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EDITORIAL COMMENT

Saving Lives by Building New Bridges

The Serengeti Mara Ecosystem Paradox*

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The Serengeti is one of the most important wildlife sites in the world, Africa's most famous, and one of the world's best studied ecosystems. The annual migration of ~1.2 million wildebeests accompanied by tens of thousands of gazelles and zebras through the Serengeti Mara Ecosystem is the world's largest remaining overland migration. An iconic portion of the migration is crossing of the Mara River, during which thousands of animals drown. It is an awful event, but the yearly massacre of 6,000 wildebeests is part of the normal ecological cycle, and it comprises only 0.5% of the total herd size. This river kills thousands of wildebeests but then gives life to everything else; these animals nourish an entire river ecosystem, and scientists who study ecosystems try to see the big picture as opposed to a flash of drama (1). Nevertheless, some animal lovers have proposed assisting the migration of wildebeests, perhaps by building bridges across the Mara. In that case, we would expect an increase in the wildebeest and zebra population, alongside an increase in disease and adverse genetics. It would result in a decrease in crocodilians and scavengers along the river but an increase in land predators along the path on the other side of the river (as more infirm animals will be taken by predators there). Unintended consequences may well result in adverse effects for both the hoofstock and their predators. Abruptly modifying the annual migration route of 1.2 million wildebeests could effectively destroy the life cycle of the species and bring the ecosystem of the national park crashing down with it. We know that nature does a wonderful job of self-regulation when humans do not interfere.

As cardiovascular specialists, we work to save lives, prevent death, and improve quality of life. We fight daily against natural selection, by tending to the infirm and hoping to offer the opportunity for our patients to live a few years longer. We fight against cardiovascular disease, a chronic and progressive enemy with no cure. Using bypass procedures and stents, we build bridges that temporarily help other humans to cross through their illness. Gaining some months or years of life is justified both for them and for us. Could it be enough to attend the wedding of a daughter or the birth of a grandchild? We accept the disruption of natural systems in order for other humans to benefit through a longer or possibly better life.

Over the last 20 years, advances in endovascular techniques have allowed clinicians to treat more complex disorders with less invasive approaches, often with special benefits for older adult and frail patients who were previously rejected for surgery and condemned to an early death. These technologies represent a powerful tool, and we have seen rapid extension of indications and territories. We have achieved reasonable results, or at least results that are noninferior or similar to those of surgical repair in many territories, from distal recanalization for peripheral arterial disease to endovascular aortic repair, thoracic endovascular aortic repair (TEVAR), carotid artery stenting, transcatheter aortic valve implantation, and percutaneous coronary intervention.

Although endovascular therapies are conquering vascular beds, there are still some cardiovascular diseases that have no scientific evidence to support a minimally invasive approach. One of these disorders is ascending aortic disease. The ascending aorta has

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inherent properties that render most of the approved treatment devices for the aortic arch and the descending thoracic aorta inappropriate. The ascending aorta changes diameter with every beat, thereby making stent graft sizing complex to calculate. In treating the acutely dissected aorta, the general consensus is to limit oversizing to 5% (2). Adding the semirigid skeleton of a stent graft will modify the natural movements and affect heart function because aortic root anatomy changes shape throughout the cardiac cycle (3). The implantation of a stent graft for acute aortic syndromes (intramural hematoma [IMH], penetrating aortic ulcer, aortic dissection) requires proximal and distal fixation and sealing of the stent (at least 1 or 2 cm). However, the potentially covered area of the ascending aorta is limited proximally by the coronary arteries or the aortic sinuses, respectively, and distally by the origin of the brachiocephalic trunk. These anatomic limitations require very accurate deployment of the stent graft.

In this issue of *JACC: Case Reports,* Wayne et al. (4) report a case of successful treatment of a complicated ascending aortic pseudoaneurysm as a late complication of a chronic Stanford type A IMH in a patient who was rejected for open surgery. Cases of endovascular treatment of the ascending aorta have been previously reported, for very selected patients or compassionate use and limited to experienced multidisciplinary teams. In addition, these published reports describe cases with either favorable anatomy or very localized disease processes, which are the exception and not the rule (5). A first-in-human endo-Bentall procedure for simultaneous treatment of the ascending aorta and aortic valve was even reported in *JACC: Case Reports,* in March of this year (6).

The potential advantages of such techniques are several: First, with no need for an open surgical approach, these procedures can be even performed using a percutaneous approach and locoregional anesthesia, so they can be offered to frail patients. Rates of post-operative complications related to these procedures are typically lower than with open surgical approaches. As Wayne et al. (4) remark, very recent studies focused on IMH are showing promising results when comparing 30-day mortality rates and are finding a mortality lower than 1% for TEVAR (7). All these advantages could push some centers to expand indications for endovascular repair for ascending aorta diseases because if transcatheter aortic valve implantation procedures, TEVAR, endovascular aortic repair, and fenestrated endovascular aortic repair are evolving and showing better results every year, why not offer endovascular repair as an alternative to patients with ascending aortic disease who refuse open operation or who are not ideal candidates for an open surgical procedure? In our opinion, a word of caution is needed—this time has not yet arrived.

Wayne et al. (4) should be complimented for their excellent report, which describes an adequate indication for endovascular treatment of a potentially deadly consequence of IMH in a high-surgical risk patient. These investigators explain which stent graft they used and why, thus adopting in our opinion a good strategy of stent delivery at the ascending aorta under rapid pacing. The use of 2 stents instead of 1 for a short and angulated zone is a maneuver that allows a more appropriate and accuracy delivery of the stents. Overlapping a short portion here is not a major issue, and these investigators could even finally achieve a 2-cm proximal and 1-cm distal landing distance to the innominate artery. We also agree with their protocol of not ballooning the stent after deployment in a critical area where any excessive trauma over the wall could create a fatal type A dissection; ballooning was limited strictly to the overlap portion. About the Zenith Alpha thoracic endovascular graft (Cook Medical, Bloomington, Indiana), we agree with Wayne et al. (4) that it is one of the more stable devices on the market, with many reports supporting excellent results in TEVAR procedures, and it can be modified and tailored to the patient's anatomy. However, in our opinion, the large profile of this device is still a disadvantage (the introducer sheath is 20-F). The instructions for use of the Zenith Cook Alpha limit the device use to a descending thoracic aorta with vascular morphological features suitable for endovascular repair and exclude the ascending aorta.

Cardiovascular medicine has been focused in recent years on minimally invasive procedures, but the future of medicine and our future indications should be based on evidence, multicenter studies, and randomized controlled trials that help us to make the appropriate decisions on treatment choices for patients with ascending aortic diseases. Except for some isolated cases in selected patients in cardiovascular centers of excellence with multidisciplinary teams, the endovascular approach to the ascending aorta is not yet an alternative to open surgical repair.

The paper by Wayne et al. (4) perfectly represents this paradigm: the right bridge was built by an expert multidisciplinary team for the carefully selected patient and has worked properly. We can change the ecosystem as doctors, and in humans it is a right thing to do. We will save more older adult and frail patients, and they will not nourish crocodiles. However, it does not mean that this therapy should be offered to the majority of patients. They would be naturally biased to cross using the lower mortality bridge, but many of them would be fit to cross the river swimming. I remember listening to this reflection from my surgeon colleague W.M. Park from Heart & Vascular Institute Cleveland Clinic Abu Dhabi, years ago.

The selection of the best approach for each particular case should lie in the hands of cardiovascular multidisciplinary teams, who must consider both surgical and endovascular complications and must explain the real options to the patient.

AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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