



**Divisione di Chirurgia Vascolare
Ospedale S. Chiara, Trento**

**INTERVENTO DI
RICOSTRUZIONE
CAROTIDEA PRIMA
DEL BYPASS
CORONARICO**

**TRATTAMENTO
DELLE PATOLOGIE
VASCOLARI
SOPRA-AORTICHE:
NUOVE STRATEGIE**

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Bolzano, 20 aprile 2013



CEA before CABG

1.4-3.8%: incidence of post-operative stroke after CABG

Increased risk with age {

- 1-1.5% : 50-60 years**
- 2-3% : 60-70 years**
- 4-7% : 70-80 years**
- 8-9% : > 80 years**

Ascher E et al., Ann Vasc Surg 2001; Brown et al., Ann Thorac Surg 2008;
Naylor et al., Eur J Vasc Surg 2011; Hillis LD et al., Circulation 2011



CEA before CABG

**22% OF PATIENTS UNDERGOING CABG HAVE
> 50% CAROTID STENOSIS**

**12% OF PATIENTS UNDERGOING CABG HAVE
> 80% CAROTID STENOSIS**

Venkatachalam S et al., Ann Vasc Surg 2012; Naylor et al., Eur J Vasc Surg 2011



CEA before CABG

SIGNIFICANT PREDICTIVE FACTORS FOR POST-CABG STROKE:

- **Prior stroke/TIA (OR 3.6)**
- **Severe carotid stenosis/occlusion (OR 4.3)**



CEA before CABG

SIGNIFICANT PREDICTIVE FACTORS FOR POST-CABG STROKE:

	STROKE RISK
▪ Asymptomatic - unilateral 50-99% stenosis	3 %
▪ Asymptomatic - bilateral 50-99% stenosis	5 %
▪ Severe stenosis + carotid occlusion	7-11 %



CEA before CABG

THERAPEUTIC STRATEGIES

“ the management of carotid arterial stenosis in patients candidates for CABG remains controversial ”



CEA before CABG

THERAPEUTIC STRATEGIES: ?

- CABG alone
- Staged CEA and CABG
- Synchronous CEA and CABG
- Staged/Synchronous CAS



LITERATURE REVIEW

REVIEW

A Systematic Review of Outcomes Following Staged and Synchronous Carotid Endarterectomy and Coronary Artery Bypass

A. R. Naylor¹, R. L. Cuffe², P. M. Rothwell² and P. R. F. Bell¹

¹Department of Vascular Surgery at Leicester Royal Infirmary and ²University, Department of Clinical Neurology, The Radcliffe Infirmary, Oxford

YEARS 1972-2002

97 STUDIES

8972 PTS

Table 2. Peri-operative outcomes for synchronous and staged CEA – CABG. *

	Operative mortality	Ipsilateral stroke	Any stroke	Myocardial infarction	Death ± Ipsilat CVA	Death ± any CVA	Death ± any CVA ± MI
Synchronous CEA + CABG							
Observed risk	359/7753	167/5643	233/7206	173/4800	413/5563	635/7260	513/4463
Risk %	4.6	3.0	4.6	3.6	7.4	8.7	11.5
95% CI	4.1–5.2	2.4–3.5	3.9–5.4	3.0–4.2	6.5–8.3	7.7–9.8	10.1–12.9
Heterogeneity (p)	0.0048	0.0002	<0.0001	0.0174	0.0001	<0.0001	<0.0001
Staged CEA – CABG							
Observed risk	36/917	20/809	25/917	33/817	39/809	56/917	72/809
Risk %	3.9	2.5	2.7	6.5	4.8	6.1	10.2
(95% CI)	1.1–6.7	1.3–3.6	1.6–3.9	3.2–9.7	2.8–6.8	2.9–9.3	7.4–13.1
Heterogeneity (p)	<0.0001	<0.0001	<0.0001	0.9968	<0.0001	<0.0001	<0.0001
Staged CABG – CEA							
Observed risk	6/302	5/87	19/302	2/221	3/87	22/302	11/221
Risk %	2.0	5.8	6.3	0.9	3.4	7.3	5.0
(95% CI)	0.0–6.1	0.0–14.3	1.0–11.7	0.5–1.4	0.0–9.80	1.7–12.9	0.0–10.6
Heterogeneity	<0.0001	0.2190	0.1784	<0.0001	0.0060	<0.0001	0.0102

* Some papers did not provide all of this information and hence the denominator will not be the same as the total number of patients in the meta-analysis.

