Training Guidelines for Endovascular Ischemic Stroke Intervention: An International Multi-Society Consensus Document


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BACKGROUND

Ischemic stroke is a leading cause of death and disability worldwide. Much of the long-term disability occurs in patients with Emergent Large Vessel Occlusion (ELVO). In fact, in these patients, occlusion of a major intracerebral artery results in a large area of brain injury often resulting in death or severe disability. Until recently, intravenous tissue plasminogen activator (t-PA) was the only proven treatment for ELVO.

However, the landscape of stroke treatment has changed with the publication of five randomized multicenter controlled clinical trials. These trials provide Class 1, Level A evidence that endovascular thrombectomy (ET) is the standard of care for patients with ELVO. In particular, thrombectomy results in significantly better clinical outcomes compared to best medical therapy in patients with acute occlusion of the intracranial internal carotid artery (ICA) and/or M1 segment of the middle cerebral artery (MCA)\(^\text{1–6}\). These results have led to guideline recommendations advocating for endovascular treatment in addition to t-PA for patients with ELVO. In addition, ET is now offered as first line therapy for patients that are not eligible for intravenous thrombolysis\(^\text{7–9}\). However, achieving the best possible clinical outcomes with endovascular stroke treatment mandates structured training and education of those physicians who are providing endovascular stroke treatment. On this regard, a recent meta-analysis of these five clinical trials showed that the vast majority of thrombectomies were performed by experienced neurointerventionalists. These include interventional neuroradiologists, endovascular neurosurgeons, and interventional neurologists who routinely perform neuroendovascular procedures\(^\text{10}\). None of the studies allowed physicians without previous experience in mechanical
thrombectomy to enroll patients. The centers participating in
these trials offered endovascular stroke therapy 24 hours a day
(with the exception of those in the EXTEND-IA trial) with
expertise in vascular neurology and neurocritical care in a
comprehensive stroke center. On-site expertise in vascular
neurology and neurocritical care is paramount to achieving
good clinical outcomes.

Geographical limitations to rapid access to acute stroke cen-
ters providing mechanical thrombectomy have led some to sug-
gest physicians without prior experience or formal neuroendo-
vascular training should consider providing coverage for these
procedures. A multidisciplinary British Intercollegiate Stroke
Working Party put forth a document outlining the safe delivery of
mechanical thrombectomy, which highlights that operators
should not normally carry out procedures with which they are
unfamiliar and that they should recognize ad-hoc arrangements
are not in the best interest of patients11.

It is also important to recognize that modern endovascular
stroke therapy focuses on direct clot removal with mechanical
devices, as compared with previous paradigms where intra-arte-
rial thrombolytic infusion was an acceptable treatment option for
large vessel occlusions12. The technical skills needed to safely de-
liver devices into the intracranial circulation are significantly
more involved than simply placing a catheter for medication in-
fusion. Catheter skills from other circulations do not replace the
need for formal training in safe intracranial microcatheter navi-
gation and device placement.

Acute ischemic stroke is a complex disease and successful en-
dovascular treatment is based on the comprehensive ability to
rapidly integrate multiple pieces of information, including: the
patient’s history, clinical examination, neuroradiological studies,
and to subsequently formulate a treatment plan. Both patient se-
lection and procedural expertise are critical to achieve a good
clinical outcome. Hence, there is a clear rationale for formal
training in both clinical neuroscience and interventional
neuroradiology.

The purpose of this document is to define what constitutes
adequate training for physicians who can provide endovascular
treatment for acute ischemic stroke patients. These training
guidelines are modeled after prior standards of training docu-
ments such as the training, competency and credentialing stan-
dards for diagnostic cerebral angiography, carotid stenting and
cerebrovascular intervention13 and the performance and training
standards for endovascular ischemic stroke treatment14, written
and endorsed by multispecialty groups. In addition, the impor-
tance of organ specific training, rigorous quality improvement
benchmarks, and minimum volume requirements needed to
maintain high quality care has been extensively described for
acute myocardial infarction, an analogous time sensitive
disease15.

This document represents the cumulative work of the societies
listed below, and represents an international consensus on ade-
quate training to safely and effectively perform these procedures:

American Academy of Neurological Surgeons/ Congress of
Neurological Surgeons (AANS/CNS)
American Society of Neuroradiology (ASNR)
Asian Australasian Federation of Interventional and Thera-
peutic Neuroradiology (AAFITN)
Australian and New Zealand Society of Neuroradiology -
Conjoint Committee for Recognition of Training in Interven-
tional Neuroradiology (CCINR) representing the RANZCR
(ANZSNR), ANZAN and NSA
Canadian Interventional Neuro Group (CING)
European Society of Neuroradiology (ESNR)
European Society of Minimally Invasive Neurologic Therapy
(ESMINT)
Japanese Society for Neuroendovascular Therapy (JSNET)
Sociedad Ibero Latino Americana de Neuroradiologica
(SILAN)
Society of NeuroInterventional Surgery (SNIS)
Society of Vascular and Interventional Neurology (SVIN)
World Federation of Interventional and Therapeutic Neuro-
radiology (WFITN)

PHYSICIAN QUALIFICATIONS
Physicians providing intra-arterial treatment for acute stroke
are required to have appropriate training and experience for
the performance of neuroangiography and interventional
neuroradiology.

