Low-Profile Visualized Intraluminal Support Stent-Only Technique for Intracranial Aneurysms—A Report of 12 Cases with Midterm Follow-Up

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■ OBJECTIVE: **To evaluate the safety and efficacy of stent-only technique with Low-profile Visualized Intraluminal Support (LVIS) for uncoilable intracranial aneurysms.**

■ METHODS: **Twelve uncoilable aneurysms in 12 patients were treated with the stent-only technique in our department from January 1, 2016, to December 31, 2017. The characteristics of the aneurysms and the patients were analyzed. The midterm follow-up results of these patients also were analyzed.**

■ RESULTS: **Twelve patients (7 male and 5 female) were enrolled in the series. The 12 aneurysms included 6 vertebral—basilar artery aneurysms, 3 internal carotid artery aneurysms (2 blood blister—like aneurysms and 1 posterior communicating artery aneurysm), 1 posterior cerebral artery dissecting, 1 anterior cerebral artery dissecting of the third segment, and 1 pseudoaneurysm at the first segment of the anterior cerebral artery. Seven aneurysms were? ruptured, whereas 5 remained unruptured. A total of 24 LVIS stents were deployed. Three aneurysms were covered by 3 overlapped stents, 6 aneurysms were covered by 2 stents, and the other 3 aneurysms were covered by 1 stent. All procedures were successful without any perioperative complications. Imaging follow-up between 3 and 10 months after operation was available in all 12 patients, with complete obliteration in 10 aneurysms, improvement in 1, and parent artery occlusion in 1.**

■ CONCLUSIONS: **LVIS stent-only technique is safe and efficacious for uncoilable aneurysms, even for ruptured ones.**

INTRODUCTION

Intracranial aneurysms occur in 1%—2% of the population; they account for approximately 80% of all nontraumatic subarachnoid hemorrhage (SAH) cases, and SAH accounts for 5%—10% of all stroke cases.[1-3] The reported rupture risk of aneurysms varies widely from 2.0 cases per 100,000 persons in China to 22.5 cases per 100,000 persons in Finland.[1,4] Once the aneurysm ruptures, 25%—50% of patients die from the initial bleeding or re-rupture. This rate was universally perceived as being underestimated because many patients died before arriving at the emergency department.[5] Furthermore, 20%—40% of survivors may suffer from chronic neurologic deficits ranging from fatigue to dementia.[1,5]

Surgical clipping and endovascular embolization are the main strategies for intracranial aneurysms. In 1991, detachable coils were used by Guglielmi; since then, various devices and techniques have been introduced for endovascular procedures. Modified coils either with different shapes or bioactive materials and other novel devices, such as WEB (Sequent Medical, Aliso Viejo, California, USA) and Pipeline (Covidien/ev3 Neurovascular, Irvine, California, USA), recently have been introduced and have greatly improved patient outcomes. Moreover, balloon and stent-assisted techniques have been widely used in wide-necked aneurysm embolization. In China, stents available for assisting intracranial aneurysm embolization include Solitaire (ev3, Irvine, California, USA), Neuroform (Boston Scientific Target, Fremont, California, USA), Enterprise (Cordis Neurovascular, Miami, Florida, USA), and Low-profile Visualized Intraluminal Support (LVIS; MicroVention-Terumo, Tustin, California, USA). These stents are all specially designed to reconstruct the aneurysm neck and protect the coils from herniating into the parent artery. Flow diverters such as Pipeline, SILK (Balt Extrusion, Montmorency, France), and Tubridge (MicroPort Scientific Corporation, Shanghai, China)

Key words
- Follow-up
- Intracranial aneurysm
- Stent-only technique

Abbreviations and Acronyms
CT: Computed tomography
DSA: Digital subtraction angiography
ICA: Internal carotid artery
LVIS: Low-profile Visualized Intraluminal Support
MRI: Magnetic resonance imaging
SAH: Subarachnoid hemorrhage

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*Citation: World Neurosurg. (2019) 129:e40-e47.
https://doi.org/10.1016/j.wneu.2019.04.174*

Journal homepage: www.journals.elsevier.com/world-neurosurgery

Available online: www.sciencedirect.com

are designed for diverting blood flow and inducing intra-aneurysmal thrombosis to gradually cure aneurysms. These flow diverters initially were designed for aneurysm treatment without coils. The LVIS stent provides a greater degree of metal coverage (approximately 23%) than the conventional Enterprise (10%) but slightly lower than that of Pipeline (approximately 30%–35%).[6] It originally was designed as a scaffold to assist coil packing. Although previous reports introduced stent-only techniques for some very small or dissecting aneurysms,[7-14] most of these reports were case reports, and the experience of using the LVIS stent-only technique is limited. LVIS stent-only techniques recently were used for treating basilar or vertebral artery aneurysms in small cases, and the detailed information on the operation and the outcome of the aneurysms were not well documented.[13-16] In this article, we share our experience for this issue.

