



# Speeding up Clinical Workflow in Cancer Staging

With *syngo* TimCT Oncology, the Department of Diagnostic Radiology at the University Hospital Freiburg uses a magnetic resonance procedure that leads to new clinical pathways: one MRI exam – the complete information. The new TimCT – Continuous Table move – application delivers excellent image quality and dramatically reduces the time to diagnosis.

By Sonja Böhm

“Suspected rectal cancer” reads the referring diagnosis from the family physician which the patient brings to the Comprehensive Cancer Center at the University Hospital Freiburg. Initially, matters proceed here as they do at many other clinics in Germany: The male patient undergoes a physical examination and is then admitted to the radiology department, where the tumor region is examined using high-resolution magnetic resonance imaging (MRI) – currently the best imaging procedure for displaying the local extent of advanced rectal cancer.

## Tumor Localization with Continuous Table Move MRI

But Freiburg has something special: The stationary, high-resolution MRI for primary diagnosis of the tumor is supplemented – during the same examination – by a continuous table move MRI measurement. The patient slowly slides through the magnet tunnel on a continuously moving table, so that the chest and abdomen can be examined using TimCT (Continuous Table move powered by Tim®) acquisition. “The liver and lungs are the two organs of greatest interest to us,” explains Arnd-Oliver Schäfer, MD, Assistant Professor and Head of the Clinical MRI section. “We know that every fifth patient with rectal cancer develops liver metastases, and every 12<sup>th</sup>, pulmonary metastases.” “The primary diagnostic procedure, the high-resolution examination of the tumor,

is critical for planning surgery,” adds Professor Mathias Langer, MD, MBA, Chairman and Medical Director of the Department of Diagnostic Radiology at the University Hospital Freiburg. “Naturally, however, it is also important to know whether it has metastasized and to which extent the primary tumor has spread. Depending on this information, the selection of the most appropriate therapy can be done prior to surgery.”

After about a 20-minute examination in Freiburg, the findings are complete – how the tumor looks, how it has expanded locally, and whether it has metastasized. “In other hospitals, you go to an MRI exam after the primary diagnosis of the tumor. Then, you go to the next examination appointment and undergo a computed tomography [CT] scan of the upper abdomen and maybe a sonogram. And then, during another appointment, a CT scan of the thorax is performed,” explains Professor Langer as he describes the usual procedure. “If you’re lucky, the examinations are performed three days in a row; if you’re not, it can take three weeks!”

## Accurate Therapy Planning

In Freiburg, MRI is performed after rectoscopy and biopsy, where a sample is taken for the histological examination. “We can perform part of the tumor characterization using MRI,” says Langer. “The various image impressions that can be obtained in magnetic resonance imaging by using

special protocols of the same slice allow for greater differentiation of the disease – we do more than verify the tumor, we are very specific about it,” he says as he explains the additional benefits of *syngo*® TimCT MRI technology – “MRI thus provides us with much more information.” The patient’s images and diagnostic findings are subsequently discussed at the interdisciplinary tumor conference. “Normally, no more than a week passes from the time the patient first comes to the hospital until the tumor conference – at that time everything is available and at the next appointment, the patient receives a therapy plan.” The plan already includes, for example, how to proceed after surgery and therapy – follow-up examinations with MRI are also a critical part of after-care. “MRI is an excellent way to gain an indication of recurrence or metastases, often at a time when the patient subjectively feels completely healthy,” says Professor Langer. “Because we perform the same examination repeatedly using a standardized protocol, we are in a good position to compare the images,” adds Schäfer. “Through semiannual examinations, we can detect metastases at an early stage – at a time when they may be resected with curative intent.”

## One MRI Examination – Maximum Information

Clearly, both the patient and hospital benefit from the new so-called T-class MRI



Movement is what it is all about: Dr. Schäfer on his way to an MRI exam (above); diagnostic work-up of a rectal cancer patient using three Tim matrix coils (below).



“Here, the oncologist, gastroenterologist, surgeon, and radiotherapist get the information they need from a single examination.”

Professor Mathias Langer, MD, Medical Director,  
Department of Diagnostic Radiology,  
University Hospital Freiburg, Germany



## Summary

### Challenge:

- Several exams, modalities, and associated rescheduling needed for evaluating the primary tumor and localizing metastases

### Solution:

- *syngo* TimCT – Continuous Table move powered by Tim (Total imaging matrix) technology

### Result:

- Complete diagnostic information (primary tumor evaluation, localization of metastases, and detailed anatomy) available after only one MRI exam

generation with *syngo* TimCT. Multiple schedulings are replaced by only one MRI scheduling. This significantly improves hospital workflow. Time and resources are saved and communication is simplified. After only one examination, the patient obtains a fast diagnosis, enabling optimum therapy planning.

“Various examinations during different appointments, where diagnostic findings have to be communicated to various clinical colleagues – there is always the risk of a loss of information,” says Professor Langer. “Here, the oncologist, gastroenterologist, surgeon, and radiotherapist get the information they need from a single examination.”

