California Pacific Medical Center
A Sutter Health Affiliate

Organization of Stroke Care: Implications of Recent Advances

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Background

- Revolutionary changes in acute stroke care
- Lack of sufficient resources to adequately manage these patients
- Strong need for triage protocols and management criteria to deal with expected volume increases

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Stent-Retriever Thrombectomy after Intravenous t-PA vs. t-PA Alone in Stroke

Jeffrey L. Saver, M.D., Mayank Goyal, M.D., Alain Bonafe, M.D., Hans-Christoph Diener, M.D., Ph.D., Elad I. Levy, M.D., Vitor M. Pereira, M.D., Gregory W. Albers, M.D., Christophe Cognard, M.D., David J. Cohen, M.D., Werner Hacke, M.D., Ph.D., Olav Jansen, M.D., Ph.D., Tudor G. Jovin, M.D., Heinrich P. Mattle, M.D., Raul G. Nogueira, M.D., Adnan H. Siddiqui, M.D., Ph.D., Dileep R. Yavagal, M.D., Blaise W. Baxter, M.D., Thomas G. Devlin, M.D., Ph.D., Demetrius K. Lopes, M.D., V[illegible] Oliver C. Singer, M.D., an[illegible]

ORIGINAL ARTICLE

Thrombectomy within 8 Hours after Symptom Onset in Ischemic Stroke

T.G. Jovin, A. Chamorro, E. Cobo, M.A. de Miquel, C.A. Molina, A. Rovira, L. San Román, J. Serena, S. Abilleira, M. Ribó, M. Millán, X. Urra, P. Cardona, E. López-Cancio, A. Tomasello, C. Castaño, J. Blasco, L. Aja, L. Dorado, H. Quesada, M. Rubiera, M. Hernández-Pérez, M. Goyal, A.M. Demchuk, R. von Kummer, M. Gallofré, and A. Dávalos, for the REVASCAT Trial Investigators*

T. Wijeratne, T.G. Phan, W. Chong, R.V. Chandra, C.F. Bladin, M. Badve, H. Rice, L. de Villiers, H. Ma, P.M. Desmond, G.A. Donnan, and S.M. Davis, for the EXTEND-IA Investigators*

LE

nt of Rapid Ischemic Stroke

L. Rempel, J. Thornton, D. Roy, tshahi, D.F. Frei, N.R. Kamal, Silver, A. Shuaib, D. Tampieri, rns, H. Choe, J.-H. Heo, es, J.L. Mandzia, J. Shankar, s, E.E. Smith, W.F. Morrish, Wong, M.W. Lowerison, E Trial Investigators*

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P.J.
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NEJM Jan 2015
NEJM Feb 11 2015
NEJM Apr 17 2015

Stent Retriever Trial Summary

Trial	n	Tx t Time (h)	NIHSS: IA group	Age	Imaging Selection	stroke to TPA	Stroke to groin	90d mRS <3	control
MRCLEAN	500	6	17	66	No	85’	260’	33%	19%
REVASCAT	206	8	17	66	Yes, CTA	117’	223’	44%	28%
ESCAPE IA	315	12	16	71	Yes, CTA	110’	186’	53%	29%
SWIFT-PRIME	196	4.5	17	65	Yes, CTP (some CTA)	110’	224’	60%	36%
Extend IA	70	6	17	69	Yes, CTP	127’	210’	70%	41%

NEJM Jan 2015
NEJM Feb 11 2015
NEJM Apr 17 2015

CPMC Data: 2012-2014

- >150 patients
  - Largest cohort in N California
- NIHSS=15 (vs. 16.5 in studies)
- Time to tx 452’ (vs avg 227 in trials)
- ~63% mRS <3 (~same as best trials)
- Uses CTA/CTP guided therapy

Stentretriever Trials Implications

- Tremendous advance relative to prior tx
  - Level 1A evidence
- Treatment **mandatory** (like PCI for AMI)
- Large number of candidate patients (>30%)
- Few guidelines on how to triage and treat patients within this new paradigm

Organizing Stroke Care: Lessons from Cardiology?

