Editorial

How Minimal is ... Minimal?

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Etymologically, there can be nothing more minimal than ... minimal. This is a paradox in its own right. Yet we are experiencing a surge of minimally invasive technologies that are constantly getting more minimal. Therefore, let us break out of the loop by replacing *minimally* invasive cardiac surgery with *less* invasive cardiac surgery. Less invasive cardiac surgery is the chameleon of the field, as it appears differently to different people. A "Blanche Dubois" of the métier, controversial in its definition, it may delineate: less trauma – less scar and better cosmesis – less risk – less pain – less tissue loss and more tissue retention – less foreign material used – less duration of operation – shorter cardiopulmonary bypass or no cardiopulmonary bypass – less hospitalisation – faster recovery, and more. Less invasive techniques are currently available for mitral valve, aortic valve, tricuspid valve, pulmonary valve, arrhythmia, bypass, congenital defect surgery and combinations of the above. Of course, the ultimate form of minimally invasive cardiac surgery must be ... no surgery, as reflected by the advent of transcatheter approaches addressing heart valve disease. The latter are still in their developmental stage and are undergoing rapid evolution. The onus is on the large-volume centres to pursue these technologies and upgrade them to the point where they can trickle down to the rest of the world and become available to the broader, subsidised population strata.

Yes, less invasive cardiac surgery may be considered the new kid on the block. But it is no longer a mere trend. It is perpetually moving from the state of innovation to that of a gold standard in the field. Surgeons, even the most conservative genre, should not be oblivious to the ever changing technological tools at hand, as well as the evolving patient demands. First, "less invasive" is in compliance with the most primary Hippocratic principles, promising the same efficacy and safety with the least possible trauma. Second, decades ago, open-heart surgery was an act of fate, a live-or-die experience, for the vertical and horizontal actors in the operating theatre, given the primitive knowledge and tools at that time. With the lightning progress brought about in the 80s and 90s, patients' demands were restored to the level of expecting not only survival, but also the fewest possible complications. Evolution in this regard did not stop there: nowadays, patients expect – very reasonably so – not only to come out of surgery alive, not only to suffer the fewest possible complications; they expect the best possible long-term result with the lowest possible re-intervention rate and surgical trauma. It is up to us to adapt to those needs.

There is another, crucial, aspect to the need for change and evolution: world disease demographics. The world's population is ageing. The pattern of cardiovascular disease is shifting towards multi-morbidity and complex cardiovascular disease.

The stuff of cardiac surgery today is not the "straightforward" single-vessel, double-vessel or triple-vessel disease: it is the complex, high risk, interventionally not amenable, polymorbid, severely obese and old patient. Hence, the surgeon has to counteract these trends with safer, faster, smaller and yet efficient procedures. To that is added the pressure of professional Darwinism. Open-heart procedures are less in demand when the pathology can be fixed non-invasively, and rightly so. The cardiac surgeon as a species is endangered, unless he assimilates change and adopts the new, advanced and less invasive technologies. Surely enough, talent is always in demand. However, there will be less demand for the maximally invasive kind of talent that nourished two generations of heart surgeons towards mind-blowing accomplishments. In the promethean sense, it was heart surgeons who performed a series of "firsts" that nowadays define cardiac therapy, including some interventional techniques. If we do not reinvent ourselves, then in Hemingway's words, we will go bankrupt two ways: "Gradually, then suddenly."

Here is where I see the great and unequivocal potential of less invasive cardiac surgery: I will term it "Pax Cordis". It is a matter of crosspollination and interaction. This will have immediate, intermediate and long-term impact. Within the realm of transcatheter applications, "heart teams" have been formed. This is a welcome development. Hybrid technologies provide the foundation for interaction between cardiology and cardiac surgery to the great benefit of the patient. Yet the hybrid portfolio – undeniably a minimally invasive one – has not yet been fully exploited: the list in Table 1 demonstrates the true and full capacity of the combined potential of cardiology and cardiac surgery, as evidenced by case reports and non-randomised studies that have already displayed some promising results. It goes without saying that the next step has to involve randomized control trials in order to underline the value of such applications. The hybrid theatre has proven instrumental on this path, and is expected to become state of the art in the years to come.

Sub-specialisation is marching on in our field. A niche is, in the meanwhile, a must-have marketing tool for the surgeon and institution. Undeniably, it is also promising more focused, more customized care for the patient. The notorious Department of Cardiothoracic and Vascular Surgery, the familiar environment most of us "grew up" in, is subject to extinction, practically and logistically not tractable, as specialised "Heart Centres" spring up to conquer the scene. This is an expected development. Cardiac and surgical care go hand in hand. We have recently read with great interest the commentary by Holmes et al[1] on the 19th century "Venn diagrams", a basic mathematical tool in our armamentarium, which help display the degree of overlap between elliptical areas representing groups or sets or sums (finite collections or aggregations of things). The degree of overlap in cardiac care is such that Heart Centres are expected to be the locus of aggregate care for the heart-sick, embedded in the same physical environment.

