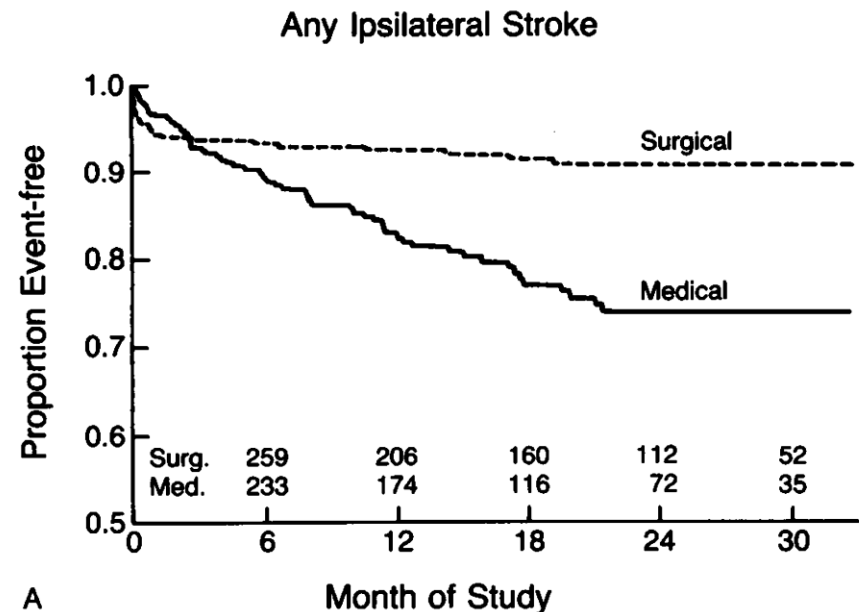


Source: Neurosurg Focus © 2008 American Association of Neurological Surgeons

# CAE of symptomatic stenosis –NASCET (1991) and ECST (1998) trials

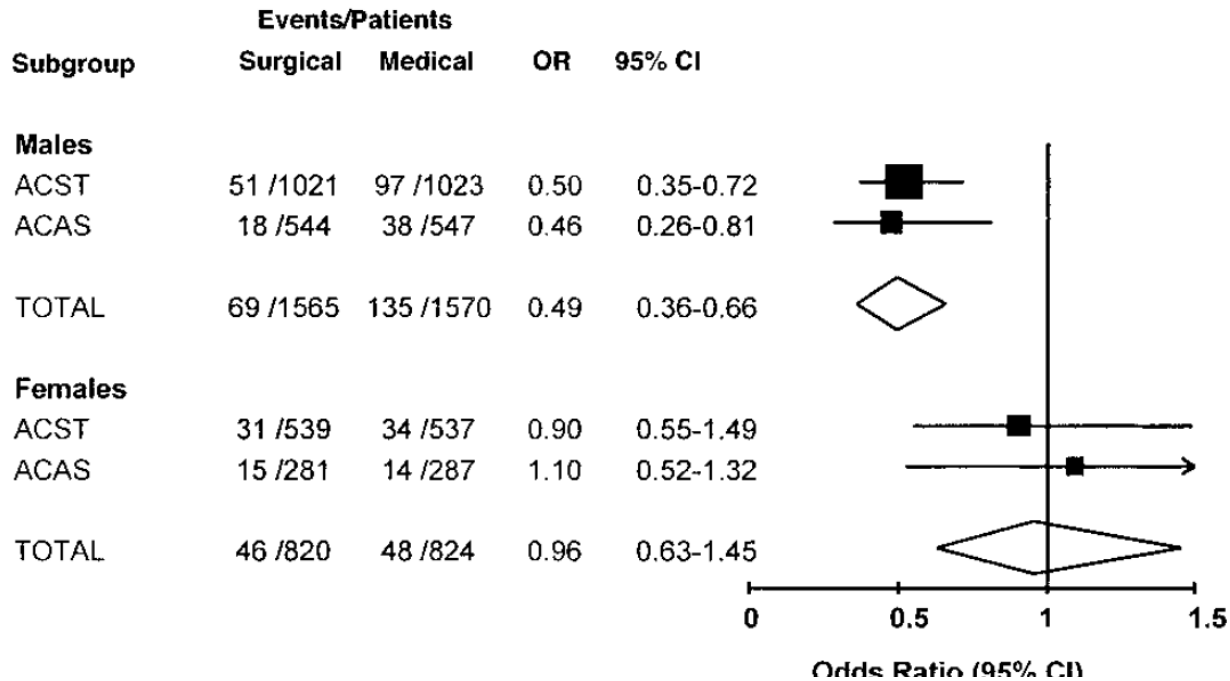
Table 2. First Adverse Events and Actuarial Failure Rates at Two Years of Follow-up, According to the Event Defining Treatment Failure.

