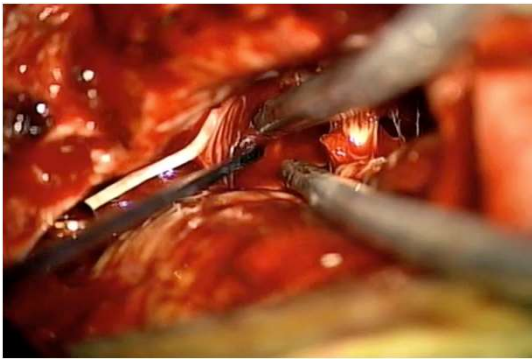


Nebraska Stroke Meeting 2024

Carlos Alvarez
Nicholas Borg
Scott Diesing
Monica Johnson
Mithun Sattur
Daniel Surdell
William Thorell
Nichole Cooks

1



2

STROKE TOPICS

- HEMORRHAGIC
 - Intracranial Hemorrhage (ICH)
 - Subarachnoid Hemorrhage (SAH)
- ISCHEMIC
 - Carotid Occlusive Disease (COD)

3

Stroke in Women

4

Ischemic Stroke

- <75yo: Women have lower incidence
- >75yo: Women have higher incidence
- Bimodal increased risk:
 - <30yo
 - >80yo
- Higher mortality rate
- Risk factors
 - Higher hypertension and A-fib rates
 - Pregnancy/Post-partum
 - OCP/HRT/Fertility Tx
- Challenges with routing to comprehensive stroke centers

5

Hemorrhagic Stroke

- Women have higher risk of ICH and aSAH, higher rate of unruptured aneurysms.
 - Menopausal decline in estrogen could contribute to aneurysm formation
 - HRT associated with decreased risk ICH
 - Early menopause increases risk of aSAH
 - 65% aSAH are women
 - More likely to have ICA aneurysm
 - A-comm aneurysms tend to be larger in women
- CAA more common in women
- Increased risk in 3rd trimester and early post-partum
 - Eclampsia/Pre-eclampsia contribute to risk
- AVM
 - Women with higher bleed and re-bleed rates
- ***Pregnancy
 - Same treatment as non-pregnancy, prioritize maternal safety

6

Cerebral Venous Sinus Thrombosis

Stroke Journal and Treatment
Volume 53, Number 10, October 2021
https://doi.org/10.1177/08914887211048888

Research Article
Cerebral Venous Sinus Thrombosis in Women: Subgroup Analysis of the VENOST Study

- Risk factors:
 - Pregnancy (5x increased risk), puerperium (6-8wk post partum, 60x increased risk), OCP, infection, inflammatory disease, thrombophilia
 - 60% of women with CVST 20-35yo
 - Pregnancy, OCP, post-partum more likely to have acute onset
 - More likely to present with headache, seizure
 - More likely to be associated with IPH
 - If CVST detected in absence of hormonal risk factors, malignancy should be investigated

7

STROKE

- HEMORRHAGIC

8

AHA/ASA GUIDELINE

2022 Guideline for the Management of Patients With Spontaneous Intracerebral Hemorrhage: A Guideline From the American Heart Association/ American Stroke Association

Reviewed for evidence-based integrity and endorsed by the American Association of Neurological Surgeons and Congress of Neurological Surgeons.

Endorsed by the Society of Vascular and Interventional Neurology

The American Academy of Neurology affirms the value of this statement as an educational tool for neurologists.

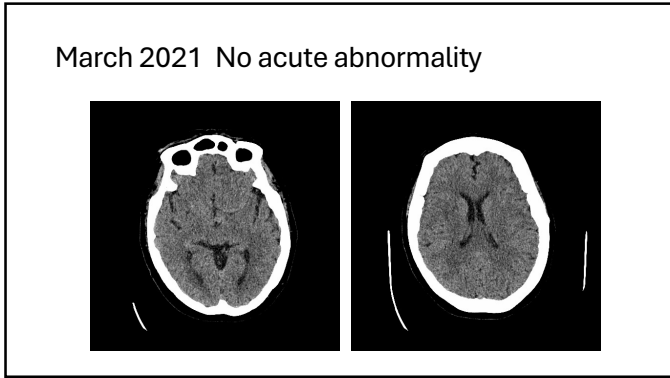
Endorsed by the Neurocritical Care Society

Steven M. Greenberg, MD, PhD, FAHA, Chair; Wendy C. Ziai, MD, MPH, FAHA, Vice Chair; Charlotte Cordonnier, MD, PhD; Der Dowlatshahi, MD, PhD, FAHA; Brandon Francis, MD, MPH; Joshua N. Goldstein, MD, PhD, FAHA; J. Claude Hemphill III, MD, MAS, FAHA; Ronda Johnson, MBA; Kiffon M. Keigheer, MD, ACNP-BC, RN, SCRNP; William J. Mack, MD, MS, FAHA; J. Mocco, MD, MS, FAHA; Eleena J. Newton, MD; Iana M. Ruff, MD; Lauren H. Sansing, MD, MS, FAHA; Sam Schulman, MD, PhD; Magdy H. Selim, MD, PhD, FAHA; Kevin N. Sheth, MD, FAHA; Nikola Spragg, MD; Katharina S. Sunnerhagen, MD, PhD, on behalf of the American Heart Association/ American Stroke Association

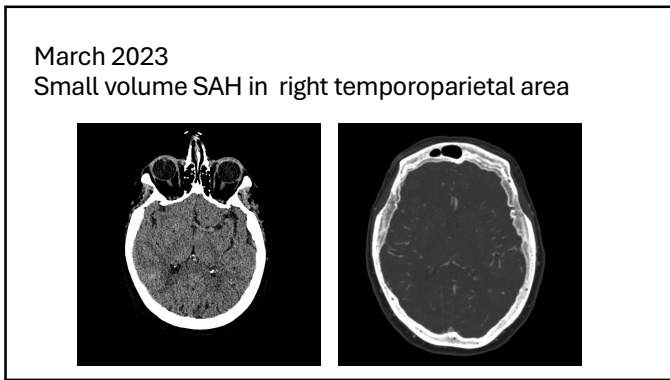
Key Words: AHA Scientific Statements # cerebral amyloid angiopathy # cerebral hemorrhage # intracranial hemorrhage # prevention # recovery # treatment

Stroke. 2022;53:e262–e361. DOI: 10.1161/STR.0000000000000407

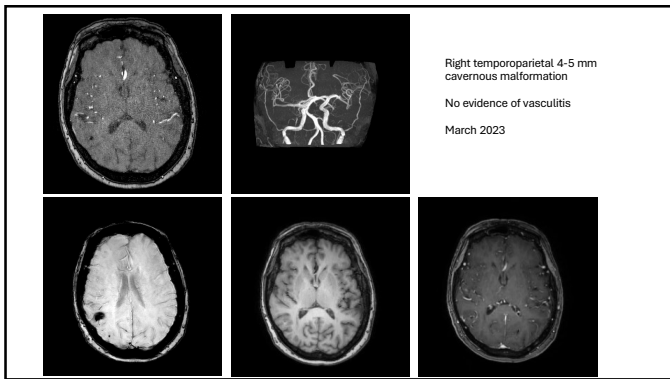
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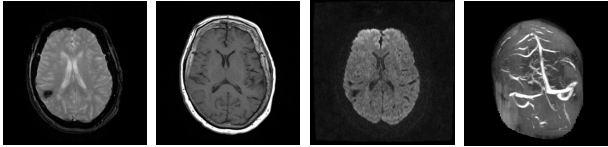
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12

October 2023

Probable incomplete thrombus right jugular bulb No acute ICH, unchanged presumed cavernoma



13

• 77 y/o female presents after collapse with left hemiparesis she is following commands, and she is oriented but only opens eyes to stimulus. Last known well within 3 hours.

• PMHx:

- HTN
- HLD
- Hypothyroidism
- Previous saddle PE on coumadin

14

Audience

What is the patients Glasgow coma score?

