

**CAROTID ANGIOPLASTY AND STENTING  
UNDER PROTECTION IS BECOMING THE  
GOLD STANDARD TREATMENT IN  
HIGH AND LOW RISK PATIENTS**

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# **CAROTID STENOSIS**

**IS C.A.S. BECOMING THE  
STANDARD OF CARE OR THE  
GOLD STANDARD  
TREATMENT ?**

# **CAROTID STENOSIS**

**C.E.A. ESTABLISHED AS THE  
GOLD STANDARD  
TREATMENT**

# CAROTID STENOSIS

ANGIOPLASTY

VS

SURGERY

# C.A.S.

■ **C.A.S CAN BE PROPOSED TO THE MAJORITY OF PATIENTS SUFFERING FROM CAROTID STENOSIS**

■ **ALTERNATIVE TO SURGERY**

■ **SAFE AND EFFICIENT PROCEDURE**

■ **BUT : SOME LIMITATIONS**

➤ **RISK OF BRAIN EMBOLIZATION**

➤ **CHALLENGING INDICATIONS**

**CLINICAL , ANATOMICAL...**

➤ **TECHNICAL PROBLEMS : STENT DESIGN**

→ **NEW TECHNIQUES**

# C.E.A. / C.A.S.

## ■ CURRENT ACCEPTABLE STROKE/DEATH RATES

- < 3% FOR ASYMPTOMATIC PATIENTS
- < 6% FOR SYMPTOMATIC PATIENTS
- < 10% FOR RESTENOSIS

NO GUIDELINES FOR HIGH /LOW RISK PATIENTS

Guidelines Ad.Hoc Committee A.H.A.

# **CAROTID STENOSIS INDICATIONS FOR REVASCULARIZATION**

**WHICH PATIENT TO TREAT?**

**SYMPTOMATIC?**

**ASYMPTOMATIC?**

**HIGH RISK? LOW RISK?**

**C.A.S.**  
**HIGH /LOW RISK PATIENTS**

**HIGH CLINICAL RISK**

# WHAT CONSTITUTES HIGH RISK?

- SOME SURGEONS BELIEVE THAT THERE IS NO ONE WHO COULD NOT BE OPERATED ON, BUT THE DATA SUGGEST THERE ARE MANY PATIENTS WHO SHOULD NOT BE OPERATED ON.
- THESE DATA ARE NOT RANDOMIZED, BUT REPORTS ON SEVERAL HIGH-RISK SUBSETS ARE NEVERTHELESS REVEALING

# RISK OF STROKE/DEATH IN HIGH SURGICAL RISK C.E.A.

- **AGE >75 YEARS :** 7%-10%
- **CONGESTIVE HEART FAILURE :** 8%-9%
- **CO-EXISTENT C.A.D. REQUIRING BYPASS SURGERY :** 8%-10%
- **CONTRALATERAL CAROTID OCCLUSION:**
  - **ACAS – 2% INCREASE OVER MEDICAL THERAPY**
  - **NASCET** 14,3%
- **PRIOR AND RECURRENT STENOSIS :** 8%-10%
  - **MAYO CLINIC**
  - **CLIVELAND CLINIC**
- **RENAL INSUFFICIENCY**
  - **Cr>1,5mg% :** 8.2%
  - **Cr>2.9mg% :** 43%

DAILY PO ET AL J. THOR CARDIOVAS SURG;JUNE 1996:111(6),1185-93  
GOLDSTEIN L.B. ET AL STROKE;APRIL 1998:29(4),750-53  
WONG J.H.ET AL STROKE;MAY 1997:28(5),891-98

# **C.A.S.**

## **HIGH SURGICAL RISK PATIENTS**

### **NASCET AND ACAS EXCLUSIONS**

- **AGE>79**
- **PRIOR IPSILATERAL C.E.A.**
- **UNSTABLE CORONARY**
- **MYOCARDIAL INFARCT IN PREVIOUS 6 MONTHS**
- **CARDIAC VALVULAR OR RHYTHM ABNORMALITY LIKELY TO CAUSE EMBOLIC CEREBROVASCULAR SYMPTOMS**
- **CONTRALATERAL OCCLUSION**
- **A MORE SEVERE LESION CRANIAL TO THE SURGICAL LESION**
- **CONTRALATERAL C.E.A. WITHIN PREVIOUS 4 MONTHS**
- **UNCONTROLLED HYPERTENSION OR DIABETES**
- **ORGAN FAILURE LIKELY TO CAUSE DEATH WITHIN 5 YEARS**
- **TOTAL OCCLUSION**
- **MAJOR SURGICAL PROCEDURE IN PREVIOUS 30 DAYS**
- **PRIOR SEVERE C.V.A.**
- **PROGRESSING NEUROLOGIC SYNDROME**

# C.A.S. INDICATIONS

## ■ HIGH RISK PATIENTS : WELL ACCEPTED

- RANDOMIZED STUDIES :SAPPHIRE STUDY
- REGISTRIES:ARCHER, BEACH, CAPTURE, CASES PMS.....
- LARGE PUBLISHED SERIES

RESULTS NON INFERIEUR TO SURGERY

BETTER OUTCOMES THAN SURGERY

F.D.A. APPROVED

## ■ LOW RISK PATIENTS : CONTROVERSIAL

- LARGE PUBLISHED SERIES

RESULTS NON INFERIEUR TO SURGERY

# **C.A.S. UNDER CEREBRAL PROTECTION U.S. SAPPHIRE STUDY**

**RANDOMIZED MULTICENTER TRIAL . HIGH RISK  
PATIENTS FOR ENDARTERECTOMY**

**C.A.S. WITH ANGIOGUARD™ XP EMBOLI PROTECTION  
GUIDEWIRE VS SURGERY**

**307 PATIENTS 156 RECEIVED PRECISE™ NITINOL STENT  
151 UNDERWENT C.E.A.**

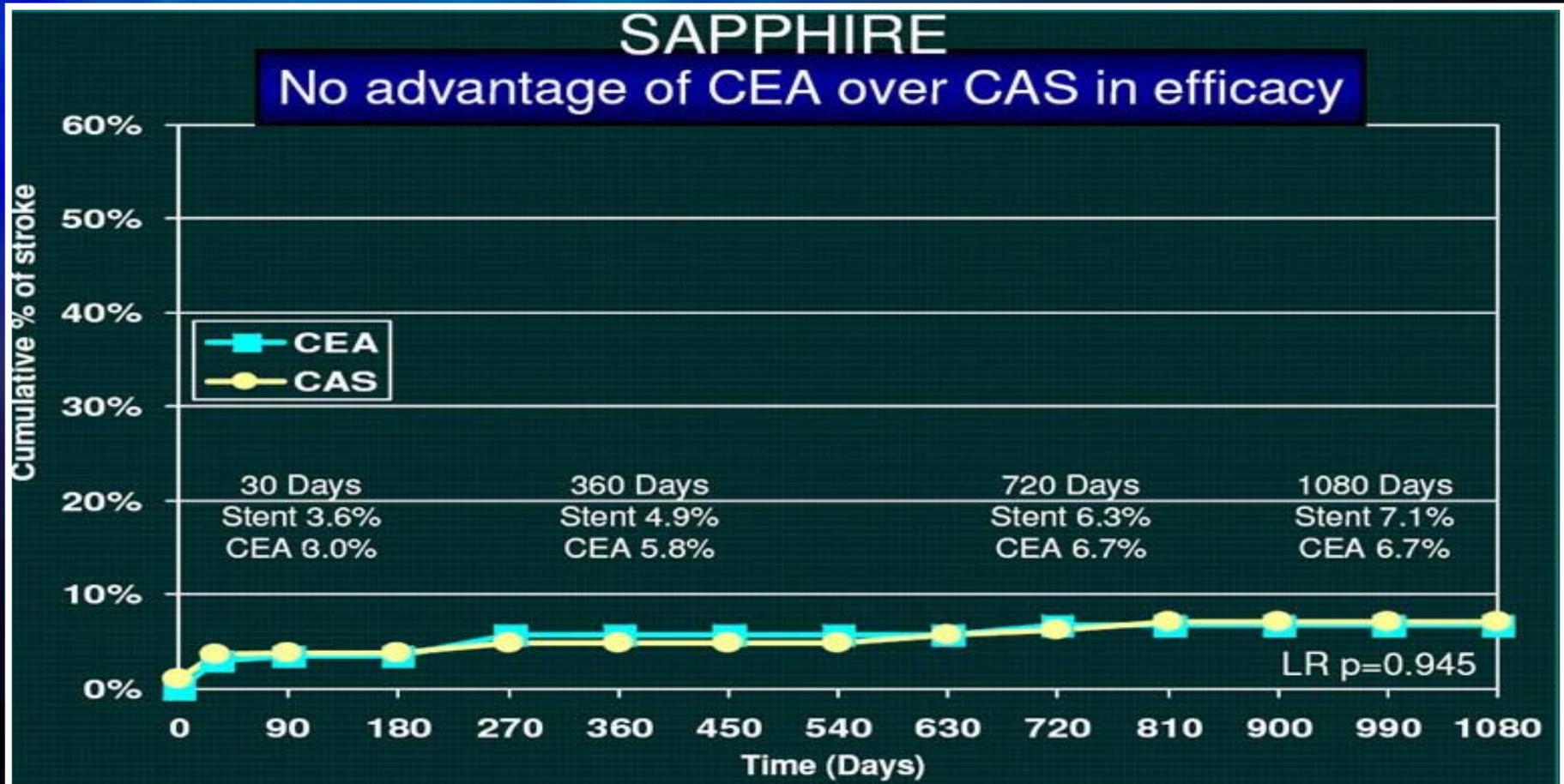
**30 DAY FOLLOW UP : MAJOR ADVERSE EVENTS  
(DEATH, STROKE, MYOCARDIAL INFARCTION)**

