SIEMENS

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Sustainable Cardiovascular Care for Clinical Experts

The Siemens Portfolio for Cardiology

Be prepared for success

Siemens is helping to fight the most threatening diseases - such as cardiovascular disease. By partnering with leading institutes and experts, Siemens helps to define new standards of care which enable medical professionals to efficiently detect diseases earlier, provide a more accurate diagnosis, and thus enable targeted therapy.

Cardiovascular care has become a field of dynamic development. On the one hand, healthcare providers are faced with ever increasing economic challenges. On the other hand, cardiovascular care providers want to safeguard their leading position and provide state-of-the-art patient care today and in the years to come. The question is how this challenge can be sustainably mastered, especially in such a challenging and dynamic environment.

Our answer is what we call sustainable cardiovascular care: a lasting partnership dedicated to a consistent, cost-effective, high-quality approach that provides a sound basis for a successful future.

Technology that provides the support you need
Delivering the best possible cardiovascular care effectively, efficiently and affordably becomes possible with technology that helps to:

- make sounder decisions
- perform safer procedures
- operate with better efficiency
- use resources wisely

That's exactly what we offer to keep you on track and perfectly prepared for a sustainable future.

Focus on things that really matter

Solutions from Siemens make it possible to

- perform non-invasive analysis of the status of coronary morphology and myocardial perfusion and viability at low dose
- assess the functional significance of an intermediate coronary artery stenosis in the cath lab
- accurately and reliably assess right ventricular function
- perform sophisticated differential diagnosis in heart failure
- improve survival chances and quality of life for patients with severe aortic stenosis and no option of valve surgery

Our portfolio for cardiovascular care

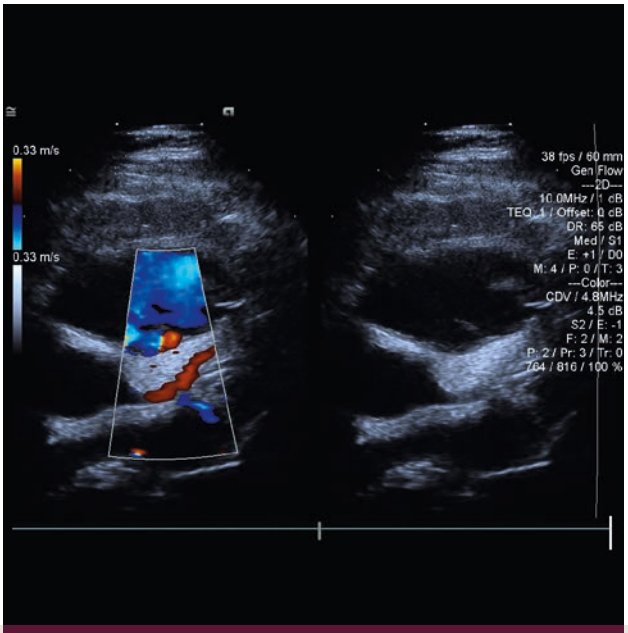
In recent years, many advancements have taken place in cardiovascular care. New imaging modalities like CT and MRI have become an integral part of cardiovascular diagnostics. But in well-established modalities such as coronary angiography, echocardiography, nuclear cardiology and cardiovascular PET•CT, exciting innovations have also taken place – helping to increase diagnostic accuracy while minimizing potential patient harm.

In the following outlines, you will see how Siemens' innovative technologies can help you improve cardiovascular care – and answer all relevant clinical questions.

Cardiovascular Imaging	Coronary Imaging	Cardiac Anatomy & Morphology	Myocardial Function	Myocardial Perfusion	Myocardial Viability	Vascular Imaging
Catheter Laboratory	•	•	•		•	•
Echocardiography	•	•	•	•	•	•
Nuclear Cardiology*			•	•	•	
Cardiac PET/CT	•	•	•	•	•	•
Cardiovascular MR	•	•	•	•	•	•
Cardiovascular CT	•	•	•	•	•	•

*including cardiovascular PET/CT

Interventional Cardiology
Electrophysiology
Laboratory Diagnostics
Information Technology
Consulting
Education, Training, and Service



Ultrasound

Coronary Angiography

Coronary imaging

Information on coronary status is of the greatest importance for managing patients with coronary artery disease (CAD), the most important disease entity in cardiology, and still the leading cause of death worldwide. The technical challenges in coronary imaging include the fast motion of the heart and the coronary arteries, breathing induced movement of the chest, and large density differences in the thorax.

Today, coronary assessment is still dominated by invasive coronary angiography; but for selected patients non-invasive coronary imaging has become a valuable alternative.

Coronary angiography

Coronary angiography is still the gold standard for coronary evaluation in clinical daily routine. It is capable of visualizing even the smallest coronary lumen alterations, due to its unmatched high temporal and spatial resolution. This is the case for all patients, regardless of heart rhythm and heart rate, heart rate stability, presence of coronary stents and coronary bypass grafts.

Additionally, coronary angiography is the only imaging modality that allows immediate therapeutic intervention in the case of a coronary occlusion or a flow-limiting coronary stenosis.

With innovations like *syngo* IZ3D, nowadays 3D coronary imaging has become part of the daily routine, particularly in complex coronary interventions, like bifurcation stenosis.

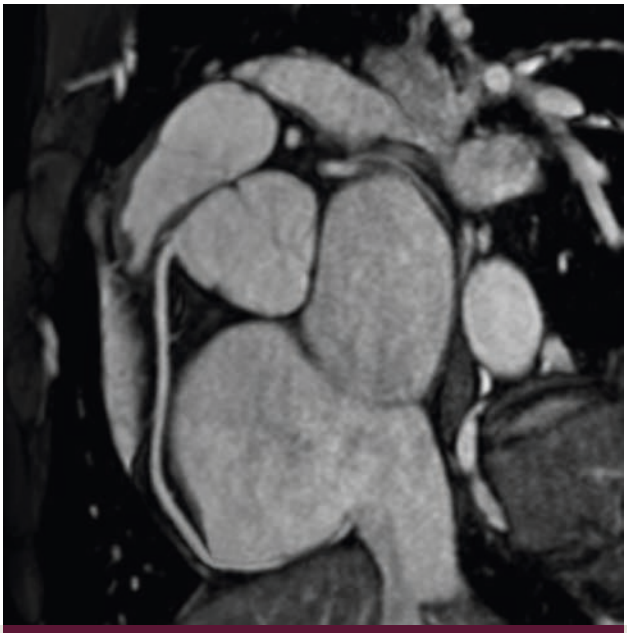
Siemens offers full integration of IVUS and FFR with the Sensis hemodynamic registration system.

Echocardiography

The transthoracic assessment of coronary flow reserve uses highly sensitive color and pulsed wave Doppler imaging to analyze coronary physiology.

Non-invasive, reproducible and comfortable for patients, echocardiographic analysis of coronary flow is ideal for optimiz-

Coronary CT Angiography



Coronary MR Angiography

ing patient care in selected cases, in both the acute setting and for follow-up.

Coronary CT angiography

In selected patients, coronary CT angiography (CTA), has become a valuable alternative to coronary angiography. Especially in acute chest pain patients with initial inconclusive ECG and lab test results, coronary CTA has proven its efficiency to exclude significant coronary stenoses in numerous clinical studies, thanks to its high negative predictive value of 99-100 %. Coronary CTA is particularly useful in excluding significant coronary artery disease. Several studies from all around the world demonstrate that cardiac CT not only improves quality of care for acute chest pain patients, but may also help to save money. An important consideration in times of budget restrictions.

Siemens' Dual Source CT technology is setting the pace and overcoming many of the limitations of single-source coronary CTA as clinical studies have demonstrated. The SOMATOM Definition Flash reduces dose to ~ 1 mSv, independent of heart rate. Dual Source CT allows not only the evaluation of native coronary arteries at a temporal resolution of down to 75 ms, but also diagnostic evaluation of stents and bypass grafts with high diagnostic accuracy.