- A. 14
- B. 13
- C. 1



77 y/o female presents after collapse with left hemiparesis she is following commands, and she is oriented but only opens eyes to stimulus. Last known well within 3 hours.

15

Audience

What NIHSS score range would be considered a moderate to severe stroke?

- A. 3-15
- B. 16-20
- C. 21-42


16

NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS)

Item	Title	Responses and Scores	Item	Title	Responses and Scores
1A	Level of consciousness	0—alert 1—drowsy 2—obedient 3—conscious/responsive	6	Motor function (MFI)	0—no test 1—effort before 5 seconds 2—able before 5 seconds 3—Left 4—Right 5—no effort against gravity 6—no movement
1B	Orientation (orientation (O))	0—answers both correctly 1—answers one correctly 2—answers neither correctly	7	Left/Right	0—no ataxia 1—ataxia in 1 limb 2—ataxia in 2 limbs
1C	Recognition of commands (C)	0—performs both tasks correctly 1—performs one task correctly 2—performs neither	8	Sensory	0—no sensory loss 1—mild sensory loss 2—severe sensory loss
2	Gait	0—normal/normal movements 1—partial gait palsy 2—complete gait palsy	9	Language	0—normal 1—mild aphasia 2—severe aphasia 3—mute or global aphasia
3	Visual fields	0—no visual field defect 1—partial hemianopia 2—complete hemianopia 3—bilateral hemianopia	10	Attention	0—normal 1—mild disorientation 2—severe disorientation
4	Facial movement	0—normal 1—mild facial weakness 2—partial facial weakness 3—complete unilateral palsy	11	Attention or inhibition	0—absent 1—mild test (1 sensory modality test) 2—severe test (2 modalities test)
5	Motor function (MFI)	0—no test 1—effort before 10 seconds 2—able before 10 seconds 3—no effort against gravity 4—no movement			

Scoring range is 0-42 points. The higher the number, the greater the severity.

Score	Stroke Severity
0	No stroke symptoms
1-4	Minor stroke
5-15	Moderate stroke
16-20	Moderate to severe stroke
21-42	Severe stroke



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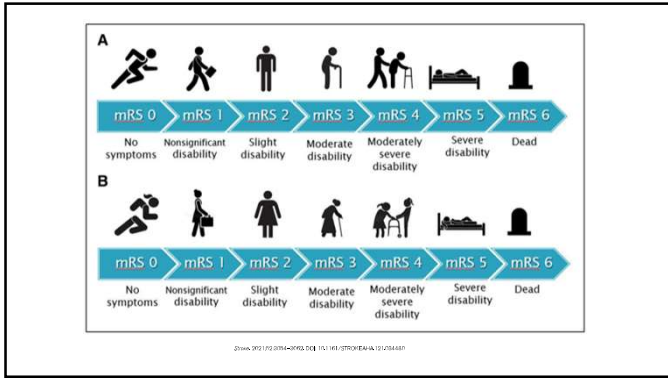
Audience

• What modified Rankin score that would be considered moderately severe disability. The individual is unable to walk without assistance and unable to attend to own needs without assistance?

- A. 3
- B. 4
- C. 5




18



19

Audience

EMS notifies the ED and patient arrives to the ED. After arrival to the ED what is the order of priority in her care?




- A. Head CT, initial clinical assessment, labs, stroke activation
- B. Initial clinical assessment, labs, stroke activation, CT head
- C. Stroke activation, initial clinical assessment, labs, CT head

20

Audience

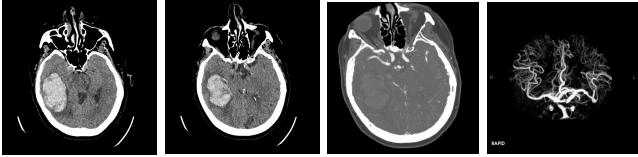
- Based on initial presentation would you give patient thrombolytics?

- A. Yes
- B. No

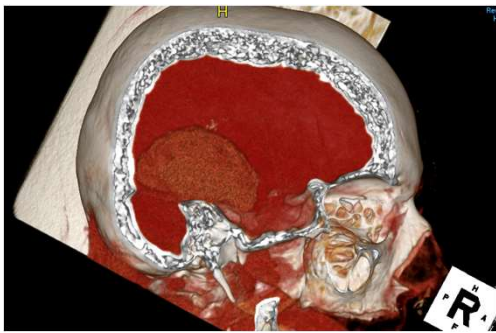


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January 2024



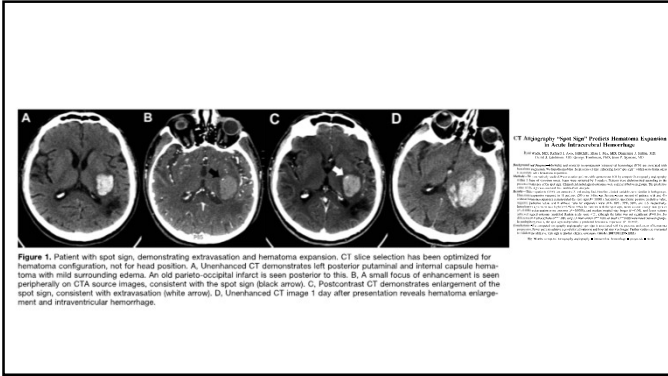
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23




24



28

Audience


- Blood pressure goals in the ER?
- A. ≤ 180
- B. ≤ 140
- C. ≤ 200



29

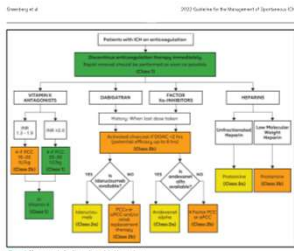
Audience

- Patient had a saddle PE and is on coumadin. Would you reverse the anticoagulation given her current neurologic status and the hemorrhage?
- A. Yes
- B. No



30

Guidelines for Management of Patients with spontaneous ICH 2022



31

Audience

• If I change the patient presentation and the patient was on Plavix not coumadin, would you give platelets?

- A. Yes
- B. No



32

Audience

• Would you start the patient on anti seizure medications?

- A. Yes
- B. No



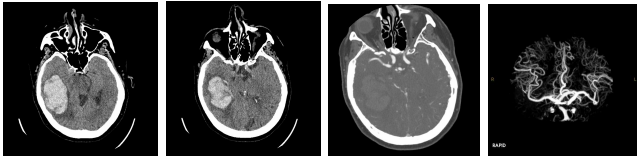
33

Audience

- What would your target blood sugar be for this critically ill patient?
- A. < 220 mg/dL
- B. < 120 mg/dl
- C. < 180 mg/dl

34

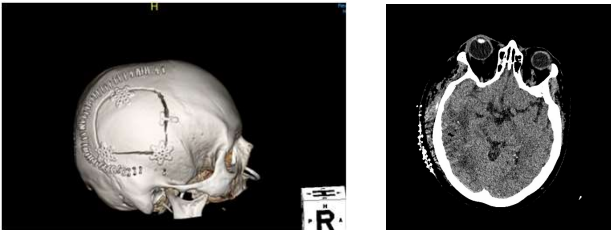
January 2024



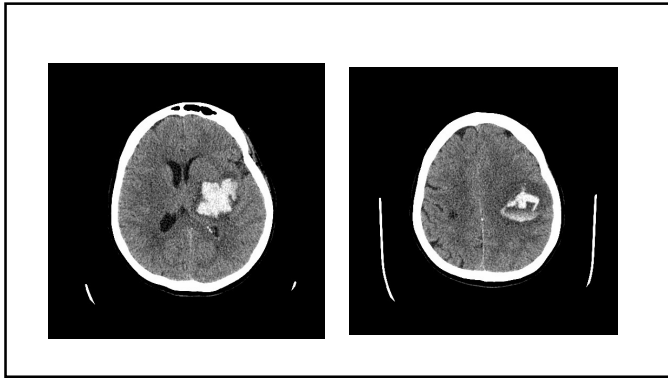
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POD#5

