Is it Reasonable to Offer Carotid Endarterectomy(within the first 48 hours) After Stroke Symptoms Start:Under What Conditions and What Precautions

THE VASCULAR GROUP

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No Disclosures

I was on writing groups SVS Carotid Guidelines and Reviewer for ESVS Carotid Guidelines

EARLY CAROTID ENDARTERECTOMY *AFTER ACUTE STROKE*

- EXPERIENCE IN 228 PATIENTS OPERATED UPON WITHIN ONE MONTH OF ACUTE STROKE

JVS 2004; 39, 148-154 Paty, et al

EFFECT OF INFARCT SIZE ON POSTOPERATIVE STROKE EXACERBATION

- **With each 1 cm increase in diameter of the preoperative infarct, the odds of postoperative stroke exacerbation increase by a factor of 1.7**
- **(Odds Ratio 95% CI: 1.7 - 2.8 by logistic regression)**

FACTORS ASSOCIATED WITH IMPROVED OUTCOME

In patients with moderate stroke severity:

- **Smaller Infarct Size**
- **Use of Eversion Technique**

CEA Technique & Postoperative Neurologic Change

Type of CEA	Stroke Exacerbation	Any Neuro Deficit
Eversion (4/158)**	1.3% (2/158) *	2.5%
Standard (9/80)	6.2% (5/80)	11.2%

* $p < 0.05$, ** $p < 0.01$

Very Urgent Carotid Endarterectomy is Associated with an Increased Procedural Risk: The Carotid Alarm Study

Eur J Vasc Endovasc Surg September 2017Volume 54, Issue 3, Pages 278–286

- Two hundred and twenty nine (55%) procedures were carried out during office hours. For patients who underwent CEA within 48 hours of the qualifying event, the combined mortality and stroke rate for surgery done during office hours was 0% (0/38) versus 16.2% (6/37) for the patients treated during out of office hours (p = .012).
- Could it be Patient Selection or Surgeon Factors and not timing

Weekend Effect in Carotid Endarterectomy

O'Donnell,TF et al Stroke 2018;49:2945-52

Of 86,123 carotid endarterectomies (CEAs), 1562 were performed during the weekend: 0.7% of asymptomatic patients vs 3.1% of symptomatic patients. In both asymptomatic patients and patients presenting with stroke (but not transient ischemic attack [TIA]), weekend operations were associated with higher risk of stroke/death and prolonged length of hospital stay compared with patients who underwent CEA during the week.

Weekend CEA should be avoided in asymptomatic patients and symptomatic patients presenting with stroke, whereas expedited CEA on the weekend should be considered after TIA.

The real question

- How do we decide timing?
- Why are operations done "Off Hours"

And who is doing them?

- Is it Patient Condition, OR availability

Poor patient Selection, young Staff ??

Is it really the timing or is it surgeon comfort

48-HOUR AGGRESSIVE APPROACH TO SYMPTOMATIC CAROTID LESIONS IN PATIENTS WITH STABLE NEUROLOGIC EXAMS PROVIDES OPTIMAL RESULTS

Nicholas J. Russo M.D., M.S., RPVI

Casey Hladik MD., Jeffrey Hnath MD., R. Clement Darling III MD

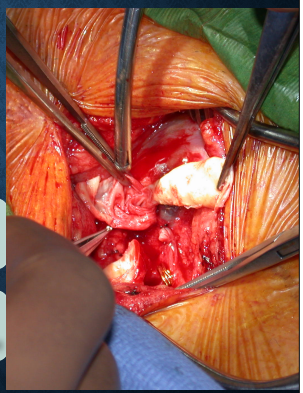
Albany Medical Center

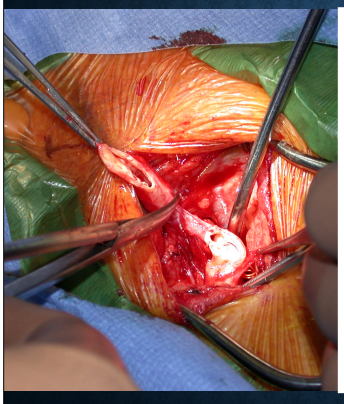
RESULTS

17, 357 total Carotid Endarterectomies performed during study time period.

