Endovascular management of stent graft dislodgement during thoracic endovascular aortic repair: a case report

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Case presentation

In November 2023, a 47-year-old male was admitted to our hospital for surgical management of an aneurysm in the proximal segment of the descending thoracic aorta (Fig 1). The patient reported no prior relevant medical interventions. Thoracic endovascular aortic repair (TEVAR) was planned. A left common carotid-to-left subclavian bypass, followed by covered stent-graft placement in the descending aorta, was scheduled to extend the proximal landing zone and prevent stent collapse into the aneurysm.

FIG 1. Preoperative three-dimensional reconstruction of thoracoabdominal aortic computed tomography angiography taken on 13 November 2023 revealed an aneurysm in the proximal segment of the descending thoracic aorta (arrow)

A covered stent graft (28 mm diameter, 150 mm long) [TAG; Gore Medical, Flagstaff [AZ], US] was deployed. Nonetheless, post-deployment angiography revealed that the stent had migrated proximally, unintentionally covering the left common carotid artery. To resolve this complication, a chimney stent was planned for the left common carotid artery. A bare metal stent (10 mm diameter, 40 mm long) [Wallstent; Boston Scientific, Marlborough [MA], US] was deployed but subsequently dislodged and migrated into the ascending aorta due to preoperative underestimation of the vessel diameter and anterior jumping of the stent during deployment (Fig 2a).

Initial attempts to retrieve the stent with a snare catheter and drag it to the femoral artery were unsuccessful (Fig 2b). Subsequently, a single-curved catheter and hydrophilic guidewire were used to selectively cannulate the migrated stent. A balloon catheter was then advanced into the stent and inflated to secure firm attachment, allowing successful traction of the stent into the right iliac artery (Fig 2c).

To restore cerebral perfusion, a second balloon-expandable stent (10 mm × 40 mm) [Express; Boston Scientific, Marlborough [MA], US] was deployed in the left common carotid artery to complete the chimney stent placement. To prevent contralateral flow obstruction and acute ischaemia in the left lower limb due to the right iliac stent, an identical stent was placed via the left femoral artery, creating a kissing stent configuration in the iliac arteries (Fig 2d). Final angiography confirmed the absence of any endoleak and demonstrated patent blood flow in the aortic arch branch vessels and both iliac arteries (Fig 2e).

The patient improved and was discharged 1 week postoperatively. Follow-up computed tomography angiography of the thoracoabdominal

