sizing discrepancy between the proximal and distal ascending aorta. Finally, fragility of the dissected ascending aorta may pose difficulties, the most concerning of which is the potential for conversion to retrograde dissection during positioning or deployment.

An absolute prerequisite for endograft consideration is uncompromised aortic valve function. With the advent of transvalvular aortic valve implantation, it may in the future be possible to offer concomitant aortic valve and TAAD repair. Current devices for transvalvular aortic valve implantation, however, require a certain degree of aortic valve stenosis and calcification to promote device fixation and obviate migration or embolization. Aortic insufficiency from dissection results in separation of the intima covering the noncoronary sinus of Valsalva, allowing the involved commissures to prolapse inward, resulting in valvular insufficiency.

In a published series of endografting for TAAD, exclusion criteria are as follows: proximal or distal landing zones smaller than 20 mm, coronary orifice involvement, acute myocardial infarction, severe aortic regurgitation (grade 3 or 4) by echocardiography, history of life-threatening ventricular arrhythmia, severe tortuosity, descending aortic narrowing, or a connective tissue disorder (Marfan’s or Ehlers Danlos syndrome) [5].

The principle goal of endograft placement for TAAD is identical to type B dissection: closure of the primary entry tear in the aorta, preservation of true luminal blood flow, and false lumen thrombosis/aortic remodeling [6]. In our case we were successful in accomplishing the first two only. We did not achieve false lumen thrombosis in the initial perioperative period but remain hopeful that follow-up imaging will demonstrate this, inasmuch as it leads to reduction in aortic diameter [6] and is associated with improved patient survival [7].

In conclusion, we present a case of TAAD endograft repair with a commercially available thoracic graft that may be the first report of its kind in the United States. Although open surgical repair remains the gold standard for TAAD, endografting may have a positive impact on the current treatment algorithm. Advances must occur in graft manufacturing, and further data are needed before wider application is appropriate.

References
femoral vein thrombus. Transthoracic and transesophageal echocardiogram demonstrated a dilated right ventricle with reduced function and a right atrial mass extending across a PFO into the left atrium (Fig 1) and across the tricuspid and mitral valves. The patient underwent emergent pulmonary embolectomy and PFO closure under cardiopulmonary bypass and aortic crossclamping. Right atrial thrombus straddling a PFO was identified and cleared, and the PFO closed. The left ventricle was explored through a separate aortotomy. No additional thrombus was found. An inferior vena cava (IVC) filter was placed on postoperative day 1, and the patient was discharged to a skilled nursing facility on a regimen of coumadin on postoperative day 10. He was doing well at last follow-up at 23 months.

Patient 2
A 41-year-old woman receiving oral contraceptive therapy presented to an outside hospital with calf pain and mild dyspnea on exertion 1 week after knee surgery. Lower extremity duplex excluded deep vein thrombosis, and the patient was reassured. The patient presented again 2 weeks later with severe dyspnea. Vital signs included a heart rate of 98 beats per minute, systolic blood pressure of 131 mm Hg, and oxygen saturation of 97% on nasal cannula. Computed tomography scanning of the chest and lower extremities demonstrated a large saddle pulmonary embolus and no deep vein thrombosis. Transthoracic echocardiogram demonstrated a dilated right ventricle with reduced function, a flattened interventricular septum, and a right atrial mass extending across a PFO into the left atrium and across the mitral valve. The patient was discharged to a skilled nursing facility on a regimen of coumadin postoperative day 10. He was doing well at last follow-up at 23 months.

