Thoughts on the future of cardiac surgery

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When I was asked to write an editorial about the future of cardiac surgery I first thought that I should go ahead and find a definition of what the future is. The definition "the future is the time that follows the present" which I found in Wikipedia was not that helpful at first sight and I remembered that a simple definition was a differentiation between the near future and the far future. As heart surgery performed on a broader basis is only 60 years old I will try to speculate about some trends for the years to come.

Surgery has accompanied mankind since the first intelligent human cultures and has survived as a discipline. Surgeons have over the course of history not always been regarded as physicians but have always played a special role in treatment of various diseases. Despite repeated attempts to classify it as a dying discipline, surgery as a specialty is well alive. And so is heart surgery. The only clear statement which can be made is that surgery as a discipline has constantly changed its appearance and will probably do so throughout the coming years. And so will heart surgery.

The following trends can be seen:

Cardiac surgery has developed as a subspecialty within the surgical community, and the profession of a cardiac surgeon is clearly defined except for the fact that three types of surgeons – pure cardiac, cardiothoracic, and cardiovascular – exist. The latter two are remnants of historical development and my prediction is that due to individual limits of performance capacity further subspecialization within cardiac surgery will occur. Individuals performing the entire spectrum of cardiac, thoracic and vascular procedures will become rare.

Cardiac surgery units which during the first phase of development were mostly restricted to academic centres are these days found in all kinds of hospitals including private practice. Two competing trends are seen. One is the foundation of small private heart centres offering heart surgery; the other is the foundation of large mega-capacity heart centres which allow for very economical resource use. My prediction is that depending on regulations at the individual state level both trends will hold. A new trend which is coming is increased use of medical tourism by which expensive heart surgery service can be acquired in an affordable manner by patients migrating from western countries to third world countries. This trend will most probably continue.

At the scientific community level cardiac surgery societies exist in most states, with varying connections to thoracic or vascular surgery. Major societies exist in all main regions of the world and support exchange of knowledge as well as global communication between heart surgeons. It can be expected that the majority of these societies will survive and that international communication and interaction will continue.

One trend that cannot be overlooked is an increased linkage of cardiac surgery to other cardiovascular disciplines rather than to general surgery or thoracic surgery. This results from the fact that heart surgeons are recognizing the need for interdisciplinary communication and cooperation. The new field of transcatheter valve treatment has specifically prompted our community to establish cooperative zones with interventional cardiology. Several publications show that interdisciplinary cooperation is a success factor for safe implementation of these new procedures. Official recommendations concerning conduct of endovascular valve treatment have been released by interdisciplinary working groups [1]. I assume that in the near future a further increased crosslink between cardiovascular subspecialties will occur. If patient and organ system centred service is to be achieved, this is an absolute necessity. This crosslink will probably also change the ward, OR, and overall hospital appearance. Work and training schedules may change accordingly. Integrated operating rooms, so-called hybrid ORs, will be implemented in several heart surgery units [2].

For the individual heart surgeon this means that he will be constantly forced to learn about associated disciplines and try to communicate well with cardiologists, radiologists, cardiac anaesthesiologists, intensivists and other cardiovascular specialists. The heart surgeon will need to find

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a reasonable balance between the multitasking abilities that he has to achieve and the overall growth of knowledge and skills that he has to contribute to a cardiovascular therapy team.

Most procedures in heart surgery are well standardized and reproducible. This makes current trends towards minimally invasive approaches difficult as learning curves can be tolerated only to a certain extent. On the other hand it is an absolute must for cardiac surgery like other surgical disciplines to develop less destructive and more patient-friendly approaches to treatment. A variety of procedures can these days be performed through thoracic mini-incisions or even in a completely endoscopic fashion. This was achieved by increased use of preoperative imaging for procedure planning, increased use of videoscopy and long-shafted instruments, intraoperative imaging for quality control, and robotic technology for completely endoscopic approaches. The trend towards approaches that involve less tissue trauma will probably continue and more complex operations will be performed in this fashion. Most probably these operations will be concentrated in dedicated centres and in these centres highly specialized surgeons will perform the interventions.