**C.A.S. : 5,8%**

**C.E.A. : 12,6%**

# C.A.S. SAPPHIRE STUDY

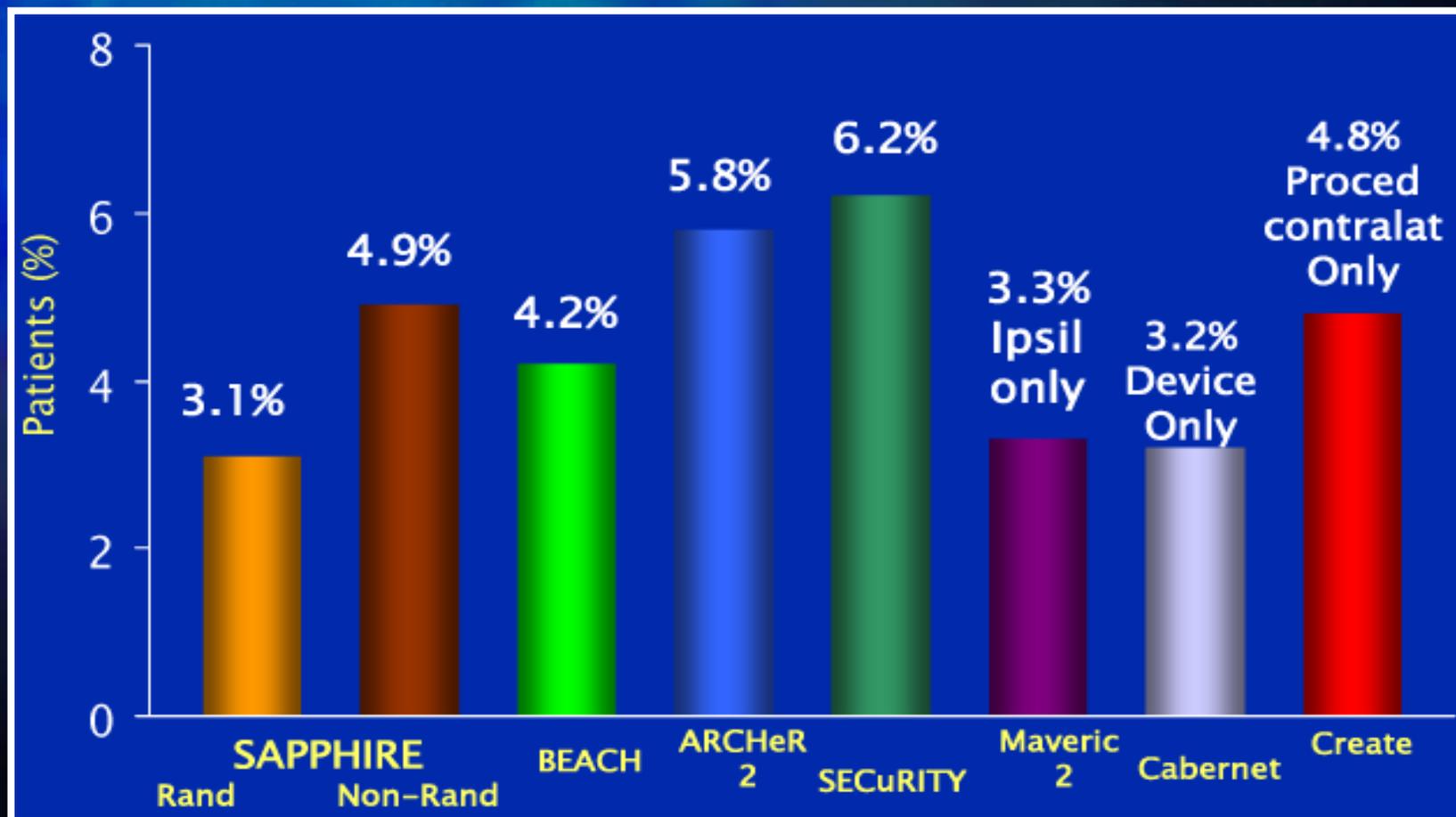
## DURABLE PATENCY AND EFFICACY IN STROKE PREVENTION



# C.A.S. UNDER PROTECTION

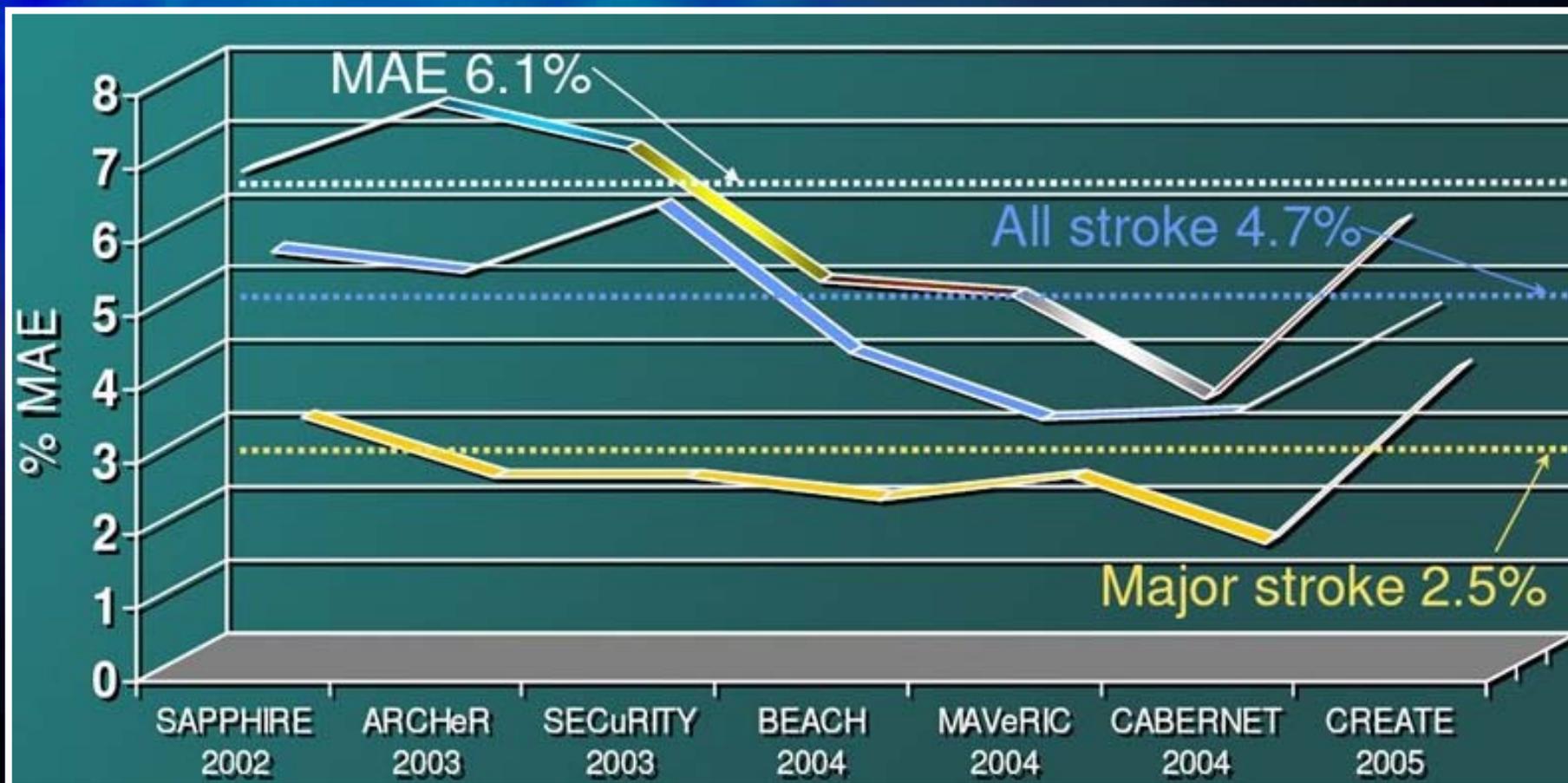
## HIGH RISK PATIENT TRIALS 30-DAY RISK OF STROKE

