Hyperacute Stenting for Acute Ischemic Stroke Is Associated with a High Rate of Symptomatic Intracranial Hemorrhage

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Introduction

- Successful recanalization of occluded intracranial arteries is associated with improved outcome after acute ischemic stroke (AIS)[1, 2] but many treatments fail to recanalize large arteries.[3]
- Numerous endovascular therapies have been attempted to recanalize occluded vessels in AIS patients who have persistent neurological deficits despite IV rtPA or as primary therapy when IV rtPA is contraindicated.[4-6]
- Some stroke centers have tried acute stenting for recanalization in hyperacute AIS patients when other measures fail.[7-12]
- We report our single-center series of AIS patients who had hyperacute stenting.

Methods

- We performed a retrospective chart review of 24 consecutive AIS patients who underwent hyperacute stenting from February of 2009 to January of 2011.
- We excluded patients stented more than 8 or 24 hours after anterior circulation or posterior circulation strokes respectively.
- In our institution, we always administer full dose IV rtPA of 0.9 mg/kg to eligible AIS patients within 4.5 hours of stroke onset.
- Diagnostic angiography is performed in all patients with AIS and National Institutes of Health Stroke Scale (NIHSS) ≥ 8 and when there is lack of rapid improvement within 1 hour of IV rtPA administration.
- In most patients, stent placement is only attempted after failure of other endovascular procedures.
- Acute stent thrombosis is seen sometimes on follow-up angiography and is usually followed-up with the use of other modalities including intra-arterial (IA) rtPA, angioplasty and/or IA abciximab infusion.
- Patients who have not been previously on anti-platelet agents are usually given a weight based loading dose of abciximab followed by a weight based IV infusion in addition to a loading dose of clopidogrel 600mg and aspirin 650 mg.

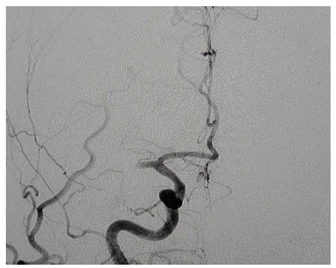

Figure 1. Right proximal middle cerebral artery (MCA) occlusion pre-stenting.

Figure 2. Right proximal middle cerebral artery (MCA) occlusion post-stenting.

Results

- We summarized our demographic data in Table 1 and our patient outcomes in Table 2.
- Our endovascular treatment with acute stenting was effective in recanalization of acute arterial occlusions with 84% partial or complete recanalization as measured on cerebral angiography and is similar to prior small acute stenting series.[7-8, 10-12]
- Symptomatic ICH (sICH) was 21% and poor outcomes related to discharge disposition was 67% in our patient population.

Table 1. Demographic Data

Demographic	Data
Number of Patients	24
Mean Age	65 years (40 to 91 years)
Sex	58% men
IV rtPA	58% (n=14)
Location of Arterial Occlusions	Proximal M1 Middle Cerebral Artery: 44% (n=11)
	Internal Carotid Artery: 40% (n10) {IA (n=5), EA (n=2) and both (n=2)}
	Basilar Artery: 12% (n=3)
	Vertebral Artery: 4% (n=1)
Etiology of Stroke	Large Vessel: 54% (n=13) {IA (n=8), EA (n=2) and both (n=3)}
	Cardioembolic: 38% (n=9)
	Other etiology: Internal Carotid Artery Dissection: 4% (n=1)
	Cryptogenic: 4% (n=1)
Intra-arterial Modalities Before Stenting	Intra-arterial rtPA: 8% (n=2)
	Angioplasty: 56% (n=14)
	Penumbra: 7% (n=2)
	MERCI Catheter: 7% (n=2)
Stent Characteristics	24 patients had 27 stents (3 patients with 2 stents)
	Initial therapy: n=6
	Salvage therapy: n=21
	Successfully Deployed: 89% (n=24)
	Intracranial: 74% (n=20)
Types of stents	Enterprise Stent: 67% (n=18)
	Precise Stent: 19% (n=5)
	Wingspan Stent: 4% (n=1)
	Neuroform Stent: 4% (n=1)
	Taxus Stent: 4% (n=1)
Intra-arterial Modalities and Treatment Post-Stenting	Intra-arterial rtPA: 37% (n=10)
	Angioplasty: 26% (n=7)
	Glycoprotein IIb/IIIa inhibitor [abciximab only]: 58% (n=14)
	Aspirin (650mg): 29% (n=7)
	Clopidogrel (600mg): 29% (n=7)