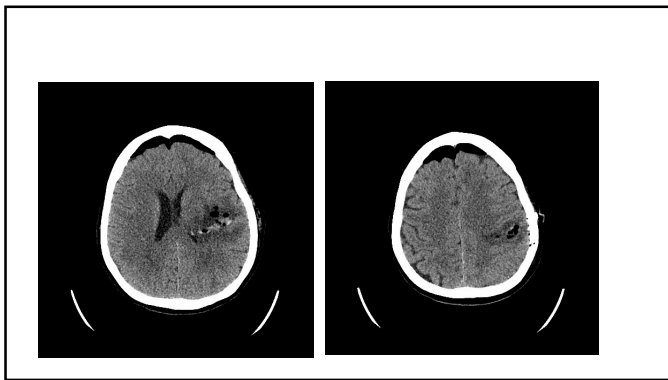
Follow commands answers questions



36



40



41

Audience

- ICH score looks at GCS, age, location, volume, and involvement of the ventricular system. What is the predicted 30-day mortality for a patient presenting with an ICH score of 4

- A. 26%
- B. 72%
- C. 97%

Component	ICH Score Item
GCS score	
3-4	2
5-6	1
7-8	0
ICH volume, cm ³	
>30	1
<30	0
BP	
Yes	1
No	0
Extension of ICH	
Yes	1
No	0
Age	
>60	1
<60	0
Total ICH Score	0-6

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Questions?

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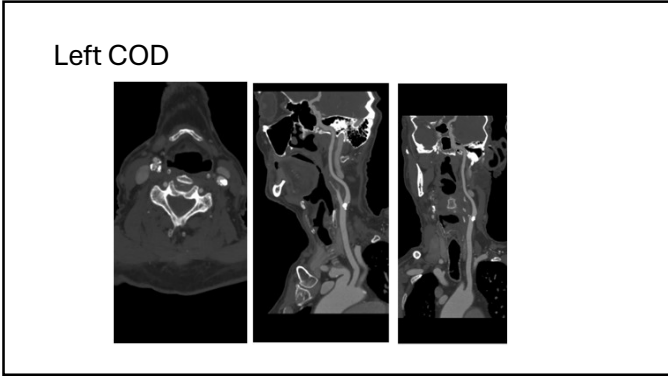
STROKE

- **ISCHEMIC**
 - Carotid Occlusive Disease
 - CEA
 - Stent
 - TCAR
 - Carotid WEB

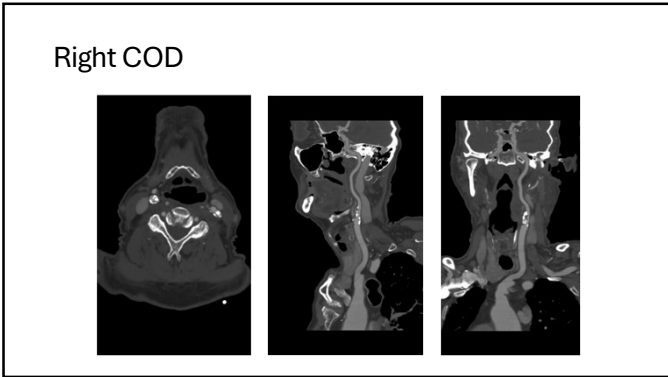
44

- 82 y/o with previous history of stroke 10 years ago resulting in right sided numbness and mild weakness. H/O atrial fibrillation on Eliquis, DM, CKD stage III, heart disease, pulmonary fibrosis, and CAD. Bilateral carotid occlusive disease
- Meds: include Eliquis (apixaban), atorvastatin, metoprolol

45



46




47

COD

- Mechanism of symptom development in COD.
- BMT
- When and how to revascularize.

48

NASCET



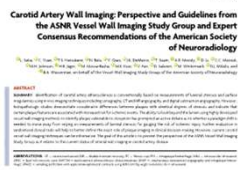
- Estimate of risk of any fatal or nonfatal ipsilateral stroke by 24 months
 - Medical **26%**
 - Surgical **9%**
- Absolute risk reduction of **17%** (for every 100 patients treated surgically 17 were spared an ipsilateral stroke over the next two years)
- Relative-risk reduction of **65%** and shows that six such patients are the number needed to be treated in order to prevent one adverse event by 24 months

Case or Cause	Medical (n = 111)	Surgical (n = 105)
Stroke	3	2
Myocardial infarction	4	4
Other ischemic heart disease	3	1
Sudden death	1	3
Other cardiovascular disease	1	0
Cancer	2	2
Respiratory disease	1	1
Other cause	4	2
Total — no. (%)	21 (6.3)	17 (6.6)

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Carotid wall imaging

Carotid Artery Wall Imaging: Perspective and Guidelines from the ASNR Vessel Wall Imaging Study Group and Expert Consensus Recommendations of the American Society of Neuroradiology



- Developing countries carotid artery narrowing reported in up to 75% men and 62 % women 65 years and older
- 18-25% of strokes due to carotid atherosclerosis

50

Imaging features of plaques at risk for stroke

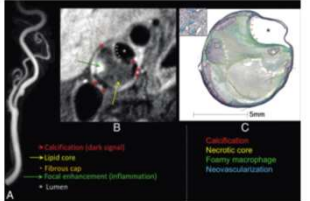


FIG 4. Carotid atherosclerotic plaque MR imaging and a specimen from a 76-year-old woman with transient ischemic attacks ipsilateral to carotid bulb stenosis, measuring 47% by the NASCET criteria demonstrated on a contrast-enhanced MRA. A, Narrowing is caused by the plaque characterized by 2D cardiac-gated double inversion recovery black blood MR imaging (B). Regional enhancement (green arrow) within the lipid core (yellow arrow) suggests focal inflammation with neovascularity as confirmed on the endarterectomy specimen (C, green circle). Contrast enhancement is also useful for delineating the fibrous cap (B and C, orange arrowheads). Calcification is identified as areas of hypointensity (B, red arrows, and C, red circle).

51

Audience

• What percent stenosis is CEA recommended over maximal medical therapy for asymptomatic carotid stenosis in LOW surgical risk patients?

- A. <50%
- B. 50-70%
- C. > 70%

52

Audience

• Optimal timing of carotid intervention for patients (mRS 0-2) presenting with acute stroke with symptomatic COD and the acute ischemic event has been managed?

- A. <24 hours
- B. 48 hours -14 days
- C. 6 months

53

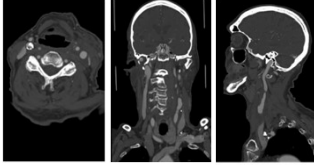
Audience

• Is routine screening for asymptomatic carotid stenosis recommended for the general population?

- A. Yes
- B. No

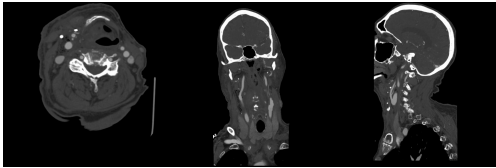
54

Post Left CEA

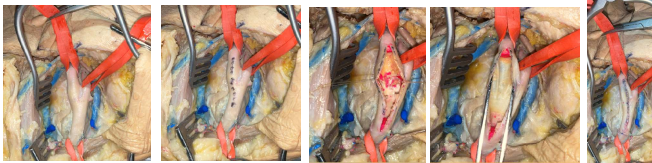


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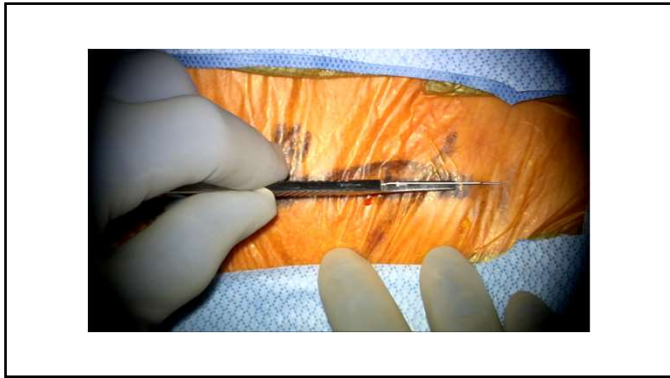
Post Right CEA approximately 2 months later