- Vast network of catheterization centers developed over decades
  - Individual hospital driven
- High number of specialists
  - Not derived from organized planning
- Gradual benchmark and guideline creation

Drawbacks: Slow development, costly, high resource utilization

Stroke System Goals

- Leverage lessons from cardiology
- Leapfrog gradual cardiac evolution
- Implement optimal system realizing current (limited) resources
- Create organized system rather than disorganized individual initiative

Important Issues

- Resource utilization
  - Optimal imaging protocol
  - Ideal triage approach
  - Best transfer methodology
- Personnel
  - Availability/Recruitment
  - Quality (credentialing)
- Optimization
  - Quality improvement
  - Research

Local Site Issues to Address

- Triage approach?
  - Screening/Imaging protocol?
  - Time window?
- Available referral centers?
  - Alternative providers?
- Transfer capability?
  - Speed/efficiency/availability?
  - Air vs. ground?

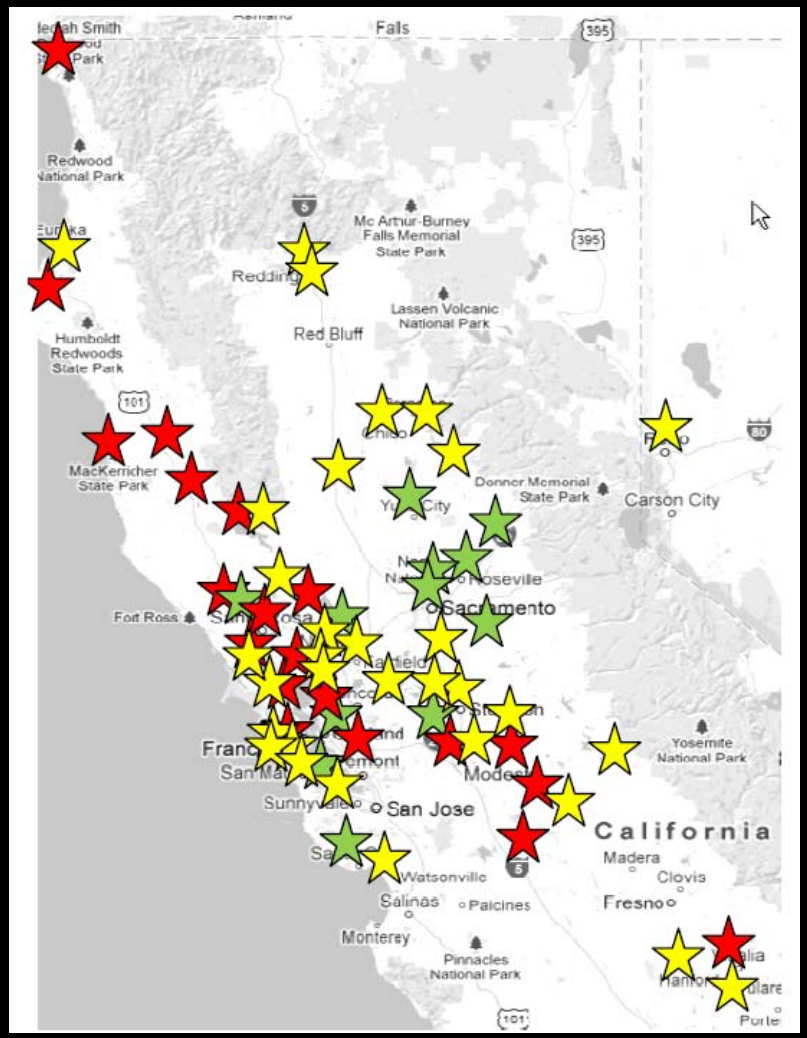
Tertiary Center Issues to Address

- Patient triage?
  - Coordination with local as well as other tertiary sites?
  - Imaging protocol?
  - Time window?
- Transfer system organization?
  - System-wide approach?
- Manpower adequacy? Quality?
- Hospital/Cath lab capacity?
- Cost?

