THE AORTIC CENTER TOOL KIT: PATHWAY FOR INSTITUTIONAL GROWTH

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Value in health care has been defined as "the health outcomes achieved per dollar spent."[1] Value should "always be" customer focused.[2] Thus, initial stages of aortic center planning and development should be grounded in altruism and its mission centered on the beneficiaries of that value: patients, their families, and communities. Operations should also reflect a core set of institutional qualities, often referred to as "pillars" or "values," based upon that core mission. Efficiency is an important function of the value equation, which represents cost relative to outcomes. Michael E. Porter, PhD, asserts that when organizations fail to prioritize value improvement in their own delivery of health services, they also fail to measure that value, and innovation slows.[1]

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DEFINING A COMPREHENSIVE AORTIC CENTER IN THEORY, DESIGN, AND FUNCTION

Aortic pathology is complex and requires complex solutions and clever technologic strategies to treat it. The modern era of aortic care has been propelled by advancements over many years, not least of which is the pioneering endovascular abdominal aortic aneurysm (AAA) technique created by Juan Parodi, MD, in 1991.[3] Aortic surgery may be simply defined as any aortic procedures falling within the purview of the best-trained cardiovascular and vascular surgeons. Advanced aortic surgery may be defined as aortic procedures falling outside the scope of standard cardiovascular or vascular surgery training. These procedures are generally performed in small numbers at a limited number of centers by personnel with focused expertise. Aortic services need to be comprehensive to treat the full spectrum of that pathology via either best medical therapy, endovascular repair, or open surgical repair, as well as perioperative care. A comprehensive aortic center should therefore be capable of and prepared to deliver a full range of aortic services.

The decision of whether to develop an aortic center should not be made solely on the basis of geography or projected patient volume. Rather, an institution should consider whether it can keep the patient engaged and offer needed services at the appropriate time. The patient should be engaged at multiple time points, from first contact, assessment, diagnosis, and clinical care, throughout any required intervention, recovery, and follow-up surveillance. An institution should also consider its ability to provide comprehensive vascular medicine evaluation and management as well as any required genetics evaluation. Tracking total costs and outcomes across a patient's care continuum can more comprehensively measure value delivered, so targeting cost reduction measures in this framework can better guide practices.

The benefit of establishing relationships with primary care referrers, engaging in provider and patient outreach,

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establishing an efficient outpatient aortic center, and using well-equipped operating suites is to serve a patient across the entire care cycle. This provides opportunity to screen, diagnose, intervene, and follow up to maximize the chances for a good outcome. An aortic outpatient clinic can provide a venue for the referral of patients with nonemergent aortic conditions and for preoperative planning and postoperative follow-up surveillance. An outpatient aortic clinic can also allow for community screening and, with outreach efforts, educate clinicians in referral clinics.

Availability may also be defined as a readiness or preparation of the health care team and patient to interact at the care initiation or throughout continuation of care. The hallmark of this interaction should be characterized by an allied focus on achieving desired outcomes and the proactive engagement of both patient and provider.[4] In 2015, Gibson et al asserted that patients can increase their likelihood of improving or maintaining their health if they are engaged in the coordination of their care.[4] Thus, individuals who are self-directed, informed by their health care provider (HCP), and are active participants in their own care are more likely to be aware of and open to evidence-based, innovative, high-value treatments. Likewise, it is important that HCPs are engaged not only for their patient's health outcomes and care experience, but also for their own health outcomes[5] and career satisfaction.[6]

Research has long shown the importance of the physician-patient alliance in a patient's readiness to engage in care.[4] Ideally, physician-patient communication should be bidirectional, timely, truthful, accurate, reliable, lawful, but also sensitive to a patient's emotions.[7-10] HCPs in both primary care and surgery have ample room for improvement in the area of empathy, as it has been reported that providers routinely miss opportunities to adequately acknowledge patient concerns, potentially undermining the care alliance.[11] A breach of trust may lead to increased risk of liability[12] and a decrease in patient compliance with medical care. HCPs should take an engaging, educational approach, be prepared to identify cues of patient unease, and be ready to educate and address their concerns.[12]

