



IX Congresso
Novas Fronteiras
em Medicina
Cardiovascular

22 a 24 de Fevereiro 2019

The Village Praia
D'El Rey - Óbidos

COMBINED CAROTID AND CARDIAC PROCEDURES

Luís Silvestre

STROKE AND CARDIAC SURGERY

MULTIFACTORIAL:

- Aortic arch atheroembolism
- Severe carotid disease
- Intracranial occlusive disease
- Embolism from the heart
- Peri-operative atrial fibrillation
- CPB-related air embolism
- Hemodynamic strokes (watershed infarcts)
- Hyperperfusion syndrome
- Hemorrhage

ATHEROEMBOLIC

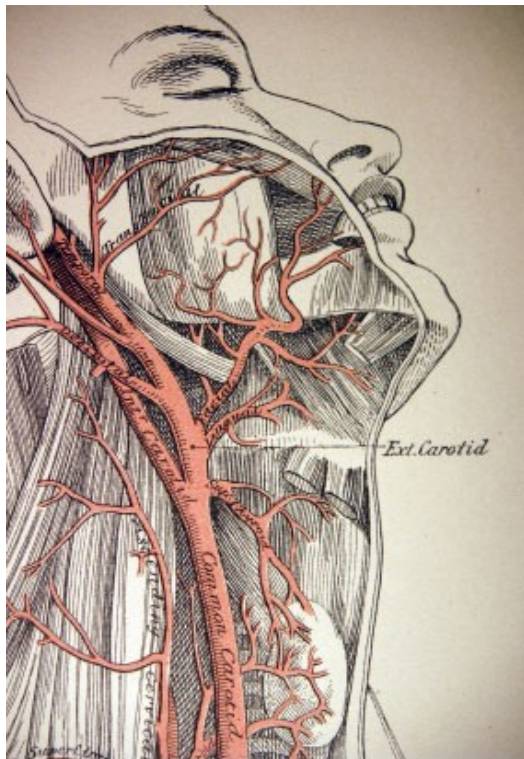
CARDIOEMBOLIC

HEMODYNAMIC

HEMORRHAGIC



CAROTID DISEASE



SYMPTOMS

- ❖ Symptomatic
- ❖ Asymptomatic

PATTERN OF CAROTID DISEASE

- ❖ >70% unilateral stenosis.
- ❖ >70% bilateral stenosis.
- ❖ >70% unilateral stenosis + contralateral occlusion.

STROKE RISK DURING CABG

SYMPTOMATIC PATIENTS

Table 2. Prevalence of preceding stroke/TIA and its association with stroke risk after CABG.

Reference	No with Preceding TIA/CVA	Peri-operative stroke risk	
		Preceding TIA/CVA	Neurologically asymptomatic
Tuman ⁵	88/2000	9/88	47/1912
Berens ⁹	138/1087	7/138	30/949
Roach ¹⁰	175/2108	18/175	48.1933
D'Agostino ¹⁵	171/1835	17/171	28/1664
Salasidis ¹⁹	28/387	0/28	24/387
Taylor ²⁶	11/453	4/11	7/442
Martin ⁴⁸	36.1669	0/36	13/1633
Adebo ⁹⁵	4/400	2/14	2/348
Overall risk	6.8%	8.5%	2.2%
95% CI	4.3–9.2%	4.9–12.0%	1.9–3.1%
Heterogeneity	<0.0001	0.2191	<0.0001

STROKE RISK DURING CABG

PATTERN OF CAROTID DISEASE

Table 9. **Risk of stroke** in duplex screened patients undergoing CABG (excluding those submitted to synchronous or staged (CEA).

Reference	Bilateral <50%	Unilateral 50–99%	Bilateral 50–99%	Occlusion + <50%	Occlusion + 50–99%	Bilateral occlusion	Symptom status
Schwartz ¹⁷	7/452	1/67	3/42	1/13	0/8	0/0	Asymp
Breslau ⁸⁰	1/84	0/10	0/6	0/1	0/1	0/0	Asymp + symp
Brener ²²	74/3894	3/49	0/10	4/29	1/5	1/3	Asymp
Total	82/4430	4/126	3/58	5/43	1/14	1/3	
Risk	1.8%	3.2%	5.2%	11.6%	7.1%	33%	
95% CI	1.4–2.2	0.0–6.5	0.0–10.8	2.1–21.2	0.0–19.7	—	
Heterogeneity	$p = 0.5551$	$p = 0.5057$	$p = 1.000$	$p = 1.000$	$p = 0.4286$	n/a	

Naylor et al. EJVES 2002;23:283-294

STROKE RISK DURING CABG

- ❖ Increased in patients with previous neurologic **SYMPTOMS**.
- ❖ Increased in patients with **CAROTID DISEASE**.
- ❖ Increases with the **SEVERITY** of carotid disease:
 - ❖ Ipsilateral stroke.
 - ❖ Any stroke.

