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Citation

Transapical endovascular repair of iatrogenic type A aortic dissection

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ABSTRACT

Intraoperative iatrogenic type A aortic dissection is a rare but known complication of cardiac surgery, with an incidence of 0.06% to 0.23%. Results are frequently catastrophic. The endovascular approach has made advances as an alternative treatment for aortic disease. However, the apical approach for transcatheter thoracic endovascular aortic repair is not well known. We present a 5-year follow-up of a case of iatrogenic type A aortic dissection after minimally invasive mitral valve repair successfully resolved by medical stabilization and subsequent transapical thoracic endovascular aortic repair. (J Vasc Surg Cases and Innovative Techniques 2018;4:257-61.)

Keywords: Aortic dissection; Endograft; Transapical

Intraoperative iatrogenic aortic dissection is a rare but potentially catastrophic complication of open heart surgery, occurring in 0.06% of cardiac operations and resulting in 48% operative mortality.[1,2] Any aortic or peripheral vessel manipulation during cardiac surgery could be a source of dissection, including femoral cannulation, cross-clamps, proximal anastomotic sites, and even intra-aortic balloon pumps. The endovascular approach has made advances as an alternative treatment for aortic disease. The apex of the left ventricle (LV) has gained popularity for introduction during transcatheter aortic valve implantation for overcoming limitations of the conventional femoral approach and supra-aortic approach, either a carotid or axillary artery.[3-6] However, the apical approach for transcatheter thoracic endovascular aortic repair (TEVAR) is not well known. The patient consented to publication of this report.

CASE REPORT

A 66-year-old woman with hypertension was admitted with shortness of breath and dizziness secondary to severe mitral valve regurgitation with P2 prolapse on March 30, 2011. She

had been stable for the preceding 3 years, and surgical valve repair was planned because of the development of these new symptoms. Minimally invasive mitral valve repair was performed with antegrade cardioplegia on April 1, 2011. Before closure of the skin, transesophageal echocardiography (TEE) revealed good performance of the repaired mitral valve without regurgitation but also showed a small, localized aortic dissection in the ascending aorta without aortic insufficiency. Because of her stable hemodynamics and localized flap, the decision was made for conservative treatment. Three days later, computed tomography (CT) of the thoracic aorta (TA) showed a type A aortic dissection at the sinotubular junction extending to at least the midabdomen, where the study was completed. The dissection also extended into the innominate and left renal artery (LRA), with the LRA supplied by both the true and false lumens. Although there was a possibility for the disease to go on, the patient did not want any further surgical treatment then. She remained stable with medical management and was discharged after 2 weeks.

