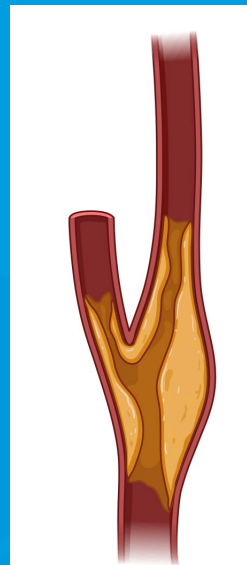
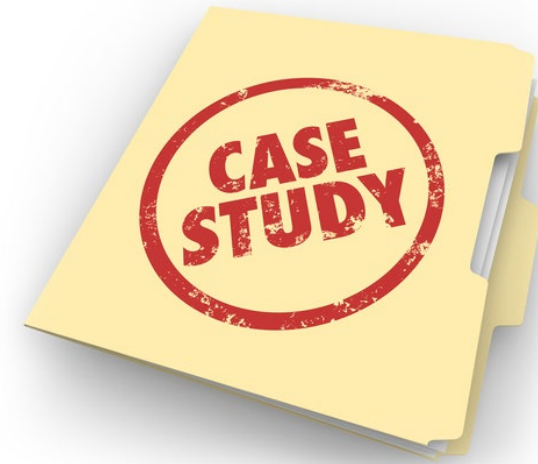


# Gestion des sténoses carotidiennes

G. Sirimarco

Médecin cheffe d'unité de neurologie, Responsable stroke unit, HRC  
Médecin agréé Stroke Center CHUV, MER UNIL





## Histoire clinique

Suivi pour **Ca urothélial**

### **FRVs :**

- Tabagisme actif
- HTA
- HCT

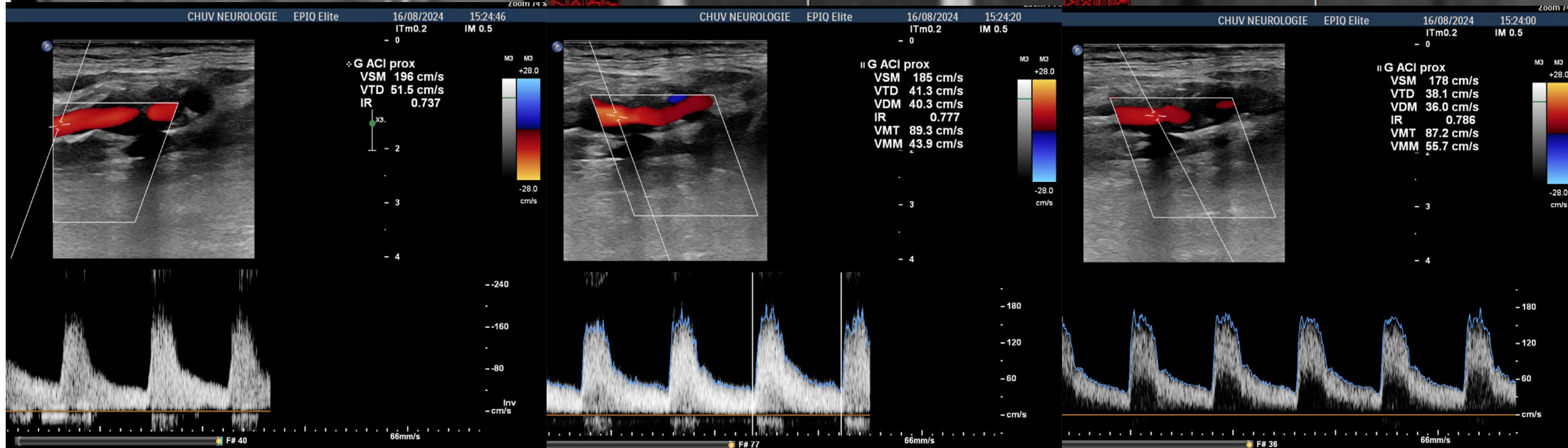
### **Athérosclérose sévère avec:**

- AOMI stade IIb
- Dernier bilan découverte des sténoses carotidiennes bilatérales asymptomatiques

# M. OE, 77 aa



HÔPITAL RIVIERA CHARLAIN





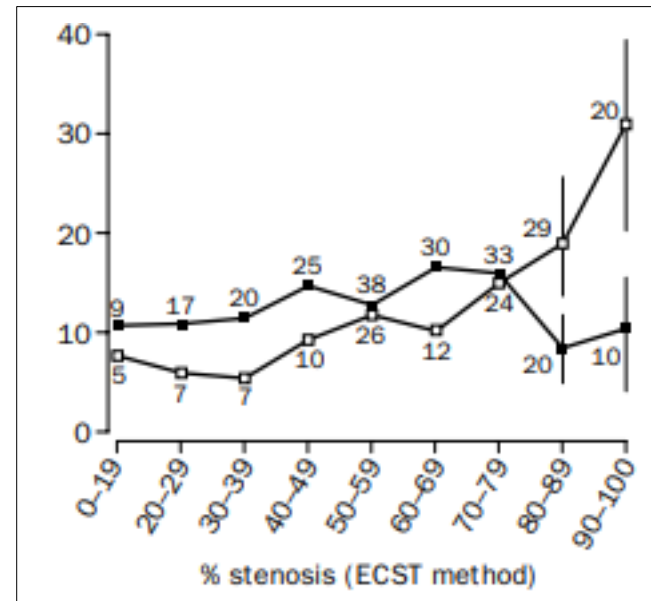
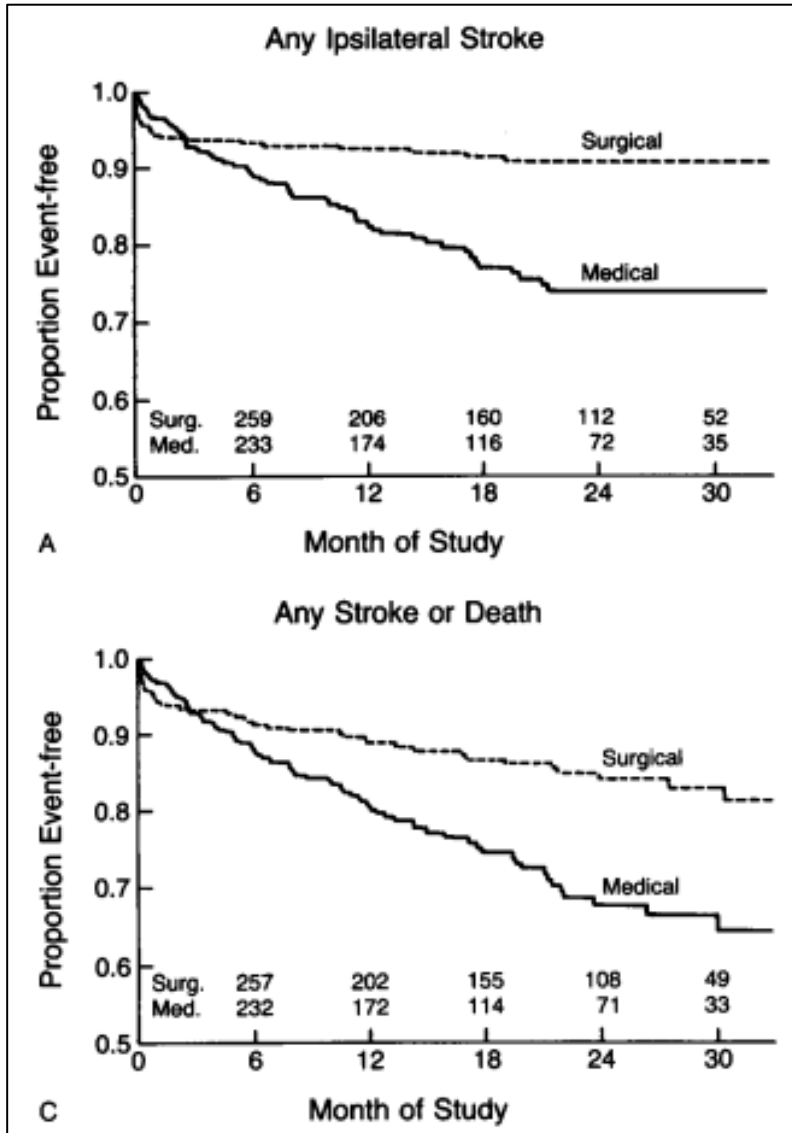
Sténose ICA G ~60% asymptomatique

→ Plaque instable

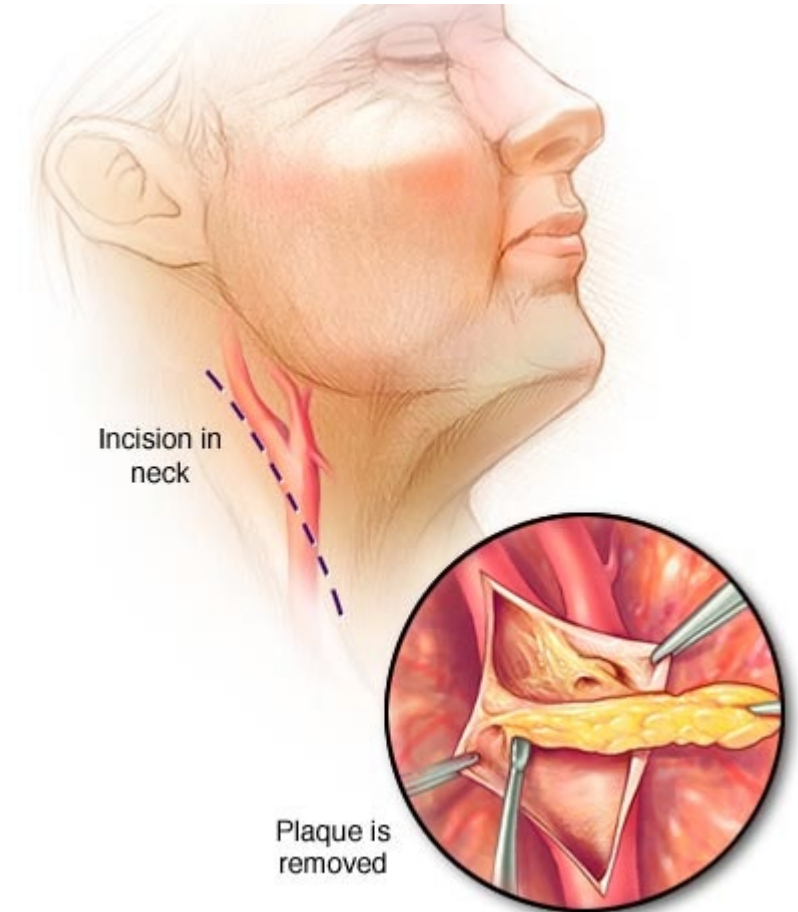
→ Intervenir ou PAS intervenir ?



