

Endovascular stent repair of celiac arterial aneurysm

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Abstract

The aim of this study was to evaluate the safety and clinical effectiveness of endovascular stent repair of celiac arterial aneurysm (CAA).

From January 2015 to December 2018, 11 patients (7 males, 4 females with a mean age of 52.2 ± 7.9 years) underwent endovascular stent repair of CAA in our center. A covered stent was used to occlude the CAA neck. Follow-up was performed 2 weeks and 1, 3, 6, and 12 months following surgery and yearly thereafter. Rates of technical success, treatment-related complications, and long-term outcome were analyzed.

Each patient was placed with 1 stent for repair of CAA. Stent was placed in the celiac and common hepatic arteries for 10 patients and was placed in the celiac artery for 1 patient. The duration of the procedure ranged from 50 to 75 minutes (mean 63.2 ± 7.2 minutes). The rate of technical success of the endovascular stent repair was 100%. No patient experienced CAA rupture or instant endoleak during or after stent insertion. Abdominal pain was relieved progressively after stent insertion. All patients were followed-up for 6 to 48 months (mean 22.4 ± 10.8 months). All patients were alive during the follow-up. No endoleaks were experienced during follow-up with 100% stent patency rate. No patient suffered splenic, hepatic, or bowel infarction during follow-up.

Endovascular stent repair is a safe, simple, and effective treatment for patients with CAA.

Abbreviations: CAA = celiac arterial aneurysm, CT = computed tomography, CTA = CT angiography, VAA = visceral arterial aneurysm.

Keywords: endovascular, stent, celiac arterial aneurysm

1. Introduction

Treatment of visceral arterial aneurysm (VAA) has been widely reported in recent years.^[1–3] Its detection rate has been further increased with the wide-scale use of contrast-enhanced computed tomography (CT). Celiac arterial aneurysm (CAA) constitutes 4.8% to 6.3% of all VAA cases and usually presents as an emergency, usually being fatal upon rupture.^[1,4]

Compared with conventional surgery, endovascular repair has gradually become the 1st-line treatment of VAA due to its minimally invasive nature.^[1–4] The scope of endovascular repair of VAA usually includes aneurysm, embolization, and stent

occlusion.^[1–4] Although endovascular repair of VAA has been commonly reported, there are few studies that have reported on endovascular repair of CAA.^[4] In this study, we thus aimed to evaluate the safety and clinical effectiveness of endovascular stent repair of CAA.

2. Patients and methods

This retrospective study was approved by the Institutional Review Board, which agreed a waiver of written informed consent.

2.1. Patients

From January 2015 to December 2018, 11 patients (7 males, 4 females with a mean age of 52.2 ± 7.9 years) underwent endovascular stent repair of CAA in our center. Baseline data of these 11 patients are presented in Table 1. Five patients had hypertension and 3 patients previously underwent abdominal surgery. Nine patients presented with abdominal pain and 2 were asymptomatic. CAA was suspected in the 2 asymptomatic patients from the results of abdominal contrast-enhanced CT, which was confirmed by CT angiography (CTA) examination.

The inclusion criteria were: definite diagnosis of CAA and maximum length of CAA ≤ 60 mm. Patients with significant dysfunction of blood coagulation, active infection, and/or active bleeding were excluded.

Diagnosis of CAA was confirmed from abdominal CTA and intraoperative celiac angiography (Fig. 1). Size of the CAA, neck length, and neck location were measured and evaluated by CTA.

Editor: Danny Chu.

The authors have no funding and conflicts of interest to disclose.

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How to cite this article: Xia FF, Fan ZQ, Huo XB, Fu YF, Xu YS. Endovascular stent repair of celiac arterial aneurysm. *Medicine* 2019;98:48(e18203).