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TOPICAL REVIEW Section Editors: Alison Halliday, MS, and Giuseppe Lanzino, MD

Carotid Interventions for Women: The Hazards and Benefits

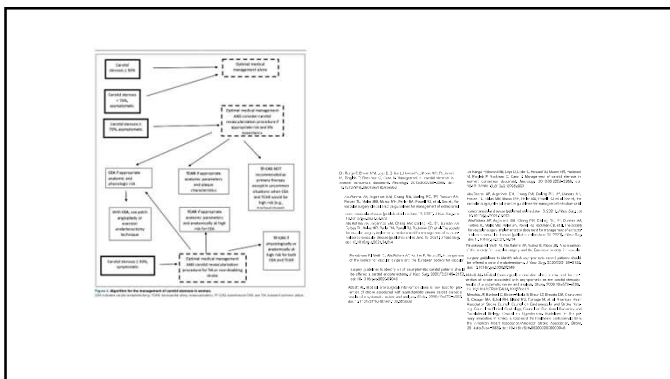
Caron Rockman¹, MD, Valeria Cassa, MD, Peter A. Schneider, MD

ABSTRACT: The goal of the current review is to examine the hazards and benefits of carotid interventions in women and to provide recommendations for the indications for carotid intervention in female patients. Stroke and cardiovascular disease are prevalent in women. There are inherent biological and other differences in men and women, which affect the manifestations and outcomes of stroke, with women experiencing worse disability and higher mortality following ischemic stroke than men. Due to the underrepresentation of female patients in most clinical trials, the ability to make firm but alternative recommendations for women specifically on the management of carotid stenosis is challenging. Although some data suggest that women might have worse periprocedural outcomes as compared to men following all carotid revascularization procedures, there is also an abundance of data to support a similar risk for carotid procedures in men and women, especially with carotid endarterectomy and transcatheter artery revascularization. Therefore, the indications for carotid revascularization are the same in women as they are in men. The choice of a carotid revascularization procedure in women is based upon the same factors as in men and requires careful evaluation of a particular patient's risk profile, anatomic criteria, plaque morphology, and medical comorbidities that might favor one technique over the other. When performing carotid revascularization procedures in women, tailored techniques and procedures to address the small diameter of the female artery are warranted.

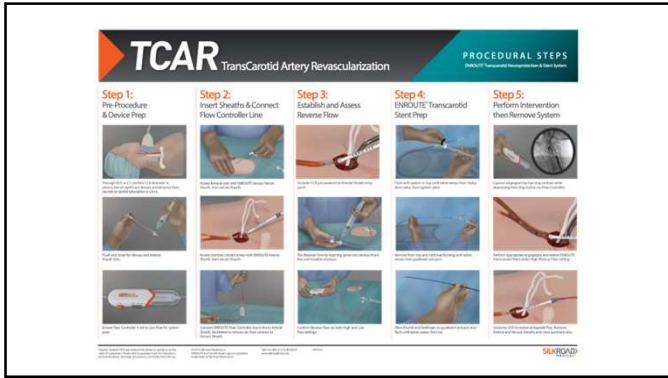
Key Words: carotid atherosclerotic disease ■ endarterectomy, carotid ■ stroke ■ women

Section	Page
Introduction	1
Carotid Artery Stenosis	2
Carotid Endarterectomy	3
Carotid Stenting	4
Transcatheter Artery Revascularization	5
Conclusion	6

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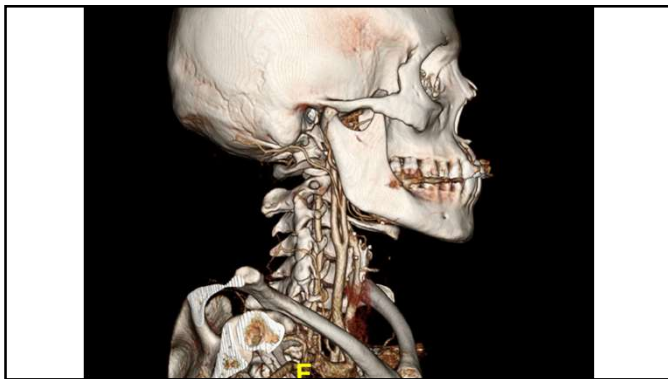


61

30 year old female, 5 months post-partum

- Sudden onset neck pain, dizziness, progresses to drowsiness
- Crete NE CT / CTA identifies occlusion of basilar artery, intubated and transferred to UNMC
- On arrival, she is intubated and paralyzed. Pupils are reactive.
- Should we do perfusion imaging or MRI?

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63



64

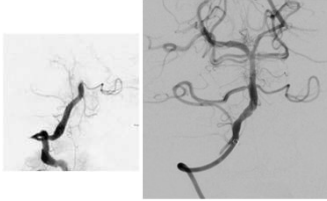
30 year old female, 5 months post-partum

- In ED:
 - Communication apps, imaging apps, procedures for emergency consent
 - Neurology, neurosurgery, ED providers greet patient at door
 - Consensus to proceed straight to angio suite
- In Angio suite:
 - Anesthesia pre-alerted, room laid out
 - Techs pre-alerted, catheters already open
 - Standardized setups, with ability to individualize

65

30 year old female, 5 months post-partum

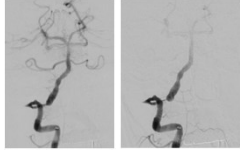
- 18:25 – patient enters Angio suite
- 18:36 – radial access is obtained
- 18:44 – catheters and stents reach the clot
- 18:45 – flow is re-established



66

30 year old female, 5 months post-partum

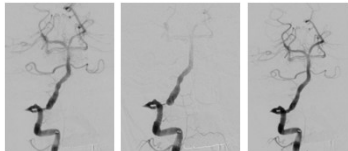
- After opening up basilar artery, we watch the vertebral artery for a while...



67

30 year old female, 5 months post-partum

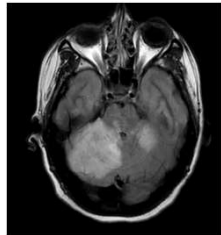
- After opening up basilar artery, we watch the vertebral artery for a while...
- The stenosis at the dissection is getting worse
- We discuss with neurology, start heparin and aspirin and place a stent



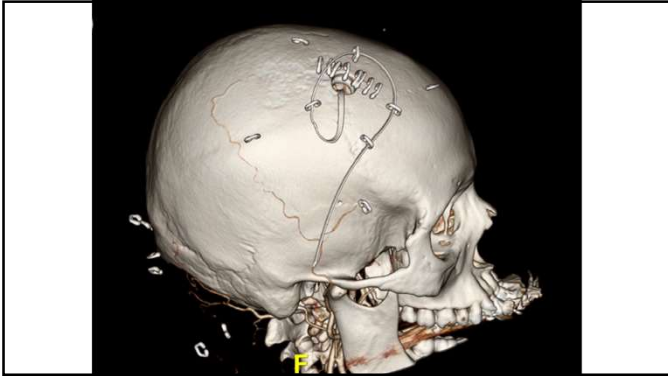
68

30 year old female, 5 months post-partum

- Blood thinners in the context of an acute stroke:
 - Smart ?
 - Dumb?
 - Lucky?
- What issues do we anticipate in the short and longer term?



69



70

30 year old female, 5 months post-partum

- 1 month on ICU
- EVD removed – no shunt
- Extubated successfully – no tracheostomy
- Speech and swallow improve with therapy – no feeding tube
- Ambulation improves with therapy – no focal deficits

- Discharged home with family support

71

- 54 y/o female last known well at 1300 presenting at 2130
- Slurred speech and left sided weakness
- BP 170/93 and BS 331
- NIHSS 10 presentation, gaze to right, left sided weakness, left sided sensory deficit, dysarthria

72

AUDIENCE

How severe is the stroke this patient who is presenting with an NIHSS of 10?