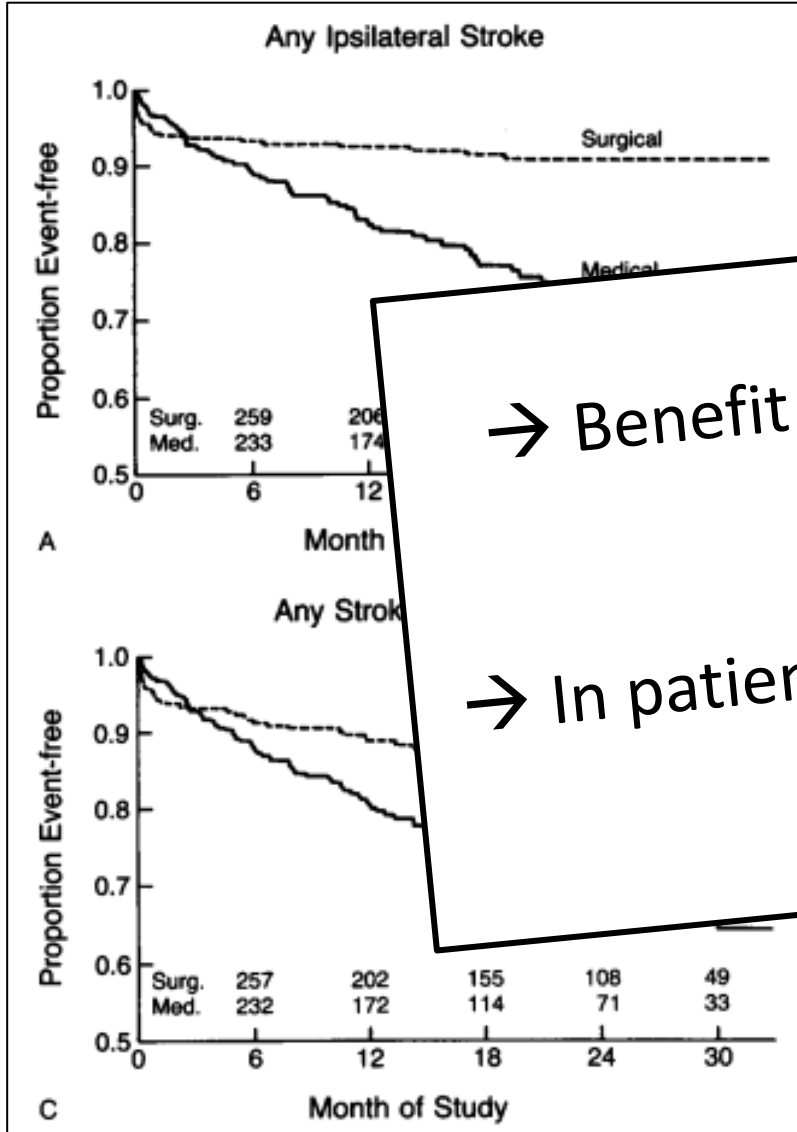
# Lessons learned ... CEA



NASCET 1991; ECST 1998



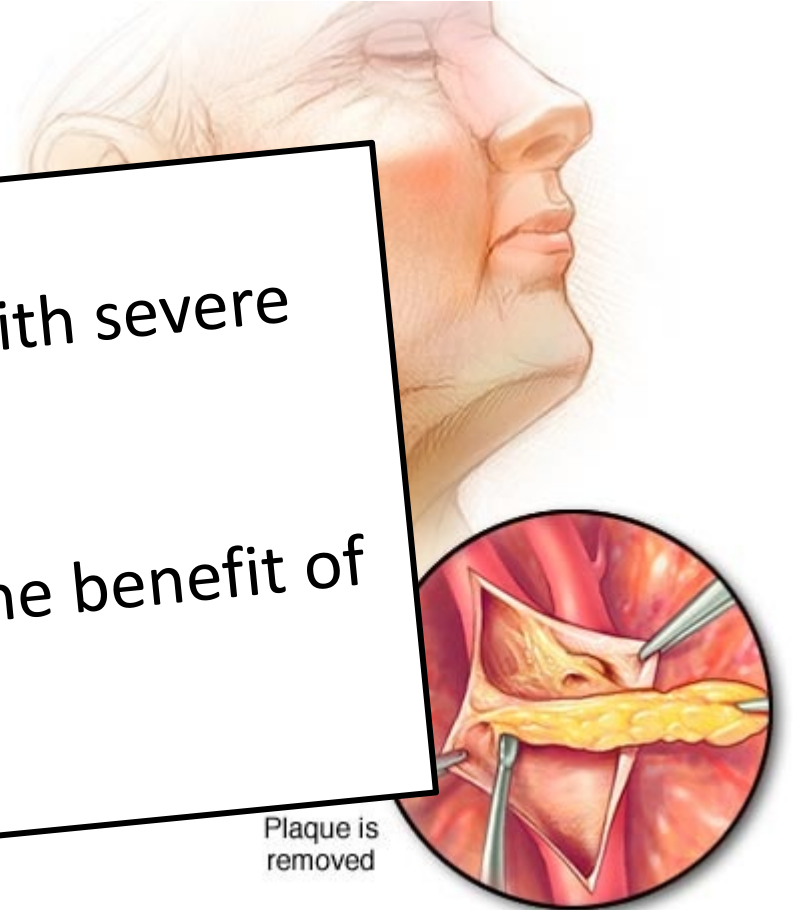
# Lessons learned ... CEA



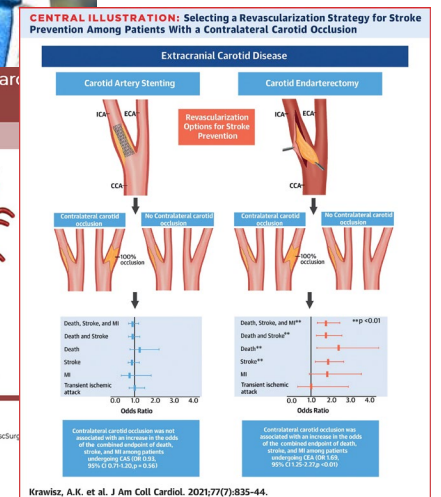
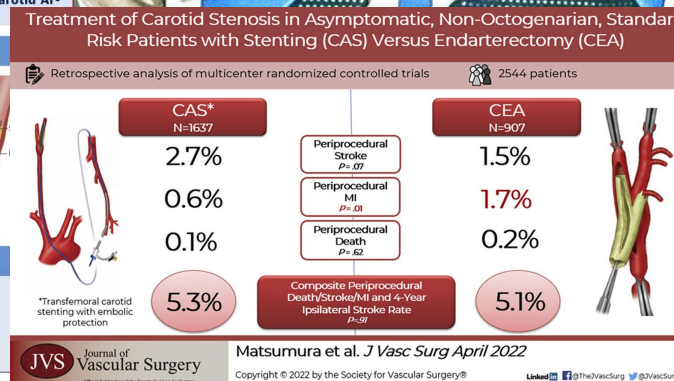
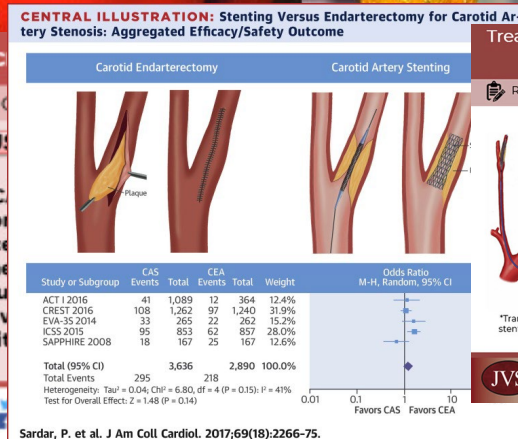
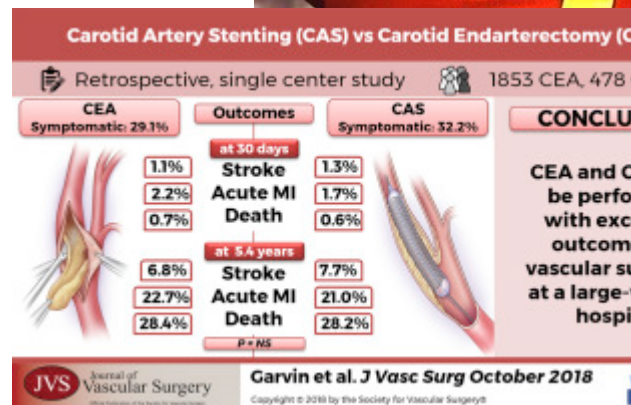
→ Benefit of CEA greatest in patients with severe carotid stenosis (70%)

→ In patients with moderate stenosis, the benefit of surgery was marginal..

NASCET 1991; ECST 1998



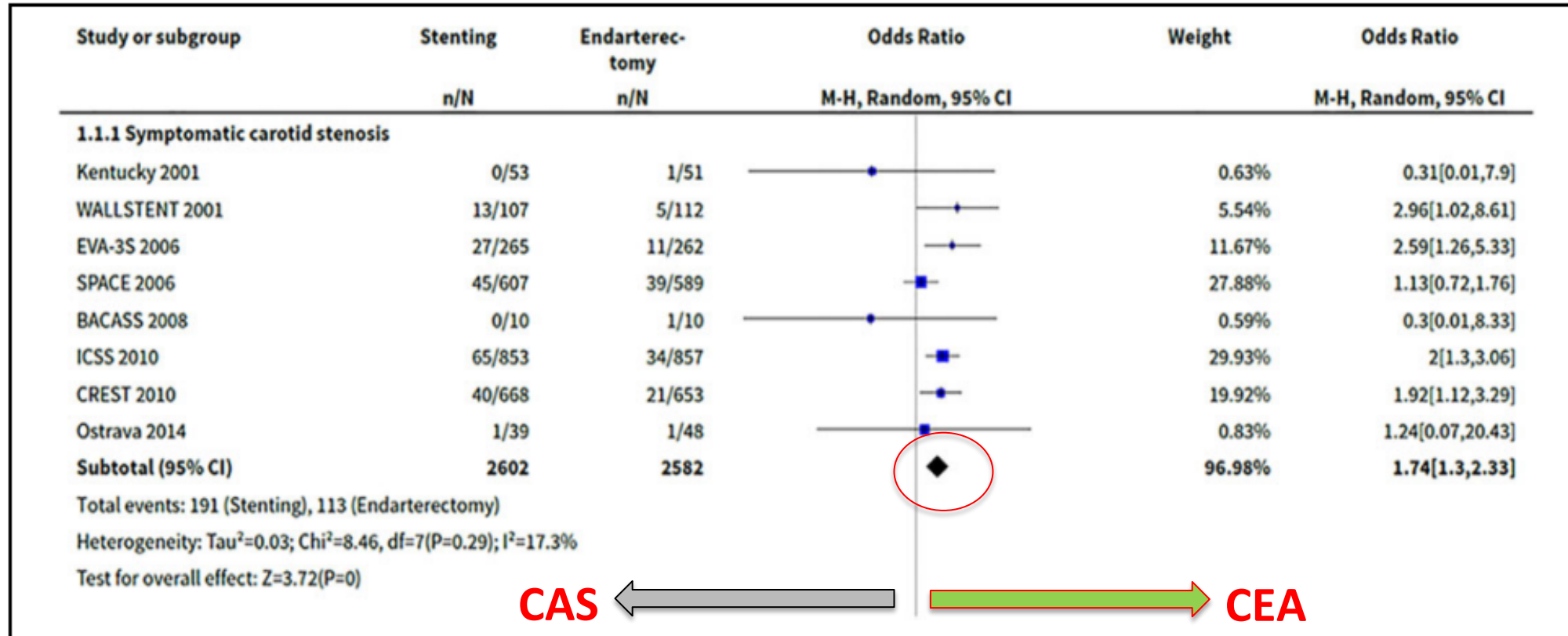
# But this is not the end of the story ...



# Symptomatic carotid stenosis



Meta-analysis of all available randomised trials (2020)

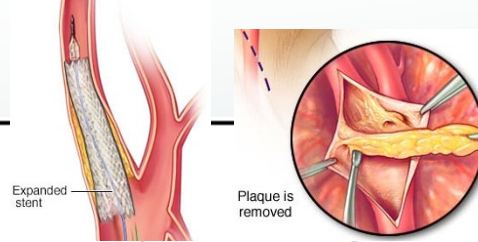


CAS was associated with a higher risk of death or any stroke than CEA

→ Increase in periprocedural strokes in CAS

→ But cranial nerve injury and MI in CEA..

