

# AXIOM Innovations

The Magazine for Interventional Radiology, Cardiology and Surgery

[www.siemens.com/angiography](http://www.siemens.com/angiography)

**SIEMENS**

## Future Trends in Interventional Radiology

Multi-disciplinary  
Interventions  
Page 26

## Navigating the Heart

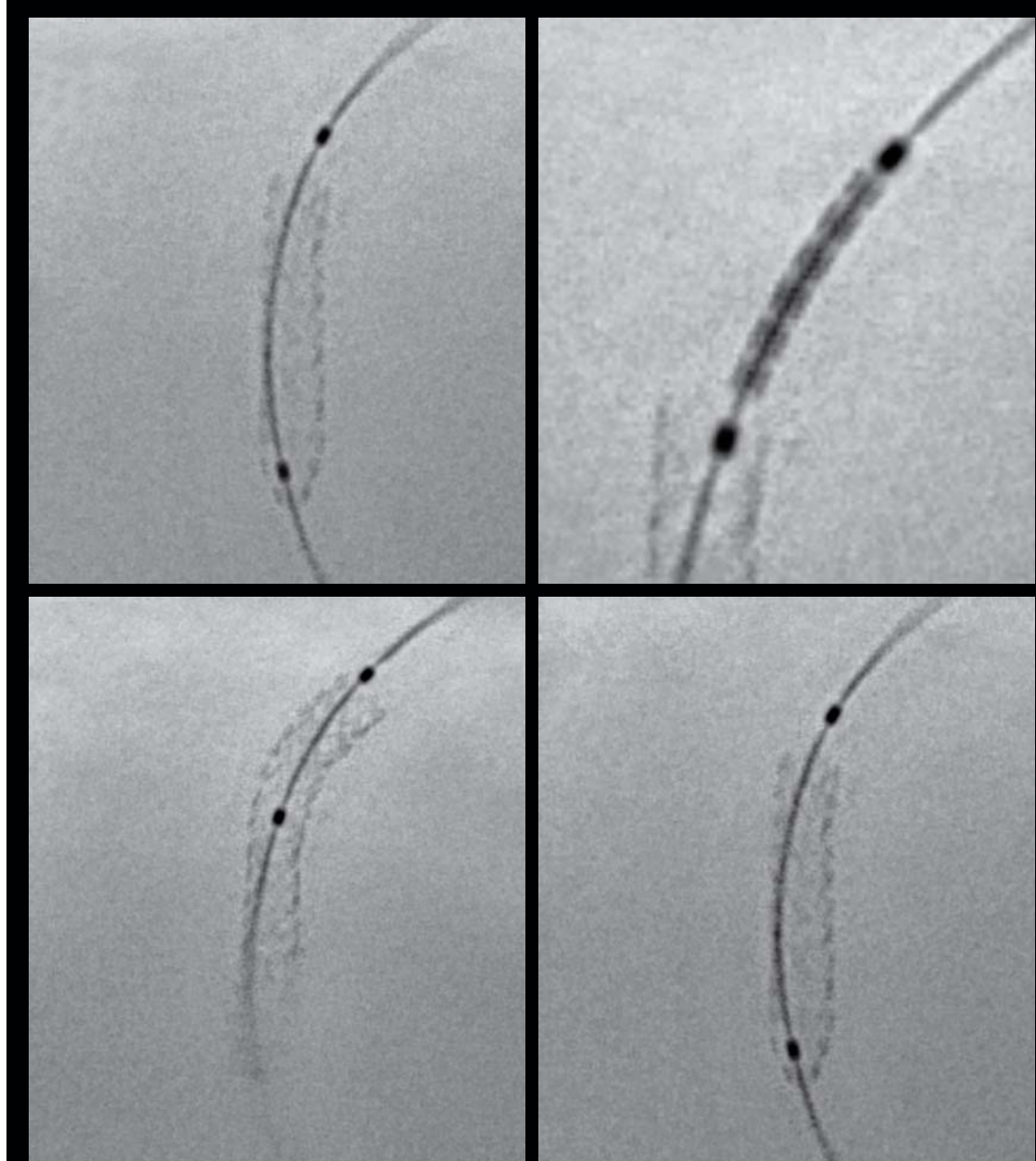
Less Dose with  
MediGuide™  
Technology  
Page 38

## Hybrid Surgery

Lessons Learned  
Page 44

## Raising the Bar

With Teamwork  
to Better Outcomes  
Page 58



## Improved Stent Visibility

CLEARstent

15

“We not only believe in close collaborative efforts between Siemens and our customers – It is also our pleasure.”

Dr. Heinrich Kolem,  
CEO of the Angiography & Interventional X-Ray Business Unit (AX)  
at Siemens Healthcare

## Dear Reader,

As you know, we at Siemens Healthcare have always been committed to providing innovative and customized solutions for our customers. Moreover, another important focus for us is to proactively collaborate alongside clinical institutes with their cutting-edge scientific research. In this way, Siemens strengthens long-term partnerships focused on generating new techniques and treatment paradigms to lead to new strategies in patient care. In the articles highlighted in this issue, you will note to recognize the importance of reducing X-ray dose without compromising image quality to enable the best diagnosis and treatment. The ALARA (As Low As Reasonably Achievable) approach increases the accountability of the interventional radiologist, interventional cardiologist, and administrator while promoting a healthy environment for patients and staff. One program we've developed and implemented within part of our partnerships is the software update we started last year. The CLEAR imaging technology and CARE (Combined Applications to Reduce

Exposure) package now comes standard with every new Artis zee® system. Since dose reduction and image quality are two key issues for physicians, their staff, and patients, we are currently updating more than 2,000 installed Artis zee systems worldwide at no extra charge. Meanwhile, we have also collected feedback from customers who have profited from this software update. For example, the team in the Department of Cardiology, Angiology and Pneumology in the Clinic of Coburg, Germany has been working with cardiac angiography systems from Siemens for over 12 years. The article highlights the customer's experience with the CLEAR and CARE update on his system. We are also engaged in a partnership with SickKids® in Toronto, Canada, who specialize in pediatric care. The doctors at SickKids pay particular attention to dose, and highly appreciate the CARE package for their young patients.

In order to continuously provide innovative solutions in response to clinical demands to support new and



Dr. Heinrich Kolem  
CEO AX Division

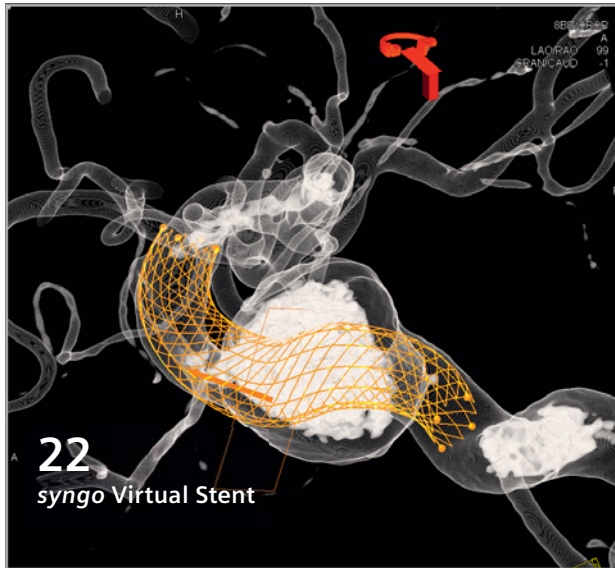
exciting procedures, we work in close cooperation with clinical experts in transradial approach (TRA) procedures. TRA is becoming more and more popular worldwide and the extract of their interesting discussion in this issue examines the the pros and cons of this new procedure.

Furthermore, we will discuss the clinical aspects on future trends in interventional radiology, the latest innovations like the use of *syngo*® DynaCT in urology, and vast experience gathered over ten years in a hybrid room. This is but a brief look at some of the topics you will read about in this issue. We would also like to invite you to one of our hands-on workshops that we offer at our headquarters, congresses, or other places in the world.

Please enjoy reading on for more details!

Dr. Heinrich Kolem

# Content



**10 Clear Benefits for Percutaneous Cardiac Interventions**  
Germany's Coburg Clinic, currently testing new imaging technology and looking back on a longstanding partnership with Siemens, has noted a dramatic improvement in image quality and diagnostic confidence through a recent upgrade that introduced CLEAR image processing. They share their initial experiences.

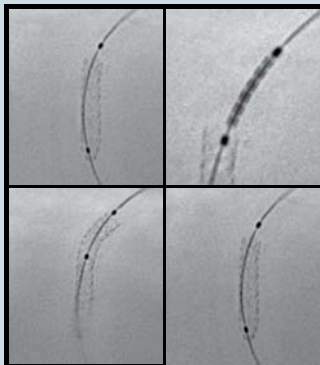
## 2 Editorial

## 6 News

## 10 Cover Story

**Clear Benefits for Percutaneous Cardiac Interventions**  
Prof. Dr. Brachmann shares initial experiences from more than thirteen years

## 71 Imprint



### Cover

Enhanced stent visualization  
*Courtesy of Professor Johannes Brachmann, M.D., 2nd Medical Clinic for Cardiology, Angiology and Pneumology, Coburg Clinic, Coburg, Germany.*

The statement by Siemens' customers described herein are based on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.



**38**  
MediGuide  
Technology

**54**  
Lower Dose,  
Better Images

## Angiography

- 18 Patient Care and Dose Saving**  
Interview with Dr. Berlis, Klinikum Augsburg in Germany
- 22 Pipeline Stent Placement for Embolization of Giant Cerebral Aneurysm**  
Clinical case
- 24 Chemoembolization with Drug-Eluting Beads**  
Clinical case
- 26 Future Trends in Interventional Radiology**  
A new approach to surgery and endovascular interventions

## Cardiology

- 31 Measurement of Fractional Flow Reserve in Routine Practice**  
FFR measurements prove useful for the Kreiskrankenhaus Erding, Germany
- 32 Coronary Stenosis**  
Clinical case

### 34 New Tools to Enhance Stent Visualization

Interview with Dr. Cornelis, Maria Middelaers Hospital in Ghent, Belgium

### 36 Statistics Suggest Transradial Approach as the Future of Coronary Interventions

Experts comment on its benefits

### 38 Navigating the Heart

Integrated MediGuide Technology helps navigation and saves dose

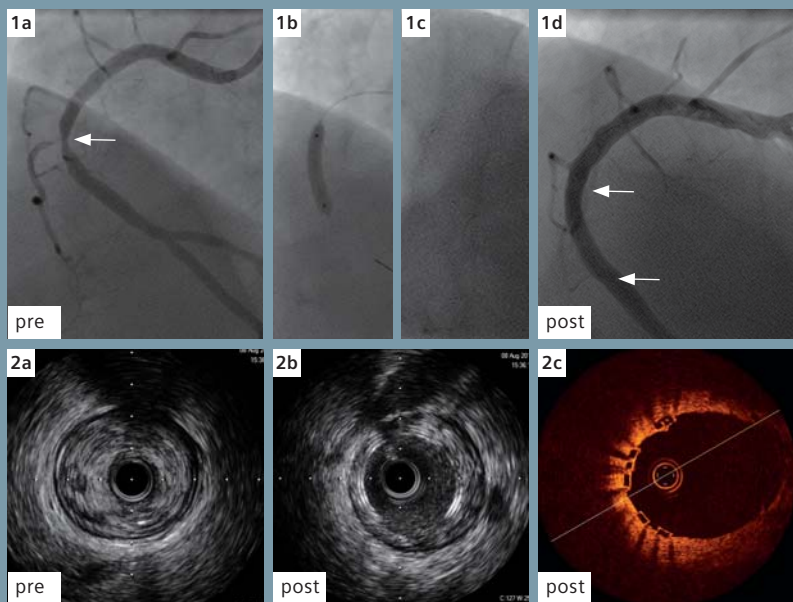
## Surgery

- 44 10 Years of Hybrid Operating Rooms in Germany**  
Prof. Dr. Torsello, shares his lessons learned from ten years of experience
- 50 Intuitive and Comfortable Reassimilations in Interventional Radiology**  
Interview with Prof. Dr. Michel, University Hospital Mannheim, Germany

## Customer Care

- 54 A Gift Pack: Lower Dose, Higher Image Quality**  
Interview with Prof. Dr. Çekirge, Hacettepe University Ankara, Turkey
- 58 Raising the Bar**  
Teamwork proves essential to lowering dose and improving patient outcomes
- 62 Benchmark in Surgical and Interventional Imaging**  
Hands-on workshop for Artis zeego® users
- 66 Want to Learn More About Transcatheter Technology?**  
Hands-on customer workshop for cardiac surgeons
- 68 Upcoming Congresses & Workshops**
- 70 Subscription & Information**

# Siemens Equipment Helps the First Implant of Bioabsorbable Stents in Brazil



**1** [a-d] Treatment of stenosis in right coronary artery.  
**2** [a-c] A bioabsorbable stent visualized by intracoronary OCT.

One of the newest topics in interventional cardiology is certainly bioabsorbable coronary implants, which are being researched by the main cardiology institutions in Brazil.

Brazil today is one of the leading centers of pioneering, research and dissemination of knowledge in this area. In September 2011 the first bioabsorbable stent was implanted in Brazil by the team of Alexandre Abizaid, M.D., responsible for Interventional Cardiology Department and Director of Scientific Studies at Dante Pazzanese Institute in Sao Paulo. The patient, a 66-year-old woman, had 93% of her right coronary artery blocked. The Siemens' Artis zee system played a key role in this minimally invasive procedure as the innovative bioabsorbable stent presents a significant challenge in terms of view. Unlike the metal stents, which are radiopaque, the bioabsorbable models have only one radiopaque marker at each end. "Therefore, the use of an appropriate high-resolution image is essential for accurate placement and for verifying the location after the procedure," concludes Abizaid.

## Dose Monitoring for the Staff

Siemens and RaySafe™ offer real-time dose monitoring in the interventional room for every individual staff member. Better control and transparency of operator dose means a lot to the staff members. "Radiation protection is taken very seriously in our department. RaySafe i2 is very helpful when it comes to radiation protection, since it provides online information on the individual operator dose. So we have the ability to react immediately if required," says Professor Arnd Dörfler, M.D., Department of Neuroradiology, University Erlangen-Nuremberg, Erlangen, Germany. This simple monitoring system offers a baseline for changing working habits. The RaySafe i2™ dosimeter can be mounted on the Artis zee and AXIOM Artis table. A group of eight people can be monitored per intervention.

The real-time display, intelligently sized at 30 mm x 25 mm x 6 mm, monitors a dose range of 1 µSv up to 10Sv. It guarantees safe monitoring with a very low dose uncertainty of only 5% or 1 µSv.



**Further Information:**

[www.unfors.com/raysafei2/](http://www.unfors.com/raysafei2/)

# Integrated Surgical Tables Dominate Hybrid ORs in Europe



Artis zeego flexibly adapts to the different segments of MAQUET's MAGNUS OR table



TRUMPF's TruSystem 7500 for Artis zee in the vascular hybrid OR with Artis zeego at Ludwigsburg Hospital, Germany

For the first time, the ordered number of hybrid ORs equipped with the Artis zeego robotic system or a ceiling-mounted Artis zee system is higher with an integrated surgical table than with an angiography table in Europe. This trend underlines the fact that hybrid ORs are used in a very interdisciplinary fashion – different user groups such as surgeons, cardiologists and radiologists share the room. With this comes the need to use dedicated tables to best respond to the specific procedures in both interventional treatment and open surgery. Vascular surgeons and radiologists, for instance, usually require a long, radiolucent table that allows for imaging the patient's body from head to toe. Orthopaedic and neuro surgeons, however, may require a segmented table enabling superior patient positioning.

Due to its unique robotic design Artis zeego is the only system on the market that can flexibly adapt to the angulations of the table segments. It even enables 3D imaging with *syngo* DynaCT in an angulated table position.

With Siemens, the customer now has the choice of three different table families. The MAGNUS OR table from MAQUET\* and the TruSystem 7500 for Artis zee from TRUMPF are fully integrated into Artis zeego and Artis zee ceiling, and come with different versions of exchangeable tabletops (one-piece carbon-fiber, and segmented tables). Despite not being a segmented table, the tried-and-proven Artis OR table from Siemens has the benefit of a fully free-floating tabletop, especially useful for cardiac procedures. It is available with Artis zee floor, ceiling, biplane and Artis zeego. With this wide array of tables it is possible to best respond to the customer's specific needs.

\* Monitoring for MAQUET's MAGNUS OR table with Artis zeego has started, commercial availability is planned for late 2012; commercial availability of the integration with Artis zee ceiling is planned for early 2013.

## Simple Way to Increase Safety in Electrophysiology

Ventricular tachycardia (VT) associated with remote myocardial infarction (MI) is frequently hemodynamically unstable and associated with multiple electrocardiographic morphologies, and hence not amenable to traditional mapping techniques that require sustained tachycardia.

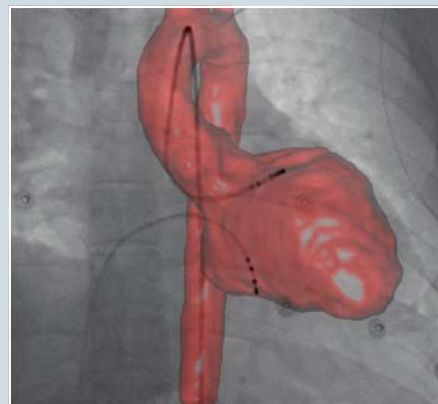
Mohan Nair, M.D. from the Max Super Speciality Hospital in India evaluated the safety, acute procedural efficacy and intermediate-term outcome of ablation of ventricular tachycardia in ischemic heart disease patients using rotational angiography and electro-anatomical 3D-based substrate mapping strategy exclusively in four patients. High-density electro-anatomic mapping was performed during sinus rhythm in all patients using the Ensite Velocity system from St. Jude Medical. The 3D visualization of the left ventricle was performed using Siemens *syngo* DynaCT Cardiac and superimposed onto the live

fluoroscopy. The scar tissue was identified and radiofrequency (RF) ablation lesions were placed in a linear fashion traversing the channels or the border zones of infarcted and normal tissue. Post ablation VT was not inducible in any of the patients. During the follow-up of  $18 \pm 3.9$  months, spontaneous VT was not recorded in any patient on regular ICD interrogation.

The conclusion of the study shows that substrate mapping can be used to identify the arrhythmogenic tissue and guide the ablation of VTs using non-irrigated RF ablation catheter. This therapeutic strategy may be considered more and more in the management of patients with multiple hemodynamically unstable VTs. The use of rotational angiography with real-time 3D reconstruction (*syngo* DynaCT Cardiac) can increase the safety of the procedure. "We used 5 sec non-gated 3D acquisition as the patient had low EF and we

wanted to limit the dye. We did not use the image for fusion with the NavX system but used it for fluoro overlay. This way we were able to manipulate the catheters more safely, avoiding excessive manipulation in the aneurysmal area," says Amitabh Yaduvanshi, M.D. of the Max Super Speciality Hospital in Delhi, India.

Results were evaluated by Mohan Nair, Amitabh Yaduvanshi, Manoj Kumar, Vikas Kataria at the Max Super Speciality Hospital, Patparganj, Delhi, India



## Trauma Surgeons Decided on a Hybrid OR



During a discussion on a future-oriented operating room, Professor Florian Gebhard, M.D., Head of the Department of Traumatology, Hand, Plastic, and Reconstructive Surgery at the University Hospital in Ulm came across a picture of the Artis zeego.

Based on in-depth discussions and a visit to the Siemens headquarters in Forchheim, Germany, Gebhard came

to the conclusion that the multi-axis system Artis zeego is the "ideal system for the OR." Furthermore he states, "Being able to use the Artis zeego in the routine OR setting, having an intra-operative 3D option and the combination with a navigation system is optimal for a trauma surgeon."

