Heartbeat

Answers for life in Sustainable Cardiovascular Care

August 2012 – Not for Distribution in the U.S.

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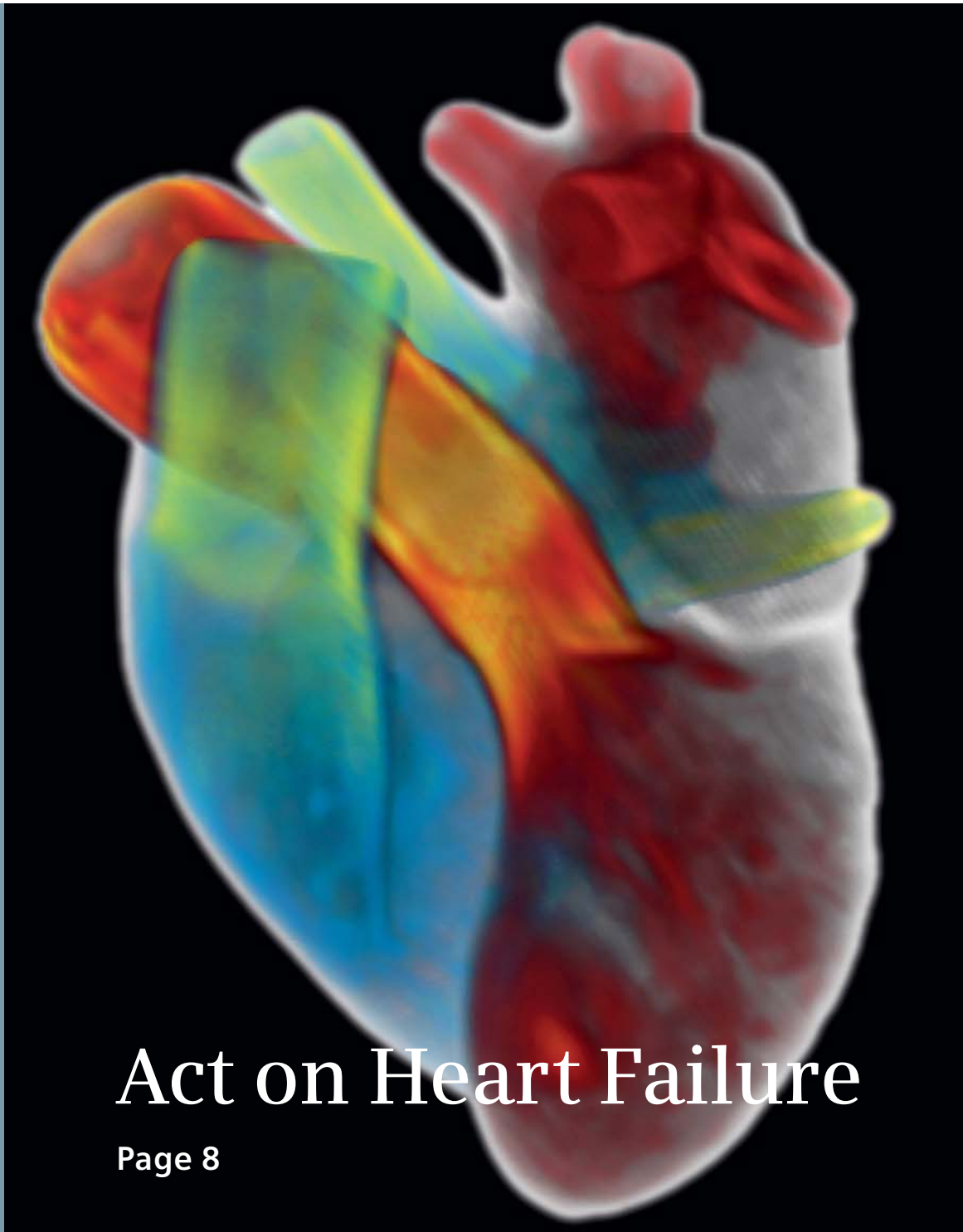

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Are you ready for the long-run?

Sustainable Cardiovascular Care

Cardiovascular care is in motion. On the one hand, healthcare systems hold increasing economical challenges. On the other hand, you want to safeguard your position as a leading cardiovascular care provider, both today and in the years to come. How to solve this issue?

With a partnership that lasts. At Siemens, we accompany you. We provide solutions that are sustainable and affordable, again and again. This is the long-run. And to navigate it, we provide you with technology that can support your ability to make sounder decisions, perform safer procedures, operate with better efficiency, and invest resources wisely. In short, we help you establish a sound basis for the future – so you are perfectly prepared for the long-run.

Answers for life.

Okan Ekinci, MD, MBA
Global Director, Cardiology
Siemens Healthcare

Dear Reader,

Significant advances have been made within the last decade in cardiovascular (CV) medicine across the entire diagnostic and therapeutic range: New interventional procedures such as transcatheter aortic valve implantation (TAVI) or mitral valve clipping have expanded the opportunity range for the treatment of structural heart disease. Imaging modalities such as 3D echocardiography, cardiovascular CT and MRI not only have further improved and converged technically, but have become emerging standards of care, e.g. in CRT and TAVI planning or SCD risk stratification respectively. Overall, they paved the way for a "more personalized" CV medicine.

However, inequities in access to these advances and innovations have increasingly become a challenge to our societies. Growing economic pressure has made the transformation towards sustainable cardiovascular care inevitable. Nowadays, implementing innovation in clinical routine requires insights into whether and how a particular innovation may help contribute to sustainable care delivery, for instance, through enabling safer procedures, sounder clinical decisions or improved operational efficiency. The fast pace of innovation and outcome orientation ultimately requires a holistic patient-centric view on clinical processes. Siemens is ready to support the multifaceted transformation towards "next generation health care" by enabling smart investments in innovative solutions for sustainable care: from imaging to health care IT, in-vitro diagnostics and consulting services. Moreover, we want to foster international exchange of ideas and experiences among our customers to use the power of community.

With this inaugural issue of Heartbeat, our new magazine for cardiovascular health care professionals, we are starting to explore the exciting world of innovations for sustainable cardiovascular care with various customers from all around the world. Among others, get to know how Australian cardiologists use *syngo*® DynaCT Cardiac to accurately perform TAVI procedures. How the MediGuide™ integration in our Artis zee® systems revolutionizes catheter tracking in EP. Understand why in Bournemouth, UK, CMR exams with the MAGNETOM® Aera equipped with Cardiac Dot Engine take less than thirty minutes and can be performed by all – 18 – radiographers.

Our first cover story focuses on the cost-driver heart failure and a new consulting service offered by Siemens Healthcare to assess and improve process maturity. Klinikum Nürnberg Süd in Nuremberg, Germany, was among the first sites that underwent a process maturity assessment; Prof. Dr. Pauschinger, Head of the Department of Cardiology, shared with us his views on optimizing heart failure management across the health care continuum.

I hope you enjoy this inaugural issue of Heartbeat!

Yours sincerely,

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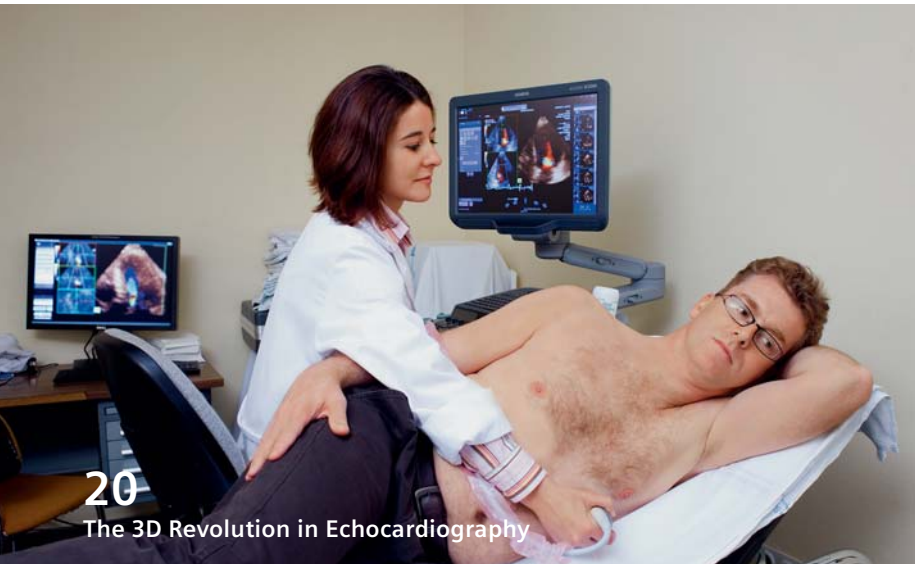

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Cover Photo: Computational fluid dynamics of the heart. Courtesy of V. Mihalef et al. Siemens Corporate Research.

Cover Story

At the Herz-Gefäß-Zentrum in Nuremberg, Germany, the focus is on interdisciplinary diagnosis and treatment of cardiovascular diseases. The inpatient area of the cardiology department of Klinikum Nürnberg Süd (building on the right) is connected to the center.

Act on Heart Failure

Prof. Dr. Matthias Pauschinger, Head of the Department of Cardiology, Klinikum Nürnberg Süd in Nuremberg, Germany, is convinced that targeted changes in defined areas can make a significant contribution to improvements in care for heart failure patients. What are the changes which should be pursued at top priority? A novel process maturity analysis provides answers.

By Dr. Carola Göring

"The approach of analyzing the entire process of clinical care has convinced me. This is truly innovative."

Professor Dr. Matthias Pauschinger,
Head of the Department of Cardiology, Klinikum Nürnberg

The Herz- und Gefäßzentrum of Klinikum Nürnberg is taking new paths to further improve care for its heart failure patients. For this purpose, Prof. Dr. Matthias Pauschinger, Head of the Cardiology Department, relies on a process maturity analysis developed by Siemens Healthcare. This new approach is based on a specific method of clinical process and structure analysis that Siemens performs in close cooperation with clinical care organizations.
In an interview, Prof. Dr. Pauschinger and Dr. Philipp Fischer, Clinical Manager, Siemens Healthcare, explain how the process maturity analysis has been used successfully at Klinikum Nürnberg, and report on the resulting changes for the hospital.

Professor Pauschinger, Klinikum Nürnberg is among the hospitals with the highest volume of heart failure patients in Europe. Why are you striving to further improve care for these patients at your hospital?

Pauschinger: It is still a fact that 55 to 60 percent of all heart failure patients die within five years after being diagnosed – in spite of innovative techniques and improved pharmacotherapy. This means that mortality has not dropped considerably in the last 25 years. Innovative technologies such as telemedicine have not proven capable of improving this situation either. In addition, we struggle with what is called the "revolving door effect": Many decompensated heart failure patients are admitted to our emergency department. We provide treatment to them to the best of our knowledge and experience, and discharge them for outpatient treatment. For reasons unknown to us, many decompensate again within a relatively short period of time and have to be readmitted to the hospital. About one out of five heart failure patients is currently readmitted to the hospital within 30 days. Therefore, in addition to the high mortality rate, the readmission rate is another important performance indicator we need to improve on.
It is our obligation to offer to these patients the best diagnostics and therapy at all times. Based on the most recent advances in clinical science, we need to continually tackle the problems in heart failure care. This poses a great challenge to all specialists involved.

Why did you decide to implement the Act on Heart Failure process maturity analysis by Siemens Healthcare in this context?

Pauschinger: The approach of analyzing the entire process of clinical care – including the outpatient sector – specifically in the framework of a highly complex disease like this has convinced me. The process maturity analysis is truly innovative. It turns out that numerous minor areas may also be affected significantly by changes. I am certain that small-scale improvements in multiple phases of the care process will lead to the quantum leap which we urgently need in the treatment of patients with heart failure. It is very commendable that Siemens uses this method to look in depth at clinical areas, supporting us with expert knowledge among peer physicians. I consider this to be an investment into the future.

What precisely is the Siemens

process maturity analysis for heart failure about?

Fischer: The objective of our approach is to cooperate with our customers to achieve targeted improvements of their heart failure care processes based on the best knowledge available globally. What is new about this is the knowledge basis, the methodology, and the approach we employ to assess and evaluate clinical structures and processes. Eventually, all this impacts the way we elaborate our suggestions for improvement.

Can you describe the approach in more detail?

Fischer: Knowledge of the current clinical guidelines alone is not enough to improve the quality of heart failure care. Defined structures must be created, and management of the complex clinical processes needs to be established – in short: process maturity improvement is the goal.
To support hospitals in this, we first analyze the status of heart failure care within the existing care structures. This analysis is based on international guidelines and on findings from current clinical studies.
In addition, we identified clinical organizations around the world that have already achieved outstanding quality of heart failure care. In close cooperation with these hospitals, we assessed and documented their structures and processes in detail – from the admission process to rehabilitation. Structured as clinical best practice expertise, these contents are an integral part of our analysis model.
On this basis, we determine the process maturity level of heart failure care on a scale from 1 (situational treatment) to 5 (optimized). Eventually, this allows us to develop a targeted improvement strategy for our clinical clients.

Professor Pauschinger, how did you experience the assessment? Were there any obstacles that had to be overcome?

Pauschinger: Well, I would rather describe this as a certain initial uneasiness about permitting assessment. If you have treated heart failure patients and performed clinical research for years, you want to get good grades for your work. Of course, no one can be equally strong in all areas. Nowadays we often use the rather neutral phrase "potential for optimization".

Is it possible to say that, by using the process maturity analysis in your department, you have implemented a culture of "converting weaknesses into strengths"?

Pauschinger: Absolutely! At first, I found it difficult to adopt this approach. Now, however, I value this type of analysis as continuous improvement that provides verifiable results which illustrate the process quality in heart failure care in a transparent manner. It is only by facing the evaluation process and engaging in it that the manifold adjustment options in transsectoral care for heart failure patients will become accessible to us.

How did your employees and the colleagues in the other departments involved in heart failure care feel about performing Act on Heart Failure?

Pauschinger: The colleagues were

highly motivated. All of them are convinced that patients are treated best by a well-functioning team. Our advantage as a regional hospital is in our dedication to delivering high-quality care to our patients. We are equipped with state of the art technology, comparable to what is available in university hospitals. Purely scientific work with the related publication and presentation pressure plays a subordinate role at Klinikum Nürnberg.

Dr. Fischer, we often hear that consulting can be a time-consuming and strenuous exercise, particularly in the clinical setting. How extensive is the heart failure process maturity analysis?

Fischer: Our approach differs somewhat from typical consulting approaches. Based on a predefined project plan with clear content-related requirements and targets, we can realize a relatively short on-site engagement of two to three days at the clinical organization. For the indication of heart failure, about 950 criteria are to be evaluated.
We schedule structured interviews with the medical specialists of the clinical departments and associated healthcare providers involved. We can adjust the schedule to preferred appointment times and also take shift schedules of the staff members into consideration. At Klinikum Nürnberg, we interviewed 26 employees, including resident general practitioners, referring cardiologists, internal medicine specialists, and practice managers from the outpatient sector, as well as physicians and nurses from the various inpatient departments involved heart failure care. In addition to the various subdisciplines of the cardiology department, selected related departments such as nephrology and cardiac surgery are included. Likewise, laboratory medicine, quality management and other clinical service providers are also part of the analysis.
In short, the heart failure process maturity analysis is a defined and concise project. Since most of the work is performed by Siemens before and after the interview phase, there is little effort for the hospital. The individual employees only need to interrupt their work for the interview, which takes between 30 minutes and an hour.

How does the assessment work?

Fischer: After the interviews, we evaluate the answers based on our process maturity model. This results in a detailed map (cf. figure on page 13) that offers an overview of all levels of care for heart failure patients. In the next step, suggestions for procedural or structural modifications are elaborated, and packages of improvement measures are developed. These can then be used by the hospital and its associated outpatient network for the targeted improvement of process quality in heart failure care.

Dr. Philipp Fischer, Clinical Manager, Siemens Healthcare

How did your interview partners react?

Fischer: The feedback was consistently very positive. We were received in a very friendly atmosphere. Most staff members were actually willing to invest more time for the interview in order to best contribute their views and the work of their departments to the analysis.

Pauschinger: I can only confirm that there has been and still is a great interest. Many staff members enquired about the results several times. The interviews were conducted over a period of merely three days, only a single room had to be reserved for this purpose, and about 26 staff members were involved. This is easy to handle and not a very large effort.

What can you tell us about your maturity level?

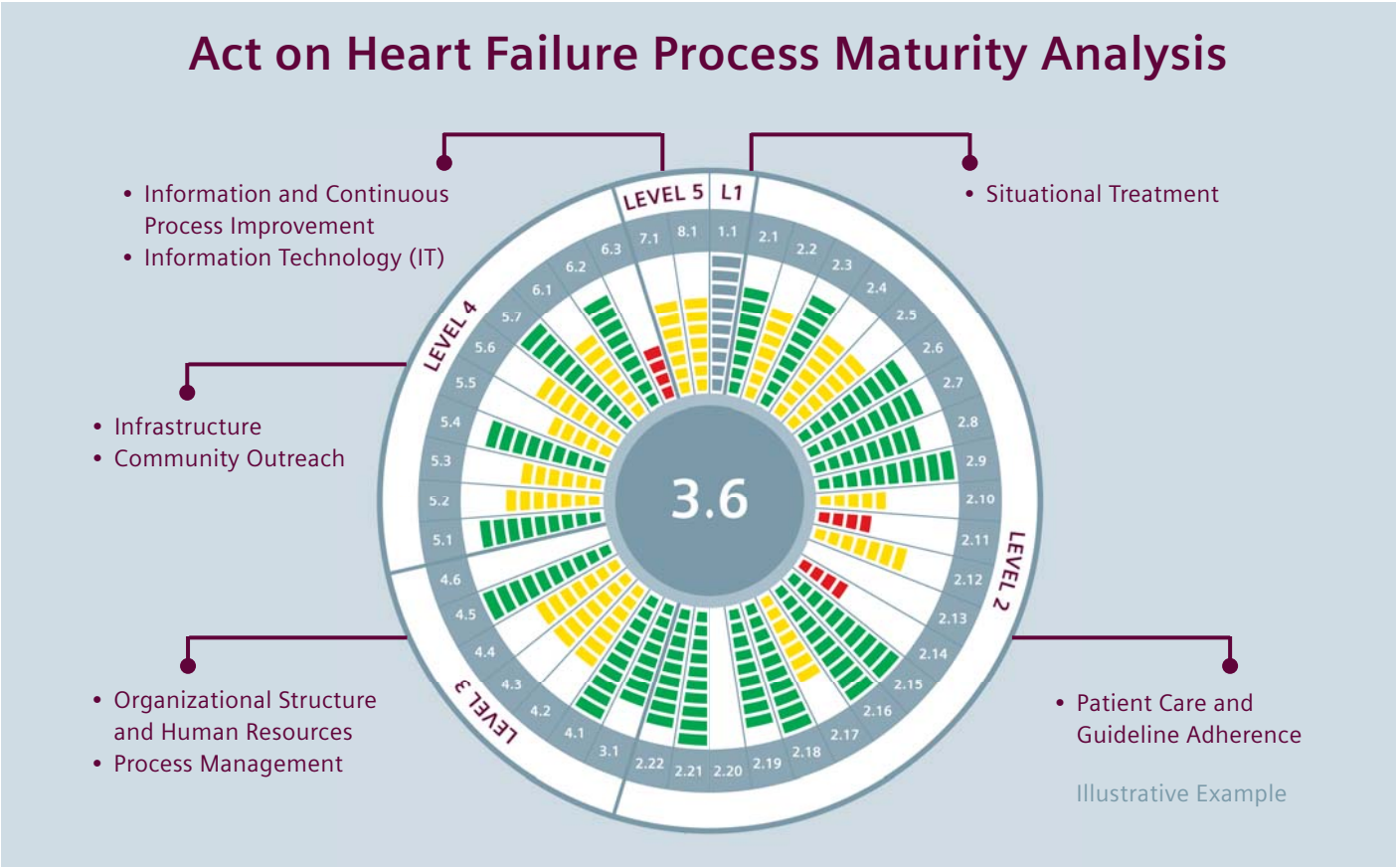
Pauschinger: As I expected, not all our processes were outstanding. Our results were very good in some areas, while others turned out much weaker. The most important factor is, however, that we now know how we compare to internationally leading hospitals in that field, and have a precise guidance on what to improve at which priority level. This helps us to take decisive steps towards better quality of care together with our colleagues in the outpatient network.

Professor Pauschinger, what do you consider to be the most important results of the process maturity?