# Subgroup Analysis



**< 70 y**

| Study or subgroup        |             |             | Odds Ratio<br>M-H, Random, 95% CI | Weight        | Odds Ratio<br>M-H, Random, 95% CI |
|--------------------------|-------------|-------------|-----------------------------------|---------------|-----------------------------------|
| EVA-3S 2006              | 10/127      | 6/106       |                                   | 7.27%         | 1.42[0.5,4.06]                    |
| SPACE 2006               | 17/347      | 22/333      |                                   | 14.41%        | 0.73[0.38,1.4]                    |
| BACASS 2008              | 0/4         | 0/2         |                                   |               | Not estimable                     |
| CREST 2010               | 9/351       | 6/327       |                                   | 7.3%          | 1.41[0.5,4]                       |
| ICSS 2010                | 20/395      | 14/404      |                                   | 13.21%        | 1.49[0.74,2.98]                   |
| Ostrava 2014             | 0/23        | 1/34        |                                   | 0.91%         | 0.48[0.02,12.18]                  |
| <b>Subtotal (95% CI)</b> | <b>1247</b> | <b>1206</b> |                                   | <b>43.11%</b> | <b>1.11[0.74,1.64]</b>            |

Total events: 56 (Stenting), 49 (Endarterectomy)  
Heterogeneity:  $\tau^2=0$ ;  $\chi^2=2.96$ ,  $df=4$  ( $P=0.56$ );  $I^2=0\%$   
Test for overall effect:  $Z=0.49$  ( $P=0.62$ )

**$\geq 70 y$**

|                          |             |             |  |               |                        |
|--------------------------|-------------|-------------|--|---------------|------------------------|
| EVA-3S 2006              | 17/138      | 5/156       |  | 7.51%         | 4.24[1.52,11.83]       |
| SPACE 2006               | 28/260      | 17/256      |  | 15.05%        | 1.7[0.9,3.18]          |
| BACASS 2008              | 0/6         | 1/8         |  | 0.85%         | 0.38[0.01,11.17]       |
| CREST 2010               | 31/317      | 15/326      |  | 14.82%        | 2.25[1.19,4.25]        |
| ICSS 2010                | 45/458      | 20/453      |  | 17.77%        | 2.36[1.37,4.06]        |
| Ostrava 2014             | 1/16        | 0/14        |  | 0.89%         | 2.81[0.11,74.56]       |
| <b>Subtotal (95% CI)</b> | <b>1195</b> | <b>1213</b> |  | <b>56.89%</b> | <b>2.23[1.61,3.08]</b> |

Total events: 122 (Stenting), 58 (Endarterectomy)  
Heterogeneity:  $\tau^2=0$ ;  $\chi^2=3.34$ ,  $df=5$  ( $P=0.65$ );  $I^2=0\%$   
Test for overall effect:  $Z=4.84$  ( $P<0.0001$ )

|                       |             |             |  |             |                        |
|-----------------------|-------------|-------------|--|-------------|------------------------|
| <b>Total (95% CI)</b> | <b>2442</b> | <b>2419</b> |  | <b>100%</b> | <b>1.67[1.22,2.28]</b> |
|-----------------------|-------------|-------------|--|-------------|------------------------|

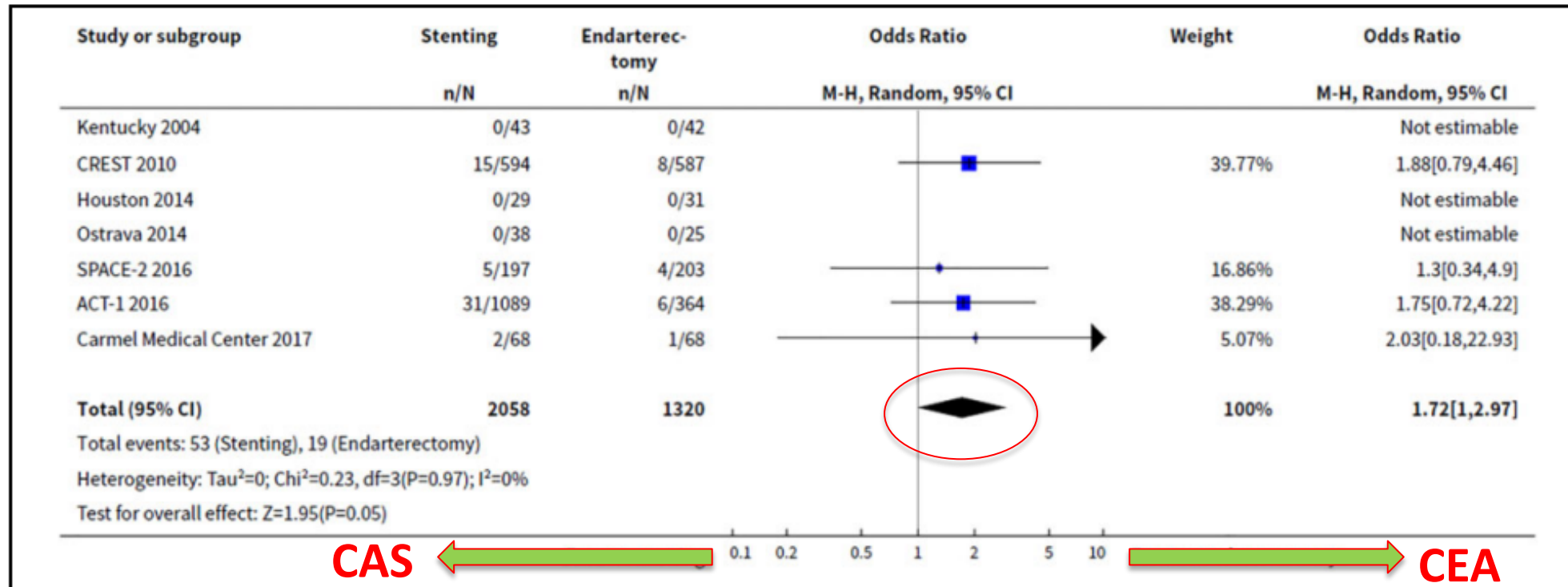
Total events: 178 (Stenting), 107 (Endarterectomy)

**CAS** ← **CEA**



# Asymptomatic carotid stenosis

Meta-analysis of all available randomised trials

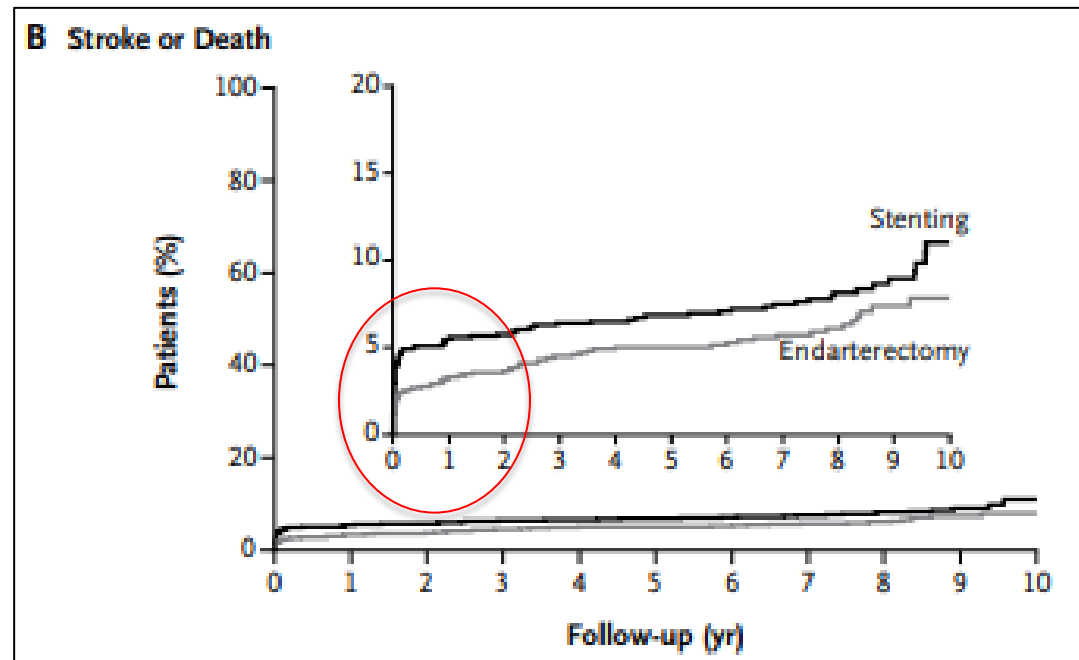
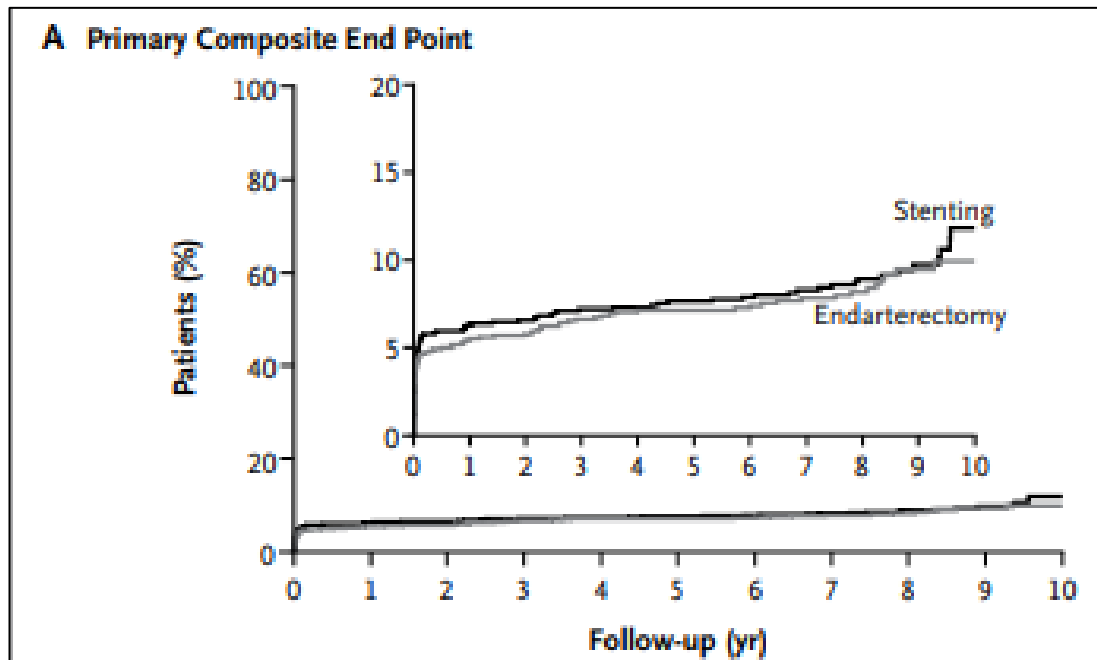


A small non-significant increase in the risk of stroke or death within 30 days of treatment with CAS compared to CEA  
→ But available evidence is insufficient

# CREST symptomatic and asymptomatic patients 10 years follow-up



Symptomatic stenosis of 70% or more and asymptomatic stenosis of 80% or more



No significant difference over 10 y

But periprocedural risk higher in CAS group than in CEA...Does (age and) symptomatic status matter?