4,362 total symptomatic Carotid Endarterectomies performed
- 1990 for CVA indication
- 2372 for TIA indication

3 Timing Groups evaluated
- CEA 1: Within 48 hours
- CEA 2: 72 hours – 30 days
- CEA 3: Greater than 30 days





RESULTS

- Mean Age was 70 years old
  - Range: 31-98 years old
- Demographics between CVA and TIA groups were similar when compared except for Hypertension being statistically higher in CVA patients (indicating homogenous group)
- Anesthesia Technique was similar between CVA and TIA
  - Greater than 80% of patient population underwent cervical regional block
- Standard surgical technique of Eversion Carotid Endarterectomy utilized.

RESULTS

Planned Shunt preoperatively – Statistically more likely to occur in CVA patients compared to TIA patients

- CVA – Planned Shunt
  - 249 (12.5%)
- TIA – Planned Shunt
  - 139 (5.8%)

Shunt on-demand

- CVA
  - 106 (5.3%)
- TIA
  - 98 (4.1%)

RESULTS – TIMING COMPARISON CVA INDICATION

Post-Op Outcomes	CEA 1 (within 48 hours)	CEA 2 (72 hours-30 days)	CEA 3 (>30 da
Stroke	3.4%	2.5%	2.1%
Mortality	0%	.8%	2.1%

RESULTS – TIMING COMPARISON TIA INDICATION

Post-Op Outcomes	CEA 1 (within 48 hours)	CEA 2 (72 hours-30 days)	CEA 3 (>
Stroke	1.1%	.8%	.9%
Mortality	.5%	.8%	0%

CONCLUSION

Stable or improving stroke exams on patients with small strokes or symptoms of TIA can likely be operated upon safely and provide good outcomes

Patients with improved neurologic exams after 48 hours may benefit from carotid revascularization earlier than previously thought

Senior level support in carotid surgery may play a large role in supporting overall good outcomes

Potential increase in mortality in patients undergoing CEA after 30 or more days for an indication of stroke

The Albany Vascular Group
Our Current Approach

- If a patient has a small, stable stroke with Carotid stenosis > 50% we will perform CEA within 48 hours

However, if it is later in the week, it may be 72 hours for logistic reasons

Is the 48 hour timing truly arbitrary and best results will occur as long as the CEA is done expeditiously by trained staff ?

Conclusion

- All stroke patients are at increased risk for recurrent event
- However , it is safe to perform CEA within 48 hours in patients with small stable strokes in experienced hands
- Optimal results will occur with a multidisciplinary specialty trained staff
- Good BP control is Mandatory
- It's the System as much as the timing

THANK YOU!

THE VASCULAR GROUP

Acute Stroke and Ipsilateral Carotid Disease
STRATEGIES

- Very Emergent Treatment (CEA < 48 hours)
- **Immediate Treatment < 1 week**
- **Intermediate Treatment 2-4 weeks**
- **Delayed Treatment – 4 to 6 weeks**

CEA for Acute Stroke
Case for Early intervention

- Up to 20 % of Stroke patients have had TIA
- Up to 40% of these TIA's occur within one week of stroke
- Delay of Intervention (6weeks) 20 % of patients will have a second major event

Bazan et al JVS June2015 1-10
Coull et al BJM 2004;328:6
Naylor AR JVS 2008;48:1059-9

CEA for Acute Stroke
Case for Early intervention
Pathophysiology

Overlying plaque in 66% early (< 4 weeks), 21% After

Disrupted Plaques lined with thrombus seen in early (< 7 days) intervention

Naylor & Abu Rahama JVS 2015;61:1642-51
Johanson et al Int J Stroke 2013;8:220-7
Liapis et al Eur J Vasc Endovasc Surg 2009;37:1-19

