Transcaval Aortic Access for Percutaneous Thoracic Aortic Aneurysm Repair: Initial Human Experience

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ABSTRACT

Transcaval aortic access has been used for deployment of transcatheter aortic valves in patients in whom conventional arterial approaches are not feasible. The present report describes its use for thoracic endovascular aortic repair (TEVAR) in a 61-year-old man with a descending thoracic aneurysm. Transcaval access was performed in lieu of a surgical iliac conduit in view of small atherosclerotic pelvic arteries. TEVAR was successfully performed, followed by intervascular tract occlusion with the use of a ventricular septal occluder. Computed tomography 2 d later demonstrated no extravasation. At 1 mo, the aneurysm was free of endoleaks, the aortocaval tract had healed, and the patient had returned to baseline functional status.

ABBREVIATIONS

IVC = inferior vena cava, TAA = thoracic aortic aneurysm, TAVR = transcatheter aortic valve replacement, TEVAR = thoracic endovascular aortic repair

Current thoracic endovascular aortic repair (TEVAR) requires large-bore arterial accesses ranging from 18 to 24 F, necessitating suitably large femoral and iliac arteries. A variety of techniques have been developed to circumvent small or diseased vessels, including placement of surgical or endovascular iliac conduits and direct abdominal aortic access (2). Although effective, these techniques require more invasive surgeries and are associated with greater morbidity and mortality, with postoperative major complication rates reaching 16% and mortality rates ranging from 3% to 12% in two large recent studies (1,2). Moreover, these surgical approaches may be contraindicated in some patients because of unfavorable anatomy or previous intervention (1,3). Transapical delivery for TEVAR represents an alternative approach to TEVAR as well, but it carries other current risks, including ventricular pseudoaneurysm formation and injury to other cardiac structures (4). Percutaneous transcaval aortic access has been used as a means to avoid these approaches in patients undergoing transcatheter aortic valve replacement (TAVR), a procedure with similar iliofemoral vessel diameter requirements as TEVAR (3). The technique entails transcatheter puncture of the abdominal aorta from the inferior vena cava (IVC), with tract closure using a nitinol occlusion device (3). Here we present the initial human experience with the use of this percutaneous approach for endovascular repair of a thoracic aortic aneurysm (TAA).

CASE REPORT

Institutional review board exemption was granted for the preparation of this case report. It complies with Health Insurance Portability and Accountability Act requirements. A 61-year-old man with a 1976 history of congenital thoracic aortic coarctation repair was found to have an asymptomatic descending TAA expanding from 4.5 cm to 5.9 cm in the repaired segment over an

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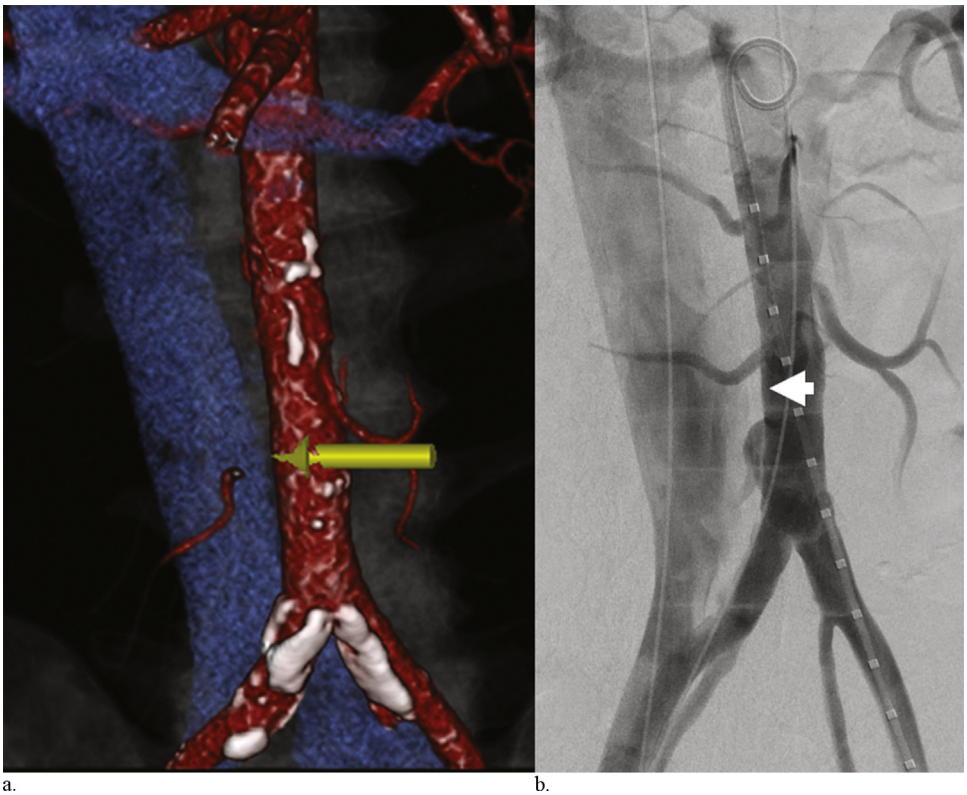
18-month period. Pertinent medical history included hypertension, hyperlipidemia, obstructive sleep apnea, and 10–20 pack-year history of tobacco use.