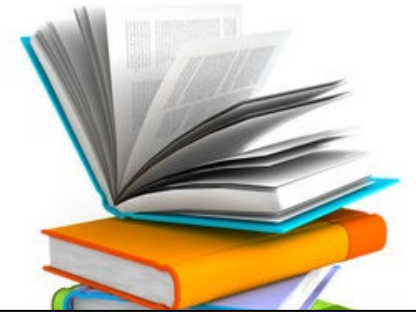


In symptomatic patients:

- ✓ CAS was associated with higher risk of stroke (30 d) than CEA
- ✓ >>>>Periprocedural Stroke in patients >70 years
- ✓ Beyond 30 days after TTT, CAS was as effective as CEA

In asymptomatic patients:

- ✓ A small non-significant increase was observed in the risk of stroke (30 d) with CAS compared to CEA
- ✓ The risk of stroke during follow-up did no differ



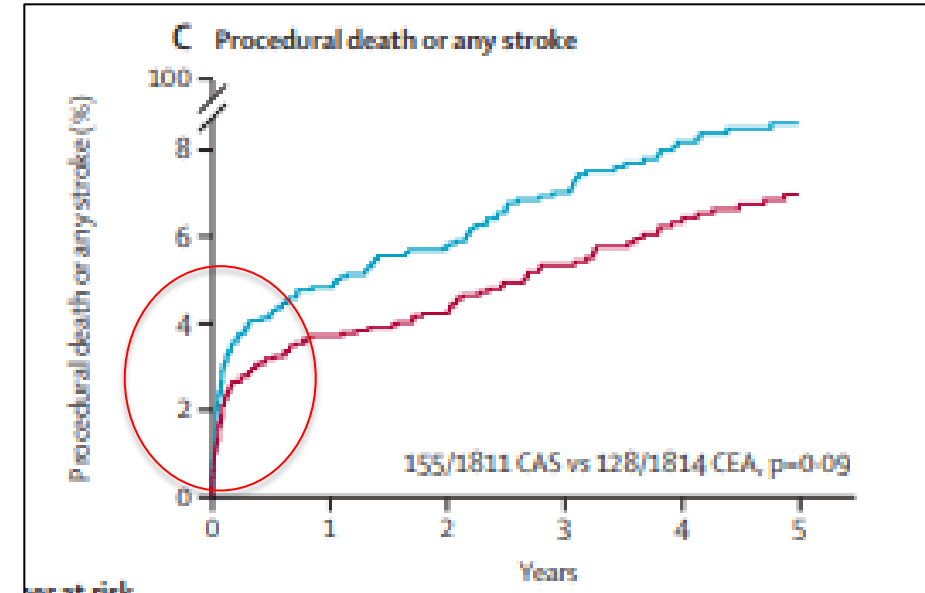
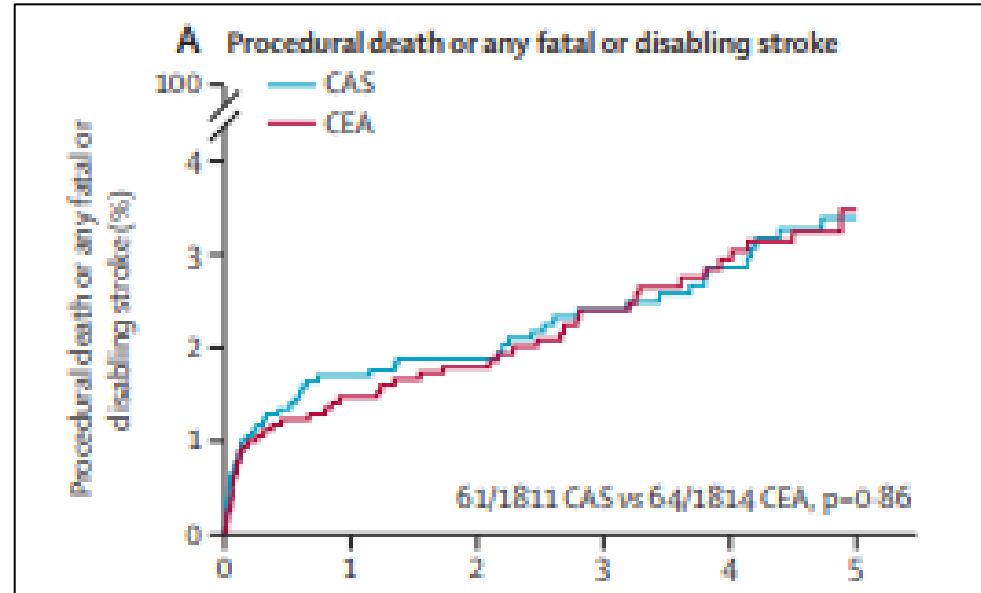
Do these data allow us to draw reliable conclusions?

- Patient recruitment performed more than 20 years ago for same RCT ...
- Medical management has evolved ...

# Asymptomatic carotid stenosis ACST-2



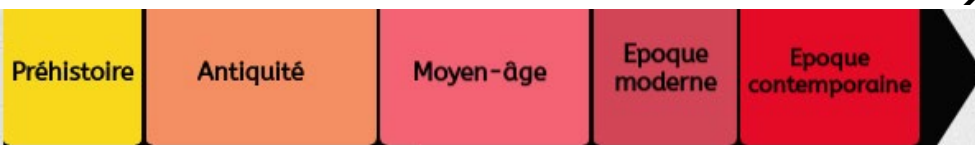
Asymptomatic carotid stenosis of 60% or higher



The effects of the two procedures on disabling or fatal events are approximately equal

→ Non-disabling procedural stroke slightly higher with CAS

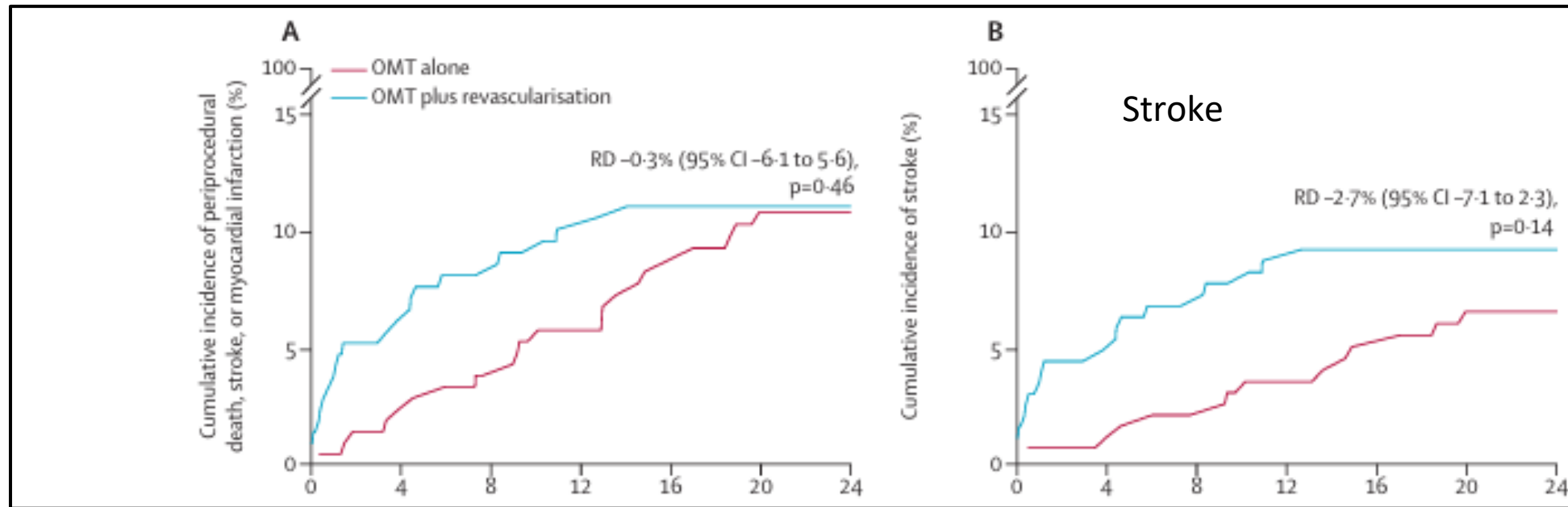
→ No effect on subgroup analysis



# Asymptomatic/low-risk symptomatic stenosis

## ECST 2

Asymptomatic or symptomatic carotid stenosis of  $\geq 50\%$  + 5-year predicted risk of ipsilateral stroke  $< 20\%$



No evidence for a benefit of revascularisation in addition to OMT

# Asymptomatic/low-risk symptomatic stenosis

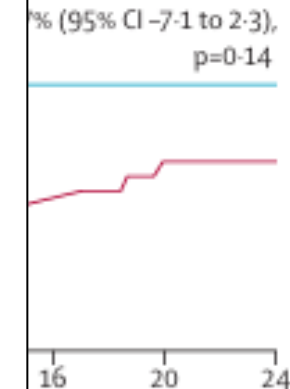
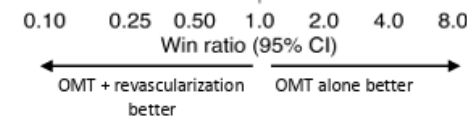
## ECST 2

Asymptomatic or

eral stroke <20%

Cumulative incidence of periprocedural death, stroke, or myocardial infarction (%)

|                                     | OMT alone (N) | OMT + revascularisation (N) | OMT alone wins (%) | OMT + revascularisation wins (%) | Win ratio (95% confidence interval) |
|-------------------------------------|---------------|-----------------------------|--------------------|----------------------------------|-------------------------------------|
| All patients                        | 214           | 214                         | 11.4               | 11.2                             | 1.01 (0.60 to 1.71)                 |
| Symptomatic                         |               |                             |                    |                                  |                                     |
| No                                  | 129           | 129                         | 9.4                | 13.7                             | 0.68 (0.35 to 1.34)                 |
| Yes                                 | 85            | 85                          | 14.6               | 7.9                              | 1.85 (0.79 to 4.35)                 |
| Age                                 |               |                             |                    |                                  |                                     |
| < 70                                | 88            | 91                          | 7.0                | 10.8                             | 0.64 (0.25 to 1.65)                 |
| ≥ 70                                | 126           | 123                         | 14.8               | 11.7                             | 1.27 (0.68 to 2.38)                 |
| Sex                                 |               |                             |                    |                                  |                                     |
| Female                              | 66            | 67                          | 16.6               | 6.8                              | 2.45 (0.91 to 6.61)                 |
| Male                                | 148           | 147                         | 9.1                | 13.4                             | 0.68 (0.36 to 1.27)                 |
| Risk group                          |               |                             |                    |                                  |                                     |
| Asymptomatic, stenosis ≤ 69%        | 47            | 48                          | 8.3                | 9.7                              | 0.86 (0.25 to 2.92)                 |
| Asymptomatic, stenosis ≥ 70%        | 82            | 81                          | 9.9                | 15.9                             | 0.62 (0.28 to 1.39)                 |
| Symptomatic, CAR score <15%         | 35            | 35                          | 11.3               | 0.0                              | NA                                  |
| Symptomatic, CAR score 15-19%       | 50            | 50                          | 16.6               | 13.1                             | 1.27 (0.50 to 3.21)                 |
| Diabetes                            |               |                             |                    |                                  |                                     |
| No                                  | 151           | 160                         | 11.1               | 10.4                             | 1.07 (0.58 to 1.99)                 |
| Yes                                 | 63            | 54                          | 12.0               | 13.1                             | 0.91 (0.35 to 2.39)                 |
| Hypertension                        |               |                             |                    |                                  |                                     |
| No                                  | 52            | 50                          | 6.0                | 8.0                              | 0.75 (0.18 to 3.09)                 |
| Yes                                 | 162           | 164                         | 13.2               | 12.3                             | 1.08 (0.61 to 1.88)                 |
| Severity of stenosis                |               |                             |                    |                                  |                                     |
| ≤ 69%                               | 103           | 91                          | 13.3               | 9.2                              | 1.44 (0.66 to 3.12)                 |
| ≥ 70%                               | 111           | 123                         | 10.0               | 13.2                             | 0.76 (0.38 to 1.53)                 |
| Contralateral stenosis or occlusion |               |                             |                    |                                  |                                     |
| ≤ 50%                               | 109           | 117                         | 9.7                | 8.8                              | 1.11 (0.50 to 2.46)                 |
| ≥ 51%                               | 71            | 59                          | 14.8               | 13.4                             | 1.10 (0.47 to 2.57)                 |
| Unknown                             | 34            | 38                          | 11.6               | 14.4                             | 0.81 (0.24 to 2.67)                 |
| Centre                              |               |                             |                    |                                  |                                     |
| Centres with ≤ 20 patients          | 89            | 87                          | 8.2                | 12.9                             | 0.64 (0.27 to 1.50)                 |
| Centres with ≥ 21 patients          | 127           | 252                         | 17.9               | 13.3                             | 1.34 (0.69 to 2.61)                 |



