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EMERGENT OPEN CONVERSION FOR STENTGRAFT DEPLOYMENT FAILURE IN A RUPTURED THORACIC ANEURYSM

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PII: S2468-4287(20)30192-1

DOI: <https://doi.org/10.1016/j.jvscit.2020.10.017>

Reference: JVSCIT 654

To appear in: *Journal of Vascular Surgery Cases and Innovative Techniques*

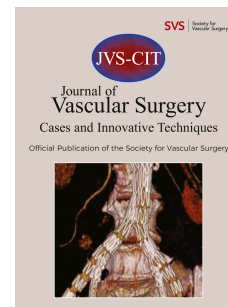
Received Date: 3 September 2020

Accepted Date: 30 October 2020

Please cite this article as: C. Kohler, T.R. Wyss, N. Mertineit, V. Makaloski, J. Schmidli, EMERGENT OPEN CONVERSION FOR STENTGRAFT DEPLOYMENT FAILURE IN A RUPTURED THORACIC ANEURYSM, *Journal of Vascular Surgery Cases and Innovative Techniques* (2020), doi: <https://doi.org/10.1016/j.jvscit.2020.10.017>.

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1 **EMERGENT OPEN CONVERSION FOR STENTGRAFT DEPLOYMENT FAILURE IN**
2 **A RUPTURED THORACIC ANEURYSM**

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1 Abstract

2 Thoracic endovascular aortic repair (TEVAR) is standard for ruptured thoracic aortic
3 aneurysm (rTAA) (1). A ninety-two y/o men presented with acute severe back pain in a stable
4 condition. Computed tomography revealed a rTAA. TEVAR (Valiant™, Medtronic-Vascular)
5 into zone 2 with intentional coverage of the left subclavian artery was planned. After release of
6 the stentgraft body proximal release of bare springs was impossible. Troubleshooting techniques
7 were applied, but tip capture could not be released. Emergent conversion to open repair was
8 performed. Intraoperative device deployment failure in TEVAR is rare. This case report
9 demonstrates the advantage of having in-house cardiac surgery backup.

1 **Introduction**

2 Thoracic endovascular aortic repair (TEVAR) is the preferred treatment option for ruptured
3 thoracic aortic aneurysm (rTAA) provided the morphology is suitable (1). This is a case report of
4 a device failure provoking emergent conversion to open aortic arch repair. The patient gave his
5 consent to publish this report.

6

7 **Report**

8 An active ninety-two years old male patient presented with acute severe back pain in
9 hemodynamically stable condition. He has a history of a ruptured infrarenal aortic aneurysm
10 treated by open repair 23 years ago and a TEVAR due to a descending thoracic aortic aneurysm
11 17 years ago. A distal TEVAR extension was performed 6 years ago due to a type Ib endoleak.
12 The patient suffers from sinus bradycardia for which he underwent pacemaker implantation 6
13 years ago. Computed tomography angiography (CTA) revealed a ruptured aneurysm of the
14 descending aorta with a maximum diameter of 88mm caused by a type Ia and III endoleak
15 (Figure 1). Additionally, a bovine arch was present. Zones 0-3 were diseased with a maximum
16 diameter of 50 mm in zone 3 and 42mm in zone 2 (oversizing 10%). Urgent treatment was
17 indicated. A TEVAR extension into zone 2 with intentional coverage of the left subclavian artery
18 was planned. By percutaneous transfemoral access a Valiant™ Thoracic Stentgraft (proximal
19 bare springs, straight configuration, diameter 46 mm, length 150 mm, Medtronic Vascular, Santa
20 Rosa, California, USA) was placed in the aortic arch. Stentgraft insertion was without difficulty.
21 The release of the stentgraft was performed under rapid right ventricular pacing by retracting the
22 integrated slider handle. Then the tip capture release handle at the rear of the delivery system
23 was unlocked and retracted, but the tip capture did not release the proximal bare springs. For the

1 Freeflo™ stentraft delivery system, the proximal bare stent is constrained by the tip capture
2 mechanism, if the tip capture mechanism fails, the proximal bare springs remains locked (Figure
3 2). The delivery system could not be withdrawn since the stentgraft body was deployed. The
4 manufacturer's instructions for use were consulted for troubleshooting techniques "alternative
5 instruction for deploying tip capture mechanism": the backend lock was removed and delivery
6 system was pulled of, clamping ring was removed, the tip capture tube was tried to retract, but
7 bare metal stent could not be released. Further endovascular means (e.g. balloon
8 disruption/dilatation of captured tip) were not considered due to unpredictable stroke risk. As
9 bailout, the decision to perform emergent conversion to open repair was made. Sternotomy, deep
10 hypothermic circulatory arrest, total arch repair with bypasses to all supra aortic vessels under
11 continuous selective antegrade cerebral perfusion was performed (Figure 3). The proximal bare
12 springs of the stentgraft were cut off the delivery system with wire forceps. The rupture side
13 could be verified. The delivery system was withdrawn. Patient was always hemodynamically
14 stable and showed good recovery. On the 7th postoperative day ,CTA revealed a persisting low-
15 flow type III or IV endoleak in the stentgraft overlap zone in the aneurysm sac at the descending
16 aorta. Therefore, a fourth thoracic stentgraft was implanted in a second operation 9 days
17 postoperatively. Finally, complete aneurysm exclusion was achieved without any endoleak
18 (Figure 4). The postoperative course was uneventful. The patient recovered well without
19 complications; he was discharged to rehab on the 15th postoperative day.