LITERATURE REVIEW

Basic Data Underlying Clinical Decision-Making in Endovascular Therapy

Open and Endovascular Management of Concomitant Severe Carotid and Coronary Artery Disease: Tabular Review of the Literature

Sridhar Venkatachalam,¹ Bruce H. Gray,² and Mehdi H. Shishehbor,³ Cleveland, Ohio, and Greenville, South Carolina

Venkatacham S et al.;
Ann Vasc Surg 2012

Table V. Combined CEA-CABG: early outcomes

Variable	n	% (range)	References
Operative death	547/11,854	5 (0-14)	1-96
Cardiac	126/4,615	3 (0-10)	1-3, 5, 7-10, 11-14, 16, 17, 20, 22-25, 27, 29, 30, 34-38, 54, 57, 59, 61, 64, 72, 73, 75, 76, 79-82, 84, 85, 87, 88, 91
Neurological	37/4,353	1 (0-5)	3, 5, 9, 10, 12, 13, 16, 17, 20, 23, 25-27, 29, 30, 33-38, 54, 56, 59, 63, 64, 71, 73, 75, 78, 81, 82, 84, 85, 91
Ipsilateral stroke/TIA/RIND	136/3,852	4 (0-11)	2, 5, 7, 10, 11, 12, 17, 19, 22, 25, 26, 28, 29, 30, 32, 33, 42-44, 46, 49, 50, 51, 53, 57, 74, 75, 62, 76, 80
<u>Anv stroke</u>	<u>380/10,243</u>	<u>4 (0-18)</u>	<u>1-17, 19-35, 37-42, 44, 46-51, 53-71, 73-77, 79-81, 83, 85, 86, 90, 92-94, 96</u>
Any TIA/RIND	173/6,841	3 (0-13)	1-5, 7, 11, 13-16, 18, 19, 21, 23, 24, 26, 30, 33, 37-39, 41, 42, 44, 46, 47, 50-52, 54, 55, 57, 58, 62, 64, 66-68, 70, 73-78, 82-84, 86, 88
<u>MI</u>	<u>187/7,027</u>	<u>3 (0-13)</u>	<u>1-4, 8-10, 12, 13, 16-20, 21, 23, 26-31, 33, 36-43, 46, 47, 50, 51, 55, 57, 58, 60, 62, 63, 65-70, 73-79, 82, 84, 85, 88, 93, 96</u>
Death + any stroke ^a	840/10,243	8 (0-26)	1-17, 19-35, 37-42, 44, 46-51, 53-71, 73-77, 79-81, 83, 85, 86, 90, 92-94, 96
<u>Death + any stroke + MI^a</u>	<u>675/6,476</u>	<u>10 (0-32)</u>	<u>1-4, 8-10, 12, 13, 16-21, 23, 26-31, 33, 34, 37-42, 46, 47, 50, 51, 55, 57, 58, 60, 62, 63, 65-70, 73-77, 79, 85, 93, 96</u>
Mean postoperative ICU length of stay (days)		3 (1-5)	33, 41, 44, 47, 48, 52, 58, 61, 66, 70
Mean postoperative hospital length of stay (days)		11 (5-22)	3, 4, 7, 10, 13, 16, 23, 25, 28, 30, 40, 48, 50, 52, 58, 60, 61, 66, 69, 70, 74

ICU, intensive care unit.

^aCalculated sum of outcomes taken independently.

