

## Open Repair of a Late Type IA Endoleak after Endovascular Aneurysm Repair for Abdominal Aortic Aneurysm: A Case Report

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**Abstract:** A 70-year-old man presented with a late Type Ia endoleak following an endovascular aortic repair (EVAR) procedure for an abdominal aortic aneurysm (AAA) performed at my institution 10 years ago. An additional aortic extension cuff was placed above the previously implanted aortic stent graft using an endovascular approach. Despite this intervention, the Type Ia endoleak persisted, and it was concluded that further endovascular treatments would be insufficient, necessitating surgical repair. The patient subsequently underwent open repair surgery due to the risk of rupture. The procedure involved removal of the stent graft, aneurysmectomy, and replacement with a bifurcated aortoiliac graft. Additionally, a suprapubic femoro-femoral crossover bypass surgery was performed to resolve the intimal damage to the left common iliac artery that occurred during stent graft removal. Open repair offers a definitive solution for complex endoleaks when endovascular methods are ineffective. However, the removal of the stent graft can result in arterial intimal injury, necessitating additional measures such as a suprapubic femoro-femoral crossover bypass to ensure adequate blood flow.

**Keywords:** Aneurysm, Aorta, abdominal aorta, iliac artery, Endovascular aneurysm repair, Surgery.

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### INTRODUCTION

Endovascular aneurysm repair (EVAR) is a safer and less invasive alternative to surgery for patients with abdominal aortic aneurysms. However, endoleaks can present a significant challenge. An endoleak is the persistent leakage of blood outside the stent graft and into the aneurysm sac, representing a common complication of EVAR. There are five types of endoleaks. Type Ia endoleaks occur when there is persistent blood flow into the aneurysm sac due to an inadequate proximal seal, which can result in aneurysm enlargement and potentially lead to rupture. This case report discusses a complex case of a late-onset endoleak following EVAR that was successfully managed with open repair.

### CASE PRESENTATION

A 70-year-old man with a history of prior endovascular aneurysm repair (EVAR) was admitted

with lower abdominal pain that had persisted for a week. Approximately 10 years ago, he had undergone successful treatment for a 54-mm abdominal aortic aneurysm (Figure 1) using a SEAL iliac branched stent graft (24×40 mm; S&G Bio Tech, Seongnam, South Korea) and iliac extensions (Right: 12×120 mm, Left: 12×102 mm, S&G Bio Tech, Seongnam, South Korea) without any evidence of an endoleak (Figure 2). However, the patient subsequently lost follow-up and returned to the hospital due to abdominal pain. Upon admission, a computed tomography (CT) scan revealed a Type Ia endoleak in the abdominal aortic aneurysm (Figure 3). An additional aortic extension cuff (S&G Bio Tech, Seongnam, South Korea) was placed above the previously implanted aortic stent graft using an interventional approach. Despite this intervention, the Type Ia endoleak persisted, and it was determined that further endovascular methods would not resolve the issue, necessitating surgical repair.

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The surgery was performed under general anesthesia with a laparotomy. Since the proximal portion of the stent was positioned above both renal arteries and the superior mesenteric artery, clamping the aorta through the laparotomy proved challenging. To address this, a left anterolateral thoracotomy was performed to allow for safe aortic clamping. The endovascular stent graft was removed through an aortic incision after thoracic aortic clamping, and the abdominal aorta, including the abdominal aortic aneurysm, was resected. An infra-renal aorto-bi-iliac bypass was then created

using a 20×10 mm Hemashield Dacron graft. Upon suturing the wound, the absence of a left femoral pulse was noted. Intraoperative angiography confirmed total occlusion of the left common iliac artery, which could not be resolved through percutaneous endovascular intervention. Intimal damage to the left common iliac artery was estimated to have occurred during stent graft removal. Consequently, a suprapubic femoro-femoral bypass surgery was performed using an 8-mm PTFE graft (Figure 4). The patient's postoperative course was unremarkable.

