Covered Stent Implantation by the Puncture Method for the Treatment of a Small Aneurysm of the Common Iliac Artery

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A method to repair endovascular aneurysms with covered stents has recently been developed. In the present paper, the implantation of a covered stent through a 12Fr sheath by the puncture method for the treatment of an isolated aneurysm of the right common iliac artery is reported. The aneurysm was less than 3 cm in diameter, and computed tomography showed no signs of aneurysm rupture, but the patient nonetheless complained of right lower abdominal pain and constipation. It was decided to implant a covered stent in lieu of surgical repair because it was difficult to prove a causal relationship between the aneurysm and the patient's complaints. Fortunately, after implantation, the symptoms were resolved. In conclusion, it is possible to choose this less invasive type of therapy for the treatment of an isolated iliac artery aneurysm if the patient complains only of general malaise and there are no certain signs of an impending rupture, although surgery should be indicated regardless of aneurysm size. (*Jpn Circ J* 2000; 64: 99–102)

Key Words: Endovascular repair; Palmatz stent; Stent-graft; Thin-walled Dacron woven graft

Isolated aneurysms of the iliac artery are rare. These aneurysms are nearly always asymptomatic until rupture, and the occurrence of ruptures is relatively frequent and often fatal.^{1,2} Surgical treatment is therefore recommended if the diameter of the aneurysm is greater than 3 cm,³ but patients sometimes refuse surgical treatment because they are symptom-free. It is difficult to prove a causal relationship between nonspecific complaints and iliac aneurysms when the diameter is less than 3 cm.

Endovascular repair of aortic aneurysms using covered stents has recently been attracting attention as a new technique for aneurysmal repair.^{4–7} The technical simplicity of inserting a covered stent into the iliac artery makes endovascular repair a good option for the treatment of iliac artery aneurysms. At present, Japanese institutions use covered stents developed in-house as these instruments are not yet commercially available in Japan. In our institute we have created a covered Palmatz stent for use in isolated aneurysms of the common iliac artery. We report here the successful treatment of an iliac artery aneurysm with this new covered stent.

Case Report

The case was a 71-year-old man who had been in good health until he was diagnosed with an isolated aneurysm of the common iliac artery (diameter, 2.2 cm; length, 4.2 cm) by chance 2 years earlier at a Japanese hospital. Surgical

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Fig 1. Pelvic computed tomography (CT) image before the implantation of a covered stent demonstrating a right common iliac artery aneurysm of 2.5 cm in maximal diameter (arrow) and no apparent aneurysmal rupture.

Fig 2. Magnetic resonance angiography (MRA) showing the saccular dilatation of the right common iliac artery involving the right internal iliac artery (arrow).

treatment was recommended at that time but he refused it because of the absence of symptoms. His personal physician referred him to our hospital for bradycardia–tachycardia syndrome, right lower abdominal pain, and constipation. A sinus arrest of 4.4 s with syncope was noted in a Holter monitor. Occult blood was found in the stool. Abdominal computed tomography (CT), magnetic resonance angiography (MRA), and intestinal irrigation were performed. The CT image demonstrated an isolated aneurysm of the right common iliac artery (maximum diameter 2.5 cm; Fig 1). Magnetic resonance angiography showed a saccular dilatation of the right common iliac artery (diameter, 20 mm; length, about 40 mm) with its distal end extending to the right external iliac artery (Fig 2). Intestinal irrigation revealed no abnormalities accounting for the occult blood. On the basis of these results, a pacemaker was implanted. In view of its small size and the absence of any sign of rupture from the CT image, it was difficult to prove a causal relationship between the aneurysm and the patient's complaints. Instead of threatening this patient surgically, we decided to perform arteriography for endovascular repair. Informed consent was obtained.

We usually employ the following procedures for covered stent implantations performed at our hospital. In the case of the iliac artery, we select the combination of Palmatz stents and thin-walled Dacron grafts. Palmatz stents are designed for percutaneous transluminal angioplasty (PTA) therapy for arteriosclerosis obliterans (ASO). They range from 4 to 8

Fig 3. Arteriogram before the implantation of a covered stent (A) showing the right common iliac artery aneurysm extending to the right external iliac artery (arrow), and an arteriogram after the implantation (B) showing no manifest leakage from the covered stent itself (arrows).

mm in diameter and 10 to 39 mm in length. For the grafts we adopt a thin-walled, woven Dacron type (0.1 mm in thickness, $2000 \text{ ml cm}^{-2} \text{ min}^{-1}$ in porosity). The graft is mounted on a stent and its leading edge is sutured to the leading edge of the stent with two 7-0 monofilament sutures. A 10Fr or 12Fr vascular sheath is positioned across the aneurysm. After wrapping the covered stent to give it a low profile, we advance it into the sheath. We usually select a 10Fr or 12Fr Teflon sheath measuring 45 cm in length. A sheath of this size makes it possible to deliver a covered stent by the puncture method, which makes the procedure less invasive. The sheath is then withdrawn, exposing the covered stent across the aneurysm. The covered stent is then deployed by ballooning.