MATERIAL AND METHODS

Patient Information

From January 1, 2016 to December 31, 2017, 12 aneurysms in 12 patients (7 males and 5 females) were enrolled for LVIS stent-only treatment. The average age of the patients was 57.83 ± 13.56 (median, 61) years, and the average medical course was 9.5 ± 16.4 (median, 4) days. Fifteen aneurysms were identified in these 12 patients, among which 3 aneurysms were excluded for analysis due to stent-assisted coiling. This study was approved by the ethics committee of the hospital, and informed consent forms were signed by all participants. Detailed information for the patients and aneurysms is summarized in Table 1.

Endovascular Procedure

All the procedures were performed with the patients under general anesthesia, and all patients underwent a 6-vessel angiography preoperatively. Then, 3-dimensional reconstruction was required to fully disclose the configurations of the aneurysm, parent artery, and adjacent perforators. The working projection was chosen to best visualize the aneurysm. The Headway 21 microcatheter (MicroVention, Inc.) was delivered along the Traxcess 14 microwire (MicroVention, Inc.) to the distal part of the aneurysm. The stent size was determined according to the diameter of the parent vessels and the length of the lesion. The stents were navigated through the Headway 21 microcatheter and released mainly by pushing. Patients with ruptured aneurysms were medicated with 300 mg of aspirin and clopidogrel 2 hours preoperatively. For patients with unruptured aneurysms, 100 mg of aspirin and 75 mg of clopidogrel were orally administered daily for 5 days. Heparin (70 IU/kg) was administered as a bolus after femoral arterial sheath placement, 2000 IU for the second hour, and 1000 IU bolus per hour intermittently thereafter with monitoring of activated clotting time within 250–300 seconds.

Antiplatelet therapy regime was adjusted on the basis of the results of the platelet agglutination test. Generally, dual antiplatelet therapy (aspirin at 100 mg/day, clopidogrel at 75 mg/day, or ticagrelor at 90 mg/day) was maintained for 3 months after the procedure, and aspirin (100 mg/day) was maintained for at least 6 months.

RESULTS

Immediate Results

Of the 15 aneurysms, 12 were covered by LVIS stent-only technique, and the other 3 aneurysms were treated by stent-assisted coiling. All stents were delivered and released uneventfully. A total of 24 LVIS stents were used. Three aneurysms were covered by 3 overlapped stents, 6 were covered by 2 overlapped stents, and the remaining 3 were covered by 1 stent (Table 1). No procedure-related complications occurred, and none of the patients suffered new neurologic deficits. Contrast-media stagnation was observed in different degrees after stent(s) implantation.

Follow-Up Results

Clinical follow-up was scheduled 1 month after discharge. No new neurologic deficits were found in all of the patients included. All of them received angiographic follow-up 3–10 months postoperatively. In Patient 3, digital subtraction angiography (DSA) follow-up was arranged 10 days and 4 months postoperatively, considering that the lesion could be a pseudoaneurysm with high rebleeding risks. At imaging follow-up, 10 (83.3%, 10/12) aneurysms disappeared, and 1 (8.3%, 1/12) aneurysm showed angiographic improvement. In-stent obliteration of the parent artery occurred in one patient, and this patient suffered from recurrent transient ischemic attack (Case 1, Patient 1). No apparent in-stent stenosis was found in other cases.

Illustrative Cases

Case 1 (Patient 1). This patient was a 44-year-old man. He was admitted to our department with the chief complaint of dizziness for 10 days. Physical examinations showed no positive signs. Computed tomography (CT) showed enlargement and calcification of the right vertebral artery. Magnetic resonance imaging (MRI) revealed a double-lumen sign indicating arterial dissection, which was confirmed by CT angiography and DSA. Three LVIS stents were overlapped to reconstruct the right vertebral artery. No brain infarction was found on CT scanning the next day after operation. This patient was discharged with no neurologic deficits. He discontinued dual antiplatelet therapy 1.5 months after discharge due to a stomach operation in a local hospital. DSA follow-up at 10 months postoperatively showed in-stent obliteration of the parent artery (Figure 1). In a telephone interview, he complained of dizziness episodes at more frequent intervals. He was diagnosed with brain infarction by a local physician on the basis of the MRI result (data unavailable). A progressive in-stent stenosis or obliteration was highly suspected, but he refused for further investigation.