| EVENT DEFINING FAILURE*           | MEDICAL PATIENTS (N = 331)     | SURGICAL PATIENTS (N = 328) | ABSOLUTE DIFFERENCE ±SE | RELATIVE-RISK REDUCTION |
|-----------------------------------|--------------------------------|-----------------------------|-------------------------|-------------------------|
|                                   | <i>events (event rate, %†)</i> |                             | <i>%</i>                | <i>%</i>                |
| Any ipsilateral stroke            | 61 (26.0)                      | 26 (9.0)                    | 17.0±3.5‡               | 65                      |
| Any stroke                        | 64 (27.6)                      | 34 (12.6)                   | 15.0±3.8‡               | 54                      |
| Any stroke or death               | 73 (32.3)                      | 41 (15.8)                   | 16.5±4.2‡               | 51                      |
| Major or fatal ipsilateral stroke | 29 (13.1)                      | 8 (2.5)                     | 10.6±2.6‡               | 81                      |
| Any major or fatal stroke         | 29 (13.1)                      | 10 (3.7)                    | 9.4±2.7‡                | 72                      |
| Any major stroke or death         | 38 (18.1)                      | 19 (8.0)                    | 10.1±3.5§               | 56                      |



Symptomatic stenosis = stroke or TIA in previous 6 months + ipsilateral ICA stenosis 50-99%.  
 NNT = 6 in 70-99% stenosis, NNT = 15 in 50-70% stenosis.

