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Case Report

Coil embolization of renal artery aneurysms: Simultaneous delivery of three microdevices with a novel 6-Fr guiding sheath

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ABSTRACT

Here, we report the case of a 59-year-old male patient who underwent transcatheter embolization of bilateral renal artery aneurysms, using 2 microballoons and 1 microcatheter, all carried within a single guiding sheath. During coil embolization in a visceral artery, there are situations that can require multiple microdevices. We developed a new 6-Fr Shephard-hook type guiding sheath (Parent Plus 60) with a lumen large enough to deliver three microdevices simultaneously. This technique can be used broadly in different clinical scenarios, and it may provide novel treatment strategies to clinicians in the future.

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Introduction

Conventional techniques of coil embolization can be technically difficult when aneurysms show complex features, particularly when aneurysms are wide necked, or when the dome-to-neck ratio is unfavorable. The use of modified techniques such as the balloon neck-plasty or dual microcatheter technique is reported to provide safe, controlled embolization in such cases [1,2].

When the aneurysm features are even more complex or require protection of multiple branches, there are clinical situa-

tions when multiple microdevices have to be simultaneously delivered to carry out a combination of modified techniques [3]. In these cases, a large lumen guiding catheter or multiple guiding systems are useful.

Several publications from neurovascular lesions have reported the usefulness of a large lumen guiding sheath for accommodating multiple microdevices [4–7]. On the other hand, the use of a large lumen guiding sheath is limited in visceral arterial lesions.

To deal with such situations, we developed a 6-Fr Shepherd hook-type guiding sheath (Parent Plus 60: Shepherd hook type) in collaboration with Medikit Co., Ltd. (Tokyo, Japan). The

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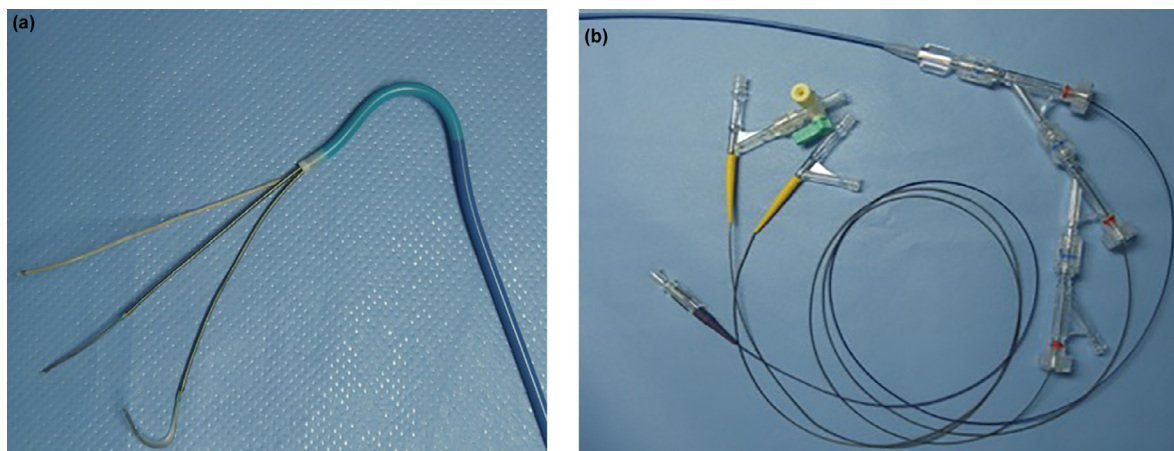


Fig. 1 – (a) Two microballoon catheters (Scepter C, MicroVention Terumo, Tustin, CA) and one microcatheter (Excelsior SL-10, Stryker, Kalamazoo, MI, USA) are deliverable from Parent Plus 60. (b) Total of three insertion valves were prepared by connecting a Y-type connector to the lateral hole of another, enabling the simultaneous manipulation of three microdevices.

shepherd hook-type design matches the shape of most abdominal aortic branches and provides strong support during the procedure. The large lumen (0.088 inches) of this catheter enables simultaneous transport of up to three microdevices (Fig. 1).