20

21 **Discussion**

22 Endovascular treatment still remains first line treatment of pathologies of the descending aorta

23 (1). An open repair including left heart bypass is more invasive, but can be useful in the presence

1 of rupture (7). Considering the patient's age, TEVAR was favoured as most reasonable therapy.
2 Intraoperative device deployment failure in TEVAR is rare. Three prospective, multicentre,
3 nonrandomized clinical studies with the same device (2-4) reported no graft complications and
4 100% successful delivery and deployment of the stent graft. (5) One-year results of the rescue
5 trial demonstrate no conversion to open repair. Another study reported device-related
6 complications of 12.5% in aortic dissection but no device deployment failure (6). There were
7 device deployment failure issues concerning a stentgraft for EVAR from another company many
8 years ago, which lead to device retrieval. We filed a report to the Swiss Medical Device
9 Vigilance Agency (SWISSMEDIC) and to the device company for device investigation. Based
10 on review of the procedural films and analysis of the delivery system the cause of the
11 deployment/expansion difficulties could not be conclusively determined. If conversion to open
12 repair is inevitable, in-house availability of a cardiac surgery service can be lifesaving. This case
13 report demonstrates that a maximal invasive therapy for initially minimal-invasive intention to
14 treat may be necessary in an extremely rare condition. Nevertheless, the indication for treatment
15 must be made individually.

16

17 **Conclusion**

18 Intraoperative stentgraft deployment failure is extremely rare. Deployment difficulties/failures
19 are recognized as a potential adverse event associated with the implantation of a stentgraft. If all
20 strategies of troubleshooting techniques fail, conversion to open surgery may be the last option to
21 rescue the patient. This case report demonstrates the advantage of having an in-house cardiac
22 surgery backup to treat such pathologies.