HISTORICAL CONTROLS FROM SURGICAL STUDIES : 11 TO 15%



# C.A.S. RESULTS IN 7 PIVOTAL TRIALS

>3100 PATIENTS



GRAY W. ISET MIAMI 2007

# C.A.S. CAPTURE 3500 STUDY

## CAPTURE 3500 VS ARCHER 30 DAY OUTCOMES ACCULINK + ACCUNET VS Xact STENT+EMBOSHEILD

Event	CAPTURE N=3500	ARChER N=581	DIFFERENCE 95% CI
Death, Stroke and MI*	6.3%	8.3%	-1.98% [-4.35%, 0.40%]
All Stroke and Death*	5.7%	6.9%	-1.20% [-3.40%, 1.00%]
Major Stroke and Death*	2.9%	2.9%	-0.04% [-1.52%, 1.44%]
Death	1.8%	2.1%	-0.29% [-1.53%, 0.94%]
All Stroke	4.8%	5.5%	-0.71% [-2.69%, 1.28%]
Major Stroke	2.0%	1.5%	0.42% [-0.68%, 1.53%]
Minor Stroke	2.9%	4.0%	-1.07% [-2.75%, 0.61%]
MI §	0.9%	2.4%	-1.50% [-2.78%, -0.21%]

\*Hierarchical-includes only the most serious event for each patient and include only each patient's first occurrence of each event

§Denotes statistically significant difference at the 0.05 level

GRAY W. ISET MIAMI 2007

# C.A.S. PERSONAL SERIES

APRIL 1995  JUNE 2007

	TOTAL	WITHOUT PROTECTION	WITH PROTECTION
PATIENTS	842	172	670
ARTERIES	902	187	715
BILATERAL ANGIOPLASTIES	60	15	45

- SYMPTOMATIC : 62%
- MEAN AGE : 70,8 ± 9,2 YEARS ( 22 – 93)
- 118 PATIENTS > 79 YEARS

# C.A.S

## PERSONAL EXPERIENCE

■ PATIENTS : 842

■ PROCEDURES: 902

SYMPTOMATIC LESIONS : 62%

➤ WITHOUT PROTECTION : 187

➤ WITH PROTECTION : 715

○ OCCLUSION BALLOON : 334

❖ THERON'TECHNIQUE : 47

❖ PERSONAL DEVICE : 10

❖ PERCUSURGE : 277

○ FILTERS : 376

❖ E.P.I. : 216

❖ FIBERNET : 58

❖ ANGIOGUARD : 60

❖ ACCUNET : 35

❖ EMBOSHIELD 7

( 2 FILTERS USED IN ONE PROCEDURE )

○ ARTERIA : 6

# C.A.S. UNDER PROTECTION

## DEMOGRAPHIC CHARACTERISTICS

- **ARTERIES : 715**                      **PATIENTS : 670**
- **MALE : 507**                      **FEMALE : 163**
- **MEAN AGE : 70,8 ± 9,3 ( 40 – 93 )**
- **RIGHT : 376**                      **LEFT : 339**
- **SYMPTOMATIC : 63 %**
- **HISTORY OF STROKE: 30%**
- **HISTORY OF T.I.A. : 37%**

# C.A.S. UNDER PROTECTION

## DEMOGRAPHIC CHARACTERISTICS

### ■ RISK FACTORS

- HISTORY OF HYPERTENSION : 72%
- UNCONTROLLED HYPERTENSION: 23%
- DIABETIS MELITUS : 22%
- DYSLIPIDEMIA : 61%
- SMOKING : 62%
- OBESITY : 15%

# C.A.S. UNDER PROTECTION

## DEMOGRAPHIC CHARACTERISTICS

### ■ ASSOCIATED DISEASES

- CORONARY DISEASES : 63%
- CARDIAC INSUFFICIENCY : 9%
- PERIPHERAL VASC. DISEASES: 27%
- RENAL STENOSIS : 10%
- RENAL INSUFFICIENCY: 8%
- PULMONARY INSUFFICIENCY : 8%

# C.A.S. UNDER PROTECTION

## DEMOGRAPHIC CHARACTERISTICS

### ■ LESION CHARACTERISTICS

- MEAN DEGREE OF STENOSIS (%) :  $81,9 \pm 9,4$
- MEAN LESION LENGTH (mm) :  $14,2 \pm 6,2$
- MEAN ARTERIAL DIAMETER (mm) :  $5 \pm 1,2$
- CALCIFIED LESIONS : 45%
- ULCERATED LESIONS : 71%
- ECHOLUCENT LESIONS : 49%
- HYPERECHOGENIC LESIONS : 51%

# **C.A.S. UNDER PROTECTION**

## **HIGH / LOW SURGICAL RISK PATIENTS**

715 ARTERIES

**HIGH RISK : 457**

SYMPTOMATIC : 297

ASYMPTOMATIC : 160

**LOW RISK : 258**

SYMPTOMATIC : 153

ASYMPTOMATIC : 105

# **C.A.S. UNDER PROTECTION HIGH SURGICAL RISK PATIENTS**

## **457 ARTERIES**

<b>CONGESTIVE HEART FAILURE ( CLASS III/IV ) AND/OR KNOWN SEVERE LEFT VENTRICULAR DYSFUNCTION LVEF&lt;30%</b>	<b>141</b>	<b>21%</b>
<b>OPEN HEART SURGERY NEEDED WITHIN 6 WEEKS</b>	<b>161</b>	<b>24%</b>
<b>RECENT M.I. (&gt; 24 Hrs AND &lt; 4 WEEKS</b>	<b>54</b>	<b>8,1%</b>
<b>UNSTABLE ANGINA ( CCS CLASS III/IV )</b>	<b>228</b>	<b>34%</b>
<b>SEVERE PULMONARY DISEASE</b>	<b>49</b>	<b>7,3%</b>
<b>CONTRALATERAL CAROTID OCCLUSION</b>	<b>54</b>	<b>8,1%</b>
<b>CONTRALATERAL CAROTID SEVERELY STENOSED ( &gt;90%)</b>	<b>127</b>	<b>19%</b>

# **C.A.S. UNDER PROTECTION HIGH SURGICAL RISK PATIENTS**

## **457 ARTERIES**

<b>CONTRALATERAL LARYNGEAL NERVE PALSY</b>	<b>3</b>	<b>0,4%</b>
<b>RADIATION THERAPY TO NECK</b>	<b>11</b>	<b>1,6%</b>
<b>PREVIOUS C.A.S. / C.E.A. WITH RECCURENT STENOSIS</b>	<b>36</b>	<b>5,4%</b>
<b>HIGH CERVICAL I.C.A. LESIONS OR C.C.A. LESIONS BELOW THE CLAVICLE</b>	<b>59</b>	<b>8,8%</b>
<b>SEVERE TANDEM LESIONS</b>	<b>15</b>	<b>2,2%</b>
<b>AGE GREATER THAN 80 YEARS</b>	<b>112</b>	<b>17%</b>
<b>RENAL INSUFFICIENCY ( CR &gt; 2,5)</b>	<b>49</b>	<b>7,3%</b>

# C.A.S UNDER CEREBRAL PROTECTION

## 30 DAY OUTCOMES

### 715 PROCEDURES

	HIGH RISK n = 457	LOW RISK n = 258	P value
T.I.A.	4 0,9%	2 0,8%	N.S.
MINOR STROKE	3 0,7%	0	N.S.
MAJOR STROKE	1 0,2%	0	N.S.
RETINAL EMBOLUS	2 0,4%	2 0,8%	N.S.
HYPERPERFUSION SYNDROME	2 0,4%	1 0,4%	N.S.
DEATH	2 0,4%	1 0,4%	N.S.
FATAL STROKE	2 0,4%		N.S.
NON STROKE DEATH		1 0,4%	N.S.
DEATH AND STROKE	6 1,3%	1 0,4%	N.S.
M.I.	1 0,2%	0	N.S.
EMBOLIC EVENTS	10 2,2%	4 1,6%	N.S.

