CRITICAL CARE MANAGEMENT

SPONTANEOUS

INTRACERBRAL HEMORRHAGE

Jignesh S Patel MD

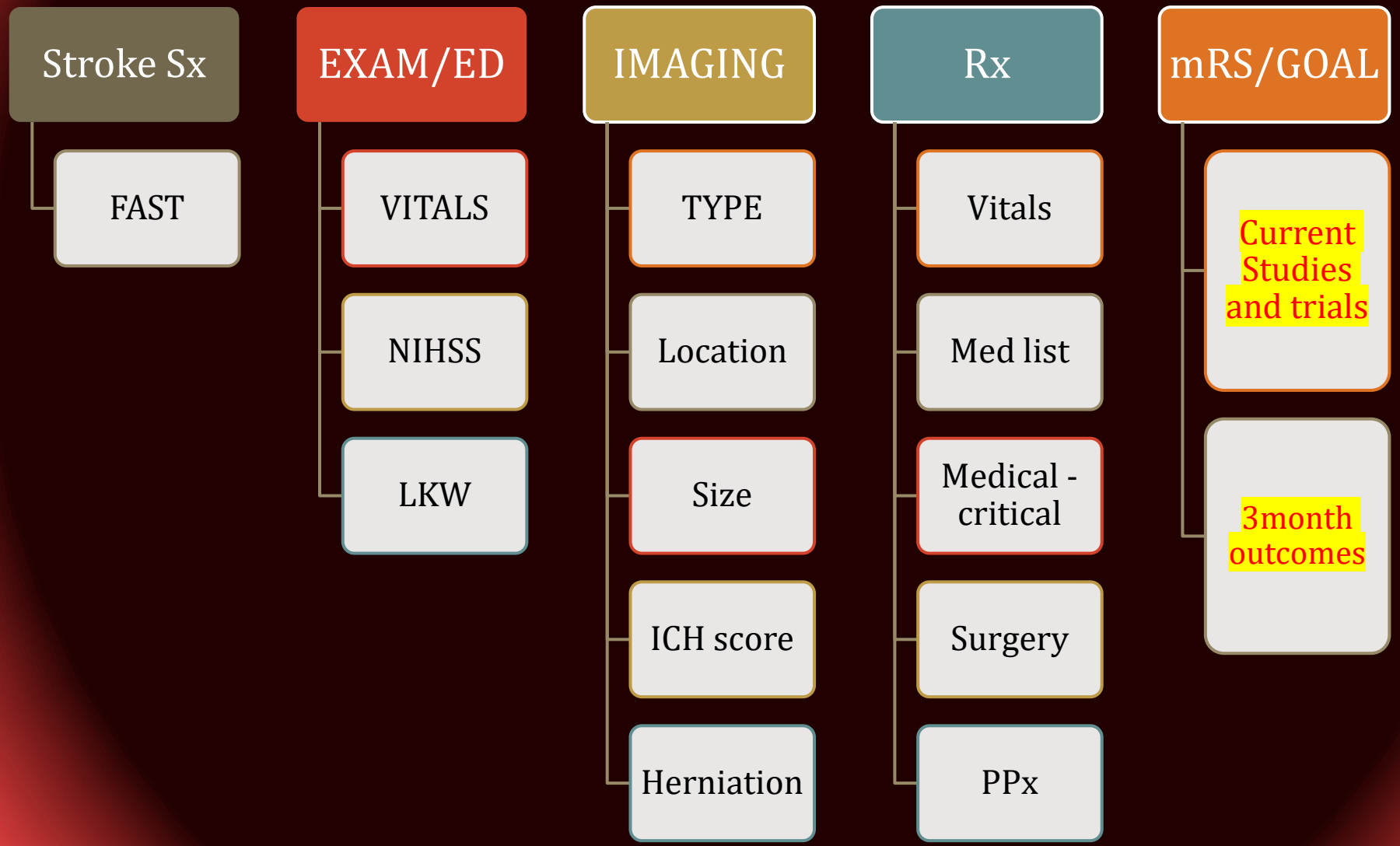
NeuroIntensivist

CME DISCLOSURE

- No Financial Relationships

- Neuroscience symposium 2023
- May 11-13

SYMPTOMS… TO GOAL



ICH/IPH

- aTraumatic (scope of ppt)
- 2nd to Ischemic Stroke
- Traumatic

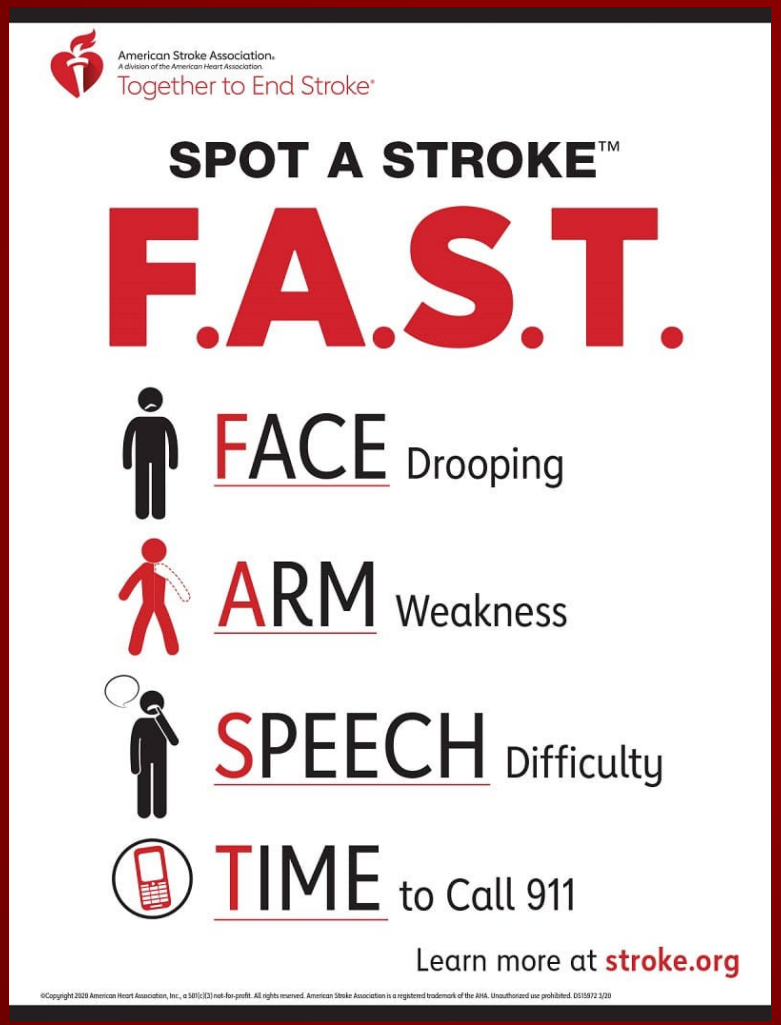
PRIMARY GOALS

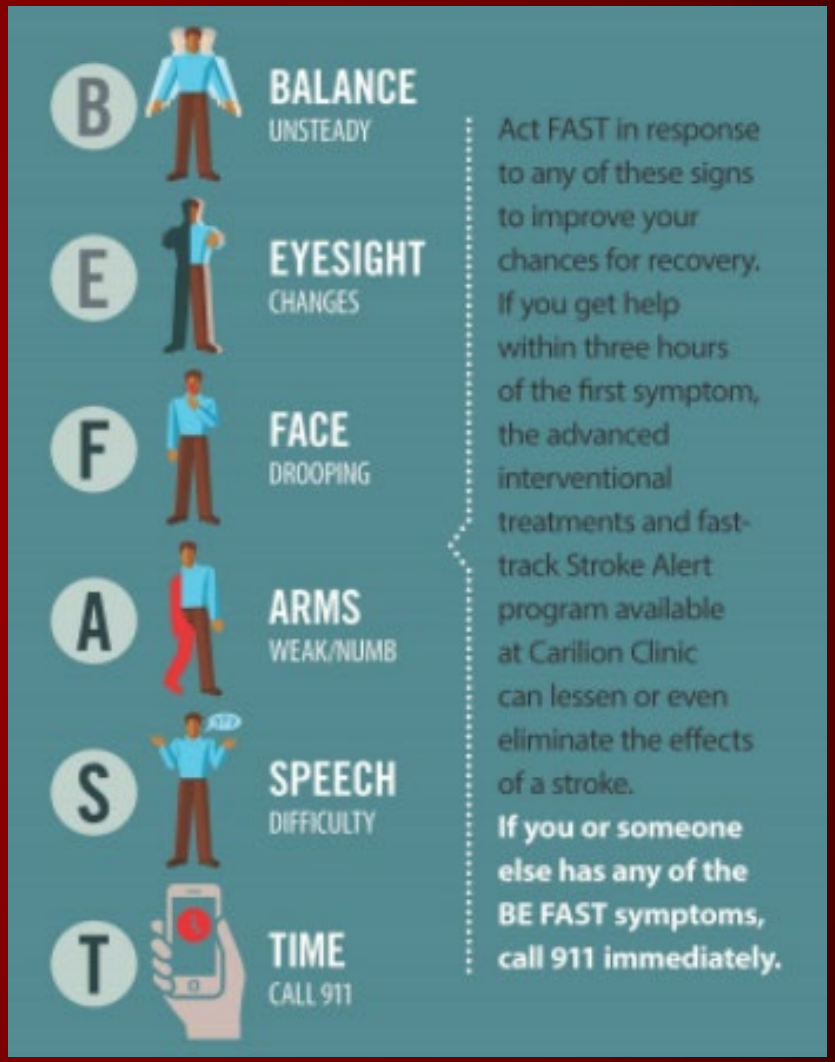
- ABCs
- Prevent expansion
- Minimizing Neurologic sequela
- Improve Functional Outcome

INITIAL STROKE SYMPTOMS

Stroke Sx

FAST





EARLY IDENTIFICATION

EXAM/ED

VITALS

NIHSS

LKW

Table 3. Classification of blood pressure for adults

Blood Pressure Classification	SBP mmHg	DBP mmHg
Normal	<120	and <80
Prehypertension	120–139	or 80–89
Stage 1 Hypertension	140–159	or 90–99
Stage 2 Hypertension	≥160	or ≥100

SBP, systolic blood pressure; DBP, diastolic blood pressure

When were they last seen at baseline?

Level of consciousness		Motor arm (left and right)	
alert	(0)	no drift	(0)
drowsy	(1)	drift before 10 seconds	(1)
stuporous	(2)	falls before 10 seconds	(2)