Methods
Preoperative Algorithm

Evaluation By Stroke Neurologist

↓

CT/MRI Perfusion scan of Brain

↓

Duplex/Angiogram of Carotid Artery

↓

Carotid Endarterectomy after plateau of symptoms

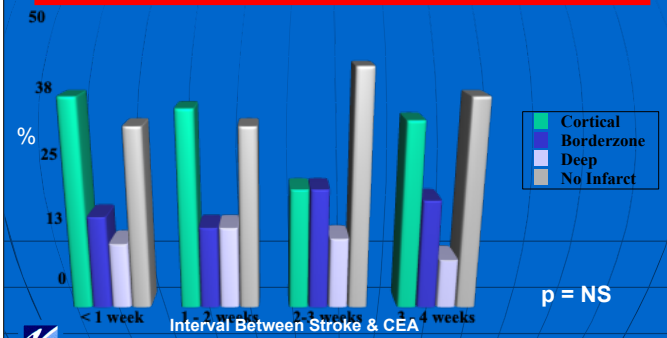
Methods
Exclusion Criteria

- **Hemorrhagic Stroke**
- **Profound Neurologic Deficit**
  - ❖ **Dense Hemiparesis**
  - ❖ **Obtundation**

Acute Stroke
Predictors of Outcome

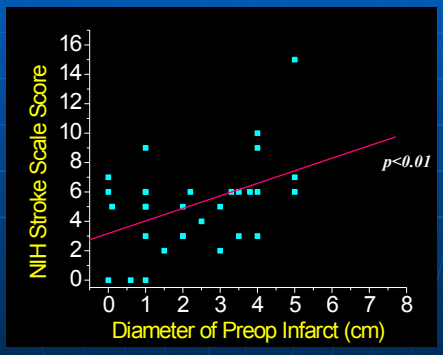
- Clinical Status – NIH Stroke Scale
- Infarct Characteristics
- Time to Surgical / Intervention

Preoperative Infarct
Location/Depth (NASCET)



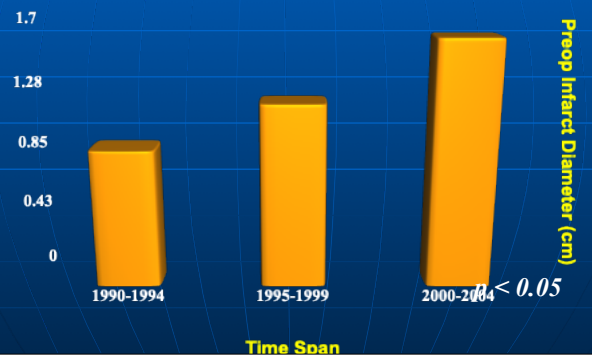
CT/MRI available for review in 74% (176/238)

NIH STROKE SCALE SCORE vs. INFARCT SIZE



Depth and location of infarct did not correlate with NIHSS Score

PREOPERATIVE INFARCT SIZE



Very Urgent Carotid Endarterectomy is Associated with an Increased Procedural Risk: The Carotid Alarm Study

Eur J Vasc Endovasc Surg September 2017Volume 54, Issue 3, Pages 278–286

- Patients undergoing CEA within 48 hours had a significantly higher risk of the combined endpoint of mortality and/or any stroke compared with the group treated 48 hours–14 days after the qualifying event; 8.0% versus 2.9% (OR 2.90, 95%CI 1.02–8.23; *p* = .049).
- But why ?
- Thrombosis was a more frequent cause of procedural ipsilateral ischaemic stroke. Given the relatively low proportion of patients with dual antiplatelet treatment in the present study, it may be speculated that some of the ipsilateral strokes could have been avoided with a more aggressive pre-operative medical therapy

Procedural Risk Following Carotid Endarterectomy in the Hyperacute Period after Onset of Symptoms

Eur J Vasc Endovasc Surg November 2013Volume 46, Issue 5, Pages 519–524

- Forty-one patients (9%) underwent surgery <48 hours of their most recent event, with a 30-day death/stroke rate of 2.4% (1/41). The procedural risk was 1.8% in 167 patients who underwent surgery within 3–7 days (3/167), falling to 0.8% in 133 patients who underwent surgery between 8 and 14 days (1/133) and 0.8% in 134 patients whose surgery took place after >14 days had elapsed (1/134). There was no evidence of any systematic differences in procedural risk by operating in the hyperacute period relating to mode of presentation (TIA, stroke, amaurosis) or age (<80 years; >80 years).

