

# Thoracoabdominal Aortic Replacement for Abdominal Aortic Aneurysm with Atypical Coarctation of Thoracoabdominal Aorta following Mitral Valve Plasty

Hitoshi Terada, MD, Teruhisa Kazui, MD, Katsushi Yamashita, MD, Naoki Washiyama, MD, Kazuchika Suzuki, MD, Takayasu Suzuki, MD, and Masato Suzuki, MD

**We successfully treated a case of a 65-year-old female with an abdominal aortic aneurysm coexisting with an atypical coarctation of thoracoabdominal aorta and celiac axis and superior mesenteric artery occlusion. A dilated inferior mesenteric artery was supplying the celiac artery and superior mesenteric artery regions. The patient also had mitral regurgitation. After a mitral valve plasty, we repaired the abdominal aortic aneurysm and the atypical coarctation of the thoracoabdominal aorta using partial extracorporeal circulation, segmental clamping, and a selective perfusion of both the bilateral renal artery and dilated inferior mesenteric artery. The patient had an uneventful hospital course and remains well. (Ann Thorac Cardiovasc Surg 2004; 10: 391–3)**

**Key words:** atypical coarctation of thoracoabdominal aorta, abdominal aortic aneurysm, mitral regurgitation, partial extracorporeal circulation

## Introduction

Although 98% of aortic coarctations are located in the proximal descending thoracic aorta near the ligamentum arteriosum, coarctation of the thoracoabdominal aorta, which is included in the category of atypical coarctation, is a rare condition accounting for 2% of cases of coarctation.<sup>1)</sup> The majority of these lesions are ascribed to Takayasu's arteritis.<sup>2)</sup> Takayasu's arteritis is a chronic, nonspecific inflammatory arteriopathic condition that commonly leads to occlusion and aneurysm formation in the aorta and its main branches.<sup>3)</sup> This inflammation results in cardiac involvement including mitral regurgitation as well as aortic regurgitation.<sup>4)</sup> This paper describes the rare case of a 65-year-old female who was successfully treated with an abdominal aortic aneurysm in association with atypical coarctation of the thoracoabdominal aorta with the aid of a partial femoro-femoral bypass fol-

*From First Department of Surgery, Hamamatsu University School of Medicine, Hamamatsu, Japan*

Received March 16, 2004; accepted for publication May 25, 2004. Address reprint requests to Hitoshi Terada, MD: First Department of Surgery, Hamamatsu University School of Medicine, 1-20-1 Handayama, Hamamatsu, Shizuoka 431-3192, Japan.

lowing mitral valve repair for mitral regurgitation.