Here, we describe a case of bilateral renal aneurysm coil embolization treated with 3 microdevices delivered via a single guiding sheath. To our knowledge, this is the first report of a visceral aneurysm coil embolization completed with three simultaneously delivered microdevices from a single access route.

Case Presentation

A 59-year-old male with no pertinent medical history was referred to our institute for a bilateral renal artery aneurysm that was diagnosed at an annual medical checkup.

Contrast-enhanced computed tomography revealed a 21 mm aneurysm on the right renal artery and a 20 mm on the left renal artery. The aneurysms were wide-necked and had slight calcification. Both aneurysms were found at the bifurcation of the renal artery, with 2 outflow branches, each feeding a wide range of renal parenchyma (Fig. 2).

Initial transcatheter arterial embolization was planned for the right renal artery aneurysm (Fig. 3). Neck-plasty of the 2 branches was considered necessary to maintain the distal blood flow.

The right femoral artery was punctured under local anesthesia, and Parent Plus 60 was inserted over the wire. Systemic heparinization was started with a 3000 IU loading dose and was maintained with a 1000 IU dose on an hourly basis. After inverting the tip, the guiding sheath was placed within the right renal artery trunk. Three Y-connectors were connected to Parent Plus 60, as shown in Fig. 1b. The Parent Plus 60 was continuously perfused with heparinized saline through the lateral hole of the proximal Y-type connector; 2 microballoon catheters (Scepter C 4 × 15 mm, MicroVen-

tion Terumo, Tustin, CA) for neck-plasty and 1 microcatheter (Excelsior SL-10, Stryker, Kalamazoo, MI, USA) for delivering coils were inserted through each of the hubs. The microcatheter was advanced to the aneurysm sac, and the microballoon catheters were advanced to an adequate position covering each of the branches and were carefully inflated under fluoroscopy. Coil packing was performed under neck-plasty with 8 detachable coils, including MICRUSFRAME S (Johnson & Johnson, Tokyo, Japan) and DELTAFILL (Johnson & Johnson, Tokyo, Japan). Postprocedural digital subtraction angiography showed embolization of the aneurysm, and the protected branches remained patent. In addition, the contrast effect of the renal parenchyma was well maintained.

The second session was subsequently performed on the left renal artery aneurysm (Fig. 4). Parent Plus 60 was inserted through the right femoral artery and positioned within the left renal artery. Two microballoon catheters (Scepter C 4 × 15 mm) and 1 microcatheter (Excelsior SL-10) were delivered through the Parent Plus 60 over the wire. The microcatheter was placed inside the aneurysm sac, and the 2 microballoon catheters were inflated at an adequate position. A total of 9 detachable coils, including MICRUSFRAME S and DELTAFILL, were placed under double balloon assistance. Dense packing was confirmed using fluoroscopy. Angiography showed embolization of the aneurysm, and contrast enhancement of the renal parenchyma was well maintained.

The 3-month follow-up contrast-enhanced computed tomography showed persistence of the bilateral aneurysm occlusion, and the branches of the aneurysms remained patent.

Discussion

Improvements in sophistication of procedural techniques and advancements in treatment devices have widened the indications for endovascular coiling of aneurysms.

The double microcatheter technique, pioneered by Baxter et al., is based on the concept of securely bracing coils be-