Cardiovascular PET.CT

Latest PET/CT scanner technology combines the possibilities of single source CT of up to 128 slices with the unique information provided by PET, such as myocardial blood flow in ml/min. As such, Cardiovascular PET/CT provides assessment of the coronary status and the hemodynamic relevance of stenosed segments.

Coronary MR angiography

Coronary MR angiography (MRA) is a promising technique for diagnostic evaluation of coronary arteries and is recommended for evaluation of coronary anomalies. Although not yet a routine method for non-invasive coronary evaluation, coronary MRA can achieve good diagnostic accuracy in patients with severe coronary calcification. New coronary MRA techniques, such as the 3D whole heart approach, already provide easy CT-like, exam planning, image acquisition, and image processing.

Cardiac anatomy & morphology

Assessment of cardiac and vascular anatomy and morphology is required for all cardiovascular diseases. From the assessment of congenital heart disease to the visualization of atherosclerotic coronary plaque, myocardial inflammation or fibrotic myocardium: New imaging modalities besides echocardiography have emerged over the last few decades that provide you with new insights and increase diagnostic confidence.

Echocardiography

Echocardiography provides comprehensive, real-time cardiac and vascular imaging at the point of care and is therefore the method of choice in most patients.

The introduction of instantaneous full-volume echocardiography with the ACUSON SC2000™ ultrasound system has ushered in a new era of RT 3D echocardiography as it allows acquisition of a full cardiac data set within one single heart beat. The latest research impressively underlines how this fascinating innovation can change the way how echocardiography is performed, but also demonstrates how the highest levels of diagnostic accuracy are becoming routine.

Intracardiac echocardiography (ICE) with the ACUSON AcuNav™ ultrasound catheter has extended the use of echocardiography to image-guided interventions by providing real-time echocardiography from within the heart. Now ICE is even available as volume echocardiography.

Cardiovascular MR

Cardiovascular MR (CMR) allows comprehensive assessment of cardiac anatomy and morphology with high spatial and temporal resolution, even in very complex cases. Since CMR does not use ionizing radiation, it plays an important role for diagnosis and monitoring especially in pediatric cardiology and congenital heart disease. The newest coil architecture, Tim® 4G, enables the acquisition of images of the highest image quality, while Cardiac Dot Engine reduces the complexity of a CMR examination to a minimum. Especially due to its ability to visualize and quantify myocardial edema and myocardial fibrosis, CMR has become an acknowledged tool for many patients with various cardiovascular diseases.

Cardiovascular CT

Cardiovascular CT with state-of-the-art technology offers very high diagnostic accuracy for the diagnostic assessment of cardiac anatomy and morphology. Cardiovascular CT with Dual Energy applications is a promising method for morphological studies. And with the SOMATOM Definition Flash, it is now even possible to perform cardiovascular CT in daily routine at very low dose levels, i.e. < 1 mSv. So even in pediatric cardiology, cardiovascular CT has become a valuable diagnostic tool.

Cardiovascular PET•CT

Hybrid scanners like the Biograph mCT Flow with up to 128 slice CT capabilities offer additional cardiovascular CT functionalites, as described above.

Cath lab

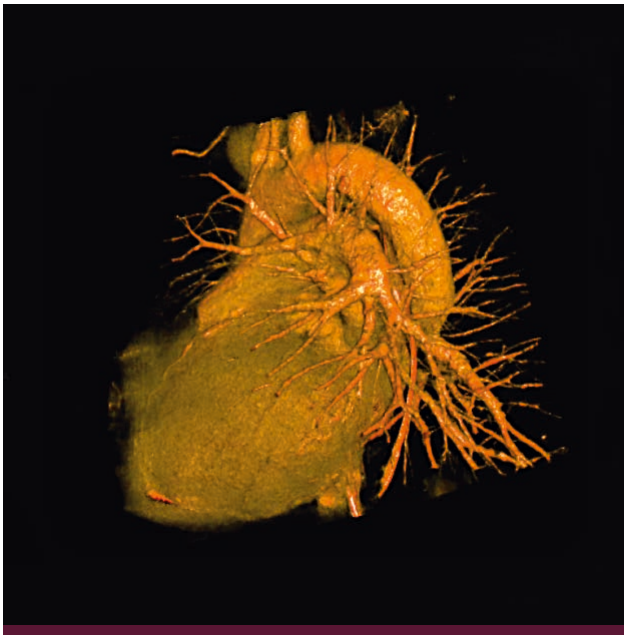
Cardiac catheterization may also be used for evaluation of cardiac anatomy, and with the introduction of innovative solutions like *syngo* DynaCT, it now also offers 3D imaging.

This is especially helpful in endovascular and structural heart procedures. Comprehensive dose saving features and highly advanced image processing have made the procedure safer and faster.

Real-time 3D echocardiography

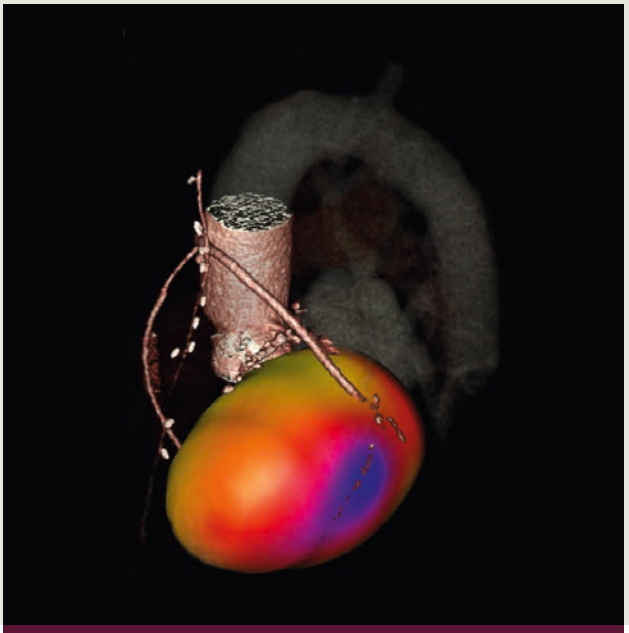
Cardiovascular MR, Courtesy of AKH, Linz, Austria

Cardiovascular CT



syngo DynaCT Cardiac

Real-time 3D echocardiography



Nuclear cardiology

Myocardial function

Myocardial function is of greatest diagnostic and prognostic importance in cardiac care. Multiple imaging modalities may be used to assess regional and global functional parameters like volumes and ejection fraction (EF), also give detailed insights into cardiac mechanics - not only under rest, but also under stress conditions. Stress-induced wall motion abnormalities or a stress-induced reduction of EF are strong indicators of hemodynamically significant Coronary Artery Disease.

Echocardiography

As it provides real-time imaging, echocardiography is ideal for the evaluation of global and regional myocardial function, providing an assessment of left ventricular ejection fraction and wall motion as part of standard practice. New applications such as eSie VVI technology provide new insights into myocardial function and mechanics. And echocardiography is also becoming 3D in daily routine. The ACUSON SC2000 offers instantaneous full-volume imaging that provides functional information of the entire heart without geometric assumptions. This increases diagnostic accuracy and reproducibility for assessment of both the left and right ventricle. Stress echocardiography will especially benefit from real-time 3D technology.

