Endovascular treatment for type B aortic dissection in a patient with Loeys-Dietz syndrome accompanied by potential lung cancer

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ABSTRACT

Loeys-Dietz syndrome is a recently recognized genetic connective tissue disorder. Aortic involvement in Loeys-Dietz syndrome is known to be more aggressive, even in young patients. Earlier and wider ranging surgical treatment is recommended because of the aggressive nature of its aortic pathology. We report the case of a 17-year-old girl diagnosed with acute type B aortic dissection accompanied by potential lung cancer. Because of rapid enlargement of the dissected aorta, urgent surgical intervention was considered to be mandatory. Considering the possible malignancy of the lung tumor, we reluctantly performed palliative thoracic endovascular aortic repair as an alternative to open surgery. However, endovascular treatment resulted in further expansion of the dissected aorta. Additional stent graft deployment at downstream aorta was performed and the false lumen flow was decreased significantly. Postoperative computed tomographic examination showed decreased descending aortic diameter with progressive false lumen thrombosis. In patients with Loeys-Dietz syndrome, the application of endovascular therapy should be performed more carefully than expected, especially if there is a reason that open surgery would be unsuitable.

Keywords: Loeys-Dietz syndrome, endovascular treatment, aortic dissection

Introduction

Loeys-Dietz syndrome (LDS) is a recently recognized multisystem connective tissue disorder (CTD) characterized by craniofacial and musculoskeletal abnormalities and aggressive aortic pathologies.\(^1\)\(^,\)\(^2\) This genetic disorder has similarities with Marfan syndrome (MFS); however, the aortic disease in LDS is known to be more aggressive, even in younger patients. Because of the aggressive nature of aortic pathologies, earlier and wider surgical intervention is recommended, whereas the application of endovascular treatment is still controversial in patients with LDS, as in other CTDs.\(^3\) In this article, we report our surgical experience in the case of a 17-year-old girl with LDS who possibly had lung cancer. She exhibited acute type B aortic dissection presenting extreme rapid enlargement of the dissected aorta and required urgent repeated thoracic endovascular aortic repair (TEVAR). Written informed consent was obtained from her parents for publication of this report.

Case report

A 17-year-old girl visited the emergency room (ER) of our hospital with a complaint of sudden-onset, severe back pain. The patient’s family history was unremarkable. She had undergone repeated open aortic surgeries at our institution. At 7 years of age, she had undergone a Bentall operation using a
stentless aortic root bioprosthesis for an annuloaortic ectasia and significant aortic regurgitation. At that time, physical examination demonstrated hypertelorism and bifid uvula, which suggested LDS. The diagnosis of LDS was confirmed by the detection of a mutation in the transforming growth factor-beta receptor type 1 (TGF-βR1) gene at the age of 10. During the follow-up, gradual enlargement of the aortic arch, to over 70 mm, was observed through annual computed tomography (CT) imaging. When she was 14 years old, graft replacement of the aortic arch and reconstruction of the brachicephalic artery and the left common carotid artery was performed.

On arrival at ER, her blood pressure was stable and laboratory examination showed no abnormal findings, although she complained of mild back pain. A CT revealed type B aortic dissection, from the descending aorta to the level of the diaphragm. The false lumen was patent and the maximum diameter of the dissected descending aorta was 20 mm (Fig. 1a, d). Despite the strict antihypertensive treatment, follow-up CT revealed rapid dilatation of the dissected descending aorta from 20 mm to 36 mm over less than 3 weeks (Fig. 1b). Furthermore, multiple pulmonary nodules were detected; the respiratory physician strongly suspected lung cancer (adenocarcinoma) (Fig. 1c). Although urgent surgical treatment should be mandatory to prevent aortic rupture, the application of open surgery requiring cardiopulmonary bypass was considered to be controversial because of its immunosuppressive effect on potential lung cancer. On the other hand, the use of TEVAR for the connective tissue disorder is more controversial. Considering the aortic emergency and the possible malignancy of the lung tumor, we decided to perform palliative TEVAR as an alternative to open surgery.

Under general anesthesia, the operation was performed. Intraoperative angiography was performed via right transbrachial route. The stent graft (The Bolton Relay Thoracic Stent Graft: Bolton Medical, Sunrise, FL, USA) was deployed at the proximal descending aorta to cover the primary entry tear. The surgical graft of the previous aortic arch repair was used as a proximal landing zone for endograft fixation. Then, the bare metal stent component (The Zenith Dissection Endovascular System: Cook Medical, Bloomington, IN, USA) was deployed to the narrow true lumen of the downstream aorta. Intraoperative angiography showed decreased false lumen blood flow, except for minimal flow through a pre-existing reentry point at the abdominal aorta.