coma	(3)	no effort against gravity	(3)
		no movement	(4)
Response to level of consciousness questions*		Motor leg (left and right)	
answers both correctly	(0)	no drift	(0)
answers one correctly	(1)	drift before 5-10 seconds	(1)
answers neither correctly	(2)	falls before 5-10 seconds	(2)
		no effort against gravity	(3)
		no movement	(4)
Response to level of consciousness commands†		Ataxia	
obeys both correctly	(0)	absent	(0)
obeys one correctly	(1)	one limb	(1)
obeys neither	(2)	two limbs	(2)
Pupillary response		Sensory	
both reactive	(0)	normal	(0)
one reactive	(1)	mild	(1)
neither reactive	(2)	severe loss	(2)
Gaze		Language	
normal	(0)	normal	(0)
partial gaze palsy	(1)	mild aphasia	(1)
total gaze palsy	(2)	severe aphasia	(2)
		mute or global aphasia	(3)
Visual fields		Facial palsy	
no visual loss	(0)	normal	(0)
partial hemianopsia	(1)	minor paralysis	(1)
complete hemianopsia	(2)	partial paralysis	(2)
bilateral hemianopsia	(3)	complete paralysis	(3)
Dysarthria		Extinction/inattention	
normal	(0)	normal	(0)
mild	(1)	mild	(1)
severe	(2)	severe	(2)

