



Review

Leadership in cardiac surgery

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Summary

Despite the efficacy of cardiac surgery, less invasive interventions with more uncertain long-term outcomes are increasingly challenging surgery as first-line treatment for several congenital, degenerative and ischemic cardiac diseases. The specialty must evolve if it is to ensure its future relevance. More importantly, it must evolve to ensure that future patients have access to treatments with proven long-term effectiveness. This cannot be achieved without dynamic leadership; however, our contention is that this is not enough. The demands of a modern surgical career and the importance of the task at hand are such that the serendipitous emergence of traditional charismatic leadership cannot be relied upon to deliver necessary change. We advocate systematic analysis and strategic leadership at a local, national and international level in four key areas: Clinical Care, Research, Education and Training, and Stakeholder Engagement. While we anticipate that exceptional individuals will continue to shape the future of our specialty, the creation of robust structures to deliver collective leadership in these key areas is of paramount importance.

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1. The need for leadership

It should be a relief to all physicians that medicine evolves, practice changes and obsolete specialties die. It is incumbent on us to ensure that this is driven by improvements in patient care.

Cardiac surgery tentatively stands on a precipice – its future growth uncertain. It has always been a challenging specialty, driven by strong, pioneering leaders [1]. Failure of leadership has always had obvious, devastating consequences [2]; however, the need for reconfiguration of leadership is now mandatory. The long-term efficacy of cardiac surgery such as valve implantation [3] and revascularization is proven [4–7]; however, many physicians and patients consider the perioperative morbidity and mortality to be unacceptably high, despite favorable comparisons with other major surgeries [8]. This has resulted in the development of several technologies – most significantly, percutaneous techniques [9,10]. While these techniques may have uncertain long-term efficacy, they clearly reduce procedural morbidity and mortality [11,12].

This has resulted in a significant increase in the number of percutaneous interventions, whereas the number of bypass operations has remained stable or declined [13,14].

The specialty now has limited ability to respond to changing circumstances because of the historic focus of pioneering surgeons on personal development at the expense of training, and the growing separation of cardiac surgery from the diagnostic process, in contrast to other specialties such as ophthalmology or urology which continue to control the entire value chain.

The leadership cardiac surgeons demonstrate in key areas will determine whether they maintain a central role in the management of ischemic and degenerative cardiovascular pathology or whether they become practitioners of a revered yet essentially peripheral surgical specialty. More importantly, it will determine whether future patients will have access to interventions with proven long-term efficacy [5]. In this article, we discuss why the specialty must evolve and how a new generation of leaders can facilitate change in four key areas (Fig. 1).

1.1. Clinical leadership

The primary driver for cardiac surgery to adapt is the need to improve patient outcomes [8]; consequently, clinical

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Fig. 1. Cardiac leadership.

leadership is critical. Societal trends such as increasing population age have resulted in older patients with greater co-morbidity undergoing cardiac surgery [15]. This increases the pressure to improve operative outcomes as it is less likely that these patients will benefit from the long-term benefits associated with cardiac surgery. This is challenging as the co-morbidities of these patient groups also increase the likelihood of poor operative outcomes [16].

To be a 'good surgeon' is an important prerequisite of being an effective clinical leader. It is not however the only prerequisite and good surgeons are not necessarily effective clinical leaders. Clinical leadership in cardiac surgery has two important elements:

1. **Quality management:** Although the operating surgeon has traditionally had responsibility for patient outcomes, the quality of patient care is too important to rest with one individual. Healthcare delivery must be quality-driven with organizational structures to ensure continuous incremental quality improvement. Performance must be continuously audited not only to ensure transparency but also because there is emerging evidence that this is an important quality improvement tool [17]. While ultimate responsibility for patient care may continue to rest with the surgeon, every member of the team should feel empowered to participate in quality improvement. A culture of rationalizing current practice and early adoption of interventions with proven efficacy should be encouraged. Although quality management models have existed since the 1920s to facilitate the development of a quality-driven culture within commercial organizations, their application in healthcare, where quality management has traditionally been the responsibility of individual clinicians, is relatively recent.

