

Sandwich Technique for Iliac Aneurysm Rupture After Treatment of Iatrogenic Type B Aortic Dissection: A Case Report

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AIM: Type B iatrogenic acute aortic dissection (IAAD) is a rare complication of diagnostic or interventional cardiac procedures. The STent Assisted Balloon Induced intimaL dISruption and rElamination in aortic dissection repair (STABILISE) technique is being increasingly used for the treatment of complicated aortic dissections. However, hemodynamic changes and the pre-existence of aneurysmal arteries could lead to “unexpected” complications.

CASE PRESENTATION: This case report shows how rescue techniques can be employed in response to such challenging handling situations, especially in emergency settings. We describe the case of a patient with bilateral common iliac artery (CIA) aneurysm subjected to coronary angiography followed by iatrogenic type B acute aortic dissection (TBAAD), treated with the STABILISE technique, further complicated with left iliac aneurysm rupture on the 9th postoperative day. During aortic bifurcated endograft deployment, the contralateral gate opened into the false lumen (FL), and it was impossible to re-enter the true lumen (TL).

RESULTS: As a rescue solution, an iliac extension was deployed parallel to the main body, using the sandwich technique, extending to the external iliac artery. Before deployment, the left hypogastric artery was embolized with coils. Despite the false lumen of the right iliac aneurysm being perfused by the patent contralateral leg, the ruptured aneurysm was excluded. At a later stage, the right hypogastric artery was embolized with several coils, and the gate was embolized using an Amplatzer™ Vascular Plug.

CONCLUSIONS: In complex cases, especially with dissections, the unexpected is around the corner. The use of off-the-shelf devices, knowledge of rescue techniques as Parallel Graft Technique (PGT) and experience in applying them can resolve situations that might otherwise be disastrous.

Keywords: iatrogenic Type B aortic dissection; STABILISE technique; ruptured iliac aneurysm; Parallel Graft Technique; sandwich technique; case report

Introduction

Type B iatrogenic acute aortic dissection (IAAD) is a rare complication of diagnostic or interventional cardiac procedures. It can occur as a result of direct mechanical damage of the aortic wall related to catheter manipulation, and increased age, high blood pressure [1], and atheromatous disease of the aorta are significant risk factors for iatrogenic dissection. As minimally invasive procedures are on the rise, the incidence of IAAD could increase in the future [2]. The STent Assisted Balloon Induced intimaL dISruption and rElamination in aortic dissection repair (STABILISE) technique is being increasingly used for the treatment of complicated aortic dissections [3]. We describe the case of

a patient affected by bilateral common iliac artery (CIA) aneurysms, who developed IAAD, treated with the STABILISE technique and further complicated by iliac artery aneurysm rupture. For this reason, the patient underwent the exclusion of the ruptured left iliac aneurysm using a bifurcated endograft landing in the external iliac arteries, in the emergency setting. The aim of this study is to identify and propose rescue techniques that can be employed in response to unexpected and challenging handling situations, especially in emergency settings.

Case Presentation

A 75-year-old female patient, affected by hypertension, atrial fibrillation and previous hysterectomy, was electively admitted to our department for bilateral asymptomatic CIA aneurysm treatment (right 30 mm, left 42 mm). The patient occasionally discovered the aneurysms with a doppler examination performed for general examination. During the preoperative assessment, the cardiologist requested a preoperative echocardiogram to better define the cardiological risk, which showed a new-onset cardiac lateroapical hy-