Received: 19 June 2019 / Received in final form: 9 October 2019 / Accepted: 27 October 2019

<http://dx.doi.org/10.1097/MD.00000000000018203>

Table 1**Baseline data.**

No./gender/age, yr	CAA neck		Maximum diameter of CAA, mm	Shape of CAA	Thrombi in CAA	Symptom
	Location	Length, mm				
1/male/45	CA, CHA	25	56	Saccular	No	Abdominal pain
2/male/63	CA, CHA	21	40	Saccular	No	Abdominal pain
3/male/56	CA, CHA	28	55	Saccular	Yes	Abdominal pain
4/female/52	CA, CHA	15	32	Saccular	No	Abdominal pain
5/male/41	CA, CHA	22	45	Saccular	Yes	Abdominal pain
6/male/45	CA, CHA	16	36	Saccular	No	None
7/female/49	CA, CHA, SA	22	56	Saccular	No	Abdominal pain
8/female/57	CA	10	29	Saccular	No	Abdominal pain
9/male/62	CA	3	14	Saccular	No	Abdominal pain
10/male/60	CA	15	27	Saccular	No	None
11/female/44	CA, CHA	20	38	Saccular	No	Abdominal pain

CA=celiac artery, CAA=celiac artery aneurysm, CHA=common hepatic artery, SA=splenic artery.