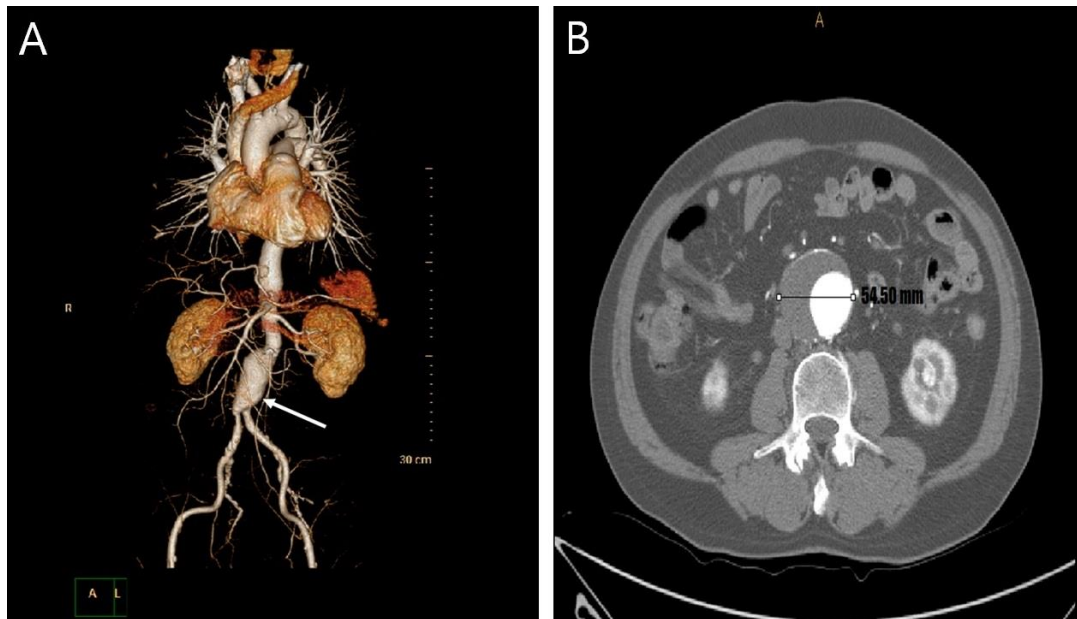


Figure 1: Computed tomography (CT) showing infra-renal abdominal aortic aneurysm (A) with a diameter of 54.50mm (B)