Table 2. Patient Outcomes

Outcomes	Data
Median NIHSS	20 (Range: 11 to 31)
Mean Time from Stroke to Stent Deployment	332 min. in vessels that recanalize (84% (n=21))
	Anterior Circ.: 300 min. (n=17) {Range 197 to 429 min}
	Posterior Circ.: 458 min. (n=4) {Range 320 to 612 min}
Angiographic TICI Scores	Pre-stenting: All with TICI Grade 0 or 1
	Post-stenting total recanalization (TICI=3): 4% (n=1)
	Post-stenting partial recanalization (TICI=2b or 2a): 80% (n=20)
Stents Failing to Canalize Arterial Occlusion	19% (n=5): 2 unsuccessful MCA, 1 extracranial ICA without distal recanalization, 2 stents with in-stent thrombi
Discharge Median NIHSS	20 (Range: 6 to 42)
Good Discharge Clinical Improvement (Discharge NIHSS ≤ 4)	0
Moderate Discharge Improvement of at least NIHSS ≤ 10	21% (n=5)
Mild Discharge Improvement of at least NIHSS ≤ 4	42% (n=10)
Worsened Outcome (NIHSS ≥ 4)	42% (n=10)
Intracranial Hemorrhage	Total ICH: 54% (n=14)
	Symptomatic ICH: 21% (n=5); median NIHSS 15
Complications	Gastrointestinal Hemorrhage: 13% (n=3)
	Decompressive Hemicraniectomy: 8% (n=2)
In-hospital Mortality	Total: 29% (n=7)
	Stroke progression: 13% (n=3)
	sICH: 13% (n=3)
	Cardiopulmonary Arrest/Septic Shock: 4% (n=1)
	Withdrawal of support: 13% (n=3)
Poor Discharge Outcomes (Death, Hospice, SNF and LTAC)	Total: 67% (n=16)
	Death: 29% (n=7)
	Hospice: 8% (n=2)
	Skilled Nursing Facility (SNF): 21% (n=5)
	Long-term Acute Care Facility: 8% (n=2)
Good Discharge Outcomes (Inpatient Rehabilitation or Home)	Total: 33% (n=8)
	Inpatient Rehabilitation: 29% (n=7)
	Home: 4% (n=1)

Table 3. Univariate Analysis of Predictors of symptomatic ICH

Present factor	sICH (n=5)	No sICH (n=19)	P-value
Age > 70	1 (20%)	8 (42%)	0.61
Diabetes mellitus	3 (60%)	5 (26%)	0.29
Admission NIHSS > 20	0	11 (58%)	0.04*
Post stent TICI 2B or better	3 (60%)	10 (53%)	>0.99
Cardioembolic stroke etiology	0	8 (42%)	0.13
IV tPA	3 (60%)	11 (58%)	>0.99
IA tPA	1 (20%)	7 (37%)	0.61
Aspirin and clopidogrel loaded	0	6 (32%)	0.28
Reopro IV	4 (80%)	10 (53%)	0.36
MERCI Retriever used	0	3 (16%)	>0.99
Penumbra cathether	0	2 (11%)	>0.99
TTR > 300 min	4 (80%)	10 (53%)	0.36

Abbreviations: sICH = symptomatic ICH; NIHSS = National Institute of Health Stroke Scale; TTR = time to recanalization from symptom onset.
Fisher's exact test. Significance of p<0.05.

Table 4. Historical Data for Acute Stroke Trials

Study	Baseline NIHSS	Recanalization Rates	sICH*	aICH†	Mortality Rates
NINDS [1]	14 (median)	N/A	6.4%	5%	17% (3-month)
ECASS III [27]	9 (median)	N/A	2.4%	27% (all ICH)	7.7% (3-month)
PROACT II [9]	17 (median)	66% tot. (19% c.)	10.2%	68% (all ICH)	25% (3-month)
IMS II trial [28]	19 (median)	60% tot. (4% c.)	9.9%	32.1%	16% (3-month)
Multi-MERCI[10]	19 (median)	54% alone and 69% a. ther.	9%	29.7%	30.6% (3-month)
Penumbra [8]	21 (mean)	100% tot. (52% c.)	10%	30%	45% (one-month)
SARIS [14]	13 (median)	100% tot. (60% c.)	5%	10%	25% (one month)
Our study	20 (median)	84% tot. (4% c.)	20.8%	37.5%	29.2% (discharge)

*symptomatic intracranial hemorrhage (sICH); †asymptomatic ICH (aICH).
IA, intra-arterial; NA, not available; tot., total recanalization (partial and complete); c.,complete recanalization; a. ther., adjunctive therapy with MERCI retriever; ICH, intracranial hemorrhage.

Discussion

- When compared to prior prospective studies involving IV rtPA as well as endovascular treatment, our patients had a higher rate of symptomatic ICH. The reasons for this are uncertain, but may relate to a number of factors including: long time to recanalization, severe strokes, use of combined aspirin and Plavix load, glycoprotein IIb/IIIa inhibitor use, concomitant IV thrombolysis, and other mechanical devices; however, none of these were predictors of sICH in our univariate analysis (Table 3).
- We often loaded clopidogrel and aspirin to prevent in-stent thrombosis. The use of multi-modality reperfusion therapy, not involving stenting, has not been linked to an increased incidence of sICH,[14] which is in contrast to our study demonstrating a high risk of sICH.
- Our in hospital mortality was high, and comparable to the 30 and 90 day mortality seen in other endovascular studies (Table 4). The reasons for this include a higher rate of sICH, but when compared to the natural history of severe stroke, this proportion of patients who died is expected.[15] Poor discharge dispositions to SNF, LTAC and/or Hospice is also predictable from the high baseline NIHSS found in our study as well as other studies.[16, 17]
- Subsequent to our retrospective study, our use of acute stenting has declined. This is related to the relatively poor outcomes we observed, as well as our involvement in newer stent modalities that do not require anti-platelet agents. Whether this leads to improvement in patient outcomes, needs to be determined.

