INTRODUCTION

The celiomesenteric trunk (CMT) is a rare developmental vascular anomaly sharing common origin of the celiac trunk and superior mesenteric artery (SMA) from the aorta [1]. An aneurysm in the CMT is very rare, but a challenging disease to treat because of the complex anatomic location. To our knowledge, this is the first case ever reported on a successful endovascular treatment of a CMT aneurysm.

CASE

A 45-year-old man was referred to our vascular clinic for a CMT aneurysm, which was incidentally found by computed tomography (CT) during a routine check. He was otherwise healthy without any symptoms. The diameter of the saccular aneurysm was 21 mm and located in the celiac trunk between the SMA orifice and celiac bifurcation (Fig. 1A). The gastroduodenal artery (GDA) was patent to form a good collateral circulation between the SMA and common hepatic artery (CHA). The left gastric artery originated separately from the aorta.

Endovascular multiple micro-coil embolization of the CHA, splenic artery (SA) and the aneurysm was done, followed by a stent-graft deployment in the superior mesenteric artery covering the orifice to the aneurysm. Postoperative course was uneventful. Only 21 cases have been previously reported in the literature, and all were treated by open surgeries. Endovascular therapy can be safely done in selected cases of a CMT aneurysm with sufficient collaterals to the liver and spleen.

Key Words: Aneurysm, Anomaly, Celiomesenteric trunk, Coil embolization, Stent-graft
Endovascular Treatment of a Saccular Aneurysm in the CMT

DISCUSSION

Visceral artery aneurysm is a rare disease, and the reported incidence is 0.1% to 0.2% of the population [1,2]. A CMT aneurysm is even rarer. A literature search revealed only 21 cases during the last 47 years [1-15], since Stanley et al. [3] reported the first case treated by open repair. All the reported cases were treated by open surgical repair. So this case, to our knowledge, is the first successful endovascular treatment of a CMT aneurysm ever reported.

Theoretically, a CMT is an embryologic error and may result in an increased risk for aneurysm formation due to the absence of a separate celiac trunk and an excessive blood influx into the origin of the CMT [2]. However, the exact relationship between the existence of a CMT and the aneurysm formation is not proven yet. During embryologic period, major visceral arteries develop from four vascular roots arising from the primitive dorsal abdominal aorta [2,4]. These four roots are united in utero by a ventral longitudinal anastomosis. During normal maturation, the first (gastric), second (hepatic), and the third (splenic) roots coalesce to form the main celiac axis, whereas the fourth root develops separately into the SMA. Alteration in the site of interruption of the ventral anastomosis will lead to the formation of a wide variety of vascular anomalies [16].

The exact natural history of this rare CMT aneurysm is unknown, but the recommendations for a visceral aneurysm can be applied to this rare disease. For the treatment of a CMT aneurysm, open surgical repair is the gold standard. The exact planning of the surgical procedures depends on the location, size, and the feature of the lesion. Preservation of the mesenteric and also hepatic circulation is the most important point. After resecting the aneurysm, direct anastomosis, reimplantation or bypass graft can be done according to the anatomy of each patient.

For selected cases, minimal invasive endovascular therapy can be applied. If feasible, a stent-graft excluding the CMT aneurysm is optimal, but usually the distance from the SMA orifice and/or from celiac bifurcation is not enough to prevent type Ia or type Ib endoleak from the landing zone after stent-graft deployment. Endovascular embolization of the aneurysm was often rejected due to the risk of ischemia to the liver and spleen, which would cause painful infarction.

However in this case, initial angiographic evaluation confirmed the good collateral circulations to the liver and spleen. Hepatic blood flow was maintained by collaterals via GDA, and splenic blood flow via short gastric arteries.

Because of the close proximity of the CMT aneurysm to the pancreas, there is a high risk of pancreatic fistula and bleeding from multiple pancreatic branches during open repair. Also there is a risk of diarrhea due to celiac plexus
injury, pancreatitis, and injury to the surrounding viscera, including the portal venous system. Dissection of anomalous hepatic or SA from SMA may be difficult because they run into the pancreatic head neural plexus or the dorsal side of the pancreas.