- A. Minor
- B. Moderate
- C. Moderate to severe

73

NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS)

Item	Title	Responses and Scores	Item	Title	Responses and Scores
1A	Level of consciousness	0—alert 1—drowsy 2—obedient 3—conscious/unresponsive	5	Motor function (arm)	0—no test 1—effort before 5 seconds 2—able before 5 seconds 3—left 4—right 5—no effort against gravity 6—no movement
1B	Orientation (person)	0—answers both correctly 1—answers one correctly 2—answers neither correctly	7	Motor function (leg)	0—no test 1—abata in 1 step 2—abata in 2 steps 3—no sensory loss 4—mild sensory loss 5—severe sensory loss
1C	Recognition of commands (2)	0—performs both tasks correctly 1—performs one task correctly 2—performs neither	8	Sensory	0—normal 1—mild aphasia 2—severe aphasia 3—mute or global aphasia
2	Gait	0—normal/normal movements 1—partial gait palsy 2—complete gait palsy	9	Language	0—normal 1—mild aphasia 2—severe aphasia 3—mute or global aphasia
3	Visual fields	0—no visual field defect 1—partial hemianopia 2—complete hemianopia 3—bilateral hemianopia	10	Attention	0—normal 1—mild disorientation 2—severe disorientation
4	Facial movement	0—normal 1—mild facial weakness 2—partial facial weakness 3—complete unilateral palsy	11	Extinction or inattention	0—absent 1—mild loss (1 sensory modality test) 2—severe loss (2 modalities tests)
5	Motor function (arm)	0—no test 1—effort before 10 seconds 2—able before 10 seconds 3—no effort against gravity 4—no movement			

Scoring range is 0-42 points. The higher the number, the greater the severity.

Score	Stroke Severity
0	No stroke symptoms
1-4	Minor stroke
5-15	Moderate stroke
16-20	Moderate to severe stroke
21-42	Severe stroke



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Audience

• Does the Field Assessment Stroke Triage for Emergency Destination (FAST-ED) scale have comparable accuracy in predicting large vessel occlusion LVO as the NIHSS?

- Yes
- No

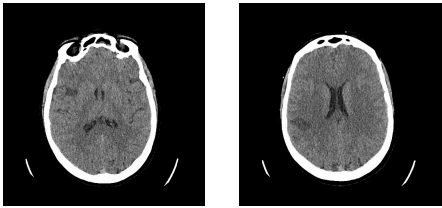
75

Audience

• The ASPECTS score partitions the cerebral hemisphere into 10 territories. Each receives a point. A score above which value resulted in a rate of SYMPTOMATIC ICH of 1% when patient was treated with thrombolytics?

- A. 5
- B. 7
- C. 9

82

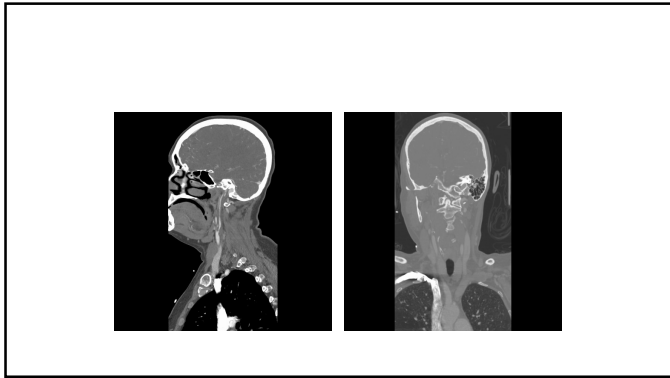


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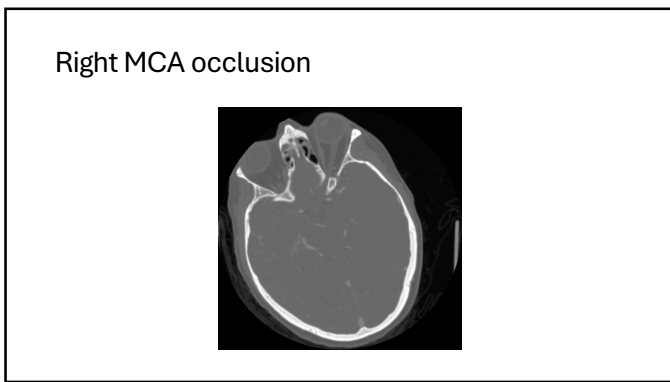
What would you give the ASPECT score?