Pauschinger: Interaction and communication are key process interfaces which require change. We have specified an improvement plan which includes three major milestones. At the moment, we define precise pathways of care for our patients with heart failure. We focus on the inpatient setting first. In a second step, we will extend the pathways to the outpatient sector as well. As part of that, we will also set up cross-sectoral protocols for diagnostic and therapeutic pathways in collaboration with our referring physicians.

What do you expect to gain from the definition of heart failure pathways of care?

Pauschinger: Imagine it is three a.m. and there is a young assistant physician in the emergency room. A patient with decompensated heart failure is admitted. Good instruction helps a lot here, not only regarding the diagnosis and treatment steps to be initiated, but also to raise safety for the patient and physi-



The heart failure process maturity analysis is composed of 41 process areas with 140 requirements and over 900 defined criteria for heart failure care, comprising both the inpatient and outpatient sector. The model allows for the structured assessment of all process areas (green bars: high degree of fulfillment; red bars: low degree of fulfillment) as well as the determination of the overall heart failure process maturity score based on structured interviews and process observations.

cian. It is not enough to know the guidelines. They must be integrated into our processes in the ward and into our communication, e.g. between the emergency department, radiology, and our cath labs.

What else do you have on your to-do list?

Pauschinger: We have already implemented one other important item: we have taken on a new member of the nursing staff specifically trained for heart failure. Her tasks include educating the patient on key aspects in his or her everyday life with heart failure and teaching symptoms of the disease the patient should be aware of. You can see by my non-medical choice of words that these conversations take place at a special level of trust between the nurse and a patient. We assume that this will help the patient to better understand the information on his or her treatment and the required lifestyle changes, and that he will be more motivated to compliantly follow these instructions. The third important topic on our project plan refers to the development of our IT system for data exchange with our referring colleagues. We have a mutual web-based eHealth platform (Soarian Integrated Care) installed for CardioNet NORIS – the collaborative network of the Herz- und Gefäßzentrum and the Praxisnetz Nürnberg Nord. While access rights permit referring physicians to view clinical information from the hospital, they cannot enter any supplementary information at the moment. We want to make this a two-way process to enable information exchange in either way in future. This change is supposed to be implemented quickly.

I assume that you intend to evaluate the success of your measures. When are you expecting to see the first results?

Pauschinger: We believe that we will be able to present the first results in about two years, that is in summer of 2014.

Professor Pauschinger, Dr. Fischer, thank you for the interesting interview.

Dr. Carola Göring *is a widely published medial journalist with more than 20 years of experiences. She writes for medical specialists as well as for the general public. Her expertise is in internal medicine, dermatology, oncology, as well as neurology and psychiatry.*

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Cardiovascular Trends

Navigating at the Peak of Innovation

The cardiological specialist area electrophysiology is becoming increasingly important. New imaging and navigation tools, multimodality and integration of systems and images are the basis for increasingly reliable diagnoses and successful treatment. Prof. Josef Kautzner, MD, PhD, Director of the Department for Cardiology at the Prague Institute for Clinical and Experimental Medicine, IKEM, is one of the world's leading electrophysiologists. A visit to Prague.

By Matthias Manych

The IKEM, situated just a few kilometers to the south of the historical city of Prague in the Czech Republic, is a unique medical research and therapy center. Offering high-level cardiology care, Josef Kautzner and his team are responsible for primary cardiology in a catchment area with a population of approximately 250,000. In addition, the cardiology department is virtually the heart of five satellite district clinics that are located within a radius of up to 100 kilometers of the IKEM. From here patients come to the IKEM for electrophysiological procedures like cardiac ablation or device implantation, percutaneous coronary intervention (PCI) or heart transplantations, if necessary direct from their home and without first making a detour via the district hospital. IKEM also serves as a super specialized cardiovascular center for patients from the entire Czech Republic. Patients also come from Croatia, Montenegro, Bosnia-Herzegovina, the Ukraine as well as the neighboring country Slovakia.

Josef Kautzner himself often travels to other European centers to help with catheter ablations that are required by patients suffering from severe heart arrhythmias. Recently he was in Linz, Austria and is about to leave for Bratislava, the capital of Slovakia, where on the following day he will treat three patients suffering from ventricular tachycardia.

Dynamic Changes

Whether coronary heart disease, heart failure, or left ventricular hypertrophy, many types of heart disease can lead to cardiac arrhythmias. When compared with ischemic heart disease such as acute myocardial infarction, Josef Kautzner sees atrial fibrillation in an epidemic development phase. In the Czech Republic one to two percent of the population is already suffering from this most frequent form of arrhythmia. Just how the developments have shifted can be seen, amongst other things, by the doctor referrals. Josef Kautzner explains: "We're capable of providing better treatment for acute situations; patients survive these far more often and have good prospects of reaching an advanced age. But this means that the frequency of atrial fibrillation is increasing. On the other hand, better therapeutic options are available, for example for hypertension and lipidemia, so that ischemic heart disease is on the decline." The number and type of operations are also unmistakable signs of the changes. "Some eight years ago, our interventional team performed around 1,500 angioplasties a year, today this lies at around 950," the cardiologist explains.

An opposite trend can be seen with catheter ablations. Also eight years ago, at IKEM 350 mostly conventional ablations were carried out annually. In comparison, today there are 850 ablation procedures a year, whereby now some 70 percent of

Professor Josef Kautzner, MD, PhD, is one of the leading international experts in the field of electrophysiology.

Josef Kautzner explains how the Artis zee Cockpit ensures an improved overview.

Professor Kautzner's team performes an ablation procedure in the new EP lab.

these are for complex cardiac arrhythmias such as atrial fibrillation or ventricular tachycardia.

The Era of Electrophysiology

During the phases that Josef Kautzner can look back on, the examination and treatment options have been significantly extended. More than 25 years ago at IKEM, the first implants were used on patients at risk of sudden cardiac death. Studies showed that an implantable cardiac defibrillator (ICD) can save lives. It was the start of a dynamic development phase in electrophysiology, followed by the introduction of cardiac resynchronization therapy (CRT).

"And now many ablation techniques are available to us; we are currently in the golden era of electrophysiology," states the physician.

Prerequisites and Challenges

What are the prerequisites for the medical success of electrophysiology; how did it become an extremely profitable specialized field? For Josef Kautzner it is clear that the development reflects the advent of novel technologies such as recording or electroanatomical mapping systems, new catheters, or implantable devices.

Then the introduction of the multislice Computed Tomography (CT) changed the way of working. "With atrial fibrillation, for example, we urgently needed imaging techniques that would show us the anatomy of the pulmonary veins. This triggered the boom of CT application and integration into mapping systems," the cardiologist reports. Now non-invasive CT imaging provides excellent images and the same applies to Magnetic Resonance Imaging (MRI). Here the late-enhancement technology provides an accurate representation of scar tissue and inflammation.

An imaging modality that has assumed great importance in the day-to-day work at IKEM is the intracardiac echocardiography (ICE). When physicians realized just how individually different the anatomy of the pulmonary veins is, they began to use ICE in 2003. This online imaging has significantly changed the workflow. In addition to the immediate feedback with respect to the anatomy, the technique also provides real-time information about tissue heating and possible thrombus formation and can noticeably improve the safety of transseptal puncture.

Overall, multimodal electrophysiology diagnostics lead to a situation where every actual condition can be determined with great reliability. At the same time radiation exposure can be minimized, which particularly with children is enormously important. According to Josef Kautzner, major diagnostic challenges still exist in being able to identify with greater accuracy patients with a high risk of sudden cardiac death. It is also still not known precisely how atrial fibrillation can be cured in multimorbid and older patients. Another important open question that relates to CRT: Is the effect of the resynchronization determined by the number of scars in the heart?

Fascinating Technologies that Help Patients

Multimodality and image integration are important prerequisites in order to be able to treat patients successfully. For this the cardiology team at IKEM uses the very latest technologies. An Artis zee® angiography system was only recently put

into service. Integral parts of the system are the latest features that improve navigation with the catheter, reduce exposure to radiation, and overall further increase the safety and success of the intervention. These include the MediGuide™ from St. Jude Medical for nearly radiation-free navigation, which operates in the C-arm of Artis zee. Using a magnetic field it senses the exact position of the catheter and projects its position in real time on a pre-recorded fluoroscopic cine loop. Now complex catheter ablations lasting up to six hours are possible, for which just a few minutes of fluoroscopy exposure suffices.
"We're very proud to be just the fourth center worldwide at which MediGuide is installed," emphasizes Josef Kautzner.
In the control room situated between the two catheter laboratories, the new screen-based workplace (Artis zee Cockpit) ensures an improved overview. In order to be able to call up a range of information such as hemodynamic results or various images from the intervention room or database, in contrast to the previous approach now all that is required are one mouse, one monitor and one keyboard. And with the system for remote navigation (Sensei X, Hansen Medical), situated on the right of the cockpit, the future has already begun.
"It is actually no longer necessary to consider which is posterior or anterior, but using the remote navigation system and software integrating it with electroanatomic mapping system, one moves the catheter intuitively in the desired direction – the concept of remote navigation works," verifies an impressed Josef Kautzner.
He assumes that the technology will lead to a standardization of the intervention inasmuch as, for example, a sensor measures the contact force of the catheter and the depth of the lesion.
This will mean that in future the workflow will be improved further. Even now it enables the radiation to be reduced since as soon as the mapping system provides the 3D geometry and the catheter is in the heart, fluoroscopy is no longer required.
At the conclusion of our visit, the Director of Cardiology at IKEM emphasizes that he is delighted to have been involved in the development of electrophysiology since the early nineties, and to see the advances in the diagnosis and treatment of arrhythmias. But in spite of his fascination with the field, he says he is not interested in every new technology since the decisive factor is that it helps the patients.

Matthias Manych, *a biologist, is a freelance scientific journalist, editor, and author specializing in medicine. His work appears primarily in specialized journals, but also in newspapers.*

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The 3D Revolution in Echocardiography

The Hospital Clínico San Carlos in Madrid, Spain, installed the ACUSON SC2000 ultrasound system in its echocardiography lab shortly after Siemens introduced the system to the market two years ago. While its accuracy, speed, and image clarity were impressive from the very beginning, physicians have also come to appreciate the ACUSON SC2000 system's ease of use and positive effect on workflows, as well as its potential to integrate future applications.

By Gregory Morley, PhD

For more than half a century, ultrasound techniques have been used to provide diagnostic information about the heart. Today, 3D ultrasound imaging has become increasingly widespread in certain specialties, such as obstetrics and gynecology, but most echocardiographers are still heavily reliant on 2D datasets – mostly due to the limitations of the heart being a dynamic organ in constant motion.

To acquire the huge amounts of data required to build up a volumetric image, echocardiography devices usually have to rely on a process where data from several consecutive heartbeats are consecutively added to provide an overall 3D image. Not only does this process take up valuable time, it also produces artifacts and other unwanted inaccuracies due to stitching because no one heartbeat is quite like the other, especially in patients with cardiac conditions.

The arrival of the ACUSON SC2000™ volume imaging ultrasound system has, however, taken volume imaging to a new level. In one heart cycle and without stitching or electrocardiography (ECG) gating, the system acquires the full volume of the heart at a 90-by-90 degree – including volumetric quantification of color Doppler, as well as the left and right ventricles. IN Focus Technology acquires and processes information at an unprecedented 2.88 Gigabytes per second, enabling never-before-seen detail and contrast resolution throughout the entire field of view. An advancement to the legendary ACUSON Sequoia™ coherent image formation technology, IN Focus Technology enables the user to focus on the entire field of view instead of a single focal zone revealing more clinically relevant information in one single image.

The ACUSON SC2000 system was launched in 2009. The echocardiography laboratory at the Hospital Clínico San Carlos in Madrid, Spain, acquired an ACUSON SC2000 system soon after its first release. The hospital has therefore been witness to the evolution of the system, from its initial versions to the latest,


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> "When you have semi-automated measurement systems, the computer will provide quantitative information to the physician."
>
> José Luis Zamorano, MD, Head, Echocardiography Laboratory, Hospital Clínico San Carlos, Madrid, Spain

most advanced and user-friendly versions. Applications such as the eSie Measure™ workflow acceleration package have considerably improved the acquisition and analysis process, and they have enabled reliable data to be generated semi-automatically.

Ever since they had access to the latest volume imaging technologies, physicians at the hospital in Madrid have been asking themselves how they could fully exploit the high-quality 3D imaging provided by the ACUSON SC2000 system in clinical practice. As Alexandra Gonçalves, MD, of the echocardiography laboratory at Hospital Clínico San Carlos puts it, "We are always looking for a better way of getting more accurate results in order to provide improved information to make our decisions."

Mitral Regurgitation: A Potential Application for 3D Technology

It is estimated that a least six million individuals in Europe and North America are thought to have some degree of mitral regurgitation[1], which represents a substantial caseload for echocardiography laboratories such as the Hospital Clínico San Carlos. Dr. Gonçalves reckons that at least 30 percent of the patients who pass through the laboratory suffer from some degree of this heart disorder.

One common method used by clinicians to estimate mitral regurgitation is the measurement of the vena contracta. This measurement is a 2D method in echocardiography which describes the smallest width of the blood flow jet. The more sophisticated and widely used proximal isovelocity surface area (PISA) method, based on 2D datasets, takes into account the entire cross section of the jet, but makes certain assumptions about the symmetry of flow. Says Gonçalves, "When 3D came along, we realized that 2D techniques were not providing an accurate picture of flow in mitral regurgitation – PISA is often not symmetric or spherical. With 3D techniques, the cardiologist has the opportunity to look at the flow in its real shape." There are certain situations in which mitral regurgitation flow is even more difficult to quantify, such as after placement of a mitral clip, where there may be two independent regurgitation jets. These are areas where 2D techniques are particularly prone to error, but where 3D techniques could, in principle, provide solid data. Siemen's new eSie PISA™ software provides semi-automatic quantification of PISA from volume color Doppler data to assess valvular disease.[2]

Gonçalves and her colleagues are working hard to validate these 3D techniques by comparing 3D results with other techniques such as magnetic resonance imaging (MRI) and cardiac catheterization. The latter two techniques may be considered the gold standard, but they have drawbacks in clinical practice; MRI is more time-consuming, not as readily available as ultrasound, and is also not indicated for all patients, while cardiac catheterization is invasive and uses X-rays. The initial results are promising. "If we use a tool that gives us a measurement of the mitral regurgitation severity, we must be sure that we are providing a correct number when we do the report," explains

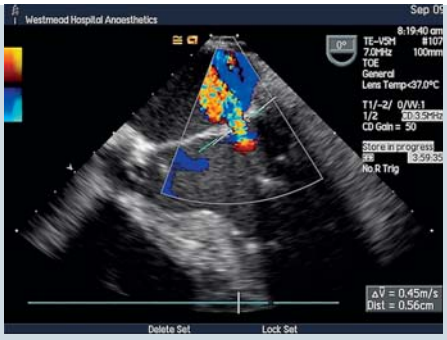
"We are always looking for a better way of getting more accurate results in order to provide improved information to make our decisions."

Alexandra Gonçalves, MD, Echocardiography Lab, Hospital Clínico San Carlos, Madrid, Spain

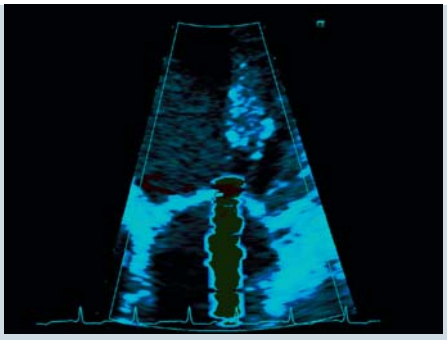
Gonçalves. "This is important because it might determine whether a patient is referred for surgery."

Towards Greater Objectivity

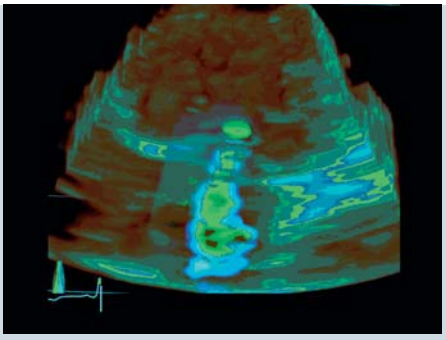
According to José Luis Zamorano, MD, Head of the echocardiography laboratory at the Hospital Clínico San Carlos, "Another important factor in favor of the 3D technique is that we have a huge inter-observer variability when using the 2D techniques. They require a number of subjective judgments that in principle will not be needed with 3D techniques, and you need to send the patient to someone who is really an expert. When you have semi-automated measurement systems, the computer will provide quantitative information to the physician." The complexity of the 2D calculations also makes them time-consuming to perform.



Vena Contracta Width: Prone to error in manual measurement and poor reproducibility. Limited by color Doppler resolution and system setting.



Assumption: 2D PISA assumes a hemispheric flow convergence, which is almost never the case. Generally results in severe underestimation of EROA in most cases.



Actual: eSie PISA. Free of geometric assumptions, calculates PISA on jets in any direction.

If a system is able to perform the greater part of tedious calculations, the cardiologists should be able to spend more time on other important tasks. However, as Gonçalves is keen to point out, "We believe that in the end, the echocardiographer always plays a crucial role. The way we do the acquisition and measurements requires training, and the person performing these tasks has to be an expert. We are, however, in a much better position if we have a system we can trust to give us results automatically without having to make assumptions about shape."

3D imaging of mitral regurgitation is still being validated. The echocardiographers at the Hospital Clínico San Carlos are aiming to present some preliminary results at the European Society of Cardiology this year. For the most part, they see the benefit of 3D echocardiography in determining left ventricular systolic function and in calculating ejection fraction. With the new eSie LVA™ volume LV analysis application, a 3D contour of the left ventricle is automatically drawn and ejection fraction data calculated. "[The system] can provide more accurate assumptions about left ventricular systolic function in asymmetrical ventricles, such as those with aneurysm," explains Gonçalves.

Looking to the Future

For the time being, 2D techniques "will continue to have their place in the daily routine, because they allow higher frame rates – which means that they keep up better with the heart's movements," concludes Gonçalves. Cardiologists are examining the potential of 3D imaging, particularly in situations where the numbers generated from 2D datasets require laborious calculations and – even more adverse – are based on assumptions that may not be generally true. In these cases, 3D imaging is expected to result in more reliable numbers and time savings. And the ACUSON SC2000 system is testimony to the advances in technology that show us that we can have it all: the entire heart. In 3D. And in real-time.

***Gregory Morley**, PhD, is a medical writer and journalist based outside Madrid. In his capacity as a medical journalist, he has attended more than 30 international medical congresses throughout Europe.*

[1] SWISS MED WKLY 2010; 140 (3–4): 36–43.
Lancet 2009 Apr 18; 373 (9672): 1382-94.
[2] Availability depending on individual country registration status.

Further Information
www.siemens.com/
echoinaheartbeat

The 2D technique requires the sonographer to make a number of subjective judgments. The one-beat-acquisition of the ACUSON SC2000 system helps to reduce inter-observer variability, increasing consistency and improving outcomes.

ACUSON SC2000 Ultrasound System – Technologies

The ACUSON SC2000 ultrasound system enables the acquisition of the complete heart volume in a single heart cycle and without stitching.

The ACUSON SC2000™ ultrasound system is the first echocardiography system on the market that offers instantaneous real-time 3D imaging of the heart. With this technology, in a single heart cycle and without stitching or ECG gating, the full heart volume can be sampled at a 90-by-90 degree angle and 16 centimeters depth at up to 40 volumes per second. Data on volumetric color flow are acquired and accurate volumes are calculated for the left and right ventricle.

New Paradigm in Image Quality

IN Focus technology, one of the latest enhancements to the ACUSON SC2000 system, delivers the same detail resolution across the entire image – from the near field to up to 16 centimeters depth – without sacrificing frame rates. An advancement to the legendary ACUSON Sequoia™ coherent image formation technology, IN Focus Technology enables the user to focus on the entire field of view instead of a single focal zone, revealing more detailed information in one image. By using the power of 64 parallel receive beams, IN Focus dramatically improves image quality at all depths to ideally display the cardiac structure, motion, and blood flow information for superior and efficient diagnostic imaging.

Semi-Automated Measurements to Reduce Exam Times

The ACUSON SC2000 system exclusively features the eSie Measure workflow acceleration package. This is the first application in the industry to provide fully automated measurements for routine echo exams increasing workflow efficiency as well as the reproducibility and quality of each exam. Customizable according to user or department requirements, eSieScan™ workflow protocols dramatically reduce the need for user interaction and the number of keystrokes during the imaging process. Exam workflows are improved on both the user level and in the entire lab. In addition, these protocols increase the consistency of results and ensure that exams are complete.

