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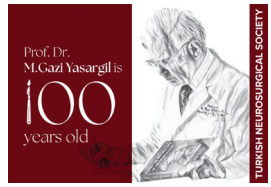

A Comprehensive Analysis of Stent during Stent Assisted Coil Embolization for Cerebral Aneurysms: A 17-Year Institutional Study

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ABSTRACT

AIM: To compare the outcomes and complications of stent-assisted coil (SAC) embolization for the treatment of cerebral aneurysms according to stent type.

MATERIAL and METHODS: Since January 2006, a total of 1293 patients have been added to our institutional aneurysm database. We excluded cases with subarachnoid hemorrhage, those not classified as Raymond Roy Class 1, and those in which flow diverters were used. Cases involving the use of overlapping stents, Y-stenting, or multiple stents were also excluded. We recorded demographic information, aneurysm characteristics, and procedural details for all patients. Patients who did not undergo diffusion-weighted magnetic resonance imaging (MRI) within 1 day postoperatively or follow-up angiography within 6 months postoperatively were excluded.

RESULTS: In total, 188 patients were included in the analysis (129 females; mean age, 58 years) who were treated for aneurysms of different sizes. Regrowth occurred in 21 patients, with the rate varying according to the stent type. In particular, the lower profile stent group had a lower regrowth rate compared to the nitinol laser stent group. The rate of postoperative infarction on diffusion-weighted MRI within 1 day postoperatively varied among stent types.

CONCLUSION: None of the stent types demonstrated clear superiority for SAC embolization, indicating that stent selection should be based on surgeon preference. Despite the low regrowth rate, careful stent selection is essential, particularly for patients at high risk of ischemic stroke or regrowth. These findings provide valuable insights for optimizing the treatment of cerebral aneurysms using SAC embolization.

KEYWORDS: Stents, Therapeutic embolization, Saccular aneurysm, Recanalization, Ischemia

ABBREVIATIONS: SAC: Stent-assisted coil, **MRI:** Magnetic resonance imaging

INTRODUCTION

In patients with aneurysms, endovascular thrombectomy is safe and demonstrates comparable functional outcomes to aneurysm neck clipping (15,22). With advancements in technology, various adjuvant techniques have been developed, including stent-assisted coil (SAC) embolization. Numerous studies have suggested that SAC embolization allows for easier coil packing compared to conventional coiling, leading to complete coil packing and a higher recanalization rate (1,2). Stent insertion also leads to flow diversion, further increasing the likelihood of recanalization (6). However, the use of stents is associated with a higher incidence of ischemic stroke compared to conventional coil embolization.

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Recent technological and medical advancements have led to the development of stents that reduce the risks of recanalization and ischemic stroke. However, most previous studies have compared the characteristics of two specific stents, limiting the applicability of the findings to the various stents used in clinical practice. Therefore, this study compared the effectiveness of various stents used for SAC embolization over a 17-year period at a single institution.

MATERIAL and METHODS

Study Design and Participants

The study protocol was approved by our institutional review board (SCHCA 2023-12-047/2023.12.27).

We retrospectively reviewed our institutional endovascular aneurysm database and retrieved data for 1,293 aneurysms managed at our hospital between January 2007 and July 2023. We excluded cases with ruptured aneurysms (n=467), coil packing not performed according to the Raymond Roy classification I (n=448), no stent insertion, coiling or balloon-assisted coil embolization only, insertion of multiple stents (such as overlapping stenting or y-stenting), or use of flow diverters (n=143). Criteria for further exclusion involved cases (n=40) where immediate post-surgery MR diffusion was not conducted to confirm post-procedural infarction or those lacking follow-up angiography, including MRA or transfemoral catheter, within at least 6 months post-procedure to assess angiography regrowth. Of the remaining 195 cases, those with non-saccular dissecting, infectious, or fusiform aneurysms (n=7), those in which diffusion-weighted magnetic resonance imaging (MRI) was not performed postoperatively to confirm the presence of post-procedural infarction, and those in which follow-up MR or transfemoral catheter angiography was not performed within 6 months to assess post-procedural aneurysm regrowth were excluded. Finally, 188 patients with saccular aneurysms who underwent conventional single SAC embolization according to the Raymond Roy classification I were included in the analysis.