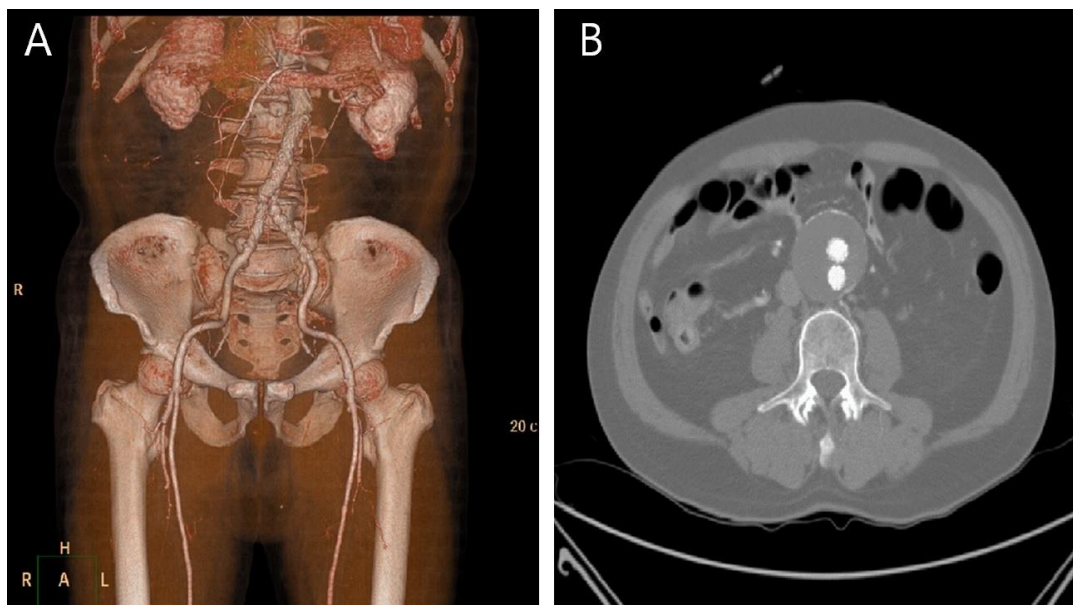
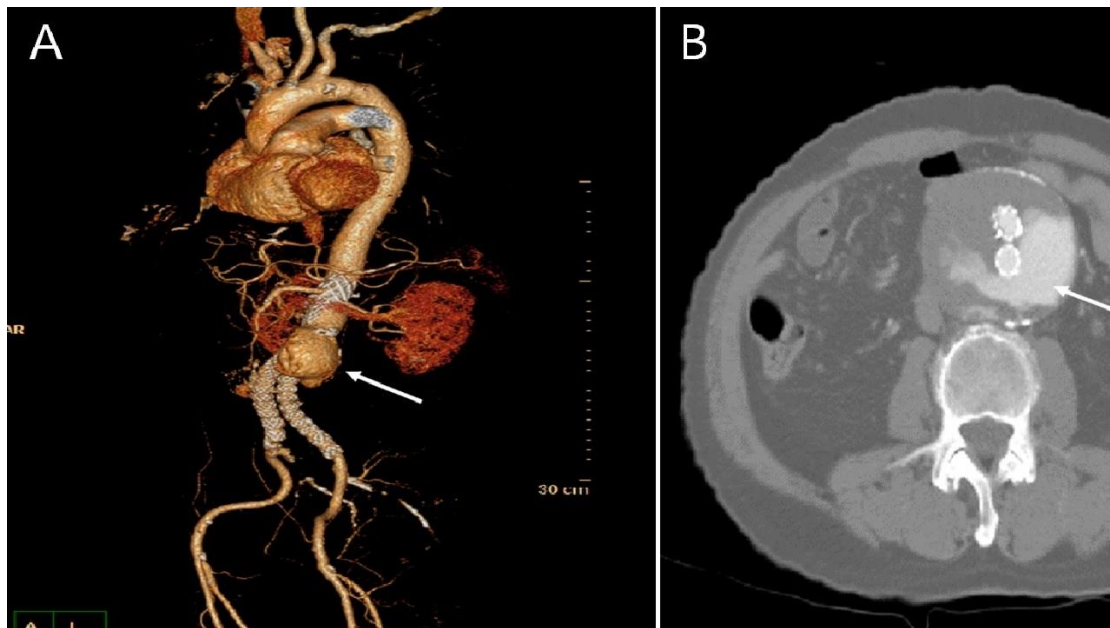


Figure 2: Computed tomography (CT) showing a successful endovascular aneurysm repair (EVAR) (A) without any evidence of an endoleak (B)



**Figure 3: Post-operative computed tomography (CT) showing an abdominal aortic aneurysm (A, white arrow) and a Type Ia endoleak (B: white arrow)**



**Figure 4: Post-operative Computed tomography (CT) showing an an infra-renal- aorto-bi-iliac bypass. The occlusion of left common iliac artery (thin white arrow) and a supra-pubic femoro-femoral bypass (thick white arrow) are noted**

## DISCUSSION

Endovascular aneurysm repair (EVAR) is a safe and less invasive alternative to surgery for patients with abdominal aortic aneurysms. However, endoleaks are the most common complication. A Type Ia endoleak occurs when the proximal part of the stent graft fails to adequately seal against the inner wall of the aorta after the EVAR procedure, allowing continued blood flow into the aneurysmal sac. Type Ia endoleaks have a high

risk of rupture [1]. These endoleaks can be classified into three categories: if they occur within 30 days after EVAR, they are termed "early"; if they persist for more than 6 months, they are considered "persistent"; and if they occur after 1 year, they are referred to as "late" [2]. If a Type Ia endoleak persists, continuous pressure is exerted on the aneurysmal sac, potentially leading to aneurysm rupture. The overall incidence of early and late Type I endoleaks is estimated to be up to 20% [3].