Harnessing 3D Data in Clinical Practice

In order to fully exploit the potential of the real-time 3D data generated by the ACUSON SC2000 system, Siemens has integrated a number of additional technologies. These include the knowledge-based eSie LVA (left ventricle analysis) application, which automatically draws the contour of the left ventricle. The application then compares the data acquired with results from a database containing thousands of clinical cases, and is able to automatically calculate ejection fraction and volume data in as little as 15 seconds, reducing exam time, increasing consistency, and improving patient care. Moreover, eSie LVA supports the standard American Heart Association segmentation, allowing standardization of exam protocols between computed tomography, magnetic resonance imaging, and molecular imaging. Unlike traditional 2D PISA, which is truly applicable only for a limited number of valvular pathologies, Siemens' exclusive eSie PISA™ software can be used on almost all patients with valvular diseases to assess valvular disease. The software computes the status of PISA and effective regurgitant orifice area (EROA), and the simple workflow delivers measurement of the EROA within seconds.

Precise Imaging Far Beyond the Basics

Every second, and often every millimeter, counts in the cardiac catheter laboratory. Physicians have to be able to visualize the state of the fine vessels with ultimate precision for diagnostic purposes and during interventions. And, as surgical invasiveness is reduced to a minimum, the necessary devices are being progressively miniaturized. The demands placed on modern angiography systems have increased in line with these developments. Professor Stefan Sack, a cardiovascular specialist and interventionalist based in Munich, relates his experiences of and plans for Artis zee.

By Matthias Manych

A rotablator is sometimes the only answer. Coronary vessel constrictions occasionally display such high-grade calcification that it is impossible to enlarge them with an angiography balloon. In these cases, a special guidewire is the only way to thread a diamond-tipped rotational catheter (with a diameter of a mere 1.2 to 2.5 millimeters) along the artery to the stenosis, which is subsequently opened at a speed of up to 280,000 revolutions per minute. Professor Stefan Sack comments: "This is just one of the instruments we use where excellent imaging is essential." The physician heads the Department for Cardiology, Pneumology and Internistic Intensive Care Medicine at the Schwabing Clinic in Munich, Germany.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Approximately 1,600 patients are treated in the clinic's two cardiac cath labs each year, which operate 24 hours a day to ensure that patients with acute myocardial infarctions receive immediate attention. This is normally necessary 10 to 15 times a week.

The angiography system selected for one of the two cardiac cath labs, a newly-built hybrid room, had to satisfy diverse requirements. On the one hand, physicians need a high-performance, flexible imaging instrument for acute clinical practice. On the other, the device must facilitate the further development of modern interventional procedures and completely new methods. Particular emphasis was placed on the following criteria: optimal image acquisition and post-processing; the variable, precise control of C-arm and examination table; customization options in line with physicians' specific requirements and the full technical integration of additional procedures. The choice fell on Artis zee®, which was commissioned by Professor Sack and his team in August 2010.

Improved Images with Reduced Radiation Dose

Stefan Sack on working with Artis zee: "The resolution is outstanding and the image quality excellent, despite the smaller detector." This flat-panel detector, which measures just 20 by 20 centimeters, was an important selection criterion, as space for treating acute patients with resuscitation technology is limited in the new cardiac cath lab. Here, a larger detector would impair the chances of achieving specific camera angles with the C-arm. The new, more powerful X-ray tubes have already proved that higher-resolution images are possible. This also pays off when it comes to screening adipose patients. According to Professor Sack, it is theoretically possible to operate Artis zee in high-energy mode, but this has proved unnecessary to date. On the contrary, the latest generation of high-tech C-arm systems is equipped with CLEAR and CARE technologies, which facilitate optimal image quality even in low-dose conditions.

These technical advances provide interventionalist Stefan Sack and his team with a broad spectrum of possible applications. CLEAR, a software package for improved image quality, further reduces image noise via filter algorithms. Additional algorithms provide for effectively compensated movement artifacts – a prerequisite for improving images of regions including the beating heart. It's all in the name with CARE, too. This software reduces exposure for examiners and patients avoiding unnecessarily high radiation doses. If, for example, a slim patient is screened, a corresponding low-dose program can be selected. Alternatively, the radiation dose is optimized by decreasing the number of X-ray pulses. Stefan Sack explains: "This is suitable for ventriculographic applications, that is images of the cardiac chambers, or for normal coronary angiography."

Precision from all Perspectives

He is impressed by his achievements with Artis zee. Firstly, progress is evidenced by sharper image definition and, secondly, by an overall quality improvement with simultaneously increased flexibility. As Stefan Sack reports, the individual technologies can be selected to meet specific requirements: "We have a special program for the coronary vessels and another for ventriculography. On the other hand, we can also customize device programming so that the projections run automatically, while the equipment's designated algorithms simultaneously provide optimal image quality and radiation reduction." This can be termed the personalization of image quality. In addition, the ergonomics – controlling the entire system via the touch screen, joystick and foot switch for example – have improved considerably, even enabling the rapid, precise positioning of the C-arm and examination table. In the new cardiac cath lab, full-body images are no longer a problem. Stefan Sack says: "It's necessary to observe the heart

from different angles in order to view and fully evaluate a stenosis."
This is where another special Artis zee feature comes into play: *syngo*® DynaCT Cardiac, which enables CT-like 3D reconstructions. After an injection of contrast media, the heart is displayed from all angles with a single rotation of the C-arm. The rotation takes just five seconds, and the 3D results can be superimposed over the fluoroscopy images in less than a minute.
Does the precision of Artis zee measurements bear comparison with another procedure whose accuracy is generally acknowledged? The modern C-arm facilitates vessel measurement via quantitative coronary analyses (QCA). Prof. Sack has compared the results with those of the intravascular ultrasound (IVUS), in which a tiny ultrasonic probe measures the vessel from the inside.
The results of both procedures tally very well. Examiners can see this on the system monitors, which display high-definition images of vessel edges and instruments in the sub-millimeter range in real time.

Faster Diagnosis and Therapeutic Decisions

The coronary angiography of a woman in her early seventies demonstrates the success of the progressive Artis zee system during a supposedly routine examination, in which the dispersion of the contrast agents aroused the surgeons' suspicions. Standard projections have just revealed a tiny deviation in the flow of contrast agent in the branch of the right coronary artery as it exits the aorta, whereupon Stefan Sack selects a 90 degree display angle. He rapidly identifies a high-grade stenosis and decides to treat it immediately. The vital coronary vessel is narrowed to such an extent that it initially requires enlargement via a balloon. When the stent is subsequently inserted, every millimeter counts. Focusing intently on the task at hand, the interventionalists follow their progress on the monitors. The small stent must be positioned in such a way that it extends 2 to 3 millimeters into the aorta from the artery and remains securely in place. After the intervention is

> “The resolution is outstanding and the image quality excellent, despite the smaller detector.”
>
> Professor Stefan Sack, MD, Head of the Department for Cardiology, Pneumology and Internistic Intensive Care Medicine, Schwabing Clinic Munich, Germany

concluded via radiographic monitoring, Professor Sack uses the fully-integrated IVUS system to check the results. Of the three screens opposite the examination table, the right-hand monitor clearly shows that both the size of the stent and its position are correct.
Summing up the intervention in the control room afterward, the physician comments: “The stenosis was located in a position which is easy to overlook.” The case effectively demonstrates the extent to which diagnostic accuracy and the reliability of therapeutic decisions have increased with Artis zee. According to Stefan Sack, the combination of improved imaging quality, sharper contrasts and higher resolution is like driving out of the mist into sunlight.

Innovative Basis

The central importance of imaging in the cardiac cath lab is emphasized once again in Professor Sack’s department. With its high-definition images and advanced image processing abilities, Artis zee optimizes standard examinations and interventions. However, this latest C-arm generation simultaneously constitutes the basis of further and even new interventional developments. Stefan Sack and his team are already using the system for percutaneous aortic valve replacement and mitral valve reconstruction. At the same time, the demands placed on imaging are increasing in line with the growing complexity of interventions. In a collaboration with Siemens, the reconstruction of the mitral valve function is being used to define what imaging still has to achieve. In Munich, 3D imaging with *syngo* DynaCT is already being used successfully in order to examine neck vessels. And Stefan Sack is planning a series of new projects with this feature: implantation of atrial appendage occlusion systems and therapeutic arteriovenous fistulas to treat patients with severe chronic obstructive pulmonary disease (COPD).

Matthias Manych *is a biologist, freelance science journalist and editor specializing in medicine. Among other topics, he writes about imaging procedures on a regular basis.*

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Minimally Invasive Aortic Valve Implantation Offers New Hope to Stenotic Patients

Since 2008, the Angiografia de Occidente cardiology group has performed 70 percutaneous aortic valve implantations. Siemens Artis zee imaging equipment is considered “indispensable” for the implants.
In Europe, the procedure is rapidly becoming standard practice for elderly patients unsuitable for open-heart surgery.

By Chris Kraul

Essential for the TAVI procedure is Dr. Antonio Dager's Artis zee system, which is equipped with *syngo* DynaCT Cardiac. It generates precise three-dimensional images that can be rotated.

The city of Cali in southwestern Colombia might not leap to mind as a hotbed of cutting-edge medical technology, but Dr. Antonio Dager and his Angiografia de Occidente clinic are in the vanguard of nothing less than a revolution in minimally invasive cardiovascular procedures that is being helped along by Siemens Artis® zee imaging systems.

Since March 2008, Dager and his associates have performed 70 transfemoral aortic valve implants (TAVIs), more than any other clinic in South America. In all cases, Artis zee® equipment was used to help diagnose the disease, usually aortic stenosis, and place the implants. Although not yet approved by the U.S. Food and Drug Administration (FDA), the relatively new procedure is rapidly becoming standard care in Europe, Canada, and Latin America for elderly stenotic patients with comorbidities who are not eligible for open-heart surgery because of their high-risk status.

Due to the relatively high volume of implants and Dager's success rate of 96 percent, his clinic was named in November 2010 to participate in a Medtronic-sponsored study of angioplasty centers worldwide that tracks the effectiveness of aortic valve implants. Medtronic is one of the principal manufacturers of the valves.

The nine Siemens imaging systems that Dager's clinic uses are "indispensable" for the 8,000 procedures – divided evenly between diagnostic procedures and angioplasties – that Dager and three other interventional cardiologists at Angiografia de Occidente perform annually at seven locations in Cali, Popayan, and Pereira.

Essential for the 45-minute TAVI procedure is his Artis zee system, which is equipped with *syngo*® DynaCT Cardiac for rotational angiography. It generates precise three-dimensional images that can be rotated, enabling him to see the aortic root from all angles. "It's better than life. It helps me pinpoint the exact place in the inferior portion of the aorta to align the TAVI device. At first there was a lot of mispositioning, but with DynaCT, results have improved significantly over the last three years," Dager said.

For pre-prodedural TAVI planning Dager also makes use of computed tomography (CT). With the Siemens SOMATOM®

With his team at Angiografia de Occidente in Colombia, Dr. Antonio Dager has performed 70 transfemoral aortic valve implants (TAVIs) – more than in any other clinic in South America. In all cases, Artis Zee equipment was used to help diagnose the disease and place the implants.

Definition CT scanner, he is able to precisely determine size, morphology, and position of the diseased aortic valve. Furthermore, the distance of the coronary ostia to the aortic annulus can be accurately assessed.

The Way We Have to See It

"Without this equipment, our work would be impossible. It can show with great definition the anatomy the way we have to see it," said Dr. Bernardo Caicedo, Dager's partner at Angiografia de Occidente. Adds Dager: "These systems are an extension of your senses, your mind, and your thoughts about the patient's condition. You can think out a case as you do the procedure, because the feedback and capture are instantaneous."

The systems also feature Siemens low-dose radiation technology that, for several reasons, makes the procedures significantly safer for patients and medical staff: Better images let Dager see organs and the progress of the guide wire more clearly, which reduces the time – and radiation – needed to make a diagnosis or place the implant. Advanced features like automated selection of filters, dose-free repositioning of collimator blades and table as well as low dose acquisition protocols reduce the exposure. The upshot is that a typical angioplasty now requires significantly less radiation than a typical procedure a few years ago. "Angiography systems used to disperse radiation indiscriminately in a cone-like path. Now, it is very targeted," says Dager. He speaks English with a faint Cajun accent, having spent some of his teenage years in New Orleans, where his father was Colombian consul. Dager's day starts at 7:30 a.m. and sometimes does not end until 10 p.m. if he has a "papa caliente" – Spanish for "hot potato", or emergency. On average, Dager performs ten diagnostic and interventional procedures per day, some lasting a few minutes, some up to three hours.

Among the 70 TAVIs he and his partners have done were eight U.S. patients who came to Dr. Dager's clinic in Cali at the insistence of cardiologists at the University of Miami Miller School of Medicine, with which Dager maintains close ties. The referrals usually come, he says, because the patients do not qualify for insurance reimbursement, and having the implant done at Angiografia de Occidente costs half as much as the cost of the procedure at a U.S. clinic.

A Dream Come True

Dager's relations with the University of Miami medical school date from 1985, when he was accepted as a four-year cardiology and hemodynamics fellow under the school's William J. Harrington Program for Latin American medical students and physicians. He cites the program as the source of much of his professional success and of his enduring passion for following the state-of-the-art in medical technology. By the time Dager began his fellowship in Miami, the Cartagena native had already spent a decade in general and intensive care practice in Cali after attending the Universidad del

"Indispensable", is Dr. Antonio Dager's verdict on the nine Siemens imaging systems that the Angiografia de Occidente clinic uses for the 8,000 procedures he and his team perform annually.

Valle medical school there.
But he had always hoped to specialize in cardiology, particularly after a beloved uncle died of aortic stenosis in 1974, when the diagnosis was a virtual death sentence. The Harrington fellowship helped him realize his dream. Upon his return to Cali in 1989, he founded Angiografia de Occidente with Dr. Caicedo, a close friend who was his chief resident during his internship in 1974.

Better Survival Rates

Dager also gets referrals because the results of the TAVIs are so compelling. Patients in their 70s diagnosed with aortic stenosis who receive the implanted valve have a 77-percent likelihood of surviving the first year and a 69-percent chance of surviving two years, results that are roughly similar to a Canadian study, Dager says. Those who do not receive implants have only a 50-percent survival rate one year after diagnosis and only 30-percent chances of survival after two years.
In their nearly four decades in medicine together, Drs. Dager and Caicedo say they have witnessed a demographic shift in patient population due to Colombia's modernizing and urbanizing population. "We're in the midst of an epidemic in dietrelated heart diseases. Lifestyles have changed from home cooking and daily siestas to more junk food and stress. As a result, we see lots more atherosclerotic and peripheral artery disease than we did 20 or 30 years ago. Stenoses get detected in patients' 40s and 50s instead of their 60s and 70s," says Dager.

Acceleration in Procedures Foreseen

That shift (which is in progress in varying degrees around the world), together with the growing success rate in TAVI procedures, is why experts are projecting a rapid acceleration in percutaneous aortic valve replacements in coming years.
The procedures have already taken off in Europe, where more than 20,000 TAVIs have been performed up to now, up from only 1,000 in 2007, Dager says.
He believes it is just a matter of time before the FDA approves TAVIs, and he has no fear he will lose patients from the U.S. On the contrary, with aging population, the need for aortic valve replacements will further increase, and possibly also among younger patients, who are more likely these days to receive implants via open-heart surgery.
"An FDA approval will give it the bona fides it needs, and worldwide demand will go up," Dager asserts.

Chris Kraul, *a former foreign correspondent with the* Los Angeles Times*, is now a freelance writer based in Bogota, Colombia.*

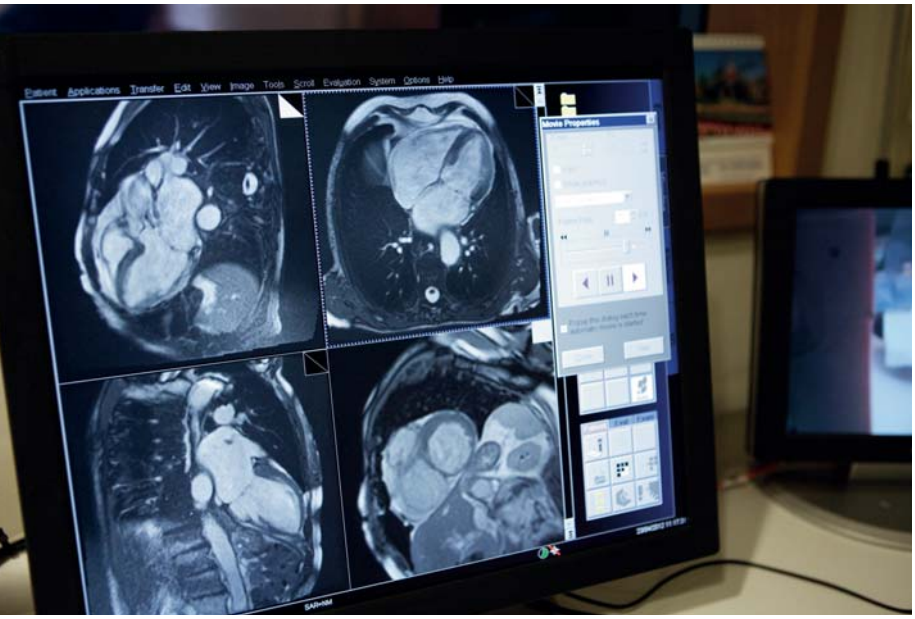
Getting to the Heart of Disruptive Technology

As experienced at Royal Bournemouth Hospital in the United Kingdom, some experts trained in traditional cardiovascular magnetic resonance (CMR) procedures become "incandescent" when told that CMR can be done more quickly and easily. But where there is ire, there is progress.

By Bill Hinchberger

To our 21st century sensibilities, air encephalography seems almost barbaric. The radiographic examination for brain tumors involved filling the intracranial cerebrospinal fluid spaces with air, normally introduced through a lumbar puncture. The procedure was made obsolete by CT scans. These days, nobody waxes nostalgic about air encephalography. But four decades ago, air encephalography had its champions. There was resistance to CT in hospitals where specialists had invested time and effort in becoming experts in this procedure. The medical profession likes to assure the public that it will always be open to better and less invasive technologies that benefit patients or save money, but it too has its share of Luddites. "Some people don't want to change," states Russell Bull, Consultant Radiologist at the Royal Bournemouth Hospital in the United Kingdom.

Russell Bull, Consultant Radiologist, Royal Bournemouth Hospital, UK.



Bull has witnessed similar kinds of resistance to the Cardiac Dot Engine, the new Siemens software that is revolutionizing the way Cardiovascular Magnetic Resonance (CMR) procedures are carried out. The Royal Bournemouth Hospital has become something of a showcase for the program – in part because physicians and staff at the hospital helped provide feedback and criticism that led to improvements in an early prototype. "It is not our job to sell the kit," says Bull's colleague Matthew Benbow, Superintendent Radiographer of the CT and MRI Department at Bournemouth. "I would hate to say that someone should buy it and have it not work for them. But some people who have come here have been very impressed."

Others not so much. "One guy told me that he was going to look at it but that it was rubbish," observes Benbow. Reminiscent of the reaction to the decline and fall of air encephalography, naysayers claim that their painstaking, hands-on modus operandi provides superior results. "They get incandescent when I say we can do it quickly and easily," says Bull. "They say that they do very few [examinations], but that they are perfect." Others might be less emphatic but still shy away from change. "Some are more open-minded, but it is like the guy who has always had a Ford Mondeo," says Benbow. "He always gets another Ford Mondeo."

Perhaps because his introduction did not come in Bournemouth, Davide Farina, MD, of the Department of Radiology at the University of Brescia Hospital in Italy, also had his doubts before his hospital acquired the Cardiac Dot Engine. "I was a bit skeptical at the start," he says. "I thought maybe we didn't need it because we had good radiographers. But I am highly impressed."

In some places, reticence is rooted in the economics of the health system. In the United States, for example, insurance companies tend to reimburse nuclear procedures at higher rates than MRI, creating a disincentive to using the latter.

Making the Case for the Cardiac Dot Engine

Despite these problems, more and more

visitors are heading to Bournemouth for a look. "If it did not work, they would just ignore it," says Bull.

One thing that hospital administrators cannot ignore is increased productivity. As the procedure is conventionally performed, technologists must manually set the scanning planes. Only a handful of them have sufficient training and experience to perform the procedure adequately, and even then they often need the radiologist at their side. By making difficult tasks easy and automatic, the Cardiac Dot Engine allows the technologist to work faster and more efficiently, potentially eliminating the need for an accompanying physician during the MRI. In Bournemouth, the hospital can now do three tests in a two-hour slot, up from two under the old system. And it achieves all of this for the same GBP 280 an hour (counting salaries, depreciation of equipment, etc.) that it costs to keep everything running, according to Benbow's rough estimate.