Case 2 (Patient 2). This 67-year-old woman complained of sudden headache for 1 day on admission. Physical examination showed neck resistance, and subsequent emergency CT scanning confirmed SAH. DSA of the right internal carotid artery (ICA) showed a small posterior communicating artery aneurysm and slight irregularity of the supraclinoid segment of ICA. However, after a careful discussion, 3 senior neurosurgeons (W.S., Yunyan Wang, and Donghai Wang) agreed that the aneurysm was not the origin of the hemorrhage, considering its small size and regular shape. Instead, the irregular supraclinoid ICA was diagnosed as a

Table 1. Patient Information

No.	Sex (M/F)	Age, Years	Rupture (Y/N)	Location and Nature	Clinical Presentations	Medical Course	No. of Stent(s)	Angiographic Follow-up	Clinical Follow-up	Remarks
1	M	44	N	R-VA dissecting	Dizziness	10 days	3	In-stent obliteration	TIA	Irregular dual antiplatelet therapy
2	F	67	Y	R-ICA BBA	Headache, nausea, vomiting	1 day	2	Cure	Good	Combined with pComA, coiled
3	F	60	Y	Basilar pseudoaneurysm	Headache, nausea, vomiting	7 days	3	Cure	Good	DSA follow-up twice
4	F	66	Y	L-P1 dissecting	Headache, nausea, vomiting	1 day	1	Cure	Good	No
5	F	42	Y	L-ICA BBA	Headache, nausea, vomiting	2 days	3	Cure	Good	No
6	M	57	N	R-VA dissecting	Dizziness, headache	15 days	2	Cure	Good	No
7	M	77	N	R-VBA dissecting	Dizziness,	2 months	1	Improvement	Good	No
8	M	37	Y	L-A1 pseudoaneurysm	Headache, nausea,	1 day	2	Cure	Good	Combined with A1 aneurysm, coiled.
9	M	62	Y	L-VA dissecting	Headache, nausea,	3 days	2	Cure	Good	No
10	M	70	N	R-VBA dissecting	Headache	5 days	2	Cure	Good	No
11	F	41	Y	L-A3 dissecting	Headache, nausea, vomiting	2 days	1	Cure	Good	No
12	M	71	N	L-ICA pComA	No symptoms	7 days	2	Cure	Good	Combined with ophthalmic aneurysm, coiled

M, male; N, no; R, right; VA, vertebral artery; TIA, transient ischemic attack; F, female; Y, yes; ICA, internal carotid artery; BBA, blood blister-like aneurysm; pComA, posterior communicating artery; DSA, digital subtraction angiography; L, left; P1, the first segment of the posterior cerebral artery; VBA, vertebrobasilar artery; A1, the first segment of anterior cerebral artery; A3, the third segment of the anterior cerebral artery.

blood blister—like aneurysm, which was responsible for SAH. The posterior communicating artery aneurysm was packed with a microcoil, and these 2 aneurysms were covered by 2 overlapped LVIS stents simultaneously. The postoperative course was uneventful, and the patient was discharged with intact neurologic function. DSA follow-up at 8 months postoperatively showed complete reconstruction of the supraclinoid ICA and disappearance of the posterior communicating artery aneurysm (Figure 2).

Case 3 (Patient 3). A 60-year-old woman was transferred to our department from a local hospital 7 days after a severe headache accompanied with nausea and vomiting. DSA revealed a side-branch pseudoaneurysm at the middle of the basilar artery. The very small aneurysm neck hindered the microcatheter placement, and 3 overlapped LVIS stents were placed across the basilar artery. Images immediately and 10 days postoperatively showed slight filling of the aneurysm sac. The second DSA follow-up at 4 months postoperatively showed complete disappearance of the aneurysm without in-stent stenosis. The covered side branches were patent, and the patient had no complaints of discomfort (Figure 3).

Case 4 (Patient 4). This patient was a 60-year-old woman. Her chief complaint was sudden headache, nausea, and vomiting for 1 day. CT scanning in a local hospital showed SAH, which was mainly located in the left cisterna ambiens. DSA confirmed a left posterior cerebral artery dissecting aneurysm. The lumen of the artery was reconstructed with a single LVIS stent. DSA follow-up at 5 months postoperatively showed complete reconstruction of the dissected artery and no in-stent stenosis (Figure 4). Furthermore, the neurologic functions of the patient were intact.

DISCUSSION

History of Stent-Only Technique for Aneurysm Treatment

Microsurgical clipping and endovascular packing are the main treatment strategies for intracranial aneurysms nowadays. The International Subarachnoid Aneurysms Trail results in 2009 greatly paved the way for endovascular intervention as its priority to microsurgical clipping.[17] Stent-assisted coil embolization was first reported in 1997.[18] Currently, it has been the first-line therapy for wide-necked aneurysms in many clinical centers.[19] In 1999, Malek et al.[20] first reported their experience for a case of iatrogenic basilar artery dissection using the stent-only technique. Since then, various aneurysms with different pathologic types have been treated with different stents in different locations.[7-9,21,22] In the reported series, the stent-only technique reached a satisfactory outcome in aneurysm treatment. Stents used in these studies included Neuroform,[7] Enterprise,[21,22] and coronary stent (AVE S670; Medtronic, Minneapolis, Minnesota, USA).[8,9]