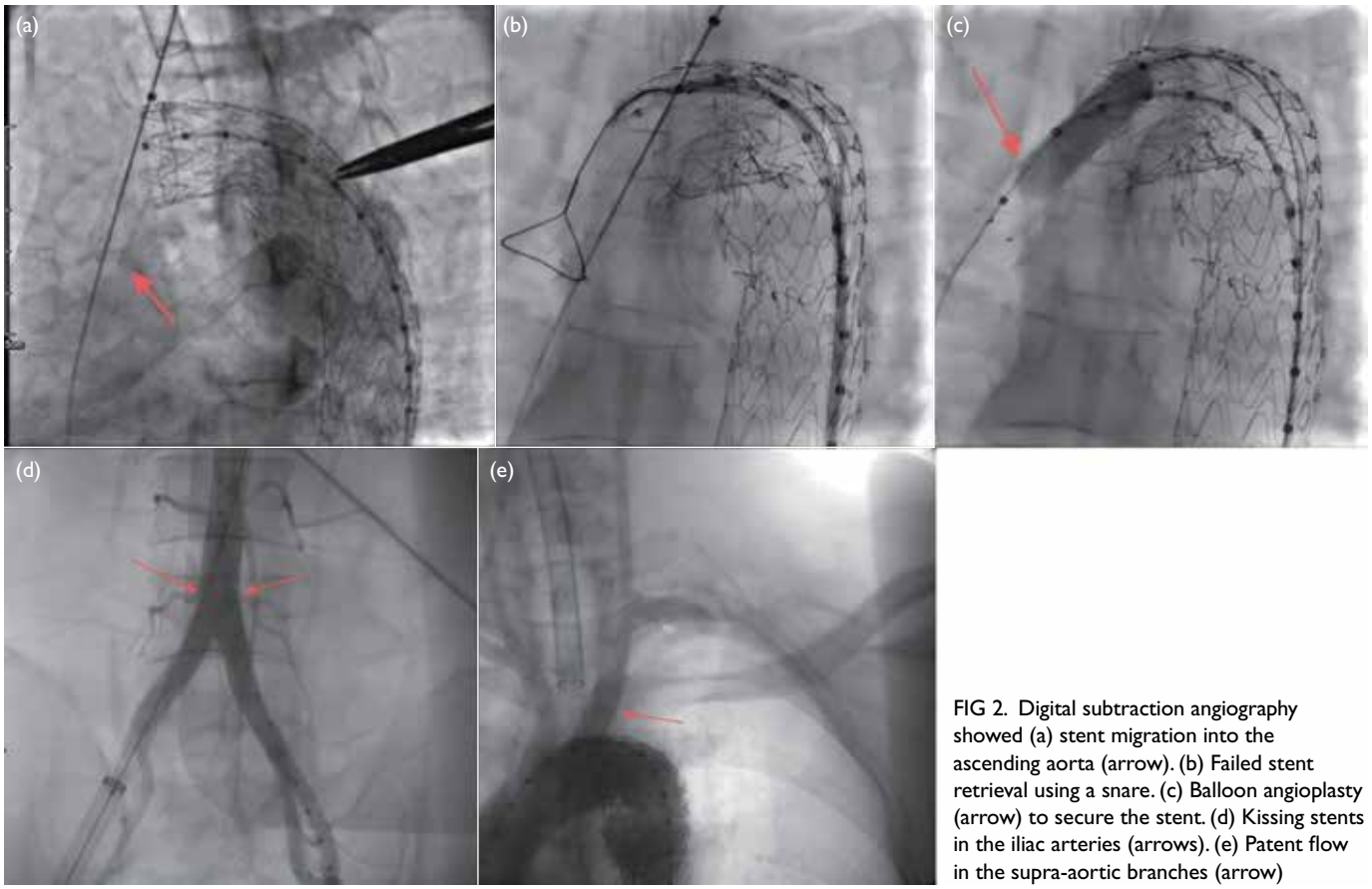

FIG 2. Digital subtraction angiography showed (a) stent migration into the ascending aorta (arrow). (b) Failed stent retrieval using a snare. (c) Balloon angioplasty (arrow) to secure the stent. (d) Kissing stents in the iliac arteries (arrows). (e) Patent flow in the supra-aortic branches (arrow)

aorta at 6 days and 6 months postoperatively revealed proper positioning of the stents, with unobstructed blood flow within the stented vessels (Fig 3).

Discussion

Thoracic aortic aneurysm (TAA) is a severe vascular disease characterised by abnormal dilation of the thoracic segment of the aorta. Between 1999 and 2020, 47 136 adults in the United States died from TAA.[1] The age-adjusted mortality rate significantly decreased from 16.2 per million in 1999 to 8.2 per million in 2013 (annual percentage change: -5.00, 95% confidence interval [95% CI]= -5.54 to -4.54; P<0.001),[1] highlighting the impact of targeted interventions.

Conventional management of TAA focuses on controlling blood pressure and heart rate, with elective surgery for eligible patients. Thoracic endovascular aortic repair has emerged as an effective, minimally invasive treatment. A previous study demonstrated that TEVAR significantly reduced 30-day all-cause mortality (odds ratio=0.44, 95% CI=0.33-0.59) and paraplegia (odds ratio=0.42, 95% CI=0.28-0.63) compared with open repair.[2] The procedure also lowers the risk of cardiac complications, transfusion need, reoperation for bleeding, renal insufficiency, and pneumonia, with a shorter hospital stay. Nonetheless, no significant differences between the two approaches have been reported for rates of stroke, myocardial infarction, aortic reintervention, or 1-year mortality.

Another study found higher early postoperative mortality with open repair but improved long-term survival.[3] Despite these advantages, TEVAR showed a higher overall mean survival rate, making it a strong contender as a first-line treatment for descending TAA. For patients with multiple co-morbidities or poor overall health, traditional open surgery carries excessive risks, further cementing TEVAR as the preferred option for this group.

When TAA is located near the supra-aortic branches, standalone TEVAR may be suboptimal. In such cases, supra-aortic branch reconstruction or bypass is necessary to extend the proximal landing zone, reducing the risk of endoleak and stent collapse into the aneurysm, and preventing catastrophic outcomes. Hybrid procedures, which combine open surgery with endovascular techniques, have emerged as a promising option for

high-risk patients. Nonetheless, even hybrid repair for thoracoabdominal aortic pathology carries significant morbidity and mortality for patients deemed unfit for conventional surgery.[4] As a result, lifelong regular follow-up is crucial for assessing the long-term performance of the graft.

Thoracic endovascular aortic repair and its graft-related complications—such as endoleak, stent fracture, and migration—can lead to aneurysm expansion, rupture, and the need for reintervention. A retrospective analysis of 123 patients treated with TEVAR for TAA, aortic dissection, penetrating aortic ulcer, intramural haematoma, or traumatic rupture revealed a stent stability rate of 99.1% at 1 year, 94.0% at 3 years, and 86.1% at 5 years.[5] Thoracic aortic aneurysm and aortic elongation were identified as key risk factors for stent migration.