IMAGING –STROKE ACTIVATION

TYPE

Location

Size

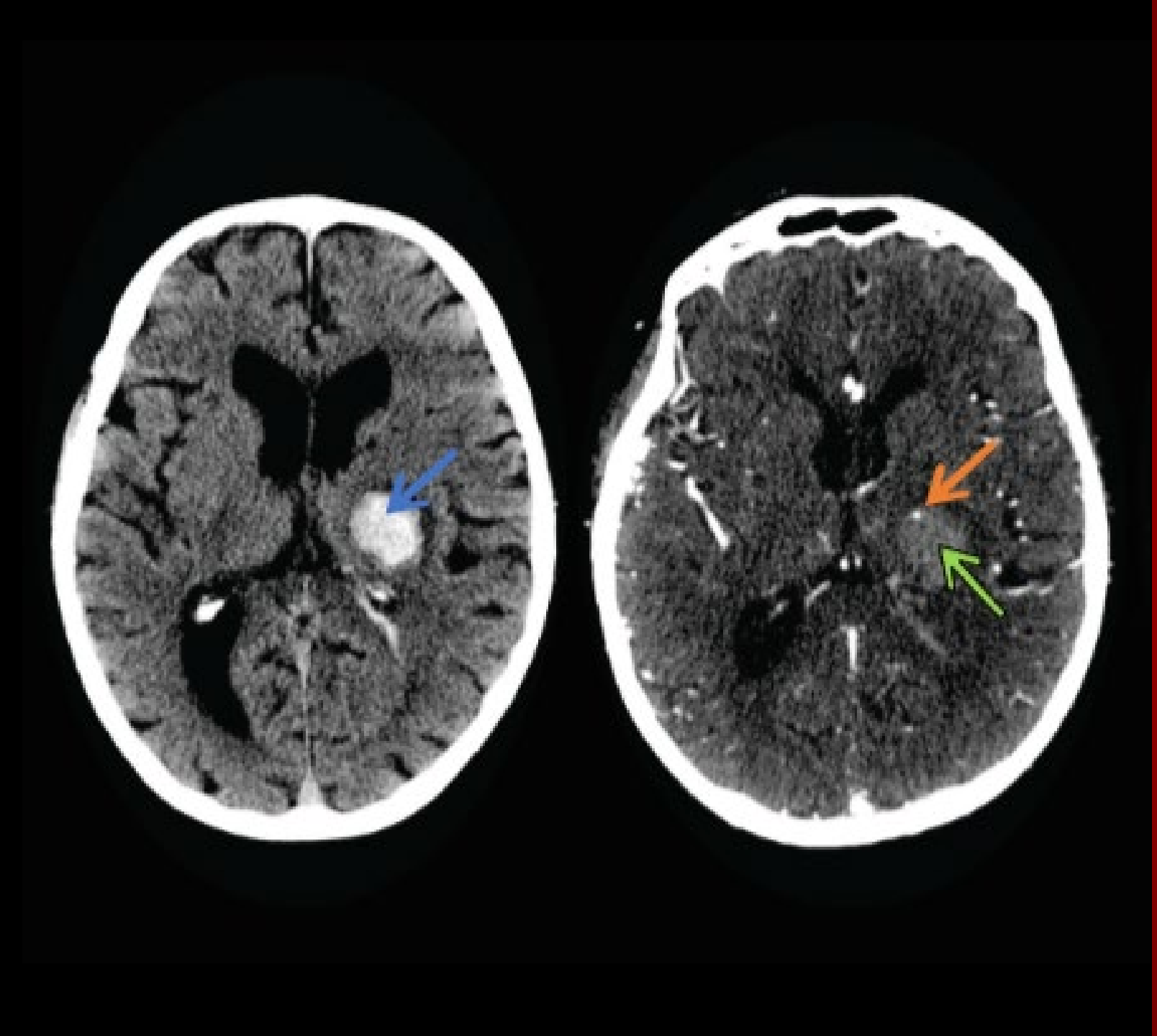
ICH score

Herniation

- SAH
- ICH
- EPH
- SDH
- IVH
- Contusion

ICH-

- Spontaneous*
  - HTN
  - AVM
  - Lesion
  - Coagulopathy
- Traumatic



CTA

- SPOT SIGN
  - Active Extravasation

IMAGING –STROKE ACTIVATION

- TYPE
- Location
- Size
- ICH score
- Herniation

- Supra/infra tentorial or IVH
- Lobar (superficial)
- BG/IC (deep)

- ABC/2

- NSICU

ICH Score (Hemphill et al.)

Feature	Finding	Points
GCS	3-4	2
	5-12	1
	13-15	0
Age	>=80	1
	<80	0
Location	Infratentorial	1
	Supratentorial	0
ICH volume	>=30cc	1
	<30cc	0
Intraventricular Blood	Yes	1
	No	0
ICH SCORE		0-6 points

ICH Score	30 Day Mortality
0	0%
1	13%
2	26%
3	72%
4	97%
5	100%
6	100%

TREATMENT STRATEGIES

Rx

- Vitals
- Med list
- Medical - critical
- Surgery
- PPx

SBP GOALS*

- Initial SBP <220
  - Target SBP 120-140
- Initial SBP >220
  - Target SBP 140-160
- MEDICATION
  - Nicardipine IV
  - Clevedipine IV
  - Labetelol

INTERACT2

Rapid Blood-Pressure Lowering in Patients with Acute Intracerebral Hemorrhage

Craig S. Anderson, M.D., Ph.D., Emma Heeley, Ph.D., Yining Huang, M.D., Jiguang Wang, M.D., Christian Stapf, M.D., Candice Delcourt, M.D., Richard Lindley, M.D., Thompson Robinson, M.D., Pablo Lavados, M.D., M.P.H., Bruce Neal, M.D., Ph.D., Jun Hata, M.D., Ph.D., Hisatomi Arima, M.D., Ph.D., Mark Parsons, M.D., Ph.D., Yuechun Li, M.D., Jinchao Wang, M.D., Stephane Heritier, Ph.D., Qiang Li, B.Sc., Mark Woodward, Ph.D., R. John Simes, M.D., Ph.D., Stephen M. Davis, M.D., and John Chalmers, M.D., Ph.D., for the INTERACT2 Investigators*

CONCLUSIONS

In patients with intracerebral hemorrhage, intensive lowering of blood pressure did not result in a significant reduction in the rate of the primary outcome of death or severe disability. An ordinal analysis of modified Rankin scores indicated improved functional outcomes with intensive lowering of blood pressure. (Funded by the National Health and Medical Research Council of Australia; INTERACT2 ClinicalTrials.gov number, NCT00716079.)

This article was published on May 29, 2013, at NEJM.org.

N Engl J Med 2013;368:2355-65.
DOI: 10.1056/NEJMoa1214609
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Assigned 6hrs

Target groups

- SBP <140
- SBP <180
  - Within 1hr

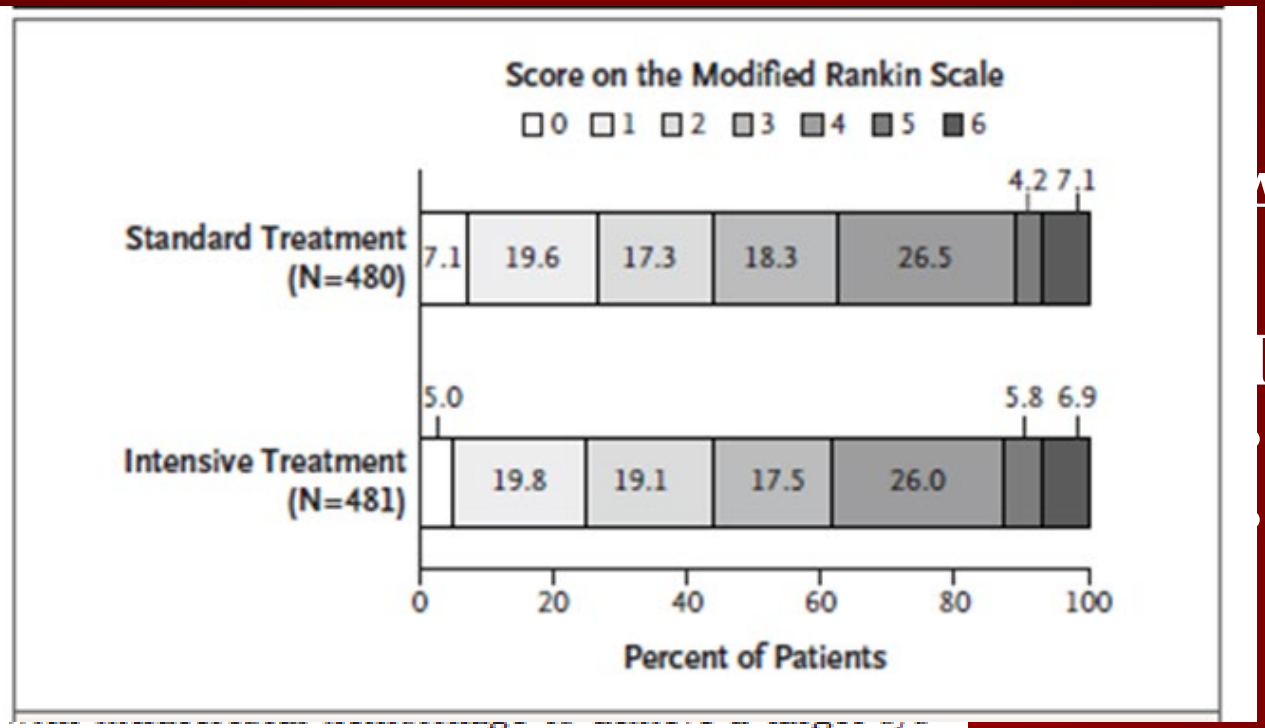
- Local protocol

- May benefit with intensive BP control on mRS

ATACH-II

Intensive Blood-P
in Patients with Acute

Adnan I. Qureshi, M.D., Yuko Y. Pale
Daniel F. Hanley, M.D., Chung Y. H
Claudia S. Moy, Ph.D., Robert Silber
Jose I. Suarez, M.D., Kazunori Toyod
Haruko Yamamoto, M.D., Ph.D., a
for the ATACH-2 Trial Investigator
Treatment Tri



