Stent-Assisted Coiling of 501 Wide-Necked Intracranial Aneurysms: A Single-Center 8-Year Experience

Yongtao Zheng[1], Yanbing Song[1], Yingjun Liu[1], Qiang Xu[2], Yanlong Tian[1], Bing Leng[1]

■ BACKGROUND: **Stent-assisted coiling has expanded the treatment of complex wide-necked intracranial aneurysms. We present our experience with stent-assisted coiling, with an emphasis on procedure-related neurologic complications and the incidence of angiographic recurrence.**

■ METHODS: **A total of 480 patients with 501 aneurysms who were treated with stent-assisted coiling between January 2007 and December 2014 were reviewed retrospectively. Baseline characteristics, procedure-related complications, angiographic follow-up results, and clinical outcomes were statistically analyzed.**

■ RESULTS: **Among the 480 patients, 423 (88%) were treated electively and 57 (11%) were treated in the context of subarachnoid hemorrhage. There were 22 (4.58%) overall procedure-related complications, which caused death in 4 patients (0.83%) and morbidity in 4 patients (0.83%). In a logistic regression analysis, the complications differed significantly among the patients with hypertension (odds ratio [OR], 2.85; 95% confidence interval [CI], 1.09–7.48; $P = 0.03$), patients with aneurysms treated with coiling before stenting (OR, 3.07; 95% CI, 1.07–8.81; $P = 0.04$), and patients treated with multiple stents (OR, 4.96; 95% CI, 1.02–24.07; $P = 0.04$). Angiographic follow-up was available for 396 patients (83.4%) for a mean of 13 months. The rates of recanalization and retreatment were 13.9% and 3.5%, respectively. In a logistic analysis, larger aneurysm size and initial incomplete aneurysm occlusion were predictors of recanalization. Clinical follow-up was available for 406 patients (85.6%) for a mean of 44.8 months, and 399 patients (98.3%) achieved a Glasgow Outcome Scale score of 5.**

■ CONCLUSIONS: **Stent-assisted coiling appears to be a safe and effective option for treating complex wide-necked aneurysms. Higher complication rates are associated with coiling before stenting, use of multiple stents, and hypertension. Stent delivery before coil deployment reduces the risk of procedural complications. Larger aneurysm size and initial incomplete occlusion are associated with aneurysm recanalization.**

Despite accumulated experience and technological improvements, endovascular embolization of wide-necked intracranial aneurysms remains a technically challenging procedure owing to the risk of coil protrusion into the parent artery and the recurrence of aneurysms.[1,2] To avoid this complication, microsurgical clipping was considered the treatment of choice for these complex, wide-necked aneurysms; however, the development of stents has provided a more attractive potential treatment option. Stent-assisted coil embolization allows for increased packing density to decrease recanalization rates and prevent coil protrusion into the parent vessel.[3] In addition, stents facilitate thrombosis of the aneurysm owing to their flow-diverting properties and aneurysm neck endothelialization.[4,5] However, significantly higher rates of procedure-related morbidity and mortality have been reported in patients who undergo stent-assisted coiling when compared with those who undergo coiling alone, especially in cases of ruptured aneurysms.[6,7] We performed this single-center, retrospective study to evaluate the angiographic and clinical results and long-term follow-up of

Key Words
- Complication
- Intracranial aneurysm
- Recanalization
- Stent-assisted coiling

Abbreviations and Acronyms
CI: Confidence interval
CT: Computed tomography
GOS: Glasgow Outcome Scale
OR: Odds ratio
SAH: Subarachnoid hemorrhage

From the Departments of [1]Neurosurgery and [2]Radiology, Huashan Hospital, Shanghai Medical College, Fudan University, Shanghai, China

To whom correspondence should be addressed: Bing Leng, M.D., Ph.D. [E-mail: lengbing99999@126.com]

Y.Z. and Y.S. contributed equally to this work.

Citation: World Neurosurg. (2016) 94:285-295.
http://dx.doi.org/10.1016/j.wneu.2016.07.017

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

treating ruptured and unruptured intracranial aneurysms with stent-assisted coiling.

METHODS

Patient Population

Between January 2007 and December 2014, among 2411 aneurysms treated endovascularly in our institution, 713 were treated with stent-assisted coiling and 1708 were treated with coiling alone. Patients were excluded who had a fusiform, traumatic, dissecting or mycotic aneurysm; an aneurysm that was manipulated before entry into the study; or a history of intracranial haemorrhage if the cause was unclear. The study protocol was approved by our hospital's Institutional Review Board. Detailed information was collected for all patients (Figure 1). The baseline data on age, sex, aneurysm characteristics (site, size, status [ruptured vs. unruptured]), duration of follow-up, type of stent, and Hunt and Hess grade were recorded. All ruptured aneurysms were confirmed by computed tomography (CT) scan. One neurosurgeon and 1 neurointervention specialist determined the treatment strategy. The use of a stent was chosen if the aneurysm was wide-necked (dome/neck ratio <2.0 and neck diameter >4 mm) or if complex morphology and location were not suitable for surgical clipping.