One month and 3 months later, CT of the thoracoabdominal aorta was performed in an outpatient setting and found no significant change of the type A aortic dissection but additionally identified extension into the aortoiliac bifurcation, probably involving the proximal aspect of the left common iliac artery (LCIA; Fig 1). The false lumen diameter appeared unchanged. During the postoperative period, she complained of some fatigue on ambulation and left leg claudication. Because of extension of dissection with symptoms and refusal of additional surgery, it was decided to proceed with transapical TEVAR (TaTEVAR). Informed consent was obtained, and we were asked to proceed with the procedure. The TaTEVAR was performed on August 25, 2011 (Fig 2). After preparation of both groins for vascular access and the level of the fifth intercostal area for a left anterior thoracotomy, a TEE probe was placed. The cardiothoracic team exposed the pericardium and apex of the LV through a left anterior thoracotomy. A double purse-string suture was placed at the dimple of the LV. The LV was then punctured with a 0.018-inch single-wall needle by the interventional radiology team. A super-stiff wire was advanced into the proximal descending TA. The
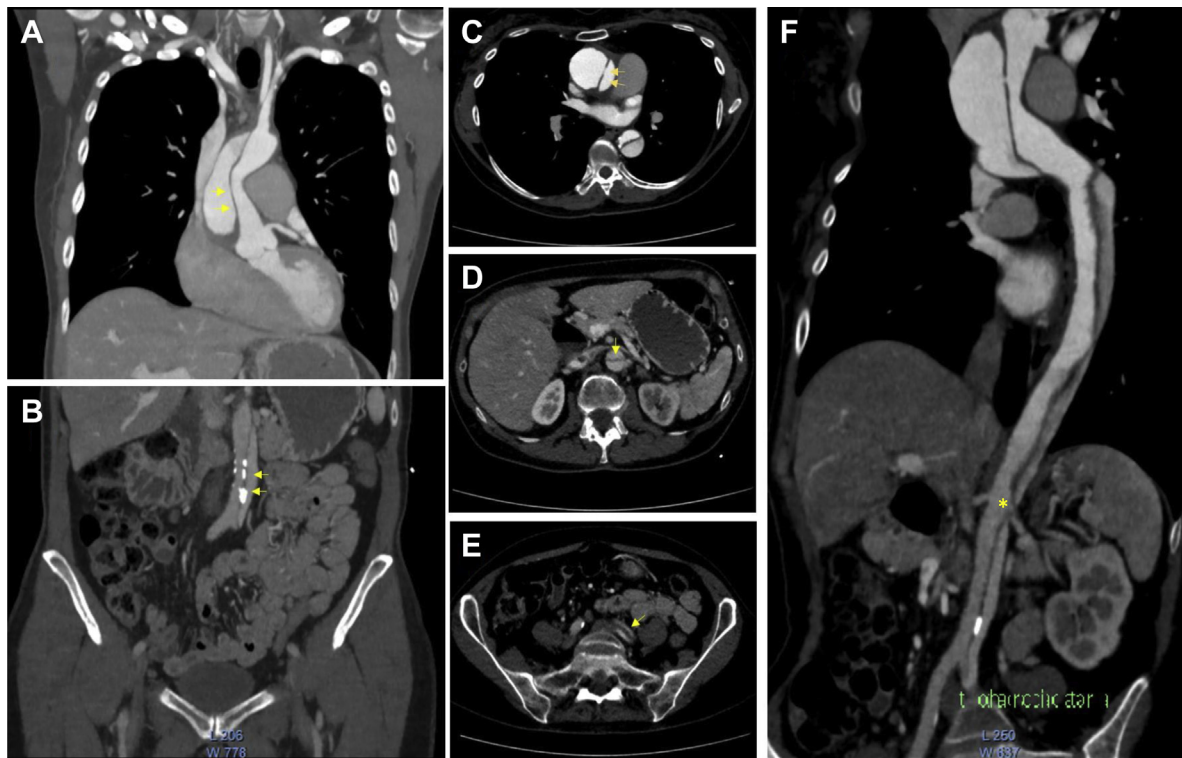
Fig 1. A-F, Computed tomography (CT) showed type A aortic dissection (*arrows*) arising from the sinotubular junction and extending through the aortic bifurcation into the left common iliac artery (LCIA). **F,** The left kidney was supplied by both the false and true lumens (*). There was no evidence of associated renal infarct.

surgical team provided the partial closure of the LV with the purse-string suture and dilated the track for the 20F sheath (W. L. Gore & Associates, Flagstaff, Ariz), which was advanced into the LV. Two 32- × 45-mm Gore Excluder cuffs were placed within the proximal TA through the transapical approach to successfully exclude a proximal fenestration between the true and false lumens of the type A dissection (Fig 2, *F*). The left thoracotomy was closed with good hemostasis. To provide blood flow from the true lumen to the LRA, a 6- × 14-mm Express (Boston Scientific, Marlborough, Mass) stent was deployed in the origin of the LRA (Fig 2, *G*). The inferior mesenteric artery (IMA) was occluded using 6- × 2-mm Tornado (Cook Medical, Bloomington, Ind) embolization coils to prevent retrograde blood flow into a false lumen and to attempt to completely cure it. Two 8- × 38-mm Atrium covered stents (Maquet, Rastatt, Germany) were sequentially deployed into the abdominal aorta (AA; Fig 2, *H*). After repeated angiography of the AA, the right groin was closed with a percutaneous closure device. There was no evidence of immediate complications. Three days later, postprocedure CT demonstrated two successfully placed stents within the ascending TA with exclusion of the type A dissection and thrombosis of the intrathoracic false lumen (Fig 3). There was persistent opacification of the false lumen from just above the level of the celiac artery to the LCIA, although it was significantly decreased in comparison to pre-TEVAR examination. CT also demonstrated a thrombosed IMA and a widely patent stent from the true lumen to the LRA. She was discharged after a 1-week hospital course.

One year later, CT showed no evidence of residual dissection and status post placement of stent graft devices in the AA with obliteration of the previously opacified false lumen without endoleak (Fig 4). Involvement of the LCIA was no longer seen, the LRA stent was patent, and the IMA remained occluded status post coil embolization. The last follow-up CT scan, 4 years postoperatively, also showed full resolution of the dissection without complication. She had good performance without related symptoms at her most recent outpatient visit in February 2018.