Table XIII. Staged CEA followed by CABG: overall early outcomes (CEA and CABG)

Variable	n	% (range)	References
Overall death	36/919	4 (0-33)	5, 8, 12, 18, 29, 34, 41, 59, 70, 71, 78, 84-86, 92, 97-99
Overall stroke (any)	23/933	2 (0-8)	5, 8, 12, 18, 29, 34, 41, 59, 70, 71, 84-86, 78, 92, 96-99
<u>Overall MI</u>	<u>59/933</u>	<u>6 (0-29)</u>	<u>5, 8, 12, 18, 29, 34, 41, 59, 70, 71, 84-86, 78, 92, 96-99</u>
Death + any stroke ^a	59/919	6 (0-40)	5, 8, 12, 18, 29, 34, 41, 59, 70, 71, 78, 84-86, 92, 97-99
<u>Death + any stroke + MI^a</u>	<u>117/919</u>	<u>13 (0-60)</u>	<u>5, 8, 12, 18, 29, 34, 41, 59, 70, 71, 78, 84-86, 92, 97-99</u>

^aCalculated sum of overall outcomes taken independently.



GUIDELINES 2004

© 2004 by the American College of Cardiology Foundation and the American Heart Association, Inc.

ACC/AHA PRACTICE GUIDELINES—FULL TEXT

ACC/AHA 2004 Guideline Update for Coronary Artery Bypass Graft Surgery

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1999 Guidelines for Coronary Artery Bypass Graft Surgery)

Developed in Collaboration With the American Association for Thoracic Surgery and the Society of Thoracic Surgeons

4.1.1.1.6. CAROTID DISEASE AND NEUROLOGICAL RISK REDUCTION.

Class IIa

1. Carotid endarterectomy is probably recommended before CABG or concomitant to CABG in patients with a symptomatic carotid stenosis or in asymptomatic patients with unilateral or bilateral internal carotid stenosis of 80% or more. (*Level of Evidence: C*)

Eagle KA et al.; Circulation 2004

GUIDELINES 2011

ACCF/AHA Practice Guideline

2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery

A Report of the American College of Cardiology Foundation/American Heart
Association Task Force on Practice Guidelines

*Developed in Collaboration With the American Association for Thoracic Surgery, Society of
Cardiovascular Anesthesiologists, and Society of Thoracic Surgeons*

Hillis LD et al.; Circulation 2011

Class IIa

1. Carotid artery duplex scanning is reasonable in selected patients who are considered to have high-risk features (ie, age >65 years, left main coronary stenosis, PAD, history of cerebrovascular disease [transient ischemic attack [TIA], stroke, etc.], hypertension, smoking, and diabetes mellitus).^{858,869} (*Level of Evidence: C*)
2. In the CABG patient with a previous TIA or stroke and a significant (50% to 99%) carotid artery stenosis, it is reasonable to consider carotid revascularization in conjunction with CABG. In such an individual, the sequence and timing (simultaneous or staged) of carotid intervention and CABG should be determined by the patient's relative magnitudes of cerebral and myocardial dysfunction. (*Level of Evidence: C*)

Class IIb

1. In the patient scheduled to undergo CABG who has no history of TIA or stroke, carotid revascularization may be considered in the presence of bilateral severe (70% to 99%) carotid stenoses or a unilateral severe carotid stenosis with a contralateral occlusion. (*Level of Evidence: C*)



GUIDELINES 2013

Practice Guidelines

2011 ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/SAIP/ SCAI/SIR/SNIS/SVM/SVS Guideline on the Management of Patients With Extracranial Carotid and Vertebral Artery Disease: Executive summary

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, and the American Stroke Association, American Association of Neuroscience Nurses, American Association of Neurological Surgeons, American College of Radiology, American Society of Neuroradiology, Congress of Neurological Surgeons, Society of Atherosclerosis Imaging and Prevention, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of NeuroInterventional Surgery, Society for Vascular Medicine, and Society for Vascular Surgery

Developed in Collaboration With the American Academy of Neurology and Society of Cardiovascular Computed Tomography

Brott TG et al.;
Cath and Cardiovasc Int 2013

16. RECOMMENDATIONS FOR CAROTID ARTERY EVALUATION AND REVASCULARIZATION BEFORE CARDIAC SURGERY

Class IIa

1. Carotid duplex ultrasound screening is reasonable before elective coronary artery bypass graft (CABG) surgery in patients older than 65 years of age and in those with left main coronary stenosis, PAD, a history of cigarette smoking, a history of stroke or TIA, or carotid bruit. (*Level of Evidence: C*)
2. Carotid revascularization by CEA or CAS with embolic protection before or concurrent with myocardial revascularization surgery is reasonable in patients with greater than 80% carotid stenosis who have experienced ipsilateral retinal or hemispheric cerebral ischemic symptoms within 6 months. (*Level of Evidence: C*)