Endovascular Procedures

All procedures were performed by three experienced neurosurgeons certified by the Korean Neuroendovascular Society. The procedures were performed under general anesthesia in a monoplane angiographic suite (before June 2013) or a biplane angiographic suite (after June 2013) with three-dimensional rotational angiographic capability (Philips Medical Systems, Best, the Netherlands). Dual antiplatelet therapy was initiated with clopidogrel (75 mg) and aspirin (100 mg), administered at least 7 days prior to the procedure, for patients with unruptured aneurysms. On the day before the procedure, the antiplatelet effects of aspirin and clopidogrel were assessed using the VerifyNow Assay (Accumetrics, San Diego, CA, USA). In cases with a poor response based on cutoff values, an additional dose of cilostazol (200 mg) was administered. Alternatively, prasugrel (10 mg) was administered as a substitute for clopidogrel.

Until 2014, a 6-Fr guiding catheter (Envoy 6F guiding catheter; Codman Neurovascular, Raynham, MA, USA) was inserted through the femoral artery and placed in the proximal parent artery. After 2014, a long 6-F sheath (6F Asahi Fubuki; Asahi, Aichi, Japan; or 6F shuttle; Cook, Bloomington, IN, USA) was used to guide a 6-F intermediate catheter (A Sofia 6F; MicroVention, Tustin, CA, USA) or a Navien 6F (Medtronic, Irvine, CA, USA) as close to the aneurysm as possible.

All interventions were performed under systemic heparinization, with the activated coagulation time monitored immediately before the procedure. For procedures involving Neuroform Atlas (Stryker, Fremont, CA, USA), LVIS Jr. (MicroVention), Headway 17 (MicroVention), or SL-10 (Stryker), a microguidewire (Traxcess 14; MicroVention or Synchro 14; Stryker) was used to access the intracranial artery distal to the aneurysm. In procedures using LVIS Blue (MicroVention), Enterprise (Codman Neurovascular), Headway-21 (MicroVention), or Prowler Select Plus (Codman Neurovascular) for delivery, a Solitaire, Rebar-18, or Rebar-27 microcatheter (Medtronic) was used. Furthermore, Renegade Hi-flow (Stryker) or Marksman (Covidien) was used for delivering Neuroform EZ (Stryker).

Microcatheters were typically inserted for the treatment of superselective catheterized aneurysms. The decision between using the jailing technique or through-the-strut technique during SAC embolization was based on the surgeon's preference.

Clinical and Angiographic Follow-up Assessments

Each assessment was analyzed in detail, focusing on the stent type used for SAC embolization. Data on sex, age, and medical history, including hypertension, diabetes, smoking status, cerebrovascular events, coronary occlusive disease, and atrial fibrillation, were extracted from medical records. Preoperative radiographs were reviewed to determine the aneurysm location and characteristics, including the distance from the neck to the dome, neck width, and maximal diameter.

Procedures performed within a single day were evaluated for procedure-related infarction on diffusion-weighted MRI, and the infarct volume was determined using the ABC/2 method (20). In cases where only spots with diffusion restriction were identified, each spot was measured individually.

Based on follow-up assessments conducted at ≥ 6 months postoperatively, including MR or transfemoral catheter angiography, recurrence of coiled aneurysms were categorized as stable occlusion (i.e., no interval change or increase in obliteration compared to the initial post-embolization angiogram), major recanalization (i.e., recanalization volume ≥ 20% of the initial aneurysm volume), minor recanalization (i.e., recanalization volume < 20% of the initial aneurysm volume), or regrowth (i.e., appearance of new aneurysmal dilatation or a daughter sac) (7).