Various techniques for treating Type Ia endoleaks have been described in the literature, with varying success rates. The initial approach to treating Type Ia endoleaks typically involves balloon dilatation or the use of endoanchors to secure the device against the vessel wall. If these methods are unsuccessful, an aortic extension cuff may be considered, provided there is adequate distance between the renal arteries and the stent graft. In cases where there is insufficient space for an aortic cuff, a Palmaz stent (Cordis Corporation) may offer an effective seal [4]. Embolization techniques have been introduced as a treatment option for Type I endoleaks. The use of microcoils, n-butyl 2-cyanoacrylate adhesive, or other embolic agents, such as Onyx, has been employed in treating Type I endoleaks, although their effectiveness remains unproven [5-7]. If these techniques fail to resolve the endoleak, conversion to conventional open surgical repair should be considered.

Open repair involving partial or complete removal of the endograft can be technically challenging and is associated with significant morbidity and mortality [8]. A recent review reported that late open conversion occurred in 0.4% to 22% of patients undergoing EVAR, with an overall rate of 1.9% [9]. Late surgical open conversion after EVAR is more challenging than standard elective aortic repair due to periaortic inflammation and the fusion of the stent graft to the aortic wall [10]. Various surgical strategies for managing late open conversion have been reported, focusing on three key considerations: the surgical approach, the site of aortic cross-clamping, and options for stent graft removal [11].

Transperitoneal or retroperitoneal approaches can be performed with similar efficacy for surgically exposing the aneurysm sac, and their selection depends on the surgeon's experience and preference [12]. The site of aortic cross-clamping is another crucial consideration in the operative management of late open surgical conversion. Performing proximal aortic cross-clamping as far away from the stent graft as possible facilitates better exposure and mobilization of the proximal end of the stent graft [13]. Suprarenal aortic clamping or thoracic aortic clamping may be utilized depending on the location of the stent graft [14]. Although some authors have advocated that complete removal of the stent graft is the safest surgical intervention to avoid potential late complications [11], it has also been suggested that explantation maneuvers may increase the risk of intraoperative aortic injury, particularly in well-incorporated endografts [15]. When performing surgical open conversion following EVAR, the debate regarding complete versus partial stent graft removal remains contentious. While some authors advocate for complete removal of the stent graft as the safest surgical intervention to mitigate potential late complications [11], it has been suggested that such removal maneuvers may

increase the risk of intraoperative aortic injury, particularly in well-incorporated endografts [15].

In this case, nearly 10 years had passed since the EVAR procedure, and the stent graft had become severely adhered to the aortic intima, making complete removal impossible. Furthermore, during the removal of the stent graft from the left iliac artery, the intima was damaged, necessitating the performance of a femoro-femoral bypass. The postoperative course was uneventful.

## CONCLUSION

A symptomatic late Type Ia endoleak following endovascular aneurysm repair (EVAR) for an abdominal aortic aneurysm poses a very high risk of rupture. If endovascular techniques fail to resolve the endoleak, conventional open repair is the only option to address these complications. In cases where surgery is performed more than 10 years after EVAR, complete removal of the stent graft may not be possible due to severe adhesion of the graft to the aortic and iliac arterial intima. Attempting to remove the stent graft could damage the intima of the aortic and iliac arteries, necessitating an additional extra-anatomic bypass.

