

## CASE REPORT

# Thoracic Aorta Dissection Associated with Aberrant Right Subclavian Artery: Treatment with Endovascular Stent-Graft Placement

Carlos E. Baccin,\* Maria A. Montenegro, and Guilherme S. Mourão

*Hospital Beneficência Portuguesa — Med Imagem, São Paulo — SP*

*Dissecting aneurysm is the condition produced by separation of the layers of the arterial wall by circulating blood. Although rare, the coexistence of aortic dissection and aberrant right subclavian artery may be catastrophic. In this study we report the endovascular treatment of a patient with thoracic aorta dissection associated with aberrant right subclavian artery. Aortic clamping proximal to the left subclavian artery in a patient with an aberrant right subclavian artery slows or eliminates flow to both vertebral arteries. Endovascular repair eliminates the complications associated with aortic clamping during surgical repair in the presence of an aberrant right subclavian artery; therefore, it should be considered the treatment of choice in this situation.*

## INTRODUCTION

Dissecting aneurysm is the condition produced by separation of the layers of the arterial wall by circulating blood. It predominates in men and is frequently seen after 50 years of age [1]. Risk factors are atherosclerosis, arterial hypertension, congenital cardiac anomalies, Marfan syndrome, pregnancy and trauma. Its incidence is 5 to 10 per million of population [2].

According to the Stanford classification of aortic dissection, type A dissection involves the ascending aorta independent of the distal extension. Type B involves transverse and/or descending aorta without involvement of the ascending aorta.

Aberrant right subclavian artery is the most common congenital aortic arch anomaly and results from the persistence of the embryonic right dorsal aorta combined with involution of the arch segment between the right common carotid artery and right subclavian artery [3, 4]. Although it may be associated with extrinsic airway or esophagus compression [5], this anomaly is often asymptomatic and is frequently an incidental finding on imaging evaluations. Eight percent of aberrant right subclavian artery has an aneurysmal origin, that should be differentiated from an aortic injury [4].

---

\*Carlos Eduardo Baccin, M.D., Department of Interventional Radiology — Med Imagem, Hospital Beneficência Portuguesa, Rua Maestro Cardim, 769 — 1o sub-solo do bloco III, São Paulo, SP, Brazil — 01323-010. E-mail: edubaccin@hotmail.com.

The objective of this study is to report the endovascular treatment of a patient with thoracic aorta dissection associated with aberrant right subclavian artery.

### CASE REPORT

A 42-year-old man was referred to Hospital Beneficencia Portuguesa de São Paulo-SP-Brazil from an outside hospital presenting sudden onset of chest pain that radiated to the back and diagnosis of ruptured non-traumatic thoracic aortic dissection. He had a past medical history of severe hypertension and was admitted in our hospital 30 days after the onset of symptoms. Anteriorposterior chest X-ray showed an enlarged aortic arch, tortuous descending thoracic aorta, and signs of left pleural effusion. EKG showed sinus rhythm, occasional ventricular premature complexes, non-specific intraventricular conduction block, and left ventricular hypertrophy with left axis deviation. MRI showed dilated aortic arch and an aberrant right subclavian artery with aortic dissection arising distally to it and extending to the abdominal aorta (Stanford type B).

The procedure was performed under general anesthesia with tracheal intubation in the angiography suite. A 5F sheath was inserted in a retrograde fashion via the

arteriotomy site in the femoral artery. A 5F pig tail was advanced into the true lumen and aortography was performed to confirm the position of the entry tear and the aberrant right subclavian artery. An intravenous bolus of 10,000 units of heparin was administered and the 5F pig tail catheter was then exchanged for the 36X110mm Braile® stent-graft (Braile, São Paulo, Brazil) over an Amplatz superstiff wire (Boston-Scientific/Med-Tech, Natick, Massachusetts). After control of blood pressure was achieved (mean blood pressure <60mmHg), the stent-graft was deployed. After removal of the delivery system, an aortogram was obtained with use of a pig tail catheter showing successful placement of the device with complete sealing of the tear (Figure 1).