Statistical Analysis

Statistical analyses were conducted using Rex (version 3.0.3; RexSoft Inc., Seoul, Korea; http://rexsoft.org/), an Excel-based software package. P-values <0.05 were considered indicative of statistical significance. Data are presented as means ± standard deviation for normally distributed variables and as medians for non-normally distributed continuous variables. Categorical variables are presented as counts with percentage.

The scores were compared among the six stents using parametric tests (analysis of variance and multiple comparison tests) and nonparametric tests (Kruskal-Wallis test and Dunn's multiple comparisons test). Nonparametric tests are suitable for use when data are not normally distributed.

RESULTS

This study included 188 patients (mean age: 58 ± 11 years) with saccular aneurysms, including 129 (68.6%) females. Hypertension was the most common comorbidity (n=90, 47.9%). The internal carotid artery was the most commonly treated artery (n=94, 50%). The mean neck-to-dome distance was 3.97 ± 1.73 mm, the mean aneurysm width was 5.15 ± 2.08 mm, and the mean neck size was 3.82 ± 1.38 mm. The maximal aneurysm diameter was 4–7 mm in 51.6% of patients.

With regard to procedure-related infarctions, 104 (55.3%) patients did not exhibit diffusion restriction, whereas 68 (36.2%) developed one to five small asymptomatic spots of diffusion restriction. The majority of the 16 (8.6%) patients with at least six spots of diffusion restriction did not develop ischemic symptoms. Only one patient developed procedure-related symptomatic of anterior cerebral artery infarction.

With regard to recanalization, most patients (n=168, 89.4%) demonstrated stable occlusion, although 3 (1.6%) had major recanalization (i.e., ≥ 20% recanalization) and required retreatment. Additionally, minor recanalization without the need for treatment occurred in 19 patients (10.1%) (Table I).

In subgroup analysis, statistically significant differences in diffusion restriction were observed among stent types (p=0.0085). Pairwise multiple comparisons revealed statistically significant associations between use of the Atlas and Enterprise stents (p=0.0347), LVIS Jr. and LVIS Blue stents (p=0.0434), LVIS Blue and Solitaire stents (p=0.0032), and LVIS Blue and Enterprise stents (p=0.0006), indicating the robustness of our results (Table II).

Recanalization, an important factor, was not categorized as minor or major based on the maximal aneurysmal diameter. Statistically significant differences were observed between aneurysms with a maximal diameter <4 mm and the remaining aneurysms (p=0.0498). Pairwise tests showed significant differences between the Atlas and Solitaire stent groups, LVIS Jr. and Solitaire stent groups, and LVIS Blue and Solitaire stent groups (p=0.0096, 0.0192, and 0.0307, respectively). No differences were found among the stent groups in terms of the proportions of aneurysms with maximal diameter of 4–7 or >7 mm. However, the maximal aneurysm diameter was significantly different among the stent groups (p=0.0278). Dunn's multiple comparisons test revealed significant differences of the Enterprise stent group with the Atlas, LVIS Jr., and LVIS Blue stent groups (p=0.0044, 0.0414, and 0.0183, respectively) (Table III).

DISCUSSION

Recent advancements in the treatment of aneurysms include the application of flow diverters with an extremely thin mesh of intertwined wires, aiming to maximize the metal surface coverage and enhance the effects of hemodynamic diversion. However, the indications for the use of flow diverters remain limited (10). SAC embolization, a widely used treatment method for cerebral aneurysms, have two main advantages. First, the stent provides a scaffold that maintains the coil position within the aneurysm, preventing coil migration into the parent artery. To achieve this, the stent struts should maximize the coverage of the aneurysm neck. Furthermore, stents with high radial strength are preferable (23). Second, the stent prevents aneurysm recurrence by reducing the velocity and volume of blood entering the aneurysm, thereby enhancing the effect of hemodynamic diversion, and by achieving a straight angle between the parent artery and its stented branch over the long term. Furthermore, stents facilitate endothelium formation in the region where they are deployed, contributing to prolonged biological effects that prevent aneurysm recurrence (13).

