When the stroke needs surgery: Hemicraniectomy and posterior fossa decompression

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Disclosures

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Outline

Who

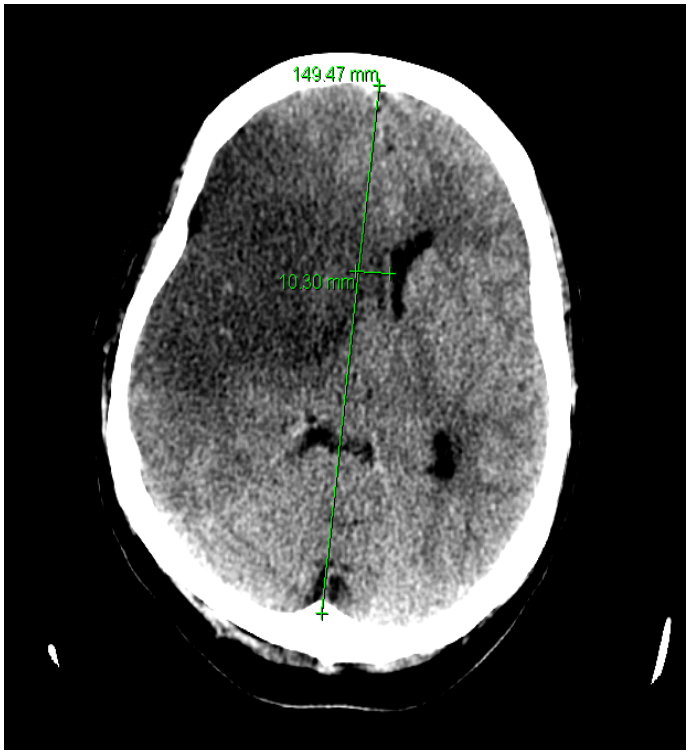
What

When

Hemicraniectomy and P-fossa decompression: Who?

- Space Occupying Ischemic Stroke
- Intracerebral hemorrhage
- Cerebellar Stroke
- Cerebellar Hemorrhage

Space Occupying Infarction



~10% of ischemic strokes
~80% mortality (medical therapy)

Torbey MT et al. Evidence-based guidelines for the management of large hemispheric
Neurocrit Care. 2015 Feb;22(1):146-64.

Decompressive Surgery for the Treatment of Malignant Infarction of the Middle Cerebral Artery (DESTINY)

A Randomized, Controlled Trial

Eric Jüttler, MD; Stefan Schwab, MD, PhD; Peter Schmiedek, MD, PhD;
Andreas Unterberg, MD, PhD; Michael Hennerici, MD, PhD; Johannes Woitzik, MD;
Steffen Witte, PhD; Ekkehart Jenetzky, MD; Werner Hacke, MD, PhD;
for the DESTINY Study Group*

Background and Purpose—Decompressive surgery (hemicraniectomy) for life-threatening massive cerebral infarction represents a controversial issue in neurocritical care medicine. We report here the 30-day mortality and 6- and 12-month functional outcomes from the DESTINY trial.

Methods—DESTINY (ISRCTN01258591) is a prospective, multicenter, randomized, controlled, clinical trial based on a sequential design that used mortality after 30 days as the first end point. When this end point was reached, patient enrollment was interrupted as per protocol until recalculation of the projected sample size was performed on the basis of the 6-month outcome (primary end point=modified Rankin Scale score, dichotomized to 0 to 3 versus 4 to 6). All analyses were based on intention to treat.

Stroke. 2007;38:2518-2525.

