Minimally invasive procedure for oncology: Siemens introduces a product portfolio for new treatment methods

At the RSNA 2009, this year's convention of the Radiological Society of North America, Siemens will be introducing its comprehensive portfolio for imaging in interventional oncology for the first time. Using these minimally invasive procedures for cancer therapy, the interventional radiologist navigates catheters or needles in the millimeter range. To this end, systems and applications are required that supply high image quality for the detection of details in soft tissue. Siemens provides high-end imaging systems and advanced applications for this purpose which support the physician in his entire workflow from tumor evaluation and procedure planning to therapy and follow-up.

The World Health Organization (WHO) predicts that cancer will become the world's most frequent cause of death in 2010, thus replacing cardiovascular diseases as the most common cause of death. More than 10.6 million people are diagnosed with cancer each year. Of these, 1.3 million are afflicted with lung cancer, 1.2 million with breast cancer, and up to 1 million patients with colorectal tumors. The number of people suffering from cancer is expected to increase by another 50 percent by 2020 (source: WHO 2003).

The traditional methods of tumor treatment include surgical removal in the course of an operation, medicinal treatment (chemotherapy) and irradiation of the tumor (radiation therapy). In addition to these proven methods, new, minimally invasive procedures suitable both for the therapy of primary tumors and for metastases have established themselves in recent years. They involve the treatment of tumors via a very small access using a catheter or a needle, while angiography systems display the position of the device in the patient's body to the physician. In this way, for example, chemotherapeutic substances or very small radioactive particles can be inserted directly in the blood vessels supplying the tumor. Furthermore, it is possible to directly destroy the tumor with energy (local thermal ablation).
The new procedures enable treatment of the tumor while largely protecting the rest of the organism, since the therapy takes place locally. The patient's quality of life is usually impaired only slightly and he or she can be released from hospital soon afterwards. These local procedures are advisable especially for patients who are advanced in years, have a poor general health condition, or are afflicted with accompanying diseases which do not permit a major operation or aggressive chemotherapy.

Siemens Healthcare has adapted its imaging systems and applications especially to the procedures of interventional oncology, e.g. transarterial chemoembolization (TACE), selective internal radiotherapy (SIRT) and radiofrequency ablation (RFA). At the RSNA 2009, Siemens presented an entire line of its innovative solutions for these treatment methods:

**syngo DynaCT** enables the display of tumors and of the complex structures of the blood vessels supplying them during therapy. Thanks to short reconstruction times, abdominal images can be made available to the treating physician within 22 seconds. An investigation recently conducted at Charité Hospital in Berlin showed that syngo DynaCT leads to repositioning of the catheter, and thus increases the reliability of the tumor treatment, in 50 percent of all chemoembolizations.

**Large Volume syngo DynaCT** offers the interventional radiologist virtually unlimited freedom of movement in combination with the robotic-based angiography system "Artis zeego". The system's flat detector rotates twice 220 degrees around the patient with such precision that cross-sectional images with a coverage of 47 centimeters are acquired. These images enable more comprehensive anatomic coverage than soft tissue images acquired with any other angiography system. The liver and lungs are covered fully.

**syngo Embolization Guidance** enables advanced planning of the embolization of tumor feeding blood vessels. Using this application, the vessel supplying the tumor can be marked, the centerline of the vessel is automatically calculated which is then superimposed on the live fluoroscopic image, thus simplifying catheter guidance during tumor embolization considerably.

With **syngo InSpace 3D/3D Fusion**, previously acquired CT, MR or PET/CT images can be fused with high-contrast 3D angiography images or with syngo DynaCT datasets in order to present all relevant diagnostic and interventional data at a glance. Besides the fused dataset can be

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1 Results of a study published in European Radiology March 2009 by Dr. Meyer, University of Berlin, Charite, Germany and Prof. Dr. Wacker, John Hopkins Hospital Baltimore, USA
overlayed on live fluoroscopic images in the interventional lab and thus provides additional information on the tumor during the procedure, e.g. regarding its activity.

If a tumor is to be treated with an ablative procedure, it is especially important to position the needles that release the energy to the tumor precisely. syngo iGuide helps to plan and position the needle. The iGuide Cappa navigation system supports the placement of radiofrequency and biopsy needles via electromagnetic navigation without requiring any radiation.

**Interventional procedures in the oncology background**

Interventional oncological procedures can be divided into two categories: Transcatheter therapies and ablative therapies.

**Transcatheter therapies:**
During chemoembolization, small particles are injected in the vessels supplying the tumor via a catheter until the vessel is occluded and the blood supply to the tumor has been stopped. Since the required nutrients and oxygen then remain absent, the tumor cells located in this area die. In addition, a chemotherapeutic substance is injected through the catheter and thus placed directly on the tumor ("local chemotherapy"). This chemotherapeutic substance also causes the cancer cells to die off.

During selective internal radiotherapy, tiny microspheres with a diameter of only 20 to 40 micrometers (thousandths of a millimeter) containing a radiation-emitting isotope are injected in the blood vessels supplying the tumor with the help of a catheter. Embolization and radiation cause the cancer cells to die off.

**Ablative therapies:**
Radiofrequency ablation (RFA) is currently the most commonly used thermoablative procedure. Using an electric generator, a high-frequency alternating current is generated outside of the body. This current is guided through the skin and directly to the center of the tumor via a cable and a long needle (probe) by means of optical control. There the tissue is heated up within a radius of several centimeters around the tip of the probe. Inside the tumor, temperatures of 50 to 90°C are reached and the malignant tissue is positively "boiled away", thus permanently destroying the tumor.