# C.A.S. UNDER CEREBRAL PROTECTION

## 30 DAY OUTCOMES

652 ARTERIES	PERCUSURGE			FILTERS		
	H.R. N=178	L.R. N=99	TOTAL N=277	H.R. N=241	L.R. N=135	TOTAL N=376
T.I.A.	2	1	3 (1%)	1	1	2 (0,5%)
MINOR STROKE	0	0	0	2	0	2 (0,5%)
MAJOR STROKE	0	0	0	0	0	0
RETINAL EMBOLUS	0	1	1 (0,3%)	2(0,8%)	1(0,7%)	3 (0,8%)
HYPERPERFUSION SYNDROME	1	0	1 (0,3%)	1	1	2 (0,5%)
DEATH	0	1	1 (0,3%)	1	0	1 (0,3%)
FATAL STROKE	0	0	0	1	0	1 (0,3%)
NON FATAL STROKE	0	1	1 (0,3%)	0	0	0
DEATH AND STROKE	0	1	1 (0,3%)	3	0	3 (0,8%)
M.I.	0	0	0	1	0	1 (0,3%)
EMBOLIC EVENTS	2	2	4 (1,4%)	5(2,1%)	2	7 ( 1,9%)

P = N.S. FOR H.R./L.R./ALL PATIENTS

# C.A.S.UNDER CEREBRAL PROTECTION

## 30 DAY OUTCOMES

### ■ DEATH AND STROKE RATE

➤ SYMPTOMATIC PATIENTS :	5 /450	1,1%
H.R.	4/297	1,3%
L.R.	1/153	0,7%
➤ ASYMPTOMATIC PATIENTS :	2 /265	0,8 %
H.R.	1/160	0,6%
L.R.	1/105	0,9%

### ■ EMBOLIC COMPLICATION RATE

➤ SYMPTOMATIC PATIENTS :	10 /450	2,3 %
H.R	7 /297	2,4%
L.R.	3 /153	2%
➤ ASYMPTOMATIC PATIENTS :	4 /265	1,6 %
H.R.	2 /160	1,3%
L.R.	2 /105	1,9%

P=NS

# C.A.S UNDER PROTECTION HIGH AND LOW RISK PATIENTS

## 588 ARTERIES

	HIGH RISK n = 326	LOW RISK n = 262	P value
MINOR STROKE	4 1,2%	3 1,1%	N.S.
MAJOR STROKE	1 0,3%	1 0,4%	N.S.
FATAL STROKE	2 0,6%	0	N.S.
ALL STROKES	7 2,1%	4 1,5%	N.S.
ALL DEATH	4 1,2%	1 0,4%	N.S.
DEATH + STROKE	9 2,8%	5 1,9%	N.S.

# C.A.S UNDER PROTECTION HIGH AND LOW RISK PATIENTS

## 30 DAY OUTCOME

**287 ARTERIES**

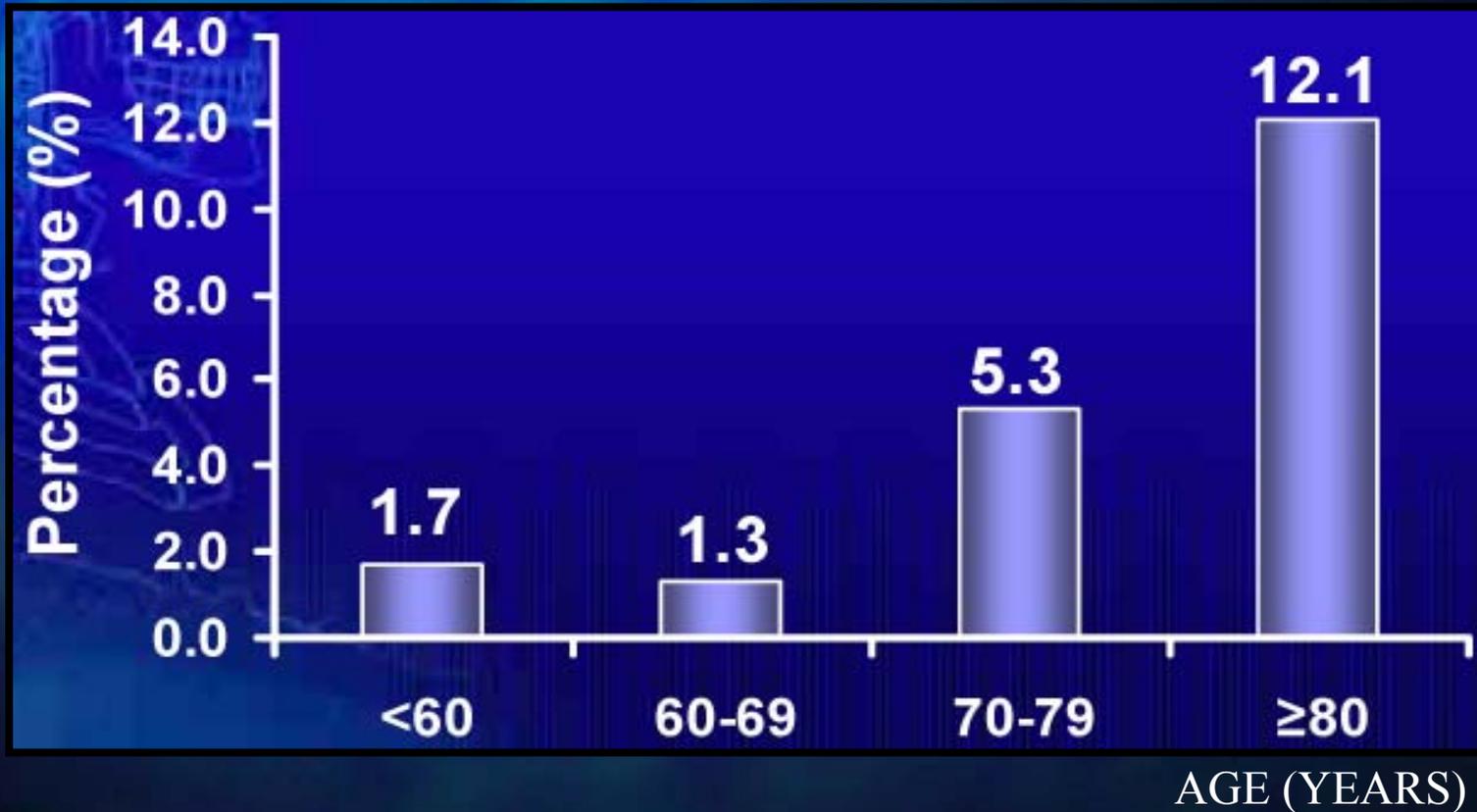
**133 WITH E.P.D.**

**154 WITHOUT E.P.D.**

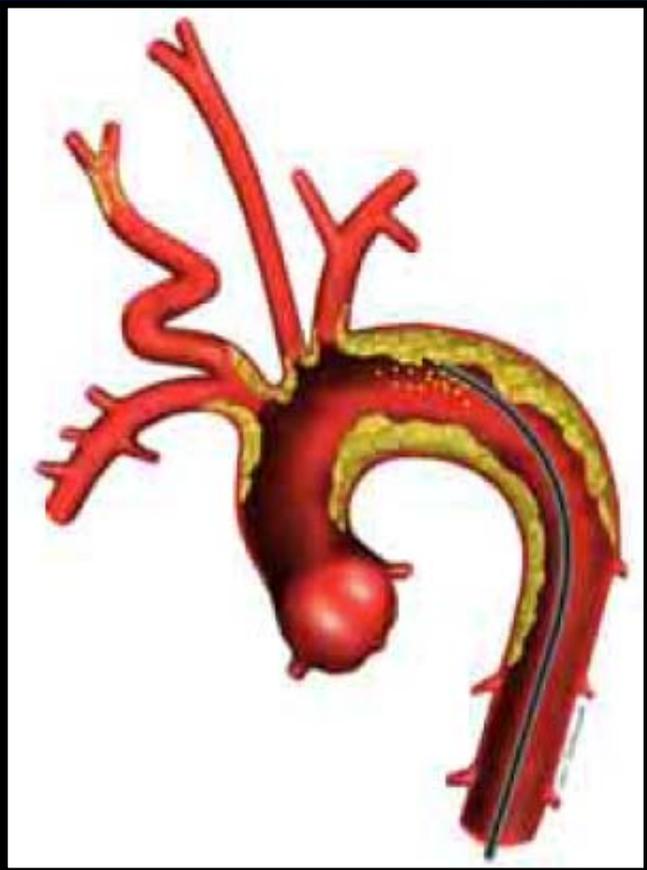
	<b>H.R.</b>	<b>L.R.</b>
<b>NBR.</b>	<b>144</b>	<b>143</b>
<b>MINOR STROKE</b>	<b>0</b>	<b>2</b>
<b>MAJOR STROKE</b>	<b>4</b>	<b>1</b>
<b>M.I.</b>	<b>0</b>	<b>0</b>
<b>DEATH</b>	<b>1</b>	<b>0</b>
<b>TOTAL EVENT RATE</b>	<b>5 (3,5%)</b>	<b>3 (2,1%)</b>