Interpretation and translation services should be available, if appropriate, for community demographics. Genuine, sustained efforts to interact and educate with cultural sensitivity can further strengthen this relationship, because differences in self-care behaviors have been recognized in patients of non-Western European origin.[13] Interaction with families and friends can also make a difference in coordinating or mediating a patient's care and can reinforce patient self-care. Preventing complications may hinge upon a piece of vital information such as an allergy to contrast or symptoms (eg, pain and claudication). Furthermore, coordination of care is planned and implemented by clear communication, face-to-face interaction, prompt telephone calls, and electronic communication, which could include spending time to reply to a patient's email with questions they forgot to ask during their preoperative visit. Patients and their family members are usually quite inquisitive, presenting opportunities to fulfill the critical need of HCPs to fully understand a patient's needs.

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TEAM DEVELOPMENT AND CORE ROLES

There are typically several different members of the health care team across a range of specialties, but the core aortic center team comprises physicians, nurses, and administrators. Achieving excellence in an aortic center requires the commitment of individual employees,

regardless of role or rank. Engagement is a universally valuable virtue in the workplace, characterized by commitment, vigor, dedication, and absorption.[4]

Physician Champions

Physicians are the core clinical decision makers in any aortic center, with a clinical, surgical, and academic focus. Physicians serve an essential leadership role in directing the health care team, interacting with consulting and referring physicians, and interfacing with administration. In this light, a physician's leadership is a championing effort, rallying the entire aortic team with energy and enthusiasm around the vision of improving patient outcomes. Physicians in the aortic center may be experienced cardiac and vascular surgeons, cardiologists, or radiologists involved in the training of residents and fellows, all of whom may interact together in a team approach to meet patient needs. Physician champions should collaborate effectively with all members of the health care team, including patients, their families, and caregivers. Administrative duties go hand in hand with patient care. Physicians should be able to plan, formulate, communicate, and support the clinical aspects of their hospital system, as well as articulating the aortic center's vision. They are resource architects, often requesting equipment, schedule modifications, additional labor, resources, or capital. They should be able to lead and facilitate communication among administration, with whom they share many leadership traits. Like administrators, physicians should be able to drive consensus, educate, and inspire others on the vision for the aortic center, acting as a liaison between the medical staff and hospital administrator. Interfacing with industry partners aids physicians in equipping their facility and team with devices and training. Physicians should also be able to participate in community service/outreach initiatives to educate patients and referral physicians.

Team Coordinator/Nurse Navigators

Nurses, physician assistants, or team coordinators are pivotal "navigators" in the aortic center and in shaping a positive health care setting. They play a leadership role in managing practical aspects of an aortic center and are often the primary liaison between the patient and the physician provider. They interface with physicians, administrators, other staff, patients, and families, and are instrumental in navigating the clinical and operational nuances of patient care. Nurse navigators will typically have at least 2 years of experience in the operating room (OR) or intensive care unit and 2 years of floor experience and are thus adept at coordinating clinical care and supervising others. They are experienced in program development, familiar with research and requirements of clinical trials, and should have compassion and motivation to lower complication rates. It is important that nurses and coordinators are duly recognized for their important contributions to quality patient care and improving outcomes, as this can promote leadership development, team building, and nurse navigator/coordinator work satisfaction.[14]

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Hospital Administrators

Hospital administrators are critical team members instrumental in achieving the vision of a comprehensive aortic center. They should enable and support the cardiovascular service line. The skill set of administrators is often rooted in business and strategic management and can provide a focus on facilitating operational and organizational efficiencies. Administrators perform a critical job behind the scenes, supporting their hospital system's delivery of care and tracking financial outcomes and other metrics in the hospital system, including labor, scheduling, operational expenses, and any other factors that may impact the cost of care. Informed administrators will have a good understanding of their system's patient population, common conditions, and clinical services and staff required, ready to use that knowledge in rolling out programs and initiatives. This requires that they are seasoned program planners with prior experience in health management, quality assurance, and/or even health policy.

