

Case Report

Endovascular aortic repair with Cardiatis® multilayer flow modulator in a patient undergone ascending aortic replacement for type I aortic dissection

 Ferhat Borulu¹,  Oguzhan Birdal²,  Eyup Serhat Calik³,  Hakan Usta³,  Bilgehan Erkut³

¹Ordu University, Medical Faculty, Department of Cardiovascular Surgery. Ordu, Türkiye

²Atatürk University, Medical Faculty, Department of Cardiology. Erzurum, Türkiye

³Atatürk University, Medical Faculty, Department of Cardiovascular Surgery. Erzurum, Türkiye

Received: Mar 14, 2023 Accepted: May 26, 2023 Published online: Jul 15, 2023

Copyright©Author[s] - Available online at <http://turkishjournalofvascularsurgery.org/>
Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License



Abstract

Aortic dissection and aneurysms are one of the most important life-threatening diseases. After ascending aortic replacement, one of the life-saving urgent surgeries for Type I aortic dissection, aneurysmatic dilatation is usually observed in the remaining portions of the aorta over time. Open surgical repair for these patients still carries a 30% mortality rate despite improvements in open surgical methods, graft materials, and technological options. Endovascular repair provides promising results in high-risk patients. A 72-year-old female patient who underwent ascending aortic replacement for type 1 aortic dissection 9 years ago was admitted to our clinic with the diagnosis of symptomatic aneurysmal dilatation in the thoracic and abdominal aortic segments. We present this case in which we used the Cardiatis® Multilayer Flow Modulator stent to conduct endovascular repair.

Keywords: Multilayer flow modulator, aortic dissecting aneurysm, endovascular aortic repair

INTRODUCTION

The results of surgical treatment of dissecting and aneurysmatic aortic diseases have gradually improved with the decrease in mortality in recent years. Nevertheless, open surgery still has a high risk for comorbidities and mortality rates related to the surgical technique. In the last decade, endovascular repair techniques of thoracic aortic problems such as dissecting

aneurysm have been used to treat these diseases, especially in high-risk patients, but they have limited use in aortic arch and ascending aortic pathologies [1,2]. In this article, we present the treatment of dissecting aortic aneurysm that occurred years later in a patient who had ascending aortic graft replacement for Type I aortic dissection using Cardiatis multi-layer flow modulator (MFM®) stent (Cardiatis, Isnes, Belgium).

CITATION

Borulu F, Birdal O, Calik ES, Usta H, Erkut B. Endovascular aortic repair with Cardiatis® multilayer flow modulator in a patient undergone ascending aortic replacement for type I aortic dissection. Turk J Vasc Surg. 2023;32(2):114-7.



Corresponding Author: Eyup Serhat Calik, Atatürk University, Medical Faculty, Department of Cardiovascular Surgery. Erzurum, Türkiye
Email: eyupserhatcalik@hotmail.com

CASE REPORT

A 72-year-old female patient who underwent ascending aortic replacement 9 years ago for type I aortic dissection was admitted to our clinic with chest, back and low back pain. Contrast-enhanced computed tomography (CT) revealed chronic dissection and aneurysmal dilatation from the aortic arch to the iliac arteries. The aortic diameter was measured as approximately 5 cm at the thoracic level and 3 cm at the abdominal (Figure 1A). Supra-aortic, visceral and renal arteries were originated from the true lumen. The false lumen and the true lumen shared the same ostium at the level of the left renal artery (Figure 1B). The aortic diameters steadily grew in the years after the prior surgery, and it was found that the patient's chronic dissection continued from the aortic arch to the iliac arteries. Since the patient's pain increased and the thoracic and abdominal aortic diameters had both risen during the previous year by roughly 1 cm and 0.5 cm, respectively, it was decided to have the aortic aneurysm repaired. Open repair was abandoned due to the high mortality and morbidity risks and endovascular repair was decided. Although TEVAR was a viable option for the treatment of aortic pathology in this patient, the rapid expansion of the aorta at both the thoracic and abdominal levels in the last year, and our concern about the continuation

of this expansion and formation of malperfusion after TEVAR led us to treat from ascending aorta to iliac arteries with MFM stenting. It was clear that covered endografts were not appropriate for the treatment of the whole aorta because occlusion of vital aortic branches such as supra-aortic, mesenteric, celiac and renal arteries would be an inevitable result.

