Case Report

Tumor Embolization Using a Small-Bore Guide via the Distal Radial Artery Approach: Report of Five Consecutive Cases

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Objective: Cardiologists use the distal radial artery (dRA) approach in daily clinical practice. This method is gradually being applied in neuroendovascular treatment. However, limited studies have been reported concerning tumor embolization using small-bore guidance via dRA.

Case Presentation: Five consecutive tumoral cases underwent endovascular embolization via the dRA approach. The right dRA was punctured, with manual confirmation of pulsation or under the guidance of ultrasonography, using a 22-G plastic cannulation needle. After the insertion of a 0.021-inch guidewire, a dilator of a 4-Fr sheath enlarged the puncture site. The 22-G plastic cannulation needle was replaced with an 18-G cannulation needle, and a 0.035 guidewire was inserted to introduce a small-bore guide. A TEMPO4 (Cordis, Miami Lakes, FL, USA; outer diameter: 1.35 mm) or a 3.6-Fr JB2 (Gadelius Medical, Tokyo, Japan; outer diameter: 1.2 mm) was used in 4 cases to convey embolization materials, whereas a 4-Fr, 16-cm sheath (Terumo, Tokyo, Japan; outer diameter: 2 mm) combined with a 4-Fr SY3 (Gadelius Medical; outer diameter: 1.4 mm) was used in 1 case. Trisacryl gelatin microspheres or *n*-butyl-2-cyanoacrylate were used as embolization materials. Hemostasis was achieved with PreludeSYNC DISTAL (Merit Medical, South Jordan, UT, USA), and the median time ± standard deviation of hemostasis was 2.00 ± 0.77 h. No complications occurred after embolization.

Conclusion: Tumor embolization using small-bore guide via the dRA approach was completed without any complications.

Keywords distal radial artery approach, neuroendovascular treatment, tumoral embolization, small-bore guiding catheter

Introduction

Preoperative endovascular tumor embolization of feeding arteries has demonstrated effective reduction in intraoperative bleeding and perioperative risks.[1)] This endovascular therapy is typically performed via the femoral arteries. However, with the advancement of endovascular devices, as well as considerations of postoperative patient comfort, alternative arterial approaches have been applied in routine practice in recent years, among which the distal radial artery (dRA) approach is notable.[2–4)]

The dRA approach was initially developed and implemented for application in the cardiovascular field.[5–8)] However, with time, this method has been gradually introduced in the neuroendovascular field.[9)] In this procedure, the use of a guide with a smaller outer diameter is recommended to minimize the risk of dRA occlusion.[10)] To date, to the best of our knowledge, there have been no reports of tumor embolization via dRA using a guiding catheter with an outer diameter of 1.4 mm or less. In this study, we present 5 consecutive tumoral cases successfully managed with endovascular tumor embolization using a small-bore guide via the dRA approach.

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Case Presentation (Table 1, Figs. 1 and 2)

Case 1: 78-year-old male

A right temporal meningioma, incidentally identified following head trauma, exhibited gradual growth over 2 years (**Fig. 1A**). Since there was also perifocal edema, surgical removal of the tumor was planned. Endovascular embolization was performed, and the tumor was removed the day after embolization. The postoperative course was uneventful.

Case 2: 85-year-old female

A right posterior meningioma was incidentally diagnosed upon admission of the patient for cerebral infarction. As the meningioma increased in size and compressed the perifocal brain (**Fig. 1B**), the patient declined craniotomy. As an alternative, the feeding artery was embolized, expecting tumor shrinkage. The postoperative course was uneventful.

Case 3: 72-year-old female

The patient underwent an operation for thyroid carcinoma. Two years after surgery, the thyroglobulin level increased, and CT, MRI (**Fig. 1C**), and positron emission tomography revealed right parietal bone metastasis. Preoperative tumor embolization was performed to remove the lesion. The tumor was removed the day after embolization. The postoperative course was uneventful.

Case 4: 68-year-old female

The patient was monitored in our outpatient neurosurgery clinic after an episode of multiple cerebral emboli resulting from a left atrial myxoma. Routine follow-up MRI revealed an increasing frontal meningioma (**Fig. 1D**). As the tumor size exceeded 20 mm, we proposed surgical removal of the growing tumor. Preoperative tumor embolization was performed. The tumor was removed the day after embolization. The postoperative course was uneventful.