**SIMILARLY GOOD OUTCOME  
CAS SHOULD BE OFFERED TO L.R.**

# C.A.S. CREST STUDY STROKE AND DEATH



# C.A.S. OCTOGENARIANS



HIGH RISK OF BRAIN EMBOLISM WITH  
TYPE 3 AORTIC ARCH    ATHEROMATOUS  
ARCH    TORTUOSITIES

AORTIC ARCH IS A SUBSTANTIAL  
SOURCE OF EMBOLI

AORTIC ARCH HAS ITS OWN SET OF  
EMBOLIC POTENTIAL

AVOID EXCESSIVE CATHETER  
MANIPULATION IN ARCH

MORE THAN 20 mn : BETTER TO QUIT

# C.A.S. IN OCTOGENARIANS

## 30 DAY OUTCOMES

902 PROCEDURES	> 80 Y.			< 80 Y.		
	TOTAL	WITHOUT EPD	WITH EPD	TOTAL	WITHOUT EPD	WITH EPD
<b>NBR</b>	118	6	112	784	181	603
<b>T.I.A.</b>	2 (1,7%)	1 (17%)	1 (0,9%)	8 (1%)	3 (1,7%)	5 (0,8%)
<b>MINOR STROKE</b>	1 (0,8%)	1 (17%)	0	5 (0,6%)	2 (1,1%)	3 (0,5%)
<b>MAJOR STROKE</b>	0	0	0	3 (0,4%)	2 (1,1%)	1 (0,2%)
<b>RETINAL EMBOLUS</b>	0	0	0	4 (0,5%)	0	4 (0,6%)
<b>HYPERPERFUSION SYNDROME</b>	0	0	0	3 (0,4%)	0	3 (0,5%)
<b>DEATH</b>				5 (0,6%)	2 (1,1%)	3 (0,5%)
<b>FATAL STROKE</b>	0	0	0	4 (0,5%)	2 (1,1%)	2 (0,3%)
<b>NON FATAL STROKE</b>				1 (0,1%)	0	1 (0,2%)
<b>M.I.</b>	0	0	0	1 (0,1%)	0	1 (0,2%)
<b>DEATH / STROKE</b>	1 (0,8%)	1 (17%)	0	13 (1,7%)	6 (3,3%)	7 (1,2%)
<b>DEATH / STROKE / M.I.</b>	1 (0,8%)	1 (17%)	0	14 (1,8%)	6 (3,3%)	8 (1,3%)

E.P.D. : EMBOLIC PROTECTION DEVICES

# C.A.S. IN OCTAGENARIANS

- 1053 PATIENTS      1222 C.A.S.
- < 80 YEARS : 1078
- > 80 YEARS : 144
- 30 DAY OUTCOME

	> 80 YEARS	< 80 YEARS
DEATH STROKE RATE	2,12%	1,11%
FATAL STROKE	2	
MINOR STROKE	1	6
MAJOR STROKE		3
DEATH	2	3

**C.A.S IS SAFE AND EFFECTIVE IN EDERLY PATIENTS**

# C.A.S. IN HIGH VOLUME CENTERS OCTOGENARIANS

STROKE / DEATH / M.I. : 0 – 30 DAYS

	ALL PTS	< 80Y.O.	≥ 80Y.O.
<b>ROUBIN et al n : 312</b>	1,3%	1,3%	1,2%
<b>MYLA et al n : 724</b>	3,5%	3,1%	1,7%
<b>WHOLEY et al n : 814</b>	1%	0,8%	1,7%
<b>REIMERS et al n : 815</b>	3,4%	3,5%	2,3%
<b>HENRY et al n : 842</b>	1,5%	0,8%	1,8%

# PATIENTS WITH CONTRALATERAL CAROTID OCCLUSION

## PERSONAL EXPERIENCE -30 DAY OUTCOMES

### 54 C.A.S. UNDER PROTECTION

#### ■ 30 DAY COMPLICATIONS

- DEATH : 0
- MAJOR STROKE : 0
- MINOR STROKE : 0
- M.I. 0
- T.I.A. : 1/54 (1,9%)
- AMAUROSIS : 1/54 (1,9%)
- DEATH / STROKE /MI 0

#### ■ INTOLERANCE DURING PROCEDURE : 4/54 (7,4%)

- PERCUSURGE : 1
- FILTERS : 3

**C.A.S.  
OCTOGENARIANS**

**HOW TO REDUCE THE RISKS ?**

# **CAROTID ANGIOPLASTY AND STENTING**

## **HOW TO REDUCE THE RISKS**

**1 - GOOD INDICATIONS (PATIENT AND LESION SELECTION)**

**2 CORRECT TECHNIQUE OF C.A.S.**

**3 - BRAIN PROTECTION DEVICES (B.P.Ds) CONSENSUS AMONG SPECIALISTS THAT B.P.D.s NEED TO BE USED IN EACH C.A.S. PROCEDURE**

**4 - GOOD CHOICE OF THE STENT AND CORRECT IMPLANTATION**

**5 – PHARMACOLOGICAL ADJUNCTS**

**6 - GOOD TEAM**

# CAROTID ANGIOPLASTY AND STENTING HOW TO REDUCE THE RISKS

**1 - GOOD INDICATIONS (PATIENT AND LESION SELECTION)**

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# CAROTID STENOSIS

## INDICATIONS FOR REVASCULARIZATION

- SYMPTOMATIC PATIENT WITH A STENOSIS > 50%
- ASYMPTOMATIC PATIENT WITH A STENOSIS > 80%

# C.A.S. ASYMPTOMATIC PATIENTS

## WHICH PATIENTS TO TREAT ?

PATIENTS WITH HIGHER RISK OF IPSILATERAL STROKE

- ULTRASONIC PLAQUE MORPHOLOGY : HETEROGENOUS HYPOECHOLUCENT PLAQUES
- PATIENTS WITH SILENT BRAIN INFARCTS
- PATIENTS WITH IMPAIRED CEREBROVASCULAR RESERVE
- PATIENT WITH ASYMPTOMATIC EMBOLIZATION IN M.C.D. BY T.C.D.

**C.A.S.**  
**HIGH /LOW RISK PATIENTS**

**CLINICAL RISK**

**ANATOMICAL RISK**

# CAROTID STENOSIS

## INDICATIONS FOR REVASCULARIZATION

### PREASSESSMENT

- CLINICAL BIOLOGICAL ASSESSMENT
- NEUROLOGICAL ASSESSMENT
- CARDIOLOGICAL ASSESSMENT
- DUPPLEX SCAN

#### PLAQUE CHARACTERIZATION

#### EVALUATION OF RISK OF EMBOLISATION ?

- C.T. SCAN / M.R.I.
- ANGIOGRAPHIC EVALUATION

**RECOGNIZE HIGH RISK PATIENT**

# **C.A.S.**

## **ANGIOGRAPHIC EVALUATION**

- **ANGIOGRAPHY OF AORTIC ARCH**
- **4 VESSEL ANGIOGRAPHY**
- **I.C.A. LESIONS CHARACTERISTICS**  
**HIGH RISK PLAQUES CALCIFICATIONS**  
**TORTUOSITIES**
- **INTRACRANIAL CIRCULATION AND**  
**CONTRALATERAL LESIONS**

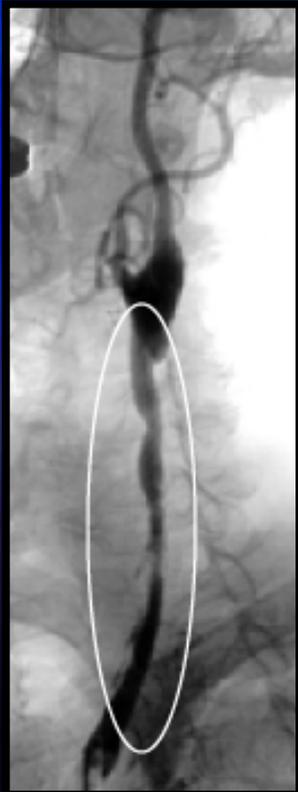
**☞ WHICH PATIENT TO AVOID**

# C.A.S.

## HIGH ANATOMICAL RISKS

- **COMPLEX AORTIC ARCH**
  - TYPE 3
  - TORTUOUS ARTERIES
- **LENGTH OF LESION**
- **PLAQUE MORPHOLOGY: ECHOLUCENT PLAQUE ( GSM < 25 ). VULNERABLE PLAQUE. IMPORTANT ROLE OF DUPLEX-SCAN, IVUS IN THE FUTURE**
- **TYPE C LESION**
- **INTRACRANIAL CIRCULATION**

# C.A.S. BETTER PATIENT SELECTION



TOO  
LONG



STRING  
SIGN



MOBILE  
CLOT



TOO  
TORTUOUS



DANGEROUS  
COMMON  
CAROTID

# **CAROTID ANGIOPLASTY AND STENTING HOW TO REDUCE THE RISKS**

**1 - GOOD INDICATIONS (PATIENT AND LESION SELECTION)**

**2 – CORRECT TECHNIQUE OF C.A.S.**

**3 - BRAIN PROTECTION DEVICES (B.P.Ds) CONSENSUS AMONG SPECIALISTS  
THAT B.P.D.s NEED TO BE USED IN EACH C.A.S. PROCEDURE**

