

Management of Stroke in the Elderly

How to Treat Percutaneously?

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What is an elderly patient?

- Depends upon the overall status of the patient, not upon the numeric age
- Depends upon the disease we are talking about
 - A 60 year old patient with a carotid stenosis is young
 - A 60 year old patient with a PFO is old
- The average age of our carotid stent patients is 71 yrs

The number of elderly patients has decreased !!

- When I started my career in 1979, almost all of my patients had been elderly
- As I am getting older, from year to year the percentage of elderly patients decreased
- My impression is this will continue

Management of stroke in the elderly

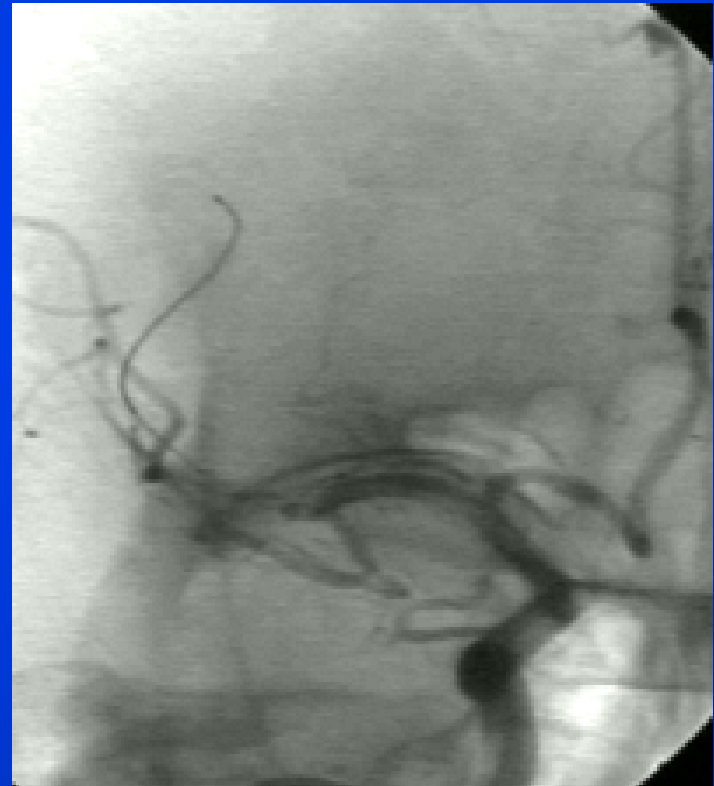
How to treat percutaneously?

- Acute treatment
- Prevention

Acute Stroke During Diagnostic Heart Catheterization

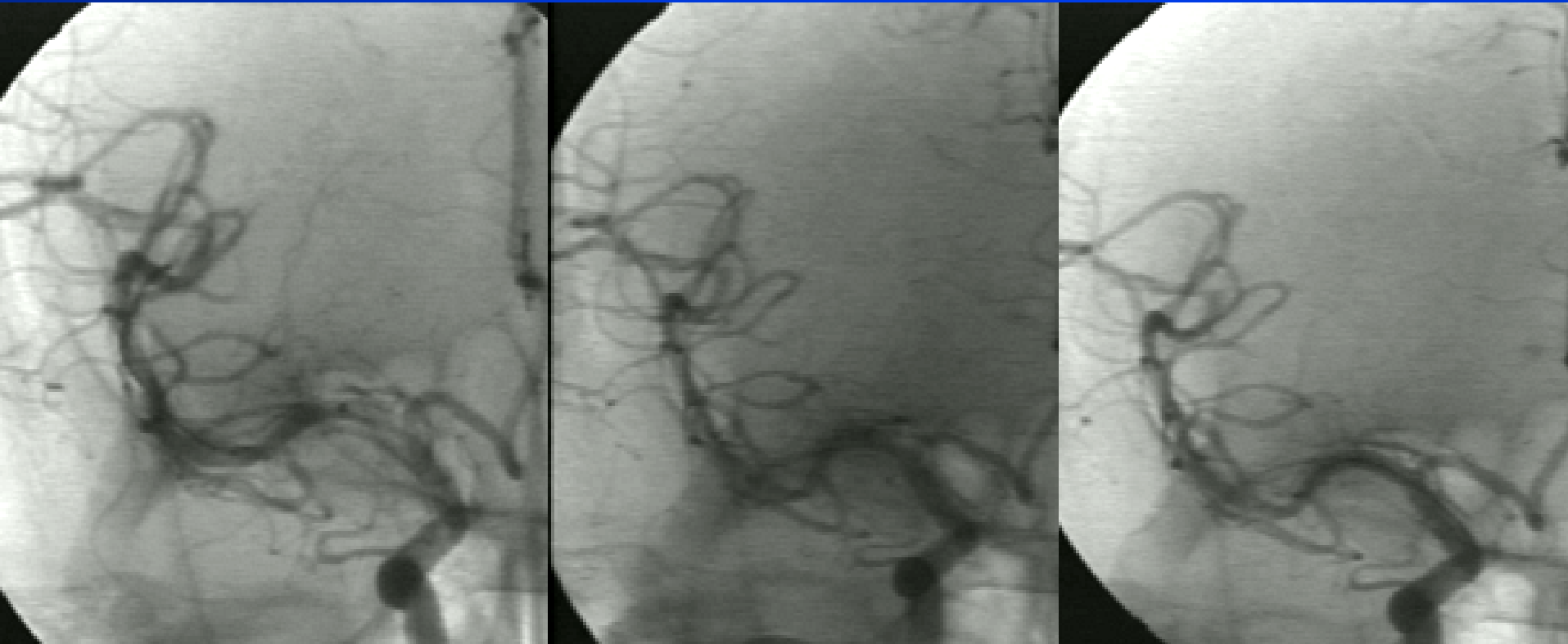


Embolic occlusion of MCA



... crossed with a wire

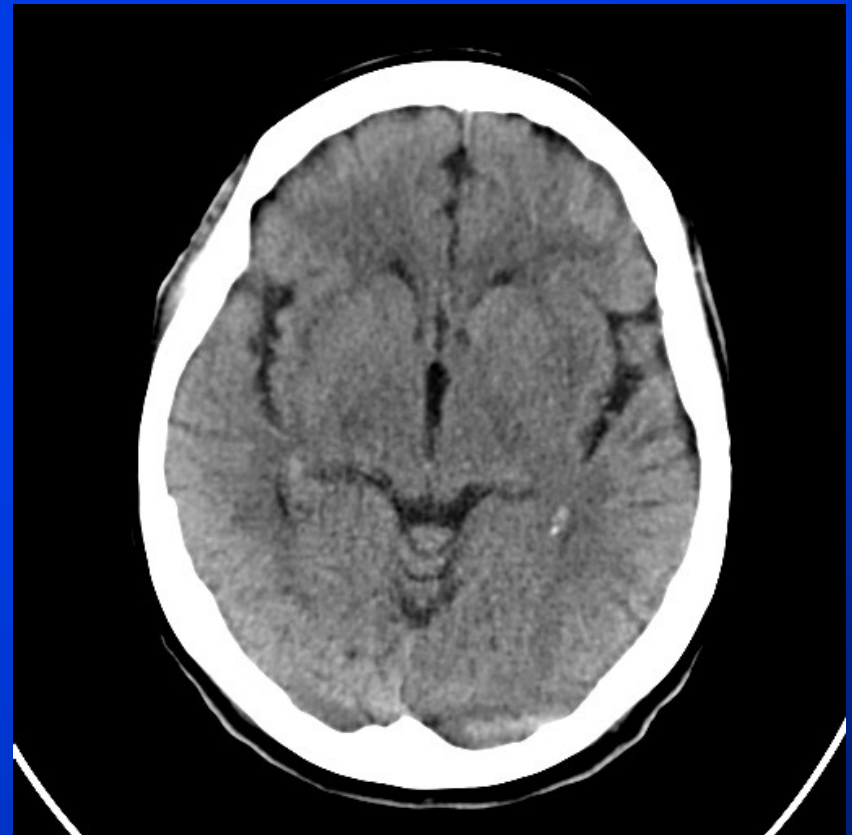
Acute Stroke During Diagnostic Heart Catheterization



Immediate restoration of flow → full recovery

Catheter Treatment of Acute Stroke

- 80 yrs, female
- sudden onset of right hemiparesis and aphasia
- Atrial fibrillation, not on anticoagulation
- Onset at 9:15pm
- Arrived to hospital at 10pm
- CT done at 10:15pm



10:36pm
Middle
Cerebral Artery
Branch
Occlusion

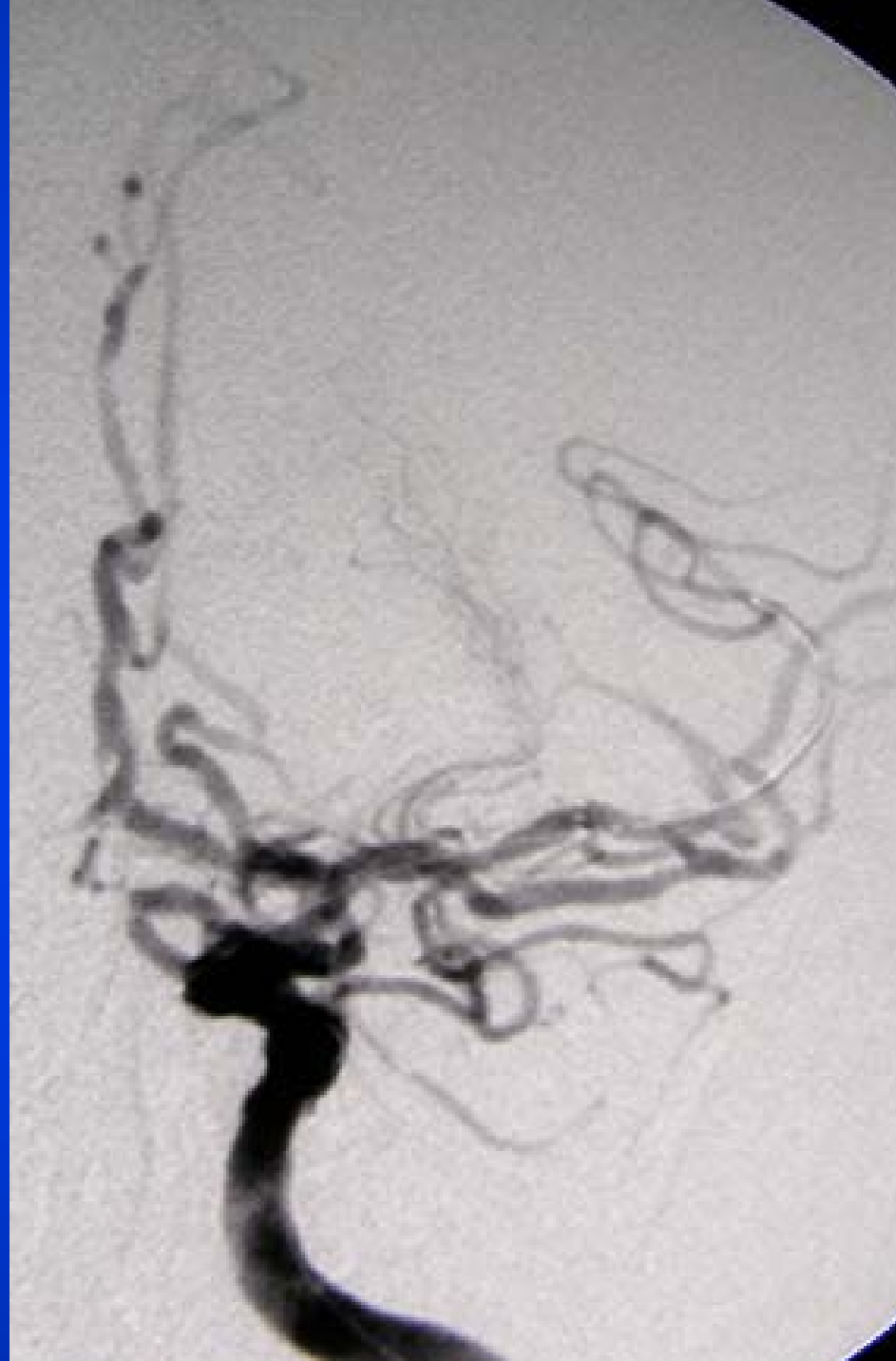


10:48

Micro-catheter
in place, no
improvement
after 10 min IA
lysis



10:58pm
After
angioplasty
and stent



Outcome

- Procedure was completed at 11:03pm
- Patient awoke with full strength on right side and following commands.



Are these all-day-cases?

- Most patients arrive too late
- Most neurologists do not refer the patients
- Most cath-labs do not have the equipment
- Most interventionalists can't do it
- Very few controlled trials
- Positive randomized trial for iv-lysis < 3hours
- IA-lysis certainly not enough, mechanical recanalization required
- So these cases are rare exceptions

IA Thrombolysis in Acute Stroke

Prolyse in Acute Cerebral Thromboembolism (PROACT II)

180 patients with occlusion of middle cerebral artery
< 6 hours of onset

↓
Randomized, intra-arterial infusion

↓
Pro-urokinase

↘
Placebo

Recanalization	66 %	18 %	*
Hämorrhage	10 %	2 %	
Mortality	25 %	27.5 %	
Favorable Outcome	40 %	25 %	*

Management of stroke in the elderly

How to treat percutaneously?

- Acute treatment
- Prevention

Management of stroke in the elderly

How to treat percutaneously?

- Acute treatment

• Prevention

Prevention of Stroke

- Carotid stenting
- Left atrial appendage closure
- PFO closure??

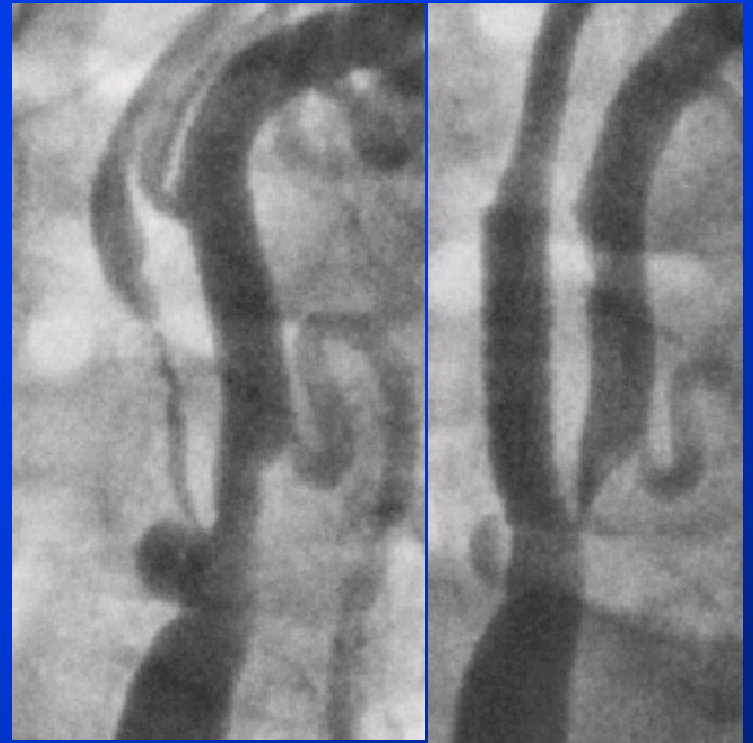
Carotid Angioplasty

- ... has been performed as early as 1979, only 2 years after the first coronary angioplasty
- ... is performed on a routine basis since the early 90ies
- Stents and other devices specifically designed for carotid interventions are available since the mid 90ies
- Embolic protection devices are available since the late 90ies
- We can treat ...