CPMC Model

- Hub and Spoke system with telemedicine and imaging access
  - Permits rapid triage and framework for communication
    - Does NOT require compatible EHR
    - Can work without telemedicine
- Highly trained neuro specialists
  - All board certified in neurocritical care, vascular neurology or both

CPMC Stroke Network



- ★ CPMC Telemedicine Sites (n~20)
- ★ Sutter Network Sites (n=29)
- ★ Other Frequently Referring Sites (n=43)

CPMC Triage Protocol Overview

- CTA/CTP all r/o acute stroke cases ≤12h
  - some sites ≤8h depending on distance
  - CTA only if minor (non disabling) sx
  - Consult Neurologist for decision assistance
- CTA/CTP if 6-24h, AND NIHSS≥10
  - If MCA occlusion: enroll in DAWN trial
  - If 6-24h and NOT DAWN candidate treatment case by case
    - Highly dependent on CTA/CTP results

DAWN SELECTED IMPORTANT INCLUSION AND EXCLUSION CRITERIA

INCLUSION:

- **NIHSS ≥10; 6-24h from last known well**
- **Occlusion of the intracranial ICA or MCA M1 (proximal MCA)**
- **In hospital or POST surgery stroke NOT excluded**

EXCLUSION :

- **Head injury ≤ 90d with deficit**
- **Major hemorrhage ≤ 30 days**
- **Glucose <50mg/dL or >400mg/dL**
- **Creatinine >3.0 mg/dL (if on dialysis no limit)**
- **Coagulation abnl (I.e.: INR > 3.0 or PTT > 3 times nl (NOAC ok if >24h))**
- **Suspected bacterial endocarditis**
- **Severe extra-cranial carotid artery stenosis/occlusion**
- **Suspected cerebral vasculitis or aortic dissection**
- **Occlusions in multiple vascular territories**

CPMC Stroke Triage >12-24h or non Treatment Candidate

- MRI ± MRA/CTA;
  - CUS if MRA/CTA unavailable (ant circ)
  - Other w/u depends on stroke morphology etc
- TIA managed similar to stroke especially if major symptoms (hemiplegia etc)
  - MRI/CTA/CTP acutely may permit d/c from ED

CPMC Suggested Local Site Triage Overview

- Many possible exceptions
- Generally better to call Stroke Neurology and discuss individual case
- However, many sites want written protocol
  - Difficult given rapidly changing situation and advances
  - Need flexibility and constant reassessment
  - Depends strongly on available local resources/capabilities

CPMC Suggested Local Site Imaging Options: CTA/CTP Available

- All patients ≤ 6-12h receive CTA/CT
  - regardless of NIHSSS
- NIHSS≥10 receive CTA/CTP
- Stroke patients receive CTA/CTP after consultation
  - Depends on local CTA/CTP availability, stroke neuro availability, distance, severity, age, other local factors