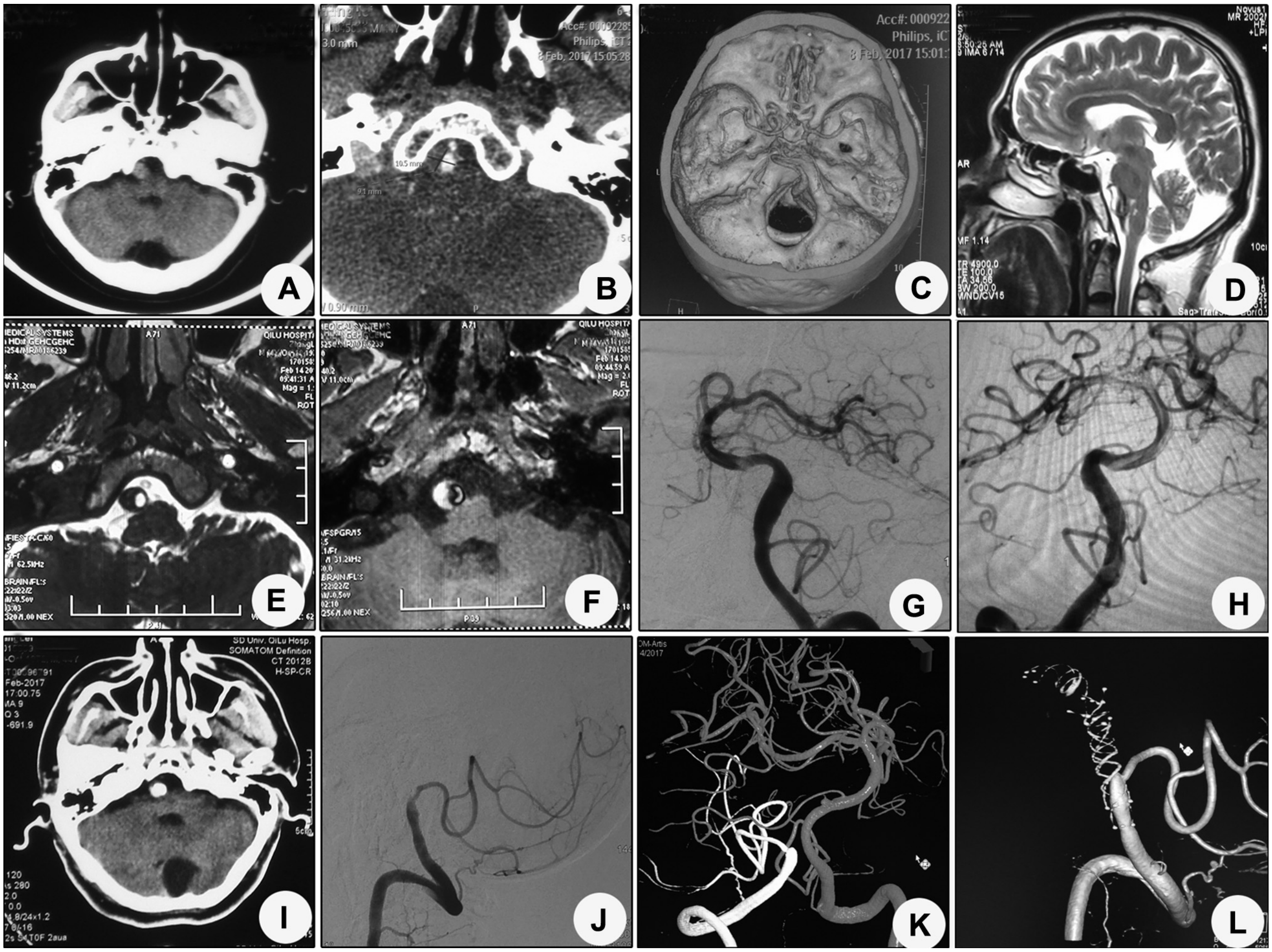

Figure 1. Illustrative imaging of Case 1, Patient 1. (**A**, **B**) Computed tomography (CT) imaging shows enlarged right vertebral artery with calcification. (**C**) CT angiography confirms right vertebral dissecting aneurysm. (**D**–**F**) Magnetic resonance imaging shows intraluminal thrombosis of the dissection. (**G**, **H**) Digital subtraction angiography (DSA) imaging confirms the diagnosis of right vertebral artery dissecting aneurysm with posterior inferior cerebellar artery involvement. (**I**) postoperative CT shows no brain infarction. (**J**–**L**) Follow-up DSA and 3-dimensional reconstruction reveal parent artery occlusion.

LVIS stent-only technique also was reported, but the series was small, and the details of this technique were not discussed.[14] In this paper, we share our own experience with LVIS stent-only technique for treating intracranial aneurysms.