### DISCUSSION

Patients with aortic dissection may present sudden onset pain localized at the front or back of the chest, which typically migrates with propagation of the dissection. They may also present syncope, dyspnea, weakness, diaphoresis, spinal cord ischemia, pulmonary edema, loss of pulses, and hyper/hypotension. Symptoms are due to the intimal tear, dissecting



**Figure 1.** Magnetic resonance angiography showing (A) the aberrant right subclavian artery (arrow) and (B) the beginning of the dissection (arrow). Digital angiography showing (C) the dissection involving the descendent aorta (white arrow) and the aneurysm (black arrow). Note the placement of the endoprosthesis before its delivery. (D) Angiographic control of the procedure showing complete sealing of the tear preserving both subclavian arteries.

hematoma, occlusion of involved arteries, and compression of adjacent tissues [6].

Although angiography is considered the gold standard for the diagnosis of dissecting aortic aneurysm; it may also be performed by transesophageal ultrasound, computerized tomography or magnetic resonance imaging [1].

The treatment of aortic dissection depends mainly on the type of lesion. Ascending aortic dissection (type A) surgical correction with reconstruction of the aortic wall is mandatory. Patients with uncomplicated and stable distal dissection (type B) may be managed clinically by control of hypertension and reduction of cardiac contractility with beta-blockers. In the setting of propagation of the dissection, compromise of major branches of the aorta, impending rupture, or continued pain, surgery should be considered [6].

Because conventional surgical repair of aortic dissection is associated with serious respiratory, renal and neurological complications, and early surgical mortality [7], alternative procedures have been developed. One of the most promising techniques is the placement of an endoluminal aortic stent-graft [8-18]. The objective of this procedure is to seal the primary arterial tear, leading to the thrombosis of the false aortic lumen. Its mortality has been estimated in 0 to 16 percent [19-25], while the surgical mortality is as high as 35 percent [26]. Moreover, endovascular stent-graft placement may also be used for the emergency treatment of acute thoracic aorta disease [13].

The total procedure time of the endovascular placement of aortic endoprosthesis — from the surgical femoral artery dissection to deployment of the stent-graft — is no more than 30 minutes [7]. In addition, there is minimal blood loss, and the patient can be discharged in two or three days.

Although rare, the coexistence of aortic dissection and aberrant right subclavian

artery may be catastrophic. Aortic clamping proximal to the left subclavian artery in a patient with an aberrant right subclavian artery slows or eliminates flow to both vertebral arteries — with subsequent brainstem infarct — all subclavian branches, arms, and legs [27, 28]. Endovascular repair eliminates the complications associated with aortic clamping during surgical repair in the presence of an aberrant right subclavian artery [10]; therefore, it should be considered the treatment of choice in this situation.

## REFERENCES

1. Abrams HL and Kandarpa K. Dissecting aortic aneurysm. In: Baum S, ed. *Abrams' Angiography : Vascular and Interventional Radiology*. Philadelphia: Lippincot-Raven; 1998 [CD-ROM].
2. Wheat MW, Jr. Acute dissecting aneurysms of the aorta: diagnosis and treatment. *Am Heart J* 1980;99:373.
3. Osborn AG. The aortic arch and great vessels. In: Osborn AG, ed. *Diagnostic Cerebral Angiography*. Philadelphia: Lippincott Williams & Wilkins; 1999, pp. 3-32.
4. Freed K and Low VHS. The aberrant subclavian artery. *Am J Roentgenol* 1997;166: 481-4.
5. Donnelly LF, Fleck RJ, Pacharn P, Ziegler MA, Fricke BL, and Cotton RT. Aberrant subclavian arteries: cross-sectional imaging findings in infants and children referred for evaluation of extrinsic airway compression. *Am J Roentgenol* 2002;178:1269-74.
6. Dzau VJ and Creager MA. Diseases of the aorta. In: Fauci AS, et al., eds. *Harrison's Principles of Internal Medicine*, 14th edition. New York: McGraw-Hill; 1998 [CD-ROM].
7. Won JY, Lee DY, Shim WH, et al. Elective endovascular treatment of descending thoracic aortic aneurysms and chronic dissections with stent-grafts. *J Vasc Interv Radiol* 12:575-82, 2001.
8. Hausegger KA, Tiesenhausen K, Schdlbauer P, Oberwalder P, Tauss J, and Rigler B. Treatment of acute aortic type B dissection with stent-grafts. *Cardiovasc Intervent Radiol* 2001;24:306-12.
9. Cambria RP, Brewster DC, Lauterbach SR, et al. Evolving experience with thoracic aortic stent graft repair. *J Vasc Surg* 2002;35:1129-36.