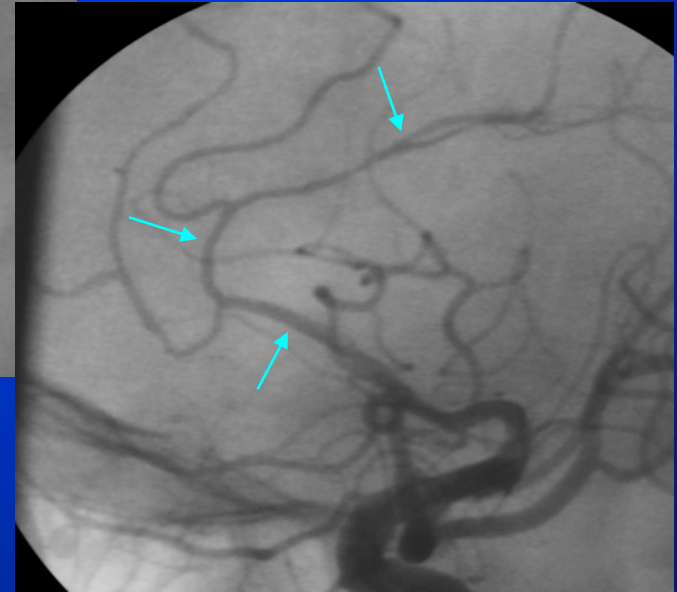
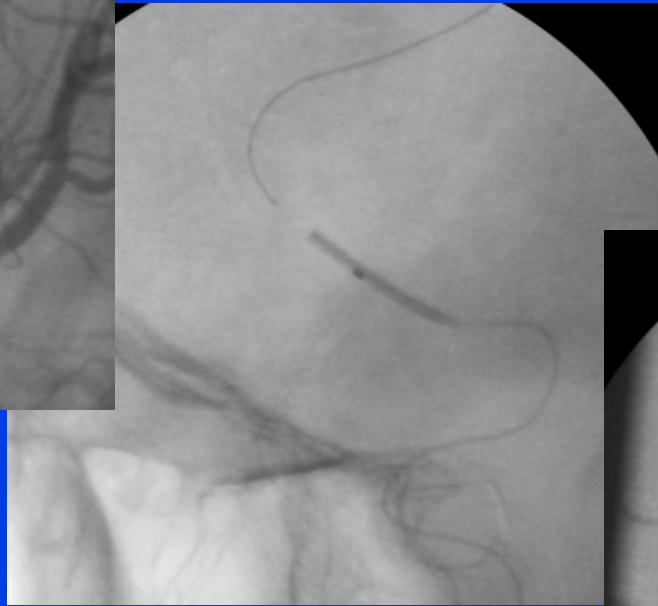
Complex Lesions



Long Lesions



Intracranial Lesions

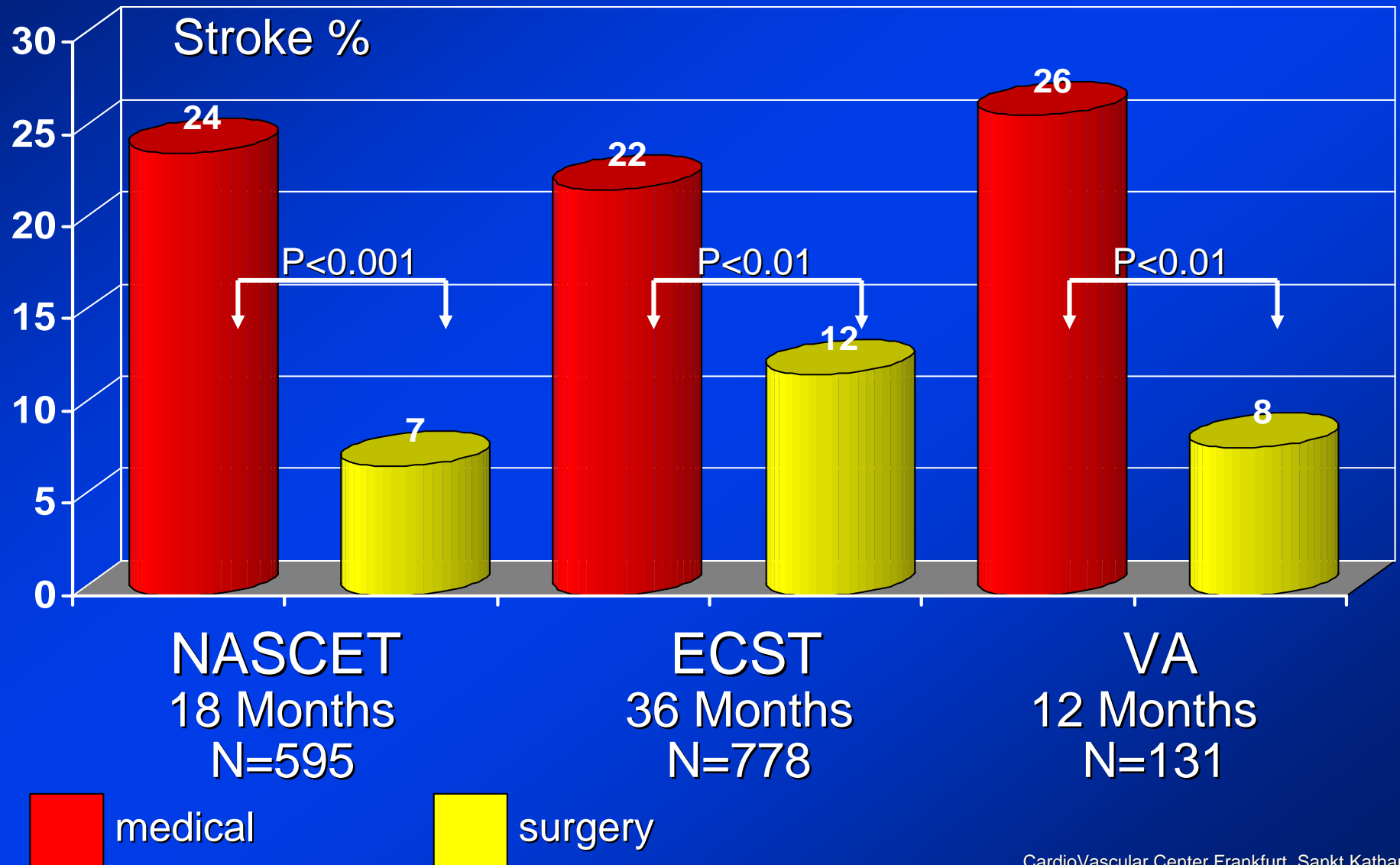


Indication for Carotid Stenting

- Surgery is indicated in carotid stenosis
- Stenting is equivalent to surgery
- Stenting is indicated in carotid stenosis

