

# Temporary Endovascular Bypass for the Treatment of Ischemic Stroke: Experiences after 104 Patients

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Mechanical thrombectomy has become a valuable addition to the endovascular treatment options for ischemic stroke. However, conventional thrombectomy leads to reperfusion only after complete thrombus removal. A promising alternative is the use of stents that displace the clot and allow for immediate reperfusion. Permanent stenting in stroke however has two important drawbacks: The length of the occluded segment must not exceed that of the stent. Failure to achieve reperfusion after placement of the stent may make consecutive attempts of mechanical thrombectomy difficult or dangerous. In addition, permanent stent placement mandates the immediate use of antiplatelet drugs. In conjunction with fibrinolytics, heparin, and endothelial damage in the affected territory this may potentially increase the risk for subsequent hemorrhage.

The **Solitaire** stent is comprised of a fully retrievable closed cell nitinol foil that folds over onto itself during retrieval with the stent cells closing in a longitudinal fashion. This design holds the potential for three different strategies in endovascular stroke treatment:

1. The stent can be used as a temporary bypass for immediate reperfusion. This maneuver can be repeated in different branches during each deployment, thus shortening procedural angio-to-reperfusion time, "buying time" for subsequent thrombectomy maneuvers.
2. Reestablished flow may increase the effectiveness of fibrinolytics due to supply of plasminogen and washout of prothrombotic mediators.
3. The Solitaire can be used for mechanical thrombectomy (mte) in two ways: fully deployed or partially recovered, thus potentially snaring parts of the clot.

Between 03/2008 and 12/2009, 104 acute stroke patients (108 occlusions) were treated with the Solitaire alone or in conjunction with other thrombectomy systems at the TU-Muenchen, Klinikum rechts der Isar. Observations concerning procedural performance and early outcome measures were entered into a database of over 300 endovascular stroke treatments that served as a control.

From this experience we believe that temporary stenting and especially the use of fully retrievable stents for mechanical thrombectomy will help to further reduce procedural angio-to-reperfusion times while increasing the rate of potentially beneficial reperfusion results. The Solitaire has proven to be the most versatile addition to our inventory of endovascular options for stroke treatment to date.

**Patients:** 104 patients (53 female, 51 male) with 108 occlusions were treated in the following locations:

ACI -T	M1	M2	ACA	VA-BA
18	54	6	6	24

The mean **NIHSS** score in the anterior circulation was **15.3 pre /7.61 post** treatment. 13 out of 84 patients with occlusions in the anterior circulation died.

In the **posterior** circulation the NIHSS score was **15.7/7.5** with a mortality of 11/23; here NIHSS of the survivors was 11.8 / 7.5.

The **clinical outcome** could only be obtained at hospital discharge for a sufficient number of patients. The number of patients with a good clinical outcome (**mRS 0-2**) was **20/78 (=25.6%)** overall and **18/60 (=30%)** in the anterior circulation.

### Recanalization:

**TIMI II/III** was achieved in **92.5%**.

**TICI 2b/3** was achieved in **79%**

TICI 0	TICI 1	TICI 2a	TICI 2b	TICI 3
n=6	n=2	n=15	n=32	n=52
21%			79%	



**Procedural data:** The majority of patients was treated in conjunction with either iv- or ia-fibrinolysis (iv: 58; ia: 32pts. - bridging concept).

The mean **onset-to-reperfusion** time was **265min.** (min=56, max=1031); median= 230min.

The mean **angio-to-reperfusion** time was **47min.** (min=5, max=186); median= 38.5min.

The Solitaire was used as the only device in 25/108 procedures. In the majority of cases it was used in conjunction with a proximal aspiration/distal access catheter (42x Penumbra reperfusion cath., 20x Concentric DAC). Other **multimodal** approaches included phenox pCR/CRC, Merci L5, Penumbra, Stents, and pta balloons. 25 procedures were monomodal, 52 bimodal, 18 trimodal, and in 15 proc. 4 or more systems were applied. In 15 pts., carotid stenting was needed.

The **mean number of passes** for mte was 2.46 (median 2, max=12).

**72.8% had TIMI II/III perfusion during/after the 1<sup>st</sup> deployment.**

Deployment	1st	2nd	3rd
Reperfusion	2a:45; 2b:12; 3:8	2a:34; 2b:8; 3:1	2a:15; 2b:11; 3:5

In 15/108 procedures, the Solitaire was only used as a **temporary bypass**. In 83/93, mechanical thrombectomy was successful with 10/93 attempts were unsuccessful.

In 10 procedures, an underlying stenosis was treated; 7 Solitaire stents were permanently implanted; in 14 pts., self-expandable stents other than Solitaire were applied.

**Adverse events:** Periprocedural **ICH: 2**, both related to penumbra Separator. Postproc. evidence of **SAH: 6**, **2 potentially related to Solitaire** use, 3 due to wire perforations, 1 unknown cause.

**Inadvertent detachment:** 1

**Dissection** of access vessels: 3/108  
Failure to reach target lesion: 1/108

**Thrombus migration** to previously unaffected territory: 4/108, all successfully reopened with Solitaire.

**Vasospasm** in target vessel: 14/108