Additionally, because two different types of images are used in localizing metastases – a fluid-sensitive one for bone marrow infiltration and pulmonary lesions, and a second one acquired in a breath-hold using contrast to localize liver metastases – the vascular display is provided to the surgeon. “We now have what we always dreamed of: all the necessary diagnostic information in only one single examination.”

### An Overview Image and many “Magnifying Glasses”

Conventional MRI systems allow for measurements of body regions up to 50 centimeters. Such a measurement is well suited for primary diagnosis of the tumor when its approximate location is known.

However, to cover larger areas, such as when localizing metastases, the patient and coil have to be repositioned for each measurement, which makes for very time-consuming examinations. In addition, slice images generated in this step-by-step manner have to be first composed on the computer before they can be diagnosed. The *syngo* TimCT procedure used in Freiburg has solved this problem with a revolutionary technique. Tim stands for ‘Total imaging matrix’ – a unique coil concept from Siemens.

Professor Langer explains the innovative technology: “Tim is a way to perform a high-resolution examination of the entire body using MRI. First, a large magnetic field is generated using a large coil – this produces an overview image much like Google™ Earth – the earth from above. Then we take magnifying glasses, in this case special coils, in which we wrap the patient from head to toe. This enables us to view every part of the body magnified, without having to reposition the patient. Optimum resolution is always provided – even down to the smallest structures. Now with TimCT, the whole concept is taken to the next level. TimCT examinations compared to conventional MRIs show a dramatic change – similar to that from climbing a ladder step-by-step to taking the elevator. The table in the TimCT MRI examination now moves continuously, just like in CT, hence the name TimCT. This dramatically simplifies workflow and

improves patient comfort – while delivering excellent clinical image quality, as shown by our experience.”

## Seamless Examination in only Six Minutes

During the examination, the patient slowly passes through the scanner at a speed of one centimeter per second. He is covered by the special coils and positioned on the continuously moving table, similar to a CT system. Normally, the acquisition quality in MRI suffers from movement. However, since several coils can be activated simultaneously with Tim, fast measurements across a broad area are possible due to parallel imaging. This ‘Multislice Acquisition’ is a critical requirement in order to perform measurements with continuous table movement.

The system’s software reconstructs images in a way that eliminates motion artifacts due to, for example, breathing. “As a result, the entire patient is examined seamlessly, and all in about six minutes.” The innovative coil concept, according to Schäfer, ensures that images are acquired at the magnet’s isocenter. “For that reason alone, the measurement quality is excellent.”

## A Dream Comes True

Professor Langer is proud that his team in Radiology together with the Department of Medical Physics under Professor Jürgen Hennig, PhD, Scientific Director of the Department of Diagnostic Radiology, Medical Physics, has developed the MRI procedure together with Siemens and their other collaborators. At the end of 2005, the procedure was tested on the first patient cohorts. “Professor Hennig and I have dreamed of whole-body examinations with MRI since the early ‘90s – we were both convinced it had to be possible somehow.” The rapid development of computed technology provided the critical prerequisite. “It gave us fast computers capable of quickly processing large quantities of data produced per unit of time.” And so it happened that the wish of the physician and the dream of the physicist became a reality.

In the meantime, several thousand examinations have been performed in Freiburg with the new technology. About 1,500 of these examinations were for rectal car-

cinoma, the most convincing application field of *syngo* TimCT technology in oncology.

Naturally, MRI can be used to localize tumors and metastases of other types of cancer. These include breast and bronchial, prostate and pancreatic cancers, as well as the display of skeletal tumors and lymphoma.

## “Not an indication today for which it can’t be used!”

The various advantages of MRI, such as excellent soft-tissue contrast, no radiation exposure, and good detail resolution, mean that the procedure is of interest for a variety of indications. In Freiburg, the procedure is additionally being used for



“The entire patient is examined seamlessly, and all in about six minutes.”

Arnd-Oliver Schäfer, MD,  
Department of Diagnostic Radiology,  
University Hospital Freiburg, Germany

diagnostic work-up of patients with recurrent Crohn’s Disease. Using contrast agents, inflammations of the intestinal wall are displayed well in MRI. The characteristics of the inflammation, involvement of the surrounding tissue, and complications such as fistulas, abscesses, and stenoses, are all well differentiated, explains Professor Langer.

Additional indications for the *syngo* TimCT technology include whole body imaging of the vascular system and inflammatory muscular diseases. Professor Langer: “With the exception of MRI, there is no procedure that can display a person’s entire muscular system and localize inflammations. There is not an indication today for which it can’t be used.”

“In three years, we may well be performing the entire spectrum with a moving table, where today the examination is stationary,” adds Dr. Schäfer. He has great hopes for diffusion-weighted imaging: “This enables better characterization of tumors, and will simplify their differentiation.”

Professor Langer says, “TimCT Oncology represents a cutting-edge technology for cancer staging with whole-body MRI and has the potential to dramatically improve patient workflow. We just love it!”

After completing her biology and chemistry studies in Heidelberg, **Sonja Böhm** worked for many years as a medical editor. She has worked as a freelancer since 1997 and regularly contributes to numerous health and medical media, and edits professional journals.

## Further Information

[www.siemens.com/  
MAGNETOM-Special-2006](http://www.siemens.com/MAGNETOM-Special-2006)