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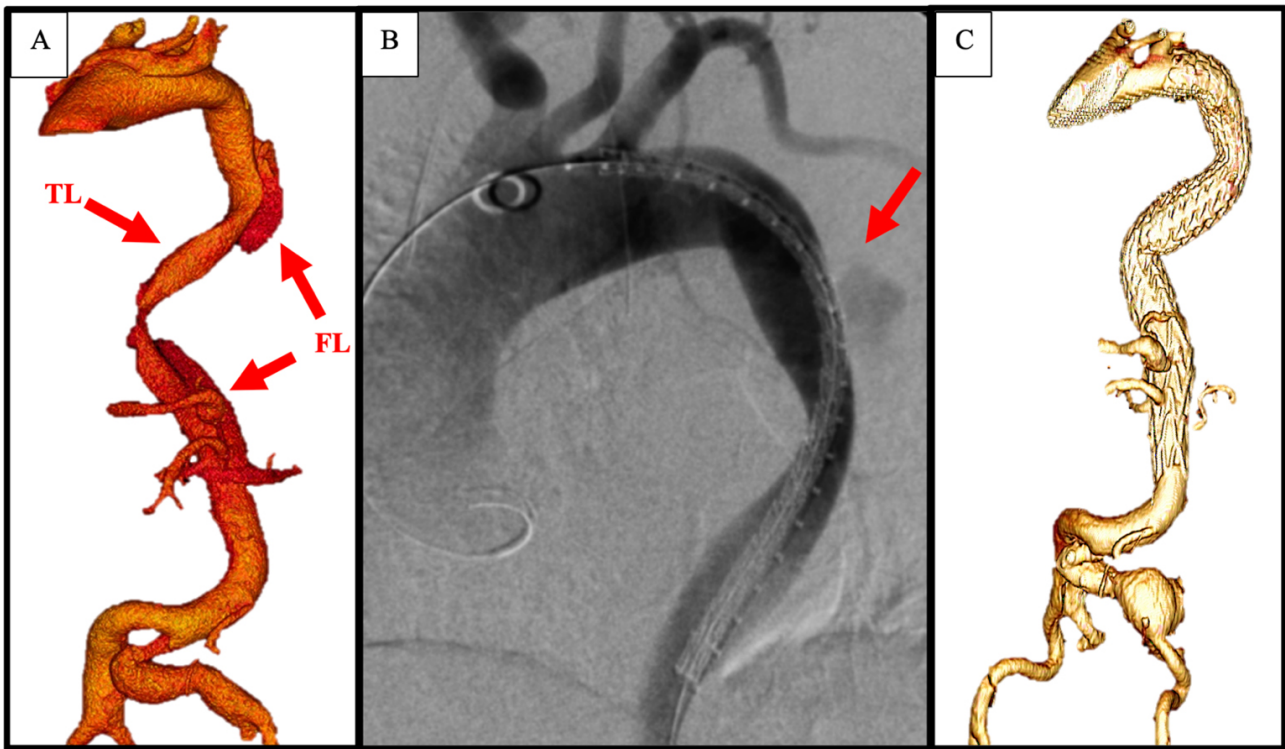


Fig. 1. TBAAD diagnosis, treatment and result/pre-operative, intraprocedural and post-operative imaging of the TBAAD. (A) CTA volume rendering reconstruction showed TBAAD, true lumen (TL) and false lumen (FL) highlighted by the arrows. (B) Intraoperative angiography, showing the primary entry tear in the descending thoracic aorta (red arrow). (C) CTA volume rendering reconstruction after treatment using STent Assisted Balloon Induced intimaL dISruption and rELamination in aortic dissection repair (STABILISE) Technique. TBAAD, type B acute aortic dissection; CTA, Computed Tomography Angiography.

pokinesis and a slightly reduced ejection fraction (40%). For this reason, a diagnostic percutaneous coronary artery angiography through right femoral access was performed.

Immediately after the procedure, the patient developed thoracic pain and uncontrolled hypertension. Due to these findings, an urgent Computed Tomography Angiography (CTA) was performed and revealed a post-procedural type B acute aortic dissection (TBAAD), with the primary entry tear in the non-aneurysmatic descending thoracic aorta, extending to the right femoral artery and left CIA, with both internal and external iliac arteries originated from the false lumen (FL). Due to the dissection characteristics and the necessity to treat the iliac artery aneurysms, we decided to treat the TBAAD with the STABILISE technique in the sub-acute phase. After this first step, we planned a second procedure of endovascular aortic repair (EVAR) with the revascularization of at least one hypogastric artery, using an iliac branch device.

The procedure was performed through percutaneous bilateral femoral access. Two thoracic GORE C-TAG endografts (TGM343420E and TGM343415E W. L. Gore & Associates, Inc., Flagstaff, AZ, USA) and a stent dissection (ZDES-46-120-US, Cook Medical Zenith Dissection Endovascular Stent - Cook Medical Europe, Bjaeverskov, Denmark) were deployed in zone 3 of the Ishimaru clas-

sification, using the STABILISE Technique. The final angiography confirmed adequate sealing of aortic devices and complete realignment with true lumen (TL) patency and FL obliteration up to the treated aorta, and patency of all aortic branches (Fig. 1).

