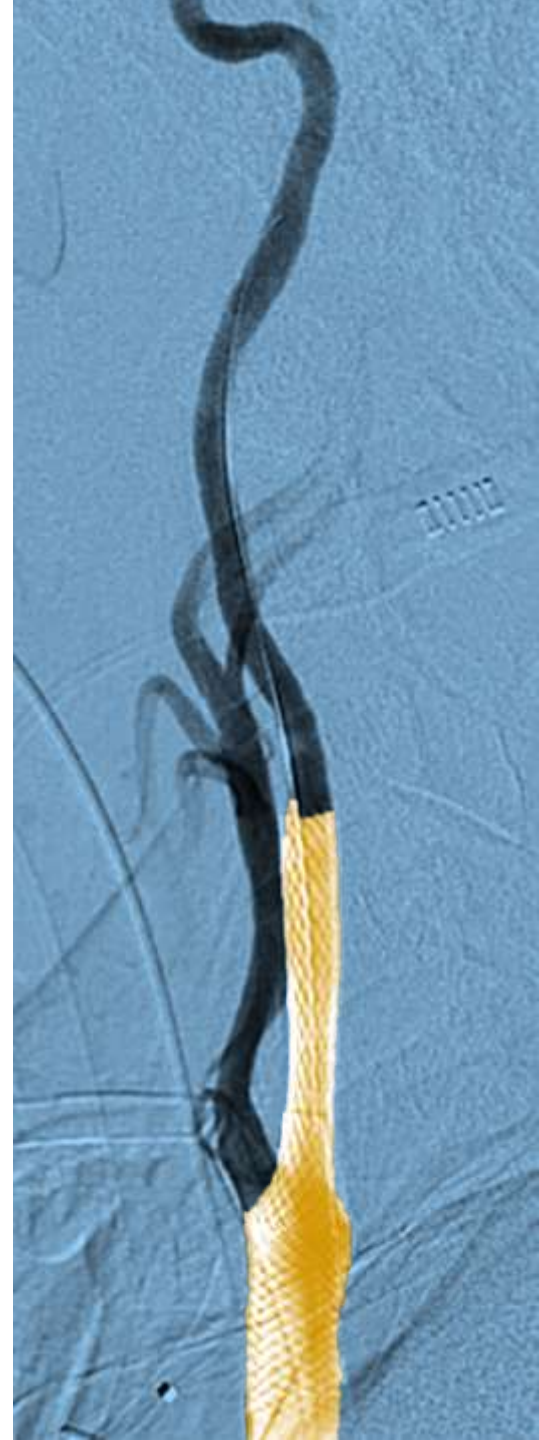


2023 STROKE AND NCC SYMPOSIUM

All Acutely Symptomatic Extracranial Carotid Occlusions **SHOULD NOT** Be Emergently Opened