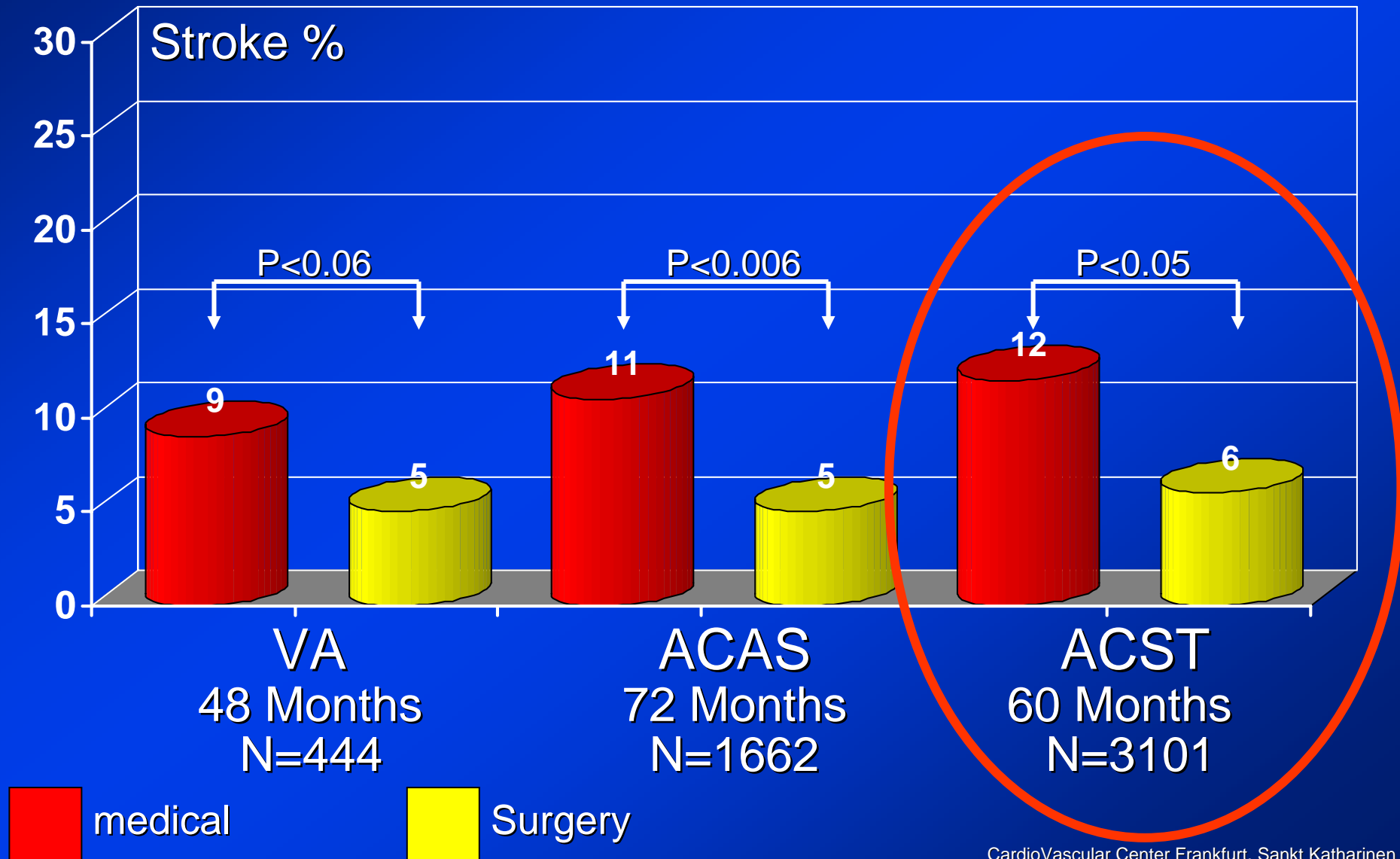
Symptomatic Carotid Stenoses

- Randomised Trials -

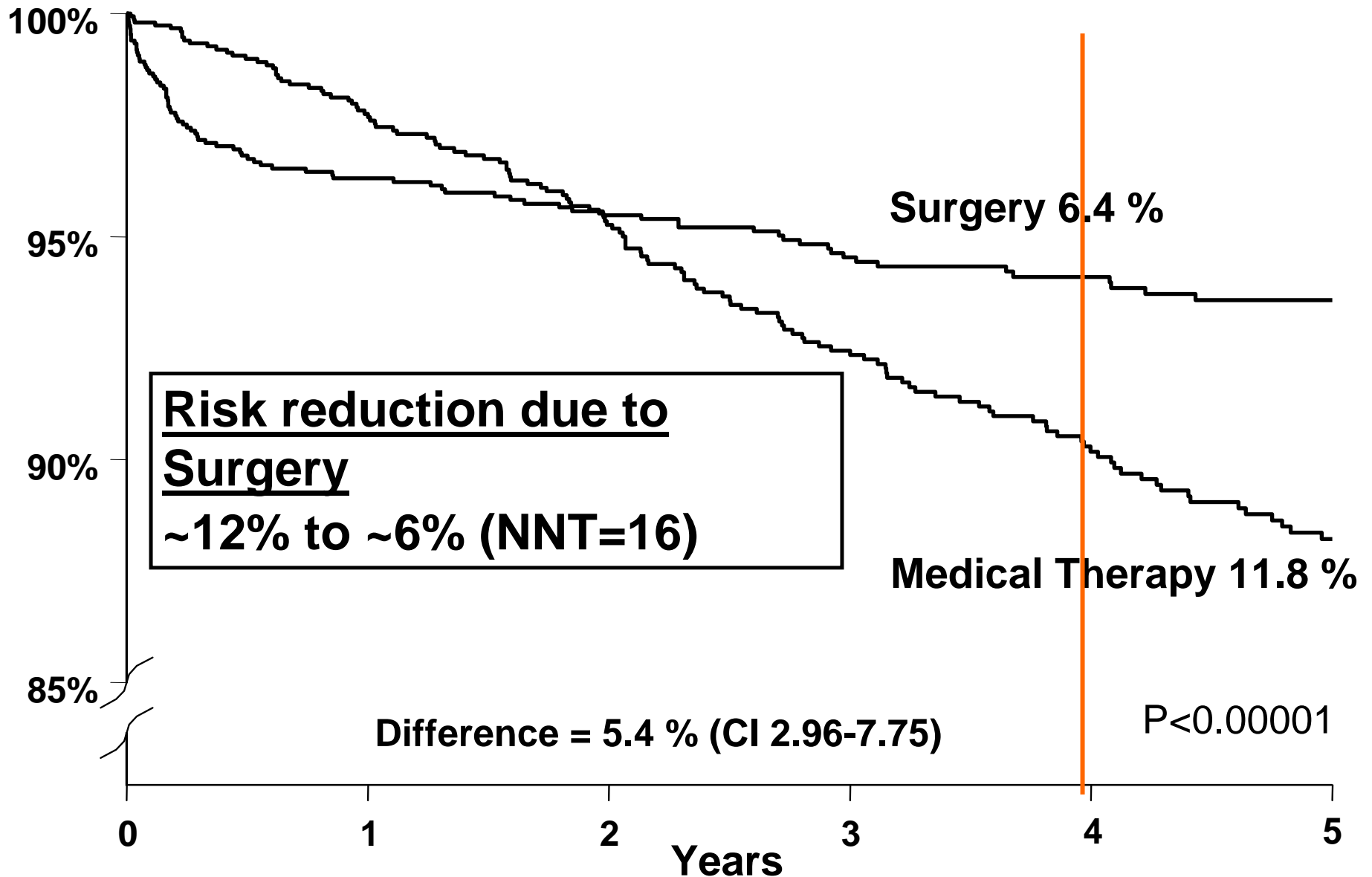


Asymptomatic Carotid Stenoses

- Randomised Trials -



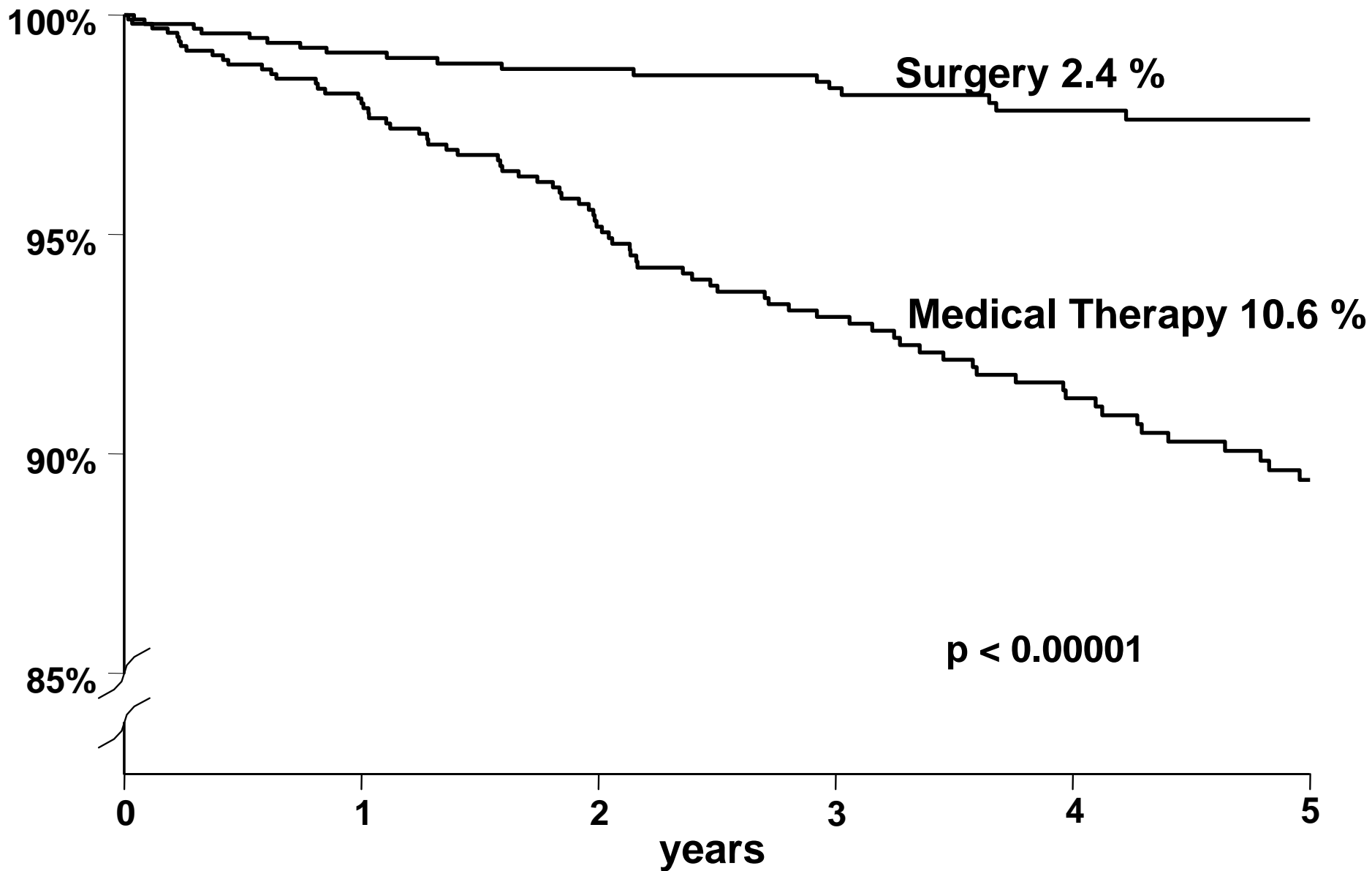
Stroke / perioperative Death



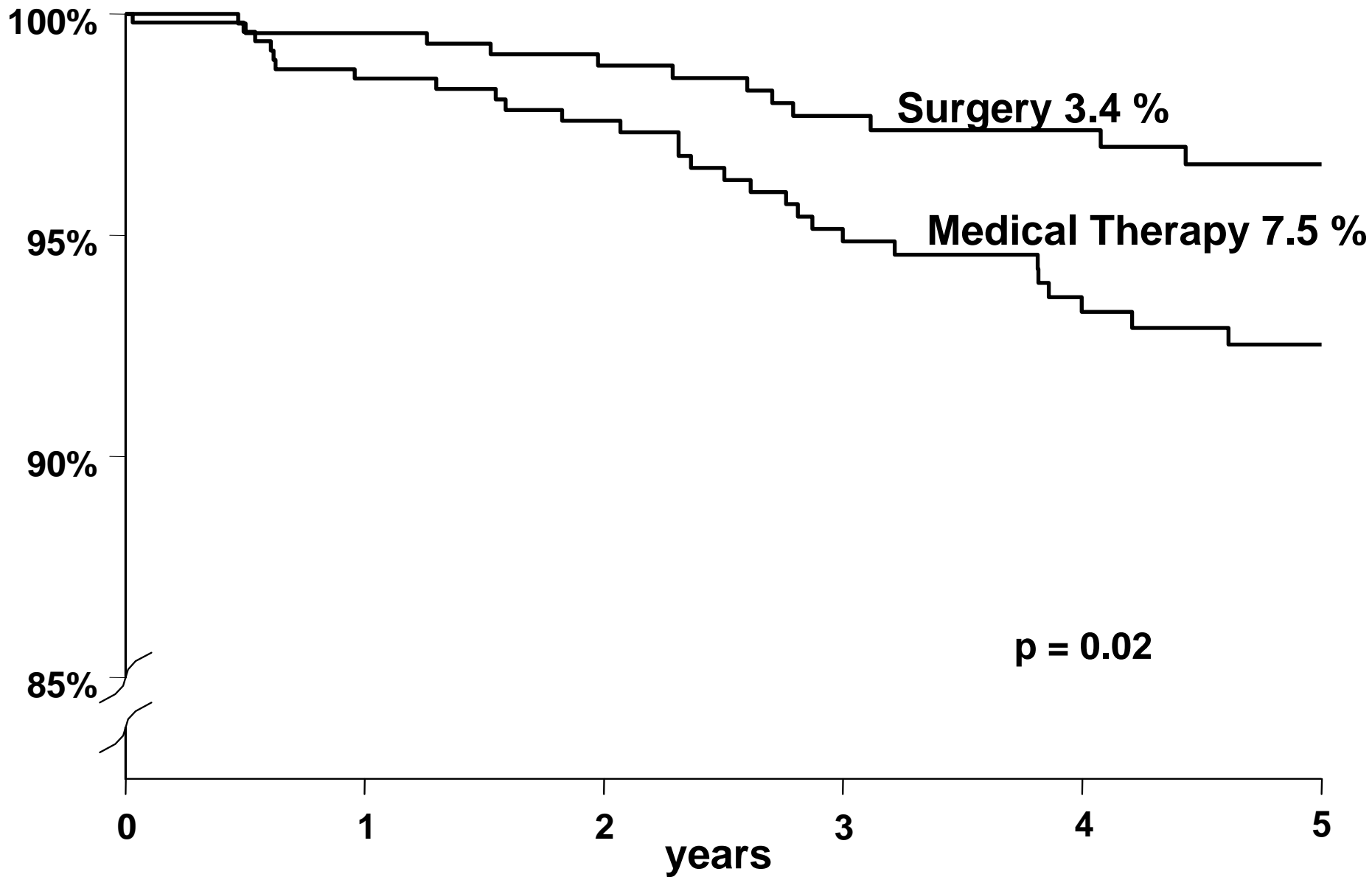
ACST was not designed
and not powered
for any subgroup analysis