Dot stands for "day optimizing throughput" and the title describes exactly what the software does. It provides a smooth workflow to achieve top-notch results with fewer headaches in a shorter period of time. "It should be like a production line without the patient feeling like it is," says Benbow.

Hospital administrators also appreciate being able to reduce the amount of radioactive waste, with its licensing and disposal problems, that would otherwise be produced by alternatives to CMR. For patients, MRI means they avoid the side-effects associated with tests that use radioactivity. "We have completely replaced nuclear medicine" [in terms of cardiac examinations], says Bull.

Benefits for Both Patients and Medical Staff

Benbow and Bull agree that the test results are at the same level as those under the old system, so the main benefit to patients is that they are able to have an examination that may not have been available before. And their wait is shorter: They now get an appointment in two instead of the previous eight weeks.

Patients might not realize it, but the quality of the test also depends on their levels of engagement and, conversely, boredom. A quicker test means that patients are more likely to pay attention, cooperate and follow instructions, for example, by holding their breath at proper intervals, during the entire duration of the examination. "If people are in there for an hour and a-half, they get fed up," Bull notes.

There is one undisputed improvement in quality, as Benbow and Bull see it – and that is when it comes to follow-up tests. Under the conventional system, the technologist must manually reset the parameters once again during a follow-up. This leaves room for variations and thus affects the results. With the Cardiac Dot Engine, the automated system ensures greater standardization. "If there is no standardization, it cannot be better," says Bull. "Occasionally there are automated planes that might not be perfect. But you can do multiple views. You can add redundancy. You can do more."

With a greater volume of tests, radiologists must pump out more reports. But no longer are they forced to sit next to the technologist during the exam to make sure that the planes and parameters are right. "That used to take ages to set up," says Bull. "Now I use my time just reporting the results."

The Cardiac Dot Engine's ease of use has both significantly reduced the training time needed for technologists and increased the number of them who can perform CMR at Bournemouth. Under the conventional system, a radiographer had to make a serious effort to learn to do CMR, and perhaps only a couple of people on any hospital's staff would be qualified to perform the procedure. At Bournemouth, all 18 technologists can handle CMR cases, easing the pressures on administrators to juggle schedules or fill in for employees on sick leave. People also enjoy working with the Dot Engine. "We use the top-range software, and we use machines that are kind of special," says Benbow. "This helps with staff retention."

But nothing is universal. "When the technologists said this was great, some of them didn't realize some of the implications," says Bull. Appointments are now booked in 40 minute slots, with the actual examinations taking 22-25 minutes. "They have to work harder now," he adds.

Bull believes that the manually aligned CMR examination will ultimately go the way of air encephalography, relegated to the annals of medical history as an anachronism of an earlier, more primitive time. "Some people tell Siemens that they want the scanner but not the software," he says. "But we had some visitors from China, and they thought it was fantastic. They want to do things fast." The radiologist adds, "This is called progress. This is disruptive technology."

Bill Hinchberger *is a Paris-based freelance writer who has contributed to The Lancet, Science and other publications.*

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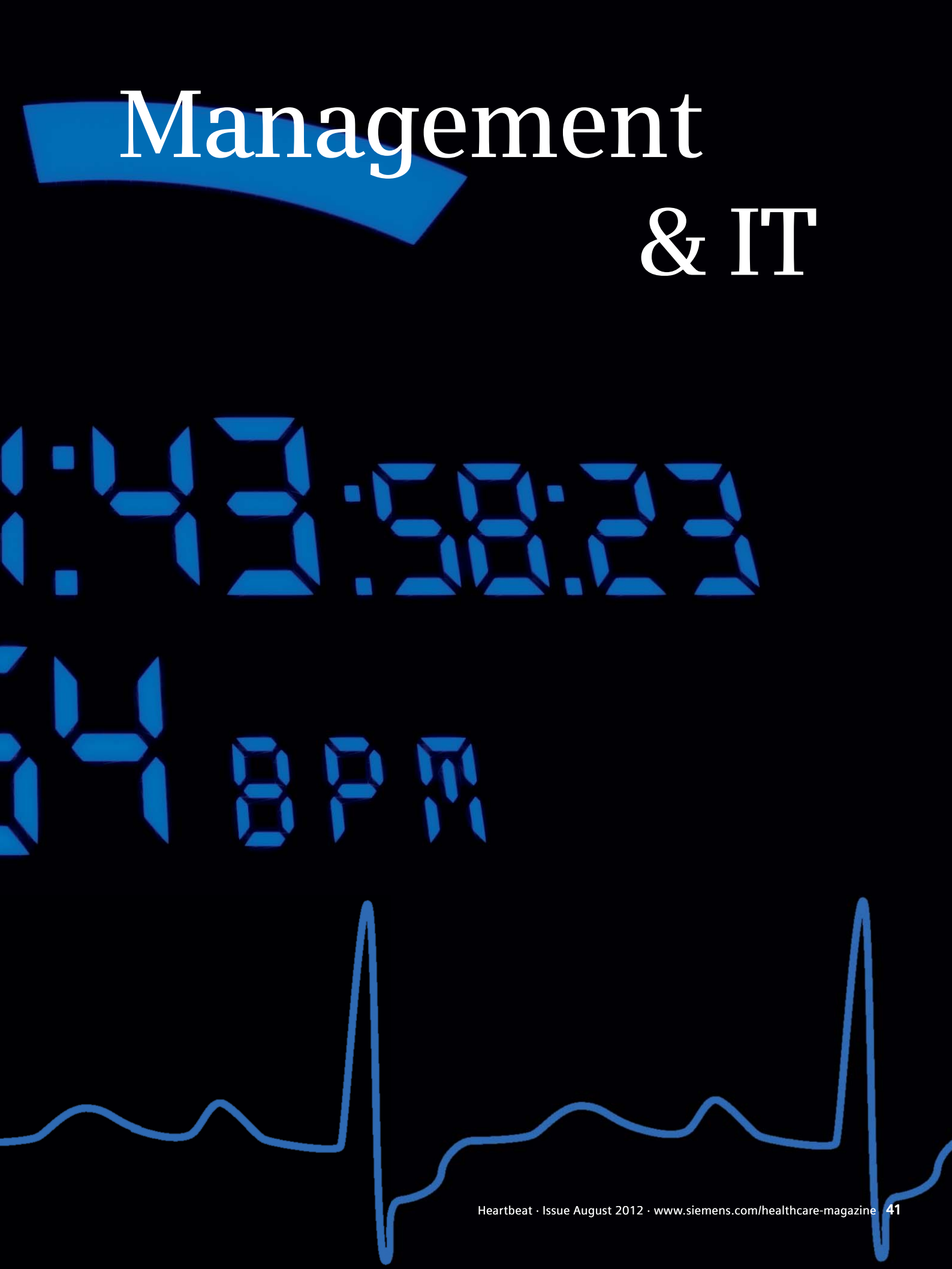

The Heart and Power of Imaging IT

In suburban Delhi, Medanta – The Medicity is leveraging the imaging IT trio of *syngo*.via, *syngo*.plaza, and *syngo* Dynamics to offer effective and affordable treatment of cardiovascular diseases.

By Swati Prasad

Medanta – The Medicity, a multi-super specialty hospital in Gurgaon India, near Delhi, was started by renowned cardiovascular and cardiothoracic surgeon Dr. Naresh Trehan in January 2010. Over the last 30 months, the hospital has earned a name for itself, with patients from across the country and overseas coming for treatment.

With Trehan at the helm, Medanta is particularly recognized for cardiology. "One of our key objectives is to offer a world-class healthcare facility in India, at affordable rates," says Trehan, Chairman and Managing director of Medanta – The Medicity.

Trehan adopted a two-pronged strategy to meet this objective. One, he hired the best doctors in the country. And two, he went for the latest technology. Medanta has some of the latest equipment, such as the dual source high-end CT SOMATOM® Definition Flash, Intra-Operative Imaging Operating Theater, 3.0 Tesla MRI, PET-CT and Digital X-Ray.

Medanta is also the first hospital in Asia to deploy the imaging IT trio of *syngo*®.via[1], *syngo*®.plaza, and *syngo*® Dynamics from Siemens.

Imaging is Key

"The imaging solutions help us diagnose, prognosticate and then plan the treatment for all kinds of diseases," says Dr. Praveen Chandra, Chairman, Division of Interventional Cardiology.

Imaging plays a key role in the diagnosis of diseases, including cardiovascular diseases. "For screening and early detection of coronary artery disease (CAD), the dual source CT is a God-sent tool. It has low radiation, and we feel comfortable sending patients for a CT scan," says Trehan.

Medanta is using the SOMATOM Definition Flash CT machine from Siemens that can capture the body's skeleton, organs, and blood vessels in the minutest of detail.

While the first stage is the acquisition of images through various source type machines, the second stage is the transport of images for post-processing and analysis, which plays a vital role in the diagnosis and treatment of patients.

New imaging applications along with technological breakthroughs in the imaging modalities have resulted in a sizable increase in image data volumes. With an increase in patient throughput and a rising demand to perform specialized procedures, there is limited time available to review and evaluate large image data sets.

Besides, considerable time has been wasted for the physical transport of images from the radiology department to the clinician.

"Earlier, doctors would listen to reports over phone and perform surgeries without seeing the images. This led to inaccuracies," says Trehan.

The imaging IT trio of *syngo* has addressed these challenges by making images available from multiple modalities to the point of care.

A Variety of Automated Tools

"If a hospital has to perform 100 angiograms, radiologists could take over a week to prepare the findings and reports. With *syngo*.via and *syngo*.plaza, radiologists are able to read cases and evaluate findings within a short span of time. They can share the cases with clinicians across the hospital, who in turn can evaluate and compare case findings," says Vivek Verma, Senior Marketing Manager, Healthcare IT – *syngo*.via and PACS, Siemens Healthcare India.

syngo.via is an advanced visualization software that enables clinicians to view, evaluate, report, and share radiological images in the manner that suits them the most.

The *syngo*.via software provides a variety of automated tools and processes to enable more efficient reading by the clinicians. For instance, through *syngo*.via, doctors can find out whether the patient is suffering from CAD or not. "If the CAD is at an early stage, cardiologist can work upon early reversal of the disease. For CAD patients, the right kind of therapy can be administered," says Trehan.

Praveen Chandra, Chairman, Division of Interventional Cardiology.

syngo.via also helps clinicians improve cardiovascular care as it equips them with comprehensive cardiovascular workflows and applications for evaluating images from multiple modalities. For instance, *syngo*.via's CT Cardio-Vascular Engine provides a dedicated workflow for CT TAVI (Transcatheter Aortic Valve Implantation) planning. TAVI is performed in patients with severely diseased aortic valve and a high risk of an open heart surgery. According to Chandra, Medanta is performing TAVI, and plans to step up such minimally invasive procedures.

In imaging IT, clinical workflows are tightly integrated with the Radiology Information System (RIS) and PACS infrastructure. PACS is a medical imaging technology which provides economical storage of and convenient access to images from multiple modalities. *syngo*.plaza is the agile Picture Archiving and Communications System (PACS) for the clinical routine. It enables efficient reading of clinical cases thanks to its fast loading performance and the wide range of useful and personalized reading tools. With *syngo*.plaza, images are accessible throughout the hospital, be it the operation theatre, the OPD or the laboratory. *syngo* Dynamics is a software solution that provides cardiologists and physicians with the necessary tools to access dynamic images along with multimodality images and clinical information. It also has tools that fully describe study findings and archive and distribute reports.

In cardiology, imaging software also helps identify viable myocardium. "Many times, patients with left ventricular (LV) dysfunction are abandoned as doctors feel they can't be cured," says Trehan. With imaging solutions, such patients can be treated by recognizing the myocardium that is hibernating and can be fixed. Knowledge about myocardial viability is very important for the management of patients with ischemic cardiomyopathy, as only viable myocardial segments will benefit from revascularization.

Medanta has four state-of-the-art cardiac cath labs and furthermore a fully equipped hybrid OR featuring the Siemens-unique Artis zeego.

At the Artis zeego hybrid OR, cardiologists can even perform surgical procedures for treating CAD patients during the angio-

Naresh Trehan, MD, Chairman and Managing Director, Medanta.

gram and angioplasty to improve the efficiency in patient care. In fact, angiography and angrioplasty can be performed at the same time at these cath labs. "This facility of Artis zeego hybrid OR was one of the first ones launched in Asia," says Chandra. Here too, solutions like *syngo*.via and *syngo* Dynamics play a vital role in determining the need for a particular cardiac procedure.

"Real-time transport of images is a great blessing," says Trehan. With instant availability of images such as an angiogram (through *syngo* Dynamics), doctors can discuss the disease with patients and their family. According to Chandra, ready access to images makes decision making a lot faster for both the doctor and the patient.

With integrated imaging IT solutions, there is little scope for misjudgments. "When angiograms are performed at the cath labs, we sit in our cabins and discuss whether an angioplasty is required or not," says Trehan, pointing to the workstations behind his desk, with live images from the cath labs.

Up to 20 Percent Cheaper

Faster diagnosis and treatment leads to higher throughput, making Medanta one of the busiest hospitals in and around Delhi. With more effective and speedier treatment, the hospital is able to draw more patients and spread costs across larger volumes. As a result, Medanta is known to be 20 percent cheaper than some of the other hospitals in and around Delhi, especially in the treatment of cardiovascular diseases.

"The imaging solutions give us a competitive edge over other hospitals in the region," says Chandra. The bigger factor, of course, is the skill-set. "The experience of all the doctors put together is hundreds of years," he adds.

[1] *syngo*.via can be used as a standalone device or together with a variety of *syngo*.via-based software options, which are medical devices in their own rights.

Swati Prasad *is a freelance business journalist based in Delhi. She reports from India for several publications overseas and has worked as a correspondent and editor for The Economic Times, Business Standard, The Indian Express and Business Today.*

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Innovations & Research

Navigating the Heart

Global Positioning System (GPS) technology provides the position of an object or a person on a map; the MediGuide™ Technology from St. Jude Medical is analogous to GPS but it determines the location of a device inside the body. This technology could change the way in which physicians track and navigate a catheter through the heart. Professor Gerhard Hindricks, MD at the Heart Center of Leipzig University in Germany and his senior physician, Associate Professor Christopher Piorkowski, MD, have explored this potential in interventional electrophysiology. Because in the treatment of arrhythmias, catheter ablation is often more effective than a drug treatment, this form of therapy has progressed rapidly in recent years. Crucial impetus has also come from the Department for Rhythmology under the direction of Hindricks. At approximately 100 centers in Germany, some 12,000 catheter ablations were carried out for the

Siemens Healthcare has combined the MediGuide Technology from St. Jude Medical in its Artis zee angiography systems. It is already being used at the Heart Center at the University of Leipzig in Germany. The MediGuide Technology determines the precise position of a catheter using magnetic localization techniques and projects it in real time onto a previously acquired fluoroscopy image. Hence catheters equipped with a sensor can be quickly and safely navigated through the heart without the necessity of constantly subjecting the patient to X-rays.

By Hildegard Kaulen, PhD

The combination of MediGuide Technology and Artis zee system leverages the precise navigation within the beating heart.

treatment of atrial fibrillation in 2011, of these some 10 percent alone in Leipzig. Together with the Cleveland Clinic in Ohio and the Mayo Clinic in Rochester, Minnesota, Hindricks' department is among the leading rhythmology centers worldwide. The cardiologist is one of the pioneers of catheter ablation and has been using this therapy since 1985. Hindricks and Piorkowski have been using the MediGuide Technology integrated in their Artis zee® system for the last eighteen months. Until just a few weeks ago, their department was the first and only center that had such an installation at its disposal. "We've always put our trust in high-end tools to help with our interventions, because the problems we treat can be very challenging," says Hindricks. The MediGuide Technology is a 3D electrophysiology (EP) catheter tracking system that is fully integrated in conventional fluoroscopy and which is registered with the mapping system. The

fluoroscopy space and the three dimensional electromagnetic sensor field used are carefully aligned. The systems no longer work independently, but rather together. “We’re dealing with a new tool,” stresses the cardiologist. Another special feature, according to Piorkowski, is the fact that the technology compensates for cardiac and respiratory motions. “Until now we were working on a moving organ using static images. Now we can even exploit the fourth dimension, since the movements of the patient are counterbalanced,” says Piorkowski.

Catheter Tracking Technology

In order to be able to integrate the MediGuide Technology, three components are required. The first are transmitters that generate a low-intensity (< 200 µT) alternating electromagnetic field and are integrated in the Artis zee fluoroscopy detector. The second component involved is a miniaturized passive single-coil sensor in the tip of the EP catheter, and the third is an electromagnetic field reference sensor attached to the patient’s sternum. The movements of the catheter are detected based on the voltage changes generated in the magnetic field. The exact position and orientation of the catheter is a function of its position in relation to the reference sensor that remains attached to the sternum throughout the whole of the intervention. In order to determine the compensation for the cardiac and respiratory motions, in addition to the reference sensor the real-time ECG derived from the heart is used. The fluoroscopy images, upon which the position of the catheter can be tracked in real time, are generated prior to the introduction of the catheter. It is based on two cine loops with a length of three heart cycles. They are prerecorded in the standard projections, e.g. right anterior oblique 30° and left anterior oblique 60°, but more projections can be taken if preferred by the physician.

Atrial Fibrillation, a Widespread Disease

Under what indications have Hindricks and Piorkowski used catheter tracking without continuous fluoroscopy up until the present time? “The prime indications are atrial fibrillation and ventricular tachycardia,” says Hindricks. “To date we have carried out around 150 procedures with the aid of the MediGuide Technology; 120 catheter ablations with a focus on atrial fibrillation, 20 interventions with ventricular tachycardia, and ten cardiac resynchronization operations.” Atrial fibrillation is an illness with increasing incidence. The cardiologist expands on this by saying that this is partially due to improved methods of detection but also to the fact that older people suffer from atrial fibrillation more frequently than younger people. Hence the incidence increases in relation to the increased age of the population. Piorkowski adds: “But we are also increasingly treating younger, lone atrial fibrillation patients. For example, the patient we treated this morning with a catheter ablation was born in 1961. He had tried out several antiarrhythmic drug therapies, all of which brought him no relief at all. Eight months ago we carried out an initial ablation and have now treated him for gaps in the electrical isolation. For him the catheter ablation is a potential curative therapy, since following the ablation of the remaining focal trigger he in all probability again will have a stable sinus rhythm, and this without medication.” According to Hindricks, this shows that innovations in medicine are not inevitably cost drivers. After all, through the potential cure of atrial fibrillation, considerable costs for drugs and other treatments can be saved. Hindricks therefore also welcomes the fact that the new guidelines for atrial fibrillation recommend that the primary catheter ablation of paroxysmal or persistent atrial fibrillation be used after only a few unsuccessful attempts at using drug therapy. He expects that

> "With the ablations carried out so far using the MediGuide Technology, we were able to reduce the exposure to radiation by half."
>
> Christopher Piorkowski, MD,
> Heart Center of Leipzig University, Leipzig, Germany

after their revision, the German guidelines will also contain such a Class 1 recommendation for this indication.

Personalized Ablation

What are the benefits of the integration of the navigation technology in Artis zee? "Fluoroscopy has clear limits," says Hindricks, "because it only provides a two-dimensional image of the beating heart and because it involves exposure to radiation. With the sensor-guided navigation of an intracardiac EP catheter, we reduce the radiation exposure and have a motion-corrected tracking system. This can also help us to personalize the ablation. After all, in the long term we want to move away from the 'one approach fits all' strategy. At present we are primarily carrying out circumferential pulmonary vein isolation in order to isolate this electrically since we know that for the majority of patients with atrial fibrillation this is where the focus of the irregular sinus rhythm lies. However, our objective is to achieve an electroanatomically guided, personalized ablation strategy." Cardiologists also see a great advantage in the reduction of the exposure to radiation. In the ideal case, only two fluoroscopy scenes would be required: at the beginning of the intervention and at the end to check on the success. Piorkowski says: "With the ablations carried out so far using the MediGuide Technology, we were able to reduce the exposure to radiation by half. The reason why we haven't achieved even better results is related to the fact that we still don't have an ablation catheter equipped with a sensor available to us because the CE Certification is still outstanding. At present we still need fluoroscopy in order to display the position of the conventional ablation catheter during the procedure."
Also, tools with MediGuide sensors embedded in them to facilitate the delivery of cardiac resynchronization therapy (CRT) are under development. "In the case of interventions for CRT, it has already been possible to reduce the radiation exposure to ten percent of the previous value," adds Hindricks. "This reduction not only benefits the patients but also his colleagues," he says, since during these interventions the radiation exposure for doctors and support staff is normally very high.