DESTINY inclusion criteria

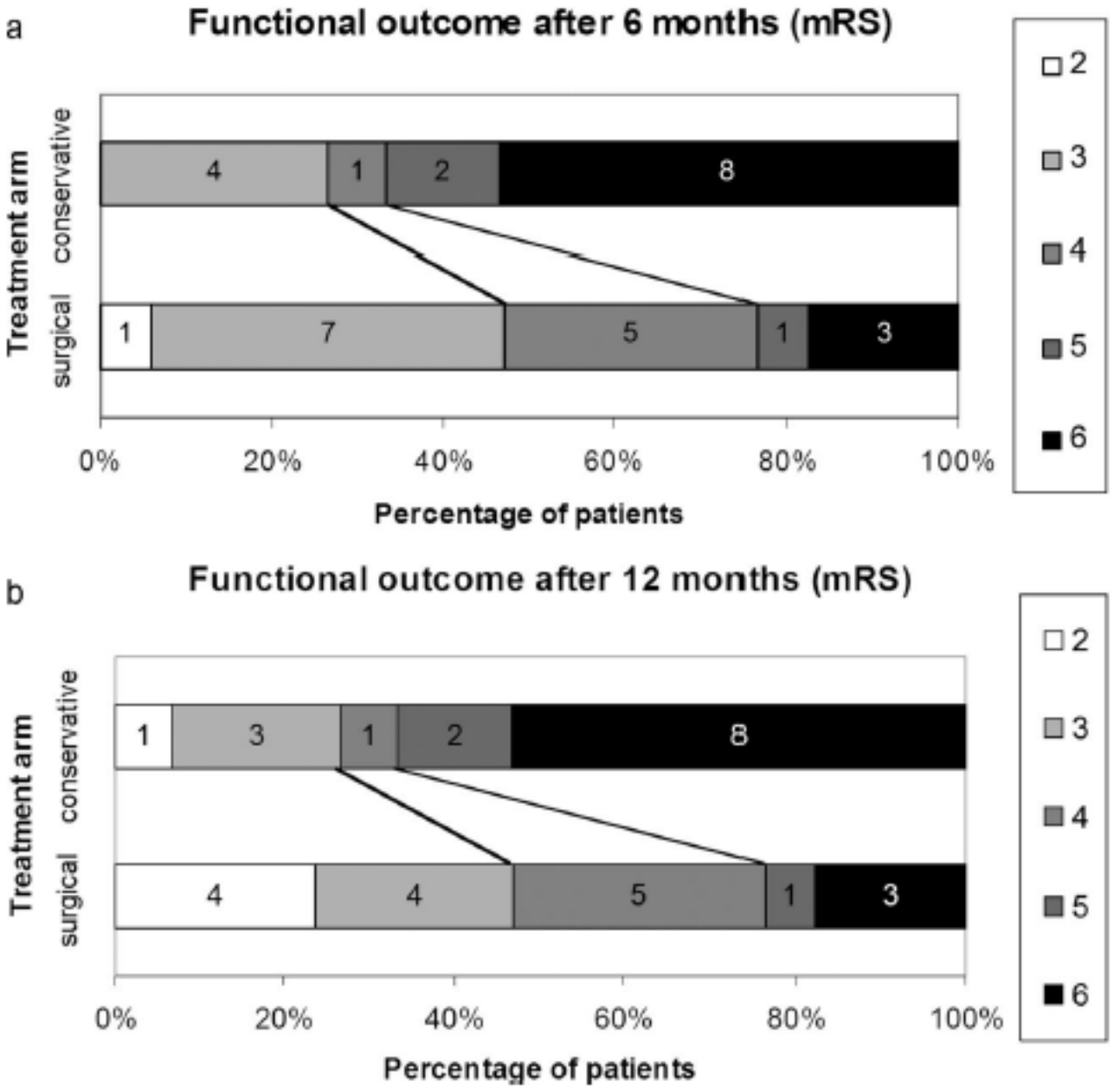
- Age 18-60
- NIHSS >18 (non-dom.) or > 20 (dom.)
- Decrease level of consciousness ≥1 (item 1a NIHSS)
- CT unilateral MCA infarct, ≥ 2/3 territory, +BG, ± ipsi. ACA or PCA
- Onset >12hrs and <36hrs before possible surgical intervention
- Treatment/surgery within 6hrs after randomization

DESTINY: *What* was decompressive hemicraniectomy?

- Bone flap diameter > 12cm
- Removal of temporal bone to floor of middle cerebral fossa
- Durotomy and insertion of dural patch
- No resection of infarcted brain

TABLE 3. Baseline Patient Characteristics by Group

	Surgery Group	Conservative Treatment Group	Total	*P* Value
	n=17	n=15	n=32	
Sex				
Male	47%	47%	47%	*P*=0.98*
Female	53%	53%	53%	
Age, y				
Mean±SD	43.2±9.7	46.1±8.4	44.6±9.1	*P*=0.44†
Median	43.0	46.0	44.5	
Range	30.0–60.0	29.0–59.0	29.0–60.0	
Hemisphere				
Dominant	53%	73%	63%	*P*=0.23*
Nondominant	47%	27%	38%	
NIHSS score on admission				
Median	21	24	22	*P*<0.01
Range	19–26	19–31	19–31	
Time from symptom onset to treatment start, h				
Mean±SD	24.4±6.9	23.8±7.8	24.1±7.2	*P*=0.66
Median	24.0	22.5	24.0	
Range	13.5–36.0	12.0–35.0	12.0–36.0	


a
Functional outcome after 6 months (mRS)
Treatment arm
conservative
surgical
4
1
2
8
1
7
5
1
3
0%
20%
40%
60%
80%
100%
Percentage of patients
2
3
4
5
6
b
Functional outcome after 12 months (mRS)
Treatment arm
conservative
surgical
1
3
1
2
8
4
4
5
1
3
0%
20%
40%
60%
80%
100%
Percentage of patients
2
3
4
5
6

Early decompressive surgery in malignant infarction of the middle cerebral artery: a pooled analysis of three randomised controlled trials

