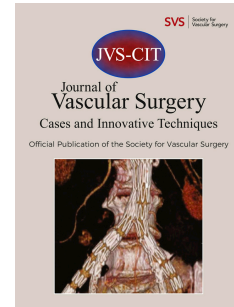


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A rare case of an acute type B aortic dissection contained infrarenal rupture of the false lumen after prior endovascular abdominal aneurysm repair

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1 **A rare case of an acute type B aortic dissection contained infrarenal rupture of the false**
2 **lumen after prior endovascular abdominal aneurysm repair**

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12 **Abstract**

13 New-onset acute type B aortic dissection (ATBD) after prior endovascular aneurysm repair
14 (EVAR) is extremely rare. The extension of aortic dissection can cause destabilization of the
15 previously implanted stent graft, thrombosis of the stent graft, and the rupture of the aneurysmal
16 sac with high mortality rate without therapy. This report describes the case of a 66-year-old
17 patient complaining of sudden abdominal pain radiating to both flanks. A computed tomography
18 angiography (CTA) of the aorta revealed ATBD with infrarenal rupture of the false lumen after
19 endovascular abdominal aneurysm repair five years prior. The patient underwent infrarenal open
20 surgical conversion with suprarenal aortic clamping and implantation of a bifurcated dacron graft.
21 Postoperatively no serious complications occurred of the treatment, except a fascial dehiscence.
22 In these cases, the patients can be treated in an emergency situation with open repair in spite of
23 the high risk for complications and mortality.

1 **Keywords:** ATBD; aortic abdominal rupture; acute type B dissection; endovascular repair;
2 open repair

3 **Introduction**

4 Acute type B aortic dissection accounts for 25% to 40% of all aortic dissections¹. Rupture of
5 acute type B aortic dissection is uncommon, occurring in fewer than 5% of all acute type B
6 dissections². Acute aortic dissection in combination with infrarenal aortic rupture after EVAR is
7 an extremely rare complication. Few case reports have described that treatment of patients with
8 ruptured aortic Stanford type B dissection after EVAR are often lethal³. In one of two cases, the
9 patient died after the open aortic repair at postoperative day 4, as a result of multisystem organ
10 failure. In the other case, the patient died without therapy after suffering cardiac arrest. Regarding
11 the endo repairs in these cases, there are no information in the literature.

12 This report describes a case of a patient who first received EVAR for treatment of an abdominal
13 aortic aneurysm (AAA) and five years later developed complicated ATBD with infrarenal aortic
14 rupture. In this case, according to Society for Vascular Surgery reporting standards for type B
15 aortic dissection from 2020, the primary entry tear of the hyperacute aortic dissection (< 24
16 hours) is in zone 3 extending to zone 9 (type B_{3,9}). Open surgery of the patient was the last
17 option for the treatment in this case.

18 For publishing, data and images were obtained from a patient publication consent form.

19 **Case report**

20 A 66-year-old-man was seen with normal blood pressure (120/70 mmHg) after rupture of the
21 infrarenal aorta and complained of sudden abdominal pain radiating to both flanks at our
22 emergency department. The patient presented with a history of smoking and arterial
23 hypertension. He had been taking candesartan 16mg as an antihypertensive drug and
24 acetylsalicylic acid 100mg per day. The physical examination of patient was unremarkable, with

1 the exception of abdominal pain radiating to both flanks. Blood analysis revealed a high serum
2 creatinine level (3.63 mg/dl). The patient mentioned treatment history of EVAR (AFX,
3 Endologix, Irvine, USA) because of an asymptomatic, abdominal aortic aneurysm (diameter 5.1
4 cm) five years prior. A computed tomography angiography (CTA) scan of the aorta showed an
5 acute aortic dissection type B with main entry distal to the left subclavian artery in combination
6 with the infrarenal rupture of the false lumen, which was not present in the last follow-up
7 contrast-enhanced CT scan of the abdomen and pelvis three years prior. Spontaneous aneurysmal
8 sac shrinkage after EVAR was not observed during last follow-up. The false lumen extended
9 distally to the infrarenal aorta (segment 4) beyond the stent graft with retroperitoneal hematoma
10 suggestive for rupture (**Fig.1**). CTA scan showed the false lumen with major supply for the right
11 kidney, as well as the superior mesenteric artery, while the celiac trunk had dual supply from
12 both lumens. The left kidney was already non-functional in the CTA scan after ATBD.
13 Additionally, the CTA showed an aneurysmal lesion of the right common iliac artery of 3.75cm,
14 and left internal iliac artery aneurysm of 3.1cm.

