Editor's Page

New Frontiers in Interventional Cardiology: From the Past to the Future

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On September 16, 1977, when Andreas Gruentzig was performing the first coronary angioplasty in Zurich, Switzerland, giving birth to a new field in cardiology, no one could foresee the tremendous explosion of interventional cardiology that would cover a broad spectrum of cardiac diseases. In 1986, the first implantation of an intracoronary stent (Wallstent) opened a new era in interventional cardiology, and drug-eluting technology appeared in 2001 to transcend the limitations of acute thrombosis and late restenosis, leading to an exponential increase in the use of stents for treating coronary heart disease. Today, different interventional therapies have evolved, many of them surpassing the surgical results.

Undoubtedly, the first choice in the vast majority of percutaneous interventions in patients with coronary artery disease are drug-eluting stents (DES), in stable and acute syndromes. Large meta-analyses have shown better long-term clinical outcomes of DES compared to bare metal stents, and DES are equally effective for the treatment of left main disease compared to surgery. Also, new stent technologies have developed, such as stents with a biodegradable polymer, or even fully biodegradable stents, giving promising results. Recent studies demonstrate that a drug-eluting balloon may be a feasible alternative for revascularisation in patients who are unsuitable candidates for drug-eluting stents, and cutting-edge technology methods are being developed, such as endothelial progenitor cell (EPC) capturing stents, coated with monoclonal antibodies that allow the stent surface to capture EPCs in the blood to accelerate endothelialisation of the stent strut.

In the field of heart failure, the majority of studies have shown a significant survival benefit after implantable cardioverter-defibrillator (ICD) implantation, by reducing arrhythmic deaths, while biventricular pacing reduces overall mortality and hospitalisation rate in patients with heart failure. Recent advances in heart failure therapeutics include leadless cardiac pacemakers, which are placed entirely inside the right ventricle and may be adjusted with smart mobile devices, and new types of entirely subcutaneous ICD. Left ventricular assist devices (LVAD) have proven their effectiveness as bridge therapy to recovery or definitive treatment (reperfusion, transplantation) and new types of biventricular VAD are currently being tested in clinical trials. Finally, telemetry techniques use special implantable devices for wireless remote monitoring of various haemodynamic parameters, providing significant benefits over standard follow-up office visits in heart failure patients.

Interventional treatment of valve disease is one expanding field of invasive cardiology. In 1988, a novel retrograde method of mitral valvuloplasty was developed in the 1st Cardiology Department of Athens Medical School; it was performed in patients with mitral stenosis with excellent clinical results. Interventional treatment of mitral regurgitation can be accomplished with a new repair procedure called MitraClip, which was associated with similar improvements in clinical outcomes compared to surgery. In 2002 Cribier introduced the transluminal implantation of artificial heart valves in patients with aortic stenosis, using a balloon expandable valve, the Cribier Edwards valve. The PARTNER trial supports transcatheter aortic valve replacement (TAVR) using the CoreValve, a self-expanding nitinol valve, as an alternative to surgery in high-risk patients with aortic valve stenosis. The experience of the 1st Cardiology

Department of Athens Medical School regarding the CoreValve shows survival rates comparable to surgery and clinical improvement up to 50-month follow up. There is also recent evidence that TAVR can be an alternative for native aortic valve regurgitation, with acceptable results.

During the past years, revolutionary interventional techniques have been developed for the treatment of resistant hypertension. Several small studies assessed the safety and efficacy of therapy with a novel implantable device, the Rheos device, in patients with resistant hypertension, with promising results.

Renal denervation has been used successfully as a therapeutic strategy to treat hypertension, or to modify the renal sympathetic system, in a variety of experimental models and in humans. More recently, chemical denervation of the sympathetic nervous system of the renal artery by local delivery of vincristine via a dedicated delivery catheter was introduced by the 1st Cardiology Department of Athens Medical School and has been tested successfully in animals, the first-in-man study being in progress. The sympathetic system has already been recognised as a target for the treatment of several other disorders, including coronary heart disease, arrhythmias and idiopathic pulmonary hypertension.

The future of interventional cardiology promises to be exciting, as technological achievements will further extend our frontiers. Cell therapy, genetic therapy, robotic technology, nanotechnology for diagnosis and treatment, creation of artificial vessels in the laboratory, and 3D printing of tissues and organs illustrate a futuristic but possible picture of interventional cardiology in the coming years.

In conclusion, interventional cardiology, shortly after its genesis four decades ago, was a treatment option for a small number of selected patients. At present, in the field of coronary artery disease, arrhythmias, valvular disease and congenital heart disease it constitutes the therapeutic approach of choice. In the future, to the extent permitted by technological developments, is estimated that the majority of cardiovascular diseases will be treated with invasive non-surgical methods.