Aortic Fenestration for Type B Chronic Aortic Dissection Complicated with Lower Limb Malperfusion Induced by Walking Exercise

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We report a case of a 55-year-old male with type B-chronic aortic dissection. Patient presented with intermittent claudication due to limb malperfusion resulting from expansion of a patent false lumen during walking regardless of normal range ankle-brachial index (ABI) at rest. Preoperative stress vascular ultrasonography was an effective modality for proper diagnosis. We should be concerned of reversible ischemia due to the dissection flap in patients with type B aortic dissection. Fenestration of the aorta can be a choice of treatment in such patients. The patient has been doing well with no ischemia for 3.5 years after the operation.

Key words: chronic aortic dissection, aortic fenestration, limb malperfusion

Introduction

Aortic dissection is complicated by peripheral vascular ischemic symptoms in about 30% of the patients.1 Obstruction of the aorta and its branches in chronic aortic dissection is caused by an expansion of the false lumen that compresses the true lumen.2 In a latest review, from 5% to 12% of patients with Type B aortic dissection were reported to have the incidence of lower limb malperfusion in acute phase.3 We report a case presented with low limb malperfusion induced by walking in chronic aortic dissection. He was treated with surgical aortic fenestration for type B chronic aortic dissection and the outcome was good.

Case Report

A 55-year-old man with a history of type B aortic dissection suffered 1.5 years ago, presented with intermittent claudication was referred to our hospital. The ABI of this patient at rest in the supine position was within the normal range. Right ankle-brachial index (ABI) was 1.07, left one was 1.05. However, the ABI worsened after walking exercise (Fig. 1a). Right ABI turned down to 0.55, left ABI turned down to 0.57.

Intermittent claudication started at distance of approximately 50 meters.

Computed tomography revealed that the false lumen was patent and that a dissection flap extended to the terminal aorta. The true lumen was compressed by the false lumen and was narrowed.

Mobile flap was detected near the terminal aorta by vascular ultrasonography, and blood flow to the bilateral limb was maintained without decrease in the ABI. However, a stress vascular ultrasonography performed after a 6-min walking exercise revealed that the subtotal occlusion of the true lumen in the terminal aorta caused by the expansion of a patent false lumen (Fig. 2). Furthermore, blood flow to the bilateral limb was reduced with simultaneous decrease in bilateral ABI.

We performed surgical resection of the flap in the terminal aorta under laparotomy. During the procedure, the dissection flap was found extended to 15 mm in the proximal position to the terminal aorta bifurcation. The distal edge was blind with a mural thrombus, though a small re-entry was present (Fig. 3). After fenestration, aortotomy was closed with 4-0 Prolene sutures reinforced with a 10-mm-width felt strip.

His symptom resolved following the operation. Achievement of functional recovery by this surgical treatment was confirmed by a stress ABI (Fig. 1b) and stress vascular ultrasonography performed after a 6-min walking exercise. Thermography after a walking test showed increased blood flow in the lower extremities, compared to the flow before the test. Enhanced computed tomography revealed...
the morphological correction. He was discharged on 21st postoperative day with no complications. After 3.5 years of operation he is doing well till date with no intermittent claudication on walking.

**Discussion**

In up to a third of patients of aortic dissection, it can be caused by peripheral vascular malperfusion and increase the risk of early death. Almost cases occur peripheral vascular malperfusion in acute phase. Crawford, et al. have well described the mechanism of obstruction of the aorta and its branches. False lumen expansion can compress the true lumen and cause aortic occlusion or obstruction of aortic branch vessel origins. Usually, most cases complicated with malperfusion of the aortic branch resulting from aortic dissection show an irreversible ischemia in any condition.