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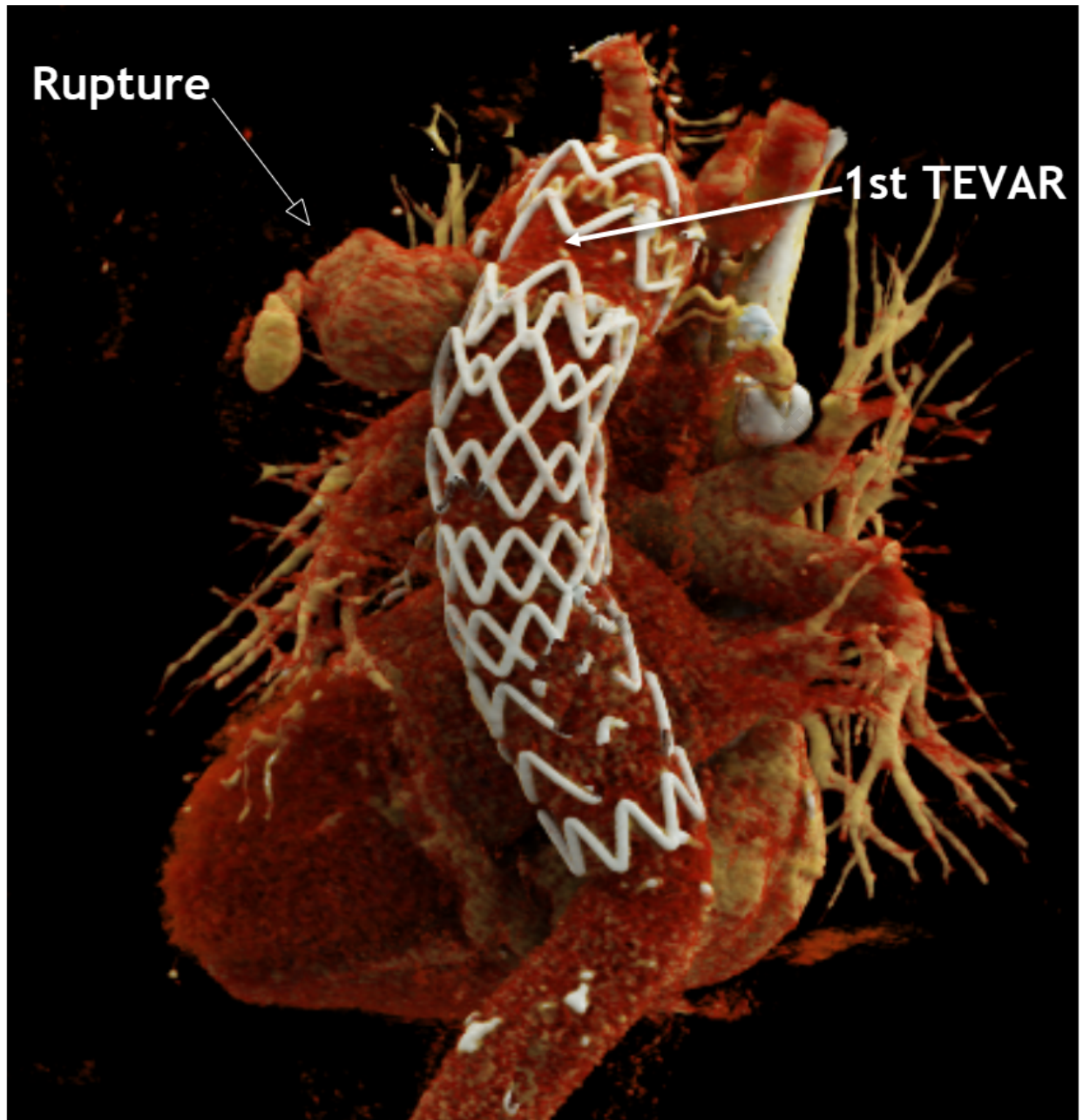
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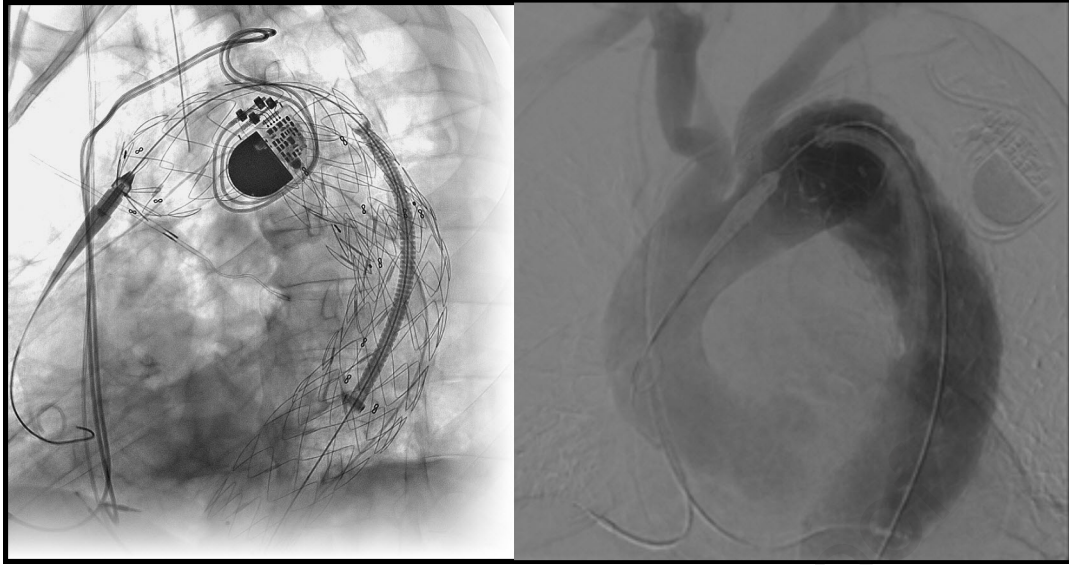
Figure 1. CT angiography (3D) showing rupture of the thoracic aneurysm due to type 1a endoleak.

Figure 2. Deployed stentgraft in the aortic arch. Failure of tip capture release mechanism.

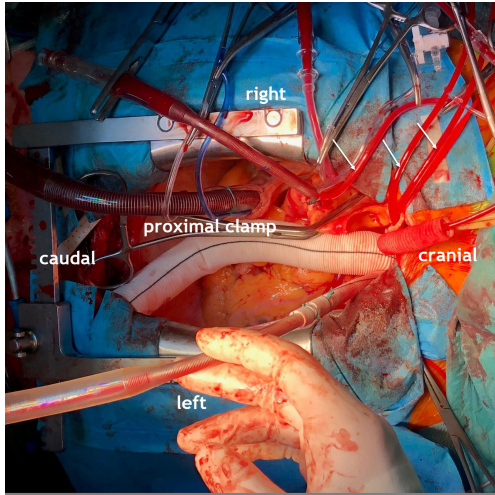
Figure 3, Intraoperative view during total arch repair under continuous selective antegrade cerebral perfusion (lines with arrows)

Figure 4. Final CT angiography (3D) demonstrating no endoleak





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