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# Interventional Stroke Treatment in Germany is a Joint Effort Between Neuro- and General Interventional Radiologists

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Ischemic stroke is a leading cause of death and disability worldwide. Severe stroke is combined with a higher risk of death and long-term disability; it occurs more often in patients with acute large vessel occlusion (LVO). In the past, intravenous tissue plasminogen activator (t-PA) was the only proven treatment option for acute stroke management including LVO. However, the results of studies analyzing the treatment of LVO with this method were unsatisfactory.

The story of endovascular treatment of acute stroke starts in Germany in 1979 when Prof. Zeumer in Aachen successfully recanalized a basilar artery occlusion with i. a. fibrinolysis. At this time, however, there were no devices to manipulate the thrombus mechanically. In the beginning of mechanical revascularization, some people tried to fracture the thrombus by microwires. In the meantime, many devices have been developed, including the MERCI retriever, the Penumbra Separator, and the phenox brush. None of these devices brought a convincing breakthrough, as shown in IMS III.

The success story of mechanical thrombectomy starts with the use of a stent which was manufactured for

aneurysm remodeling. The so-called Solitaire stent proved how effectively endovascular stroke treatment can be.

In 2015, five randomized, multicenter prospective trials demonstrated the clinical benefit of mechanical revascularization using stent retrievers. These results led to guideline recommendations advocating endovascular treatment in addition to t-PA for patients with large vessel occlusion, and as first line therapy for patients who are not eligible for intravenous thrombolysis (Class 1, Level A evidence).

For treatment of large vessel occlusion, these results changed everything for everyone.

For patients, the chance to overcome an ischemic stroke without severe disability is now twofold higher.

For the medical community, the number of patients to be treated with this method has increased considerably. This faces us with the problem of capacity. We need more hospitals and more stroke units, with optimized operational procedures to provide the patients with the best medical treatment before, during, and after acute revascularization. And from an interventional point of view, we need more man power to treat all the eligible patients 24/7. So, in summary, more interventionalists with stroke skills are required; and in the stroke treatment as an interdisciplinary setting, we have to organize the whole stroke treatment from onset to discharge in a professional manner. This is mandatory to define binding arrangements for endovascular stroke treatment.

It is amazing that in 2016, within 1 year of the publication of the RCTs, an international multisociety consensus document was published, and the leading societies all over the world had found a consensus statement for international training guidelines for endovascular stroke intervention. The guidelines for stroke thrombectomy were

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simultaneously published in JNIS, INR, Neuroradiology, and other journals (This article was distributed under the terms of the creative commons attribution 4.0.license—<http://creativecommons.org/licenses/by/4.0/>) in March 2016. The following societies are contributors: AANS/CNS; ASNR; AAFITN; CCINR; ANZSNR; ANZAM; NSA; CING; ESMINT; ESNR; JSNET; SILAN; SNIS; SVIN; and WFITN. The mammoth project of formulating a worldwide standard was implemented in a remarkably short time, thus showing the importance of the evolution in mechanical stroke therapy.

Taking into account that a scientific evidence for this therapy has only existed for 2 years, there are still several unsolved problems and unanswered questions. To point out a few of them alone: Do we have enough specialists who can perform this therapy, and who should perform the therapy? What is the standard of care for training and education in interventional stroke treatment?

Throughout the world this question is answered in various ways in different countries. Endovascular stroke treatment is performed by miscellaneous specialties with different qualifications.

However, we think that there exists a common ground in all different approaches, meaning: Successful endovascular stroke treatment is based on the comprehensive ability to rapidly integrate patient history, severity of the disease, dedicated interpretation of CT and or MRI images, resulting in a treatment decision and plan. Patient selection, procedural expertise and personal interventional skills are critical to achieve a quick revascularization and therefore a good clinical outcome.

These developments also had an impact on the German curriculum for endovascular stroke treatment of DeGIR (German Society of minimal invasive Radiology) and DGNR (German society of Neuroradiology).

Fortunately, a training concept for endovascular stroke treatment that complies with the international training guidelines in many respects was started as soon as in 2012. The DeGIR/DGNR concept is a structured training system with three levels of certification: level 1—basic qualification in interventional radiology (IR); level 2—specialized training in IR and interventional neuroradiology (INR); and level 3—qualification as a teaching and training institution.

The DeGIR/DGNR concept aims to qualify interventional radiologists and interventional neuroradiologists by structuring the training of interventional procedures, both in theory and in practice. The conditions to obtain the “Stroke” Module E of level 2 require participation in DeGIR/DGNR-certified courses with the achievement of 30 credit points per module. Module E can be achieved by

radiologists as well as neuroradiologists with certification of at least 100 independently performed treatments in Module E with at least 30 intracranial and at least 30 extracranial procedures. After completing the requirements for Module E, oral and written tests are required for accreditation. The documentation of the interventional procedures of the participating institutes in the DeGIR database is also mandatory.

The German endovascular stroke treatment concept is closely linked with the stroke unit concept of the German Stroke and Neurological Societies (DSG and DGN). DeGIR-certified interventionalists are present in all 107 German transregional stroke units (85 % neuroradiological and 15 % radiological interventionalists). In fact, endovascular stroke treatment can be performed 24 h a day and 7 days a week in 127 hospitals in Germany. As of now, 320 interventionalists are accredited for Module E.

In order to educate more radiological specialists in interventional stroke treatment, a dedicated training should be offered. It should be preferentially done in high-volume centers, under the direction of a neurointerventionalist.

We need highly qualified interventionalists with skills in using catheters in brain-supplying vessels and profound background of neurovascular anatomy with respect to clinical presentation of stroke patients. In Germany, a board-certified Radiologist needs 5 years of training in general radiology and another 3 years to get the subspecialty in neuroradiology. The training and education program for acute stroke treatment is closely linked and implemented to the residency. This is the reason why in Germany stroke neurointerventionalists have a background of radiology and neuroradiology. Within the next years and with increasing stroke cases, we will be able to train even more neurointerventionalists to improve the endovascular stroke network. This is a process that takes some time, but should not be borne on the backs of patients.

The international guidelines for training and education in endovascular stroke treatment are a very important step toward standardizing stroke treatment worldwide. The German training and education program is broadly consistent with the international training guidelines, and were lucky to implement relevant training outlines early enough before endovascular stroke treatment became an evidence-based therapy.

Joining forces between interventional neuroradiologists and general interventional radiologists allows us to build an effective quality-based network to offer interventional treatment to all relevant patients in time and around the clock. Close cooperation with neurologists, however, is mandatory to optimize treatment options and indications.