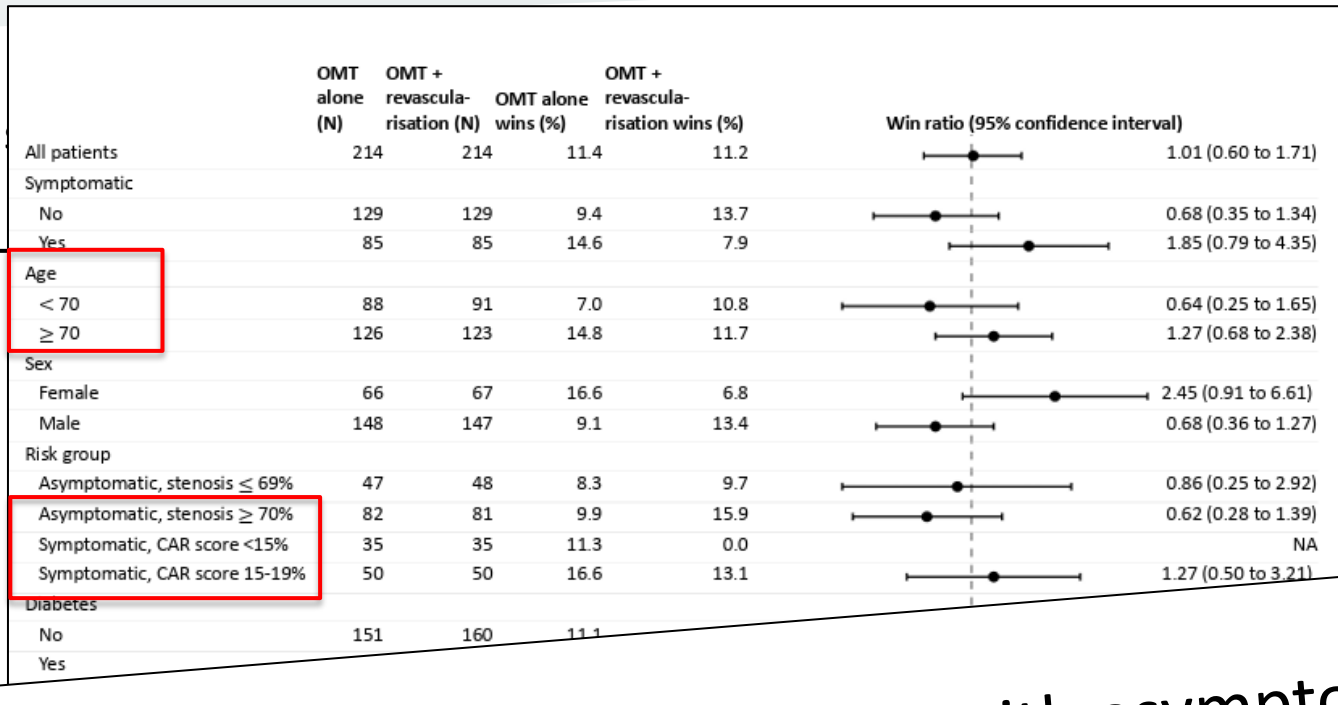
# Asymptomatic/low-risk symptomatic stenosis

## ECST 2

Asymptomatic or

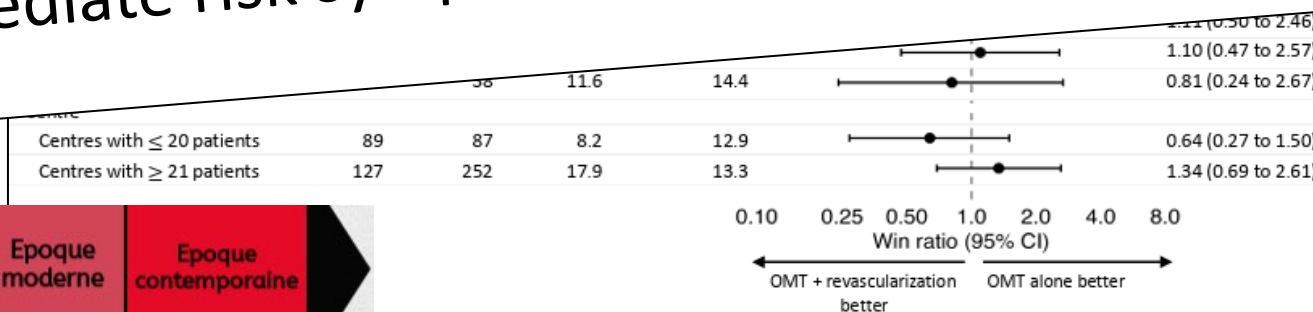
eral stroke <20%

ve incidence of periprocedural  
ike, or myocardial infarction (%)



% (95% CI -7.1 to 2.3),  
p=0.14

→ The results support treating patients with asymptomatic or low/intermediate risk symptomatic carotid stenosis with OMT alone





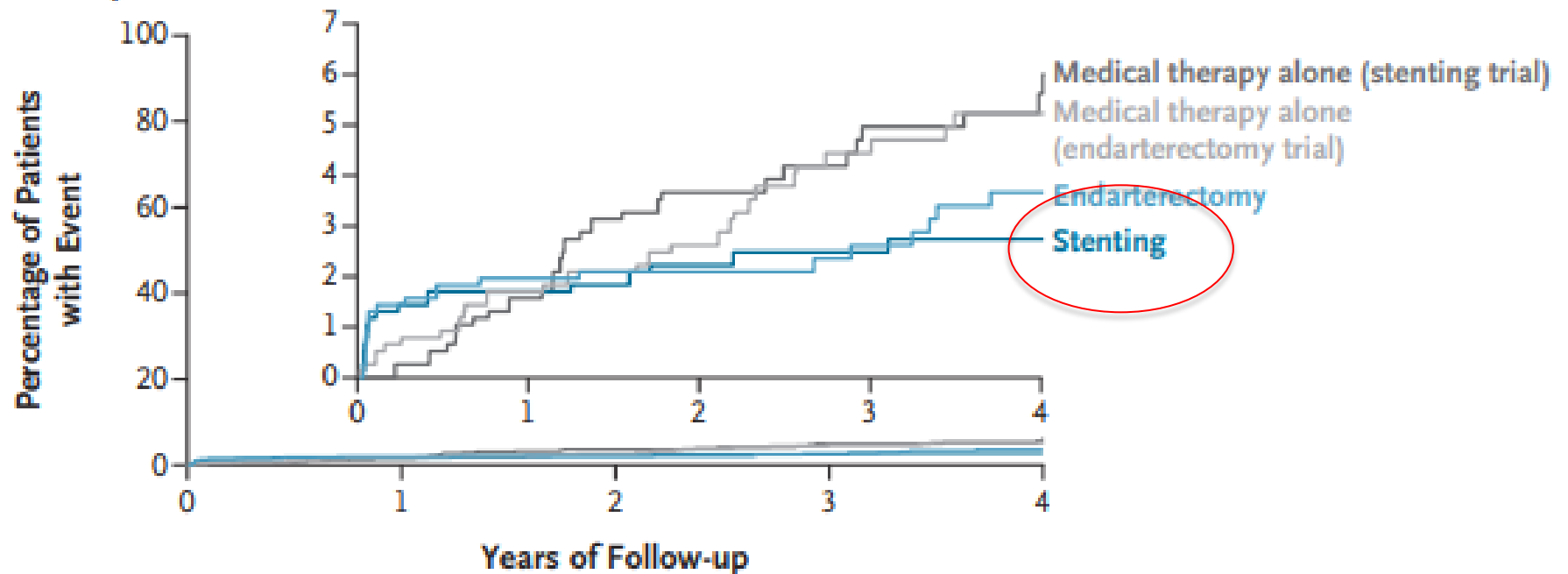
It's not over yet ... Nov 21 2025

## CREST 2

Asymptomatic carotid stenosis  $\geq 70\%$   
MT alone vs CAS + MT and vs CEA + BMT



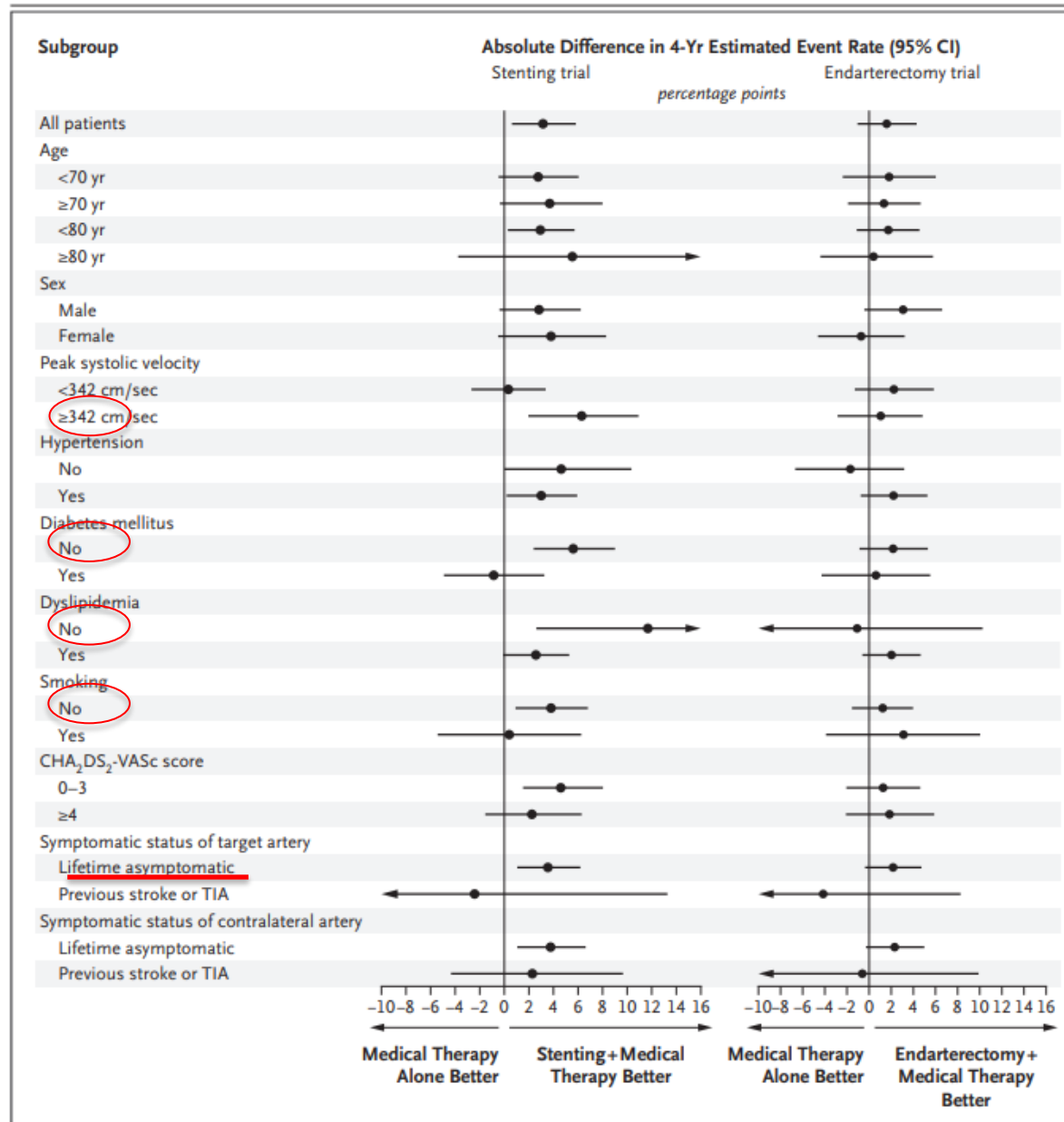
### A Primary-Outcome Analysis



- In patients with asymptomatic high-grade stenosis CAS led to a lower risk of a composite outcome (perioperative stroke/death/ipsilateral stroke within 4 y) than MT alone
- CEA did not lead to a significant benefit