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Administrators can perform a unifying role in the planning and implementation of an aortic center. Administrator leadership provides oversight of program development and the use of research and planning tools, including market research, SWOT, and the aortic center tool kit to build their program. This oversight also carries the responsibility to engage all stakeholders, and so administrators should be adept in engaging all departments and professionals individually, and also facilitating interprofessional collaboration. They can also be instrumental in identifying barriers to the realization of an aortic center's vision, capable of effectively formulating and communicating for the aortic center together with physician champions and able to represent the aortic center to administrative leadership and external stakeholders.

Multidisciplinary Team Collaboration

The benefits of a multidisciplinary team approach have been lauded across virtually all health care specialties. In aortic disease, several studies report value in the multidisciplinary model of care. For instance, multidisciplinary teams have been shown to safely perform endovascular aneurysm repair of thoracoabdominal aortic aneurysms[15] and improve recovery, reduce morbidity, and reduce length of stay for minimally invasive AAA surgery.[16] Various cardiovascular surgeries, such as cardiac resynchronization and ventricular assist device interventions, have reported advantages in clinical outcomes[17] and reductions in cost.[18] The approach has also been reported advantageous in critical limb ischemia[19] and, most recently, for patients requiring endovascular carotid revascularization.[20] It has been reported as an important, if not essential, approach in the prevention of spinal cord ischemia after thoracic endovascular aortic repair.[15,21]

High-volume multidisciplinary thoracic aortic surgery teams have been reported as effective in treating type A aortic dissections.[22] For any acute aortic dissection, a standardization of the multidisciplinary approach in regional aortic centers can shorten time to treatment and represent a "new paradigm" for one of the most common types of aortic catastrophes.[23] The multidisciplinary approach is thought to improve survival even in smaller patient populations, such as Marfan syndrome.[24]

A multidisciplinary team comprises a cross-functional group of people focused on the outcome and overall well-being of the patient before, during, and after any clinical or surgical assessment or intervention. The surgeon or interventionist often acts as the team leader and directs the planning of patient care, working closely and collaboratively with the facility transfer system to facilitate safe and expeditious patient transfers.

Before the patient arrives, the physician leader directs the staff in preparing the facility, receiving the patient, and taking the steps required after arrival. If the physician leader suspects that operative intervention may be needed, then he or she prepares the department and assembles the needed staff. After the patient arrives, the physician leader and nursing staff should continue to work collaboratively with laboratory and radiology personnel and physicians to obtain the required hematologic and radiologic results and/or to upload any images already obtained at the transferring facility to the institution's picture archiving and communication system (PACS). The nurse navigator and clergy serve an important role in interacting with family members, updating them and offering support until further clinical information is available. Working in the background are the administrative team members, who should ensure that all team members are readily available and the equipment needed to perform the required procedures/interventions is on standby and in good working condition.

Developmental Costs and Capital Equipment

Initial capital investment is a prerequisite to having a well-equipped, functional team to plan and implement treatment in a comprehensive aortic center. There are notable operational costs associated with transfer management, requiring round-the-clock employee teams and labor in aortic centers, emergency departments, and radiology and laboratory departments. But these systems are usually already in place in most institutions, as is 24-hour OR staff. Nonstandard expenses may include some of

the higher-cost equipment, including high-resolution computed tomography scanners and a current hybrid suite. Multiple interventional specialties[25] are increasingly relying on hybrid suites as a necessity, particularly for advanced aortic procedures[26] and for minimizing risk, increasing safety for personnel and patients.[27] Costs of a hybrid suite (see supplement p 18 for brief discussion) can also be a sizable investment. The cost of constructing the suite with good-resolution systems can range from $1.3 million to $2.1 million, not including the cost of support equipment, such as a contrast injector, an IVUS system, and associated support wires, catheters, and stocking of a thoracic, abdominal, and peripheral stent inventory. A shelf stock of thoracic and infrarenal aortic endografts is also needed for emergent cases. These items add up to a significant initial investment, but are necessary to treat various aortic pathologies. To cover these costs, a strong business plan—including marketing outreach and operational plans—should be developed and implemented upon the launch of the aortic center.