Patient 3
A 39-year-old man with a sacral chondroma 6 years after prior resection and radiation had local and metastatic recurrence including IVC tumor thrombus and pulmonary embolus. He was treated with anticoagulation therapy but presented with progressive dyspnea, fatigue, and tachycardia. Workup demonstrated extensive tumor thrombus extending from the pelvis to the right atrium, but resolution of the prior pulmonary embolus. The patient was scheduled for elective caval and cardiac tumor thrombectomy utilizing circulatory arrest. During preparation for cannulation the patient developed hypotension and profound shock. Transesophageal echocardiography confirmed the above findings (Fig 2). Right atrial thrombus straddling a PFO was identified and cleared and the PFO closed. Intraoperative transesophageal echocardiogram demonstrated extension of thrombus both across the tricuspid valve into the right ventricle and pulmonary artery, resulting in a severely dilated right ventricle with reduced function, as well as new thrombus across a PFO (Fig 3). Emergent cardiopulmonary bypass was instituted, and pulmonary embolectomy as well as right atrial and IVC thrombectomy were performed with aortic crossclamping and circulatory arrest through the chest and abdomen. Right atrial thrombus straddling a PFO was identified and cleared and the PFO closed. Intraaortic balloon pump support was required during weaning from cardiopulmonary bypass. An IVC filter was placed intraoperatively, and the patient was discharged to home on a coumadin regimen on postoperative day 8. He was doing well at last follow-up at 4 months.

Fig 1. Transesophageal echocardiography (midesophageal bicaval view) demonstrating (A) a right atrial mass that (B) extends across a patent foramen ovale into the left atrium.

Fig 2. Transesophageal echocardiography (midesophageal four-chamber view) demonstrating right ventricular dilation and a right atrial mass extending across a patent foramen ovale into the left atrium.
Comment

Pulmonary embolectomy is usually reserved for significant hemodynamic instability or contraindications to thrombolysis. Other less common scenarios lending themselves to surgical therapy include right-side heart thrombus, namely, “clot in transit,” and thrombus straddling a PFO, or “paradoxical embolus in transit” with impending arterial thromboembolism. In these scenarios, the risks of surgery are outweighed not only by the risk of bleeding with thrombolysis, but also by the occasionally described risk of thrombolysis-induced clot fragmentation and embolization [7].

The literature contains several reports of paradoxical emboli in transit, with no clear consensus on management. Few analyses of the existing reports have been published. Myers and colleagues [7] analyzed 174 patients from 154 studies of impending paradoxical embolism. Surgical thromboembolectomy demonstrated a significant reduction of the composite of mortality and systemic embolism compared with anticoagulation therapy or thrombolysis [7]. In a separate, similar analysis by Fauveau and associates [6], 36 of 88 patients with thrombus straddling a PFO presented with systemic embolism before treatment, with the most common site being cerebral in 26 patients. These findings support the surgical treatment of paradoxical embolus in transit. Furthermore, PFO closure is a potential benefit of surgical embolectomy in preventing recurrent paradoxical embolism.

We present 3 patients with paradoxical embolus in transit, 2 with a preoperative diagnosis as part of the workup for massive or submassive pulmonary embolus and 1 who likely embolized intraoperatively during caval and right atrial tumor thrombectomy. With advances in perioperative care, pulmonary embolectomy can be performed with excellent survival rates, with adverse outcomes mainly related to preoperative hemodynamic instability [8]. In the current report, no patient had systemic embolization, and all had unremarkable postoperative courses and were alive and well several months postoperatively.

Given the morbidity associated with paradoxical systemic embolization, the site of which is most frequently cerebral, paradoxical embolus in transit may be considered a strong indication for surgery. This requires confirmation by larger studies, ideally in a prospective fashion, which is unlikely to be performed owing to several logistical obstacles, including the rarity of the disease. Until then, the treating clinician must use judgment combined with data from case reports and “meta-analyses” of these to make the best individualized decision for each patient.

References


Successful Palliation of a Child With Left Ventricular Noncompaction Cardiomyopathy and Tricuspid Atresia to Fontan Procedure

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Fig 3. Transesophageal echocardiography (midesophageal four-chamber view) demonstrating inferior vena cava tumor thrombus extending into the right atrium and across a patent foramen ovale into the left atrium.