Distal stent graft – induced new entry after frozen elephant trunk procedure for type a aortic dissection: two cases report

*Phung Duy Hong Son[1,2], Nguyen Tung Son[1], Nguyen Van Dan[1]**

ABSTRACT

Objectives: We report two clinical cases that wherein stent graft-induced new entry (dSINE) after frozen elephant trunk (FET) procedure for type A aortic dissection were resolved successfully by additional stent graft placement.

Methods: Describe rare clinical cases.

Results*:* Two patients were hospitalized after FET procedure for type A aortic dissection treatment. The former had refractory abdominal pain and the latter had sudden chest pain; both their abdominal thoracic CT scanner showed dSINE. We decided to place additional stent grafts to cover the new entry. Both patients recovered well and were discharged after 5 and 12 days, respectively, without any significant complications.

Conclusions*:* Supplemental stent graft placement is an effective and safe treatment choice for dSINE post-FET procedure.

Keywords*: distal stent graft-induced new entry; frozen elephant trunk procedure; type A aortic dissection; endovascular intervention; Viet Duc university hospital.*

INTRODUCTION:

The frozen elephant trunk (FET) procedure is known to effectively treats aortic dissections and aortic aneurysms. FET is used especially when the intimal tear is in the aortic arch, proximal descending aorta, or with younger patients. However, the incidence of reinterventions following FET remains significant. Stent graft-induced new entry (SINE), is defined as the new tear caused by the stent graft and excludes those arising from physiological disease progression or iatrogenic injury from endovascular manipulation.[1] dSINE (distal stent graft-induced new entry) happens in 15.8 -18% of cases and may lead to a mortality rate up to 25% without treatment.[2] We report 2 cases of dSINE after the FET procedure, which was solved by using a new stent graft for distal entry coverage.[9]

CASE REPORT:

Case 1: The first patient is a 62-year-old male with history of an untreated abdominal aortic aneurysm. He presented to our emergency department with severe acute onset and tearing substernal chest pain radiating to his back. Computed tomography angiography (CTA) indicated a type A aortic dissection with unclear intimal entry tear. We decided to do a hybrid surgery via total sternotomy: hemiarch replacement, debranching of the left common carotid and left subclavian arteries, and stent graft coverage for the remainder of the aortic arch and descending aorta. Cardiopulmonary bypass was established through axillary artery and right atrium cannulation. At the rectal temperature of

[1]Viet Duc University Hospital,
[2]Hanoi Medical University
**Corresponding author: Nguyen Van Dan*
Email: bsdanhmu@gmail.com
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28°C, after circulatory arrest and bilateral selective brain perfusion by both sides of the common carotid artery, a stent graft was inserted anterogradely into the descending aorta through the proximal descending aorta and we replaced the hemiarch with a 28mm Gelweave vascular and debranched left subclavian artery and left common carotid artery to prosthesis vascular via 8mm dacron tube. Additionally, the proximal end of stent graft was sutured to the distal end of the prosthesis vascular. The cardiopulmonary bypass and aortic cross-clamp durations were 330 and 205 minutes, respectively.

The postoperative period was uneventful. CTA revealed that the stent graft was placed adequately. No visible endoleak was found and the false lumen had thrombosed completely. The patient recovered without complications and was discharged after 29 days. Additional CTAs were performed at 1, 3, 6, and 12 months, all showing positive outcomes. However, he returned to our care after 2 years due to refractory abdominal pain. His CTA showed a new intimal that began at the stent graft's distal edge graft (picture 1), dissecting retrograde to the descending aorta and to the infrarenal abdominal aorta – resulting in a 51mm aneurysm.

Figure 1: dSINE on CT scanner

Thus, we decided to cover the new intimal tear by placing a supplemental stent graft at descending aorta. Post-stent placement, no further tears were found and the patient was discharged 5 days later without complication. The patient's 1 month follow-up also verified lack of complications.