Nuclear cardiology

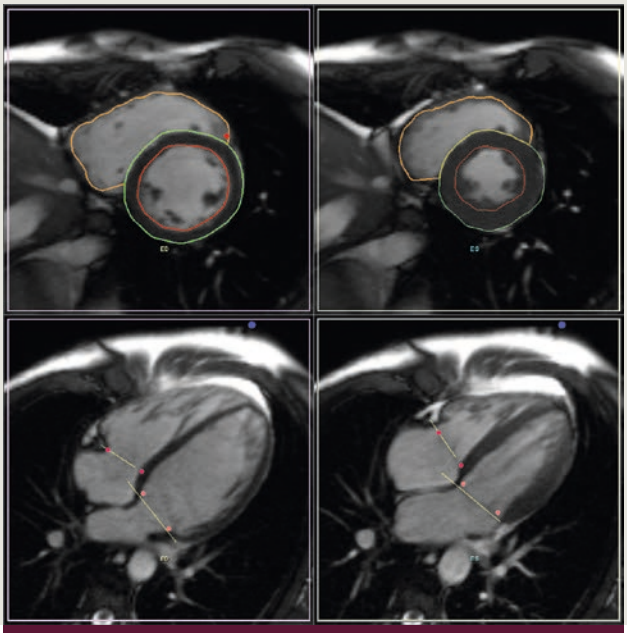
When using ECG gating in myocardial perfusion studies, PET/CT, SPECT, SPECT/CT, and most recently xSPECT[1] allow analysis of global and regional LV function, adding diagnostic power to myocardial perfusion studies.

With IQ•SPECT, cardiac SPECT imaging is reaching new heights, as it helps to reduce acquisition time up to 75% or in dose reduction up to less than 75% without compromising image quality.

Cardiovascular MR

Aside from real-time 3D echocardiography, cardiovascular MR (CMR) is the current standard for evaluation of global and regional cardiac function. As image quality in CMR doesn't depend on the patient's habitus, high-quality images can

Cardiac CT



Cardiac MR

be achieved in most patients without contraindications to MRI. All chambers and wall segments, including those of the right ventricle, can be analyzed with high reproducibility and accuracy. Additionally, dobutamine stress CMR offers ischemia evaluation with the same examination protocol, diagnostic accuracy and safety profile known from stress echocardiography.

Cardiovascular CT

Since cardiac CT offers high temporal and spatial resolution, it can also provide important functional LV and RV information. The diagnostic accuracy of cardiac CT at rest is comparable to that of CMR. CT allows physicians to analyze not only global but also regional wall motion, in both acute and chronic settings with good diagnostic accuracy.

Cath lab

Invasive ventriculography allows for the analysis of left ventricular regional wall motion and ejection fraction when this information is required for immediate decision making, but is not yet available from other imaging modalities. Right heart catheterization allows an accurate estimation of cardiac output and pulmonary arterial pressure and is of great diagnostic power, especially in complex congenital heart disease and valvular disease.

[1] Symbia Intevo and xSPECT are not commercially available in all countries. Due to regulatory reasons their future availability cannot be guaranteed. Please contact your local Siemens organization for further details.

Myocardial perfusion

Identifying stress-induced myocardial perfusion deficits is a well-established approach for evaluating the presence and severity of coronary artery disease. In clinical practice, nuclear cardiology is the most often used approach, with cardiovascular MR catching up. Myocardial contrast echocardiography and cardiac CT are currently under scientific evaluation for this clinical question.

Nuclear cardiology

Nuclear cardiology, using either SPECT or PET, is established for myocardial perfusion assessment since decades. Its clinical value is well evaluated in symptomatic patients, for preoperative evaluation of patients with high risk of CAD, and for the follow-up of known CAD.

Nuclear cardiology offers the unique advantage to detect perfusion abnormalities at peak stress with linear perfusion dependent tracer extraction and trapping in the myocardium, using either exercise or pharmacological stress.

Perfusion abnormalities at peak stress are sensitive for the definition of inducible ischemia, which is associated with early and moderate CAD. Absence of defects is a very robust indicator for an excellent prognosis even in patients with multiple risk factors. PET using radio-labeled 13N Ammonia or 82Rb and SPECT using 99mTc MIBI or 201 Thallium enable the assessment of myocardial perfusion.

Hybrid technologies (SPECT/CT and PET/CT) allow individualized attenuation correction, which increases diagnostic quality. With IQ•SPECT, perfusion, function and Calcium score can be combined in a 5 min SPECT/CT exam.

Cardiovascular PET•CT

As an inherently quantitative modality, PET provides absolute quantification of myocardial perfusion. Innovations like *syngo*.PET Myocardial Blood Flow on Biograph™ mCT enable quantification of myocardial blood flow in ml/min/g.

Myocardial contrast echocardiography

Myocardial contrast echocardiography (MCE) utilizes ultrasound contrast agents in order to assess myocardial perfusion in real time. As a highly portable method with real-time image acquisition and interpretation and no ionizing radiation, MCE is an ideal bedside technique. Recent studies have shown that MCE has the potential to change patient management, increase accuracy, and reduce overall costs.

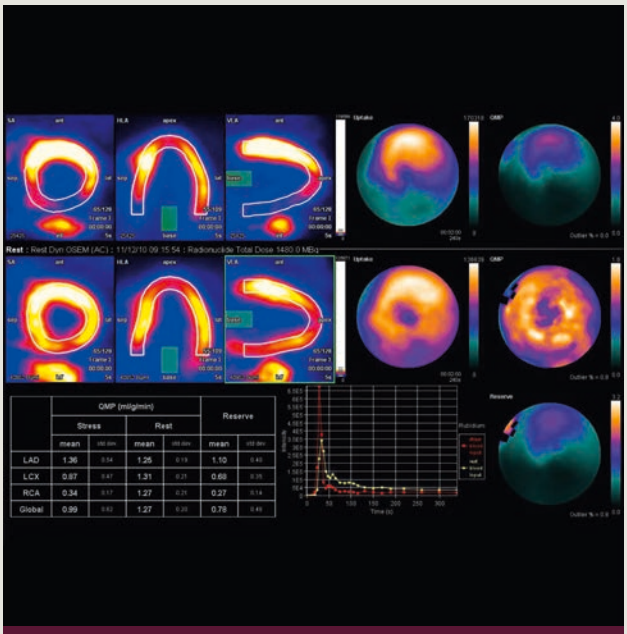
Cardiovascular MR

In recent years, cardiovascular MR (CMR) has become an acknowledged alternative for the evaluation of myocardial perfusion. In stress perfusion CMR, exam protocols are largely identical to the ones used in nuclear cardiology, i.e. adenosine and dipyridamole are used as vasodilators. Myocardial first pass of a gadolinium MR contrast agent is acquired after some minutes of continuous vasodilator application. Diagnosis can be made either by visual assessment of the perfusion images or by a semi-quantitative analysis using either an automatically generated upslope map provided by Inline Time Course Evaluation within the Cardiac Dot Engine, or post-processing software.

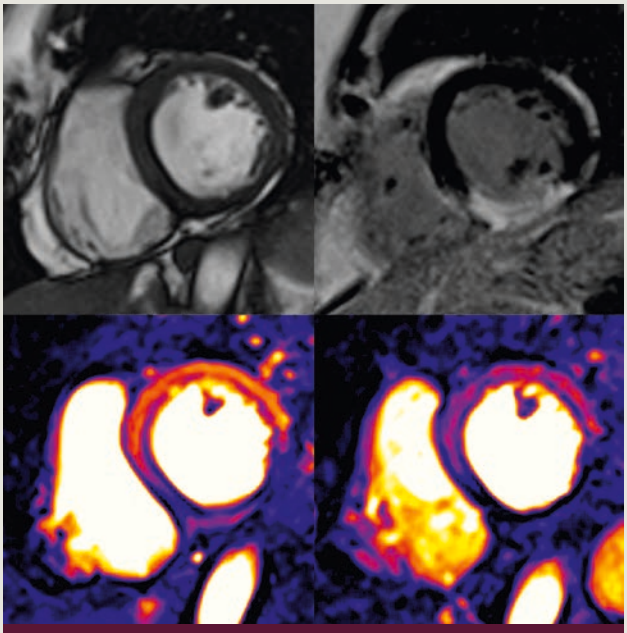
Cardiovascular CT

In addition to the evaluation of the coronary status and cardiac function, cardiovascular CT may also analyze myocardial perfusion based on the kinetics of an iodinated contrast agent. Similar to CMR, CT data are acquired after continuous i.v. administration of the contrast agent. When using Dual Energy applications like *syngo*.CT DE Heart PBV, even absolute quantification of the iodine uptake is possible. The SOMATOM Definition Flash even allows the calculation of quantitative values for blood flow and volume. Study results look very promising and dose levels compare to those of conventional SPECT myocardial perfusion assessment.

