

The challenge & opportunity in mechanical thrombectomy for ischemic stroke

Mechanical thrombectomy is a medical procedure used to remove clots blocking blood flow to the brain tissue for ischemic stroke patients. Mechanical thrombectomy involves using a device, such as a stent retriever or aspiration catheter, to remove the clot.

According to estimates from the American Heart Association, approximately 175,000 mechanical thrombectomies were performed in the United States in 2020. The global market for brain mechanical thrombectomy devices is expected to grow significantly in the coming years due to several factors: an increase in predisposing factors for ischemic stroke, and the development of new and improved thrombectomy devices.

The urge to develop new minimally invasive technologies for thrombectomy is more significant now than ever. All players and technologies are seeking solutions to the procedure's complications. Some of the major players in the market include Stryker, Medtronic, and Johnson & Johnson. These companies offer a range of devices, including stent retrievers, aspiration catheters, and thrombectomy pens.

Some of the potential complications of mechanical thrombectomy include:

1. Hemorrhage: Mechanical thrombectomy can cause bleeding at the procedure site, either from the arterial puncture site or from the location of the clot removal. This bleeding may require additional medical treatment, such as a blood transfusion or surgery.
2. Arterial dissection or perforation: The procedure risks causing damage to the blood vessel, such as a tear or hole, which can lead to bleeding or the formation of a new clot.
3. Vasospasm: The procedure may cause the blood vessel to constrict or spasm, decreasing blood flow to the brain and potentially leading to additional stroke symptoms.
4. Infection: there is a risk of infection at the site of the procedure or elsewhere in the body.
5. Adverse reaction to the contrast agent: A contrast agent injected into the blood vessels to help visualize them during the procedure can cause allergic reactions or kidney damage in some patients.
6. Embolization: Small pieces of the clot or other debris can break off and travel to other parts of the brain during the procedure, leading to new clots or blockages. Factors that may increase the risk of distal emboli complications include the use of specific thrombectomy devices, the presence of underlying conditions such as atherosclerosis or vasculitis, and the use of anticoagulant medications.

Embolization:

During mechanical thrombectomy, a device, such as a stent retriever or aspiration catheter, is used to remove the clot from the vessel. However, it is possible for small pieces of the clot or other debris to break off and travel to other parts of the brain during the procedure, leading to the formation of new clots and blockages. This is known as embolization.

Embolization may be critical to patients' clinical outcomes, as the distal emboli will eventually block smaller vessels and prevent blood and oxygen flow to the penumbra. The risk of embolization during mechanical thrombectomy can be minimized by using different thrombectomy techniques that are based on clot retrieving rather than clot fragmentation or crushing.

Physicians plan the thrombectomy according to several parameters to minimize the risk of embolization. The physician carefully assesses the clot and surrounding vessels prior to the procedure, as certain factors, such as the size and location of the clot and the presence of underlying arterial abnormalities, may increase the risk of embolization. In addition, the choice of the device performing the thrombectomy is crucial for increasing the success rate and improving the patient's chances of survival and future quality of life.

Thrombectomy Device Types:

There are several types of brain clot-retrieving devices, each with unique features and benefits. Some of the most common types are:

1. **Stent Retrievers:** Stent retrievers are wire-mesh devices placed over the clot and expanded to capture it. They are then withdrawn from the blood vessel, pulling the clot with them. Stent retrievers can be used in various clot locations and are typically easy to use and well-tolerated by patients. They provide only a partial solution for embolization with less than a 37% rate of complete reperfusion to the brain post-procedure.
2. **Aspiration Catheters:** Aspiration catheters are long, thin tubes with a suction device at the end. They are inserted into the blood vessel and used to suction the clot out of the vessel. Aspiration catheters are generally less expensive and easier to use than other devices, but they may be less effective at removing larger clots. Neurosurgeons usually combine the use of aspiration catheters with Stent Retrievers. This technique achieves better reperfusion results but is still limited to less than a 35% success rate.
3. **Thrombectomy Pens:** Thrombectomy pens are handheld devices that use a high-speed jet of saline to fragment and remove the clot. They are generally easy to use and can be inserted through a small puncture in the skin, but they may be less effective at removing larger clots. In addition, they are not very effective in preventing embolization.
4. **Angiojet Thrombectomy:** Angiojet thrombectomy is a procedure that uses high-pressure pulses of saline to fragment and remove the clot. It is generally more effective

at removing larger clots than other devices, but it requires a larger puncture in the skin and may be more expensive. This technique is also risky for distal embolization.

The TICI Recanalization Score:

The TICI (Thrombolysis In Cerebral Infarction) score is a tool used by physicians to assess the degree of recanalization (re-opening) of a blood vessel following treatment for ischemic stroke. It is commonly used to evaluate the effectiveness of mechanical thrombectomy in patients with ischemic stroke and to guide treatment decisions.

The TICI recanalization score is based on the degree of blood flow restoration in the affected blood vessel after mechanical thrombectomy. The score is based on a scale of 0 to 3, with 0 indicating no blood flow restoration, 1 indicating partial blood flow restoration, 2 indicating good blood flow restoration, and 3 indicating complete blood flow restoration.

The higher the TICI score, the more influential the mechanical thrombectomy has been in restoring blood flow. Better blood flow restoration will lead to less brain tissue damage and better clinical outcomes.

Inretio Present a New Perspective for Clot Retrieving Devices:

Inretio's vision is to improve stroke care by reducing thrombectomy complications and reducing patients' suffering and the burden of stroke on society. To achieve this vision, Inretio developed an innovative concept of clot-retrieving devices that can help reduce the complications associated with thrombectomy and improve outcomes for patients with ischemic stroke.

The PREVA device is a protective clot retriever designed to access the clot distally to remove it. The device uses a distal basket to "ensnare" the clot and encapsulate it, protecting the brain from sub-clots during the procedure. This allows the complete removal of the clot and its fragments, ensuring revascularization of the brain tissue.

The PREVA device is the only clot retrieval device that uses this approach, which will potentially be more effective in improving vascularization and functional outcomes in patients with ischemic stroke.

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