STROKE RISK DURING CABG

ARGUMENTS IN FAVOUR OF SYNCHRONOUS SURGERY

- ❖ The incidence of neurologic complications increases according the severity of carotid disease: (Naylor- EJVES, 2003).

	STROKE RISK	PREVALENCE
No carotid disease:	2%	
Unilateral >50% stenosis:	3.2%	5.5
Bilateral >50% stenosis:	5.2%	2.2
Carotid occlusion:	7-12%	1.5

- ❖ There are observations suggesting improvement of cerebral hemodynamics after CEA with decreased stroke risk of CABG.
(Nakamura- Ann Thor Surg, 2008) (Van der Heyden- EJVES, 2010).

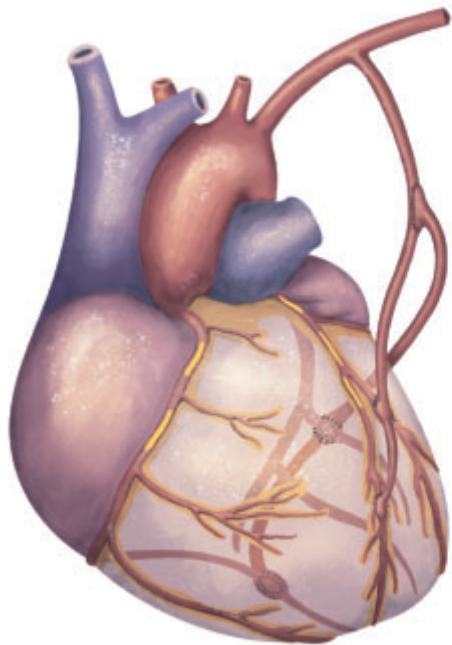
STROKE RISK DURING CABG

ARGUMENTS AGAINST SYNCHRONOUS SURGERY

- ❖ Low risk of stroke in patients with unilateral asymptomatic carotid stenosis (3-5%). (Castaldo- EJVES, 2010) (Naylor- EJVES, 2010)
- ❖ 50-60% of peri-operative strokes occur without evidence of carotid disease. (Naylor. EJVES 2002)
- ❖ At least 50% of neurologic events are not related to the ipsilateral carotid stenosis. (Naylor / EJVES, 2002)
- ❖ MRI studies suggest that most of peri-operative strokes occur in cerebral areas unrelated to the carotid stenosis. (Barbut- Ann Thorac Surg, 1998)



STROKE RISK DURING CABG



WHAT HAS CHANGED?

- ❖ Coronary revascularization without CPB.
- ❖ Coronary revascularization with IMA (without aortic clamping).



SYNCHRONOUS CARDIAC AND CAROTID REVASCULARIZATION

Eur J Vasc Endovasc Surg (2010) 40, 303–308



Synchronous Cardiac and Carotid Revascularisation: The Devil is in the Detail

A.R. Naylor*



Table 3 30-Day outcomes following synchronous carotid endarterectomy and cardiac surgery stratified for neurological symptom status and stenosis severity.

Parameter	n=	Death	Ipsilateral stroke	any stroke	Death/ipsilateral stroke	Death/any CVA
<i>Asymptomatic</i>						
Unilat 70–99% ^a	37	3 (8.1%)	0 (0.0%)	1 (2.7%)	3 (8.1%)	3 (8.1%)
Bilat 70–99%	29	1 (3.4%)	1 (3.4%)	1 (3.4%)	2 (6.9%)	2 (6.9%)
Occlusion + 70–99%	15	1 (6.7%)	0 (0.0%)	0 (0.0%)	1 (6.7%)	1 (6.7%)
<i>Prior stroke/TIA</i>						
Unilat 70–99%	27	1 (3.7%)	0 (0.0%)	0 (0.0%)	1 (3.7%)	1 (3.7%)
Bilat 70–99%	13	0 (0.0%)	0 (0.0%)	1 (9.7%)	0 (0.0%)	1 (9.7%)
Occlusion + 70–99%	11	1 (9.1%)	1 (9.1%)	1 (9.1%)	1 (9.1%)	1 (9.1%)

No statistical significance detected between any two categorical variables in this table using Fishers Exact Test.

^a After January 2004, no synchronous procedures were performed in patients with a unilateral, asymptomatic 70–99% stenosis.