Class IIb

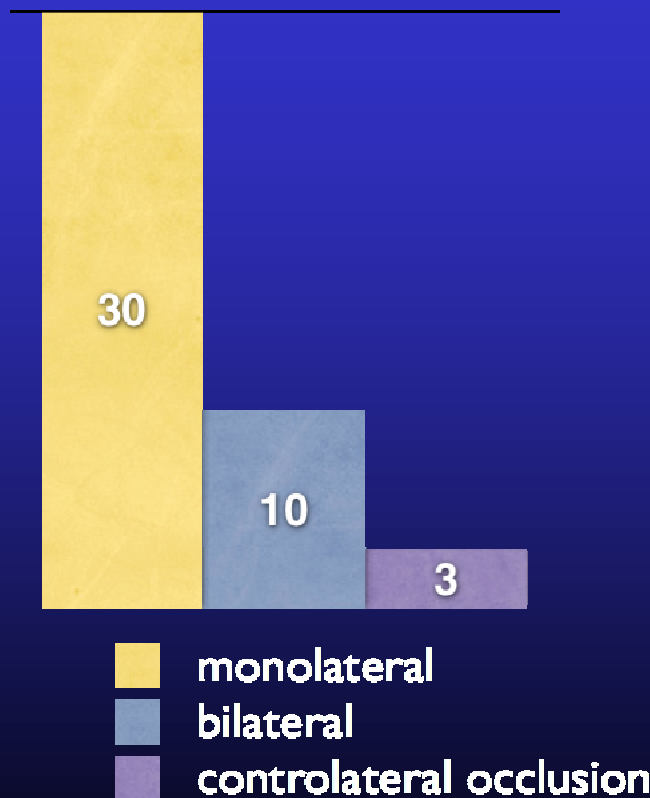
1. In patients with asymptomatic carotid stenosis, even if severe, the safety and efficacy of carotid revascularization before or concurrent with myocardial revascularization are not well established. (*Level of Evidence: C*)

PERSONAL EXPERIENCE

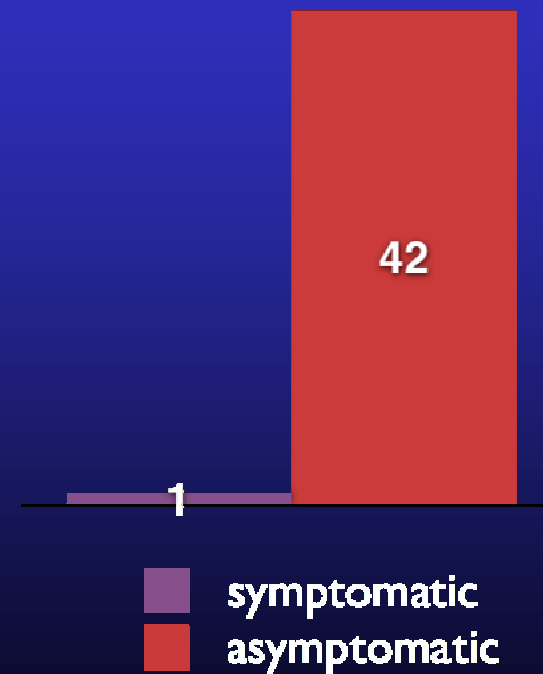
2003-12

43 pts (35 m - 8 f)