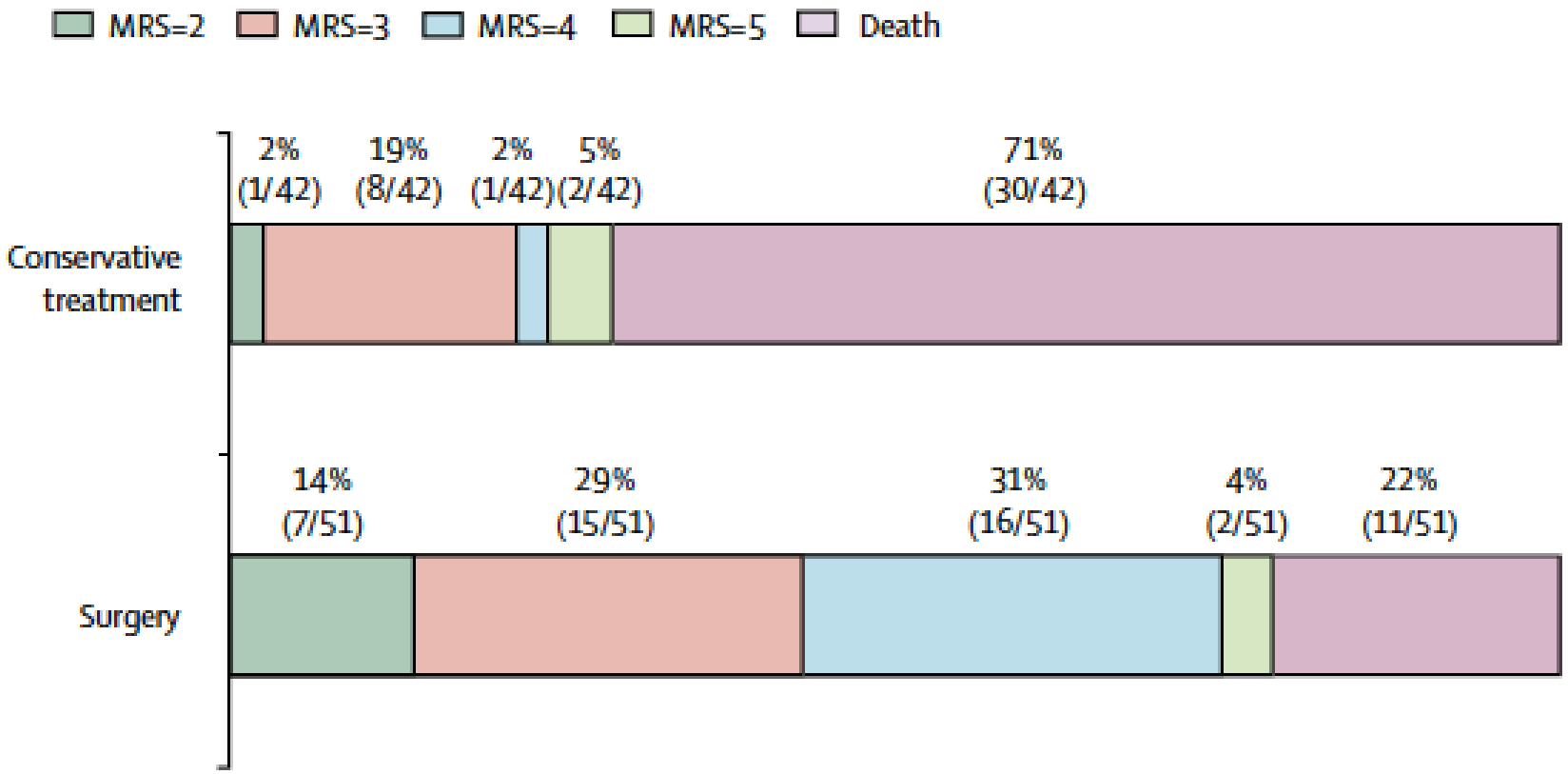
Katayoun Vahedi, Jeannette Hofmeijer, Eric Juettler, Eric Vicaut, Bernard George, Ale Algra, G Johan Amelink, Peter Schmiedeck, Stefan Schwab, Peter M Rothwell, Marie-Germaine Bousser, H Bart van der Worp, Werner Hacke, for the DECIMAL, DESTINY, and HAMLET investigators

Summary

Background Malignant infarction of the middle cerebral artery (MCA) is associated with an 80% mortality rate. Non-randomised studies have suggested that decompressive surgery reduces this mortality without increasing the number of severely disabled survivors. To obtain sufficient data as soon as possible to reliably estimate the effects of decompressive surgery, results from three European randomised controlled trials (DECIMAL, DESTINY, HAMLET) were pooled. The trials were ongoing when the pooled analysis was planned.

Lancet Neurol 2007; 6: 215–22
Published Online February 9, 2007
DOI:10.1016/S1474-4422(07)70036-4

See Reflection and Reaction



Vahedi K, et al. Lancet Neurol. 2007

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Hemicraniectomy in Older Patients with Extensive Middle-Cerebral-Artery Stroke

Eric Jüttler, M.D., Ph.D., Andreas Unterberg, M.D., Ph.D., Johannes Woitzik, M.D., Ph.D., Julian Bösel, M.D., Hemasse Amiri, M.D., Oliver W. Sakowitz, M.D., Ph.D., Matthias Gondan, Ph.D., Petra Schiller, Ph.D., Ronald Limprecht, Steffen Luntz, M.D., Hauke Schneider, M.D., Ph.D., Thomas Pinzer, M.D., Ph.D., Carsten Hobohm, M.D., Jürgen Meixensberger, M.D., Ph.D., and Werner Hacke, M.D., Ph.D., for the DESTINY II Investigators*