Case 5: 57-year-old female (Fig. 2)

The patient underwent MRI because of complaints of sensory disturbance in the right lower extremity. A right parasagittal meningioma was incidentally identified. MRI T1-Gd images (**Fig. 2A** and **2B**) showed a maximum diameter of 27 mm and possible invasion of the superior sagittal sinus. In addition, there were cortical veins compressed anteriorly and posteriorly, and surgery was suggested in anticipation of possible future venous occlusion. Preoperative tumor embolization was performed (**Fig. 2C**–**2F**). The tumor was removed the day after embolization. The postoperative course was uneventful.

Endovascular surgery

The location of the dRA was confirmed using ultrasonography. The dRA approach was performed when the internal diameter was 2 mm or greater. Under local anesthesia, the dRA was punctured with a 22-G plastic cannulation needle. Following the puncture, a 0.021-inch guidewire was introduced, and a dilator of a 4-Fr sheath was inserted along the guidewire to enlarge the puncture site. Subsequently, the 22-G plastic cannulation needle was replaced with an 18-G size, and a 0.035-inch, 180-cm, shapeable-tip guidewire was inserted to introduce a small-bore guide. Either a TEMPO4 (Cordis, Miami Lakes, FL, USA; outer diameter: 1.35 mm) or a 3.6-Fr JB2 (Gadelius Medical, Tokyo, Japan; outer diameter: 1.2 mm) was introduced into the external carotid artery. In only 1 case (Case 4), the sheathless procedure was not successfully accomplished. In this unsuccessful case, a 4-Fr, 16-cm sheath (Terumo, Tokyo, Japan; outer diameter: 2 mm) combined with a 4-Fr SY3 (Gadelius Medical; outer diameter: 1.4 mm) was used instead. Subsequently, a TENROU S (KANEKA MEDIX, Osaka, Japan) combined with a microcatheter (Excelsior SL-10 [Stryker, Kalamazoo, MI, USA], DeFrictor Nano [Medico's Hirata, Osaka, Japan], or DeFrictor BULL [Medico's Hirata]) was used to approach the targeted artery, at which point arterial embolization was performed. As embolization agents, *n*-butyl-2-cyanoacrylate with lipiodol and 2-fold diluted trisacryl gelatin microspheres (Embosphere 100-300; Nippon Kayaku, Tokyo, Japan) were applied in 1 and 4 cases, respectively. Microcoil embolization was performed simultaneously when necessary. Following the injection of embolization agents, the tumor staining decreased or disappeared (**Figs. 1I**–**1L** and **2F**). All devices were manually retrieved, and PreludeSYNC DISTAL (Merit Medical, South Jordan, UT, USA) was used to achieve hemostasis. The median hemostatic time was approximately 2 h (minimum–maximum time: 1.5–3.5 h). No postoperative complications were observed.

Discussion

Five consecutive cases of intracranial tumors, which were embolized using small-bore guide via the dRA approach, were described. The tumors were successfully embolized.

Table 1 Summary of 5 cases of preoperative middle meningeal artery embolization via the dRA approach

Case Age (y), sex	Tumoral location	Targeted artery	Guiding system (OD) Microcatheter Microguidewire	Embolization material	Procedure time (h)	Compilations	Hemostasis
1 78, m	Rt, temporal	MMA (petrosquamous branch)	TEMPO4 (1.35 mm) Excelsior SL-10 TENROU S 1014	Two-fold diluted trisacryl gelatin microspheres 100–300 (0.9 mL) (Embosphere)	1 h 7 m	None	Prelude-SYNC DISTAL (air: 6 mL)
2 85, f	Rt, temporal	MMA (posterior convexity branch)	TEMPO4 (1.35 mm) DeFrictor Nano, DeFrictor BULL TENROU S 10	14.3% NBCA/lipiodol i-ED COIL Complex SilkySoft 1 mm × 2 cm	1 h 53 m	None	Prelude-SYNC DISTAL (air: 8 mL)
3 72, f	Rt, parietal	MMA (frontal branch)	TEMPO4 (1.35 mm) DeFrictor BULL TENROU S 10	Two-fold diluted trisacryl gelatin microspheres 100–300 (10 mL) (Embosphere) ED COIL ExtraSoft 2 mm × 6 cm	2 h 20 m	None	Prelude-SYNC DISTAL (air: 8 mL)
4 68, f	Rt, frontal	MMA (frontal branch)	4-Fr, 16-cm sheath (2 mm) + 4-Fr SY3 (1.4 mm) DeFrictor BULL TENROU S 10	Two-fold diluted trisacryl gelatin microspheres 100–300 (1 mL) (Embosphere)	1 h 54 m	None	Prelude-SYNC DISTAL (air: 8 mL)
5 57, f	Rt, parietal	MMA (posterior convexity branch)	3.6-Fr JB2 (1.2 mm) Excelsior SL-10 TENROU S 1014	Two-fold diluted trisacryl gelatin microspheres 100–300 (1 mL) (Embosphere)	1 h 16 m	None	Prelude-SYNC DISTAL (air: 8 mL)