## REFERENCES

1. Brown, A., Saggi, G. K., Bown, M. J., Sayers, R. D., & Sidloff, D. A. (2016). Type II endoleaks: challenges and solutions. *Vascular Health and Risk Management*, 12, 53-63. doi: 10.2147/VHRM.S81275.
2. O'Donnell, T. F., McElroy, I. E., Mohebbi, J., Boitano, L. T., Lamuraglia, G. M., Kwolek, C. J., & Conrad, M. F. (2022). Late type 1A endoleaks: associated factors, prognosis and management strategies. *Annals of Vascular Surgery*, 80, 273-282. doi: 10.1016/j.avsg.2021.08.057.
3. Mehta, M., Sternbach, Y., Taggart, J. B., Kreienberg, P. B., Roddy, S. P., Paty, P. S., ... & Darling III, R. C. (2010). Long-term outcomes of secondary procedures after endovascular aneurysm repair. *Journal of vascular surgery*, 52(6), 1442-1449. doi: 10.1016/j.jvs.2010.06.110.
4. Kato, N., Semba, C. P., & Dake, M. D. (1996). Embolization of perigraft leaks after endovascular stent-graft treatment of aortic aneurysms. *Journal of Vascular and Interventional Radiology*, 7(6), 805-811. doi: 10.1016/s1051-0443(96)70852-7.
5. Rosen, R. J., & Green, R. M. (2008). Endoleak management following endovascular aneurysm repair. *Journal of Vascular and Interventional Radiology*, 19(6), S37-S43. doi: 10.1016/j.jvir.2008.01.017.
6. Maldonado, T. S., Rosen, R. J., Rockman, C. B., Adelman, M. A., Bajakian, D., Jacobowitz, G. R., ... & Lamparello, P. J. (2003). Initial successful management of type I endoleak after endovascular aortic aneurysm repair with n-butyl cyanoacrylate

- adhesive. *Journal of vascular surgery*, 38(4), 664-670. doi: 10.1016/s0741-5214(03)00729-8.
7. Grisafi, J. L., Boiteau, G., Detschelt, E., Potts, J., Kiproff, P., & Muluk, S. C. (2010). Endoluminal treatment of type IA endoleak with Onyx. *Journal of vascular surgery*, 52(5), 1346-1349. doi: 10.1016/j.jvs.2010.06.021.
  8. Gao, Y., Miserlis, D., Garg, N., & Pipinos, I. (2019). Novel open technique for repair of endograft migration. *Journal of Vascular Surgery Cases, Innovations and Techniques*, 5(2), 88-90. doi: 10.1016/j.jvscit.2018.08.007.
  9. Moulakakis, K. G., Dalainas, I., Mylonas, S., Giannakopoulos, T. G., Avgerinos, E. D., & Liapis, C. D. (2010). Conversion to open repair after endografting for abdominal aortic aneurysm: a review of causes, incidence, results, and surgical techniques of reconstruction. *Journal of Endovascular Therapy*, 17(6), 694-702. doi: 10.1583/1545-1550-17.6.694.
  10. Klonaris, C., Lioudaki, S., Katsargyris, A., Psathas, E., Kouvelos, G., Doulaptis, M., ... & Kouraklis, G. (2014). Late open conversion after failed endovascular aortic aneurysm repair. *Journal of vascular surgery*, 59(2), 291-297. doi: 10.1016/j.jvs.2013.07.106.
  11. Botsios, S., Bausback, Y., Piorkowski, M., Werner, M., Branzan, D., Scheinert, D., & Schmidt, A. (2014). Late open conversion after endovascular aneurysm repair. *Interactive cardiovascular and thoracic surgery*, 19(4), 622-626. doi: 10.1093/icvts/ivu203.
  12. Kelso, R. L., Lyden, S. P., Butler, B., Greenberg, R. K., Eagleton, M. J., & Clair, D. G. (2009). Late conversion of aortic stent grafts. *Journal of Vascular Surgery*, 49(3), 589-595. doi: 10.1016/j.jvs.2008.10.020.
  13. Böckler, D., Probst, T., Weber, H., & Raithele, D. (2002). Surgical conversion after endovascular grafting for abdominal aortic aneurysms. *Journal of Endovascular Therapy*, 9(1), 111-118. doi: 10.1177/152660280200900118.
  14. Brinster, C. J., Fairman, R. M., Woo, E. Y., Wang, G. J., Carpenter, J. P., & Jackson, B. M. (2011). Late open conversion and explantation of abdominal aortic stent grafts. *Journal of vascular surgery*, 54(1), 42-46. doi: 10.1016/j.jvs.2010.12.042.
  15. Matsagkas, M., Kouvelos, G. N., & Peroulis, M. (2014). Safe and fast proximal aortic control using an aortic balloon through direct graft puncture for the explantation of an abdominal endograft with suprarenal fixation. *Interactive cardiovascular and thoracic surgery*, 18(4), 519-521. doi: 10.1093/icvts/ivt557.