**4 - GOOD CHOICE OF THE STENT AND CORRECT  
IMPLANTATION**

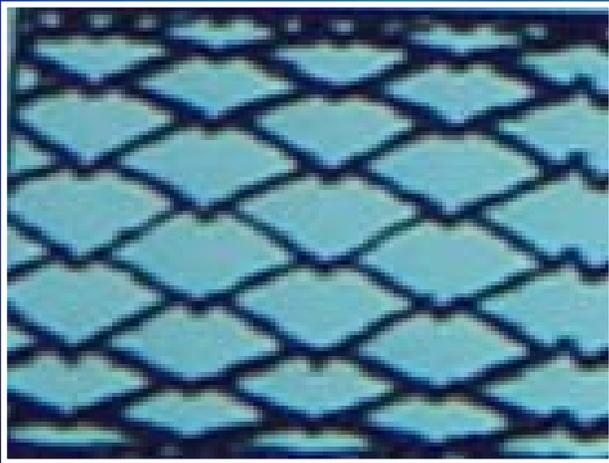
**5 – PHARMACOLOGICAL ADJUNCTS**

**6 - GOOD TEAM**

# C.A.S. STENT DESIGN

## CLOSED CELL STENTS

LASER CUT



CLOSED-CELL PATTERN  
ONE-TO-ONE CELL RELATION  
e.g ABBOTT-XACT  
BOSTON-NEXSTENT

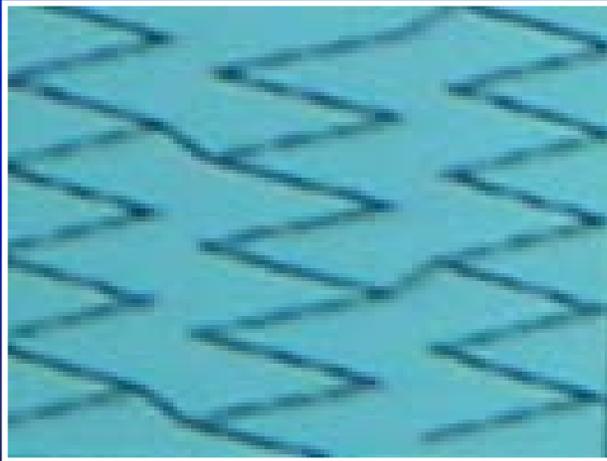
BRAIDED



WOVEN TUBE  
ONE-TO-ONE CELL RELATION  
e.g WALLSTENT

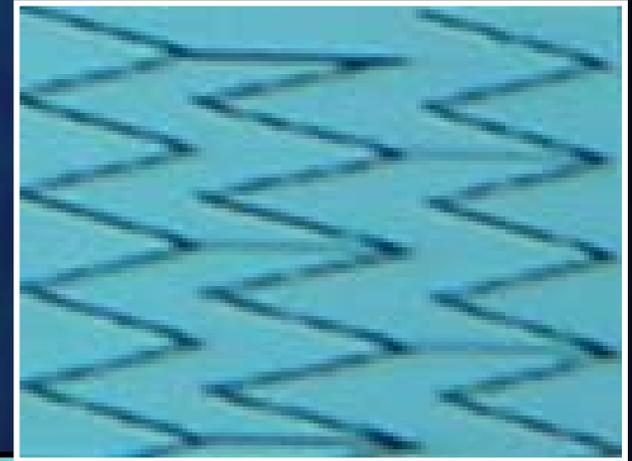
# C.A.S. STENT DESIGN

## OPEN CELL STENTS

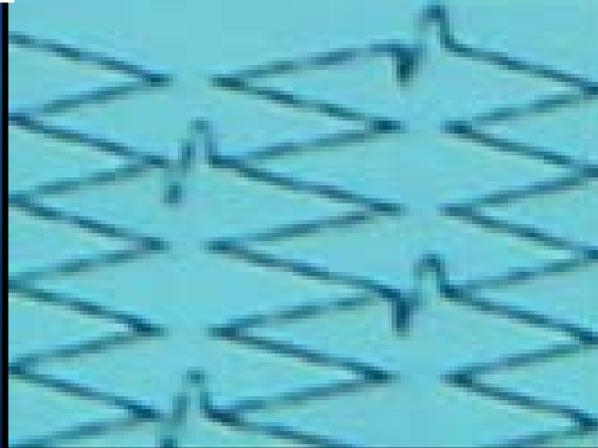


PERIODIC PEAK-PEAK  
NONFLEX CONNECTORS  
E.G. CORDIS - PRECISE

PERIODIC PEAK-PEAK  
FLEX CONNECTORS  
E.G. OPTIMED SINUS

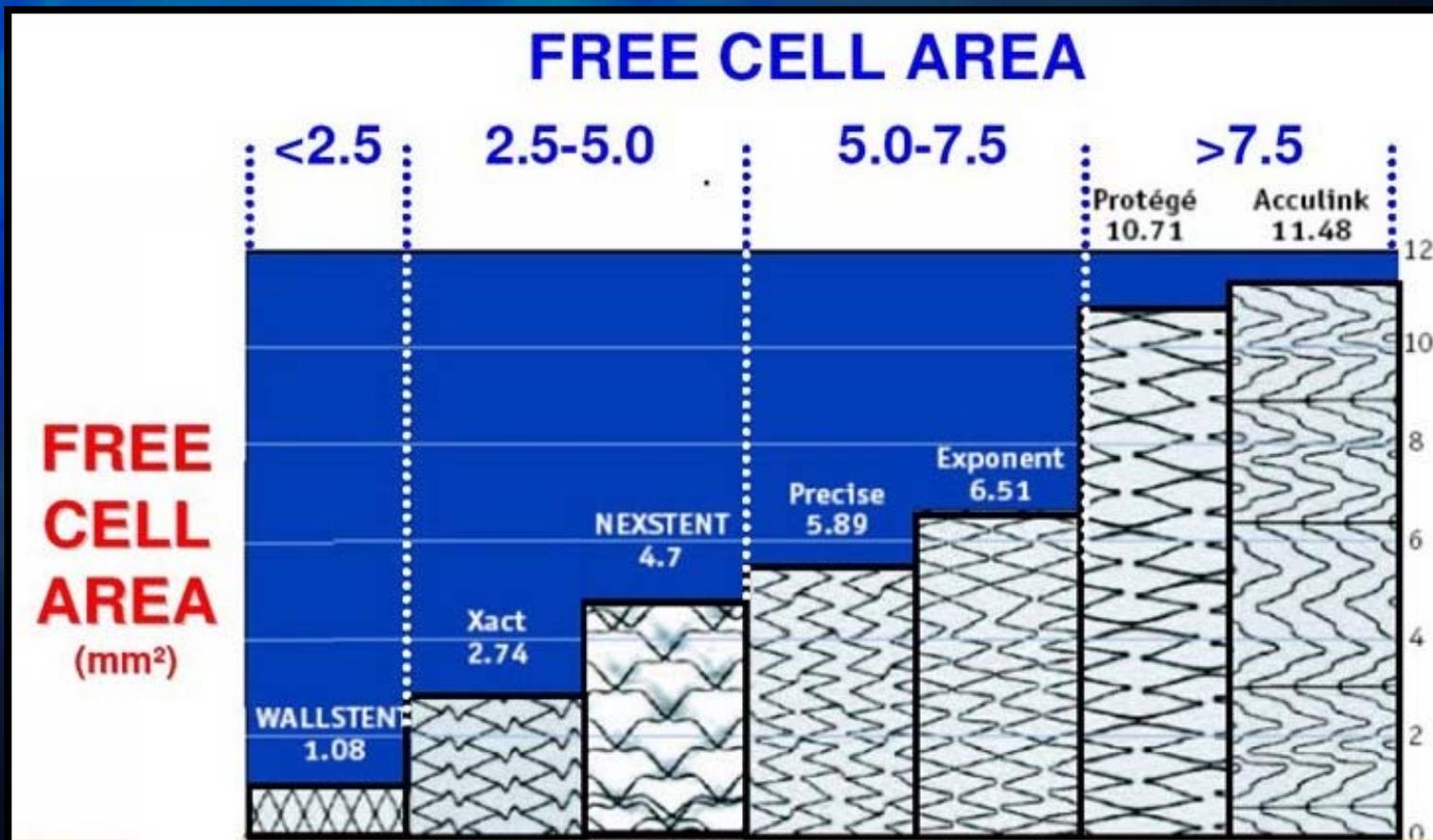


PERIODIC PEAK-VALLEY  
NONFLEX CONNECTORS  
E.G. COOK - ZILVER

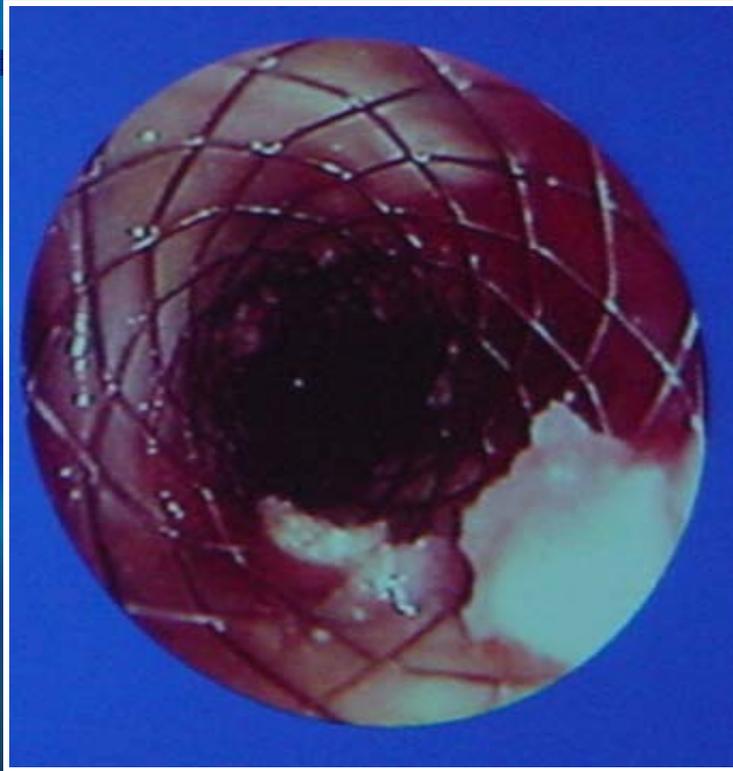


RINGS CONNECTED BY "BRIDGES"

# C.A.S. STENT DESIGN

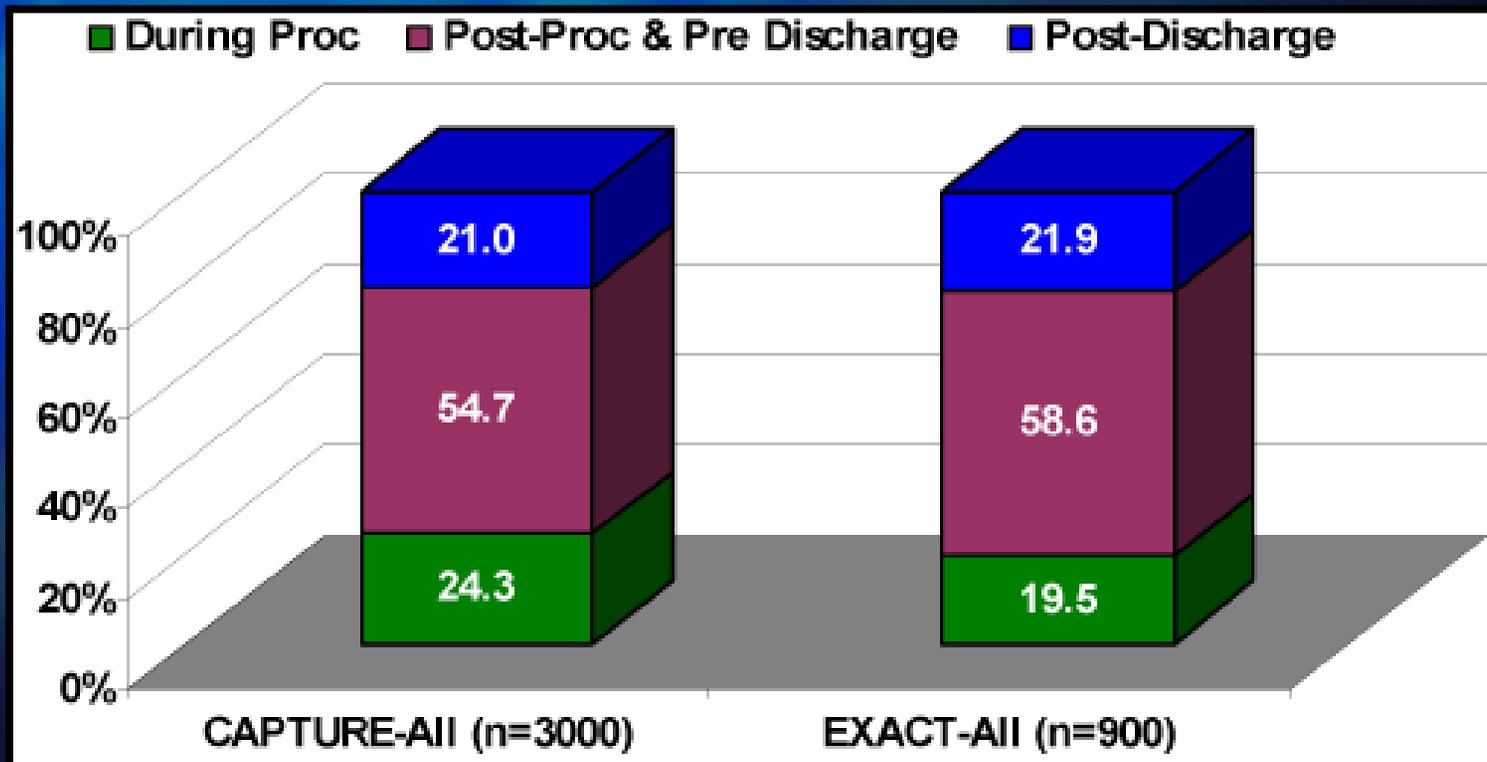


# C.A.S. STENT DESIGN



**ROLE OF PLAQUES PROLAPSE  
INCREASE EMBOLIC RISK → DELAYED EMBOLIC  
EVENTS**

# CAPTURE 3000 VS EXACT 900: TIMING OF STROKE



THE MAJORITY OF STROKE OCCUR  
POST PROCEDURE AND BEFORE DISCHARGE

# C.A.S. ROLE OF STENT DESIGN

## BOSIERS'S SERIES – 30 DAY OUTCOME

	<b>OPEN CELL</b> N=63	<b>CLOSED CELL</b> N=235
<b>STROKE/DEATH</b>	1,6%	0,9%
<b>DEATH</b>	0%	0,4
<b>T.I.A., STROKE, DEATH</b>	<b>11,1%</b>	3%

