Editorials

Happy Birthday Echocardiography: Where do we go from Here?

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The year 2003 was the 50th Birthday of the founding of Echocardiography and the 200th anniversary since the birth of Johann Christian Doppler (1803-1853). Echocardiography really started in 1953 when Inge Edler, a physician, together with Hellmuth Hertz, an engineer and the son of a Nobel laureate in Physics, performed the first human echocardiogram which they called an Ultrasound Cardiography (UCG). They used a shipyard sonar machine in Malmo, Sweeden made by Siemens Co, Germany that was used to detect structural flaws in boats, called an "ultrasonic reflectoscope". This instrument is now in the Museum of Medical History in Lund but will be travelling around the word this year to celebrate Echocardiography, including being on show at the EuroEcho meeting in Barcelona. The images were understandably very crude and the knowledge of what it represented false. While the posterior left ventricular wall and anterior mitral leaflet were visualised, they thought initially that the anterior mitral leaflet was left atrial wall. Even the greatest can get it wrong! On 29th October 1953, Edler and Hertz recorded the first "Ultrasound Cardiogram" and published their findings the following year. Edler went on to become a pioneer in echocardiography while Hertz went on to invent the ink jet printer.

Interestingly, in 1963, Harvey Feigenbaum out of frustration with the numerous limitations of cardiac catheterisation and angiography, borrowed an unused echoencephalography machine to scan the heart and noticed that cardiac images could be recorded and became the first person to describe a posterior pericardial effusion. By substituting "cardio" for "encephalo" it was this machine's origins that gave the rise to the name "echocardiography".

In the meantime in 1956, Satumora, Yoshida and Nimura were the first to apply the Doppler principle to the use of ultrasound to cardiac recordings, but the resulting signals were interpreted as being caused by movements of the heart muscle and from the valve leaflets. Interestingly, no signal could be attributed to blood flow and consequently the method was of no interest to cardiologists! In the early 1960's Edler with his clinical skills in auscultation and phonocardiography, thought that he could discern the sound of blood flow in a very noisy signal of Doppler equipment. In 1969 during the first World Conference in Ultrasonic Diagnosis in Vienna, Edler and K. Lindstrom presented their ultrasound Doppler studies, including the first 40 clinical intracardiac Doppler recordings for the evaluation of aortic and mitral valve incompetence.

The present

Never before has the pace of innovations in echocardiography been so swift. Echocardiography today has been revolutionised alongside competition from other imaging modalities such as cardiovascular Magnetic Resonance Imaging and computer tomography. In particular, it has responded to new clinical challenges in the diagnosis and treatment of coronary artery disease. Firstly, we now have contrast echocardiography and myocardial perfusion is just around the corner. Although we are still awaiting the contrast manufacturers' approval for the detection of myocardial perfusion, it has already become a clinical reality. Secondly, on-line three-dimensional echocardiography is with us. The first machines have been made commercially available by Philips since January 2003. Although this is not entirely new, it is the first time that a large company has invested so much in the development of real-time three-dimensional echocardiography with all state-of-the-art imaging capabilities. Competition will follow very swiftly. Thirdly, we now have new revolutionary methods to study ventricular function with very high temporal resolution, far exceeding the capabilities of cardiac Magnetic Resonance. Modalities such as tissue Doppler, myocardial strain and strain rate are just some unique tools to assess systolic and diastolic ventricular function that no other imaging modality will ever be able to do. We have new challenges looming however. As machines are getting bigger and better, providing more information than ever before, yet others become smaller and cheaper, potentially available to all! While the world of echocardiography is still coming to terms with these new "toys", the small hand-held echo machines, are rapidly becoming even smaller with ever improving image quality and functions. Do you spot the danger? Yes, certainly! Who will be using them and how ? There is no doubt that they will be a useful complement to the clinical examination and supplement to the good old stethoscope. At last, a true hand-held cardioscope available to all!

The need for regulating echocardiography

One of the big problems of echocardiography, not applicable to other imaging modalities is the lack of a regulatory body that ensures training and quality control. Unlike nuclear medicine and radiology that tightly control MRI and Nuclear imaging modalities, echocardiography is open to everybody in a very cost-efficient way. This almost guarantees clinical disasters! Not surprising therefore, people who are not appropriately trained perform echocardiographic examinations in a totally uncontrolled fashion, thus diminishing the standards of the technique.

Echocardiography performed in well-organised departments provides de facto a high standard and comprehensive description of the cardiac anatomy and function. All imaging techniques, from Echo to CMR and Nuclear are "operator-dependent" and are only as good as the person who obtains them! It is a fallacy to believe that nuclear or CMR methods are more "objective" than echocardiography. I would argue the opposite. It is the openness and wide use of echocardiography by non-experts that occasionally give the technique a bad reputation. Is this not true for thallium too?

The issue of training is clearly of pivotal importance in every aspect of life, including medicine and regulatory bodies have being set, ultimately, to safeguard the patient.

The newly formed European Association of Echocardiography (previous working group on echocardiography) has finalised an accreditation process with an exit examination for future echocardiographers. This is accepted and promoted by the European Society of Cardiology and individual member states and National Societies such as the Hellenic Cardiological Society will be called to adopt similar accreditation policies. Although this process will not be obligatory in the first instance, it will help to improve training and delivery of echocardiography services nationally and homogenise the quality within Europe. In countries such as the US and the UK where such regulatory bodies have been in place for several years, delivery of echocardiography services has significantly improved.

The future

Never before has the future of echocardiography has been so bright. With companies being integrated, investment in research and development has doubled over the past 5 years and technological innovations are put into clinical practice at such a speed that has become very difficult to follow, even for dedicated echocardiographers. Echocardiography sub-specialisation now includes contrast experts, tissue Doppler experts, transoesophageal and stress echo experts, three-dimensional experts etcetera. It is very difficult for a single person to be expert in all

these modalities unless they operate in a well-developed and organised department with good technical support. A new breed of "Academic echocardiologists" is appearing who devote teaching and research time as opposed to simple application of the technique as a clinical tool.

The trend to imaging modalities is the development of the study of the ventricular function and the non-invasive imaging of the coronary arteries, while the traditional perfusion methods are rapidly becoming old-fashioned. The cost of radiation by the traditional nuclear modalities as well as the new multi-sliced computer tomography will always be a prohibiting factor for future applications and lead to their eventual demise. Cardiac Magnetic Resonance Imaging is rapidly entering routine clinical cardiology practice but its high running cost prohibits its first-line use. When Magnetic Resonance Angiography (MRA) becomes a reality, it will certainly be a major breakthrough in clinical cardiology. Echo and CMR are the imaging modalities of the future and will be complementary, with echo being the most cost-effective and patient-friendly examination and CMR the high end of cardiac imaging in special clinical scenarios. I am confident that during the next decade we will enjoy the explosion of new, more sophisticated echo and CMR modalities the benefits of which our patients will ultimately enjoy.