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EDITORIAL COMMENT

# On the Endovascular Climb to the Type A Dissection Summit, Reaching a New Base Camp*

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Over the last 20 years since its introduction, thoracic endovascular aortic repair (TEVAR) has progressed from an alternative to open operative therapy in patients at high or prohibitive surgical risk to a widely adopted clinical practice to manage a variety of thoracic aortic lesions. Initially applied to descending thoracic aortic aneurysms, TEVAR is now approved for the treatment of patients with type B aortic dissection and traumatic aortic injury (1).

Recently, ongoing clinical trials of branched grafts that expand the application of TEVAR to the aortic arch and thoraco-abdominal segment are extending the scope of endovascular therapy to previously unapproachable thoracic zones.

Now, only 1 uncharted thoracic territory remains—the ascending aorta, and with it the potential to touch one of the holy grails of endovascular therapy—type A dissection. Previous pioneering endovascular experience over the last 10 years in this intimidating aortic segment has been limited to anecdotal case reports that detail the trials and tribulations of interventionalists who attempt to use approved descending devices to treat a smorgasbord of ascending aortic pathologies (mycotic aneurysms, surgical anastomotic leaks, penetrating ulcers, pseudoaneurysms, and so on) (2–6).

Remarkably, there exists a paucity of reports of TEVAR to treat patients with acute type A dissection compared with the diverse assortment of publications that describe its application in nondissection lesions (7–11). Perhaps, this is not so surprising given the daunting anatomic and physiologic complexities posed by type A disease relative to the less vexing task of plugging a focal hole in an otherwise intact aortic wall.

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Notably, one group in China has demonstrated a sustained commitment to engaging the formidable endovascular challenge of type A dissection. Previously, they have described their procedural experience and short-term follow-up results (12). In this issue of the *Journal,* Li et al. (13) provide an interesting and valuable new chapter in their ongoing quest with a report of the long-term outcomes (median follow-up of 72 months, range 61 to 81 months) of endograft placement. Indeed, this description of longitudinal 6-year follow-up in 15 highly selected patients represents an important step forward toward opening the door for others interested in evaluating the opportunity for TEVAR in the setting of type A dissection.

There are a number of critical points that readers should glean from the investigators' experience. The 15 patients detailed represent only a small fraction of the 181 patients with type A dissection evaluated at their facility during the study period. One hundred forty-two went directly to open surgical repair. The remaining 41 were judged "unfit" for surgery by a panel of physicians due to multiple high-risk factors defined in the report. These 41 underwent further evaluation during which 15 patients were selected for TEVAR. The remaining 26 were managed medically. It is important to understand the details of the selection process in order to properly interpret the long-term outcomes.

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In this context, all patients >70 years of age were deemed high risk for surgery and then, considered for TEVAR exclusively. Thus, at a minimum, 142 of 181 (79%) of the evaluated type A patients were <70 years of age. This suggests that the population of patients evaluated for type A dissection in China is much younger than the mean age of patients in North America and Europe and raises the possibility a cultural variation in the disease process.

Also, it is important to note that only 1 of the TEVAR patients was treated <8 days after the initial diagnosis. Seven underwent TEVAR between 8 and 30 days after symptom onset and 7 were repaired after 30 days and up to 353 days. As such, many of the individuals in this report are proven by the chronicity of their disease at the time of TEVAR therapy to be among a fortunate highly select group of acute type A survivors. This fact should influence the advisability of generalizing results from this report to predict possible outcomes for TEVAR in a more representative acute type A patient population.

Nonetheless, the long-term results in this particular group are encouraging. There were no deaths in follow-up, and although 4 patients required reintervention, only 2 were for aortic-related events. In the ascending aorta, significant enlargement of the true lumen and corresponding decreases in the false lumen and transaortic diameter were observed at 12 months after TEVAR; however, no further changes were evident subsequently. In addition, left ventricular ejection fraction remained normal and there was minimal impact on aortic valve function after TEVAR.

At this stage, as the field moves cautiously forward to more broadly address the obvious key questions of who, how, when, and with what, it may be of interest to review where we are today. It is generally appreciated, as Li et al. (13) point out, that the ascending aorta presents some novel challenges to TEVAR not encountered previously by the current generation of thoracic endografts. As we contemplate how best to approach the opportunity in the ascending aorta, it is important to keenly study each of the features that make this segment unique if we have a hope of developing a strategy that will achieve a successful and durable result.

Anatomically, the dissected ascending segment challenges current device technology with a large diameter, short parking space between coronary and innominate arteries; noncylindrical lumen, irregular, tapered, or reverse tapered geometry; and short radius of curvature—especially acute at the proximal and distal margins. Physiologically, relative to the forces that affect the descending segment, the ascending aorta experiences higher flow rates, increased compliance, and greater dynamic deformation due to cardiac motion, proximal aortic translation with ventricular ejection and respiratory motion.

It is distinctly possible that today's off-the-shelf TEVAR devices used in our initial type A experience may need to undergo radical changes to provide an enhanced conformability, compliance, and durability that may prove necessary to better tackle this extreme test. The future type A devices will likely move beyond cuffs and short cylinders designed previously for the abdominal and descending thoracic aortas to purpose-built grafts focused on the specific challenges of a dissected ascending aorta. In addition, considerations will need to take into account not only the prosthetic graft, but also its integrated delivery system.

As the first report to provide details of long-term outcomes following TEVAR treatment of patients with type A dissection, Li et al. (13) have succeeded in moving the discussion beyond the novelty level of "look, it can be done" to the next developmental stage, poised on the threshold of a prospective clinical trial. This is a valuable contribution. I wonder, however, if the current TEVAR technology is ready to withstand the rigors it will face when we enter the next phase.

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**KEY WORDS** ascending aorta, endovascular graft, TEVAR, type A aortic dissection