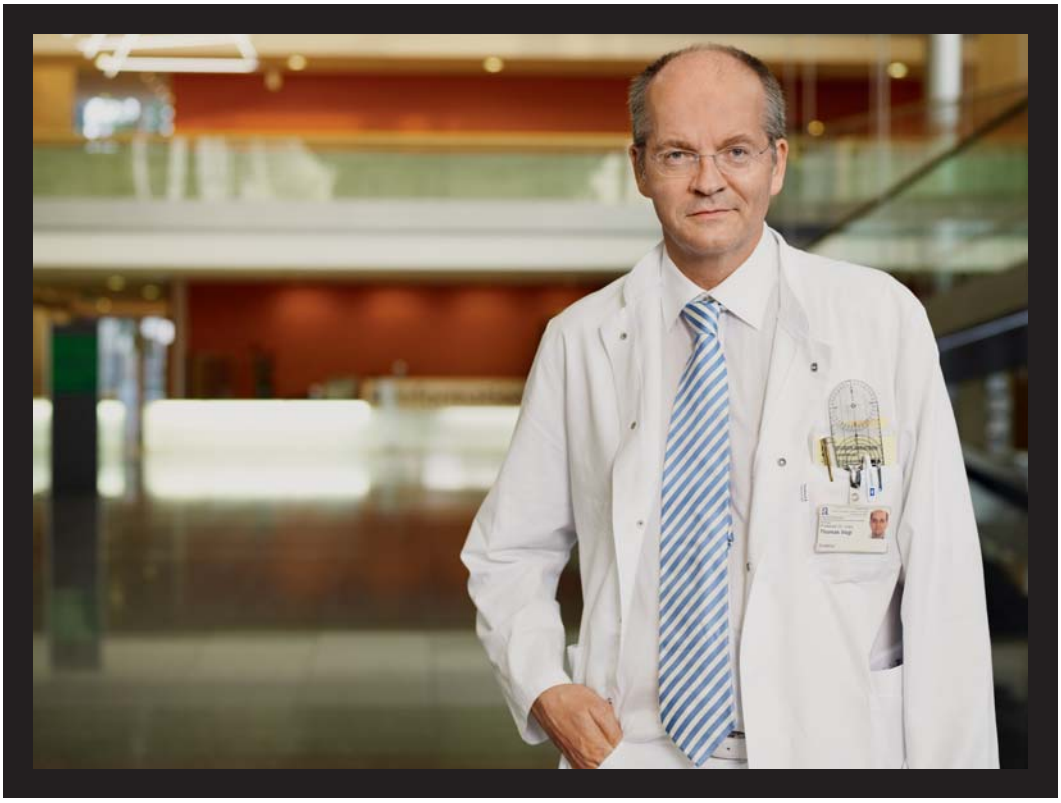


Thomas Vogl, MD, Head of the Department for Diagnostic and Interventional Radiology at the University Hospital of Frankfurt, Germany

Advanced Imaging Provides New Possibilities for Minimally Invasive Tumor Treatment

Interventional procedures are steadily gaining importance for treating malignant tumors. Whenever it is possible to provide the physician with excellent image quality and a good overview during an intervention, patients can be treated faster and more successfully.

By Martina Lenzen-Schulte, MD

Anyone who is still talking about the three pillars of cancer therapy has missed the most recent developments. For some time now, tumors have not just been excised by surgeons, radiated by radiation therapists, or treated by oncologists with chemotherapy or cytotoxins. In addition to these three strategies, interventional methods are steadily gaining importance, basically becoming the fourth pillar of treatment. Since advanced imaging is an essential prerequisite for these procedures, interventional tumor therapy is performed in the angiography lab. The manifold procedures now available for cancer therapy are becoming indispensable for treatment of locally defined tumors.