The Artis zeego was recently installed together with the latest navigation system, Curve™ by Brainlab AG, Feldkirchen, Germany. Gebhard believes the greatest possible safety for minimally invasive procedures can be achieved through the combination of intra-procedural 3D imaging and navigation. With this ability peak precision can be achieved. Furthermore, he believes that the workflow can be accelerated thanks to the easy operation of the Artis

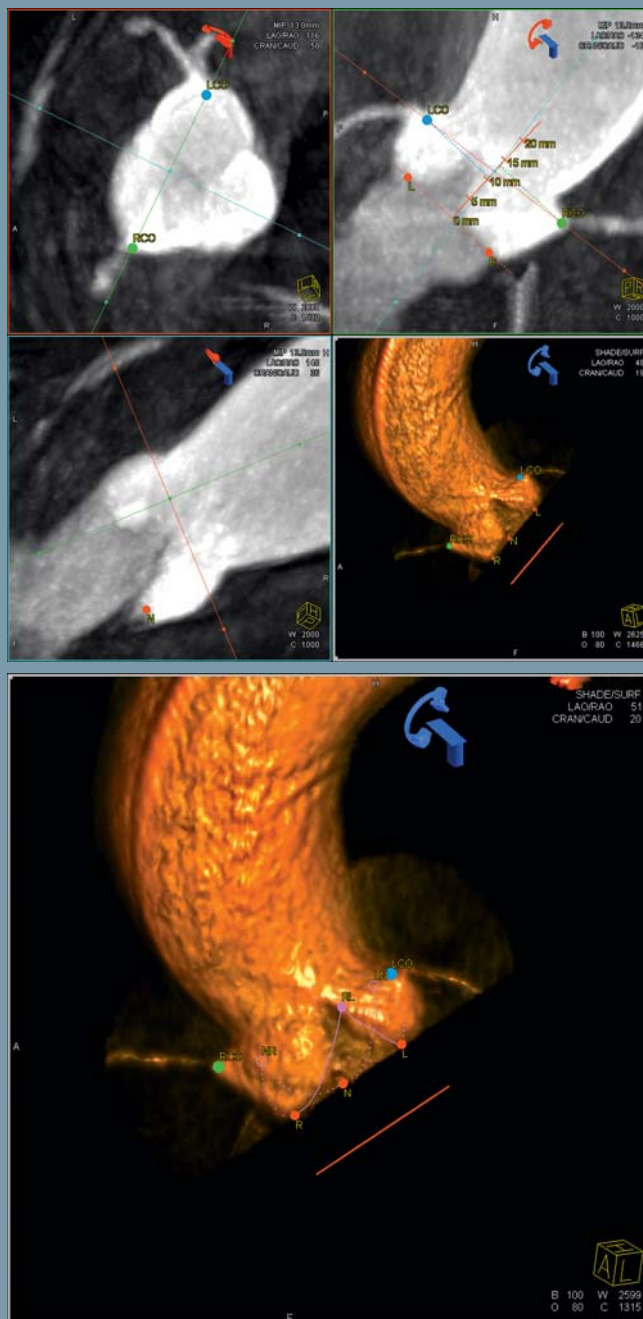
zeego by the surgeon alone, without additional manpower, and that patient dose can be reduced.

Gebhard is already following a vision of using the interdisciplinary hybrid OR. Several departments plan on working in this room, using navigation combined with 3D imaging: the Department of Neurosurgery with an emphasis on neurovascular surgery, the Department of Heart Surgery, which will focus on minimally invasive valve procedures together with the Department of Cardiology, and the Department of Cranio-Maxillofacial Surgery with a focus on facial reconstructions. Gebhard believes that this multidisciplinary hybrid operating room will improve the management of difficult and extremely complex procedures.



# New Hope for Patients with Severe Aortic Stenosis

An estimated 45,000 patients have received TAVI (Transcatheter Aortic Valve Implantation, also referred to as TAVR, Transcatheter Aortic Valve Replacement, in the U.S.) worldwide, but experience with the procedure in the United States lags far behind that in Europe. With FDA approval of the new Edwards Sapiens transcatheter heart valve in November 2011, U.S. hospitals can now also take advantage of the procedure and offer new treatment options to patients with severe aortic stenosis. Only a couple of weeks later, the FDA cleared the new Siemens *syngo* Aortic ValveGuide software for the Artis zee and Artis zeego interventional imaging systems. The new software automatically reconstructs a 3D representation of the aortic root from cross-sectional *syngo* DynaCT images acquired with the angiography system. With the aid of anatomical landmarks in the 3D vessel representation, *syngo* Aortic ValveGuide calculates the exact perpendicular view on the aortic root. The C-arm adjusts to the corresponding angulations for live fluoroscopy, enabling the physician to precisely position the new valve. Prior to *syngo* Aortic ValveGuide, users had to rely on preprocedural (or intraprocedural) CT, manually co-recording it with live fluoroscopy and overlaying it onto a live fluoroscopy image to determine the correct angulation. This process required additional steps and highly skilled personnel. Siemens has already gathered extensive clinical experience with the new application in Europe. Now, U.S. customers can also profit from precise guidance and an improved workflow for TAVI procedures. William O'Neill, M.D., Chief Medical Officer at the University of Miami Health System, uses *syngo* DynaCT to evaluate the anatomy of the aortic root and the position of the coronary ostia. "The overlay of the intra-procedural 3D image over live fluoroscopy gives us an additional level of confidence for the valve implantation," explains O'Neill. "The automated workflow of the *syngo* Aortic ValveGuide makes the procedure easier – and the indication of a perpendicular view plane helps to make it even safer."



3D view of the segmented aortic root with landmarks showing a correct angle for valve implantation.



# Clear Benefits for Percutaneous Cardiac Interventions

Germany's Coburg Clinic, currently testing new imaging technology and looking back on a longstanding partnership with Siemens, has noted a dramatic improvement in image quality and diagnostic confidence through a recent upgrade that introduced CLEAR image processing and CARE dose-saving technology to the Artis zee family of systems.



## CLEAR Benefits

- Optimized image acquisition for all patients
- Comprehensive image processing
- Customized image display to preferences
- Standard with every Artis zee system
- Comprehensive range of applications to enhance image quality and increase certainty during interventions.
- Enhanced image quality by real-time processing without increasing the dose.



The partnership between the Coburg Clinic and Siemens goes back more than a decade, and Professor Johannes Brachmann, M.D., Head Physician of the 2nd Medical Clinic for Cardiology, Angiology and Pneumology, and his colleagues have worked with a number of Siemens systems over the course of those years.

A Siemens COROSKOP cardiac angiography unit, which was installed at the clinic in 1999, supported the clinical team for more than 20,000 cardiac catheterizations before being replaced with an Artis zee floor-mounted cath lab in 2011. Similarly, the clinic's Siemens BICOR biplane system capably handled electrophysiology interventions at the clinic for more than 12 years before also being replaced in 2011 with a new Artis zee biplane system.

**“It was this dedication and the innovational power of Siemens that allowed us to grow the way we did.”**

Professor Johannes Brachmann, M.D., Head Physician of the 2nd Medical Clinic for Cardiology, Angiology and Pneumology, Coburg Clinic, Coburg, Germany.

In doing so, all four cath labs are now state-of-the-art Artis zee systems equipped with the added benefit of CLEAR image processing and Siemens, dose-reducing CARE (Combined Applications to Reduce Exposure) package, both of which are standard with all newly purchased Artis zee systems. The older two systems already received an update to the latest software version, an update which is currently given at no extra charge to the entire Artis zee installed base of more than 2,000 systems worldwide.

Brachmann reports that the update with the latest software version has resulted in dramatically improved image quality and reduced dose that helps him and his colleagues perform procedures such as percutaneous cardiac interventions with confidence. “New image algorithms

“New image algorithms from recent updates deliver the best images we have ever seen.”

Professor Johannes Brachmann, M.D.,  
Head Physician of the 2nd Medical  
Clinic for Cardiology, Angiology and  
Pneumology, Coburg Clinic, Coburg,  
Germany.



from recent updates deliver the best images we have ever seen,” says Brachmann. “Today, images show a very homogenous contrast distribution, sharp vessel edges, and minimal background noise. Siemens has done a great job with image processing enhancements.”

### A History of Collaboration

The partnership between Coburg Clinic and Siemens began in 1998. Back then, the hospital only had one film-based cath lab, where approximately 500 purely diagnostic catheterizations were performed each year. Around that time Siemens approached Brachmann and his colleagues at the Coburg Clinic, which is located 60 kilometers north of the Siemens headquarters in Forchheim. “It didn’t take very long until we and Siemens discovered the poten-

tial for collaboration to drive projects in interventional cardiology and electrophysiology,” says Brachmann. He enjoys the close collaboration with Siemens’ dedicated innovations group, who enabled the hospital’s project ideas to be implemented and strongly supported. Since 1998, more than 15 clinical collaborations have been completed or are in progress. The clinic’s cardiology department is now one of the largest and most respected centers for the treatment of cardiovascular disease in Germany. “It was this dedication and the innovational power of Siemens that allowed us to grow the way we did,” says Brachmann.

Last year alone, the Coburg Clinic performed more than 4,500 cardiac catheterizations, including more than 4,000 percutaneous cardiac interventions and

completed nearly 800 electrophysiology interventions. In addition, the hospital conducted 2,600 cardiac MRI exams.

### A Dramatic Improvement

Brachmann has worked with image intensifier and flat detector (FD) systems and admits that he was not impressed by the first flat-detector images he saw. “We were really disappointed by the image quality this revolutionary new technology produced,” he says. “The resolution had increased, but the contrast was poor and, compared to images from the old image intensifier, the noise was terrible. From a technical point of view, we knew the images were better, but our perception was the opposite. It took us a while to get used to this.”



“However,” he says, “the advent of CLEAR image acquisition and processing produces a superior level of quality.” CLEAR came to the Artis zee family with the latest software version, released in 2010, and the new MEGALIX Cat Plus X-ray tube, which features industry-unique flat emitter technology. With 250 mA, MEGALIX Cat Plus offers the highest maximum fluoroscopy current available to optimize contrast at low kVs. The increased current is up to 40% greater than what filament technology provides and ensures excellent image quality, particularly in the growing population of obese patients. In addition, CLEARcontrol, the histogram-based grey value measurement, takes into account the exposure values of the whole image to ensure minimal overexposure and provide an even grey value distribution to optimize brightness and contrast

throughout the entire image. CLEAR image processing itself consists of three individual modules. CLEARview conducts a dose-adaptive noise reduction and increases image sharpness, especially for images acquired at low doses. CLEARvessel automatically detects vessel edges in the image and enhances contrast to improve vessel edge visibility. CLEARmotion compensates for motion artifacts of fast moving fine structures such as guidewires or catheters and enables optimal visualization of small vessels. Individual preferences in image display also play an important role in how well image quality is perceived. To accommodate for that, CLEARchoice allows users to choose the image quality of their preference. Interventionalists who prefer sharper images, for example, can set their preferences accordingly,

while colleagues who prefer smoother images can optimize their display to suit that preference. The Artis zee touch panel allows users to quickly and easily access their preferred settings from the tableside. The latest addition to CLEAR image processing is CLEARstent, which enables cardiologists to rapidly and precisely assess proper stent deployment. At the press of a tableside button, CLEARstent automatically enhances stent visibility. “With over 30 cases per day, we need a quick and easy way to assess proper stent deployment,” says Brachmann. “Even though technologies like OCT (optical coherence tomography) give a much greater level of detail, we like the straightforward operation of CLEARstent. Everything is done automatically. The development of increasingly finer stent struts and growing concerns



## Coburg Clinic: Compassion and Quality in Patient Care

For more than 100 years, the Coburg Clinic in the Bavarian city of Coburg, Germany, has stayed at the forefront of medicine by combining compassionate care with the most advanced technology. The 510-bed academic teaching clinic of the University Würzburg plays an important role in the education of the next generation of physicians and has particular areas of emphasis in nephrology, oncology, and cardiology.

The 140-bed cardiology clinic at Coburg Clinic is one of the largest and most respected centers

for the treatment of cardiovascular disease in Germany. It offers a full range of catheter-based interventions, treatment of cardiac arrhythmias, as well as the implantation of pacemakers and defibrillators. Its catheterization labs are equipped with one Artis zee floor-mounted system, one Artis zee biplane system and two Artis zee ceiling-mounted systems, one of which is set up as a combined Angio-MR MIYABI system to ease patient transfer and allow interventional procedures to be easily controlled by MR.

about radiation dose make the solution even more valuable," Brachmann adds. 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. Automatic region of interest selection ensures the visibility of the entire stent and not just the region in between catheter balloon markers. The enhanced image or sequence is saved as a regular DICOM scene and can be started, stopped, accelerated, decelerated, windowed or zoomed. It also can be stored to PACS to be reviewed on any DICOM viewer.

Brachmann notes that he and his colleagues have only been using CLEARstent for three months and have yet to fully integrate it into their workflow. But they already are experi-

encing promising results. "It has given us important information regarding procedural success and more than once allowed us to improve our outcome," he says and adds "early observations suggest a useful application of CLEARstent also in absorbable scaffold for coronary interventions."

### Reducing Dose with CARE

The cardiology team at the Coburg Clinic is committed to working according to the ALARA (As Low As Reasonably Achievable) principle for the benefit of patients as well as staff. For their coronary interventions, they normally use 7.5 f/s, sometimes even less. Only in very rare cases will they increase the frame rate to 15 f/s.

Back in 1994, the feature known as CAREvision had already marked the beginning of a strong commitment by

Siemens to continuous development and release of features reducing X-ray exposure of both patient and staff. In 2010, this commitment grew even stronger after Siemens decided to include these features in every Artis zee system free of charge, also updating all installed systems in the field.

"We were impressed with the Siemens initiative to provide the CARE package to the entire Artis zee installed base," says Brachmann. "Features like CAREposition, which enables radiation-free positioning of the patient, and CAREmonitor, which gives angulation-dependent information about the applied skin dose, help us save a lot of dose as we treat our patients." Efforts on reducing the radiation dose for the clinical team is becoming even more essential when we look at our next physician generation. While up to



80 % of our current medical students are female, only 14 % of cardiologists today are women. This is largely due to women's concerns about being exposed to radiation during child-bearing age and we need to develop a suitable working environment for them to fill the spots and needs to train tomorrow's interventional cardiologists. The role of the industry is crucial here and Siemens is showing great leadership with their CARE solution.

Additional CARE features include the afore-mentioned CAREvision, which provides variable fluoro pulse rates that can be adapted according to the clinical need to reduce dose by up to 75 %, and CAREfilter, which achieves a skin dose reduction of up to 50 % by automatically adjusting the filter size based on the patient's weight and the angulation of the C-arm. CAREprofile allows radiation-free collimation to precisely target the region of interest without using fluoroscopy. All of these features

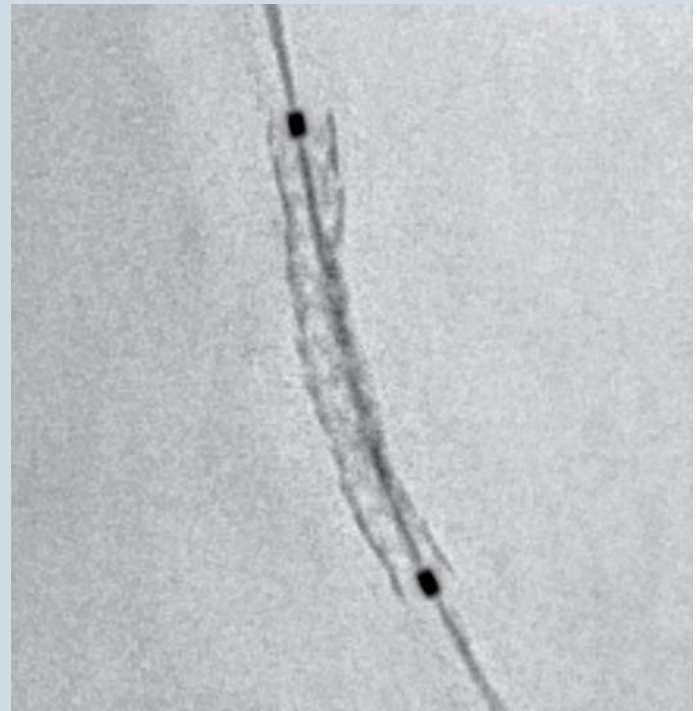
“Today, images show a very homogenous contrast distribution, sharp vessel edges, and minimal background noise. Siemens has done a great job with image processing enhancements.”

Professor Johannes Brachmann, M.D.,  
Head Physician of the 2nd Medical Clinic for Cardiology,  
Angiology and Pneumology, Coburg Clinic, Coburg,  
Germany.





CLEARstent post implantation of a stent in the RCA



CLEARstent acquisition after stent implantation in the LCA

are complemented by low-dose acquisition of 2D and 3D images. And to account for and encourage increased operator awareness about saving dose, CAREguard informs the operator when institution-defined overall dose thresholds are exceeded. The newly developed CAREmonitor now even allows the display of an angulation-dependent skin dose based on an individually calculated patient model related to the patient's height and weight. For reporting and analysis, CAREreport automatically generates DICOM structured dose reports while CARE analytics allows further statistical evaluations of the emitted dose.

### The Best Is Yet to Come

While the advances from our latest software update are certainly welcome, Brachmann notes that new developments in the field of interventional cardiology will necessitate even further improvements. One of the next big challenges for coronary interventions

will be bioabsorbable scaffolds. As their name indicates, these are not rigid metal structures like today's stents, but are designed to disappear after several months when their job has been done. Unfortunately, this also makes them almost invisible on X-ray. "The ability to visualize these stents and assess their proper deployment will be essential in the future," says Brachmann. He adds that another important topic will be the integration and registration of alternative imaging modalities such as OCT into the X-ray fluoroscopy images. While OCT gives great detail about the inside of the vessel and stent adaptation, X-ray images allow the evaluation of the position of the stent with respect to the vessel topography. One of the very first Artis zee systems, at that time still known as AXIOM Artis, was installed at Coburg Clinic in 2006. Continuing that tradition of leadership, the clinic recently became the first site in the world to test Siemens'

latest catheterization lab prototype in a clinical setting. Brachmann reports that the new system allows his team to significantly drive down dose while retaining image quality. He is currently conducting a study to quantify dose savings, but preliminary results indicate a reduction of up to 30%. "We are very proud to have been selected to develop new equipment with Siemens," says Brachmann. "We treated the first patient with the prototype catheterization lab just a couple of months ago, and I must say, the results exceeded my expectations."

CLEAR imaging with CARE. Type in this URL to hear experiences from Artis zee users: [www.siemens.com/clear-care](http://www.siemens.com/clear-care)

#### Contact

[hanno.herrmann@siemens.com](mailto:hanno.herrmann@siemens.com)

# Patient Care and Dose Saving in Interventional Neuroradiology

Since 1993, Ansgar Berlis, M.D., Head of the Neuroradiology Department at Klinikum Augsburg in Germany has gathered experience using different neurointerventional systems. Then in 2010 a new installation was planned and Berlis chose the Siemens' Artis zee biplane system. This system is equipped with two large flat detectors and many of the latest features such as *syngo* DynaCT, Artis zee Large Display, the integrated heated mattress as well as low dose fluoroscopy and low dose acquisition. About 300 interventions are performed in his department per year including to treat aneurysms, stroke and AVM. In this interview Berlis shares his outstanding experiences with the Artis zee biplane system, the low dose protocols, the Siemens applications and the integrated heated mattress.

By Ralf Krümtünger

**Dr. Berlis, you have been working with an Artis zee biplane system since 2010. What are the important features from your point of view and what new possibilities support your daily work?**

Most important for my daily work are the major advantages with respect to 3D functionality, especially during the treatment of cerebral aneurysms.

Another important point is the excellent quality of the images, especially when using the low dose protocols.

The functionality of a table with a tilting tabletop extends the possibilities for treatment of patients with increased brain pressure.

The table and C-arm movements are not time-consuming and the tableside controls allow very fast changes between different programs [conventional angiography, rotational angiography and *syngo* DynaCT], which are necessary for decision making during neuro interventions.