Conclusions

- Hyperacute stenting for patients with AIS and persistent large vessel occlusions was associated with a high sICH rate, and overall poor patient outcomes.
- Therefore, prospective data collection may be indicated to determine the best techniques, antiplatelet loading regimen, and stent types.

References

1. Rha J-H, Saver JL. The impact of recanalization on ischemic stroke outcome: A meta-analysis. Stroke. 2007;38:967-973.
2. Zaidat OO, Suarez JI, Sunshine JL, et al. Thrombolytic therapy of acute ischemic stroke: Correlation of angiographic recanalization with clinical outcome. AJNR Am J Neuroradiol. 2005;26:880-884.
3. Wolpert SM, Bruckmann H, Greenlee R, et al. Neuroradiologic evaluation of patients with acute stroke treated with recombinant tissue plasminogen activator. The rt-pa acute stroke study group. AJNR Am J Neuroradiol. 1993;14:3-13.
4. Bose A, Henkes H, Alfke K, et al. The penumbra system: A mechanical device for the treatment of acute stroke due to thromboembolism. AJNR Am J Neuroradiol. 2008;29:1409-1413.
5. Furlan A, Higashida R, Wechsler L, et al. Intra-arterial prourokinase for acute ischemic stroke. The proact ii study: A randomized controlled trial. Prolyse in acute cerebral thromboembolism. JAMA. 1999;282:2003-2011.
6. Smith WS, Sung G, Saver J, et al. Mechanical thrombectomy for acute ischemic stroke: Final results of the multi merci trial. Stroke. 2008;39:1205-1212.
7. Brekenfeld C, Schroth G, Mattle HP, et al. Stent placement in acute cerebral artery occlusion: Use of a self-expandable intracranial stent for acute stroke treatment. Stroke. 2009;40:847-852.
8. Levy EI, Mehta R, Gupta R, et al. Self-expanding stents for recanalization of acute cerebrovascular occlusions. AJNR Am J Neuroradiol. 2007;28:816-822.
9. Levy EI, Siddiqui AH, Crumlish A, et al. First food and drug administration-approved prospective trial of primary intracranial stenting for acute stroke: Saris (stent-assisted recanalization in acute ischemic stroke). Stroke. 2009;40:3552-3556.
10. Mocco J, Hanel RA, Sharma J, et al. Use of a vascular reconstruction device to salvage acute ischemic occlusions refractory to traditional endovascular recanalization methods. J Neurosurg. 2010;112:557-562.
11. Roth C, Papanagiotou P, Behnke S, et al. Stent-assisted mechanical recanalization for treatment of acute intracerebral artery occlusions. Stroke. 2010;41:2559-2567.
12. Zaidat OO, Wolfe T, Hussain SI, et al. Interventional acute ischemic stroke therapy with intracranial self-expanding stent. Stroke. 2008;39:2392-2395.
13. Shaltoni HM, Albright KC, Gonzales NR, et al. Is intra-arterial thrombolysis safe after full-dose intravenous recombinant tissue plasminogen activator for acute ischemic stroke? Stroke. 2007;38:80-84.
14. Gupta R, Vora NA, Horowitz MB, Tayal AH, Hammer MD, Uchino K, et al. Multimodal reperfusion therapy for acute ischemic stroke: Factors predicting vessel recanalization. Stroke. 2006;37:986-990.
15. Adams HP, Davis PH, Leira EC, et al. Baseline nih stroke scale score strongly predicts outcome after stroke: A report of the trial of org 10172 in acute stroke treatment (toast). Neurology. 1999;53:126-131.
16. Sato S, Toyoda K, Uehara T, et al. Baseline nih stroke scale score predicting outcome in anterior and posterior circulation strokes. Neurology. 2008;70:2371-2377.
17. Schlegel D, Kolb SJ, Luciano JM, et al. Utility of the nih stroke scale as a predictor of hospital disposition. Stroke. 2003;34:134-137.
18. Hacke W, Kaste M, Bluhmki E, et al. Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke. N Engl J Med. 2008;359:1317-1329.
19. Tomsick T, Broderick J, Carrozella J, et al. Revascularization results in the interventional management of stroke ii trial. AJNR Am J Neuroradiol. 2008;29:582-587.
20. Tissue plasminogen activator for acute ischemic stroke. The national institute of neurological disorders and stroke rt-pa stroke study group. N Engl J Med. 1995;333:1581-1587.

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