## Case Report

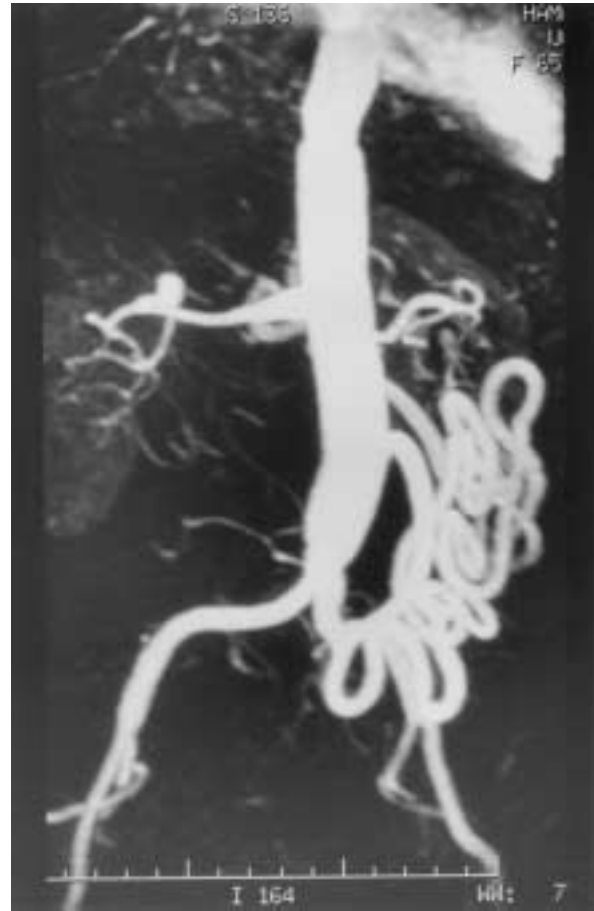
The patient is a 65-year-old female. She suffered from an unknown fever for a month at the age of 13 and felt calf pain when walking up several flights of stairs at the age of 42. She had been suffering from hypertension and receiving medical treatment for over 30 years. The result of physical examination showed the asymptomatic abdominal palpable mass. Preoperative C-reactive protein level was normal. Echocardiography revealed severe mitral regurgitation due to a prolapse of the posterior leaflet. Blood pressure was at 136/76 mmHg and 134/74 mmHg in the right and left arm with medication, respectively. Systolic blood pressure of both lower extremities were at 100 mmHg. Ankle brachial indices were 0.73 and 0.75 on the right and left, respectively. A chest radiograph demonstrated slight cardiomegaly and tortuosity of the descending aorta. An abdominal radiograph showed calcification of the thoracoabdominal aorta. Computed tomography demonstrated severely stenosed thoracoabdominal aorta with calcification and an abdominal aortic aneurysm with a maximum diameter of 7 cm.



**Fig. 1.** Preoperative magnetic resonance angiography showing atypical coarctation of the thoracoabdominal aorta with complete obstruction of the celiac and superior mesenteric artery and an infrarenal abdominal aortic aneurysm. Strikingly evident is the large meandering mesenteric artery originating from the inferior mesenteric artery.

Magnetic resonance angiography established atypical coarctation at the level of the diaphragm with a complete obstruction of the celiac and superior mesenteric arteries. Bilateral renal arteries were detected and an abdominal aortic aneurysm located in the infrarenal portion. A dilated meandering inferior mesenteric artery supplying the celiac and SMA regions was also detected (Fig. 1).

A two-stage operation was scheduled. First, a mitral valve plasty using quadrangular resection of the posterior mitral leaflet through a median sternotomy under cardiopulmonary bypass. A histopathological study of the resected posterior mitral leaflet showed myxomatosis with calcification. Four weeks later, a thoracoabdominal graft replacement was performed. The aorta was exposed through a left thoracoabdominal incision. After a femoro-



**Fig. 2.** Postoperative magnetic resonance angiography showing revascularization of the thoracoabdominal aorta with a successful anastomosis of the dilated inferior mesenteric artery and bilateral renal arteries.

femoral bypass was established, the descending aorta was segmentally cross-clamped at the level of the eleventh vertebra. A proximal anastomosis between the descending aorta and a 20 mm woven Dacron graft (Hemashield; Meadox Medical, Oakland, NJ) was accomplished with a 4-0 monofilament running suture. The eleventh intercostal artery was preserved in the proximal native aorta. A femoral artery perfusion was temporarily arrested and both the thoracoabdominal aorta with coarctation and the aneurysm was opened. The twelfth intercostal artery, first lumbar artery, the celiac artery and superior mesenteric artery was occluded. Severe calcification around the right renal artery was removed. The selective perfusion with 12 Fr balloon catheters (Fuji System, Tokyo, Japan) of both renal arteries and the dilated inferior mesenteric artery was performed at the rate of 400 ml per minute. Both renal arteries were resected in a button shape and anasto-

mposed to the side holes made in the graft with a 5-0 monofilament running suture. Next, the dilated inferior mesenteric artery was similarly resected and anastomosed. Finally, a distal anastomosis was completed just above the aortic bifurcation with a 4-0 monofilament running suture. Postoperative magnetic resonance angiography displayed satisfactory reconstruction of the dilated inferior mesenteric artery and both renal arteries 20 days after operation (Fig. 2). Histopathological study of the resected abdominal aortic aneurysmal wall showed only a slight inflammatory change while that of the thoracoabdominal aortic coarctation had severe calcification. The patient had an uneventful hospital course and remains well. No anastomotic aneurysm was demonstrated on computed tomography at 2 years after operation.