In addition, since we have the wireless footswitch, there is no cable to damage. We previously encountered this difficulty several times after a patient's bed rolled over the wire of the old footswitch.

**What are the key aspects of your daily work and what are your "favorite" interventions?**

My favorite interventions are aneurysm treatments (case 1, figure 1 + 2) and treatment of cerebral as well as spinal arterio-venous malformations (case 2 and 3, figure 3 - 5). The advancement of tools, devices and embolization

agents has been incredible during the last decade, therefore the number of interventions has increased worldwide. The neuro interventionalists can be happy that the angiography technology is showing the same tendency in development.

**Could you tell us which systems features and applications are most important and how those features support your work?**

The quality of the 3D reconstruction and the high resolution of *syngo* DynaCT allow better planning of the procedure as well as real-time adaptation of planning during the interventions. Although the quality is not quite at the same level as regular CT, it has great advantages in that it is available immediately and is less subject to artifacts from metal structures such as after stenting and coiling of cerebral aneurysms.

**What is your vision for the future and what can be improved?**

As for the future, emergency cases with severe stroke could be directly examined in the angio suite without previous regular CT or MRI and then be treated immediately after *syngo* DynaCT, *syngo* DynaCT angiography and perhaps perfusion *syngo* DynaCT. Time is brain – therefore the most important consideration is the loss of time caused by moving between CT, MRI and the angio suite.

Improvements are ongoing. My suggestion for the future involves 3D post-processing at bedside in the angio suite. I would like to see this made more

comfortable for the interventionalist in scrubs.

**Are you using Roadmap during your interventions or do you prefer the Overlay/Ref function? If you are using both, please let us know when you prefer what and why?**

I prefer Roadmap due to the high contrast differentiation. Roadmap with contrast medium is used for navigation in small brain vessels and during the placement of the first and last coil.

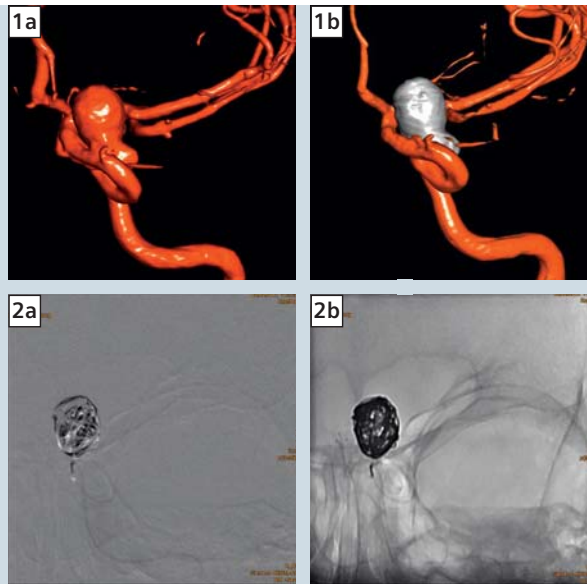
“Non contrast” Roadmap (case 2, figure 2) is used during embolization with liquids or coils in cases with clear definition, the neck of the aneurysm, and the parent artery.

Overlay/Ref is helpful when crossing the carotid bifurcation as it uses images acquired as part of our standard workflow. The advantage is that no further contrast and additional fluoroscopy for subtraction is required.



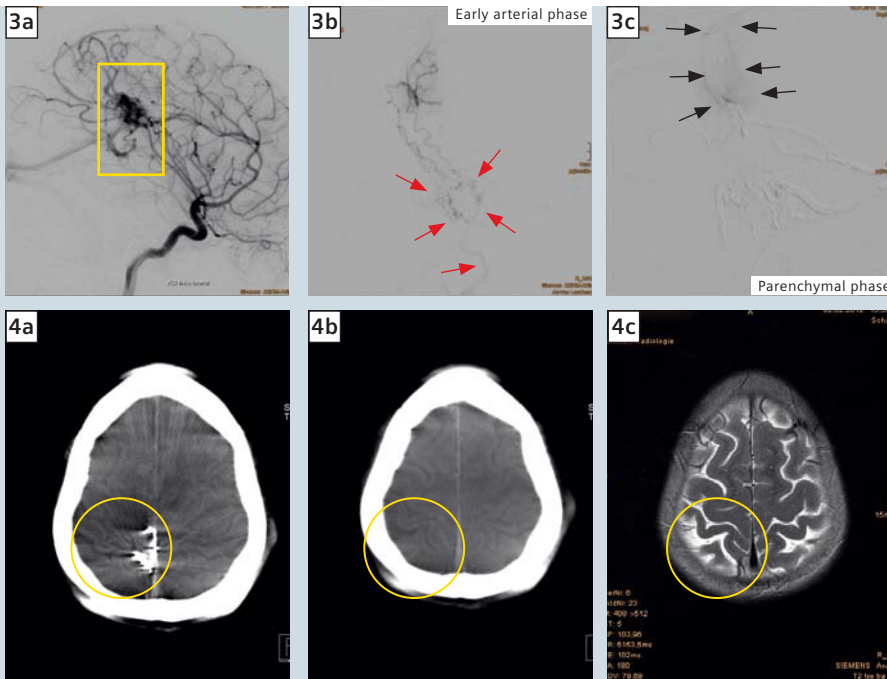
“Time is brain – therefore the most important consideration is the loss of time caused by moving between CT, MRI and the angio suite.”

Ansgar Berlis, M.D.,  
Head of the Neuroradiology Department  
at Klinikum Augsburg, Germany



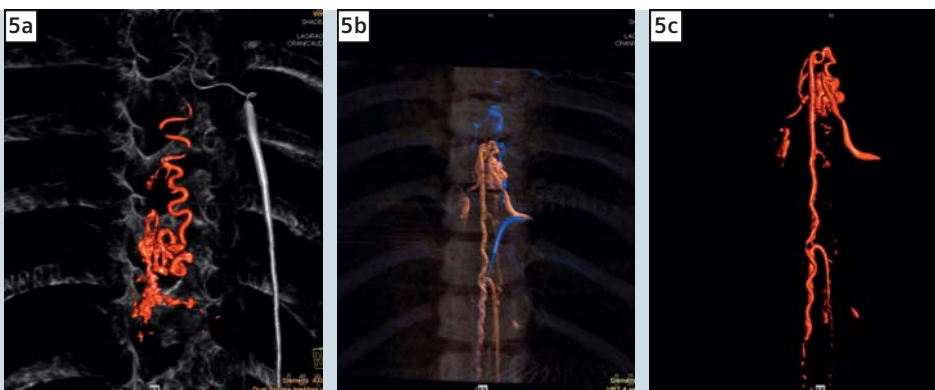
**1 a+b** 54-year-old female with large supraophthalmic ICA aneurysm. Aneurysm before (a) and after stent-assisted coil embolization (b).

**2 a+b** After stent and first coil placement, the second coil is placed using the “non contrast roadmap technique” to optimize the visualization of the new coil. The new coil looks black instead of white, like the previous coil.



**3 a-c** 31-year-old male with callosal AVM. A contrast medium injection via a microcatheter into the parietal branch of the right callosomarginal artery shows the AVM nidus with the vein (red arrows) and the gyral enhancement (black arrow).

**4 a-c** 20-second syngo DynaCT technology combined with microcatheter contrast injection (Fig. 4a) and without contrast injection (Fig. 4b) and the corresponding axial T2w-images (Fig. 4c) allowing clearly to depict the enhancement of the post-central gyrus (yellow circle). Embolization in this position would result in sensory defects of the right leg.



**5 a-c** 4-year-old boy with acute paraplegia due to a medullary bleeding at level TH 9/10. A residual AVM that is fed by two feeders arising from the descending anterior spinal artery that originates from the A. radicularis magna (Adamkiewicz) of the segmental artery TH10.

The 2nd and 3rd from left show a dual volume 3D angiography of the anterior spinal artery including arterial and venous phases. The embolic material and the guiding catheter are blue-colored.

**Are you satisfied with the functionality and image quality?**

Yes. I am satisfied with the image quality; your Roadmap, in particular, is excellent.

**As for ease of use, would you say it meets your expectations and do you think our system is intuitive?**

I find your fluoroscopy and Roadmap are easy to use, simple and self-explanatory and there are many positive advantages with your post-procedure image processing tools. Initially, as a new Siemens user, I found the learning curve quite steep. However, since working with experienced users for 1.5 years, the learning curve has flattened now even though I am sure there are still some things to learn about post-processing. As of today I would say your system is easy to handle and really intuitive.

**How satisfied are you with the image quality of syngo DynaCT and for which interventions would you suggest syngo DynaCT is indispensable?**

The image quality of syngo DynaCT has increased tremendously since the last software update. Although syngo DynaCT is not equal to a regular CT, the important questions we have during or after neuro interventions can be checked very quickly, such as in cases that need fast diagnosis: like with hemorrhage, did the patient suffer from a stroke, or did the patient develop a hydrocephalus? These very important questions can be successfully answered in most cases by using syngo DynaCT and therefore our expectations are fulfilled.

The quality of syngo DynaCT is high and we have implemented a routine workflow during AVM procedures where we use syngo DynaCT with contrast injections via the micocatheter to identify critical areas that might be harmed after using liquid embolics (figure 3 and 4) and which we need to exclude for embolization.

We have an increasing number of syngo DynaCT angio examinations,

especially in cases after cervical and intracranial stenting. syngo DynaCT is also routinely used during myelography as well as during vertebroplasty and kyphoplasty in order to localize the correct placement of the cement.

**Bringing dose to the lowest possible level without compromising image quality is a very important goal for Siemens. Dr. Berlis, could you tell us if image quality at the lowest possible dose does satisfy you?**

In most of the cases we use low dose programs, which have absolutely sufficient image quality for working without compromise for the patient.

**How do low dose acquisition programs support you during your daily work?**

We routinely start with low dose programs and only sometimes change to a higher level if the treatment requires exceptional image quality to ensure patient safety, independent of the dose.

**Dr. Berlis, please tell us how a patient with the presumptive diagnosis of stroke is treated in your hospital?**

In our routine workflow, patients with severe stroke get a conventional CT followed by a CTA, and in some cases perfusion CT. These scans require around 20 minutes or more. Patients without large infarcts and with large vessel occlusion of proximal cervical, intracranial and basal brain arteries are selected for intra-arterial recanalization. The same is true when a clot length of more than 7 mm in the anterior circulation is detected.

Patients meeting these criteria are then transferred to the angio suite. Those who present within 4.5 hours after stroke onset are treated with intravenous thrombolysis while the angio suite is set up and the patient is prepared for general anesthesia. Most of these patients are treated under general anesthesia.

In all stroke cases a post-procedural syngo DynaCT is acquired to detect

bleeding and to identify contrast pooling as a predictor of the definitive stroke area.

**Could you tell us for which interventions the integrated heated mattress is used and what makes it so important for neuro interventions?**

We use the heated mattress for all long-duration interventions with or without anesthesia. That said, since the heated mattress is so well accepted by all patients, especially those with back pain, we are also using it more and more for short diagnostic procedures.

Interventions can take from 30 min to several hours. In addition, infusions given to the patient can contribute to a significant decrease in the body temperature of the patient.

If there is no way to keep the patient's temperature stable during the procedure, the patient must be warmed up again following the intervention, which may also lead to a prolonged recovery from anesthesia.

It is also important to mention that this negative effect is particularly observable in small children and babies due to the high body surface compared to their body mass.

**Why would you recommend the heated mattress to other colleagues?**

The heated mattress is fully integrated into the system. The control module is very simple, easy to use, and allows individual adjustment of the temperature for each patient from tableside in the angio suite. Furthermore, the heated mattress can be cleaned easily and is highly appreciated by every patient. This in conjunction with the clinical benefits is the reason I recommend it to any colleague.

**Contact**

ralf.kruntuenger@siemens.com

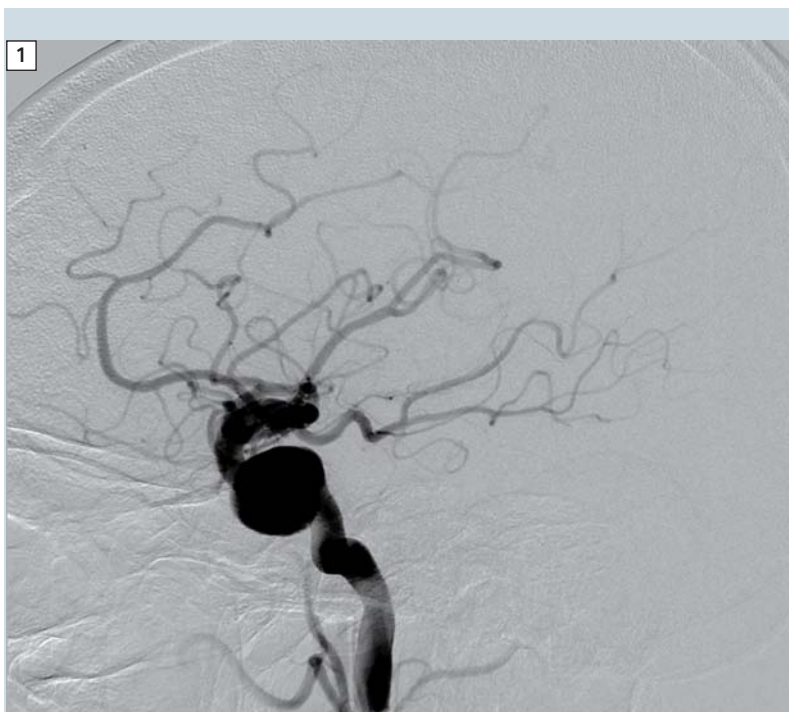
# Pipeline Stent Placement for Embolization of Giant Cerebral Aneurysm Supported by *syngo* DynaCT and *syngo* Neuro Aneurysm Analysis

Courtesy of Michael J. Alexander, M.D.,

Department of Neurosurgery, Cedars-Sinai Medical Center, Los Angeles, CA, United States



Michael J. Alexander, M.D., and Mike Tom, IR Team Leader at Cedars-Sinai, during a procedure in their Artis zee biplane lab.



1 DSA image demonstrating a giant aneurysm of the right internal carotid artery.

## Patient history

Female patient presents with increasing retro-orbital pain and a right 6th nerve palsy.

## Diagnosis

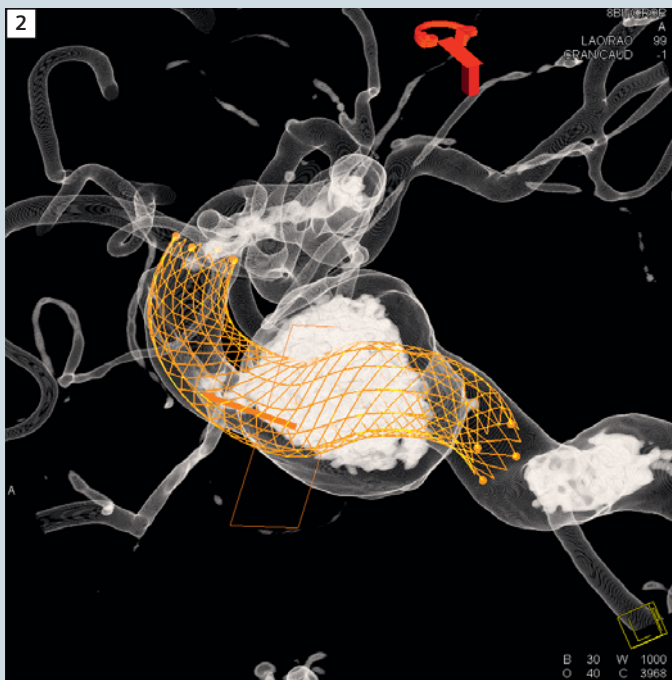
CTA scan demonstrated evidence of a giant right cavernous internal carotid artery aneurysm with a partial thrombosis and a smaller left carotid aneurysm. Treatment of the aneurysm using a Pipeline device was scheduled.

## Treatment

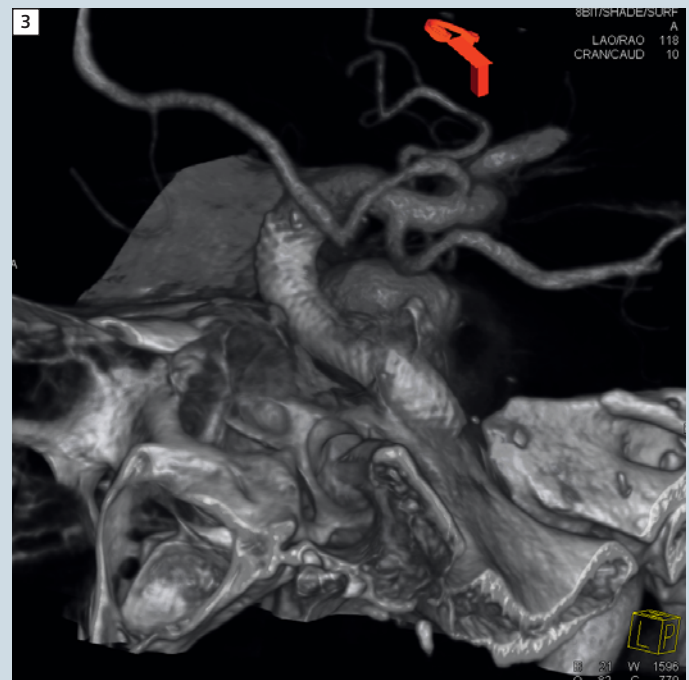
After a DSA acquisition of the right common carotid a 3D DSA (5sDSA) was performed. The dataset get transferred and reconstructed at *syngo* Workplace automatically, and *syngo* Neuro Aneurysm Analysis was activated. After an automated segmentation of the target area, seed points were placed in the aneurysm as well as proximal and distal in the right internal carotid artery. *syngo* Neuro Aneurysm Analysis then

calculated the size of the aneurysm, dome height and width and a centerline along the vessel. Based on this path a virtual stent was displayed. By adjusting its diameter and length the virtual stent was set to the actual vessel size and shape. The graphic was then overlaid onto live fluoro using *syngo* iPilot Dynamic/Enhanced.

A microcatheter was advanced past the aneurysm into the right middle cerebral



**2** 3D DSA images from a 5sDSA acquisition are used for an evaluation with *syngo* Neuro Aneurysm Analysis (incl. Virtual Stent). The application helps to determine length and diameter of a stent device and gives the user helpful guidance when this image is overlaid onto the live fluoro image.



**3** A 20s DR *syngo* DynaCT confirmed nicely the correct position of the two Pipeline devices which were delivered to embolize the giant aneurysm.

artery. Then, a Pipeline flow diverter device measuring 5 mm x 20 mm was delivered. Since there was still a contrast jet seen following placement of the first device, a second Pipeline stent measuring 5 mm x 16 mm was placed. A final 20 sec *syngo* DynaCT confirmed correct positioning of both devices. There was a marked decrease of contrast flow into the aneurysm and it was stagnant in later phases.

### Comments

Fast and reliable planning of the deployment of the Pipeline devices was possible thanks to the seamless semi-automatic workflow in *syngo* Neuro Aneurysm Analysis (incl. Virtual Stent). Relevant measurements are displayed by default and overlaying the virtual stent graphic onto live fluoro is helpful to confirm the landing zone of the device. Using *syngo* iPilot is useful since it follows all C-arm and table movements during the procedure.

### Contact

heike.theessen@siemens.com

# Chemoembolization with Drug-Eluting Beads Supported by *syngo* DynaCT

Courtesy of Tobias F. Jakobs, M.D.,  
Department of Diagnostic and Interventional Radiology,  
Barmherzige Brüder Hospital, Munich, Germany



## Patient history

A 63-year-old female with liver dominant metastases from breast cancer.

## Diagnosis

Treatment-refractory liver metastases from breast cancer. History of radioembolization (SIRT) of the right liver lobe. Due to the complex arterial anatomy of the left liver lobe (figure 1), SIRT of the left liver lobe was abandoned.

