

What future for coronary artery bypass surgery

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Abstract

The future of CABG can be bright if cardiac surgeons will change the paradigm followed so far and will return in *history*, abandoning the current comfortable life and accepting the burden represented by the cost of innovation, which has a path already mapped out but not sufficiently trodden for guilty lack of commitment.

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Medicine is the science of uncertainty and the art of probability

William Osler

Heart surgeons are like pianists, there are great technicians and there are artists

A Heart Surgeon's - Little Instruction Book

A hilarious article by Gianni Angelini (1) describes the return to Earth of a couple of doctors, he a cardiac surgeon and she a cardiologist, after a twenty-year stay on the planet Mars. They were understandably concerned about reestablishing their clinical practice and while the cardiologist discovered that a lot had changed and that she would have to undergo new training, the cardiac surgeon was surprised by how minimal changes had taken place in his daily practice and he was pleased to see that he was able to start operating immediately because almost nothing had changed in 20 years. There was still debate whether coronary artery surgery (CABG) should be done on-pump or off-pump, whether using single or multiple arterial grafts and whether the right internal thoracic artery or the radial artery should be used. In other words, the most commonly performed cardiac operation worldwide with almost 400,000 surgeries per year (2) hadn't changed for more than two decades as if cardiac surgeons had placed themselves *out of history* (3) maintaining the

status quo , refusing to accept the change and motivating the refusal with the lack of indubitable scientific evidence (4). In the meanwhile interventional cardiology had flourished for the opposite reasons, making coronary angioplasty accepted and practiced well beyond the real value attested by scientific evidence (5).

What the reasons of this behavior? Certainly not the lack of incentives to change, just remember what Bruce Lytle wrote in 1999 in his historical paper about the results of bilateral internal thoracic artery harvesting: “It has been the position of some coronary artery surgeons that the consideration of multiple arterial grafting could be ignored because no clear evidence existed that outcomes were improved for any patient subsets. That position is no longer tenable” (6). However after more than twenty years the proportion of multiple arterial grafts currently used in North America is less than 10% (7) and cardiac surgeons are (instrumentally?) still looking for pristine scientific evidence to justify the use of multiple arterial grafts (8). The same fate has been struck to other innovations over the course of twenty years, like off-pump CABG and composite Y-T grafts from LITA, to name a couple. Proposed by a few enthusiastic innovators they have been considered not effective (if not potentially dangerous) by the majority of cardiac surgeons, some of whom have at times (artfully?) reported adverse results hindering their spread (9).

There is more than the assumed lack of scientific evidence to explain this reluctance to change, as the cost of change itself (10). Regrettably the very good results achievable by the traditional *on-pump-LITA-LAD-plus-SV-grafts-from-ascending-aorta* strategy distracts attention from the benefits of more technically challenging procedures. To put it another way: why change a simpler technique that provides good results with a more complex one that *could* provide better results?

The intrinsic nature of CABG surgery is therefore the main obstacle to its improvement. Coronary surgery is micro-vascular surgery, for which superlative technical skill is essential (11). Here, the better the quality of suturing, the better the result of the operation, all other boundary conditions being equal. At the same time CABG has been (and currently is) the daily bread-and-butter of cardiac surgery, considered by many surgeons a boring procedure to leave to residents at the beginning of their career, preparatory to less frequent procedures reputed of greater professional prestige. The net result of this mixture is resistance to paradigm change (12), and the maintenance of the “puzzle-solving” of the previous paradigm, in other words the status quo.

The way to change paradigm goes through the restoration of CABG surgical dignity, abandoning anachronistic legacies of the past and breaking free from the *one-size-fits-all practice*, making patient specific operations as much as possible. To achieve this goal the human factor is extremely relevant. CABG requires advanced levels of expertise and skills that cannot be provided by all the surgeons. CABG results can still be greatly improved but this improvement goes hand in hand with a parallel increase in technical complexity. Daily *intentional practice* is hence mandatory to change the paradigm, to switch the default setting from on-pump to off-pump, from aorto-coronary to Y-T graft bypass, from saphenous vein to multiple arterial grafts, from standard sternotomy to mini-thoracotomy. Constant dedication to CABG improvement should make coronary surgery a subspecialty within the big picture of cardiac surgery. As a consequence institutions dealing with coronary artery disease patients should strive to have dedicated CABG teams (13).

All these innovations are already among us but only a few see them. They just need to be unveiled and practiced in the right way by properly trained cardiac surgeons, wisely blended to make CABG patient specific. We could change the paradigm overnight if we were ready to do it. But we are not. And here we get to the heart of the problem: CABG training, or what makes a cardiac surgeon an excellent CABG surgeon. Many qualities are required, some essential, others merely desirable. Excellent technical skill is key being CABG micro-vascular surgery. Someone is gifted with steady hand and terrific precision of movements, someone else is ham fisted and would do better to devote himself to other sectors like valve surgery. Mentors should properly orient residents helping them to express their personal talents. Then practice takes over. As Aristotele said we are what we repeatedly do, so excellence is not an act but a habit. Practice should come first on low fidelity simulators, as Paul Sergeant has elegantly demonstrated (14), and only after in the clinical setting. Last but not least comes the cardiac surgeon’s mindset. A good CABG surgeon should be obsessed for details, starting with patient’s clinical history and phenotype evaluation, passing through

accurate coronary angiography analysis, planning the surgical strategy and executing it

perfectly, up to postoperative management. As mentioned above within the new paradigm innovations should be blended to provide a patient specific operation, abandoning the one-size-fits-all modality. First-class judgement is therefore important, oriented to the recognition of individual patient characteristics and aimed at the specificity of the operation.

The future of CABG for triple vessel disease can be bright if cardiac surgeons will change the paradigm followed so far and will return in *history*, abandoning the current comfortable life and accepting the burden represented by the cost of innovation, which has a path already mapped out but not sufficiently trodden for guilty lack of commitment. Off-pump, multiple arterial grafts and composite Y-T grafts are a reality and are just waiting to be used more frequently in clinical practice. Doing so would take a huge step forward in the development of CABG.

Further innovations could probably come from robotics, artificial intelligence and coronary suture devices but they will materialize only if preceded by a complete mindset change on the part of cardiac surgeons which can serve as a stimulus for research, change that is not going to be minor and that should embrace also major changes in the cardiac surgery training curriculum for the next generation of surgeons.

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