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Technical Note

Initial Clinical Experience of Using a Newly Designed Preshaped Microguidewire in Acute Endovascular Thrombectomy

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Abstract

Mechanical thrombectomy has been widely used for the treatment of acute ischemic stroke. During this procedure, operators must navigate the microcatheter with a microguidewire (MGW) into vessels that cannot be visualized on fluoroscopy as rapidly as possible. In this study, we developed a modified pigtail-shaped MGW (MPMGW) for security and controllability. Moreover, the efficacy of the MPMGW for the treatment of acute ischemic stroke was assessed. The MPMGW was designed using 0.014 MGW. Because we created four MPMGWs during a clinical evaluation before the launch in the market, these wires were used in four consecutive patients with acute ischemic stroke in the single institution. The occluded arteries were the basilar artery (n = 1), middle cerebral arteries (M1 and M2, n = 2), and internal carotid artery (n = 1). All four procedures were conducted without any complications. The procedures included navigating the MGW and passing it through the clot. Complete recanalization was achieved in all cases. The average time between femoral artery puncture and recanalization was 15 min. The use of the preshaped MPMGW in acute thrombectomy was effective in terms of both security of procedure and reduction in recanalization time.

Keywords: *Acute ischemic stroke, endovascular treatment, microguidewire, modified pigtail-shaped, preshape, thrombectomy*

Introduction

Rapid recanalization is the most effective treatment for acute ischemic stroke due to major cerebral artery occlusion.[1] Recently, endovascular technologies and techniques for acute ischemic stroke have continuously evolved. However, endovascular stent clot retrieval is still challenging to perform and has risks, particularly for beginners, because operators must navigate the microcatheter with a microguidewire (MGW) into far distal vessels that cannot be visualized on fluoroscopy as rapidly as possible. Some authors have reported the use of a modified pigtail-shaped MGW (MPMGW) for various endovascular treatments.[2-6] Although the MPMGW is effective for acute thrombectomy, the manual quick shaping of this wire requires some skills. The common measurement of the round tip is >3.0 mm. Therefore, we designed a preshaped MPMGW with a round tip measuring 2.5 mm. Herein, we report the initial clinical experience using preshaped MPMGW for the treatment of acute ischemic stroke.

Materials and Methods

Microguidewire

A preshaped MPMGW was designed using a 0.014 MGW (Eiger 0.014; Medical Innovation Co., Ltd., Tokyo, Japan) [Figure 1]. The tip was bent round, with a diameter of 2.5 mm, and a portion with a length of 2.0 mm was kept straight. At the 10.0 mm proximal side of the tip, the wire was bent at 135°. The round tip was designed to prevent vessel injury. The 2.0-mm straight portion facilitated the easy insertion of the wire into the microcatheter. The bent tip allowed operators to select branches with torque. The MGW was packed with an introducer sheath beforehand, as navigation into the microcatheter was quickly performed. Because we created four preshaped MPMGWs during a clinical evaluation before launching in the market, these wires were used in four consecutive patients with acute ischemic stroke in a single institution.

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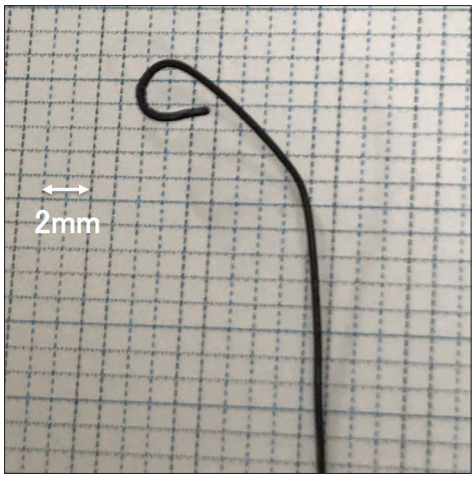

Figure 1: Image of the preshaped modified pigtail-shaped microguidewire

Endovascular procedure

The ASAP technique[7] is commonly used for the anterior circulation, and the simple stent retrieving is used for the posterior circulation. The guiding catheter, aspirator, microcatheter, and stent retriever were selected based on the operator's preference. The preshaped MPMGW was used in all procedures.

Results

A summary of the clinical data, devices used, and clinical outcomes are shown in Tables 1-3, respectively. The occluded arteries were the basilar artery (n = 1), middle cerebral arteries (M1 and M2, n = 2), and internal carotid artery (n = 1). The guiding catheters used were 6-Fr Envoy (90 cm; Codman, Raynham, MA, USA) for posterior circulation and 9-Fr Optimo (Tokai Medical Products, Aichi, Japan) for anterior circulation. Penumbra ACE 68 (Penumbra, Alameda, CA, USA) was used as an aspirator. Moreover, Rebar 18 and Marksman microcatheters (Medtronic, Minneapolis, MN, USA) were used. Revive (Codman) and Solitaire (Medtronic) stent devices were used as clot retrievers. The operative images of representative patients are shown in Figures 2 and 3.

All four procedures have been conducted without any complications, and the procedures involved navigating the MPMGW and passing it through the clot. Complete recanalization was achieved in all cases. The average time between femoral artery puncture and recanalization was 15 min.

