

Effect of Age on Outcomes of Endovascular Stroke Therapy: National Trends from 2004 to 2012 Xingwen Sun; Srikanth Boddu MD; David Kimball; Ning Lin MD Department of Neurosurgery, New York Presbyterian Hospital / Weill Cornell Medical Center, New York, NY.



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Introduction

Endovascular treatment of acute ischemic stroke (AIS) has evolved rapidly with the advent of mechanical devices such as the Mechanical Embolus Removal in Cerebral Ischemia (MERCI), Penumbra system, and Solitaire FR. We aim to study the national trend of utilization and outcome after endovascular intervention for patients with AIS with respect to technological changes.

Current Literature

--Recent large stroke trials (MR RESCUE2, IMS III3, Synthesis expansion4) did not show a benefit for endovascular intervention and casting doubt on the utility of this therapeutic method as a whole.

--Design limits of these trials (patient selection problems, lack of vascular imaging confirmation for large vessel occlusion, etc5.

--Technology for mechanical thrombectomy has undergone rapid evolution from the advent of MERCI to Penumbra to Solitaire.

--Most current randomized trials (MR CLEAN6, ESCAPE7) utilized the most current technology and showed clear benefits for endovascular therapy, confirming the superiority of Stentretriever to prior generation of devices.

Methods

We analyzed the Nationwide Inpatient Sample (NIS) to study clinical outcome of endovascular stroke therapy over three periods: 2004-2007 (post-MERCI), 2008-2011 (post-Penumbra), and 2012 (post-Solitaire). AIS patients who underwent endovascular clot retrieval were identified with ICD-9 codes. Morbidity and mortality were evaluated as a function of patient age and of concomitant thrombolytic agent administration.

Data Source

Data obtained from the Nationwide Inpatient Sample (NIS), a component of the Healthcare Cost and Utilization Project (HCUP) sponsored by U.S. Dept. of Health & Human Services. The database includes approximately 20% stratified sample of all inpatient admissions to nonfederal hospitals in United States. Detailed information about NIS is available at http://www.hcup-us.ahrq.gov.

Results

From 2004-2012, the number of AIS patients treated with endovascular intervention increased each year. The overall inhospital mortality in this cohort of patients decreased significantly from post-MERCI (25.2%), post-Penumbra (19.9%), to post-Solitaire period (17.1%, OR 0.733, 95% CI 0.666-0.808), although the rate of intracerebral hemorrhage increased slightly (0.10 vs. 0.17 vs. 0.20). In subgroup analyses based on age, the mortality decrease from 3 periods of technological changes was significant for patients older than 65 (27.3% vs. 23.2 vs. 17.5%, p<0.001), and trending towards significance for those younger than 65 (24.0 vs. 17.2 vs. 17.4, p=0.07). Multivariate logistic regression demonstrated that mortality rate for patients between 65 and 80 and patients older than 80 decreased significantly from post-Penumbra to post-Solitaire period (both p<0.001) after adjustment of gender, ethnicity, geographic location, and co-morbidities.

Figure 1 Treatment trends in the management of acute ischemic stroke (AIS)											
4									3.48		
3							3.07	3.12			
5 -						2.0					
2 -				1.69	1.7				1.57		
5 -		1.29	1.43					1.32	1.57		
1 - 1	0.86				0.72		0.97				
5 -		0.26	0.28	0.37							
0	0.05			_			,				
	2004	2005 - N	2006 / t-PA	2007	2008 Mech. Thr	2009 ombecto	2010 my	2011	2012		

Table 1											
	2004-07	2008-11	p-value (04-07 vs. 08-11	2012	p-value (12 vs. 08-11)						
Number of patients	5924	25483	N/A	8615	N/A						
Mean Age (<u>+</u> SD)	60.2 (<u>+</u> 16)	63.3 (<u>+</u> 15.5)	<0.0001	64.5(<u>+</u> 15)	<0.0001						
Mean CCS (<u>+</u> SD)	4.3(<u>+</u> 2.5)	5.2 (<u>+</u> 2.5)	<0.0001	5.6(<u>+</u> 2.5)	<0.0001						
Mortality (%)	1496(25.3)	5109(20.1)	<0.0001	1475(17.1)	<0.0001						
ICH (%)	568(9.6)	2671(10.5)	0.04	830(9.6)	0.03						
Pneumonia (%)	438(7.4)	1596(6.3)	0.0016	530(6.2)	0.73						
Gastrostomy (%)	751(12.7)	3470(13.6)	0.06	1315(15.3)	0.0002						
Tracheostomy (%)	24(0.4)	1002(3.9)	<0.0001	355(4.1)	0.46						
Mean stay (<u>+</u> SD)	12.4 (±11.3)	10.8 (±11.0)	<0.0001	10.8 (±12)	0.443						

Conclusions

The utilization of endovascular thrombectomy in AIS patients increased steadily over time. The inhospital mortality significantly decreased from post-MERCI (2004-2007), post-Penumbra (2008-2011), to post-Solitaire (2012) era, especially in patients with older age.

Learning Objectives

By the conclusion of this session, participants should be able to 1) describe the technological advances in different generation of mechanical thrombectomy device, 2) understand the effect of age on clinical outcomes after endovascular stroke therapy.

References

 Tissue Plasminogen Activator for Acute Ischemic Stroke. N Engl J Med.
1995;333(24):1581-1588.
Kidwell CS, Jahan R, Gornbein J, Alger JR, Nenov V, Ajani Z, et al. A trial of imaging selection and endovascular treatment for ischemic stroke. N Engl J Med. 2013;368:914-923.

Broderick JP, Palesch YY, Demchuk AM, Yeatts SD, Khatri P, Hill MD, et al. Endovascular therapy after intravenous t-PA versus t-PA alone for stroke. N Engl J Med. 2013;368:893-903.
Ciccone A, Valvassori L,Nichelatti M, Sgoifo A,Ponzio M,Sterzi R, et al.Endovascular treatment for acute ischemic stroke. N Engl J Med. 2013;368:904-913.

 5. Berkhemer OA, Fransen PS, Beumer D, van den Berg LA, Lingsma HF, Yoo AJ, et al. A Randomized Trial of Intraarterial Treatment for Acute Ischemic Stroke. N Engl J Med. 2014.
6. Goyal M, Demchuk AM, Menon BK, Eesa M, Rempel JL, Thornton J, et al.Randomized assessment of rapid endovascular treatment of ischemic stroke.N Engl J Med.2015;372:1019-1030.