Procedural Risk Following Carotid Endarterectomy in the Hyperacute Period after Onset of Symptoms

Eur J Vasc Endovasc Surg November 2013Volume 46, Issue 5, Pages 519–524

- In summary; this audit has found no evidence that the procedural risk increases when CEA is performed in the hyperacute period after a recent TIA or non-disabling stroke, including when performed in elderly patients

Optimal Results Will Occur with a Multidisciplinary Group

- Vascular Surgeons
- Trained Stroke Neurologists
- Aggressive Neuro-Interventionalists
- Neuro ICU/Step down units
- Trained Neuro/Vascular Nurses
- Impeccable blood pressure control post operatively

Thesis: Is it Reasonable to Offer Urgent Carotid Endarterectomy(within the first 48 hours) in Patients with Minor Strokes

- Absc
- Does it 2? Probab
- But you pert Peripro control)

DISCLOSURES

NOTHING TO DISCLOSE

STUDY DESIGN

Single Academic Vascular Surgery Group:
Retrospective Review
Prospectively maintained data

January 1990 to December 2019

Demographics, comorbidities, operative details and outcomes were abstracted

LIMITATIONS

- Retrospective study
  - Unable to analyze all the real-time factors that may have contributed to outcomes
- Surgeon Bias
  - Limited because the same private vascular group provides services to the community hospitals but unable to quantify individual surgical skillset
- Not all strokes are caused by carotid disease
- Results may vary with larger numbers or at other tertiary care centers

THANK YOU

Recent Data from The Albany Experience
(Non audited data)

- 971 eCEA in patients with acute strokes no difference between <48 hours and one week (3.5% vs 3.0% Stroke Mortality)

Thesis: Is it Reasonable to Offer Urgent Carotid Endarterectomy(within the first 48 hours) in Patients with Minor Strokes

- Absolutely!
- Does it matter if it is 24,48,72? Probably not
- But you need an experienced mutidisciplanry team with expert Periprocedural Care (esp BP control)

Lessons Learned
Patient Selection

- **There Must Be "Brain" to Save**
- **NIHSS less than 10, sometimes up to 15**
- **Symptoms Peaked, Some Improvement**
- **Center with Multidisciplinary Team**
- **CEA unless patient not OR Candidate then CAS**

Conclusions

- In Patients with Stable neurologic function after mild/moderate stroke, CEA may be performed < 1 week after stroke onset with acceptable results
- Optimal Results and improvement in Neurologic Function may be achieved with coordination of Acute Stroke Neurology and Vascular Surgery Services with designated staff and facilities

TIME IS WHAT PREVENTS EVERYTHING FROM HAPPENING AT ONCE.

Albert Einstein

PICTUREQUOTES.COM

Everything
is hard before
it is easy.
-Goethe

CEA For Acute Stroke

Delay due To Concerns For Hemorrhage

Study	Year	Type of Study	No. of patients with cerebral hemorrhage after CEA	Total number of patients	Suggested wait time
DeBakey et al [5]	1963	Retrospective analysis	6	900	1-2 weeks.
Wylie et al [10]	1964	Retrospective analysis	5	179	
Blaisdell et al [11]	1969				At least 2 weeks
Caplan et al [12]	1978	Case report	2	2	6 weeks
Chordanoa et al [15]	1985	Retrospective analysis	5	330	5 weeks

CEA for Acute Stroke
Case for Early intervention

Study	Year	Type of Study	No. of patients with cerebral hemorrhage after CEA	Total number of patients	Suggested wait time
Whittemore et al [13]	1985	Retrospective analysis	0	28	Within 7 days(average day 11)
Donick et al [15]	1985	Retrospective analysis	0	245	Within 2 weeks (average day 10)
Protz et al [16]	1986	Case report	0	3	Within 24 hours.
Khana et al [17]	1988	Retrospective analysis	0	774	Within one week
Fossthal et al [18]	1988	Retrospective analysis	2	29	Within 3 –21 days
Little et al [19]	1989	Prospective clinical trial	2	27	Within 30 days(average day 14)
Pitrowski et al [20]	1990	Prospective clinical trial		129	No difference between < / > 6 weeks.
Gasecki et al [21]	1990	Retrospective		100	No difference between < / > 30 days.
Khan et al [22]	1999	Retrospective study		1065	Within 30 days.