## Discussion

The stenotic lesions lying in a part of the aorta other than the aortic isthmus are defined as atypical coarctation. Although the etiology of this case was unclear, based on the past history including an earlier presentation for hypertension, being female, this presumed etiology would be Takayasu's arteritis. Our patient's clinical and histopathologic findings were consistent with Takayasu's arteritis in the late "burned out" stage, which is characterized by marked intimal and adventitial thickening, dystrophic calcification, and progressive luminal narrowing and stenosis.<sup>5)</sup> Combination coarctation and an aortic aneurysm accounts for 9.0 to 45.2% of cases of aortic coarctation.<sup>3,5)</sup> Fifty-one percent of aortic aneurysms combined with aortic coarctation were located distal to the coarctation.<sup>2)</sup> The mechanism for the occurrence of aneurysm had many sources, such as congenital weakness of the arterial wall, hypertension of the proximal portion, infection, and poststenotic dilatation.<sup>3)</sup> On the other hand, mitral valve diseases in Takayasu's arteritis are relatively uncommon, while aortic regurgitation is reported to be present in 13 to 44% of cases.<sup>6,7)</sup> It was unclear whether mitral regurgitation was related to Takayasu's arteritis or not, based on the histopathological findings of the mitral

valve in the present case. A mild valvular lesion may be exacerbated by increased hemodynamic loads occurring in secondary hypertension.

Operative indication for thoracoabdominal aortic replacement including the lesion of atypical coarctation might appear controversial, because the pressure gradient between proximal and distal sides of the coarctation stood at 36 mmHg. However, cross-clamping the distal descending aorta was necessary because the thoracoabdominal aorta was severely calcified and an abdominal aortic aneurysm occurred in a juxtarenal position. In addition, the inferior mesenteric artery was dilated and was the only collateral source to the abdominal organs except for the kidney. A surgical technique using femoro-femoral partial bypass, segmental clamping, and a selective perfusion of both bilateral renal arteries and a dilated inferior mesenteric artery proved useful in protecting the abdominal organs.<sup>8)</sup>

## References

1. Sealy WC. Coarctation of the aorta and hypertension. *Ann Thorac Surg* 1967; **3**: 15–28.
2. Lande A. Takayasu's arteritis and congenital coarctation of the descending thoracic and abdominal aorta: a critical review. *Am J Roentgenol* 1976; **127**: 227–33.
3. Miyata T, Sato O, Koyama H, et al. Long-term survival after surgical treatment of patients with Takayasu's arteritis. *Circulation* 2003; **108**: 1474–80.
4. Talwar KK, Kumar K, Chopra P, et al. Cardiac involvement in nonspecific aortoarteritis (Takayasu's arteritis). *Am Heart J* 1991; **122**: 1666–70.
5. Chieh JJ, Brevetti LS, Scholz PM, et al. Multiple isolated aneurysms in a case of "burned out" Takayasu aortitis. *J Vasc Surg* 2003; **37**: 1094–7.
6. Honig HS, Weintraub AM, Gomes MN, et al. Severe aortic regurgitation secondary to idiopathic aortitis. *Am J Med* 1977; **63**: 623–33.
7. Isomura T, Hisatomi K, Yanagi I, et al. The surgical treatment of aortic regurgitation secondary to aortitis. *Ann Thorac Surg* 1988; **45**: 181–5.
8. Kazui T, Komatsu S, Yokoyama H. Surgical treatment of aneurysms of the thoracic aorta with the aid of partial cardiopulmonary bypass: an analysis of 95 patients. *Ann Thorac Surg* 1987; **43**: 622–7.