CONCLUSIONS

The treatment of participants [illegible] tolic blood pressure of 110 to 139 mm Hg did not result in a lower rate of death or disability than standard reduction to a target of 140 to 179 mm Hg. (Funded by the National Institute of Neurological Disorders and Stroke and the National Cerebral and Cardiovascular Center; ATACH-2 ClinicalTrials.gov number, NCT01176565.)

This article was published on June 8, 2016, at NEJM.org.

N Engl J Med 2016;375:1033-43.
DOI: 10.1056/NEJMoa1603460
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Assigned 4-5hr

Target groups
- SBP 110-139
- SBP 140-179
  - Within 2hrs

- Nicardipine
- Ended early
  - No benefit to functional outcome

	Combined (n=3829)	INTERACT2 (n=2829)	ATACH-II (n=1000)
Demographics			
Age, years	63·1 (12·9)	63·5 (12·9)	61·9 (13·1)
Sex			
Men	2400 (63%)	1780 (63%)	620 (62%)
Women	1429 (37%)	1049 (37%)	380 (38%)
Asian ethnicity	2490 (65%)	1928 (68%)	562 (56%)
Clinical features			
History of hypertension	2841/3799 (75%)	2048/2826 (72%)	793/973 (82%)
Current use of antihypertensive drugs	1769/3819 (46%)	1274/2826 (45%)	495/993 (50%)
SBP at randomisation, mm Hg	178 (19)	179 (17)	175 (25)
NIHSS score	11 (6–16)	11 (6–16)	11 (6–16)
GCS score	14 (13–15)	14 (12–15)	15 (13–15)
Intracerebral haemorrhage characteristics on brain imaging			
Haematoma volume, mL	10·8 (5·6–19·3)	11 (5·8–19·5)	10·2 (5·1–18·4)
Haematoma location			
Basal ganglia or deep structures	2510/3067 (82%)	1630/2076 (79%)	880/991 (89%)
Lobar	413/3067 (13%)	303/2076 (15%)	110/991 (11%)
Infratentorial or posterior fossa	144/3067 (5%)	143/2076 (7%)	1/991 (<1%)
Intraventricular haemorrhage	1004/3601 (28%)	740/2613 (28%)	264/988 (27%)
Early SBP control			
Time from intracerebral haemorrhage onset to randomisation, h	3·6 (2·7–4·4)	3·7 (2·8–4·7)	3·1 (2·3–3·9)
Treated with multiple agents	1524 (40%)	1309 (46%)	215 (22%)
Achieved SBP, mm Hg*	147 (15)	149 (16)	142 (13)
Magnitude of SBP reduction, mm Hg†	29 (22)	29 (21)	31 (25)
SBP variability, mm Hg‡	14 (8)	14 (8)	12 (6)
Other treatment			
Intubation	326/3771 (9%)	189/2779 (7%)	137/992 (14%)
Neurosurgery			
Evacuation or decompression	125/3771 (3%)	81/2779 (3%)	44/992 (4%)
Intraventricular catheter	155/3771 (4%)	85/2779 (3%)	70/992 (7%)

Data are mean (SD), n (%), n/N (%), or median (IQR). ATACH-II=second Antihypertensive Treatment of Acute Cerebral Haemorrhage trial. GCS=Glasgow Coma Scale. INTERACT2=second Intensive Blood Pressure Reduction in Acute Cerebral Haemorrhage Trial. NIHSS=National Institute of Health Stroke Scale. SBP=systolic blood pressure. *Mean SBP in 1–24 h. †SBP at randomisation minus minimum SBP within 1 h. ‡SD of SBP in 1–24 h.

Table 1: **Summary of baseline characteristics by trial**

Blood pressure control and clinical outcomes in acute intracerebral haemorrhage: a preplanned pooled analysis of individual participant data

Tom J Moullaali, Xia Wang*, Reneé H Martin, Virginia B Shipes, Thompson G Robinson, John Chalmers, Jose I Suarez, Adnan I Qureshi, Yuko Y Palesch, Craig S Anderson*

Lancet Neurol 2019; 857–64

In summary, our findings indicate that there are benefits to achieving early and smooth control of systolic blood pressure potentially to levels as low as 120–130 mm Hg in adults who have been admitted to hospital with mild-to-moderate acute intracerebral haemorrhage.

difficult to assess head-to-head analysis of functional improvement mRS in 3months