However, the use of stents has certain limitations, primarily the risk of in-stent thrombosis due to the foreign-body reaction within blood vessels. To mitigate the risk of in-stent thrombosis, dual antiplatelet therapy should be used for at least 5 days prior to the procedure. Antiplatelet resistance or hypersensitivity requires dose adjustment or the use of alternative medications with different mechanisms of action. In cases of resistance, the use of high doses or the addition of alternative medications with different mechanisms of action may be necessary. Conversely, in cases of hypersensitivity, adjustment of medication dose is needed due to the increased bleeding risk. Furthermore, antiplatelet therapy must be continued even after the procedure (17,18,21).

Stents are categorized based on the manufacturing method, namely laser cutting (e.g., Neuroform EZ, Atlas, Enterprise, and Solitaire stents) or wire braiding (e.g., LVIS Blue and LVIS Jr.). In terms of cell design, Neuroform EZ and Atlas are representative of the open cell configuration. Each stent has unique features depending on its manufacturing method and design, which can be useful in certain clinical settings. However, previous studies have mainly compared the outcomes between two stent types (3,5,9,14,19). In the present study, we compared the efficacy and safety of six commonly used stent types in terms of aneurysm regrowth, recanalization, and post-procedural infarction, while accounting for potential confounding variables.

Kim et al. demonstrated that postprocedural infarction is closely associated with age and radiological infarction after coiling. In our study, there were no significant age differences among stent groups, and we adjusted the regimen based on the reactivity of antiplatelet agents (11). In our analysis, the stent groups showed significant differences in the rate of diffusion restriction (p=0.0085). Furthermore, pairwise tests for each stent revealed that the LVIS Blue group had a higher number of postprocedural infarctions than the Enterprise stent, Solitaire, and LVIS Jr. groups. Additionally, the Atlas and Enterprise stent groups differed significantly (p=0.0347) due to the higher friction between wires and thrombogenicity of stents made of thin wire braiding, involving dozens of thin wires woven together like a braid or hair. Atlas stents have a smaller