- A. 5
- B. 8
- C. 10

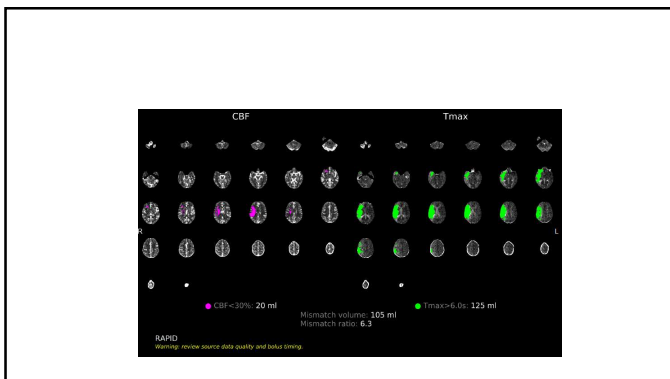
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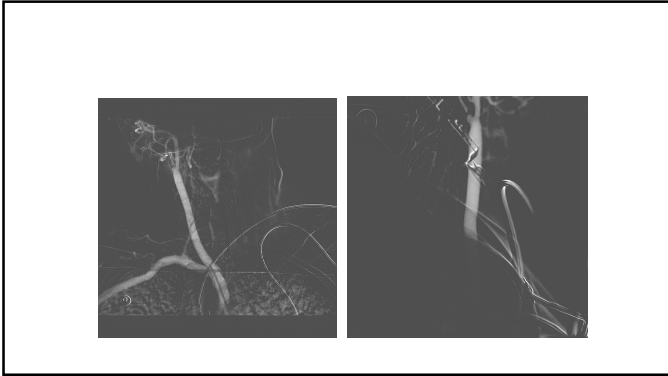
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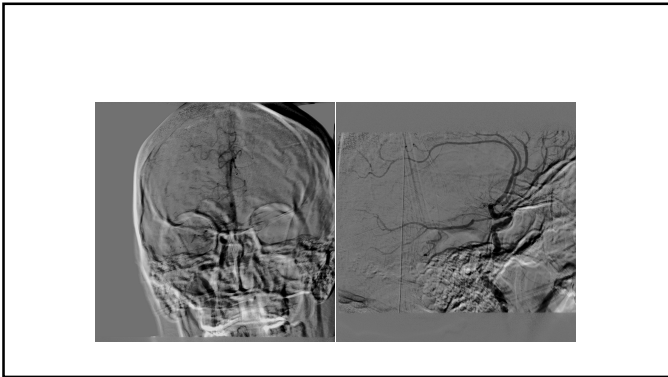
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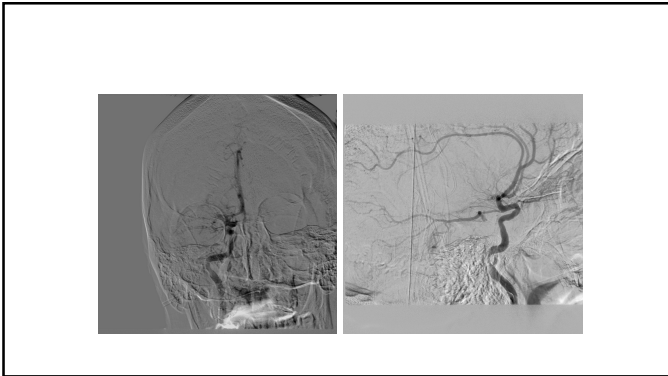
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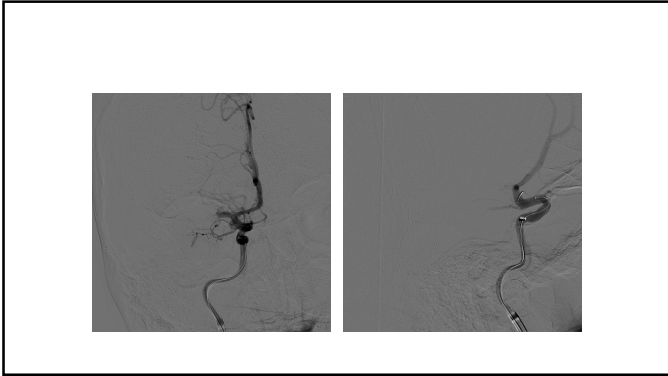
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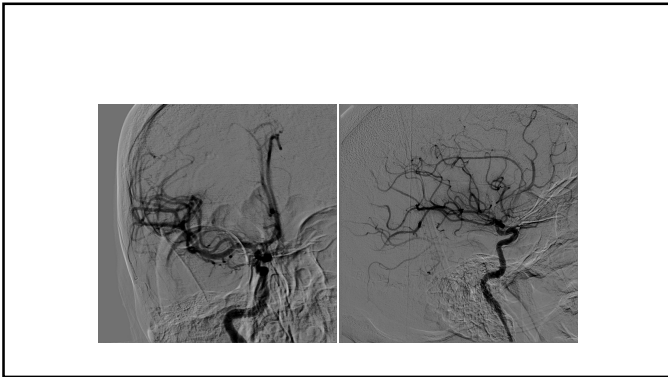
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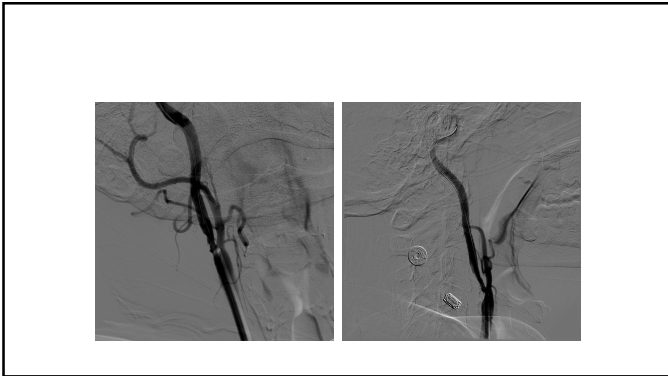
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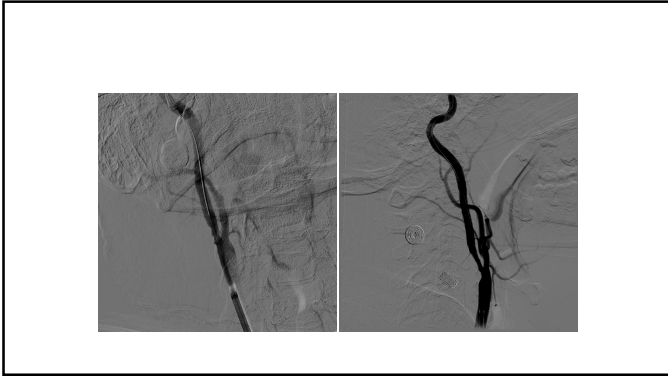
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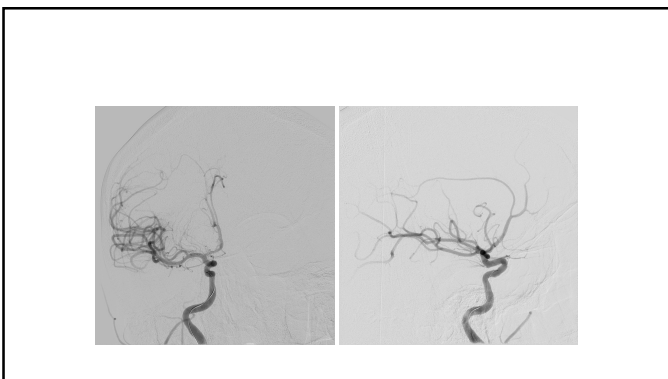
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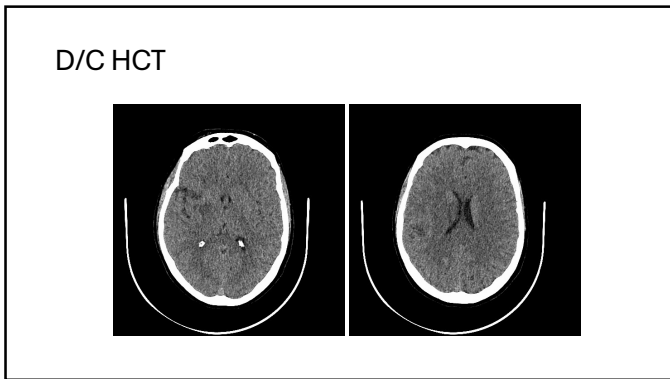
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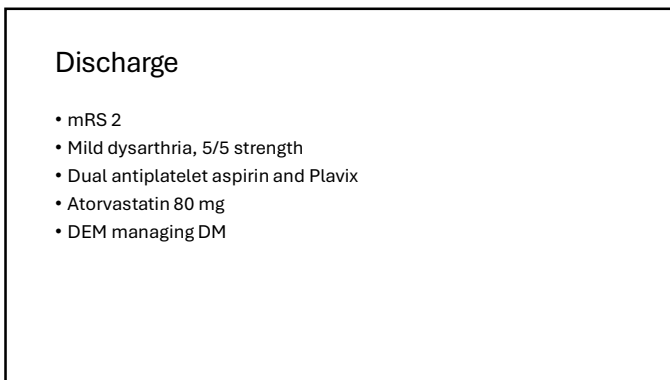
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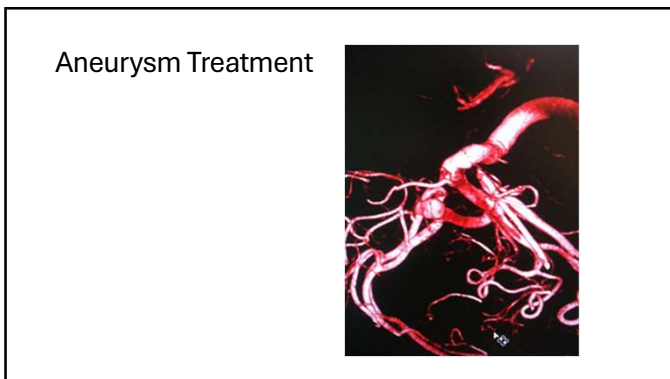
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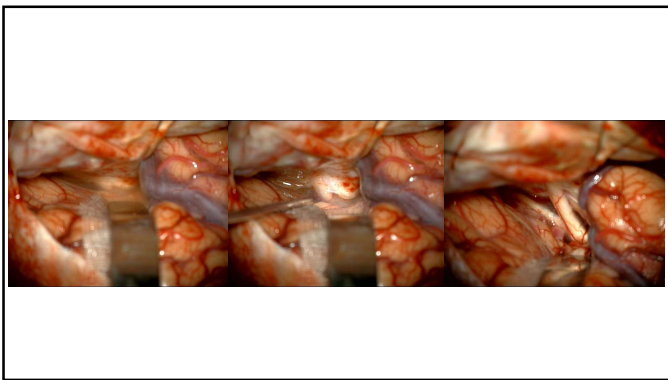
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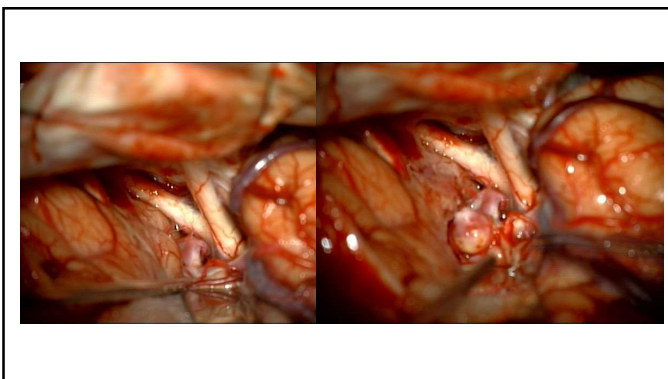
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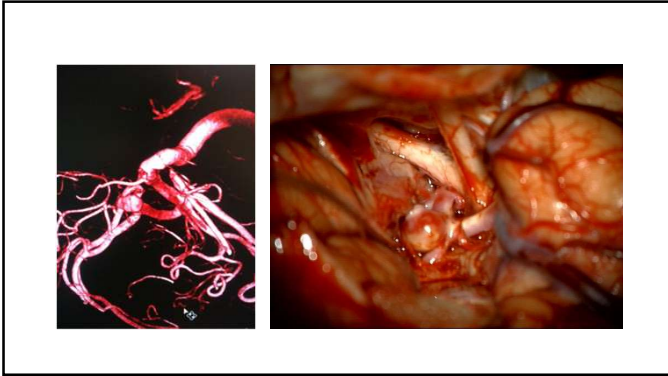
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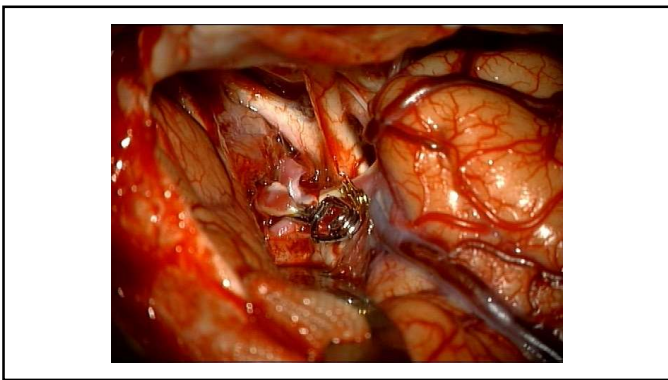
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Audience