Anyway,
let's look for the subgroups

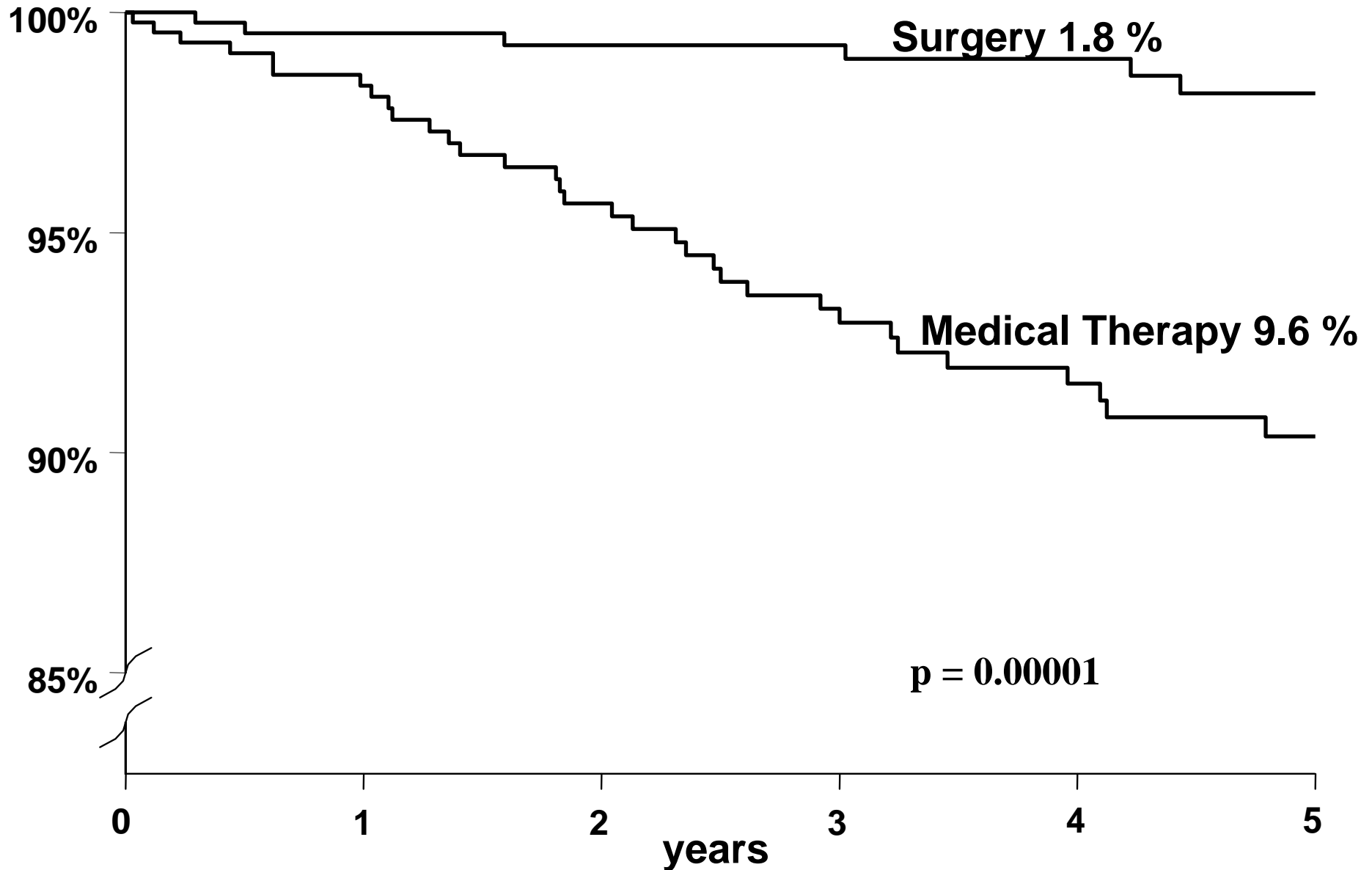
Men



Women

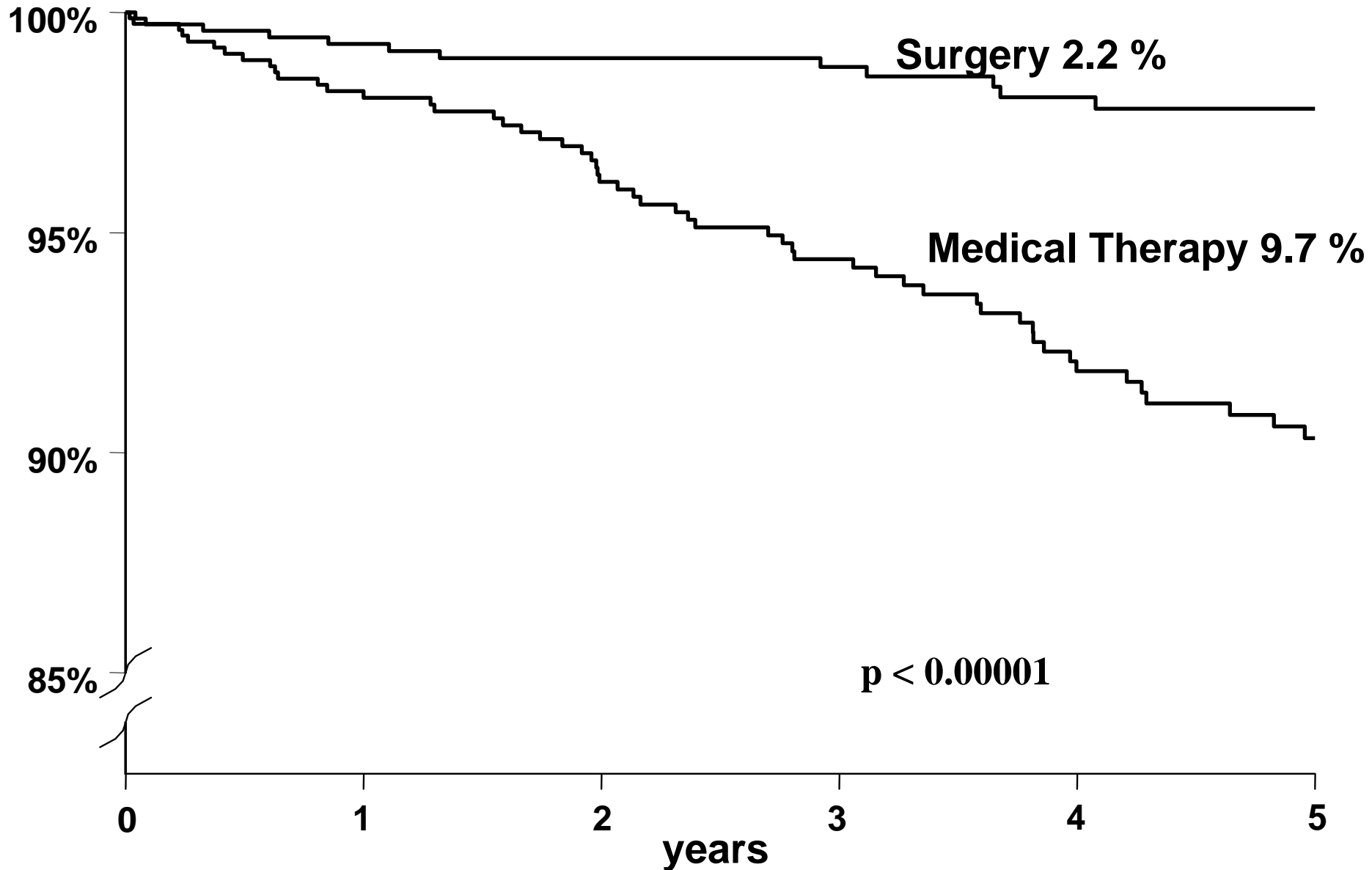


< 65 years

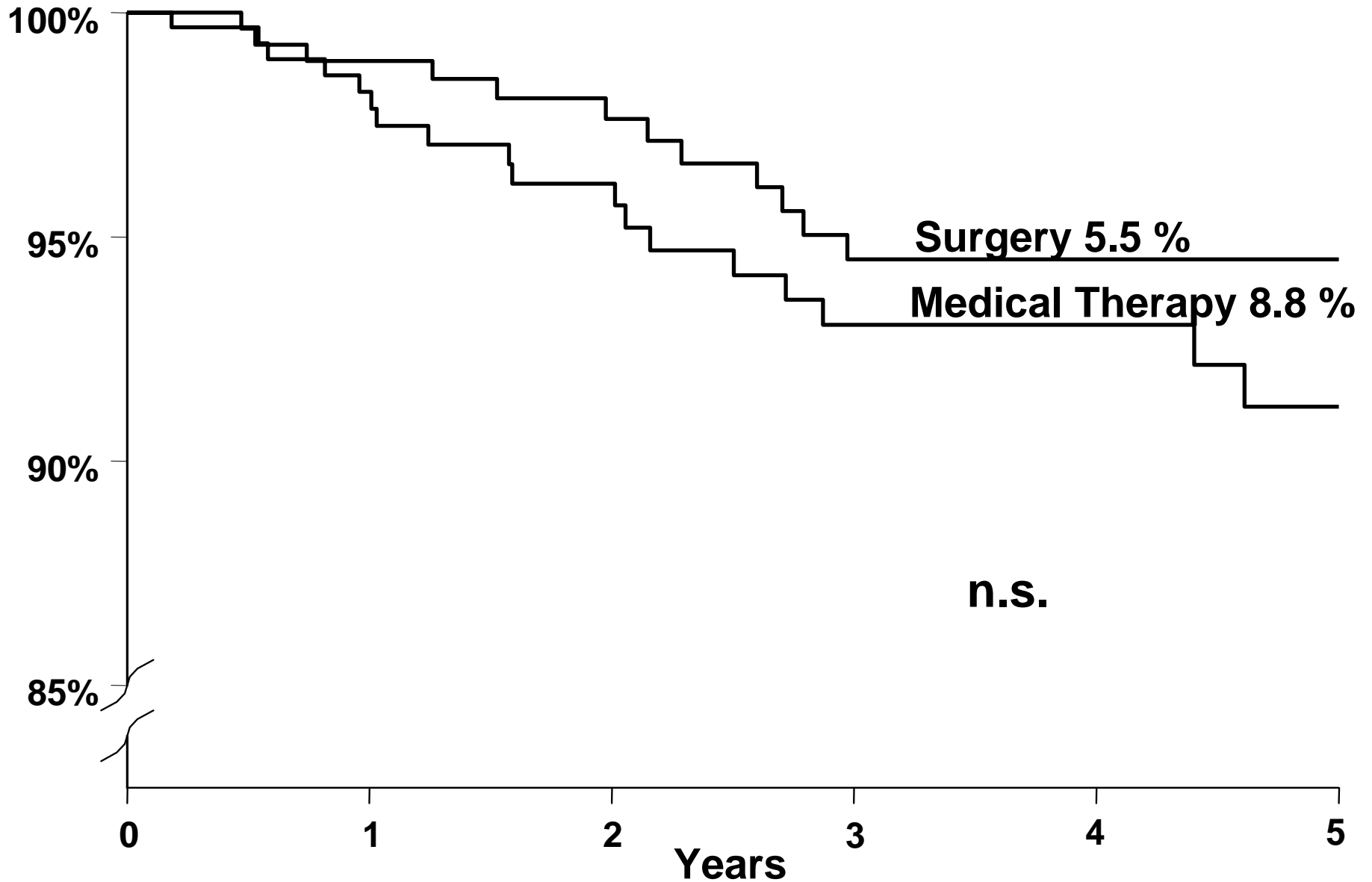


p = 0.00001

65 - 74 years



> 75 years



.... if "elderly" means
>75 years ...

.... than it is not proven that
surgery is better than medical
therapy in elderly patients

.... but there is still a trend
supporting surgery

Indication for Carotid Stenting

- ✓ Surgery is indicated in carotid stenosis
- Stenting is equivalent to surgery
- Stenting is indicated in carotid stenosis

Stenting vs Surgery

Randomized Trials

- Leicester Trial (Naylor et al)
- Wallstent Trial
- Lexington Trials (Brooks)
- CAVATAS
- Sapphire
- EVA 3S
- SPACE

Leicester Trial

Randomized study of carotid angioplasty and stenting versus carotid endarterectomy:
A stopped trial

- Planned to randomise 300 pts to surgery or stenting
- 23 pts. actually randomised
- 10 x surgery: No complications
- 7 x stent: 5 x stroke (=72%)

Lesson we should have learned:

No randomized trials during the initial learning curve

Wallstent Trial

- 219 pts randomised
- 30 day peri-procedural stroke & death:
 - CEA 4.5%
 - CAS 12.1% } 0.049
- Problems
 - No embolic protection
 - Peripheral stent
 - No Plavix
 - Very limited operator experience

Lesson we should have learned:

No randomized trials during the initial learning curve

Lexington Trial (sympt. Pts.)

Brooks WH et al, JACC 2001

	CEA	Stent
n	51	53
Death	1	0
TIA	0	1
Hospital Stay (days)	2.7	1.8

Lexington Trial (Asympt. Pts.)

Brooks WH et al, Neurosurgery 2004

	CEA	Stent
n	42	43
Death	0	0
Stroke/TIA	0	0
Cranial nerve palsy	3 (transient)	0
Bradycardia/Hypotension		5 (transient)
Anesthesiological complications	4 (mild)	0
Hospital stay (days)	1.7	1.5

Randomized Trial:

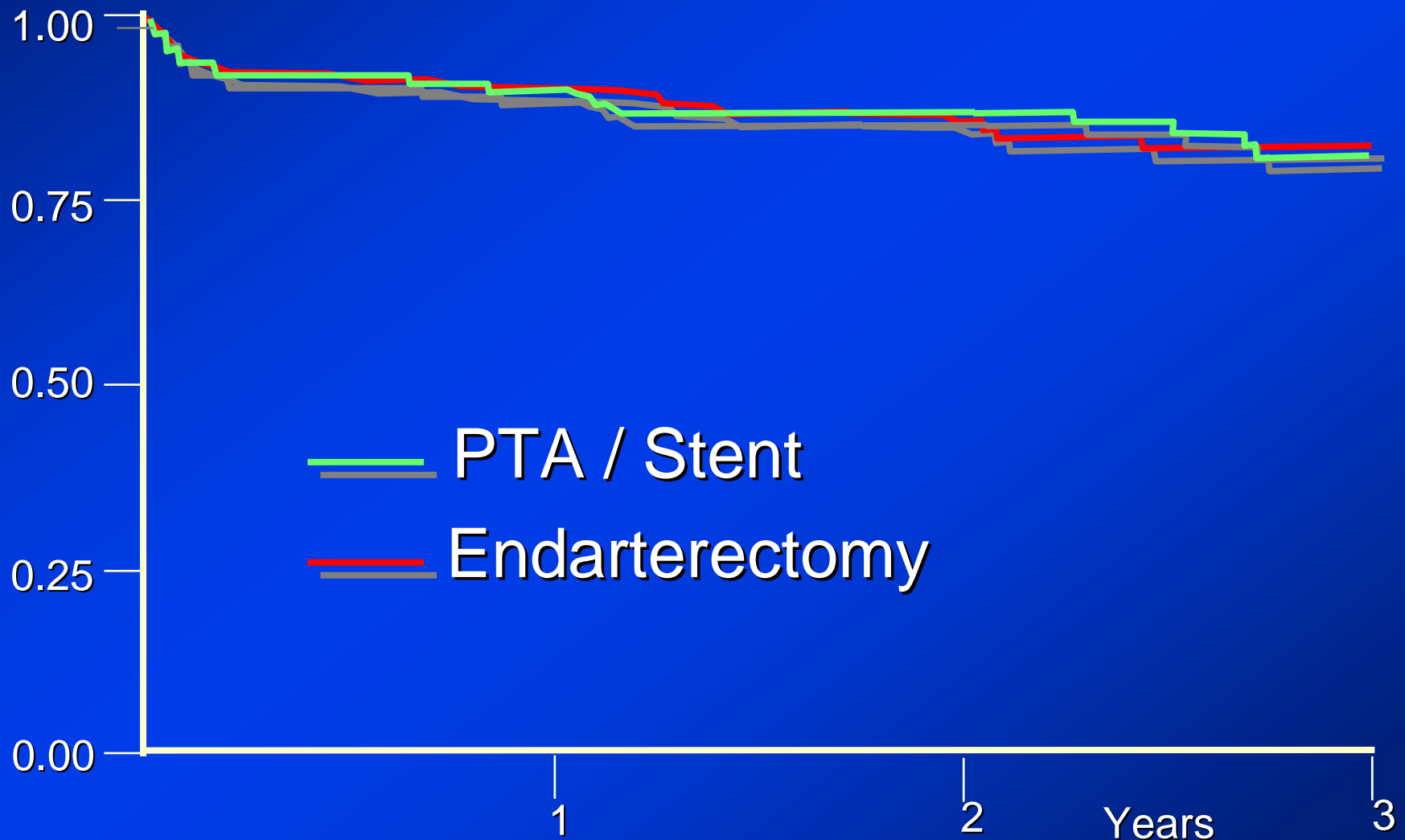
CAVATAS

504 symptomatic patients, randomised to surgery or PTA (only 25 % stents!)

	PTA	Surgery	
Major stroke/death	6.4 %	5.9 %	
Stroke or death	10 %	10 %	
Cranial nerve injury	-	9 %	*
Hematoma	1.2 %	6.7 %	*

* $P < 0.05$

CAVATAS: Survival free of disabling stroke or death



Sapphire Study Protocol

Screened: 2294 patients

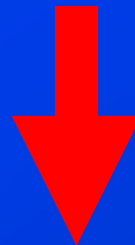


747 patients met inclusion/exclusion criteria
50% Stenosis in Sx, 80% Stenosis in Asx, ≥ 1 comorbidity criteria
Neurologist, Surgeon, Interventionalist

Surgical
Refusal



CONSENSUS



Interventional
Refusal

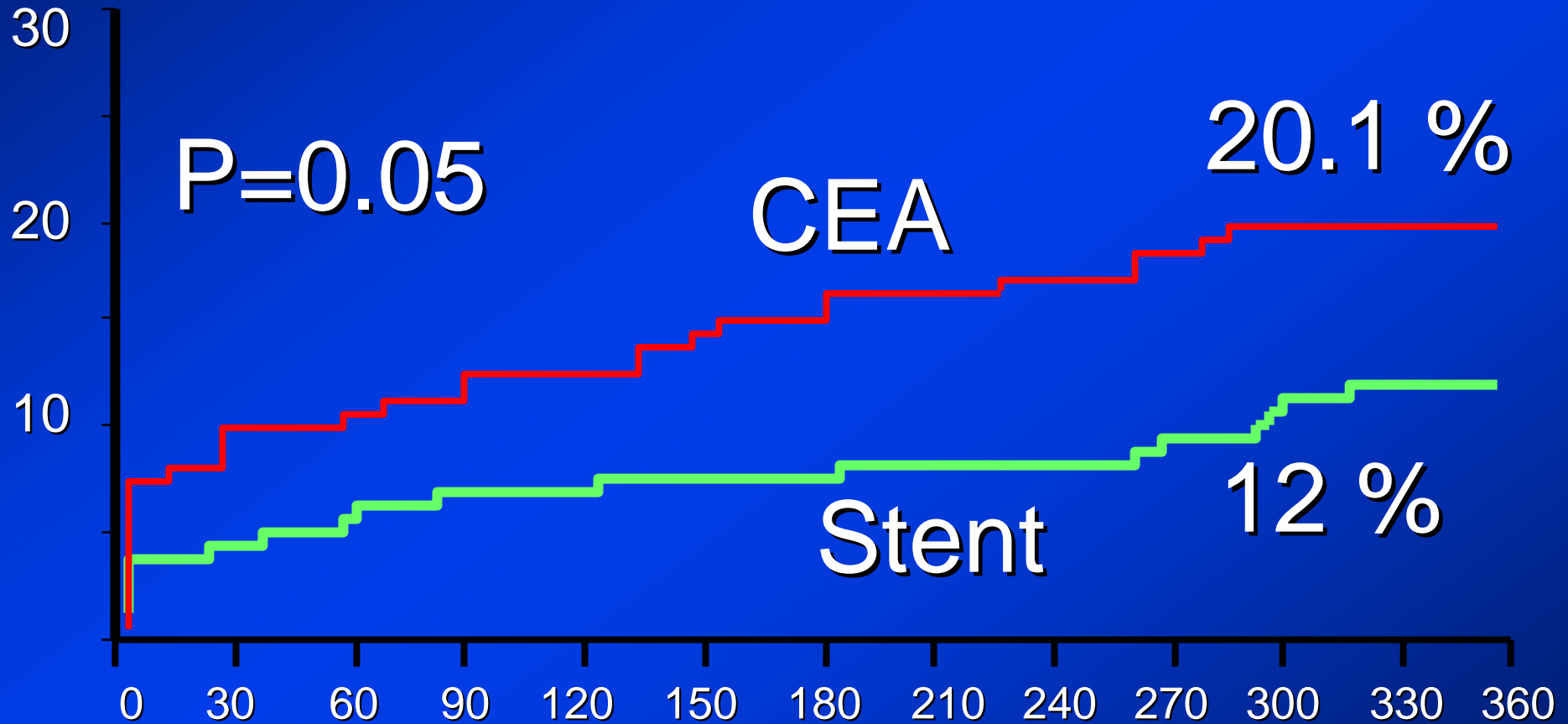


Stent Registry
406

RANDOMIZED
334 (310 treated)
Stenting =167, CEA=167

Surgical Registry
7

Sapphire 1 Year Primary End-point



Randomised Patients

1 year

	Stent	OP	P
Death	7.0 %	12.9 %	0.08
Stroke	5.8 %	7.7 %	0.52
Major ipsilateral	0.0	3.5	0.02
Major non-ipsilateral	0.6	0.7	0.97
Minor ipsilateral	3.8	2.2	0.37
Minor non-ipsilateral	2.0	2.1	0.89
MI	2.5 %	8.1 %	0.03
Q	0.0	1.3	0.15
Non-Q	2.5	6.7	0.08
Death/Stroke/MI	12.0 %	20.1 %	0.05

EVA 3S

- Multicenter randomized trial comparing CEA and CAS
- Trial stopped early because of bad outcome after stenting
- Investigators became qualified after only 10 CAS procedures

Lesson we should have learned:

No randomized trials during the initial learning curve

SPACE

- Multicenter randomized trial
 - 33 centers with Neurology, Surgery and Interventional Radiology departments
- CEA versus Stenting in symptomatic carotid stenosis
- With or without protection devices
- Sponsored by research foundations, scientific societies and industry