> "With the sensor-guided navigation of an intra-cardiac EP catheter, we reduce the radiation exposure and have a motion-corrected tracking system. This can also help us to personalize the ablation. However, our objective is to achieve an electroanatomically guided, personalized ablation strategy."
>
> Professor Gerhard Hindricks, MD,
> Heart Center of Leipzig University, Leipzig, Germany

A Treatment Platform

For what other types of interventions is the Artis zee system with integrated MediGuide Technology also suited? "We see the system as a treatment platform for cardiovascular illnesses, with electrophysiology being the first application," says Hindricks. "The system could be considered for all situations where devices have to be tracked in the body under X-ray guidance," adds the cardiologist. "I can well imagine that this system could also be used to implant heart valves, to deposit stem cells in the heart or to place special drugs in specific spots, such as in oncology. Ultimately the applications will depend upon what instruments are equipped with a sensor for navigation," explains Hindricks.
Will catheter ablation be safer with the use of navigation? "At present it is not possible to say exactly since the number of cases treated is too small – but we expect this to be the case," says Hindricks. However, a catheter ablation is no longer new territory today. It is a routine procedure with a measurable complication rate of three percent. The three key complications are thromboembolisms, a pericardial tamponade, which leads to a rapid fall in blood pressure, and the esophageal-atrial fistula following injury to the esophagus, that lies on the rear wall of the left atrium. Hindricks and Piorkowski advocate that catheter ablations should only be carried out in centers that possess the necessary experience and equipment and that have documented this through a certification process.

Dr. Hildegard Kaulen *is a molecular biologist. Following further studies at the Rockefeller University in New York and the Harvard Medical School in Boston, she has been working for prestigious daily newspapers and scientific magazines as a freelance journalist since the mid-nineties.*

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New Tools to Enhance Stent Visualization

With increasingly finer stent struts and patients and clinicians becoming more and more dose conscious, interventional cardiologists need a fast and easy way to assess proper stent deployment with minimum radiation. Ghent's Maria Middelares Hospital in Belgium has been selected as one of Siemens Cardiology's Clinical Test Sites for new features strengthening their Artis zee cath lab.

Kristoff Cornelis, MD,
Department of Interventional Cardiology, Maria Middelares Hospital, Ghent, Belgium

The Maria Middelares Hospital in Ghent currently performs approximately 1,000 PCIs per year, and the team has access to all contemporary interventional tools such as balloons, stents, rotational atherectomy, IVUS, etc. The clinical collaboration with Siemens has allowed Kristoff Cornelis, MD, interventional cardiologist, to use Artis zee's® new CLEARstent. We had the chance to visit Cornelis in his lab and we asked for a short interview. Here he shares his first experiences with Artis zee and CLEARstent.

Dr. Cornelis, why do you need stent enhancement software and what are its most important requirements?

I believe stent enhancement is a great asset when dealing with more complex lesions. It allows better recognition of stent morphology and behavior in bifurcations and long lesions where multiple stents need to overlap. Furthermore, it allows evaluation of stent expansion without additional use of contrast.

Dr. Cornelis, what is new about the CLEARstent feature you have worked with over the last five months?

Like IC Stent [Artis zee's previous stent enhancement feature], CLEARstent runs directly on the Artis zee system. It can be activated by using an organ program, where the system automatically acquires the images necessary for calculation, or by one click-activation via touch display. It can also be activiated via the Artis zee workplace for post-processing of pre-acquired scenes.
Depending on the presence of contrast agent, CLEARstent either shows the stent-enhanced image or automatically toggles between the stent-enhanced image and the contrast filled vessel. On the new software I especially like that automatic ROI selection ensures the visibility of the whole stent and not only the region in between catheter balloon markers.

What have your experiences been after using CLEARstent?

The current configuration allows for fully automatic detection of the balloon markers and automatic processing of the enhanced image. There is no need for offline adjustments.
I once had a bifurcation case where I planned to perform a V-stenting. The main vessel was already treated with a stent proximal in the carina. The distal stents needed to be inflated alternately. Before inflating the last stent, we performed a CLEARstent acquisition. Here we found that the distal stent was not overlapping the proximal stent, and the third stent was damaging the second. This allowed us to change strategy. We finally were able to get a full scaffolding of both branches and the carina, based on the CLEARstent acquisition.
I predict an even broader use of this technique, since it's so user friendly.

If QCA is used to measure vessel size and degree of stenosis, do you think CLEARstent can be of value to measure stent expansion?

Currently IVUS is used as a gold standard to measure stent expansion, but it's an expensive tool and sometimes cumbersome to use. CLEARstent allows a very adequate border detection, and when calibrated correctly might even replace IVUS in evaluation of stent expansion.

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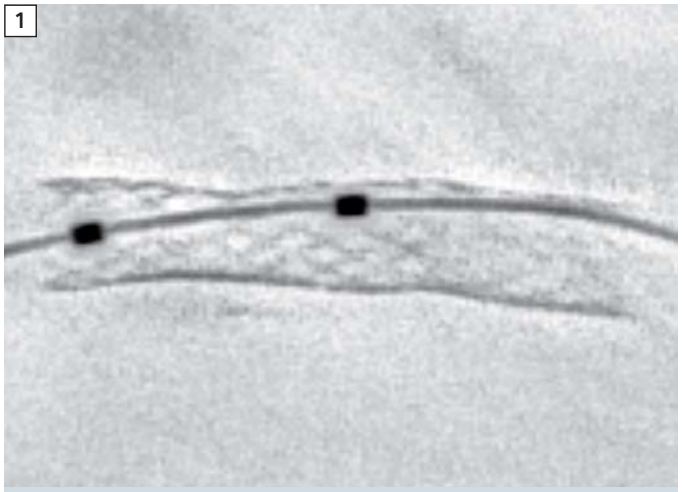
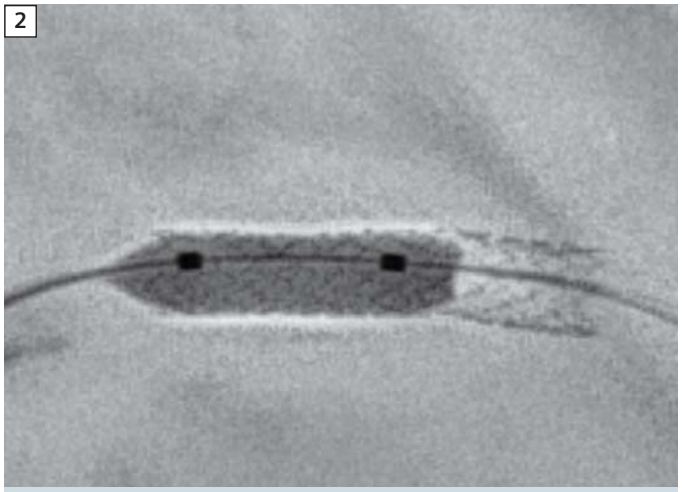
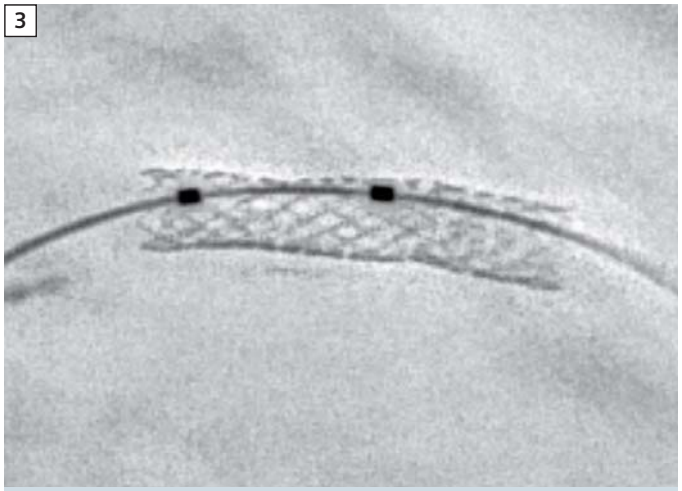


1 Unsufficient deployment of a stent



2 Post-dilatation with a balloon



3 Final expanded stent

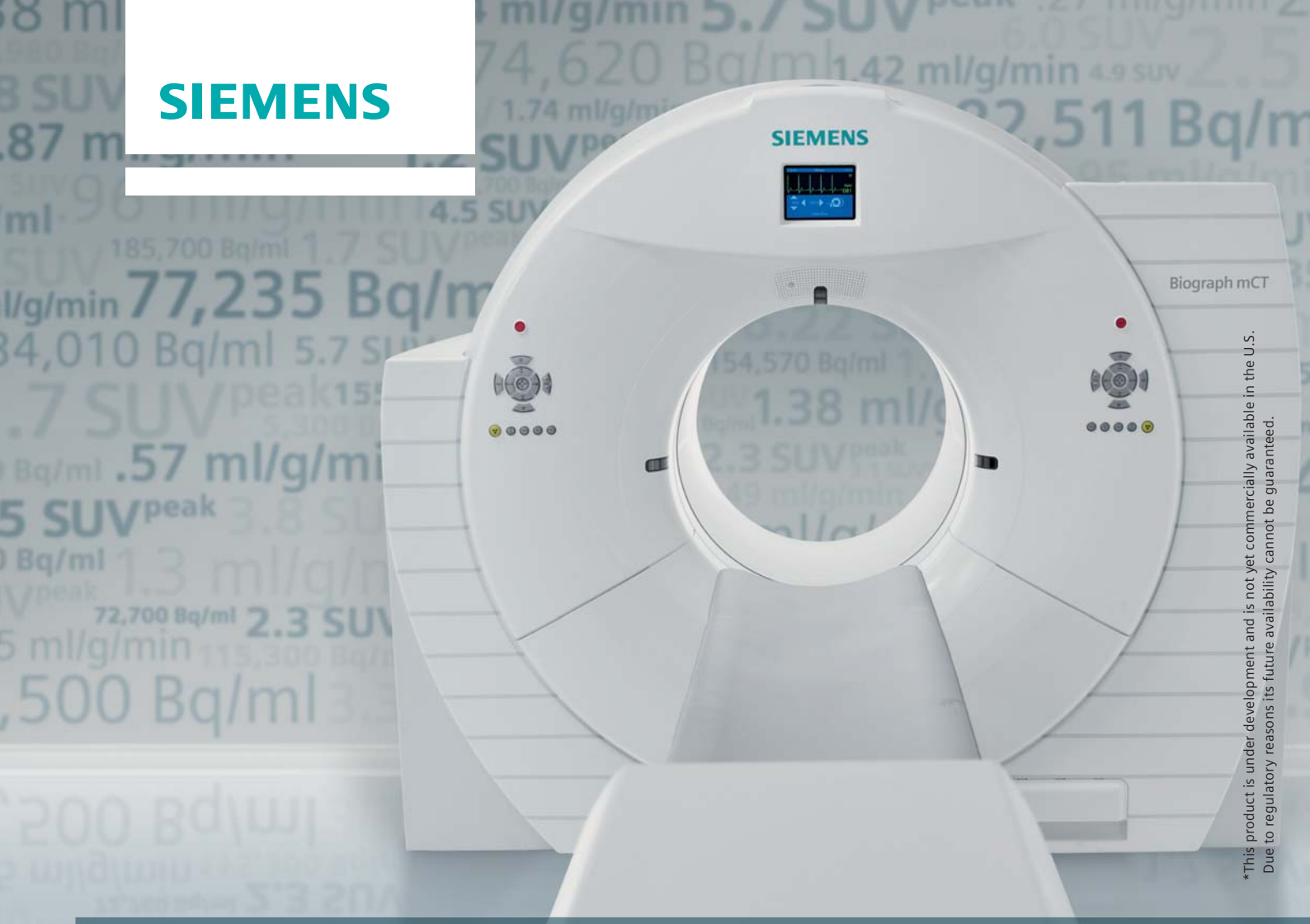
Technical Aspects

CLEARstent – Taking stent enhancement to the next level

- Automated 5-second acquisition or use of pre-acquired images
- Stent ROI to avoid cut-off images
- Simultaneous information of looped display and vessel (contrast flow)
- Live fluoro overlay for image guidance during complex procedures
- PACS compatibility for review of scenes using any DICOM viewer
- No separate workstation needed

The enhanced image or sequence is saved as a regular DICOM scene and can be manipulated accordingly, e.g. started, stopped, accelerated, decelerated, windowed or zoomed. It can also be stored to PACS to be reviewed on any DICOM viewer.

SIEMENS



*This product is under development and is not yet commercially available in the U.S. Due to regulatory reasons its future availability cannot be guaranteed.

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Pioneering Intelligent SPECT: IQ•SPECT Quickens the Pace of Cardiac Imaging

Being on the leading edge of patient care is nothing new for the University Hospital of the University of Michigan Medical School in Ann Arbor, Mich., USA. Two years ago, it became one of the first to implement IQ•SPECT technology from Siemens Molecular Imaging, not only taking SPECT•CT imaging to the next level, but also winning over both referring physicians and patients.

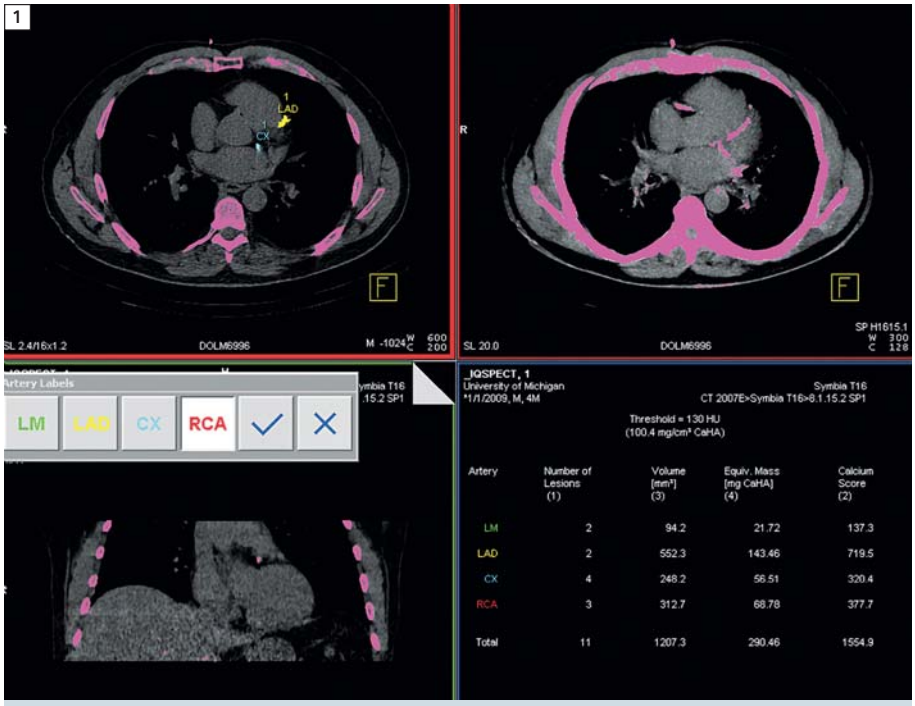
By Gina Narcisi

Study Proves Success

In a clinical study conducted by the University of Michigan, 54 patients indicated for perfusion imaging underwent 15- to 20-minute exams with a Siemens Symbia T16 SPECT•CT system and then with the same system for four minutes with the addition of IQ•SPECT.

The physicians found that, upon review, 33 of the 54 studies were rated of good or excellent quality from the traditional SPECT exams and 36 of the 54 studies received the same rating with IQ•SPECT. The study concluded that four-minute perfusion imaging with IQ•SPECT, compared to conventional SPECT•CT, provides comparable images in both quality and normalcy.

IQ•SPECT also boosts equipment utilization. While other systems provide quick cardiac imaging, most are dedicated cardiac systems that cannot be utilized for any other exam. "The Symbia T16 SPECT•CT system with the IQ•SPECT option permits the use of the same imaging system to perform conventional SPECT•CT nuclear medicine exams, and in a matter of a couple minutes, transform into a quick cardiac imaging system," says James Corbett, MD, director of



1 CT Calcium score study shows very high calcium score with extensive calcification involving all three coronary arteries.

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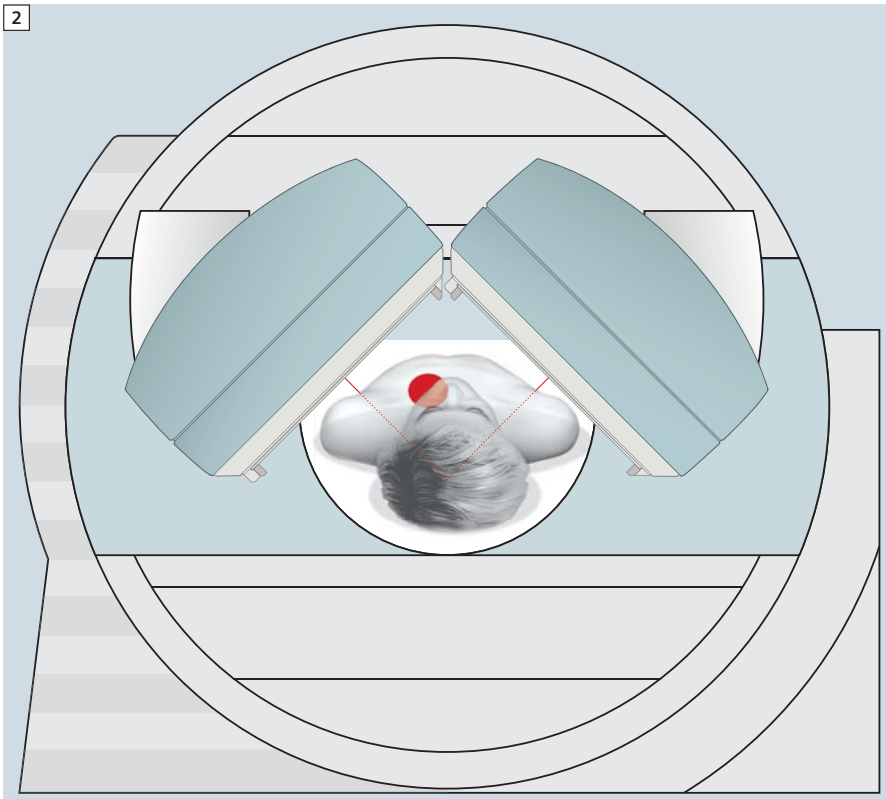
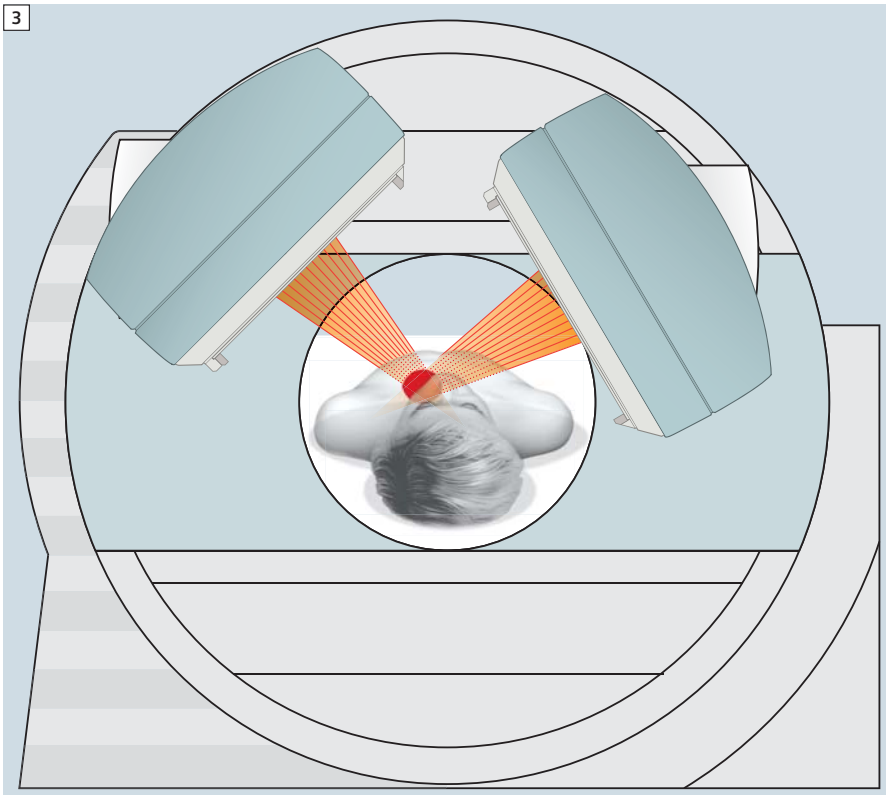


2 Conventional SPECT

3



3 IQ•SPECT

cardiovascular nuclear medicine within the department of Radiology, Nuclear Medicine Division of the University of Michigan Heath System. "The IQ•SPECT option offers a nice degree of flexibility."