Although the immediate result in this case is satisfactory, we do not know the long-term patency of the SMA stent-graft. Therefore long-term follow-up is mandatory for this kind of endovascular therapy.

A literature review of the CMT aneurysm written in English is summarized in Table 1. A total of 22 cases including our case has been reported. Interestingly 15 cases were from Far East Asia (Korea, Japan, and China), and 7 cases were from Western countries (USA, Italy, and France). Excluding a case series of Wang et al. [15] with insufficient data, the characteristics of the CMT aneurysm were analyzed (n=15). The morphology was mainly saccular in 12 (80%), or fusiform in 3 (20%). The location of the aneurysm was most common in the celiac trunk in 11 (73%), followed by CMT bifurcation in 3 and CMT orifice in 1. All operated cases were treated by aneurysmectomy and revascularization, except one case of endoaneurysmal Dacron patch repair [4]. Revascularization was done by direct anastomosis of celiac trunk to CMT in 7, bypass or interposition graft in 3, primary repair of aneurysm neck in 2, and reimplantation of celiac trunk into aorta in 1. Theoretically high flow in the conjoined CMT can be the cause of aneurysm and the separation of the celiac trunk and SMA may be prudent, but this procedure increases the complexity and risk of operation. Interestingly, in the literature, separation of the celiac trunk and SMA was done only in 1 case with reimplantation of celiac trunk to aorta [2]. No case of recurrent aneurysm has been reported whether the separation was done or not.

For treating this rare aneurysm, we should follow the basic principles for the treatment of visceral artery aneurysms. Furthermore, careful planning of surgical procedures according to the location, size, and the feature of the lesion, as well as collateral circulation are needed.

In conclusion, this report showed the world-first case of a successful endovascular treatment of a CMT aneurysm. Endovascular therapy can be done safely in selected cases of CMT aneurysm with sufficient collaterals to the liver and spleen.

| Table 1. Reported cases of CMT aneurysm |
|----------------------------------------|
| First author, year | Country | Case | Age (y) | Sex | Shape | Size (mm) | Location | Revascularization |
|---------------------|---------|------|---------|-----|-------|-----------|----------|------------------|
| Stanley et al., 1970 [3] | USA | 1 | 48 | M | Fusiform | NS | CMT orifice | Bypass |
| Bailey et al., 1991 [4] | USA | 1 | 46 | F | Saccular | 60 | Celiac trunk | Endoaneurysmal Dacron patch repair |
| Detroux et al., 1998 [5] | France | 1 | 51 | M | Saccular | 50 | Bifurcation | Primary repair of aneurysm neck |
| Matsumoto et al., 1999 [6] | Japan | 1 | 53 | M | Fusiform | 40 | Bifurcation | Interposition graft, SA reimplantation |
| Kalra et al., 2003 [7] | USA | 1 | 52 | F | Saccular | 20 | Celiac trunk | Direct anastomosis |
| Matsuda et al., 2006 [8] | Japan | 1 | 36 | M | Saccular | NS | Celiac trunk | Direct anastomosis |
| Mammano et al., 2009 [9] | Italy | 1 | 51 | M | Saccular | 33 | Celiac trunk | Primary repair of aneurysm neck |
| Iida et al., 2010 [10] | Japan | 1 | 46 | M | Saccular | 30 | Celiac trunk | Direct anastomosis |
| Obara et al., 2009 [11] | Japan | 1 | 73 | M | Fusiform | 25 | CMT | Bypass |
| Wang et al., 2010 [12] | China | 1 | 53 | M | Saccular | 38 | Celiac trunk | Primary repair & reimplantation of SMA to celiac trunk |
| Guntani et al., 2011 [13] | Japan | 1 | 82 | M | Saccular | 25 | Celiac trunk | Direct anastomosis |
| Higashiyama et al., 2011 [14] | Japan | 1 | 54 | M | Saccular | 40 | Celiac trunk | Direct anastomosis |
| Wang et al., 2014 [15] | China | 7 | – | – | NS | NS | NS | NS |
| Lipari et al., 2015 [2] | Italy | 1 | 52 | M | Saccular | 30 | Celiac trunk | Reimplantation of celiac trunk to aorta |
| VonDerHaar et al., 2015 [1] | USA | 1 | 45 | M | Saccular | 30 | Celiac trunk | Direct anastomosis |
| Current Study | Korea | 1 | 45 | M | Saccular | 21 | Celiac trunk | Endovascular coil embolization, SMA stent-graft |