A multidisciplinary team consisting of cardiovascular surgeons, interventional radiologists, and interventional cardiologists determined that endovascular repair would be preferable to open surgical TAA repair. The patient's < 6-mm-diameter external iliac arteries were unsuitable for introduction of the 22-F sheath required for the chosen endograft. The proximity of the caudal aorta and IVC and relative absence of mural aortic calcification suggested that the patient would prove a favorable candidate for a transcaval approach (Fig 1a). The patient was offered an open surgical common iliac artery exposure and a percutaneous transcaval approach and indicated his desire to avoid open surgery. As part of obtaining informed consent, the risks of the transcaval access, including the investigational nature of the procedure, were discussed in depth.

Procedure

A cerebrospinal fluid lumbar drain was placed to reduce the risk of spinal cord ischemia. Transcaval aortic access was performed by using previously described means (3). Under general anesthesia, the right common femoral vein and bilateral femoral arteries were accessed percutaneously. Simultaneous aortography and cavography were performed, confirming the target access sites identified on preoperative computed tomography (CT; Fig 1). After systemic heparinization, a 6-F curved guiding catheter (RDC; Boston Scientific, Marlborough, Massachusetts) was advanced from the femoral vein. A 0.014-inch guide wire (Asahi Confienza Pro 12; Abbott Vascular, Santa Clara, California) with 10 mm of its leading tip amputated was advanced through a long transitional catheter (PiggyBack; Vascular Solutions, Minneapolis, Minnesota) and support catheter (Minnie Support Catheter; Vascular Solutions, Maple Grove, Minnesota) and, together, positioned in the caudal IVC. The PiggyBack hydrophilic catheter has a 0.035-inch outer diameter and 0.014-inch inner diameter that allows conversion into 0.035-inch inner-lumen catheters, and it is typically used in the periphery. A 15-mm nitinol GooseNeck snare (Covidien, Plymouth, Minnesota) was placed at the aortic target site by a left femoral arterial approach. An electrocautery device was attached to the caval guide wire (Bovie Medical, Clearwater, Florida) and energized by using the "cut" setting at 50–70 W. Short 1–2-second bursts of energy were administered while the wire was advanced into the abdominal aorta. The wire was snared within the abdominal aorta and, together with the enclosing snare, advanced into the thoracic aorta. The transitional catheter and the support catheter followed into the thoracic aorta, after which the original wire and inner catheter were removed



a. b.

Figure 1. **(a)** Volume-rendered three-dimensional reconstruction of preoperative CT angiogram demonstrates the ideal target area for puncture from the IVC into the abdominal aorta (green arrow). **(b)** Simultaneous aortogram and cavogram demonstrate the intended puncture site (arrow).