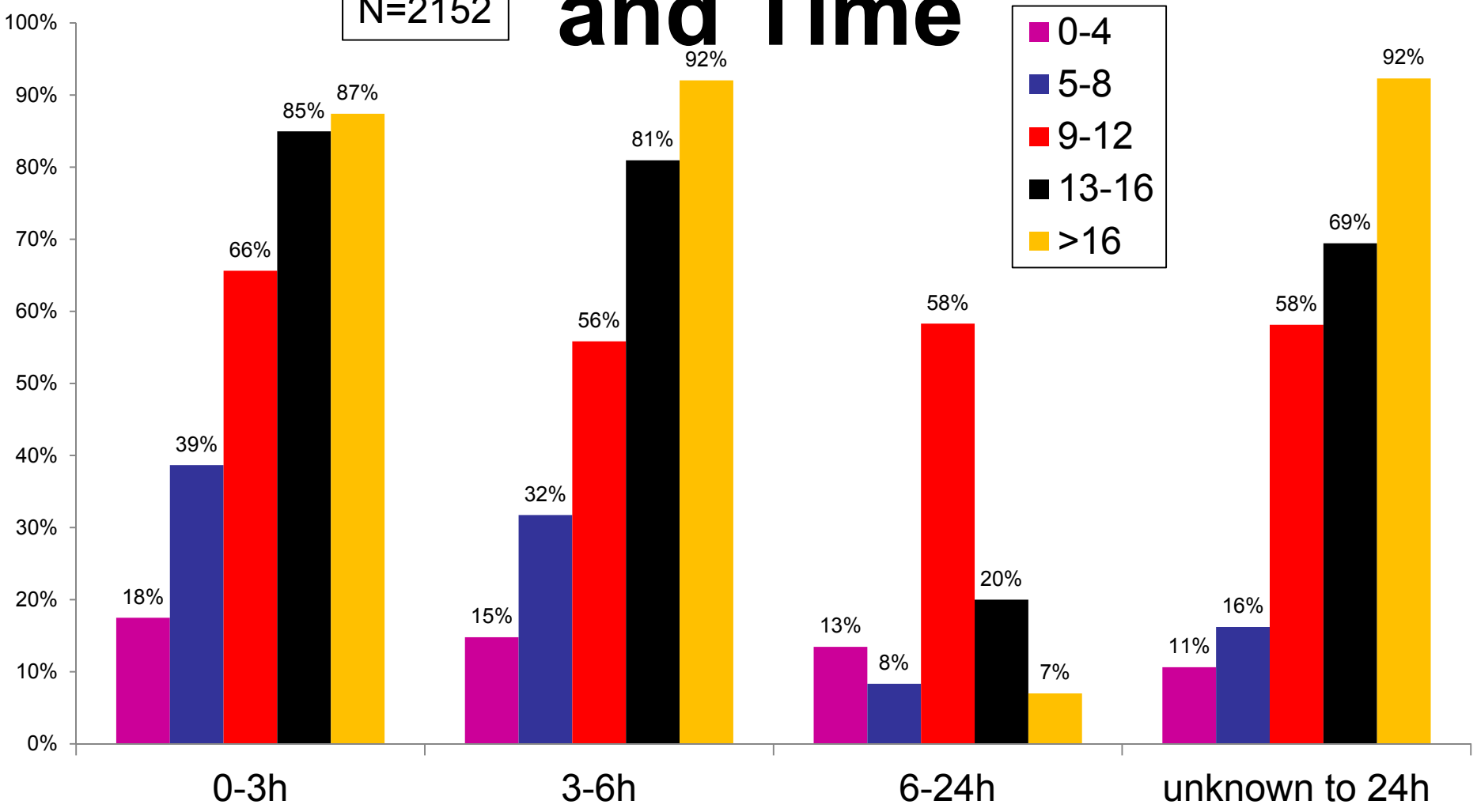
CPMC Suggested Remote Site Options: NO CTA/CTP Available

- ≤24h AND sx disabling (no NIHSS cut-off)
  - Consult stroke neurologist for possible transfer
- >24h or minor symptoms
  - local management vs. transfer for higher level of care

Other Local Site Issues

- CTA/CTP
  - Image acquisition speed/availability
  - CT technician/radiology experience
    - CTP in particular requires significant training
- Unclear if CTP needed for remote patients
  - CTA more useful for triage purposes?
  - Question of which patients to screen?
  - Generally higher NIHSS=more likely occlusion

% LA Occlusion by NIHSS and Time



Mirjam R. Heldner et al. Stroke. 2013;44:1153-1157

CPMC Transferred Pt Protocol

- Transfer IA candidates receive CTA/CTP even if previously performed
  - To assess current brain/vascular state after transfer

Tertiary Center Issues

- Capacity: Most centers under-resourced
  - ~40% acute strokes (≤24h) have vessel occlusion
  - Physicians
    - High on-call burden; few qualified (credentialing)
  - Call teams, facilities limited
    - ≥ 2 simultaneous stroke management?
- Triage: in hospital and throughout network
- Quality control: transfer/treatment speed
- Communication internal/external

Stroke Network Issues

- Treatment guidelines
  - IV rt-PA use criteria
  - IA tx time windows (6, 8, 12, 24h?)
- Transfer guidelines
  - Triage to closest capable site
  - Alternate sites if primary is unavailable
- Centralized/coordinated transfer center?

Conclusion

- A comprehensive reassessment of stroke management is needed
- Careful consideration of resources is necessary
- An ideal system is feasible but must be thought out and executed in a logical way