Igor Rybinnik, M.D

Rutgers Robert Wood Johnson Medical School
Department of Neurology



DISCLOSURES

No relevant
financial
conflicts to
disclose

Some cases were
modified slightly
for teaching
purposes

Focus on isolated
extracranial ICA
occlusion, *not*
tandem
occlusions



62M



TIME FROM LAST KNOWN WELL

13 hours



NEURO DEFICITS

**Dysarthria, left facial
droop, left arm
weakness, mild neglect**



NIHSS SCORE

5



OCCLUDED VESSEL

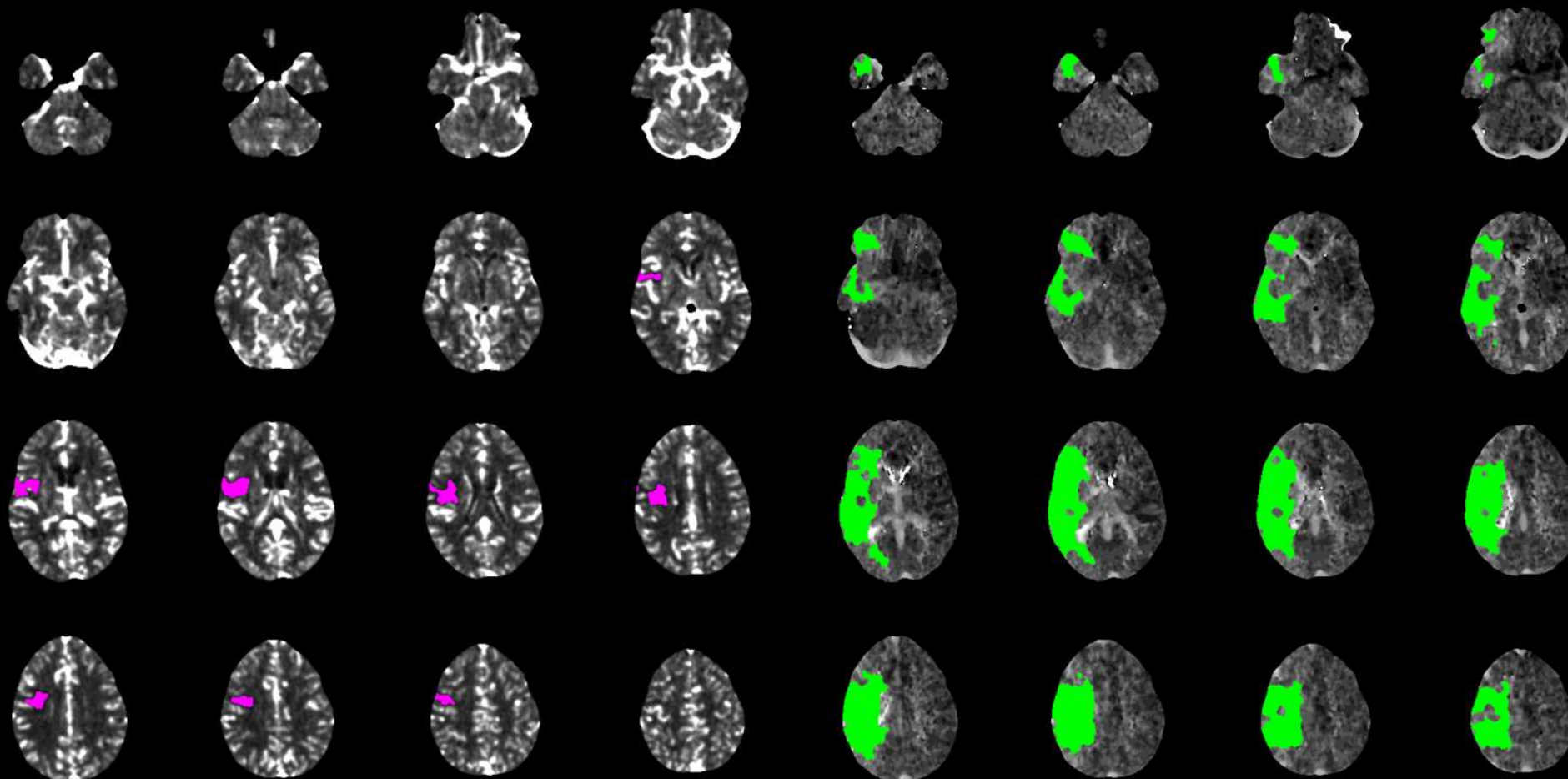
Right cervical ICA



© IGOR RYBINNIK

RUTGERS
Robert Wood Johnson
Medical School

INITIAL CTP



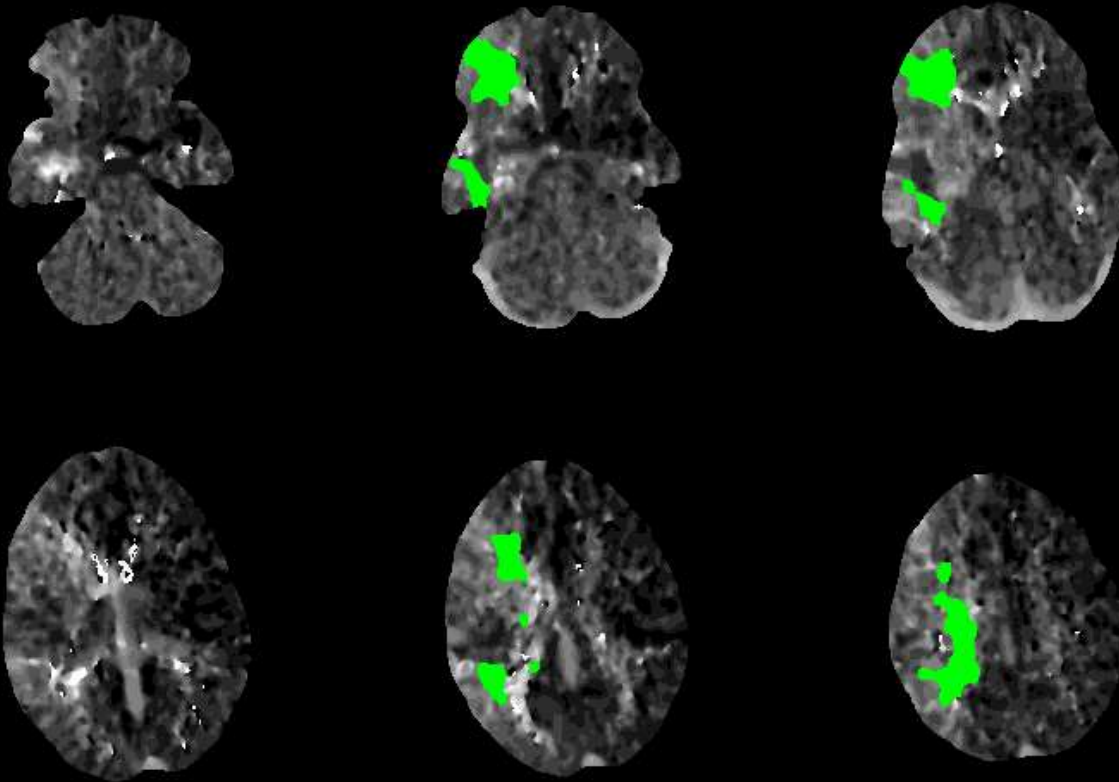
CBF<30% volume: 11 ml

Tmax>6.0s volume: 152 ml

Mismatch volume: 141 ml

Mismatch ratio: 13.8

69 HOUR FOLLOW-UP CTP AFTER BP AUGMENTATION

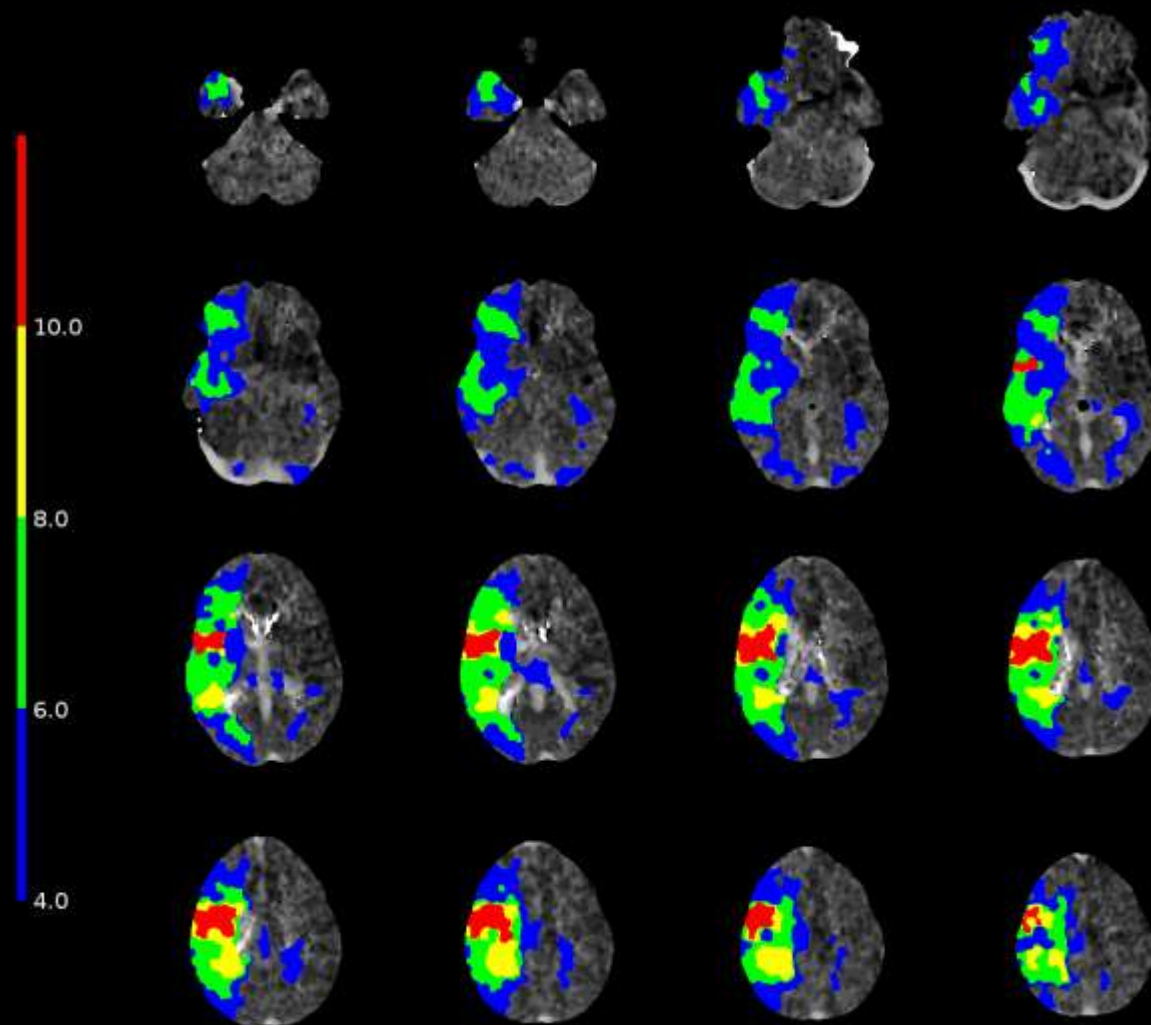


Improved clinically
with blood