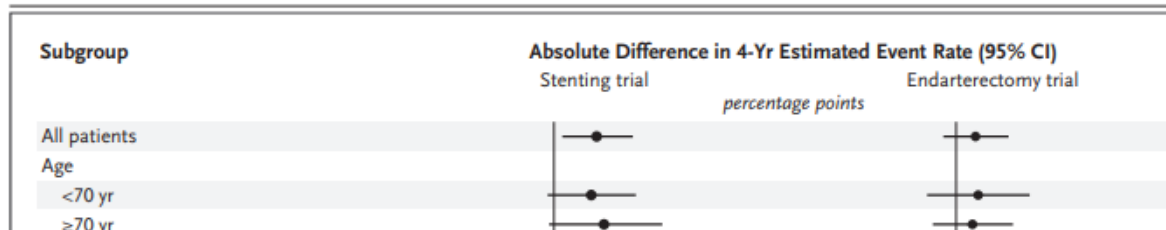


# It's not over yet ...

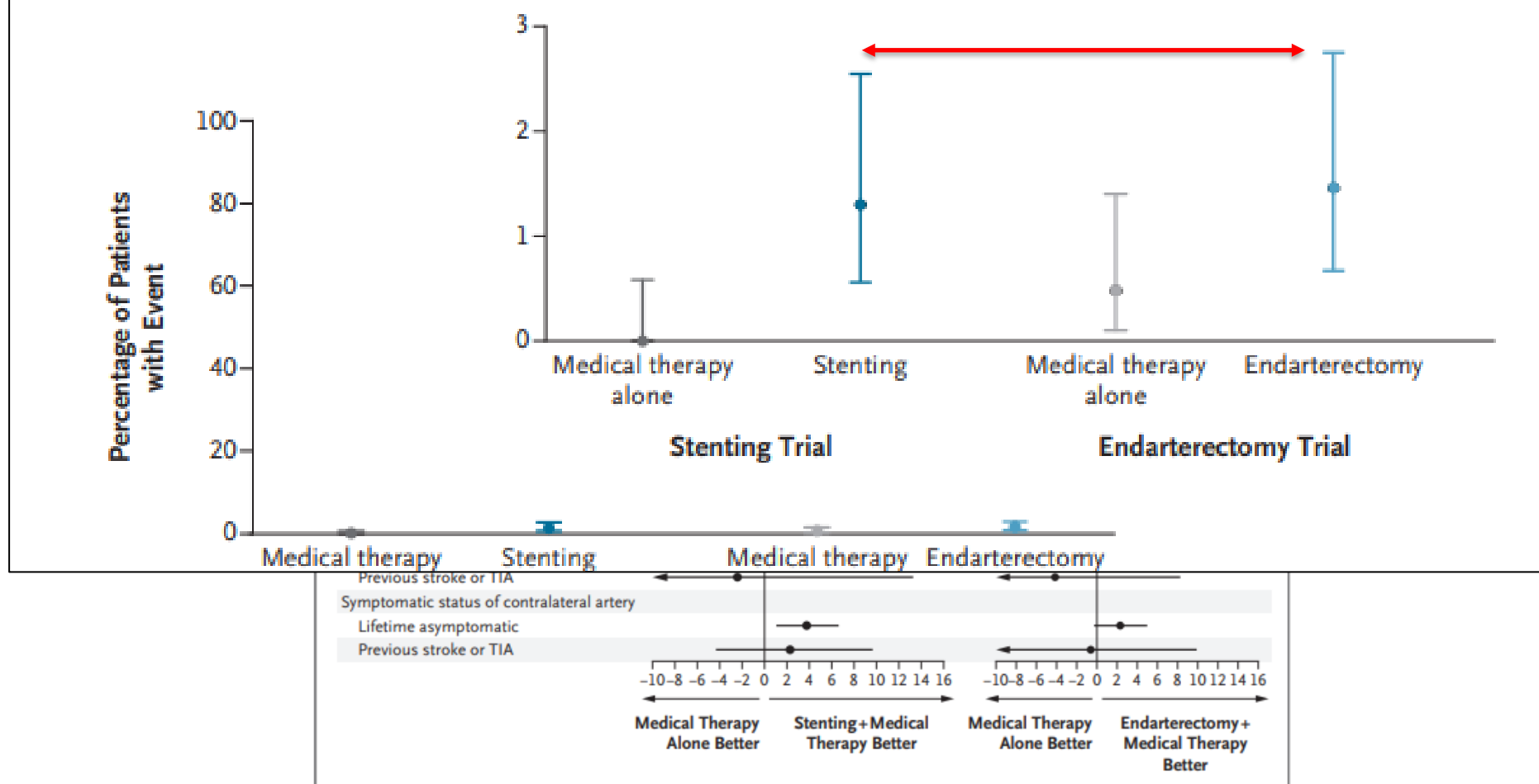




# It's not over yet ...



## B Periprocedural Component of Primary-Outcome Analysis (days 0 to 44)



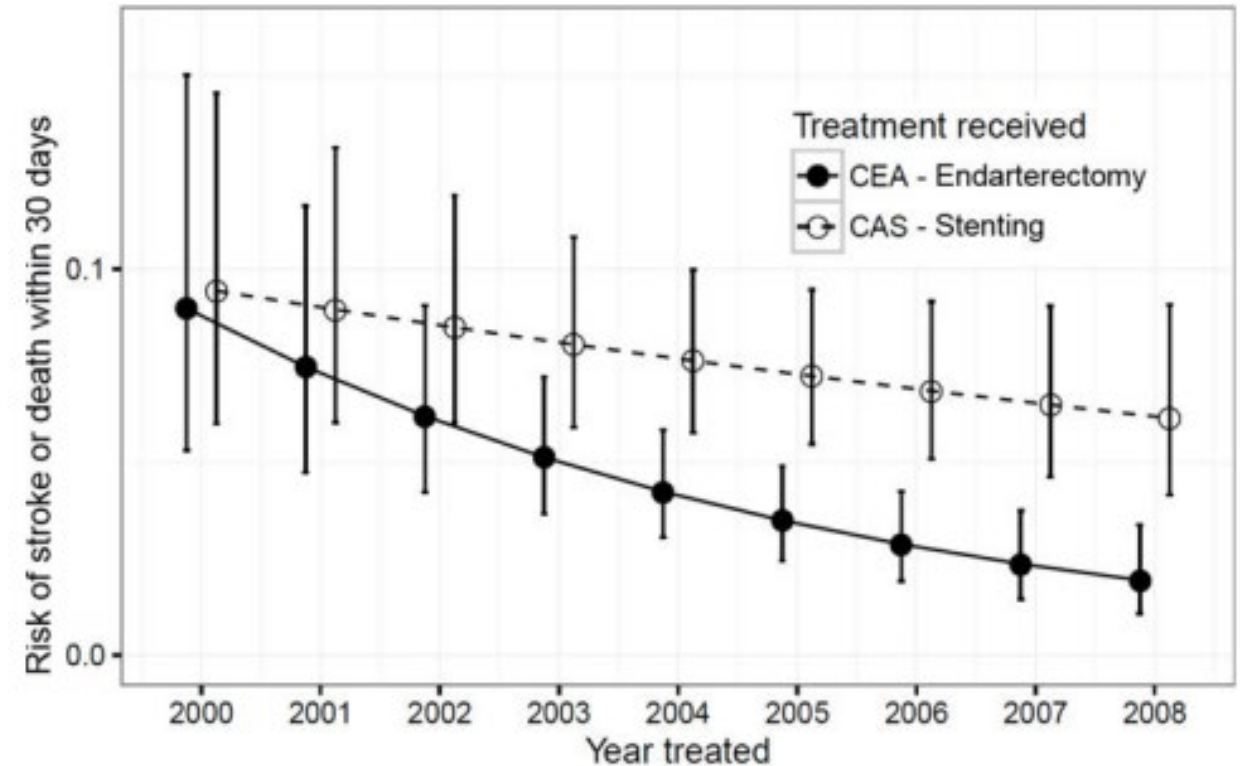
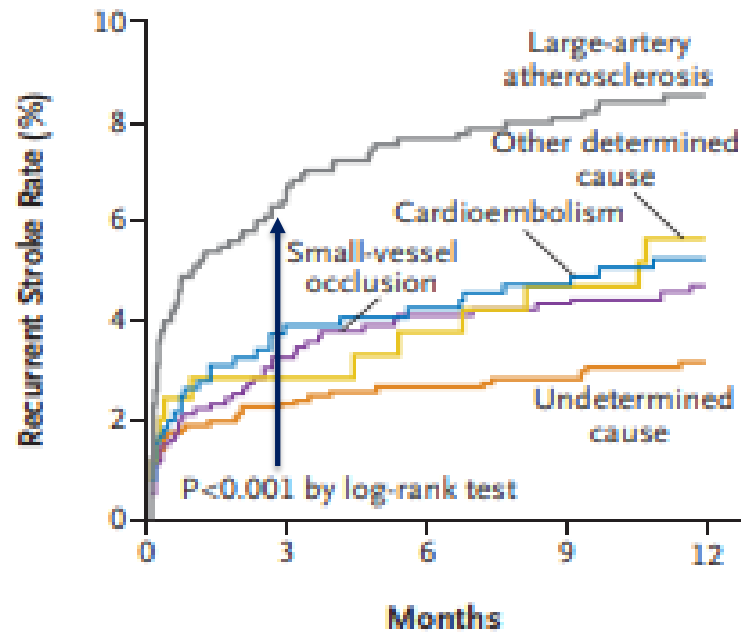


# Once again ... it's not over yet

## Lessons learned - 2

Stroke risk associated with carotid stenosis has decreased !

**D** Rate of Recurrent Stroke According to Cause of TIA or Minor Stroke (TOAST Classification)





# Once again ... it's not over yet

## Lessons learned - 2

Stroke risk associated with carotid stenosis has decreased !