It is an absolute necessity that cardiac surgeons learn how to perform catheter-based techniques and get involved not only in the new transcatheter valve implantations but also in stent-grafting of thoracic aortic disease, and other forms of catheter-based interventions. My prediction is that some surgeons in cooperation with interventional cardiologists and radiologists will acquire the necessary skills in hybrid room settings, while others will try to implement such programmes even without assistance by an interventionist. The fact that cardiac surgeons can treat complications adequately and can offer the whole spectrum of invasive procedures in a specific field may be an attractive factor for patients who undergo catheter-based interventions. It is a current point of discussion whether heart surgeons should even change their name to "cardiovascular interventionists" or "specialists in cardiovascular interventions". I speculate that this change may occur.

In general there is additional need for training in all types of cardiac imaging. Surgeons will also understand the necessity to learn about molecular biology, genomics, tissue engineering, cell therapy and gene therapy. Despite the fact that integration of these fields into our specialty is extremely challenging, involvement is absolutely necessary in order to make heart surgery an up-to-date and competitive field.

Coronary surgery will probably continue the trend towards use of more arterial grafts and the acceptance of this strategy is generally good. There will be ongoing controversy regarding performance of the procedures on or off pump. Both variations will be performed. Conduct of a large prospective randomized trial comparing the two options would be desirable but remains a highly difficult task. Hybrid coronary intervention may receive increasing interest as the value of a functioning LIMA to LAD graft is generally recognized [3].

In valve surgery the tendency to perform procedures through minimal access will certainly go on. Catheter-based techniques show promising results [4]. Whether they can be implemented on a broader basis will depend on results during the initial application phase. Prospective randomized trials will have to be performed and will certainly be carried out.

Congenital heart surgery will also try to involve less invasive surgical forms of treatment. This, however, will happen for simpler forms of congenital defects such as ASDII, VSD or aortic coarctation. Transcatheter techniques which now also include pulmonary valve implantation will mainly affect treatment of pathology of the right ventricular outflow tract. It is unlikely that highly complex congenital disease will soon be treated less invasively as adequate repair strategies require perfect access.

One major field where heart surgeons are needed is treatment of patients with heart failure. The extreme shortage of donor organs for heart transplantation will render these forms of surgical therapy highly attractive options. It is very unlikely that ventricular assist devices will be installed without any surgical access, and alternative strategies such as mitral valve repair and left ventricular restoration require specific surgical skills. Survival of the heart surgeon in these fields is almost guaranteed.

Surgical treatment of thoracic aortic disease has become routine at many centres and is these days far away from the frightening aspect that it had some years ago. While catheter-based techniques will be increasingly applied, the majority of surgeons will probably be reluctant to use limited access for this type of surgery. More and more surgeons will perform endovascular techniques themselves or in cooperation with interventional radiologists or cardiologists.

Surgical treatment of atrial fibrillation has become an integral part of our specialty and success rates allow broad application. Epicardial ablation techniques through minithoracotomy or through ports is increasingly applied and the near future will bring attempts to perform hybrid interventions with catheter-based techniques [5], maybe even in a simultaneous manner.

Heart surgery will certainly survive and differentiate further. There will at least always be complex disease that cannot be tackled by catheter-based techniques at all or end-stage disease where surgery is the only option. An approach where only end-stage disease is treated surgically, however, is not desirable and surgeons should be involved in finding the optimal window for a procedure in a patient's disease history. One clear fact is that heart surgery and heart surgeons will change their appearance during the years to come and that this change can be regarded as something exciting and stimulating. Constant complaining about losses of therapy

segments certainly does not help. Losses can often be compensated by interesting new gains. Cardiac surgeons should keep in mind that they are still an exclusive, small group of therapists who should be proud of what they are doing. The reputation may not be as bright as for the first and second generation of heart surgeons but is still excellent.

Coming back to the definition of the future in Wikipedia I have throughout the writing of this article come to the conclusion that the definition is not too bad. The future as "the time that follows the present" comes faster than we think. We as cardiac surgeons have to be open to change, and our community needs to be well prepared and very alert in order to react properly to the challenges which are about to come.

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