## Treatment

A planar angiogram revealed a separate origin of the gastro-hepatic trunk together with the right inferior phrenic artery from the aorta (figure 1). Short gastric branches (arrow) arising from the left hepatic artery are detected. A microcatheter is positioned superselectively in the left hepatic artery distal to the origin of the gastric branches and a power-injection angiographic run is performed (figure 2). A falciform artery is visualized immediately (figure 2, red

arrow). To confirm that no vessels other than the falciform artery are at risk for an ectopic embolization of the drug-eluting beads in non-target territories, a *syngo* DynaCT was performed 8sDR; 5 s X-ray delay; 15 cc of volume (50 % contrast (300 mg iodine/cc) / 50 % of saline) at 1.5 cc per second followed by saline with the same injection parameters). Instant multiplanar reformats (MPR) demonstrate nicely the contrast uptake of the segments 2 and 3 of the left liver lobe (figure 3) with no contrast enhancement of the gastric wall (arrow). Reviewing all MPRs (figures 4 and 5) in addition to the falciform artery, contrast enhancement of the distal esophagus (arrows) is revealed, which was not recognized initially when looking at the planar angiogram only (inferior esophageal artery, figure 2, blue arrows). The color-coded volume rendered dataset (figure 6) as well as the curved MPR (image 7) nicely illus-

trate the course of the falciform artery (yellow arrows). Before delivering the drug-eluting beads the falciform artery was coil-embolized (figure 8) and the treatment was performed safely and uneventfully with special attention to the inferior esophageal arteries (carefully avoiding reflux).

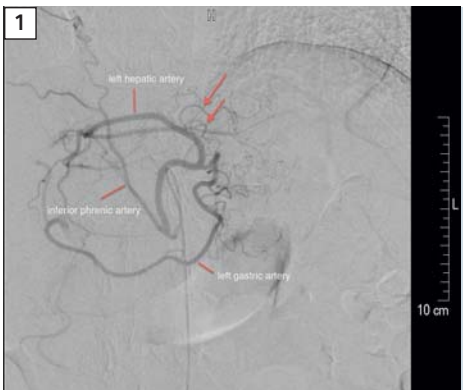
## Comments

The patient neither described any symptoms during the treatment nor side-effects during follow-up. PET-CT performed 2 months after DEBTACE revealed photopenic defects in the former area of the liver metastases, indicating a favorable response to treatment.

## Contact

simone.hinrichs@siemens.com



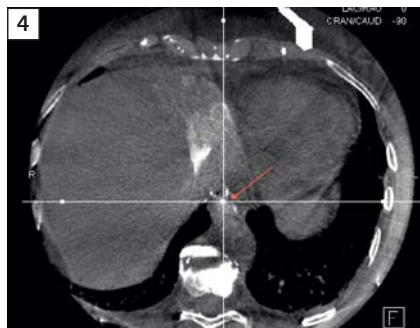


**1** Complex arterial anatomy of the left liver lobe with gastric branches (arrows) arising from the left hepatic artery.

**2** Power injection angiography run: A falciform artery is visualized immediately (red arrow) by inserting a microcatheter in the left hepatic artery distal to the origin of the gastric branches. Suspicious arteries crossing the diaphragm are detected (blue arrows).



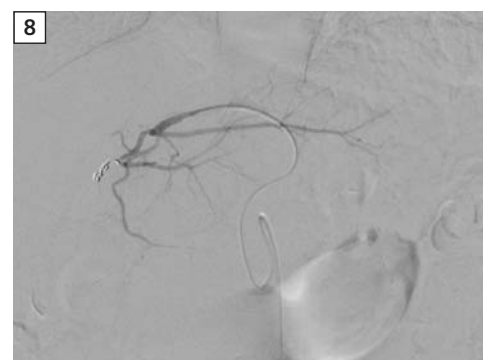
**3** Instant multiplanar reformats (MPR) to demonstrate the contrast uptake of segments 2 and 3 of the left liver lobe without contrast enhancement of the gastric wall (arrow).



**4 + 5** Furthermore, MPR visualizations (figures 4 and 5) reveal contrast enhancement of the distal esophagus (arrows), indicating that the suspicious arteries in figure 2 (blue arrows) are inferior esophageal arteries that should not be embolized with drug-eluting beads.



**6 + 7** Color-coded, volume-rendered dataset (figure 6) together with curved MPR (image 7) show the morphology of the falciform artery (yellow arrows).



**8** Coil embolization of the falciform artery to prepare treatment with drug-eluting beads.

# Future Trends in Interventional Radiology

Future trends in interventional radiology will certainly lead to fewer complications, less mortality, and faster recovery of the patient. The key to these advances is the hybrid setting for multidisciplinary interventions. Prof. Johannes Lammer, M.D., Head Radiologist at the Department for Cardiovascular and Interventional Radiology of the AKH in Vienna, Austria, is very proud of the acquired multi-axis system, Artis zeego. In his point of view procedures are safer, more complete, and more efficient with this system – for the benefit of the patient. More is yet to come, as the scope of the system for future applications is wide.

By Irène Dietschi

The angio room is equipped with surgical lamps attached to the ceiling, an angiographic table lined with flat screens of impressive size, anesthetics' equipment placed in two corners, a number of computers protected by a glass wall in the entrance area, and, governing the scene, the impressive robotic C-arm of Siemens' Artis zeego in the center: A hybrid room concept in the Department of Cardiovascular and Interventional Radiology at AKH (Allgemeines Krankenhaus) hospital in Vienna, Austria.

"The room is hybrid in two respects," explains Professor Johannes Lammer, Head of the Department since 1992 and former President of the European Society for Cardiovascular and Interventional Radiology: "First, it allows for endovascular procedures but also procedures where you have a combination of surgery and endovascular interventions called hybrid procedures. Artis zeego is a hybrid multi-axis imaging system: it yields the classic X-ray information of an angiography appliance; and beyond that, the robotic technology offers a lot more flexibility when it



A close-up, profile view of an older man with a mustache and glasses, smiling. He is wearing a white lab coat. The background is a soft, out-of-focus blue.

“Our procedures  
have become  
safer, more  
complete  
and more  
efficient –  
for the benefit  
of the patient.”

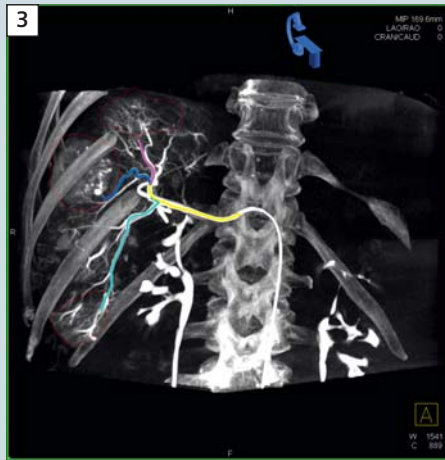
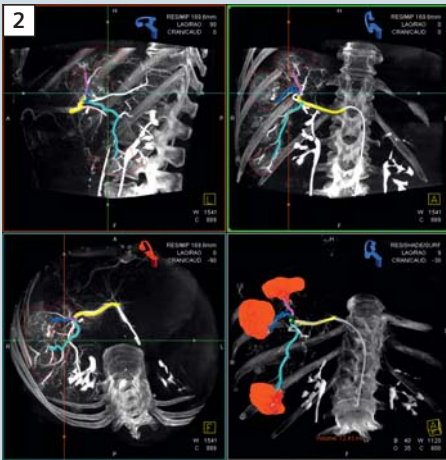
Prof. Johannes Lammer, M.D.,  
Head Radiologist,  
Department for Cardiovascular  
and Interventional Radiology  
AKH Vienna, Austria.



**1** Contrast-enhanced syngo DynaCT scan of the liver.

**2** Liver tumors and feeding vessels segmented by syngo Embolization Guidance.

**3** VRT visualization of tumor feeding vessels, identified by syngo Embolization Guidance.



“Formerly, this complication was often not detected until a control CT was performed days later. Today the Artis zeego enables confirmation during the very same intervention that the stent graft was placed in the exact location.”

Prof. Johannes Lammer, M.D.,  
Head Radiologist  
Department for Cardiovascular  
and Interventional Radiology  
AKH Vienna, Austria.

comes to patient access and the ability to rotate the C-arm around the patient and to generate CT-like images from practically any angle.” Lammer’s department had the Artis zeego installed in June 2010. Experience with it has been very good. “The combination of angiography and computed tomography works very well. Our procedures have become safer, more complete and more efficient – for the benefit of the patient.” At the AKH Vienna the main activity of interventional radiology used to be cardiovascular interventions. In recent years, another field has gained equal importance: the field of interventional oncology for the treatment of tumors. The aim of a chemoembolizations is to

cut off the tumor’s blood supply and hence to stop its growth. Encouraged by effective interventions, Lammer’s team is increasingly applying this method for liver tumors. “The interventional radiologist aims to target the tumor as precisely as possible,” he explains, “placing his microcatheters into all the vessels that provide the tumor with blood.” Supported by imaging, the embolization is then carried out by particles that are injected into the arterial vessels feeding the tumor.

### Minimized Risk of Incomplete Embolization

In conventional angiography, there is considerable risk that the embolization will remain incomplete because the vas-

cular system of the liver is very complex and hard to visualize. “A control CT the day after the procedure used to yield the relevant information: whether we had embolized the tumor completely or whether we had missed part of it,” says Lammer. In the latter case, the procedure had to be repeated. Artis zeego minimizes the risk of incomplete embolization substantially. By rotating the C-arm, the robotic system delivers a 3D view of the organ with a large field of view to be able to visualize the vascular system of the tumor in full. “The potential to create live 3D images is really very helpful – no matter how complex the volume we are focusing,” says Lammer. “Not only does it enhance our efficiency, it also decreases the total



toxicity of the liver." In the end, this means fewer complications, less mortality, and faster recovery of the patient.

### An Investment in Quality

Does "higher efficiency," equal more cases per day? Has the workflow become faster with Artis zeego?

Lammer shakes his head. "It wasn't our aim to increase the number of patients, but to invest in quality," he says. "The advantages of the system, meaning the ability to do more complex motions and to be less invasive, are really for the benefit of our patients now. That's the main reason why the AKH chose to acquire Artis zeego." Moreover, he says, business relations between the hospital and Siemens are well established. "The

company's service is very good," he emphasizes.

With the help of Artis zeego radiological interventions are more precise and more complete. "Think of aortic therapy," Lammer says. "This originally surgical field has been replaced to a very large extent by endovascular procedures." One problem which often arises in stent graft implantation is that the graft doesn't seal completely so that small amounts of blood still leak into the aneurysm. "Formerly, this complication was often not detected until a control CT was made days later. Today the Artis zeego enables confirmation during the very same intervention that the stent graft was placed in the exact location."

Transcatheter aortic valve implantation (TAVI) benefits from Artis zeego as well: with the 3D images created the exact positioning of the valve and hence the avoidance of paravalvular leaks become easier. On this basis Lammer predicts that TAVI, although still regarded as a novel method for high-risk patients, has a "great future" in interventional cardiology.

### Hybrid Settings for Multidisciplinary Interventions.

In Lammer's view, the destiny of interventional radiologists lies in the hybrid setting for multidisciplinary interventions. He believes that the scope of a system such as Artis zeego is much wider than what it has been used for so far. He mentions the embolization of uterine myomas, a minimally invasive procedure which an increasing number of women prefer to the classical gynecological procedure of hysterectomy. "In the beginning gynecologists reacted with a certain amount of resistance to the 'meddling' by another discipline, but then they started to acknowledge the benefits," says Lammer. Another field is vertebroplasty. "Here at the AKH it is done by the orthopedists, and they use their own device," Lammer explains. "But a rotating CT system would certainly be helpful, as would be in many cases where biopsies are involved." The pre-requisite for such changes is good teamwork. "In hybrid rooms there are many disciplines working together – radiologists, cardiologists, heart surgeons, vascular surgeons, neurosurgeons, orthopedists, gynecologists, urologists, hepatologists, and many more," says Lammer. "If they want to use an accomplished system like Artis zeego to the advantage of the patient, it is indispensable that they work hand in hand."

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

#### Contact

mariana.aquino@siemens.com



SIEMENS

# Hands-on Tutorials at this year's ESC congress

August 25 - 29, Munich, Germany

Cardiac imaging is rapidly developing, driven by the introduction of new imaging approaches. In order to keep you updated in the field of state-of-the-art cardiovascular imaging, Siemens Healthcare is providing a comprehensive set of Hands-on Tutorial (HOT) sessions during this year's ESC congress.

You will have the opportunity to learn from renowned clinical experts how to perform and analyze 3D imaging in the cath lab, how to benefit from integrated FFR measurements and how to optimize your reporting.

## Our Hands-on Tutorial Program

### **Multi-modality image guidance in 2D and 3D for structural interventions**

Markus Fueller, M.D., Munich, Germany

### **3-dimensional image guidance during ablation procedures**

Klaus Kurzidim, M.D., Regensburg, Germany

### **Control your time with automated reporting – benefit of integrated illustrations, fractional flow reserve, and dose analysis**

Mohammed Natour, M.D., Heidelberg, Germany

For further sessions on real-time 3D echocardiography, comprehensive studies with cardiac CT, cardiac MRI and PET-CT please refer to our ESC webpage.

[www.siemens.com/healthcare](http://www.siemens.com/healthcare)

# Measurement of Fractional Flow Reserve (FFR) in Routine Practice

“The integrated FFR on AXIOM Sensis XP makes it much easier to implement FFR measurements into routine practice, and thus significantly improves the efficiency of coronary procedures for our patients.”

Lorenz Bott-Flügel, M.D., Head of Invasive Cardiology at the Kreiskrankenhaus Erding, Erding, Germany



The Kreiskrankenhaus Erding, a regional teaching hospital of the Technical University Munich, is one of the first sites working with the new AXIOM Sensis XP option Integrated Measurement of Fractional Flow Reserve (FFR). The newly planned and built cath lab is in service since March 2011. The Artis zee ceiling and AXIOM Sensis XP are mainly used for coronary procedures – about 400 PCIs per year. In July 2011 the Integrated FFR option was installed and quickly became an indispensable part of the daily routine. Bott-Flügel, M.D., Head of Invasive Cardiology uses fractional flow

reserve measurements in approximately every fourth procedure. What he appreciates about the integration with AXIOM Sensis XP is that there is no preparation time, it is always available and ready to use, even if FFR measurements were not planned beforehand.

“Quite often during a procedure it turns out that there is a stenosis difficult to judge visually. Then we just put the FFR pressure wire in place and start the measurement via AXIOM Sensis XP. The FFR waveforms are displayed on the Sensis monitor,” explains Bott-Flügel. “FFR values are calculated automatically

and also stored in the database for the final report. This is so convenient and at the same time really improves our clinical outcomes.”

According to Bott-Flügel the visual judgement of a coronary stenosis can be misleading, but with a quick check of the fractional flow reserve unnecessary placement of stents can be avoided, and seemingly low-grade, but hemodynamically relevant stenoses, can be identified as treatment targets.

“With FFR you can get interesting insights,” says Bott-Flügel. (Please read the clinical case on the next two pages.)

# Coronary Stenosis Evaluation Supported with integrated FFR

Courtesy of Lorenz Bott-Flügel, M.D.,  
Department of Invasive Cardiology, Kreiskrankenhaus Erding, Germany



Lorenz Bott-Flügel, M.D., Head of Invasive Cardiology at the Kreiskrankenhaus Erding, Erding, Germany

## Patient history

A 72-year-old male with ongoing chest pain is being evaluated for coronary stenosis.

The patient has had a history of two myocardial infarctions in 1980 and 1994 and stents had been previously placed in the RCA and RCX. Due to a pathologic stress echocardiography, performed several weeks before, demonstrating moderate ischemic wall motion abnormalities in the anterior wall, a diagnostic left-heart catheterization was performed using radial approach, which is used in 80% of the procedures.

## Diagnosis

Good long-term results in the previously stented RCX and RCA; moderately calcified stenosis of the proximal and medial LAD (visually graded as being maximum 25-50%).

## Treatment

The FFR pressure wire was then introduced into the LAD and 140 µg/kg/min adenosine were given intravenously. After equilibration the FFR measurement did reveal a significant stenosis (FFR = 0.67\*).

Pullback of the pressure wire demonstrated a pressure jump just distal to the bifurcation with the 2<sup>nd</sup> diagonal branch, and along the proximal part of the LAD, which seemed rugged, thus maybe resembling an unstable plaque. After predilatation with a 3.5 mm balloon, a long drug-eluting stent (BioMatrix FlexTM 3.5 mm – 35 mm, Biosensors International) was implanted. Post placement, another FFR measurement showed a significant improvement (FFR = 0.85).

## Comments

Just from the angio it hardly looked like even a 50% stenosis but the whole

area seemed very rugged, like an unstable plaque (scene 1 on Artis). It is known that even a moderate stenosis in a major vessel, in this example the LAD, can constitute a hemodynamically relevant obstruction to antegrade blood flow. With the FFR values and the location of the lesion, it was possible to identify the culprit lesion and to successfully place a stent.

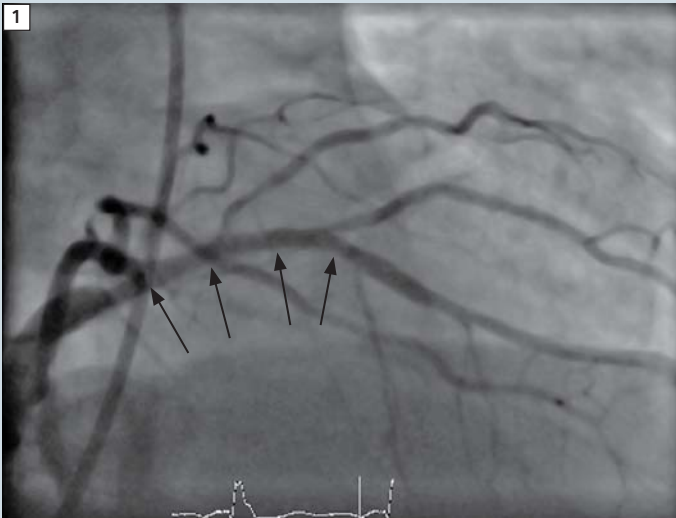
With the use of AXIOM Sensis FFR and Artis zee, Bott-Flügel is able to easily navigate the smart user interface, quickly obtain values to determine treatment, and have short fluoro run times.

\* An FFR < 0.75 indicates that the lesion is causing ischemia and should be considered for treatment (PCI).

## Contact

andrea.beulcke@siemens.com

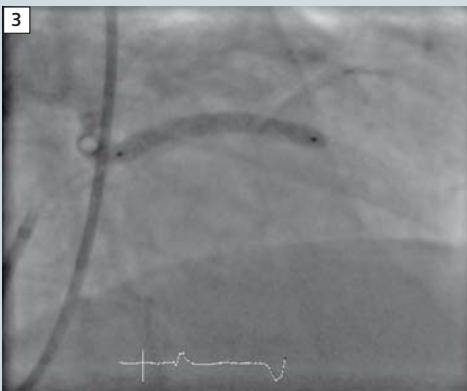




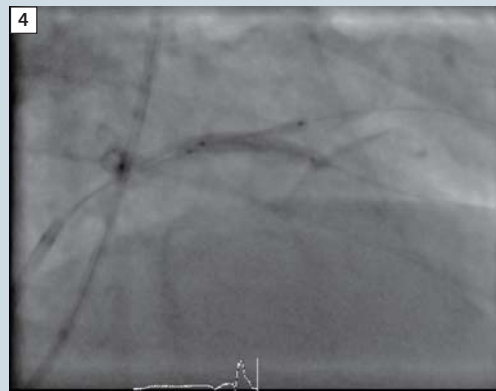
**1** Angiogram of the left anterior descending artery revealing only moderate vessel irregularities (arrows); both diagonal branches show 50% stenosis at their origins.