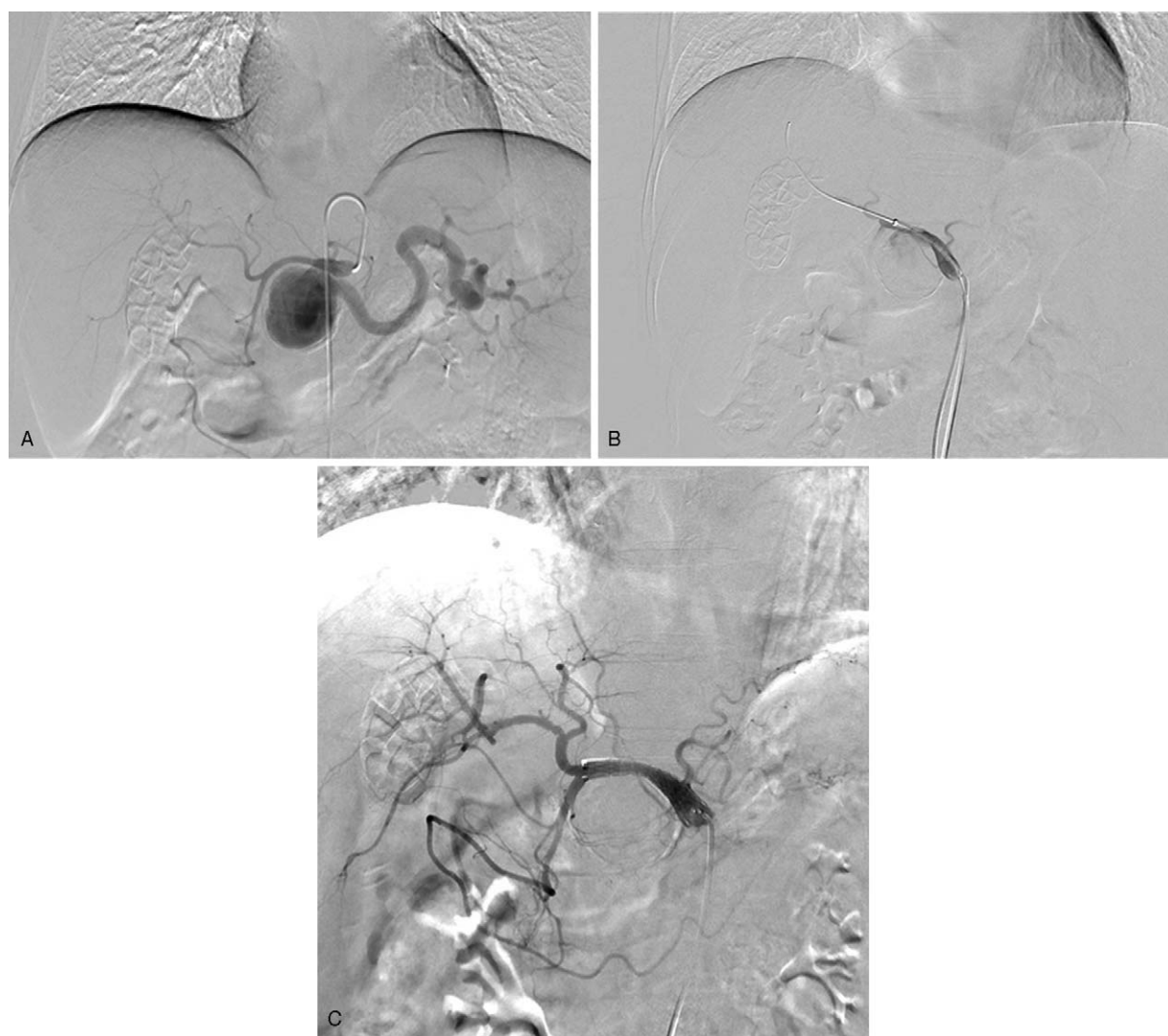


Figure 1. Procedure for endovascular stent repair of celiac artery aneurysm (CAA). (A) Angiography revealed the location and size of a CAA. (B) Stent delivery system placed at the site of the neck of the CAA. (C) CAA successfully sealed using a covered stent.

2.2. Stents

All stents were covered (Fluency; Bard, Murray Hill, NJ). The diameter of each stent was 1.2 times as that of the celiac artery with a length that was at least 20 mm longer than the neck length of the aneurysm (at least 10 mm at the both sides).

2.3. Endovascular treatment

All treatments were performed under the guidance of fluoroscopy and local anesthesia. A 5F angiographic catheter (Cordis, Warren, NJ) was placed at the ostium of the celiac artery and the contrast-medium was injected to confirm CAA. After confirmation, the catheter was sent to the distal side of the hepatic artery via a standard 0.035-inch guidewire (Terumo, Tokyo, Japan). This was then replaced with a stiff 0.035-inch guidewire (Cook, Bloomington, IN). Finally, a 9F stent delivery system was guided to the CAA neck site via the stiff guide wire which released the stent to seal the CAA neck (Fig. 1). The stent was inserted into the celiac and common hepatic arteries or only celiac artery. Celiac angiography was performed again to confirm the patency of the stent and whether there was an endoleak.

All patients were given aspirin (100 mg/d) and clopidogrel (75 mg/d) after treatment for 6 months. Thereafter, a single aspirin was taken for life.

2.4. Definitions and follow-up

Endovascular stent repair was considered a technical success if no contrast medium filled the CAA after stent insertion. Follow-up was performed 2 weeks and 1, 3, 6, and 12 months following surgery and yearly thereafter. Follow-up assessment included abdominal CTA and physical examination.

2.5. Statistical analysis

Continuous data were expressed as mean \pm standard deviation and categorical variables were presented in terms of frequencies or percentages. All statistical analyses were performed by SPSS version 16.0 (SPSS, Chicago, IL).

3. Results

3.1. Assessment of endovascular treatment

The rate of technical success of the endovascular stent repair for CAA was 100% (Table 2). Each patient was placed with 1 stent.

Stent was placed in the celiac and common hepatic arteries for 10 patients and was placed in the celiac artery for 1 patient (No. 9 patient).

No patient experienced CAA rupture or instant endoleak during or after the stent insertion procedure. The duration of the procedure ranged from 50 to 75 minutes (mean 63.2 ± 7.2 minutes). The hepatic and gastroduodenal arteries were patent after stent insertion. Abdominal pain was relieved progressively after stent insertion.