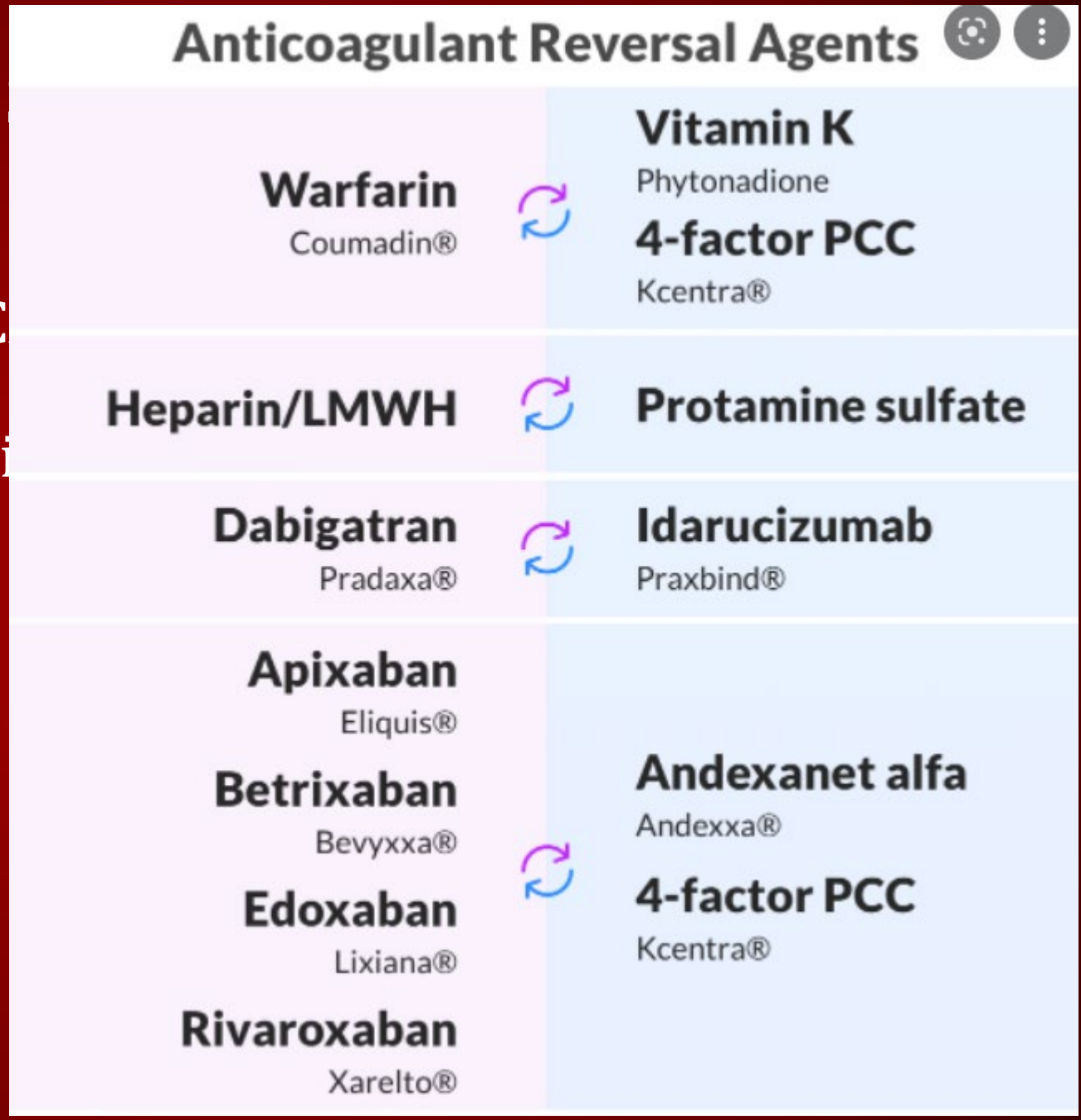
TREATMENT

Rx

- Vitals
- Med list
- Medical - critical
- Surgery
- PPx

MEDIC

- Initi
  -
  -
  -
  -
  -



Very Quick Guide to Reversing Antithrombotic Therapy

Agent	Half-life	Renal Disease	Reversal
Aspirin	15-30 minutes	No change	DDAVP, Platelet Transfusions (?)
Clopidogrel	8 hours	Metabolites renally cleared	DDAVP(?), 2 units of platelet transfusions
Prasugrel	7 hours	Metabolites renally cleared	DDAVP(?), 2 units of platelet transfusions
Ticagrelor	7 hours	No change	DDAVP(?), 2 units of platelet transfusions (may be ineffective)
Abciximab	30 minutes	No change	Platelet Transfusion
Tirofiban	2 hours	Decrease dose by 50% if ClCr < 30 ml/min	Platelet transfusions, DDAVP, cryoprecipitate, dialysis
Eptifibatide	2-3 hours	Decrease dose by 50% if ClCr < 30 ml/min	Platelet transfusions, DDAVP, cryoprecipitate, dialysis
Unfractionated Heparin	30-150 minutes	45-225	Protamine - see table
Low Molecular Weight Heparin	2-8 hours	4-16 hours	Protamine - see table
Fondaparinux	17-21 hours	Clearance decreased by 50% if ClCr < 30 ml/min	PCC 50 units/kg
Argatroban	40 minutes	No change	PCC 50 units/kg
Bivalirudin	25 minutes	60% dose reduction if ClCr < 30 ml/min	PCC 50 units/kg
Dabigatran	12-14 hours	Avoid if ClCr < 30 ml/min	Idarucizumab 5grams
Apixaban	12-14 hours	Can be used in dialysis patients	PCC 50 units/kg or Andexanet
Betrixaban	19-27 hours	50% reduction if CrCl 15-30 ml/min, Avoid if ClCr < 15 ml/min	PCC 50 units/kg
Edoxaban	10-14 hours	50% reduction if CrCl 30-60 ml/min, Avoid if ClCr < 30 ml/min	PCC 50 units/kg
Rivaroxaban	4-9 hours	Avoid if ClCr < 15 ml/min	PCC 50 units/kg or Andexanet
Warfarin	36 hours	50% reduction in CYP C2P9	vitamin K, FFP, PCC, rVIIa - see table
Streptokinase		Hepatically cleared	Plasma, platelet, cryoprecipitate
tPA	3 minutes	Hepatically cleared	Plasma, platelet, cryoprecipitate
Reteplase	13-16 minutes	Hepatically cleared	Plasma, platelet, cryoprecipitate
Tenecteplase	15-20 minutes	Hepatically cleared	Plasma, platelet, cryoprecipitate

PCC = prothrombin complex concentrates, FFP = Fresh Frozen Plasma

REVERSAL AGENTS

- Anticoagulation medication
- Dosage
- Time of last use
- Institution specific

- Phone a pharmacist

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MULTIPLE STUDIES – EXPANSION AND OUTCOME

Table 1. Treatment or Prognostic Studies Using Hemorrhage Volume Growth as the Primary Outcome Measure

Trial name	Year	Study population	Intervention or factor	Imaging end point
rFVIIa phase 2B trial[11]	2005	Noncoagulopathic spontaneous ICH	rFVIIa vs placebo	Percentage change in hematoma volume at 24 h
rFVIIa for TBI[28]	2008	Traumatic brain contusion	rFVIIa vs placebo	Absolute change (in mL) in hemorrhage volume
INTERACT-1[29]	2008	Noncoagulopathic spontaneous ICH	Systolic blood pressure <140 mm Hg vs <180 mm Hg	Percentage change in hematoma volume at 24 h
PREDICT[30]	2012	Noncoagulopathic spontaneous ICH	Presence or absence of CTA spot sign	Hematoma expansion, defined as a ≥6 mL or 33% increase in size
SPOTLIGHT and STOP-IT[31]	2019	Spot sign with noncoagulopathic ICH	rFVIIa vs placebo in patients with CTA spot sign	Absolute change in ICH volume (in mL)
STOP-AUST[32]	2020	Spot sign with noncoagulopathic ICH	TXA vs placebo	Hematoma expansion, defined as an increase of ≥6 mL or 33%

Abbreviations: CTA, computed tomography angiography; ICH, intracerebral hemorrhage; rFVIIa, recombinant activated factor VIIa; TBI, traumatic brain injury; TXA, tranexamic acid.

Table 2. Trials of Hemostatic Therapy With Clinical Outcome as the Primary End Point[a]

Trial name	Year	Study population	Intervention or factor	Primary end point
FAST[33]	2008	Noncoagulopathic spontaneous ICH	rFVIIa vs placebo	90-d mRS of 4-6
PATCH[34]	2016	Patients with spontaneous ICH receiving antiplatelet agents	Platelet transfusion vs no platelet transfusion	90-d mRS shift analysis
TICH-2[35]	2018	Noncoagulopathic spontaneous ICH	TXA vs placebo	90-d mRS shift analysis
CRASH-3[36]	2019	TBI	TXA vs placebo	TBI-related death within 28 d

Abbreviations: ICH, intracerebral hemorrhage; mRS, modified Rankin score; rFVIIa, recombinant activated factor VIIa; TBI, traumatic brain injury; TXA, tranexamic acid.