Strategic change requires underlying theories, paradigms and assumptions to be reviewed. This will invariably change core systems and processes, which will in turn affect everyday tools, methods and procedures. Consequently, quality management models can be categorized as relating to (a) everyday tools, methods,

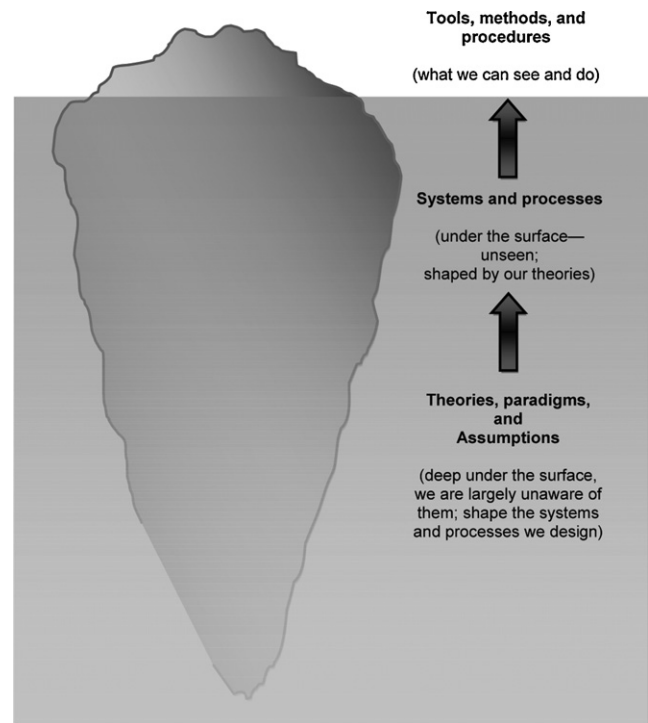


Fig. 2. The Iceberg model: a framework for viewing quality improvement tools and methods [18].

- and procedures; (b) core systems and processes or (c) underlying theories, paradigms and assumptions (Fig. 2). Quality management models have different strengths and weaknesses, although many were not designed to be applied in healthcare. It is therefore important that these models should be tailored to meet the needs of individual organizations and teams [18].
2. **Disruptive innovation** is a term used in business and technology to describe innovations that improve a product or service in ways that the market does not expect in contrast to continuous, sustaining innovation which results in incremental improvement [19,20]. Improvements in long-term outcomes following cardiac surgery have reached a plateau where incremental gains are at the expense of progressively increasing resources. Similarly, while quality improvement frameworks are important, the extent to which operative morbidity and mortality can be improved within the constraints of current technology and practice is limited. Consequently, improvement in patient outcomes can only be sustained with disruptive innovation. Novel technology such as tissue engineering, minimal access instrumentation, less invasive perfusion and mechanical support systems need to be core elements of future cardiothoracic practice. The challenge is to deliver tangible benefits to patient care quickly and safely. The pioneers of cardiac surgery innovated in an era when alternative treatments were few, if any [1]. Any success was complete success. As ischemic and degenerative heart disease is now managed with relative success, any failure is now complete failure. This is the reason why academic leadership is an essential adjuvant to clinical leadership in modern cardiothoracic surgery.