Table I: Baseline Characteristic

Variable		Stent type						
		Atlas	**LVIS jr.**	**LVIS blue**	**Enterprise**	**Solitaire**	**Neuroform EZ**	**Total / p value**
Female (n, %)		38 (62.3)	20 (66.7)	19 (73.1)	41 (68.3)	9 (69.2)	2 (100)	129 (68.6) / 0.719
Age, years		59 ± 11	58 ± 11	57 ± 11	58 ± 12	58 ± 13	62 ± 12	58 ± 11 / 0.5274
Hypertension (n, %)		30 (49.2)	13 (43.3)	12 (46.2)	29 (48.3)	5 (38.4)	1 (50)	90 (47.9) / 0.9521
Diabetes mellitus (n, %)		14 (23)	4 (13.3)	3 (11.5)	6 (10%)	0	0	27 (14.4) / 0.2253
Smoking (n, %)		16 (26.2)	5 (16.7)	5 (19.2)	5 (8.3)	2 (15.4)	0	33 (17.6) / 0.2562
Cerebrovascular event (n, %)		7 (11.5)	6 (20)	0	16 (26.7)	1 (7.7)	0	30 (16.0) / **0.0167***
Coronary heart disease (n, %)		2 (3.3)	1 (3.3)	1 (3.8)	2 (3.3)	0	0	6 (3.2) / 0.9899
Atrial fibrillation (n, %)		2 (3.3)	1 (3.3)	0	0	0	0	3 (1.6) / 0.6642
Location (n, %)	ICA	25 (41)	5 (16.7)	25 (96.2)	27 (45)	12 (92.3)	0	94 (50.0)
	ACA	21 (34.4)	16 (53.3)	1 (3.8)	18 (30)	0	2 (100)	58 (30.9)
	MCA	10 (65.6)	4 (13.3)	0	8 (13.3)	0	0	22 (11.7)
	basilar	4 (6.6)	5 (16.7)	0	3 (5)	1 (7.7)	0	13 (6.9)
	VA	1 (1.6)	0	0	0	0	0	1 (0.5)
Neck to dome size, mm		3.59 ± 1.25	4.11 ± 2.40	3.40 ± 1.11	4.33 ± 1.80	4.98 ± 1.92	3.40 ± 0.57	3.97 ± 1.73 / 0.0832
Width, mm		.76 ± 1.53	5.54 ± 2.74	4.22 ± 1.64	5.56 ± 2.25	5.98 ± 2.01	5.40 ± 0.85	5.15 ± 2.08 / 0.1537
Neck size, mm		3.40 ± 1.00	3.79 ± 1.51	3.02 ± 1.22	4.34 ± 1.34	4.95 ± 1.68	4.50 ± 0.00	3.82 ± 1.38 / 0.194
Maximal diameter (n, %)	<4mm	22 (36.1)	6 (20)	13 (50)	17 (28.3)	2 (15.4)	0	60 (31.9)
	4~7mm	33 (54.1)	19 (63.3)	9 (34.6)	26 (43.3)	7 (53.9)	2 (100)	96 (51.6)
	>7mm	6 (9.8)	5 (16.7)	4 (15.4)	13 (21.7)	4 (30.8)	0	32 (17.2)
No. of diffusion spot (n, %)	0	30 (49.2)	17 (56.7)	7 (26.9)	38 (63.3)	10 (76.9)	1 (50)	104 (55.3)
	1~5	24 (39.3)	10 (33.3)	16 (61.5)	15 (25)	3 (23.1)	1 (50)	68 (36.2)
	6~10	5 (8.2)	1 (3.3)	2 (7.7)	3 (5)	0	0	11 (5.9)
	<10	2 (3.3)	2 (6.7)	1 (3.8)	0	0	0	5 (2.7)
Regrowth (n, %)	Stable occlusion	58 (95.1)	28 (93.3)	25 (96.2)	44 (78.6)	10 (76.9)	2 (100)	167 (88.8)
	Minor recanalization	3 (4.9)	1 (3.3)	1 (3.9)	9 (16.1)	2 (15.4)	0	16 (8.5)
	Major recanalization	0	1 (3.3)	0	3 (5.4)	1 (7.7)	0	5 (2.7)
Major complication						1		

ICA: *Internal carotid artery,* ***ACA:*** *Anterior cerebral artery,* ***VA:*** *Vertebral artery,* ***MCA:*** *Middle cerebral artery.*

Table II: Analysis for the Association of Diffusion Restriction with Each Stent Type

Variable	Stent type						
	Atlas	LVIS jr.	LVIS blue	Enterprise	Solitaire	Neuroform EZ	p-value
No diffusion restriction	30	17	7	38	10	1	
Diffusion restriction	31	13	19	22	3	1	**0.0085***

Pairwise Test for Multiple Comparisons of Mean Rank Sums (Dunn'sTest)

Variable	Diff.Rank	Z-value	p-value
Atlas vs LVIS jr.	5.5792	0.5042	0.6141
Atlas vs LVIS blue	21.2733	1.8303	0.0672
Atlas vs Enterprise	19.3977	2.1121	**0.0347***
Atlas vs Solitaire	28.3997	1.8734	0.061
Atlas vs Neuroform EZ	5.2459	0.1471	0.883
LVIS jr. vs LVIS blue	26.8526	2.0195	**0.0434***
LVIS jr. vs Enterprise	13.8185	1.2307	0.2184
LVIS jr. vs Solitaire	22.8205	1.3849	0.1661
LVIS jr. vs Neuroform EZ	0.3333	0.0092	0.9927
LVIS blue vs Enterprise	40.671	3.4535	**0.0006***
LVIS blue vs Solitaire	49.6731	2.9468	**0.0032***
LVIS blue vs Neuroform EZ	26.5192	0.7283	0.4665
Enterprise vs Solitaire	9.0021	0.592	0.5557
Enterprise vs Neuroform EZ	14.1518	0.3963	0.699
Solitaire vs Neuroform EZ	23.1538	0.6143	0.539

p-value < .05 is significant.