[a] For the purposes of this analysis, trials of blood pressure lowering for ICH were not considered hemostatic interventions.

From: **Recommended Primary Outcomes for Clinical Trials Evaluating Hemostatic Agents in Patients With Intracranial Hemorrhage: A Consensus Statement**

JAMA Netw Open. 2021;4(9):e2123629. doi:10.1001/jamanetworkopen.2021.23629

TREATMENT STRATEGIES

Rx

- Vitals
- Med list
- Medical
- Surgery
- PPx

Neuro Protection

Early Mobility -> PT/OT

- SCCM/NCCS
- Stroke Certification – Neurochecks
- Minimizing sedation
- ICP precautions
- Imaging and readjusting targets
  - SBP
  - Na+
  - ABGs
  - Fever: central vs infection
  - euGlycemia

Rx

Vitals

Med list

Medical

Surgery

PPx

TREATMENT STRATEGIES

Continued Deterioration

Neurosurgical Evaluation

- ICH Evacuation –Craniotomy
- Minimally Invasive Surgery
  - SCUBA (endoscopic)
- Decompressive Hemicraniectomy

STICH TRIAL

Interpretation: Patients with spontaneous supratentorial intracerebral haemorrhage in neurosurgical units show no overall benefit from early surgery when compared with initial conservative treatment.

Clinical Trial > Lancet. 2005 Jan 29-Feb 4;365(9457):387-97.
doi: 10.1016/S0140-6736(05)17826-X.

Early surgery versus initial conservative treatment in patients with spontaneous supratentorial intracerebral haematomas in the International Surgical Trial in Intracerebral Haemorrhage (STICH): a randomised trial

A David Mendelow [1], Barbara A Gregson, Helen M Fernandes, Gordon D Murray, Graham M Teasdale, D Terence Hope, Abbas Karimi, M Donald M Shaw, David H Barer, STICH investigators

TREATMENT STRATEGIES

Rx

- Vitals
- Med list
- Medical
- Surgery
- PPx

Medically/Surgically Stable

- DVT (48-72hrs)
- GI (mechanically ventilated)
- Seizure (lobar: AED x7days)

- Early Nutrition
- CAUTI/CLABSI
- VAPs

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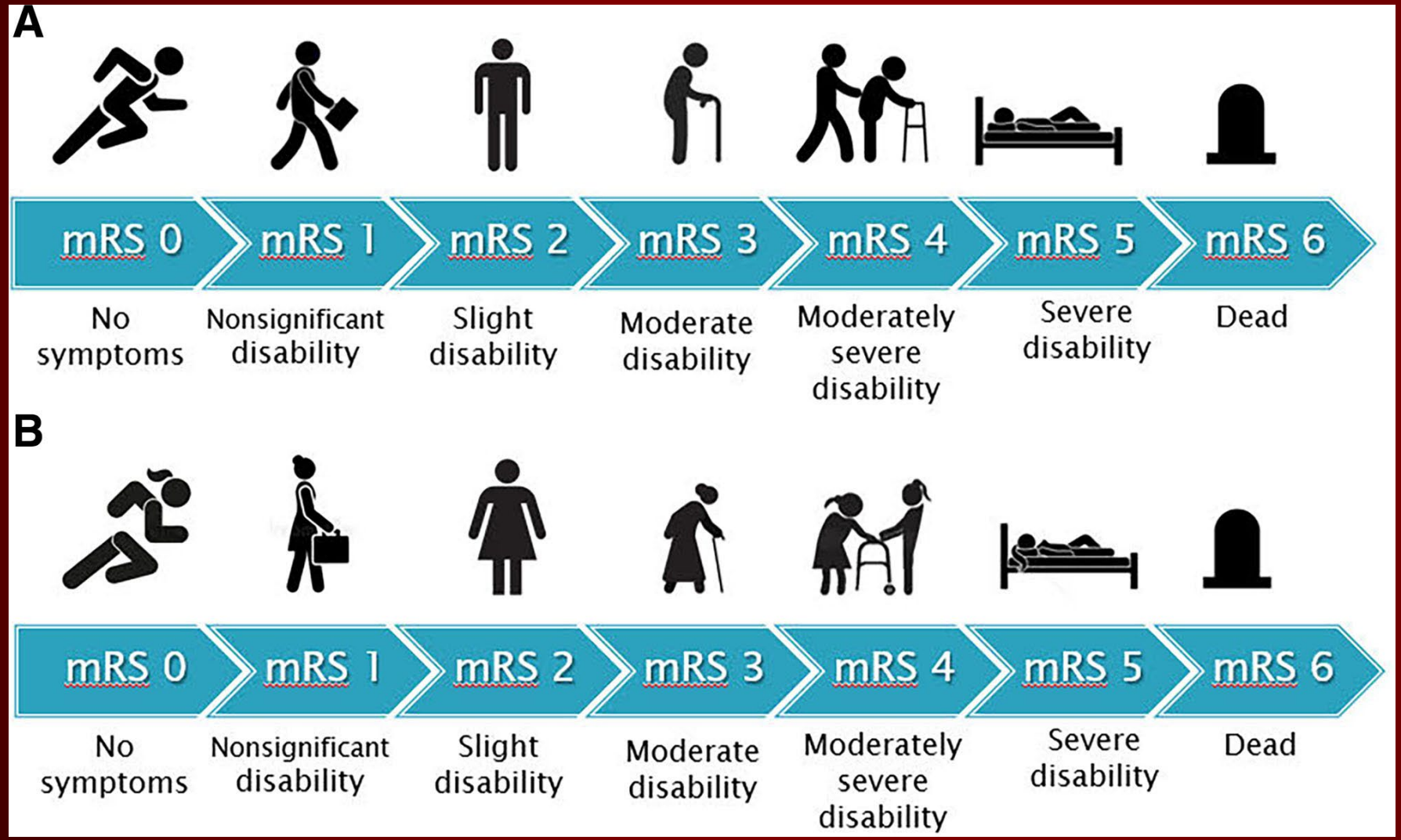
FUNCTIONAL OUTCOMES

Standardized Nomenclature for Modified Rankin Scale Global Disability Outcomes: Consensus Recommendations From Stroke Therapy Academic Industry Roundtable XI

Jeffrey L. Saver, Napasri Chaisinanunkul, Bruce C.V. Campbell, James C. Grotta, Michael D. Hill, Pooja Khatri, Jaren Landen, Maarten G. Lansberg, Chitra Venkatasubramanian, Gregory W. Albers and on behalf of the XIth Stroke Treatment Academic Industry Roundtable

Originally published 29 Jul 2021 | https://doi.org/10.1161/STROKEAHA.121.034480 | Stroke. 2021;52:3054–3062