1.2. Academic leadership

As academic leadership becomes more important to the future of cardiac surgery its practice becomes more difficult [21]. The science and technology that underpinned any aspect of cardiac surgery were once readily accessible to the well-informed surgeon. The sophistication of cardiac surgery has increased exponentially and the frontier of scientific and technological understanding is now far from clinical practice. Complex engineering and technology will facilitate the next generation of operating platforms. Tissue engineering, stem cell biology, advanced imaging techniques and individualized pharmacotherapy may play an important role in the future of cardiac surgery. This has numerous implications for the future leaders of academic cardiac surgery, including the following:

1. Modern research must be multi-disciplinary, and any future leader in cardiac surgery must have strong interpersonal skills and the ability to build cohesive multi-disciplinary teams.
2. It is crucial that cardiac surgeons have a robust scientific background in the technologies that will define the future of cardiac surgery. It is no longer acceptable for cardiac surgeons to do research for the sake of doing research, for career progression or to tick a box on the *curriculum vitae*. The future of the specialty is dependent on cardiac surgeons looking to the long-term future of the specialty when completing their research and being viewed as credible physician-scientists by potential academic collaborators.
3. It is important that structures are created at a departmental, local, national, and international level to facilitate rapid technology transfer from the laboratory to the clinic with reciprocal transfer of information back to the laboratory to inform future innovation. This will require investment, the creation and strengthening of structures and the involvement of cardiac surgeons at every stage.
4. The dynamic nature of cardiovascular technology makes traditional methods for evaluating novel practice problematic. This has historically resulted in some areas of practice developing without being underpinned by a strong evidence base with potentially detrimental consequences for patients. Conversely, many patients are denied potentially effective treatments as surgeons are justifiably reluctant to apply technology when there is little evidence supporting its effectiveness. Consequently, it is incumbent on surgical academics to develop a pragmatic framework with which to evaluate new technology. This will require a multi-center, regional or even nationally coordinated permanent clinical trial networks to ensure that novel technology can be quickly and robustly evaluated. Clinical trials must be integrated with registries to ensure their applicability to clinical practice. A framework must be developed to provide clinical guidance in conditions of uncertainty or imperfect information. This will require the development and popularization of novel methodological tools.
5. Selection of the optimum strategy in clinical practice often requires multiple outcomes to be considered. As the

evidence is often complicated or apparently contradictory [22,23], academic cardiac surgeons must continue to be actively engaged not only with other academics, but also with the patients and the wider medical community to ensure that all relevant evidence is considered [24,25].

6. Finally, surgeons of all levels of seniority should be encouraged to engage in research and technology transfer that will have an impact on patient care. This presents two challenges: first, if surgeons are to be encouraged to engage in research they must be incentivized to engage in research that is useful and scientifically robust. Second, for surgeons to be effective academics, academic training must be integrated with surgical training. While this may be challenging, it is imperative both to ensure that individual surgeons are equipped to engage in high-impact research and to ensure that the specialty maintains its strategic importance.

1.3. Education and training

Despite some interest in anastomotic devices, anastomotic techniques have remained largely unchanged since the Carrel techniques were first described in 1902 [26]. By contrast, the advent of minimally invasive operating platforms and off-pump coronary artery bypass grafting has made the operating environment significantly more challenging as cardiac surgeons are forced to operate through smaller incisions on moving targets, often using tools that are not intuitive [27]. Other aspects of cardiac surgery, such as valve surgery, are also becoming technically more challenging as preservation and repair is increasingly preferred to replacement [28].

Training cardiac surgeons to perform increasingly demanding procedures is problematic, especially as outcomes are now strictly audited and the profession and general public are justifiably less tolerant and more conscious of medical error [29]. While not the primary cause, changes to career structure and employment law in some countries may also augment this problem [30].

There is no easy solution to the problem of training tomorrow's cardiac surgeons; however, several central paradigms of surgical training must change. Training needs to be structured while focusing on competencies and not the time spent on them. The concept of a defined training that formally ends in final accreditation is outdated. It does not reflect that accreditation should be based on competency and that a surgeon who is safe and competent to perform some aspects of cardiac surgery may not also be competent to perform all other aspects of the specialty. It suggests that personal development and training slows down, or even arrests, after completion of training. The pace of innovation that is both likely and necessary in cardiac surgery will force training to continue throughout a surgeon's career [31]. The reluctance of senior surgeons to learn new techniques cannot be allowed to block innovative practice that will improve care [32]. Finally, the concept of a formal training period resulting in accreditation does not reflect that individuals will acquire the multi-faceted skill-set needed for a career in modern cardiac surgery in different sequences and at different rates.