# CEA of asymptomatic stenosis – ACAS (1993) a ACST (2004) trials

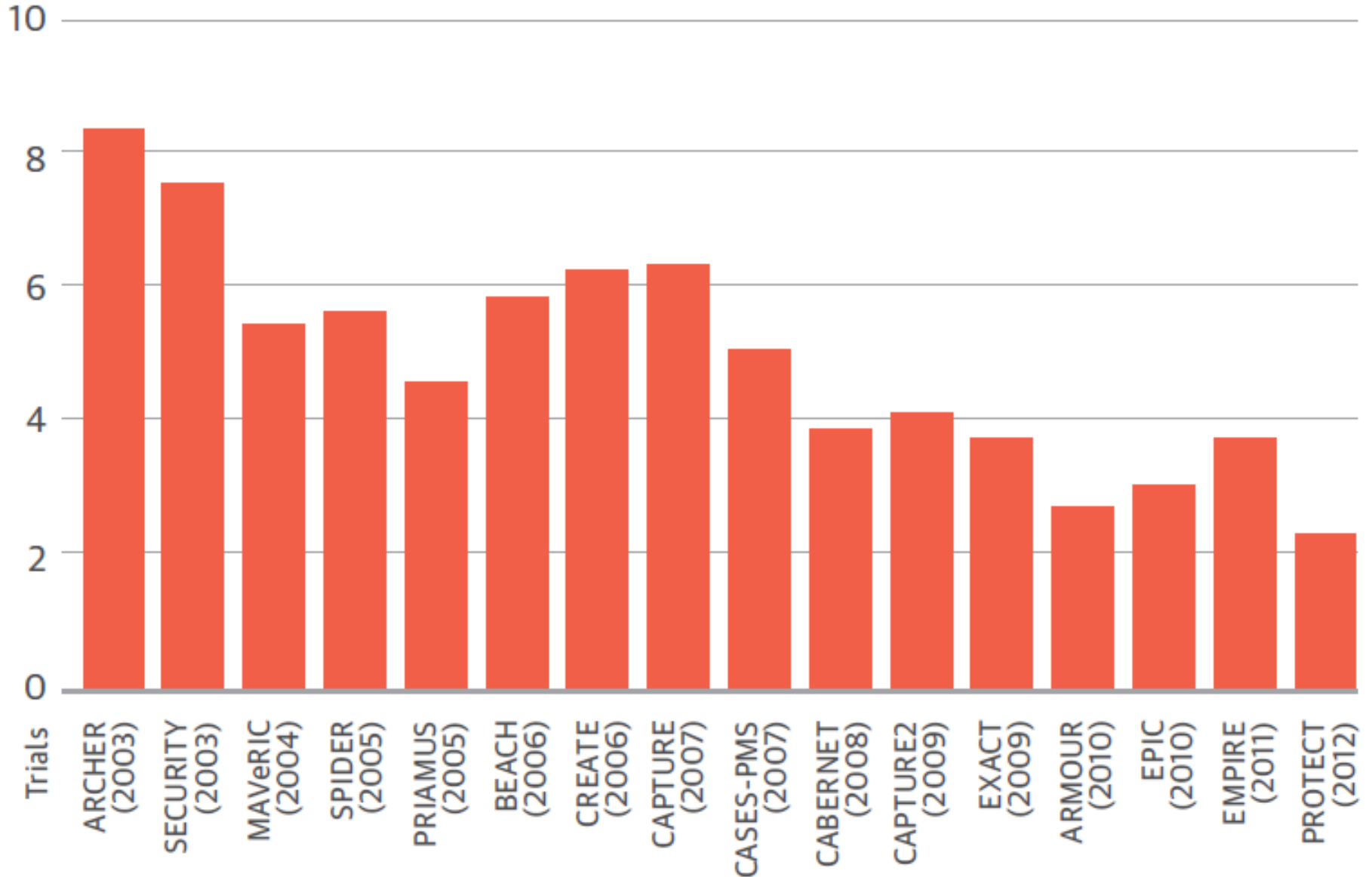


In the asymptomatic patients  $\leq 75$ y of age with 70-99% stenosis of ICA performing CEA halved the risk of ipsilateral