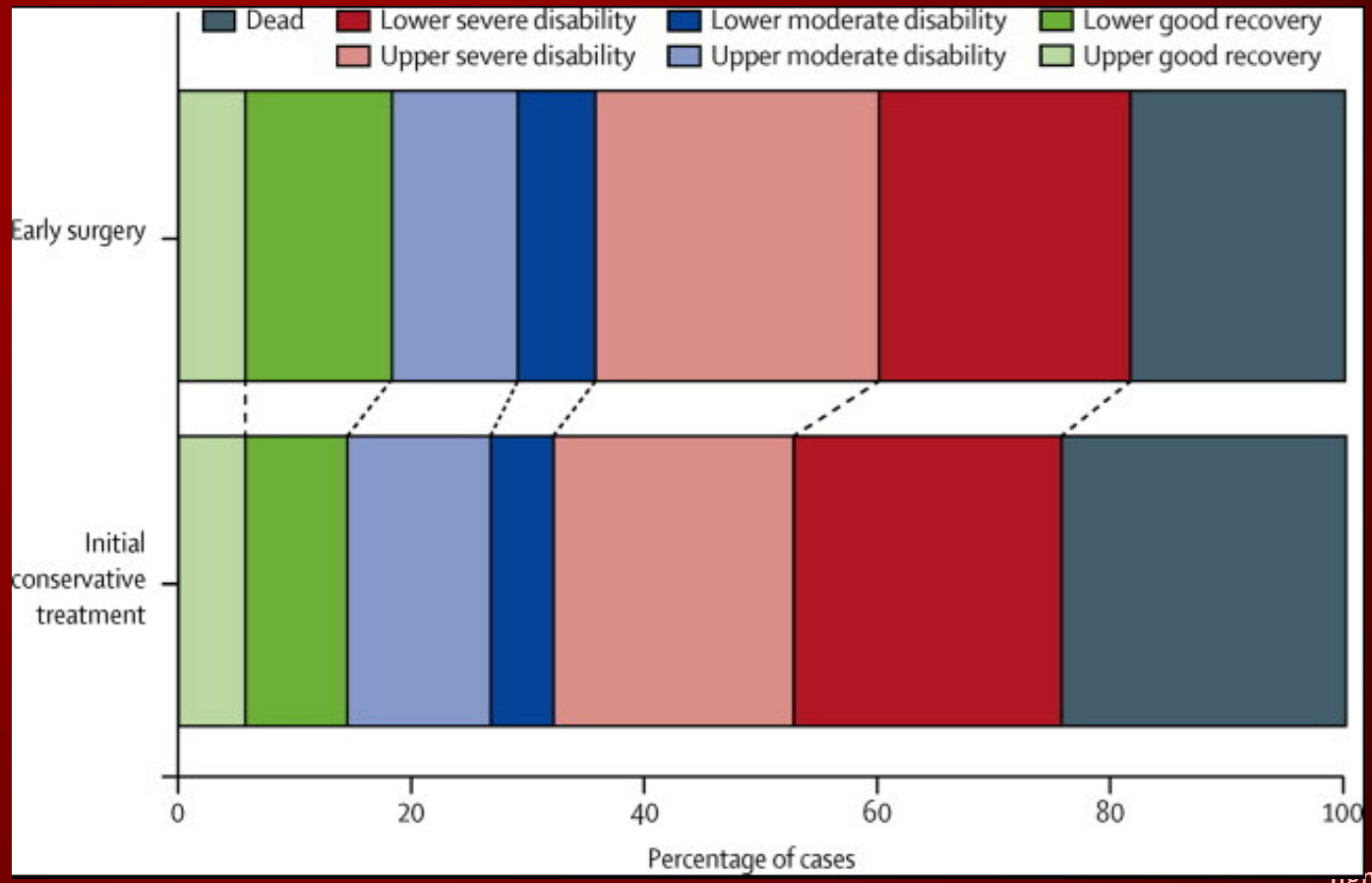
STICH II TRIAL

Interpretation The STICH II results confirm that early surgery does not increase the rate of death or disability at 6 months and might have a small but clinically relevant survival advantage for patients with spontaneous superficial intracerebral haemorrhage without intraventricular haemorrhage.

Early surgery versus initial conservative treatment in patients with spontaneous supratentorial lobar intracerebral haematomas (STICH II): a randomised trial

A David Mendelow, Barbara A Gregson, Elise N Rowan, Gordon D Murray, Anil Gholkar, Patrick M Mitchell, for the STICH II Investigators

Lancet 2013; 382: 397–408
Published Online
May 29, 2013
http://dx.doi.org/10.1016/S0140-6736(13)60986-1



FUNCTIONAL OUTCOMES

Katsuki, M., Kakizawa, Y., Nishikawa, A. *et al.* Endoscopic hematoma removal of supratentorial intracerebral hemorrhage under local anesthesia reduces operative time compared to craniotomy. *Sci Rep* **10,** 10389 (2020). https://doi.org/10.1038/s41598-020-67456-x

Article | Open Access | Published: 25 June 2020

Endoscopic hematoma removal of supratentorial intracerebral hemorrhage under local anesthesia reduces operative time compared to craniotomy

Masahito Katsuki, Yukinari Kakizawa, Akihiro Nishikawa, Yasunaga Yamamoto & Toshiya Uchiyama