pressure
augmentation

Penumbra volume
improved

NIHSS score 2 on
discharge

INITIAL CTP



Tmax>10.0s volume: 21 ml

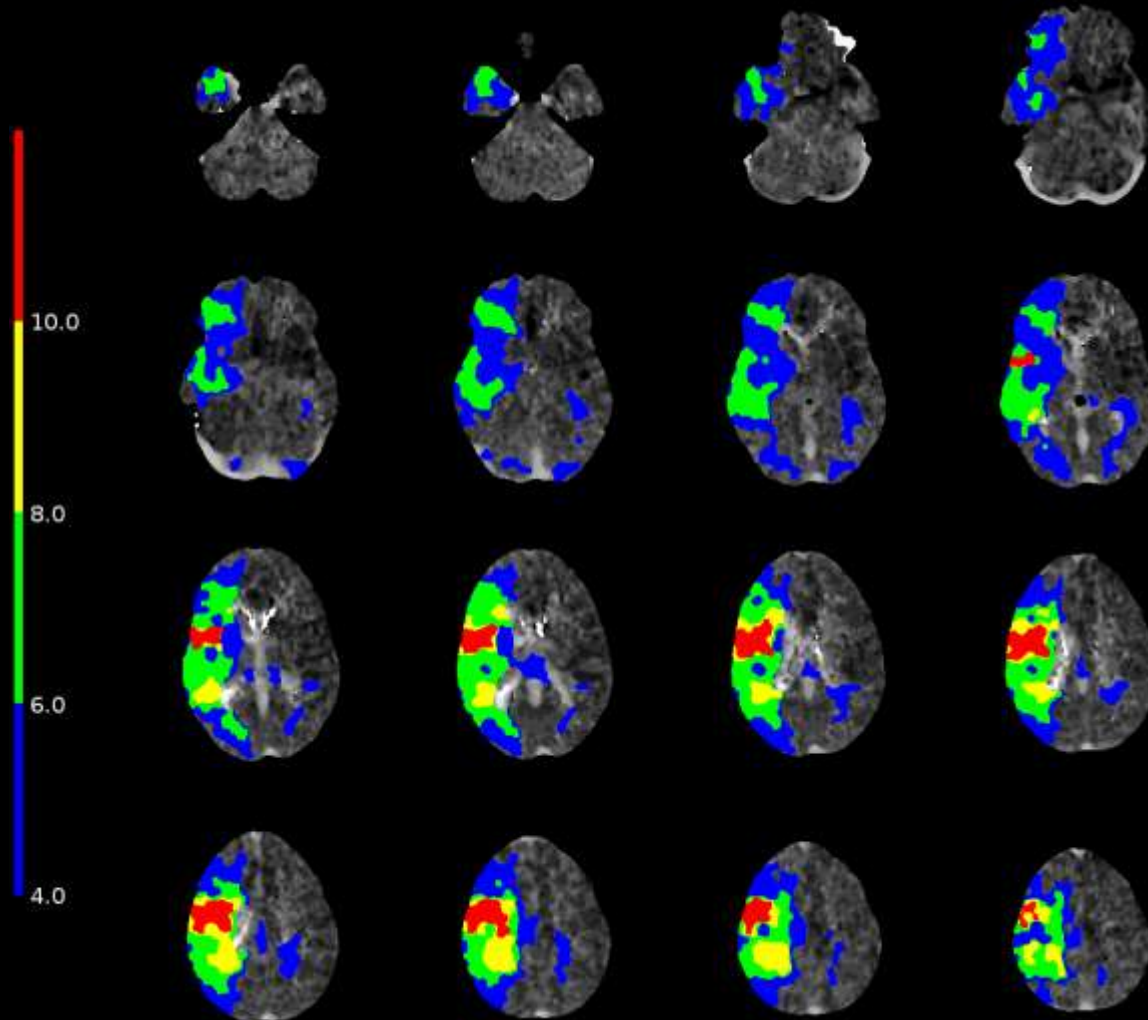
Tmax>8.0s volume: 51 ml

Tmax>6.0s volume: 152 ml

Tmax>4.0s volume: 314 ml

Hypoperfusion Index (Tmax>10s/Tmax>6s): 0.1

Hypoperfusion Index ($T_{max} > 10s / T_{max} > 6s$): 0.1



HYPOPERFUSION INDEX

≥ 0.34

**IS A PREDICTOR
OF POOR
COLLATERAL
FLOW AND