carotid stenosis > 70%

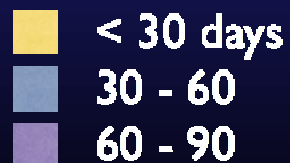
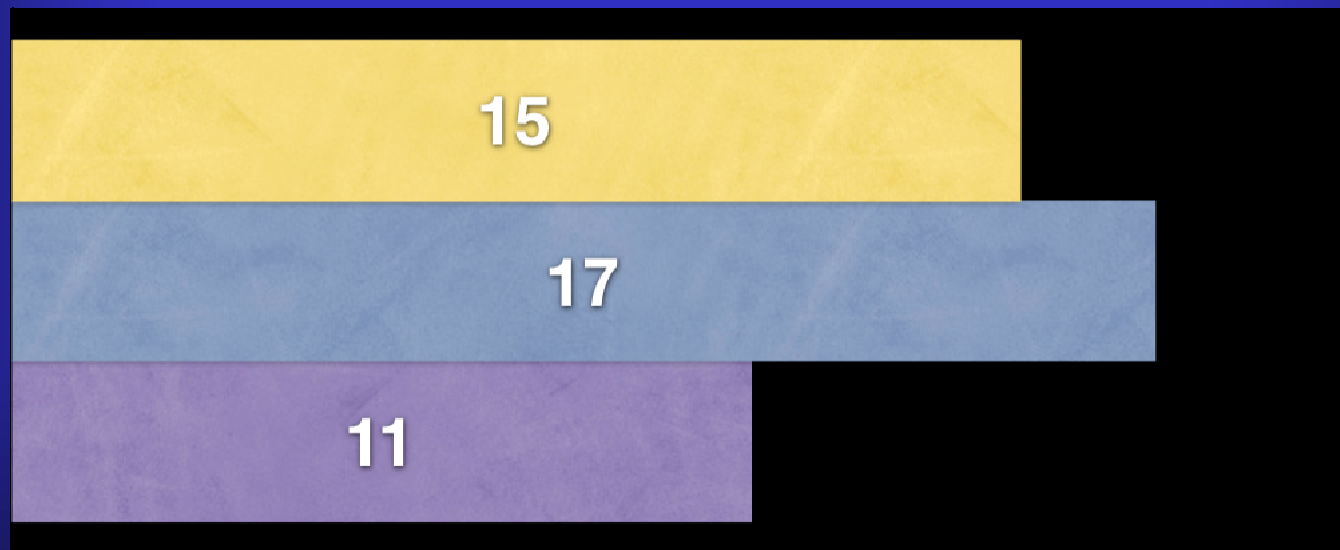


