

Simultaneous Surgical Treatment of Type B Dissection Complicated With Visceral Malperfusion and Abdominal Aortic Aneurysm

Role of Aortic Fenestration

Gianfranco Filippone, MD^{1*}, Gabriele Ferro, MD¹, Cristiana Duranti, MD²,
Gaetano La Barbera, MD¹, Francesco Talarico, MD¹

¹Division of Vascular and Endovascular Surgery, Palermo, Italy; ²Section of Radiology, Ospedale Civico e Benfratelli, Palermo, Italy

Abstract

Aortic dissection occurs in about 5% of patients with coexistent abdominal aortic aneurysm (AAA); combined type B dissection complicated with visceral malperfusion and AAA is an uncommon aortic emergency and patients presenting with complications of thoracic aortic dissection have a dismal prognosis related to difficulties in treatment strategies. Despite tremendous improvement of endovascular techniques, surgical aortic fenestration represents a quick, safe, and effective procedure able to restore flow in an otherwise malperfused aorta. This procedure has to be kept in mind because subsets of patients cannot be treated conventionally due to either prohibitive risk of aortic replacement, anatomic contraindication, or limitations of percutaneous procedures. Herein we report a case of a patient presenting with type B aortic dissection complicated by visceral malperfusion and AAA which was successfully treated simultaneously by open AAA repair and surgical fenestration. We focus on the mechanism of malperfusion and on the role of surgical fenestration.

Copyright © 2013 Science International Corp.

Key Words

Aortic dissection · Visceral malperfusion · Fenestration

Introduction

Aortic dissection occurs in 5% of patients with coexistent abdominal aortic aneurysm (AAA) increasing the risk for aortic rupture [1]; about 30% of acute type B dissections present life-threatening complications with a dismal prognosis due to high mortality caused by this catastrophic aortic emergency [2]. Moreover, association between AAA and type B dissection complicated by visceral malperfusion represents a clinical rarity but presents a challenge in both diagnosis and therapeutic strategies [3].

Herein we report a case of a patient presenting with type B aortic dissection complicated by visceral malperfusion and concomitant AAA which was successfully treated simultaneously by open AAA repair and surgical fenestration. We focus on the mechanism of malperfusion and on the role of surgical fenestration.

A 67-year-old hypertensive man experienced an acute type A dissection and was operated on one year earlier with a Bentall procedure and subtotal arch replacement using two grafts. He was admitted to our hospital complaining of persistent abdominal pain without peripheral pulse deficit; laboratory findings showed abnormal liver function test results and lactate elevation. Aware of the clinical history, a com-