Theoretical Mechanism of Stent-Only Technique for Aneurysm Treatment

The initial role of stents in stent-assisted coil embolization is to serve as a scaffold to prevent coils from herniating into the parent artery. With an increasing number of aneurysms being successfully treated with the stent-only technique, the potential underlying mechanisms were raised. Stents can change the blood flow pattern in an aneurysm sac, disrupt the flow pattern, increase flow stagnancy, reduce inflow momentum, and decrease the impact zone under high flow.[23] These phenomena were mainly caused by parent artery angle modification and blood flow blockage into the aneurysm sac. These hemodynamic changes may help prevent aneurysm rupture or growth. As for dissecting aneurysms, the radial force of the stent could stabilize the vessel wall and reset the dissected flap to reconstruct the vessel lumen.[10] The immediate flow redirection with the disruption of intra-aneurysmal flow and dispersion of the inflow jet theoretically provides some immediate protection from hemorrhage; stent endothelialization with subsequent intravascular remodeling accounts for the angiographic improvement and long-term durability of this endovascular remodeling strategy.[7]

Considerations for Stent Choice

The commercially available stents could be divided into 2 categories: laser-cut and braided stents. The commonly used laser-cut stents in China include Enterprise, Neuroform, and Solitaire, whereas the braided stents include LEO (Balt, Montmoreency,

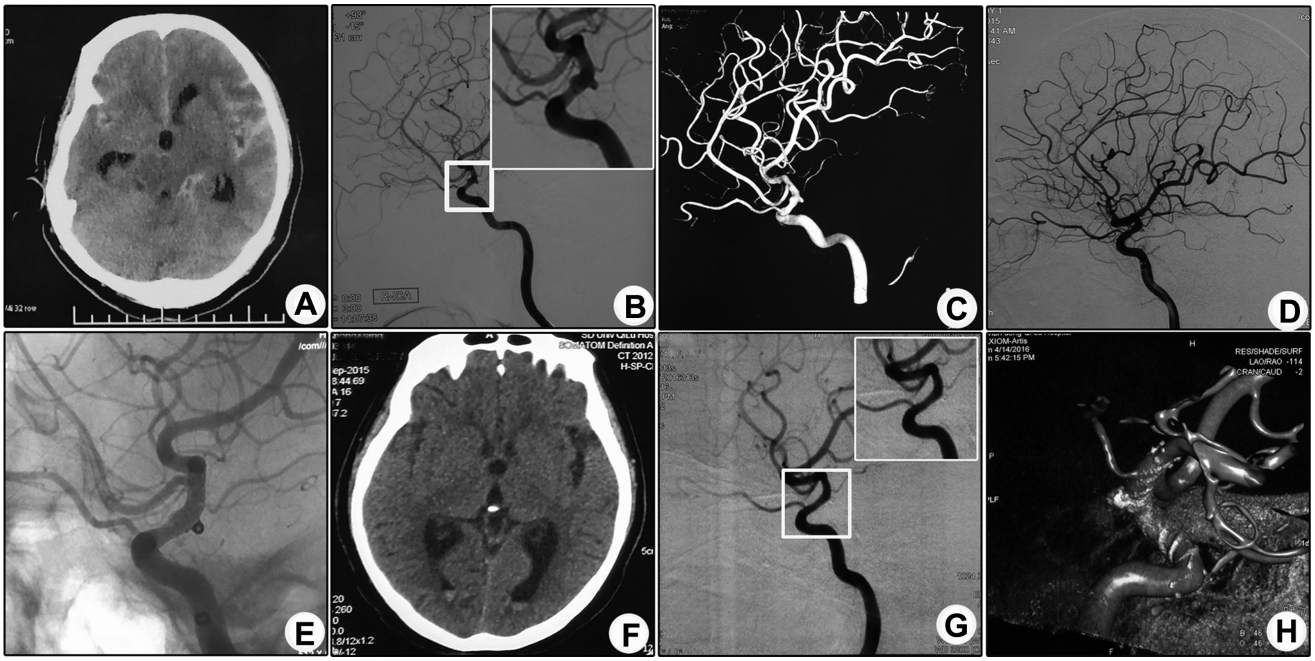

Figure 2. Illustrative imaging of Case 2, Patient 2. (**A**) Computed tomography (CT) scanning shows subarachnoid hemorrhage. (**B**, **C**) Digital subtraction angiography (DSA) and 3-dimensional (3D) reconstruction imaging show a small and regular posterior communicating artery aneurysm and irregularity of the supraclinoid segment of the right internal carotid artery. (**D**, **E**) Two lesions were covered by the same 2 stents. (**F**) Postoperative CT shows no brain infarction and slight hydrocephalus. (**G**, **H**) DSA follow-up and 3D reconstruction reveal complete healing of the 2 lesions.