FACTORS ASSOCIATED WITH IMPROVED OUTCOME

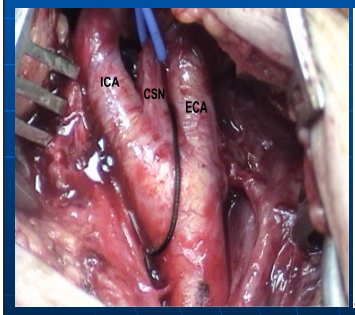
In patients with mild to moderate stroke severity:

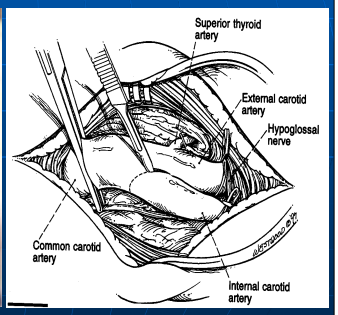
- **Smaller Infarct Size**
- **Use of Eversion Technique**

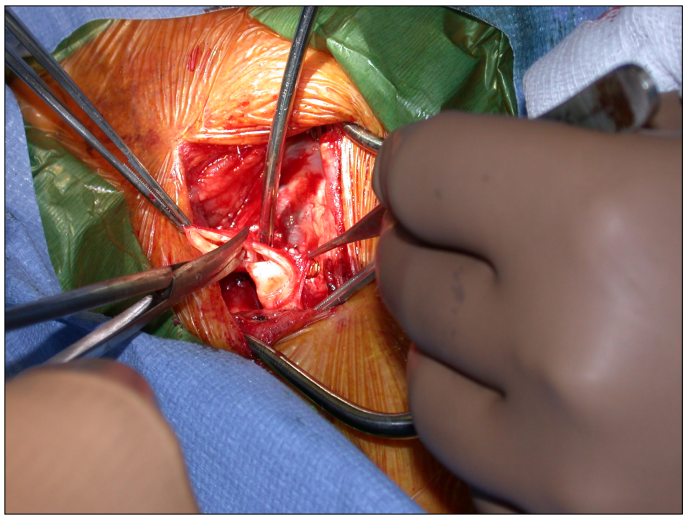
ENTZ, 1997
EVERSION CEA VS PATCH CLOSURE

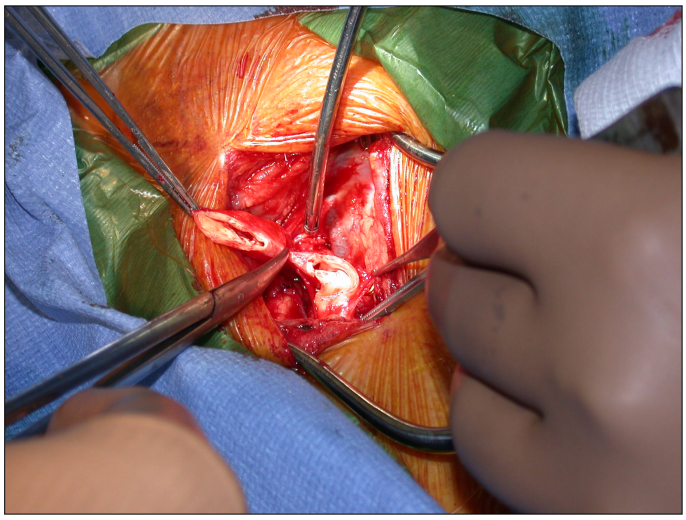
N=715	EVERSION	STANDARD
STROKE MORTALITY	0.95%	2.90%
CLAMP TIME	22.4 Minutes	34.9 Minutes
OR TIME	52.8 Minutes	90.9 Minutes

