

# Three Disease Patterns Detected with a Single Scan

Sixty-four-slice computed tomography provides highly defined images of the heart.

Cardiologists at the German Heart Center in Munich, Germany, have been using a SOMATOM Sensation Cardiac 64 since October 2004. This is a report of their experiences.

*By Ulrike Zechbauer*

For quite some time now, the media has been reporting that chest pain, back pain, or pain in the arms are indicative of a heart attack. Despite these warnings, many people suffering from these symptoms refuse to go to the doctor. The reasons for their difficulties are ready-made: a change in weather, problems with the children at school... Only when the pain gains in momentum and becomes unbearable will they visit the emergency room.

When the patient is suspected of having a heart attack, the hospital will take blood and an ECG. For some patients their trip to the emergency room may prove to be a false alarm: the lab values are within normal

range, the ECG does not show anything specific – most likely not a heart attack after all. But what is causing the pain then? An aortic dissection, or a pulmonary embolism? In cases like these, computed tomography has the key to the answer. A patient does not have to do more than hold his breath for 15 seconds, and the entire thorax is scanned. And it doesn't take more than a single scan to diagnose one of the three disease patterns – or rule it out.

About one-fourth of the patients are simply lucky: their coronary heart disease was detected in time. But the fate of many people takes a different and to them completely unexpected turn.



“THE TRIPLE RULE OUT DIAGNOSTICS allows for the detection of three diseases with a single scan,” says Stefan Martinoff, M.D., clinical director of the Institute of Radiology and Nuclear Medicine at the German Heart Center in Munich, Germany.



“THE POSSIBILITIES are fantastic,” says cardiologist Jörg Hausleiter (center), shown together with radiologist Stefan Martinoff (left).

Coronary heart disease is the number one killer in the Western industrialized world. Statistically, tumors are the second most frequent cause of death, but they lag far behind. Tumors are considered to be especially insidious, because they frequently escape diagnosis until it is too late. It is much less known that heart attacks can be of a similar insidious nature. “Approximately half of all heart attacks occur without warning,” explains Stefan Martinoff, M.D., clinical director of the Institute for Radiology and Nuclear Medicine at the German Heart Center in Munich. “And in half of these cases the infarct is deadly.”

### World Reputation

Middle-aged men, fully involved in their professional lives, are especially vulnerable. Acute heart attacks are disproportionately high in this age group. “Early detection of coronary heart disease in this population group means

that we can turn the clock back with an imaging modality and reduce the mortality rate,” stresses Martinoff. The German Heart Center in Munich is synonymous with world-renowned top medical expertise. Various fields of study involving diagnostic and therapeutic approaches to cardiovascular disease are combined under one roof. Throughout Europe, the center is reputed to be one of the most famous facilities supported by superior imaging methods. Among the diagnostic systems used is the fastest computed tomography scanner in the world. Since October last year, the system has provided valuable services to the specialists onsite.

In as little as 0.33 seconds the gantry rotates once around the patient. A temporal resolution of 83 milliseconds suffices to freeze the movements of the beating heart. The high spatial resolution of below 0.4 millimeters enables images that display the finest of

anatomical details inside the body. The SOMATOM Sensation® Cardiac 64 system, introduced by Siemens in the summer of 2004, entered the market just in time for the 30-year celebration of computed tomography. Since then, this imaging method has experienced quantum leaps. "Where we formerly had to compromise between the speed of a scan and the resolution of an image, the new CT system allows us to generate images within the shortest time possible and at a previously unknown level of resolution," states Martinoff. "With SOMATOM Sensation Cardiac 64, cardiac image generation has greatly stabilized and is far more precise than ever before. When we examined our first patient with the system, we were really surprised. For the first time, we could see the smallest side branches of the coronary arteries, and even the right coronary artery was clearly detectable and detailed down to the last segment. This vessel has always been our 'problem child,' since it is difficult to display. We also appreciate that the system is so easy to operate. And if you know its predecessor, the 16-slice scanner, you are able to immediately operate it thanks to the uniform *syngo*® user interface."