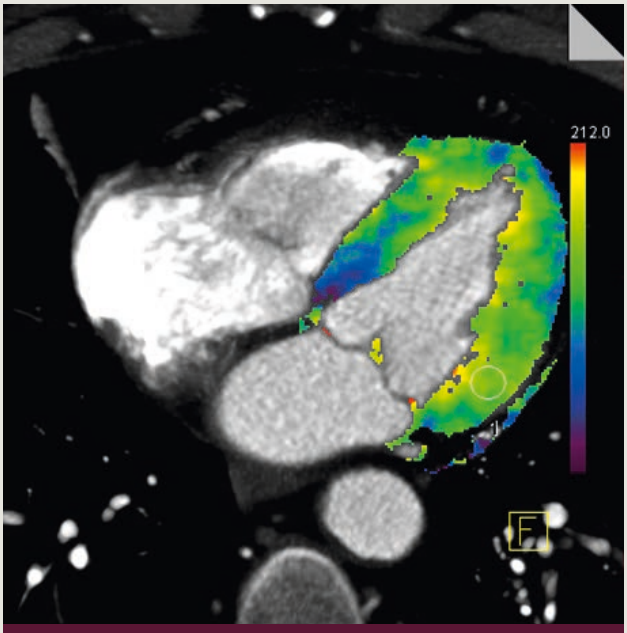
Myocardial Contrast Echography



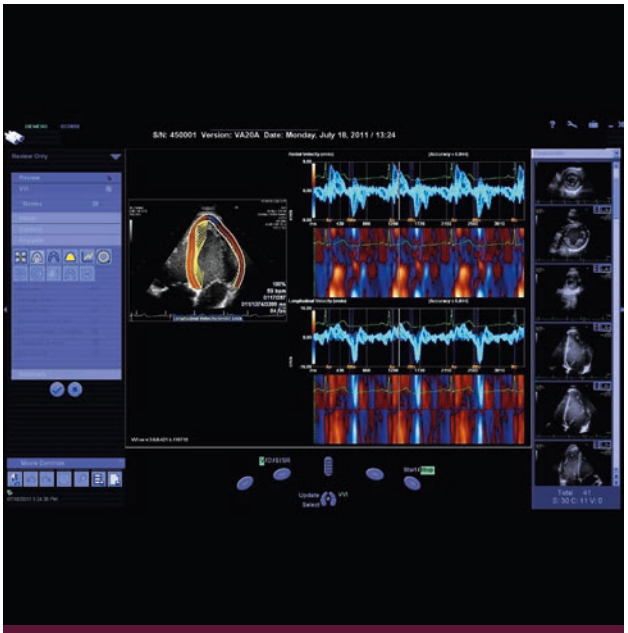
Absolute myocardial blood flow quantification in ml/min with PET
Courtesy of Dr. Parthiban Arumugam MD., Manchester Royal Infirmary, University of Manchester, UK



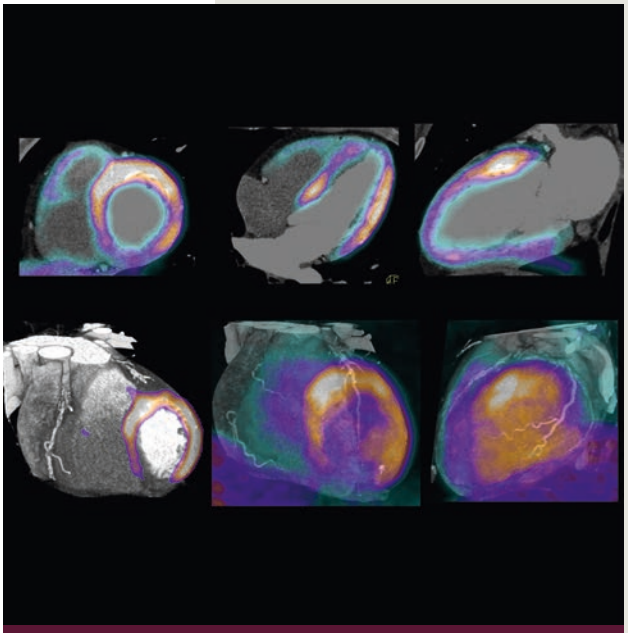
MR Myocardial Perfusion
Courtesy of Helios Klinikum Berlin-Buch, Berlin, Germany



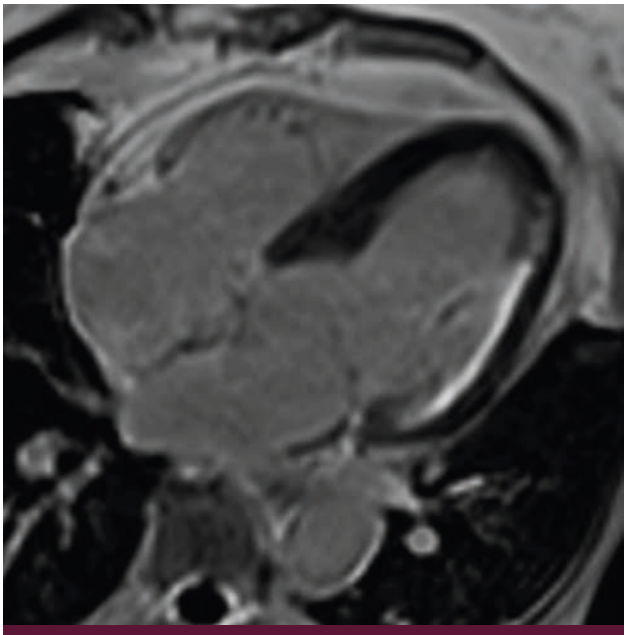
CT Quantitative Dynamic Myocardial Perfusion



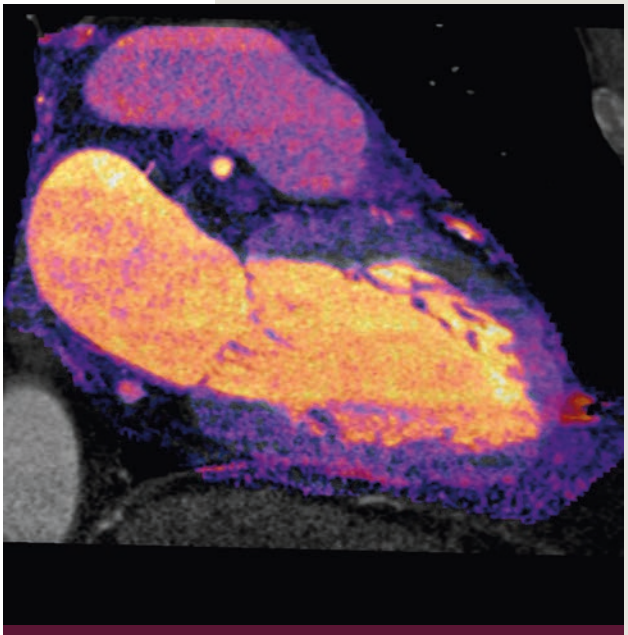
Echocardiography



PET•CT myocardial perfusion with integrated coronary CT
Courtesy of Erick Alexanderson, MD, UNAM, Mexico City, Mexico



CMR – Late Enhancement
Courtesy of Centre Cardio Thoracique de Monaco, Monaco



Dual Energy Cardiac CT – Late Enhancement

Myocardial viability

Information about myocardial viability is very important for managing patients with previous myocardial infarction or ischemic cardiomyopathy, as only viable myocardial segments will benefit from revascularization. Several diagnostic approaches to assess myocardial viability exist – through the evaluation of diastolic wall thickness, myocardial contractility, myocardial perfusion or myocardial metabolism. The visualization of myocardial scar tissue is especially valuable. To answer these questions, several imaging modalities may be used: nuclear cardiology, cardiovascular MR, echocardiography or cardiovascular CT.