In the case reported here, arteriography demonstrated dilatation of the right common iliac artery with a diameter of almost 25 mm, length of nearly 40 mm, and a distal end extending to the external iliac artery. The left internal iliac artery was patent. The Dacron graft (diameter, 12 mm; length, 60 mm) was selected and 2 Palmatz stents (P3908c, the longest available at that time) were required to cover the entire lesion. We had to modify our technique to implant the stents at the leading and trailing edges of the graft. At first a 5Fr Shephard-Cook catheter was inserted via the left femoral artery to the ostium of the right internal iliac artery. Coil embolization of the internal iliac artery (3-mm and 8-mm metallic coils) was performed to avoid retrograde filling via the catheter. After mounting the leading edge of the graft on the stent and suturing it at a

Fig 4. Pelvic computed tomography (CT) image after implantation demonstrating the covered stent in the right common iliac artery with no manifest leakage (arrow).

point 1 cm from the leading edge of the stent with two 7-0 monofilament sutures, the covered stent was remounted on the PTA balloon catheter (diameter, 8 mm; length, 80 mm). Once the guidewire was placed across the aneurysm, a 12Fr Teflon sheath (length 45 cm) was inserted via the right femoral artery and positioned across the aneurysm. The tip was placed proximally, wrapped, and advanced into the sheath up to the neck of the aneurysm. The sheath was retracted and the covered stent was deployed by inflation of the balloon. The second stent was inserted over the guidewire to the trailing edge of the graft while it was dilated. Postdilatation of the stent was performed with a PTA balloon catheter (diameter, 10 mm; length, 40 mm; Fig 3). Arteriography just after the procedure revealed a small leak from the graft. Computed tomography during the subsequent hospital stay did not demonstrate a leak (Fig 4). Arteriography and the CT 3 months later revealed patency of the covered stent and complete aneurysmal thrombosis (Fig 5). Right lower abdominal pain and constipation resolved after the procedure.

Discussion

It is very difficult to decide the timing of the surgical treatment of isolated aneurysms for the iliac artery. In addition, these rare lesions are usually asymptomatic until rupture, frequently with a high mortality rate.^{1,2} Based on the natural course of these aneurysms, surgical treatment is recommended when the maximum diameter is greater than 3 cm.³ Smaller, asymptomatic aneurysms usually have a

Fig 5. Arteriography (A) and pelvic computed tomography (CT) (B) 3 months later demonstrating patency of the covered stent (arrow) and absence of the aneurysm filling with contrast medium (arrows).

good prognosis.⁸

In the case reported here, the patient was asymptomatic, and the aneurysm was less than 3 cm in diameter when diagnosed, 2 years prior to admission. At that time the patient had refused surgical treatment. At the time of referral he had complaints of continuous right lower abdominal pain and constipation, but the aneurysm was small and there were no radiographic signs of impending rupture. While no causal relationship could be established between the complaints and the aneurysm at that time, McCready has reported that 58% of patients with iliac aneurysms who complained of abdominal pain had already ruptured.³ Lowry and Kraft have also reported that most patients with isolated aneurysms of the iliac artery had no abdominal pain or gastrointestinal complaints unless there was impending rupture.⁸ Based on this information, we were concerned about the slight, but distinct possibility of impending rupture.^{1-3,8,9} However, given the difficulty in finding signs of impending rupture, especially in cases with small aneurysms, the high risk of death if rupture does occur seems to merit as radical a treatment as possible.¹⁰ As the patient refused surgical repair and the possibility of aneurysmal rupture seemed remote, we offered him the alternative of endovascular repair with a covered stent.

