



Endovascular Therapies for Ischemic Stroke in Children – Unique Opportunity, but Far Behind the Adult Population

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Introduction

Pediatric strokes are as common as pediatric brain tumors, and are one of the top ten causes of death in children. However, children with stroke often experience a delay in diagnosis, and variable treatment, if any, secondary to a lack of prospective clinical evidence and treatment guidelines.

Methods

We performed a literature search of pediatric stroke cases managed off-label with endovascular treatment.

Results

51 cases of pediatric strokes were treated with intra-arterial (IA) fibrinolytics (n = 24) or IA-mechanical thrombectomy with or without IV- or IA-fibrinolytics (n = 27) in patients as young as 2 years old, with a time to treatment averaging 14 hrs and range up to 72 hours. Complete or incomplete recanalization was achieved in 95% of cases. Hemorrhage occurred in 35% (n = 7/20) of patients in the IA-fibrinolytic group alone; but only one of these patients was symptomatic. Only one patient in the IA-mechanical thrombectomy group experienced asymptomatic hemorrhage (4.2%), and this patient also received IA-fibrinolytic therapy.

Table 1: IA-fibrinolysis only vs. IA-mechanical thrombectomy (with or without IV or IA fibrinolysis) – Baseline Characteristics

	All	IA-fibrinolysis	IA-mechanical thrombectomy (with or without IV or IA-fibrinolysis)
Total cases, no (%)	51	24 (47)	27 (53)
Age, ave (range)	10.4 (2-18)	10.5 (2-18)	10.3 (2-17)
Males, no. (%)	27 (57.4)	10 (40)	17 (73.9)
Systemic risk factors			
Cardiac, no (%)	18 (35.3)	7 (29.2)	11 (40.7)
Infection, no (%)	6 (11.8)	5 (20.8)	1 (3.7)
Hypercoagulable, no (%)	6 (11.8)	3 (12.5)	3 (11.1)
Vasculitis, no (%)	4 (<1)	2 (8.3)	2 (7.4)
Trauma, no (%)	3 (<1)	2 (8.3)	1 (3.7)
None, no (%)	17 (33.3)	6 (25.0)	11 (40.7)
Cerebrovascular risk factors			
Dissection, no (%)	8 (15.7)	4 (16.7)	4 (14.8)
TIA or stroke, no (%)	3 (5.9)	0 (0.0)	3 (11.1)
Other, no (%)	4 (7.8)	3 (12.5) ¹	1 (3.7) ²
None, no (%)	36 (70.1)	17 (70.8)	19 (70.4)
Vessels occluded			
Anterior, no (%)	30 (58.8)	13 (54.2)	17 (63.0)
Posterior, no (%)	21 (41.2)	11 (45.8)	10 (37.0)
Time to treatment, ave hrs (range)			
	14.7 (2.0-72.0)	13.7 (2.2-72.0)	15.8 (2.0-72.0)

¹MCA stenosis, diagnostic angiogram, pseudoaneurysm.
²Hypothermia.
 IA = intra-arterial, IV = intravenous.

Table 2: IA-fibrinolysis only vs. IA-mechanical thrombectomy (with or without IV or IA fibrinolysis) – Post-procedural Outcomes

	All	IA-fibrinolysis	IA-mechanical thrombectomy (with or without IV or IA-fibrinolysis)
Recanalization, no (%)			
Complete	38 (64.4)	16 (59.3)	22 (68.8)
Incomplete	18 (30.5)	9 (33.3)	9 (28.1)
None	3 (5.1%)	2 (7.4)	1 (3.1)
NA	7 (13.7)	6 (11.8)	1 (3.7)
Post-procedural complication, no (%)			
Hemorrhage	8 (18.2)	7 (35.0)	1 (4.2) ¹
Asymptomatic hemorrhage	7 (15.9)	6 (30.0)	1 (4.2) ¹
Symptomatic hemorrhage	1 (2.3)	1 (5.0)	0 (0)
Other	3 (6.8)	1 (5.0) ²	2 (8.3) ³
None	33 (75.0)	12 (60.0)	21 (87.5)
NA	5 (9.8)	4 (16.7)	1 (3.7)

¹patient received both IA-mechanical thrombectomy and IA-tPA
²limb ischemia requiring amputation
³coil dislodged, new emboli
 IA = intra-arterial, IV = intravenous; NA = not available.

Table 3: IA-mechanical thrombectomy (with or without IV or IA-fibrinolysis)

Type of intervention, no (%)	n = 27
IA-mechanical thrombectomy only	13 (48.1)
IA-mechanical thrombectomy + IA fibrinolytic	12 (44.4)
IA-mechanical thrombectomy + IV fibrinolytic	2 (7.4)
Types of mechanical devices, no (%)	
n = 35	
Penumbra	7 (20.0)
Solitaire	6 (17.1)
Merci	6 (17.1)
Balloon angioplasty	6 (17.1)
Other	6 (17.1) ¹
Trevo	2 (5.7)
Guidewire	2 (5.7)

¹Attractor 18, CAPTURE, IN-Time, Phoenix, Retriever 18, Wingspan
 IA = intra-arterial, IV = intravenous.

Conclusions

In the context of recent emerging data supporting the benefits of IA-mechanical thrombectomy in the adult population, we are seeing more case reports emerging in the pediatric literature that support the effectiveness of IA-mechanical thrombectomy with few hemorrhagic complications.

Learning Objectives

- 1) Describe the barriers to diagnosis and treatment of pediatric strokes.
- 2) Discuss the evolution of adult neuro-endovascular stroke management.
- 3) Review the existing data on neuro-endovascular stroke management in the pediatric population.