15 The patient declined surgery due to potential complications, such as dialysis and intestinal
16 ischemia. However, after 12 hours, the patient decided for the surgery after speaking with his
17 family. After receiving informed consent, the patient underwent infrarenal open surgical
18 conversion, with suprarenal aortic clamping of 30 minutes, and implantation of a bifurcated
19 dacron graft (Hemagard, GETINGE, Göteborg, Sweden). The identification of the true lumen of
20 dissection was unproblematic because the aortic neck with the stent graft inside was easy to
21 identify. Proximal aortic anastomosis including the whole aortic wall was infrarenal with end-to-
22 end configuration after removal of the stent graft. Distal anastomoses were performed on the left
23 external iliac artery and right common iliac artery with end-to-end configurations. The non-

1 functional left renal artery after ATBD and left internal iliac artery with aneurysm were ligated.
2 The duration time of surgery was 210 minutes. Estimated blood loss was 200 ml.
3 The postoperative course was significant for a transient elevation of creatinine, and oliguria that
4 improved gradually. Ultrasound was performed, which showed normal perfusion of the right
5 kidney. The relevant postoperative complication was a fascial dehiscence after two weeks, which
6 was closed with Vicryl mesh (Johnson& Johnson, New Brunswick, USA) and treated with
7 vacuum therapy for another two weeks. Afterwards, wound dehiscence was treated
8 conservatively.
9 The postoperative computed tomography scan after three weeks showed unaltered type B
10 dissection of the thoracic aorta, and successful surgical treatment of ATBD with infrarenal false
11 lumen rupture after EVAR, and reperfusion of the right kidney artery (**Fig.2**).

13 **Discussion**

14 Antegrade TBAD after endovascular repair of AAA is an extremely rare, and potentially lethal
15 condition. Only a few cases describe aortic dissection post aortic aneurysm repair.³⁻⁷
16 Nomura³ et al. summarized in 2018 case reports of similar antegrade complicated TBAD. They
17 found that timing of aortic dissection after abdominal aorta repair varied from 11 weeks to 10
18 years. Different complications after ATBD in combination with EVAR were described, such as
19 endograft thrombosis in 8/10 cases, endograft collapse in 8/10 cases, or rupture in 2/10 cases,
20 with often disastrous outcomes. Treatment with aortic rupture is described as difficult or not
21 possible because of risk of multiorgan failure postoperatively.
22 In the case described above, life-threatening type B aortic dissection in normotensive patient
23 occurred five years after uneventful treatment for infrarenal aneurysm with EVAR. Normal blood
24 pressure during the aortic dissection is unusual. The blood pressure was measured after the

1 rupture of the infrarenal aorta, but most likely the acute type B dissection was caused by high
2 blood pressure. In the literature, all patients with the same conditions were normotensive⁸⁻⁹.
3 The recommended surveillance for endovascular graft is usually 3- and 6-months post repair, and
4 then annually¹⁰. In this case, the patient lost follow up in the last three years prior to the ATBD
5 with infrarenal rupture of false lumen. Spontaneous type B aortic dissection is the most probable
6 cause, given the period of five years between ATBD and the repair of AAA. The device-related,
7 procedure-related dissection of aorta after stent graft implantation will usually occur in a shorter
8 time after surgery. The post-procedure contrast-enhanced CT scan of the whole aorta of the
9 patient on the third postoperative day showed no evidence of aortic dissection.
10 Presumably the stress to the calcified, aortic wall from high blood pressure weakened the aorta
11 wall, which caused an acute type B dissection with main entry distal to the left subclavian artery.
12 Apparently, the increased pressure in diastole in the false lumen was sufficient to dissect the
13 aortic wall beyond the proximal origin of the prior stent graft. The radial force exerted by the
14 endograft over the length of the proximal neck was obviously exceeded by the dissection lumen.
15 The false lumen of the dissection terminated in the excluded aneurysm sac, resulting in a lack of
16 outflow, and caused a rupture of infrarenal aorta.
17 In our opinion, the design of the aortic endograft doesn't have an impact on the risk of rupture
18 during TBAD. The aortic dissection is an arterial wall disease, in which the inner layer of the
19 aortic wall tears and separates from the middle layer of the aortic wall. The dissection is not
20 between the aortic wall and the endograft. If the endograft would increase the rupture risk during
21 dissection, it would lead to a local rupture or penetration of the stent graft in the aortic neck. In
22 our case we don't see that.
23 Endovascular treatment of complicated type B dissection using TEVAR for entry occlusion is
24 common. The standard treatment with TEVAR in ATBD with combination of infrarenal aortic