clinical presentation

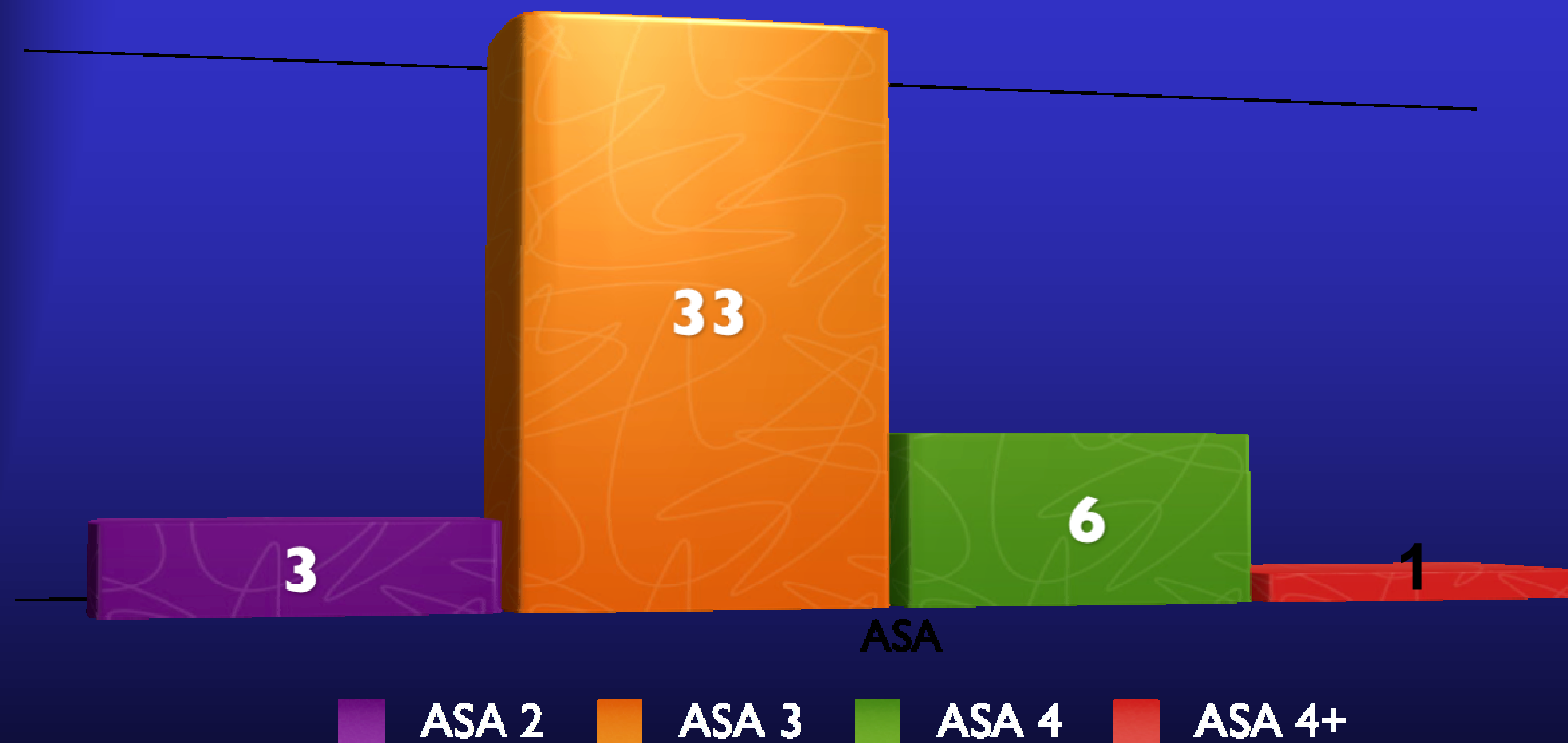


TIMING