cell size than the existing Neuroform EZ, which increases thrombogenicity (4,12). However, in this study, postprocedural infarction was limited to a few asymptomatic spots on diffusion-weighted images, except for a single case. Therefore, even if a specific stent exhibits greater thrombogenicity, it may not have significant clinical implications

We compared the efficacy of the stents based on disease recurrence. Pierot et al. demonstrated that aneurysm recanalization depends on several patient and aneurysm factors, such as current smoking, aneurysm status, aneurysm size, neck size, and aneurysm location (16). However, our study focused solely on unruptured aneurysms with complete occlusion according to Raymond Roy classification 1. Furthermore, due to the absence of smoking patients in Neuroform EZ stents group and the exclusion of non-saccular aneurysms (such as dissecting, infectious, and fusiform aneurysms), statistically significant results could not be obtained. Among the 188 included patients, there were no cases of middle cerebral artery aneurysm treatment in the stent groups, except in the Atlas, LVIS Jr., and Enterprise stent groups, preventing adjustment for location. Jeon et al. demonstrated significant differences between aneurysms with maximal diameters of < 7 and ≥ 7 mm that underwent complete occlusion according to Raymond Roy classification 1 (8). Therefore, we stratified patients based on maximal diameter (< 4, 4–6, or ≥ 7 mm). Major recanalization occurred in only three (1.6%) cases; therefore, we compared the combined rates of major and minor recanalization for each stent. The recanalization rate was significantly different between arteries with a maximal dimeter <4 mm and those with larger diameters (p=0.0498); however, this finding should be interpreted with caution due to the small size of the Solitaire stent group, which included only two cases of which one was of minor recanalization. Furthermore, the recanalization and stable occlusion rates differed significantly according to maximal aneurysm size (p=0.0278). Post-hoc pairwise multiple comparisons confirmed differences between the Enterprise and Atlas stents, and between the LVIS Jr. and LVIS Blue stents. Wire-braiding methods, such as LVIS, exhibited better compliance than laser-cutting methods of closed-cell stents, resulting in a higher metal coverage rate. Additionally, foreshortening is associated with higher pore density, which

Table III: Analysis for the Association of Recanalization for Each Stent Type

Variable			Stent type						
			Atlas	LVIS jr.	LVIS blue	Enteprise	Solitaire	Neuroform EZ	p-value
Maximal diameter	<4mm	Stable occlusion	22	6	12	14	1	0	
		Recanalization	0	0	1	3	1	0	**0.0498***
	4~7mm	Stable occlusion	30	18	9	22	6	2	
		Recanalization	3	1	0	4	1	0	0.7316
	>7mm	Stable occlusion	6	4	4	8	3	0	
		Recanalization	0	1	0	5	1	0	0.3027
Total		Stable occlusion	58	28	25	44	10	2	
		Recanalization	3	2	1	12	3	0	**0.0278***

**p-value < 0.05 is significant*

Pairwise Test for Multiple Comparisons of Mean Rank Sums (Dunn'sTest) in maximal diamter <4mm

Variable	Diff.Rank	Z-value	p-value
Atlas vs LVIS jr.	0	0	1
Atlas vs LVIS blue	2.2692	0.7753	0.4382
Atlas vs Enteprise	5.2059	1.9269	0.054
Atlas vs Solitaire	16	2.5894	**0.0096***
LVIS jr. vs LVIS blue	2.2692	0.5495	0.5826
LVIS jr. vs Enterprise	5.2059	1.3103	0.1901
LVIS jr. vs Solitaire	16	2.3422	**0.0192***
LVIS blue vs Enterprise	2.9367	0.9527	0.3408
LVIS blue vs Solitaire	13.7308	2.1607	**0.0307***
Enterprise vs Solitaire	10.7941	1.7258	0.844

**p-value < 0.05 is significant*

Pairwise Test for Multiple Comparisons of Mean Rank Sums (Dunn'sTest) in total size