1 rupture of false lumen after EVAR would be ineffective because of multiple reentries, and
2 therefore not a treatment option. Only open abdominal repair in spite of the high risk for
3 complications and operative mortality is possible.

4 In the present case, after suprarenal clamping of the aorta within 30 minutes, there was no celiac
5 artery (CA), superior mesenteric artery (SMA), or lower leg malperfusion. Postoperatively, the
6 patient had a few days of acute kidney insufficiency, while in the intensive care unit which
7 improved gradually despite single kidney perfusion.

8 Postoperative computed tomography scan showed unaltered type B dissection of thoracic aorta,
9 which now classified as uncomplicated, and without conspicuous finding after the surgical
10 treatment.

11 **Conclusions**

12 We described a very rare case of ATBD in combination with infrarenal false lumen rupture after
13 EVAR. Open surgery of complicated infrarenal aorta rupture and non-functional left kidney after
14 acute type B dissection is the treatment of choice in hemodynamically stable patients despite the
15 high risk of complications, especially dialysis. Treatment of postoperative uncomplicated type B
16 dissection of thoracic aorta is conservative, with follow-up examination with CTA scan of the
17 chest in 6 months and annually. Nevertheless, patient condition, morbidity, and age of patient
18 play a role in surgical outcome, and therefore has to be analyzed individually.

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4 **Author contribution**

5 **E.Streck:** design and conception; data analysis, data collection and interpretation; writing –
6 original draft. **Y.Souri:** design and data collection. **A. Hyhlik-Dürr:** conception; supervision;
7 writing-review and editing.

8 **Declaration of conflicting interests**

9 The authors declared no potential conflicts of interest with respect to the research, authorship,
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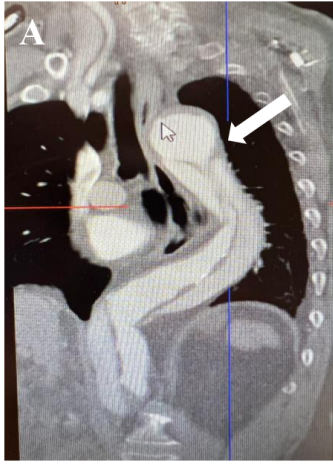
24

1 **References**

- 2 1. G Chad Hughes. Management of acute type B aortic dissection; ADSORB trial. *J Thorac*
3 *Cardiovasc Surg.* 2015;49:158-62. doi: 10.1016/j.jtcvs.2014.08.083
- 4 2. Estrera AL, Miller III CC, Safi HJ, Goodrick JS, Keyhani A, Porat EE, et al. Outcomes of
5 medical management of acute type B aortic dissection. *Circulation.* 2006;114: I384-9.
6 doi:10.1161/CIRCULATIONAHA.105.001479.
- 7 3. Nomura Y, Nagao K, Hasegawa S, Kawashima M, Tsujimoto T, Izumi S, et al. Fatal
8 Complications of New-Onset Complicated Type B aortic dissection after endovascular
9 abdominal aortic aneurysm repair: report of 2 cases and literature review. *Vascular and*
10 *Endovascular Surgery.* 2018;53: 255-8. doi: 10.1177/1538574418819540
- 11 4. Iyer V, Rigby M, Vrabec G. Type B aortic dissection after endovascular abdominal aortic
12 aneurysm repair causing endograft collapse and severe malperfusion. *J Vasc Surg.* 2009;50:
13 413-6. doi: 10.1016/j.jvs.2009.03.060.
- 14 5. van Keulen JW, Toorop RJ, de Borst GJ, Scharn DM, Prokop M, Moll FL, et al. Abdominal
15 stent-graft collapse due to progression of a Stanford type B dissection. *J Endovascular*
16 *Ther.* 2009;16(6):752-4. doi: 10.1583/09-2891.1.
- 17 6. Vainas T, Tielliu IFJ, de Vries BMW, van der Laan VM, Zeebregts CJ, van den Dungen
18 JJAM. Acute type B dissection complicated by infrarenal aortic stent-graft collapse with
19 spontaneous re-expansion. *J Endovascular Ther.* 2014;21(2):353-5. doi: 10.1583/13-4595L.1.
- 20 7. Yoshiga R, Morisaki K, Matsubara Y, Yoshiya K, Inoue K, Matsuda D, et al. Emergency
21 thoracic aortic stent grafting for acute complicated type B aortic dissection after a previous
22 abdominal endovascular aneurysm repair. *Surg Case Rep.* 2015;1(1): 99. doi: 10.1186/s40792-
23 015-0096-3