Strong leadership is important to ensure that trainers, trainees, relevant professional colleagues and healthcare providers are involved in designing and modifying training programs to ensure that they fulfill both current and future requirements of cardiac surgeons. Robust mechanisms must ensure that training is designed with the ultimate goal of patient benefit in mind. Traditional surgical apprenticeship will need to be supplemented by high-fidelity simulation and wet-lab experience for surgeons of all seniority. Continuous, iterative change to training programs may be more successful than radical restructuring and leaders must ensure that a dynamic framework exists in which change can occur and be evaluated.

1.4. Stakeholder engagement

The traditional model of clinical care consists of the clinician 'provider' delivering care to patient or 'consumer' of healthcare. In reality, this is far more complicated; usually a third-party 'payer', such as an insurance company or government, pays for the cost of healthcare. The modern surgeon also usually represents the end of a complex 'value-chain' in which medical device companies and other commercial organizations are important partners [33]. The involvement of several stakeholders significantly complicates the climate in which care is delivered and successful leaders in cardiac surgery must consider the role of all stakeholders.

1.4.1. Government and insurance companies

Aging populations in the developed world have resulted in greater demand for health and social care, relative to taxation revenues and insurance contributions. As patient's expectations of healthcare and the cost of delivering modern healthcare are also increasing, third-party payers increasingly seek to rationalize spending on healthcare [34]. Similarly, spending on clinical research [35–37] and education [38] is being critically appraised and rationalized. A successful head of department must be financially astute to ensure that core clinical, teaching and research activities are adequately funded [39]. They must also be familiar with the complex conceptual framework and vocabulary that is used to justify the cost-effectiveness of clinical interventions and increasing research [40].

1.4.2. Industry

The involvement of commercial organizations such as manufacturers of medical device companies in the value chain deserves special consideration. Unlike other markets, the 'consumer' or patient does not choose the product. This is done by the 'providers' of care. Often neither the 'provider' nor the 'consumer' pays for the product; instead, a third-party 'payer' finances purchasing of the product. The 'payer' often recovers costs from 'consumers' only indirectly through taxation or insurance premiums and, as a result, individual patients will largely be unaware about the cost of their care. This has resulted in unique market dynamics in which the cost of a device is unrelated to the demand for it and the demand is, to an extent, determined by the manufacturer. For example, devices can be improved incrementally, unlike pharmaceuticals, in order to justify the cost demanded by manufacturers. Continuous incre-

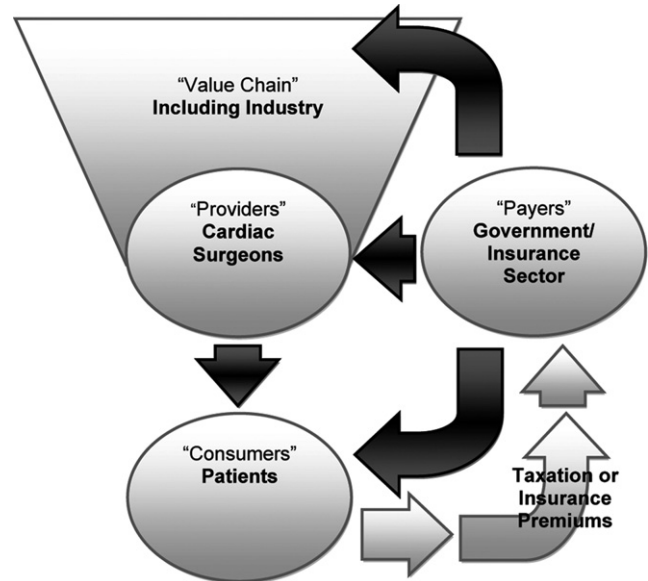


Fig. 3. The healthcare environment.