Echocardiography

Low-dose dobutamine stress echocardiography is an excellent and the most often used approach to evaluate myocardial viability. If initially akinetic segments start to contract after the administration of dobutamine, this indicates that such segments are viable.

Nuclear cardiology

In nuclear cardiology, two techniques are used to assess myocardial viability: SPECT and PET.

Viable myocardium demonstrates an affinity for glucose compared to irreversibly damaged myocardium.

PET has the capability to directly image the glucose affinity of ischemic but viable myocardium by using the glucose analog FDG. Increased FDG uptake indicates viable myocardium.

FDG PET is therefore the gold standard for myocardial metabolism assessment, and its accuracy is increased when using PET/CT.

Besides analysis of myocardial perfusion and function in ECG-gated studies, SPECT enables the identification of ischemic but viable myocardium when applying ^{201}Tl redistribution studies. The initial uptake of ^{201}Tl depends on regional perfusion, whereas the sustained ^{201}Tl uptake depends on cell membrane integrity and thus myocyte viability. Innovations like IQ•SPECT drastically reduce acquisition time and dose, while at the same time maintaining diagnostic accuracy.

Hybrid technologies (SPECT/CT and PET/CT) allow individualized attenuation correction, which increases diagnostic quality and additional analysis of the coronary status, if appropriate CT technology is available.

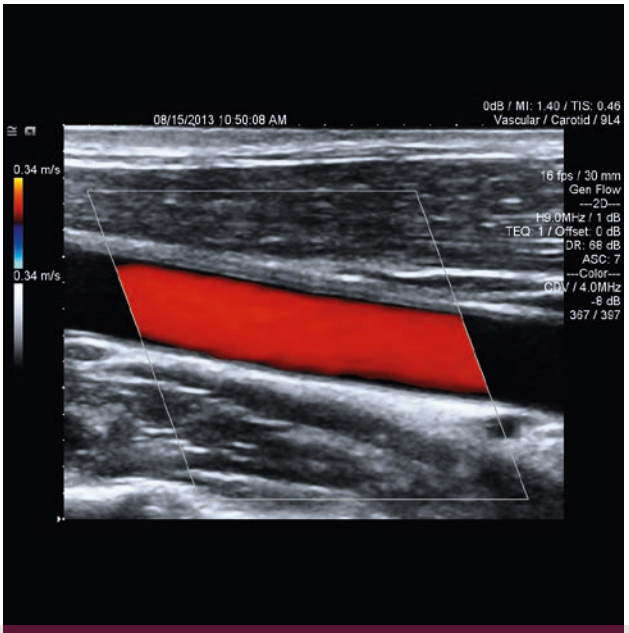
Cardiovascular MR

Cardiovascular MR (CMR) is a valuable diagnostic tool for analyzing myocardial viability. LV dysfunction at rest and contractile reserve during the infusion of low-dose dobutamine can be assessed by CMR in a similar way as in echocardiography. In addition, CMR can be used for myocardial perfusion studies. Most importantly, CMR offers direct visualization of irreversibly damaged myocardium by applying a technique called “delayed enhancement.” Delayed enhancement offers diagnostic accuracy comparable to SPECT. Especially for the detection of small and subendocardial infarctions.

Cardiac CT

In chronic myocardial infarction, delayed enhancement may also be demonstrated in CT. In initial studies, diagnostic accuracy of CT delayed enhancement compares to CMR. Furthermore, CT can be used to assess wall thickness and function at rest, which are also parameters of myocardial viability.

syngo DynaCT for tomographic imaging in the angio lab



Ultrasound

Vascular imaging

In addition to diseases of the heart, cardiology also covers the management of diseases of the vascular system like aortic dissection or pulmonary embolism. Also, cerebrovascular disease or peripheral artery disease are often manifest in CAD patients because atherosclerosis is the underlying disease in all of them. For vascular imaging, angiography, CT, MRI and ultrasound are used, each with specific strengths and indications. The latter offer not only visualization of vessel lumen, like angiography, but also analysis of the vessel wall.

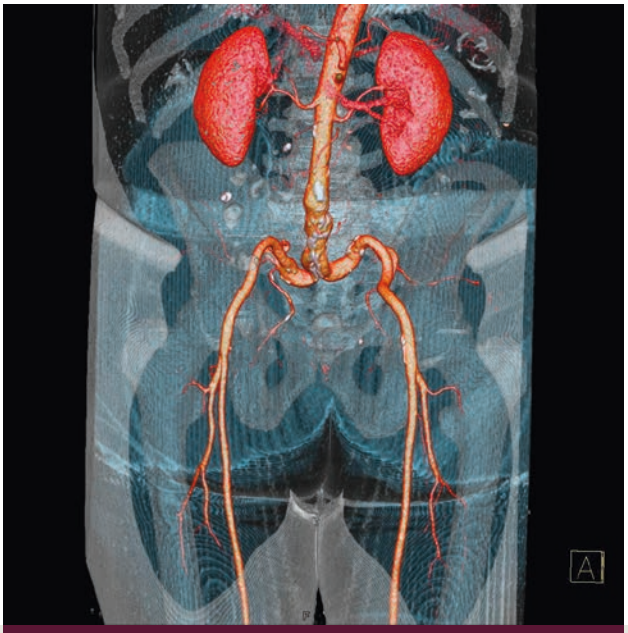
Angiography

Over the last decade angiography has become a mainly interventional modality in vascular disease assessment, as the non-invasive imaging approaches offer diagnostic accuracy comparable to angiography. In the interventional angio lab, innovative applications like *syngo* DynaCT allow tomographic imaging to visualize endoleaks, for example. This is of the greatest importance in the rapidly emerging hybrid therapies of vascular diseases like EVAR (endovascular aneurysm repair) or TEVAR (thoracic endovascular aneurysm repair).

Ultrasound

Ultrasound is the most commonly used imaging modality in vascular medicine as anatomical and morphological information can be combined with the hemodynamic information from color flow and spectral Doppler. Ultrasound contrast agent imaging enhances the visualization of the vessels and can be used to assess the vascularization of the tissues supplied. Ultrasound allows the imaging of interventional procedures in real time. Widely available, free of ionizing radiation, and low in cost, it is the method of choice for monitoring vascular disease.

MR angiography
Courtesy of University Hospital UCLA, Los Angeles, USA



CT angiography with Dual Energy

Magnetic resonance

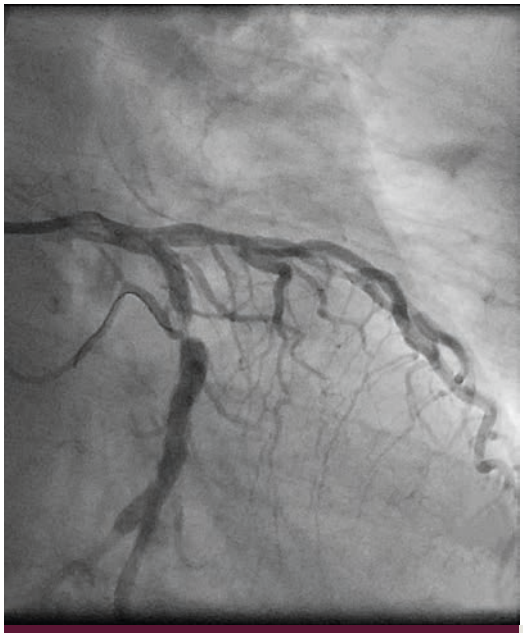
MR delivers fast and accurate angiography results, including flow. MR angiography does not necessarily need contrast agents when using "non contrast enhanced" MRA sequences, and does not apply ionizing radiation. With today's ability to scan during continuous table movement, a whole body MR angiography with the TimCT Angio Dot Engine now takes only a matter of minutes. Furthermore, MR-guided vascular interventions are currently a promising field of research.

