Thrombectomy – interventional therapy for stroke treatment

- Promising extension of existing treatment approach for ischemic strokes
  becoming established alongside thrombolysis, the standard procedure
- New treatment allows longer response time and increased treatment success
- Numerous studies support positive results of thrombectomy
- Siemens offers a range of imaging systems, each tailored to the customer’s particular treatment strategy

Strokes are currently one of the most common causes of death. Every year, around 17 million people suffer a stroke, 70 percent of whom live in countries with low or average incomes. [1] Older people in particular are at risk, and the proportion of the world’s population represented by this age group is constantly increasing. As a consequence, healthcare systems will face growing numbers of cases and the associated costs in the future, which means hospitals will need to focus much more on treating stroke patients and continually improve the treatments they offer.

Thrombectomy – for which imaging systems are indispensable – is gaining ground as a successful method of treatment. Imaging systems can be combined in three different ways to identify the most appropriate treatment and, as appropriate, perform the most suitable thrombectomy – and all are supported by Siemens technologies.

Medical science distinguishes between two types of stroke, ischemic and hemorrhagic. The most appropriate countermeasures depend on the type of stroke. Hemorrhagic strokes are caused by a burst blood vessel that causes a brain hemorrhage and thus an increase in intracranial pressure. This presses the brain against the skull, leading to the death of more and more brain cells if the patient is
Ischemic strokes are much more common, however, since they account for 80 percent of cases. In these cases, an occlusion caused by a thrombus (blood clot) or a constricted blood vessel leaves the brain inadequately supplied with blood. The oxygen and glucose needed to supply energy can no longer reach the brain and the brain cells start to die off. Every minute without treatment following a stroke will involve the death of two million brain cells, and extremely serious disabilities may result. And so the time-to-treatment is the deciding factor in such cases. An irreversible cerebral infarction can be the result if the vascular occlusion cannot be cleared without delay.

Thrombolysis is currently the standard procedure for an ischemic stroke. This involves the neurologist injecting a solution (thrombolytic agent) intravenously. This solution contains drugs that activate a degradation enzyme that is naturally available within the body and open up the vessels again. This procedure is only likely to succeed, however, if the blood clot is no longer than eight millimeters. Also, if more than four-and-a-half hours have elapsed since the onset of the stroke, using this drug increases the possibility of brain hemorrhage, which puts the patient at further risk. Because the thrombolytic drug has a powerful blood-thinning action and can also dissolve fresh scar tissue, it is also not suitable for every patient. Patients who are already taking blood thinners, suffer from a coagulation disorder or a tumor or have recently undergone surgery run the risk of hemorrhage with thrombolytic treatment as a matter of course.

Mechanical intervention for recanalization
Alongside thrombolysis, a further approach has become established in clinical practice in recent years to deal with occlusions of the major cerebral vessels: thrombectomy. This involves the mechanical removal of the blood clot from the blocked cerebral artery by a neuroradiologist using a microcatheter, in addition to the administration of the thrombolytic drug. Three studies in the New England Journal of Medicine in 2013 still concluded, however, that this form of treatment provided no positive effect. Therefore this treatment option had been neglected at first. This poor assessment is now thought to have resulted from a poor patient
selection and the use of older instruments that broke up the blood clot within the vessel, triggering new vascular occlusions. Now, however, thrombectomy has become an established treatment approach, especially when larger vessels are occluded.