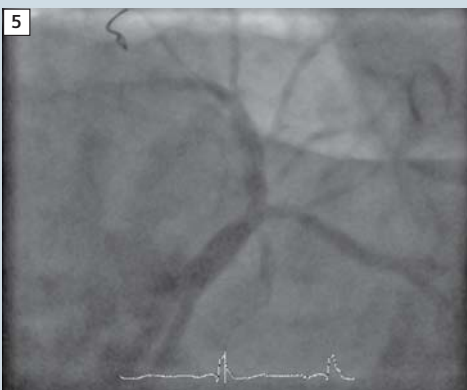
**2** FFR measurement of the LAD distal to the 2<sup>nd</sup> diagonal branch demonstrated a hemodynamically significant stenosis (FFR = 0.67).



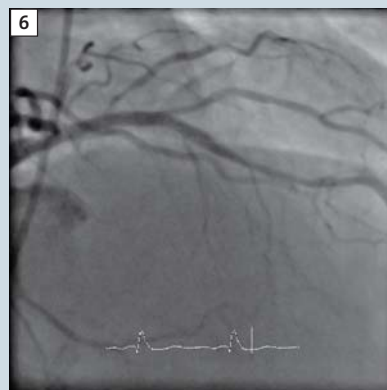
**3** Placement of a long drug-eluting stent (BioMatrix Flex™ 3.5 mm x 35 mm).



**4** Final kissing-balloon maneuver with simultaneous PTCA of the LAD and the 2<sup>nd</sup> diagonal branch. No additional stent was placed in the diagonal branch.



**5** Final result after stent implantation (LAO 45°, CAUD 20°).



**6** Very good angiographic result after stent implantation.

# 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 Middelaes 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, M.D.,  
Department of Interventional Cardiology, Maria Middelaes  
Hospital, Ghent, Belgium

The Maria Middelaes 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, M.D., 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 activated 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

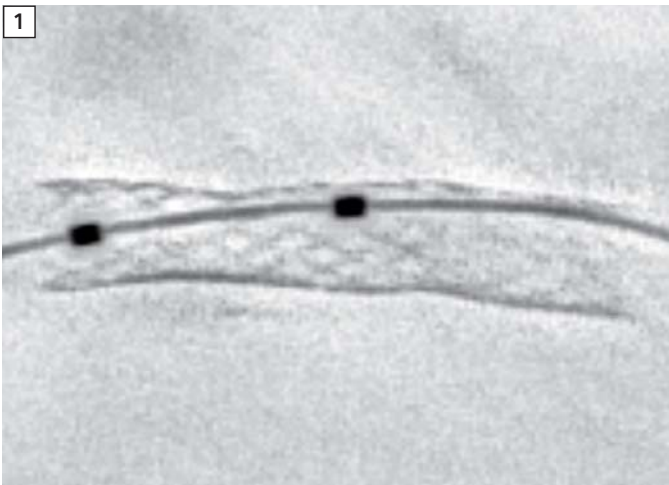
stents needed to be inflated alternately. Before inflating the last stent, we performed a CLEARstent acquisition. Here we found that the distal stent was not overlapping the proximal stent, and the third stent was damaging the second. This allowed us to change strategy. We finally were able to get a 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?

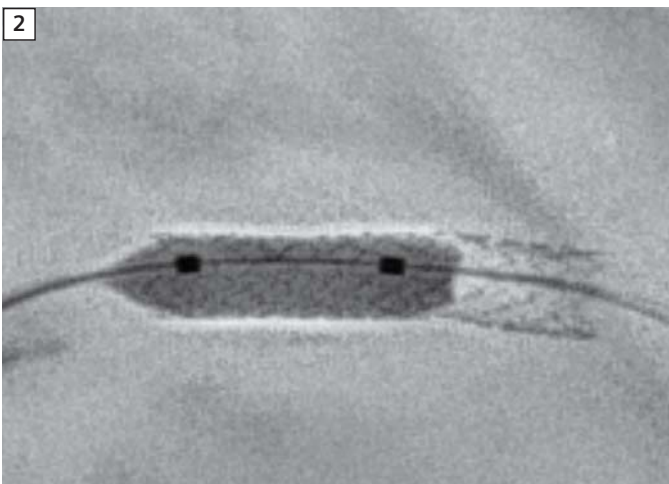
Currently IVUS is used as a gold standard to measure stent expansion, but it's an expensive tool and sometimes cumbersome to use. CLEARstent allows a very adequate border detection, and when calibrated correctly, might even replace IVUS in evaluation of stent expansion.

## Contact

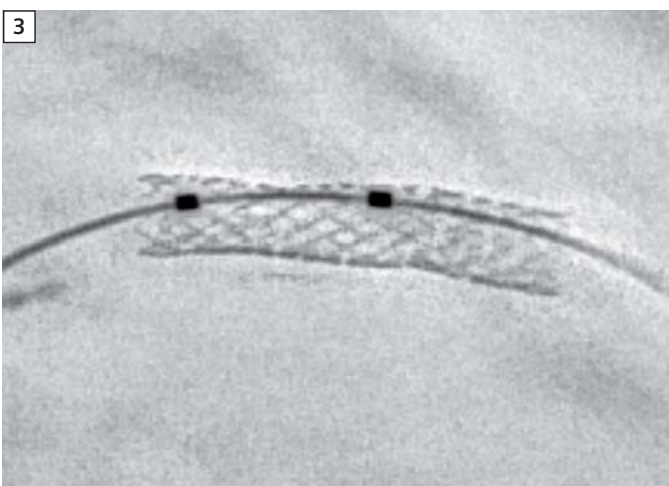
hanno.herrmann@siemens.com



**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.

# 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 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. Dr. Josef Ludwig of Erlangen, Germany; Dr. Ferdinand Kiemeneij, Netherlands; Dr. Ian Gilchrist, U.S.; Dr. Shigero Saito, Japan; and Dr. Stephan Achenbach, 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,

**“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, M.D.,  
Department of Interventional Cardiology,  
University of Amsterdam,  
Amsterdam, Netherlands

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.

#### **Participants in the TPA expert interview in Erlangen, February 2012**

##### **Prof. Josef Ludwig, M.D.**

Department of Cardiology and Angiology,  
University of Erlangen-Nuremberg, Erlangen,  
Germany (Moderator)

##### **Prof. Stephan Achenbach, M.D.**

Department of Cardiology, University of  
Giessen, Giessen, Germany

##### **Ian C. Gilchrist, M.D.**

Heart and Vascular Institute, Penn State Hershey  
Heart and Vascular Institute, Hershey, PA, USA

##### **Ferdinand Kiemeneij, M.D.**

Department of Interventional Cardiology,  
University of Amsterdam, Amsterdam,  
Netherlands

##### **Shigeru Saito, M.D.**

Department of Cardiovascular Medicine, Shonan  
Kamakura General Hospital, Kamakura, Japan

#### **Interviewed separately**

##### **Jim Nolan, M.D.**

Department of Cardiology, University Hospital of  
North Staffordshire, Staffordshire, UK

#### **Contact**

hanno.herrmann@siemens.com

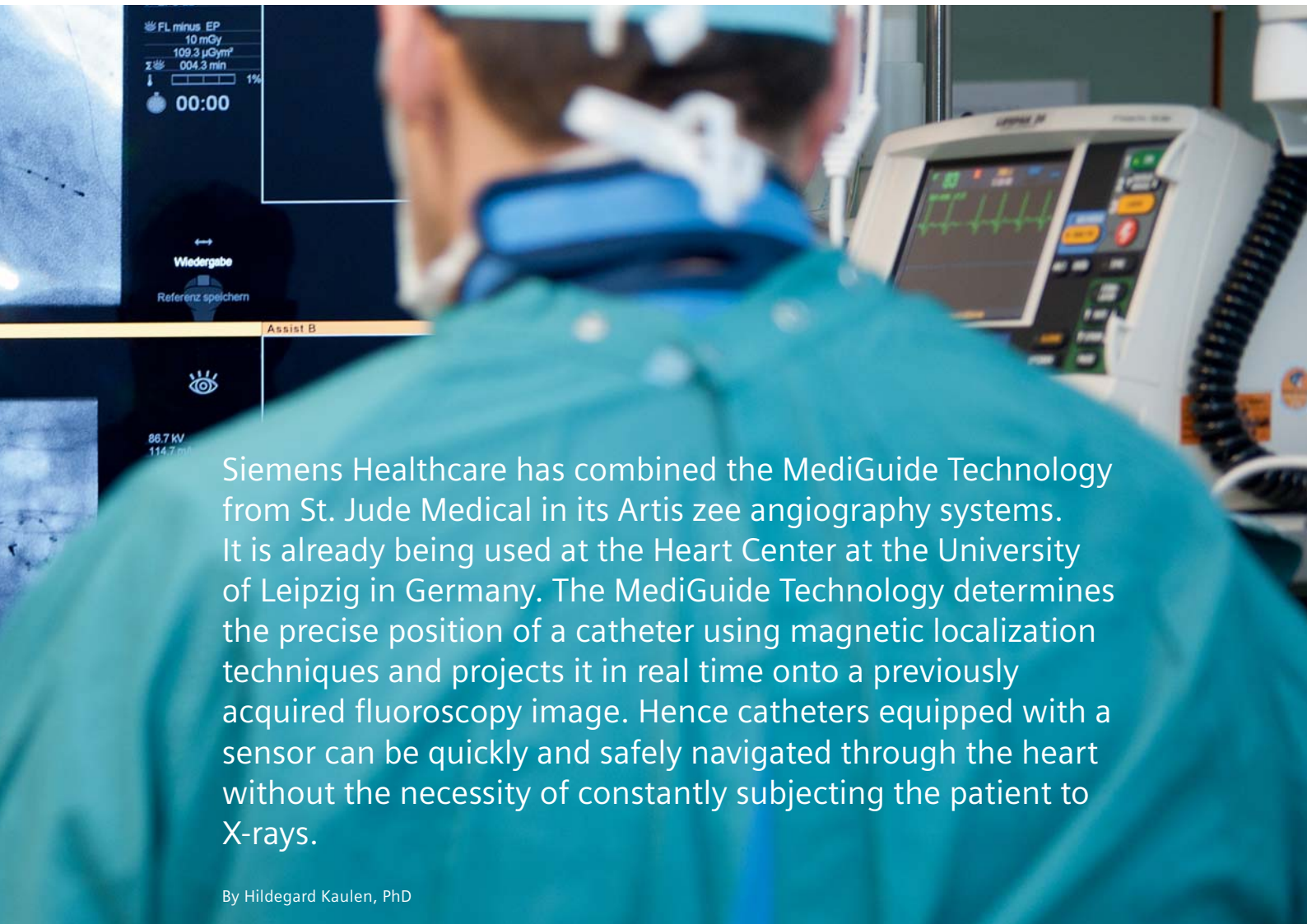
# Navigating the Heart



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 physi-

cians track and navigate a catheter through the heart. Professor Gerhard Hindricks, M.D. at the Heart Center of Leipzig University in Germany and his senior physician, Associate Professor Christopher Piorkowski, M.D., 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



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.

catheter ablations were carried out for the 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

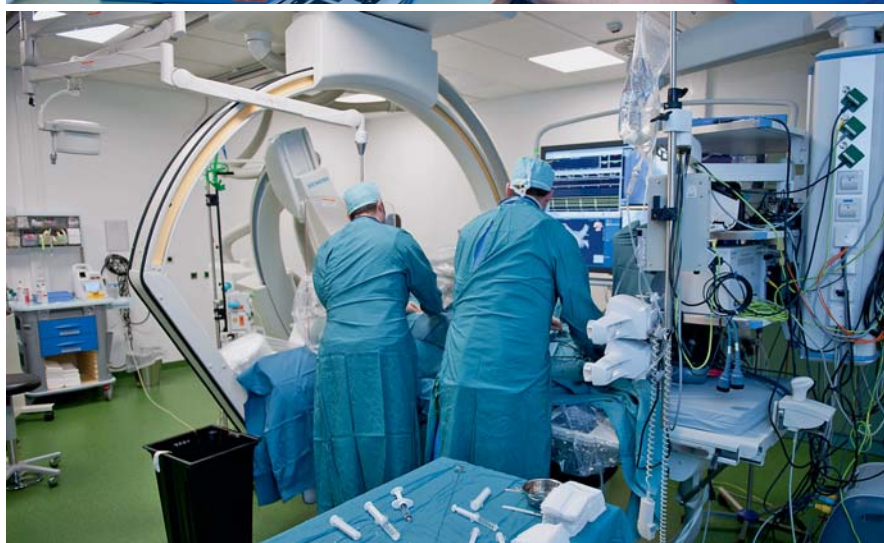
In order to be able to integrate the MediGuide Technology, three components are required. The first are transmitters that generate a low-intensity ( $< 200 \mu\text{T}$ ) alternating electromagnetic field and are integrated in the Artis zee fluoroscopy detector. The second component involved is a miniaturized 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



“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 electro-anatomically guided, personalized ablation strategy.”

Professor Gerhard Hindricks, M.D.,  
Heart Center of Leipzig University, Leipzig, Germany



“With the ablations carried out so far using the MediGuide Technology, we were able to reduce the exposure to radiation by half.”

Christopher Piorowski, M.D.,  
Heart Center of Leipzig University, Leipzig, Germany



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 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 electro-anatomically 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.

### 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 sys-

tem 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.*

**Contact**  
dietrich.till@siemens.com

# 10 Years of Hybrid Operating Rooms in Germany: Lessons Learned

At the beginning there was a vision: sparing patients from open surgery and saving hospital administrators from having to have a huge intensive care unit. With the dawn of endovascular procedures it became clear to Professor Giovanni Torsello, M.D., of Münster in Germany, that hybrid rooms would be the future.

By Wiebke Kathmann, PhD

When Torsello got started ten years ago he was one of the pioneers in the field and the first to build a hybrid room in Germany – in his case a relatively small investment and a big success. Asked about how he, being a vascular surgeon, came to set up a hybrid room, Professor Giovanni Torsello, M.D., Chief Physician at the St. Franziskus Hospital in Münster and Director of the Center of Vascular and Endovascular Surgery at the University of Münster, Germany, explains: “We noticed that many elderly, weak, and high risk patients had difficulties recovering after vascular operations. We wanted to solve the problem

without harming the patient. Minimally invasive procedures, with the option to continue as open surgery if needed, seemed to be the answer.”

With this vision in mind, Torsello seized his chance to set up a hybrid room when hearing about a new, vacant, and spacious operating room at the St. Franziskus Hospital in 2002. The situation was ideal as it already was an operating room with the sterile environment needed, with sluices, changing rooms for men and women, and – another big pro – in a central location. “It wasn’t an isolated application which saved us a lot of money,” recalls Torsello. He and his





team introduced an excellent imaging system into the sterile environment – the high-quality AXIOM Artis C-arm angiography system – and got started. Soon after the administration realized that there was a big demand. Patients came from all over Germany and neighboring countries to be treated by Torsello and his team. But not only patients, physicians in training and senior physicians also cued up to learn and practice this approach, a situation satisfying not only to Torsello but the administration as well.

### Serving the Patient Better

The demand for hybrid interventions and hybrid rooms is tremendous and will continue to grow as age as well as obesity and diabetes take more of a toll on the vascular system.

More and more complex lesions and lesions in locations that are difficult to reach by catheter or stent need to be treated. Due to the incredible developments in vascular therapy over the past decades the goal of today is

to keep interventions as minor as possible. Especially in aorto-iliac occlusive disease, emergency interventions, and thoracic or aorto-iliac aneurysms, endovascular interventions increased tremendously between 2000 and 2010, sparing patients the opening of abdomen or thorax.

All these interventions strongly depend on high quality digital subtraction angiography (DSA) systems in the operating room – not just for treating small lesions but to better serve the patient, as Torsello points out. At the St. Franziskus Hospital almost all patients with aneurysms are treated endovascularly now, more than 300 per year. It has become the therapy of choice. “Compared to open surgery we have reduced in-hospital mortality, complication rate, median length of stay, and cost,” says Torsello.

### Central or Isolated Location?

As a pioneer Torsello has provided many colleagues with advice and only recently set up the second-generation hybrid

room in his hospital, which will soon be followed by a third hybrid room at the Center of Vascular and Endovascular Surgery at the university – one of the biggest and most innovative centers of vascular intervention in Europe.

From his experience with his first hybrid room Torsello favors a centrally located hybrid room. His recommendation: “If you have the opportunity to connect the hybrid room to a central operating tract, do so. That way you do not need to deal with construction issues and sluices – which saves money.”

His new hybrid room at the hospital was built as an isolated application starting from a radiology space, which brought about challenges regarding workflow and storage of equipment causing the architect quite a headache.

**Hybrid operating rooms are preferably installed in an existing surgical wing to minimize reconstruction and to reduce costs**



Artis zee floor in the head-end position during the intervention.

## Consider Workflow

In Torsello's eyes, workflow is an extremely important aspect in designing a hybrid room. If the room is used by multiple disciplines, storage is an extremely challenging issue. Not all the materials can be kept in the common space. Therefore, all teams using the hybrid room need to enter with a little cart holding their special prostheses. Whenever a special catheter is needed during an intervention, the material needs to be fetched from quite far, with the hopper having to change from sterile to non-sterile and back. That complicates matters.

**Workflow is an important issue to consider when setting up a hybrid room.**

Regarding the setup of the hybrid room itself there was very little change from the first to the second of Torsello's hybrid rooms. The basic layout, concept, and angio system have stayed the same, even though the second-generation hybrid room is a multidisciplinary one.

## High Quality Imaging a Must

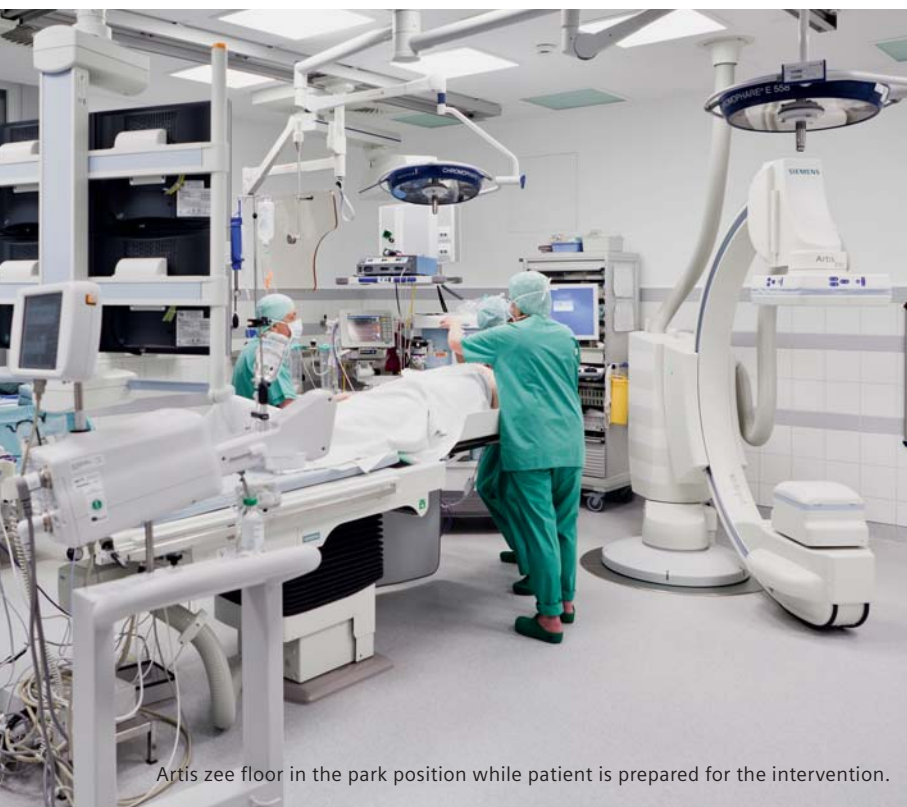
The big step of the past ten years was to bring excellent imaging into the sterile setting. This brought about qualitative improvements in regard to more complex interventions, research options, patient volume, performance, and patient satisfaction. Therefore, choosing the right angio system is key. Experience shows that medical engineering companies should be included early on in the planning process as hybrid rooms are extremely complex working environments, with the angio system being the centerpiece and all other equipment revolving around it. Torsello's first-generation hybrid room was equipped with an AXIOM Artis. "We very much valued the overlay function that is the option to steplessly change between the native image and the summed-up image. It made all the difference for therapy." Other important features for him are pulsed fluoroscopy to reduce dose for patient and staff, some preprogrammed working positions to simplify workflow, and, mainly

for aneurysm interventions, an automap function, which spares the patient extra angiograms and therefore contrast agent. Fluoroscopy time is another important issue. Most C-arms do not fulfill the requirements for long continuous or pulsed fluoroscopy over several hours and need to be given time to cool down – a catastrophe for the patient. If hybrid interventions play a prominent role or the hybrid room is shared with a cardiac surgeon, even more sophisticated solutions like the Artis zeego are needed.