Computed Tomography

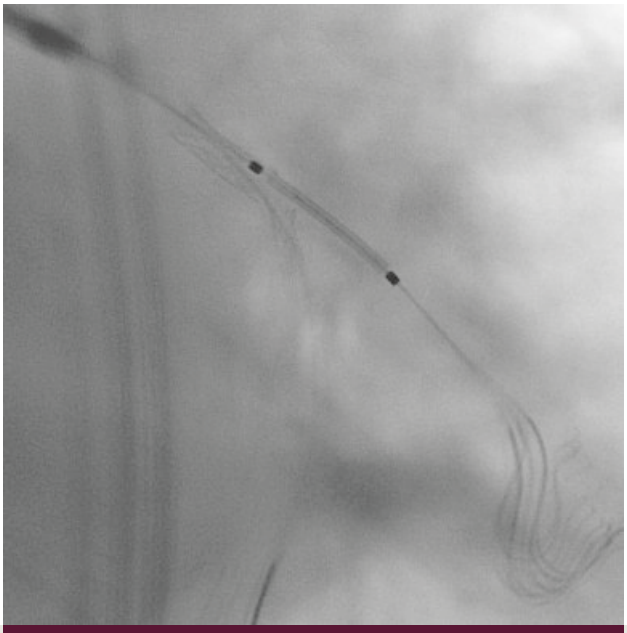
CT has been established in vascular diagnostics for two decades as it delivers fast and accurate results regarding the vascular status. Innovative applications like Dual Energy routinely allow for precise and immediate bone or calcification removal, resulting in improved true lumen assessment. Recent innovations like the adaptive 4D Spiral allow for whole organ perfusion analysis beyond the detector width.

Nuclear Cardiology

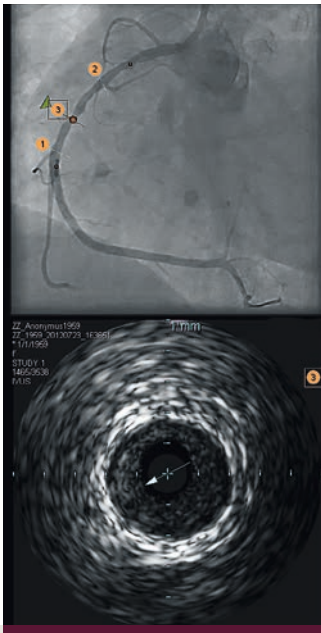
Offering the same applications as CT, hybrid PET/CT and hybrid SPECT/CT provide a single scanner solution while also providing nuclear medicine tests.



Coronary Angiography



CLEARstent live for improved stent visualization



IVUS Map for coregistration of

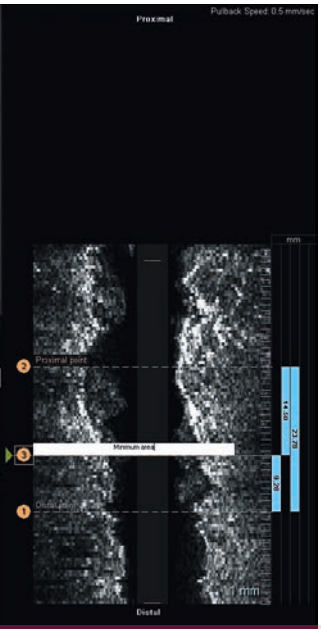
Interventional Cardiology

Imaging in cardiology is not only used for diagnostic purposes, it is also mandatory for interventional or minimally invasive procedures in cardiovascular medicine. For image-guided interventions, real-time imaging delivered in the best possible image quality is mandatory. In many interventions different imaging modalities are used, simultaneously combining their specific strengths.

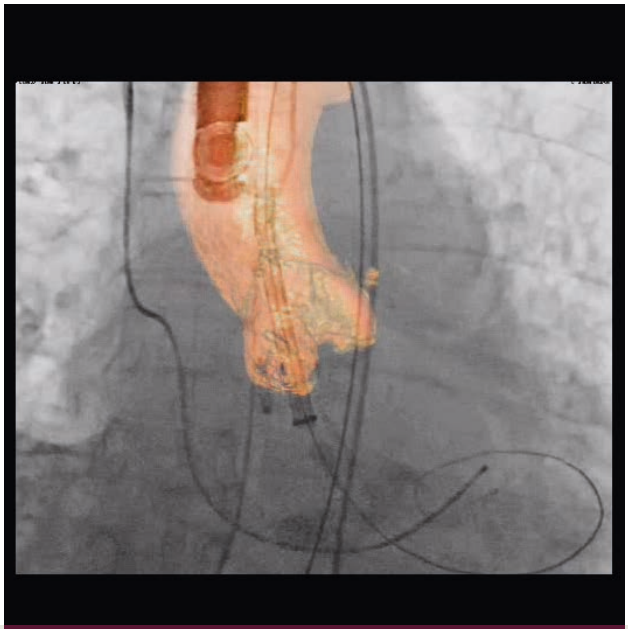
Interventional cardiology

The best example of how imaging may change patient management is percutaneous coronary intervention (PCI). Since its introduction thirty years ago, PCI has become the guideline recommended therapy in acute myocardial infarction and is widely applied in patients suffering from significant coronary artery disease. With the introduction of drug-eluting stents, the long-term success of PCI procedures has improved significantly. Good coronary stent apposition is of greatest importance for a sustainable coronary intervention, however stents are sometimes hard to see, which makes it difficult for the physician to judge proper stent apposition. Special software tools like CLEARstent live improve stent visibility. Advanced imaging may be indicated in complex coronary interventions like revascularization of CTO or bifurcational lesions.
Siemens' card angiography systems also offer fully integrated IVUS imaging and FFR assessment.

Interventional therapy in cardiology, however, is not limited to coronary interventions. More and more, interventional therapies are becoming valid alternatives to surgical therapies or enable minimally invasive therapies for patients with congenital or structural heart disease. A great example of this development is transcatheter aortic valve implantation (TAVI) for patients with severe aortic valve stenosis whose risk for conventional cardiac surgery is too high. An innovative imaging technique called *syngo* DynaCT 360 supports these



IVUS and coronary angiography



syngo iGuide during transcatheter aortic valve implantation

Intracardiac echo for guidance of ASD occlusion

highly complex procedures. A five-second high speed rotational scan is done and delivers CT-like three-dimensional images directly in the cath lab which can then be overlaid onto live fluoroscopy and used to guide the valve prosthesis positioning and deployment. *syngo* Aortic Valve Guide offers even more sophisticated guidance during positioning and deployment of the valve prosthesis. ASD closure and VSD closure are also established interventional therapies, while interventional occlusion of the left atrial appendage is becoming a promising therapy in patients with atrial fibrillation and contraindication to oral anticoagulation.