INFARCT
GROWTH**

MacLellan A, et al. *JSCVD* 2022;31(1):106-208

Normani AZ, et al. *Neurology* 2021;97(21):e2079-87

Any stroke or
operative death

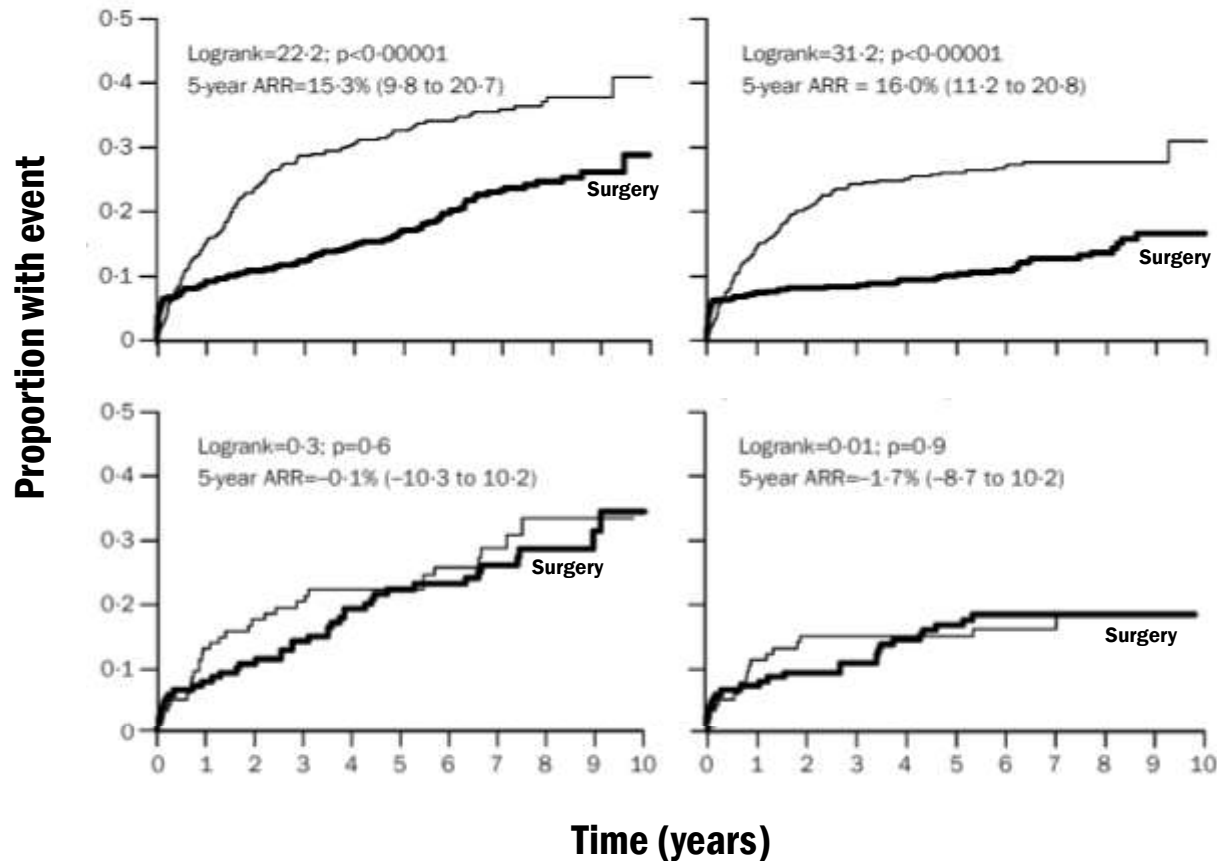
Ipsilateral ischemic
stroke and any operative
stroke/death

CEA VERSUS MEDICAL THERAPY POOLED ANALYSIS OF ECST, NASCET, VA TRIALS

Rothwell J, Carotid Endarterectomy Trialists' Collaboration, et al. *Lancet*.
2003;361(9352):107