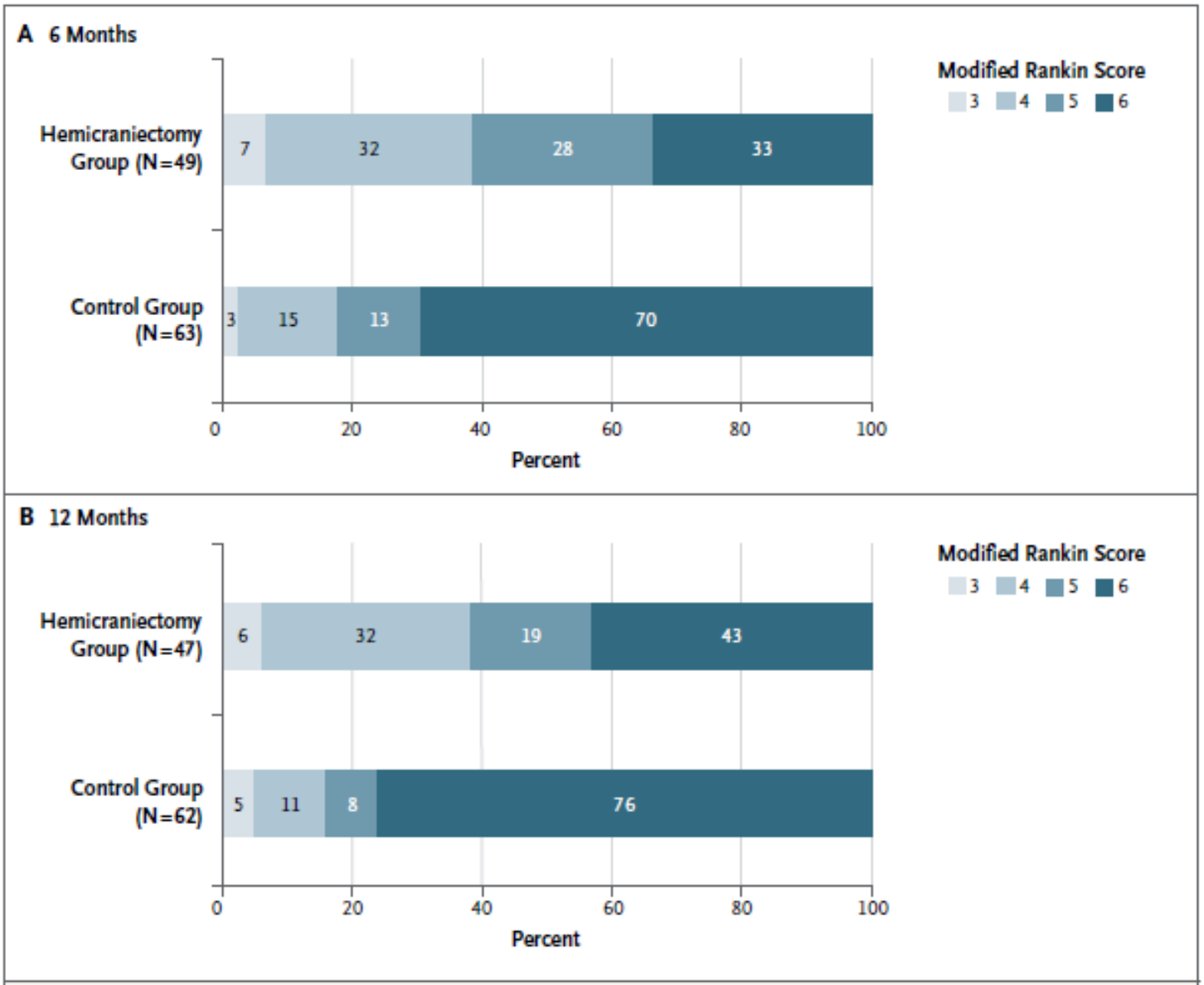
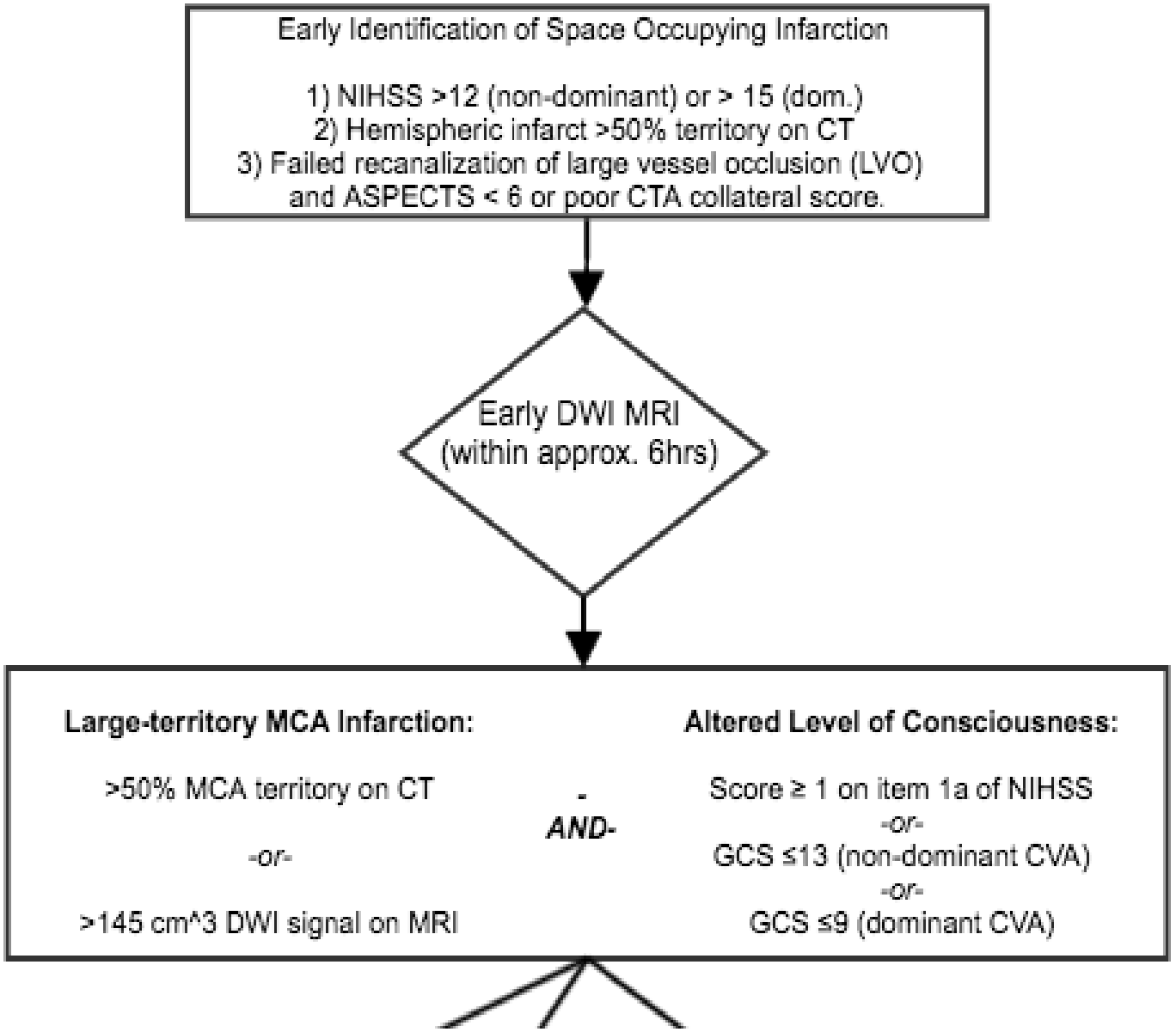