Discussion

Some authors have previously reported that the use of an MPMGW is an extremely safe and versatile method for neuroendovascular procedures.[2-6] The round tip of the wire prevents unintentional entry into the perforating branches or blebs of an aneurysm and reduces the risks of perforation if it enters them erroneously. Moreover, MPMGW is useful

Table 1: Summary of clinical data

	Age/ Sex	Location	02A (min)	NIHSS	ASPTECTS	Af
Case 1	87/M	BA	120	34	6	+
Case 2	75/M	M2	100	20	9	+
Case 3	42/F	M1	30	16	7	-
Case 4	70/M	ICA	330	28	5	+

BA – Basilar artery; M – Middle cerebral artery; ICA – Internal carotid artery; O2A – Onset to arrival time; NIHSS – National Institutes of Health Stroke Scale; CT – Computed tomography; ASPECTS – Alberta Stroke Program Early CT score

Table 2: Summary of applicated devices

	GC	Aspirator	MC	MGW	stent
Case 1	6F Envoy	-	Reabar 18	Eiger 14	Revive 4.5*22
Case 2	9F Optimo	ACE 68	Rebar 18	Eiger 14	Solitaire 4*40
Case 3	9F Optimo	ACE 68	Marksman	Eiger 14	Solitaire 4*40
Case 4	9F Optimo	ACE 68	Marksman	Eiger 14	Solitaire 6*40

GC – Guiding catheter; MC – Microcatheter; MGW – Microguidewire

Table 3: Summary of clinical outcomes

	tPA	Number of pass	TICI	P2R (min)	mRS 30
Case 1	-	1	3	14	5
Case 2	+	2	3	22	1
Case 3	-	1	3	10	0
Case 4	+	1	3	15	3

TICI – Thrombolysis in cerebral infarction scale; P2R – Puncture to recanalization time

in acute thrombectomy. When a stent retriever is used, the MGW must pass through the occluded vessel, which is not observed during angiography. The MPMGW can be safely advanced across a lesion even if an unseen aneurysm is in the distal vessel. The wire also provides better vessel selectivity with torque. When a guide catheter cannot be advanced up to the common carotid artery, the MPMGW allows selection into the internal carotid artery and navigation into intracranial small arteries with the same tip shape. Moreover, this type of MGW facilitates better microcatheter trackability, because it acts as an anchor in the distal vessels compared to a conventional right-angled shape MGW.

Before we developed the preshaped MPMGW, we manually used Chikai 14 MGW (Asahi Intecc Co., Ltd., Aichi, Japan). Beginners often take a few minutes to shape the wire. Furthermore, making the small round tip is quite challenging for beginners and even experts. Therefore, the preshaped MPMGW was designed to facilitate a rapid procedure and recanalization.

In this case series, the MGW can be smoothly inserted into the microcatheter and navigated up to around the M2–M3 junction. The small round tip can always be navigated at the occluded area without any manipulations

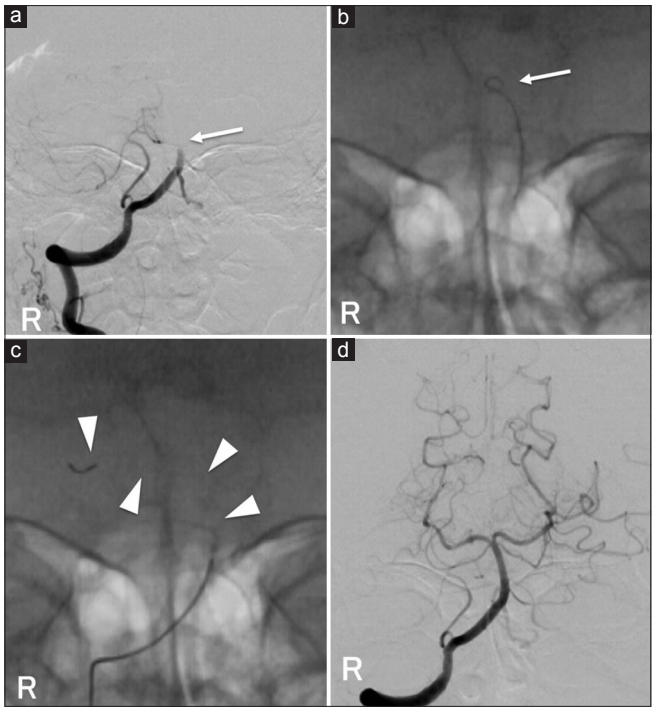

Figure 2: Images of case 1. R indicates the right side. (a) Right vertebral angiographic image showing basilar trunk occlusion (arrow). (b) Tip of the preshaped microguidewire (arrow). (c) The stent retriever is deployed (arrowheads). (d) Complete recanalization has been achieved

Figure 3: Images of case 4. R indicates the right side. *P* indicates the posterior side. (a) Anterior to posterior view. Right carotid angiographic image showing internal carotid artery occlusion (arrow). (b) Lateral view. Right carotid angiographic image showing internal carotid artery occlusion just distal to the ophthalmic artery (arrow). (c) The tip of the preshaped microguidewire (arrow). (d) Complete recanalization has been achieved

and negotiations. Moreover, it never migrated into the branching and perforating arteries.

In cases no. 1 and no. 4, the tip of the MGW appeared bent during penetration of the clots, which were found relative hard. As previously reported,[3] the configuration of the MGW provides information about the quality of the clot during penetration. The preshaped MPMGW was harder, and it can penetrate hard clots more smoothly than the Chikai 14 MGW without dislocation of clots distally. Since both patients presented with hard clots, the corkscrew penetrating method was used.[4]

The present study had some limitations. That is, a small sample was included, the same operator conducted all of the procedures, and the study was performed in a single institution. Moreover, the time between puncture and recanalization in our study was shorter than that of previous studies.[8] Thus, the recanalization rate and clinical outcomes in this study were good and comparable to those in large-scale studies, but we lacked sufficient statistical power to determine whether the MPMGW has an effect on outcomes. Despite these limitations, we believe that the results of this study can significantly contribute to the currently available clinical information about rapid recanalization in acute thrombectomy. However, large-scale, multicenter trials must be conducted to validate the results of the current study.

The use of the preshaped MPMGW in acute thrombectomy was effective in terms of both security of procedure and reduction in recanalization time.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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