Table 1. Hybrid portfolio to be expanded and explored.

- Mitral valve repair + PCI
- Percutaneous mitral valve repair + MIDCAB or MVST
- Coronary bypass surgery
  - MIDCAB + TAVI (PAVI)
  - OPCAB + TAVI + (PAVI)
- Aortic valve replacement (beating heart) + PCI
- Mitral valve replacement (beating heart) + PCI
- Transcatheter aortic valve replacement, beating heart + PCI
  - Transfemoral approach
  - Transapical approach
- Assist device implantation in heart failure + causal therapy (+ PCI, + mitral clip, etc.)
- Robotic cardiac surgery
- Endovascular surgery (+ all the components above)
- Open aortic surgery (+ all the components above)
- Atrial fibrillation therapy (+ all the components above)
- Combined paediatric cases

The last and not least substantial offspring of the recent developments in less invasive and hybrid cardiac treatments is the ... "hybrid surgeon". I consider this the inevitable course of our profession in the years to come: a heart therapist who trains in aspects of both disciplines, cardiac surgery applications as well as interventional skills. Concurrently, the heart therapist defines his niche more specifically: structural heart disease, "mitral valve surgeon", "off-pump surgeon", TAVI specialist, and so on. Some of the world's most prominent programs have adopted the integrated training formula and disregard excessively long excursions in general surgery. We will see the "common trunk" shrinking in praxis, and turning to a common trunk of rotations adjunct to the field of interest, including echocardiography, angiography, intensive care, etc.

We in our institution, like others, recognise the asymmetry of development in the cardiac therapies field and strive to adapt. Great neighborhood relationships with our cardiologists are key. We share

a heart team approach, as well as angio and valve rounds. Mortality, morbidity and audit sessions are key. Research, development, and innovation are key aspects for diversification, performance and excellence, towards establishing our status as a referral hub in the region. For instance, join me as I explain SIMICS (single-incision minimally invasive cardiac surgery), addressing the mitral and tricuspid valves as well as arrhythmias and atrial septal defects. A valid point of criticism aimed at the existing minimally invasive techniques is the number of accessory incisions and port-holes that need to be fashioned, apart from the working incision. For a standard minimally invasive mitral valve surgery procedure, ports are usually necessary for the aortic cross-clamp, the left atrial lift retractor, the camera, the CO_2 insufflation. An additional incision in the groin is needed to cannulate the femoral vessels for cardiopulmonary bypass. The associated costs for all these materials are not negligible. Likening the result to a sieve or strainer, on a light-hearted note, is not so far from the truth. Hence we have developed simple, cheap and efficient tools in our institution, and make use of other specialised instruments, in order to eliminate all adjunct key holes: a left atrial retractor,[2] the Glauber clamp, and the Proglide system, by which less invasive mitral valve surgery is now feasible through a single working incision and nothing else (Figure 1; unpublished data). In another preclinical trial, we have developed a sutureless mitral valve, which is applied through a twist-and-click mechanism, very much like a bayonet connection, thereby reducing the cross-clamp and operation time to one third of the usual.[3] Other groundbreaking contributions by our colleagues in Italy and Switzerland (sutureless valves, endovascular aortic clamps, etc.) have added substantially to the maturation of what has now grown to be the strongest minimally invasive cardiac surgery programme in the region.

Εν ενὶ λόγῳ, less invasive cardiac surgery is a minimal technique with a maximal impact. It is not the next feat of surgical ordealism, but is here to stay. It will provide a defining platform, a springboard for the heart specialist of the future. Allow me to conclude, citing my compatriot, Aristotle: "Excellence is an art won by training and habituation. We do not act rightly because we have virtue or excellence, but we rather have those because we have acted rightly. We are what we repeatedly do. Excellence, then, is not an act but a habit."

Figure 1. Single-incision minimally invasive cardiac surgery, in this case mitral valve repair. A patient with hepatitis and stroke recovered from a lengthy coma following complicated endocarditis to then undergo mitral valve repair. This picture was taken at the follow up approximately 4 weeks postoperatively. The operation was carried out through a singular, lateral working port. The femoral incision for cannulation and cardiopulmonary bypass, portholes for camera, left atrial retractor, CO_2 insufflation and aortic cross-clamp were omitted. First in man (according to our search and knowledge).

Minimally invasive cardiac surgery is being judged upon its merits and it seems to be becoming such a habit. We ought to give it "maximal" attention.

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