**HIGHER RISK OF T.I.A. WITH OPEN CELL STENT**

**C.A.S.**

**S. E. STENT EFFECTS**

**HIGH EMBOLIC RISK PLAQUES**

- **NEED FOR DIFFERENT STENTS AND TECHNIQUES**
- **USE CLOSED CELL STENTS EXCEPT IN TORTUOUS VESSELS**
- **METICULOUS CLEANING OF THE DILATED AREA (ASPIRATION WITH ASPIRATION CATHETER OR GUIDING) TO AVOID DELAYED EMBOLIC EVENTS**
- **ROLE OF NEW PROTECTION DEVICES**

# **CAROTID ANGIOPLASTY AND STENTING HOW TO REDUCE THE RISKS**

**1 - GOOD INDICATIONS (PATIENT AND LESION SELECTION)**

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**3 - BRAIN PROTECTION DEVICES (B.P.Ds)  
CONSENSUS AMONG SPECIALISTS THAT B.P.D.s  
NEED TO BE USED IN EACH C.A.S. PROCEDURE**

**4 - GOOD CHOICE OF THE STENT AND CORRECT IMPLANTATION**

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**6 - GOOD TEAM**

# **C.A.S**

## **UNDER CEREBRAL PROTECTION**

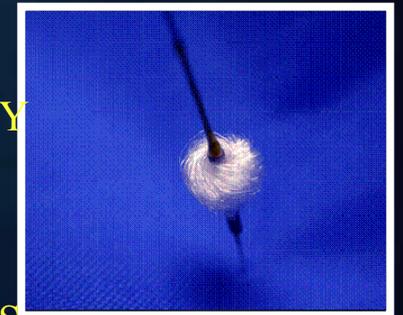
- **E.P.D. CAN NOT PREVENT FROM ALL NEUROLOGICAL COMPLICATIONS**
- **ALL E.P.D. ARE NOT EQUIVALENT**
- **CURRENT E.P.D. HAVE LIMITATIONS**
- **IMPROVEMENTS IN E.P.D. ARE INDISPENSABLE**
- **CHOOSE CAREFULLY YOUR E.P.D.**

**C.A.S. UNDER PROTECTION**  
**A NEW 3D FILTER: FIBERNET®**  
**(LUMEN BIOMEDICAL)**



**FIBERNET® IS A NOVEL E.P.D. THAT INCORPORATES THE ABILITY TO ALLOW FLOW DURING THE PROCEDURE (FILTER), CAPABILITY TO CAPTURE SMALL PARTICLES (OCCLUSION BALLOON) AND IS DELIVERABLE AS A STANDARD CORONARY GUIDEWIRE**