4-Fr, 16-cm sheath, Terumo, Tokyo, Japan; DeFrictor BULL, Medico's Hirata, Osaka, Japan; DeFrictor Nano, Medico's Hirata; dRA, distal radial artery; ED COIL ExtraSoft, KANEKA MEDIX, Osaka, Japan; Embosphere, Nippon Kayaku, Tokyo, Japan; Excelsior SL-10, Stryker, Kalamazoo, MI, USA; f, female; i-ED COIL Complex SilkySoft, KANEKA MEDIX; JB2, Gadelius Medical, Tokyo, Japan; m, male; MMA, middle meningeal artery; NBCA, *n*-butyl-2-cyanoacrylate; OD, outer diameter; PreludeSYNC DISTAL, Merit Medical, South Jordan, UT, USA; Rt, right; SY3, Gadelius Medical; TEMPO4, Cordis, Miami Lakes, FL, USA; TENROU S, KANEKA MEDIX; y, years old

No complications related to endovascular therapy occurred postoperatively.

When the dRA approach was selected, the dRA located in the anatomical snuffbox (shaped by the margins of the extensor pollicis brevis, extensor pollicis longus, and extensor retinaculum) or that located near to the trapezium is usually punctured.[11] As the use of this approach was applied in percutaneous coronary intervention, it has extended into the field of cardiovascular medicine owing to its safety and effectiveness.[4,11] After the establishment of safe and effective evidence of the dRA approach in the field of neuroendovascular medicine, [9] this approach was applied in several procedures, including diagnostic digital cerebral angiography, aneurysmal embolization, arteriovenous malformation occlusion, carotid artery stenting, dural arteriovenous fistula occlusion, intracranial stenting, mechanical thrombectomy, and thrombolysis.[2–4] However, the application of the dRA approach to tumor embolization remains relatively infrequent.[3] In addition, no study has focused on the application of the dRA approach only for tumor embolization.

Tumor embolization should be performed with minimal complications, as it serves as an adjunct or a safer alternative to tumor resection. In the conventional radial approach, the use of a larger guide may increase the risk of access site-related complications.[12,13] In contrast, the dRA approach is associated with a significantly lower risk of proximal radial artery occlusion, access site hematoma, and bleeding.[14,15] Additionally, using a sheath with a smaller outer diameter can help reduce the incidence of early dRA occlusion in the dRA approach.[10] To further minimize access-related complications, especially when compared to the conventional radial approach, the dRA approach should be preferred, along with the use of a guide with the smallest possible outer diameter. However, intraprocedural angiography using a small-bore guide is not possible because the inner