France) and LVIS. As for laser-cut stents closed-cell and open-cell stents could be identified according to the connection differences of the struts. Enterprise and Solitaire are closed-cell stents, whereas Neuroform is an open-cell stent. Generally, the laser-cut stents harbor stronger radical force, and the braided stents harbor a greater metal coverage rate. Balloon-expandable stents always have a stronger radical force but are currently seldom used for intracranial vasculature.[24] Closed-cell stents are generally stiffer than open-cell stents, making them more efficient in modifying the angle between the parent artery and the aneurysm, redirecting the main flow from the aneurysm to the distal artery. The main advantages of braided stents are high compliance and metal coverage rate. The high metal coverage rate on the aneurysm orifice results in low momentum force on the aneurysm sac and stagnation of blood. The metal coverages of LVIS, Enterprise, Neuroform, and Solitaire stents are 23%, 10%, 10%, and 6%, respectively.[6] Theoretically, we recommend laser-cut stents with high radical force for dissecting aneurysms with small aneurysm sac. Braided stents with high metal coverage may be more suitable for side-wall aneurysm in a relatively straight parent vessel, as further verified by computational fluid dynamics analysis and animal experiments. Grant used an oversized open-cell stent (1 mm larger than the artery) to treat ruptured blood blister-like aneurysms.[11] The oversized stent in a relatively thin vessel would provide a larger radical force and a higher metal coverage rate than the regular-sized stent, thereby promoting aneurysm healing. In this series, all side-wall, dissecting, and pseudoaneurysms are included, but the volume is extremely limited. Further studies with different types of stents and aneurysms should be conducted for a definitive advice for stent choice. The WILLIS (Microport, Shanghai, China) stent is the first covered stent exclusively designed for intracranial vasculature usage and has demonstrated promising applications in selected cases,[12] but perforator reservation and stiffness of the stent greatly restrict its application. Covered stent was not discussed in this issue.

Number of Stents Needed

Bare stent implantation could divert the blood flow from the aneurysm and decrease but not eliminate the short-time rupture risk. Thrombosis would occur gradually in the aneurysm sac and subsequently heal the lesion. Theoretically, multiple-stent implantation in a stent-in-stent fashion could enhance the flow-diverting effect and increase intra-aneurysmal homeostasis, thereby promoting aneurysm healing. This theory raises the debate on how many stents are sufficient to induce intra-aneurysmal thrombosis. A single stent may not be sufficient, whereas multiple stents in a stent-in-stent fashion may increase the risk of perforator coverage and in-stent thrombosis. In our 12 cases, a total of 24 LVIS stents were used; 3 aneurysms were covered by 3 overlapped stents, 6 aneurysms by 2 overlapped stents, and the remaining 3 by 1 stent. Aneurysm disappeared in 10 patients and graphically improved in 1 patient in the angiographic follow-up with no rebleeding. In a patient who received three stents deployed in a stent-in-stent fashion (Case 1, Patient 1, Figure 1), in-stent occlusion was found, and this patient suffered from repeated ischemic