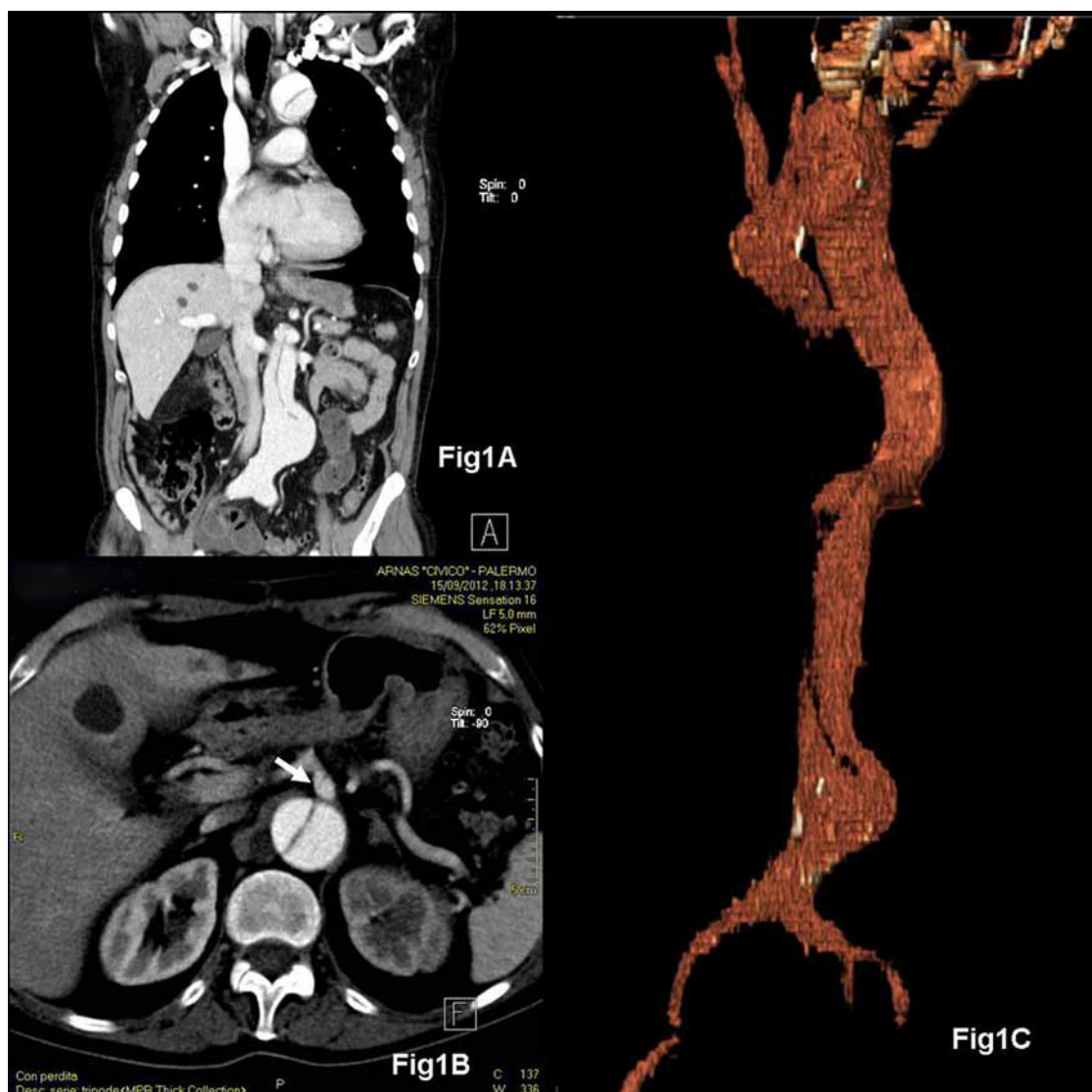


Figure 1. (A) Preoperative CT scan demonstrated extension of the dissection from distal arch to proximal neck of abdominal aortic aneurysm; (B) CT image showing true lumen compression of celiac trunk; (C) 3Mensio CT image demonstrating visceral malperfusion due to the false lumen being overpressurized.

puted tomography (CT) scan was proposed. The scan showed the two grafts used for extended aortic replacement and a type B dissection with an overpressurized false lumen originating below the subclavian artery (Fig. 1A), compressing a very thin true lumen with subocclusion of the celiac trunk and mesenteric artery (Fig. 1B). The spiralized cul de sac of the dissection stopped at the origin of an infrarenal, 5-cm abdominal aortic aneurysm (Fig. 1C).

The CT images were reconstructed with the 3Mensio medical imaging software program for a better visualization of the malperfusion mechanism, and the

patient was prepared for an emergent open AAA repair and surgical fenestration.

The abdomen was penetrated through a midline laparotomy and gross inspection showed a dark colored, bruised and pulseless long segment of the small bowel (Fig. 2A). The aorta was cross clamped below the left renal vein, and upon opening the AAA, the cul de sac of dissection with a large false lumen and a virtual true lumen was identified just above the AAA proximal neck (Fig. 2B). Fenestration of the intimal flap was performed, excising as much intima as possible in both a circumferential and longitudinal extent toward