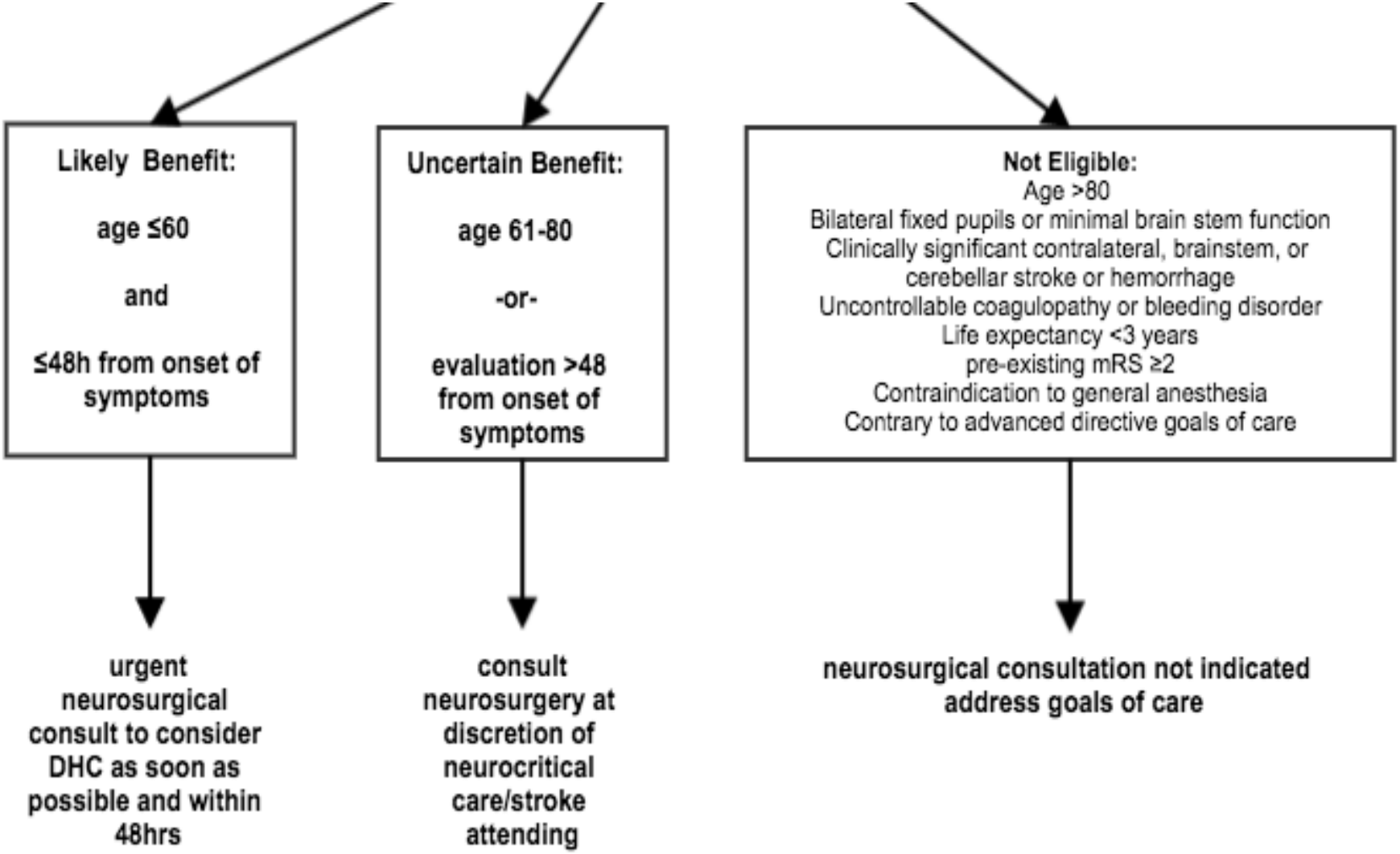