Onsite Tumor Control

In doing so, different possibilities are applied: For example, vessels that solely supply the tumor are blocked via transarterial embolization. When chemotherapeutic substances are injected only in these vessels, toxic medications do not strain the entire organism, they only harm the tumor. In this case, one speaks of transarterial chemoperfusion. Both methods can be combined into transarterial chemoembolization or TACE. Additional treatments involve destroying the tumor via laser, heat, (extreme) cold, or radiation. The objective is always to accurately position destructive reagents or energies in the tumor focus and to avoid collateral damage in adjacent tissue. The team of Thomas Vogl, MD, Head of the Department for Diagnostic and Interventional Radiology at the University Hospital of Frankfurt, Germany, masters ten interventional therapies, which offer an individually optimized solution to the patient. “Tumor foci in the lungs are a particular challenge,” explains Vogl. On one hand, the organ is very large, and on the other hand, extreme care has to be taken not to injure important vessels located immediately adjacent to the heart. “Even if it is not possible to operate, the patient still benefits. His quality of life is improved and/or his lifespan is extended when these foci are removed individually,” says the radiologist.

Online, Whole-lung Display

For the first time, the new C-arm system Artis zeego®, in combination with the Large Volume *syngo*® DynaCT software, offers the possibility to display the lung as a whole – that is, online during the operation. Previously, no system was able to deliver large-volume, soft-tissue images

Treatment of Local Tumor Foci is Increasing

Lung cancer, colon cancer, and breast cancer are the most frequent cancers in Western industrialized countries.[1] For women, they constitute about 50 percent of all malignant tumors. For men, lung and colon cancer alone represent 70 percent of all cancer types.[2] The frequency of these tumors is currently increasing in Europe as well as worldwide. In the long term, this will not change because the population's longevity in industrial nations is increasing steadily.

Lung Cancer

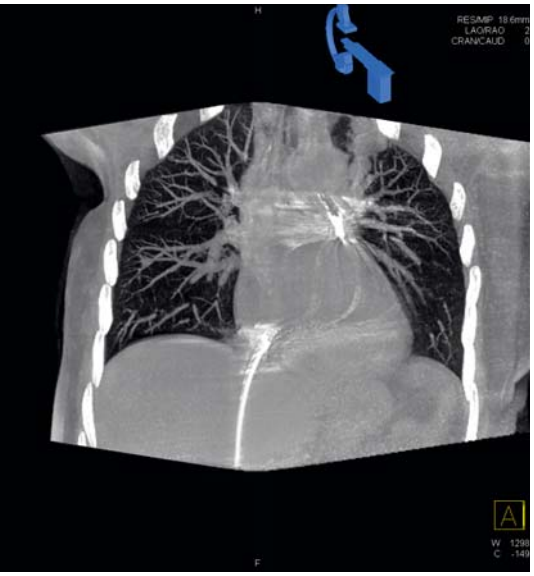
Lung cancer affects more than 1.3 million people worldwide.[3] Despite a downward trend in the U.S., the yearly number of new patients is reaching 180,000. In Europe, the number is close to 400,000, in Japan, it is 85,000, and in Germany, the yearly number is approaching 45,000 new patients.[1, 4, 5, 6, 7, 10] Metastases are also quite commonly malignant lung foci. Only 20 to 30 percent[8] of all patients can be operated at the time of diagnosis.[9] For all others, local, interventional tumor therapies are increasingly used.

Colon Cancer

In Europe, colon cancer cases amount to 300,000 patients per year, in the U.S., 150,000, and more than 70,000 in Germany.[11, 12, 13] Colon cancer preferentially metastasizes to the liver – at the time of diagnosis, 15 to 20 percent of the patients already have liver metastases.[13]
Together with liver-cell carcinoma, they represent the majority of all tumor foci in the liver.[14] These are operable in only 10 to 25 percent of cases. For the large number of remaining foci, interventional tumor therapy is often the only chance of improving the quality of life, extending longevity or even curing the patient.

Breast Cancer

Breast cancer affects about one out of ten women in industrial nations.[16] There are more than 50,000 new cases per year in Germany[17], 350,000 in Europe – more than a quarter of all cancers in women[16] – 200,000 in the U.S., despite a slightly downward trend due to a decrease in hormone therapy, and more than 1.2 million worldwide.[8, 16, 18] Up to 13 percent of breast cancer patients develop liver metastases, which can be treated with interventional tumor therapy.[19] The efficacy of interventional tumor therapy is improving steadily. First findings indicate that local treatment may lengthen the patient's survival as compared to systemic chemotherapy, which makes this approach even more interesting.