DISCUSSION

Manipulation and cross-clamping of the ascending aorta with antegrade cardioplegia might be implicated in this case. When localized dissection of the ascending aorta was found on intraoperative TEE, the risk of sequential surgical treatment was considered along with the risk of iatrogenic type A aortic dissection. For conventional surgical treatment of this complication, the possibility of superimposed dissection, difficulty in obtaining alternative access for cardiopulmonary bypass, and, similarly, difficulties with cerebral and myocardial protection related to either dissection-induced malperfusion or the unplanned need for alteration in cannulation site necessitated by the dissection should be considered. Because hemodynamic status was stable during the operation and the intraoperative TEE showed a localized flap, conservative management was decided. Although the aortic dissection

Fig 2. Transapical thoracic endovascular aortic repair (TaTEVAR) and sequential angioplasty of the left renal artery (LRA), distal aorta, and inferior mesenteric artery (IMA) were performed successfully. **A-F,** Successful placement of two Gore Excluder cuffs within the proximal thoracic aorta (TA) through a transapical approach to exclude a proximal fenestration between the true and false lumens. **G,** Placement of an LRA stent at the ostium. **H,** Deployment of two Atrium (Maquet) stents within the infrarenal abdominal aorta (AA) after coil embolization of the IMA. **I,** A small amount of contrast material is visualized within the false lumen that does not extend along the length of the true lumen.

progressed from the ascending aorta to involve the LCIA, IMA, and LRA, she nonetheless remained stable. We had ample time for discussion with the cardiothoracic team and the patient's family. Extensive strategic planning of the procedure was also possible. Although most pathologic processes involving the ascending aorta or aortic arch are considered unamenable to current endovascular treatment, she had excessively high risk for open repair because of recent heart surgery and manipulation of the aorta. Importantly, it was thought that transapical access would offer a more direct, anatomically favorable approach to the ascending aorta with the small caliber of the iliofemoral arteries (5 to 6 mm), the tortuosity of the aorta, and the bulky devices commercially available in 2011.