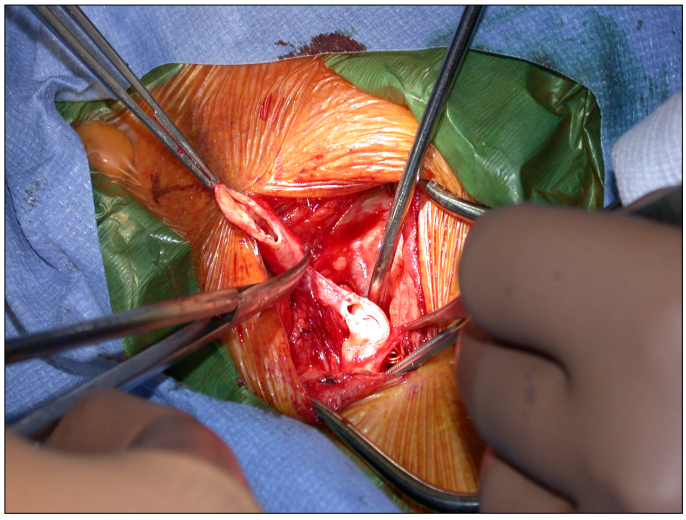
EVERSION TECHNIQUE

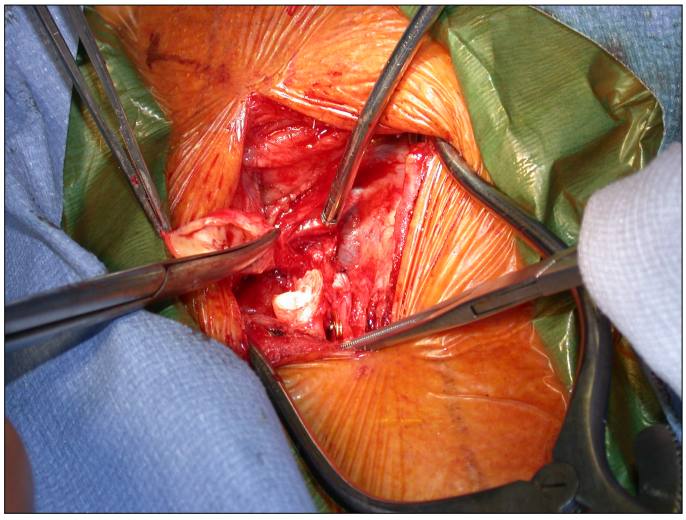


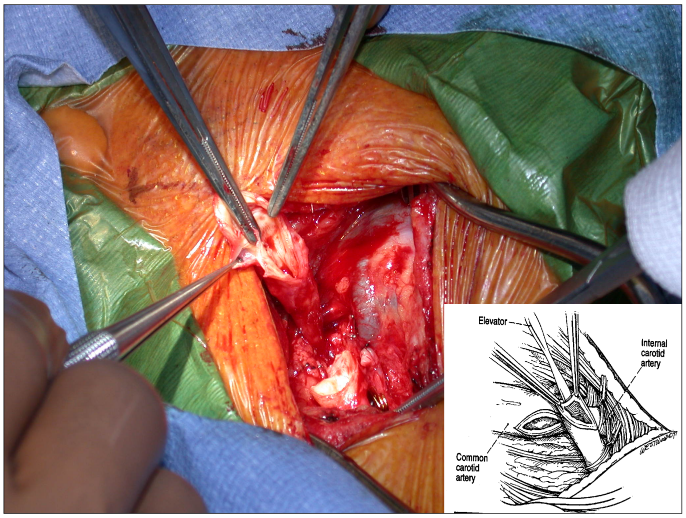


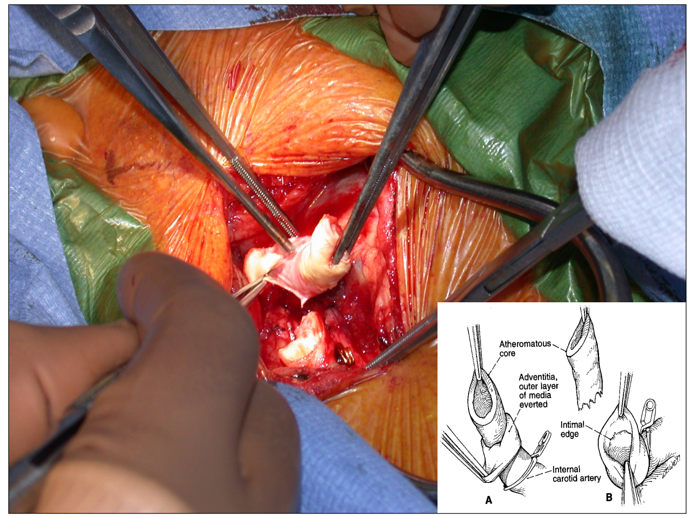


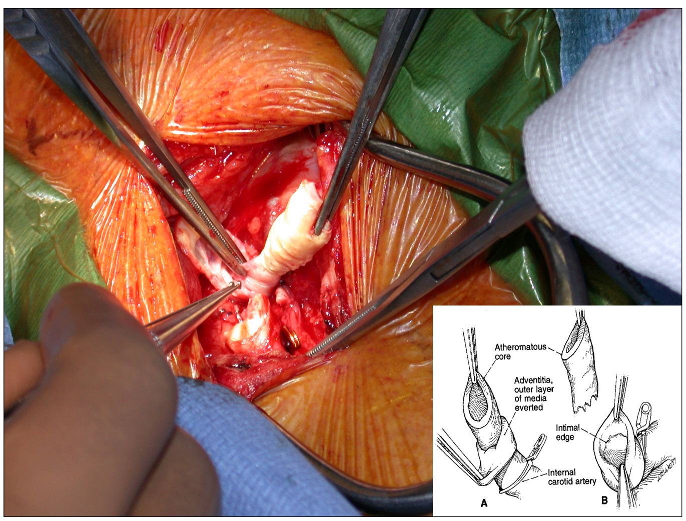


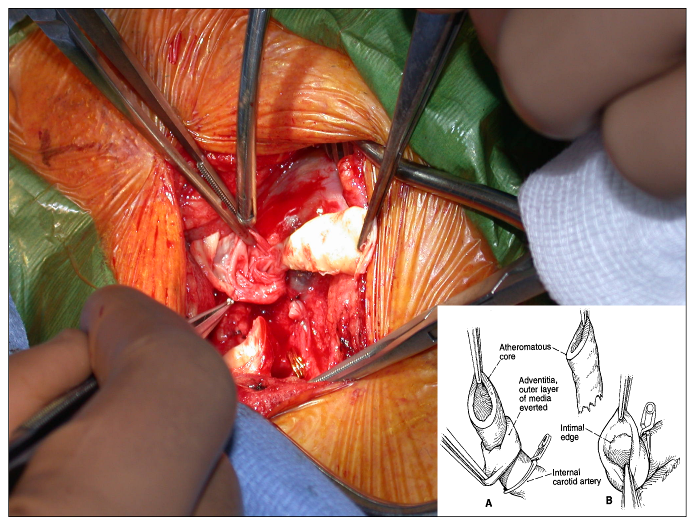


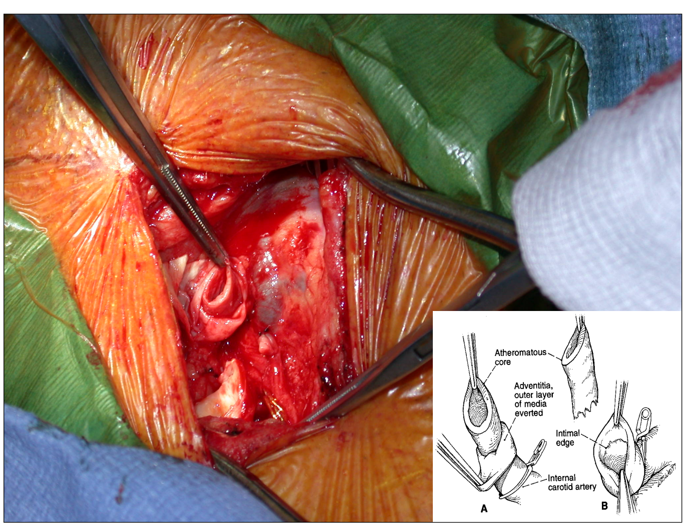


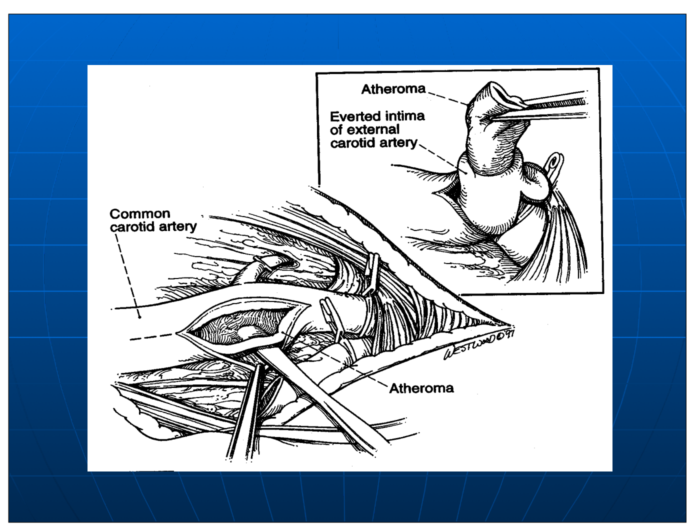

Elevator
Internal carotid artery
Common carotid artery

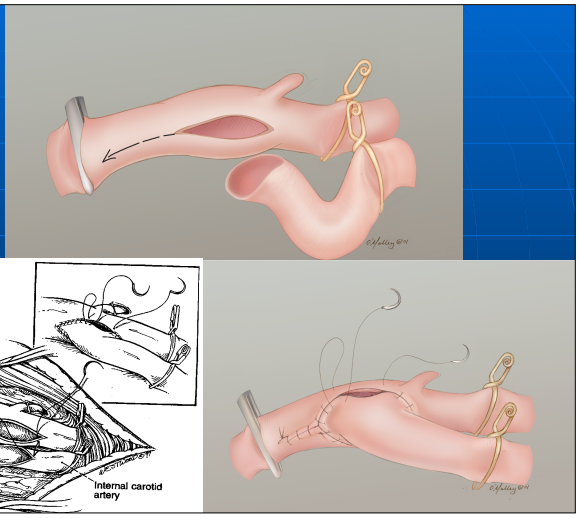

Atheromatous core
Adventitia, outer layer of media everted
Intimal edge
Internal carotid artery
A
B


Atheromatous core
Adventitia, outer layer of media everted
Intimal edge
Internal carotid artery
A
B


Atheromatous core
Adventitia, outer layer of media everted
Intimal edge
Internal carotid artery
A
B


Atheromatous core
Adventitia, outer layer of media everted
Intimal edge
Internal carotid artery
A
B


Atheroma
Everted intima of external carotid artery