**Key to success is bringing excellent imaging to the sterile OR environment.**

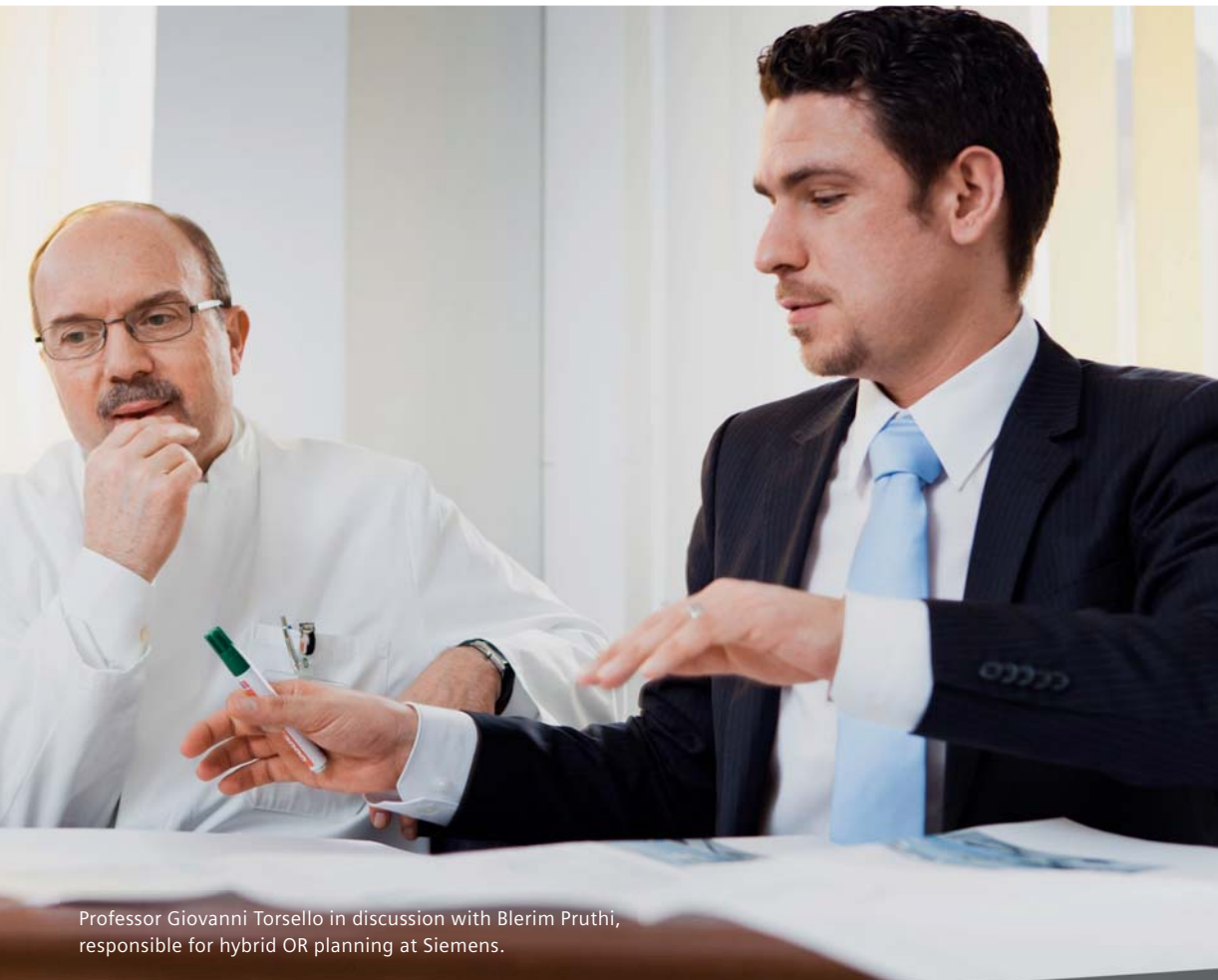
## Autonomy a Key Issue

Handling is another key issue when performing angiography in the OR. Using a regular C-arm necessitates the help of other people to support the examiner. Therefore, a precise language to communicate about directions is needed. With employees changing jobs a lot

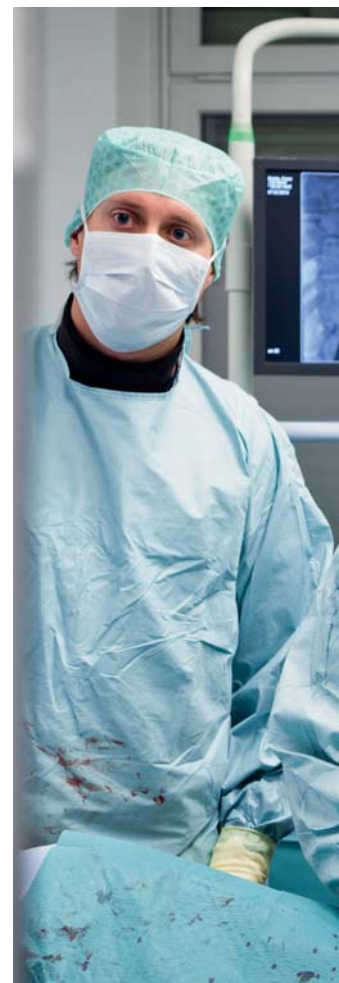


Artis zee floor in the park position while patient is prepared for the intervention.





Professor Giovanni Torsello in discussion with Blerim Pruthi, responsible for hybrid OR planning at Siemens.



this information is hard to convey with the required precision. Surgeons might lose their nerve in complex interventions. Therefore, Torsello favors a set-up where the examiner navigates the table himself.

The surgeon needs to navigate the table himself.

### Size Matters

This is not only true for the hybrid room itself but the table, too. A hybrid room should have a minimum size of 50 square meters (540 square feet), suggests Torsello. If hybrid interventions play a prominent role or the hybrid room is shared with a cardiac surgeon, as will be the case in his third hybrid room at the university, an even bigger room is needed for the team to move

about without the risk of becoming non-sterile or hurting someone with the C-arm. From his experience Torsello recommends not to have any closets in the room.

Space is extremely important. 50 m<sup>2</sup> are the minimum, 70 m<sup>2</sup> if it is a multidisciplinary hybrid room.

From his ten years of experience Torsello recommends a free-floating table that can be tilted from all positions and has a rack for auxiliary equipment. For ergonomic reasons it shouldn't be too wide. "As long as one works with a catheter the width is not that important. But when working bent down for hours to reach the middle line of the patient the body position will lead to problems unless the table is narrow."

Choose a narrow table that can be tilted.

### Laminar Airflow a Necessity?

The participation of a hygienist and medical engineer in setting up a hybrid room is of utmost importance. Both can give valuable input as to whether a floor- or ceiling-mounted angio system is preferred – issues that must be decided at an early stage. "Combining a ceiling mounted C-arm and a laminar air flow (LAF) ceiling is very complex and expensive. The efficacy of the LAF is reduced when the ceiling-mounted C-arm is in working position. Therefore, we recommend floor-mounted C-arm systems which can be installed even under existing LAF ceilings," says Blerim Pruthi, the responsible planner for





hybrid rooms at Siemens, the dominant player in the market.

Whether laminar airflow is needed largely depends on national regulations and the interventions performed. At the St. Franziskus Hospital the team has successfully worked without it for the past ten years.

**Involve hygienist and medical engineers early on.**

### Investment confidence

The fear of administrators ending up with an empty hybrid room can easily be dissipated. Between September 2003 and December 2011 Torsello's team performed 8,651 interventions in their hybrid room, 5,671 of them endovascular interventions and angiographies, 1,975 combined interventions, and

1,005 conventional operations. If the 300 aneurysm treatments he does per year alone were performed as open surgery, the size of the intensive care unit would have to be increased by another 30 beds – an impressive argument for administrators.

Besides, a hybrid room is very helpful in conventional operations as it permits one to check the restoration of blood flow. In the long run this leads to fewer revision operations.

### 10 years from now

Ten years after getting started Torsello is more convinced than ever that the future lies in endovascular procedures and hybrid rooms. "For those 10 to 20 percent of patients in whom the anatomical situation is not suited for endovascular treatments, we will still

need vascular surgeons trained in conventional operations. But we no longer need pure operating rooms – they can perform the intervention in the hybrid room." Hybrid interventions will become the standard operation of the future. The evolution is not over yet. Fenestrated endografts for aneurysms involving visceral arteries are one of the new frontiers.

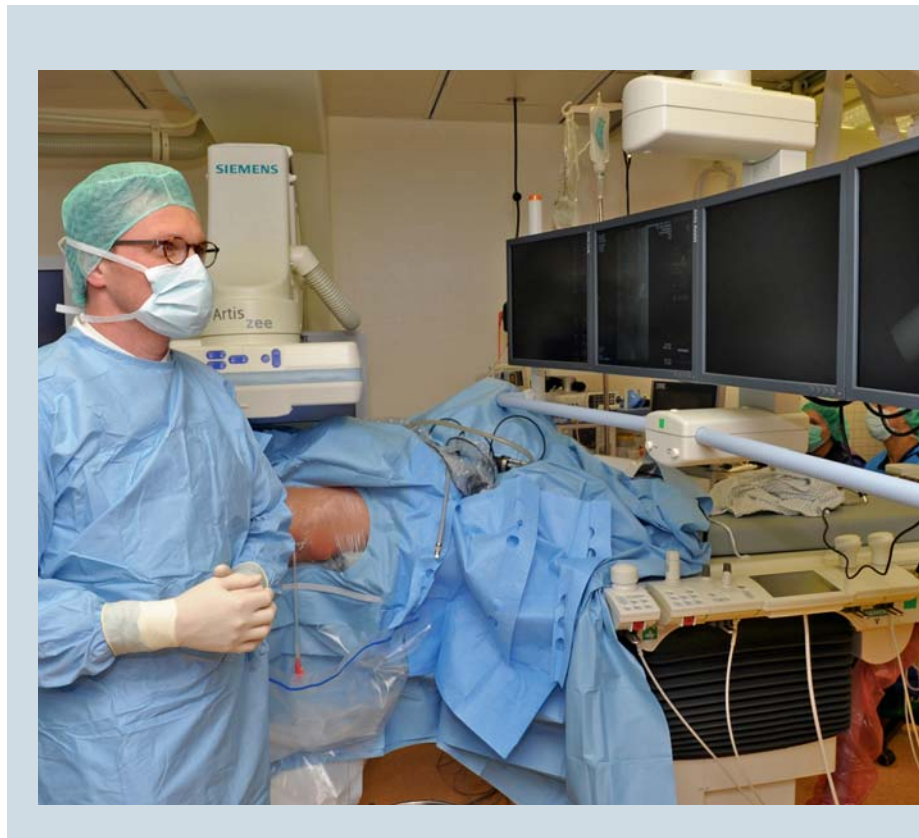
*Wiebke Kathmann is a frequent contributor to medical magazines for physicians of German-speaking media. She holds a Master in biology and a PhD in theoretical medicine and worked as an editor for many years before becoming a freelancer in 1999. She is based in Munich, Germany.*

### Contact

thomas.hartkens@siemens.com

# Intuitive and Comfortable Reassimilations in Endourology

Prof. Maurice Stephan Michel, M.D., Head of the Urology Department at the University Hospital of Mannheim, is the first urologist worldwide using an Artis zee ceiling system. The system was launched in November 2011 and will be used mainly for kidney stone therapy. The imaging technology with the possibility of 3D reconstructions will be very helpful to detect small fragments and also perform interventions with the highest possible safety.



**How did you come up with the idea of using an 3D angiography system for urology?**

After having implemented many innovations and developments in ultrasound technology over the last several years and decades, we noticed a standstill regarding X-ray imaging in urology. Configurations of tables and X-ray tubes were made but no noticeable progress was achieved, and we were in the situation that we needed a new X-ray system. Of course we wanted a system that evidenced progress in X-ray technology with better imaging that

could help us to achieve better clinical results for our patients.

So we looked at the Artis zee ceiling system and how it could be integrated in a urology department. After many discussions with Siemens and a visit to the headquarters in Forchheim, we finally found a way, together with the management board of the university, to implement the system and finance it. Professor Stefan Schönberg, M.D., Head of the Radiology Department at the University Hospital of Mannheim was involved from the start.

**What was most important to you regarding the system? Especially considering the fact that you can have 3D imaging with a CT or MRI system, too.**

We need an interventional workplace. Interventional means to have access to the patient from all sides. That's why conventional CT technology did not apply. An MRI system especially in combination with ultrasound for prostate biopsies would have been another option. However, the development of the instruments and the methods of tracking metabolism pathways or a molecular



tissue analysis will need another 5-10 years to develop. We decided on Artis zee ceiling because of the fast and great image acquisition and that we can use the instruments we are used to.

**Could you please explain the history of the implementation? How long was the process from your initial thoughts to the execution of your plans?**

In 2008 we had the initial discussions, then the negotiations with the management board; so we finally ordered in June 2011.

**At the moment you are the first urologist worldwide who has a 3D system in his endourology suite. How does it feel to be a pioneer?**

In the beginning you are definitely impressed with being a pioneer, especially after three years of planning and convincing many people that this way is the right way.

However, that feeling passed quickly. We are a university hospital that is doing routine patient care. We have started a scientific concept but certainly don't feel extraordinary. We do our job and it is a very nice system to work

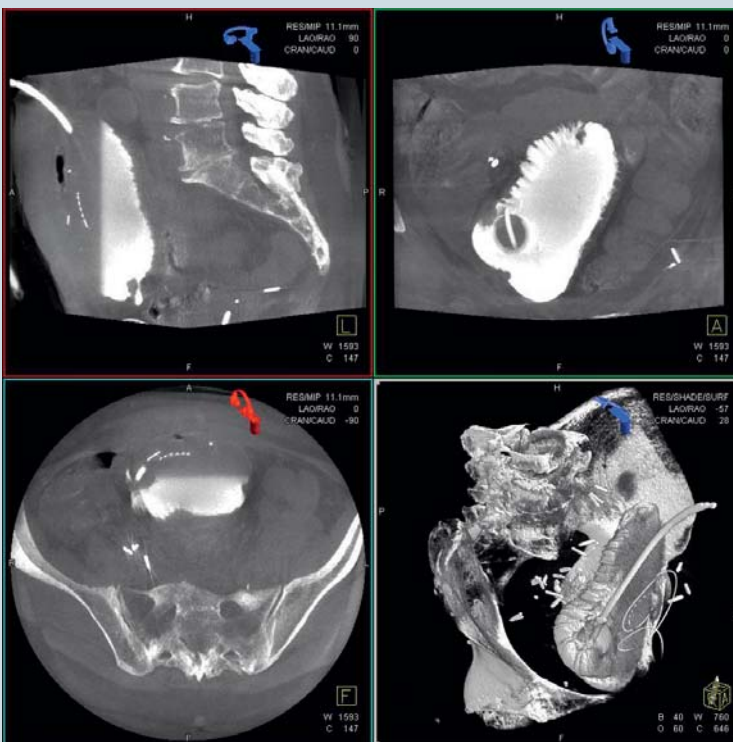
with. That is what we are happy about. Now we want to see the facts and see in what way the system is beneficial for the patient. That's all that matters in the end.

**What are the clinical indications to use 3D imaging? Where do you see the advantages?**

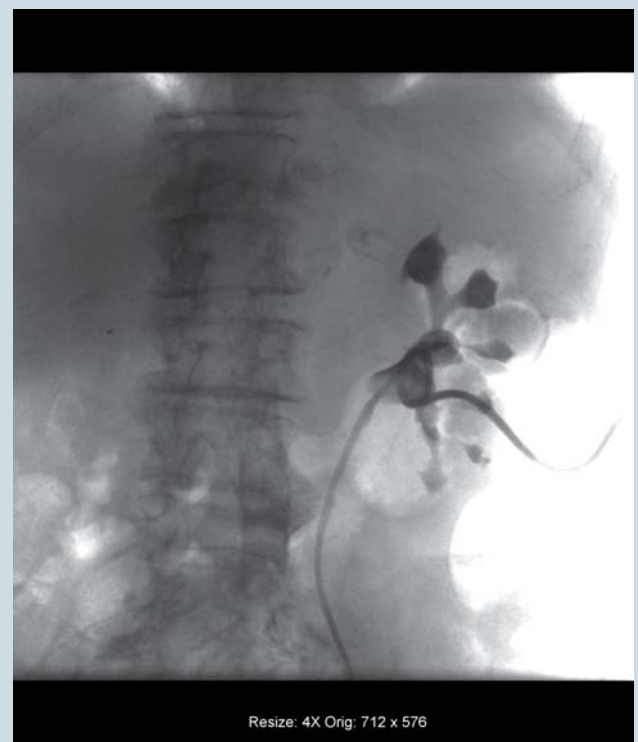
The highest goals are patient safety, minimal radiation dose and best therapeutic outcome. One of the main targets is to find the lowest possible radiation dose with the Artis zee ceiling for the patient. Without

“However if you can avoid second treatments due to optimized procedures then it is definitely one factor in improving cost-effectiveness as well as patient satisfaction. The way we see it, the patient is clearly in the focus.”

Professor Maurice Stephan Michel, M.D.,  
Head of the Urology Department at the University Hospital of Mannheim, Mannheim, Germany



3D reconstruction of urinary bladder



Placement of a catheter into the kidney

scientific proof we have initially achieved very good results with the new Artis zee regarding radiation dose and image quality when we compare it with the old system for identical procedures.

#### So you have initiated clinical trials?

Yes, exactly. This is very important. Besides the radiation dose for the patient we are also investigating radiation exposure for the surgeon. Ideally radiation dose must be reduced for the urologist, too.

Furthermore, we will have trials for the different interventions, like stone therapy, catheter placement in the kidney-urinary bladder and reconstructions of the urinary tract. Another important topic is the imaging of pathologies with respect to better detection along with interventions of carcinomas in the upper urinary tract. If you look at cost-effectiveness, measuring radiation dose does not appear. Not for the doctor or the patient. However, if you can avoid second treatments through optimized procedures,

then it is definitely one factor in improving cost-effectiveness as well as patient satisfaction. The way we see it, the patient is clearly in the focus. We are a university hospital, therefore it is our responsibility to calculate risks and benefits before introducing new technologies worldwide. The whole world is covered with da Vinci® systems for cancer surgery in urology. Here we missed collecting good prospective scientific data. Now there are many patients who want to be taken care of.

**What is your vision in general? You mentioned an MRI system in the OR and just now the da Vinci system, which is a minimally invasive surgical robot. Where do you see imaging in a few years?**

With a very thorough view on radiation dose. I see a quick, uncomplicated interventional imaging X-ray system with 3D reconstruction possibilities, with individualized radiation dose in regard to special interventions for the individual patient. The goal should be to have customized low radiation programs for standard procedures.

Additionally, intelligent imaging that can show molecular processes in the tissue for special tumor biological questions and tumor detection is definitely very interesting and important. However, this means not only diagnostics but also interventions with minimally invasive procedures like biopsies.

