The Evolution of Endovascular Selection Criteria
An MGH Perspective

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Disclosures

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Recent Endovascular Stroke Trials

- SWIFT-PRIME: Solitaire 100%
- EXTEND-IA: Solitaire 100%
- ESCAPE: Stentriever 86%
- REVASCAT: Solitaire 100%
- MR CLEAN: Stentriever 82%
- IMS III: IA TPA 48% + MERCI 28%
- MR RESCUE: MERCI 58%

Sample size
- 70
- 200
- 500

mRS 0-2: absolute increase (%)
- 30
- 20
- 10
- 0

Onset to groin (minutes)
Who Do We Know Benefits?

Clinical criteria
Age >18 (no clear upper age limit)
Functionally independent (mRS <2)
Significant neurologic deficit (NIHSS ≥6)
Onset to groin puncture ≤6hrs

Radiological criteria
No large established stroke (ASPECTS ≥6)
Anterior vessel occlusion (ICA and/or M1 MCA segments)
But There Are Many in Need

- 750,000 ischemic strokes
- 120,000 large vessel occlusions
- 5,000 stroke rescues

/year in the USA
The Challenge of Variability

Stroke Neurology
MGH Algorithm:
Both clinical and radiological criteria
Selection circa 2012

CT and MRI

**MGH Acute Stroke Imaging Algorithm**

- **NCCT**
- **CTA**
- **DWI**

Accessible Proximal Occlusion & MRI Eligible

- **yes**
  - **IA Therapy**
  - **Accessible proximal occlusion and DWI < 70 cc?**
    - **yes**
    - **No IA Tx**
    - **no**
      - **MR perfusion**

- **no**
  - **CT perfusion**

Gonzalez RG, et al, JNIS, 2013
Of 1348 subjects identified, 118 (8.7%) met the criteria for LTB and 62 (52%) underwent IAT. There was a significant increase in rates of IAT among LTB patients after protocol implementation (61% vs 40%, p<0.02).

These data provide evidence that a uniform approach to patient selection for open-label or compassionate use of IAT may improve the rates of patient inclusion for intervention as well as the homogeneity of the patient cohort.
Reasons for not performing IAT in the LTB group

1. Late presentation in the intervention window (21.4%)
2. Rapid improvement (16.1%)
3. Family refusal (14.3%)
4. Neuroimaging features of limited tissue at risk (11%)
5. Extensive clot burden identified by endovascular team (7.2%)
6. Reason unclear/unrecorded (7.2%)
7. Advanced age (5.3%)
8. Technical challenge identified by endovascular team (5.3%)
9. Carotid dissection (4%)
10. Advanced directives (4%)
11. Hemorrhagic conversion (1.7%)
12. Trial enrollment (1.7%).
Selection circa 2016

Goals

• Modify our MGH approach based on the available new Class 1 Level A data
• Increase autonomy and consistency for cases with proven benefit
• Expand to capture cases that we think are probable to benefit
Endovascular Screening Criteria

For **ALL** patients with

**NIHSS ≥4**

**LSW <24hrs**

Assess the following:

**Clinical**

- Age
- Last seen well
- Premorbid baseline mRS (and dementia)
- Candidacy for IV tPA

**Radiological**

- Hemorrhage excluded
- Evidence of ischemic stroke
- Presence of LVO (ICA, M1, M2, BA)
- Core infarct volume (ASPECTS or DWI)
- Quality of collaterals

Using these screening criteria classify patients as

- Proven
- Uncertain
- Unlikely

to benefit from endovascular therapy.

Page Neuroendovascular fellow 33722 immediately for all cases.

Evaluate for enrollment in active clinical trials.
Endovascular Criteria

Treatment process for all cases initiated by Stroke and Endovascular Fellows

Clinical (must meet all)
- NIHSS $\geq 6$
- Time $\leq 6$ hours from LSW to expected groin puncture
- Age 18-85 years
- Premorbid condition
  - mRS $\leq 1$
  - Life expectancy $>12$ months

Radiological (must meet all)
- Intracranial ICA or MCA M1 occlusion
- Small established infarct core volume by either imaging modality
  - if by CT criteria: visual estimation of ASPECTS $\geq 6$ on NCCT
    - symmetric collaterals on CTA
  - if by MRI criteria: $\leq 70$cc DWI by ABC/2 measurement
Endovascular Criteria

Treatment only if both Stroke and Endovascular Attendings agree

**Clinical (must meet all)**
- NIHSS ≥4
- Time: ≤16 hours anterior circulation; ≤24 hours posterior circulation
- Premorbid condition
  - mRS ≤3
  - Life expectancy >12 months