(...) only one of these patients (1.3%) suffered a stroke in the hemisphere ipsilateral to the non-operated, contralateral stenosis (patient had a 90% stenosis pre-operatively).



TIMING OF CAROTID ENDARTERECTOMY

Short-term results of a randomized trial examining timing of carotid endarterectomy in patients with severe asymptomatic unilateral carotid stenosis undergoing coronary artery bypass grafting

Giulio Illuminati, MD,^a Jean-Baptiste Ricco, MD,^b Francesco Calio, MD,^a Maria Antonietta Pacile, MD,^a Fabio Miraldi, MD,^c Giacomo Frati, MD,^c Francesco Macrina, MD,^c and Michele Toscano, MD,^c *Rome, Italy; and Poitiers, France*

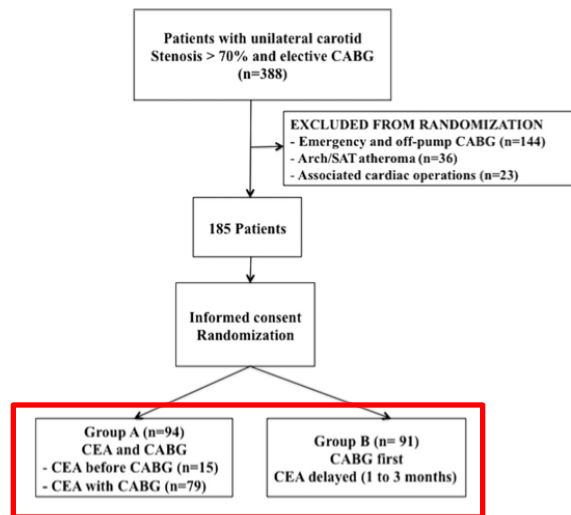


Fig. Flow chart of the study also shows the inclusion and exclusion criteria. CABG, Coronary artery bypass graft; CEA, carotid endarterectomy; SAT, supra-aortic trunks.

(J Vasc Surg 2011;54:993-9.)

CEA-CABG SYNC/(or
before)

Table II. Postoperative stroke, death, and cervical hematoma by univariate analysis

Variable	Group A n = 94 No. (%)	Group B n = 91 No. (%)	P
Operative mortality	1 (1.0)	1 (1.1)	.98
All strokes ^a	0 (0.0)	7 (7.7)	.008
90-day combined stroke/death ^b	1 (1.0)	8 (8.8)	.018
Post-op cervical hematoma	2 (2.1)	0 (0.0)	.16

^aRelative risk, 0.92 (95% confidence interval, 0.87-0.97); number needed to treat to avoid a stroke = 13.

^bRelative risk, 0.92 (95% confidence interval, 0.86-0.98), number needed to treat = 12.9.



EXTENT OF CEREBRAL ARTERY ATHEROSCLEROSIS

CLINICAL RESEARCH

Cardiac Surgery

Stroke Risk After Coronary Artery Bypass Graft Surgery and Extent of Cerebral Artery Atherosclerosis

Eun-Jae Lee, MD,* Kyoung-Hyo Choi, MD,
Seung-Whan Lee, MD,§ Seong-Wook Park,
Suk-Jung Choo, MD,|| Cheol-Hyun Chung,
Jong S. Kim, MD,* Sun U. Kwon, MD*

Seoul and Seongnam, South Korea

Objectives	We aimed to define the relationship between cerebral artery atherosclerosis and post-CABG stroke.
Background	Although cerebral artery atherosclerosis and carotid artery disease has been shown to be underlying post-CABG stroke risk factors, the extent of underlying post-CABG stroke remains unclear.
Methods	Pre-operative magnetic resonance angiography (MRA) of intracranial and extracranial cerebral arteries as determined by the number of stenotic lesions (within 14 days) were classified as follows: no atherosclerosis (0 lesions), mild atherosclerosis (1 lesion), moderate atherosclerosis (2 lesions), and severe atherosclerosis (3 or more lesions). Strokes caused by other mechanical factors (e.g., embolism, dissection, or aneurysm) were excluded. Intracranial atherosclerosis (ICA) was defined as atherosclerosis of the intracranial arteries, and extracranial atherosclerosis (ECA) was defined as atherosclerosis of the extracranial arteries. ICA and ECA were differentiated as follows: ICA = intracranial atherosclerosis; ECA = extracranial atherosclerosis.
Results	Stroke occurred in 33 patients (10.5%). The incidence of stroke was significantly higher in patients with moderate to severe ICA (odds ratio: 1.35; 95% confidence interval: 0.45-4.05) and constituted >40% of both ICA and ECA. Intracranial atherosclerosis was the most common type of atherosclerosis (59.8%) and constituted >40% of both ICA and ECA.
Conclusions	Cerebral atherosclerosis was closely related to post-CABG stroke. The extent of cerebral artery atherosclerosis, apart from the extracranial carotid artery, may be useful to predict the likelihood of post-CABG stroke.

