Percutaneous Embolization of Hemodialysis Fistulas by AMPLATZER Vascular Plug with Midterm Follow-up

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ABSTRACT

Purpose: To determine the midterm technical and clinical results of endovascular occlusion of native hemodialysis fistulas with the use of the AMPLATZER Vascular Plug (AVP) I and AVP II.

Materials and Methods: Data from 21 patients who underwent endovascular occlusion of their native fistulas between March 2008 and October 2009 were retrospectively evaluated. The reasons for closing the fistulas were hyperdynamic heart failure (n = 2), venous aneurysm with skin ulceration and nipple formation with impending rupture (n = 5), central venous occlusion that could not be recanalized by an endovascular approach (n = 7), dialysis-associated steal syndrome (n = 2), and critical hand ischemia with a nonhealing ulcer or necrosis (n = 5).

Results: All fistulas were embolized successfully by the end of the intervention. No procedure-related complications were observed after the intervention. The follow-up time ranged from 5 months to 24 months, with a mean of 13.5 months.

Conclusions: The results of this study suggest that the AVP is a safe and effective device for the endovascular occlusion of hemodialysis fistulas in selected cases.

ABBREVIATIONS

AVP = AMPLATZER Vascular Plug, CVO = central venous occlusion, DASS = dialysis-associated steal syndrome
HHF = hyperdynamic heart failure

Complications associated with arteriovenous access are commonly encountered in patients who undergo chronic hemodialysis therapy (1). These complications occur as a result of hemodynamic alterations potentiated by fistula flow and include central venous occlusion (CVO), dialysis-associated steal syndrome (DASS), ischemia, and hyperdynamic heart failure (HHF) (2,3). There are currently many surgical and percutaneous procedures to overcome access-related problems while maintaining function (4–6). However, if percutaneous and surgical procedures are not applicable or if they fail, it is necessary to close the fistula. Surgical ligation is the preferred treatment, but surgery is sometimes difficult because of ulcerations or severe edema and swelling, or surgery may be delayed as a result of patient comorbidities (1). Under these conditions, an endovascular approach may be necessary to manage the problem (4).

One of the endovascular methods to occlude a fistula is to use the AMPLATZER Vascular Plug (AVP; AGA Medical, Golden Valley, Minnesota). The present study retrospectively demonstrates the midterm technical and clinical results of the endovascular occlusion of hemodialysis fistulas with an AVP.

MATERIALS AND METHODS

This study was conducted with the approval of our institutional review board, with a waiver of informed consent. Twenty-one consecutive patients who underwent endovascular embolization of hemodialysis fistulas at a single institution during an 18-month period were included in the study.

Patient Population

The data from 21 consecutive patients who underwent endovascular occlusion of a hemodialysis fistula at a single

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Table. Demographic, Fistula, Treatment, and Follow-up Details

Pt. No.	Sex/Age (y)	Fistula Type	Fistula Age (mo)	Indication	AVP Type/Size (mm)	Follow-up (mo)
1	M/64	Radiocephalic	34	Rupture risk	AVP II, 22	16
2	F/38	Radiocephalic	30	HHF	AVP I, 14/16	16
3	F/55	Brachiocephalic	28	Rupture risk	AVP I, 16	15
4	M/73	Radiocephalic	42	Ischemia	AVP I, 10	14*
5	F/54	Brachiocephalic	41	CVO	AVP I, 16	12
6	F/76	Brachiobasilic	29	Ischemia	AVP I, 14/14	11
7	M/33	Brachiocephalic	35	CVO	AVP I, 12	12
8	M/54	Brachiocephalic	39	CVO	AVP I, 10	12†
9	F/64	Radiocephalic	47	Ischemia	AVP I, 10	11
10	M/71	Brachiocephalic	41	DASS	AVP I, 12	21
11	M/78	Radiocephalic	52	Rupture risk	AVP I, 10	22
12	F/69	Brachiobasilic	50	HHF	AVP I, 14	24
13	M/69	Brachiocephalic	48	DASS	AVP II, 18	11
14	F/63	Radiocephalic	36	CVO	AVP I, 12/10	11
15	F/65	Radiocephalic	1/2	Ischemia	AVP I, 8	5‡
16	F/69	Brachiocephalic	12	Ischemia	AVP II, 22	8
17	M/71	Brachiocephalic	48	CVO	AVP I, 14	12
18	M/57	Radiocephalic	72	Rupture risk	AVP I, 10	15
19	M/67	Brachiocephalic	24	CVO	AVP I, 12	17
20	F/69	Radiocephalic	24	Rupture risk	AVP I, 12	12
21	F/75	Brachiobasilic	1/2	CVO	AVP I, 10	7

Note.—AVP = AMPLATZER Vascular Plug, CVO = central venous occlusion, DASS = dialysis-associated steal syndrome, HHF = hyperdynamic heart failure.
* Died of stroke.
† Died of sepsis.
‡ Died of myocardial infarction.

university hospital between March 2008 and October 2009 were retrospectively evaluated (**Table**). Of the 21 patients, there were 11 women and 10 men, with a median age of 63.5 years (range, 38–78 y).

The mean age of the fistulas was 35 months (range, 15 d to 71 mo). Of the 21 autogenous fistulas, nine were radiocephalic (ie, Brescia–Cimino), nine were brachiocephalic, and three were brachiobasilic. The indications for closing the fistulas were HHF (n = 2), venous aneurysm with skin ulceration and nipple formation with impending rupture (n = 5), CVO that could not have been recanalized by an endovascular approach (n = 7), DASS (n = 2), and critical hand ischemia with a nonhealing ulcer or necrosis (n = 5).

The patients with CVO had severe swelling and edema of the extremity, making it difficult to detect and ligate the fistula surgically. These patients previously had undergone many recanalization procedures in the interventional radiology unit. After the failure of the last recanalization attempt, endovascular embolization was performed (**Fig 1**). Patients with DASS and critical hand ischemia with nonhealing ulcers or necrosis had trophic changes, coldness, and numbness of the extremity. Their symptoms worsened during hemodialysis. Four of the patients (patients 4, 6, 15, and 16; **Table**) also had a concurrent nonhealing infection of the digits at admission (**Fig 2**). It was concluded that the endovascular approach would be minimally invasive and optimal for these patients in view of the ulcers and necrosis of the hand as well as the accompanying infection. Two patients with HHF experienced symptoms of reduced exercise intolerance, palpitations, and dyspnea. A precordial midsystolic murmur was detected in both patients, whose condition was categorized as class III according to New York Heart Association functional classification.

Seven patients were inpatients referred by the cardiovascular surgery department. Two of these patients underwent endovascular therapy because of surgical failure of the ligation procedure (patients 2 and 11; **Table**). Surgical ligation under general anesthesia was planned for three patients, but severe comorbidities did not allow for these patients to be candidates for surgery (patients 9, 12, and 20; **Table**). Two of the patients were scheduled to undergo endovascular therapy in view of the complex anatomy of their fistulas (patients 10 and 13; **Table**).

Embolization Technique

The brachial artery was punctured by using an antegrade approach under sonographic guidance with a 4-F Micro-Stick introducer set (Medcomp, Harleysville, Pennsylvania). The venous segment of the fistula was also punctured under sonographic guidance, and an introducer sheath (5–7-F Avanti sheath; Cordis, Miami Lakes, Florida) was