Prevention of Type II Endoleak Using the AMPLATZER Vascular Plug Before Endovascular Aneurysm Repair

M. Burbelko [a,c], M. Kalinowski [a,c], J.T. Heverhagen [a], E. Piechowiak [a], A. Kiessling [a], J. Figiel [a], Z. Swaid [b], J. Geks [b], W. Hundt [a,*]

[a] Department of Radiology, Philipps University Marburg, Germany
[b] Department of Surgery, Philipps University Marburg, Germany

WHAT THIS PAPER ADDS

Endovascular abdominal aortic aneurysm repair (EVAR) is an effective alternative treatment to open aneurysm repair and the number of EVAR procedures performed continues to grow worldwide. This less invasive technique has been established as a safe and effective method of aneurysm exclusion. In this study, we evaluated type 4 and 2 AVPs (AVP4, AVP2) in the prevention of type II endoleaks in visceral and lumbar vessels prior to EVAR. We show that the use of AVPs prior to EVAR is an effective technique in preventing the development of type II endoleaks.

Objective: We evaluated the feasibility of visceral artery and lumbar artery (LA) embolization using AMPLATZER vascular plug (AVP) types 4 and 2 (AVP4, AVP2) prior to endovascular aneurysm repair (EVAR) to prevent the development of a type II endoleak.

Methods: Between January 2008 and April 2010, 45 arteries in 33 male patients were embolized with 44 AVP4 and one AVP2. Artery name and diameter; device number and size; and intervention, fluoroscopy, and deployment times for each procedure and each device were recorded. Computed tomography (CT) angiography was performed 2 days and 3, 6, 12, 18, 24, and 36 months after EVAR to confirm successful EVAR and embolotherapy, exclude endoleaks, and evaluate aneurysm shrinkage.

Results: AVP4 devices were implanted into the inferior mesenteric arteries in 33 cases, lumbar arteries in seven cases, and pelvic and renal arteries in two cases each. An AVP2 device was inserted into the gluteal artery in one case. The success rate was 100%, with total occlusion of all target vessels. No endoleaks were found in follow-up CT angiography.

Conclusion: The use of AVP prior to EVAR is an efficient embolization technique that prevents the development of type II endoleaks.

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INTRODUCTION

Endovascular abdominal aortic aneurysm repair (EVAR) is an effective alternative treatment to open aneurysm repair,[1] and the number of EVAR procedures performed continues to grow worldwide. This less invasive technique has been established as a safe and effective method of aneurysm exclusion.[2] Incomplete exclusion of the aneurysmal sac from the circulation, called an endoleak, is the most frequent complication after EVAR (occurring in 10—45% of cases),[3] and can be associated with aneurysm enlargement and rupture.[4] Given the association of type I and III endoleaks with adverse clinical outcomes,[5] they are considered treatment failures. In contrast, the importance of type II endoleaks, which occur at some interval after EVAR in 20—30% of patients, remains controversial.[6]

Some working groups[7,8] doubt the role of patent side branches (the inferior mesenteric artery [IMA] and lumbar artery [LA]) and the type II endoleak in late postoperative aneurysm shrinkage. This could be disproven by several studies. Fujita[9] reported a reintervention rate of approximately 26% after EVAR caused by expansion of the aneurysmal sac because of a type II endoleak. Axelrod[10] and Sheehan[11] showed a positive effect of preoperative side branch embolization with greater shrinkage of the aneurysm sac diameter. Different strategies have been proposed for the prevention and treatment of type II endoleaks, but no clear consensus exists. Prophylactic intervention can be performed prior to EVAR (preoperatively) or during EVAR (intraoperatively), and opinions have varied widely. Some

[c] Both authors contributed equally.

* Corresponding author. W. Hundt, Department of Radiology, Philipps University Marburg, Baldingerstrasse, 35043 Marburg, Germany.
E-mail address: hundt@med.uni-marburg.de (W. Hundt).

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working groups advocate the use of prophylactic visceral artery and LA embolization, whereas others intervene only if an aneurysm grows during EVAR follow-up.

The classical technique is embolization with stainless steel or platinum coils over a microcatheter using the coaxial technique.[12] This method has some disadvantages, such as long procedure and fluoroscopy time, risk of coil dislocation with a non-target embolization or occlusion of relevant collateral vessels, and high costs because of the use of the microcatheter and several coils for vessel occlusion.