Maximum Speed

IQ•SPECT can be used across most cardiac patient populations, Corbett says. However, he notes it is particularly advantageous for patients suffering from a history of heart failure or lung disease who may have difficulty laying flat for more than a few minutes. "To be able to get the whole SPECT exam done in four minutes is a huge advantage," he says.

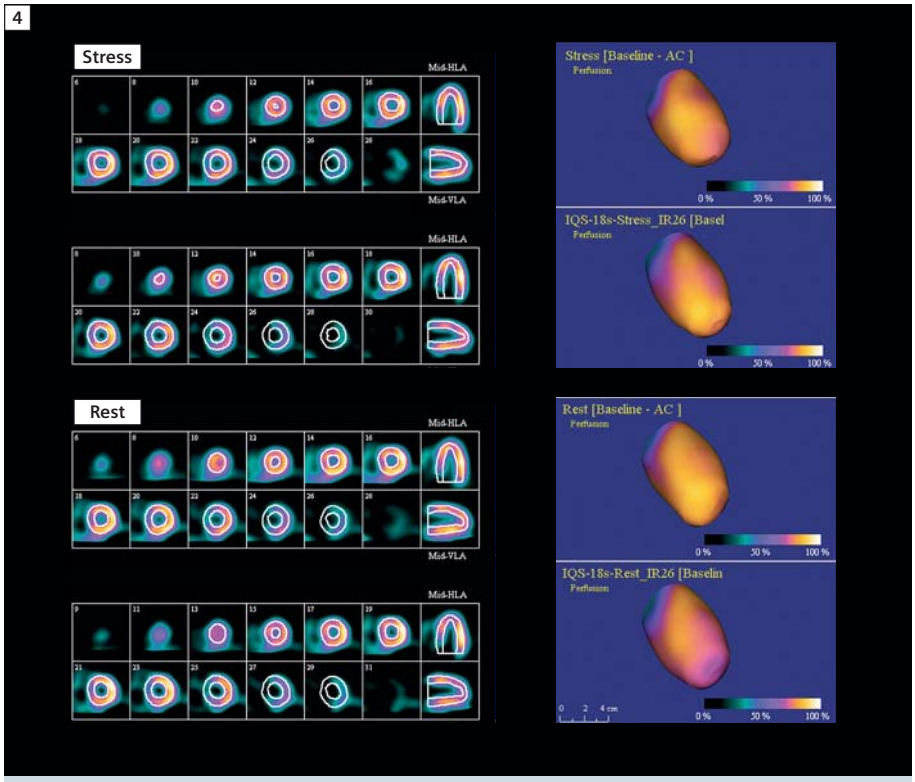
Referring physicians are appreciating the flexibility as well. "It opens up the possibility of referring patients who were unable to tolerate a conventional SPECT scan simply because they were too sick," explains Corbett. "To be able to do an entire study in five minutes for that kind of patient is really the difference between being able to do the study and not."

IQ•SPECT was designed with patient comfort in mind as well. While the position of the table remains the same, the head holder has been modified and the detectors are not as close to the patient as they are on a traditional SPECT system, which has made the offering more comfortable for claustrophobic patients.

"The patients like it a lot," Corbett notes. "We've gone through a long phase of dual imaging patients with both the conventional protocol and with IQ•SPECT. Certainly, the IQ•SPECT scans are far preferred by physicians and patients."

Minimum Dose

Patients undergoing an IQ•SPECT exam receive the same radiation dose in four minutes as patients undergoing a traditional 15- to 20-minute SPECT acquisition. However, a four-minute scan consists of only two minutes of data acquisition, with the remaining two minutes involving only gantry and detector motion. "If you extend the acquisition time by just two minutes, you have twice as much image data," Corbett explains. "Thus, if you use half the radionuclide dose and increase the image acquisi-



4 Myocardial perfusion SPECT shows normal perfusion during stress and rest.

tion time to a six-minute scan, you would have the same image statistics as a full dose exam."

The radiotracer dose can be adjusted based on the patient, he says. Healthier individuals who do not face the same limitations as those suffering from severe illness or claustrophobia can be given half the dose. On the other hand, the solution offers the flexibility for patients who have limited table time to be given the full dose and a shorter exam, achieving the same data as the patient undergoing a four-times longer exam.

Implementation and Utilization

IQ•SPECT was implemented on an existing Symbia T16 SPECT•CT system in the cardiovascular nuclear medicine laboratory at the new cardiovascular center adjacent to the University hospital. The initial mission was to shorten exam times for cardiac SPECT workups for patients who, because of illness, may have difficulty tolerating a 12-, 15- or 20-minute scan, says Corbett.

"Having the ability to do a scan of comparable quality in four minutes is an attractive solution," he notes.

While the imaging system is used for cardiac-related studies 95 percent of the time, it is very flexible and ready at moment's notice for non-cardiac studies and general nuclear medicine should the main nuclear medicine laboratory need additional scanning capabilities.

Intelligent Technology

Three core IQ•SPECT technologies, the SMARTZOOM collimator, cardio-centric acquisition and IQ•SPECT reconstruction, enable quicker exam times, better image resolution and lower injected dose.

Corbett sees the redesigned SMARTZOOM collimator as the key element to accelerated workflow and to reduced dose. The five-minute cardiac workup is the result of a four-minute acquisition of a full-count SPECT scan and one additional minute for CT-based attenuation correction and calcium scoring. Uniquely, the center of the field of view magnifies the heart, but avoids truncating images of the torso. This enables the collection of the maximum amount of information from the heart in a fraction of the time of a typical SPECT exam.

IQ•SPECT's cardio-centric acquisition uses the flexible gantry motions on the Symbia platform. It allows detectors to rotate around a virtual center of rotation that is positioned so the heart is always imaged in the most sensitive area of the collimator.

In addition to the cardio-centric collimators and acquisition, the IQ•SPECT 3D iterative reconstruction algorithm fully models the position of each of the 48,000 collimator holes. It provides distant-dependent isotropic (3D) resolution recovery, CT-based attenuation correction and energy window-based scatter correction.

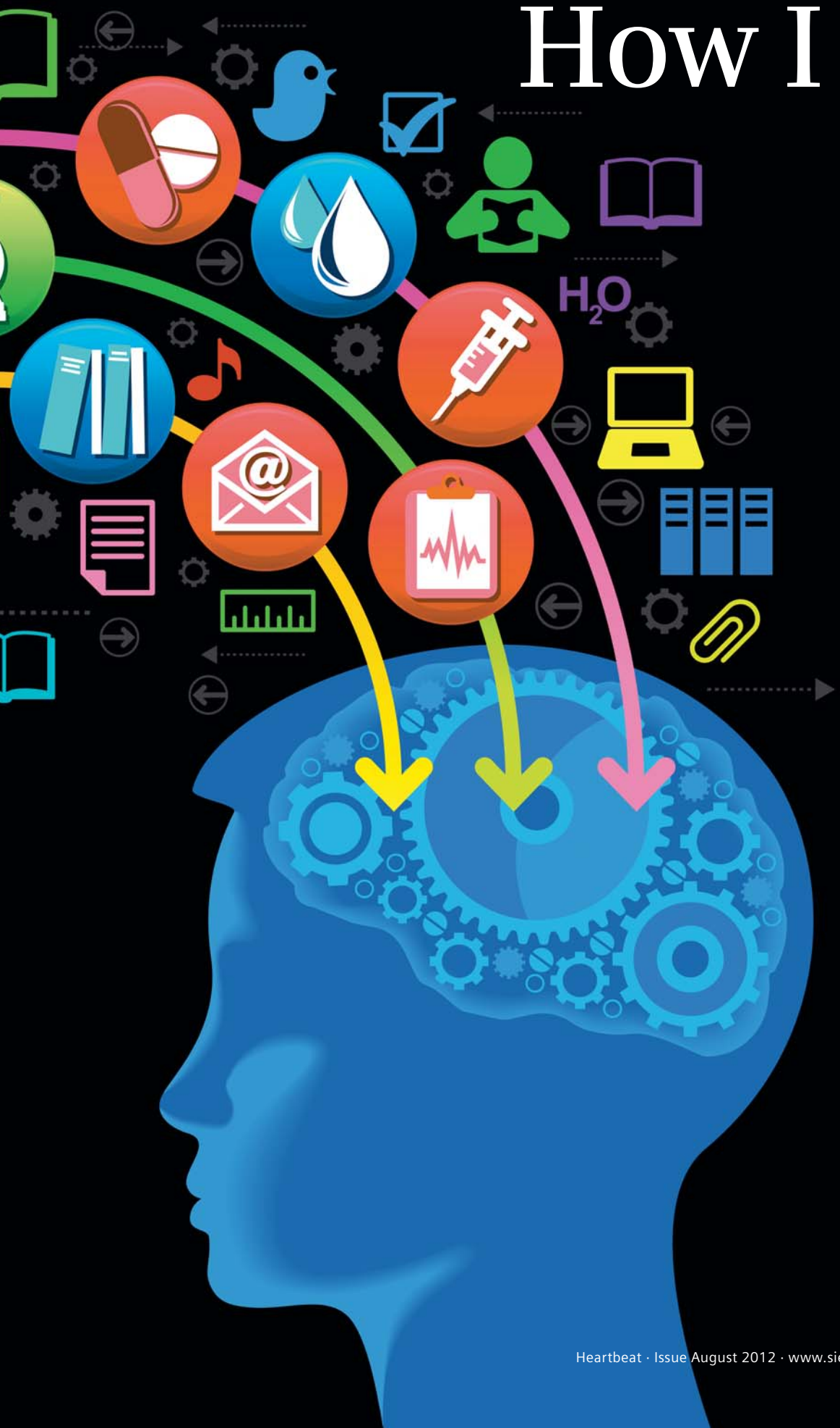
The intelligent technology also offers a robust semi-automated patient setup feature, which adjusts to identify the position of the heart via a touch screen monitor and optimizes gantry orbit definition for use within different patient populations, including average, bariatric and pediatric patients. This very sophisticated feature takes just 30 seconds to one minute to set up, Corbett says.

__Gina Narcisi__ is a medical writer focused on imaging and cardiology. She is based in Rhode Island, USA.

> "Having the ability to do a scan of comparable quality in four minutes is an attractive solution."
>
> James Corbett, MD, Director of Cardiovascular Nuclear Medicine within the Department of Radiology, Nuclear Medicine Division of the University of Michigan Health System


√123

How I do it



Accurate Placement of Aortic Valves

Supported by *syngo* DynaCT Cardiac

By Walters DL, MD[1], Crowhurst J., Chief Radiographer[1], and Aroney C., MD[1,2]

[1] Cardiology Department, Prince Charles Hospital, Brisbane, Qld., Australia
[2] Holy Spirit Northside Private Hospital, Chermside Qld., Australia

"We found that the use of *syngo* DynaCT Cardiac significantly reduces the overall contrast volume and radiation dose required for the TAVR procedures. It accurately determines the choice of valve deployment position."

J. Crowhurst, Chief Radiographer, Department of Cardiology, Prince Charles Hospital Brisbane, Australia

The emerging technique of Transcatheter Aortic Valve Replacement (TAVR) is offering treatment options to many patients who are ineligible for open heart surgery due to frailty and other co-morbidities.
The success of this procedure is greatly dependent on the alignment of the valve prosthesis in the aortic root. The valve must be profiled perfectly perpendicular to the X-ray beam before deployment. This requires multiple aortograms being performed, which is time-consuming, inaccurate and uses significant contrast media volumes.
Performing a pre-operative or peri-operative CT scan can demonstrate the correct C-arm angle for placement of the valve. The cardiology team at the Prince Charles Hospital has compared the effectiveness of pre-operative CT against peri-operative C-arm CT for these procedures.

Method

Patients enrolled in the TAVI program were separated into two groups. One group was studied with pre-operative CT scans and the other underwent peri-operative C-arm CT (*syngo*® DynaCT Cardiac). Predicted C-arm angulations from both groups were decided using Siemens *syngo* InSpace 3D software.
In all cases, the Artis zee® system was positioned using the CT scan's predicted angle. An aortogram was performed to confirm the accuracy of the predicted profile. Total contrast volume was noted for the revalving procedure including contrast required for the *syngo* DynaCT Cardiac.

Comments

In the pre-operative CT group, the correct C-arm angulation was demonstrated in less than 30 % of cases, versus 93 % of cases where *syngo* DynaCT Cardiac was used to determine the angle. Initial findings show the average re-valving procedural contrast volume for the pre-operative CT group was 285 cc, versus 210 cc for the *syngo* DynaCT group. As a comparison over the combined CT + re-valving procedure, the total contrast volume for the pre-operative CT group was 335 cc, versus 210 cc for the *syngo* DynaCT group.
Not only does the use of *syngo* DynaCT Cardiac result in the reduction of contrast required, it importantly also allows us to achieve a significant reduction in radiation dose. Indeed, through the entire assessment and intervention the amount of dose per patient was reduced on average from 255.5 cGy with a pre-procedural CT to 214.2 cGy when *syngo* DynaCT Cardiac is used instead.

Conclusion

The treatment with peri-operative C-arm CT with *syngo* DynaCT Cardiac significantly demonstrates a more precise angle of the C-arm when compared to traditional pre-operative CT. As the use of contrast media is critical for patients suffering from renal impairment, the use of *syngo* DynaCT Cardiac indicated to be the system of choice as less contrast media and radiation dose was delivered in comparison to pre-operative CT.

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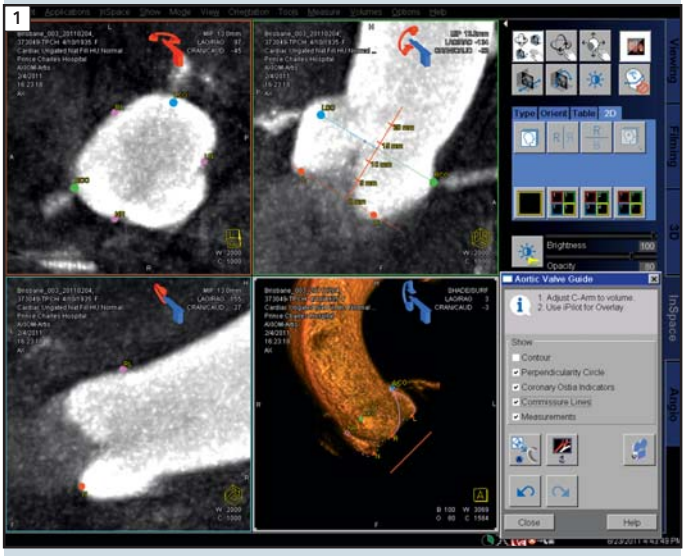
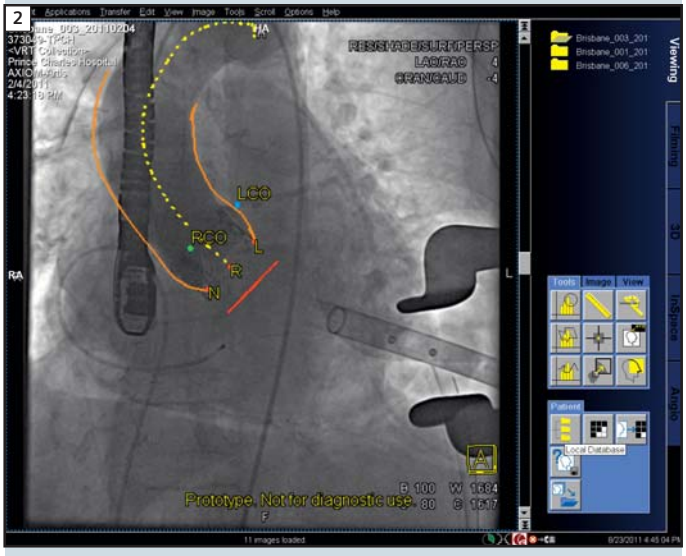
"Due to the increased accuracy of valve placement with *syngo* DynaCT Cardiac, this technique has become an integral part of all of the TAVI cases within our hospital."

Darren Walters, MD, Director of Cardiology,
Prince Charles Hospital Brisbane, Australia



1 Aortic root segmentation result based on *syngo* DynaCT Cardiac 3D Volume.



2 Overlay of anatomical information and landmarks onto live fluoro for image guidance during valve positioning.

Left Atrial Appendage Occlusion

Supported by *syngo* DynaCT Cardiac

By Harald Johannes Rittger, MD,
II. Medizinische Klinik, Klinikum Coburg, Germany

Case 1

Patient History

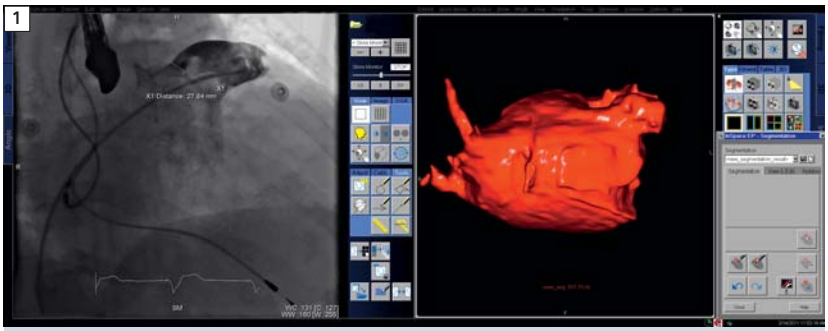
Her overall condition forced the decision for closure of left atrial appendage. 79-year-old female with coronary artery disease. The patient has a history of coronary artery disease and a reduced ejection fraction of 35 %, diabetes mellitus, hypertension, atrial fibrillation since November 2005. Ten months later the patient developed ischemic stroke and she underwent coumadin therapy. In the following month she suffered from an acute brain hemorrhage and therefore oral anticoagulation was contraindicated.

Diagnosis

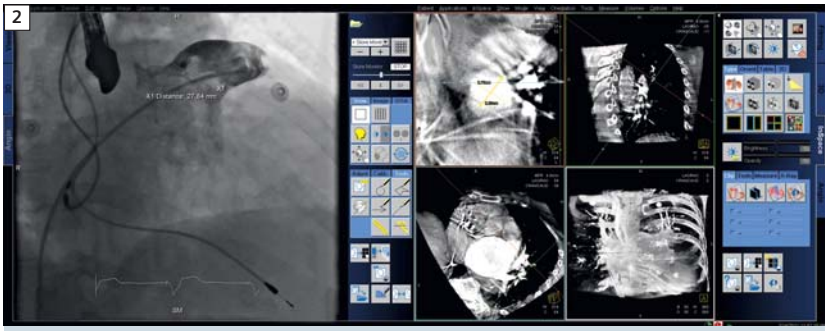
Her overall condition forced the decision for closure of left atrial appendage.

Treatment

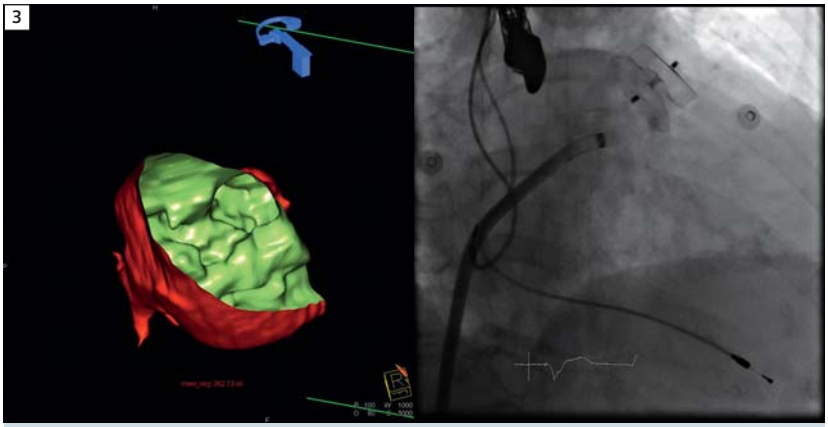
- Estimation of the pulmonary transition time with test injection of 20 cc contrast media (flow 20 cc/sec.) into the main pulmonary artery measuring the time to the appearance of CM in the LA by overview acquisition angiography.
- Rotational angiography in inspiration breath hold along a circular 198° arc (99° RAO to 99° LAO) in 5 sec. with the C-arm system.