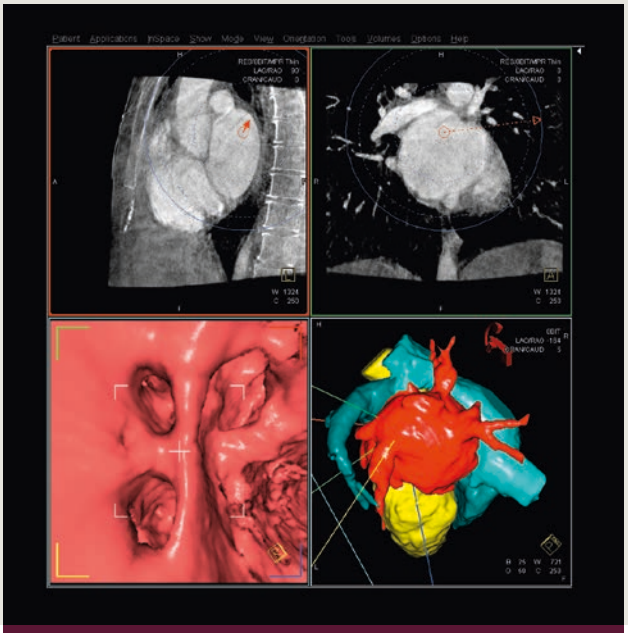
Transesophageal echocardiography and intracardiac echocardiography

In many institutions intraprocedural transesophageal echocardiography (TOE) is used to complement fluoroscopy in many cardiac interventions. The ACUSON AcuNav™ V ultrasound catheter brings the first real-time volume ICE catheter into the interventional cardiology market improving catheter visualization and providing physician a choice of conscious sedation vs general anesthesia. This catheter helps to improve the outcome of interventional procedures while reducing both procedure and fluoroscopy time leading to improved patient safety and recovery.

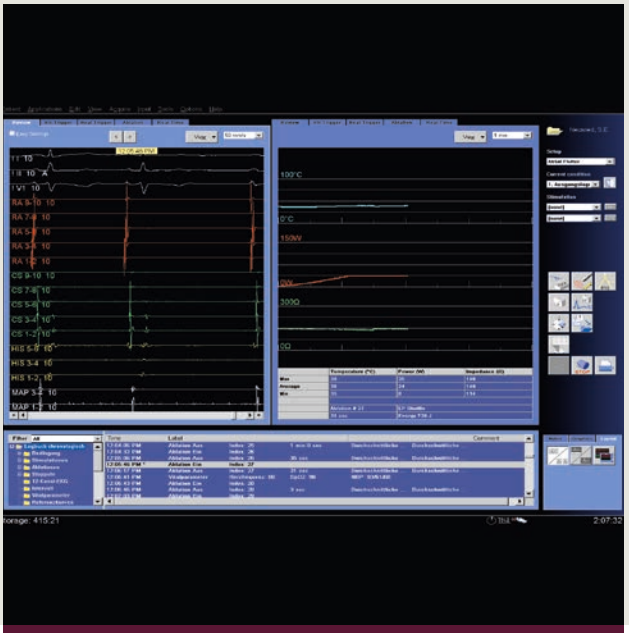
MAGNETOM Artis Combi Suite

Excellent soft tissue contrast, high spatial and temporal resolution, as well as 3D and 4D imaging, make MRI ideal for cardiac interventions. With MAGNETOM® Artis Combi Suite[1], the benefits of MRI can be brought to cardiovascular interventional procedures. Top-of-the-line MR imaging and optimized clinical workflows put you at the leading edge – giving you more detail and supporting procedures such as atrial fibrillation ablation. The enabler of this Combi Suite, the Combi Dockable Table, smoothly transfers the patient to and from the MRI system.

[1] The product is not commercially available in all countries. Due to regulatory reasons its future availability cannot be guaranteed. Please contact your local Siemens organization for further details.



syngo DynaCT Cardiac for 3D visualization of the left atrium and the pulmonary veins



Real-time monitoring of ablation parameters

Electrophysiology

Over the past few years, many innovations have taken place in the field of electrophysiology. Electrophysiology has developed from a mainly diagnostic approach to an integrated approach, offering a definite cure of arrhythmias. Innovations in electrophysiology have created a strong demand for highly integrated solutions capable of supporting smooth workflows for the most complex procedures in the EP lab. Siemens has put together one of the most forward-looking portfolios for electrophysiology, an integrated solution specially geared to the needs of the electrophysiologist.

Pulmonary vein isolation in atrial fibrillation

New visualization tools deliver detailed information on individual patient anatomy which helps to optimize the planning and performance of the EP procedures. Ablation therapy is an established therapy for right atrial tachycardias like atrial flutter and has shown its value in therapy of ventricular tachycardia. Until some years ago, the most frequent rhythm disorder, atrial fibrillation, could not be cured. Patients were treated with drugs and cardioversion, but the results were disappointing. Now, for the first time pulmonary vein isolation (PVI) offers these patients a possible cure. With a better understanding of the underlying disease, the introduction of 3D imaging in the EP lab with *syngo* DynaCT Cardiac has also made PVI more efficient. Siemens offers a full integration of anatomic images from DynaCT, CT and MRI with the two leading electroanatomic mapping systems: Biosense-Webster's Carto® 3 System and St. Jude Medical's EnSite NavX™ platform.

Overlay of 3D Imaging onto live fluoroscopy

Intracardiac volume echo for precise imaging of the pulmonary veins

Cardiac resynchronization therapy in severe heart failure

Device therapy, which is very common in EP, also benefits from comprehensive imaging information, especially in challenging procedures like cardiac resynchronization therapy (CRT). CRT improves heart failure therapy significantly, but the non-responder rate is still very high. Imaging helps to select the appropriate patient and to plan CRT in an optimized way. Real-time 3D echocardiography offers accurate assessment of EF and cardiac dyssynchrony, while CMR enables identification of myocardial scar tissue, and CT or MRI allow exact visualization of the cardiac vein's anatomy. These comprehensive data can then be used in the EP lab to guide the implantation procedure. Innovative applications like *syngo* DynaCT Cardiac and *syngo* iPilot facilitate CRT implantation significantly. Intracardiac echocardiography may also be used to reduce procedure and fluoroscopy times, but also to prevent potentially harmful complications.

Echocardiography

The monitoring of CRT is commonly performed with echocardiography. Innovative applications such as eSie VVI ™ technology of instantaneous full-volume imaging offer new views on myocardial motion and mechanics and have the potential to improve CRT, from the identification of suitable patients, to procedural guidance, to follow-up.

Intracardiac echocardiography

Intraprocedural fully functional intracardiac echocardiography using the ACUSON AcuNav™ V ultrasound catheter may help to reduce procedure and fluoroscopy times, but also to prevent potentially harmful complications. Real-time 3D imaging with the ACUSON AcuNav™ V ultrasound catheter not only improves visualization of both the catheter and tissue targets during EP procedures, but also very early detection of thrombus formation.

Laboratory Diagnostics

The complex nature of cardiovascular disease highlights the importance of cardiac biomarkers in the management of cardiac patients. In vitro testing is an essential tool in cardiovascular risk assessment, diagnostics and therapy monitoring.

Cardiac risk assessment

While the effective therapy of patients with acute coronary syndrome has led to a significant decrease in related mortality rates, there is a great need for preventive strategies that focus on cardiovascular risk assessment. Early detection of cardiovascular disease is important to protect and maintain health status and quality of life, and also to avoid burdening healthcare systems with unnecessary costs. Siemens' comprehensive offering of cardiac biomarkers includes essential and well evaluated parameters for CV risk assessment.