Endovascular Procedure

All procedures were performed under general anesthesia using a femoral approach. Systemic heparinization was initiated immediately after the insertion of a femoral introducer sheath. Three main types of stents were used to treat wide-neck aneurysms: Enterprise stents (Codman, Raynham, Massachusetts, USA), Neuroform stents (Boston Scientific/Target, Fremont, California, USA) and Solitaire stents (Covidien, Irvine, California, USA). Other types of stents were used in 20 patients. The choice of stent was based on the surgeon's preference and the patient's anatomy. Strategies for deployment of the stent in relation to coiling included the following: stenting before coiling, coiling before stenting, and stenting alone.

A 5.0 or 6.0 Fr Envoy guiding catheter (Cordis, Miami Lakes, Florida, USA) was positioned in the internal carotid artery via the common femoral artery for anterior circulation aneurysms or in the vertebral artery for posterior circulation aneurysms. The stent

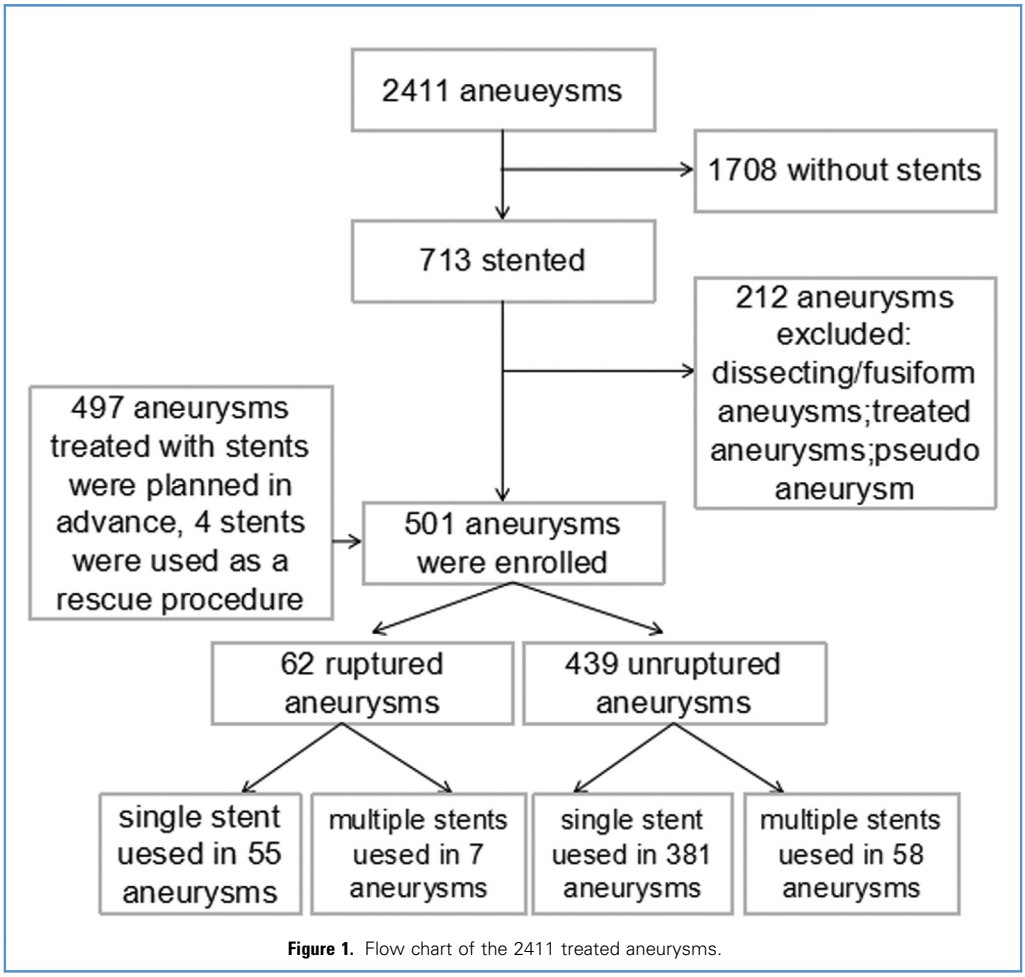

Figure 1. Flow chart of the 2411 treated aneurysms.