NEUROVASCULAR RESCUE

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Memorial Regional Hospital
STROKE IN CARDIAC CATHETERIZATION

• Overall incidence is low:
  – Diagnostic procedure: 0.03-0.3%
  – PCI: 0.3-0.4%
• High morbidity and mortality
• Patient risk factors: female gender, diabetes mellitus, hypertension, prior CVA or renal failure
• Advanced CAD, prior CABG, extensive plaques on TEE, decreased LVEF

*Circulation 2008;118:678-683*
OTHER RISK FACTORS

• Long catheterization procedures, urgent procedures, use of intraaortic balloon counterpulsation
• Large caliber catheters: Judkins left and Multipurpose guiding catheters
• Vascular access: transradial vs transfemoral approach
ETIOLOGY

- Air embolism
- Thrombus formation in catheter or on its surface
- Disruption of atheroma in the aortic arch during catheter manipulation
- Microemboli frequently detected by TCD
- Cerebral hemorrhage
PRESENTATION

- Often occurs during or immediately after the procedure but can be delayed up to 36 hrs
- Visual disturbance, motor weakness, aphasia, altered mental status
- Vertebrobasilar involvement in ~1/2 cases
- Asymptomatic in 15%
- Embolus most frequently lodged in MCA or ICA bifurcation
DIAGNOSTIC TESTING

- CT
- MRI: DWI/PWI
- Cerebral angiography
TREATMENT

- Many ischemic strokes are due to emboli from thrombi formed in an extracranial artery or the heart
- These older and harder clots are less responsive to thrombolytics
- Larger clot burden and tortuous cerebrovascular anatomy render treatment more difficult
- There is no defined standard of acute treatment
- Only approved treatment: IV t-PA 0.9 mg/kg up to 3 hrs (NINDS trial)  
  
NEJM 1995;333:1581-1587
PROBLEMS WITH IV t-PA

- Neurologist has to see the patient
- NIHSS score at least 4
- PT<15
- SBP must be <185, DBP must be <110
- CT brain must be “normal”
- Does not work well for large vessel occlusions
- 6% risk of symptomatic ICH
- Risk of groin or retroperitoneal hematoma, systemic bleeding
CONTRAINDICATIONS FOR IV t-PA

- Seizure at symptom onset
- Any history of ICH
- GI or any serious hemorrhage within 3 weeks
- Major surgery or trauma within 2 weeks
- Stroke or head trauma within 3 months
- Clinical history suggesting SAH
IV t-PA FOR PROXIMAL VASCULAR OCCLUSION

- Both baseline and 3 month F/U NIHSS scores significantly worse with “hyperdense MCA sign”
- Recanalization with IV t-PA: partial 30%, complete 4.3%
- Recanalization with IA t-PA: ~70%

NINDS Trial
PROACT II
PROLYSE IN ACUTE CEREBRAL THROMBOEMBOLISM

• Open label trial
• 180 pts with proximal MCA occlusion <6 hrs
• NIHSS 4-30
• Randomized 2:1 - 9 mg IA r-proUK over 2 hrs + IV heparin vs IV heparin alone

## PROACT II

<table>
<thead>
<tr>
<th></th>
<th>IA r-ProUK</th>
<th>Control</th>
<th>( p ) value</th>
</tr>
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<tbody>
<tr>
<td>Recanalization</td>
<td>67%</td>
<td>18%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>mRS &lt;2</td>
<td>40%</td>
<td>25%</td>
<td>.04</td>
</tr>
<tr>
<td>Mortality</td>
<td>24%</td>
<td>27%</td>
<td>NS</td>
</tr>
<tr>
<td>Symptomatic ICH</td>
<td>10%</td>
<td>1.8%</td>
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</tbody>
</table>