- **Arteriosclerosis/Inflammation**
  hsCRP, Myeloperoxidase, Fibrinogen
- **Dyslipidemia**
  Total Cholesterol, HDL-cholesterol, LDL-cholesterol, Triglycerides, Apolipoprotein B, Apolipoprotein A-1, Lipoprotein (a)
- **Left Ventricular Overload:**
  BNP, NT-proBNP

Acute care

In acute chest pain, fast and accurate differential diagnosis is of utmost importance. But often patient history, physical examination, initial lab testing and electrocardiogram are not diagnostic. Innovative lab tests like high-sensitivity troponins help to make the differential diagnostic process faster and more accurate, resulting in earlier therapy. We offer an extensive menu of biomarkers that are essential for accurate and timely diagnosis in the emergency patient:

- **Acute Coronary Syndrome**
  Troponin I, BNP, NT-proBNP, CKMB, Myoglobin
- **Plaque Instability/Inflammation**
  hsCRP, Myeloperoxidase
- **Heart Failure**
  BNP, NT-proBNP, Troponin I
- **Dyspnea**
  BNP, NT-proBNP, Troponin, D-Dimer, Fibrinogen, arterial oxygen concentration, RBC

Information Technology

***syngo* Dynamics optimizes clinical workflows through the integration of cardiovascular imaging and information, enabling faster, better, and more cost-effective healthcare. Providing with a logical, comprehensive and flexible system fulfilling the requirements set by your department and healthcare organization objectives.**

Innovative and integrated IT systems for the future

With *syngo* Dynamics you can rapidly read multi-modality images and create reports for your cardiovascular patients. Studies from across your enterprise can be accessed quickly, and are available at your fingertips. Customizable templates enable you to tailor evidence-based structured reporting to efficiently meet your needs and workflow. And in conjunction with *syngo*.via[1], you have fast access to multimodality 3D routine and advanced reading functionality. All of this creates a solid basis for your decision making. In addition, you can conveniently access the system from wherever[2] you are, using a wide variety of Internet-enabled devices.[3,4]

Future-proof IT infrastructure for efficient patient outcomes

syngo Dynamics provides access to accurate patient images and information. Healthcare providers have the ability to easily access records and perform ad hoc analytics from wherever[2] and whenever they are needed to support existing and emerging strategic IT initiatives and enable better patient carew.[1]

[1] *syngo*.via can be used as a standalone device or together with a variety of *syngo*.via-based software options, which are medical devices in their own right.
[2] Prerequisites include: Internet connection to clinical network, DICOM compliance, meeting of minimum hardware requirements, and adherence to local data security regulations.
[3] Diagnostic reading of images with a web browser requires a medical grade monitor using the original quality viewer.
[4] *syngo* Dynamics Mobile is not for diagnostic use. *syngo* Dynamics Mobile is designed for optimal performance on the iPad and iPhone. It may or may not function on other devices, such as Android-based devices.

Advisory Services

The transition to value-based healthcare delivery in the context of cost containment poses major challenges to healthcare providers. Are you ready to face them? Does your strategy allow you to fully exploit clinical, operational, and financial efficiency potentials at your institution?

Siemens Healthcare Consulting (SHC) – linking strategy, processes, and technology.

We bring our extensive experience and detailed knowledge of healthcare systems, medical processes, and medical technology and medical technology to the table. Our team is made up of specialists with expertise in process analysis & management, medical technology, healthcare IT, and care management, offering services in two main areas:

- Strategy & Transformation – Prepare your business & services for next generation healthcare
- Clinical & Operational Performance – Exploit the full potential of your existing or future infrastructure and clinical set-up.

By analyzing and optimizing your healthcare infrastructure, capacities, and processes, SHC can support you in concentrating on core competencies and achieving measurable progress in key areas. **Our experts for clinical process optimization support you in smoothly transforming workflows and implementing benchmark processes.**

In cardiovascular care, SHC additionally offers dedicated advisory services improving process maturity, the prerequisite for highest clinical, operational, and financial efficiency:

- **Act on Heart Failure**
- **Act on Acute Coronary Syndrome**

We work together with you to acquire a clear, in-depth understanding of your current situation and develop an effective plan of action based on guidelines, global best-practice standards, and benchmarks. **Delivered in a modular fashion and based on the local needs, skills, and capabilities, the advisory services may encompass process maturity assessment, implementation program management and monitoring, as well as re-assessments.**

We offer our services for specific departments in your organization or for the entire healthcare enterprise. Our partnership can give you a lasting competitive edge.

Act on Outcomes

Act on Outcomes is a new consulting approach for the systematic assessment and improvement of hospital operations and clinical processes for selected diseases. Physicians and managing directors face the challenge of integrating efficient diagnostic and therapeutic workflows into their clinical environment. Based on best-practices, guideline adherence, and the latest clinical and scientific knowledge, key levers can be identified to help optimize the quality of care.

The methodology
Act on Outcomes is based on a clinical process maturity model that was specifically developed for multidirectional workflows in hospitals and across the care continuum. It aims to:

- analyze and evaluate the actual individual situations
- develop and implement suggestions for improvement
- weigh the effects on process workflows
- verify the improvement in the quality of care

Act on Outcomes is driven by an interdisciplinary team of experts from Siemens: Physicians, strategy and process consultants, as well as economists, engineers and IT experts. Our clinical centers of competence work with internationally recognized experts. In this way we continuously integrate the latest trends and developments from clinical and scientific medicine into our concepts.

In cardiovascular care, Siemens Healthcare offers the Act on model for acute coronary syndrome and heart failure.

Education, Training, and Service

Providing viable healthcare economically means delivering the highest quality care possible efficiently and productively, something that we at Siemens Healthcare Customer Services understand. Which is why we work closely with you, bringing our experience and innovative solutions to help you to maintain uptime, improve performance and optimize workflow for sustainable healthcare while delivering quality results. Which means better productivity and greater cost-effectiveness. You can depend on us as a trusted partner.

Whatever your needs, we can do more for you – from providing training to keeping your medical equipment up and running. Staying up to date will increase both the competence and the reputation of your cardiology department and your entire institution – which can affect the number of your patients. And thanks to our wide range of proactive services, you can minimize unscheduled system downtimes and thus patient rescheduling.

We know what it means to deliver more.

Enhanced expertise, greater efficiency and high productivity are key for best diagnostic quality, faster patient throughput and optimized resource management. We understand the importance of regular training and consulting, tailored to you and your staff's needs. Our global team of Siemens certified clinical education and application specialists are experienced healthcare professionals, who understand your clinical needs. Our dedicated User Services portfolio uniquely positions us as a parnter of choice when it comes to wanting more out of your investment, maintanable - year-on-year. Becauce we deliver more.

Siemens Customer Services – rest assured, we are there for you.

Especially in cardiovascular care, imaging is playing an increasingly important role in diagnosis and therapy. Top performance, improved uptime, higher reliability: with today's medical systems, availability is more than simply replacing parts, it's about being proactive. As an essential part of our proactive services, the Guardian Program™ offers remote real-time monitoring of your angiography system. By continuously supervising your system for possible deviations from current norms, the Guardian Program™ helps to ensure a high level of system availability. The Guardian Program™ is making it possible to detect and resolve system errors before malfunctions occur. As an additional service offering, the Guardian Program™ including TubeGuard can predict the majority of all potential CT tube failures within the SOMATOM Definition family.

Cardiovascular Reference Centers

Siemens Healthcare aims to be the leading company offering integrated clinical workflow-oriented solutions and the preferred partner for the development of innovative diagnostic and therapeutic strategies in cardiovascular medicine, thereby creating added value for our customers. Clinical Reference Centers demonstrate the impact of multimodal disease-focused solutions from Siemens and exceptional clinical expertise on the quality and efficiency of cardiovascular care.

The partnership between Siemens Healthcare and the Clinical Reference Centers is based on three pillars:

- Exchange Experience - during multimodality clinical workflow customer visits
- Share Knowledge - in multimodality clinical training courses and fellowships
- Support Development - by cross-modality application development and in a medical advisory role for clinical pathways.

Trainings and Fellowships

The Reference Centers conduct fellowships and training for cardiologists, cardiac surgeons, cardiovascular nurses, and other medical professionals several times throughout the year. For more information please contact your Siemens representative.

For further information please visit us on our cardiology website:
www.siemens.com/cardiology

Scan with your mobile phone.

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