### Dangerous Calcifications Detected in Time

In addition, the innovative scanner accurately visualizes soft (non-calcified) plaque in vessels. "Soft plaques are high cholesterol deposits in vessels. According to today's knowledge, soft plaques lead to heart attacks more frequently than hard, calcified plaques," explains Jörg Hausleiter, M.D., cardiologist at the Clinic for Cardiovascular Disease at the German Heart Center. "When these soft plaques rupture, blood clots form, vessels are blocked, and the result is a heart attack. The SOMATOM Sensation Cardiac 64 allows us to clearly display and diagnose dangerous soft plaques in many more patients than before. I am convinced that plaque diagnosis will be playing a large role in preventing heart attacks." Adds Martinoff, "For patients with unclear chest pain, we had to perform

a number of examinations in the past, involving the aorta, the heart and the lungs. For the first time, we are now able to perform the so-called 'Triple Rule Out Diagnostics' in one single scan." The term "Triple Rule Out" combines the most frequent causes for acute chest pain. This could involve aortic dissection, when the inner layer of the aorta's artery wall splits open (dissects); a pulmonary embolism; or coronary heart disease. But emergencies constitute only a small percentage of patients who are examined with the innovative CT system. Patients prone to heart attacks, or those that already have bypasses or stents, make up a much larger group.

### Triple Rule Out Diagnostics: One Scan, Three Disease Patterns

"We see many patients that come in with a risk anamnesis, for example because one of their relatives died from a heart attack," continues Martinoff. "Many of these people wake up every night in fear that they may have an infarct. They actually do show Angina pectoris. However, despite the discomfort experienced, the cardiologist cannot reach a confident pathological diagnosis, since the stress ECG is usually unremarkable and the typical cardiac enzyme values do not show pathological changes. As a next step, cardiologists send these patients to us to be able to eliminate coronary heart disease by examining them with the cardiac CT. Quite often, the CT is without pathological findings. We are able to not only reassure the patient, we also save him visits to the emergency room and in-patient hospital stays. Where we previously had patients undergo heart catheterization to eliminate coronary heart disease, we can now examine them with modern imaging methods and put them at ease earlier than ever before." The assessment of stents has also improved considerably. While conventional systems make it virtually impossible to see the inner stent area, the new 64-slice CT system enables – depending on location, size, and material – satisfactory evaluation. For example, it is



JÖRG HAUSLEITER, M.D., works closely with his colleagues from the radiology department.



SOMATOM Sensation Cardiac 64 also visualizes soft plaques.

possible to determine the viability or restenosis of stents. "It's simply fantastic," says Hausleiter. Yet there are still more advantages offered by SOMATOM Sensation 64 Cardiac. Since the exposure time for a cardiac examination has been reduced from 16 to 9 seconds, less contrast agent must be injected. Another group that benefits from cardiac CT are patients with bypasses that are being controlled with catheters. To see the detailed anatomy of blood vessels, physicians perform a CT angiography. Based on the diagnosis reached, subsequent catheter manipulation can be reduced to a minimum, making the intervention much more patient-friendly.

### Hand in Hand

In tandem with their high quality standards, radiologists and cardiologists diagnose CT images together. "One of our strengths and specialties at the German Heart Center is the long-term, close cooperation between the Cardiovascular Clinic, headed by Professor Albert Schömig, M.D., and the Clinic for Radiology and Nuclear Medicine. Coronary CT is at its best and optimal patient care is ensured only when specialists of both disciplines sit together at the same table," emphasizes Martinoff. "A radiologist should never forget that coronary heart disease is a

dangerous disease. When he diagnoses it alone, the responsibility for the patient is his alone as well. But he cannot be both a radiologist and a highly trained cardiologist at the same time," offers Martinoff with conviction. "This is why cooperation is a must, although it is not practiced everywhere due to frequent competition between the two specialties."

However, the German Heart Center is a renowned example of cooperation. Numerous radiologists and cardiologists the world over visit the center every year to apply the experience gained at the center to their own hospitals.

"We are currently training our visiting physicians in the use of SOMATOM Sensation 64 Cardiac. But our guests not only profit from us, we are also profiting from them. We have made some excellent international connections during the past years," concludes Martinoff. "We are very proud of our worldwide network of physicians and scientists. Our objective is to steadily increase the quality of medical care."

**Author:** Ulrike Zechbauer has a master's degree in biology. As a scientific journalist, she publishes in media such as Spektrum der Wissenschaft, Focus, and Handelsblatt.