stroke (12% vs. 6%) (with 3% of peroperative strokes). The benefit was only seen in men.

NNT = 17.

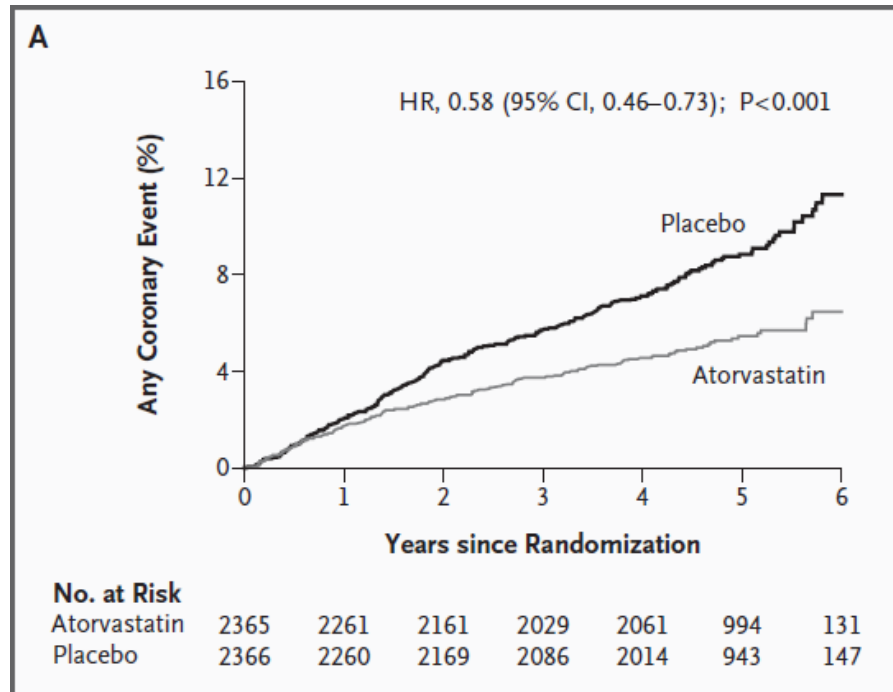
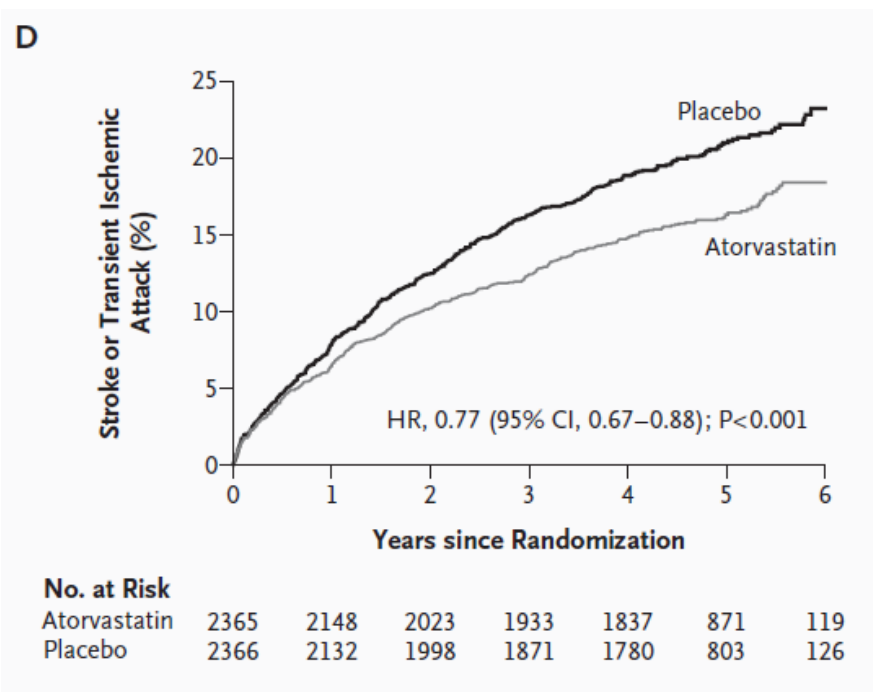
# Improvement in CAS outcomes 2003-2012