Protocols Streamline Patient Access and Care

Protocols can guide the multidisciplinary team throughout an expected care continuum and treatment pathway and act as a checklist of essential actions the institution has standardized as a best practice.[28] Emergency medical services (EMS; eg, field emergency medical technicians, paramedics, and flight nurses) is responsible for transport to a transfer center.[29] Reimerink et al reported that 83% of EMS workers followed a ruptured AAA (rAAA) protocol, posing a risk of harm to some patients by delaying fluid resuscitation (controlled hypotension).[30] It is important to train EMS personnel in relevant aortic protocols and include EMS leaders when developing protocols. The EMS team delivers patients to emergency nurses and physicians, who may then send the patient to the aortic center and OR/hybrid suite team. Intensive care unit teams would then be needed with blood bank support and other staff to streamline the patient flow throughout each step.[31]

Obtaining buy-in from all team members and administration is necessary before developing and standardizing protocols.[32] This may not always be an easy process, but defining roles and establishing a cohesive team ready to respond to emergent and nonemergent cases can streamline patient care. Transfer protocols may help with streamlining interfacility patient transfers. A 2010 single-center study by Starnes et al at Harborview Medical Center (Seattle, Washington) reported significantly improved rAAA outcomes after implementing a protocol coordinating transfer and care.[33] These transfer protocols are not well developed in other parts of the United States, and national standards do not exist. A 2015 survey of 85 physician members of the Western Vascular Society found that the majority of respondents (60%) did not have a formal rAAA protocol at their institution, and > 70% reported that they did not use a transfer protocol.[34] The authors concluded that the development of national guidelines could potentially reduce inefficiencies and adverse outcomes of interfacility rAAA transfers.[34] Aortic centers can likely contribute significantly to a standardization process because most have already developed these protocols. Standardized protocols have been reported to facilitate earlier recognition of stroke symptoms and earlier treatment of carotid stenosis.[35]

Access to an aortic center should be planned and provided for throughout all phases of patient care, including anticipated and unanticipated touch points with the patient, in person or electronically. This element is a core feature of the perioperative surgical home model, as advocated by the American Society of Anesthesiologists.[36,37] General phases of patient care include preoperative, intraoperative, postoperative, and follow-up time frames. The aortic center must be accessible to nonemergent patients and must make it easy to connect with and enroll patients who simply require medical therapy and regular follow-up in the clinic. With such a diverse group of professionals delivering care, it is important for all team members to collaborate regionally to develop care protocols.[29] Some electronic health record (EHR) systems are capable of integrating computer-based protocols that can further streamline the care delivery process, with automatic alerts and prompted next steps.[38] Imaging protocols are also needed to standardize language and scanning practices to maximize safety and facilitate rapid diagnostic response.[39] Barriers to rapid response protocols reported in the literature are predominantly sociocultural in nature and can be addressed with repeated training and reinforcement of an institution's commitment to the vision of the center and the integrity of the rapid response system.[40]

There are three major classes of protocols: elective care protocols, emergency care protocols, and functional care protocols. Protocols are useful in mapping out a care pathway, as well as serving as a framework for monitoring outcomes data. Protocols can be broad or individualized for the condition. For instance, rAAAs can be planned for with the development of a protocol that calls for the earliest activation of the aortic team. This response can be streamlined if handled by a dedicated nurse on staff or at the transfer center who activates "code aorta" and immediately prepares the operating suite and facility for the emergent case. The institutions and physicians should agree on the transfer protocol, with orders for care speci-

TABLE 1. "GUILT BY ASSOCIATION" THORACIC AORTIC ANEURYSM (TAA) SCREENING INDICATORS FOR PATIENTS AND FAMILY MEMBERS[41]