Endovascular repair has recently attracted attention as a less invasive therapy, but each institute performing the procedure in Japan has to rely on the use of a covered stent of its own making because no commercial models are yet available in the country. Our institute has implanted covered stents designed in-house for the repair of thoracic

and abdominal aneurysms in 10 patients. In the case reported here we used a Palmatz stent because the target lesion was the common iliac artery^{4,11}. When this patient was treated, the longest available stent was 39 mm in length. As this was shorter than the aneurysm, 2 Palmatz stents were used in series to repair the whole aneurysm. Now that longer stents and polytetrafluoroethylene (PTFE) grafts are available, a greater variety of covered stent configurations can be used¹²⁻¹⁴. Outcomes should improve as the devices become more sophisticated.

Arteriography and CT 3 months after the procedure revealed patency of the covered stent, absence of aneurysmal filling with contrast medium, and complete aneurysmal thrombosis. In our earlier experience with 10 implantations, this type of thin-walled, woven Dacron graft showed some degree of leakage just after the procedure because of its high porosity. However, follow-up examinations several months later did not show leakage. In the present case we obtained the same outcome. Fortunately the patient had no complaints after the procedure and the prognosis looks fine. This treatment may be effective in decompressing the aneurysm, which might have helped resolve the patient's complaints.¹⁵ The relationship between the implantation of the covered stent and the disappearance of the patient's complaints still remains unclear.

We concluded that this less invasive therapy can be safely and effectively applied to cases not definitively indicated for surgical treatment because of the unlikelihood of impending rupture. This technique is likely to become more widespread as newer devices are developed.

References

1. Richardson JW, Geenfield LJ: Natural history and management of iliac aneurysms. *J Vasc Surg* 1988; **8**: 165-171
2. Zuckerman DA, Yucel EK: Iliac artery aneurysms: radiographic evaluation. *Clin Imaging* 1993; **17**: 213-221
3. McCready RA, Pairolero PC, Gilmore JC, Kazmier FJ, Cherry KJ, Hollier LJ: Isolated iliac artery aneurysms. *Surgery* 1983; **93**: 688-693
4. Parodi JC: Endovascular repair of abdominal aortic aneurysms and other arterial lesions. *J Vasc Surg* 1995; **21**: 549-557
5. Katzen BT, Becker GJ, Benenati JF, Zemel G: Stent grafts for aortic aneurysms: the next interventional challenge. *Am J Cardiol* 1998; **81**(7A): 33E-43E
6. Beregi JP, Prat A, Willoteaux S, Vasseur MA, Boularand V, Desmoucelle F: Covered stents in the treatment of peripheral arterial aneurysms: procedural results and midterm follow-up. *Cardiovasc Intervent Radiol* 1999; **22**: 13-19
7. Kaneda T, Takamoto S: A case of intestinal obstruction following stent graft placement for an abdominal aortic aneurysm. *Jpn Circ J* 1999; **63**: 567-568
8. Lowry SF, Kraft RO: Isolated aneurysms of the iliac artery. *Arch Surg* 1978; **113**: 1289-1293
9. Perdue GD, Mittenthal MJ, Smith III RB, Salam AA: Aneurysms of the internal iliac artery. *Surgery* 1983; **93**: 243-246
10. Mehard WB, Heiken JP, Sicard GA: High-attenuating crescent in abdominal aortic aneurysm wall at CT: a sign of acute or impending rupture. *Radiology* 1994; **192**: 359-362
11. Murphy KD, Richter GM, Henry M, Encarnacion CE, Le VA, Palmatz JC: Aortoiliac aneurysms: management with endovascular stent graft placement. *Radiology* 1996; **198**: 473-480
12. Reddy SG, Rothstein CP, Saker MB, Kane RA, March RJ, Matalon TAS: Placement of a PTFE-covered wallstent through a 12 Fr sheath for the exclusion of a common iliac artery aneurysm. *Cardiovasc Intervent Radiol* 1999; **22**: 152-154
13. Marin ML, Veith FJ, Panetta TF, Cynamon J, Sanchez LA, Schwartz ML, et al: Transluminally placed endovascular stented graft repair for arterial trauma. *J Vasc Surg* 1994; **19**: 698-706
14. White R, Kopchok G, Zalewski M, Ayres B, Wilson E, de Virgilio C, et al: Comparison of the deployment and healing of thin-walled expanded PTFE stented grafts and covered stents. *Ann Vasc Surg* 1996; **10**: 336-346
15. Schurink GW, Aarts NJ, Wilde J, van Baalen JM, Chuter TA, Kool LJS, et al: Endoleakage after stent-graft treatment of abdominal aneurysm: implications on pressure and imaging, an in vitro study. *J Vasc Surg* 1998; **28**: 234-241