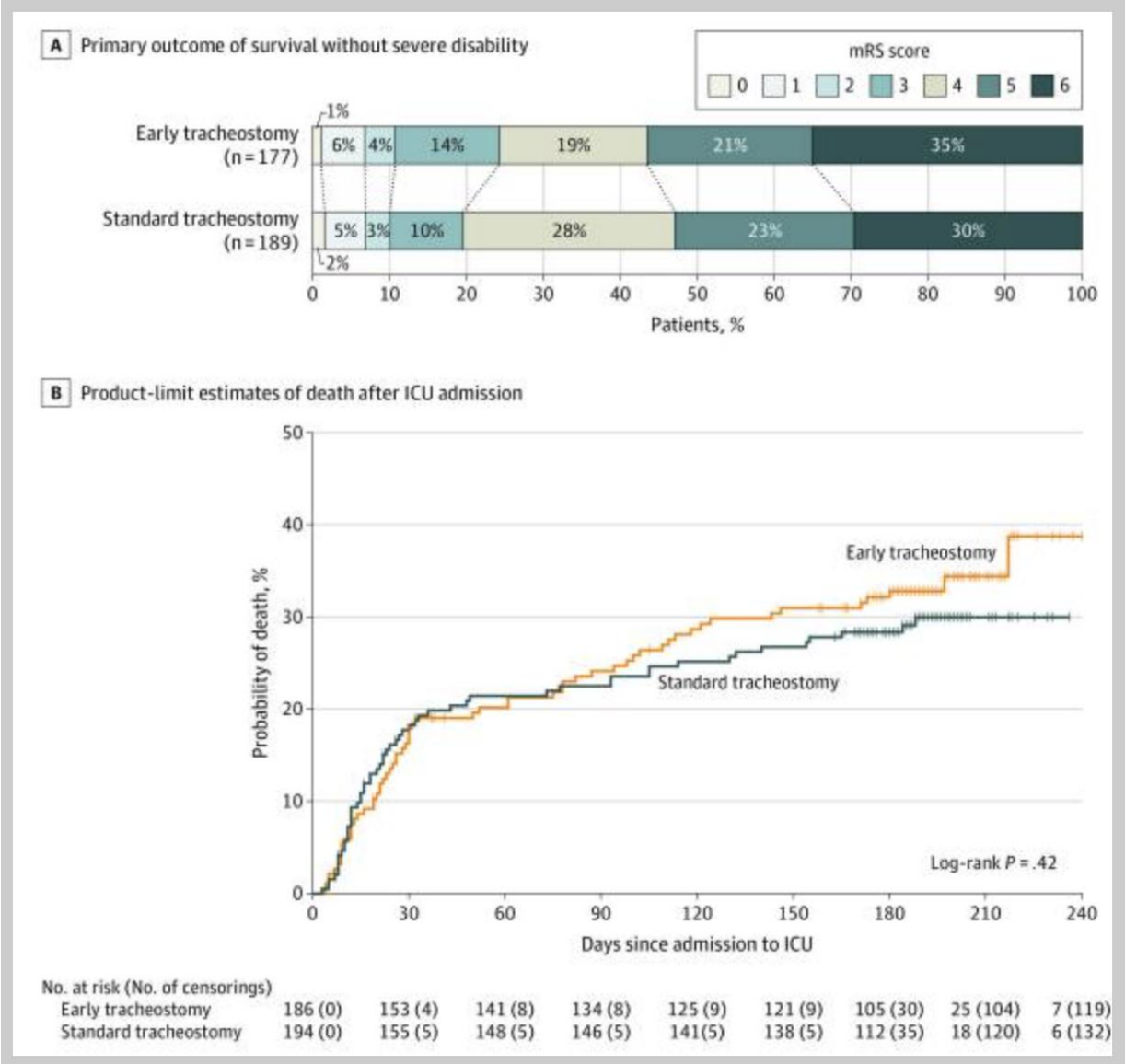
Figure 1. Functional Outcome after Hemicraniectomy and after Conservative Treatment Alone According to the Modified Rankin Score.