CMT, celiomesenteric trunk; –, not available; M, male; F, female; NS, not stated; SA, splenic artery; SMA, superior mesenteric artery.
REFERENCES

1) VonDerHaar RJ, Shah A, Nissen NN, Gewertz BL. Primary intra-aneurysmal surgical repair of a celiomesenteric trunk aneurysm. J Vasc Surg Cases 2015;1:50-52.

2) Lipari G, Cappellari TF, Giovannini F, Pancheri O, Piovesan R, Baggio E. Treatment of an aneurysm of the celiac artery arising from a celiomesenteric trunk: report of a case. Int J Surg Case Rep 2015;8C:45-48.

3) Stanley JC, Thompson NW, Fry WJ. Splanchnic artery aneurysms. Arch Surg 1970;101:689-697.

4) Bailey RW, Riles TS, Rosen RJ, Sullivan LP. Celiomesenteric anomaly and aneurysm: clinical and etiologic features. J Vasc Surg 1991;14:229-234.

5) Detroux M, Anidjar S, Nottin R. Aneurysm of a common celiomesenteric trunk. Ann Vasc Surg 1998;12:78-82.

6) Matsumoto K, Tanaka K, Ohsumi K, Nakamur M, Obara H, Hayashi S, et al. Celiomesenteric anomaly with concurrent aneurysm. J Vasc Surg 1999;29:711-714.

7) Kalra M, Panneton JM, Hofer JM, Andrews JC. Aneurysm and stenosis of the celiomesenteric trunk: a rare anomaly. J Vasc Surg 2003;37:679-682.

8) Matsuda H, Ogino H, Ito A, Sasaki H, Minatoya K, Higashi M, et al. Aneurysm of the celiac artery arising from a celiomesenteric trunk. J Vasc Surg 2006;44:660.

9) Mammano E, Cosci M, Zanon A, Picchi G, Tessari E, Pilati P, et al. Celiomesenteric trunk aneurysm. Ann Vasc Surg 2009;257:e7-e10.

10) Iida Y, Obitsu Y, Komai H, Shigematsu H. Aneurysm of the celiacomesenteric trunk: a rare anomaly. Eur J Vasc Endovasc Surg Extra 2010;19:e10-e12.

11) Obara H, Matsumoto K, Fujimura N, Ono S, Hattori T, Kitagawa Y. Reconstructive surgery for a fusiform common celiomesenteric trunk aneurysm and coexistent abdominal aortic aneurysm: report of a case. Surg Today 2009;39:55-58.

12) Wang Y, Chen P, Shen N, Yang J, Chen J, Zhang W. Celiomesenteric trunk with concurrent aneurysm: report of a case. Surg Today 2010;40:477-481.

13) Guntani A, Yamaoka T, Kyuragi R, Honma K, Iwasa K, Matsumoto T, et al. Successful treatment of a visceral artery aneurysm with a celiacomesenteric trunk: report of a case. Surg Today 2011;41:115-119.

14) Higashiyama H, Yamagami K, Fujimoto K, Koshiba T, Kumada K, Yamamoto M. Open surgical repair using a reimplantation technique for a large celiac artery aneurysm anomalously arising from the celiomesenteric trunk. J Vasc Surg 2011;54:1805-1807.

15) Wang C, Cai X, Liang F, Chu F, Chen G, Duan Z. Surgical treatment of celiomesenteric trunk aneurysm-7 case report. Biomed Mater Eng 2014;24:3487-3492.

16) Panagouli E, Venieratos D, Lolis E, Skandalakis P. Variations in the anatomy of the celiac trunk: a systematic review and clinical implications. Ann Anat 2013;195:501-511.