**And maybe being able to fuse different imaging modalities?**

Yes, absolutely.

**Systems that can be handled easily and that are user-friendly?**

Yes, I see specialized smaller systems for specialized questions. Especially for frequently asked questions like prostate biopsies. We do 600,000 biopsies in Germany per year. There you can definitely start thinking about an appropriate system.

**That is a considerable number!**

Definitely, as we have to consider that 600,000 are the ones taken to find the 50,000 carcinomas.

**What is your interim result after having used the new Artis zee system for about two months?**

First of all, I need to say that it was a big adjustment for all co-workers. The technological leap from the old Uroskop systems to the new 3D imaging system is huge. Probably as huge as adjusting from a 1970 VW Golf to a fully equipped 2013 Mercedes sports car.

If you imagine someone from 1970 driving a car like that, he would be rather overstrained. He could drive it without question, but would probably drive a little too fast because he would have trouble evaluating the speed.

What I am saying is that we approach the new technology very diligently and carefully because we especially want the radiation dose to be monitored closely. All in all, we are very happy with the new system.

We will find a way together with Siemens to evaluate the system regarding urology needs, and in the foreseeable future we will reach a good solution.

Conclusively, I would definitely decide that way again. Anyone considering a system like that is responsible for precisely evaluating its use. I would recommend coming to Mannheim to take a close look at the system and to discuss the use of the system critically. Technical advances often lead to uncritical use and this should not be the case, especially with radiation dose.

I am looking forward to seeing the scientific results and then re-evaluating.

#### Contact

[ina.schwabenland@siemens.com](mailto:ina.schwabenland@siemens.com)



**“We decided on Artis zee ceiling because of the fast and great image acquisition and because we can use the instruments we are used to.”**

Professor Maurice Stephan Michel,  
M.D., Head of the Urology Department  
at University Hospital of Mannheim,  
Mannheim, Germany

# A Gift Pack: Lower Dose, Higher Image Quality

In an interview with AXIOM Innovations, Professor Saruhan Çekirge, M.D., Head of the Department of Interventional Neuroradiology at Hacettepe University School of Medicine in Ankara, Turkey, discusses the latest dose-saving and image quality update, given at no cost to owners of the Artis zee family of interventional C-arm systems.

By Selda Emre Aydıngöz, M.D.



Hacettepe University Medical School began with the establishment of The Child Health Department affiliated with Ankara University Medical School in 1954. Today the Hacettepe University School of Medicine is one of the most famous of its kind in Turkey. The Faculty of Medicine ranks as the first in Turkey in internationally cited publications. The Department of Interventional Neuroradiology has been working with Artis zee systems for four years. The systems are used for more than 4,000 diagnostic or therapeutic procedures per year.

Siemens is currently undertaking the largest field update in its history with the latest software platform on over 2,000 Artis zee systems installed worldwide. More than 1,600 systems have been updated already, providing both dose-saving features (CARE) and outstanding image quality (CLEAR). Professor Saruhan Çekirge, M.D., has had more than four years of experience working with Artis zee, and his highly equipped clinic was a test center for the new platform for a year prior to its official launch.

## How long have you been working with Artis zee systems?

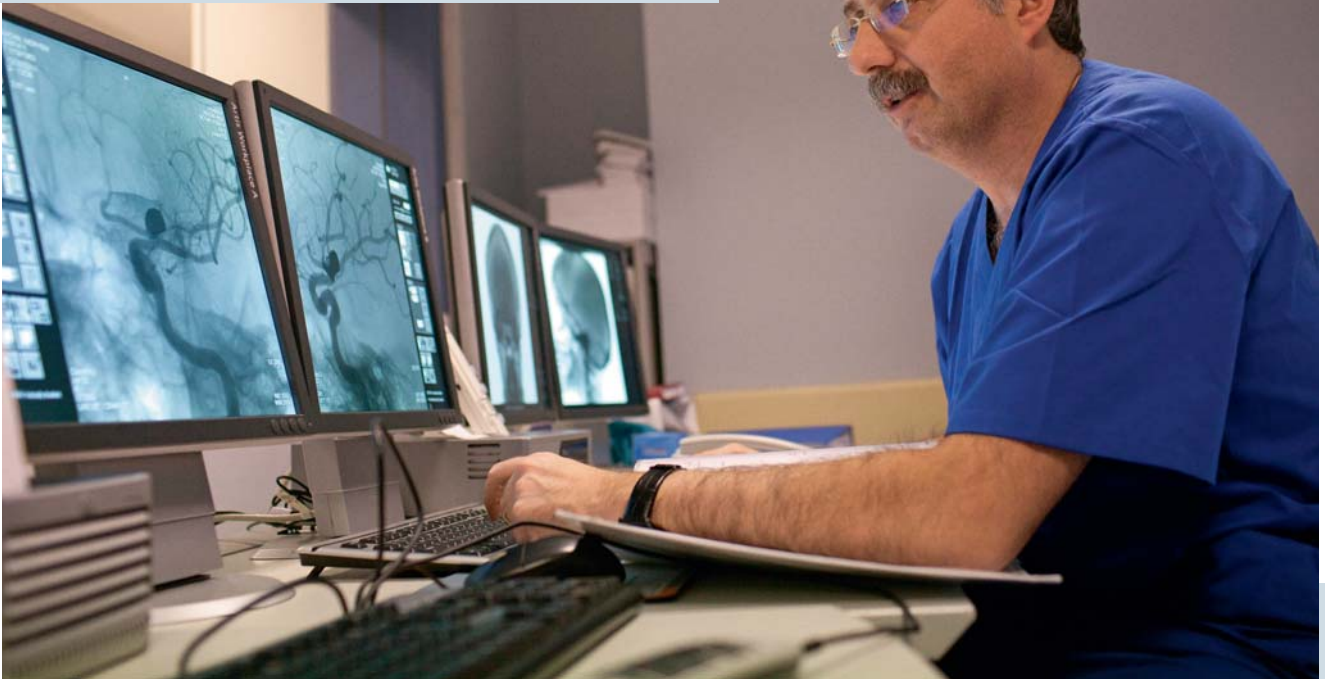
We have been working with Artis zee systems since 2008 and we now have three neurology-dedicated biplane Artis zee angiography rooms.

## How many and what type of procedures are done with this system annually at your institution?

We have a very busy neurointerventional service, treating more than 400 cerebral aneurysms as well as 100 cerebral arteriovenous malformations and dural arteriovenous fistulas. We perform around 300 cerebral revascularization procedures, many tumor embolizations, acute stroke treatments, and more each year, in addition to 1,000 diagnostic neuroangiographies. We also share these rooms with our peripheral vascular interventional radiology group. So, more than 4,000 diagnostic and therapeutic interventions are being performed annually through us.

“We can reduce the radiation dose by up to 72 percent.”

Prof. Saruhan Çekirge, M.D., Head of the Department of Interventional Neuroradiology, Hacettepe University School of Medicine, Ankara, Turkey



**When was your system updated to the latest software platform?**

We have been working very closely with engineers in the R&D [research and development] team of Siemens Healthcare Angiography Division on developing new software and improving existing software for complex neurointerventional procedures. Many features of the new platform were already developed and used as prototypes in our service during the last 12 months before the platform was officially released.

**What is your general reaction to the worldwide Siemens initiative to update 2,000 systems?**

Siemens has been the leader in flat-panel angiography technology since 2005. They have the largest global market share. This has put a big burden on their shoulders for keeping their cus-

tomers' angiography systems updated with the most recent technology, which changes and improves at an unbelievable pace. I am very happy that Siemens takes this responsibility very seriously, and it will have a great impact on patient treatment and operator safety; not only with improved software for the treatment of complex cerebrovascular disease, but also with applications like CARE for radiation safety.

**How has image quality changed with this update?**

We already had excellent image quality in two-dimensional [2D] and three-dimensional [3D] angiography and *syngo* DynaCT with the previous software. However, with the recent update, the quality of 3D imaging and *syngo* DynaCT improved substantially.

**How specifically did the improvements like image quality benefit you during your daily routine and allow you to improve certain procedures?**

3D imaging quality is the most important point during the preoperative evaluation of cerebral aneurysms, in order to be able to understand the exact anatomy of the aneurysm neck and of the corresponding vessels close to the neck. Patient and procedural safety increases parallel to this understanding. With the new platform, we have an important improvement in the quality of 3D imaging. It is sharper and shows even very small vessels and perforators much more clearly in relation to the aneurysm and its neck, thereby allowing us to understand the anatomy much better. We also had very high quality with *syngo* DynaCT imaging with pre-existing software.

# Summary

## Challenge

- High-quality imaging to improve the ability of physicians to perform diagnostic and neurointerventional imaging procedures with higher efficiency
- Reduce radiation dose during interventional procedures
- Provide application training to every Artis zee customer

## Solution

- Update more than 2,000 Artis zee systems installed worldwide with the latest software platform, providing both outstanding image quality (CLEAR) and dose-saving features (CARE)
- Give free application training after the update to every customer

## Result

- Improved software of Artis zee systems for the treatment of complex cerebrovascular diseases
- Substantial improvement in the quality of 3D imaging, which is most important during the preoperative evaluation of cerebral aneurysms
- Great improvement in 2D angiography and fluoroscopy quality, providing sharper fluoroscopy and digital subtraction angiography images
- Reduction in the radiation dose by up to 72 percent by adjusting radiation dose according to the procedure's needs
- Supplying Artis zee customers with the latest image quality and dose-saving features – even after installation
- Allowing customers to work better with the new software



With this new software, in addition to the very powerful new X-ray tube of the Artis zee systems, 2D angiography and fluoroscopy quality – which is the “bread and butter” of neurointerventional procedures – has improved to a great extent. We have much sharper fluoroscopy and digital subtraction angiography images now. This has become extremely important, since many cerebral endovascular procedures today involve implantable tools like microstents and flow diverters, and it is essential to see them clearly during their deployment in the cerebral vessels.

### How do you benefit from the advanced applications of syngo DynaCT during your daily routine?

The installation of syngo DynaCT in our practice has been the most important and revolutionary advancement in neuroradiology in the last decade. It opened a completely different avenue for us. We are able to have CT-like imaging on the angiography table before, most importantly during, and after the procedure, especially if there is an emergent need after an intraoperative complication. We have started to perform CT angiography with intrarterial or intravenous contrast administration and have excellent CT angiography images to understand and evaluate the anatomy, preoperative treatment approaches, and results with

the ultimate precision. Finally, syngo DynaCT in combination with syngo Neuro PBV IR allows us to perform functional imaging like CT perfusion to evaluate acute stroke patients on the angiography table. This still-ongoing improvement will eventually make flat-panel angiography equipment a “one-stop shop” in which an acute stroke patient can be taken in for functional diagnostic imaging, and then receive interventional treatment directly thereafter if necessary.

### Can you adjust the image quality according to your preferences?

Yes, certainly. By adjusting the fluoroscopy quality and changing the pulse rate, we can reduce the radiation dose





by up to 72 percent. This is the same for syngo DynaCT applications.

**How important is dose reduction during neurology interventions, and how do you rate Artis zee's abilities to reduce dose?**

This is extremely important not only for the patient, but also for operators. Artis zee applications like CAREvision, CAREprofile, CAREfilter, CAREposition, and low dose syngo DynaCT have greatly improved dose reduction and made it adjustable according to the neurointerventional procedure's needs. So, although this system is very close to perfect, there should be no limits to reducing the radiation dose without hindering the image quality. Siemens

certainly and constantly needs to work on that very important safety issue.

**Which dose reduction application do you find most useful?**

CAREvision and the low dose syngo DynaCT application.

**Did you receive and benefit from application training?**

Since we have been working closely with the Siemens R&D team all along, we have been continuously receiving application training, which has been very useful for all members of the team.

CLEAR imaging with CARE. Type in this URL to hear experiences from Artis zee users: [www.siemens.com/clear-care](http://www.siemens.com/clear-care)

*Selda Emre Aydingöz earned her MD from Hacettepe University Medical School and a PhD in pharmacology from the Hacettepe University School of Pharmacology. She is certified as an editor in life sciences (ELS) and has worked as a clinical research associate, a contract medical writer/editor, and a freelance writer. She is the founder of Edita Medical Writing and Editing Ltd., based in Ankara, Turkey.*

**Contact**

[vera.juennemann@siemens.com](mailto:vera.juennemann@siemens.com)



# Raising the Bar

The Hospital for Sick Children, commonly known as SickKids, is recognized as one of the world's foremost pediatric healthcare institutions. Located in downtown Toronto, SickKids employs 9,600 people, with more than 14,000 admissions, 11,000 surgical procedures, and more than 5,000 interventional radiology procedures each year.



It is a teaching hospital for the University of Toronto. The hospital's research institute is the largest children's research facility in Canada, employing about 2,000 people. The research institute is known for its work in stem cells and childhood cancer. The Siemens Artis zeego is the hospital's newest and most technologically advanced angiographic imaging equipment.

Teamwork between Siemens and doctors at The Hospital for Sick Children in Toronto is leading to lower radiation dose and better outcomes for patients and staff alike.

By Ron French

When The Hospital for Sick Children (SickKids) in Toronto entered negotiations with Siemens Healthcare, they were doing more than shopping for a new piece of imaging equipment. They were creating a partnership. Installation of the Siemens Artis zeego in October 2010 gave SickKids, Canada's leading center dedicated to advancing children's health, state-of-the-art 2D and 3D imaging and more precise dose control for both patients and staff. But making the most of that technology took more than flipping a switch. Interventional radiologists Bairbre Connolly, M.D., and Joao Amaral, M.D., continue to work with Siemens engineers to modify the equipment to meet

the hospital's needs. The doctors call it an "evolving" process that continues to help improve the hospital's – and Siemens' – ability to serve children of all ages. "There's a learning curve for physicians and Siemens," says Connolly. "The whole world of imaging has evolved."

## New Technology, New Challenges

Image resolution continues to increase, but so do concerns about the cumulative effect of radiation to patients. Radiation exposure per capita has more than doubled in the past 20 years in the United States, according to a report by the National Council on Radiation Protection and Measurements.

“Let’s see what we can do about lowering the radiation. This is something that has to happen in unison with the company.”

Joao Amaral, M.D., Pediatric Interventional Radiologist, SickKids, Toronto, Canada



“We needed the engineers to tweak what they could to improve quality while trying to keep the dose low.”

Bairbre Connolly, M.D., Pediatric Interventional Radiologist, SickKids, Toronto, Canada

That same report revealed that nuclear medicine imaging, CT and interventional radiology account for a quarter of imaging procedures in the United States, but contribute 89 percent of total radiation exposure.

Interventional radiology uses imaging to provide guidance during minimally invasive procedures, particularly in cardiovascular medicine, cerebrovascular medicine, transplant and oncology, as well as for line placement and other procedures involved in the diagnosis and treatment of a wide variety of conditions. “There’s increasing concern about the adverse effects of radiation,” says Connolly, who grew up and trained in Ireland before coming to SickKids in 1993. “People are now looking at ways of reducing dose as much as possible because of the long-term effects.” That challenge is even more vital in pediatrics. “Kids have a longer life span to show the adverse effects from radiation,” Connolly says. There is also growing research that children are more susceptible to the negative impact of radiation. “Some people believe cells in children are up to five to ten times more vulnerable to the effects of radiation,” adds Connolly. “It’s crucial that we lower dosage as much as possible.”

### Lower Dose and Better Workflow

Siemens has long been a leader in dose reduction. Artis zeego, the flagship of Siemens interventional imaging equipment and the only system in the market with robotic technology, and the Artis zee system family offer unparalleled dose savings and image quality. Design characteristics of Artis zee enable ergonomic, streamlined, efficient

operation, all of which support dose reduction. All systems come equipped with the Siemens' CARE applications as a standard, providing the operator an extensive set of features to reduce radiation dose. Users can optimize system parameters such as exposure time, photon energy and others to match clinical needs while making the dose as low as reasonably achievable.

The room with the Artis zeego system is also equipped with a Siemens Artis zee Large Display. The 56" monitor can display images in different sizes providing the physicians with a larger view of the anatomy. Also new for SickKids are the 3D rotational angiography features and *syngo* DynaCT to provide soft tissue images during the procedures. Connolly notes the new capabilities of portrait and landscape imaging and virtual CT were not available.

SickKids installed the Artis zeego in a hybrid room, giving clinical teams easy and efficient patient access in a suite with state-of-the-art imaging equipped with OR standards. Both physicians use the room for different types of procedures.

### An Evolving Partnership

Siemens didn't just hand over the keys to the shiny new Artis zeego and walk away. Company engineers have been a regular presence in Toronto, learning the unique needs of doctors here while physicians adjust to the new technology.

It has been a learning experience for everyone. "There are so many things you can change on the new equipment, the software and the computer behind it that it takes a fair amount of time to get the image right," says Amaral,

who trained in Brazil before coming to Canada to work at SickKids. "Companies make machines for adults. You challenge them, saying, 'Do you know what you're getting into?' Because you're talking about a machine that has to be capable of imaging patients ranging from a premature baby weighing 500 grams to an 18-year-old weighing 150 kilos. Being able to tweak the machine to have low radiation and good image quality is a challenge, and it is a challenge that evolves. That's why when we purchase equipment, we also have to have a commitment from the company," says Amaral, "because we want to reduce radiation on one hand, and we want an image that is diagnostic on the other – maybe not the best image quality – this shows we are thinking of the child first, not the pleasure of seeing a beautiful image."

Connolly adds, "We needed the engineers to tweak what they could to improve quality while trying to keep the dose low." At one point, she says, doctors and engineers "put the dose down so low that we couldn't see the (guide) wires, and we had to go back up until we found a happy medium. It's difficult to optimize a very complex array of parameters."

Siemens recently delivered a free software package update to hospitals around the globe that have Artis zee systems installed. Called CARE (Combined Applications to Reduce Exposure), the package allows doctors to better monitor dose accumulation and save radiation dose. "In one study, we looked at kids who were coming back for the eighth or ninth visit [for procedures involving radiation] in a short space of time," Connolly says.

"That's where the dose metric program which we've been working on with Siemens is going to be hugely valuable. We would like to use that as a tracking system on an individual patient basis, and also for sets of procedures so we can track the average dose for certain procedures. The long-term goal is to be able to tell over time the cumulative dose for an individual patient," she explains. "We're not there yet."

Connolly also would like to see the software advance to the stage that it could incorporate accumulated dose levels across different vendors. "Siemens might be in this room, but the next time Johnny comes in for a procedure, it might be in another room," with imaging equipment from a different company, Connolly says. "We need to be able to track Johnny's dose from room to room."

Connolly and Amaral continue to push the limits of the Artis zeego. "With some procedures, the image comes up great, and we try to challenge the company," says Amaral. We tell them, "That's great that you gave me that image. Now let's raise the bar. Let's see what we can do about lowering the radiation. This is something that has to happen in unison with the company."

*Ron French is a freelance writer and senior writer for Bridge Magazine, where he focuses on healthcare, economics and education. He lives in Lansing, Michigan, USA.*

#### Contact

sabine.wich@siemens.com

# Benchmark in Surgical and Interventional Imaging

By Ahmed Maideen Sadayan



Siemens supported a 3-day foundation course in endovascular surgery with a speaker session in cooperation with the Singapore General Hospital. Seventy participants from the Asia Pacific region and as far away as Russia took part, and the Artis zeego was the star of the show.

This foundation course was designed for vascular surgeons, cardiologists, radiologists and trainees as well as paramedical nursing staff with minimal endovascular experience, but who intend on starting an endovascular intervention program or pursue a career in endovascular surgery. Participants were able to observe the use of an Artis zeego placed in an endovascular operating theatre (hybrid OR) as well as an Artis zeego installed in the Interventional Radiology Center of Singapore General Hospital. Live cases, with simultaneous video transmission to the participants' venue, were performed by Benjamin Chua, FRCS, Consultant Vascular Surgeon and Director Endovascular Surgery, SGH, and Manish Taneja, M.D., FRCR, Consultant Interventional Radiologist and Deputy

Director VIR, on the two Siemens Artis zeego systems, which were the first ones installed in the region.