DHC in Ischemic Stroke: Putting it all together.




Likely Benefit:
age ≤60
and
≤48h from onset of symptoms
Uncertain Benefit:
age 61-80
-or-
evaluation >48 from onset of symptoms
Not Eligible:
Age >80
Bilateral fixed pupils or minimal brain stem function
Clinically significant contralateral, brainstem, or cerebellar stroke or hemorrhage
Uncontrollable coagulopathy or bleeding disorder
Life expectancy <3 years
pre-existing mRS ≥2
Contraindication to general anesthesia
Contrary to advanced directive goals of care
urgent neurosurgical consult to consider DHC as soon as possible and within 48hrs
consult neurosurgery at discretion of neurocritical care/stroke attending
neurosurgical consultation not indicated address goals of care

Related supports: (Tracheostomy)



Bösel J, et al. SETPOINT2 and the IGNITE Study Groups. Effect of Early vs Standard Approach to Tracheostomy on Functional Outcome at 6 Months Among Patients With Severe Stroke Receiving Mechanical Ventilation: The SETPOINT2 Randomized Clinical Trial. JAMA. 2022 May 17;327(19):1899-1909. doi: 10.1001/jama.2022.4798. PMID: 35506515

Intracerebral hemorrhage (a brief review)

ICH surgical trials in brief

STICH

- Equipoise required for enrollment
- Randomization within 24hrs of presentation
- 26% cross-over to surgical arm