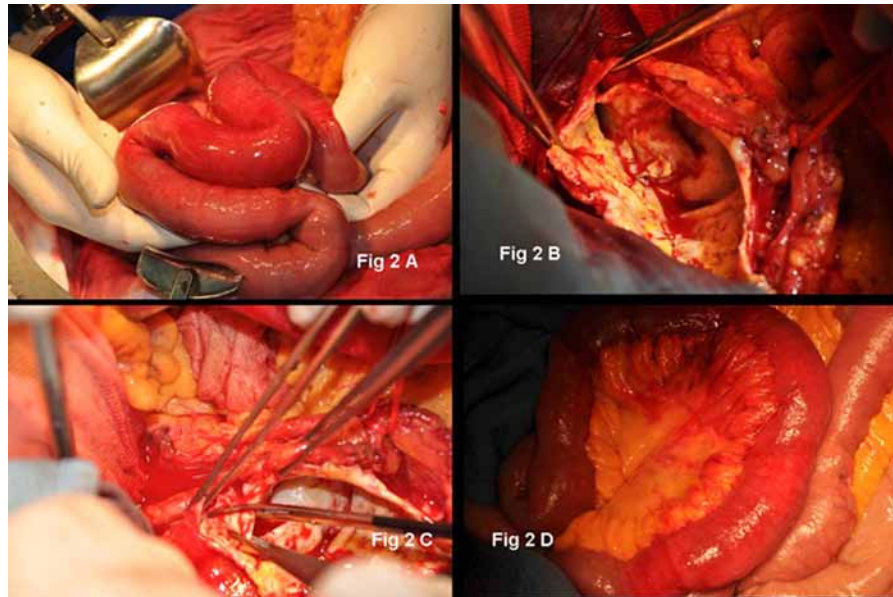


Figure 2. (A) Intraoperative view showing ischemic small bowel; (B) intraoperative view showing forcep opening true lumen of the dissected aorta; (C) incision of the intimal flap; (D) recovery of the small bowel after fenestration and AAA repair.

the proximal clamp (Fig. 2C). At the end of the procedure, a 20mm straight woven Dacron graft was sutured to the proximal aortic stump. Distal anastomosis above the aortic bifurcation completed the operation.

Inspection of the small bowel revealed rosy colored loops that, except for a very short segment, was otherwise viable; with recovery of vitality there was no need for resection (Fig. 2D).

The postoperative course was uneventful; a continuous decrease in biomarkers of end-organ ischemia was observed and after completion of a CT scan control (Fig. 3A and 3B) the patient was discharged to home two weeks later. At one year follow up, the patient is doing well and CT control shows a stable diameter at the top of the descending aorta.

As reported by Cambria, occurrence of acute dissection in an aorta previously afflicted with atherosclerotic aneurysm is unusual. In a series of 325 patients with aortic dissection, he identified only 5% of them with coexistent aneurismal disease. He pointed out that this association appears to increase the risk of aortic rupture in both the proximal and distal aorta, also indicating that the presence of a juxtaposed atherosclerotic aneurysm greater than 5 cm constitutes a “complicated” dissection and standard anti-hypertensive therapy fails to prevent aortic rupture.

The fate of the false lumen following primary repair of an aortic dissection influences the outcome of the

patient; remaining patent or partially thrombosed, it may be a source of complications, like for our patient where a life-saving operation converted a type A into a type B dissection.

Type B aortic dissection is generally treated with medical therapy when uncomplicated, but about 30% of cases at clinical presentation are complicated either by hemodynamic instability or by vascular ischemia with high risk of mortality if untreated [4].

The association between AAA and type B aortic dissection complicated with visceral malperfusion represents a clinical rarity but presents a challenge in both diagnosis and operative indications. The majority of patients with complicated type B dissection have a spiral aorta with collapse of the true lumen. In our patient the dissection progressed downward through the posterolateral wall of the descending thoracic aorta and then spiraled anteriorly, ending at the level of the origin of the abdominal atherosclerotic aneurysm.

The role of atherosclerotic plaque in the natural history of aortic dissection is uncertain. The analysis made by Roberts suggests that atherosclerotic plaque frequently serves to terminate the dissection process but the situation is quite different when atherosclerotic or degenerative aneurysm is present. In such a circumstance, rupture of the aneurysm is the more likely scenario.



Figure 3. (A) postoperative CT scan showing reexpansion of the true lumen; (B) 3Mensio CT scan demonstrating blood flow restored into visceral vessels and the AAA graft replacement.

The incidence of aortic branch vessel involvement in aortic dissection ranges from 25% to 50% [5]; expansion of the false lumen at the expense of the true channel is the most common mechanism of vascular obstruction. Absence of a distal re-entry site in the dissected aorta or its branches may jeopardize blood flow in the true channel to the point of total occlusion, leading to secondary distal thrombosis inside the aortic branch vessel.

According to evolving CT scan criteria, two types of ischemia mechanisms are depicted: aortic type and branch type. In the first one there is collapse of the true lumen inside the aorta while in the latter the dissection flap narrows the true lumen of a visceral artery [2].

Despite tremendous improvement in surgical and endovascular techniques, some patients cannot be treated either conventionally due to the prohibitive risk of an open procedure, or percutaneously due to anatomic contraindications or limitations of catheter-based interventions. A percutaneous procedure may consume time in a patient that needs quick intervention due to impending bowel infarction [7]. These

circumstances associated with the presence of the AAA that is a complication “per se” led us to perform surgical fenestration to restore flow in the true lumen and AAA repair at the same time.