We decided to perform an endovascular procedure with MFM® for all aortic tissue from the ascending aorta to the iliac arteries in order to preserve vital branches' patency. We performed the endovascular intervention, using 2 aortic and 2 peripheral MFM® stents, patient in supine position, under local anesthesia and sedoanalgesia. Femoral artery cannulations were achieved by placing 6 French (F) introducer sheaths (Terumo Europe N.V., Leuven, Belgium) through bilateral groin incisions. A 5-F pigtail catheter (Medtronic, Minneapolis, MN, USA) was gradually advanced into the ascending aorta by torque movement, and confirmed by intermittent injection of contrast agent to be in the true lumen. Then, a 0.33 mm rigid guidewire (Lunderquist; Cook Medical, Bloomington, IN, USA) was advanced via the pigtail catheter to the coronary sinus and the catheter was removed. Next, the aortic 25x150 mm MFM® stent was placed from the level of the thoracic 10th vertebra to the aortic bifurcation.

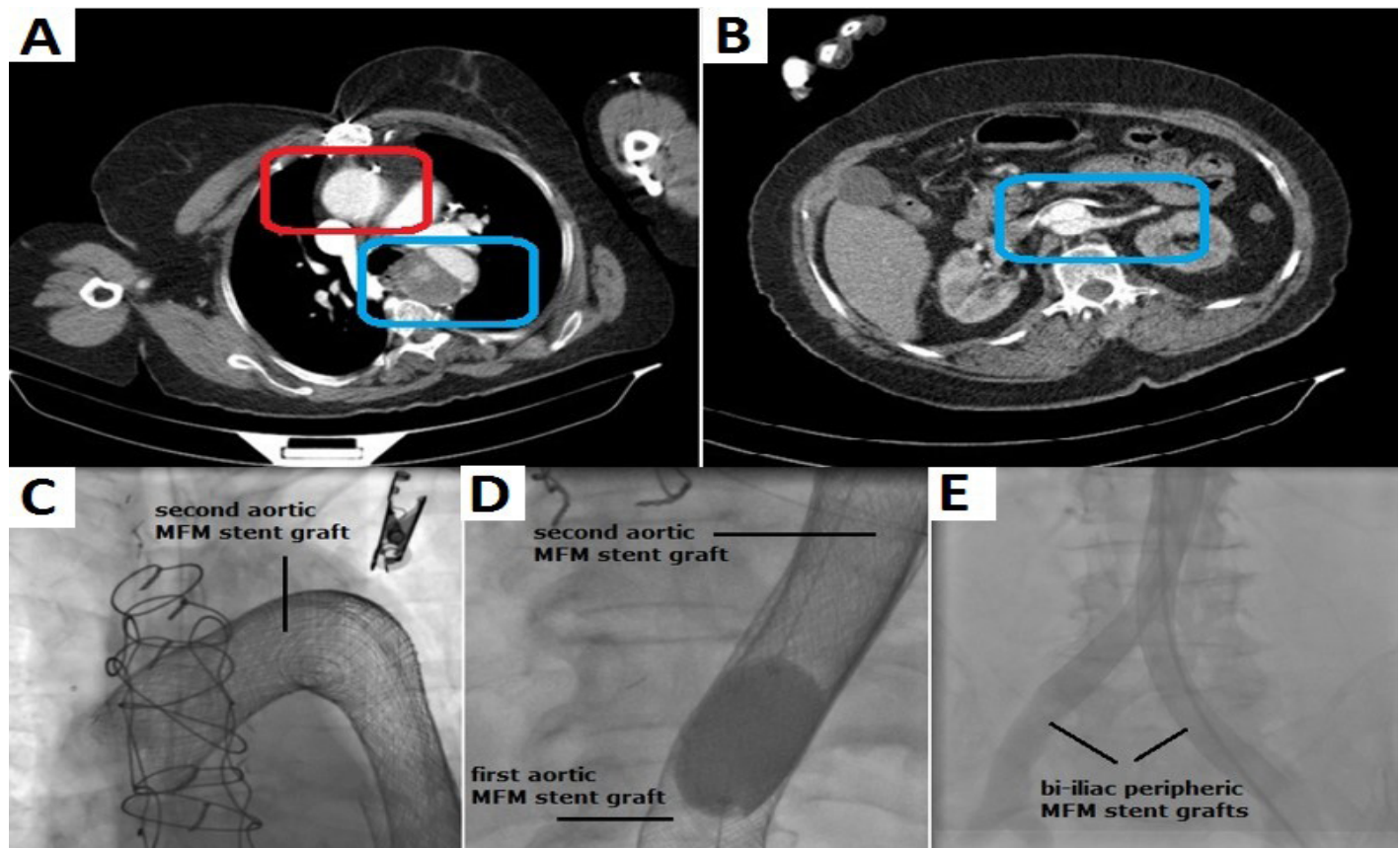


Figure 1. Previous Ascending aortic graft (red frame) and aneurysmal dissection in descending aorta (blue frame) (1A). Aortic aneurysm dissecting at the level of the renal arteries and perfusion of the renal arteries (blue frame) (1B). The MFM® stents applied from the ascending aorta to the iliac arteries (1C, 1D, 1E)