10. Semba CP, Kato N, Kee ST, et al. Acute rupture of the descending thoracic aorta: repair with use of endovascular stent-graft. *J Vasc Interv Radiol* 1997;8:337-42.
11. Hutschala D, Fleck T, Czerny M, et al. Endoluminal stent-graft placement in patients with acute aortic dissection type B. *Eur J Cardiothorac Surg* 2002;21:964-9.
12. Farber A, Wagner WH, Cossman DV, et al. Isolated dissection of the abdominal aorta: clinical presentation and therapeutic options. *J. Vasc. Surg.* 36:205-10, 2002.
13. Czermak BV, Waldenberger P, Perkmann R, et al. Placement of endovascular stent-grafts for emergency treatment of acute disease of the descending thoracic aorta. *Am J Roentgenol.* 2002;179:337-45.
14. White RA, Donayre C, Walot I, Lee J, and Kopchok GE. Regression of a descending thoracoabdominal aortic dissection following staged deployment of thoracic and abdominal aortic endografts. *J Endovasc Ther* 2002;9(suppl 2):92-7.
15. Haulon S, Koussa M, Beregi JP, Decoene C, Lions C, and Warembourg H. Stent-graft repair of the thoracic aorta: short-term results. *Ann Vasc Surg* 2002;16:700-7.
16. Orend KH, Scharrer-Pamler R, Kapfer X, Kotsis T, Gorich J, and Sunder-Plassmann L. Endovascular treatment in diseases of the descending thoracic aorta: six-year results of a single center. *J Vasc Surg* 2003;37:91-9.
17. Lepore V, Lonn L, Delle M, et al. Endograft therapy for disease of the descending thoracic aorta: results in 43 high-risk patients. *J Endovasc Ther* 2002;9:829-37.
18. Lopera J, Patino JH, Urbina C, et al. Endovascular treatment of complicated type-B aortic dissection with stent-grafts: midterm results. *J Vasc Interv Radiol* 2003;14:195-203.
19. Dake MD, Kato N, Mitchell RS, et al. Endovascular stent-graft placement for the treatment of acute aortic dissection. *N Engl J Med* 1990;340:1546-52.
20. Mitchell RS, Miller DC, and Dake MD. Endovascular stent-graft repair of thoracic aortic aneurysms. *Semin Vasc Surg* 1997;10:257-71.
21. Mitchell RS. Endovascular stent-graft repair of thoracic aortic aneurysms. *Semin Thorac Cardiovasc Surg* 1997;9:257-68.
22. Nienaber CA, Fattori R, Lund G, et al. Non-surgical reconstruction of thoracic aortic dissection by stent-graft placement. *N Engl J Med* 1999;340:1539-45.
23. Ehrlich M, Grabenwoeger M, Zumelzu FC, et al. Endovascular stent-graft repair for aneurysms on the descending thoracic aorta. *Ann Thorac Surg* 1998;66:19-25.
24. Kato N, Hirano T, Takeda K, et al. Treatment of aortic dissections with percutaneous intravascular endoprosthesis: comparison of covered and bare stents. *J Vasc Interv Radiol* 1994;5:805-12.
25. Moon MR, Mitchell RS, Dake MD, Zarins CK, and Fann JI. Simultaneous abdominal aortic replacement and thoracic stent-graft placement for multilevel aortic disease. *J Vasc Surg* 1997;25:332-40.
26. Kato N, Shimono T, Hirano T, Ishida M, Yada I, and Takeda K. Transluminal placement of endovascular stent-grafts for the treatment of type A aortic dissection with entry tear in the descending aorta. *J Vasc Surg* 2001;34:1023-8.
27. Haesemeyer SW and Gavant ML. Imaging of acute traumatic aortic tear in patients with an aberrant right subclavian artery. *Am J Roentgenol* 1999;172:117-20.
28. Kawamoto S, Bluemke DA, and Fishman EK. Aortic dissection involving aberrant right subclavian artery: CT and MR findings. *J Comput Assist Tomogr* 1998;22:918-21.