Risk of Death, Stroke or Myocardial Infarction Within 30 Days of Procedure (%)



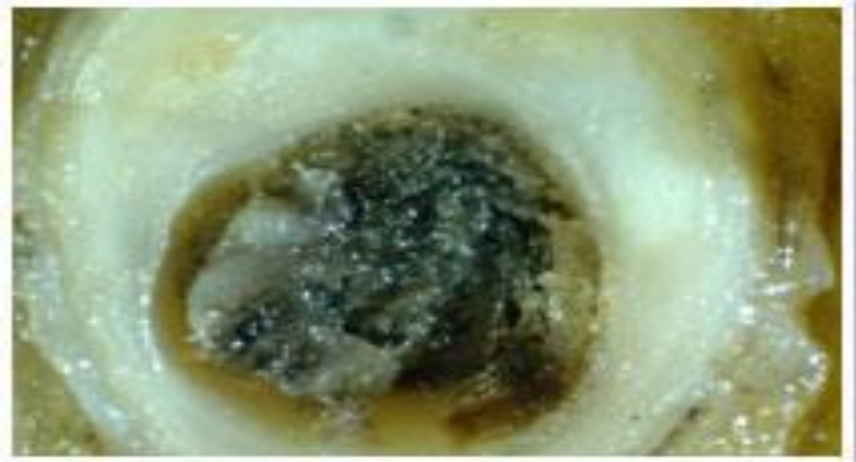
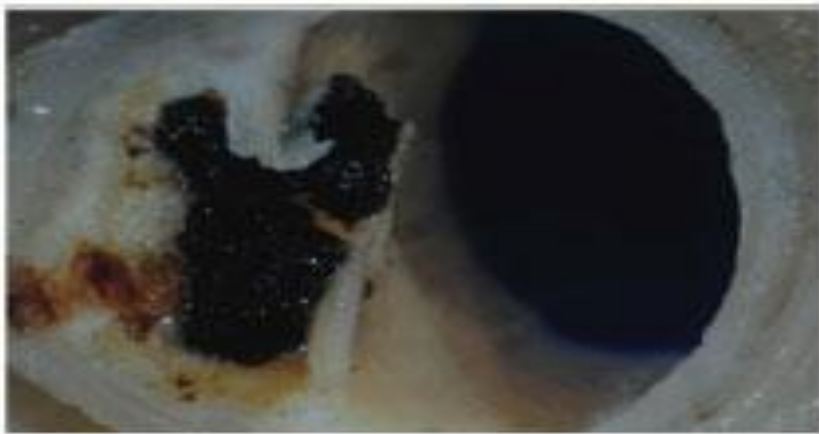
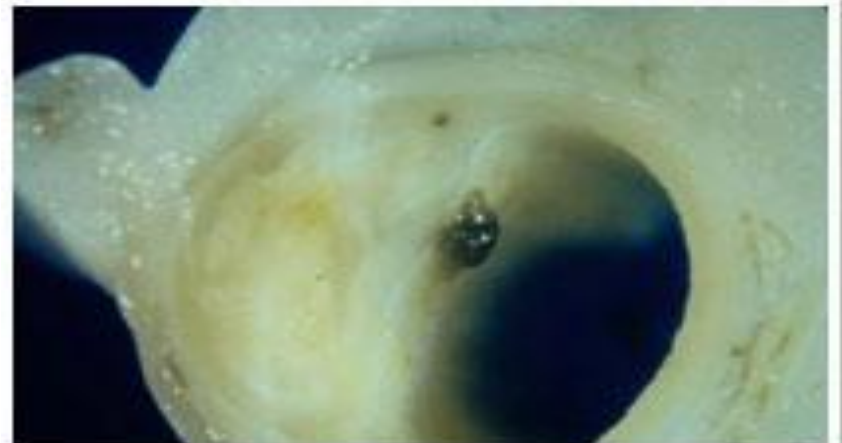
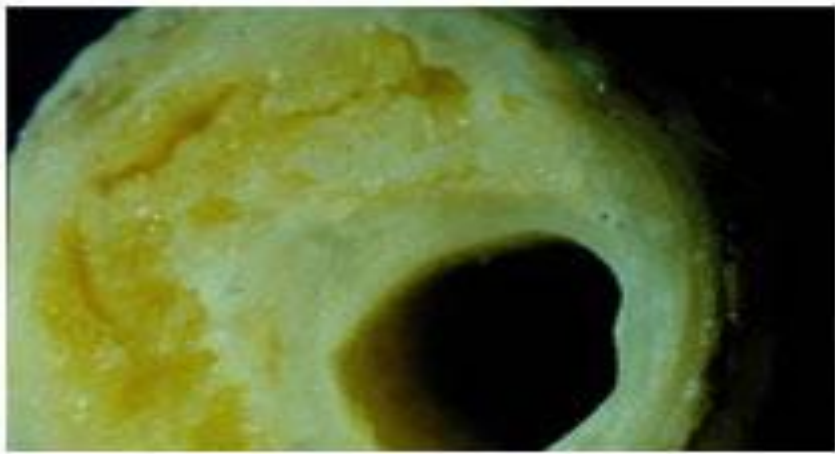


# Optimální medikamentósní terapie



Pts. who had had stroke or TIA and LDL  $\geq 2,6$  mmol/l, atorvastatin 80mg vs. placebo. In 1007 (21%) pts. with carotid stenosis was the largest benefit of statin therapy – 33% RRR of stroke or TIA and 43% RRR of MI or coronary revascularization.

# Klíčem je složení plátu



# Rizikové faktory dosud asymptomatické stenosisy

|                             |   |
|-----------------------------|---|
| <b>Clinical<sup>a</sup></b> | <ul style="list-style-type: none"><li>• Contralateral TIA/stroke<sup>121</sup></li></ul>  |
| <b>Cerebral imaging</b>     | <ul style="list-style-type: none"><li>• Ipsilateral silent infarction<sup>122</sup></li></ul>   |
| <b>Ultrasound imaging</b>   | <ul style="list-style-type: none"><li>• Stenosis progression (&gt; 20%)<sup>123</sup></li><li>• Spontaneous embolization on transcranial Doppler (HITS)<sup>124</sup></li><li>• Impaired cerebral vascular reserve<sup>125</sup></li><li>• Large plaques<sup>b126</sup></li><li>• Echolucent plaques<sup>96</sup></li><li>• Increased juxta-luminal black (hypoechoogenic) area<sup>127</sup></li></ul> |
| <b>MRA</b>                  | <ul style="list-style-type: none"><li>• Intraplaque haemorrhage<sup>128</sup></li><li>• Lipid-rich necrotic core</li></ul>  |

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# **Závěry evidence**

**Nedostatek kvalitních dat ve vztahu  
CAS vs CEA.**

**Výborné výsledky ve zkušených  
rukou.**

**Nejistota stran CAS vs CEA vs OMT.**

# Neškodit

Ne všechny „atraktivní“ stenosis je třeba ošetřit.

