Extracorporeal circulation

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Cardiac surgery with extracorporeal circulation was considered a major medical achievement in the twentieth century, as well as an improvement in the field of biological sciences [1-6]. It may be compared to the conquest of outer space and the arrival of humans to the moon.

We can also compare it with developments triggered by the atomic domain, which allowed the production of large amounts of energy from matter.

Unfortunately, the atomic energy achievement also allowed man to the creation of destructive weapons, putting at risk the integrity of the planet.

Unlike this invention, the advent of extracorporeal circulation has created new possibilities for curing heart disease never imagined in the first half of last century.

The possibility to correct heart defects under direct vision was an old dream insistently pursued by many professionals despite repeated failures that frustrated those who ventured to replace the pump function of the heart, and the respiratory and ventilatory functions of the lungs.

Nowadays, it is difficult for young people to imagine the countless difficulties faced by a surgeon to be able to divert all the blood from the patients to an external circuit to keep them alive.

Entering the heart chambers was made possible by this discovery in an almost bloodless field and to correct birth [7-10] or acquired defects [11-15], which restricted the lives of those who had the misfortune to present problems in the blood propulsive organ and in their own lives.

I could do a retrospect of all the experiments conducted by renowned scientists, before all the knowledge and material conditions leading this battle into a successful outcome.

The history of cardiac surgery is a real saga that treading the path toward this far-reaching scientific and social achievement, had to overcome prejudices and taboos [1-6].

Plenty of other knowledge came along with this new technology relating to the physiology of circulation, the body’s reactions to surgical aggressions and the domain knowledge in relation to the internal environment, in which all our cells are immersed and where metabolism is developed with the production of energy that makes us live [16-27]. These studies resulted in the understanding of homeostasis, a complex system of self-regulation responsible to maintain the multiple vital parameters within normal levels, during production of the energy previously cited.

Catabolites, heat, carbon dioxide, acids, water and other chemicals elements are resulted from this process and must be processed and/or eliminated.

It allowed great advances both in Medicine and Research, not only restricted to the cardiovascular system, but benefiting in a conspicuous way from the knowledge required in all fields of Biology.

I mention, as examples, the understanding of variations in acid-base and hydrosaline balance, indispensable for achieving these systems stability during extracorporeal circulation.

These knowledge do not only have benefits for the cardiovascular surgery, but for all specialties, creating basic concepts to patient care during large and small surgical interventions, including the subsequent postoperative period. Since this field of physiology was dominated, it was possible to understand the consequences of acid-base and hydrosaline imbalances in critical states, such as cardiogenic shock, septic shock and many others. It is also essential for the multidisciplinary team that performs cardiac surgery - including cardiac surgeons, anesthesiologists, perfusionists, intensivists, nurses, physiotherapists, psychologists, in other words, the whole support group - to understand that experience from years of practice and studies within this attractive field result in the security offered to patients nowadays.

In particular, the perfusionist has great responsibility during the surgical procedure, since they virtually have in their hands and under their eyes the life of the patient who is being operated.

In this period, when the blood circulation and breathing are being artificially maintained, the organic physiology must be monitored and adjusted to stay within the strictest parameters of normality.

The study of gas exchange is essential for the proper conduct of Extracorporeal Circulation. If they are not properly known, keeping the patient in perfect condition for the supply of oxygen and substrates is impossible, followed by the carbon dioxide and catabolites removal in...
the best way possible. Temperature control throughout the operation is another aspect of great importance and its implications, both in the period of hypothermia which is often necessary to decrease metabolism, as in the warm-up period, should be part of the whole team and the perfusionist’s sound knowledge, when performing the surgical act.

Deep hypothermia with circulatory arrest is a procedure that goes beyond our imagination, giving us the possibility to fully stop the circulation for an hour or more, and after the warm up, conducted with strict criteria, see the patient back to their state of homeothermic metabolism and life.

This technique allows us to restore lesions in complex congenital heart disease in children with very low weight or, more generally, in areas of difficult access, giving the surgeon the opportunity to work with bloodless field in the correction of defects that would otherwise be impossible to correct.

The study of equipment and knowledge of every detail in its operation are essential [28-30], not only for the perfusionist, as for the whole team, that should work in perfect understanding, thus no detail escapes from the correct and instant observation of the person in charge, avoiding jeopardizing the patient’s life, as well as their physical and mental integrity [31,32].

The air intake in the arterial circuit is a disastrous oversight, which totally dependent on the continued attention of the perfusionist, who may possibly be aided in this occupation by sensors that detect bubbles, disrupting the blood pumping and sounding alarms.

In fact, the cardiac surgery with extracorporeal circulation is a highly complex procedure and it should be understood this way.

The professionals must have deep knowledge in order to perform it safely, strongly embedded in their thinking, thus their decisions are automatic and immediate.

In pursuance of these skills, two assumptions should be considered: solid theoretical knowledge and extensive training services that are able to teach with competence, responsibility and safety the professionals who are dedicated to specific functions in this area.

I had the privilege of experiencing almost the entire evolution of cardiac surgery in the last 50 years, and strongly believe that taking part in this “adventure” was an experience that can not be described in simple words.

It was a wonderful experience that left me with the indelible mark of a successful major achievement in the field of Medicine and Surgery.

However, the supreme challenge to the golden rule of Cardiac Surgery remains: On the day after the operation, the patient should be stable, awake, alert and extubated. Any eventual bleeding will already have stopped, diuresis will be within normal parameters, as well as the routine tests. The patient is ready to be transferred to the ICU room. One more patient was then saved and our mission was accomplished!

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REFERENCES