AMPLATZER vascular plugs (AVPs), another type of embolization device, are used in interventional radiology to occlude arteries and veins of large and middle calibre.[13] Indications reported in the literature include hypogastric and aorto-iliac aneurysms,[13] pulmonary[14] and renal arteriovenous malformations,[15] and subclavian aneurysms.[16] Their use in EVAR procedures for occluding type II endoleaks is limited. It has only recently been addressed in a small series and a few case reports.[17] In this study, we evaluated AVPs in the prevention of type II endoleaks in visceral and lumbar vessels prior to EVAR.

METHODS

We retrospectively reviewed the medical records and images (computed tomography [CT] and digital subtraction angiography) of patients who underwent endovascular management prior to EVAR between January 2008 and April 2010.

The average patient age was 69.8 years (range 51—86 years). A pre-procedural assessment included a full clinical evaluation and standard blood tests. All patients underwent contrast-enhanced abdominal CT (Somatom Definition; Siemens, Erlangen, Germany) using multiplanar reconstruction. We recorded the names and diameters of all vessels in both patient groups (with and without embolization). According to our internal hospital standard, visceral arteries and LAs with diameters greater than 2.5 mm found on multiplanar reconstruction of the CT scan were considered for embolization. We recorded the numbers and sizes of the devices used to occlude the vessels as well as the intervention and fluoroscopy times for each procedure and device.

The coagulation profiles of all patients were within normal limits at procedure time. All of the procedures were performed under local anesthesia 1—4 weeks prior to EVAR. Prophylactic antibiotics (1 g sulbactam and 2 g ampicillin, Unacid 3 g iv; Pfizer, NY, USA) were routinely used. All but one procedure (case 1, use of the AVP2, a 65-cm/6-F sheath [Destination, Terumo, Japan]) were performed via 4-F femoral access (Brite Tip Sheath; Cordis, Miami, FL, USA). After catheterization of the target vessel using an angiographic catheter with a 0.038 inch lumen (Sidewinder I, Tempo Aqua; Cordis), an AVP (St. Jude Medical, St. Paul, MN, USA) was introduced into the target vessel close to the aorta. The plug diameter was 30—50% larger than the target artery diameter according to the manufacturer's recommendation. After plug placement within the artery, a single nonsubtracted image was obtained to document the correct AVP position. If the device position was satisfactory, it was deployed by rotation of the delivery wire in a counterclockwise direction. Post-embolization angiography was performed to confirm plug position and arterial patency/occlusion. After catheter and sheath removal, the arterial puncture was closed using manual compression. To confirm the therapeutic success of EVAR and exclude any endoleaks, CT angiography was performed 2—3 days and 3, 6, 12, 18, 24, and 36 months after EVAR. The patency of the embolized vessels, existence of endoleaks, and changes in aneurysm size were evaluated.

Table 1. Description of all vessels in the embolized and non-embolized group.

Embolization group			Non-embolization group		
Pat. no.	Number of vessels (>2.5 mm)	Number of vessels (<2.5 mm)	Pat. no.	Number of vessels (>2.5 mm)	Number of vessels (<2.5 mm)
1	4	14	1	—	16
2	1	17	2	—	15
3	1	19	3	—	21
4	1	13	4	—	15
5	1	14	5	—	13
6	1	15	6	—	18
7	1	18	7	—	20
8	1	12	8	—	10
9	2	14	9	—	22
10	2	15	10	—	15
11	3	17	11	—	17
12	5	16	12	—	23
13	1	17	13	—	20
14	2	13	14	—	17
15	1	14	15	—	16
16	1	15	16	—	14
17	1	16	17	—	18
18	1	14	18	—	23
19	1	15	19	—	13
20	1	13	20	—	16
21	1	17	21	—	19
22	1	15	22	—	14
23	1	16	23	—	18
24	1	13	24	—	15
25	1	15	25	—	14
26	1	16	26	—	16
27	1	18	27	—	18
28	1	14	28	—	13
29	1	16	29	—	18
30	1	14	30	—	12
31	1	15	31	—	17
32	1	16	32	—	15
33	1	14	33	—	14
34	1	16	34	—	18
35	1	17	35	—	20
36	1	15	36	—	14
37	4	17	37	—	18
			38	—	16
Total	52	565		—	631