

Interweaving Reality

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“Mathematics does not happen in the real world. What it does is to model it in a useful way... the question is no longer whether or not God plays dice, but how He does it.”

IAN STEWART⁽¹⁾

Mortality in cardiac surgery is related to a risk that is dependent on the patient, the attending team, and the socio-economic environment. The sum of these factors is determinant of a truth, of which statistics only show a part and hide the foundation. Logics is a tool that is useful for describing “linear” cause-effect situations, but if these situations become “non-linear”, complex or erratic—as in the case of biological systems—, their analysis within these terms generates contradictions. Although the analysis is formal, paradoxes are not banished. (2)

The work *Real Facts in Cardiovascular Surgery in Argentina. The CONAREC XVI Registry*, by Lowenstein et al, (3) is undoubtedly very important, but its value would be diluted if we denied that science describes real facts, not truths, as it is very well expressed in the title of the work. To talk about mortality and major complications is too sad for the adjective “surgical”, since the risk should go through sequences that threaten the pathology and its severity, the topography, etc. (impossible to be fully covered in the analysis) in a *being* made up of organs, psyche, environment, and society. Surgery is a partial aspect of the so called “surgical mortality” within multidisciplinary sequences, which encompasses from the patient’s comprehensive characteristics to the institutional characteristics and capacities, as well as the degree of social development where they occur. The many variables should let us see that the scores are far from the certainty we search for. It is also important to take into account that in the case of high-incidence diseases such as coronary heart disease (57.4% in the work by Lowenstein et al) (3), the group undergoing surgery is selected by interventional hemodynamics, and this implies more compromised patients. However, this concept should be understood within the promising advances of treatments, which have become complementary. A coronary artery bypass surgery, impossible to be fully solved with any of the methods without increasing patient risk, can now be performed by surgery and angioplasty sequentially, without using extracorporeal circulation. The same happens with aortic stenosis treated recently with the transapical aortic valve replacement method. (4)

The therapeutic decision implies weighing the risks and benefits of the cardiac surgery against the progression of the disease. When these data are incomplete in relation to the prognosis of surgery, experience and intuition are of vital importance in order to take a decision that is not reflected in the coolness of the scores used.

There are patient factors affecting the risk, which include not only the characteristics of the condition and other underlying diseases, but also the nutritional status, which is usually ignored in these instances. The factors that should be added to the risk include anesthesia (type and duration), experience of the team, and facility resources, which include special control and nursing care. We lack objective data on the impact of many of these factors, resulting in a morbidity and mortality assessment in which they are disregarded.

Even in the study of comparable groups of patients and surgeries, there is no certainty of the risk. It is not the same among institutions that perform the same surgeries. We still have to learn a lot about the experience of the surgeon and the anesthesiologist, the anesthetic agents, and the human and instrumental devices for controlling. Mortality is inherent to each place, and not only to the surgical team. Perhaps the *triage*, as a method of selection and classification of procedures based on therapeutic needs and available resources for care, could set more appropriate costs and benefits in an organized health system.

While the work of Lowenstein et al (3) is framed within mathematics, which is abstract to the truth, it shows us—despite the incompleteness of statistical analysis and the heterogeneity that factors contributing to risk are subject to in Argentina—the evidence that severe elderly patients or patients with marginal physiologic reserve can undergo surgery with acceptable risk, while two decades ago they would have been considered inoperable. And this represents another success for researchers, demonstrating the hard work of participating groups. In this regard, some of them must have undoubtedly dealt with higher-risk populations.

As techniques and resources developed, there has been progress that lead patients with severe impairments to surgery. Today, the role of the internist should not be limited only to select the surgical approach, but also to contribute to the care and to the preoperative and postoperative evaluation. (5) This role includes the personalized patient education. It is common that

patients undergo surgery with high values in various analysis of risk factors. Regarding smoking, diabetes, dyslipidemia, hypertension, and chronic obstructive pulmonary disease, which are variables analyzed by Lowenstein et al, (3) each patient had an average of 1.7 of these variables when entering the operating room. In the work by Barandon et al, (6) 91% of the preoperative patients had at least one abnormality in their cholesterol metabolism. Patients who do not have any other disease than the surgical pathology, and no general conditions, surgical mortality is low. On the other hand, to operate a patient for whom a fatal event after the surgery is likely to occur is an error, the same as not to operate a patient for which surgery outweighs the risk without surgery.

Two cardiologists are talking.

- In my *Institution A*, surgical mortality is 9%.
- We are better; where I work, in *Institution B*, it is 5%.
- In our statistics, the average age is 73 years old, and the youngest was 69, because we care for the elderly.
- Ah, no! The experience we published is different. Our patients are young, 56 years old on average; the oldest was 63.
- I'm afraid we need a multivariate analysis.
- Better a *multivariable* analysis. It may be appropriate to talk about *multivariable analysis* in order to apply it to the situation in which a single dependent variable and multiple independent variables are analyzed.

TOWARDS AN INTERWEAVING AND DYNAMIC THEORY OF REALITY

Variables are interrelated, participating in a comprehensive and dynamic network. All parts of a system are interconnected. This interpretation of the events breaks the Greek thought of the rigid, fundamental, invariable elements. This theory, called "bootstrap" by its creator, Geoffrey Chef, is based on the concept that biological processes do not respond to mathematical realities. This interweaving of all its components

that Chef proposes includes even the conscience in the self-consistency of the whole. (7) This concept seems to be ambiguous and difficult to grasp for the Cartesian clockwork mechanism of the medical systems, but the interrelation provides coherence to reality. (8)

Not even surgical mortality can be analyzed in reductionist terms. It is not feasible to discern about a therapy ignoring the mind and the natural order of the individual. These formulations do not try to invalidate the study of the biological aspects of diseases, they try to get close to the fluid and changing reality; that is what science is concerned.

Mortality of cardiac surgery is usually expressed including all the deaths during hospitalization. This situation overestimates the actual risk of surgery, and provides an incomplete picture of the quality of care beyond the surgery and the social culture in which the activity takes place. The work of Lowenstein et al (3) is a genuine encouragement for each patient to find his/her place.

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