The apex of the LV is the "front door" to the arterial vascular system and as such has gained popularity in thoracic endovascular aortic valve repair.[3-6] However, TaTEVAR is not well known. Although no access issues have been described so far during TaTEVAR, complications related to the transapical thoracic endovascular aortic valve repair remain a concern, including bleeding from the LV apex, formation of an LV apex pseudoaneurysm, and development of a late ventricular septal defect.[7-9] Our patient had no related symptoms and no evidence of complications on immediate CT, and a follow-up CT scan 4 years later showed full resolution of the dissection. The long-term follow-up in this case of TaTEVAR for iatrogenic aortic dissection is highly unique and valuable.
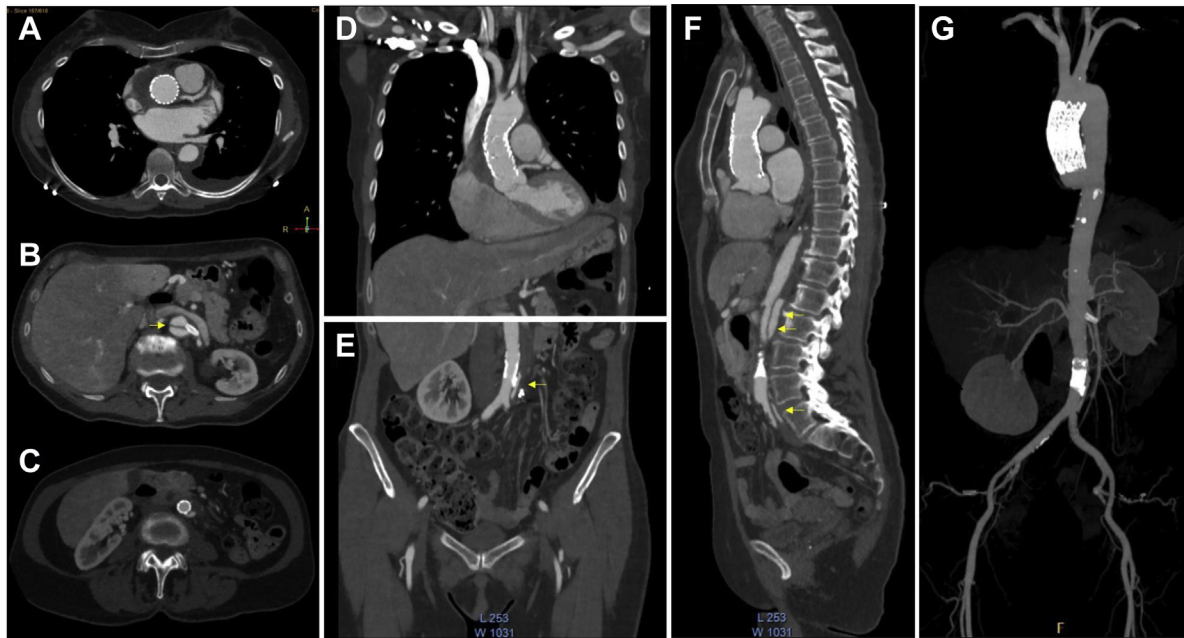
Fig 3. Post-transapical thoracic endovascular aortic repair (TaTEVAR) follow-up computed tomography (CT) findings. **A,** Demonstration of TaTEVAR of a type A dissection with patent coronary arteries and no significant interval change in location of the Gore Excluder cuffs. **B-G,** Persistent opacification (*arrow*) of the abdominal portion of the false lumen beginning at the level of the superior mesenteric artery and extending inferiorly adjacent to the infrarenal abdominal aortic stents. **F,** The dissection extends into the common iliac artery on the left side without significant interval change compared with preprocedure imaging. **B** and **G,** Widely patent renal arteries bilaterally including a stent within the proximal aspect of the left renal artery (LRA) extending from the true lumen into the renal artery.
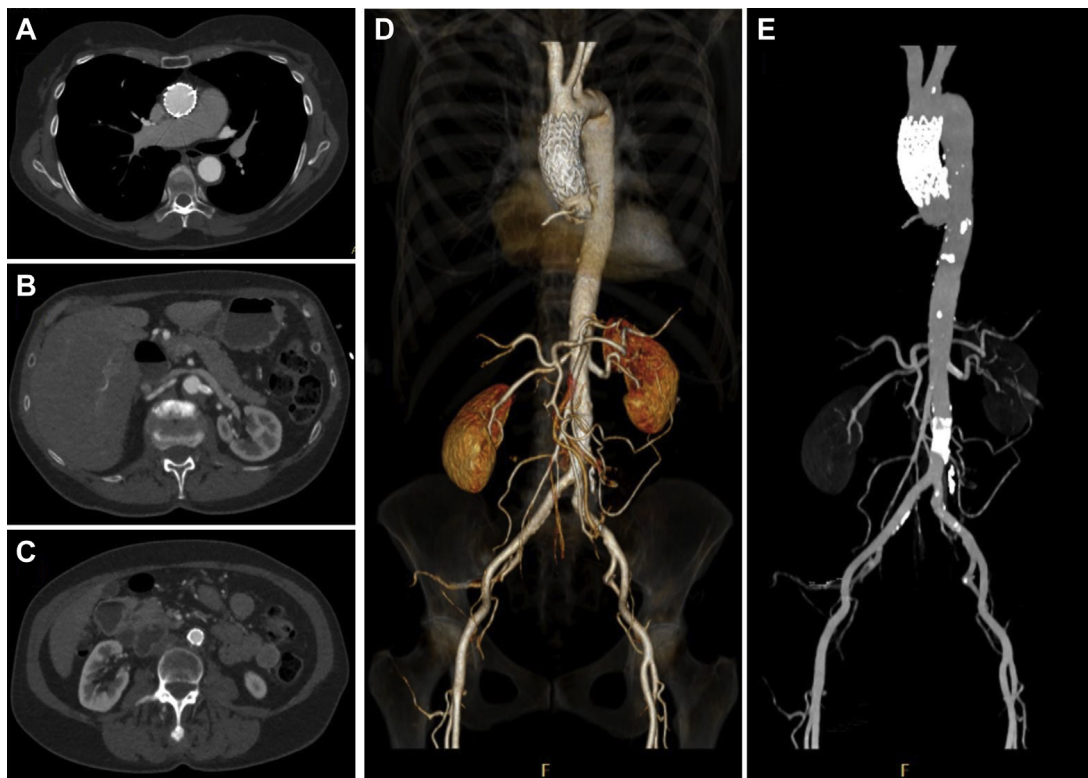

Fig 4. Most recent follow-up computed tomography (CT) findings on November 5, 2015. **A-E,** No significant residual dissection present. **C, D,** and **E,** Resolution of the false lumen opacification seen on previous examinations within the abdominal portion of the dissection. **B, D,** and **E,** Patent left renal artery (LRA) stent.

CONCLUSIONS

We report a case of a 66-year-old woman with the rare complication of iatrogenic type A aortic dissection after minimally invasive mitral valve repair. Although she remained stable for 3 months on conservative management, our patient was managed successfully with TaTEVAR and remained fully resolved 4 years later.

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