Large Volume *syngo* DynaCT – MIP reconstruction before chemoperfusion of the lung

in a quality high enough to support contrast agent display of the vessels.
"The advantages are such that we are already using the new system for half of our lung interventions," confirms Vogl. He continues explaining the benefits of the larger overview. "We save up to one third of the time required for interventions, with a higher level of confidence. I would not want to do without this possibility for lung interventions."
One of the most recent studies documents additional advantages for patients. The innovative system was compared to standard methods for 31 patients who suffered from either lung cancer, metastases of other kinds of cancer in the lungs, or from cancer of the pulmonary pleura. "Thanks to the knowledge we gain online from the clearly arranged images during the examination, we were able to reposition the catheter in a more targeted manner for 30 to 37.5 percent of the patients, depending on the treatment," says Vogl during a discussion with *Medical Solutions*. "This means that without the prerequisites of this new imaging technique, the chemotherapeutic agents would not have been optimally injected into the correct vessels for nearly one-third of the patient cohort."
It is plausible to predict that clinical results are improved with this method and that success stories of this kind support its application for a continuously growing number of patients who show malignant tumor foci in the lungs.

Standard Methods Fall Short

In the meantime, other international teams are also confirming the findings made in Frankfurt. Thus, interventional soft tissue imaging with *syngo* DynaCT provided additional information for approximately 60 to 90 percent of all patients treated with TACE because of liver cancer. As a result, the catheter could be adjusted to the individual treatment position in about 40 percent of all patients. Results of this kind are not surprising, considering that, for the first time, the entire liver can be displayed in the abdominal cavity via the Large Volume *syngo* DynaCT on the Artis zeego C-arm system.
However, it is not just about the size of the display. "Seeing our treatment online allows us to simulate the therapy before-

hand. At the same time, it enables us to check the results. If the embolization is insufficient – the vessel supplying the tumor is not fully blocked – we can continue right away and close this artery completely."

This is of great importance to a large number of patients. While lung cancers still account for five percent of the interventions in Frankfurt currently, therapy for focal hepatic tumors has reached one-fourth of the entire patient cohort. "Per year, we treat up to 400 patients with liver cell carcinoma, that is, tumors of liver-cell origin. However, most cancer foci in the liver are metastases of other tumors," explains Vogl.

Cancer Foci in the Liver on the Rise

Trend: upward – because a large number of killers metastasize particularly in the liver. For example, more than half of all patients suffering from colon cancer show metastases in the liver as early as during the initial diagnosis or within the first year following diagnosis. By then, the primary colon cancer may have even been eradicated. Previously, locating a metastasis often suggested widespread disease. Today, however, we know that the tumor may have only metastasized in the liver.

Eliminating these foci oftentimes provides patients with years free of further discomfort and without any negative impact on quality of life. This can be particularly important to those patients in which tumors are increasing but the primary tumor no longer limits the therapeutic effort. This applies in particular to breast cancer patients, whose metastases are now, for the most part, treated with interventional therapy. It is also true for treatment of the pelvic region, where metastases or recurring tumors frequently appear. Their local therapy accounts for up to 15 percent of all cases in Frankfurt.

"We are not only able to offer a variety of interventional methods, we also see a growing number of indications as demonstrated by the example of the liver," continues Vogl and outlines the steadily extended number of implementations. Prior to surgical intervention, for example, the radiologists reduce the liver foci to make them operable. Additionally, recurrences following initially successful treatments are handled interventionally. As it were, one of the interventional methods will be applied at several instances along the pathway of tumor pathology.

Martina Lenzen-Schulte, MD, *is a physician, author, and medical journalist. She is a frequent contributor to medical magazines and the scientific pages of German-speaking public media.*

Summary

Challenge:

- Tumor pathologies are increasing around the world
- A large number of these tumors, but also metastases, and recurrences are non-operable. For this reason, effective, tissue-sparing methods for local tumor control are required

Solution:

- Interventional procedures that allow the foci to be destroyed locally by means of medication, radiation, heat, or cold
- High-resolution imaging that allows online simulation of the intervention, correction when necessary, and the checking of results

Result:

- Complete organ overview even with large organs (lungs, liver) via Large Volume *syngo* DynaCT, a unique feature of the Artis zeego C-arm system
- Correction of the original therapy for 30 to 40 percent of the patient cohort
- Additional information in 60 to 90 percent of the treatments
- Time-savings are as high as one-third of the time required for a single intervention

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Further Information

www.siemens.com/oncology