D Rate of Recurrent Stroke According to Cause of TIA or Minor Stroke (TOAST Classification)



Recurrences risk reduction → improvement of secondary prevention  
Peri-procedural risk reduction → improvement of interventional techniques  
(proximal embolic protection and mesh-covered stents)

→ CREST-2: NNT = 31 ... but 1.7% p.y. stroke risk in MT group

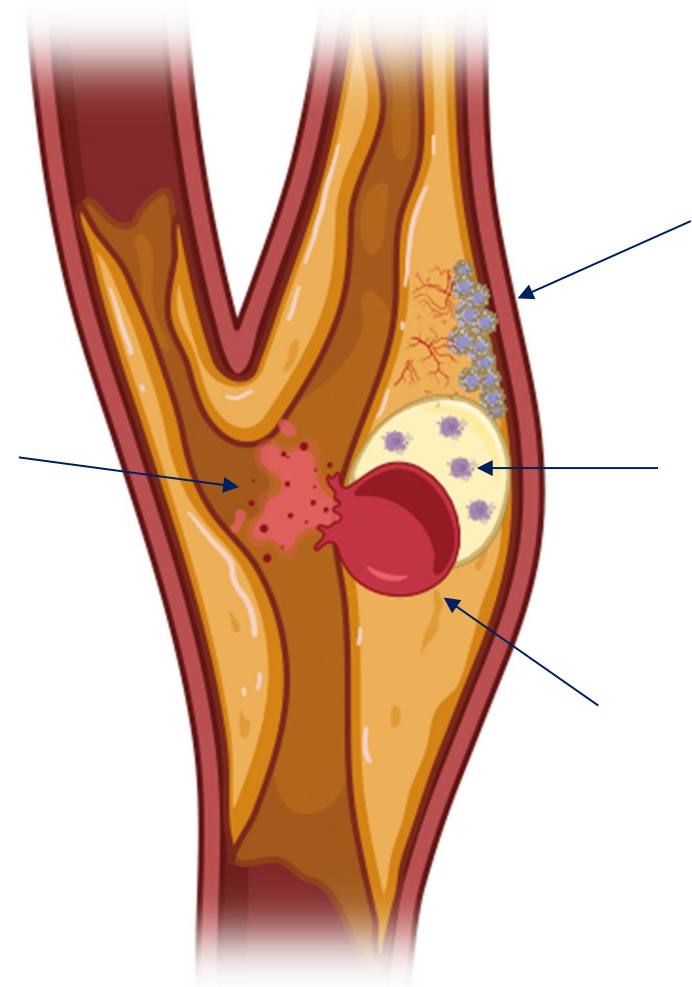
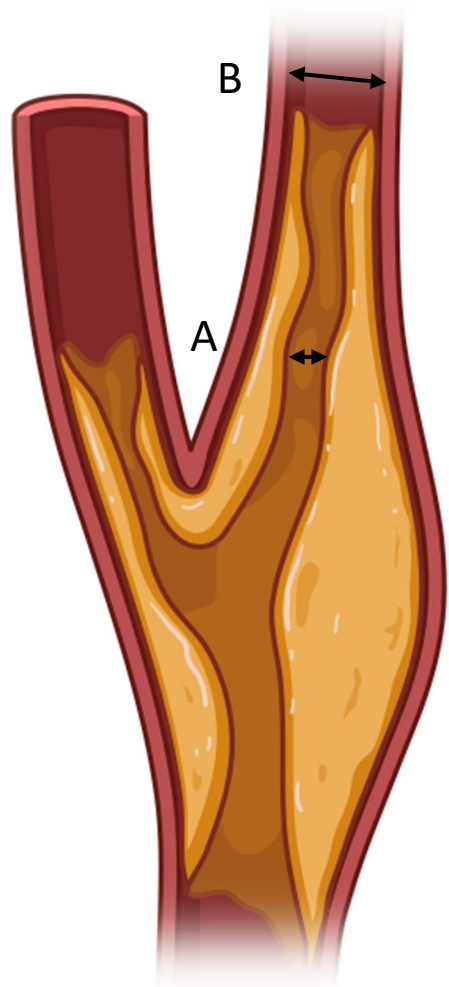
→ **NNT = 77 ??**



Mais alors..  
Quand faut-il intervenir ?

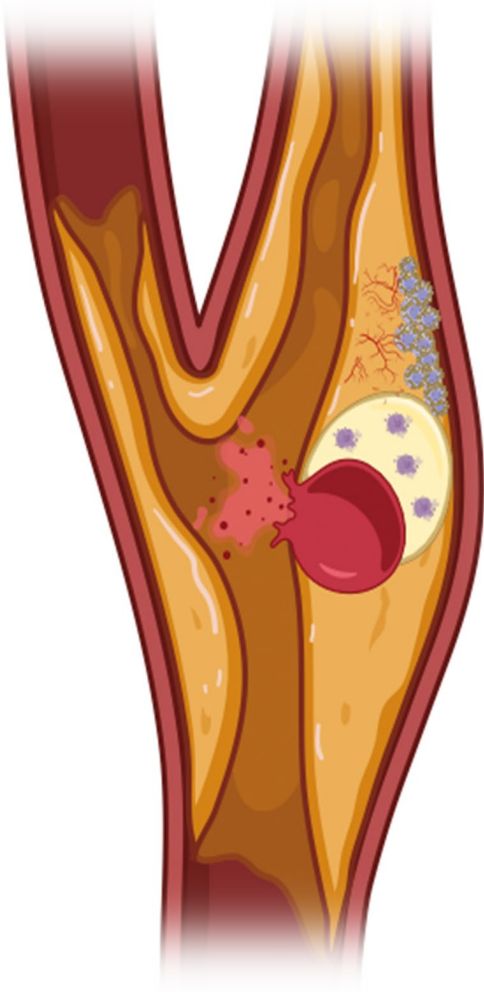


# A step backwards



$$\text{NASCET} = \frac{B-A}{B} \times 100 = \% \text{ stenosis}$$

# Identifying high-risk carotid plaques



Factors strongly associated with stroke risk :

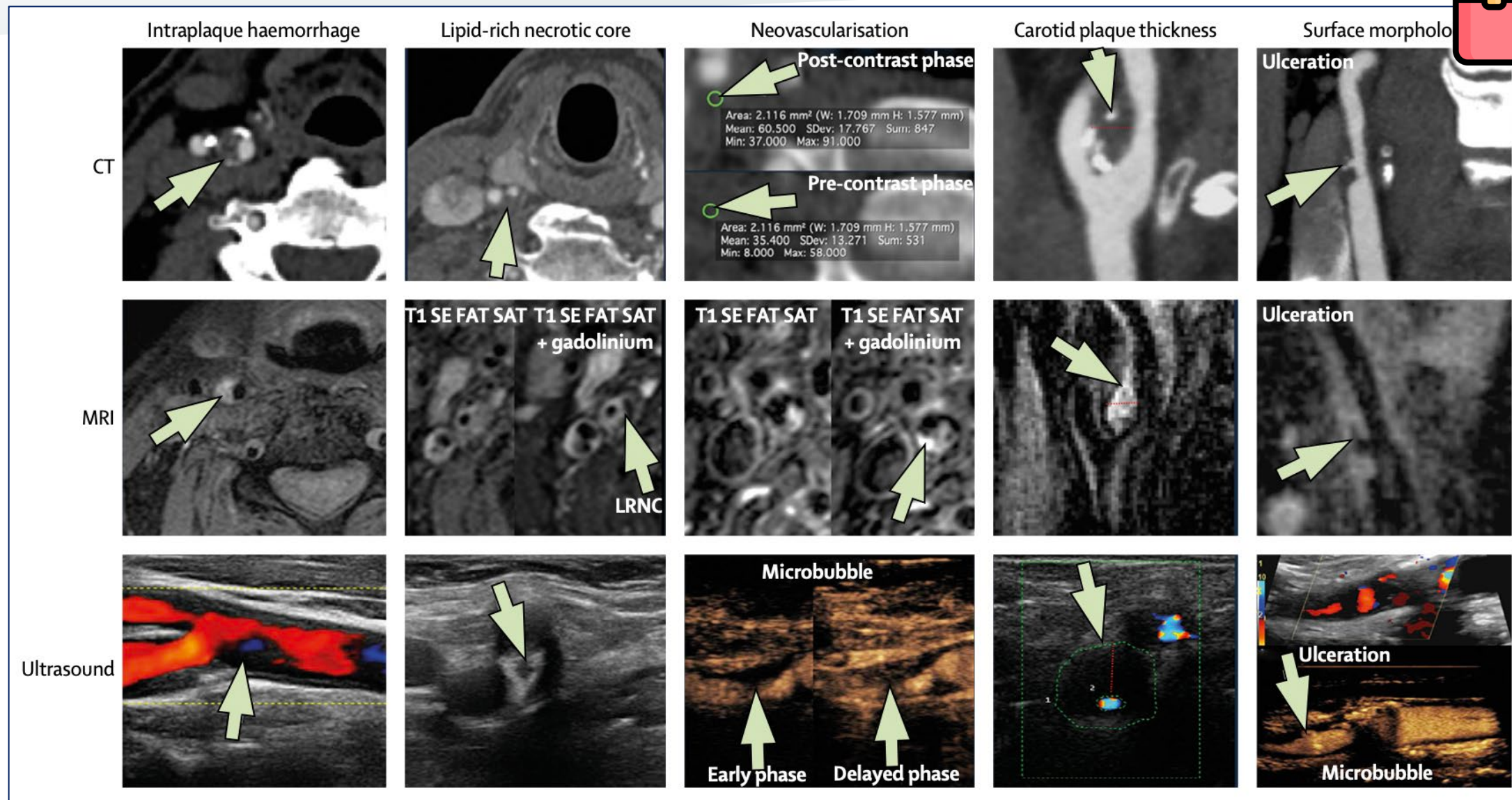
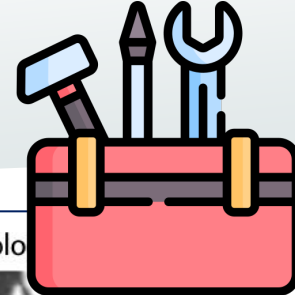
## → Plaque morphology

- Lipid-rich necrotic core (LRNC): **HR 3.00**
- Thin/ruptured fibrous cap (TRFC): **HR 5.93**
- Intraplaque hemorrhage (IPH): **HR 7.9 and 10.2** (in asymptomatic and symptomatic patients respectively) → plaque progression – LRNC rapid enlargement (28.4% with IPH vs -5.2% no IPH)

## → HITS (high-intensity transient signals) during monitoring

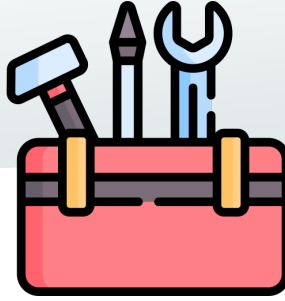
- Asymptomatic stenosis : HITS presents **HR 7.46**
- Symptomatic carotid stenosis : HITS presents **OR 9.57**

# Identifying high-risk carotid plaques – Imaging



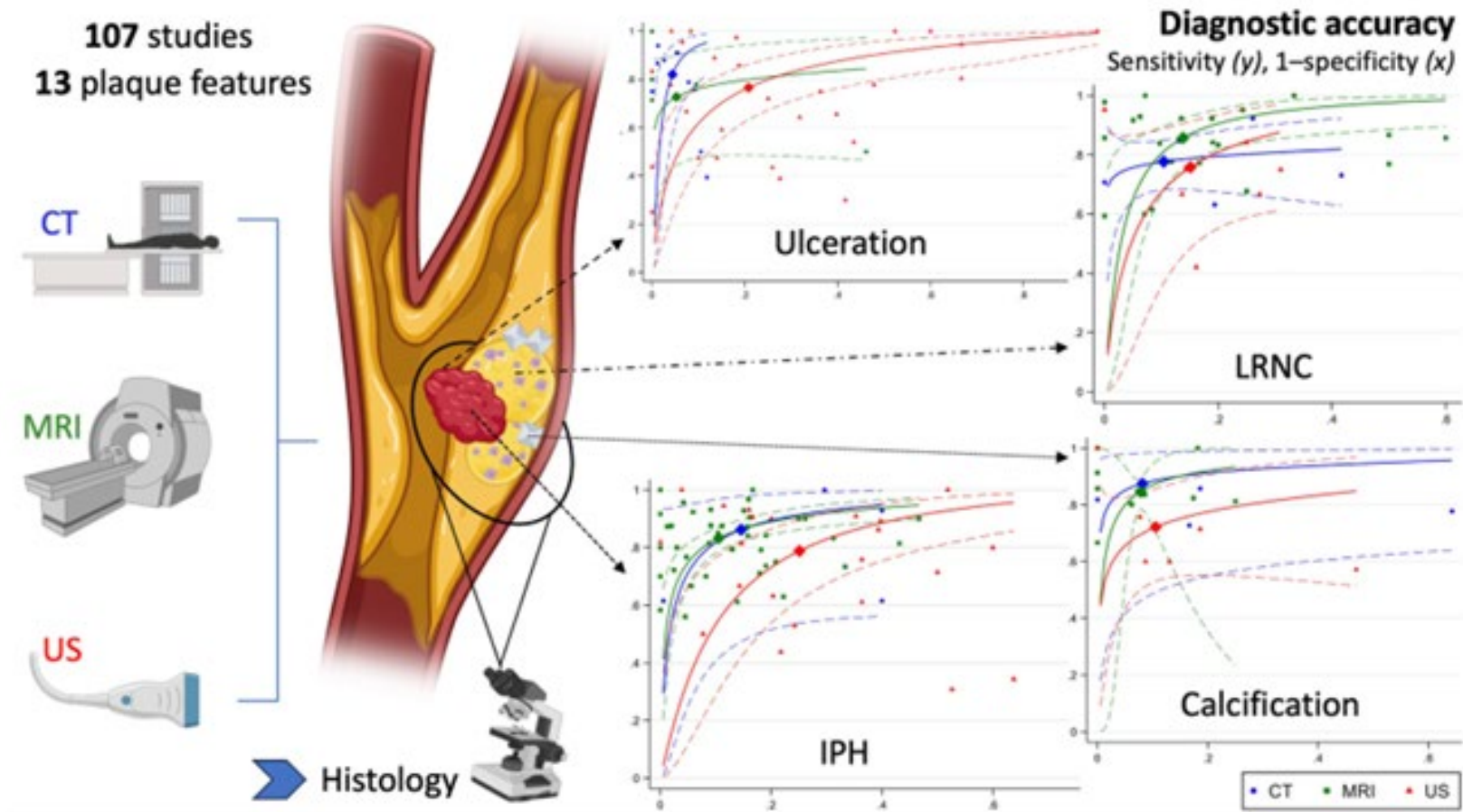
# Identifying high-risk carotid plaques

## Imaging Meta-analysis



CT → **High diagnostic accuracy** for identifying ulceration, calcification and IPH detection