Whereas earlier attempts at thrombectomy by aspirating (i.e. sucking out) the thrombus involved the risk that fragments of the clot would break away and cause further occlusions, the state-of-the-art Stent Retriever used in most cases today enables the blood clot to be removed intact. This is done by expanding a wire mesh within the clot and completely enclosing it. The clot can then be mechanically drawn out of the vessel, enabling the vessel to be re-opened more swiftly, especially in cases involving large blood clots that would take a long time to break down using thrombolysis. Further decisive advantages are that blood clots more than eight millimeters long can also be removed safely and that the time window for the treatment using thrombectomy can be extended from four-and-a-half to six hours, as long as there is still an area of the brain to be salvaged. This also means that patients for whom thrombolytic therapy is contraindicated can be treated using this method. In Germany, thrombolysis can be used to treat around 7-10% of stroke patients. Based on conservative estimates, thrombectomy could increase the number of treatable patients in Germany by five percent, or 10,000 people per year.\[3\] Thrombectomy could also shorten the entire period of hospitalization for stroke patients. A total of four published studies currently document the extraordinary success of thrombectomy.\[4\] They show that this form of therapy reduces the risk of long-term damage and increases the proportion of patients that can be helped. Long-term neurological damage is less common, which means that they can continue living independently. The overall economic effects of thrombectomy must therefore also be assessed as extremely positive.\[5\]

**Three options for imaging when conducting thrombectomy**

Imaging systems such as computed tomography (CT) or magnetic resonance imaging (MRI) are indispensable when it comes to identifying the cause and the opportunities to treat a stroke as quickly as possible. In an initial stage, they serve to rule out the possibility of hemorrhage. The next stage is to locate the occlusions and define them more accurately. If thrombectomy is considered the right treatment, an x-ray device is used to help guide the catheter. Currently, a distinction is made
between three procedures using different combinations of systems for diagnosis and further treatment, all of which are supported by Siemens technology.

The traditional procedure uses CT or MRI as the method for initial diagnosis, before the patient is treated in a neuroradiological catheterization laboratory. A microcatheter is inserted via the groin and guided to the blood clot under x-ray, and the clot is then mechanically removed. A downside to this approach is the time that is lost in moving the patient to the different locations within the hospital for the various stages.

Combined models such as Miyabi Angio-CT\(^1\) can also be used. This involves a combination of an Artis angiography system and a Somatom Definition AS/AS+ or a Somatom Definition Edge Sliding Gantry System. The CT is mounted on rails and travels to the Artis system table. This makes it possible to perform the intervention immediately after the imaging stage without having to move or transfer the patient once again in between these steps. This saves valuable time. Alternatively, the CT and angiography system can also be installed as a two-room solution and spatially separated with a sliding door, allowing them to be used in combination if required. This also enables the CT to be used for routine diagnostic tasks in the hospital.

A cost effective combined solution is in use at the Neuroradiology Unit at the Heidelberg University Hospital as part of a study: a CT from the Somatom Definition AS model series in combination with Siemens’ Cios Alpha mobile C-arm\(^2\). By combining both devices there is no need to move the patient, who also no longer needs to wait for treatment if the hospital’s angio systems are being used to capacity.\(^6\) The C-arm is capable of representing the blood vessels in the brain, enabling the blood clot to be directly removed. Image quality is sufficient for thrombectomy, but does not offer the possibility to cover more complex interventions.

A third option does without the CT for diagnosis and uses solely an angio suite, as happens at the Neuroradiology Unit of Magdeburg University Hospital. This makes use of a one or two-level system from the Artis Q series. The DynaCT technology from Siemens achieves image quality close to that of a CT, which is sufficient both to rule out a hemorrhage and to represent the blood vessels. The syngo DynaPBV also makes it possible to show the distribution of blood in brain tissue directly on the
angiography device, which identifies which area of the brain has to be salvaged. An advantage with this version is that diagnosis and treatment are both provided using a single modality.

The decision as to which modalities and which workflow are the most suitable is always left to the customer and the individual focus of the treating hospital in each case. Siemens Healthcare offers suitable solutions for all three workflow versions. In all cases, the result of treatment can be reviewed and documented directly in the angio suite using DynaCT technology following the intervention to ensure high treatment quality.

1 Miyabi Angio-CT is a customized solution and not commercially available in all countries. Due to regulatory reasons the future availability cannot be guaranteed. Please contact your local Siemens organization for further details.

2 Product not yet commercially available.

The products/features (here mentioned) are not commercially available in all countries. Due to regulatory reasons their future availability cannot be guaranteed. Further details are available from the local Siemens organizations.

Sources


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