Common carotid artery
Atheroma



Impact of Acute Cerebral Ischemic Lesions and Their Volume on the Revascularization Outcome of Symptomatic Carotid Stenosis

Rodolfo Pini, MD, Gianluca Faggioli, MD, PhD, Matteo Longhi, MD, Andrea Vacirca, MD, Liborio Ferrante, MD, Mauro Gargiulo, MD, PhD, Antonio Freyrie, MD, Andrea Stella, MD
University of Bologna, Bologna, Italy

- CIL volume in symptomatic carotid stenosis seems to influence the 30-day outcome independently from the timing of carotid revascularization. A CIL volume >4000 mm3 could be considered a significant predictor for postoperative stroke after carotid revascularization.
- **JVS June 2016Volume 63, Issue 6, Supplement, Page 142S**

ICA Stent Implantation in 25 Patients with Acute Stroke

:Preliminary Results

Nedeltchev et al

>Radiology 2005;237:1029-37

21% Mortality 8% ICH

>

Clinical Research

Journal of the American College of Cardiology

Volume 58, Issue 23, 29 November 2011, Pages 2363–2369

21 Patients, Mortality 13.9% Recanalization of 63%

Carotid Artery Stenting in Acute Stroke Jovin et Al Emergency Stenting Of Extracranial ICA Occlusion inAcute Stroke Has A High Revascularization Rate

>Stroke 2005;36:2426-30

Mortality 20% ICH 6%

Treatment of Acute Stroke due to Extracranial Carotid Disease

Controversy

- Timing
  - > 4-6 weeks
  - < 4 weeks
  - < 1 week
- Selection
  - Mild vs moderate Stroke
  - Plateau vs. resolution of symptoms

Prior Results (JVS 2004; 39:148-54)

- Risk of stroke after CEA correlated with initial infarct size
- Risk of perioperative stroke similar in all intervals< 1 month
- NIHSS score correlated with initial infarct size

Conclusions

- Difficult to interpret CAS studies for acute strokes as most results mix indications (Strokes with Symptomatic Disease),however, results appear to be better with CEA than CAS in acute strokes
-