MRI → Superior in detecting LRNC, fibrous tissue/cap, and **IPH** age



LRNC =  
Lipid-rich necrotic core

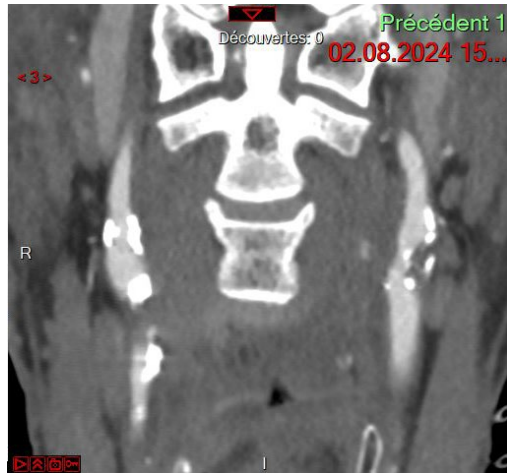
IPH =  
Intraplaque hemorrhage

# Et notre patient?

Sténose carotide interne  $\geq 60\%$  ? **OUI**

Symptomatique ? **NO**

Risque AVC élevé (plaque instable) ? **OUI**



- Sténose «sévère»? **NO**

- FRVs ? **OUI**

- Bonne santé? Esperance de vie > 10 ans ? **NO**

→ **Ø Intervention, mais**

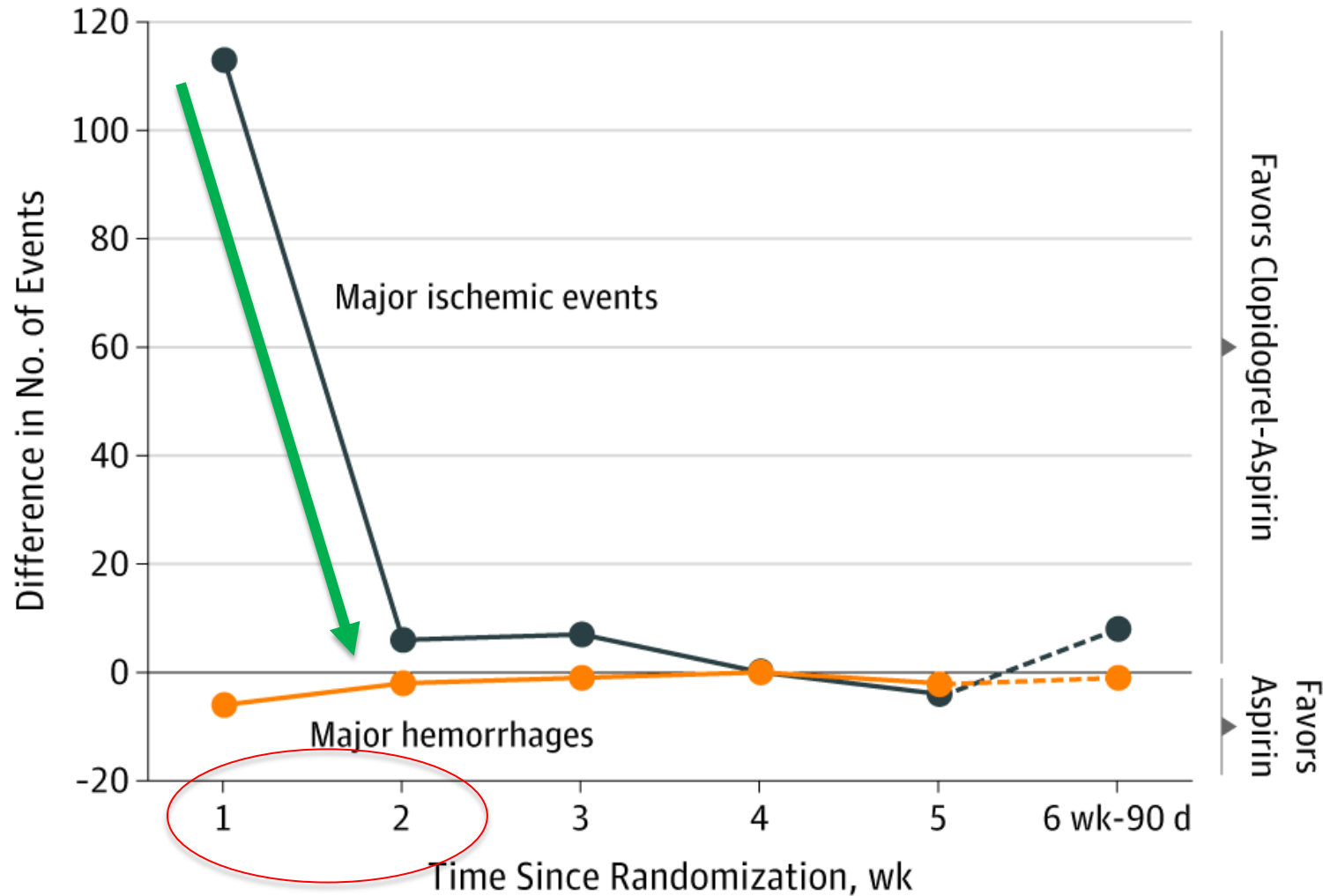
- Traitement médical optimal

- Suivi clinique 3-6 mois sans Doppler

- Contrôle FRVs



# Optimal medical therapy Symptomatic stenosis



# Optimal medical therapy Atherosclerosis subgroup

## Ischemic stroke – risk difference

| Study or Subgroup            | DAPT   |       | MAPT   |       | Weight | Risk Difference     |                     | Risk Difference |
|------------------------------|--------|-------|--------|-------|--------|---------------------|---------------------|-----------------|
|                              | Events | Total | Events | Total |        | M-H, Random, 95% CI | M-H, Random, 95% CI |                 |
| <b>1.1.1 ASA+CLOP vs ASA</b> |        |       |        |       |        |                     |                     |                 |
| CARESS 2005                  | 0      | 51    | 4      | 56    | 6.6%   |                     |                     |                 |
| CHANCE 2015                  | 0      | 51    | 4      | 56    | 6.6%   |                     |                     |                 |

In patients with symptomatic atherosclerosis, DAPT was superior to MAPT in preventing stroke recurrence without increasing bleeding risks

0.00 [-0.03, 0.03]

Heterogeneity: Not applicable  
Test for overall effect: Z = 0.00 (P = 1.00)

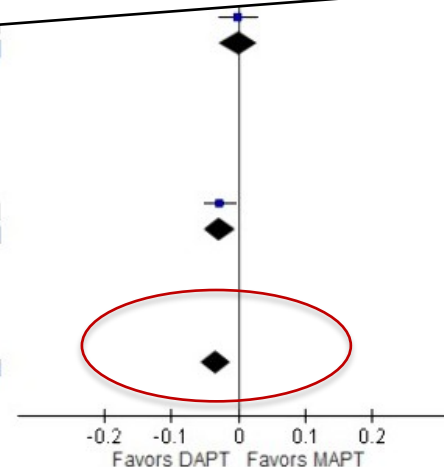
### 1.1.3 ASA+TICA vs ASA

|                          |    |             |     |             |              |                             |
|--------------------------|----|-------------|-----|-------------|--------------|-----------------------------|
| THALES 2020              | 87 | 1136        | 127 | 1215        | 20.3%        | -0.03 [-0.05, -0.00]        |
| <b>Subtotal (95% CI)</b> |    | <b>1136</b> |     | <b>1215</b> | <b>20.3%</b> | <b>-0.03 [-0.05, -0.00]</b> |

Total events: 87 / 127  
Heterogeneity: Not applicable  
Test for overall effect: Z = 2.37 (P = 0.02)

|                       |  |             |  |             |               |                             |
|-----------------------|--|-------------|--|-------------|---------------|-----------------------------|
| <b>Total (95% CI)</b> |  | <b>2114</b> |  | <b>2161</b> | <b>100.0%</b> | <b>-0.03 [-0.05, -0.01]</b> |
|-----------------------|--|-------------|--|-------------|---------------|-----------------------------|

Total events: 132 / 209  
Heterogeneity: Tau<sup>2</sup> = 0.00; Chi<sup>2</sup> = 15.83, df = 7 (P = 0.03); I<sup>2</sup> = 56%  
Test for overall effect: Z = 2.87 (P = 0.004)  
Test for subgroup differences: Chi<sup>2</sup> = 4.60, df = 2 (P = 0.10); I<sup>2</sup> = 56.5%



# Traitement médical optimal

## Nos recommandations

### Sténoses symptomatiques:

1<sup>er</sup> jour

- Charger Aspirine (250 mg i.v.) et Clopidogrel (300mg)

Dès 2<sup>ème</sup> jour

- Continuer Aspirine & Clopidogrel pour 2 semaines (+ IPP)
- Puis Clopidogrel au long cours



### Toutes sténoses : Traiter +++ dyslipidémie

- LDL < 1.4 mmol/L et ≥ 50% réduction du LDL
- Rosuvastatine 10/20 ou atorvastatine 40/80, en principe tjrs avec ezetimibe 10
- **Si** LDL > 1.8 mmol/L malgré 2 statines dose max. tolérée ± ezetimibe:  
Anti-PCSK9 injectables, acide bempedoïque

PeC de tous les FRVs : HTA, Diabète (OAD réduisant les événement vasculaires), tabagisme, sédentarité..

# Take home messages



✓ **En général: TRAITEMENT MEDICAL OPTIMAL**

Revascularisation selon décision individualisée

Stratification du risque - morphologie de plaque

✓ **Sténoses Symptomatiques:**

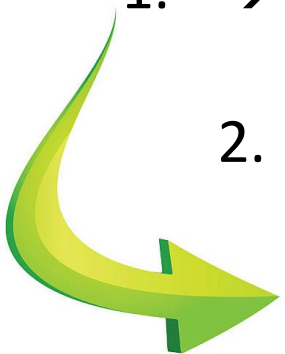
- $\geq 70\%$  : intervenir rapidement sauf exception
- 50-69% : considérer risque de récurrence selon critères
- Proposer CEA - option CAS si  $< 70$  ans

✓ **Sténoses Asymptomatiques:**

1. → Sténose radiologiquement instable et patient « jeune » et patient demandeur ?

2. → Considérer degré de sténose, FRVs et ATCD, centre expérimenté ?

3. → Proposer CAS pour les patients éligibles



# Merci de votre attention