However, in the present case, despite a normal ABI at rest, walking exercise induced bilateral leg malperfusion in chronic phase. His limb malperfusion was resolved on holding the walking exercise. To the best of our knowledge, only two similar cases have been reported by Nakahira, et al., in which reported two cases of patients with type B chronic aortic dissection with a patent false lumen who presented with intermittent claudication despite a resting ABI of 1.0. They reported that the cause of leg malperfusion in the two cases was postural change, and they concluded that patients with type B aortic dissection with a patent false lumen should be carefully followed up, considering the postural reversibility of branch malperfusion. The cause of leg malperfusion in the present case
was the stress caused by walking exercise. The mechanism of leg malperfusion in this case was thought that compression of the true lumen by the patent false lumen with small re-entry became severe with elevation of the false lumen pressure by increasing cardiac output resulted from walking stress. If patients with type B aortic dissection with a patent false lumen present intermittent claudication, a stress ABI and a vascular ultrasonography should be keys to a proper diagnosis.

In latest review reported by Mauro Gargiulo, et.al., the incidence of lower limb malperfusion in Type B aortic dissection was ranged from 5% to 12% in 10 case series. Clinical features of lower limb malperfusion in Type B aortic dissection were that 97% cases were acute onset, chronic onset cases was only 3%. In almost cases, lower limb malperfusion in Type B aortic dissection presented as acute limb ischemia, and bilateral clinical presentation occurred in more than half of all cases. The development
of lower limb malperfusion in chronic phase, like as our case, is very rare, and only four cases were reported in the literature.5,6)

De Bakey, et al. reported the first survivor of the aortic fenestration in 1955.7) There are some reports on the efficacy of aortic fenestration for aortic dissection.7–9) Gargiulo, et al. described in his review the results of fenestration therapy for lower limb malperfusion in Type B aortic dissection. In almost cases treated in acute phase (97%), surgical and endovascular treatments were performed in 37% (51 patients) and 47% (65 patients), respectively. Surgical treatments include open fenestration, extra-anatomical bypass and aortic replacement. In patients treated by a surgical procedure, technical success was 100%, 30-day morbidity was 31% and 30-day mortality was 14%. On the other hand, technical success of endovascular treatment was 88%, 30-day morbidity was 46% and 30-day mortality was 8%.3)

About the detail of four cases treated in chronic phase, one case was treated by extra-anatomical bypass and the other cases were treated by surgical fenestration with or without grafting. All cases could obtain the successful revascularization and the hospital survival.5,6) Surgical aortic fenestration above the abdominal aortic bifurcation was very simple and useful strategy in our case. In this point, although a few cases were reported, we might have to bear the surgical fenestration in our mind as one promising method for revascularization in chronic phase.

Regarding the indication of aortic fenestration, Panetton, et al. have described that the key issue for aortic fenestration was careful patient selection.6) Most important factor of the indications for fenestration is the presence of organ or bilateral lower extremity malperfusion caused by true lumen compression with a patent false lumen. This suggestion validates the usefulness of open aortic fenestration in the present case.

Careful patient selection is necessary for making a proper treatment. In the present case, stress vascular ultrasonography revealed detailed morphological and hemodynamic changes. It was very useful for us to confirm that the true lumen was compressed by the expansion of the patent false lumen during the walking exercise, which induced bilateral limb malperfusion; for this reason, we performed surgical resection of the flap of the terminal aorta. In the present case, it was important and essential to perform a proper preoperative diagnosis based on the stress vascular ultrasonography.

We had the options to perform an aortic fenestration or a bypass to treat the patient’s limb malperfusion. We considered that aortic fenestration as a better option to resolve the limb malperfusion for the advantages of direct and prompt relief from the bilateral limb malperfusion. In addition, we selected the surgical resection of the flap in this case because of no aneurysmal change and stiff aortic wall of the chronic dissection in the terminal aorta. Furthermore, if we performed the prosthetic graft replacement of the terminal aorta, we would have had to accept the residual false lumen in the proximal aorta.

Conclusion

Patients with Type B chronic aortic dissections with patent false lumen may sometimes present with intermittent claudication induced by walking exercise. Stress ABI and vascular ultrasonography are essential for a proper diagnosis. Aortic fenestration is a simple, useful, and effective procedure to correct malperfusion caused by aortic dissection in selected patients.

Disclosure Statement

All authors have no conflict of interest.

References