1 Side by side display of angiography and segmented left atrium.

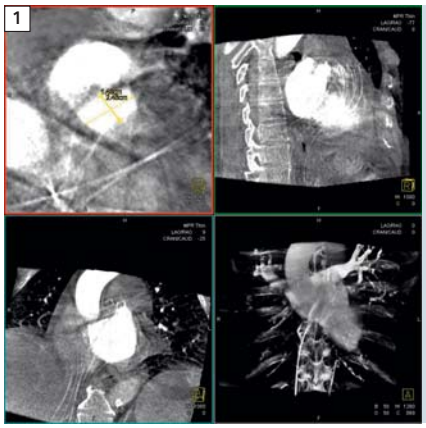


2 Quantitative measurement of the size of the left atrial appendage.



3 Mesh clipped inside view of the left atrium towards the ostia of the left atrial appendage.

- Image acquisition with administration of 80 cc of CM into the main PA with a standard pigtail catheter (flow 15 cc/sec.) using a large focus with preferred 70 kVp, automatic exposure control, system dose 0.54 µGy/pulse. Collection of about 250 projection images data at 60 frames/sec.
- Device implantation: Successful closure of the LAA with an ACP Occluder (Amplatzer™ Cardiac Plug, 28 mm) after transseptal puncture.



1 Quantitative measurement of the size of the left atrial appendage.

Case 2

Patient History

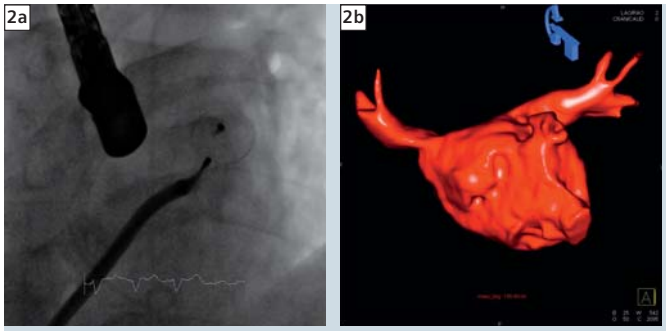
81-year-old male. The patient has a history of atrial fibrillation since September 2008. In the following year he developed ischemic stroke and allergy to coumadin therapy (tongue swelling) and hematuria.

Diagnosis

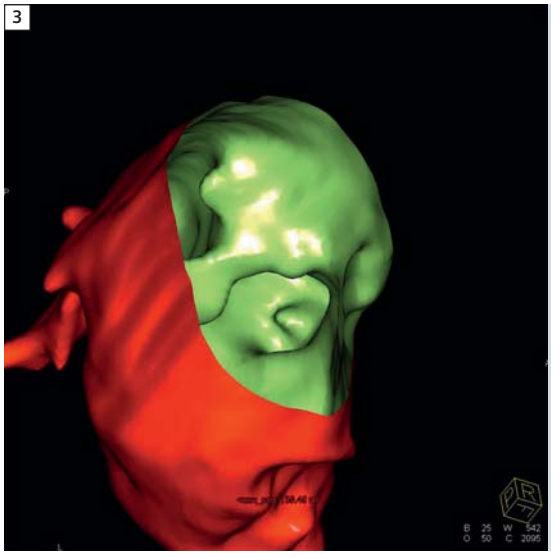
Decision for closure of left atrial appendage.

Treatment

- Test injection with 10 cc CM (transit time).
- Injection of 70 cc contrast (flow 15 cc/sec.) into the pulmonary artery.
- Rotational angiography (*syngo*® DynaCT Cardiac run) 5 sec. with radiation delay of 7 sec.
- Device implantation: After transseptal puncture, successful closure of the LAA with an ACP Occluder (Amplatzer™ Cardiac Plug, 24 mm).



2 Side-by-side display of angiography (a) and segmented left atrium (b).



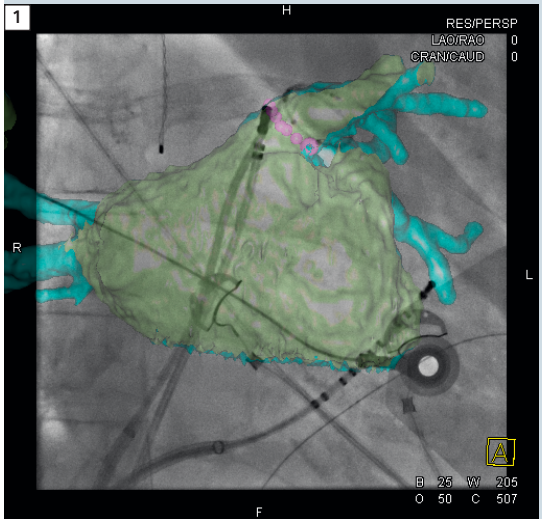
3 Mesh clipped inside view of the left atrium towards the ostia of the left atrial appendage.

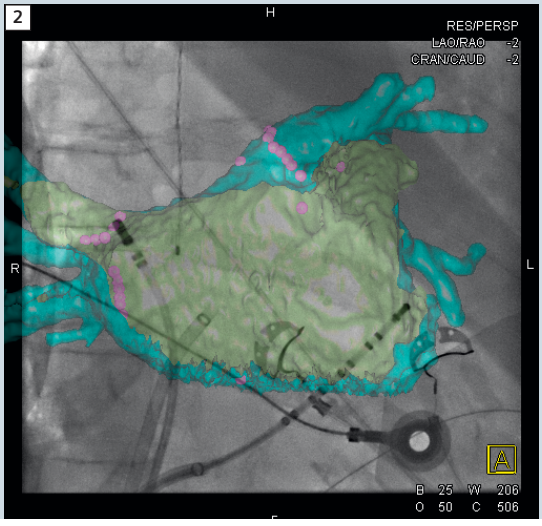
Overlay of MRI Images in Pulmonary Vein Isolation

MRI images help the electrophysiologist to understand the anatomy and plan the right ablation strategy for pulmonary vein isolations. The 3D image is superimposed onto the live fluoroscopy und improves the guidance of the catheter during ablation therapy in the EP lab.

By Rukshen Weerasooriya, MD

Radio-frequency (RF) catheter ablation of atrial fibrillation (AF) is highly dependent on an understanding of the complex and variable anatomy of the pulmonary vein (PV) – left atrial (LA) junction. While CT 3D fluoroscopic overlay technique has been previously described, we have investigated the use of magnetic resonance (MRI) image fluoroscopic overlay (with *syngo*® iPilot), which has the distinct advantage of lower exposure to ionizing radiation. Figure 1 demonstrates the antero-posterior view of the position of the circumferential mapping catheter and the ablation catheter in the left superior pulmonary vein. The fluoro overlay involves a surface model generated using *syngo*® InSpace EP and *syngo* iPilot.
Figure 2, on the other hand, offers a view onto the right pulmonary veins.
A decapolar catheter has been placed within the coronary sinus via a long curved sheath, and an esophageal temperature probe is also present. Using this technology, major aspects of anatomy such as the intervenous ridges, venous calibre, early branching, accessory veins, roof pouches and appendage position can be appreciated. The *syngo* InSpace EP software enables cross-sectional representation of the left atrial anatomy (Fig. 3); a type of "endoscopic" fluoro overlay view, as well as tagging of ablation points, shown as pink tags at the ostium of the pulmonary veins (Fig. 1 and 2).





1 Automated coregistration of 3D MRI of LA and pulmonary veins. Intra-procedural overlay during PV RF ablation.

2 Position marker of ablated region on MRI-based overlay during ablation of right inferior pulmonary vein.

Professor Weerasooriya, MD surrounded by his team.

"The ability to leave tags at ablation sites gives us confidence.
The clear demonstration of anatomical variants of the pulmonary veins is really important as there is no such thing as normal left atrial anatomy – variation is the norm."

Professor R. Weerasooriya MD,
Department of Cardiology,
Hollywood Private Hospital, Perth, Australia

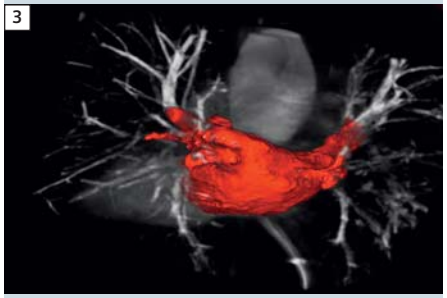
The MR images were obtained using a Siemens 1.5T Avanto scanner. All sequences were acquired during a breath-hold of 15-20 seconds. An initial test bolus is given to assess transit time to the left atrium. Left atrial morphology was acquired after injection of 0.2 mmol/kg of gadolinium-diethylene triamine penta-acetic acid (injection rate 3-4 cc/sec) and appropriate time delay using a Flash 3D sequence with axial imaging and voxel size 1.0 x 0.8 x 1.0 mm; TR/TE 2.91/1.1 msec; flip angle 25 degrees; FoV 350 mm; matrix 224 x 448.

Prior to the ablation procedure, a low dose five-second 3D rotational fluoroscopic imaging (*syngo* DynaCT) without contrast is performed with T6 to T9 in the field of image. Using *syngo* InSpace 3D/3D Fusion, the *syngo* DynaCT and MR data are displayed fused together. The bony landmarks of the vertebral column are used for alignment and registration of the MR data set to enable accurate image overlay. During the ablation, the segmented left atrium from the MRI is displayed superimposed on the live fluoro image using *syngo* iPilot.

The MR-fluoro overlay image, derived from the MR data set, is updated in real time to match the position of the angiography system, maintaining an accurate overlay. An internal view of the left atrium is obtained using clip planes. Ablation points can be recorded by placing a tag at the tip of the ablation catheter. The tags are shown as part of the MR fluoro overlay.

syngo InSpace 3D/3D Fusion, *syngo* InSpace EP, and *syngo* iPilot software have enabled rapid and efficient fusion of the MR and fluoroscopic images at Hollywood Private Hospital in Perth, Australia. Using this software, pulmonary vein isolation can be undertaken in a safe and effective manner. Studies are currently underway to carefully evaluate the success and complication rates as well as radiation dose using this novel technology further. Initial results of applying this new approach to MR-guided PV isolation on a group of 43 consecutive patients with symptomatic AF have allowed us to perform the entire procedure without an EP mapping system. Despite removing the dedicated electro-anatomical mapping system, cases are performed with similar fluoro time, radiation dose to the patient, and procedure time, while the preparation time has been reduced. A further improvement is the marked dose reduction to the operator performing the case as the low dose 3D acquisition can be performed with clinical staff out of the room.

3



3 Automated 1-click segmentation of the left atrium during ablation preparation

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SOMATOM Definition AS+ Scanning: Coronary Artery Anomaly

By Peter Wilson, MD, Department of Radiology, Northside Medical Imaging, Coffs Harbour, Australia, Robert Dittrich, Siemens Healthcare Australia and New Zealand

History

A 72-year-old male patient was initially referred to the hospital due to chest pain. Anomalous left main coronary artery origin was found on coronary angiography. The coronary anatomy was clarified in more detail with a retrospectively gated coronary CT Angiography.

Diagnosis

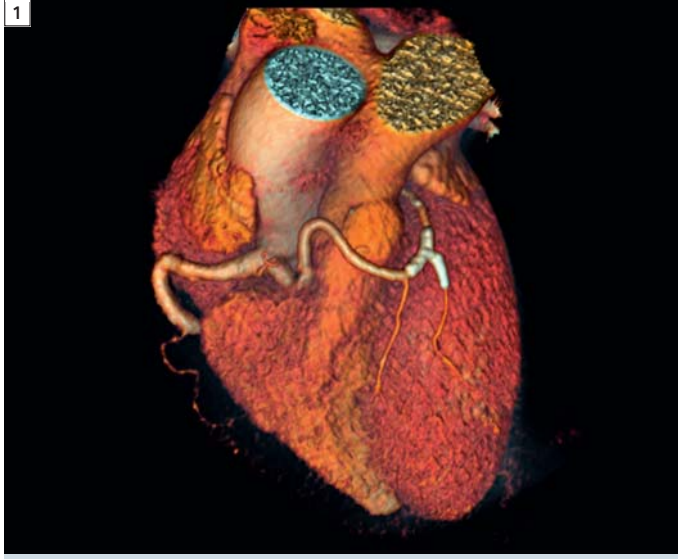
An anomalous left main coronary artery origin from the right sinus of Valsalva in conjunction with the origin of the right coronary artery was found with CT Angiography. The left main coronary artery subsequently had an unusual course anterior to the pulmonary trunk. Patent stenting in the left coronary artery was detected to pass the ostium of a second diagonal branch. A branch stent had been placed proximal of the second diagonal artery. Both stents were discovered to be patent. Small plaque formations were found in the coronary arteries elsewhere without significant stenosis. No infarction was visible. The left ventricular function (ejection fraction, EF) was detected to be normal (55 %) and the calcium score moderate.
Totally applied radiation dose including Calcium Scoring was 4.17 mSv (using the published conversion factor of 0.014 mSv/mGy cm).

Comments

Coronary artery anomalies are difficult to characterize on catheter angiography. CT coronary angiography is ideal to demonstrate the course of anomalous arteries and the anatomy of their origins. This helps in deciding whether the anomaly places the patient at higher cardiac risk or if it is a benign variant. An assessment of coronary stents is now feasible by this method. In this case the anomaly seemed benign. These complex stents were shown to be patent.

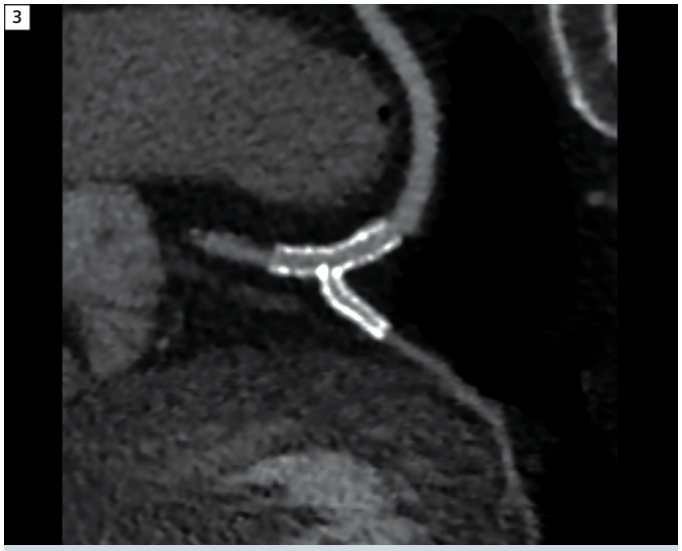
Examination Protocol

Scanner	*SOMATOM Definition AS+*		
Scan mode	*Coronary CTA*	***Effective dose***	*2.28 mSv*
Scan area	*Heart*	***Slice collimation***	*128 x 0.6 mm*
Scan length	*137 mm*	***Slice width***	*0.6 mm*
Scan direction	*Cranio-caudal*	***Spatial Resolution***	*0.33 mm*
Scan time	*7.87 s*	***Reconstruction increment***	*0.3 mm*
Tube voltage	*100 kV*	***Reconstruction kernel***	*126 / 146*
Tube current	*57 mAs*	***Contrast***	
Rotation time	*0.3 s*	***Volume***	*70 ml*
Dose modulation	*CARE Dose4D*	***Flow rate***	*5 ml/s*
$CTDI_{vol}$	*10.04 mGy*	***Start delay***	*Bolus tracking*
DLP	*163 mGy cm*	***Postprocessing***	*syngo 3D*

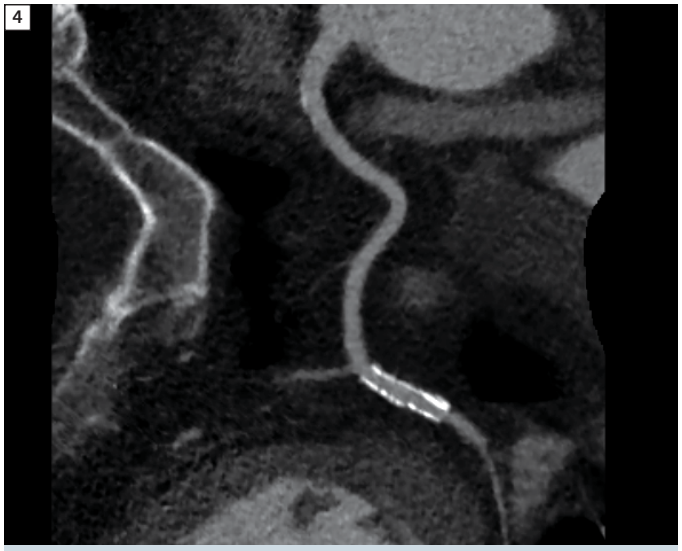


1 VRT overview showing the course of the left coronary artery (LAD).

2 VRT overview showing the distal right coronary artery (RCA).

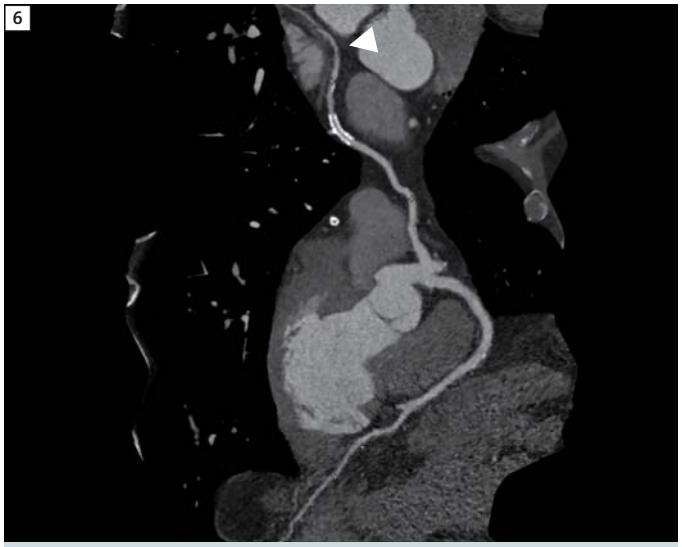


3 Curved multiple planar reformation of the LAD and diagonal branch displays two stents after bifurcation.



4 Patent in-stent lumen of the LAD stent was visualized by curved MPR.

5 MIP overview highlighting the common ostium of left and right coronary artery.



6 Curved MPR discovering the region from the posterior descending artery (PDA arrow) to the distal left circumflex coronary artery (LCX arrowhead).

Reference Sites

The Monaco Cardio-Thoracic Center (CCM) combines an interdisciplinary approach with cutting-edge technology such as the MAGNETOM Aera 1.5 T scanner for cardiac MRI.

“If you can’t see, you can’t treat”

The Monaco Cardio-Thoracic Center (CCM) is in many ways a remarkable clinic: whether pioneering in interdisciplinary collaboration or in the creation of the first hybrid operating room in Europe, it has always been at the forefront of medical and information technology evolution. For Siemens, the CCM is the first European Reference Center Cardiovascular Medicine.

By Irène Dietschi

While tourists stroll down Monaco's avenue d'Ostende to the port with its showy yachts and inviting restaurants, the Cardio-Thoracic Center (CCM), located on the very same road in a fancy nine-floor-building, is buzzing with quite a different activity on this bright afternoon in early August. On the fourth floor of the CCM, in one of the operating rooms, a surgery team is busy conducting a bypass operation. About half a dozen other patients on the same floor are recovering from their surgical interventions, supervised by watchful nurses.

On the third floor, a different team is performing the magnetic resonance imaging (MRI) and computed tomography (CT) examinations scheduled for the afternoon. An elderly lady glides through the gantry of the Siemens SOMATOM® Definition Flash, which takes hundreds of razor-thin pictures of her thorax and abdomen in just a few seconds. Not only has CT scanning with this system become much faster, it also exposes the patient to minimal radiation: less than three millisievert as opposed to ten millisievert in earlier-generation systems.

Next in turn is a six-year-old boy who has come here with his parents for a cardiac check. The boy underwent surgery on his heart at the CCM as a newborn, suffering from a transposition of the great arteries, a malformation which the doctors had detected prenatally. All is fine, the brave little chap and his parents are informed right after the CT scanning procedure is over.

In the room adjacent to the observation area, an 87-year-old male patient undergoes cardiac MRI, surrounded by the wide opening of the latest MR 1.5 T scanner, a Siemens MAGNETOM® Aera. The room has a window which allows the patient to see the blue Monacan sky from the stretcher. The sunlight softens the cool blue light around the system. Along with the high level technology, such soft factors and the good preparation of the patient are vital for the outcome of the examination, explains Dr. Stéphane Rusek, Head of IT Infrastructure and Medical Technology at the CCM.

