

The future of cardiac surgery

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Current cardiac surgery provides a tremendous array of surgical options for patients for the treatment of various cardiac diseases. Coronary artery bypass grafting, heart valve replacement and the correction of congenital heart diseases are valuable and established options for many patients around the world. However in recent years, the field of interventional cardiology, especially in the treatment of coronary artery disease, has expanded and developed to a level which raises the discussion between cardiologists and cardiac surgeons about the best treatment of patients with cardiac diseases. Although one may expect, that the result of this competition between the two specialties has led to optimised and integrated treatment paths for patients with cardiac diseases, only a few randomized, prospective trials with a significant number of patients have been published to compare the benefits of surgical treatment to other forms of therapy.

The roots of cardiology date back to the Egyptian and Greek era's, in which the anatomy and physiology of the heart has always attracted contemporary physicians. Since the development of modern internal medicine in the second half of the 19th century, cardiology has evolved continuously as a subspecialty of internal medicine. Improved diagnostic tools and a steadily increasing knowledge over cardiac diseases opened the door to provide medical therapy for cardiac disease, however the important and generally young group of patients with congenital cardiac disease have also benefited from this development. Though anatomic location and pathophysiology of atrial and ventricular septal defects clearly guided the way to cure this congenital heart disease with surgical means, technical equipment to approach those defects in a non-beating heart within a blood-dry surgical field was not available.

Creativity, pure innovation and lessons learned from failure were the driving force for the pioneers in cardiac surgery to cure these patients. Due to the potential to treat congenital heart defects with the use of extracorporeal circulation, the failure of the first generation of heart lung machines did not lead to the abandonment of open heart surgery. Since then cardiac surgery has emerged quickly with

breathhtaking speed over the last 50 years and opened surgical options to former untreatable diseases. In a steady process of creativity, improvement and innovation, valve and aortic surgery, coronary artery bypass and transplantation of thoracic organs were consecutive and logical steps within this development. Therefore cardiac surgery emerged as a new speciality providing the only treatment option for many patients without any competition from neighbouring medical fields.

The creative and innovative phase of the early days was slowly replaced by steady improvement and a refinement of existing techniques. On the one hand this enables cardiac surgeons to perform complex procedures on a high level of quality today, whereas, on the other hand, less efforts were made to be innovative in this field. However, the deceleration of the innovative drive together with a rising number of competing treatments of cardiac diseases (i.e. percutaneous transluminal coronary angioplasty, interventional closure of atrial septum defects) led to a new situation for the specialty of cardiac surgery. Used to success and convinced by the established methods of cardiac surgery, new surgical strategies to treat common and untreatable diseases were not developed. Virtues like vision, creativity, innovation and the ability to accept failure as necessary part in the development of innovations were discarded and lost in the busy and demanding everyday surgical activities.

Parallel to the blooming times of cardiac surgery, the field of cardiology changed dramatically. Until the first percutaneous transluminal coronary angioplasty was performed in 1979, there was no competing treatment option to coronary artery bypass grafting for a period of about two decades in the therapy of coronary artery disease. Vision, innovation and creativity developed the specialty of cardiology beyond the former limitation to diagnosis and medical treatment of cardiac disease. The refinement of tools and the steady improvement of technical equipment led to a breathtaking boom of interventional treatment of patients with coronary artery disease (1000 patients in 1980 to more than 2 Millions worldwide in 2001).

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Consequently the number of coronary artery bypass grafting is decreasing since the second half of the 1990s. With the encouraging experience of catheter guided procedures in coronary artery disease, interventional cardiologists currently perform closure of atrial septal defects without open heart surgery. Furthermore there is the challenge to provide catheter based therapy of valvular disease (valvuloplasty) or valve replacement avoiding sternotomy and cardiopulmonary bypass in a comparable quality to current valve replacements or reconstructions performed by cardiac surgeons.

In summary, interventional cardiology and cardiac surgery have expanded their treatment options within the last 4 decades. The history shows that the development of both groups is closely related to each other. For example, percutaneous angioplasty has always been supported with the back-up of cardiac surgeons in case the angioplasty fails and the therapy of the increasing group of patients with congestive heart failure is requiring close cooperation of cardiologists and cardiac surgeons. Despite the currently available options in the treatment of cardiac disease supported by publications either by cardiologists or cardiac surgeons, randomized, prospective trials to compare the benefits of surgical treatment to other forms of therapy are rare. There are many reasons for the lack of such data, but funding policies of research projects play a major role.

Funding of clinical research by non-profit organisations is steadily declining and replaced by industrial support which has also decreased significantly over the last years. In cardiac surgery, the development of minimal invasive cardiac technologies has created a new phenomenon, which is the pressure from the industry on media and patients as well as on surgeon's thought process and hence his actions. The development of new devices for approach, exposure, stabilisation, visualisation, cardiopulmonary bypass and the introduction of robotics were partly suggested by surgeon's needs. At the time, the industry discovered the business-potential of this innovative field, expensive, and mostly disposable, equipment was launched for minimal invasive cardiac surgery. Fashion and media-driven pressure on patients make the physicians almost no longer free to choose their procedures. Furthermore it is obvious, that when innovations are achieved without resorting to specific equipment, they become less interesting for the industry. Similar to the development in cardiac surgery, the industry discovered the emerging market in interventional cardiology. Based on the needs of the cardiologist, industrial funding is necessary to develop devices for catheterisation and stenting of coronary arteries. Trials funded by the manufacturer of coronary-stents, platelet inhibitors

aim to reach the same level of coronary revascularization compared to the current standard of coronary artery bypass grafting. Companies producing pacemakers and automated internal defibrillators are funding investigations to support the indication of these devices and potentially enlarge their market.

This leads to the challenge for the researcher in the field of cardiology and cardiac surgery to remain unbiased when research is suggested and supported by the industry. Alert readers and participants of scientific presentations may have noticed the upcoming "quality-assignment" of scientific studies, the so called "non-industry funded" publications. Research may be supported by industrial finance; however one has to be equipped with a sharp sense to avoid overstating the true range of those studies. The medical community and, much more importantly, the patients have to be protected from scientific results, which were influenced by economic interests rather than potential benefits for the patient.

Based on this circumstance, publications were often restricted to specifically treated patients undergoing either treatment in the hands of surgeons or cardiologist. However the community of cardiac surgeons and cardiologists is on the way to fill this critical gap. Prospective, randomized multicenter studies like STICH (Surgical Treatment for Ischemic heart failure) and SYNTAX, were established to answer questions, whether surgical or interventional treatment of cardiac diseases like ischemic heart failure or coronary artery disease can be treated with the best possible benefit for the patient.

This guides a potential new way for the community of cardiac surgeons and cardiologists. Collaboration should be emphasized and replace the sometimes less productive competition between the specialities, which can be driven by economic considerations. The challenges are offered by the patient, who is only interested in receiving the best possible treatment, regardless to which group the physician belongs.

Application of stem cells, controlled reperfusion of myocardium after interventional revascularization, surgery in the prevention of atherosclerosis, routine surgery for acute myocardial infarction or widespread application of extracorporeal circulation for patients who require cardiopulmonary resuscitation may sound new to us today. The drive and direction for the efforts of cardiologists and cardiac surgeons for the future is not hard to find. The view from the past demonstrated in an impressive way, that innovations in the field of cardiac disease may evolve quickly, providing survival and a new quality of life for the steadily increasing number of patients.