Later, the aortic MFM® stent 45x150mm in diameter was attached to the ascending aortic graft and opened (Figure 1C). And this second MFM® stent was extended into the first MFM® stent placed and balloon (Reliant; Medtronic) dilated at the junction (Figure.1D). Finally, 2 peripheral 16x120 mm MFM® stents, proximal portions approximately 5 cm inside the first MFM® aortic stent, were placed in the bilateral iliac

arteries (Figure 1E). After the procedure, distal peripheral pulses were palpable, and organ perfusion was normal. The patient was discharged asymptotically on postoperative day 2 with 75 mg clopidogrel daily. In the sixth month follow-up, flow was good in the MFM® graft lumen and aortic branches in the control CT, and thrombus had formed around the graft (Figure 2).

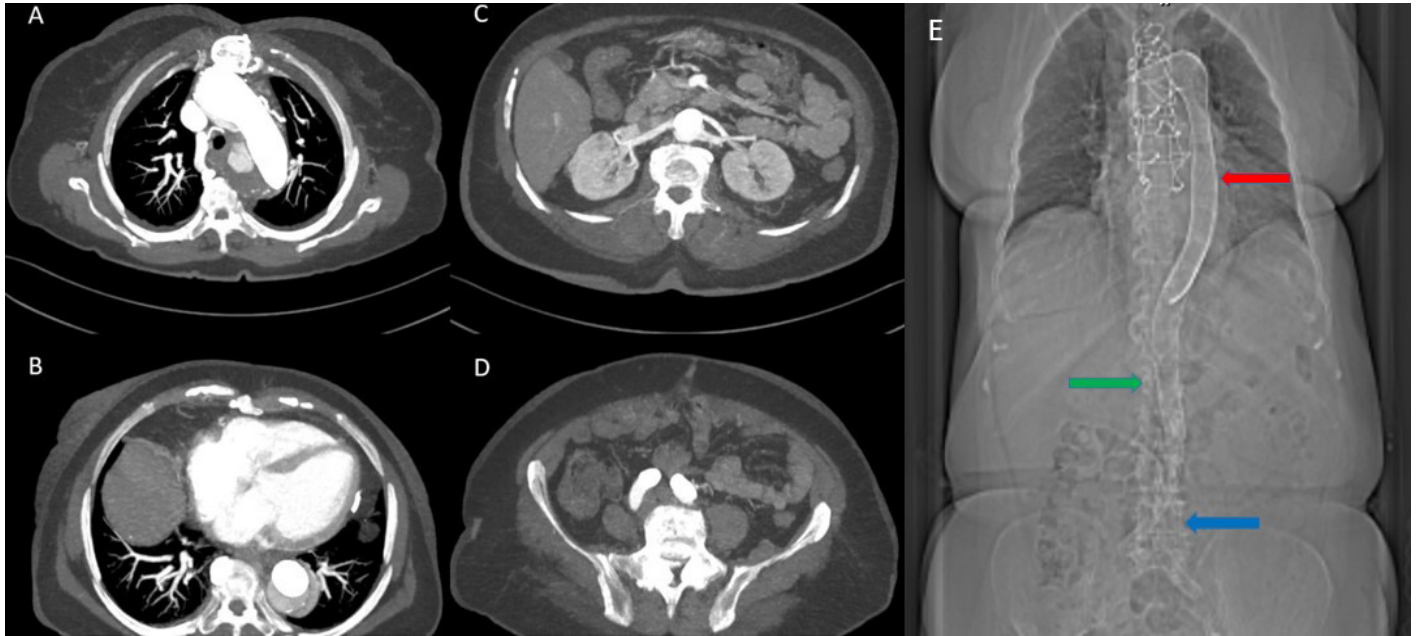


Figure 2. Sixth month computed tomography image. Levels of arcus aorta (2A), thoracic aorta (2B), renal arteries (2C) and iliac arteries (2D). Note the decreased flow and thrombus formation around the stents. **Figure 2E** shows direct radiography of the multilayer stent placed from the aortic arch to the bilateral iliac artery in tomography: Red arrow indicates thoracic stent, green arrow indicates abdominal and blue arrow indicates iliac stents

DISCUSSION

Endovascular repair has been employed often in aortic dissections and aneurysms, particularly following proximal aortic surgery, in recent years due to its efficacy in treating aortic disorders. Endovascular treatment of anatomically appropriate aortic dissections has a much less morbidity and mortality than open surgery, with the closure of the entry sites, creating a low-pressure false lumen and causing thrombosis [2].