Table 3

Association of Post-CABG Stroke With Types of Atherosclerotic Disease

	No Post-CABG Stroke (n = 1,334)	Post-CABG Stroke (n = 33)	p Value
ECCA disease	332 (24.9)	12 (36.4)	0.154
Extracranial cerebral atherosclerosis	595 (44.6)	21 (63.6)	0.034
Intracranial cerebral atherosclerosis	598 (44.8)	27 (81.8)	<0.001
Extracranial and/or intracranial cerebral atherosclerosis	864 (64.8)	30 (90.9)	0.001

Values are given as n (%).

CABG = coronary artery bypass grafting; ECCA = extracranial carotid artery.



SEVERE CAROTID DISEASE IN CARDIAC SURGERY PATIENTS

- ❖ Cause of ipsilateral stroke preventable by CEA?
- ❖ Predictive of global stroke risk (any stroke) / marker of increased atherosclerotic risk?
(aortic arch; intracranial; cardioembolic)

CHULN EXPERIENCE



DEPARTAMENTO
CORAÇÃO e VASOS

CENTRO HOSPITALAR
LISBOA NORTE, EPE

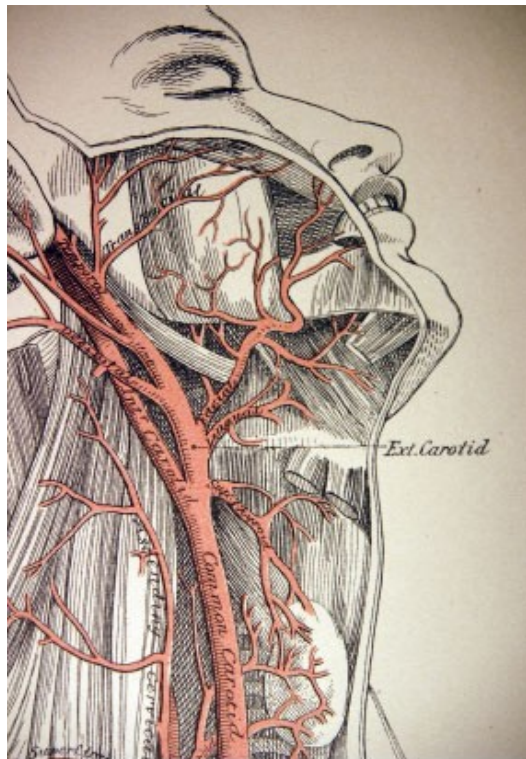


- ❖ 191 patients/ 191 synchronous procedures.
- ❖ Mean age: 71.3 yrs (52-85)
- ❖ Males: 71%
- ❖ Asymptomatic: 86.9%
- ❖ Symptomatic: 13.1%
 - Stroke- 19
 - TIA- 5
 - AF- 1
- ❖ Mean degree of stenosis: 86.8% (70-95%).



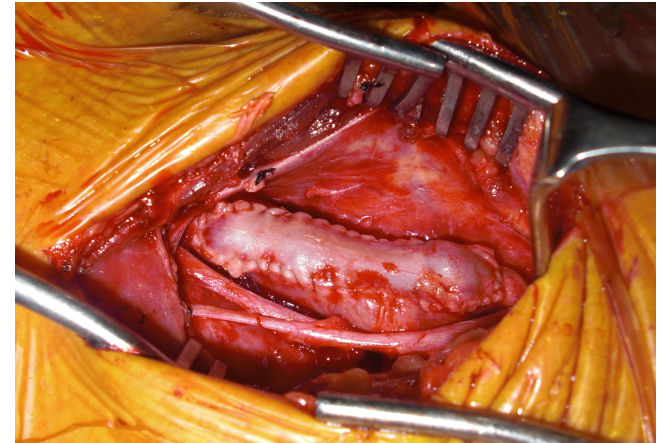
CAROTID DISEASE:

- ❖ Unilateral $>70\%$ (contralateral $<60\%$): **118 (61.7%)**
- ❖ Unilateral $>70\%$ + Contralateral 60-69%: **30 (15.7%)**
- ❖ Bilateral $>70\%$ stenosis: **33 (17.2%)**
- ❖ Unilateral $>70\%$ + Contralateral occlusion: **10 (5.2%)**