Despite an uneventful postoperative course,
Follow-up CT at 2 weeks after primary TEVAR demonstrated an increasing descending aortic diameter from 36 mm to 48 mm (Fig. 2a, b). The descending aorta was enlarged with persistent false lumen blood flow (Fig. 2c). Furthermore, the dissection of brachiocephalic artery was seen. Since the aortic dissection continued to progress in spite of entry closure with primary TEVAR and antihypertensive therapy, secondary TEVAR was planned to reduce persistent false lumen blood flow. Angiography demonstrated increased false lumen flow through the new intimal tear induced by the distal end of the stent graft. Additional stent graft deployment was performed and the false lumen flow was decreased significantly. The postoperative course was uneventful, and she was discharged on postoperative day 12. After a 14-month follow-up period, she continues to do well. Although recent CT image showed decreased descending aortic diameter (41 mm) with progressive false lumen thrombosis (Fig. 3a, b, c), her untreated native aorta remains at high risk for adverse events. The diameter of
the dissected brachiocephalic artery was slightly increased to 22 mm. On the other hand, the size and number of pulmonary nodules were also unchanged. Timely recognition of progressive aortic disease and appropriate timing of aortic re-intervention are major concerns for proper management in the near future.

Discussion

LDS is a rare genetic CTD first described in 2005.1) Although LDS has similarities with MFS, they have distinctive phenotypes and genetic features. LDS is an autosomal dominant genetic disorder caused by the mutation of the TGF-βRI or 2 genes, whereas MFS is caused by the mutation of the gene coding for fibrillin-1. LDS is phenotypically characterized by the triad of hypertelorism, bifid uvula, and/or cleft palate as well as generalized arterial tortuosity throughout the entire aortic system.2) These characteristics are not found in patients with MFS. The differential diagnosis between the two syndromes is important because the progression and prognosis of aortic and branch vessel disease in both conditions is significantly different.2,4) Compared with MFS, the vascular pathology in LDS tends to be more aggressive, even in younger patients. Because of a higher incidence of aortic adverse events, an earlier and wider surgical strategy is occasionally needed to prolong the patient’s life expectancy. In LDS patients with acute aortic dissection, rapid aortic enlargement was seen to occur within a short period even if optimal hypertensive therapy was administered.5),6)

Inoue et al. reported a 6-year-old boy diagnosed with acute type B dissection whose dissected aorta enlarged from 36 mm to 39 mm within 2 weeks.5) In our present case, the disease progression was more rapid than that seen in previous reported LDS cases.5), 6) The dissected descending aorta dilated from 20 mm to 36 mm in less than 3 weeks after the onset. Furthermore, it was very surprising that follow-up CT at 2 weeks after primary TEVAR revealed an increasing descending aortic diameter from 36 mm to 48 mm. In addition to the fragility of the aortic wall, which is normally seen in patients with LDS, the radial force of the endovascular graft was strong enough not only to dilate the true lumen but also to enhance the total aortic enlargement. Furthermore, the new dissection of brachiocephalic artery appeared after primary TEVAR. Once acute aortic dissection appears in patients with LDS, rapid progression of aortic pathology is a major concern during acute patient management. LDS patients with acute aortic dissection require frequent follow-up CT examination during hospitalization, because a lack of follow-up monitoring may also lead to a catastrophic aortic event.

Although improvements in patient care have prolonged survival of patients with CTDs, their entire native aorta remains at high risk.3) Graft replacement of diseased aorta with open surgery is considered to be the gold standard in treatment. Even in the evolving endovascular era, the use of TEVAR for CTDs is still controversial.3) Roselli et al. reported their surgical experience of 121 patients with CTDs.3) Of these, only 2 patients underwent primary TEVAR for acute complicated type B dissection, except for hybrid or staged TEVAR cases. They mentioned that both patients were deemed high risk for emergent open repair. In elective hybrid or staged TEVAR, the surgical grafts from previous repairs provided a stable landing zone for endograft fixation. If a good proximal landing zone was not available, an open approach was preferred. A staged approach with the use of a combination of open and endovascular repair is a feasible strategy whose benefits outweigh the risks in patients with CTDs. With careful patient selection, TEVAR may prove to be a valuable tool for aortic emergencies even in patients with CTDs.7) However, according to previous reports, including the present case,5), 6) LDS seems to be more aggressive and progressive than other CTDs. In our case, palliative TEVAR was reluctantly taken into consideration to treat the life-threatening rapid progression of aortic pathology, because potential lung cancer was highly suspected. However, TEVAR in LDS resulted in further expansion of the dissected aorta. Therefore, in patients with LDS, the application of TEVAR should not be considered without careful discussion, especially if there is any reason why the patient would be unsuitable for open surgery. Fortunately, in
our case, the size and number of pulmonary nodules were not dramatically changed during follow-up. LDS is known to be associated with hematological malignancies, however, there have been no report of lung cancer in young patient with LDS. If the diagnosis of lung cancer can be ruled out by biopsy, open aortic surgery should be considered as an alternative to endovascular treatment in the near future. In patients with LDS, timely recognition of progressive aortic pathology and aggressive surgical intervention is crucial for proper management.\textsuperscript{4,8)}

**References**