**70-99%
STENOSIS**
EXCLUDING NEAR OCCLUSION

**NEAR
OCCLUSION**
>99%

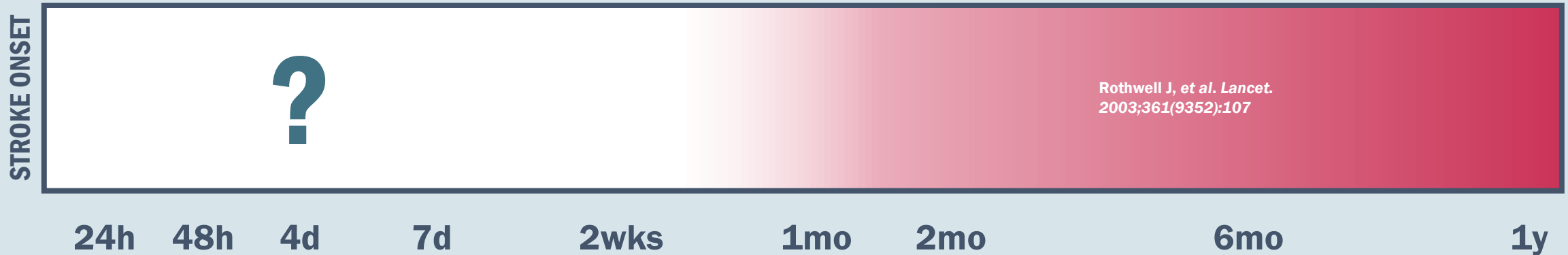


Revascularization of cervical
ICA near-occlusion/occlusion

Benefit unknown

Revascularization of cervical
ICA near-occlusion/occlusion

Ineffective



ICARO-3 STUDY: IVT OR ENDOVASCULAR FOR AIS ASSOCIATED WITH CERVICAL CAROTID ARTERY OCCLUSION WITHIN 6-HOUR WINDOW

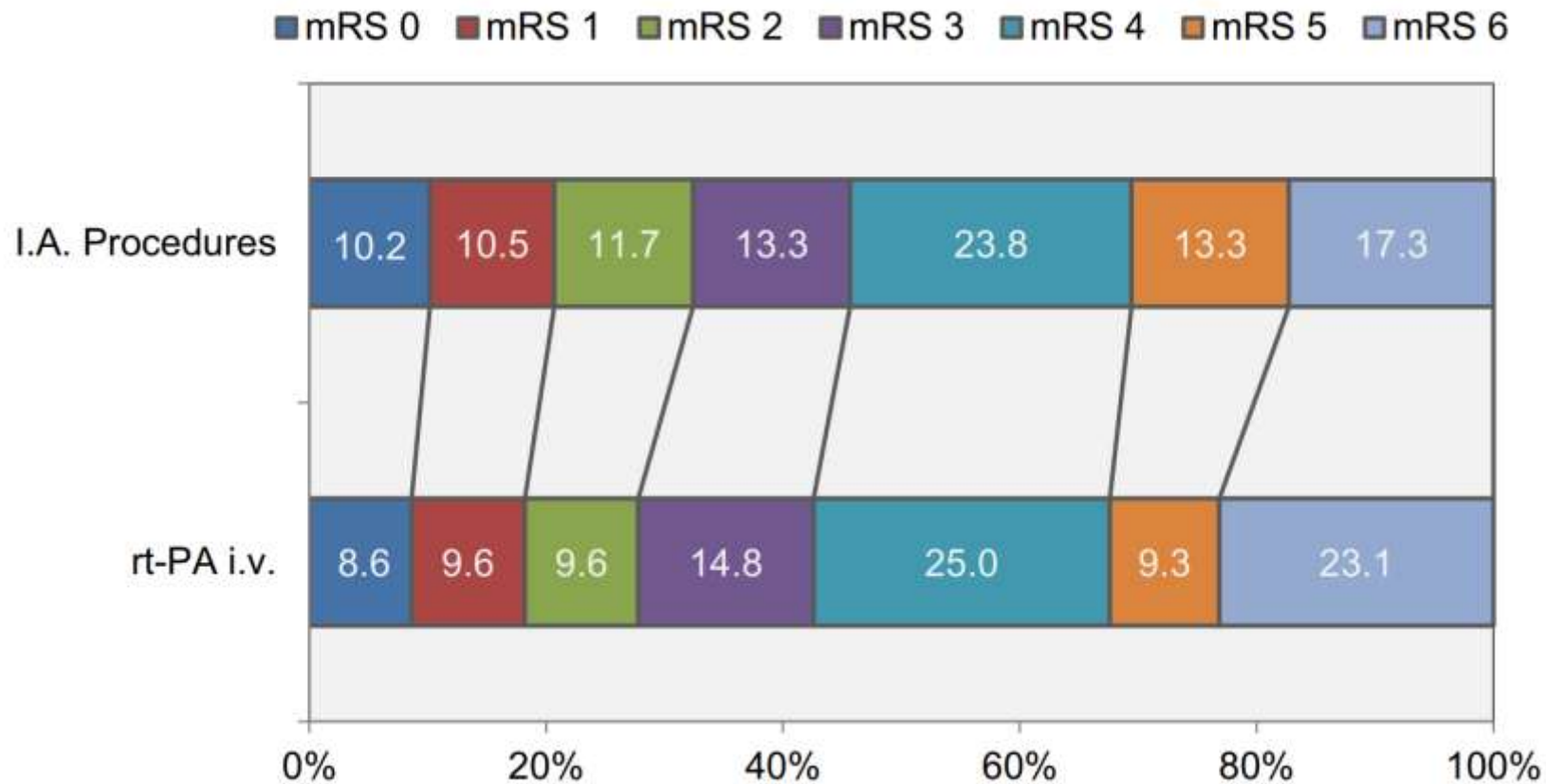
Paciaroni M, et al. *J Neurol* 2015;262:459-468