Scientific Reports **10**, Article number: 10389 (2020) | Cite this article

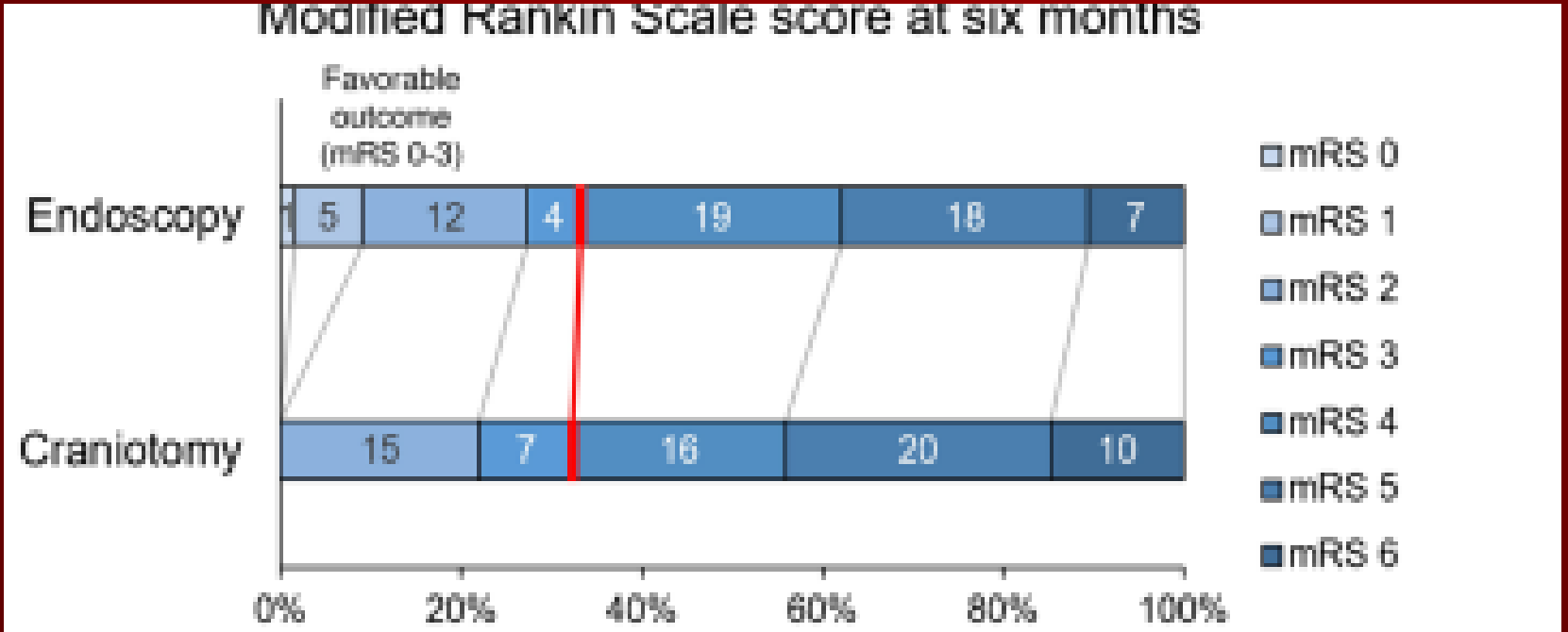
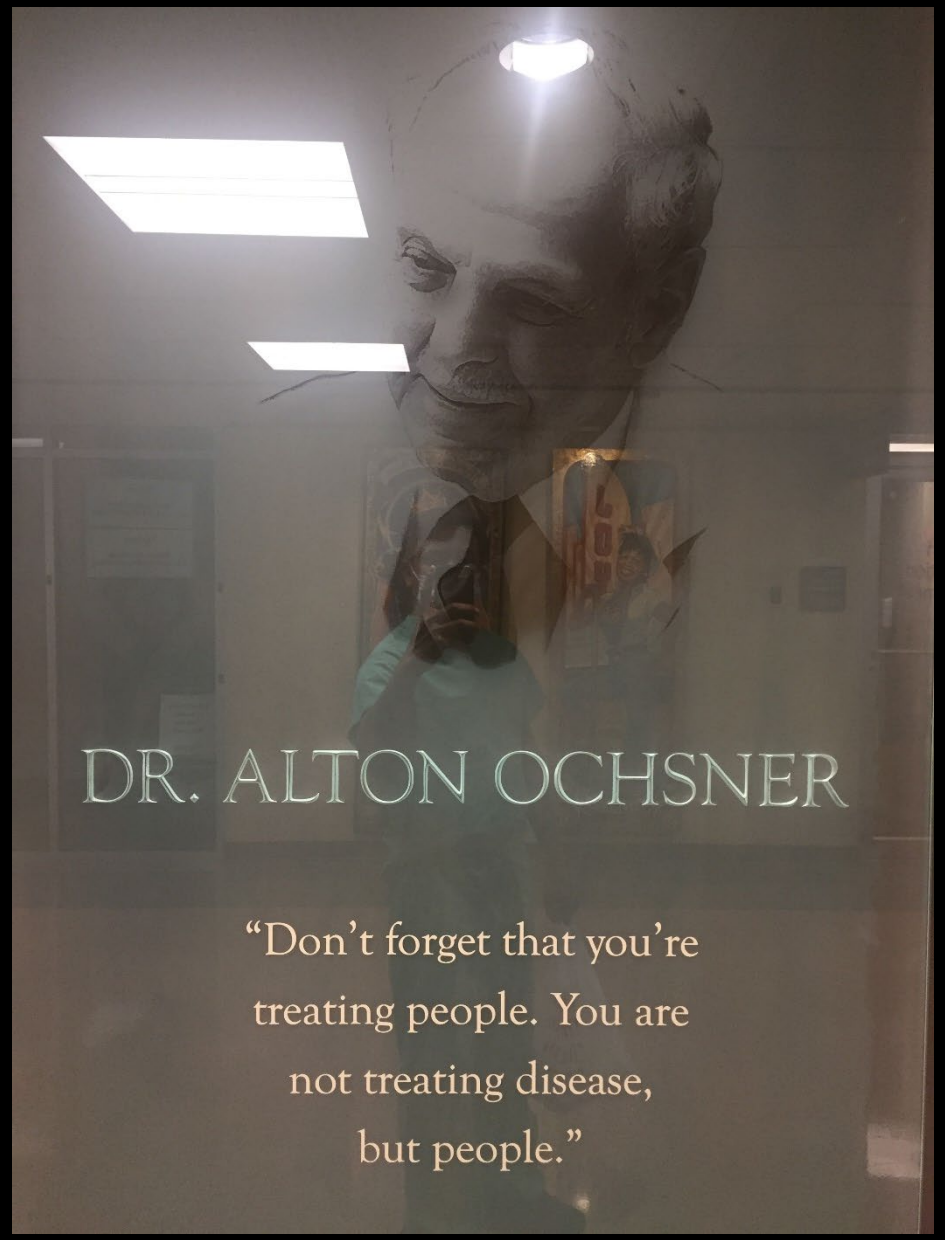


Figure 2. Modified Rankin Scale (mRS) score at 6 months after the surgery

PRIMARY GOALS

- ABCs
- Prevent expansion
- Minimizing Neurologic sequela
- Improve Functional Outcome



THANK YOU

"Don't forget that you're treating people. You are not treating disease but people."

-Dr. Alton Ochsner

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The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure

Table 14. Estimated prevalence of the metabolic syndrome using the Adult Treatment Panel III definition among normal weight, overweight, and obese men and women in the National Health and Nutrition Examination Survey III

Category	BMI, kg/m²	Metabolic Syndrome Prevalence, Percent	
		Men	Women
Normal weight	<25.0	4.6%	6.2%
Overweight	25.0–29.9	22.4%	28.1%
Obese	>30	59.6%	50.0%

BMI, body mass index

Source: Park YW, et al. The metabolic syndrome: Prevalance and associated risk factor findings in the US population from The Third National Health and Nutrition Examination Survey, 1988–1994. Arch Intern Med *2003;163:427–36.*

Table 7. Identifiable causes of hypertension

- Chronic kidney disease
- Coarctation of the aorta
- Cushing's syndrome and other glucocorticoid excess states including chronic steroid therapy
- Drug induced or drug related (see table 18)
- Obstructive uropathy
- Pheochromocytoma
- Primary aldosteronism and other mineralocorticoid excess states
- Renovascular hypertension
- Sleep apnea
- Thyroid or parathyroid disease

Table 3. Classification of blood pressure for adults

Blood Pressure Classification	SBP mmHg	DBP mmHg
Normal	<120	and <80
Prehypertension	120–139	or 80–89
Stage 1 Hypertension	140–159	or 90–99
Stage 2 Hypertension	≥160	or ≥100

SBP, systolic blood pressure; DBP, diastolic blood pressure

Table 15. Relative 10-year risk for diabetes, hypertension, heart disease, and stroke over the next decade among men initially free of disease stratified by baseline body mass index

BMI	Diabetes	Hypertension	Heart Disease	CVA
18.5–21.9	1.0	1.0	1.0	1.0
22.0–24.9	1.8	1.5	1.1	1.1
25.0–29.9	5.6	2.4	1.7	1.3
30.0–34.9	18.2	3.8	2.2	2.1
>35.0	41.2	4.2	2.4	2.5

BMI, body mass index; CVA, cerebrovascular accident

Source: Field AE, et al. Impact of overweight on the risk of developing common chronic diseases during a 10-year period. Arch Intern Med *2001;161:1581–6.*

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