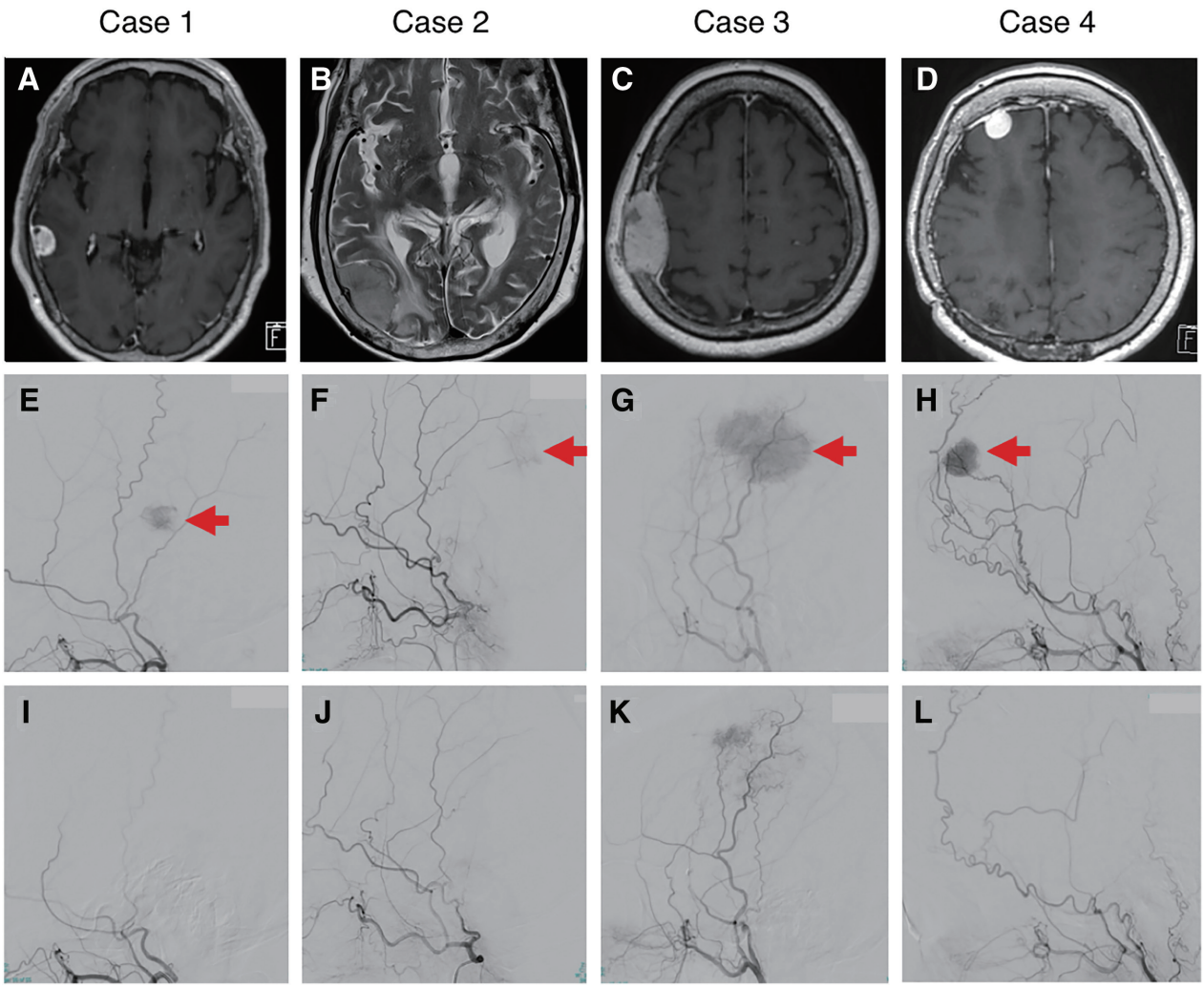

Fig. 1 MRI scans (**A**, T1-Gd; **B**, T2; **C** and **D**, T1-Gd) showing intracranial tumors in Cases 1 to 4. Angiographic images during tumor embolization via the dRA approach are shown in **E**–**L**. Tumor staining before embolization (red arrows in **E**–**H**) decreased or disappeared after embolization (**I**–**L**). dRA, distal radial artery

lumen is occupied by the microcatheter. Therefore, caution is required during embolization, as real-time angiographic assessment may be limited.

To date, there have been no reports of tumor embolization via dRA using a guiding catheter with an outer diameter of 1.4 mm or less. Rodriguez Caamaño et al. performed 2 external carotid artery embolizations, 1 of which was tumor embolization. However, their report does not appear to mention intraprocedural devices.[16] Umekawa et al. performed tumor embolization using the dRA approach for 3 cases.[3] Although they also used a 4-Fr guiding system during the procedure, a 4-Fr FUBUKI Dilator Kit (Asahi Intecc, Aichi, Japan) with an outer diameter of 2.09 mm was used in their study. Fuga et al. performed tumor embolization using the dRA approach for 4 cases.[17] They used a 3-Fr guiding sheath (Axcelguide; Medikit, Tokyo, Japan), with an outer diameter of 1.76 mm. In the present study, tumor embolization via the dRA approach was completed using a 4-Fr TEMPO (Cordis) with an outer diameter of 1.35 mm or a 3.6-Fr JB2 (Gadelius Medical) with an outer diameter of 1.2 mm in a sheathless procedure in 4 cases. In fact, this strategy of using a small-bore guide could contribute to reducing potential perioperative complications at the puncture site.