The postoperative course was complicated by acute abdominal pain and hypotension that occurred on the 9th post-operative day and an urgent CTA showed left iliac artery aneurysm rupture. Consequently, the patient was transferred to the operating room to exclude the ruptured iliac aneurysm using a bifurcated endograft landing in the external iliac arteries. Nevertheless, during the procedure, after the GORE EXCLUDER® (RLT281412, W. L. Gore & Associates, Inc., Flagstaff, AZ, USA) main body deployment in the TL, the contralateral gate ruptured the frail lamella and opened into the FL. After several attempts, it was impossible to re-enter the TL after contralateral gate catheterization. As a rescue solution, after placement of a guidewire between the dissection stent and the bifurcated endograft, an iliac extension was deployed parallel to the main body, using the sandwich technique, extending to the external iliac artery. Before deployment, the left hypogastric artery was embolized with coils.

However, despite the FL of the right iliac aneurysm was perfused by the patent contralateral leg, the ruptured aneurysm

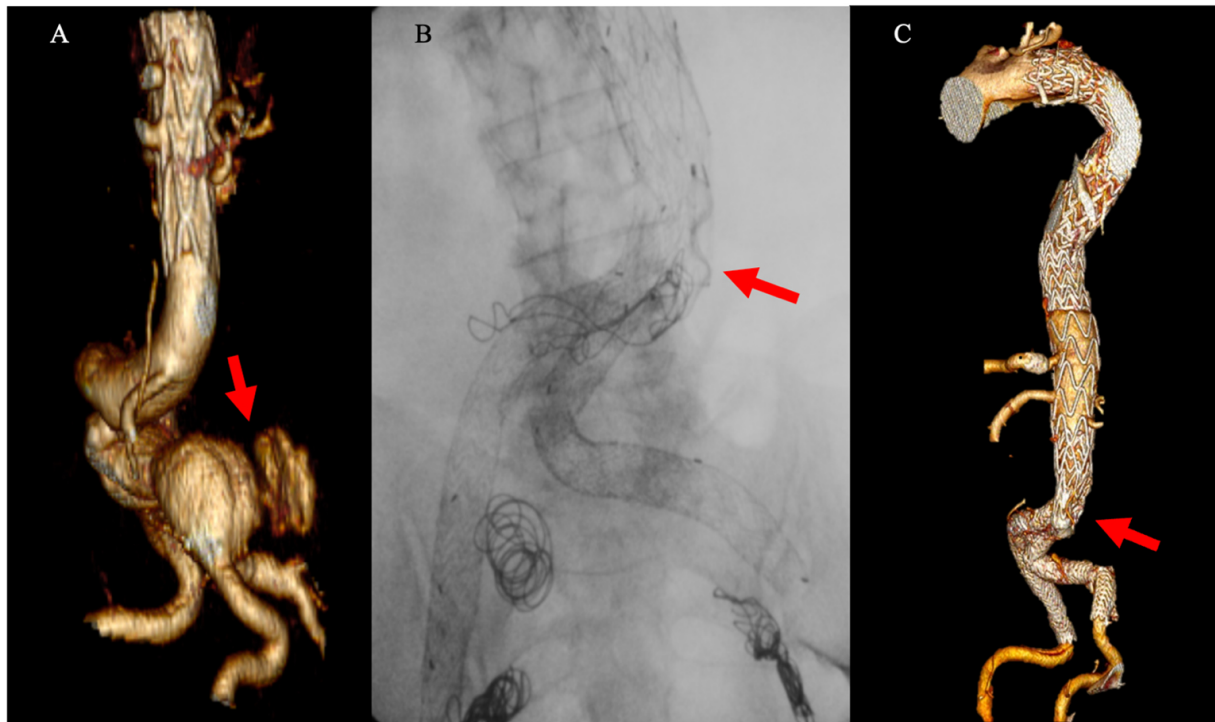


Fig. 2. Left iliac artery aneurysm rupture: diagnosis and treatment imaging. (A) Preoperative Computed Tomography Angiography (CTA): the red arrow showed the left iliac artery aneurysm posterior rupture. (B) Intraoperative angiography after iliac extension placement using the sandwich technique and left hypogastric artery embolization with coils, with the red arrow pointing at the Amplatzer Vascular Plug in the contralateral gate. (C) Final CTA volume rendering reconstruction after final treatment, with the contralateral gate embolized with the plug and the patent parallel graft (red arrow).

was excluded, the patient became hemodynamically stable and was transferred to intensive care unit (Fig. 2). The patient was discharged on the 10th postoperative day in good general condition.

One month later, an adjunctive surgical step was required: using a surgical axillary access, the right hypogastric artery (FL) was embolized with several standard Ruby® coils (<https://www.penumbrainc.com/pdf/embolization-system-coil-reference-guide/>, Penumbra, Alameda, CA, USA), passing through the endograft contralateral leg. The gate was embolized using a 20 mm Amplatzer™ Vascular Plug (9-AVP2-020, Abbott, Chicago, IL, USA).