mental improvement also makes performing robust clinical trials difficult. Consequently, it is almost impossible for 'payers' to control costs without the cooperation of 'providers' who have specialist knowledge of device function. Often neither 'providers' nor 'consumers' pay for devices; consequently, there is little incentive to seek value for money and as a significant increase in the cost of a device may represent only a marginal increase in cost compared to the cost of the operating theatre staff, other consumables, perioperative care and long-term follow-up, there may not even be much incentive for 'payers' to seek value for money [33]. As the 'provider' lies in the center of this complicated 'web' of healthcare finance, surgical leaders have both additional responsibility and opportunities (Fig. 3).

In 2003 the global cardiovascular devices market was worth approximately \$16.2 billion annually. Surgical devices accounted for only 15% (\$2.5 billion) of this market and had a growth rate of 17%. Interventional cardiology accounted for a third of the market (\$5.4 billion) and had a growth rate of over 35%. Coronary stents alone are worth more than all surgical cardiovascular devices combined (\$3.4 billion) with a growth rate of 50% (Fig. 4) [33]. As the medical device sector

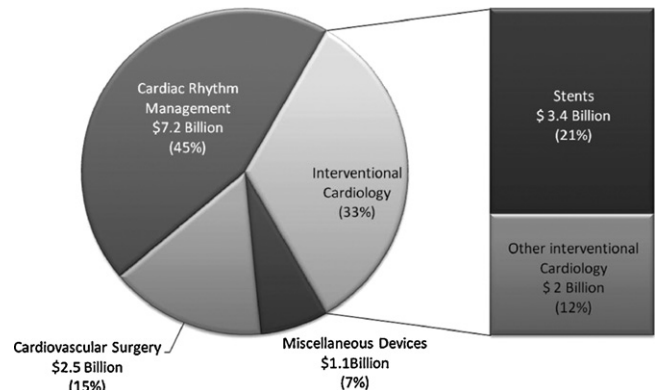


Fig. 4. The 2003 global cardiovascular device market, \$ billions (%) [33].

ultimately facilitates the application of novel technology in clinical practice and uniquely drives demand for their own products, surgeons must engage with this sector or device manufactures will go where there is a market for their products – to interventional cardiology. If cardiac surgery does not continue to employ innovative technology it will become extinct as will the paradigm of revascularization using anatomical bypass which may continue to be relevant in certain population subgroups.

The involvement of industry in medical research, although widespread and arguably essential [41], has traditionally been viewed with suspicion because of potential conflicts of interest [42]. The need to obtain research funding of any kind may, however, be associated with unethical behavior [43,44]. Industry-funded research is cited more, suggesting it may be of a higher quality [45]. Furthermore, there is evidence to suggest that industry funding of research accelerates the translation of technology into patient benefit [46]. As cardiac surgery becomes increasingly dependent on expensive science, technology and intellectual property, industry involvement may be critical. The role of commercial organizations in study design, analysis and the decision to publish must be explicit and regulated. Care must be taken to ensure that patient benefit, and not commercial interest, is driving healthcare innovation [8]. If this is achieved in a robust, pragmatic and transparent manner not only would this be superior to many contemporary models for industry involvement but may have benefits for patients, healthcare providers, academics and surgeons.

Similarly, the role of commercial organizations in education and training must also be considered [47]. Training cardiac surgeons requires investment of considerable time and resources. As the future is uncertain, involvement of industry stakeholders in training may help to ensure the skills of future cardiac surgeons meet the demands of future technology. To involve commercial organizations in training programs in a meaningful fashion without compromising their integrity and focus on the quality of patient care is a substantial but necessary challenge for the leaders of cardiac surgery.