CAROTID PROCEDURE

- ❖ Immediately before sternotomy.
- ❖ Conventional CEA: **96.3%**
 - Venous patch : 93.7%*
 - Dacron patch: 2.1%*
- ❖ Eversion CEA: **2.6%**
- ❖ Venous graft interposition: **0.5%**
- ❖ Ascending Aorta-carotid bypass graft: **0.5%**
- ❖ Mean stump pressure: **59 mmHg (20-112)**
- ❖ Shunt: **31.9%** (Javid or Pruitt-Inahara / stump pressure < 50 mmHg)
- ❖ Immediate closure of cervicotomy: **99.4%**

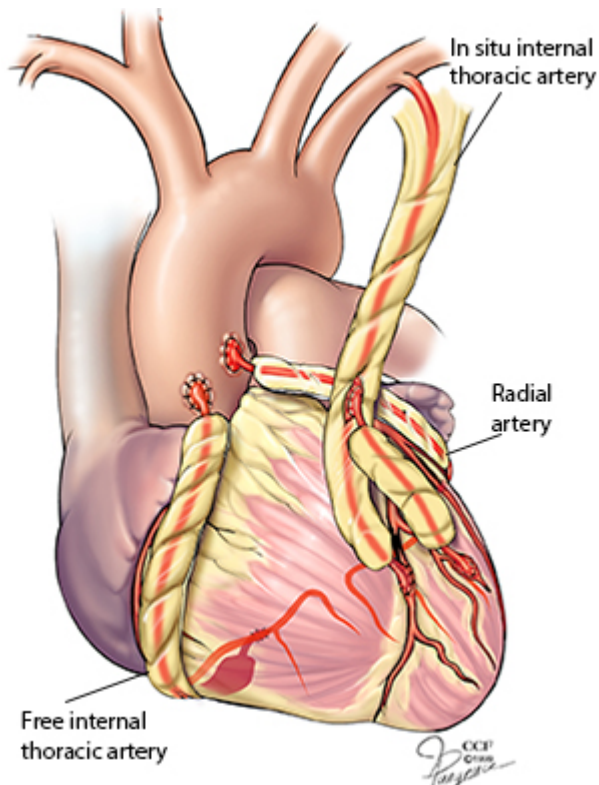




CHULN EXPERIENCE

CARDIAC PROCEDURE

- ❖ CABG: **67%**
- ❖ CABG + LV aneurysmectomy: **1.0%**
- ❖ CABG + valvular replacement: **16.3%**
- ❖ Isolated valvular replacement: **15.2%**
- ❖ CABG + mixoma resection: **0.5%**

