



The Role of Interventional Radiologists in Acute Ischemic Stroke Interventions: A Joint Position Statement from the Society of Interventional Radiology, the Cardiovascular and Interventional Radiology Society of Europe, and the Interventional Radiology Society of Australasia

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ABBREVIATIONS

AHA = American Heart Association, EVT = endovascular thrombectomy

Stroke is a major public health issue. Worldwide, the incidence of new strokes is 16.9 million per year (1). In the United States, the incidence of new strokes is 795,000 per year, of which 87% are ischemic (2). Endovascular thrombectomy (EVT) is proven to provide better clinical outcomes in patients with ischemic strokes caused by large-vessel occlusion compared with best medical therapy alone (3–12). Furthermore, endovascular thrombectomy has proven to be cost-effective (13). The American Heart Association (AHA) and multiple international stroke organizations

recommend EVT as standard of care for selected patients (14–18). Based on 2015 AHA guidelines, it is estimated that approximately 10–20 patients per 100,000 per year are eligible for EVT in the United States (19,20). However, only a fraction of these patients are currently being treated (21). In addition, the most recent AHA guidelines now include patients with symptom duration as long as 24 hours and consider the treatment of vessel occlusions in locations other than the internal carotid artery and M1 segments, such as the anterior cerebral artery and M2 branches (16). With these expanded indications, it is now estimated that as many as 31 patients per 100,000 per year may be eligible for EVT in the United States (22).

Are there enough physicians to treat these patients? The population of the United States in 2017 was 326 million. Based on the estimate of 31 patients per 100,000 per year, there should be approximately 100,000 patients per year eligible for EVT in the United States. Stroke centers vary in case volume, but if the average stroke center performs 200 EVT procedures per year and requires 4 physicians to provide 24-hour, 7-day service, 500 stroke centers with at least 2,000 physicians are needed. The United States currently has only 231 certified comprehensive and thrombectomy-capable stroke centers (23,24). The population of Europe is 741 million, corresponding to 230,000 EVT-eligible patients and the need for 4,600 physicians at 1,150 stroke centers. If more than 4 physicians per stroke center are needed to provide services and avoid 1:4 on-call shifts, the need for physicians becomes even more acute.

Geographic inaccessibility to stroke centers also reduces treatment with EVT (25). Patients can be treated locally with intravenous thrombolytic agents and then transferred to an endovascular-capable stroke center, but this leads to delays in EVT of 95–140 minutes (26–28). Alternatively, patients can be transported directly to an endovascular stroke center, but this may delay intravenous thrombolytic therapy (29). Neither approach addresses the issues of adequate physician numbers to perform EVT or the geographic distribution of interventional physicians. The shortage of physicians and comprehensive stroke centers providing EVT has been confirmed by the stroke neurology community (30,31), who recommend that patients be treated locally rather than having long transfer delays.

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Interventional radiologists have core residency neuroimaging training, including computed tomography and magnetic resonance imaging. In addition, interventional radiologists have fellowship training and experience with angiography, guiding catheters, sheaths, closure devices, and thrombolytic medications; are extremely facile with microcatheters and microwires; and perform advanced revascularization procedures throughout the body. Additional training is necessary to learn the clinical and technical factors unique to stroke patients. Models for the additional training have been published (32–35) and may be revised in the future. This training is intended to provide interventional radiologists with the cognitive and technical skills necessary to treat patients and obtain outcomes that meet international benchmarks (36). Published data support this training model in the United States and Europe. In a 2015 survey in the United States, 60% of primary stroke centers reported that they provided EVT, and, of these, 41% rely on interventional radiologists (37). In The Netherlands, more than 75% of EVT procedures are performed by interventional radiologists because of the shortage of neurointerventionists (van Zwam W, personal written communication, July 23, 2018). This includes the Multi-center Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands (MR CLEAN) centers, whose outcomes first confirmed the significant benefit of EVT compared with best medical therapy. These findings are consistent with the fact that the Society of Neurointerventional Surgery, with 600 members worldwide (38), does not have the capacity to cover EVT treatment worldwide or in the United States.

Results from individual hospital case series of EVT performed by interventional radiologists have demonstrated outcomes comparable to those of international trials (39–44). At present, there are no publications including the Highly Effective Reperfusion Evaluated in Multiple Endovascular Stroke Trials (HERMES) data that show different outcomes associated with interventional radiologists compared with neurointerventionists (4,45).

There is a clinical need for more interventional physicians to provide EVT. Interventional radiologists have a current and growing role in this care, and interventional radiology societies are committed to provide the necessary stroke education to interventional radiologists. The position of the authoring interventional radiology societies is as follows:

- a. Acute ischemic strokes caused by occlusion of large arteries to the brain is a significant clinical and public health problem.
- b. Reversal of symptoms from these strokes requires rapid and safe removal of the occluding thrombus. The improvements in clinical outcomes after endovascular therapy for a large-vessel occlusion have been proven.
- c. The availability of EVT remains limited by distance from endovascular-capable stroke centers and lack of 24-hour, 7-day availability at some hospitals.
- d. EVT should be provided as part of the services of a rigorous, structured, multispecialty care team including vascular neurologists, with tracking of outcomes.
- e. The appropriateness of new facilities offering EVT depends on the needs of the community and infrastructure of the hospital, including 24-hour, 7-day availability of neurology, anesthesiology, and diagnostic and interventional radiology services.
- f. Appropriately trained interventional radiologists can evaluate stroke patients and provide emergent EVT with good outcomes.
- g. The neurointerventional skills used by interventional radiologists to perform EVT are not intended to perform specific neurointerventional procedures such as cerebral aneurysm occlusion and cerebral embolization.
- h. Appropriately trained interventional radiologists can provide care, especially where neurointerventional physicians are not available, and help provide 24-hour, 7-day care working in partnership with neurointerventional physicians where they are available.
- i. Training of interventional radiologists to perform EVT should consist of clinical neurology and care of the stroke patient, stroke imaging, and performance of EVT.

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