CHARACTERISTIC	eICA OCCLUSION ENDOVASCULAR ± IVT, IAT (6H) (n=324)	eICA OCCLUSION IVT ONLY (4.5H) (n=324)
Median Age	65 (54-73)	66 (54-74)
Male sex	63% (205)	63% (205)
Median NIHSS score	16 (11-20)	16 (12-20)
Cause of carotid occlusion		
Atherosclerosis	52% (168)	55% (178)
Dissection	11% (36)	14% (45)
Tandem occlusions	13% (43)	14% (22)

ICARO-3 STUDY: IVT OR ENDOVASCULAR FOR AIS ASSOCIATED WITH CERVICAL CAROTID ARTERY OCCLUSION WITHIN 6-HOUR WINDOW

Paciaroni M, et al. *J Neurol* 2015;262:459-468

OUTCOME	eICA OCCLUSION ENDOVASCULAR ± IVT, IAT (n=324)	eICA OCCLUSION IVT ONLY (n=324)
TICI 2a-3	69% (182/265)	
Safety endpoints within 90 days		
Any ICH	37% (120) OR 2.82 (95% CI, 1.95-4.06)	17% (56)
Parenchymal Hematoma	15% (50) <i>p</i> =0.0001	4% (14)
Death	18% (57)	23% (75) OR 0.61 (95% CI, 0.4-0.93)
Favorable outcome mRS 0-2 at 90 days	32% (105)	27% (89) OR 1.27 (95% CI, 0.9-1.77)



Ordinal analysis

adjusted for age, sex, NIHSS,
presence of diabetes mellitus and
atrial fibrillation

OR 1.15

95% CI, 0.86-1.54

$p = 0.33$

Early revascularization of cervical ICA
near-occlusion/occlusion

Probably not beneficial

Late revascularization of cervical ICA
near-occlusion/occlusion

Ineffective

STROKE ONSET

Paciaroni M, et al.
J Neurol 2015;262:459-468

J, et al.
2003;361(9352):107

24h

48h

4d

7d

2

6mo

1y



LET'S GIVE OUR INTERVENTIONALISTS THE BENEFIT OF THE DOUBT

**Successful
reperfusion rate
too low**

**TICI 2a-3
69%**

**Severe sICH
incidence too
high**

**Parenchymal
Hematoma**

15%

Fatal ICH

6%

**Non-uniform
endovascular
approach, use
of IA TPA may
not reflect
current practice**

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pat
gro**

LET'S GIVE OUR INTERVENTIONALISTS THE BENEFIT OF THE DOUBT

rate

**Severe sICH
incidence too
high**

**Parenchymal
Hematoma**

15%

Fatal ICH

6%

**Non-uniform
endovascular
approach, use
of IA TPA may
not reflect
current practice**

**Study was
underpowered
(needed 1300
patients per
group)**



**Rybinnik is so old.
I finished my fellowship
years after ICARO-3.
And NASCET? Really!?
How about some modern
data?**

MORE RECENT EVIDENCE: RETROSPECTIVE COHORTS

Outcome and Treatment Effects in Stroke Associated with Acute Cervical ICA Occlusion

n = 22

Gliem M, et al.
PLoS ONE 2017;12(1):e0170247

Angioplasty, stenting for symptomatic extracranial non-tandem internal carotid artery occlusion

n = 107

Jadhav A, et al. *J NeuroIntervent Surg* 2018;10:1155–1160

Endovascular Reperfusion for Acute Isolated Cervical Carotid Occlusions

n = 9

de Castro-Afonso LH, et al.
Intervent Neurol 2019;8:27–37

Acute Stroke Treatment by Surgical Recanalization of Extracranial ICA Occlusion

n = 12

Schubert J, et al. *Vasc and Endovasc Surg* 2019;53(1) 21-27

MORE RECENT EVIDENCE: RETROSPECTIVE COHORTS

Angioplasty,
stenting for
symptomatic
extracranial
non-tandem
internal
carotid artery
occlusion

n = 107

Jadhav A, et al. *J NeuroIntervent Surg*
2018;10:1155–1160

Angioplasty/stenting is safe and feasible

Occlusions were mostly atherosclerotic

Median NIHSS >6-8

Excellent recanalization

Increased rate of distal embolization

Trend towards better outcomes

Treated with DAPT

MORE RECENT EVIDENCE: RETROSPECTIVE COHORT WITH CONTROL GROUP

Waters M, et al. *Stroke Vasc Interv Neurol*. 2022;2:e000174

CHARACTERISTIC	eICA OCCLUSION ENDOVASCULAR ± IVT (24H) (n=40)	eICA OCCLUSION MEDICAL THERAPY ONLY (n=33)
Age	68 (60-77)	73 (60-82)
Baseline NIHSS score	13 (7-16)	3 (1-8) $p < 0.0001$
Age in NIHSS ≥ 6 cohort	69 (60-78) n=33	83 (76-88) n=11, $p=0.009$
Cause of carotid occlusion		
Atherosclerosis	78% (31)	85% (28)
Dissection	20% (8)	15% (5)
Received IV thrombolysis	50% (20) $p=0.002$	15% (5)
Treated with DAPT for at least 30 days	All	24% (8)