Absolute benefit 15%
Relative benefit 58%
Number needed to treat 7
AbESTT II

ABCIXIMAB IN EMERGENT STROKE TREATMENT

• Stroke onset <5 hrs
• Abciximab 0.25 mg/kg IV bolus followed by 0.125 mcg/kg/min infusion for 12 hrs vs placebo
• No difference in outcome at 3 months
• Within 5 days, 5.5% of abciximab treated and 0.5% placebo treated patients had symptomatic or fatal ICH (p=0.002)
• Trial terminated due to unfavorable benefit risk profile

Stroke 2008 Jan;39(1):87-99
CT without contrast
HYPERDENSE MCA SIGN

Ratio > 1.2

53 HU

40 HU
PENUMBRA STROKE TRIAL

- Single arm multicenter trial
- 125 patients. 24 international centers
- Stroke within 8 hours of onset
- NIHSS score >8
- Complete occlusion of a large intracranial vessel
PENUMBRA RESULTS

- 81.6% rate of revascularization vs 48.2% historical control ($p<0.0001$)
- 3.2% serious adverse events
- 11.2% symptomatic ICH
- >4 point improvement NIHSS score at discharge: 57.8%
- mRS <2 at 90 days: 25%
PENUMBRA

- Available in Europe since June 2007
- FDA approval in US in December 2007
MERCI DEVICE
Mechanical Embolus Removal in Cerebral Ischemia
CT without contrast
Merci retriever
1ST pass

Lt ICA
2nd pass

Lt ICA
CT without contrast
• 121 pts enrolled: 114 pts were treated with the Merci Retriever System. Median age: 71 yrs
• Median baseline NIHSS score: 19
• Median time from symptom onset to angio: 6 hours
• Procedure related adverse events: 7%
• Symptomatic ICH: 8%
• Recanalization in 54%
• Mortality 39% through 3 months (25% with recanalization vs 53% if not recanalized)

Stroke 2005;36:1432-1440
• Overall, 34% pts achieved a >10 point improvement in NIHSS
• Of those pts successfully revascularized, 53% had a >10 point improvement in NIHSS
• Of those pts unsuccessfully revascularized, 16% had a >10 point improvement in NIHSS
• Received FDA approval since August 2004
MULTI MERCI TRIAL

• 164 patients with angiographically proven large vessel occlusive strokes
• 15 participating stroke centers in North America
• Same study design as MERCI trial except:
  • Included failed IV lytic (t-PA) patients
  • Included next generation Merci® Retriever L5

L5

New V series
## MULTI MERCI TRIAL

### Revascularization

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Successful Revascularization Post-Procedure</td>
<td>68.3%</td>
<td>(112/164)</td>
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### Symptomatic Hemorrhage

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>Count</th>
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<tbody>
<tr>
<td>Overall</td>
<td>9.8%</td>
<td>(16/164)</td>
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<tr>
<td>Symptomatic PH-2</td>
<td>2.4%</td>
<td>(9/164)</td>
</tr>
<tr>
<td>Failed IV t-PA Patients</td>
<td>10.4% (5/48)</td>
<td></td>
</tr>
<tr>
<td>Symptomatic PH-2</td>
<td>2.1%</td>
<td>(1/48)</td>
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</tbody>
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### Good Outcome (90-day mRS ≤ 2)

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<th>Description</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>36.3%</td>
<td>(58/160)</td>
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### Mortality at 90 days

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<tr>
<th>Description</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>33.5%</td>
<td>(54/161)</td>
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>2/3 of patients achieved revascularization
>1/3 patients are functionally independent at 90 days
Large symptomatic hemorrhages (PH-2) were infrequent
OTHER STROKE DEVICES

- NeuroFlo (CoAxia)
- MicroLysUS infusion catheter (EKOS)
- Neuronet device (Guidant)
- Catch device
- Phenox clot retriever
- Alligator retrieval device (Chesnut Medical)
- Balloon angioplasty
- Stents: Neuroform, Enterprise, Leo, Solitaire/Solo, Wingspan
CONCLUSION

- Activate brain attack
- Do not remove femoral sheath!
- Send STAT coags
- Review of meds given intraprocedurally
- Consider STAT CT brain
- Consult Neurology and INR
- Admit patient to Neuro ICU