- What proportion of aneurysm need to be treated?
- A. None
- B. Very Few
- C. Most
- D. All

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Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment

International Study of Unruptured Intracranial Aneurysms Investigators*

	<7 mm		7-12 mm	13-24 mm	>25 mm
	Group 1	Group 2			
Cavernous carotid artery (n=210)	0	0	0	3.0%	6-4%
AC/MC/IC (n=1037)	0	1-5%	2-6%	14-5%	40%
PostP comm (n=445)	2-5%	3-4%	14-5%	18-4%	50%

AC=anterior communicating or anterior cerebral artery, IC=internal carotid artery (not cavernous carotid artery), MC=middle cerebral artery, PostP=communicating, posterior cerebral arterial system, or the posterior communicating artery.

Table 4: 5-year cumulative rupture rates according to size and location of unruptured aneurysm

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Audience

- What is the presentation of a ruptured cerebral aneurysm typically?
- A. Sudden severe headache
- B. Focal neurologic deficit
- C. Seizure

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Fisher

Fisher Scale		Modified Fisher Scale	
1	Focal thin SAH	1	Focal or diffuse thin SAH, no IVH -IVH
2	Diffuse thin SAH	2	Focal or diffuse thin SAH, with IVH +IVH
3	Thick SAH present	3	Thick SAH present, not IVH -IVH
4	Focal or diffuse thick SAH with significant ICH or IVH	4	Thick SAH present, with IVH +IVH

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WFNS (World Federation of NeuroSurgeons) Grading Scale

	GCS	Focal Neuro Deficit
1	15	Absent
2	13-14	Absent
3	13-14	Present
4	7-12	Present or absent
5	<7	Present or Absent

Hunt and Hess

Grads	Clinical Findings
I	Asymptomatic or mild HA
II	Moderate to severe headache or CN palsys
III	Confused, drowsy, mild focal signs
IV	Stupor
V	Coma

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Audience

- The US Nationwide Inpatient Sample and international studies suggest that treatment aneurysmal subarachnoid hemorrhage in high-volume center is associated with lower risk of in hospital death and higher odds of good functional outcome?

- A. True
- B. False

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Aneurysmal treatment

- Coil placement endovascularly
- Clipping via craniotomy

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Post aneurysm treatment

- Admit to ICU
- Blood pressure management
- Vasospasm watch
- Monitor sodium
- Prevention of DVTs

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Vasospasm

- Intracranial vessels spasm leading to ischemic stroke
- Occurs post bleed day 3-14
- Nimodipine
- Transcranial doppler
- Treatment
 - Increase blood pressure
 - Maintain euvolemia
 - Invasive interventions
 - Angioplasty
 - Intra-arterial verapamil

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Sodium management

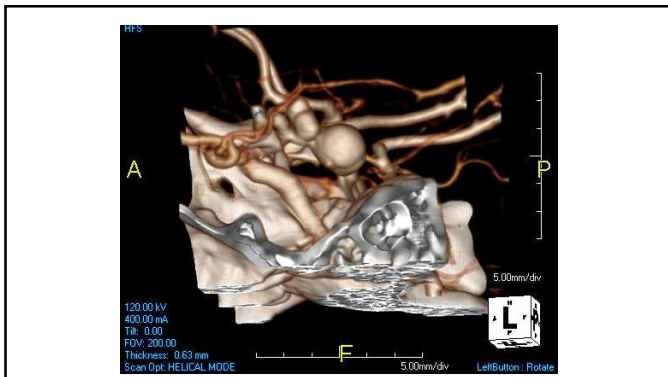
- Cerebral salt wasting
 - Hypovolemic hyponatremia
 - Associated with worse outcomes
- Central diabetes insipidus
 - Very uncommon

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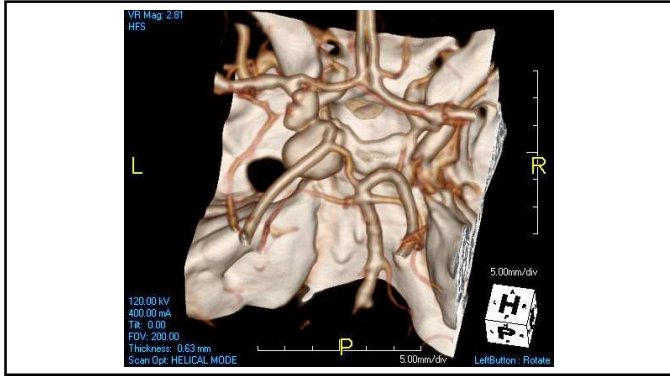
Other systemic complications

- Fever
- Cardiac
 - Stress induced cardiomyopathy
 - Cardiac arrest
- Respiratory
 - Neurogenic pulmonary edema
 - ARDS
 - Ventilator associated pneumonia