## Tři praktické rady



# Dobrá rada č. 1

## SELEKCE PACIENTŮ

**75-85 LET**

**ASYMPTOMATICKÁ LÉZE**

**OPAKOVANÁ CMP**

**SNÍŽENÁ CV REZERVA**

**SNÍŽENÁ KVALITA ŽIVOTA**

**BUDE PROFITOVAT ???**





# Dobrá rada č. 2

## SELEKCE LÉZE

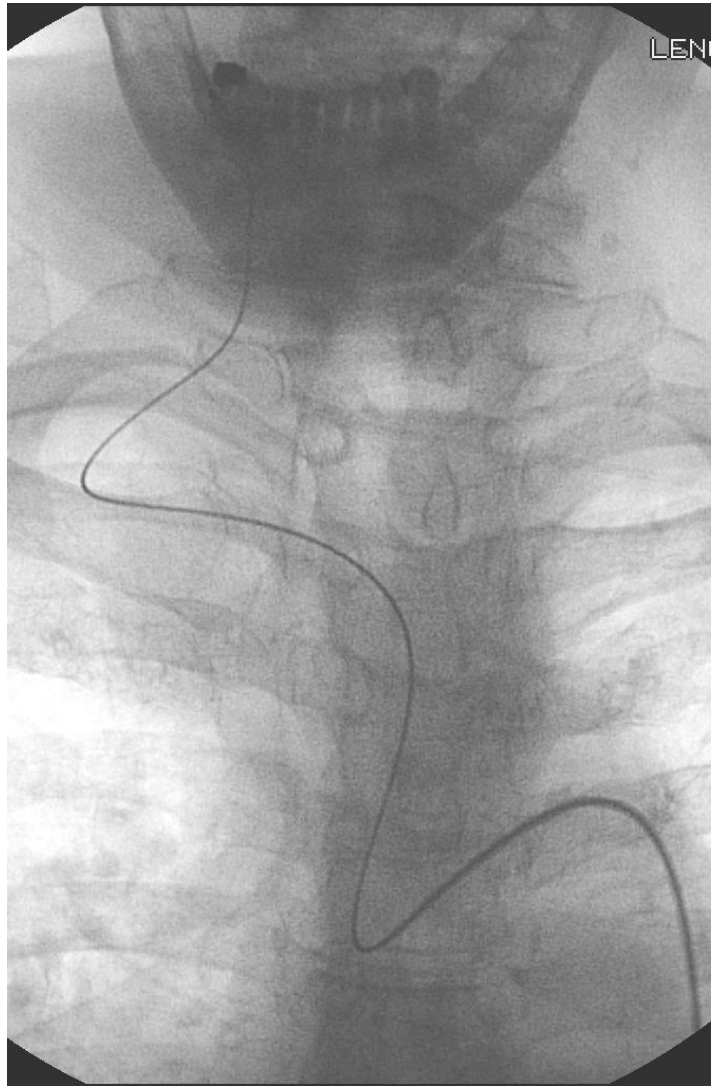
**TORTUOSITY**

**KALCIFIKACE**

**TYP OBLOUKU**

**TROMBUS**

**LIPIDOVÉ JÁDRO?**



# Dobrá rada č. 3

## SELEKCE LÉKAŘE

**LEARNING CURVE**

**VLASTNÍ VÝSLEDKY**

**MEZIOBOROVÁ SPOLUPRÁCE**

**TÝMOVÁ SPOLUPRÁCE**

**REGISTR**

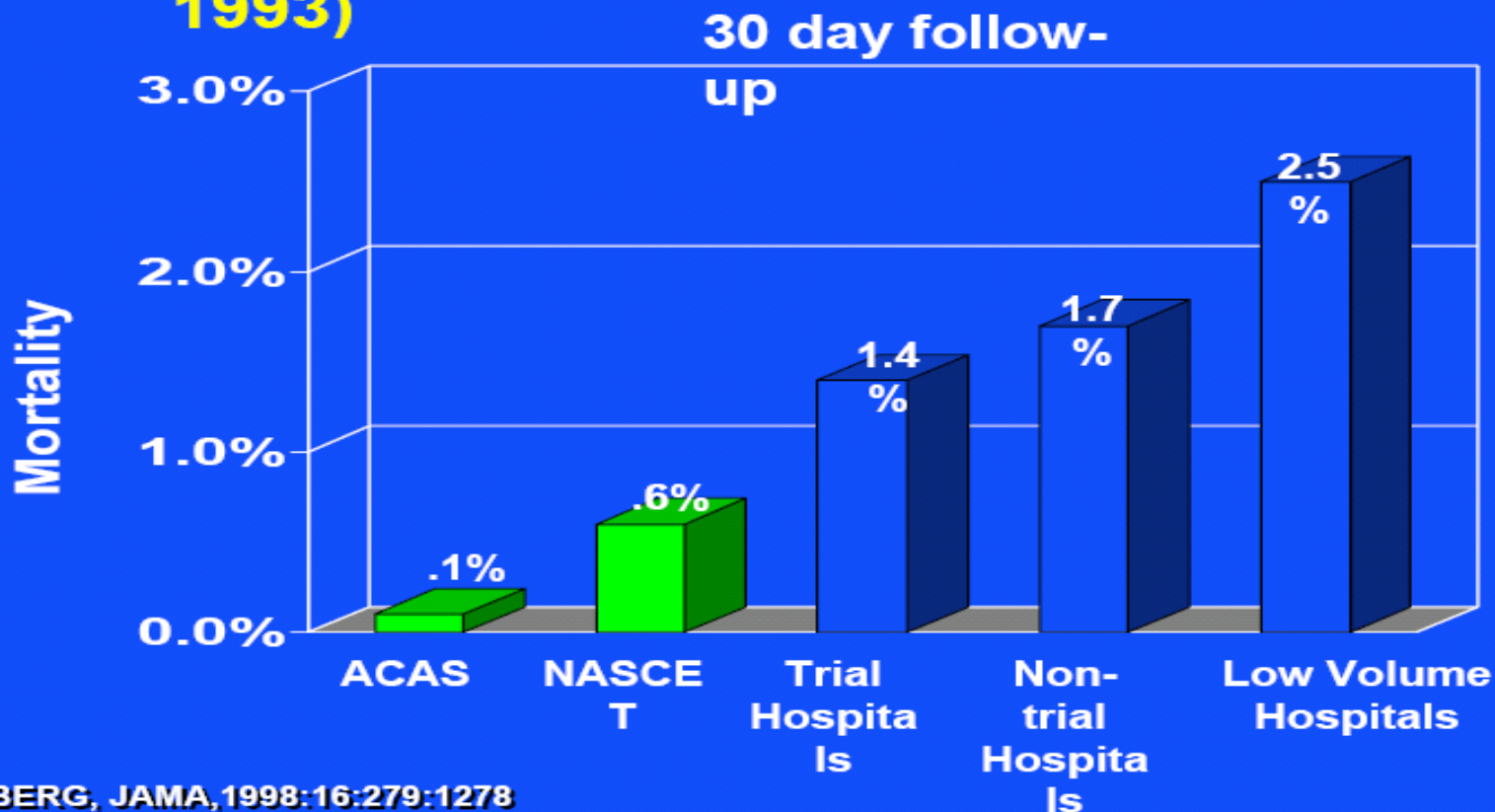




# Jak vypadá reálný život?

## *CEA Mortality*

113,000 Medicare Patients (1992-1993)



# Take-home messages

- Některé karotické stenosis způsobují CMP.
- Čím vyšší riziko aterosklerosis, tím vyšší riziko karotické stenosis.
- CAS vs CEA vs OMT: zatím nevyřešené dilema.
- Incidence CMP po revaskularizaci je nízká:
  - ACT I – CAS 0.4% per year, CEA 0.5% per year.
  - CREST – CAS 0.7% per year, CEA 0.6% per year.
  - (navíc 2-4% periprocedurální CMP/AIM/smrt)
- Klíčem bude riziková stratifikace dle složení plátu.