We recognize that the specific training pathways may differ
across nations, but the consensus is to mandate adequate training
to perform emergent endovascular stroke intervention. These
cognitive requirements consist of baseline training and qualifica-
tions as well as ongoing professional education, which are essen-
tial for safe and efficient patient management.

It is also important to point out that these qualifications are for
new practitioners who are not currently performing acute stroke
intervention with mechanical thrombectomy. We understand
that there are current practitioners (who are board certified or
board eligible in radiology, neurology or neurosurgery) who may
have trained prior to the establishment of formal training path-
ways, and have acquired the necessary skills listed below to safely
and effectively treat these complex patients. We would still expect
the same requirements for maintenance of qualifications as listed
below.

I. Baseline training and qualifications:
1. Residency training (in radiology, neurology or neurosurgery)
which should include documented training in the diagnosis and
management of acute stroke, the interpretation of cerebral arte-
riography and neuroimaging under the supervision of a board-
certified neuroradiologist, neurologist or neurosurgeon with sub-
sequent board eligibility or certification. The residency program
and supervising physicians should be accredited according to
national standards as they pertain to the countries involved.
Those physicians who did not have adequate such training
during their residencies must spend an additional period (at
least one year) by training in clinical neurosciences and neu-
roimaging, focusing on the diagnosis and management of acute stroke, the interpretation of cerebral arteriography and neuroimaging prior to their fellowship in neuroendovascular interventions.

AND

2. Dedicated training in Interventional Neuroradiology (also termed Endovascular Neurosurgery or Interventional Neurology) under the direction of a Neurointerventionalist (with neuroradiology, neurology or neurosurgical training background), at a high-volume center. It is preferred that this is a dedicated time (minimum of one year), which occurs after graduating from residency (i.e., a fellowship). A training program accredited by a national accrediting body is also strongly preferred but not required. Published standards exist for various countries16–22. Within these programs, specific training for intra-arterial therapy for acute ischemic stroke should be performed, including obtaining appropriate access even in challenging anatomy, microcatheter navigation in the cerebral circulation, knowledge and training of the use of stroke specific devices and complication avoidance and management.

While various national standards will have differing procedure requirements, we encourage practitioners to meet their national minimum procedural and training standards. Fellowships which are not accredited by national credentialing bodies should still have adequate training to meet their local minimum procedure requirements. In addition, we expect that minimum training numbers for stroke thrombectomy may increase in future revisions of these standards given the recent developments in the field.

II. Maintenance of physician qualifications:
It is vital that the physician have ongoing stroke specific continuing medical education. A minimum of 16 hours of stroke specific education every 2 years is suggested. Individual physician outcomes should conform to national standards and institutional requirements. In addition, the physician should participate in an ongoing quality assurance and improvement program. The goals of this quality assurance program for stroke therapy would be to monitor outcomes both in the peri-procedural period and at 90 days. The quality assurance program must review all emergency interventional stroke therapy patients. In addition, participation in a national quality improvement registry, when available, is also encouraged. Outcomes should be tracked and recorded. While threshold levels for recanalization, complication rates, etc. have yet to be established, we suggest the following as a minimum:

1. Successful recanalization (modified TICI 2b or 3) in at least 60% of cases.
2. Embolization to new territory of less than 15%.
3. Symptomatic intracranial hemorrhage (i.e. Parenchymal Hematoma on imaging with clinical deterioration) rate less than 10%.

Hospital requirements: Successful treatment of the ELVO patient does not occur in a vacuum, but rather with the framework of a multi-disciplinary team. As such, we feel it is critical that the patients be treated in a center, which has 24/7 access to the following:

1. Angiography suites suitably equipped to handle these patients, as well as equipment and capability to handle the complications.
2. Dedicated stroke and intensive care units (preferably dedicated neuro-intensive care unit), staffed by physicians with specific training in those fields.
4. Neurosurgery expertise, including vascular neurosurgery
5. All relevant neuroimaging modalities (CT/CTA, MR/MRA, Trans-cranial Doppler [TCD]), including 24/7 access to CT and MRI.

SUMMARY

We, as a group of international multi-disciplinary Neurointerventional societies involved in the endovascular management of acute ischemic stroke, have put forth these training guidelines. We believe that a neuroscience background, dedicated neurointerventional training, and stringent peer review and quality assurance processes are critical to ensuring the best possible patient outcomes. Well-trained neurointerventionalists are a critical component of an organized and efficient team needed to deliver clinically effective mechanical thrombectomy for acute ischemic stroke patients.

REFERENCES

11. White PM. Standards for providing safe acute ischemic stroke thrombectomy services.