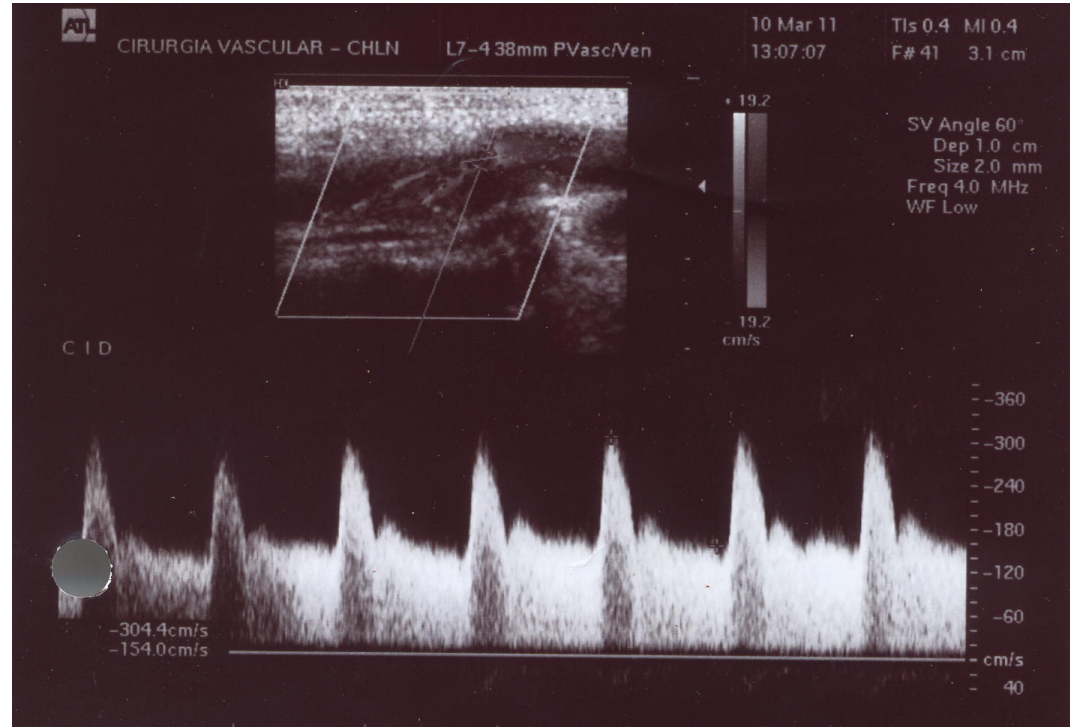


CPB: 38.8%

OFF-PUMP: 61.2%

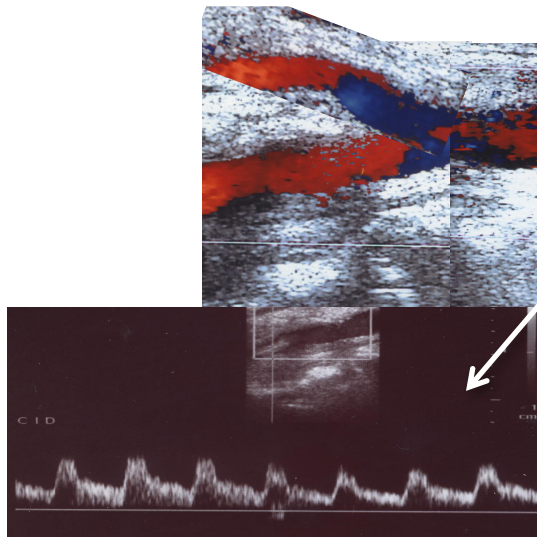
CHULN EXPERIENCE

- ❖ Male, 76 yrs.
- ❖ Asymptomatic.
- ❖ EUROSCORE- 15.3
- ❖ Right ICA: 95%
- ❖ Left ICA: 70%
- ❖ Right CEA + Off-pump CABG.



1 day PO:

Major stroke/right ICA t



ENCE





CHULN EXPERIENCE – RESULTS

Table 2: 30-day outcomes.

	<i>n</i>	<i>30-day Mortality</i>	<i>Ipsilateral stroke</i>	<i>Any stroke</i>	<i>Death + Ipsilateral stroke</i>	<i>Death + Any stroke</i>
		<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>
All patients	191	12 (6.2)	1 (0.5)	5 (2.6)	13 (4.4)	15 (7.8)
Male	137	7 (5.1)	1 (0.7)	5 (3.6)	8 (5.8)	10 (7.2)
Female	54	5 (9.2)	0	0	5 (9.2)	5 (9.0)
Symptomatic	25	1 (0.4)	1 (4.0)	2 (8.0)	2 (8.0)	3 (12)
Asymptomatic	166	11 (6.6)	0	3 (1.8)	11 (6.6)	12 (7.2)
Carotid disease:						
Unilateral >70%*	118	8 (6.8)	0	2 (1.6)	8 (6.8)	10 (8.4)
Unilateral >70% + Controlateral 60-69%	30	1 (6.7)	0	1 (3.3)	1 (6.7)	1 (3.3)
Bilateral >70%	33	2 (6.0)	1 (3.0)	1 (3.0)	3 (9.0)	3 (9.0)
Unilateral >70% + Controlateral occlusion	10	1 (10.0)	0	1 (10.0)	1 (10.0)	1 (10)
Cardiac procedure:						
CABG	130	11 (8.4)	1 (0.7)	4 (3.0)	12 (9.2)	14 (10.7)
CABG+ventricular aneurysmectomy	1	0	0	0	0	0
CABG+ valvular replacement	34	0	0	0	1 (2.9)	1 (2.9)
Isolated valvular replacement	25	1 (4.0)	0	1 (4.0)	0	0
CABG+Mixoma resection	1	0	0	0	0	0
CPB**	74	3 (4.0)	0	1 (1.3)	0	0
Offpump	117	9 (7.7)	1 (0.8)	4 (3.4)	0	0

* Controlateral stenosis <60%.

** Cardiopulmonary bypass.



CHULN EXPERIENCE – RESULTS

Risk factors and outcome in European cardiac surgery: analysis of the EuroSCORE multinational database of 19030 patients[☆]

F. Roques*, S.A.M. Nashef, P. Michel, E. Gauducheau, C. de Vincentiis, E. Baudet, J. Cortina, M. David, A. Faichney, F. Gabrielle, E. Gams, A. Harjula, M.T. Jones, P. Pinna Pintor, R. Salamon, L. Thulin

Service de chirurgie cardiovasculaire, CHU de Fort de France, 97200 Martinique, France
Received 22 September 1998; received in revised form 8 March 1999; accepted 11 March 1999



What does **EuroSCORE** mean?