### Biography of Dr. Stefan Martinoff

Stefan Martinoff, M.D., is the vice medical director of the German Heart Center in Munich (DHM) since 2005 and the clinical director of the Institute for Radiology and Nuclear Medicine at the DHM since 1998.

Nine years ago he was heavily involved in building and establishing the first completely digital radiation department in Bavaria at the DHM.

In December 1991 he started his career at the DHM as the senior physician at the Institute of Radiology. Prior to that he worked as senior physician and acting chief physician of radiology in the municipal hospital Starnberg, Germany.

Between 1985 and 1991, he interned, specializing in radiology at the Radiological Clinic of the Ludwig-Maximilian-University in Munich (LMU). He also completed his medical studies at the LMU between 1977 and 1983.

## Case Study

An 81-year-old, slightly obese female patient was hospitalized presenting hyperintensive dysfunction with acute coronary syndrome. She complained about sudden pain in the back without it radiating to other parts of the body.

The ECG did not show pathological evidence. Echocardiography showed pronounced left ventricular hypertony.

The initially performed cardiac CT excluded the presence of aortic dissection and pulmonary embolism. The tentative diagnosis was a higher-degree stenosis of the LAD. The cardiac catheterization performed the same day showed coronary artery disease with a slightly limited global LV function (EF = 54%).

A high-degree stenosis in the area of the LAD was successfully dilated in the same session using PTCA and stenting. Subsequent to the intervention, the patient was symptom free; changes in ECG or enzyme values were not present.



Fig. 1

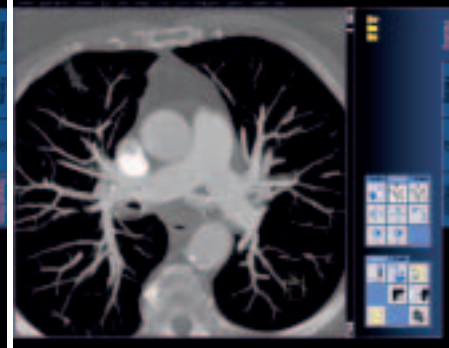


Fig. 2

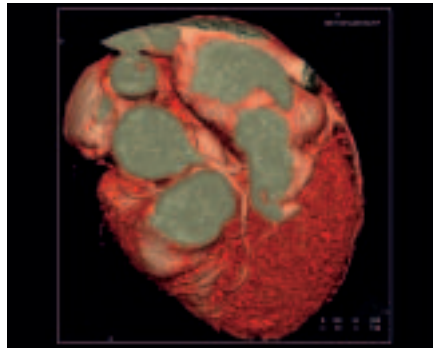


Fig. 3

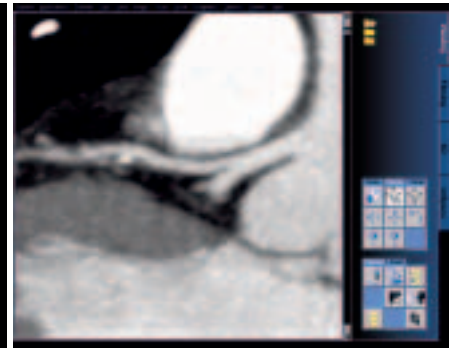


Fig. 4



Scanner	SOMATOM Sensation Cardiac 64
Scan length	175.5 mm
Scan time	15 sec
Heart rate	58 bpm
KV	120 kV
Effective mAs	550 mAs
Rotation time	0.33 sec
Slice collimation	64 x 0.6 mm
Pitch	0.2
Kernel	B20f
Contrast	80 cc, 4 cc/sec

### Multislice CT examination of the heart, summary evidence:

- Exclusion of aortic dissection in the thoracic region, evidence of arteriosclerotic changes with calcifications and thrombotic wall deposits as well as a spherical, approx. 7 mm large thrombus adhering to the wall at 7 o'clock in the mid-descending aorta [Fig. 1]
- No indications of pulmonary embolism [Fig. 2]
- Coronary anomaly with RCA exiting from the left coronary sinus [Fig. 3]
- CT indications for a higher-degree stenosis in the LAD, changeover in the first diagonal branch, moderate stenosis in the distal LCx [Fig. 4]
- Low-grade dystelectatic pulmonary parenchymal changes, left, basal segment
- Evidence of coronary calcification, lying below the 25 percentile margin according to age and sex