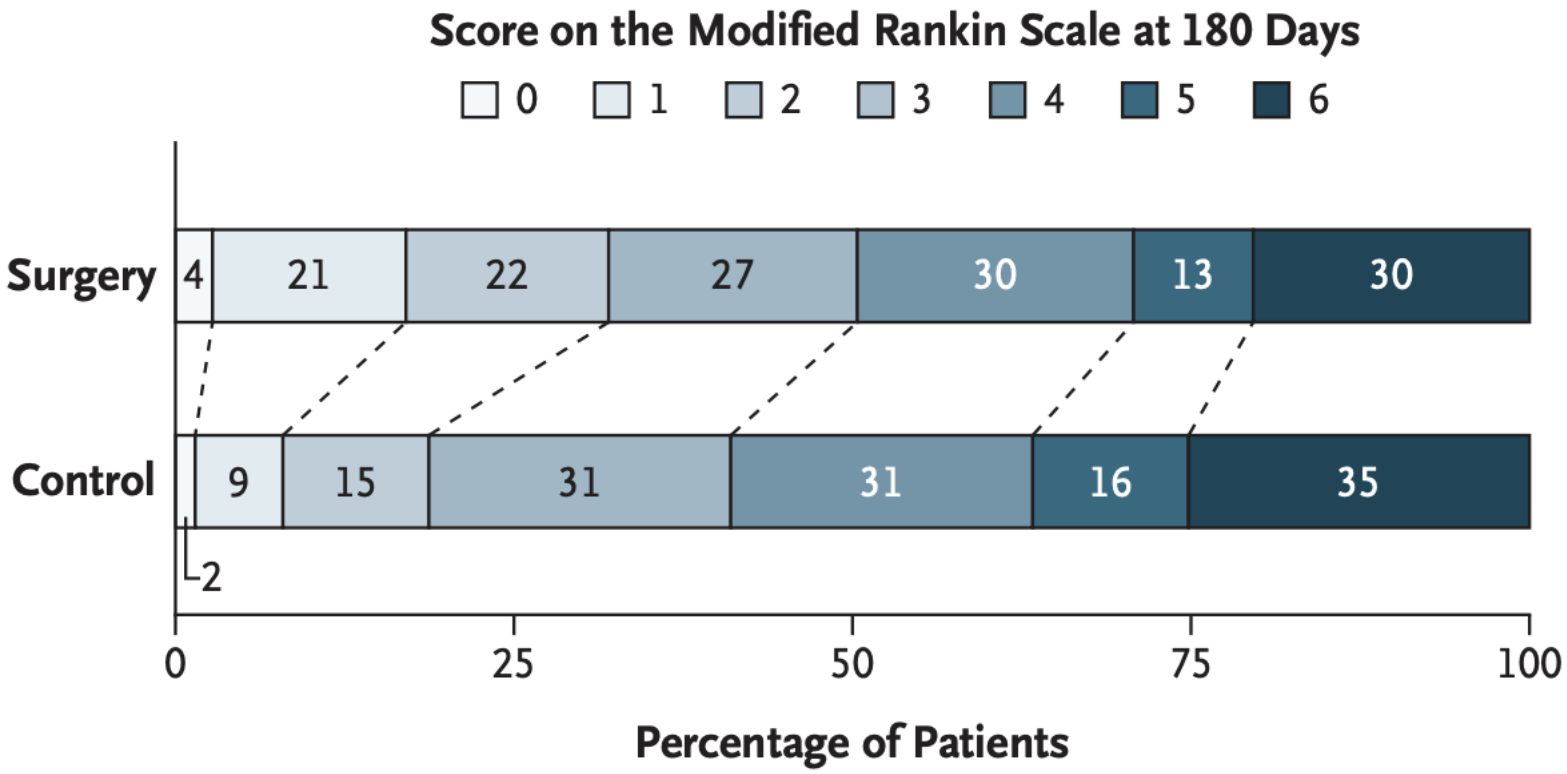
STICH II

- Superficial (<1cm from cortex) ICH
- Randomized within 12hrs of admission
- No difference from medical tx arm

ENRICH

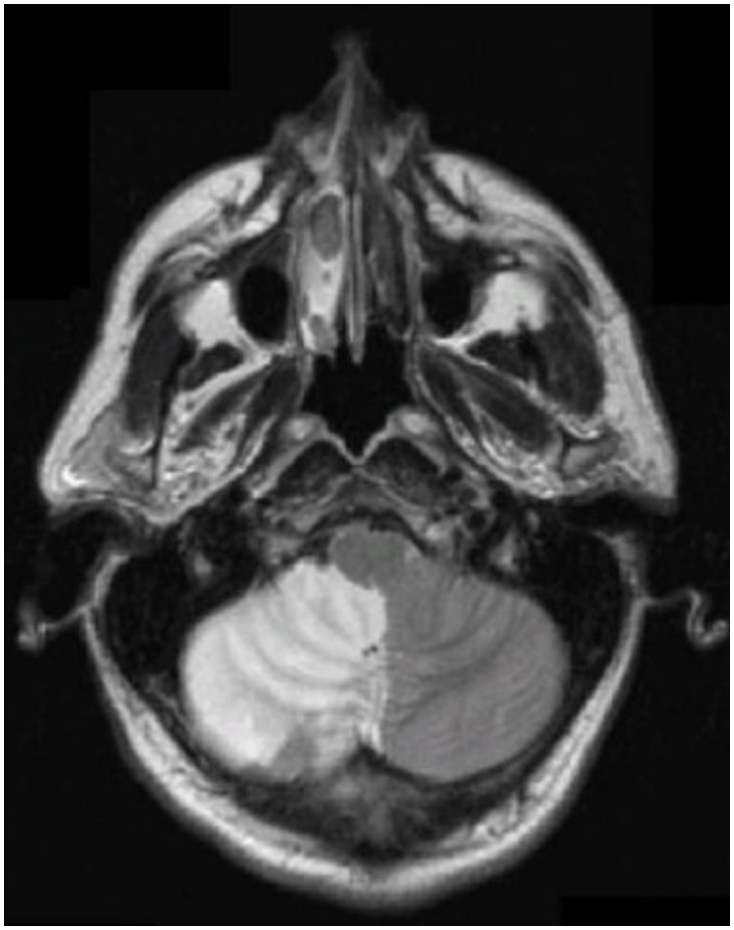
- Lobar or BG hemorrhage (30 – 80 ml)
- MIS at < 24-hours from onset
- Utility-weighted mRankin at 180 days.

ENRICH trial results



Pradilla G, et al. ENRICH Trial Investigators. Trial of Early Minimally Invasive Removal of Intracerebral Hemorrhage. N Engl J Med. 2024 Apr 11;390(14):1277-1289.

P-fossa decompression



Cerebellar Hemorrhage	Cerebellar Ischemic Stroke
Neurosurgical emergency	Variable approach
>3cm (15ml) generally operable	>1/3 or causing deterioration
EVD generally after decompression	EVD less common

AHA guideline: Urgent surgical hematoma evacuation with or without EVD if: 1) deteriorating neurologically, or 2) brainstem compression and/or hydrocephalus, 3) or have cerebellar ICH volume ≥15 mL

AHA guideline: SOC with dural expansion in patients with deterioration with brainstem compression despite maximal medical therapy.

Summing it up: When

Stroke type	Location	Timing
Ischemic	Hemispheric	<48hrs
Ischemic	Cerebellar	Clinical syndrome
ICH	Hemispheric	DHC- Variable (2-96hrs) MIS- < 24-hrs
ICH	Cerebellar	Emergent depending on size

Summary

- Strokes requiring decompression or evacuation remain a clinical challenge
- Algorithmic approach to DHC in ischemic stroke can be helpful
- Approaches to ICH remain variable due to trial limitations
- Optimal approach remains highly individualized with alignment of patient and family expectations with data on outcomes

Thank you.

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