SPACE

- Primary endpoint
 - Ipsilateral stroke or death within 30 days
- Secondary endpoints
 - Ipsilateral stroke or vascular death < 24mo
 - Ipsilateral major stroke or death < 30 days
 - Any stroke < 24 mo
 - Re-stenosis > 70%
 - Procedural failure

SPACE

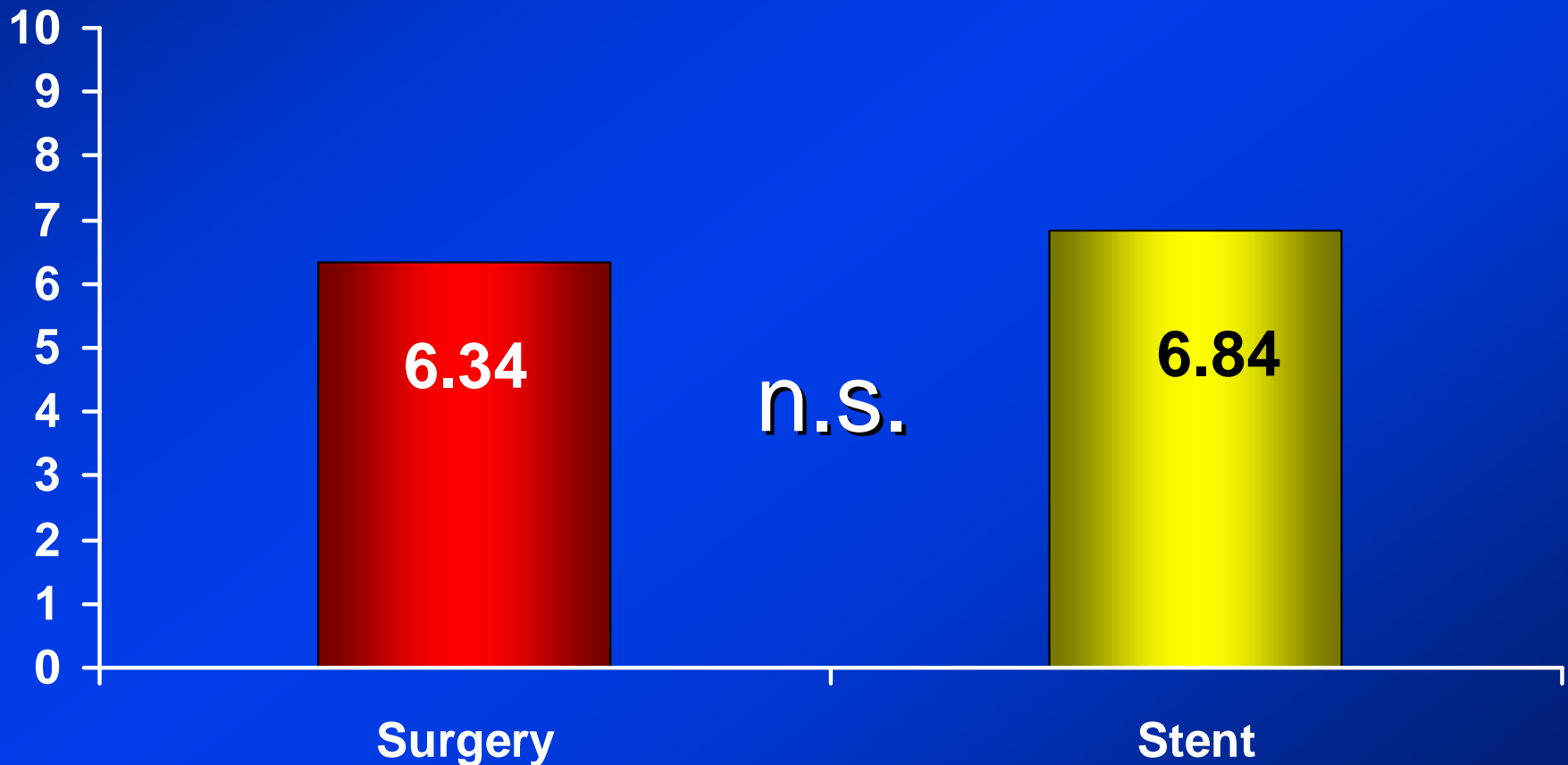
- Trial stopped after the second interim analysis after 1200 patients
 - Power to reach significance for the non-inferiority endpoint with 1900 patients was calculated to be only 50%
 - > 2500 patients would be needed to achieve 80% power
 - Slow recruitment
 - Absence of further funding

SPACE

Randomized	1200	
	CAS	CEA
Consent withdrawn	6	11
Intention to treat	599	584
Not treated	1	1
Cross over	13	6
Actual treatment	585	577
Embololic protection	29%	

SPACE

Primary Endpoint: Ipsilateral Stroke and Death @ 30 Days



SPACE

- No significant difference regarding the primary end-point ipsilateral stroke or death < 30 days
- No significant differences between CAS and CEA
 - Regarding secondary endpoints
 - Subgroups

SPACE

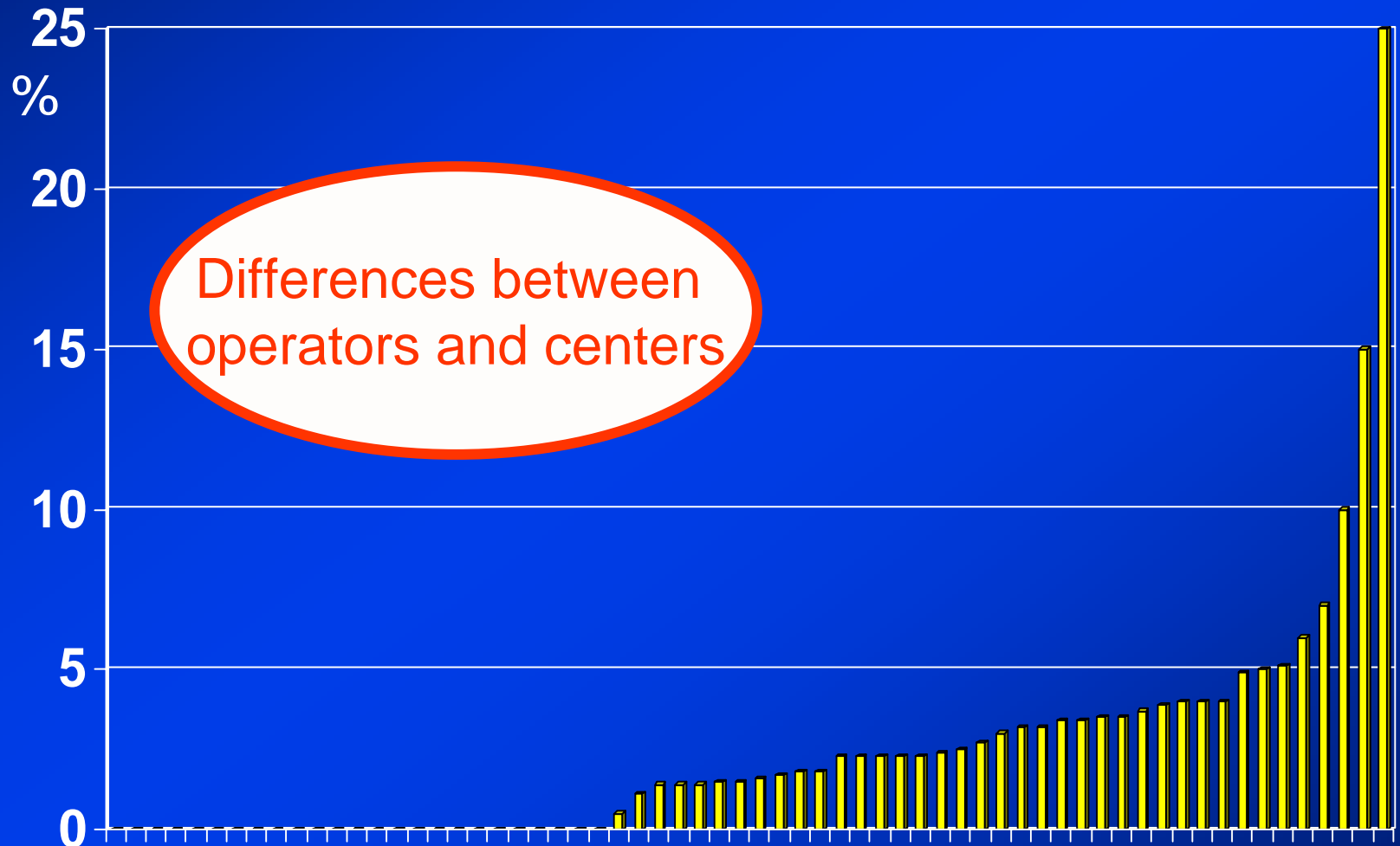
- Important to know
 - Limited availability of embolic protection devices
 - Some operators had limited experience with embolic protection devices
 - Not included as end-points (primary or secondary)
 - Myocardial infarction
 - Contralateral stroke
 - Cranial nerve palsy
 - Length of hospital stay
 - Other MAE
 - 71% of CAS performed without embolic protection
 - Trial stopped early
 - Large pt numbers but still underpowered

In all clinical trials the
Differences between
CEA and CAS have
been very small

Differences between individual
patients, operators and institutions
are much more important

Carotid Stenting

Major Stroke and Death, 1999-2005



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What you always have to keep in mind in elderly patients



Their life expectancy should be long enough in order to be able to benefit from the procedure

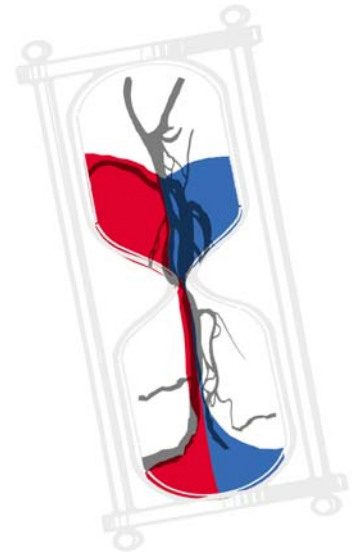
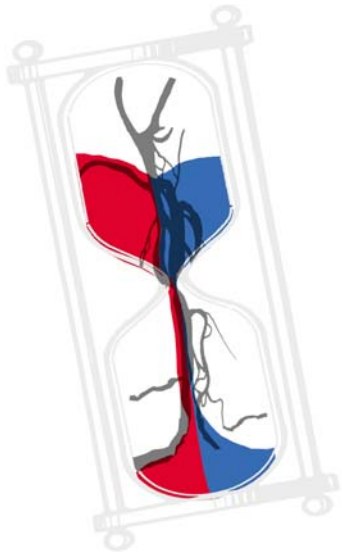
Life Expectancy

	Men	Women
75 yrs	10.2 yrs	13.4 yrs
80 yrs	7.7 yrs	10.2 yrs
85 yrs	5.8 yrs	7.6 yrs
90 yrs	4.3 yrs	5.5 yrs
95 yrs	3.2 yrs	3.7 yrs
100 yrs	2.3 yrs	2.4 yrs

6th International Course on Carotid Angioplasty ICCA VI

And Other Cerebrovascular Interventions
With Live Case Demonstrations
And Hands-on Workshops

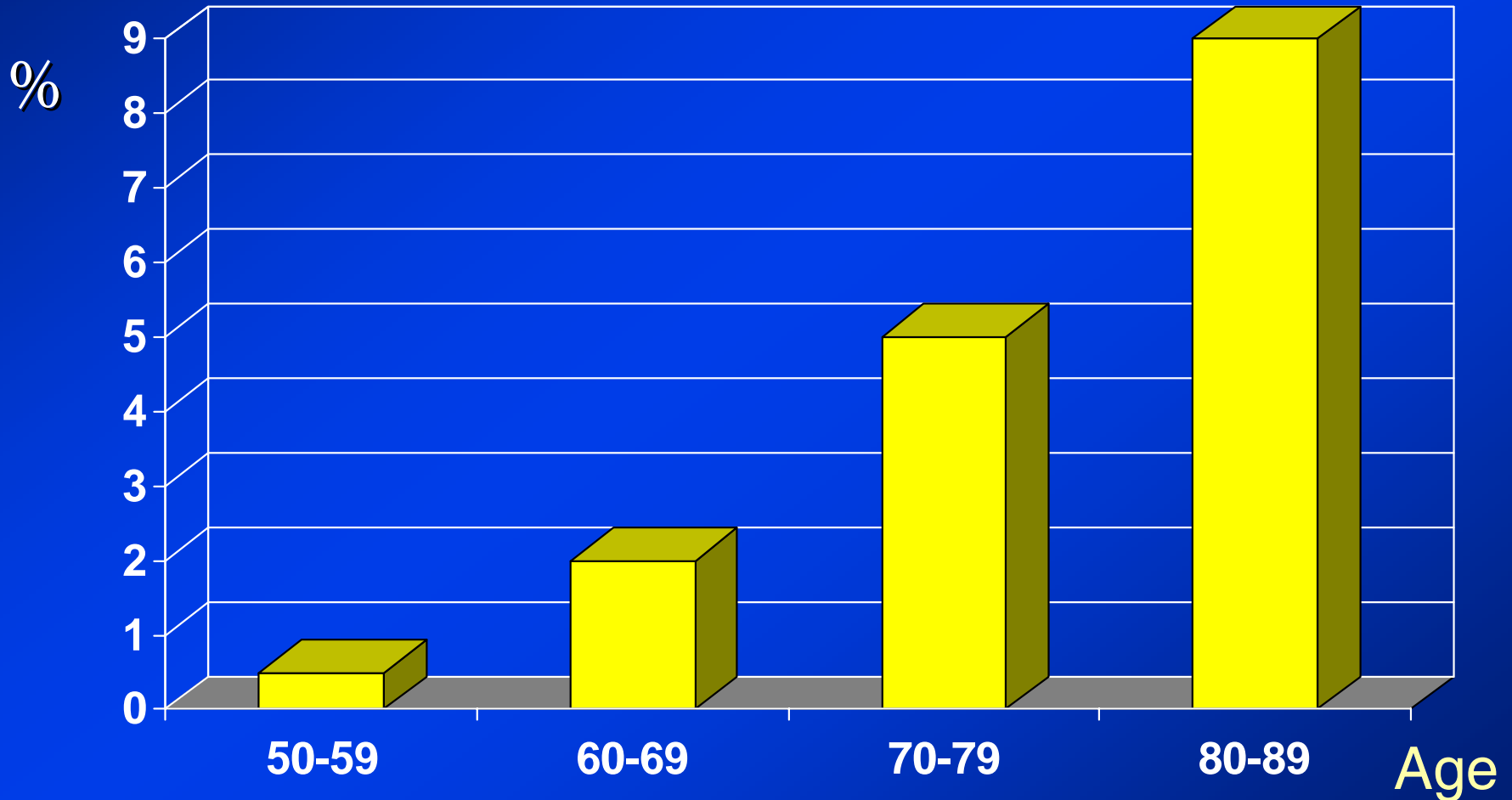
Frankfurt, Germany
November 23-25, 2006
www.iccaonline.org