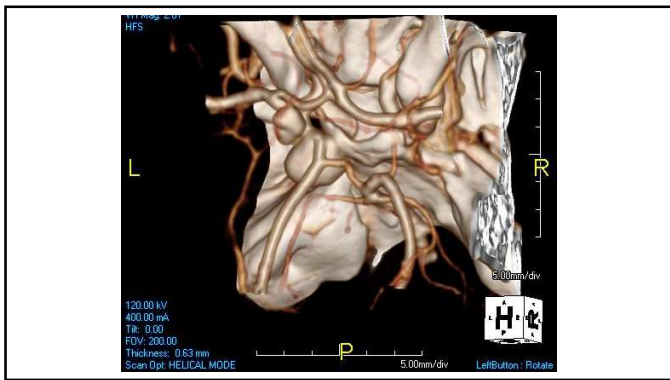
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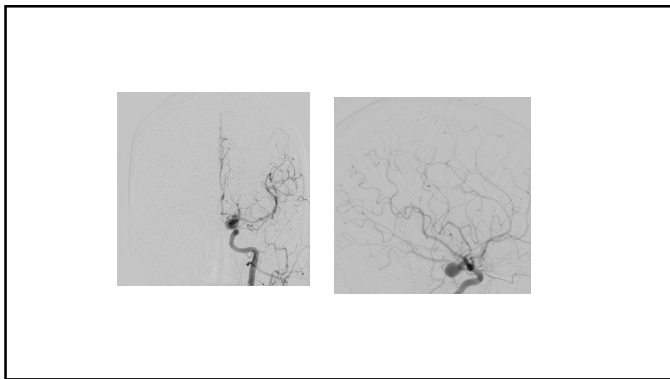
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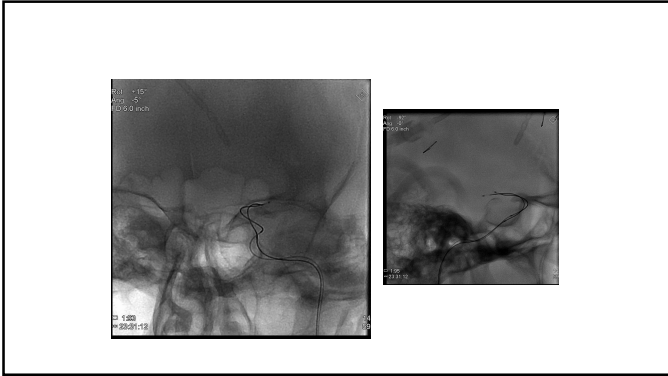
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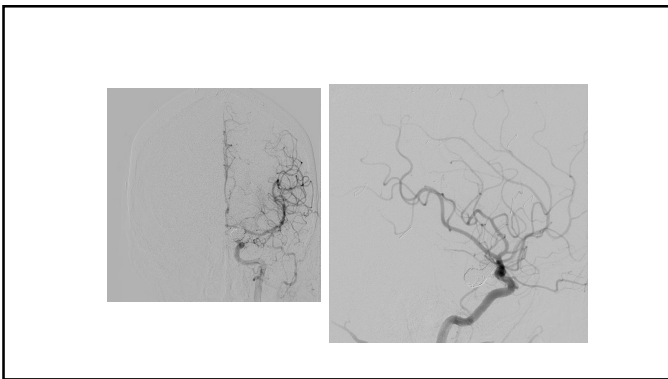
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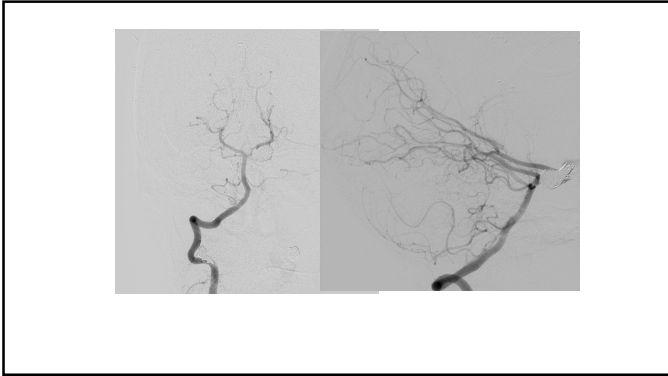
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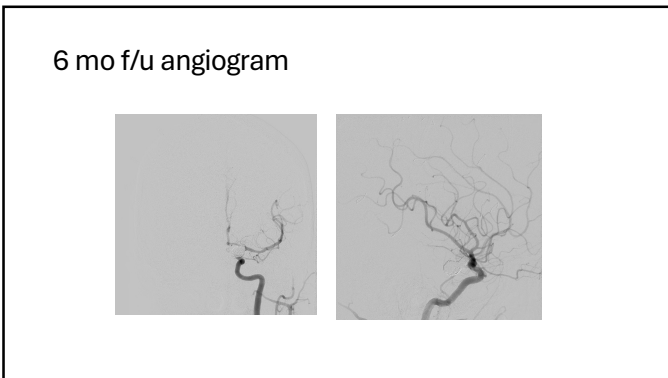
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Audience

- Based on a large international trial ISAT (International Subarachnoid Aneurysm Trial) inpatients with ruptured intracranial aneurysm where endovascular coiling and neurosurgical clipping are options which showed a nearly 7% absolute risk reduction in dependency or death?
- A. Open surgery
- B. Endovascular Coil embolization

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International Subarachnoid Aneurysm Trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised trial

International Subarachnoid Aneurysm Trial (ISAT) Collaborative Group*

Interpretation In patients with a ruptured intracranial aneurysm, for which endovascular coiling and neurosurgical clipping are therapeutic options, the outcome in terms of survival free of disability at 1 year is significantly better with endovascular coiling. The data available to date suggest that the long-term risks of further bleeding from the treated aneurysm are low with either therapy, although somewhat more frequent with endovascular coiling.

Summary

Background Endovascular stentlike coil treatment is being increasingly used as an alternative to craniotomy and clipping for some ruptured intracranial aneurysms, although the relative benefits of these two approaches have yet to be established. We conducted a randomised, multicentre trial to compare the safety and efficacy of endovascular coiling with standard neurosurgical clipping for such aneurysms judged to be suitable for both treatments.

Methods We enrolled 2143 patients with ruptured intracranial aneurysms and randomly assigned them to neurosurgical clipping (n=1070) or endovascular treatment by detachable platinum coils (n=1073). Clinical outcomes were assessed at 2 months and at 1 year with blinded measurements of disability and death. The primary outcome was the proportion of patients with a modified Rankin scale score of 2-6 (dependency or death) at 1 year. Trial recruitment was stopped by the steering committee after a concealed interim analysis. Analysis was per protocol.

Findings 190 of 801 (23.7%) patients allocated endovascular treatment were dependent or dead at 1 year compared with 252 of 792 (31.8%) allocated neurosurgical treatment (p<0.001). The relative and absolute risk reductions in dependency or death after allocation to an endovascular versus neurosurgical treatment were 22.6% (95% CI 8.8-34.2) and 6.9% (2.5-11.3), respectively. The risk of rebleeding from the ruptured aneurysm after 1 year was low per 1276 and zero per 1081 patients for patients allocated endovascular and neurosurgical treatment, respectively.

Interpretation In patients with a ruptured intracranial aneurysm, for which endovascular coiling and neurosurgical clipping are therapeutic options, the outcome in terms of survival free of disability at 1 year is significantly better with endovascular coiling. The data available to date suggest that the long-term risks of further bleeding from the treated aneurysm are low with either therapy, although somewhat more frequent with endovascular coiling.

Lancet 2002; 360: 1261-74
See Commentary page 1262

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International Subarachnoid Aneurysm Trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised trial

International Subarachnoid Aneurysm Trial (ISAT) Collaborative Group*

- **23.7%** patients allocated to endovascular treatment were dependent or dead at 1 year
- **30.6%** patients allocated to neurosurgical treatment were dependent or dead at 1 year
- **Relative risk reduction** in dependency or death after allocation to endovascular vs neurosurgical treatment was **22.6%**
- **Absolute risk reduction** in dependency or death after allocation to an endovascular vs neurosurgical treatment **6.9%**
- **Re-bleed after 1 year** 2/1276 end and 0/1081 neurosurgical patients

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Caseload as a factor for outcome in aneurysmal subarachnoid hemorrhage: a systematic review and meta-analysis

A systematic review
HERMANN D, BOGGARDT M.D., MARTENS J, VAN AMERINGEN, M.D.,
JONES M, NYS, M.D., PH.D., LUETT P, WITTNER, Ph.D.,
ANDER L, M, YOUNG, M.D., Ph.D., J, ANDER-GUSTENIS, M.D., Ph.D.,
AND RONALD H. M. A. BOUTER, M.D., Ph.D.
Departments of Neurosurgery and Epidemiology and Biostatistics, and Scientific Institute for Quality of Healthcare (IQ Healthcare), and Radboud University Nijmegen Medical Center, Nijmegen, The Netherlands

1. Retrospective
2. Selection mainly from northern US databases
3. High volume center likely to have endovascular affecting treatment modality with may affect outcome
4. Used unadjusted core data to obtain comparability
5. Difference between low and high volume is artificial
a. POSSIBLE Distinction is 20-30 patients

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CaseLoad as a factor for outcome in aneurysmal subarachnoid
hemorrhage: a systematic review and meta-analysis
A systematic review

***Treatment of patients with ruptured
intracranial aneurysm in high-volume centers
is associated with lower in-hospital mortality
compared with low-volume centers***