Covered endovascular stent graft applications (TEVAR and/or EVAR) may impair vital organ perfusion by closing the side branches of the aorta and lead to undesirable consequences. With the use of aortic MFM® stents in recent years, occlusion of aortic branches has been prevented and organ perfusions have been preserved [2,3]. Aortic dissection continues in the remaining portions of the aorta, just as it did in the current patient who underwent ascending aortic surgery due to Type I aortic dissection, and aneurysmal dilatation eventually appears. Since the entire aorta is compromised in these patients, there

are only two options for treatment: endovascular repair or total aortic replacement with a significant mortality rate. To maintain organ perfusion, the endovascular intervention technique that is used must have the capability of preserving the patency of the aortic branches. Aortic MFM® stents produced for this purpose have become very important and life-saving products [4]. MFM® devices have many features such as restoration of healthy laminar blood flow, preservation of branch artery patency, organized stable thrombus formation, rapid endothelialization along the vessel wall, and an effective minimally invasive implantation procedure. These stents are also used effectively in the treatment of aneurysms of aortic branches, such as renal artery [5].

The Cardiatis MFM® is made from interconnected multilayered layers and cobalt-alloy metallic wires, naked and self-expanding braided wire tapered. It has a 3D layered structure that reduces turbulence, without causing an organizing thrombus and any reduction in collateral blood flow [4-6]. MFM® increases the intraluminal thrombus load in the complex thoracoabdominal aortic aneurysms and thus closes the aneurysm sac and maintains

the patency of the aortic branches. The mechanism of flow modulation is based on the configuration of the aneurysm and presence or absence of collaterals. If branches are present, the flow is redirected to the collaterals owing to the Venturi effect. The MFM® converts the turbulence in the aneurysm sac to laminar flow. The laminar flow in the aneurysm decreases the shear stress on the aneurysm wall, and thus increases the gradual development of thrombus as a result of the decreased flow rate in the aneurysm [7]. Consequently, rupture risk is decreased. Besides, the device maintains the patency of the vital branches such as mesenteric, renal, intercostal, and lumbar arteries.

In conclusion, the MFM® endovascular treatment has been shown to be a life-saving option in patients who have previously undergone cardiac surgery and an open surgical alternative in selected patient groups with Type I aortic dissection.

Patient informed consent: Written informed consent was obtained from the patient's legal guardians.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: All authors contributed equally to the article.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Petrov I, Stankov Z, Tasheva I, Stanilov P. Endovascular treatment of acute aortic dissection Stanford Type A. *JACC Cardiovasc Interv.* 2018;11:218-9.
2. Nienaber CA, Sakalihasan N, Clough RE, Aboukoura M, Mancuso E, Yeh JSM, et al. Thoracic endovascular aortic repair (TEVAR) in proximal (Type A) aortic dissection: ready for a broader application?. *J Thorac Cardiovasc Surg.* 2017;153:S3-11.
3. Hynes N, Sultan S, Elhelali A, Diethrich EB, Kavanagh EP, Sultan M, et al. Systematic review and patient-level meta-analysis of the streamliner multilayer flow modulator in the management of complex thoracoabdominal aortic pathology. *J Endovasc Ther.* 2016;23:501-12.
4. Calik E, Erkut B. Endovascular repair of a Stanford Type A dissection with the Cardiatis multilayer flow modulator. *Interact Cardiovasc Thorac Surg.* 2019;28:321-3.
5. Canyigit M, Cam A, Cetin H, Altunoğlu A, Hıdıroğlu M. The use of the Cardiatis multilayer flow modulator stent to treat sequential saccular aneurysms of the renal artery in a solitary kidney. *Turk Gogus Kalp Dama.* 2015;23:354-8.
6. Sultan S, Sultan M, Hynes N. Early mid-term results of the first 103 cases of multilayer flow modulator stent done under indication for use in the management of thoracoabdominal aortic pathology from the independent global MFMVR registry. *J Cardiovasc Surg.* 2014;55:21-32.
7. Oderich GS. Evidence of use of multilayer flow modulator stents in treatment of thoracoabdominal aortic aneurysms and dissections. *J Vasc Surg.* 2017;65:935-7.