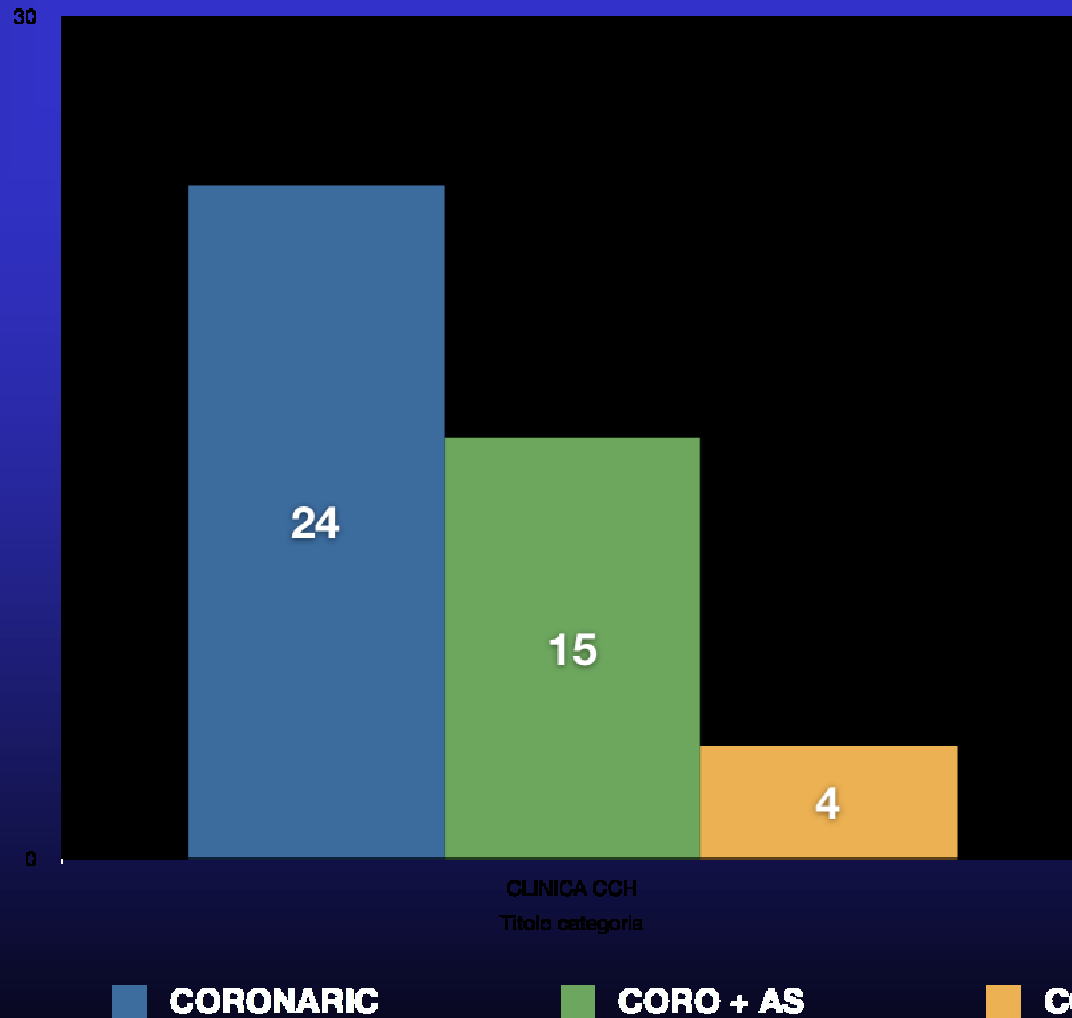
patient n° and interval between procedures