The final angiography showed the endograft and bilateral external iliac arteries patency with occlusion of both internal iliac arteries, in the absence of endoleak. The IAAD was completely excluded and the abdominal organs were well perfused. A Computed Tomography Angiography (CTA) was performed before discharge and the patient was enrolled in our follow-up protocol, with 6- and 12-month CTA showing patent aortic endografts and complete exclusion of iliac aneurysms without endoleaks. We decided on a slightly closer follow-up considering exceptional nature of the case.

This case has been reported in line with the Case Report (CARE) Guidelines to ensure the accuracy and completeness of the report (**Supplementary material**).

Discussion

Type B aortic dissection (TBAD) could be a rare but catastrophic complication of percutaneous coronary intervention. From the IRAD database (<https://www.iradonline.org/home>), IAAD emerged as a complication of cardiac surgery or catheterization in almost 6% of all the cases studied [4]. In the last years, the STABILISE technique has emerged as a treatment option in aortic dissection, whose main advantage is the promotion of complete remodeling through the reapposition of the flap against the aortic wall [5]. This technique has produced excellent results, especially in the relief of malperfusion and in the reduction of late reinterventions.

In our case, the complexity of the concomitant presence of iatrogenic dissection and bilateral iliac aneurysms led us to consider the STABILISE technique as the only feasible intervention, preparatory to a second elective stage endovascular iliac aneurysm exclusion. This technique gains us greater aortic TL instead of a narrowed design of aortic dissection in the infrarenal zone.

Furthermore, the hemodynamic changes developed after the endovascular exclusion of the TBAD have made the aortic wall weaker, leading to the lamella rupture. It could justify the gate opening in the FL during the endovascular repair of a common iliac aneurysm rupture in an urgent setting.

This occurrence is not one of its kind, indeed, it has also been described by Dajci A *et al.* [6], where the iliac branch for the hypogastric artery opened in the FL and the surgical group embolized it through a percutaneous gluteal artery access.

The impossibility of TL cannulation made us find a valid alternative treatment with Parallel Graft Technique (PGT). This was the only available option that avoided the open conversion or all iliac axis occlusion and cross-over.

Wu ZY *et al.* [7] and Kansagra K *et al.* [8] described this strategy as a feasible alternative to management of complex Aorto-iliac endovascular repair and our experience confirms their assessment, given the patency of the grafts one year after the procedure and the absence of signs of endoleaks.

The second-stage procedure was necessary to guarantee the FL embolization and to avoid the type 2 endoleak, which would otherwise have put the patient's life at risk by continuing to supply the false lumen and the iliac aneurysm [9]. Otherwise, the embolization of the gate and the right hypogastric artery was performed 1 month after the ruptured aneurysm endovascular repair, favoring and allowing the formation of collateral circles to prevent intestinal and spinal cord ischaemia. We decided to embolize the gate of the aortic bifurcated endograft, opened into the false lumen, using Amplatzer™ Vascular Plug. The hypogastric arteries were embolized by coils because it was the easiest and safest way to do it, using low-profile devices to easily reach our target.

The one-month-stage procedure of gate and FL embolization with plug and coils avoided intestinal and spinal cord ischaemia in the patient at the end of the last procedure, as used in Fenestrated and Branched Endovascular Repair (F/BEVAR) procedure [9].

Conclusions

The rupture of iliac artery aneurysms after an iatrogenic aortic dissection, probably secondary to hemodynamic changes, is a rare complication that occurred in this case. In this contest, we have reported the possibility to use the STABILISE technique as first step of a multi-stage procedure, whose second time was supposed to be the elective treatment of the iliac aneurysms. In this case, the only feasible option was the use of PGT in a different configuration, in order to save the patient's life. The advantage of using "off the shelf" materials is its capacity to adapt to different anatomical challenges that can occur intra-operatively. Knowledge and experience in these rescue techniques can resolve situations that might otherwise be disastrous.

Availability of Data and Materials

The datasets used and analysed during the current study are available from the corresponding author.

Author Contributions

RC, WM, and ADG conceptualized the study; RC and AM curated the methodology; WM and FM validated the study; RC and MA drafted the manuscript; RC and WM performed the formal analysis; MA, SG and WM analysed the data; LDM designed and supervised the project. All authors contributed to important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The patient provided her informed consent to publication of this case report. Written informed consent was obtained from the individual for the publication of any potentially identifiable images or data included in this article. This case report was performed according to the Declaration of Helsinki. Institutional Review Board Approval was not required.

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Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.62713/ai.c.3955>.

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