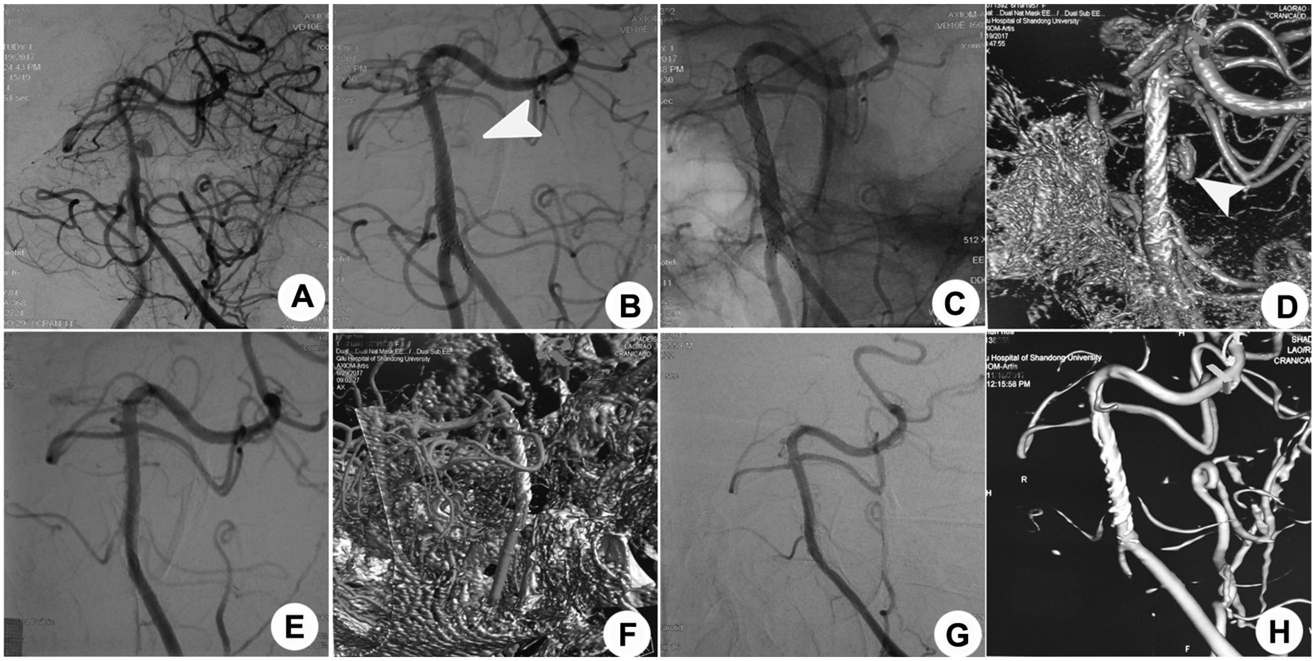

Figure 3. Illustrative imaging of Case 3, Patient 3. (**A**) Digital subtraction angiography (DSA) shows a pseudoaneurysm at the middle of basilar artery. (**B**–**D**) DSA and 3-dimensional (3D) reconstruction show slight filling of the aneurysm after deploying 3 overlapped stents. The *white arrowheads* in panel B and D represent the slight contrast filling of the aneurysm. (**E**, **F**) DSA images of the first follow-up 10 days postoperatively. (**G**, **H**) DSA images of the second follow-up 4 months postoperatively.

attack. Irregular dual antiplatelet therapy may be responsible for the occlusion, and we could not exclude the effects of the overlapped stents. Overlapped stents may trigger more aggressive neo-intimal hyperplasia, leading to parent artery stenosis and even occlusion. In ruptured aneurysms with high risk of hemorrhage, we can use the stent-in-stent technique to decrease the short-time hemorrhagic risk. In unruptured aneurysms, one stent may be enough to induce a sufficient hemodynamic modification. As approved by the Food and Drug Administration, the flow diverter Pipeline has a metal coverage of 30%–35% in nominal diameter,[6] and the theoretical metal coverage rate of 2 overlapped LVIS is 23%–46%. In addition, 33.3% (1/3) of parent artery was occluded in our patients who received 3 overlapped stents. Hence, we suggest that even for ruptured aneurysms, 2 overlapped LVIS stents should be enough, and more stents are not recommended. The diameter of the parent artery and the adjacent perforators should also be considered when deciding the number of stents to be overlapped.

Complications and Their Prevention in the Stent-Only Technique

Given that bare stent implantation could not exclude the aneurysm from the circulation immediately and the demand for dual antiplatelet therapy after stent deployment, aneurysm bleeding or rebleeding is the main concern of this technique. In our 12 cases, bleeding or rebleeding did not occur. Dual antiplatelet was recommended after stent deployment to prevent acute in-stent thrombosis. The sensitivity of the 2 drugs varies remarkably in the population. In our institution, the platelet inhibition rate was monitored to direct the antiplatelet therapy. If the inhibition rate was high in both agents, mono-antiplatelet therapy would be preferred, especially in ruptured cases. If a patient was not sensitive to these drugs, ticagrelor would be prescribed, especially in unruptured cases with multiple-stent deployment. Moderate-to-severe in-stent stenosis with the Neuroform self-expanding intracranial stent occurred in 5.8% of patients treated.[25] In our series, parent artery occlusion was found in 1 case (1/12, 8.33%, Case 1, Patient 1, Figure 1) during 10 months of angiographic follow-up. Aside from irregular dual antiplatelet therapy, multiple-stent deployment may induce aggressive hyperplasia of the neo-intima. In our opinion, the inner stent should cover the proximal end of the outer stent(s), decreasing the probability of a rough inner wall and keeping the laminar flow in the parent artery. In addition, the stable laminar flow would decrease the risk of acute thrombosis. Side-branch coverage is another concern after multiple-stent deployment. In our series, no perforator-associated complications were found. Similar results were gained in Pipeline embolization device. In most cases, we recommend 2 LVIS stents deployed in a stent-in-stent fashion, reaching a relative balance among bleeding prevention and perforator conservation, as well as in-stent stenosis.

Angiographic Follow-Up Regime

Standard angiographic follow-up regimes were unavailable for patients who received the stent-only technique. As the bleeding risk remains after stent deployment, we prefer a close angiographic follow-up regime. However, the high cost and risk of the procedure should also be considered. The metallic artifacts greatly restricted CT angiography and magnetic resonance