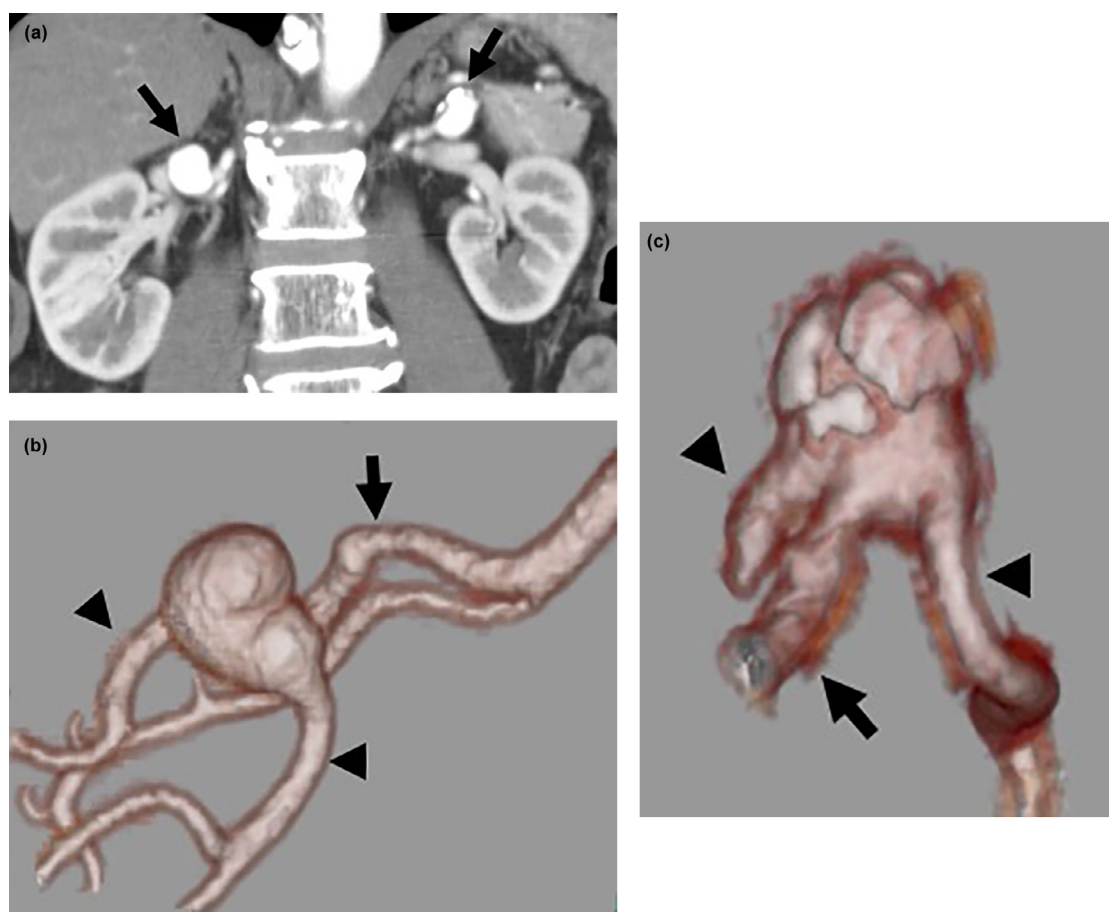


Fig. 2 – (a) An abdominal contrast enhanced computed tomography (CT) demonstrates bilateral renal artery aneurysms (arrow). (b) 3D CT angiography shows the right renal artery aneurysm located at the bifurcation of the main renal artery (arrow) and consisted of two branches (arrowhead). (c) The left renal artery aneurysm was also found at the bifurcation of main renal artery (arrow) and consisted of two branches (arrowhead).

side one another to achieve a stable configuration inside the aneurysm [2]. The balloon remodeling technique, or balloon-assisted coiling, involves temporary inflation of a balloon catheter in front of the neck of the aneurysm during each coil placement [1].

Such advanced techniques require multiple microcatheters to be delivered to the lesion at one time; thus, large lumen guiding catheters or multiple guiding catheters are necessary. Placing two guiding catheters on a parent target artery may induce embolic complications related to the disturbance of the arterial flow. Moreover, as the number of puncture sites increases, risk of complications also increases [6].

Several publications in cases of neurovascular lesions have reported the efficacy of a large lumen guiding sheath for sending multiple microdevices to the target. Luzardo et al. reported that the Envoy 6-Fr guiding catheter (Codman, Raynham, MA, USA) can simultaneously accommodate both the microcatheter and the balloon microcatheter for balloon-assisted coiling [4].