The fenestration technique was first described in 1935, but the largest series have been reported by the Harvard and Yale groups [5,6]. Once control of the aorta is achieved, the vessel is crossclamped, usually below the renal arteries, and transected. The intimal flap is identified and a portion of the dissecting membrane is removed, sliding the scissors up to the level of the proximal clamp. In conclusion, the aim of the procedure is to form a re-entry point to decompress the false lumen and equipoise pressure in both channels of the aorta, permitting a re-expansion of the true lumen.

The interval between the appearance of complications and surgical treatment is related to the poor prognosis of complicated type B dissection. Surgical fenestration as previously described extraperitoneally, or in our case transperitoneally, in association with AAA repair can be performed quickly without specialized endovascular or imaging equipment.

Experience with short- and long-term outcomes following fenestration is scant, however, both the Yale and Harvard series demonstrated a three-year and five-year survival rate of 77% and 55%, respectively, with an almost 100% reperfusion rate. Failure of successful reperfusion was noted only in patients with a delay in the diagnosis of more than 48 hours after onset of dissection. It is of interest to note that no late aneurysmal development was noted in the survivors [5,6,8].

Combined type B aortic dissection complicated by visceral malperfusion and AAA represents an uncommon aortic emergency. Despite tremendous improvement of endovascular techniques, this challenging disease still carries high mortality mainly due to

difficulties relieving visceral ischemia. Surgical fenestration represents a safe, quick, and effective procedure; flow is restored above and below the site of operation. The best results are achieved when it is performed immediately on presentation with organ ischemia. In conclusion, this technique should be kept in the surgeon's repertoire because subsets of patients cannot be treated conventionally due to prohibitive risk of thoracic aortic replacement and/or anatomic contraindications or limitations of percutaneous procedures.

[Comment on this Article or Ask a Question](#)

References

1. Cambria RP, Brewster DC, Moncure AC, Steinberg FL, Abbot WM. Spontaneous aortic dissection in the presence of coexistent or previously repaired atherosclerotic aortic aneurysm. *Ann Surg*. 1988;208:619–624.
2. Uchida N, Shibamura H, Katayama A, Aishin K, Sutoh M, Kuraoka M. Surgical strategies for organ malperfusion in acute type B aortic dissection. *Interac Cardiovasc Thorac Surg*. 2009;8:7678. 10.1510/icvts.2008.186247
3. Roberts CS, Roberts WC. Combined thoracic aortic dissection and abdominal aortic fusiform aneurysm. *Ann Thorac Surg*. 1991;52:537–540. 10.1016/0003-4975(91)90920-L
4. Fattori R, Botta L, Lovato L, Biagini E, Russo V, Casadei A, et al. Malperfusion syndrome in type B dissection: role of the endovascular procedures. *Acta Chir Belg*. 2008;108:192–197.
5. Panneton JM, The SH, Cherry KJ, Hofer JM, Gloviczki P, Andrews JC, et al. Aortic fenestration for acute or chronic aortic dissection: An uncommon but effective procedure. *J Vasc Surg*. 2000;32:711–727. 10.1067/mva.2000
6. Pradhan S, Elefteriades JA, Sumpio BE. Utility of the aortic fenestration technique in the management of acute aortic dissections. *Ann Thorac Cardiovasc Surg*. 2007;13:296–300.
7. Hartnell GG, Gates J. Aortic fenestration: A why, when and how to guide. *Radiographics*. 2005;25:175–189. 10.1148/rg.251045078
8. Trimarchi S, Jonker FHW, Muhs BE, Grassi V, Righini P, Upchurch GR, et al. Long-term outcomes of surgical fenestration for complicated acute type B aortic dissection. *J Vasc Surg*. 2010;52:261–266. 10.1016/j.jvs.2010.02.292

Cite this article as: Filippone G, Ferro G, Durante C, La Barbera G, Talarico F. Simultaneous Surgical Treatment of Type B Dissection Complicated With Visceral Malperfusion and Abdominal Aortic Aneurysm: Role of Aortic Fenestration. *Aorta* 2013;1(2):126–130. DOI: <http://dx.doi.org/j.aorta.2013.12.008>