It stands for **E**uropean **S**ystem for **C**ardiac **O**perative **R**isk **E**valuation. You can read about it in [here in the literature](#), and use it [here in our multi-lingual online calculator](#).

- ☐ ***Patient-related factors***
- ☐ ***Cardiac-related factors***
- ☐ ***Operation-related factors***

MEAN EUROSORE IN PRESENT SERIES

MORTALITY: 19.53%

SURVIVERS: 9.93%

CHULN EXPERIENCE – RESULTS

RESULTS OF CARDIOTHORACIC DEPARTMENT (HOSPITAL SANTA MARIA)

Table 4: Comparison of mortality and all-stroke rate of synchronous CEA-cardiac surgery with historic controls from the same Cardiac Surgery Department.

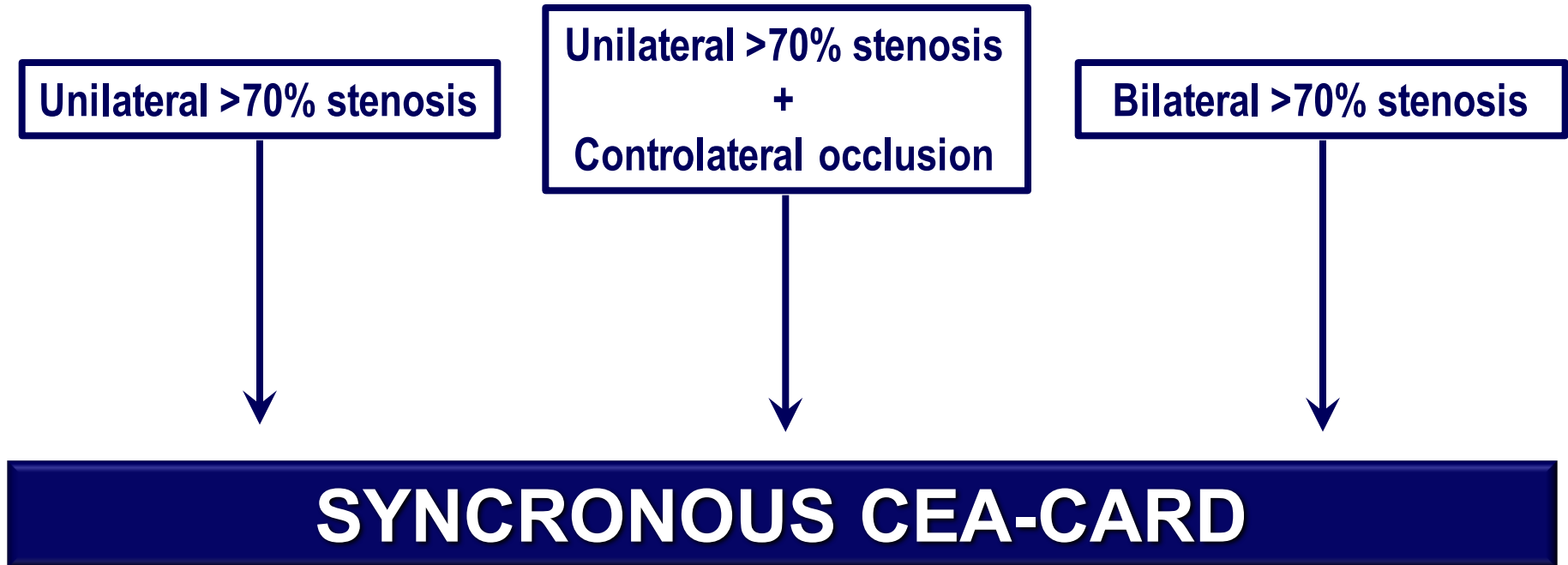
	CABG 2005-2006		CABG 2009	CABG 2012-2014	SYNCHRONOUS CEA-CARDIAC SURGERY 2004-2011
	CPB* N=252	OFF-PUMP N=500	OFF-PUMP N=190		N=191
Mortality (%)	4.4	2	4.2	< 2	6.2
Stroke (%)	2.8	1.2	1.1	< 1	2.6

* Cardiopulmonary bypass.