Kai et al. developed and introduced the 6-Fr guiding catheter, the Slim Guide, as a device for manipulating mul-

multiple microdevice techniques [6,7]. They reported 30 cases of intracranial aneurysm treated by either the double microcatheter technique or the balloon-assisted technique via a single access route.

In contrast, the use of large lumen catheters for visceral aneurysm embolization is limited. Greben et al. was the first to report a series of embolization of visceral vascular lesions treated with multiple microcatheter techniques through a single vascular access [8]. In their series, a 6-Fr guiding catheter (Envoy Guiding catheter, Cordis) was introduced through a 6-Fr vascular sheath. Lee et al. reported a series of visceral aneurysms treated with a double microcatheter technique from a single 8-Fr guiding sheath (8 F Flex- or Ansel Guiding sheath) [9]. Lee et al. reported that a double-angle-shaped Ansel Guiding sheath is a potential option for treating visceral and renal vascular lesions, but the shepherd hook-type form is superior in terms of the support during the procedure and the multiplicity of use in the visceral parent arteries.

Modified techniques for embolization of wide-necked renal artery aneurysms have been described using the stent-assisted technique [10], balloon-assisted technique [11], and covered stents [12]. In the present case, a double-balloon re-

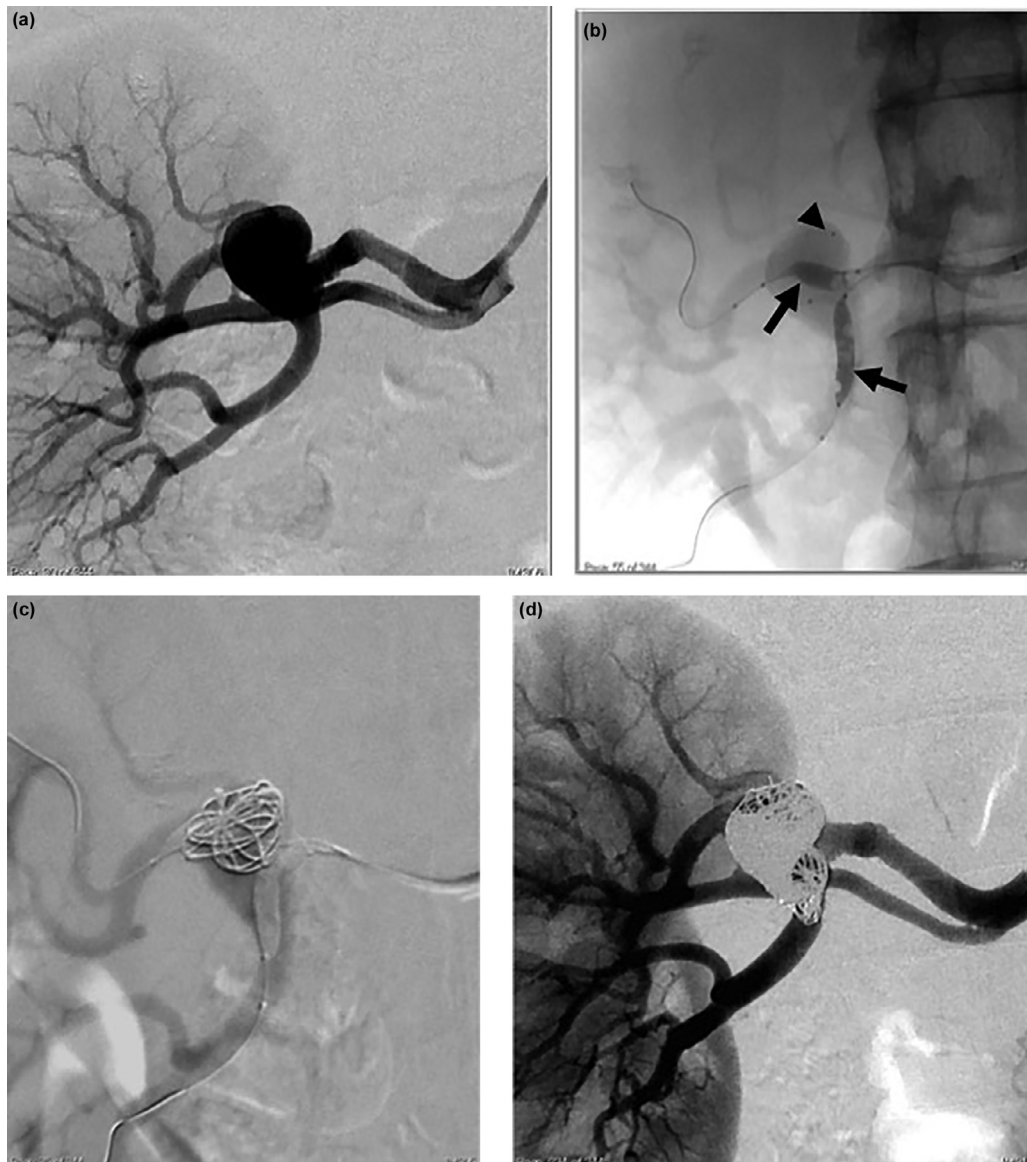


Fig. 3 – (a) An angiography from the right renal artery showing the aneurysm with 2 outflow branches. **(b)** Two microballoons (Scepter C, arrow), and one microcatheter (Excelsior SL-10) are delivered from the Parent Plus 60. Contrast medium was injected through the lateral hole of the proximal Y-type connector, showing the microballoons and the microcatheter are at the adequate position to start coiling. **(c)** Coil packing was performed under double microballoon assistance. **(d)** Angiography after embolization of the aneurysm demonstrates preserved circulation to the branches of the aneurysm.

modeling technique, a technique borrowed from interventional neuroradiology practice [13], was considered suitable to protect the 2 branches of the aneurysms. This case is the first to report the adaptation of this technique to visceral aneurysm embolization.