MORE RECENT EVIDENCE: RETROSPECTIVE COHORT WITH CONTROL GROUP

Waters M, et al. *Stroke Vasc Interv Neurol*. 2022;2:e000174

OUTCOME	ENDOVASCULAR ± IVT (n=40)	MEDICAL THERAPY ONLY (n=33)
mTICI 2c-3	85% (34)	NA
Procedural complications within 90 days		NA
Intracranial embolic complications	7.5% (3)	
Delayed stent reocclusion	5% (2)	
sICH	5% (2)	0 p=0.43
Good outcome mRS 0-2 at 90 days	73% (29) OR 1.7 (95% CI, 0.64-4.6)	61% (20)
NIHSS score ≥ 6 cohort	66% (22/33) OR 9.0 (95% CI, 1.65-49.0)	18% (2/11)

Early revascularization of cervical ICA
near-occlusion/occlusion

Safe, beneficial?

Late revascularization of cervical ICA
near-occlusion/occlusion

Ineffective

STROKE ONSET

Jadhav A, et al. *J NeuroIntervent Surg* 2018;10:1155-1160

Waters M, et al. *Stroke Vasc Interv Neurol*. 2022;2:e000174

Rothwell J, et al.
Lancet 2003;361(9352):107

24h

48h

4d

7d

2wks

1mo

2mo

6mo

1y

AMERICAN STROKE ASSOCIATION 2019 GUIDELINES FOR THE MANAGEMENT OF ACUTE ISCHEMIC STROKE

Powers J, et al. *Stroke* 2019;50:e344–e418.

Treatment of **tandem occlusions** (both extracranial and intracranial occlusions) when performing mechanical thrombectomy may be **reasonable**.

IIb

B-R

The usefulness of **emergent or urgent carotid endarterectomy (CEA)/carotid angioplasty and stenting** when clinical indicators or brain imaging suggests a small infarct core with large territory at risk (eg, penumbra), compromised by inadequate flow from a critical carotid stenosis or occlusion, or in the case of acute neurological deficit after CEA, in which acute thrombosis of the surgical site is suspected, is **not well established**.

IIb

B-NR

In patients with **unstable neurological status** (eg, stroke-in-evolution), the efficacy of **emergency or urgent CEA /carotid angioplasty and stenting** is **not well established**.

IIb

B-NR

ALL ACUTELY SYMPTOMATIC
EXTRACRANIAL CAROTID
CRITICAL STENOSES
SHOULD NOT
BE EMERGENTLY OPENED

Randomized-controlled evidence is necessary to define
the **optimal patients** that would benefit from intervention.

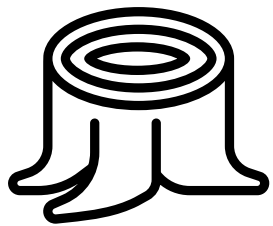


**SOME
SHOULD
BE EMERGENTLY OPENED**

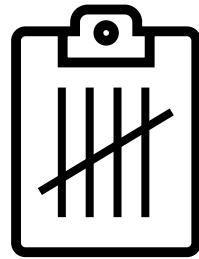
**ACUTELY SYMPTOMATIC
EXTRACRANIAL
CRITICAL STROKE**



ACUTELY SYMPTOMATIC EICA OCCLUSIONS THAT MAY BENEFIT FROM EMERGENT REVASCULARIZATION



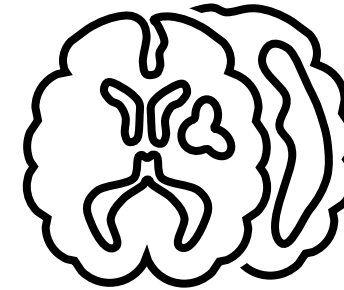
AGE
<80



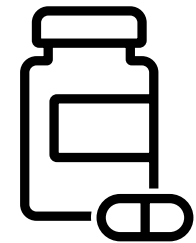
NIHSS SCORE
>6



MECHANISM OF OCCLUSION
Athero.



MULTIMODAL IMAGING
High HIR



MEDICAL THERAPY
DAPT

Thank you