CONCLUSIONS

- ❖ In the present experience the synchronous CEA-cardiac surgery strategy was associated to a very low risk of ipsilateral peri-operative stroke.
- ❖ This approach did not seem to have a positive impact on the global risk of stroke or mortality, despite the low ipsilateral stroke risk.
- ❖ This is in accordance with recent observations suggesting that carotid disease is a marker of increased atherosclerotic risk.

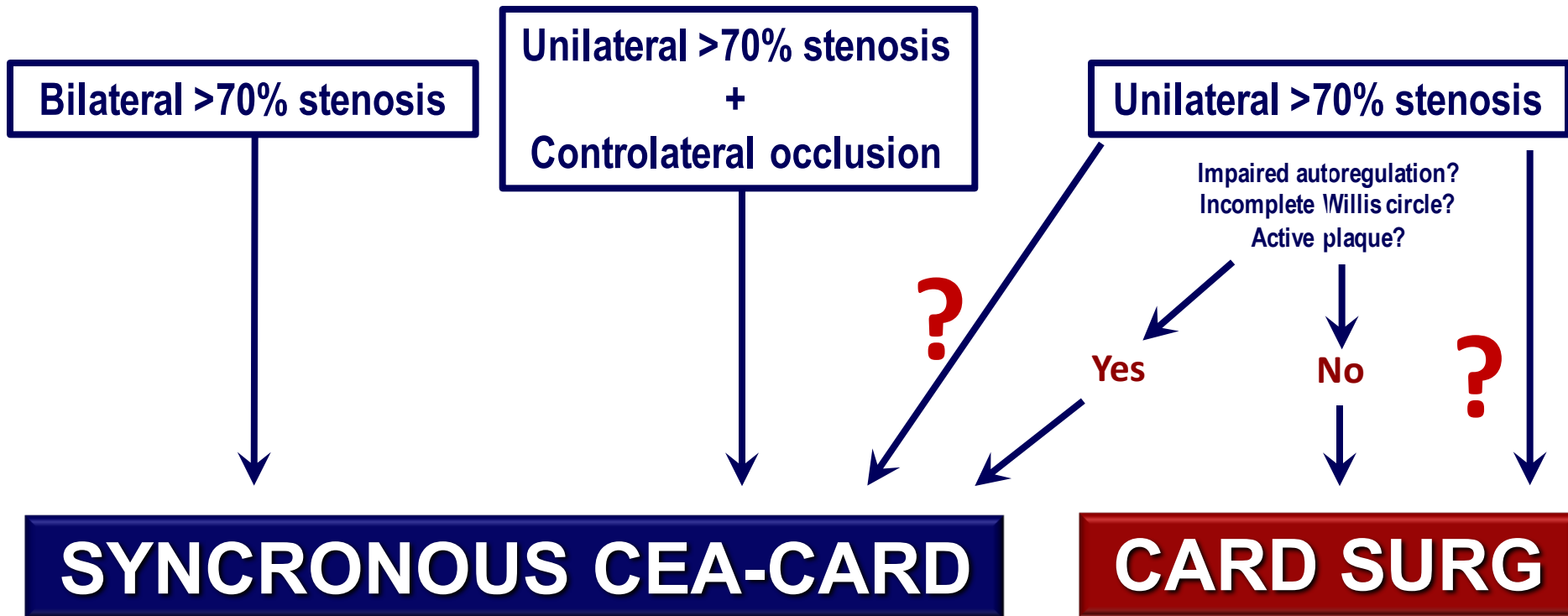
SYMPTOMATIC CAROTID DISEASE





SYNCHRONOUS CARDIAC AND CAROTID REVASCULARIZATION

ASYMPTOMATIC CAROTID DISEASE



SYMPTOMATIC

In patients scheduled for CABG, with recent (<6 months) history of TIA/stroke:

- Carotid revascularization should be considered in patients with 50 - 99% carotid stenosis.^{319,320}
- Carotid revascularization with CEA should be considered as first choice in patients with 50 - 99% carotid stenosis.^{319,320}
- Carotid revascularization is not recommended in patients with carotid stenosis <50%.

IIa

B

IIa

B

III

C

ASYMPTOMATIC

In neurologically asymptomatic patients scheduled for CABG:

- Carotid revascularization may be considered in patients with bilateral 70 - 99% carotid stenosis or 70 - 99% carotid stenosis and contralateral occlusion.
- Carotid revascularization may be considered in patients with a 70 - 99% carotid stenosis, in the presence of one or more characteristics that may be associated with an increased risk of ipsilateral stroke,^c in order to reduce stroke risk beyond the perioperative period.
- Routine prophylactic carotid revascularization in patients with a 70 - 99% carotid stenosis is not recommended.

IIb

C

IIb

C

III

C