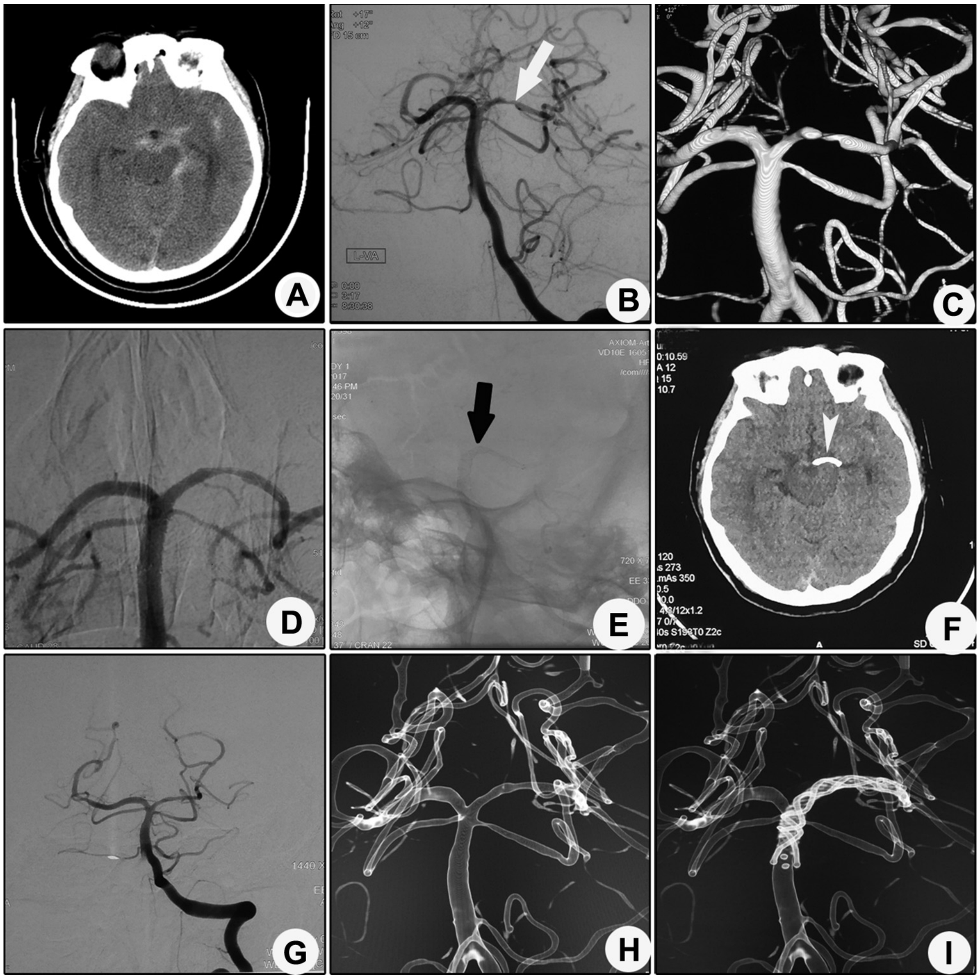

Figure 4. Illustrative imaging of Case 4, Patient 4. (**A**) Computed tomography (CT) scanning shows subarachnoid hemorrhage. (**B**, **C**) Digital subtraction angiography (DSA) and 3-dimensional (3D) DSA reveal the left posterior cerebral artery dissection. (**D**, **E**) A single stent was deployed to reconstruct the lumen of the left posterior cerebral artery. (**F**) postoperative CT reveals no brain infarction. (**G**–**I**) Follow-up DSA and 3D reconstruction show complete healing of the dissection with no intraluminal stenosis. The *white arrow* in panel B shows irregularity of the left PCA; *black arrow* in panel E and *white arrowhead* in panel F show the image of the stent.

angiography applications in the follow-up. We prefer angiographic DSA follow-up 3 months after the operation. For Patient 3, we arranged the first DSA follow-up merely 10 days after the operation due to the high rebleeding risk. All patients in our series underwent DSA follow-up. The angiographic interval should be based on a complicated consideration including the configurations of the aneurysm, the immediate imaging findings after operation, and the antiplatelet regime.

Limitations

Although the stent-only technique reached a satisfactory outcome in our series, this study still has some limitations. First, the volume of the patient is extremely small; large-volume studies are needed to obtain a definite conclusion. Second, all the patients were enrolled in a single center. In fact, most of the patients were treated by a single neuroradiologist (W.S.); thus, selection bias was apparent. Third, with small volume, the diameter, pathologic type, and location of the aneurysms are not considered for predicting the outcome. Lastly, the follow-up course is relatively short; the long-term effect of the technique needs further investigation.

CONCLUSIONS

Although the enrolled patients were few, our initial results revealed that the stent-only technique with LVIS is feasible and safe for uncoilable intracranial aneurysms, even for ruptured ones. The detailed information for this technique should be further investigated with more studies in multiple centers. The results of this study provide supportive evidence for lumen reconstruction strategy for treating intracranial aneurysm, considering that the dispute remains between lumen reconstruction and intra-aneurysmal packing.

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Conflict of interest statement: This work was supported by grants from the National Natural Science Foundation of Shandong Province of China (No. 2017CXGC1203, 2017G006012, 2013GGE27006) and TaiShan Scholars of Shandong Province of China (No. ts201511093).

Received 10 February 2019; accepted 20 April 2019

Citation: World Neurosurg. (2019) 129:e40-e47.
https://doi.org/10.1016/j.wneu.2019.04.174

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