CEA : ASA CLASSIFICATION



CCH DISEASES



coronaric 24
mixed 19

VASCULAR PROCEDURES

- Preoperative Color Doppler & Angio TC
- Preoperative Cerebral MR or CT
- General anaesthesia and brain monitoring (TC Doppler – NIRS)
- Routine shunt (Pruitt)
- Eversion technique
- 24 h intensive care unit p.o. stay

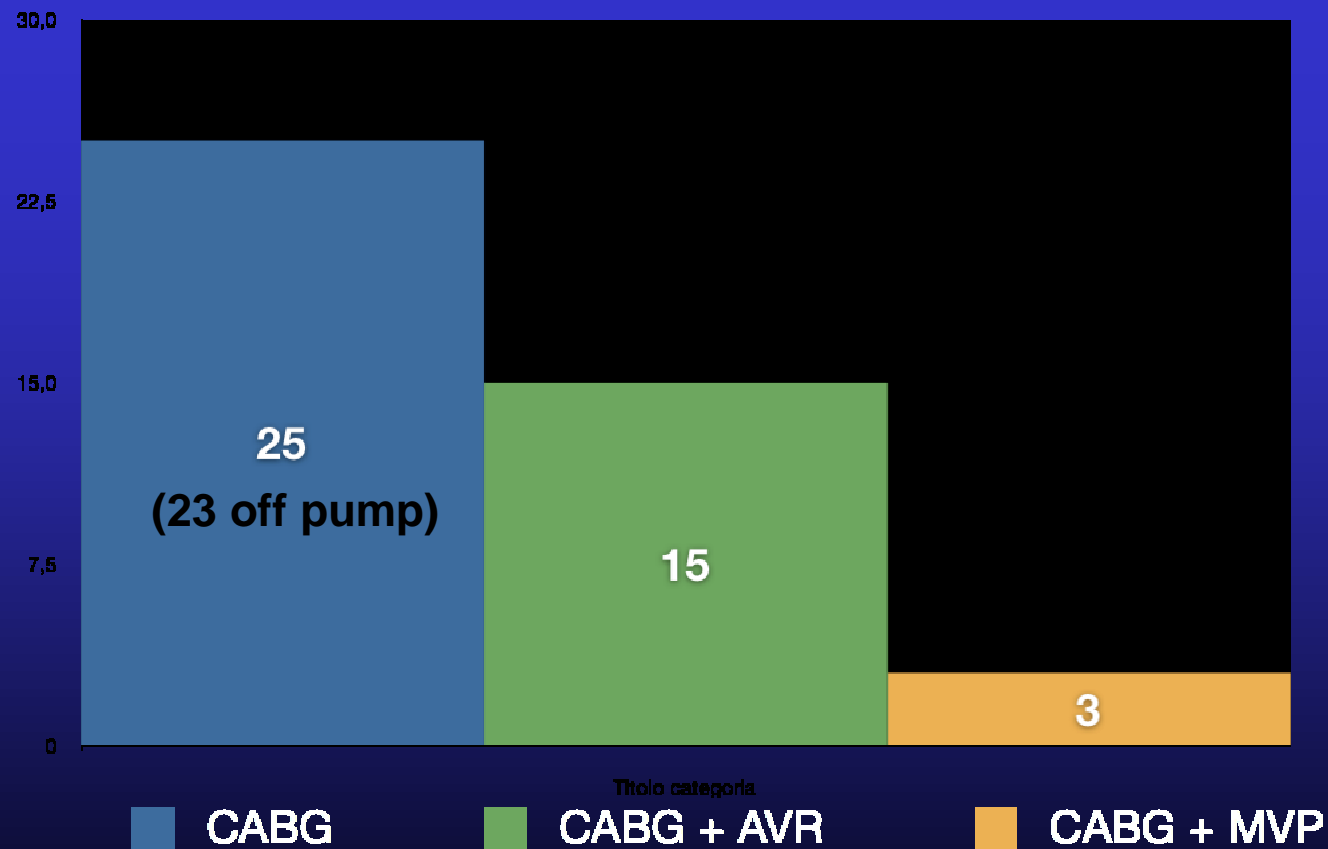
RESULTS post CEA

Stroke /TIA	0 %
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MI	0 %
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Mortality	0 %
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STAGED CCH PROCEDURES



RESULTS post CABG

- Stroke /TIA 0 %
- MI 0 %
- Mortality 0 %



CCH TECHNIQUE & RESULTS

1998-2012

2006 beating heart CABG patients

Elective cases 38.6 %

Urgent cases 56.6 %

Emergency cases 4.7 %

Redo 1.4 %

NEUROLOGICAL COMPLICATIONS

TIA 3 cases (0.15%)

STROKE 2 cases (0.1%)

OVERALL MORTALITY : 20 cases (1%)



CCH TECHNIQUE & RESULTS

2003-2012

137 over-80 years

Beating heart CABG

Previous TIA/STROKE 5 %

Carotid Disease 36%

CEA before CABG 15%

NEUROLOGICAL COMPLICATIONS

No TIA

No STROKE

OVERALL MORTALITY : 2.06%



CCH TECHNIQUE & RESULTS

OFF-PUMP CABG SURGERY

Standard stabilization with Octopus Device

Routine epi-aortic sonogram

**Double mammary graft or mammary and
sequential venous graft**

**No venous by-pass graft if significant aortic
disease**



STROKE & CABG

- Post CABG strokes occur in patients without significant carotid artery disease
- Only 30%-40% strokes could be prevented by prophylactic CEA



STROKE and CABG

The etiology of post CABG stroke is multifactorial:

- **Aortic arch disease**
- **Carotid artery disease**
- **Prolonged cardiopulmonary bypass**
- **Left main disease**
- **(ventricular thrombosis)**
- **(diabetes, smoking , endocarditis)**
- **(pulmonary disease)**



conclusions

- A single ideal revascularization strategy is unlikely to exist
- An individualized approach is mandatory
- Whenever possible, off-pump CABG and “no-touch” technique seems to be the therapeutic strategy of choice in patients with supraortic disease, both in synchronous and staged CEA + CABG procedures



conclusions

The rationale of CEA + CABG seems to be:

- Symptomatic carotid stenosis
- Asymptomatic bilateral severe stenosis or severe stenosis with contralateral occlusion
- Asymptomatic carotid stenosis in patients “at risk” or candidates to undergo on-pump CABG
- Evidence of “vulnerable plaque”



conclusions

The rationale of preventive CEA (over the CAS) seem to be:

- **The risk of general anaesthesia of CEA is low (only 6 MI or cardiac death over 2000 CEA)**
- **Embolic high risk of CAS by guidewire driving in the arch**
- **Antiplatelet treatment: uncertainties**