Siemens European Reference Center Cardiovascular Medicine

The Monaco Cardio-Thoracic Center is an autonomous 40-bed hospital devoted to thoracic and cardiovascular diseases. Built at the end of the Eighties, its aim has been to enable permanent and international teams of doctors to accommodate patients from the Mediterranean region as well as from other European countries. With more than 2,500 catheterizations and nearly 1,000 cardiovascular surgeries per year, the CCM has a respectable activity, including interventions such as percutaneous treatment of congenital malformations, aortic valve replacement, and vascular endoprosthesis. Moreover, the CCM is the first Siemens European Reference Center Cardiovascular Medicine. How this came to be is a story in itself, strongly linked with the origins of the center.

"The concept of this center is to provide a complete facility for all thoracic pathologies, open for pediatric as well as adult patients, a facility which is not divided into different departments but which is characterized by a close interdisciplinary collaboration of all the participants," explains Prof. Vincent Dor, the founder of the CCM. At the end of the Seventies, he and his colleagues originally had in mind to build several such institutions in Europe. However, thrown back by the strict regulations in other countries, Prof. Dor ended up in Monaco, where Princess Grace and – after her death in 1982 – her husband Rainier III, Prince of Monaco, were strong promoters of the idea.

The collaboration with Siemens started as early as 1985. "After all the costs had been calculated, we suggested to three big companies to become partners," recounts Prof. Dor, "but Siemens was the only one which agreed. That was the

CT scanning redefined: apart from being much faster, the Siemens SOMATOM Definition Flash also exposes patients to minimal radiation.

In 1987, Siemens and the CCM teamed up to build the first hybrid operating room in a European cardiovascular center.

beginning of our partnership." Siemens then financed the whole equipment on a leasing contract over seven years. In 1987, the CCM started to treat patients and has been prosperous ever since, which is one reason why the partnership with Siemens became more prominent. Prof. Dor: "Our establishment as Siemen's Reference Center is a major step in our goal to advance the complete medical and surgical treatment of all thoracic and cardiovascular disorders." With a staff of 220 employees, including two permanent surgeons, three permanent cardiologists, two permanent anesthesiologists, and one engineer, the CCM is able to manage more than 5,000 hospitalizations per year.

At the Forefront of Technological Evolution

"In order to perform good cardiology and cardiac surgery you must have the best imaging possible," Prof. Dor explains. "It is the autopsy of the living." The CCM has always moved at the forefront of technological evolution, providing cross-modality analyses and equipping its operating and diagnostics rooms with the most advanced systems available – not all, but most of them by Siemens. "Siemens and other companies are now mandatory in our activities," says cardiologist Dr. Filippo Civaia, who happens to be the first cardiologist in France to have been certified in cardiac MRI. "Systems rendering high-quality images are a key part. If you can't see, you can't treat," he continues. Dr. Civaia mentions the example of a 50-year-old lady who underwent a CT examination the very morning of our meeting, in which the scan revealed more pathological findings than he originally was looking for. "This example shows," Dr. Civaia emphasizes, "that in order to 'play' on these systems, you need human expertise." Above all that means interdisciplinary collaboration, a "global approach," as Dr. Civaia calls it. The key feature of the CCM is not to place the imaging into a special radiological department, but to place the instruments right into the middle of the activity.

Europe's First Hybrid Room

Together with Siemens, the CCM was the first cardiovascular center in Europe to construct a hybrid operating room as early as 1987. "When we began with the project back in 1986," Prof. Dor recounts, "the architects designed one of the two cathlab rooms for patients who needed surgery immediately but couldn't be moved." The result was a state-of-the-art operating theatre with a radiological facility built inside. "It was a 'hybrid room' according to today's understanding," says Prof. Dor, "although we didn't use that term back then. We called it an 'angio surgical room'." Since its opening in 1989, more than 6,000 procedures have been conducted in this room, and since then the complete equipment has been renewed three times.

The CCM management has examined the utilization of their 'angio surgical' or hybrid room very carefully over the years. "For example, we've treated well over 2,000 cardiac infarctions, 535 in an acute phase, twelve of which needed a conversion to cardiac surgery immediately in the same room," explains Prof. Dor. This could be done without any trouble. For other procedures, such as angiography, angioplasty, valvuloplasty, or vascular stenting interventions, the ratio of imperative conversion to immediate surgery was about the same. The nurses and techni-

cians have multiple skills, mastering both surgical as well as radiological techniques. In the last few years, clinics around the world invested a lot in hybrid operating rooms. "When I see all the current hype about hybrid operating technology, it makes me laugh because we have been doing this for over twenty years!", says Prof. Dor. "Monaco was a pioneer in this field without knowing it."

Demographic Changes and Evolving Imaging Technology

Meanwhile, for the sake of the patients, technology improves continuously. No different than any other cardiovascular clinic in the western world, the CCM is affected by demographic changes. "We see an increase in coronary artery and degenerative valvular diseases in our center," says Managing Director Guy Nervo, "and we have noticed that the amount of patients between 80 and 90 years old asking for treatment has constantly risen in the last years." The mean age of patients is around five years higher than two decades ago. In short: patients are older and sicker. These global trends ask for sound decisions by many participants.

New imaging software such as Siemens *syngo*®.via makes multimodality interdisciplinary decision-making easier and patient data more widely accessible. In the future, referring local specialists such as neurologists will also have access to multimodality patient data.
Imaging technology is also evolving. A few months ago, the CCM installed Siemens *syngo* DynaCT Cardiac into their hybrid room for three-dimensional interventional imaging. "We have used the *syngo* DynaCT Cardiac on 15 patients so far," explains engineer Dr. Stéphane Rusek, "and it has proven very helpful for certain indications." In transapical aortic valve implantation, for example, the 3D imaging helps a lot to assess the exact position of the valve. Thus, the procedure becomes faster and more precise, with only 15 milliliters of contrast agent used.

Quantum Leaps to be Expected

"We are at the edge of technology, and we still need to make progress," says Dr. Rusek. A mathematician by training, Dr. Rusek has been developing the IT tools of the CCM since the very beginning. Moreover, he drives long-term collaborations with virtually every business unit of Siemens Healthcare and contributes to new product development. Dr. Rusek believes that quantum leaps are still to be expected. "When we look at computed tomography, we must admit that until around 2005, the technology was at a poor level, rendering low quality images and many false results as a consequence." Recently, however, the CTs have become much faster, plus they expose the patients to much less ionizing radiation while improving on image quality and requiring much lower doses of contrast agent. Nevertheless, according to Dr. Rusek, there is still a great potential for research and development: "For new cardiac indications, we need higher spatial resolution. We want to be able to go inside the vessel wall. For example, we need better visualization of the plaque inside the arteries." In short: today is just the beginning of a new era.

Irène Dietschi *is an award-winning medical writer based in Olten, Switzerland.*

Photos: *Cardio-Thoracic Center Monaco*

Cardiology Education

Continuing education is a major pillar of Siemens' dedication to ever better healthcare. The wide spectrum of cardiology offerings includes clinical fellowships, clinical workshops with leading experts in their fields, e-learning and application trainings from basic to advanced level – empowering users to tap the full potential of their systems and to improve their clinical and financial outcomes.

Angiography

Training / Event More information / registration	Target Groups	Date / Duration	Place	Language
Interventional Cardiology Fellowship Programm (registration via Siemens representative)	Physicians / Radiographers	on request	Leopoldina Hospital Schweinfurt, GER	German / English
System Applicaton Training – Artis zee (www.siemens.com/AXIOM-E-Learning)	Physicians / Radiographers	e-learning	web based	English
System Applicaton Training – AXIOM Sensis (www.siemens.com/AXIOM-E-Learning)	Physicians / Radiographers	e-learning	web based	English
System Applicaton Training – Dose Management (www.siemens.com/AXIOM-E-Learning)	Physicians / Radiographers	e-learning	web based	English
System Applicaton Training – Advanced Applications (www.siemens.com/AXIOM-E-Learning)	Physicians / Radiographers	e-learning	web based	English
System Applicaton Training – Understanding EP (www.siemens.com/AXIOM-E-Learning	Physicians / Radiographers	e-learning	web based	English
Hands-on Workshop Transcatheter Techniques (david.groke@siemens.com)	Physicians	2x / year	Forchheim, GER	English

Find further trainings under:
www.siemens.com/cardiologyeducation

Scan QR-Code with Smartphone!

Cardiovascular CT

Training / Event More information / registration	Target Groups	Date / Duration	Place	Language
Cardiac CT Level II Training (www.bir.org.uk)	Radiologists / Cardiologists	Sep 11 – 14, 2012	London, UK	English
CTA Interpretation Course (www.siemens.com/SOMATOMEducate)	Radiologists / Cardiologists	Sep 27 – 28, 2012	Erlangen, GER	English
Clinical Workshop on Cardiac CT (www.siemens.com/SOMATOMEducate)	Radiologists / Cardiologists	Oct 17 – 19, 2012	Munich, GER	English
Clinical Workshop on Cardiac CT (www.siemens.com/SOMATOMEducate)	Radiologists / Cardiologists	Dec 12 – 14, 2012	Munich, GER	English

Cardiovascular MR

Training / Event More information / registration	Target Groups	Date / Duration	Place	Language
Herzbildgebung in der MRT (www.siemens.com/medical-training-center)	Radiologists / Cardiologists	Aug 30 – Sep 1, 2012 Oct 25 – 27, 2012	Erlangen, GER	German
MRI Advanced for Angiography (www.siemens.com/medical-training-center)	Radiologists/ Cardiologists/ Angiologists	on request	Erlangen, GER	English
MR Basic Physics for Cardiologists (www.siemens.com/medical-training-center)	Cardiologists	on request	Munich, GER	English
Clinical Workshop on Cardiac CT (www.siemens.com/SOMATOMEducate)	Radiologists / Cardiologists	Dec 12 – 14, 2012	Munich, GER	English

Echocardiography

Siemens Healthcare is introducing a new Ultrasound collaboration site for a high quality fellowship for cardiologists and sonographers in the Netherlands. The Erasmus Medical Center (MC) is an internationally recognized center for high-quality, compassionate care, highly rated transfer of knowledge and high-quality knowledge sharing.
The goal of the fellowship and training program is to clearly enable the attendees to understand the concept of high end 2D and 3D transthoracic echocardiography with the Acuson SC2000™ volume imaging ultrasound system and the *syngo*® SC2000 Workplace when integrated into a professional clinical set up.
Erasmus MC in cooperation with Siemens Healthcare is offering two different education models to professionally fulfill the different requirements of the trainees and fellows:
The first model is an intensive two day 3D/4D Echo Course, in which the fellows and trainees will have a theoretical and technical introduction followed by hands-on training. With the guidance and supervision of an experienced user, the fellows will be able to practice their knowledge on selected clinical cases.
The second model is a highly valuable two-day job shadowing during which the fellow will be able to observe a minimum of six 2D/3D outpatient exams that will be conducted with the ACUSON SC2000 system. The shadowing also includes the complete 3D analysis of the patients.

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Statistics Suggest Transradial Approach as the Future of Coronary Interventions

Transradial Approach (TRA): History and facts

The first description of transradial arterial catheterization was published in 1948. Transradial access was made available for therapeutic procedures of coronary angioplasty in the 1990s. One of the pioneers was Ferdinand Kiemeneij of the Netherlands.

With TRA, cardiologists use the radial artery near the wrist as the entry point, carefully moving thin catheters, sheaths, and wires through the circulatory "highway" to the heart. During this process, the surgeon can expand a balloon, place a stent (a small metal tube), and thus open a blocked artery without having to use open surgery.

Since 2000, the transradial approach for coronary intervention has been become increasingly popular. Its greatest advantage is the very low occurrence of bleeding complications at the access site. It also creates opportunities for safe outpatient PCI, which means more interventions can be done and costs can be saved.

The increased use of radial access is also due to technological advances in sheath and catheter design and surgeons' increasing familiarity with TRA.

TRA procedures are especially attractive for patients with problems such as bad backs or lung disease because they can stand up and walk around shortly after the procedure. With the femoral approach, patients are generally required to stay still on their backs for four to six hours.

TRA has been known to have a longer learning curve, and some potential for unsuccessful completion of procedure. This may be changing with the improvement of equipment and training programs. Most known complications are benign.

A number of factors indicate that the transradial approach (TRA) should be considered the future of percutaneous coronary intervention (PCI): patient well-being, less risk of post-procedure bleeding, and a shorter hospital stay. At a TRA experts' seminar held at the Universitätsklinikum Erlangen-Nuremberg, Erlangen, Germany in February, 2012, Ferdinand Kiemeneij and other physicians argued persuasively in favor of choosing TRA over alternative procedures.

The use of TRA procedures means starting endovascular or coronary interventions in the radial artery of the wrist instead of at the femoral artery in the groin. In the 20 years it has been in use, TRA has become increasingly popular in most parts of the world, with important exceptions such as the U.S. and Australia. In February 2012, experts from all over the world gathered in Erlangen near Nuremberg in southern Germany to discuss the various approaches for PCI and to review statistics gathered in clinical studies. Four of these experts took part in a filmed discussion, moderated by Prof. Josef Ludwig, MD, Erlangen, Germany: Ferdinand Kiemeneij, MD, Netherlands; Ian Gilchrist, MD, U.S.; Shigero Saito, MD, Japan; and Stephan Achenbach, MD Germany.

Conclusions from the TRA Experts' Meeting

Transradial Approach (TRA) is the future of percutaneous coronary intervention (PCI). A number of factors point to TRA as the best alternative for interventional procedures: less risk of post-procedural bleeding, patients' well-being and satisfaction, and shorter duration of hospital stays.

An increasing number of clinical investigations indicate that use of TRA results in lower mortality rates and less bleeding complications. This procedure has steadily gained popularity in most parts of the world; in many European countries and in Japan, it accounts for more than 70 percent of PCI procedures. In the U.S. and a few other countries, radial access is still not a common procedure, despite all the promising results already documented.

Prof. Dr. Ludwig in discussion with the clinical experts for transradial approach Dr. Gilchrist, Dr. Kiemeneij, Dr. Saito, and Prof. Dr. Achenbach (from left to right).

In February 2012, leading TRA experts from all over the world gathered in Erlangen, Germany, to discuss the pros and cons of the radial and femoral coronary intervention procedures. One discussion point was why TRA has been so widely accepted in many parts of the world, but still very seldom used in the U.S., for instance, and what might happen in the future.

U.S. surgeon and TRA expert Ian C. Gilchrist believes that TRA will probably increasingly be used in the U.S. with more focus now being put on length of stay at hospitals. TRA has been shown to allow patients to go home early without risk of complications. This creates opportunities for a major increase in the number of outpatients receiving PCI.

Another driving force in the U.S., according to Gilchrist, is that the advantages of TRA are being spread by word of mouth and people are asking for it in growing numbers.

From the Netherlands, TRA pioneer and expert Ferdinand Kiemeneij reported that clinical studies showed more than 1,700 outpatients were able to return to their homes within a few hours, with none suffering more than minor problems. Even limited discomfort was unusual.

Kiemeneij described how his center was built according to the same standards as international airport lounges to help patients relax before the intervention. A similarly relaxing environment awaits the patients after the procedure.

A nurse and technical resources are available, but discreetly placed so as not to worry the patients. If their situation at home allows it, they can leave the hospital after about four hours, with follow-up checks being done by telephone.

"Today, it is almost unethical not to use TRA, considering how important it is to minimize bleeding complications," Kiemeneij said during a group discussion at the Erlangen meeting.

> "TRA is generally accepted in China. There is no long history of femoral approach, so the radial approach has had an easier route to acceptance than in many other countries. And today, it is almost unethical not to use TRA, considering how important it is to minimize bleeding complications."
>
> Ferdinand Kiemeneij, MD,
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> University of Amsterdam,
> Amsterdam, Netherlands

Participants in the TPA expert interview in Erlangen, February 2012

Prof. Josef Ludwig, MD
Department of Cardiology and Angiology, University of Erlangen-Nuremberg, Erlangen, Germany (Moderator)

Prof. Stephan Achenbach, MD
Department of Cardiology, University of Giessen, Giessen, Germany

Ian C. Gilchrist, MD
Heart and Vascular Institute, Penn State Hershey Heart and Vascular Institute, Hershey, PA, USA

Ferdinand Kiemeneij, MD
Department of Interventional Cardiology, University of Amsterdam, Amsterdam, Netherlands

Shigeru Saito, MD
Department of Cardiovascular Medicine, Shonan Kamakura General Hospital, Kamakura, Japan

Interviewed separately

Jim Nolan, MD
Department of Cardiology, University Hospital of North Staffordshire, Staffordshire, UK

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European Society of Cardiology Congress (ESC)

Siemens Hands-on Tutorials Program for Room B12

	Saturday, August 25	Sunday, August 26	Monday, August 27	Tuesday, August 28
09:00 am – 10:30 am		**Multi-modality image guidance in 2D and 3D for structural interventions** Markus Füller (Munich, DE)	**3-dimensional image guidance during ablation procedures** Klaus Kurzidim (Regensburg, DE)	**Evaluation of 3D color volume of mitral regurgitation: a real and more accurate quantification?** Alexandra Goncalves (Porto, PT)
11:00 am – 12:30 pm		**Benefits of advanced echo imaging technologies – case study presentations** Carla Sousa (Porto, PT)	**Transthoracic 3D echocardiography of the left ventricle: data acquisition and assessment of function** Ralph Stephan von Bardeleben Frank Patrick Schmidt (Mainz, DE)	**Control your time with automated reporting – benefit of integrated illustrations, fractional flow reserve, and dose analysis** N.N.
01:00 pm – 02:30 pm	**Evaluation of 3D color volume of mitral regurgitation: a real and more accurate quantification?** Alexandra Goncalves (Porto, PT)	**Transthoracic 3D echocardiography of the left ventricle: data acquisition and assessment of function** Ralph Stephan von Bardeleben Frank Patrick Schmidt (Mainz, DE)	**Clinical application of sensitive cardiac troponin in the early approach of acute myocardial infarction** Raphael Twerenbold Miriam Reiter Philip Haaf (Basel, CH)	**Clinical application of sensitive cardiac troponin in the early approach of acute myocardial infarction** Christian Müller (Basel, CH)
03:00 pm – 04:30 pm	**Benefits of advanced echo imaging technologies – case study presentations** Alexandra Goncalves Carla Sousa (Porto, PT)	**Control your time with automated reporting – benefit of integrated illustrations, fractional flow reserve, and dose analysis** N.N.	**Multi-modality image guidance in 2D and 3D for structural interventions** Markus Füller (Munich, DE)	**3-dimensional image guidance during ablation procedures** Klaus Kurzidim (Regensburg, DE)

Siemens Hands-on Tutorials Program for Room B13

	Saturday, August 25	Sunday, August 26	Monday, August 27	Tuesday, August 28
10:00 am – 11:30 am		**Technical principles, clinical indications and analysis of cardiac computed tomography datasets** Matthias Kerl (Frankfurt, DE)	**Cardiac magnetic resonance imaging in cardiomyopathies** Giso von der Recke (Bonn, DE)	**Technical principles, clinical indications and analysis of cardiac computed tomography datasets** Matthias Kerl (Frankfurt, DE)
12:00 am – 01:30 pm		**Molecular imaging – benefits in coronary artery disease** Wolfgang Schäfer (Mönchengladbach, DE)	**Technical principles, clinical indications and analysis of cardiac computed tomography datasets** Matthias Kerl (Frankfurt, DE)	**Cardiac magnetic resonance imaging in ischaemic heart disease** Giso von der Recke (Bonn, DE)
02:00 pm – 03:30 pm	**Pulmonary veins – magnetic resonance imaging techniques and flow quantification** Jean-Nicolas Dacher (Rouen, FR)	**Technical principles, clinical indications and analysis of cardiac computed tomography datasets** Matthias Kerl (Frankfurt, DE)	**Cardiac magnetic resonance imaging in ischaemic heart disease** Giso von der Recke (Bonn, DE)	**Molecular imaging – benefits in coronary artery disease** Daniela Knollmann (Mönchengladbach, DE)
04:00 pm – 05:30 pm	**Technical principles, clinical indications and analysis of cardiac computed tomography datasets** Matthias Kerl (Frankfurt, DE)	**Pulmonary veins – magnetic resonance imaging techniques and flow quantification** Jean-Nicolas Dacher (Rouen, FR)	**Technical principles, clinical indications and analysis of cardiac computed tomography datasets** Matthias Kerl (Frankfurt, DE)	**Cardiac magnetic resonance imaging in cardiomyopathies** Giso von der Recke (Bonn, DE)

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