Case 2: The second case involved a 58-year-old man wherein the left thigh was amputated due to trauma. He presented to our emergency department with sudden and severe abdominal pain. The CTA showed a type A aortic dissection with an intimal tear in the proximal descending aorta and the false lumen was seen clearly distal to the level of subclavian artery. We decided to do an emergency modified FET procedure. The technique for this patient is identical for the previously aforementioned case

with a 34x200x34 mm Valiant Captivia Stent Graft and a 24mm Gel weave tube. Cardiopulmonary bypass and cross-clamp times were 180 and 130 min, respectively. The patient recovered well and was discharged after 18 days. One year follow up showed no complications, although he returned after 14 months due to substernal chest pain. The resulting CTA also showed a type IA endoleak at the proximal edge of the stent graft. As a result of the stent being placed in zone 1, surgical intervention was indicated to remove the endoleak. Following the procedure, the patient recovered well and was discharged after 12 days. However, he was hospitalized again after a year because of sudden chest pain. The CTA indicated a new intimal tear at the distal edge of the stent graft.

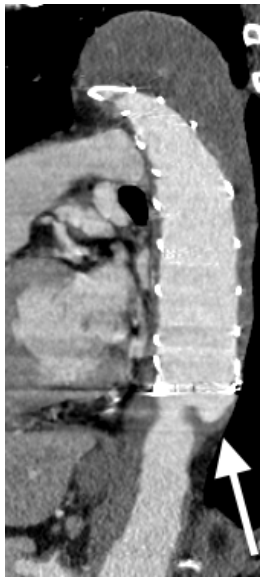

Figure 2: dSINE on CT scanner

We used one more stent graft for the new tear coverage, identical to the first case.

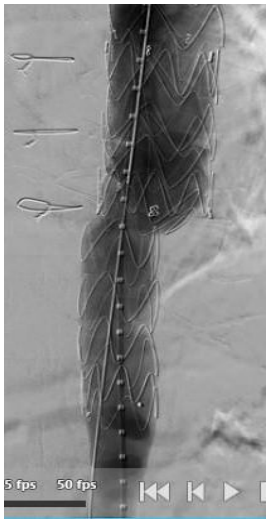

Figure 3: Additional stent graft for new entry tear coverage

The later CTA showed that the stent was placed adequately, and the false lumen thrombosed completely. His 12 months follow-up showed no significant complications.

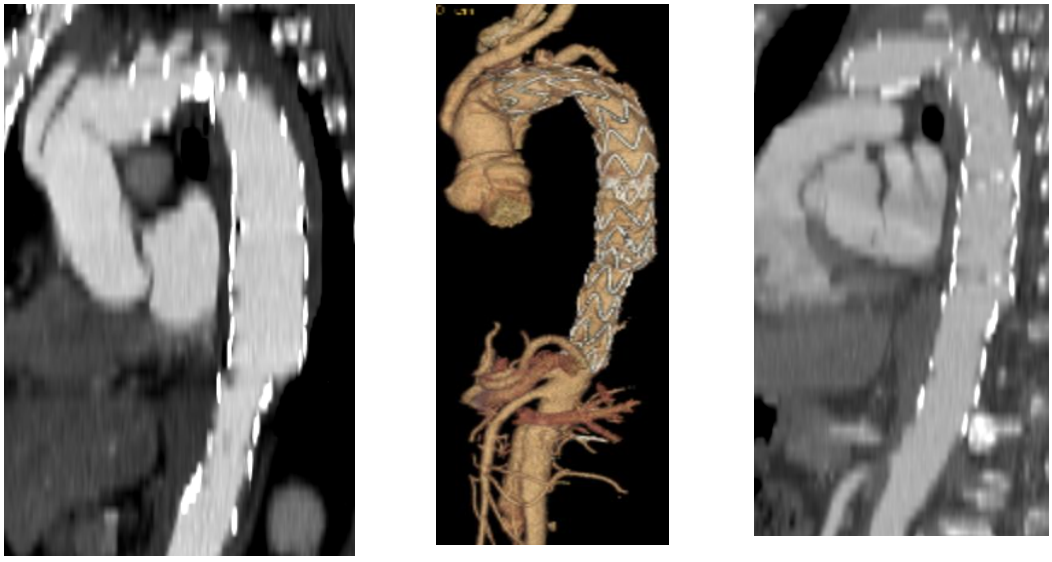

Figure 4: After stent graft placement (left, middle) and one year follow-up (right)

DISCUSSION:

Recently, the FET procedure has become an effective treatment for aortic dissection via promotion of aortic remodeling in the downstream aorta and reduction of reintervention risk.[3] However, the disadvantages like neurological complications and SINE.[4] dSINE is one reason for reintervention after TEVAR. Many causes of dSINE have been reported, such as the phase of dissection (more frequently in chronic dissection)[5]; distal stent graft oversizing > 20%;[6] springback force, expansion force, and length < 145mm of the stent graft; aortic remodeling mismatch.[2] Without treatment, possible complications consists of a new patent false lumen, pseudoaneurysm, and/or aortic rupture.[7] Criteria for reintervention for dSINE include: (1) recurrent pain of the chest, back, or abdomen; (2) a DMax of 4 to 6 cm with patent false lumen; (3) persistent local enlargement of the false lumen (>5 mm within 6 months); and (4) formation of a pseudoaneurysm.[8]

Dong et al suggests that there is a strong association of SINE tears with intrinsic aortic intimal disease or weakness as the incidence of SINE was 33.33% among Marfan patients vs 3.26% among non-Marfan patients. They also suggest that the relevance of SINE tears with graft construction, bare metal struts, and radial force of the devices and argue that SINE tears are more common in TEVAR for dissections than aneurysms, supporting the rationale that the tear may be due to an intrinsic weakness of the intima.[1] Quing Li et al reported a series of 95 patients with distal SINE after TEVAR and

concluded that re-TEVAR may improve long-term survival significantly.[9]

For reducing the incidence of SINE, most practitioners prefer a more tapered stent graft. Okamura covered the rigid distal stent edge using a graft to reduce mechanical stress on the intima and radial force of the distal stent in order to prevent SINE.[10] However, there are no reports showing the significant effect of these methods.

CONCLUSION:

Distal SINE after the FET procedure is not uncommon and may occur with sidious onset post-operative. Herein, we propose reintervention with additional stent for new entry coverage may improve long-term survival.

REFERENCES

1. Dong Z, Fu W, Wang Y, et al. Stent graft-induced new entry after endovascular repair for Stanford type B aortic dissection. *J Vasc Surg*. 2010;52(6):1450-1457. doi:10.1016/j.jvs.2010.05.121

2. Nomura Y, Tonoki S, Kawashima M, et al. Distal Stent Graft-Induced New Entry after Total Arch Replacement with Frozen Elephant Trunk for Aortic Dissection. *Ann Vasc Dis*. 2021;14(4):362-367. doi:10.3400/avd.oa.21-00105

3. Shrestha M, Martens A, Kaufeld T, et al. Single-centre experience with the frozen elephant trunk technique in 251 patients over 15 years. *Eur J Cardio-Thorac Surg Off J Eur Assoc Cardio-Thorac Surg*. 2017;52(5):858-866. doi:10.1093/ejcts/ezx218

4. Czerny M, Eggebrecht H, Rousseau H, et al. Distal Stent Graft-Induced New Entry After TEVAR or FET: Insights Into a New Disease From EuREC. *Ann Thorac Surg*. 2020;110(5):1494-1500. doi:10.1016/j.athoracsur.2020.02.079

5. Feng J, Lu Q, Zhao Z, et al. Restrictive bare stent for prevention of stent graft-induced distal redissection after thoracic endovascular aortic repair for type B aortic dissection. *J Vasc Surg*. 2013;57(2 Suppl):44S-52S. doi:10.1016/j.jvs.2012.06.117

6. Pantaleo A, Jafrancesco G, Buia F, et al. Distal Stent Graft-Induced New Entry: An Emerging Complication of Endovascular Treatment in Aortic Dissection. *Ann Thorac Surg*. 2016;102(2):527-532. doi:10.1016/j.athoracsur.2016.02.001

7. https://fyra.io. Distal Stent Graft–Induced New Entry. Endovascular Today. Accessed March 6, 2023. https://evtoday.com/articles/2016-jan-supplement2/distal-stent-graftinduced-new-entry

8. Hiratzka LF, Bakris GL, Beckman JA, et al. 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines for the Diagnosis and Management of Patients With Thoracic Aortic Disease. *J Am Coll Cardiol*. 2010;55(14):e27-e129. doi:10.1016/j.jacc.2010.02.015

9. Li Q, Ma WG, Zheng J, et al. Distal Stent Graft-Induced New Entry After TEVAR of Type B Aortic Dissection: Experience in 15 Years. *Ann Thorac Surg*. 2019;107(3):718-724. doi:10.1016/j.athoracsur.2018.09.043

10. Okamura H, Kitada Y, Wada Y, Adachi H. Covered frozen elephant trunk technique for prevention of distal stent graft-induced new entry. *Interact Cardiovasc Thorac Surg*. 2022;35(1):ivac033. doi:10.1093/icvts/ivac033.