Cirugía Cardiovascular 30 (2023) 77–78

Editorial

Continuity in nature and coronary surgery

Continuidad en la naturaleza y cirugía coronaria

Paul Sergeant

Prof.em. KU., Leuven, Belgium

What will the future be of coronary surgery?

In May 1987, I was asked at my PhD defence "What allows you to predict the outcome after a therapy". I stumbled about rich variables, powerful mathematics, strong supercomputers and clever guidance. The question was asked by my clever PhD mentor. The correct answer, not the one I gave, was "Continuity in Nature".

If we can structure the future of coronary surgery into a single mathematical equation, then, according to the Law of Continuity[1,2] by Euler and Leibniz, it should be a continuous curve going whichever way without gaps, jumps, cups, or angles. The curve is defined by the variability of the predicting parameters. This mathematical concept has proven to be valid in many domains of science as nature, biology, physics. So, if we have a rich collection of predicting variables in combination with the appropriate mathematics and computing power, we can have a clear view of the vector for tomorrow, next week, next month in the need for coronary surgery, the practice of coronary surgery, coronary surgeons, coronary surgery units.

But already in 1831 (Bolzano) and in 1860 (Cellérier) formulated, but did not publish, continuous, nowhere-differentiable functions, later in 1872 defined as Weierstrass functions[3] that redefined the concept of continuous curves and destabilized the concept of continuity in nature, including cusps, jumps and gaps. So, predicting the future gets mathematically a lot more complicated.

Predicting the colour of Swans was easy, they were always white. But in 1696 Willem de Vlamingh, from the Dutch-Asiatic Shipping line, identified the first black Cygnus Astratus in Australia and destabilized predicting for all to understand. The Covid tsunami and the war in Ukrain are typical "black swan" events that destabilize the prediction of the future.

A medical therapy is a production line with a cost and resource structure and with an early and late cost/benefit, therefore very similar to a business but with a massive number of production sites, production line collaborators and no overruling authority. So, at first view very little structure, very little chance of survival at the long term. Only 36% of the companies last 10 years, 21% last 20 years and only 0.5% have what it takes to last 100 years. This survival is not based on random accidental causes but on numerous business, economic and technological changes.

Sun-Tzu has told us that if one wants to understand the "enemy", one first has to understand what one's own army is doing. So how did we implement fundamental processes of business optimization into our own daily practice.

No single industry has a future without a permanent process of closing quality control circles. This means establishing steps to improve quality, quality benchmarks, check service qualities, analyze the variance between controls and the actual, check the statistical limits of the variances, take corrective actions, and repeat the whole process. Any interested observer has identified that none of this has happened in the cardiac surgical domain. Some regional and supra-regional quality control databases have been created; they include a very limited list of nominal variables, not the ones needed but the ones readily available, and a ridiculous outcome monitoring not even covering the long-established early hazard curve. Patients are treated for late results not 30-day intervals. Never is there the ambition to annihilate risk, only to reach and compare positively versus a regional or supra-regional average. Media and Colleagues are only interested in ranking. The fact that they fail in having the appropriate variables for ranking, seems no obstruction. Quality control has nothing to do with ranking!

Standard operating procedures (S.O.P.) is the very first step in business optimization. Coronary surgery is a production process with considerable material and human resources, as well as possible technical variations. Within nearly all CV surgical departments, there are as many ways in treating a coronary surgery patient as there are surgeons, often confronted with even more combinations if there are several anaesthesiologists and several perfusionists. In large units the number of variations could exceed 100. Any quality control business consultant would implement as soon as possible S.O.P. in the company "Coronary Surgery".

The number of staff in an operating theatre drives the cost in human resources. In some operating theatres, a team of three (one surgeon, one anaesthesiologist, one scrub nurse) performs a smooth full arterial, no-touch-aorta off-pump revascularisation. In other operating theatres we identified the opposite extreme, namely a staff of ten: two anaesthesiologists, two anaesthesia nurses, two perfusionists, one running nurse, one scrub nurse, a surgeon, a resident. The complexity of communication increases in parallel with the team size because there are more pathways through which people communicate. In a production team, communicating badly increases exponentially the possibility of mistakes. But such a large operational crew comes to the attention of the hospital administrations, currently under massive pressure of allocating limited human resources to their medical therapeutic processes. And this overuse of human resources comes at a financial cost, often not covered by the reimbursements.

Coronary surgery is in a retreat situation. Von Clausewitz, Jomini and Sun Tzu describe in their different masterpieces on the art of war that a retreat situation is of the most difficult nature. It demands the best trained soldiers. Therefore, the training of our coronary surgeons demands our attention. No standardization, no

E-mail address: paulsergeant133@gmail.com

https://doi.org/10.1016/j.circv.2022.09.002

strict curricula on knowledge and skills, no deconstruction in teachable components, no OSATS-based qualitative and quantitative assessments, a global and total absence of simulation and scenario training, except in some rare units and in those now participating in the My Virtual Surgery project. Our three famous generals would clearly see the retreat of coronary surgery as a mission doomed to fail. The coronary surgeons have also failed to implement the evidence obtained in the progress of surgery namely complete arterial revascularisation, no touch aorta, off-pump CABG.

Some surgeons believe that the solution can be found in reducing the incision and calling this lesser invasive surgery. The incision is only one of the different parameters to define invasiveness, a mostly cosmetic one. A catheter will always give the smallest of incisions. So, another mission doomed to fail, unless late evidence can be given that a complete arterial revascularisation can be obtained surgically versus the catheter techniques. Late evidence on survival, freedom from angina, freedom from infarct, freedom from graft failure all at 10–15–20 years. A picture of a 3 cm incision on LinkedIn is not (yet) scientific evidence? Others believe in combining hybrid approaches. This is one product going through two mandatory therapeutic processes, having the operational costs of both processes combined and with the benefit of the one with the worst late result.

Therefore, survival of coronary surgery is not impossible but major steps are needed immediately to rethink all processes before, during and after surgery.

Conflict of interest

The author of this editorial declares that he has no conflict of interest.

References

1. Umberto B. The higher calculus: a history of real and complex analysis from Euler to Weierstrass. New York: Springer; 1986.
2. Clifford T. The rational mechanics of flexible or elastic bodies. Introduction to Leonhardi Euleri Opera Omnia 2nd series, vol. 11. Zurich: Orell Füssli; 1960.
3. Hardy GH. Weierstrass nondifferentiable function. Trans Am Math Soc. 1916;17:301–25.