- 1 8. Haulon S, Greenberg RK, Khwaja J, Turc A, Srivastava SD, Eagleton M, et al. Aortic
2 dissection in the setting of an infrarenal endoprosthesis: a fatal combination. *J Vasc Surg.*
3 2003; 38(5): 1121-4. doi: 10.1016/s0741-5214(03)00931-5
- 4 9. Daniel G, Ben Ahmed S, Warein E, Gallon A, Rosset E. Type B Aortic Dissection with
5 Abdominal Aortic Aneurysm Rupture one year after Endovascular Repair of Abdominal
6 Aortic Aneurysm. *Annals of Vascular Surgery.* 2016: 229.e7-e10.
7 doi:10.1016/j.avsg.2015.11.022
- 8 10. Daye D, Walker TG. Complications of endovascular aneurysm repair of the thoracic and
9 abdominal aorta: evaluation and management. *Cardiovasc Diagn Ther.* 2018;8(1): 138-156.
10 doi: 10.21037/cdt.2017.09.17
11

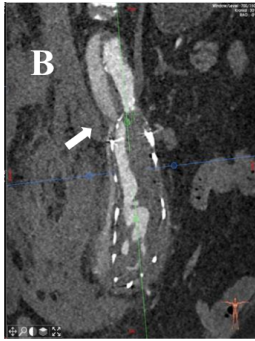
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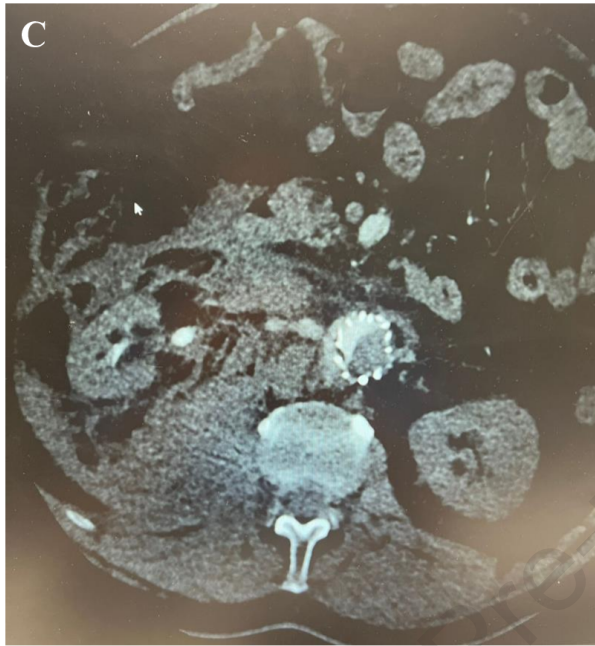
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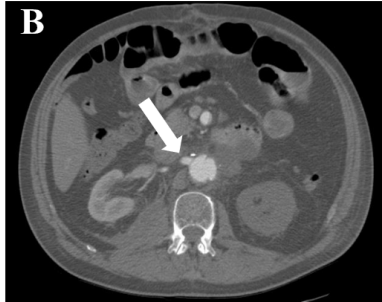
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Figure 1. Preoperative CT images of aorta demonstrating acute type B dissection at the level of the descending aorta with (A), hematoma after infrarenal rupture of the false lumen ATBD after EVAR with AFX stentgraft (B), no perfusion of left renal artery after ATBD (C). Arrow shows an entry tear (A) and re-entry tear (B) on the CT scan.

Figure 2. Postoperative CT image of aorta after removal of the stent graft AFX and implantation of a bifurcated dacron graft (A) with reperfusion of the right kidney artery (B)

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