Percutaneous Atrial Appendage Closure

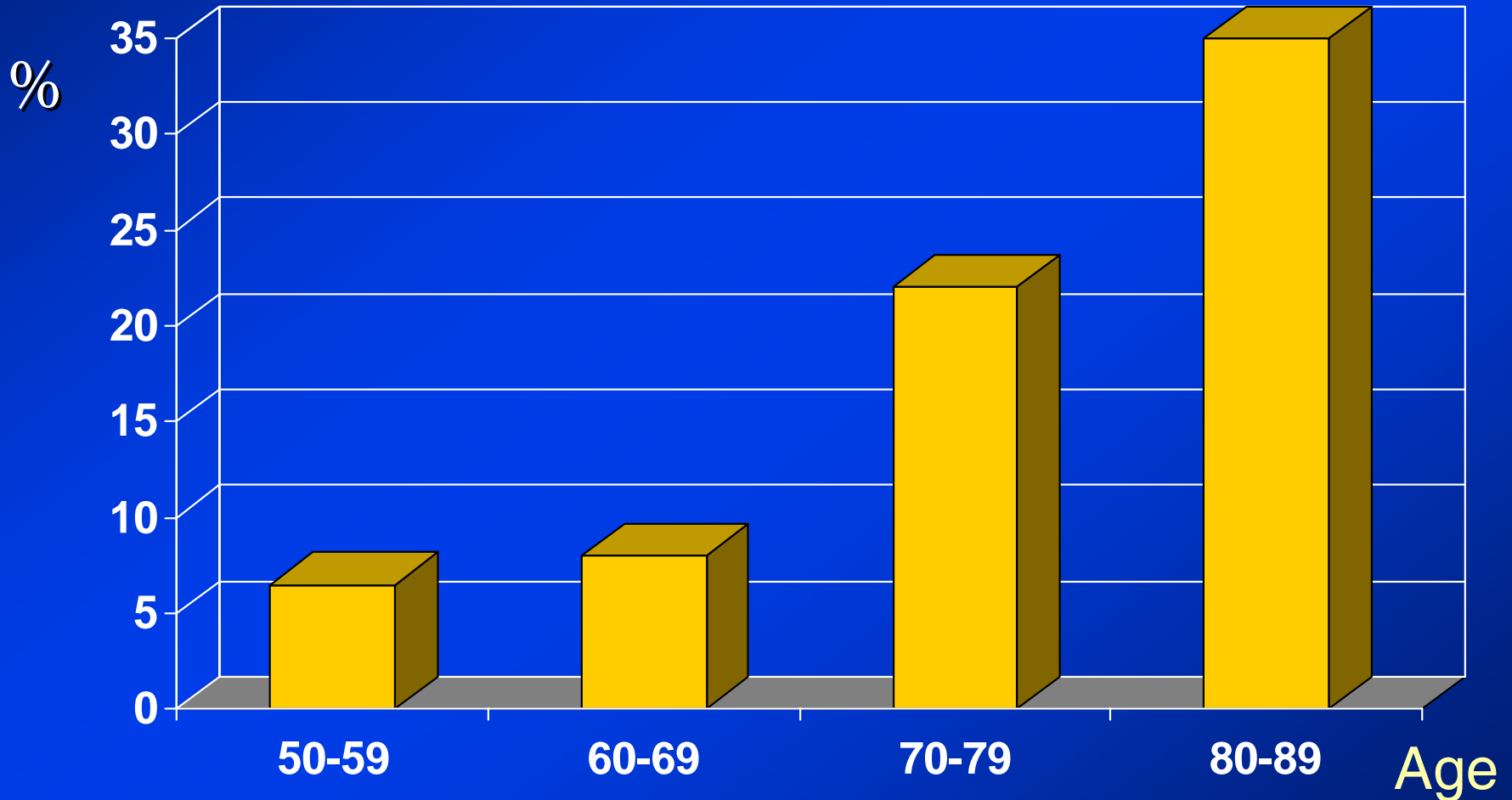
Prevalence of Atrial Fibrillation

Framingham Study, Wolf, 1991



AF is one of the most important stroke causes

Framingham Study, Wolf, 1991



What is the stroke risk
in atrial fibrillation



Additional risk factors for an embolic stroke in atrial fibrillation

- Age >65
- Prior TIA / stroke
- Hypertension
- Diabetes
- Coronary heart disease
- Reduced LV function
- LAA flow velocity <20 cm/sec
- Spontaneous LAA echo contrast

What is the Annual Risk of Stroke?

Nat. Registry of AF: CHADS₂

CHADS Score	# Pts n=1773	# Strokes n=94	NRAF adjusted Stroke Rate (95% CI)
0	120	2	1.9 (1.2-3.0)
1	463	17	2.8 (2.0-3.8)
2	523	23	4.0 (3.1-5.1)
3	337	25	5.9 (4.6-7.3)
4	220	19	8.5 (6.3-11.1)
5	65	6	12.5 (8.2-17.5)
6	5	2	18.2 (10.5-27.4)

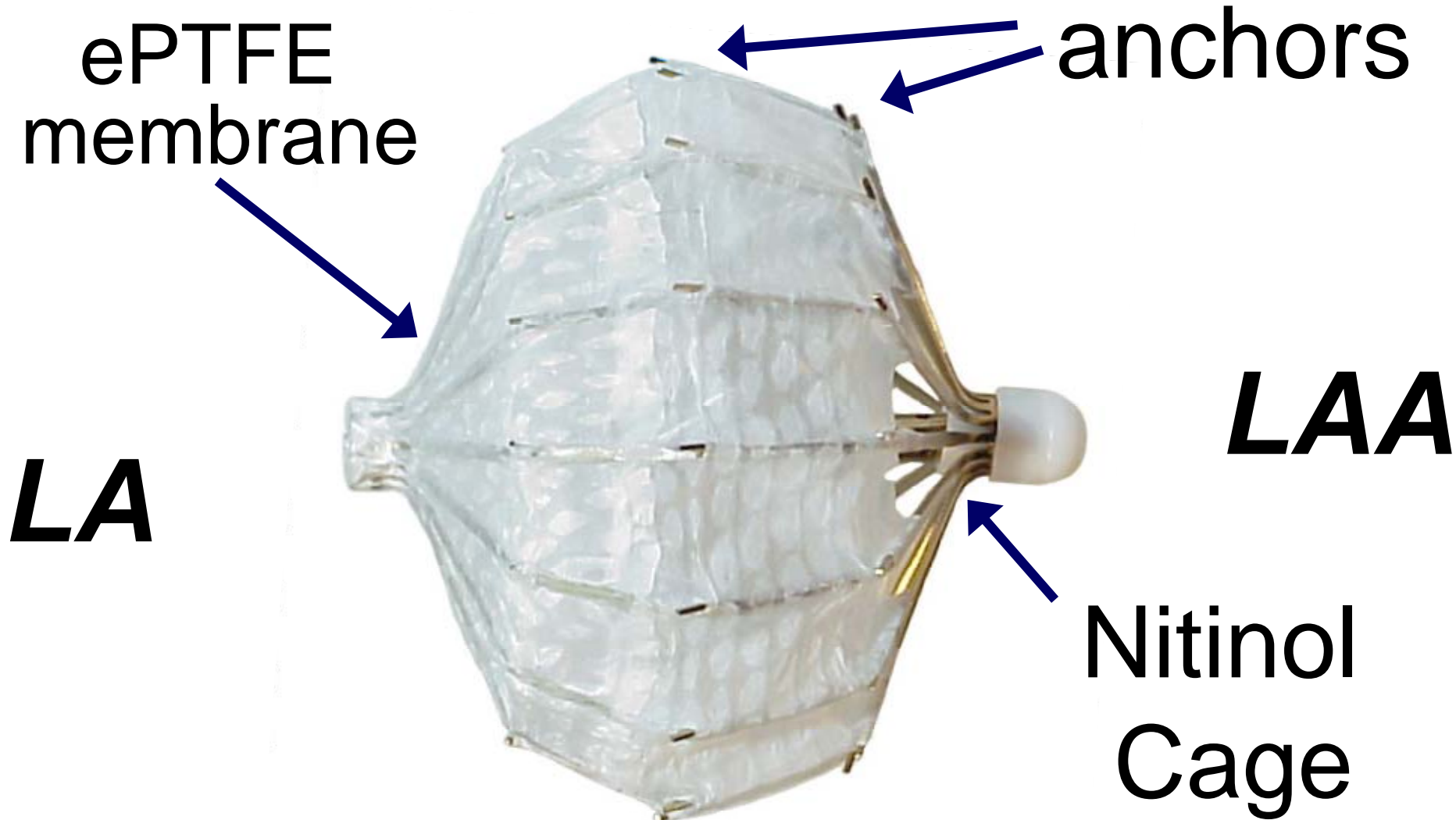
**"Let's prescribe
Coumadin!"**

**Difficult in clinical
practice**

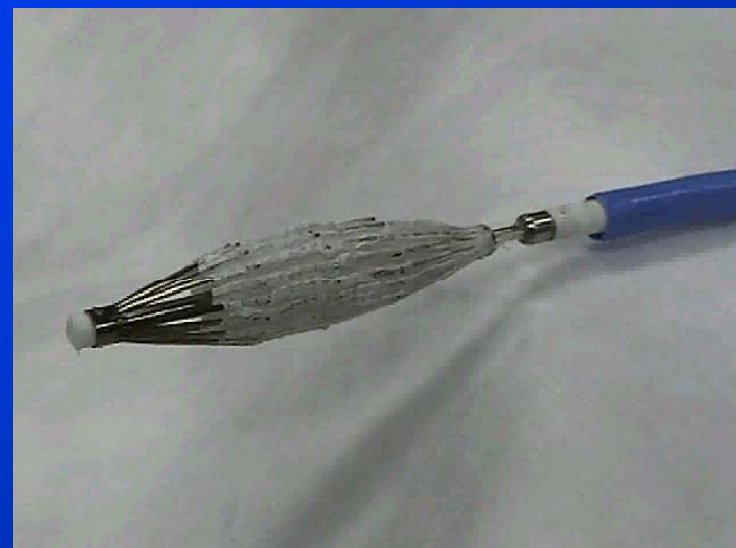
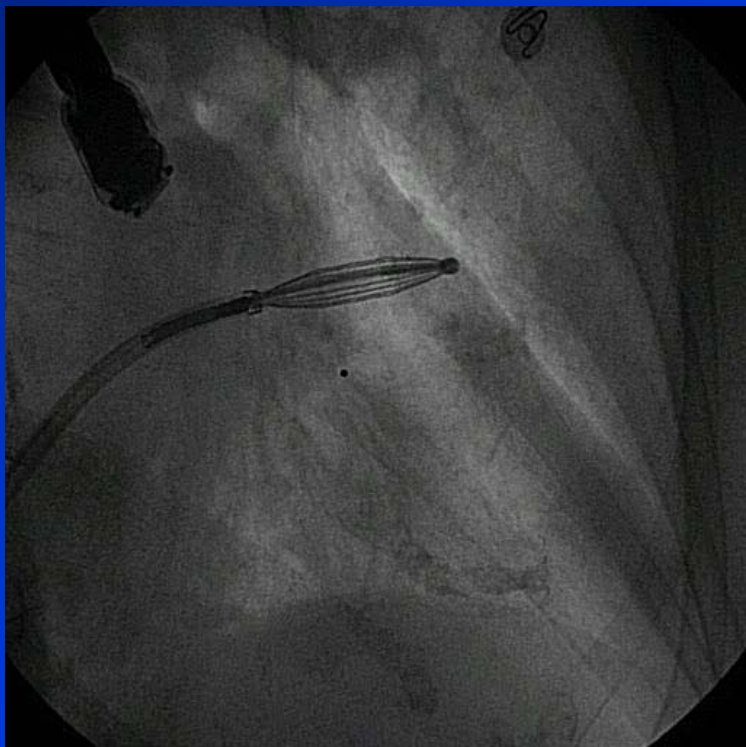
- Any localized or general physical condition in which the hazard of hemorrhage might be greater than the potential clinical benefits of anticoagulation
- Any personal circumstance in which the hazard of hemorrhage might be greater than the potential clinical benefits of anticoagulation
- Pregnancy
- Hemorrhagic tendencies
- Blood dyscrasias.
- Recent or contemplated surgery of central nervous system
- Recent or contemplated surgery of the eye
- Recent or contemplated traumatic surgery resulting in large open surfaces
- Gastrointestinal bleeding
- Genitourinary tract bleeding
- Respiratory tract bleeding
- Cerebrovascular hemorrhage
- Cerebral aneurysms
- Dissecting aorta
- Pericarditis
- Pericardial effusions
- Bacterial endocarditis
- Threatened abortion
- Eclampsia
- Preeclampsia
- Inadequate laboratory facilities
- Unsupervised patients
- Senility
- Alcoholism
- Psychosis
- Lack of patient cooperation
- Spinal puncture
- Other diagnostic procedures with potential for uncontrollable bleeding
- Therapeutic procedures with potential for uncontrollable bleeding
- Major regional anesthesia
- Lumbar block anesthesia
- Malignant hypertension

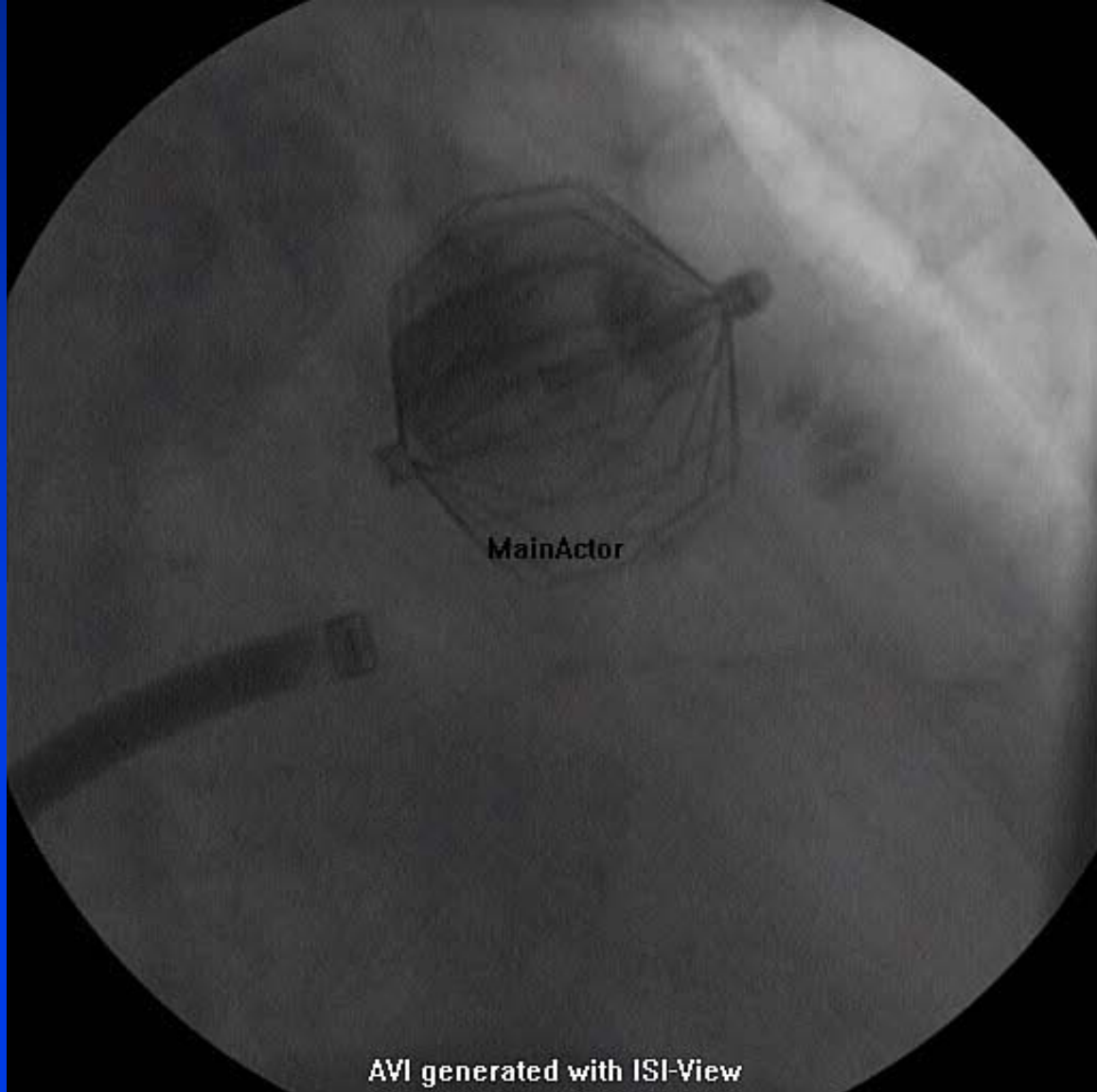
90 % of Clot form
in the Left Atrial
Appendage

