Interventional Radiologists and Endovascular Therapy for Acute Ischemic Strokes

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ABBREVIATIONS

CSC = comprehensive stroke center, EVT = endovascular therapy, SNIS = Society of NeuroInterventional Surgery, TPA = tissue plasminogen activator

Effective endovascular therapy (EVT) for acute ischemic stroke requires a rapid multidisciplinary response with technically successful revascularization and few complications (1). Overall EVT times can be delayed by transfer of these patients to endovascular-capable hospitals (2,3), potentially leading to worse outcomes (3,4). Skilled body interventional radiologists can contribute to the pool of physicians providing EVT, allowing this care to be available locally without the need for transfer (5–8). There continues to be controversy regarding the training necessary for interventional radiology physicians to perform EVT (9–11). This commentary provides evidence to support the value of rapid access to EVT and the role of interventional radiology in providing this care.

Locally available care matters. Mortality is associated with increasing distance between the transferring hospital and the comprehensive stroke center (CSC) (3). Therefore, the American Heart Association recommends that patients not bypass the local hospital where intravenous alteplase (ie, tissue plasminogen activator [TPA]) is available in favor of a CSC if the diversion would add more than 15–20 minutes of transport time (12). The patient can subsequently be transferred to an endovascular-capable hospital if needed. This improves time to receive intravenous TPA, but delays time to EVT by 95–140 minutes (2,3). For every 30-minute delay in endovascular revascularization, the likelihood of a good outcome is reduced by approximately 5%–8% (2,13,14). These delays also decrease the likelihood of even receiving EVT if the patient is no longer within an accepted time window for treatment or if the stroke has progressed to irreversibility and ineligibility for treatment. In the Spanish Catalonia registry (4), when a CSC was locally available, 10.5 per 100,000 patients received EVT. When patients were not local but within 1 hour, only 3.7 per 100,000 patients were treated, along with a delay of 82 minutes. When patients lived more than 1 hour from the CSC, only 2.7 per 100,000 patients were treated with EVT, along with a delay of 120 minutes.

The poor outcomes and human costs of these delays can, in theory, be addressed in several ways (15). Intravenous TPA can be given in the ambulance with the use of a mobile computed tomography system, such that diversion to a CSC does not delay TPA administration. This procedure is beginning at a few centers. EVT can be provided 24 hours a day, 7 days a week at hospitals where it may not currently be available at all times. Processes of transfer can be made more efficient. EVT can be provided at more centers, avoiding the need for transfer or longer distances to transfer. This also avoids the economic and personal/family costs of needless transfer of as many as 41% of stroke patients who do not qualify for EVT despite meeting clinical criteria (16). However, increasing local availability of EVT may not be justifiable if competing local EVT centers already exist.

Interventional radiologists can augment physician manpower to increase the local availability of EVT. Interventional radiologists are trained in neuroanatomy and imaging and have expertise in endovascular catheterization, including the use of microcatheters and microwires, and endovascular interventions with the use of diverse devices, including clot retrieval devices used for peripheral vascular applications. This background serves as the foundation for further training and experience in stroke interventions. Interventional radiology participation in stroke cases would not dilute the experience of other neurointerventional physicians treating other neurovascular conditions such as cerebral aneurysms or vascular malformations.

There is controversy regarding what further training is appropriate for an interventional radiologist before caring

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Table. Comparison of Technical and Clinical Outcomes and Complications for Endovascular Acute Ischemic Stroke Treatment Performed by Interventional Radiologists Versus Neurointerventional Physicians

Study	Type	Specialty	No. of Pts.	Years of Data	Agent	Median NIHSS Score	Median Age (y)
Belisle et al (5)	Case series	IR	83	2004–2007	Lysis	17	69
Burkhart et al (7)	Case series	IR	40	2008–2011	70% MERCI	18	75
Fjetland et al (6)	Case series	IR	39	2009–2011	SR/aspiration	17	68
Šaňák et al (8)	Case series	IR	50	2010–2012	SR	18	67
INSTOR (*http://www.strokeregistry.org*)	Registry	IR	742	2013–2016	SR/aspiration	15	70–74
PROACT II (23)	RCT	NI	121	1996–1998	Lysis	17	64
IMS III (25)	RCT	NI	434	2006–2012	Lysis, MERCI, aspiration	17	69
HERMES (1)	RCT	NI	634	2010–2014	SR/others	17	66
MultiMERCI (21)	Registry	NI	164	2005–2006	MERCI	19	68
Bern* (27)	Registry	NI	227	2010–2012	SR/aspiration	16	68
Catalonia (4)	Registry	NI	536	2011–2012	NR	18	68
NASA (28)	Registry	NI	354	2012–2013	SR	18	67
SIR (18)	Guideline	–	–	–	–	–	–
SNIS (15)	Guideline	–	–	–	–	–	–

Study	mRS Score 0–2 at 90 d (%)	Revascularization†	SICH (%)	Door to Puncture Time (min)	Procedure Time (min)
Belisle et al (5)	51	76% ≥ TICI 2	6	NR	131
Burkhart et al (7)	50	65% ≥ TICI 2	10	NR	NR
Fjetland et al (6)	36	75% ≥ TIMI 2, 59% TIMI 3	8	NR	NR
Šaňák et al (8)	60	94% ≥ TICI 2, 72% TICI 3	6	NR	50
INSTOR (*http://www.strokeregistry.org*)	52	76% ≥ TICI 2b	8	113	NR
PROACT II (23)	40	66% ≥ TIMI 2	10	NR	120
IMS III (25)	41	23%–44% ≥ TICI 2b	6	NR	NR
HERMES (1)	46	71% ≥ mTICI 2b	4	116‡	48
MultiMERCI (21)	36	68% ≥ TIMI 2	10	NR	96
Bern* (27)	40	71% ≥ TICI 2b	10	NR	79
Catalonia (4)	43	74% ≥ TICI 2b	6	115	95
NASA (28)	42	85% ≥ TIMI 2, 73% > TICI 2b	10	77	101
SIR (18)	30	60% ≥ TICI 2	12	75% ≤ 120	90
SNIS (15)	–	60% ≥ TICI 2b	10	–	–

A score of 0–2 indicates a good clinical outcome.
IR = interventional radiology; MERCI = Mechanical Embolus Removal in Cerebral Ischemia device; mTICI = modified Thrombolysis in Cerebral Infarction; mRS = modified Rankin score; NI = neurointerventional; NIHSS = National Institutes of Health Stroke Scale; NR = not reported; RCT = randomized controlled trial; SICH = symptomatic intracranial hemorrhage; SIR = Society of Interventional Radiology; SNIS = Society of NeuroInterventional Surgery; SR = Stentriever; TICI = Thrombolysis In Cerebral Infarction; TIMI = Thrombolysis In Myocardial Infarction.
*Data limited to anterior circulation strokes.
†The definition of successful revascularization has changed over time from TICI or TIMI ≥ 2 to TICI or mTICI ≥ 2b.
‡For non transferred patients.