**UTILIZES A MESH OF 150 - 600 PET FIBERS TO CAPTURE EMBOLIC PARTICLES IN A "3DIMENSIONAL FILTER"  
FIBERS INCORPORATED ON A 0,014" CORONARY GUIDEWIRE (190cm ) WITH A SHAPEABLE TIP  
DOES NOT REQUIRE A DELIVERY SHEATH FOR DELIVERY DEPLOYMENT  
AVAILABLE IN 5 SIZES FOR VESSELS 1,75 -7.0 MM IN DIAMETER  
BETTER WALL APPPOSITION THAN WITH OTHER FILTERS  
EXCELLENT PARTICULE ENTRAPMENT  
RETRIEVAL SHEATH WHICH IS A N ASPIRATION CATHETER**



**C.A.S. UNDER PROTECTION  
LIMITATIONS**

**LEARNING CURVE  
OPERATOR EXPERIENCE**

# C.A.S. EXPERIENCE – LEARNING CURVE

	GROUP 1 CASES n°1 TO 50 N = 50	GROUP 2 CASES n°51 TO 100 N = 50	GROUP 3 CASES n°101 TO 150 N = 50	GROUP 3 CASES n°151 TO 200 N = 50	GROUP 3 CASES n°201 TO 246 N = 46
<b>TECHNICAL SUCCESS</b>	47 (94%)	49 (98%)	50 (100%)*	50 (100%)*	46 (100%)*
<b>HOPITAL LENGTH OF STAY (D)</b>	1.6±1.2	1.3±1.1	1.4±0.7	1.5±0.6	1.4±0.8
<b>PROCEDURAL VARIABLES</b>					
a) <b>PROCEDURAL TIME (min)</b>	58±10	43±11*	39±8†	36±10†	38±12†
b) <b>CONTRAST USED (ml)</b>	98±24	79±19*	55±15†	53±12†	50±15†
<b>COMPLICATIONS</b>					
a) <b>CARDIOPULMONARY</b>	2 (4%)	2 (4%)	1 (2%)	1 (2%)	1 (2%)
b) <b>HEMORRHAGIC</b>	3 (6%)	1 (2%)	0*	0*	0*
c) <b>STROKE (T.I.A.)</b>	1 (2%)	0	0	0	0
d) <b>STROKE (MINOR)</b>	1 (2%)	1 (2%)	0	0	0
e) <b>STROKE (MAJOR)</b>	1 (2%)	0	0	0	0
<b>30 DAY DEATH</b>	1 (2%)	0	0	0	0
<b>30 DAY STROKE/DEATH</b>	4 (8%)	1 (2%)*	0†	0†	0†
<b>OVERALL COMPLICATION RATE</b>	9 (18%)	4 (8%)†	1 (2%)‡	1 (2%)‡	1 (2%)‡

\*P <.05 WHEN COMPARED TO GROUP 1

†P <.03 WHEN COMPARED TO GROUP 1

‡P < .01 WHEN COMPARED TO GROUP 1

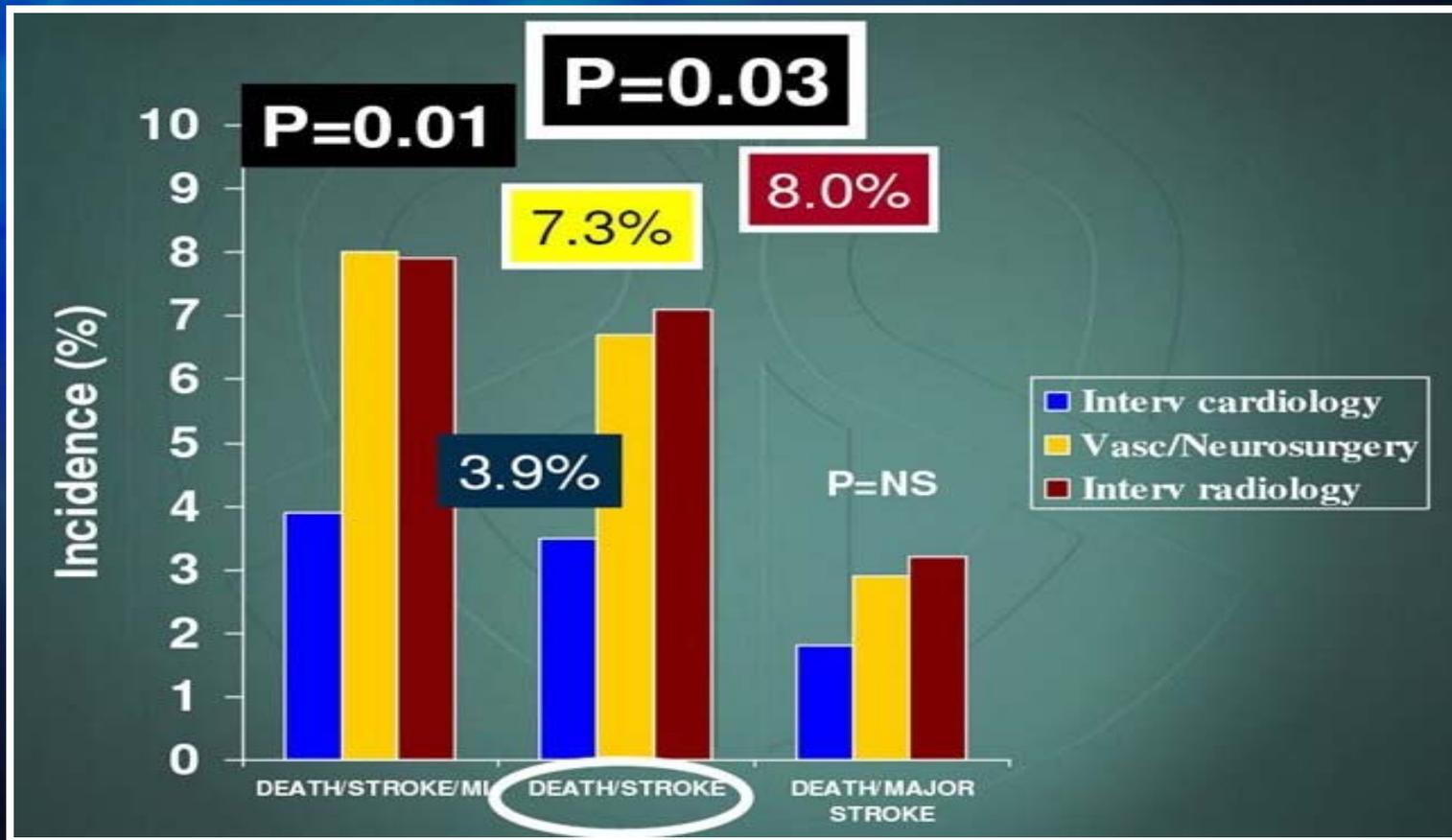
# C.A.S. CREST STUDY

LEAD - IN N= 1479

• <b>Cardiology</b>	<b>567(38%)</b>
• <b>Surgery</b>	<b>450(30%)</b>
• <b>Radiology</b>	<b>251(17%)</b>
• <b>Neuro-Radiology</b>	<b>136(9%)</b>
• <b>Neurology</b>	<b>11</b>
• <b>Unclassified</b>	<b>60</b>

# C.A.S. CREST STUDY

## TOTAL POPULATION 30 DAY EVENTS BY SPECIALITY



# **C.A.S. UNDER PROTECTION IN HIGH AND LOW RISK PATIENTS CONCLUSIONS**

- **C.A.S. WITH DISTAL EMBOLIC PROTECTION DEVICES HAS FAVORABLE LOW EVENT RATE**
- **C.A.S. HAS SIMILARLY GOOD OUTCOME IN H.R. AND L.R. PATIENTS**
- **A METICULOUS TECHNIQUE IS NEEDED AS WELL AS GOOD INDICATIONS ,GOOD PATIENT AND LESION SELECTION**
- **COMPARED TO H.R. PATIENTS, L.R. PATIENTS HAVE A TREND TOWARDS LOWER SHORT TERM MAJOR EVENT RATE, BUT THE DIFFERENCES DID NOT REACH STATISTICAL SIGNIFICANT**

# **C.A.S. UNDER PROTECTION IN HIGH AND LOW RISK PATIENTS CONCLUSIONS**

- **PROTECTION DEVICES ENLARGED THE INDICATIONS FOR C.A.S. AND SHOULD NOT BE LIMITED TO H.R. PATIENTS**
- **C.A.S. SHOULD BE OFFERED TO L.R. PATIENTS**
- **BETTER PROTECTION DEVICES WILL BE SOON ON THE MARKET**
- **C.A.S. UNDER PROTECTION IS BECOMING THE GOLD STANDARD TREATMENT**