PLAATO™ Device



Implantation





MainActor

AVI generated with ISI-View

PLAATO

- EU/US Feasibility Trial 111 pts
- EU Registry 150 pts*
- Out of study pts 271 pts



Almost identical study protocols

Results

- Occluder implanted 273/ 291 93.8 %
- Mean procedure time [min] 66
- Mean Flouroscopy time [min] 18± 9
- Mean follow up time [mos] 12.2
- Patient years 297

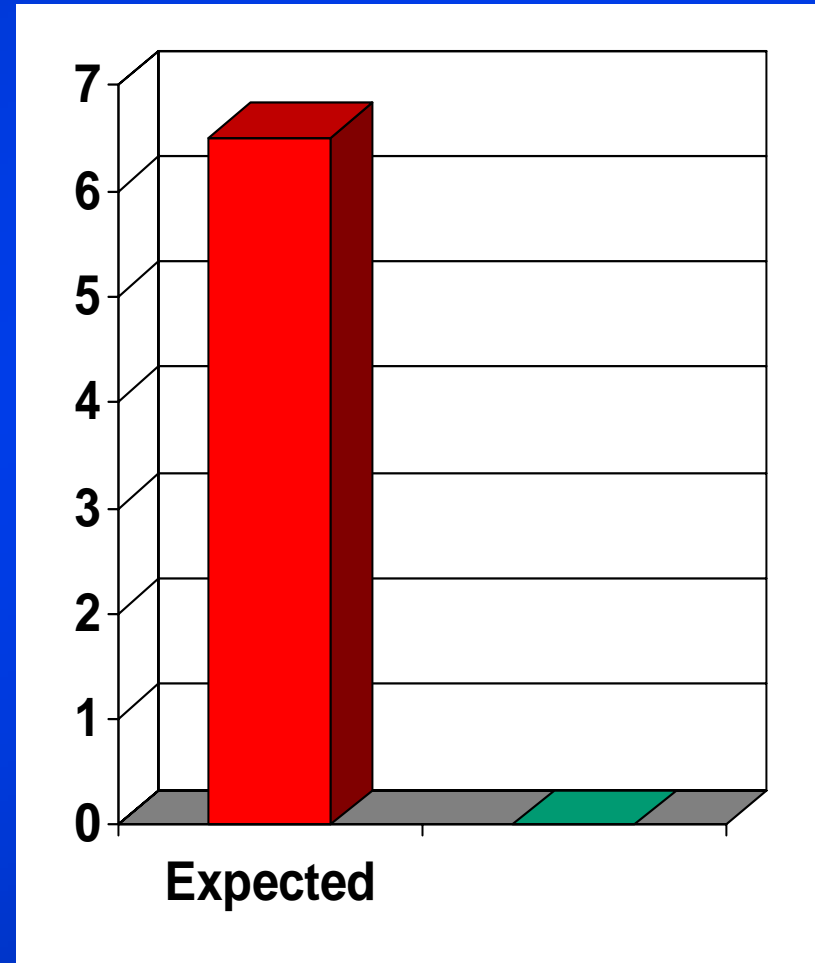
Complications

• Death	2	0.7%
- Hemodynamic collapse @ 12 hrs		
- CHF aggravated by anesthesia @ 1 day		
• Tamponade	10	3.4%
- Surgery (3) or Pericardiocentesis (9)		
• Pericardial Effusion	10	3.4%
- Pericardiocentesis (1) or no treatment (9)		
• Groin complications	6	2.1%
- Pseudoaneurysm of the femoral artery (1)		
- Hematoma (2)		
• Thrombus (no sequelae)	4	1.4%
• Embolization	1	0.3%
- Catheter retrieval without sequelae		
• No complications >30 days		

Can we Prevent Stroke?

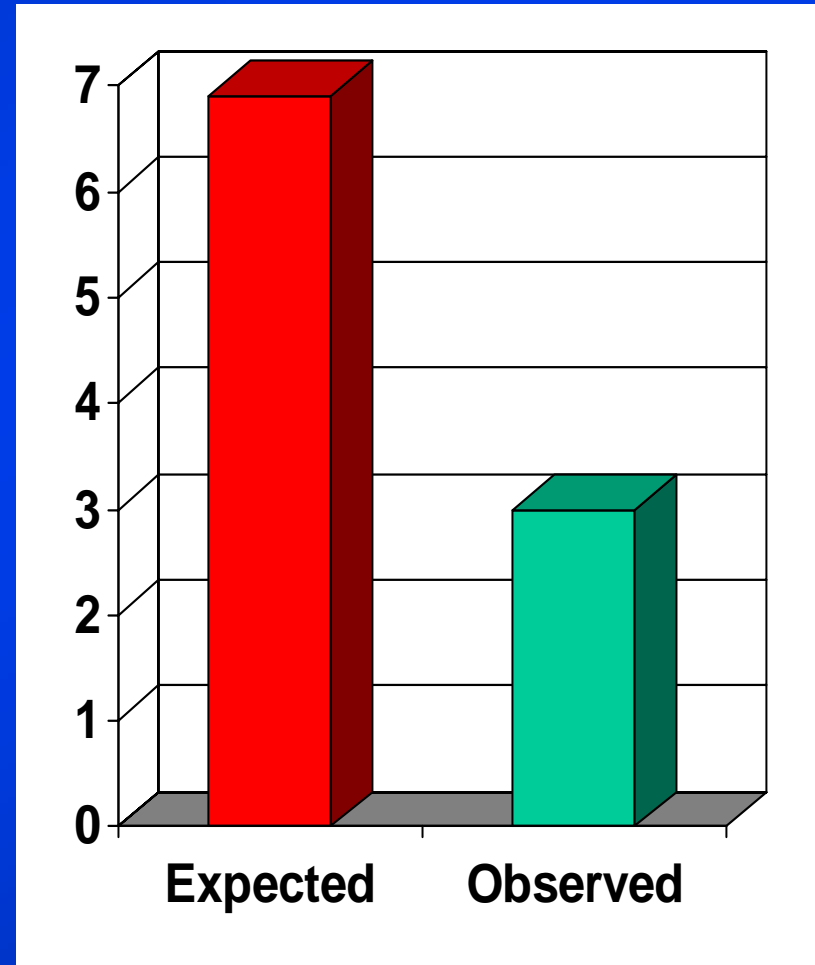
Can we prevent stroke?

- Expected incidence of stroke (CHADS2 score): 6.5%



Can we prevent stroke?

- Expected incidence of stroke (CHADS₂ score): 6.9%
- Observed incidence of stroke 3.0%
- Estimated risk reduction by PLAATO 54%



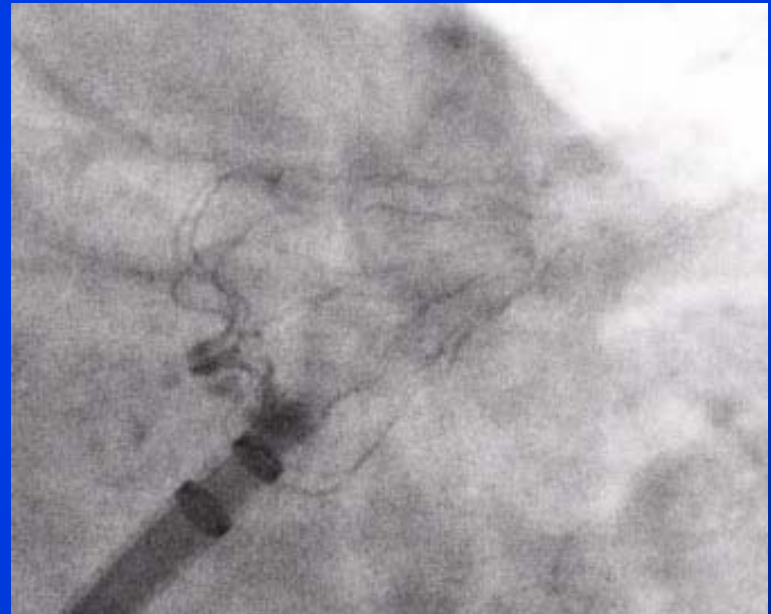
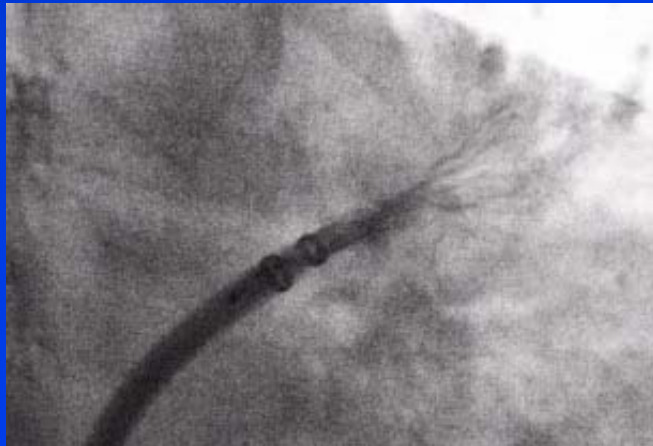
WATCHMAN Device



- Nitinol frame
- 160 micron PET filter
- row of fixation barbs around the mid perimeter
- 21, 24, 27, 30 mm

Ongoing randomized trial device versus anticoagulation

WATCHMAN Device



CSI 2007

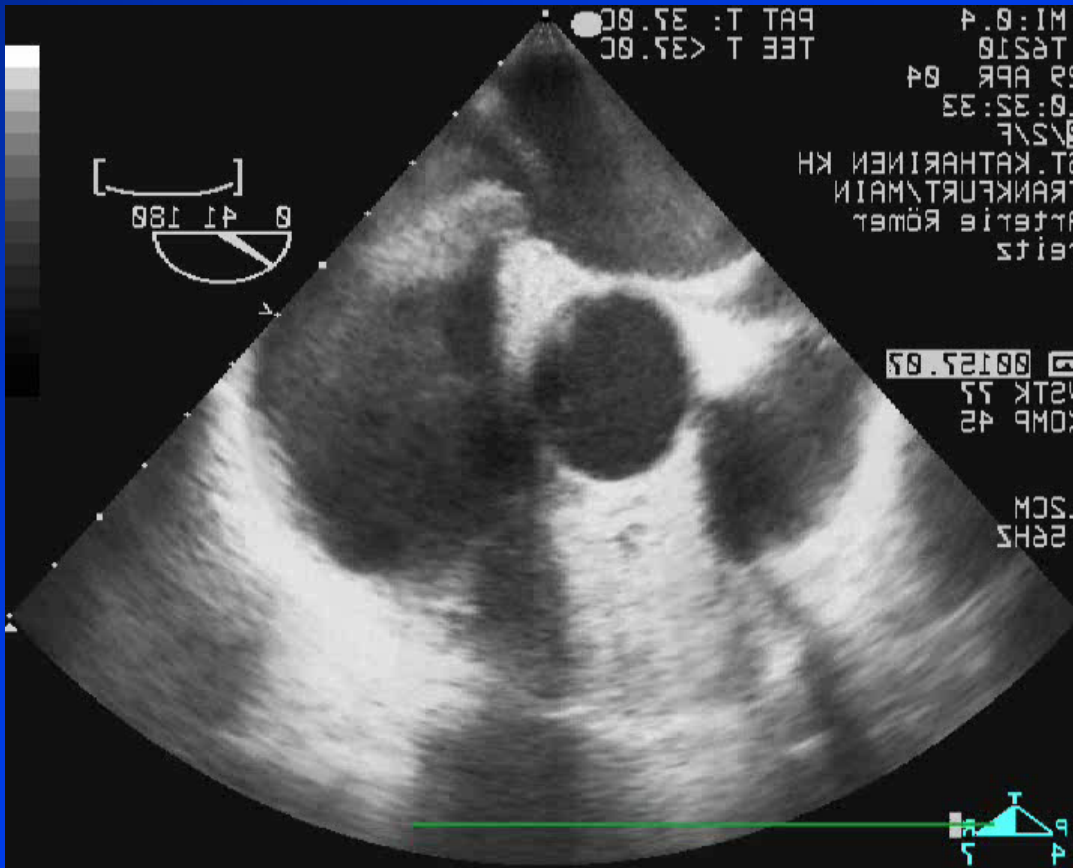
Congenital and Structural Interventions
10th International Congress
With Live Case Demonstrations
and Hands-on Workshops