This procedure may not always be successful because catheter navigation may be difficult due to left-sided lesions, vascular tortuosity, and spasm. In Case 4, the sheathless procedure was not achieved, so a 4-Fr, 16-cm sheath (Terumo; outer diameter: 2 mm) combined with a 4-Fr SY3 (Gadelius Medical; outer diameter: 1.4 mm) was used instead. In such

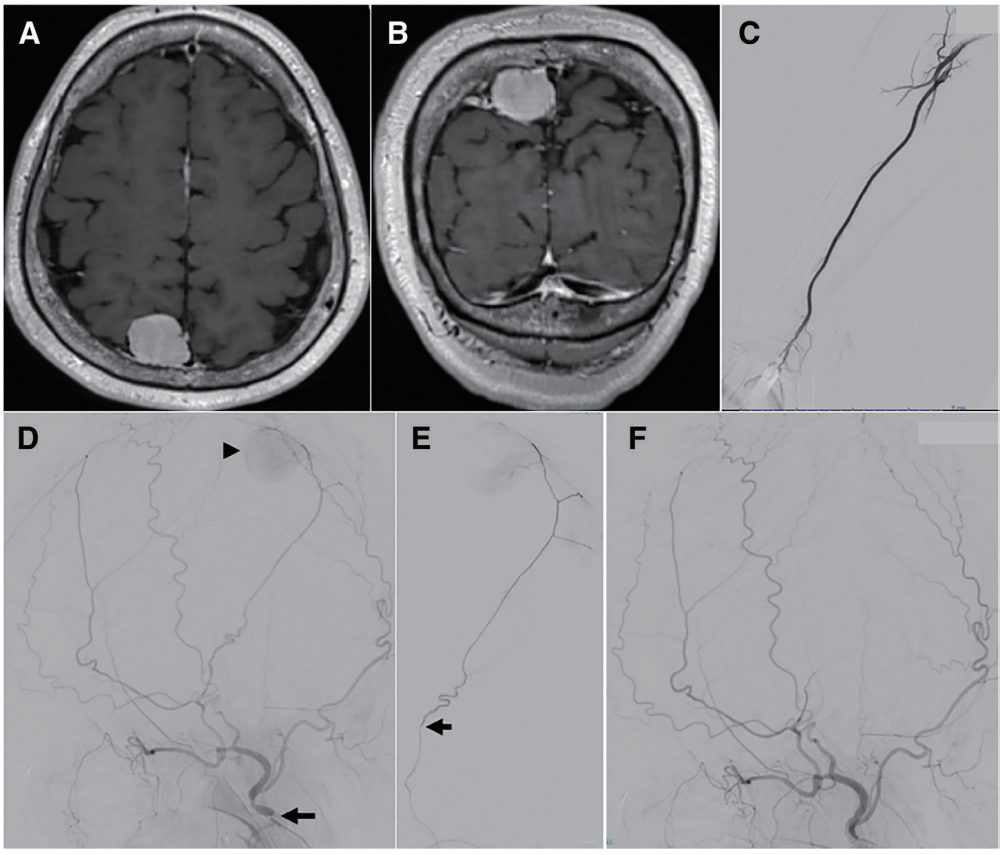

Fig. 2 (**A** and **B**) MRI T1-Gd images in Case 5 (**A**, axial; **B**, coronal) showing an enhancing lesion with a maximum diameter of 27 mm located adjacent to the superior sagittal sinus. (**C**) Right dRA puncture. (**D**) Right ECAG, lateral view, showing tumor staining (arrowhead) from the left MMA parietal convexity branch. The arrow indicates the position of the tip of the 3.6-Fr JB2 catheter. (**E**) Selective angiography of the left MMA parietal convexity branch. The arrow indicates the position of the tip of the Excelsior SL-10 catheter. (**F**) Right ECAG after embolization, lateral view, showing disappearance of the tumor staining. dRA, distal radial artery; ECAG, external carotid angiography; Excelsior SL-10, Stryker, Kalamazoo, MI, USA; JB2, Gadelius Medical, Tokyo, Japan; MMA, middle meningeal artery

instances, the use of a Simmons-shaped guide, either alone or in combination with a sheath, and an approach via the left radial or femoral artery should be considered.

Conclusion

Tumor embolization via the dRA using a small-bore guide was completed without any complications.

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Disclosure Statement

The authors declare that they have no conflicts of interest.

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