	Indicator	Recommendation
Patients	AAA Intracranial aneurysm Bicuspid aortic valve Coarctation of the aorta Bovine aortic arch Origin of left vertebral artery directly from aortic arch Polycystic kidney disease Intra-abdominal simple cysts (kidney or liver) Temporal arteritis Autoimmune syndromes (eg, Behçet syndrome, Reiter syndrome, ankylosing spondylitis, early onset osteoarthritis)	**Imaging for TAA**
Family/genetic	**Syndromic** Patient affected by TAA (Marfan syndrome, Ehler-Danlos syndrome, Loeys-Dietz syndrome)	**Imaging and genotyping for TAA** Image/genotype all first-order family members (echocardiogram ± CT scan)
	Nonsyndromic Patient affected by TAA	**Imaging for TAA** Image all first-order family members (echocardiogram ± CT scan)
	Patient affected by bicuspid aortic valve	**Imaging for TAA** Image all first-order family members for bicuspid valve, TAA

fied before and during transfer, including acute blood/fluid management, blood pressure management, and rapid imaging as needed. In the past, physicians themselves would have to assemble the team to get them in rapidly. With a nurse handling the coordination, this frees up the physician to take care of the patient.

Research Trials, Databases, and Collaboration

An aortic center should have the institutional capacity for research trials to further the collective knowledge in treating disease. The ability to work closely with regulatory monitors and device manufacturers can be beneficial because most devices have unique characteristics. Manufacturer representatives can offer support with technical questions and provide some advice on equipment and devices needed to accommodate the aortic center's needs. For every condition, patient tracking capabilities are essential to build institutional knowledge of outcomes. For instance, a 2015 study emphasized the importance of mortality data tracking for rAAAs and symptomatic abdominal aortic aneurysms (sAAAs), concluding that analyzing these data is essential to identify areas of opportunity that may lead to improved survival in the "complex patient population" served by Exempla Saint Joseph Hospital (ESJH) in Denver, Colorado.[31] The authors analyzed rates of abdominal compartment syn-

drome and transfusion and identified future transfusion needs through a case debriefing process. ESJH developed the protocol database as a standardized means of tracking these patients by participating in the standardized Vascular Quality Initiative, a collaborative of regional groups governed by the Society for Vascular Surgery that collects, analyzes, and shares data to improve patient care. Participation in consortia like this has other perks, such as satisfying institutional data benchmarking and physician-specific certification requirements. It can also satisfy a physician's requirements to maintain certification by the American Board of Surgery.

Marketing, Education, and Screening

Marketing the debut and operation of an aortic center to the community plays an integral role in the development and success of the program. An active outreach plan can offer large dividends in increased patient referrals, as well as elevating the program's visibility in the local community and region. Publishing and reporting improved outcomes and anticipated improved mortality rates associated with a center will also support the continued success of the program. Accomplishing these items requires some capital investment for developing and implementing a marketing plan, as well as an investment of time by the physician and administrative leaders.

Personal visits to outlying emergency physicians and referral physicians are an important way to put a human face with the physician's name and aortic program. Having a brochure as a leave-behind allows further review of the program by referring physicians after the meeting. It is also an easy way to leave contact information for transfers from the outlying institution. Educational seminars and continuing medication education dinners are another tactic to market the program to the local and regional HCP community, as well as to provide a platform for local experts to further educate referral physicians in initial screening and action needed for a range of aortic pathologies. For instance, for silent thoracic aneurysms, Elefteriades and colleagues proposed adopting an approach that considers a host of factors and conditions that may point to its detection in a "guilt by association" fashion (Table 1).[41] This approach can effectively expand the multidisciplinary team's reach to positively affect the community, establish a good working relationship with allied HCPs, effectively present the center's expertise and capabilities, and build goodwill for a sustainable community partnership. Each of these measures require time, effort, and financing, but they can reap dividends to the aortic center as well as patients in offering a more rapid diagnosis, treatment, and expeditious transfer to the appropriate destination facility. These measures are aligned with the vision of an aortic center that can potentially yield benefits in decreasing morbidity and mortality. No matter how small these benefits are, they should not be ignored. ■

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