Frankfurt/Germany
June 7-9, 2007

www.csi-congress.org



Embolus Crossing a PFO



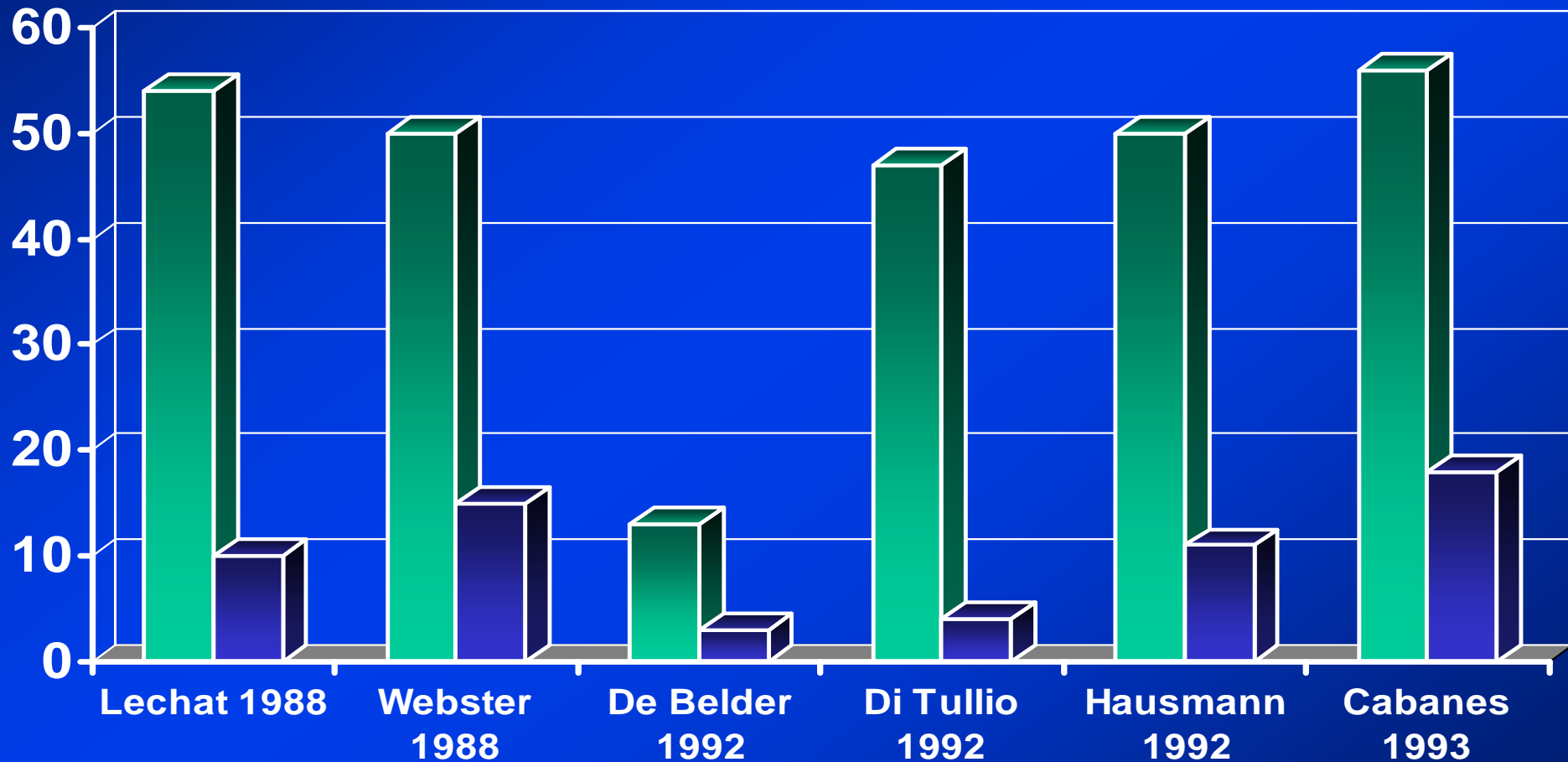
- Peripheral embolism
- Death
- Stroke

72 years old

So there is no
question that a PFO
may cause stroke,
even in the elderly

How frequent
is this?

Prevalence of PFO in Patients With "Cryptogenic" Stroke

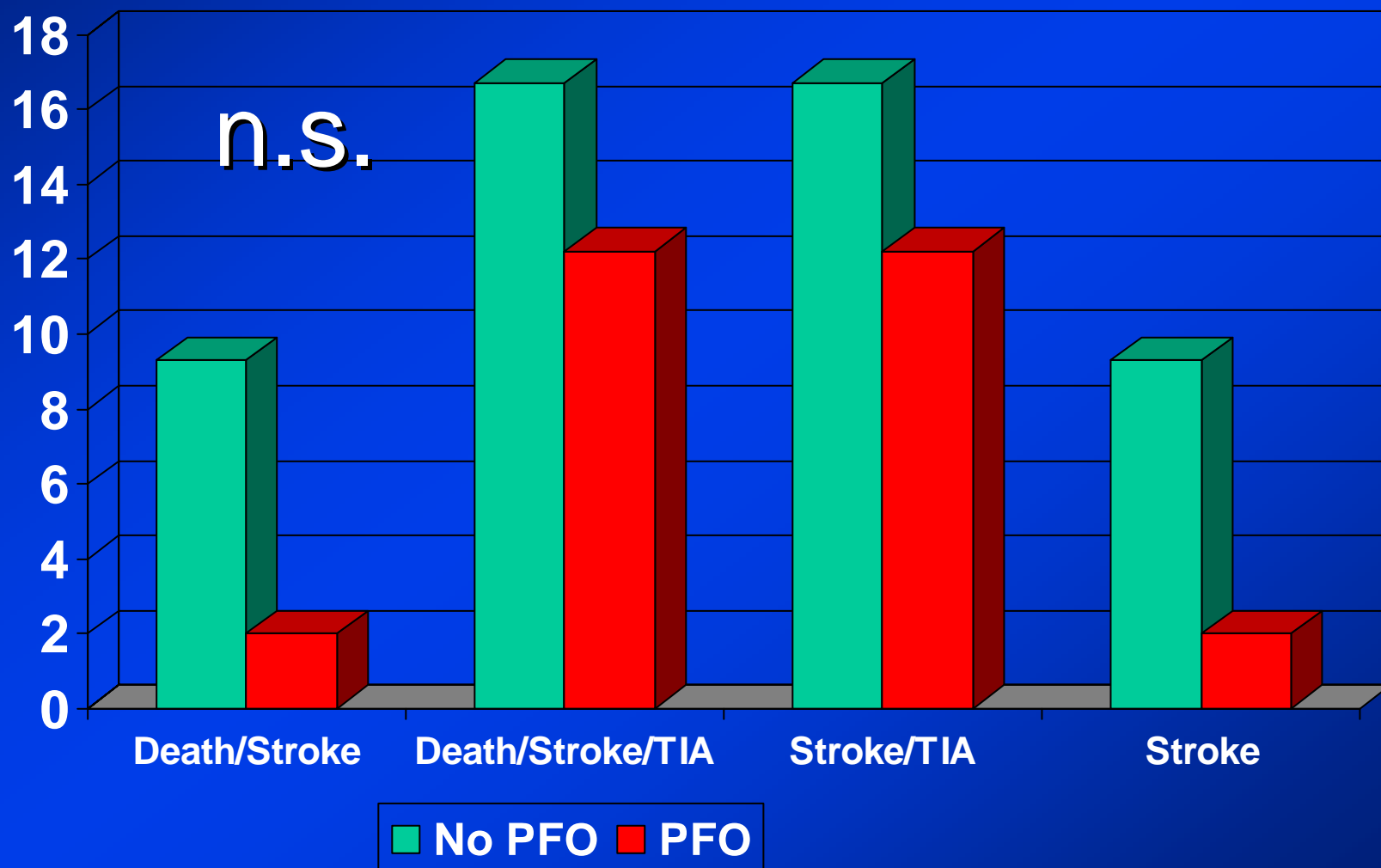


■ Cryptogenic Stroke ■ Control

No data about PFO as
cause of a stroke in
the elderly

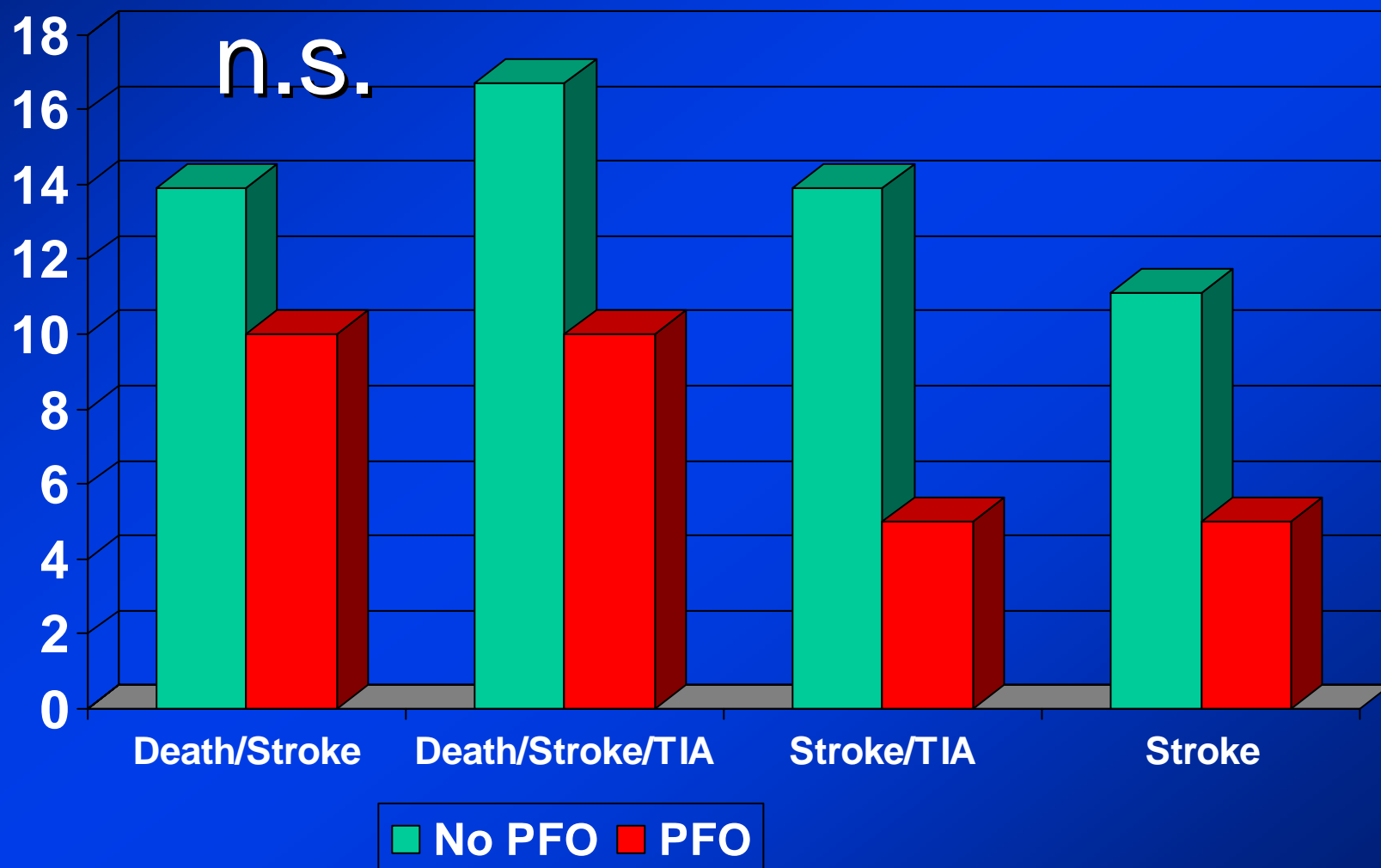
Cryptogenic Stroke Patients

< 55 years, medical therapy, FU 2 years



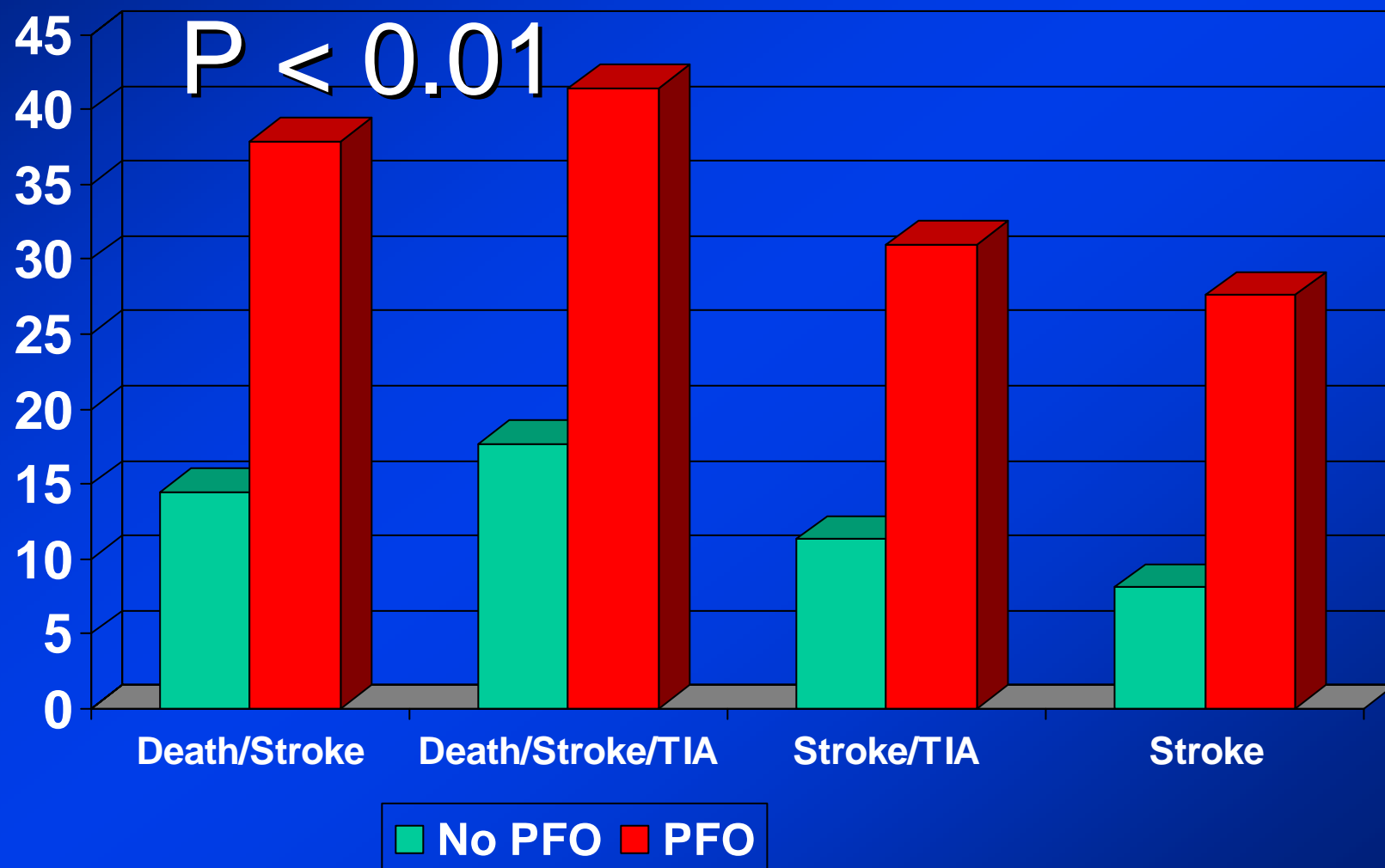
Cryptogenic Stroke Patients

55-65 years, medical therapy, FU 2 years



Cryptogenic Stroke Patients

>65 years, medical therapy, FU 2 years



Homma S, PICSS Investigators, *Stroke* 2004

Take Home Messages

- Catheter treatment of acute stroke
 - Rarely performed (time window)
 - Mechanical recanalization probably preferable
- Prophylactic treatment plays a major role
 - Carotid stenting probably effective
 - But no randomized trials in the elderly
 - Benefit depends upon live expectancy
 - Left atrial appendage closure
 - Probably as effective as anticoagulation
 - Randomised trials are pending
 - PFO closure
 - Rarely indicated in elderly
- All this is not important at all anyway
 - In a few years there will be no elderly patients anymore