The CAA neck involved the splenic artery in one patient (No. 7). However, embolization of the proximal splenic artery was not performed prior to stent insertion because the extent of involvement of the splenic artery was very limited. Postoperative angiography did not reveal any flow back of the contrast medium into the CAA sac via collateral circulation.

3.2. Follow-up

The 11 patients were followed-up for 6 to 48 months (mean 22.4 ± 10.8 months). All patients were alive during follow-up and no endoleak was experienced during that period. Stent patency rate was 100% and no patient suffered splenic, hepatic, or bowel infarction during follow-up.

4. Discussion

This study demonstrated the safety, clinical effectiveness, and long-term outcome of endovascular stent repair for CAA. Initial results were satisfactory, with instantaneous and long-term effectiveness being good in all patients.

The etiology of CAA remains unclear. The potential reasons may include arteriosclerosis, surgical history, and infection.^[5-7] Compared with open surgery for VAA, endovascular repair is associated with lower early complication rate (7.4% vs 28.6%; $P = .025$) and higher 2-year survival rate (69.4% vs 46.4%; $P = .038$).^[11] The purpose of endovascular repair of CAA is to reduce the volume of blood flow into the CAA sac and prevent its rupture. A number of researchers have performed coil or medical glue embolization for VAAs, revealing a technical successful rate of 98% with low postoperative mortality rate (8.3%).^[8] However, the mean size of the VAAs in this study was only 24 mm.^[8] In the present study, 8 of the 11 patients (72.7%) had a CAA > 30 mm in size. If coil embolization had been conducted, the cost of treatment would have been extremely high. In

Table 2

Treatment outcomes.

No	Stent size, mm \times mm	Duration of procedure, min	Follow-up, mo	Outcomes		
				Endoleak	Patency	VI
1	8 \times 60	65	6	No	Yes	No
2	8 \times 60	60	12	No	Yes	No
3	8 \times 60	60	12	No	Yes	No
4	8 \times 40	50	24	No	Yes	No
5	8 \times 60	55	24	No	Yes	No
6	8 \times 60	75	24	No	Yes	No
7	8 \times 60	65	24	No	Yes	No
8	8 \times 40	60	24	No	Yes	No
9	8 \times 30	70	24	No	Yes	No
10	8 \times 40	70	24	No	Yes	No
11	8 \times 60	65	48	No	Yes	No

VI = visceral infarction.

addition, the embolic agent might have spilled over if the CAA neck was wide.

In contrast to embolization, covered stent occlusion for CAA can shorten the duration of the procedure, decrease the probability of intraoperative rupture, and save treatment costs. In this study, the technical success rate was 100%, comparable to that in previous studies of covered stent occlusion for CAAs and cranial internal carotid artery aneurysms (80.9–100%).^[4,9] The high technical success rate might be attributed to the following factors: the diameter of stent was larger than that of the celiac artery; this strategy can result in sufficient pressure on the neck of the CAA; a longer stent length completely covered the neck of the CAA.

In addition, the long-term outcome in the patients in this study was satisfactory. Delayed endoleak was not found in any patient. This finding was comparable to a previous study of stent occlusion for CAAs.^[4] Li et al^[9] reported 8 patients with incomplete seal of aneurysm after covered stent insertion. However, follow-up CTA demonstrated that residual endoleak was not evident or had decreased in all 8.^[9]

Although the stent occluded the ostium of the splenic artery, no patient suffered splenic infarction during follow-up. This can be attributed to abundant abdominal collateral circulation affording sufficient blood supply to the spleen.^[10]

This study has some limitations, including its retrospective design, a rather small sample size, and lack of a control group. However, because CAA is a rare disease, these data may be adequate to demonstrate the clinical effectiveness of this technique.

In conclusion, although further clinical trials are required, our results indicate that endovascular stent repair is a safe, simple, and effective technique for patients with CAA.

Author contributions

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Writing – original draft: Feng-Fei Xia.

Writing – review & editing: Feng-Fei Xia, Yu-Fei Fu.

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