The first case was done on the Artis zeego in the hybrid OR and was a complicated endovascular aortic stent graft procedure with accompanying bilateral iliac and renal stenting (chimney procedure). The Artis zeego hybrid OR system, with its highly flexible robotic C-arm featuring a wireless footswitch, provided the surgeons with excellent image quality and unsurpassed 3D imaging capabilities. There was zero patient/table movement throughout the procedure, even though it involved bilateral groin approaches as well as the right brachial approach. The robotic C-arm of the Artis zeego was manipulated for imaging of the arms, groin, renal, celiac and aorta, without moving the patient. With its excellent image quality, visualizing the fine vessels and ruling out any post-procedural endoleaks was a breeze.

The second live case was done on the Artis zeego unit in the Interventional Radiology Center. It was the first Artis zeego in the region and was recently

updated with the latest software to the satisfaction of the users, who are staunch users of the CARE & CLEAR features. A bilateral iliac angioplasty with stenting was demonstrated on a patient who had a chronic occlusion of the distal aorta with collaterals from the inferior mesenteric artery to the iliac arteries. The highly flexible robotic C-arm of the Artis zeego was manipulated for imaging of the arms, neck and up to the pelvis without moving the patient. With CARE and CLEAR, optimal dose reduction and excellent image quality were achieved, which impressed the participants of the course. The procedure was successfully completed with good results.

Participants of this workshop found that Siemens Healthcare is a preferred vendor in the hybrid OR market in the region and the Artis zeego proves itself as a premium imaging system from Siemens Healthcare.

## Contact

kellie.koh@siemens.com

maideen.sadayan@siemens.com



- 1** Pre-stent graft
- 2** Post-stent graft (chimney)
- 3 + 4** Pre-intervention – bilateral iliac angiogram
- 5** Post-intervention

The future is flexible

# Join the Artis zeego Club



Artis zeego is a unique imaging system – in many ways. With one-of-a-kind robotics this multi-axis system owns extraordinary versatility. The Artis zeego enables unparalleled applications, for example, cross-sectional *syngo* DynaCT 360 visualization in a single 6-second sweep - in other words fast CT-like coverage.

## Join and be one of our exclusively privileged members of the Artis zeego Club!

With the purchase of an Artis zeego system, you automatically receive membership to the Artis zeego Club – a world of service and value designed to enhance your Artis zeego ownership experience.

The club lets you access services and resources to increase your knowledge of system operation, exchange insights with other Artis zeego owners and experts and learn how to perform new techniques to further improve your productivity and stay at the cutting edge.

[www.siemens.com/  
artis-zeego-club](http://www.siemens.com/artis-zeego-club)





## Artis zeego Club members enjoy special privileges and have access to:

### *Dedicated Artis zeego team*

Receive privileged advice and assistance – from Artis zeego experts.

Knowledge base access and dedicated technical and clinical knowledge – through unique video demonstrations, webcasts and educational programs.

### *Complimentary software updates\**

Stay on the cutting edge – with continuous system software updates at no extra charge.

### *Articles & case reports*

Learn about the latest Artis zeego techniques through exclusive articles and case sharing.

### *Journal club*

Keep up-to-date on current developments with special monthly journal reports from clinical experts.

### *Tech corner*

Get the inside story on groundbreaking technologies and the latest technical developments – *syngo* DynaCT 360, *syngo* iGuide, *syngo* Embolization Guidance, etc.

\*Service hours not included



# Want to Learn More About Transcatheter Technology?

## Hands-on customer workshop for cardiac surgeons

Transcatheter-based treatment of valvular heart diseases is gaining more meaning nowadays. These highly sophisticated procedures require a dedicated feel for the materials used, e.g. catheters, and especially for imaging in the hybrid OR. Teamwork, communication, and coordination between the single disciplines are mandatory. Siemens offers a workshop to cardiothoracic surgeons to simulate transcatheter procedures in a real environment, under close to real conditions to get a feel for the “dos” and “don’ts”.

Siemens offers an international workshop twice a year at the Siemens AX (Angiography and Interventional X-Ray Systems) headquarters in Forchheim, Germany. In February 2012 the first cardiac surgery workshop took place, and seven participants from Mexico, Israel, The Netherlands, Portugal, The United Kingdom, and Germany participated. The course was led by experienced clinical experts in both cardiology and surgical aspects. Together with Francesco Maisano, M.D. and Guisepppe Bruschi, M.D., both

cardiac surgeons, Professor Wolfram Voelker, M.D., an interventional cardiologist, developed this unique two-day training course to create comprehensive training for cardiac surgeons who were interested in moving into the field of transcatheter technologies. The workshop offered the perfect mix of theory and interactive hands-on sessions in small learning groups. The combined knowledge and experience of these three physicians, together with the use of different simulators, the introduction of materials like guidewires

and catheters, and the use of a real imaging system ensured that participants of this course would experience first-class training in transcatheter-based treatments.

In three simulated cath labs/hybrid ORs set up in the Siemens training facilities in Forchheim, the participants had the chance to extend their know-how in catheter techniques step by step. This covered everything from getting vascular or surgical access to the right choice of application. In detail, participants learned how to select and handle guidewires, catheters and implanting devices to angiographic projections. They received information about procedural actions such as access, puncture, wires, flushing and closing techniques, the steps for transcatheter aortic or mitral valve therapies. Additionally, intra-operative 3D imaging applications like *syngo* DynaCT and *syngo* Aortic ValveGuide were demonstrated. Finally, the participants got a deeper knowledge in the different possibilities of closing devices. Furthermore, they gained more knowledge about patient selection for these kinds of procedures, optimized imaging for angiography, and intra-operative 3D visualization. Other important parts of the program were basic principles of radiation protection and the prevention of complications. The participants appreciated the abil-



“A great course I would suggest to anyone who wants to be involved in a TAVI team.”

Francisco Xavier Treviño Garza, M.D.,  
Department for Surgery at the Hospital San José  
Tec de Monterrey, México.

ity to use intra-operative 3D imaging such as *syngo* DynaCT and *syngo* Aortic ValveGuide by themselves and many stated that this training was very valuable.

In the hands-on sessions – which formed the main part of the course – the participants were trained in gaining vascular access, handling the different types of guidewires and catheters, dealing with complications and how to implant a transcatheter valve by using different simulators.

Throughout the whole workshop, especially during the hands-on sessions, the participants had the chance to learn from the clinical experiences of clinical experts by discussing complication management and patient selection.

Due to the small groups (a maximum of three participants) the training was very intense and everyone had the chance to learn from the clinical experts. Juan A. Quintanilla Gutierrez, M.D., Hospital San José TEC de Monterrey, and Centro Medico Zambrano-Hellion expressed their enthusiasm about the session. “Perfect! Small groups and direct contact with the experts made this workshop a great training opportunity.”

#### Contact

david.groke@siemens.com

# Upcoming Congresses 2012

We always would like to give you the opportunity to get in “touch” with the real system and learn more about system handling to keep you in step with

the latest technological advances. You will have the chance to experience our technology at international congresses, trade fairs, and workshops. In the list

below you will find information on various events where we offer you the opportunity to meet AX.

Title	Location	Short Description	Date	Contact
SVS	National Harbor, MD, USA	Annual Meeting of Vascular Society	June 7 - 9	<a href="http://www.vascularweb.org">www.vascularweb.org</a>
ESTS	Essen, Germany	European Society of Thoracic Surgeons	June 10 - 13	<a href="http://www.ests.org">www.ests.org</a>
Cardiostim	Nice, France	Cardiac Electrophysiology & Cardiac Techniques	June 13 - 16	<a href="http://www.cardiostim.com">www.cardiostim.com</a>
WCIO	Chicago, IL, USA	World Conference on Interventional Oncology	June 14 - 17	<a href="http://www.wcio2012.org">www.wcio2012.org</a>
UKRC	Manchester, UK	UK Radiological Congress	June 25 - 27	<a href="http://www.ukrc.org.uk">www.ukrc.org.uk</a>
SOLACI	Mexico D.F., Mexico	Sociedad Latinoamericana de Cardiología Intervencionista	Aug 8 - 10	<a href="http://www.solaci.org">www.solaci.org</a>
ESC	Munich, Germany	European Society of Cardiology Congress	Aug 25 - 29	<a href="http://www.escardio.org">www.escardio.org</a>
AOCR	Sydney, Australia	Asian-Oceanian Society of Radiology and The Royal Australian and New Zealand College of Radiologists	Aug 30 - Sep 2	<a href="http://www.aocr2012.com">www.aocr2012.com</a>
ESMINT	Nice, France	European Society of Minimally Invasive Neurological Therapy	Sept 6 - 8	<a href="http://www.esmint.com">www.esmint.com</a>
CIRSE	Lisbon, Portugal	Cardiovascular and Interventional Radiological Society of Europe	Sept 15 - 19	<a href="http://www.cirse.org">www.cirse.org</a>
ESVS	Bologna, Italy	European Society for Vascular Surgery	Sept 19 - 21	<a href="http://www.esvs.org">www.esvs.org</a>
DGU	Leipzig, Germany	German Society of Urology	Sept 26 - 29	<a href="http://www.dgu-kongress.de">www.dgu-kongress.de</a>



JFR	Paris, France	Journées Francaise de Radiologie	Oct 19 - 23	<a href="http://www.sfrnet.org">www.sfrnet.org</a>
TCT	Miami, FL, USA	Transcatheter Cardiovascular Therapeutics	Oct 22 - 26	<a href="http://www.tctconference.com">www.tctconference.com</a>
EACTS	Barcelona, Spain	European Association for Cardio-Thoracic Surgery	Oct 27 - 31	<a href="http://www.eacts.org">www.eacts.org</a>
Medica	Düsseldorf, Germany	Trade Show	Nov 14 - 17	<a href="http://www.medica.de">www.medica.de</a>
RSNA	Chicago, IL, USA	Annual Meeting	Nov 25 - 30	<a href="http://www.rsna.org">www.rsna.org</a>

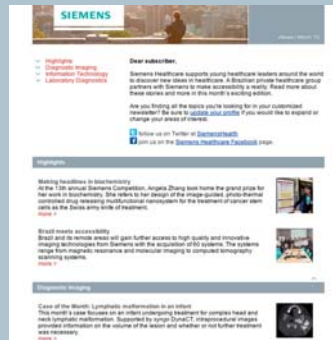
# Siemens Healthcare Publications

Our publications offer the latest information and background for every healthcare field. From the hospital director to the radiological assistant – here, you can quickly find information relevant to your needs.



## Medical Solutions

Innovations and trends in healthcare. The magazine is designed especially for members of hospital management, administration personnel, and heads of medical departments.



## eNews

Register for the global Siemens Healthcare News-letter at [www.siemens.com/healthcare-eNews](http://www.siemens.com/healthcare-eNews) to receive monthly updates on topics that interest you.



## AXIOM Innovations

Everything from the worlds of interventional radiology, cardiology, fluoroscopy, and radiography. This bi-annual magazine is primarily designed for physicians, physicists, researchers, and medical technical personnel.



## MAGNETOM Flash

Everything from the world of magnetic resonance imaging. The magazine presents case reports, technology, product news, and how-to articles. It is primarily designed for physicians, physicists, and medical technical personnel.



## SOMATOM Sessions

Everything from the world of computed tomography. With its innovations, clinical applications, and vision, this bi-annual magazine is primarily designed for physicians, physicists, researchers, and medical technical personnel.



## Imaging Life

Everything from the world of molecular imaging innovations. This bi-annual magazine presents clinical case reports, customer experiences, and product news and is primarily designed for physicians, hospital management and researchers.

For current and past issues and to order the magazines, please visit [www.siemens.com/healthcare-magazine](http://www.siemens.com/healthcare-magazine).

# AXIOM Innovations

© 2012 by Siemens AG, Berlin and Munich, All Rights Reserved

## Publisher

Siemens AG  
Medical Solutions  
Angiography & Interventional  
X-Ray Systems  
Siemensstr. 1,  
91301 Forchheim, Germany

## Responsible for contents

Heinrich Kolem, Ph.D.

## Chief editor

Nadine Meru, Ph.D.  
nadine.meru@siemens.com

## Co-editor

Sabine Wich  
sabine.wich@siemens.com

## Editorial board

Anne Figel, Vera Jünnemann,  
Dirk Sunderbrink, Andrea Beulcke,  
Thomas Hartkens, Anne-Eloise Cournut,  
Fernanda Cristina Moreira, Ina Schwabenland,  
Hanno Herrmann, Mariana Aquino, Heike  
Theessen, Simone Hinrichs, Ralf Krumtüngr,  
Dietrich Till, David Groke, Maideen Sadayan

Stephan Achenbach, M.D.,  
Department of Cardiology,  
University of Giessen,  
Giessen, Germany

Michael J. Alexander, M. D.,  
Department of Neurosurgery,  
Cedars-Sinai Medical Center,  
Los Angeles, CA, United States

Joao Amaral, M.D.,  
Bairbre Connolly, M.D.,  
Department of Pediatric Interventional  
Radiology, SickKids,  
Toronto, Canada

Ansgar Berlis, M.D.,  
Department of Neuroradiology,  
Klinikum Augsburg,  
Augsburg, Germany

Lorenz Bott-Flügel, M.D.,  
Department of Internal Medicine,  
Kreiskrankenhaus Erding,  
Erding, Germany

Johannes Brachmann, M.D.,  
Medical Clinic for Cardiology, Angiology and  
Pneumology, Klinikum Coburg,  
Coburg, Germany

Saruhan Çekirge, M.D.,  
Department of Interventional Neuroradiology,  
Hacettepe University School of Medicine,  
Ankara, Ankara, Turkey

Kristoff Cornelis, M.D.,  
Department of Interventional Cardiology,  
Maria Middelaes Hospital,  
Ghent, Belgium

Ian C. Gilchrist, M.D.,  
Heart and Vascular Institute,  
Penn State Hershey Heart and Vascular  
Institute, Hershey, PA, United States

Gerhard Hindricks, M.D.,  
Christopher Piorowski, M.D.  
Heart Center of the Leipzig University,  
Leipzig, Germany

Tobias F. Jakobs, M.D.,  
Department of Diagnostic,  
and Interventional Radiology,  
Barmherzige Brüder Hospital,  
Munich, Germany

Ferdinand Kiemeneij, M.D.,  
Department of Interventional Cardiology,  
University of Amsterdam,  
Amsterdam, The Netherlands

Johannes Lammer, M.D.,  
Department for Cardiovascular and  
Interventional Radiology,  
AKH Vienna, Vienna, Austria

Josef Ludwig, M.D.,  
Department of Cardiology and Angiology,  
University of Erlangen-Nuremberg,  
Erlangen, Germany

Maurice Stephan Michel, M.D.,  
Urology Department,  
University Hospital Mannheim,  
Mannheim, Germany

Jim Nolan, M.D.,  
Department of Cardiology,  
University Hospital of North Staffordshire,  
Staffordshire, United Kingdom

Shigeru Saito, M.D.,  
Department of Cardiovascular Medicine,  
Shonan Kamakura General Hospital,  
Kamakura, Japan

Giovanni Torsello, M.D.,  
St. Franziskus Hospital Münster,  
Center of Vascular and Endovascular Surgery,  
University of Münster,  
Münster, Germany

## Production

Michael Brumme  
Siemens Healthcare

## Layout and editorial staff

Satzwerker – Jäger & Tupper  
Karlsruhe, Germany

## Printer

Rotaplan Offset Kamman Druck GmbH  
Hofer Strasse 1  
93057 Regensburg, Germany

AXIOM Innovations on the net:

[www.siemens.com/healthcare-magazine](http://www.siemens.com/healthcare-magazine)

## Includes text and photographic contributions

from Primafila AG, Zurich /  
independent Medien-Design, Munich.

Note in accordance with § 33 Para. 1 of the Federal Data Protection Law: Dispatch is made using an address file which is maintained with the aid of an automated data processing system. We remind our readers that, when printed, X-ray films never disclose all the information content of the original. Artifacts in X-ray, CT, MR and ultrasound images are recognizable by their typical features and are generally

distinguishable from existing pathology. As referenced above, healthcare practitioners are expected to utilize their own learning, training and expertise in evaluating images.

Partial reproduction in printed form of individual contributions is permitted, provided the customary bibliographical data such as author's name and title of the contribution as well as date and pages of "AXIOM Innovations"

are cited. The editors request that two copies be sent to their attention. The consent of the authors and editors is required for the complete reprint of an article. Manuscripts submitted without prior agreement as well as suggestions, proposals and information are always welcome; they will be carefully assessed and submitted to the editorial board for review.

## Global Siemens Headquarters

Siemens AG  
Wittelsbacherplatz 2  
80333 Muenchen  
Germany

[www.siemens.com/healthcare-magazine](http://www.siemens.com/healthcare-magazine)

## Global Siemens Healthcare Headquarters

Siemens AG  
Healthcare Sector  
Henkestr. 127  
91052 Erlangen  
Germany  
Phone: +49 9131 84-0  
[www.siemens.com/healthcare](http://www.siemens.com/healthcare)

## Legal Manufacturer

Siemens AG  
Wittelsbacherplatz 2  
DE-80333 Muenchen  
Germany

Order No. A91AX-81101-16C1-7600 | Printed in Germany | CC 572 061215. | © 06.2012, Siemens AG

On account of certain regional limitations of sales rights and service availability, we cannot guarantee that all products included in this brochure are available through the Siemens sales organization worldwide. Availability and packaging may vary by country and are subject to change without prior notice. Some / All of the features and products described herein may not be available in the United States or other countries.

The information in this document contains general technical descriptions of specifications and options as well as standard and optional features that do not always have to be present in individual cases.

Siemens reserves the right to modify the design, packaging, specifications and options described herein without prior notice. Please contact your local Siemens sales representative for the most current information.

In the interest of complying with legal requirements concerning the environmental compatibility of our products (protection of natural resources and waste conservation), we recycle certain components. Using the same extensive quality assurance measures as for factory-new components, we guarantee the quality of these recycled components.

Note: Any technical data contained in this document may vary within defined tolerances. Original images always lose a certain amount of detail when reproduced.

For product accessories see:  
[www.siemens.com/medical-accessories](http://www.siemens.com/medical-accessories)

The statement by Siemens' customers described herein are based on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.

### Global Business Unit Address

Siemens AG, Medical Solutions  
Angiography & Interventional X-Ray Systems  
Siemensstr. 1  
DE-91301 Forchheim  
Germany  
Phone: +49 9191 18-0  
[www.siemens.com/healthcare](http://www.siemens.com/healthcare)

### Local Contact Information

#### Asia/Pacific:

Siemens Medical Solutions  
Asia Pacific Headquarters  
The Siemens Center  
60 MacPherson Road  
Singapore 348615  
Phone: +65 9622-2026  
[www.siemens.com/healthcare](http://www.siemens.com/healthcare)

#### Canada:

Siemens Canada Limited  
Medical Solutions  
2185 Derry Road West  
Mississauga ON L5N 7A6  
Canada  
Phone: +1 905 819-5800  
[www.siemens.com/healthcare](http://www.siemens.com/healthcare)

#### Europe/Africa/Middle East:

Siemens AG, Medical Solutions  
Henkestr. 127,  
DE-91052 Erlangen  
Germany  
Phone: +49 9131 84-0  
[www.siemens.com/healthcare](http://www.siemens.com/healthcare)

#### Latin America:

Siemens S.A., Medical Solutions  
Avenida de Pte. Julio A. Roca No 516, Piso 7  
C1067ABN Buenos Aires  
Argentina  
Phone: +54 11 4340 8400  
[www.siemens.com/healthcare](http://www.siemens.com/healthcare)

### USA:

Siemens Medical Solutions U.S.A., Inc.  
51 Valley Stream Parkway  
Malvern, PA 19355-1406  
USA  
Phone: +1-888-826-9702  
[www.siemens.com/healthcare](http://www.siemens.com/healthcare)