**Radiological (must meet all)**

**Anterior circulation**
- Proximal arterial occlusion (ICA, M1, M2)
- Small established infarct core volume by either imaging modality
  - if by MRI criteria: ≤70cc DWI by ABC/2 measurement
  - if needed, by CT criteria: visual estimation of ASPECTS ≥ 5 on NCCT
  - Excellent collaterals on CTA

**Posterior circulation**
- Proximal arterial occlusion (basilar, dominant vertebral)
- ≤50% infarction of pons, midbrain or thalamus
Endovascular Criteria

No endovascular treatment offered

Clinical (if meets any)

- NIHSS <4
- Time: >16 hr from LSW for Anterior circulation; >24 hr Posterior circulation
- Premorbid condition
  - mRS ≥4
  - major medical co-morbidity
  - Life expectancy of <12 months

Radiological (if meets any)

Anterior circulation
- Large established core by either imaging modality
  - by CT criteria: ASPECTS ≤4 on NCCT (or)
    : malignant collateral pattern
  - by MRI criteria: infarct core >100cc DWI by ABC/2 measurement
- Distal arterial occlusion (M3, M4, A2)

Posterior circulation
- >50% infarction of pons, midbrain or thalamus
- Distal arterial occlusion (e.g. isolated PCA)
For patients with NIHSS ≥6:

Anterior Circulation
LSW <6hrs

Medical/Surgical Management

NCCT

Cerebral hemorrhage?

Yes
No

CTA
Large vessel occlusion (LVO)?

No
Yes

CTA
Axial MIPs
Symmetric Collaterals?

No
Yes

MRI
DWI <100cc?

No
Yes

Uncertain to Benefit
Proven Benefit

Endovascular Therapy
NCCT
Cerebral hemorrhage?
Yes
No

Medical/Surgical Management

CTA
Large Vessel Occlusion (LVO)?
No
Yes

MRI
DWI volume <70cc (anterior)?
Sparing of thalami, pons or midbrain (posterior)?
No
Yes

All patients are Uncertain to Benefit

Endovascular Therapy

For patients with NIHSS ≥6:
Anterior Circulation
LSW 6-16hrs

Posterior Circulation
All patients <24hrs
(includes wake-up strokes)

Note, this imaging approach may vary for patients enrolled in a research trial
The Near Horizon: Time Window Expansion

16 hours, larger volume inclusion

24 hours\smaller volume inclusion
Selection 2017/2018: Proposed
Treatment process for all cases initiated by Stroke and Endovascular Fellows

• Clinical (must meet all)
  – NIHSS ≥6
  – Time ≤24 hours from LSW to expected groin puncture
  – Age 18-95 years
  – Premorbid condition
    • mRS ≤2
    • Life expectancy >12 months

• Radiological (must meet all)
  – ≤ 6 hours from LSW to expected groin puncture
    • Intracranial ICA or MCA M1 occlusion
  – 6-24hrs from LSW to expected groin puncture
    • Intracranial ICA or MCA M1 occlusion
    • Small established infarct core volume by either imaging modality
      – if by CT criteria: ASPECTS ≥ 7 on NCCT
        » Adequate collateral pattern on CTA
      – if by MRI criteria: ≤70cc DWI by ABC/2 measurement
Endovascular Criteria

Treatment only if both Stroke and Endovascular Attendings agree

Clinical (must meet all)
- NIHSS ≥ 4
- Time: ≤24 hours from LSW to expected groin puncture
- Premorbid condition
  - mRS ≤ 4
  - Adequate life expectancy

Radiological (must meet all)

Anterior circulation
- Proximal arterial occlusion (ICA, M1, M2)
- Small established infarct core volume by either imaging modality
  - if by MRI criteria: ≤120cc DWI by ABC/2 measurement
  - if needed, by CT criteria: visual estimation of ASPECTS ≥ 5 on NCCT
  - non malignant collaterals on CTA

Posterior circulation
- Proximal arterial occlusion (basilar, dominant vertebral)
- ≤70% infarction of pons, midbrain or thalamus
Endovascular Criteria

No endovascular treatment offered

Clinical (if meets any)
- NIHSS <4
- Time: >24 hr from LSW for Anterior circulation; >24 hr Posterior circulation
- Premorbid condition
  - mRS ≥4
  - major medical co-morbidity
  - Life expectancy

Radiological (if meets any)

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Conclusions

- Key to have institutional protocols – increases patient treatment
- Work-flow protocols unrelated to patient characteristics are important
- Decisions cannot be made based on whims, personal opinions, timing, holidays, vacation schedules
- Review data and results
- Re-evaluate established protocols altering data
- Imaging criteria are important
Thank you.