Thoracic stent-graft migration is a common complication of TEVAR. Intraoperative dislodgement of branch stents into the ascending aorta is a rare but life-threatening event. In this case, the left common carotid artery stent dislodged into the ascending aorta during the procedure. The conventional response is to convert to open surgery to retrieve the stent, but this increases surgical time and complexity and may be challenging in emergencies. Delayed revascularisation can lead to cerebral infarction or neurological impairment.

Accurate preoperative assessment of vessel diameter, appropriate oversizing, and meticulous intraoperative technique can effectively reduce the risk of stent dislodgement. In this case, a balloon catheter was used to pull the dislodged stent into the right iliac artery, followed by prompt revascularisation of the left common carotid artery, thereby minimising neurological risk. A stent was placed in the left iliac artery to prevent contralateral limb ischaemia. Intraoperative digital subtraction angiography and postoperative computed tomography angiography confirmed proper stent positioning and patency of the graft vessels.

This case demonstrates that the use of a balloon catheter to retrieve dislodged branch stents to a distal location facilitates effective endovascular management. With meticulous intraoperative monitoring, minimally invasive techniques can address complex complications, avoiding the risks associated with open surgery. This approach provides a novel endovascular strategy for managing branch stent dislodgement.

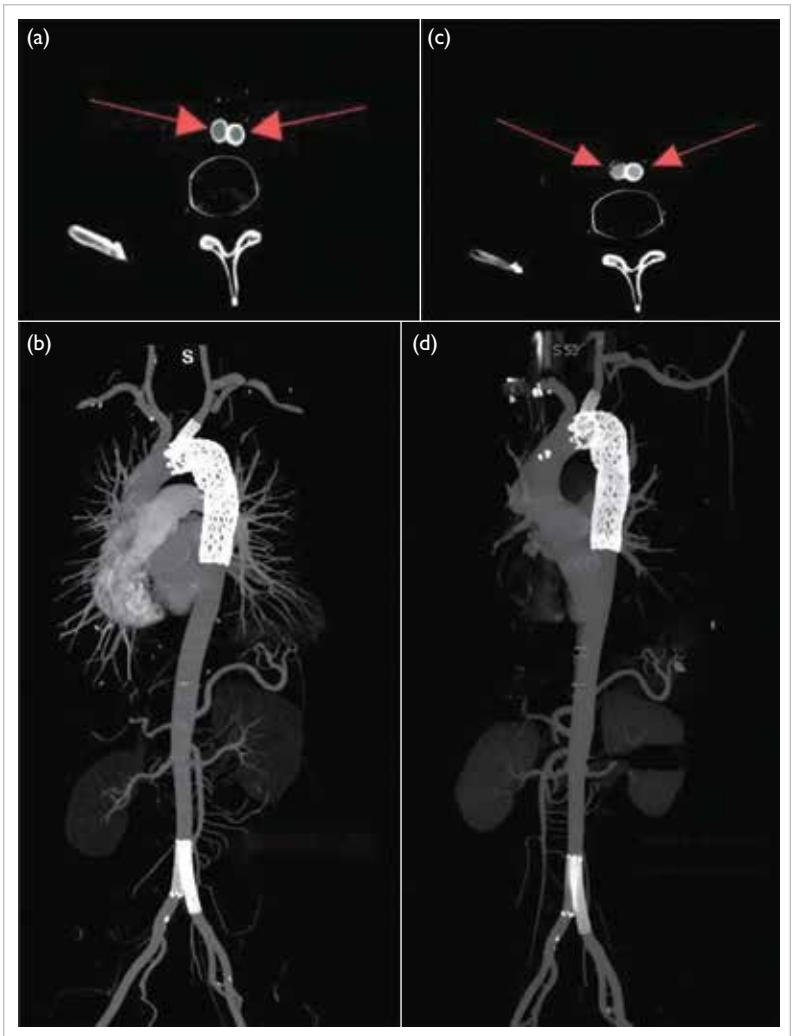

FIG 3. Postoperative thoracoabdominal computed tomography angiography at 6 days (a, b) [24 November 2023] and 6 months (c, d) [2 May 2024] demonstrated no stent migration, with unobstructed blood flow within the stent and vessels, and kissing stents in the iliac arteries (arrows in [a] and [c])

Author contributions

Concept or design: C Zeng, Q Min.
Acquisition of data: R Ye, Y Li.
Analysis or interpretation of data: C Zeng, Q Min, Z Le.
Drafting of the manuscript: X Duan, Q Duan.
Critical revision of the manuscript for important intellectual content: F Liu.

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

All authors have disclosed no conflicts of interest.

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Ethics approval

The patient was treated in accordance with the Declaration of Helsinki and provided written informed consent for all treatments and procedures, as well as for publication of this case report and the accompanying clinical images.

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