1.4.3. Patients and colleagues

Patients are often neglected key stakeholders. Ultimately, the most pressing driver for cardiac surgery to evolve is the general dissatisfaction that many patients and physicians feel with the operative morbidity and mortality associated with cardiac surgery. The leadership of cardiac surgeons must respond to the concern of patients with clinical, academic and educational innovation. They must also work with medical colleagues and patients to assist patients in making complex trade-offs between long-term benefits and short-term disutility that is inherent in many types of surgery. This may require consent procedures and the methods by which we articulate and explain risk to patients to be reviewed, in order to ensure that all stakeholders are fully engaged. For example, there is evidence to suggest that patients perceive the long-term risks associated with percutaneous interventions to be lower than physicians [48,49]. While differential perception of procedural risk by patients and physicians is not confined to cardiovascular medicine [50], this must be addressed. Where current best practice is not being

implemented [51,52] the reasons should be explored openly, without blame and recrimination. This may require involvement of the wider profession and multi-disciplinary team actions. In Europe this now has added significance, as following the accession of the European Convention on Human Rights into the Law of Member States, informed consent is no longer a matter of professional good practice but has a firm legal basis [52]. Finally, cardiac surgeons should investigate novel diagnostic strategies that may facilitate more direct patient engagement [53,54].

2. Leadership structures

Whether it is possible for one individual to be a clinically active cardiac surgeon, a good teacher and an excellent researcher while fulfilling other responsibilities, is questionable [55]. The demands placed on leaders can be so onerous as to discourage long-term involvement of the most talented [21]. While historically there have been many models of leadership, the importance of distributive leadership is increasingly recognized [56]. Consequently, not only are effective leaders required but also effective leadership structures, aligned with organizational strategic goals [18,57]. Leadership structures must provide the authority and framework for decision-making to be delegated and responsibility to be shared. Sufficient information, training and logistic support must be provided to facilitate good decision-making. Leadership structures must achieve the difficult balance of promoting engagement while still permitting strategic decisions to be made quickly and efficiently. Leadership in the key areas that we have identified is needed nationally and internationally; however, the foundation for this is the development of strong local leadership structures. Leadership structures must work even when our leaders are not exceptional, while simultaneously allowing exceptional individuals to flourish and be supported.

Ultimately, patient interest must come first and every cardiac unit must have a culture of excellence through collective clinical leadership and accountability, regardless of level or role. Clinical excellence alone however is not enough, and cardiac surgeons who are not only good clinicians but will also show leadership in other areas in which they excel must be actively recruited. Examples of such professionals can be the recruitment of a talented teacher to head the department's training commitments or an academic surgeon to collaborate with scientific colleagues, formulate and define research strategy and supervise research students. There is considerable interest in developing leadership in clinical trainees [58,59]; how to achieve this for surgeons and surgical trainees needs to be better understood and characterized [60].

The concept of the rounded surgical leader, embedded within effective leadership structures in which leadership is distributed, may contrast markedly from the traditional notion of a charismatic leader [61]. This is deliberate. First, our concept of surgical leadership facilitates structured development of individual and institutional leadership capabilities. Secondly, while the charismatic surgical leaders undoubtedly have unparalleled capacity to innovate and improve services, they can equally often be a conservative

force that effectively resists innovation to the detriment of patient care [32,62].

3. Conclusion

Our specialty needs to evolve to avoid being sidelined. It is our duty to ensure that this does not occur. Future patients must have choice and access to the best long-term interventions. Furthermore, the development of cardiovascular science is enhanced by having a spectrum of biological and clinical perspectives.

The need for innovation and leadership in cardiac surgery is considerable but should not be daunting. If we act now these goals are achievable. In our opinion, cardiac surgery has a tangible and promising future. Pioneering cardiac surgeons neglected team development in order to develop individual excellence. If we focus on leadership structures rather than individual leaders, on incremental evolution from the local to the international level and on developing a culture of innovation and investment, the mistakes of the past can be avoided and the challenges of the future can be addressed.

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