Parent Plus 60 was designed to facilitate multiple microdevice procedures in visceral arterial lesions. Interventional radiologists are acquainted with shepherd hook-type catheters, as the form matches most of the abdominal aortic branches. The inner lumen measures 0.088 inch, which is large enough to deliver 3 microdevices simultaneously without issue. During our procedure, manipulation of each microdevice was in-

dependent from the others, that is, one microdevice did not affect the other 2 microdevices.

In the present case, 2 Scepter C microballoons and one Excelsior SL-10 was inserted. Other deliverable combinations of microdevices through Parent Plus 60 can be 1 high flow microcatheter (3-F Renegade Hi-Flo Microcatheter, Boston Scientific, Natick, MA) and 2 microballoon catheter (Scepter C), 2 high flow microcatheter (Renegade Hi-Flo) and 1 microballoon catheter (Scepter C), or 2 high flow catheter (Renegade Hi-Flo) and 1 microcatheter (Excelsior SL-10). Each of the high-flow microcatheters can also coaxially carry a single microcatheter, which enables the construction of a triaxial sys-



Fig. 4 - (a) An angiography from the left renal artery shows the aneurysm located at the bifurcation of the main renal artery. (b) Two microballoons (Scepter C, arrow), and 1 microcatheter (Excelsior SL-10) are delivered from the Parent Plus 60. (c) Fluoroscopic image demonstrating the inflated Scepter C balloons with delivery of the initial detachable coil within aneurysm sac. (d) Angiography after completion of the procedure demonstrating complete obliteration of the aneurysm sac with preservation of flow into the distal branches and renal parenchyma.

tem [14]. Therefore, a combination of advanced techniques, such as the balloon-assisted double microcatheter technique or triple microcatheter technique [15], is possible through a single Parent Plus 60 catheter.

Conclusion

This is the first case in literature to report the success and safety of coil embolization of visceral aneurysms with three simultaneously delivered microdevices from a single access route. Additionally, a variety of modified techniques to perform embolization are possible through a single access route, using multiple microdevices delivered by Parent Plus 60. This

device can be used broadly in different clinical scenarios, and it may provide novel treatment strategies to clinicians in the future.

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