the rib to be anteriorly displaced and within 7 mm of the descending aorta (Figure 2). We elected to remove the rib fragment, and the patient was discharged within 1 week. Sata and colleagues⁶ also reported successful resection of a rib fragment seen to be migrating toward the thoracic aorta over serial CT scans. Sata and colleagues elected to perform open thoracotomy for rib resection, as in our case; however, a video-assisted thoracoscopic approach also may be a viable option in less complicated cases.

CONCLUSIONS

Although rib fracture–induced injury of the aorta is rare, given the severe implications of aortic injury, we recommend consideration of prophylactic resection of the rib fragments that threaten the aorta. Imaging studies such as

CT and 3-dimensional reconstructions may assist physicians in developing their threshold for prophylactic surgery in the future.

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Cardiac transapical approach: A new solution for the treatment of complex thoracic aortic disease

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Endovascular repair of descending thoracic aorta pathology has become a well-recognized therapeutic option,¹ although several patient results are unsuitable anatomically for standard treatment with current devices.² Severe vascular occlusive disease may not allow the insertion of these large devices through the iliofemoral vessels or the abdominal aorta. We report a patient with impending rupture of a descending thoracic aorta aneurysm who underwent endovascular aortic repair using a transapical approach through the left ventricular apex.

CLINICAL SUMMARY

An 83-year-old man with history of systemic hypertension, dilated cardiomyopathy, chronic atrial fibrillation, diabetes mellitus, and chronic renal insufficiency was admitted to the emergency department of our hospital for

cough with hemoptysis. A thoracoabdominal computed tomographic scan showed a multiple saccular pseudoaneurysm (38 × 57 × 40 mm) located on the left supero-lateral margin of the aortic wall, just beyond the origin of the left subclavian artery, with parietal thrombosis and perivascular hematoma (Figure 1, A). The lesion was complicated by the presence of 2 penetrating ulcers with bulging of the aortic wall. In this location, the inner layer of the aorta seemed to be very thin and partially interrupted. Angiography performed in the operating room confirmed the diagnosis. Unfortunately, emergency standard retrograde delivery of a thoracic stent graft was not feasible because of severe occlusive disease of the iliofemoral vessels (Figure 1, B). Moreover, the presence of a significant right subclavian artery tortuosity was judged to be an important and additional concern. Thus, considering the concomitant systemic comorbidities of the patient, and our experience with transapical aortic valve replacement, we decided that this minimally invasive approach would be the best option to deploy the endovascular aortic stent.

The patient was placed under general anesthesia and intubated with a single-lumen endotracheal tube. Imaging was provided by an angiographic C-arm system (Philips Veradius R1; Philips Healthcare, Best, The Netherlands). A left minithoracotomy incision was made in the fifth

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FIGURE 1. A, Preoperative left anterior oblique view of the thoracic aorta (volume rendering image). The *arrowhead* indicates the profile of the biggest saccular pseudo-aneurysm. B, Preoperative volume rendering image showing heavy calcification of the abdominal aorta and iliac branches. C and D, Postoperative multislice computed tomographic angiography at 2 weeks showing that the metallic grid is adhered to the aortic wall and the aneurysmal sac is excluded correctly.

intercostal space. Using a rib retractor, the left ventricular apex was exposed and 2 pledgeted purse-string sutures were placed on it. The apex was accessed and a flexible guidewire was advanced across the aortic valve and into the descending aorta. After the insertion of a 22F Gore DrySeal sheath (W. L. Gore & Associates, Inc, Flagstaff, Ariz), the Gore Conformable TAG thoracic endoprosthesis (15 × 31mm; W. L. Gore & Associates) was prepared in the standard fashion and was advanced across the aortic valve and ascending aorta up to the descending thoracic aorta (Figure 2, A-C). Correct placement of the endoprosthesis was obtained at angiography by marking the origin of the left subclavian artery from the aortic arch with a guidewire positioned in the subclavian artery (Figure 2, C). Then, precise deployment was safely performed in the standard fashion, avoiding accidental coverage of the left subclavian artery (Figure 2, C). Aortic angiography demonstrated satisfactory endovascular repair, with the exclusion of the aneurysmal lesion and without any evidence of endoleak (Figure 2, D). Control computed tomographic scan performed 2 weeks after surgery confirmed the good results of the procedure (Figure 1, C and D).

DISCUSSION

Antegrade strategies for the placement of aortic stent grafts such as the axillary approach, ascending aortic delivery, or direct placement of aortic stent grafts have been investigated.³ These techniques have proved to be effective in the treatment of complex thoracic aortic disease that is not suitable anatomically or physiologically for the usual approaches.

To the best of our knowledge, this is the first report of a mini-invasive transapical delivery of a stent graft for the repair of a complex descending thoracic aorta aneurysm. Technical success obtained in this case demonstrates that endovascular treatment of thoracic aortic disease can be performed safely in select patients by a left minithoracotomy and a transapical ventricular approach. This technique could be particularly useful in patients in whom standard retrograde delivery of thoracic stent graft results is not feasible because of severe occlusive disease of the iliofemoral vessels, because antegrade deployment of an aortic endoprosthesis is technically demanding as a result of previous cardiac surgery, or because of an anatomic tortuosity of the right subclavian artery. Although our strategy proved to be safe and effective during the early period, the

FIGURE 2. Left anterior oblique angiogram during the endovascular procedure. A, The guidewire is in the aortic arch and the endoprosthesis is proceeding along the ascending aorta. B, the endoprosthesis is pushed forward in the aortic arch. C, The endoprosthesis reaches the correct position when it crosses the guidewire in the subclavian artery (landmark indicated by the *arrowhead*). D, Angiogram immediately after endoprosthesis opening showing the restoration of normal aortic caliber without contrast leakage (*arrowhead* indicates the aortic root).

long-term outcome of these new strategies needs to be evaluated further.

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