Variable	Diff.Rank	Z-value	p-value
Atlas vs LVIS jr.	1.95	0.2942	0.7686
Atlas vs LVIS blue	0.9808	0.1409	0.888
Atlas vs Enteprise	15.6696	2.8482	**0.0044***
Atlas vs Solitaire	17.4231	1.9187	0.055
Atlas vs Neuroform EZ	4.5000	0.2107	0.8332
LVIS jr. vs LVIS blue	2.9308	0.3679	0.7129
LVIS jr. vs Enterprise	13.7196	2.0399	**0.0414***
LVIS jr. vs Solitaire	15.4731	1.5676	0.117
LVIS jr. vs Neuroform EZ	6.4500	0.2971	0.7664
LVIS blue vs Enterprise	16.6504	2.3602	**0.0183***
LVIS blue vs Solitaire	18.4038	1.8226	0.0684
LVIS blue vs Neuroform EZ	3.5192	0.1613	0.8718
Enterprise vs Solitaire	1.7534	0.1916	0.881
Enterprise vs Neuroform EZ	20.1696	0.9429	0.3458
Solitaire vs Neuroform EZ	21.9231	0.9709	0.3316

**p-value <0.05 is significant*

promotes blood flow and neointima formation, thereby reducing the recurrence rate. Furthermore, the relatively recently introduced Atlas stent showed a higher metal coverage rate than the Enterprise stent, indicating less stable occlusion with smaller cells.

This study compared postprocedural infarction and recanalization rates among six stents commonly used for SAC. Despite the minor risks of clinically significant infarction and major recanalization, SAC is a useful treatment for cerebral aneurysms and there are several differences among stent types. Therefore, the choice of stent should be individualized according to the patient's medical history and condition, rather than on the basis of aneurysm profile or surgeon preference.

This study had several limitations. First, it was a retrospective observational study; therefore, the results may have been affected by various biases, such as recall and observer biases, due to the self-reported nature of the data. Second, only 188 patients were included in the analysis, which made it more difficult to detect significant differences. In particular, the Neuroform EZ stents were only selected for two cases, respectively, leading to low statistical power. Third, due to the small sample size, we could not perform comparative analyses according to aneurysm location, which is a potential confounding variable. A larger sample size is required in future studies to allow for comprehensive comparisons. Fourth, postoperative magnetic resonance angiography or transfemoral catheter angiography was performed at ≥ 6 months following enrollment. Given that previous studies have evaluated outcomes for only 3 years following recanalization, studies with longer follow-up durations are needed (24).

CONCLUSION

We compared six commonly used stents for SAC of cerebral aneurysms and found significant differences in postprocedural infarction and aneurysm recanalization. Despite the study limitations, wire-braiding methods (e.g., LVIS) have the potential for higher compliance rates and lower recurrence rates. However, caution is needed when interpreting our findings due to the retrospective study design, small sample size, and potential biases associated with the institutional stent preference. Further studies with longer follow-up durations and larger sample sizes are needed to confirm the efficacy and safety of different stents. Given that stent type affects postprocedural outcomes, clinicians should carefully consider patient characteristics when selecting a stent for SAC. Further studies with large sample sizes and longer follow-up periods are needed to enhance our understanding of the comparative effectiveness of the various stents used in clinical practice.

Declarations

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Availability of data and materials: The datasets generated and/or analyzed during the current study are available from the corresponding author by reasonable request.

Disclosure: The authors declare no competing interests.

AUTHORSHIP CONTRIBUTION

Study conception and design: JHP, SMY
Data collection: JHP, JJS, HJO, JMA, KK
Analysis and interpretation of results: KK, JHP
Draft manuscript preparation: KK, JHP
Critical revision of the article: KK, GYY, SMY, JHP
Other (study supervision, fundings, materials, etc...): JHP, SMY
All authors (KK, JHP, GYY, JMA, HJO, JJS, SMY) reviewed the results and approved the final version of the manuscript.

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